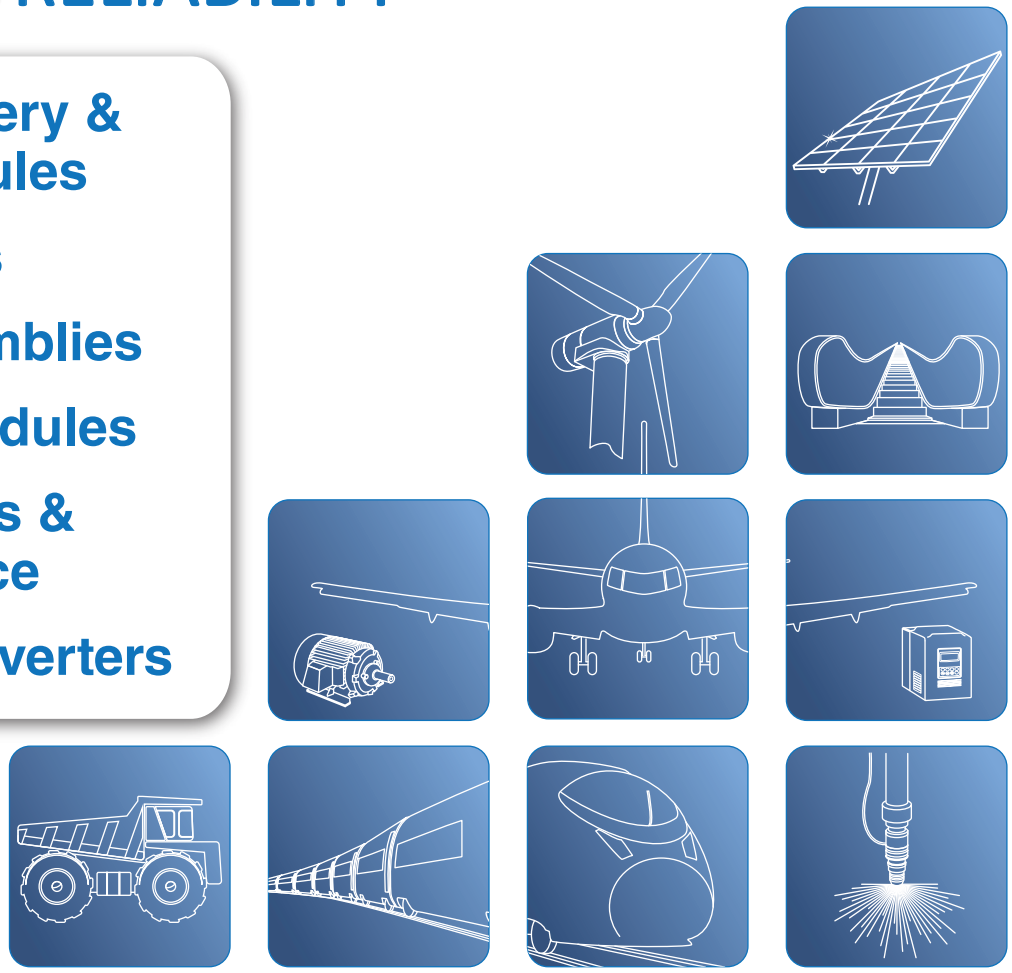
POWEREX®

Power Semiconductor Solutions

2015 Product Catalog

EXPERTISE ■ INNOVATION ■ RELIABILITY

- IGBTs
- Hybrid & SiC Modules
- MOSFET Modules
- IPMs
- DIPIPM™
- Discrete Thyristors
- Discrete Rectifiers
- Thyristor & Diode Modules
- Fast Recovery & Diode Modules
- Assemblies
- IGBT Assemblies
- Custom Modules
- Gate Drivers & IPM Interface
- DC-DC Converters



IGBTs

Applications Include:

- Hybrid Electric Vehicles (HEV/EV)
- Inverters
- Medical Power Supplies
- Motor Drives
- Servo Drives
- Traction Inverters
- UPS
- Welding

Circuit Configurations:

- Single
- Chopper
- Dual
- H-Bridge
- 6-Pac
- 7-Pac
- CIB

Development Kits available for some types. (Section M, Gate Drivers)

TABLE OF CONTENTS

VOLTAGE: 250V TO 6500V
CURRENT: 35A TO 2500A

250 Volt IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)


CM200TU-5F

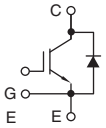

CM600HA-5F

MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS										
					Static				Dynamic						
					Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times			
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns
250V Single IGBT															
CM600HA-5F	250	600	1200	2500	600	10	1.2	1.7	165	7.5	5.6	1000	4000	1000	500
250V 6-Pac IGBT															
CM200TU-5F	250	200	400	2500	200	10	1.2	1.7	66	3.0	2.3	700	1800	700	500

	FREE WHEEL DIODE			THERMAL CHARACTERISTICS					
				Interface Per Module	IGBT (Max.)	Diode (Max.)		Outline Drawings	
Type	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	Weight Grams	Number	Page
250V Single IGBT									
CM600HA-5F	600	2.0	300	0.04	0.13	0.19	400	2	A-26
250V 6-Pac IGBT									
CM200TU-5F	200	2.0	300	0.09	0.21	0.47	680	3	A-26

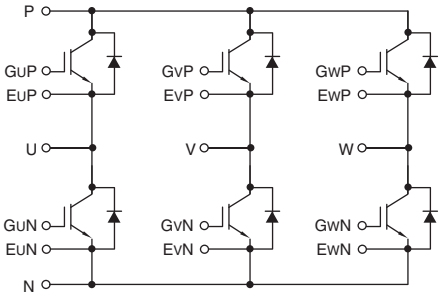
250V Single IGBT

CM600HA-5F



250V 6-Pac IGBT

CM200TU-5F



Numbering System

CM450DX-24S1 is a 450 Ampere, 1200 Volt, Dual IGBT

CM450DX–24S1

(1) (2) (3) (4) (5) (6)

(1) CM = IGBT Module

(2) Current Rating: I_C (Amperes)

(3) B = Four-in-One
D = Dual
E = Chopper
H = Single
M = CIB
R = Seven-in-One
T = Six

(4) Outline or Minor Change

(5) Voltage, V_{CES} Volts (x50)

(6) A = A-Series IGBT
F = 4th Generation Trench Gate
H = Total Performance H-Series Module
NF = 5th Generation CSTBT™ Trench Gate, Total Performance NF-Series Module
NFH = Total Performance NFH-Series Module, for High Frequency Use 30kHz to 70kHz
R = High Voltage, Low Loss
S = 6th Generation CSTBT™ Trench Gate
S1 = Gen. 6.1 CSTBT Trench Gate

CSTBT is a registered trademark of Mitsubishi Electric Corp.

600V Standard Frequency Application IGBTs, Up to 20kHz

NF-Series Dual IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

CM150DY-12NF, CM200DY-12NF, CM300DY-12NF

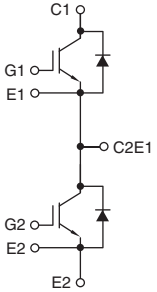
CM400DY-12NF

CM600DY-12NF

MAXIMUM RATINGS (IGBT Inverter Sector)						ELECTRICAL CHARACTERISTICS											FREE-WHEEL DIODE			THERMAL CHARACTERISTICS				Weight	Outline Drawings	
						Static				Dynamic																
						Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times							IGBT (Max.)	Diode (Max.)	IGBT Under Chip (Max.)	Contact Thermal Resistance			
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(c-f)}$ °C/W	Grams	Number	Page
NF-Series Dual IGBTs																										
CM150DY-12NF	600	150	300	97	2500	150	15	1.7	2.2	23	2.8	0.9	120	100	300	300	150	2.6	150	0.21	0.47	0.16	0.07	310	5	A-27
CM200DY-12NF	600	200	400	93	2500	200	15	1.7	2.2	30	3.7	1.2	120	120	300	300	200	2.6	150	0.19	0.35	0.13	0.07	310	5	A-27
CM300DY-12NF	600	300	600	89	2500	300	15	1.7	2.2	45	5.5	1.8	120	120	350	300	300	2.6	150	0.16	0.25	0.093	0.07	310	5	A-27
CM400DY-12NF	600	400	800	92	2500	400	15	1.7	2.2	60	7.3	2.4	300	200	450	300	400	2.6	250	0.11	0.19	0.066	0.04	400	6	A-27
CM600DY-12NF	600	600	1200	89	2500	600	15	1.7	2.2	90	11.0	3.6	500	300	750	300	600	2.6	250	0.11	0.18	0.046	0.02	580	7	A-28

NF-Series Dual IGBTs

CM150DY-12NF, CM200DY-12NF, CM300DY-12NF,
CM400DY-12NF, CM600DY-12NF



600V Standard Frequency Application IGBTs, Up to 20kHz

NF-Series 6-Pac IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

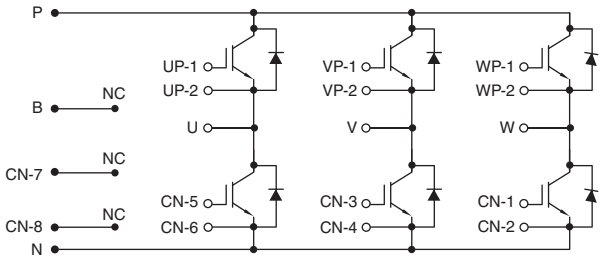
CM75TL-12NF,
CM150TL-12NF

MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS												FREE-WHEEL DIODE		
	Inverter Sector					Static				Dynamic										
						Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times							
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns
6-Pac IGBTs																			
CM75TL-12NF	600	75	150	102	2500	75	15	1.7	2.2	11.3	1.4	0.45	120	100	300	300	75	2.8	100
CM150TL-12NF	600	150	300	93	2500	150	15	1.7	2.2	23.0	2.8	0.9	120	100	300	300	150	2.8	150

THERMAL CHARACTERISTICS							
	Inverter Sector						
Type	IGBT Under Chip (Max.) $R_{th(j-c)}$ °C/W	Diode Under Chip (Max.) $R_{th(j-c)}$ °C/W	Contact Thermal Resistance $R_{th(c-f)}$ °C/W	Weight Grams	Outline Drawings Number	Page
6-Pac IGBTs						
CM75TL-12NF	0.29	0.51	0.085	350	1	A-26
CM150TL-12NF	0.17	0.31	0.085	350	1	A-26

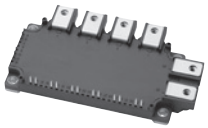
6-Pac IGBTs

CM75TL-12NF, CM150TL-12NF



600V Standard Frequency Application IGBTs, Up to 20kHz

NX-Series 7-Pac IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)



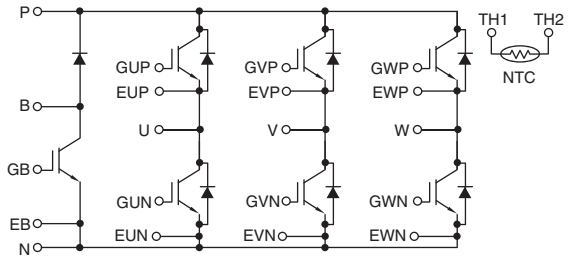
CM100RX-12A, CM150RX-12A,
CM200RX-12A

MAXIMUM RATINGS											ELECTRICAL CHARACTERISTICS												FREE-WHEEL DIODE		
	Inverter Sector					Brake Sector					Static				Dynamic										
											Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times						
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	V_{RMS} Isolation Volts	V_{CES} Volts	I_C@T_C' Amperes	I_{CM}@T_C' Amperes	T_C' °C	P_d Watts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns
7-Pac IGBTs																									
CM100RX-12A	600	100	200	84	2500	600	50	100	103	280	100	15	1.7	2.1	11.3	1.4	0.45	100	100	300	400	100	2.8	200
CM150RX-12A	600	150	300	78	2500	600	75	150	84	280	150	15	1.6	2.0	15.0	2.0	0.6	120	100	350	550	150	2.8	200
CM200RX-12A	600	200	400	82	2500	600	100	200	88	400	200	15	1.6	2.0	20.0	2.7	0.8	120	150	350	550	200	2.8	200

THERMAL CHARACTERISTICS								
	Inverter Sector		Brake Sector					
Type	IGBT Under Chip (Max.) $R_{th(j-c)}$ °C/W	Diode Under Chip (Max.) $R_{th(j-c)}$ °C/W	IGBT Under Chip (Max.) $R_{th(j-c)}$ °C/W	Diode Under Chip (Max.) $R_{th(j-c)}$ °C/W	Contact Thermal Resistance $R_{th(c-f)}$ °C/W	Weight Grams	Outline Drawings Number	Page
7-Pac IGBTs								
CM100RX-12A	0.31	0.59	0.44	0.85	—	350	11	A-29
CM150RX-12A	0.24	0.46	0.44	0.85	—	350	11	A-29
CM200RX-12A	0.17	0.33	0.31	0.59	—	350	11	A-29

7-Pac IGBTs

CM100RX-12A, CM150RX-12A, CM200RX-12A



600V Standard Frequency Application IGBTs, Up to 20kHz

Dual Extended Temperature Range IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

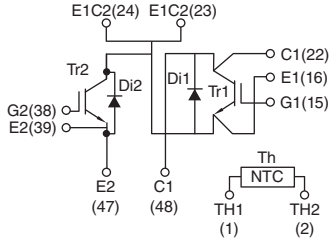
QID0640020

QID0660023

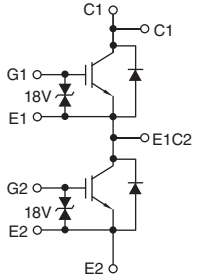
MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS														FREE-WHEEL DIODE			THERMAL CHARACTERISTICS				
						Static Test Conditions		T_j = 25°C		Dynamic																	
										V_{GE} = 0V, f = 1KHz				Resistive Load Switching Times													
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	$T_{j(MAX)}$ °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	Typ. $V_{CE\ (SAT)}$ Volts	Max. $V_{CE\ (SAT)}$ Volts	V_{CE} Test Cond.	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	IGBT (Max.) $R_{th(j-c)}$ °C/W	Diode (Max.) $R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawings Number	Page
Dual Extended Temperature Range IGBTs																											
QID0640020	600	400	800	150	2500	400	15	1.7	2.1	10	50	5.3	1.6	200	200	400	600	—	—	200	0.112	0.192	220	10	A-29
QID0660023	600	600	1200	150	2500	600	15	1.7	2.2	10	90	11.0	3.6	500	300	750	300	—	—	250	0.075	0.120	270	48	A-43

Dual Extended Temperature Range IGBTs

QID0640020



QID0660023



600V Standard Frequency Application IGBTs, Up to 20kHz
Single and Low Side Chopper IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

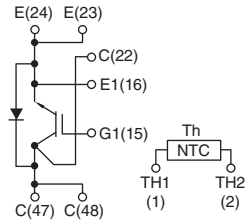

QIS0660004


QIQ0645001

MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS													FREE-WHEEL DIODE			THERMAL CHARACTERISTICS				
						Static Test Conditions		T_j = 25°C		Dynamic																
								Typ.	Max.	V_{GE} = 0V, f = 1KHz				Resistive Load Switching Times							IGBT (Max.)	Diode (Max.)			
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	$T_{j(MAX)}$ °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE\ (SAT)}$ Volts	$V_{CE\ (SAT)}$ Volts	V_{CE} Test Cond.	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawings Number	Page
Single IGBT																										
QIS0660004	600	600	1200	150	2500	600	15	1.7	2.1	10	69	8.0	2.4	700	250	700	600	—	—	300	0.079	0.132	220	10	A-29
Low Side Chopper IGBT																										
QIQ0645001	600	450	900	125	2000	450	15	2.1	2.8	10	45	15.9	9	350	600	350	300	450	2.2	110	0.075	0.075	400	49	A-43

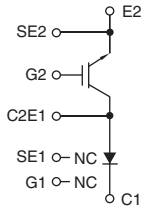
Single IGBT

QIS0660004



Low Side Chopper

QIQ0645001



600V High Frequency Application IGBTs, 30kHz to 70kHz
NFH-Series Dual & Chopper IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)


CM100DUS-12F, CM150DUS-12F, CM200DU-12NFH

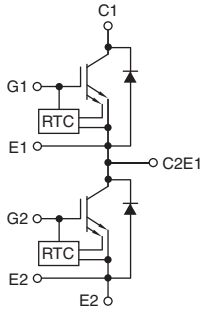

CM300DU-12NFH, CM400DU-12NFH, CM600E3U-12NFH


CM600DU-12NFH

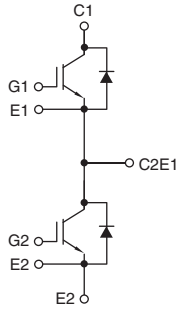
MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS											FREE WHEEL DIODE			THERMAL CHARACTERISTICS					
					Static				Dynamic															
					Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times							IGBT (Max.)	Diode (Max.)	IGBT Under Chip (Max.)		Outline Drawings	
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	Weight Grams	Number	Page
NFH-Series Dual IGBTs																								
CM100DUS-12F	600	100	200	2500	100	15	2.0	2.7	27	1.8	1.0	100	80	300	150	100	2.6	150	0.35	0.70	0.23	310	8	A-28
CM150DUS-12F	600	150	300	2500	150	15	2.0	2.7	41	2.7	1.5	120	100	350	150	150	2.6	150	0.24	0.47	0.19	310	8	A-28
CM200DU-12NFH	600	200	400	2500	200	15	2.0	2.7	55	3.6	2.0	120	100	350	150	200	2.6	150	0.21	0.35	0.15	310	18	A-32
CM300DU-12NFH	600	300	600	2500	300	15	2.0	2.7	83	5.4	3.0	250	120	500	150	300	2.6	200	0.16	0.24	0.10	400	19	A-32
CM400DU-12NFH	600	400	800	2500	400	15	2.0	2.7	110	7.2	4.0	400	120	700	150	400	2.6	200	0.13	0.18	0.076	400	19	A-32
CM600DU-12NFH	600	600	1200	2500	600	15	2.0	2.7	166	11.0	6.0	700	300	1400	150	600	2.6	200	0.11	0.12	0.053	400	24	A-34
NFH-Series Chopper IGBT																								
CM600E3U-12NFH	600	600	1200	2500	600	15	2.0	2.7	165	10.8	6.0	—	—	—	150	600	2.6	—	0.088	—	0.051	400	19	A-32

NFH-Series Dual IGBTs

CM100DUS-12F, CM150DUS-12F

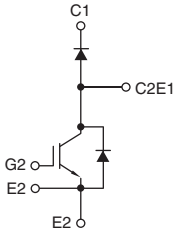


CM200DU-12NFH, CM300DU-12NFH, CM400DU-12NFH, CM600DU-12NFH



NFH-Series Chopper IGBT

CM600E3U-12NFH



1200V Standard Frequency Application IGBTs, Up to 20kHz

A-Series Single & Dual IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)


CM400HA-24A, CM600HA-24A

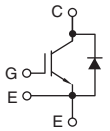

CM100DY-24A


CM600DY-24A

MAXIMUM RATINGS (IGBT Inverter Sector)						ELECTRICAL CHARACTERISTICS											FREE-WHEEL DIODE			THERMAL CHARACTERISTICS				Outline Drawings	
						Static				Dynamic										IGBT Under Chip (Max.)	Diode Under Chip (Max.)	Contact Thermal Resistance	Weight		
						Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times												
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(c-f)}$ °C/W	Grams	Number	Page
A-Series Single IGBTs																									
CM400HA-24A	1200	400	800	87	2500	400	15	2.1	3.0	70.0	6.0	1.4	550	180	600	350	400	3.8	250	0.053	0.080	0.02	480	29	A-36
CM600HA-24A	1200	600	1200	80	2500	600	15	2.1	3.0	105.0	9.0	2.0	660	190	700	350	600	3.8	250	0.034	0.053	0.02	480	29	A-36
A-Series Dual IGBTs																									
CM100DY-24A	1200	100	200	84	2500	100	15	2.1	3.0	17.5	1.5	0.34	100	70	400	350	100	3.8	150	0.186	0.34	0.022	310	20	A-33
CM600DY-24A	1200	600	1200	80	2500	600	15	2.1	3.0	94.0	8.0	1.8	660	190	700	350	600	3.8	250	0.034	0.062	0.018	580	22	A-33

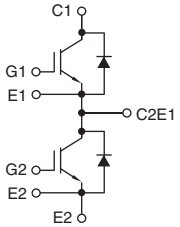
A-Series Single IGBTs

CM400HA-24A, CM600HA-24A



A-Series Dual IGBTs

CM100DY-24A, CM600DY-24A



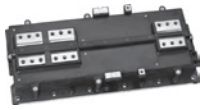
1200V Standard Frequency Application IGBTs, Up to 20kHz
S-Series Dual & AC Switch, MPD S-Series & NF-Series Dual IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

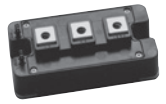

CM300DY-24S


CM400C1Y-24S, CM450DY-24S, CM600DY-24S


CM800DY-24S


CM900DUC-24S, CM1400DUC-24S

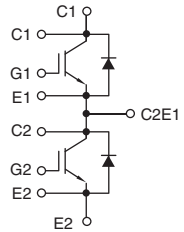

CM2500DY-24S


CM100DY-24NF

MAXIMUM RATINGS (IGBT Inverter Sector)						ELECTRICAL CHARACTERISTICS											FREE-WHEEL DIODE			THERMAL CHARACTERISTICS				Weight	Outline Drawings	
						Static				Dynamic			Inductive Load Switching Times													
						Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V										IGBT (Max.)	Diode (Max.)	IGBT Under Chip (Max.)	Contact Thermal Resistance			
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(c-f)}$ °C/W	Grams	Number	Page
S-Series Dual IGBTs																										
CM300DY-24S	1200	300	600	120	2500	300	15	1.7	2.15	30	6	0.5	800	200	600	300	300	2.25	300	0.066	0.12	—	0.02	400	6	A-27
CM450DY-24S	1200	450	900	125	2500	450	15	1.7	2.15	45	9	0.75	800	200	600	300	450	2.15	300	0.045	0.068	—	0.018	580	16	A-31
CM600DY-24S	1200	600	1200	116	2500	600	15	1.7	2.15	60	12	1.0	800	200	600	300	600	2.15	300	0.03	0.06	—	0.018	580	16	A-31
CM800DY-24S	1200	800	1600	117	2500	800	15	1.7	2.15	80	16	1.32	800	200	600	300	800	2.15	300	0.028	0.045	—	0.015	1200	25	A-34
S-Series Dual AC Switch																										
CM400C1Y-24S	1200	350	800	124	2500	400	15	1.85	2.3	40	8	0.66	800	200	600	300	400	1.7	300	0.056	0.95	—	0.018	580	4	A-27
MPD S-Series Dual IGBTs																										
CM900DUC-24S	1200	900	1800	125	2500	900	15	1.55	1.9	90	18.0	1.5	900	250	950	350	900	1.65	450	0.023	0.039	—	0.006	1450	23	A-34
CM1400DUC-24S	1200	1400	2800	124	2500	1400	15	1.55	1.9	150	30.0	2.5	900	250	950	350	1400	1.65	450	0.016	0.026	—	0.006	1450	23	A-34
CM2500DY-24S	1200	2500	5000	56	2500	2500	15	1.7	2.4	250	25.0	3.0	800	200	700	300	—	—	300	0.016	0.027	—	0.0038	2000	38	A-39
NF-Series Dual IGBT																										
CM100DY-24NF	1200	100	200	113	2500	100	15	1.8	2.5	23	2.0	0.45	120	80	450	350	100	3.2	150	0.19	0.35	0.13	0.07	310	5	A-27

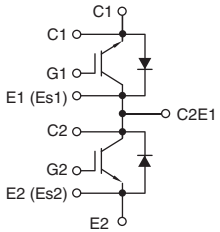
S-Series Dual IGBTs

CM300DY-24S, CM450DY-24S, CM600DY-24S, CM800DY-24S



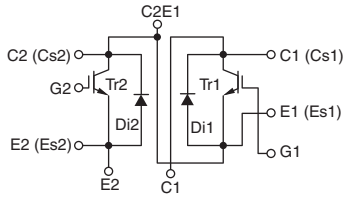
S-Series Dual AC Switch IGBT

CM400C1Y-24S

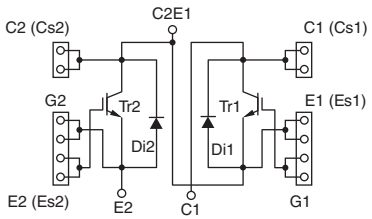


MPD S-Series Dual IGBTs

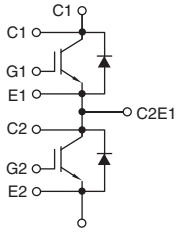
CM900DUC-24S



CM1400DUC-24S

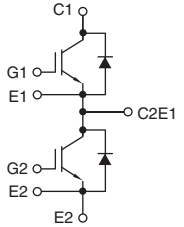


CM2500DY-24S



NF-Series Dual IGBT

CM100DY-24NF



1200V Standard Frequency Application IGBTs, Up to 20kHz

NF-Series 6-Pac & 7-Pac IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

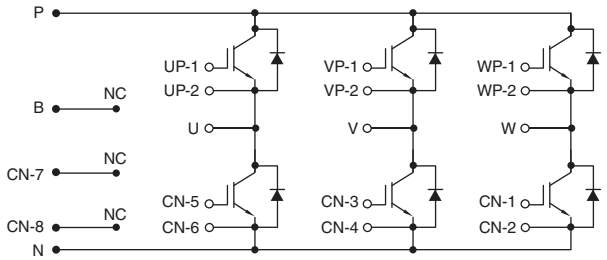
CM50RL-24NF,
CM50TL-24NF

MAXIMUM RATINGS											ELECTRICAL CHARACTERISTICS											FREE-WHEEL DIODE		
	Inverter Sector					Brake Sector					Static				Dynamic									
											Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times						
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	V_{RMS} Isolation Volts	V_{CES} Volts	I_C@T_C' Amperes	I_{CM}@T_C' Amperes	T_C' °C	P_d Watts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns
6-Pac IGBT																								
CM50TL-24NF	1200	50	100	94	2500	—	—	—	—	—	50	15	2.1	3.0	8.5	0.75	0.17	100	50	300	350	50	3.8	100
7-Pac IGBT																								
CM50RL-24NF	1200	50	100	94	2500	1200	30	60	104	290	50	15	2.1	3.0	8.5	0.75	0.17	100	50	300	350	50	3.8	100

THERMAL CHARACTERISTICS								
	Inverter Sector		Brake Sector					
Type	IGBT Under Chip (Max.) $R_{th(j-c)}$ °C/W	Diode Under Chip (Max.) $R_{th(j-c)}$ °C/W	IGBT Under Chip (Max.) $R_{th(j-c)}$ °C/W	Diode Under Chip (Max.) $R_{th(j-c)}$ °C/W	Contact Thermal Resistance $R_{th(c-f)}$ °C/W	Weight Grams	Outline Drawings Number	Page
6-Pac IGBT								
CM50TL-24NF	0.32	0.43	—	—	0.085	350	1	A-26
7-Pac IGBT								
CM50RL-24NF	0.32	0.43	0.43	0.65	0.085	350	1	A-26

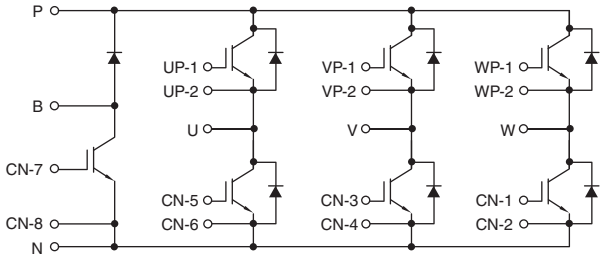
6-Pac IGBT

CM50TL-24NF



7-Pac IGBT

CM50RL-24NF



1200V Standard Frequency Application IGBTs, Up to 20kHz

NX-Series Dual IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

CM150DX-24S,
QIS1260015

CM225DX-24S1,
CM300DX-24S1,
CM450DX-24S1,
CM600DX-24S1

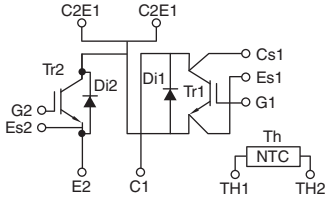
CM600DXL-24S,
CM1000DXL-24S

MAXIMUM RATINGS							ELECTRICAL CHARACTERISTICS										FREE-WHEEL DIODE		
Inverter Sector							Static				Dynamic								
							Test Conditions		Typ.	Max.	Switching Energy		Inductive Load Switching Times						
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	P_d Watts	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	$E_{(on)}$ mJ	$E_{(off)}$ mJ	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	E_{rr} mJ
NX-Series Dual IGBTs																			
CM150DX-24S	1200	150	300	120	1150	2500	150	15	1.7	2.15	24.2	16.0	800	200	600	300	150	2.15	12.2
CM225DX-24S1	1200	225	450	96	1250	4000	225	15	1.8	2.25	21.7	23.1	800	200	600	300	225	2.1	17.0
CM300DX-24S1	1200	300	600	107	1850	4000	300	15	1.7	2.15	30.7	35.7	800	200	600	300	300	2.0	19.0
CM450DX-24S1	1200	450	900	107	2775	4000	450	15	1.7	2.15	35.8	52.4	800	200	600	300	450	2.0	28.0
CM600DX-24S1	1200	600	1200	94	3330	4000	600	15	1.85	2.35	91.5	63.1	800	200	600	300	600	2.7	36.0
CM600DXL-24S	1200	600	1200	119	4545	2500	600	15	1.7	2.15	20.3	60.1	800	200	600	300	600	2.15	69.2
CM1000DXL-24S	1200	900	2000	124	7500	2500	1000	15	1.7	2.15	45.6	97.1	800	200	600	300	1000	2.15	96.7

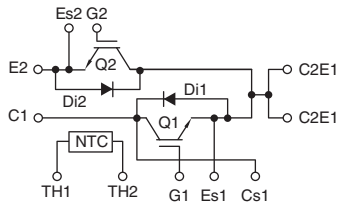
THERMAL CHARACTERISTICS						
Inverter Sector						
Type	IGBT Under Chip (Max.) $R_{th(j-c)}$ °C/W	Diode Under Chip (Max.) $R_{th(j-c)}$ °C/W	Contact Thermal Resistance $R_{th(c-f)}$ °C/W	Weight Grams	Outline Drawings Number	Page
NX-Series Dual IGBTs						
CM150DX-24S	0.13	0.23	0.015	350	10	A-29
CM225DX-24S1	0.12	0.18	0.015	350	50	A-44
CM300DX-24S1	0.081	0.13	0.015	350	50	A-44
CM450DX-24S1	0.054	0.086	0.015	350	50	A-44
CM600DX-24S1	0.045	0.072	0.015	350	50	A-44
CM600DXL-24S	0.033	0.063	0.007	690	39	A-39
CM1000DXL-24S	0.02	0.038	0.007	690	39	A-39

NX-Series Dual IGBTs

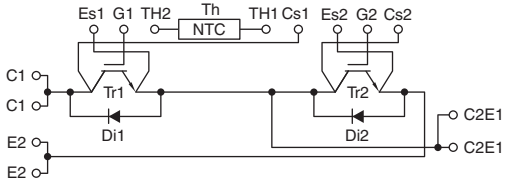
CM150DX-24S



CM225DX-24S1, CM300DX-24S1, CM450DX-24S1, CM600DX-24S1



CM600DXL-24S, CM1000DXL-24S



1200V Standard Frequency Application IGBTs, Up to 20kHz

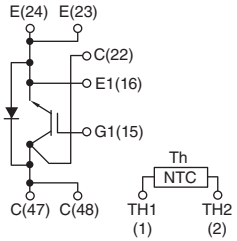
Single & Dual Extended Temperature Range IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

QIS1260015,
QID1230015

MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS														FREE-WHEEL DIODE			THERMAL CHARACTERISTICS				
						Static Test Conditions		T_j = 25°C		Dynamic																	
										V_{GE} = 0V, f = 1KHz				Resistive Load Switching Times													
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	$T_{j(MAX)}$ °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	Typ. $V_{CE\ (SAT)}$ Volts	Max. $V_{CE\ (SAT)}$ Volts	V_{CE} Test Cond.	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	IGBT (Max.) $R_{th(j-c)}$ °C/W	Diode (Max.) $R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawings Number	Page
Single Extended Temperature Range IGBT																											
QIS1260015	1200	600	1200	150	2500	600	20	2.0	2.6	10	100	9.0	2.0	660	190	700	600	—	—	—	0.033	0.028	330	10	A-29		
Dual Extended Temperature Range IGBT																											
QID1230015	1200	300	600	150	2500	300	20	2.0	2.6	10	47	4.0	0.9	550	180	600	600	—	—	250	0.079	0.144	220	10	A-29		

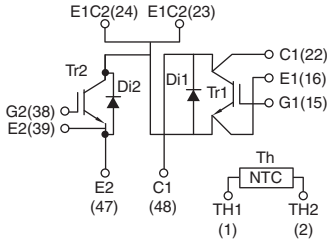
Single Extended Temperature Range IGBT

QIS1260015



Dual Extended Temperature Range IGBT

QID1230015



1200V Standard Frequency Application IGBTs, Up to 20kHz

NX-Series Chopper & 6-Pac IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

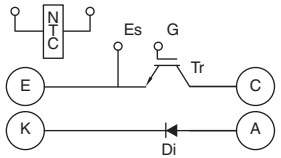
CM150EXS-24S,
CM200EXS-24S,
CM300EXS-24S

CM75TX-24S

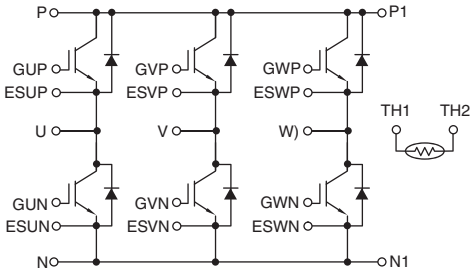
MAXIMUM RATINGS							ELECTRICAL CHARACTERISTICS										FREE-WHEEL DIODE		
Inverter Sector							Static				Dynamic								
							Test Conditions		Typ.	Max.	Switching Energy		Inductive Load Switching Times						
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	P_d Watts	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	$E_{(on)}$ mJ	$E_{(off)}$ mJ	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	E_{rr} mJ
NX-Series Chopper IGBTs																			
CM150EXS-24S	1200	150	300	120	1150	2500	150	15	1.7	2.15	24.2	16.0	800	200	600	300	300	2.15	12.2
CM200EXS-24S	1200	200	400	119	1500	2500	200	15	1.7	2.15	30.7	21.5	800	200	600	300	400	2.25	14.2
CM300EXS-24S	1200	300	600	119	2270	2500	300	15	1.7	2.15	41.0	32.0	800	200	600	300	600	2.25	22.0
NX-Series 6-Pac IGBTs																			
CM75TX-24S	1200	75	150	122	600	2500	75	15	1.7	2.15	7.3	8.0	300	200	600	300	75	2.15	6.9
CM100TX-24S1	1200	100	200	107	625	4000	100	15	1.7	2.15	5.9	9.7	800	200	600	300	100	2.0	9.7
CM150TX-24S1	1200	150	300	107	935	4000	150	15	1.7	2.15	16.6	17.6	800	200	600	300	150	2.0	11.0

THERMAL CHARACTERISTICS								
Inverter Sector								
Type	IGBT Under Chip (Max.) $R_{th(j-c)}$ °C/W	Diode Under Chip (Max.) $R_{th(j-c)}$ °C/W	Contact Thermal Resistance $R_{th(c-f)}$ °C/W	Weight Grams	Outline Drawings Number	Page
NX-Series Chopper IGBTs								
CM150EXS-24S	0.13	0.23	0.025	210	43	A-41
CM200EXS-24S	0.10	0.19	0.025	210	43	A-41
CM300EXS-24S	0.066	0.12	0.025	210	43	A-41
NX-Series 6-Pac IGBTs								
CM75TX-24S	0.25	0.4	0.015	300	13	A-30
CM100TX-24S1	0.24	0.37	0.015	330	52	A-45
CM150TX-24S1	0.16	0.26	0.015	330	52	A-45

NX-Series Chopper IGBTs
CM150EXS-24S, CM200EXS-24S,
CM300EXS-24S

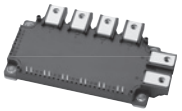


NX-Series 6-Pac IGBTs
CM75TX-24S, CM100TX-24S1, CM150TX-24S1



1200V Standard Frequency Application IGBTs, Up to 20kHz

NX-Series 7-Pac IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)



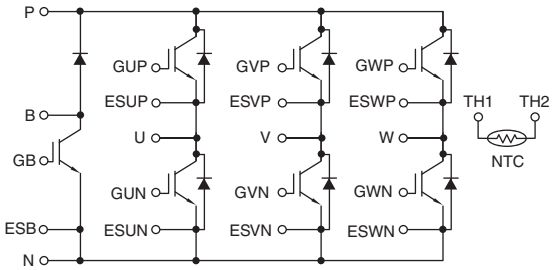
CM75RX-24S,
CM100RX-24S1,
CM150RX-24S1

MAXIMUM RATINGS												ELECTRICAL CHARACTERISTICS										FREE-WHEEL DIODE		
Inverter Sector							Brake Sector					Static				Dynamic								
												Test Conditions		Typ.	Max.	Switching Energy		Inductive Load Switching Times						
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	P_d Watts	V_{RMS} Isolation Volts	V_{CES} Volts	I_C@T_C' Amperes	I_{CM}@T_C' Amperes	T_C' °C	P_d Watts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	$E_{(on)}$ mJ	$E_{(off)}$ mJ	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	E_{rr} mJ
NX-Series 7-Pac IGBTs																								
CM75RX-24S	1200	75	150	121	600	2500	1200	50	100	125	425	75	15	1.7	2.15	7.3	8.0	300	200	600	300	75	1.7	6.9
CM100RX-24S1	1200	100	200	107	625	4000	1200	50	100	113	340	100	15	1.7	2.15	5.9	9.7	300	200	600	300	100	2.0	9.7
CM150RX-24S1	1200	150	300	107	935	4000	1200	75	150	109	480	150	15	1.7	2.15	16.6	17.6	800	200	600	300	150	2.0	11.0

THERMAL CHARACTERISTICS								
	Inverter Sector		Brake Sector					
Type	IGBT Under Chip (Max.) $R_{th(j-c)}$ °C/W	Diode Under Chip (Max.) $R_{th(j-c)}$ °C/W	IGBT Under Chip (Max.) $R_{th(j-c)}$ °C/W	Diode Under Chip (Max.) $R_{th(j-c)}$ °C/W	Contact Thermal Resistance $R_{th(c-f)}$ °C/W	Weight Grams	Outline Drawings Number	Page
NX-Series 7-Pac IGBTs								
CM75RX-24S	0.25	0.40	0.35	0.63	0.015	370	11	A-29
CM100RX-24S1	0.24	0.37	0.44	0.66	0.015	370	53	A-45
CM150RX-24S1	0.16	0.26	0.31	0.47	0.015	370	53	A-45

NX-Series 7-Pac IGBTs

CM75RX-24S, CM100RX-24S1, CM150RX-24S1



1200V High Frequency Application IGBTs, 30kHz to 70kHz

NFH-Series & NFJ-Series Dual & NFH-Series Chopper IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)


CM100DU-24NFH,
CM150DU-24NFH


CM200DU-24NFH,
CM300DU-24NFH

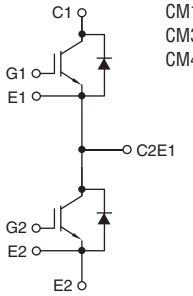

CM300DY-24NFH,
CM300E3Y6-24NFH,
CM400E3Y6-24NFH


CM300DX1-24NFJ


CM400DU-24NFH,
CM400DU-24NFJ,
CM600DU-24NFH

MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS												FREE WHEEL DIODE			THERMAL CHARACTERISTICS				Outline Drawings	
					Static				Dynamic																
					Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times							IGBT (Max.)	Diode (Max.)	Contact Thermal Resistance				
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	Weight Grams	Number	Page
NFH-Series & NFJ-Series Dual IGBTs																									
CM100DU-24NFH	1200	100	200	2500	100	15	5.0	6.5	16	1.3	0.3	100	50	250	150	100	3.5	150	0.22	0.47	0.17	310	18	A-32
CM150DU-24NFH	1200	150	300	2500	150	15	5.0	6.5	24	2.0	0.45	150	80	400	150	150	3.5	150	0.19	0.35	0.13	310	18	A-32
CM200DU-24NFH	1200	200	400	2500	200	15	5.0	6.5	32	2.7	0.6	300	80	500	150	200	3.5	250	0.15	0.24	0.095	400	19	A-32
CM300DU-24NFH	1200	300	600	2500	300	15	5.0	6.5	47	4.0	0.9	300	80	500	150	300	3.5	250	0.11	0.18	0.066	400	19	A-32
CM300DY-24NFH	1200	300	600	2500	300	15	5.0	6.5	47	4.0	0.9	300	80	500	150	600	3.5	250	0.066	0.1	0.040	400	6	A-27
CM300DX1-24NFJ	1200	300	300	2500	300	15	5.0	6.5	47	5.6	1.1	300	80	500	150	300	3.0	150	0.66	0.93	0.15	330	10	A-29
CM400DU-24NFH	1200	400	800	2500	400	15	5.0	6.5	63	5.3	1.2	300	100	500	150	400	3.5	250	0.12	0.23	0.051	580	24	A-34
CM400DU-24NFJ	1200	400	800	2500	400	15	5.0	6.5	63	5.3	1.2	300	100	500	150	400	5.5	100	0.51	0.093	0.02	580	24	A-34
CM600DU-24NFH	1200	600	1200	2500	600	15	5.0	6.5	95	8.0	1.8	400	120	700	150	600	3.5	250	0.083	0.15	0.034	580	24	A-34
NFH-Series Chopper IGBTs																									
CM300E3Y6-24NFH	1200	300	600	2500	300	15	5.0	6.5	47	4.0	0.9	300	80	500	150	600	2.8	100	0.071	0.411	0.020	400	6	A-27
CM400E3Y6-24NFH	1200	400	800	2500	400	15	5.0	6.5	63	5.3	1.2	300	100	500	150	800	2.8	100	0.057	0.098	0.020	400	6	A-27

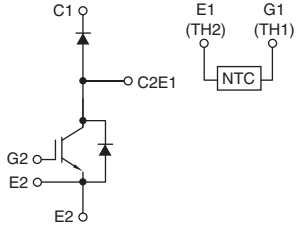
NFH-Series & NFJ-Series Dual IGBTs



CM100DU-24NFH, CM150DU-24NFH, CM200DU-24NFH,
CM300DU-24NFH, CM300DY-24NFH, CM300DX1-24NFJ,
CM400DU-24NFH, CM400DU-24NFJ, CM600DU-24NFH

NFH-Series Chopper IGBTs

CM300E3Y6-24NFH, CM400E3Y6-24NFH



1700V IGBTs

A-Series Single & Dual, S-Series Dual IGBTs,

(Refer to device datasheets at www.pwrx.com for test conditions.)

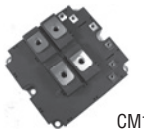

CM500HA-34A


CM75DY-34A,
CM100DY-34A,
CM150DY-34A


CM200DY-34A


CM300DY-34A

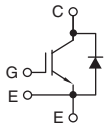

CM400DY-34A


CM1200DC-34S

MAXIMUM RATINGS (IGBT Inverter Sector)						ELECTRICAL CHARACTERISTICS											FREE-WHEEL DIODE			THERMAL CHARACTERISTICS					Weight	Outline Drawings	
						Static				Dynamic			Inductive Load Switching Times							IGBT (Max.)	Diode (Max.)	IGBT Under Chip (Max.)	Diode Under Chip (Max.)	Contact Thermal Resistance			
						Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V										$R_{th(j-c)}$	$R_{th(j-c)}$	$R_{th(j-c)}$	$R_{th(j-c)}$	$R_{th(c-f)}$			
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ µs	t_r µs	$t_{d(off)}$ µs	t_f µs	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	°C/W	°C/W	°C/W	°C/W	°C/W	Grams	Number	Page
A-Series Single IGBT																											
CM500HA-34A	1700	500	1000	87	3500	500	15	2.2	2.8	120.0	14.0	2.6	900	500	1200	250	500	3.2	650	—	—	0.025	0.042	0.015	480	29	A-36
A-Series Dual IGBTs																											
CM75DY-34A	1700	75	150	111	3500	75	15	2.2	2.8	18.5	2.1	0.4	200	150	550	350	75	3.0	300	—	—	0.16	0.29	0.022	310	20	A-33
CM100DY-34A	1700	100	200	108	3500	100	15	2.2	2.8	24.7	2.8	0.53	200	150	550	350	100	3.0	300	—	—	0.13	0.21	0.022	310	20	A-33
CM150DY-34A	1700	150	300	112	3500	150	15	2.2	2.8	37.0	4.2	0.8	550	190	750	350	150	3.0	450	—	—	0.078	0.15	0.02	310	20	A-33
CM200DY-34A	1700	200	400	109	3500	200	15	2.2	2.8	49.4	5.6	1.06	550	190	750	350	200	3.0	450	—	—	0.063	0.11	0.02	400	21	A-33
CM300DY-34A	1700	300	600	108	3500	300	15	2.2	2.8	74.0	8.4	1.6	600	200	850	350	300	3.0	450	—	—	0.043	0.072	0.02	580	22	A-33
CM400DY-34A	1700	400	800	107	3500	400	15	2.2	2.8	98.8	11.2	2.12	600	230	1000	350	400	3.0	500	—	—	0.033	0.055	0.014	1200	9	A-28
S-Series Dual IGBT																											
CM1200DC-34S	1700	1200	2400	110	4000	1200	15	1.95	2.7	216.0	8.0	1.6	0.6	0.16	1.2	0.1	1200	2.3	0.2	0.0185	0.042	—	—	0.016	800	28	A-35

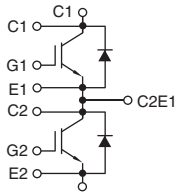
A-Series Single IGBT

CM500HA-34A



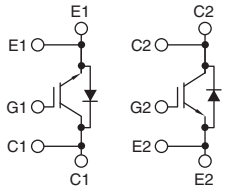
A-Series Dual IGBTs

CM75DY-34A, CM100DY-34A, CM150DY-34A,
CM200DY-34A, CM300DY-34A, CM400DY-34A



S-Series Dual IGBT

CM1200DC-34S



1700V IGBTs

MPD S-Series Dual & MPD NF-Series Chopper IGBTs,

(Refer to device datasheets at www.pwrx.com for test conditions.)

CM1000DUC-34SA,
CM1000E3U-34NF

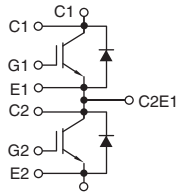
CM1800DY-34S

MAXIMUM RATINGS (IGBT Inverter Sector)						ELECTRICAL CHARACTERISTICS											FREE-WHEEL DIODE			THERMAL CHARACTERISTICS					Weight	Outline Drawings	
						Static				Dynamic										IGBT (Max.)	Diode (Max.)	IGBT Under Chip (Max.)	Diode Under Chip (Max.)	Contact Thermal Resistance			
						Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times														
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ µs	t_r µs	$t_{d(off)}$ µs	t_f µs	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(c-f)}$ °C/W	Grams	Number	Page
MPD S-Series Dual IGBT																											
CM1000DUC-34SA	1700	1000	2000	125	4000	1000	15	1.9	2.4	260.0	27.0	5.0	900	350	1250	400	1000	4.0	400	0.015	0.024	—	—	0.060	1450	23	A-34
CM1800DY-34S	1700	1800	3600	66	3500	1800	15	2.1	2.6	460.0	48.0	8.0	1100	200	950	500	1800	2.0	350	0.016	0.027	—	—	0.038	2000	38	A-39

MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS												FREE-WHEEL DIODE			THERMAL CHARACTERISTICS				Weight	Outline Drawings	
					Static				Dynamic											Interface Per Module	IGBT (Max.)	Diode (Max.)				
					Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times														
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ µs	t_r µs	$t_{d(off)}$ µs	t_f µs	I_{FM} Amperes	V_{FM} Volts	t_{rr} µs	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	Grams	Number	Page
MPD NF-Series Chopper IGBT																									
CM1000E3U-34NF	1700	1000	2000	3500	1000	15	2.45	2.80	220	25.0	4.7	0.6	0.15	0.9	0.2	2000	3.0	0.45	0.012	0.014	0.023	1400	23	A-34

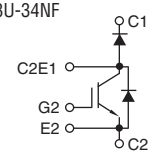
MPD S-Series Dual IGBT

CM1000DUC-34SA,
CM1800DY-34S



MPD NF-Series Chopper IGBT

CM1000E3U-34NF



1700V IGBTs

NX-Series Dual & Chopper IGBTs,

(Refer to device datasheets at www.pwrx.com for test conditions.)

CM150DX-34SA, CM200DX-34SA, CM300DX-34SA, CM450DX-34SA

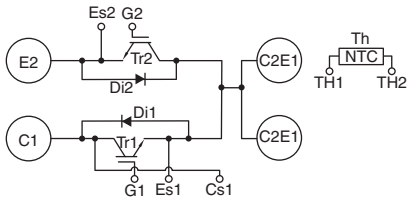
CM450DXL-34S, CM600DXL-34S

CM200EXS-34SA

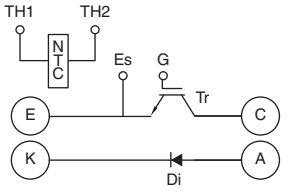
MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS											FREE-WHEEL DIODE		
Inverter Sector						Static				Dynamic									
						Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times						
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns
NX-Series Dual IGBTs																			
CM150DX-34SA	1700	150	300	125	4000	150	15	1.9	2.4	26	1.1	0.26	400	100	700	600	150	4.0	300
CM200DX-34SA	1700	200	400	125	4000	200	15	1.9	2.4	35	1.5	0.35	400	100	700	600	200	4.0	300
CM300DX-34SA	1700	300	600	125	4000	300	15	1.9	2.4	52	2.2	0.52	400	100	700	600	300	4.0	300
CM450DX-34SA	1700	450	900	125	4000	450	15	2.25	2.9	79	8.0	1.36	300	120	350	120	450	3.8	100
CM450DXL-34SA	1700	450	900	125	4000	450	15	1.9	2.4	119	9.8	2.2	900	150	900	400	450	2.6	300
CM600DXL-34SA	1700	600	1200	125	4000	600	15	1.9	2.4	158	13.0	2.9	900	150	900	400	600	2.6	300
NX-Series Chopper IGBT																			
CM200EXS-34SA	1700	200	400	125	4000	200	15	2.2	2.7	35	1.5	0.35	400	100	700	600	400	4.0	300

THERMAL CHARACTERISTICS							
Inverter Sector					Outline Drawings		
Type	IGBT Under Chip (Max.) $R_{th(j-c)}$ °C/W	Diode Under Chip (Max.) $R_{th(j-c)}$ °C/W	Contact Thermal Resistance $R_{th(c-f)}$ °C/W	Weight Grams	Number	Page	
NX-Series Dual IGBTs							
CM150DX-34SA	0.1	0.16	0.015	350	44	A-42	
CM200DX-34SA	0.075	0.12	0.015	350	44	A-42	
CM300DX-34SA	0.05	0.08	0.015	350	44	A-42	
CM450DX-34SA	0.05	0.08	0.015	330	44	A-42	
CM450DXL-34SA	0.034	0.052	0.007	690	39	A-39	
CM600DXL-34SA	0.026	0.039	0.007	690	39	A-39	
NX-Series Chopper IGBT							
CM200EXS-34SA	0.075	0.12	0.025	210	43	A-41	

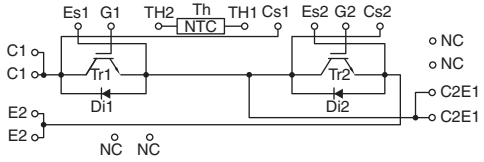
NX-Series Dual IGBTs
CM150DX-34SA, CM200DX-34SA, CM300DX-34SA, CM450DX-34SA



NX-Series Chopper IGBT
CM200EXS-34S



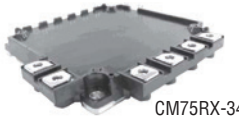
CM450DXL-34SA, CM600DXL-34SA



1700V IGBTs

NX-Series 7-Pac IGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

CM75RX-34SA



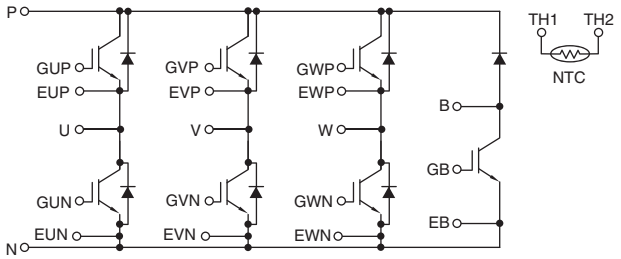
CM150RXL-34SA

MAXIMUM RATINGS											ELECTRICAL CHARACTERISTICS												FREE-WHEEL DIODE		
	Inverter Sector					Brake Sector					Static				Dynamic										
											Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times						
Type	V_{CES} Volts	I_C@T_C' Amperes	I_{CM} Amperes	T_C' °C	V_{RMS} Isolation Volts	V_{CES} Volts	I_C@T_C' Amperes	I_{CM}@T_C' Amperes	T_C' °C	P_d Watts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns
7-Pac IGBTs																									
CM75RX-34SA	1700	75	150	125	4000	1700	50	100	125	600	75	15	1.9	2.4	20.0	1.6	0.36	200	100	700	600	75	2.6	200
CM150RXL-34SA	1700	150	300	125	4000	1700	75	150	125	830	150	15	2.0	2.5	40.0	3.3	0.73	400	100	700	600	150	2.7	200

THERMAL CHARACTERISTICS								
	Inverter Sector		Brake Sector					
	IGBT Under Chip (Max.)	Diode Under Chip (Max.)	IGBT Under Chip (Max.)	Diode Under Chip (Max.)	Contact Thermal Resistance		Outline Drawings	
Type	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(c-f)}$ °C/W	Weight Grams	Number	Page
7-Pac IGBTs								
CM75RX-34SA	0.18	0.27	0.25	0.35	0.015	370	12	A-30
CM150RXL-34SA	0.1	0.16	0.18	0.27	0.007	690	42	A-41

7-Pac IGBTs

CM75RX-34SA, CM150RXL-34SA



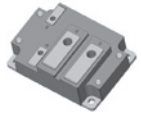
1700V HVIGBTs

Single, Dual, & Chopper HVIGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

CM1800HC-34N, CM1200E4C-34N, CM2400HC-34N

CM1800HCB-34N

CM1200DB-34N, CM1200DC-34N

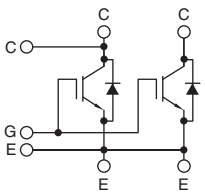


QIS1760002, QIS1790001

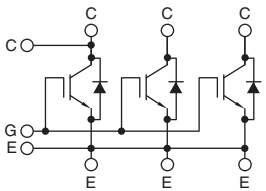
MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS											FREE-WHEEL DIODE			THERMAL CHARACTERISTICS					
					Static				Dynamic										Interface Per Module	IGBT (Max.)	Diode (Max.)			
					Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times												
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ µs	t_r µs	$t_{d(off)}$ µs	t_f µs	I_{FM} Amperes	V_{FM} Volts	t_{rr} µs	$R_{th(c-f)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawings Number	Page
1700V Single HVIGBTs																								
CM800HA-34H	1700	800	1600	4000	800	15	2.75	3.58	93	13.3	5.1	1.2	1.5	2.0	0.6	800	3.12	2.0	0.012	0.015	0.048	1500	26	A-35
CM1200HA-34H	1700	1200	2400	4000	1200	15	2.75	3.58	140	20.0	7.6	1.2	1.5	2.0	0.6	1200	3.12	2.0	0.008	0.010	0.032	1500	26	A-35
CM1800HC-34N	1700	1800	3600	4000	1800	15	2.15	—	264	14.4	4.2	1.0	0.35	2.0	0.25	1800	2.4	1.0	0.011	0.013	0.028	800	27	A-35
CM1800HCB-34N	1700	1800	3600	4000	1800	15	2.0	—	352	19.2	5.6	0.95	0.3	1.6	0.25	1800	2.35	1.2	0.007	0.009	0.013	1500	30	A-36
CM2400HC-34N	1700	2400	4800	4000	2400	15	2.15	—	352	19.2	5.6	1.0	0.35	2.0	0.25	2400	2.4	1.0	0.008	0.0098	0.021	800	27	A-35
CM2400HCB-34N	1700	2400	4800	4000	2400	15	2.1	—	396	21.6	6.3	0.95	0.3	1.6	0.25	2400	2.5	1.2	0.006	0.008	0.012	1500	30	A-36
QIS1760002	1700	600	1200	3500	600	15	2.0	2.5	104	4.4	1.04	TBD	TBD	TBD	TBD	600	—	0.3	0.015	0.026	0.038	600	56	A-46
QIS1790001	1700	900	1800	3500	900	15	2.0	2.5	156	6.6	1.56	0.4	0.1	0.7	0.6	900	—	0.3	0.015	0.018	0.028	600	56	A-46
1700V Dual HVIGBTs																								
CM600DY-34H	1700	600	1200	4000	600	15	2.75	3.58	70	10.0	3.8	1.2	1.5	2.0	0.6	600	3.12	2.0	0.016	0.02	0.064	1500	31	A-36
CM800DZ-34H	1700	800	1600	4000	800	15	2.80	3.64	72	9.0	3.6	1.6	2.0	2.7	0.8	800	3.38	2.7	0.020	0.025	0.043	1500	31	A-36
CM1200DB-34N	1700	1200	2400	4000	1200	15	2.15	2.80	176	9.6	2.8	1.0	0.4	1.2	0.3	1200	2.3	1.0	0.016	0.018	0.04	1300	28	A-35
CM1200DC-34N	1700	1200	2400	4000	1200	15	2.15	—	125	12.5	2.1	1.2	0.3	1.8	0.4	1200	2.3	2.0	0.008	0.0195	0.04	1000	28	A-35
1700V Chopper HVIGBTs																								
CM600E2Y-34H	1700	600	1200	4000	600	15	2.75	3.58	70	10.0	3.8	1.2	1.5	2.0	0.6	600	3.25	2.0	0.016	0.02	0.064	1500	32	A-37
CM1200E4C-34N	1700	1200	2400	4000	1200	15	2.15	2.80	176	9.6	2.8	0.8	0.4	1.2	0.3	1200	2.6	1.0	0.016	0.019	0.042	800	27	A-35

1700V Single HVIGBTs

CM800HA-34H, CM1200HA-34H, CM1800HC-34N, CM2400HC-34N



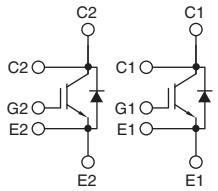
CM1800HCB-34N, CM2400HCB-34N



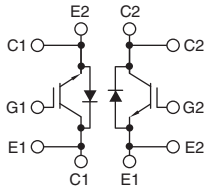
QIS1760002, QIS1790001

1700V Dual HVIGBTs

CM600DY-34H, CM800DZ-34H

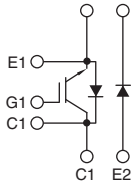


CM1200DB-34N, CM1200DC-34N

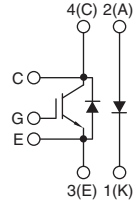


1700V Chopper HVIGBTs

CM600E2Y-34H



CM1200E4C-34N



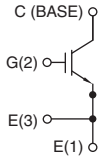
2500V IGBT, (Refer to device datasheets at www.pwrx.com for test conditions.)

QIS2510001

MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS												FREE-WHEEL DIODE			THERMAL CHARACTERISTICS		Weight	Outline Drawings	
						Static Test Conditions		T_j = 25°C		Dynamic											IGBT (Max.)	Diode (Max.)			
								Typ.	Max.	V_{GE} = 0V, f = 1KHz				Resistive Load Switching Times											
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	$T_{j(MAX)}$ °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CES\ (SAT)}$ Volts	$V_{CES\ (SAT)}$ Volts	$V_{CE(SAT)}$ Test Cond.	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	Grams	Number	Page
2500V Single IGBT																									
QIS2510001	2500	100	200	150	TBD	100	15	3.2	4.2	10	10	1.1	0.33	TBD	TBD	TBD	TBD	—	—	—	0.10 Typ.	—	21	46	A-42

2500V Single IGBT

QIS2510001



3300 Volt HVIGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)


CM400HG-66H


CM400DY-66H


CM800HB-66H

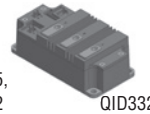

CM800HC-66H, CM1000HC-66R


CM1200HG-66H


CM1500HG-66R


CM800E2C-66H, CM800E6C-66H, CM1000E4C-66R, CM1200HC-66H, CM1500HC-66R

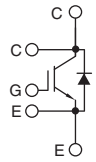

QID3310005, QID3320002


QID3320004

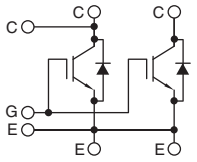
MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS												FREE-WHEEL DIODE			THERMAL CHARACTERISTICS					
					Static				Dynamic											Interface Per Module	IGBT (Max.)	Diode (Max.)			
					Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times													
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ µs	t_r µs	$t_{d(off)}$ µs	t_f µs	I_{FM} Amperes	V_{FM} Volts	t_{rr} µs	$R_{th(c-f)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawings Number	Page
3300V Single HVIGBTs																								
CM400HG-66H	3300	400	800	10200	400	15	3.3	4.2	60	6.0	5.4	1.6	1.0	2.5	1.0	400	3.6	1.4	0.018	0.030	0.060	520	35	A-38
CM800HB-66H	3300	800	1600	6000	800	15	3.8	4.94	120	12.0	3.6	1.6	2.0	2.5	1.0	800	3.64	1.4	0.008	0.012	0.024	1500	33	A-37
CM800HC-66H	3300	800	1600	6000	800	15	3.3	4.2	120	12.0	3.6	1.6	1.0	2.5	1.0	800	2.8	1.4	0.008	0.013	0.025	1000	41	A-40
CM1000HC-66R	3300	1000	2000	6000	1000	15	2.45	—	140	8.7	4.0	1.0	0.28	2.7	0.3	2000	2.15	0.5	0.009	0.012	0.0225	900	41	A-40
CM1200HC-66H	3300	1200	2400	6000	1200	15	3.3	4.29	180	18.0	5.4	1.6	2.0	2.5	1.0	1200	3.64	1.4	0.008	0.010	0.020	2200	30	A-36
CM1200HG-66H	3300	1200	2400	10200	1200	15	3.3	4.2	180	18.0	5.4	1.6	1.0	2.5	1.0	1200	3.6	1.4	0.006	0.010	0.020	1350	36	A-38
CM1500HC-66R	3300	1500	3000	6000	1500	15	—	5.0	210	13.0	6.0	1.0	0.25	2.7	0.3	1500	2.15	0.55	0.008	—	0.015	1200	30	A-36
CM1500HG-66R	3300	1500	3000	10200	1500	—	2.15	—	210	13.0	6.0	1.0	0.28	2.7	0.3	1500	2.15	0.50	0.006	0.0085	0.0155	1400	14	A-31
3300V Dual HVIGBTs																								
QID3310005	3300	100	200	9000	100	15	2.7	3.3	12	0.8	0.35	0.8	0.16	3.2	1.3	200	—	0.5	0.018	0.150	0.22	900	37	A-38
QID3320002	3300	200	400	9000	200	15	2.7	3.3	23	1.5	0.7	0.8	0.16	3.2	1.3	200	—	0.85	0.018	0.074	0.11	900	37	A-38
QID3320004	3300	200	400	6000	200	15	2.7	3.0	23	1.5	0.7	0.8	0.16	3.2	1.3	400	—	0.85	0.018	0.060	0.096	800	51	A-44
QID3340001	3300	400	800	6000	400	15	2.7	3.3	46	3.0	1.3	1.0	0.28	2.7	0.3	800	—	0.7	0.010	0.036	0.0675	900	57	A-46
QID3350001	3300	500	1000	6000	500	15	2.7	2.85	58	3.6	1.6	1.1	0.31	3.0	0.33	1000	—	0.7	0.008	0.0275	0.052	900	57	A-46
3300V Split Dual HVIGBT																								
CM400DY-66H	3300	400	800	6000	400	15	4.4	5.72	40	4.0	1.2	1.0	2.0	2.0	1.0	400	4.29	1.2	0.016	0.036	0.072	1500	34	A-37
3300V Chopper HVIGBTs																								
CM800E2C-66H	3300	800	1600	6000	800	15	3.8	4.94	120	12.0	3.6	1.6	2.0	2.5	1.0	800	3.8	1.4	0.008	0.013	0.025	1500	30	A-36
CM800E6C-66H	3300	800	1600	6000	800	15	3.3	4.2	120	12.0	3.6	1.6	1.0	2.5	1.0	800	2.8	1.4	0.008	0.013	0.025	1500	30	A-36
CM1000E4C-66R	3300	1000	2000	6000	1000	15	2.45	—	140	8.7	4.0	1.0	0.28	2.7	0.3	2000	2.15	0.5	0.007	0.012	0.0225	1200	30	A-36

3300V Single HVIGBTs

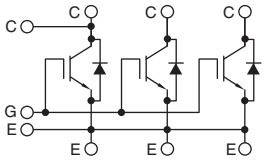
CM400HG-66H



CM800HB-66H, CM800HC-66H, CM1000HC-66R

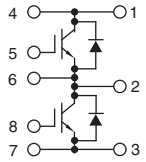


CM1200HC-66H, CM1200HG-66H, CM1500HC-66R, CM1500HG-66R

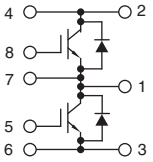


3300V Dual HVIGBTs

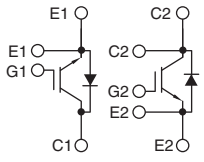
QID3310005, QID3320002



QID3320004

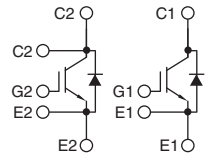


QID3340001, QID3350001



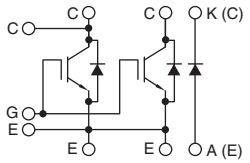
3300V Split Dual HVIGBT

CM400DY-66H



3300V Chopper HVIGBTs

CM800E2C-66H, CM800E6C-66H, CM1000E4C-66R



4500V HVIGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)

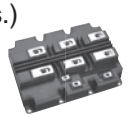

CM400HB-90H, CM600HB-90H


CM600HG-90H


CM800HC-90R


CM800HG-90R


CM900HB-90H, CM900HC-90H


CM900HG-90H


CM1200HC-90R


CM1200HG-90R


QID4515001, QID4515002, QID4520002, QIF4515002


QID4515004

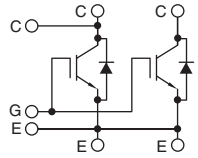

QIS4506001


QIS4506002

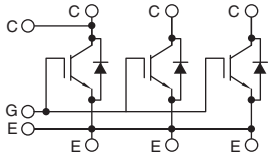
MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS											FREE-WHEEL DIODE			THERMAL CHARACTERISTICS				
					Static				Dynamic										Interface Per Module	IGBT (Max.)	Diode (Max.)		
					Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V, f = 1mHz			Inductive Load Switching Times											
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ µs	t_r µs	$t_{d(off)}$ µs	t_f µs	I_{FM} Amperes	V_{FM} Volts	t_{rr} µs	$R_{th(c-f)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawings Number Page
4500V Single HVIGBTs																							
QIS4506001	4500	60	120	TBD	60	6.0	3.0	3.9	9.0	0.65	0.2	2.40	2.40	6.0	1.2	—	—	—	—	0.10 Typ.	—	21	46 A-42
QIS4506002	4500	60	120	TBD	60	6.0	3.0	3.9	9.0	0.65	0.2	2.40	2.40	6.0	1.2	—	—	—	—	0.10 Typ.	—	21	47 A-43
CM400HB-90H	4500	400	800	6000	400	5.0	3.0	3.9	72	5.30	1.6	2.40	2.40	6.0	1.2	400	4.0	1.8	0.015	0.023	0.045	1500	33 A-37
CM600HB-90H	4500	600	1200	6000	600	15	3.0	3.9	108	8.00	2.4	2.40	2.40	6.0	1.2	600	4.0	1.8	0.010	0.015	0.030	1500	33 A-37
CM600HG-90H	4500	600	1200	10,200	600	15	3.45	—	108	8.00	2.4	2.40	1.20	6.0	1.2	600	4.8	1.8	0.009	0.016	0.033	1000	40 A-40
CM800HC-90R	4500	800	1600	6000	800	15	3.5	5.1	117	7.30	3.3	0.95	0.3	3.6	0.4	800	2.5	0.7	0.009	0.015	0.029	900	15 A-31
CM800HG-90R	4500	800	1600	10,200	800	15	3.5	—	117	7.30	3.3	1.00	0.28	3.6	0.35	1600	2.5	0.7	0.009	0.016	0.0295	900	45 A-42
CM900HG-90H	4500	900	1800	10,200	900	15	3.45	—	162	12.0	3.6	2.40	1.20	6.0	1.2	1800	4.8	—	0.006	0.011	0.022	1350	36 A-38
CM900HB-90H	4500	900	1800	6000	900	15	3.0	3.9	162	12.0	3.6	2.40	2.40	6.0	1.2	900	4.0	1.8	0.007	0.010	0.020	2200	30 A-36
CM900HC-90H	4500	900	1800	6000	900	15	3.0	3.9	162	12.0	3.6	2.40	2.40	6.0	1.2	900	4.0	1.8	—	—	—	2200	30 A-36
CM1200HC-90R	4500	1200	2400	6000	1200	15	3.5	—	175	11.0	5.0	1.00	0.30	6.25	0.4	2400	2.6	0.7	0.006	0.095	0.0185	1200	17 A-32
CM1200HG-90R	4500	1200	2400	10,200	1200	15	3.3	—	180	12.0	6.0	0.95	0.25	5.8	0.4	1200	2.6	0.9	0.006	0.010	0.019	1400	14 A-31
4500V Dual HVIGBTs																							
QID4515001	4500	150	300	9000	150	15	3.5	3.9	18	1.33	0.4	1.50	0.50	3.5	1.2	300	—	1.8	0.018	0.087	0.174	900	37 A-38
QID4515002	4500	150	300	9000	150	15	3.8	—	19	1.22	0.55	1.00	0.30	3.6	0.36	300	—	0.7	0.018	0.083	0.157	900	37 A-38
QID4515004	4500	150	300	6000	150	15	3.8	—	19	1.22	0.55	1.00	0.30	3.6	0.36	300	—	0.7	0.018	0.079	0.149	800	51 A-44
QID4520002	4500	200	400	9000	200	15	3.5	—	29	1.83	0.83	1.00	0.30	3.6	0.36	400	—	0.7	0.018	0.055	0.104	900	37 A-38
4500V Dual Common Collector HVIGBT																							
QIF4515002	4500	150	300	9000	150	15	3.8	—	19	1.22	0.55	1.00	0.30	3.6	0.36	150	—	0.7	0.018	0.083	0.157	900	37 A-38

4500V Single HVIGBTs

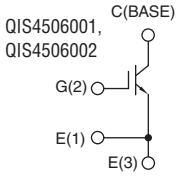
CM400HB-90H, CM600HB-90H, CM600HG-90H, CM800HC-90R, CM800HG-90R



CM900HB-90H, CM900HC-90H, CM900HG-90H, CM1200HC-90R, CM1200HG-90R

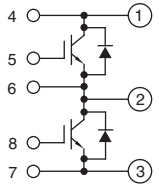


QIS4506001, QIS4506002

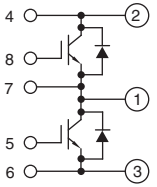


4500V Dual HVIGBTs

QID4515001, QID4515002, QID4520002

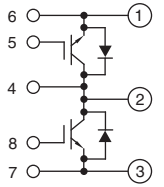


QID4515004



4500V Dual Common Collector HVIGBT

QIF4515002



6500V HVIGBTs, (Refer to device datasheets at www.pwrx.com for test conditions.)


CM400HG-130H


CM400E2G-130H,
CM400E4G-130H,
CM600HG-130H


CM750HG-130R

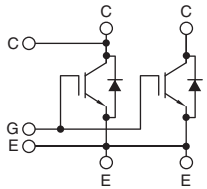

CM200HG-130H


QIS6502002

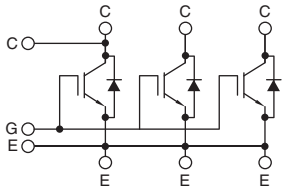

QIC6508001,
QID6508001

MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS											FREE-WHEEL DIODE			THERMAL CHARACTERISTICS					
					Static				Dynamic															
					Test Conditions		Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V			Inductive Load Switching Times							Interface Per Module	IGBT (Max.)	Diode (Max.)			
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CE(SAT)}$ Volts	$V_{CE(SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ µs	t_r µs	$t_{d(off)}$ µs	t_f µs	I_{FM} Amperes	V_{FM} Volts	t_{rr} µs	$R_{th(c-f)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawings Number	Page
6500V Single HVIGBTs																								
QIS6502002	6500	25	50	—	25	15	4.2	—	6.28	0.38	0.06	0.64	0.27	1.54	0.62	—	—	—	0.10	0.140	—	20	47	A-43
CM200HG-130H	6500	200	400	10200	200	15	5.10	—	41	2.5	0.7	1.20	0.35	6.6	3.3	200	4.0	2.4	0.018	0.042	0.066	800	35	A-38
CM400HG-130H	6500	400	800	10200	400	15	4.50	—	82	5.0	1.4	1.20	0.35	8.2	0.5	400	4.0	1.0	0.009	0.021	0.033	1000	40	A-40
CM600HG-130H	6500	600	1200	10200	600	15	5.10	—	124	7.6	2.2	1.20	0.35	4.5	4.5	600	3.8	2.4	0.006	0.014	0.024	1500	36	A-38
CM750HG-130R	6500	750	1500	10200	750	15	3.30	—	140	6.0	2.4	1.15	0.20	8.3	0.5	750	2.8	0.8	0.006	0.012	0.024	1400	14	A-31
6500V Dual HVIGBT																								
QID6508001	6500	85	170	9000	85	15	3.8	—	15	0.95	0.44	TBD	TBD	TBD	TBD	170	—	0.7	0.018	0.100	0.175	900	37	A-38
6500V Dual Common Emitter HVIGBTs																								
QIC6508001	6500	85	170	9000	85	15	3.8	—	15	0.95	0.44	TBD	TBD	TBD	TBD	170	—	0.7	0.018	0.100	0.175	900	37	A-38
6500V Chopper HVIGBTs																								
CM400E2G-130H	6500	400	800	10200	400	15	4.50	—	82	5.0	1.4	1.20	0.35	8.2	0.5	800	4.0	1.0	0.009	0.021	0.033	1350	36	A-38
CM400E4G-130H	6500	400	800	10200	400	15	4.50	—	82	5.0	1.4	1.20	0.35	8.2	0.5	800	4.0	1.0	0.009	0.021	0.033	1350	36	A-38

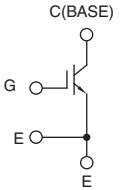
6500V Single HVIGBTs
CM400HG-130H



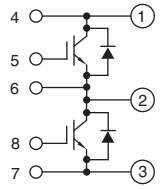
CM200HG-130H, CM600HG-130H, CM750HG-130R



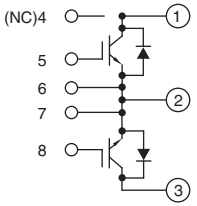
QIS6502002



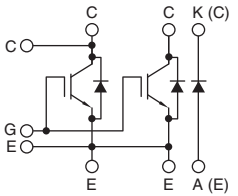
6500V Dual HVIGBT
QID6508001



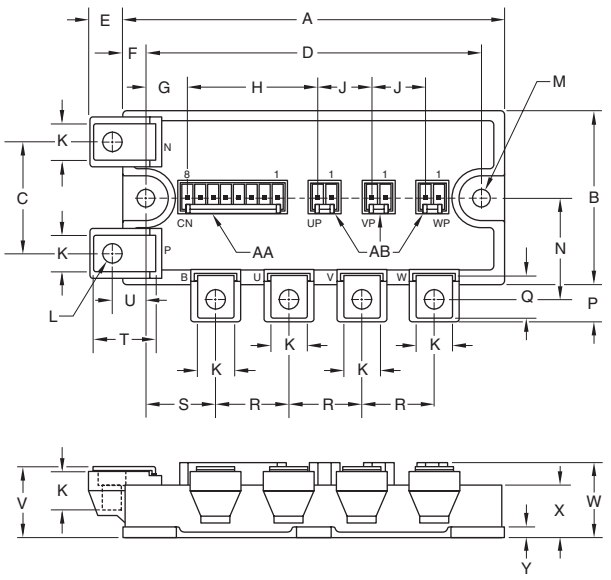
6500V DualCommon Emitter HVIGBT
QIC6508001



6500V Chopper HVIGBTs
CM400E2G-130H, CM400E4G-130H



1 CM50RL-24NF, CM50TL-24NF, CM75TL-12NF, CM150TL-12NF

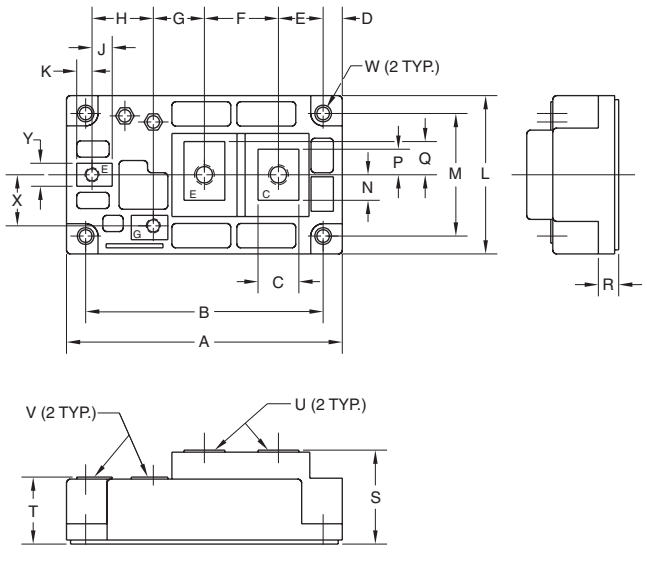


Dim.	Inches	Millimeters
A	4.72	120.0
B	2.17	55.0
C	1.39	35.0
D	4.17±0.02	106.0±0.5
E	0.43	11.0
F	0.28	7.0
G	0.54	13.62
H	1.61	40.78
J	0.67	17.0
K	0.47	12.0
L	M5 Metric	M5
M	0.22 Dia.	5.5 Dia.

Dim.	Inches	Millimeters
N	1.23	32.0
P	0.47	11.75
Q	0.53	13.5
R	0.91	23.0
S	0.87	22.0
T	0.76	19.75
U	0.42	10.75
V	0.87+0.04/-0.02	22.0+1.0/-0.5
W	0.91	23.2
X	0.63	16.0
Y	0.12	3.0

Housing Types (J.S.T. Mfg. Co. Ltd.)
AA – B8P-VH-FB-B
AB – B2P-VH-FB-B

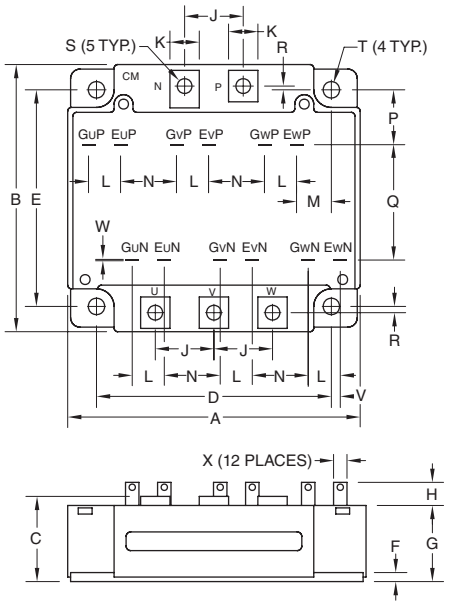
2 CM600HA-5F



Dim.	Inches	Millimeters
A	4.25	108.0
B	3.66	93.0
C	0.63	16.0
D	0.30	7.5
E	0.69	17.5
F	1.14	29.0
G	0.79	20.0
H	0.94	24.0
J	0.31	7.9
K	0.24	6.0
L	2.44	62.0
M	1.89	48.0

Dim.	Inches	Millimeters
N	0.39	10.0
P	0.39	10.0
Q	0.51	13.0
R	0.33	8.5
S	1.42	36.0
T	1.02	25.8
U	M6 Metric	M6
V	M4 Metric	M4
W	0.22 Dia.	5.5 Dia.
X	0.79	20.0
Y	0.35	9.0

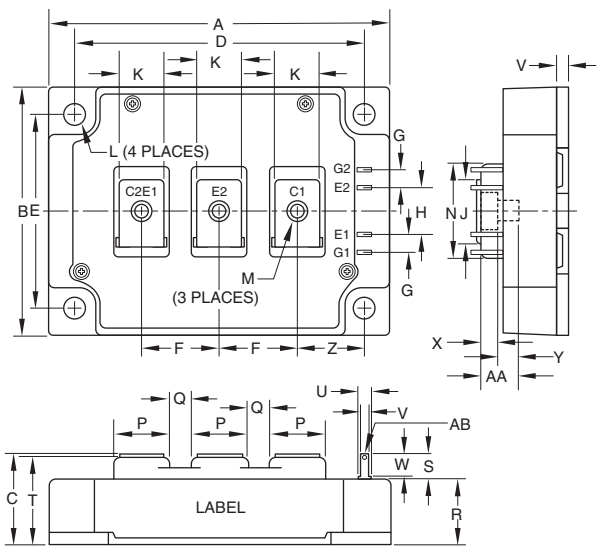
3 CM200TU-5F



Dim.	Inches	Millimeters
A	4.21	107.0
B	4.02	102.0
C	1.14 +0.04/-0.02	29.0 +1.0/-0.5
D	3.54±0.01	90.0±0.25
E	3.15±0.01	80.0±0.25
F	0.16	4.0
G	1.02	26.0
H	0.31	8.1
J	0.91	23.0
K	0.47	12.0
L	0.43	11.0

Dim.	Inches	Millimeters
M	0.57	14.4
N	0.85	21.7
P	0.67	17.0
Q	1.91	48.5
R	0.15	3.75
S	M5	M5
T	0.22 Dia.	5.5 Dia.
U	0.02	0.5
V	0.03	0.8
W	0.02	0.5
X	0.110	2.8

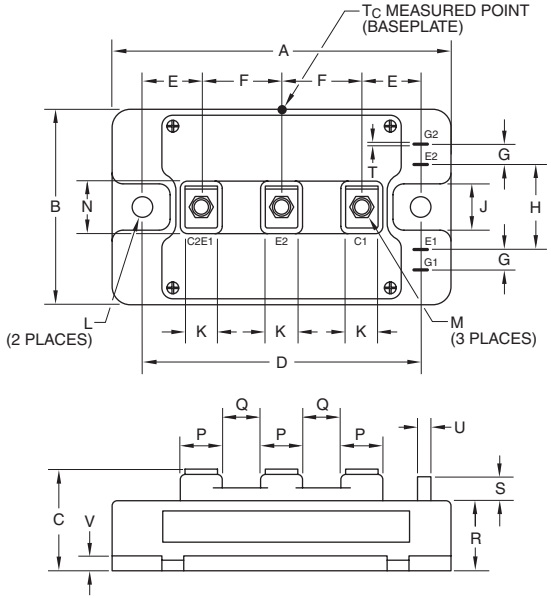
4 CM400C1Y-24S



Dim.	Inches	Millimeters
A	4.33	110.0
B	3.15	80.0
C	1.14+0.04/-0.02	29.0+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	2.44±0.01	62.0±0.25
F	0.98	25.0
G	0.24	6.0
H	0.59	15.0
J	0.81	20.5
K	0.55	14.0
L	0.26 Dia.	6.5 Dia.
M	M6 Metric	M6
N	1.18	30.0

Dim.	Inches	Millimeters
P	0.71	18.0
Q	0.28	7.0
R	0.84	21.2
S	0.33	8.5
T	1.10	28.0
U	0.16	4.0
V	0.11	2.8
W	0.29	7.5
X	0.21	5.3
Y	0.26	6.7
Z	0.85	21.5
AA	0.47	12.0
AB	t = 0.02	t = 0.5

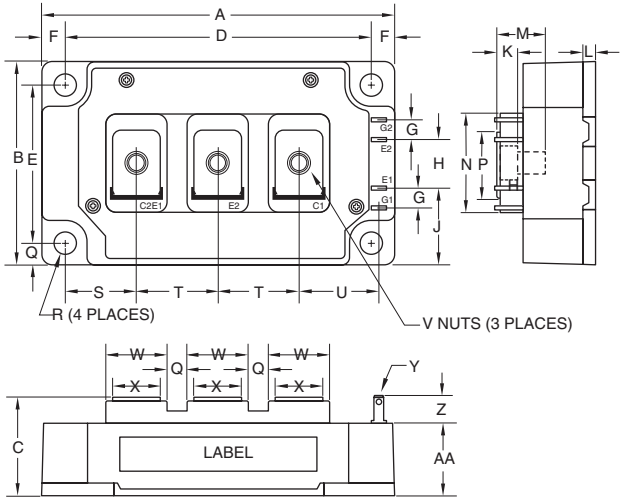
5 CM100DY-24NF, CM150DY-12NF, CM200DY-12NF, CM300DY-12NF



Dim.	Inches	Millimeters
A	3.70	94.0
B	1.89	48.0
C	1.14+0.04/-0.02	29.0+1.0/-0.5
D	3.15±0.01	80.0±0.25
E	0.67	17.0
F	0.91	23.0
G	0.16	4.0
H	0.71	18.0
J	0.51	13.0
K	0.47	12.0

Dim.	Inches	Millimeters
L	0.26 Dia.	6.5 Dia.
M	M5 Metric	M5
N	0.79	20.0
P	0.63	16.0
Q	0.28	7.0
R	0.83	21.2
S	0.30	7.5
T	0.02	0.5
U	0.110	2.8
V	0.16	4.0

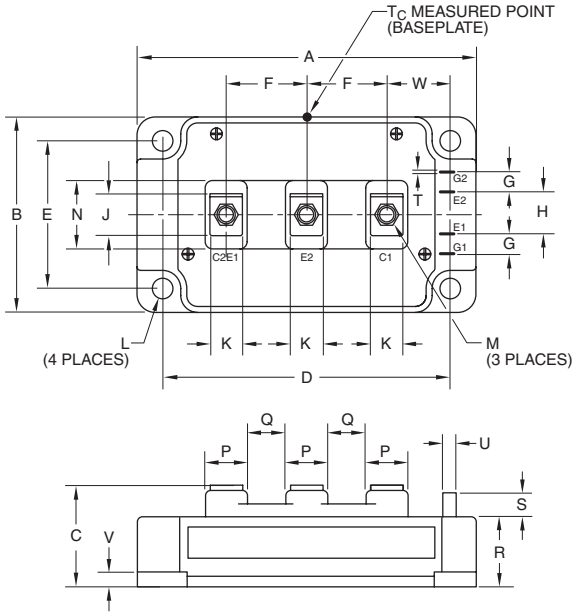
6 CM300DY-24S, CM300DY-24NFH, CM300E3Y6-24NFH, CM400DY-12NF, CM400E3Y6-24NFH



Dim.	Inches	Millimeters
A	4.25	108.0
B	2.44	62.0
C	1.18+0.4/-0.02	30.0+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	1.89±0.01	48.0±0.25
F	0.29	7.5
G	0.24	6.0
J	0.689	17.5
H	0.59	15.0
K	0.244	6.2
L	0.16	4.0
M	0.56	14.2
N	1.18	30.0

Dim.	Inches	Millimeters
P	0.79	20.0
Q	0.28	7.0
R	0.26 Dia.	6.5 Dia.
S	0.85	21.5
T	0.98	25.0
U	0.94	24.0
V	M6 Metric	M6
W	0.71	18.0
X	0.55	14.0
Y	0.02	0.5
Z	0.33	8.5
AA	0.87	22.2

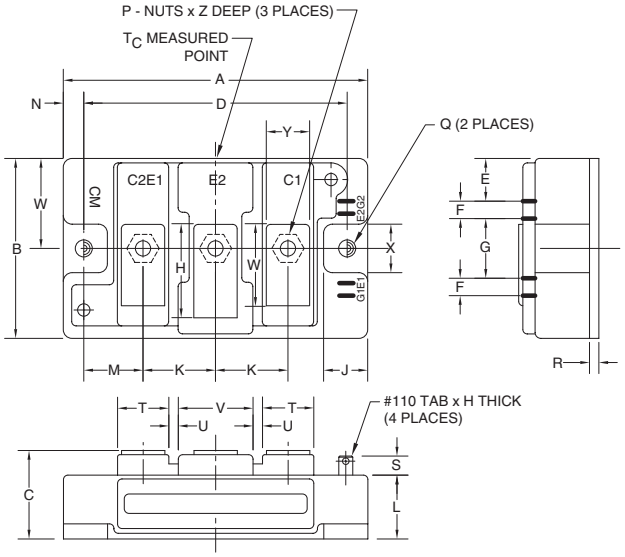
7 CM600DY-12NF



Dim.	Inches	Millimeters
A	4.33	110.0
B	3.15	80.0
C	1.14+0.04/-0.02	29.0+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	2.44±0.01	62.0±0.25
F	0.98	25.0
G	0.24	6.0
H	0.59	15.0
J	0.81	20.5
K	0.55	14.0
L	0.26 Dia.	6.5 Dia.

Dim.	Inches	Millimeters
M	M6 Metric	M6
N	1.18	30.0
P	0.71	18.0
Q	0.28	7.0
R	0.83	21.2
S	0.33	8.5
T	0.02	0.5
U	0.110	2.8
V	0.16	4.0
W	0.85	21.5

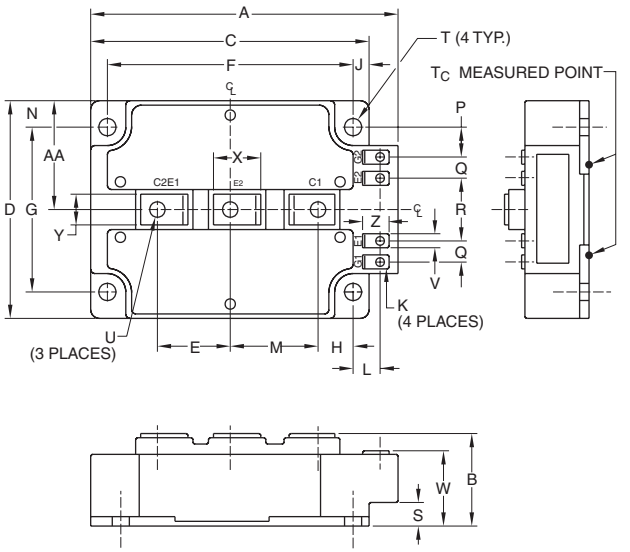
8 CM100DUS-12F, CM150DUS-12F



Dim.	Inches	Millimeters
A	3.70	94.0
B	1.89	48.0
C	1.18 +0.04/-0.02	30.0 +1.0/-0.5
D	3.15±0.01	80.0±0.25
E	0.43	11.0
F	0.16	4.0
G	0.71	18.0
H	1.06	27.0
J	0.53	13.5
K	0.91	23.0
L	0.83	21.2
M	0.67	17.0

Dim.	Inches	Millimeters
N	0.28	7.0
P	M6.5 Metric	M6.5
Q	0.26 Dia.	6.5 Dia.
R	0.02	4.0
S	0.30	7.5
T	0.63	16.0
U	0.10	2.5
V	1.0	25.0
W	0.94	24.0
X	0.51	13.0
Y	0.47	12.0
Z	0.47	12.0

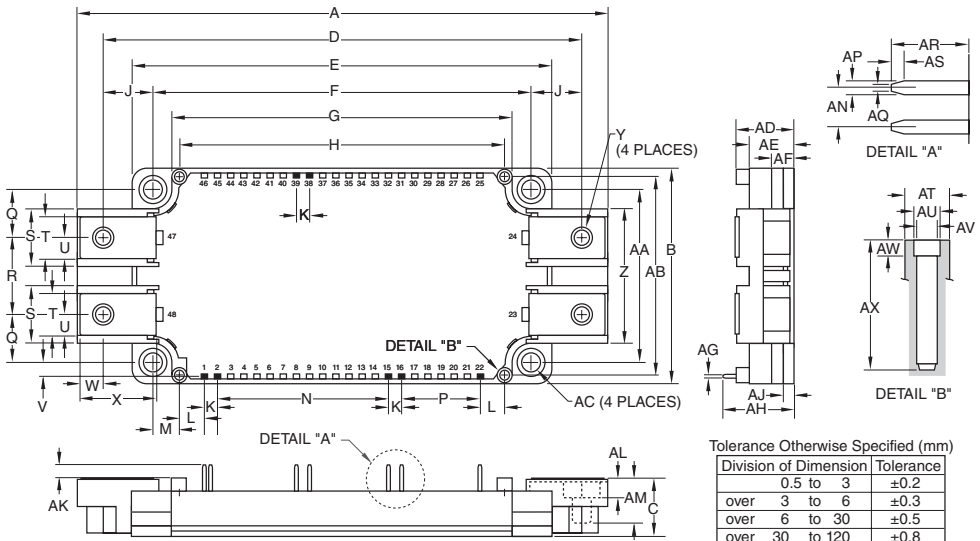
9 CM400DY-34A



Dim.	Inches	Millimeters
A	5.51	140.0
B	1.38+0.04/-0.02	35.0+1.0/-0.5
C	5.12	130.0
D	5.12	130.0
E	1.42	36.0
F	4.33±0.01	110.0±0.25
G	4.33±0.01	110.0±0.25
H	0.54	13.8
J	0.39	10.0
K	M4 Metric	M4
L	0.45	11.5
M	1.72	43.8
N	0.39	10.0

Dim.	Inches	Millimeters
P	0.80	20.4
Q	0.57	14.5
R	1.57	40.0
S	0.31	8.0
T	0.26 Dia.	6.5 Dia.
U	M8 Metric	M8
V	0.35	9.0
W	0.96+0.04/-0.02	24.5+1.0/-0.5
X	1.02	26.0
Y	0.79	20.0
Z	0.59	15.0
AA	2.56	65.0

10 CM150DX-24S, CM300DX1-24NFJ, QID0640020, QID1230015, QIS066004, QIS1260015



Tolerance Otherwise Specified (mm)

Division of Dimension	Tolerance
0.5 to 3	±0.2
over 3 to 6	±0.3
over 6 to 30	±0.5
over 30 to 120	±0.8
over 120 to 400	±1.2

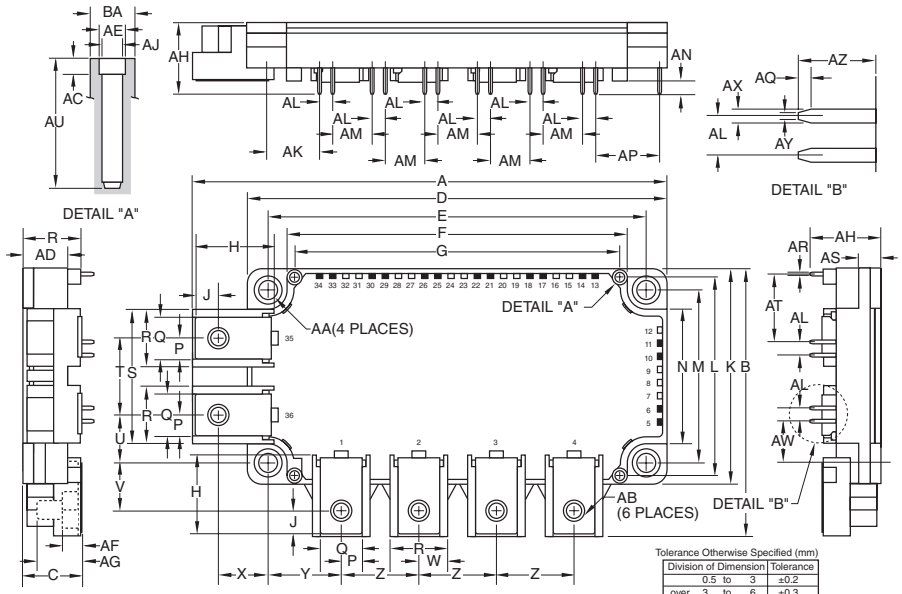
The tolerance of size between terminals is assumed to ±0.4

Dim.	Inches	Millimeters
A	5.98	152.0
B	2.44	62.0
C	0.67+0.04/-0.02	17.0+1.0/-0.5
D	5.39	137.0
E	4.79	121.7
F	4.33±0.02	110.0±0.5
G	3.89	99.0
H	3.72	94.5
J	0.53	13.5
K	0.15	3.81
L	0.28	7.25
M	0.30	7.75
N	1.95	49.53
P	0.9	22.86
Q	0.55	14.0
R	0.87	22.0

Dim.	Inches	Millimeters
S	0.67	17.0
T	0.48	12.0
U	0.24	6.0
V	0.16	4.2
W	0.37	6.5
X	0.83	21.14
Y	M6 Metric	M6
Z	1.53	39.0
AA	1.97±0.02	50.0±0.5
AB	2.26	57.5
AC	0.22 Dia.	5.5 Dia.
AD	0.67+0.04/-0.02	17.0+1.0/-0.5
AE	0.51	13.0
AF	0.27	7.0
AG	0.03	0.8

Dim.	Inches	Millimeters
AH	0.81	20.5
AJ	0.12	3.0
AK	0.14	3.5
AL	0.26	6.5
AM	0.53	13.5
AN	0.15	3.81
AP	0.05	1.15
AQ	0.025	0.65
AR	0.29	7.4
AS	0.05	1.2
AT	0.17 Dia.	4.3 Dia.
AU	0.102 Dia.	2.6 Dia.
AV	0.088 Dia.	2.25 Dia.
AW	0.12	3.0
AX	0.49	12.5

11 CM75RX-24S, CM100RX-12A, CM150RX-12A, CM200RX-12A



Tolerance Otherwise Specified (mm)

Division of Dimension	Tolerance
0.5 to 3	±0.2
over 3 to 6	±0.3
over 6 to 30	±0.5
over 30 to 120	±0.8
over 120 to 400	±1.2

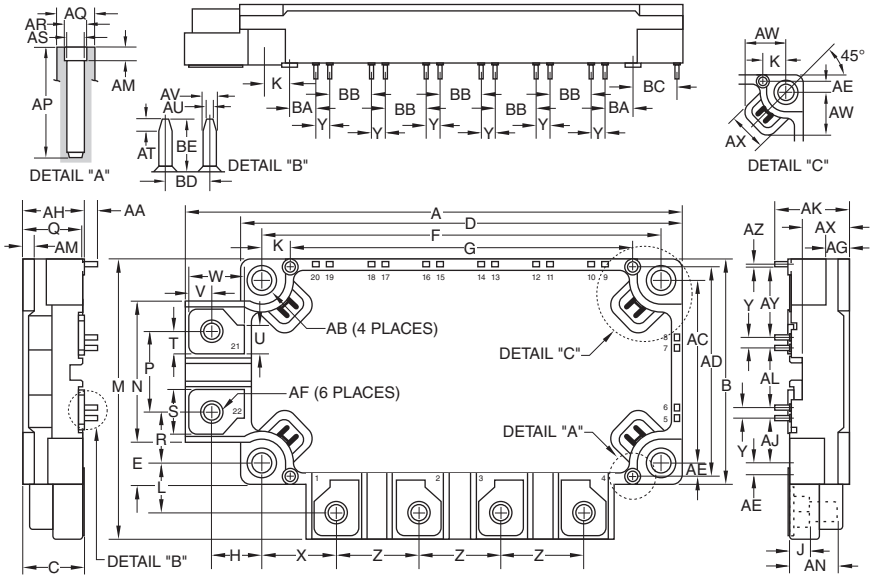
The tolerance of size between terminals is assumed to ±0.4

Dim.	Inches	Millimeters
A	5.39	136.9
B	3.03	77.1
C	0.67+0.04/-0.02	17.0+1.0/-0.5
D	4.79	121.7
E	4.33±0.02	110.0±0.5
F	3.89	99.0
G	3.72	94.5
H	0.83	21.14
J	0.37	6.5
K	2.44	62.0
L	2.26	57.5
M	1.97±0.02	50.0±0.5
N	1.53	39.0
P	0.24	6.0
Q	0.48	12.0
R	0.67	17.0
S	1.53	39.0

Dim.	Inches	Millimeters
T	0.87	22.0
U	0.55	14.0
V	0.54	13.64
W	0.33	8.5
X	0.53	13.5
Y	0.81	20.71
Z	0.9	22.86
AA	0.22 Dia.	5.5 Dia.
AB	M5 Metric	M5
AC	0.12	3.0
AD	0.51	13.0
AE	0.102 Dia.	2.6 Dia.
AF	0.21	5.4
AG	0.49	12.5
AH	0.81	20.5
AJ	0.088 Dia.	2.25 Dia.

Dim.	Inches	Millimeters
AK	0.59	15.00
AL	0.15	3.81
AM	0.45	11.43
AN	0.14	3.5
AP	0.75	19.05
AQ	0.05	1.2
AR	0.03	0.8
AS	0.27	7.0
AT	0.77	19.68
AU	0.49	12.5
AV	0.60	15.24
AW	0.46	11.66
AX	0.04	1.15
AY	0.02	0.65
AZ	0.29	7.4
BA	0.17 Dia.	4.3 Dia.

12 CM75RX-34SA

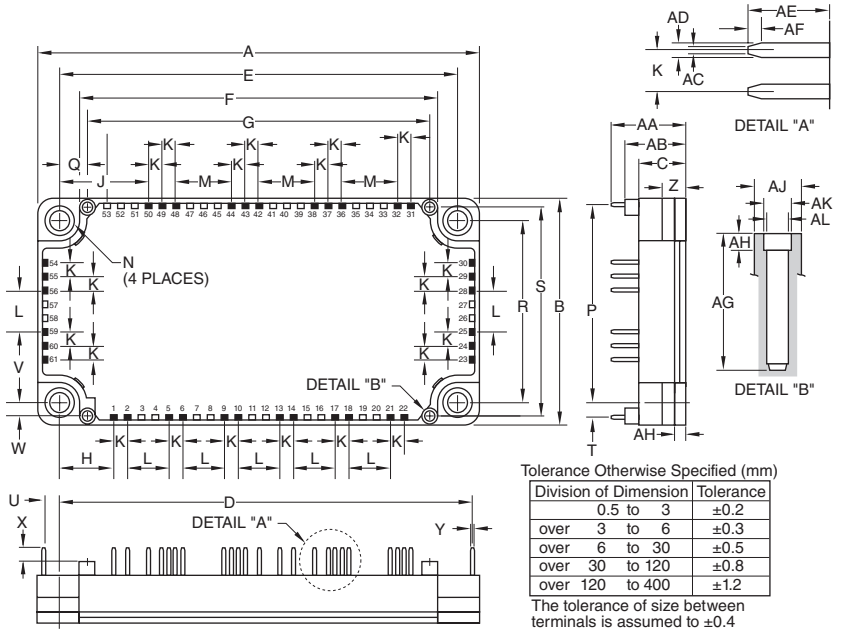


Dim.	Inches	Millimeters
A	5.39	136.9
B	2.44	62.0
C	0.67+0.04/-0.02	17.0+1.0/-0.5
D	4.79	121.7
E	0.45	11.5
F	4.33±0.02	110.0±0.5
G	3.72	94.5
H	0.53	13.5
J	0.23	5.9
K	0.30	7.75
L	0.53	13.64
M	3.02	77.1
N	1.53	39.0
P	0.87	22.0
Q	0.65	16.5
R	0.55	14.0
S	0.47	12.0
T	0.24	6.0

Dim.	Inches	Millimeters
U	0.31	8.0
V	0.37	6.5
W	0.61	15.64
X	0.81	20.71
Y	0.15±0.008	3.81±0.2
Z	0.9	22.86
AA	0.14	3.5
AB	0.22 Dia.	5.5 Dia.
AC	1.97±0.02	50.0±0.5
AD	2.26	57.5
AE	0.14	3.75
AF	M5	M5
AG	0.27	7.0
AH	0.67	17.0
AJ	0.44±0.008	11.67±0.2
AK	0.81	20.5
AL	0.60±0.008	15.24±0.2
AM	0.12	3.0

Dim.	Inches	Millimeters
AN	0.53	13.4
AP	0.49	12.5
AQ	0.18 Dia.	4.5 Dia.
AR	0.102 Dia.	2.6 Dia.
AS	0.088 Dia.	2.25 Dia.
AT	0.05	1.2
AU	0.02	0.65
AV	0.04	1.15
AW	0.54	13.7
AX	0.51	13.0
AY	0.75	19.12
AZ	0.021±0.008	0.55±0.2
BA	0.28±0.008	7.24±0.2
BB	0.43±0.008	11.42±0.2
BC	0.46±0.008	11.8±0.2
BD	0.15	3.81
BE	0.18	4.5

13 CM75TX-24S



Tolerance Otherwise Specified (mm)

Division of Dimension	Tolerance
0.5 to 3	±0.2
over 3 to 6	±0.3
over 6 to 30	±0.5
over 30 to 120	±0.8
over 120 to 400	±1.2

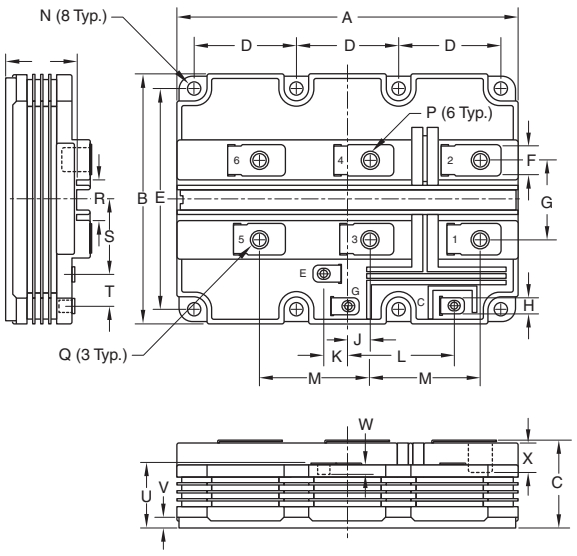
The tolerance of size between terminals is assumed to ±0.4

Dim.	Inches	Millimeters
A	4.79	121.7
B	2.44	62.0
D	4.49	114.05
E	4.33±0.02	110.0±0.5
F	3.9	99.0
G	3.72	94.5
H	0.59	15.0
J	0.96	24.52
K	0.15	3.81
L	0.45	11.43
M	0.6	15.24

Dim.	Inches	Millimeters
N	0.22 Dia.	5.5 Dia.
P	2.13	54.2
Q	0.30	7.75
R	1.97±0.02	50.0±0.5
S	2.26	57.5
T	0.165	4.2
U	0.16	4.06
V	0.46	11.66
W	0.14	3.75
X	0.14	3.5
Y	0.03	0.8
Z	0.28	7.0

Dim.	Inches	Millimeters
AA	0.81	20.5
AB	0.67	17.0
AC	0.03	0.65
AD	0.05	1.15
AE	0.29	7.4
AF	0.047	1.2
AG	0.49	12.5
AH	0.12	3.0
AJ	0.17 Dia.	4.3 Dia.
AK	0.102 Dia.	2.6 Dia.
AL	0.088 Dia.	2.25 Dia.

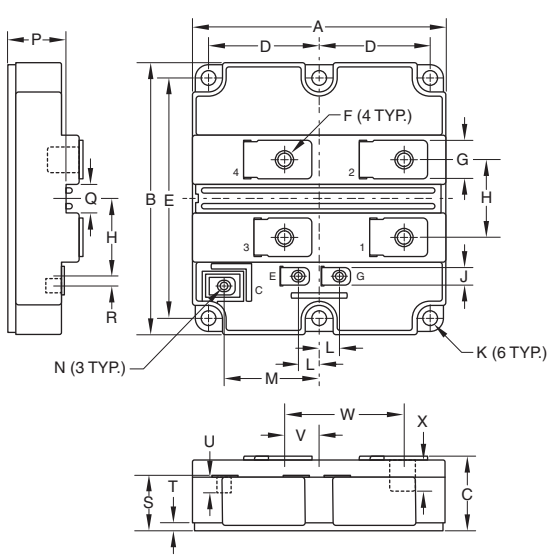
14 CM750HG-130H, CM1200HG-90R, CM1500HG-66R



Dim.	Inches	Millimeters
A	7.5±0.02	190.0±0.5
B	5.51±0.02	140.0±0.5
C	1.88+0.04/-0.02	48.0+1.0/-0.5
D	2.24±0.01	57.0±0.25
E	4.88±0.01	124.0±0.25
F	0.67+0.04/-0.02	17.0+1.0/-0.5
G	1.73±0.012	44.0±0.3
H	0.35±0.008	9.0±0.2
J	0.47±0.012	12.0±0.3
K	0.55±0.012	14.0±0.3
L	2.33±0.012	59.2±0.3

Dim.	Inches	Millimeters
M	2.42±0.012	61.2±0.3
N	0.28 Dia.	7.0 Dia.
P	M8 Metric	M8
Q	M4 Metric	M4
R	0.86±0.012	22.0±0.3
S	1.61±0.012	41.0±0.3
T	0.71±0.012	18.0±0.3
U	1.50±0.02	38.0±0.5
V	0.20±0.008	5.0±0.2
W	0.30 Min.	7.7 Min.
X	0.65 Min.	16.5 Min.

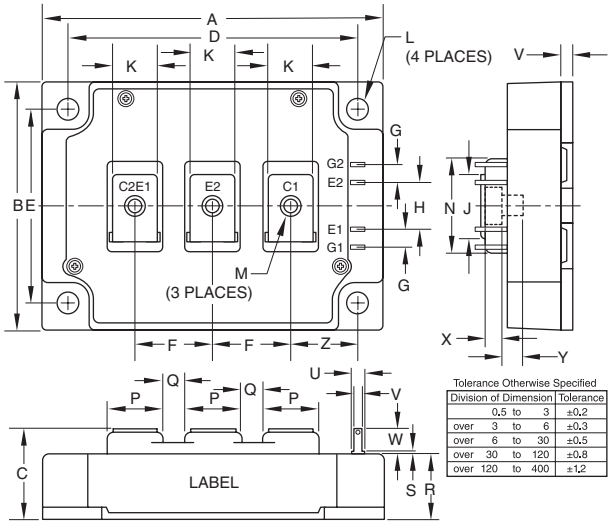
15 CM800HC-90R



Dim.	Inches	Millimeters
A	2.54±0.02	130.0±0.5
B	5.51±0.02	140.0±0.5
C	1.50+0.04/-0.02	38.0+1.0/-0.5
D	2.24±0.01	57.0±0.25
E	4.88±0.01	124.0±0.25
F	M8 Metric	M8
G	0.78±0.012	20.0±0.3
H	1.57±0.012	40.0±0.3
J	0.35±0.008	9.0±0.2
K	0.28 Dia.	7.0 Dia.
L	0.092±0.012	10.65±0.3

Dim.	Inches	Millimeters
M	1.92±0.012	48.8±0.3
N	M4 Metric	M4
P	1.16±0.02	29.5±0.5
Q	0.59±0.012	15.0±0.3
R	0.86±0.012	22.0±0.3
S	1.10±0.02	28.0±0.5
T	0.20±0.008	5.0±0.2
U	0.30 Min.	7.7 Min.
V	0.71±0.012	18.0±0.3
W	2.42±0.012	61.5±0.3
X	0.65 Min.	16.5 Min.

16 CM450DY-24S, CM600DY-24S



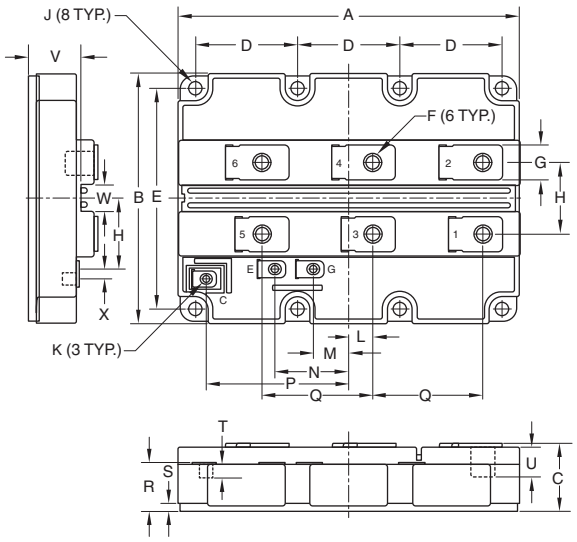
Tolerance Otherwise Specified

Division of Dimension			Tolerance
0.5	to	3	±0.2
over 3	to	6	±0.3
over 6	to	30	±0.5
over 30	to	120	±0.8
over 120	to	400	±1.2

Dim.	Inches	Millimeters
A	4.33	110.0
B	3.15	80.0
C	1.14+0.04/-0.02	29.0+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	2.44±0.01	62.0±0.25
F	0.98	25.0
G	0.24	6.0
H	0.59	15.0
J	0.81	20.5
K	0.55	14.0
L	0.26 Dia.	Dia. 6.5
M	M6 Metric	M6

Dim.	Inches	Millimeters
N	1.18	30.0
P	0.71	18.0
Q	0.28	7.0
R	0.83	21.2
S	0.33	8.5
T	0.0157	0.4
U	0.110	2.8
V	0.16	4.0
W	0.30	7.5
X	0.21	5.3
Y	0.47	12.0
Z	0.85	21.5

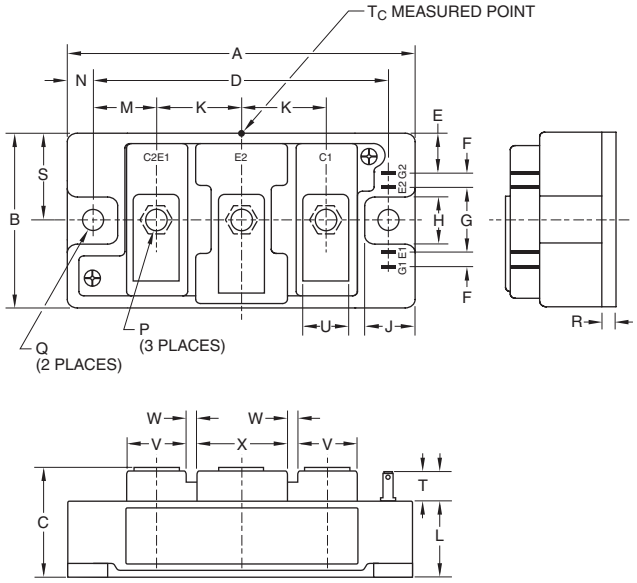
17 CM1200HC-90R



Dim.	Inches	Millimeters
A	7.5±0.02	190.0±0.5
B	5.51±0.02	140.0±0.5
C	1.50+0.04/-0.02	38.0+1.0/-0.5
D	2.24±0.01	57.0±0.25
E	4.88±0.01	124.0±0.25
F	M8 Metric	M8
G	0.78+0.04/-0.02	20.0+1.0/-0.5
H	1.57±0.012	40.0±0.3
J	0.28 Dia.	7.0 Dia.
K	M4 Metric	M4
L	0.51±0.012	13.0±0.3

Dim.	Inches	Millimeters
M	0.79±0.012	20.25±0.3
N	1.62±0.012	41.25±0.3
P	3.12±0.012	79.4±0.3
Q	2.42±0.012	61.5±0.3
R	1.10±0.02	28.0±0.5
S	0.20±0.008	5.0±0.2
T	0.30 Min.	7.7 Min.
U	0.65 Min.	16.5 Min.
V	0.20±0.008	5.0±0.2
W	0.59±0.02	15.0±0.5
X	0.20±0.012	5.2±0.3

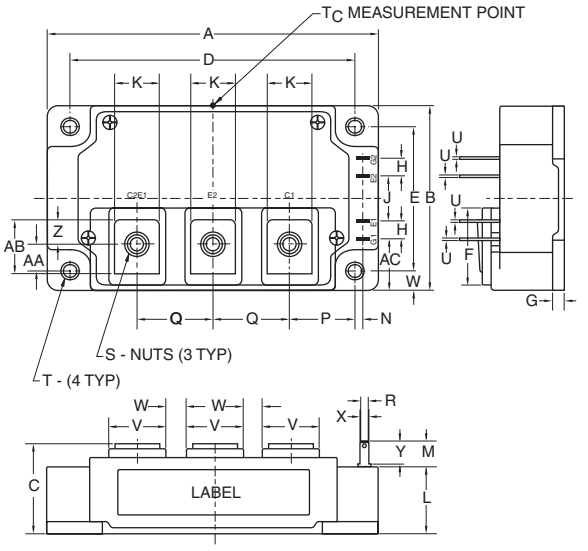
18 CM100DU-24NFH, CM150DU-24NFH, CM200DU-12NFH



Dim.	Inches	Millimeters
A	3.70	94.0
B	1.89	48.0
C	1.18+0.004/-0.02	30.0+1.0/-0.5
D	3.15±0.01	80.0±0.25
E	0.43	11.0
F	0.16	4.0
G	0.71	18.0
H	0.51	13.0
J	0.53	13.5
K	0.91	23.0
L	0.83	21.2

Dim.	Inches	Millimeters
M	0.67	17.0
N	0.28	7.0
P	M5 Metric	M5
Q	0.26 Dia.	6.5 Dia.
R	0.02	4.0
S	0.94	24.0
T	0.3	7.5
U	0.47	12.0
V	0.63	16.0
W	0.1	2.5
X	0.98	25.0

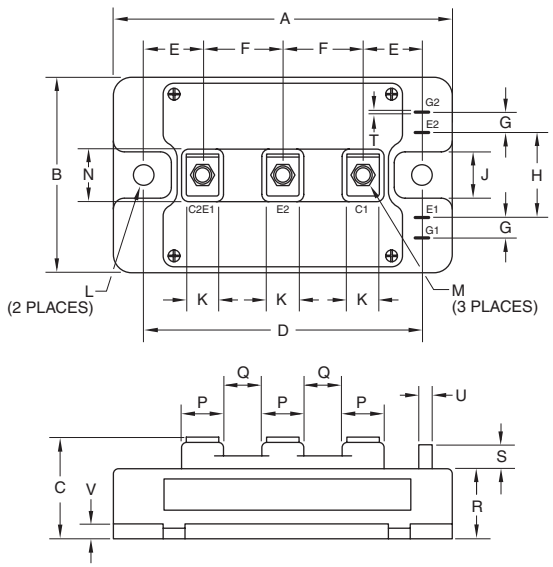
19 CM200DU-24NFH, CM300DU-12NFH, CM300DU-24NFH, CM400DU-12NFH, CM600E3U-12NFH



Dim.	Inches	Millimeters
A	4.25	108.0
B	2.44	62.0
C	1.14+0.04/-0.02	29.0+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	1.88±0.01	48.0±0.25
F	0.67	25.7
G	0.16	4.0
H	0.24	6.0
J	0.59	15.0
K	0.55	14.0
L	0.87	22.0
M	0.33	8.5
N	0.10	2.5
P	0.85	21.5

Dim.	Inches	Millimeters
Q	0.98	25.0
R	0.110	2.8
S	M6 Metric	M6
T	0.26 Dia.	6.5 Dia.
U	0.002	0.5
V	0.71	18.0
W	0.28	7.0
X	0.16	4.0
Y	0.3	7.5
Z	0.325	8.25
AA	0.624	8.85
AB	0.709	18.0
AC	0.69	17.5

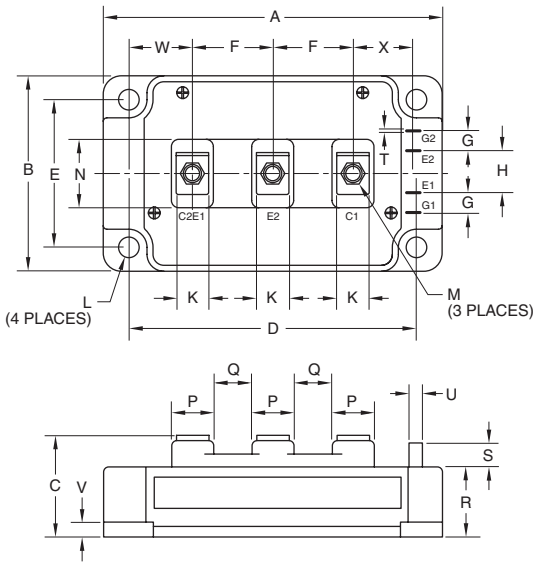
20 CM75DY-34A, CM100DY-24A, CM100DY-34A, CM150DY-34A



Dim.	Inches	Millimeters
A	3.70	94.0
B	1.89	48.0
C	1.14+0.04/-0.02	29.0+1.0/-0.5
D	3.15±0.01	80.0±0.25
E	0.67	17.0
F	0.91	23.0
G	0.16	4.0
H	0.71	18.0
J	0.51	13.0
K	0.47	12.0

Dim.	Inches	Millimeters
L	0.26 Dia.	6.5 Dia.
M	M5 Metric	M5
N	0.79	20.0
P	0.63	16.0
Q	0.28	7.0
R	0.83	21.2
S	0.30	7.5
T	0.02	0.5
U	0.110	2.8
V	0.16	4.0

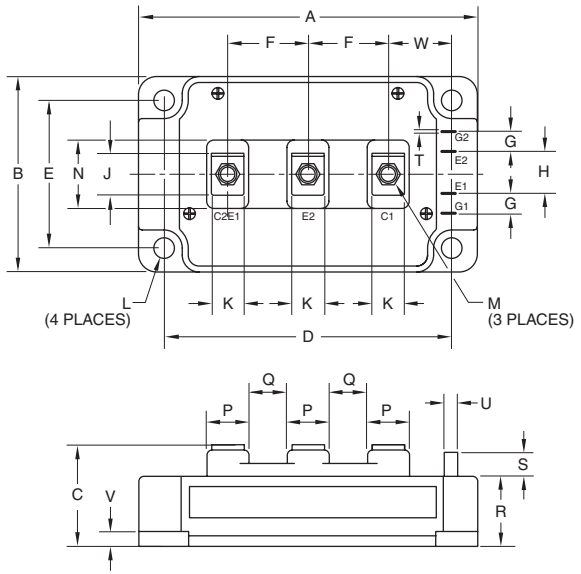
21 CM200DY-34A



Dim.	Inches	Millimeters
A	4.25	108.0
B	2.44	62.0
C	1.18+0.04/-0.02	30.0+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	1.89±0.01	48.0±0.25
F	0.98	25.0
G	0.24	6.0
H	0.59	15.0
K	0.55	14.0
L	0.26 Dia.	6.5 Dia.
M	M6 Metric	M6

Dim.	Inches	Millimeters
N	1.18	30.0
P	0.71	18.0
Q	0.28	7.0
R	0.87	22.2
S	0.33	8.5
T	0.02	0.5
U	0.110	2.8
V	0.16	4.0
W	0.85	21.5
X	0.94	24.0

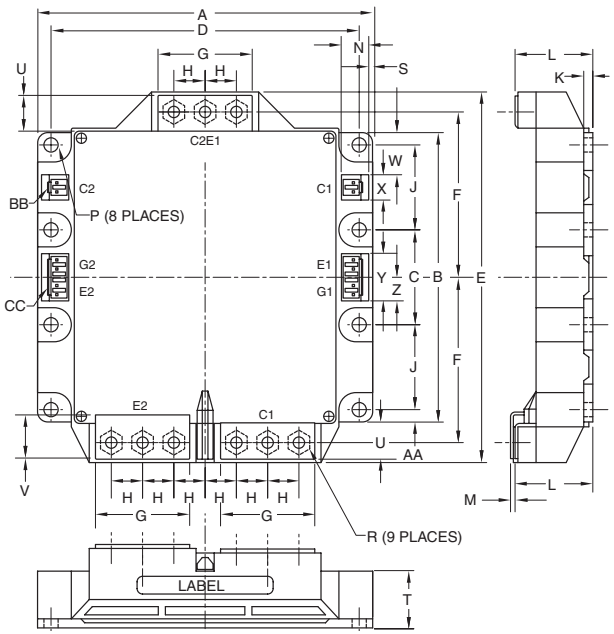
22 CM300DY-34A, CM600DY-24A



Dim.	Inches	Millimeters
A	4.33	110.0
B	3.15	80.0
C	1.14+0.04/-0.02	29.0+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	2.44±0.01	62.0±0.25
F	0.98	25.0
G	0.24	6.0
H	0.59	15.0
J	0.81	20.5
K	0.55	14.0
L	0.26 Dia.	6.5 Dia.

Dim.	Inches	Millimeters
M	M6 Metric	M6
N	1.18	30.0
P	0.71	18.0
Q	0.28	7.0
R	0.83	21.2
S	0.33	8.5
T	0.02	0.5
U	0.110	2.8
V	0.16	4.0
W	0.85	21.5

23 CM900DUC-24S, CM1000DUC-34SA, CM1000E3U-34NF, CM1400DUC-24S

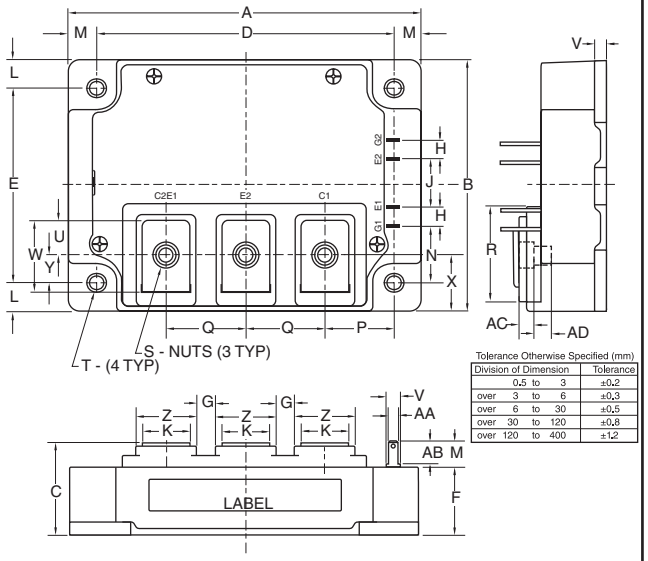


Dim.	Inches	Millimeters
A	5.91	150.0
B	5.10	129.5
C	1.67±0.01	42.5±0.25
D	5.41±0.01	137.5±0.25
E	6.54	166.0
F	2.91±0.01	74.0±0.25
G	1.65	42.0
H	0.55	14.0
J	1.50±0.01	38.0±0.25
K	0.16	4.0
L	1.36 +0.04/-0.02	34.6 +1.0/-0.5

Housing Type (J.S.T. MFG. CO. LTD)
BB = VHR-2N
CC = VHR-5N

Dim.	Inches	Millimeters
M	0.075±0.008	1.9±0.2
N	0.47	12.0
P	0.26	6.5
R	M6 Metric	M6
S	0.08	2.0
T	0.99	25.1
U	0.62	15.7
V	0.71	18.0
W	0.75	19.0
X	0.43	11.0
Y	0.83	21.0
Z	0.41	10.5
AA	0.22	5.5

24 CM400DU-24NFH, CM400DU-24NFJ, CM600DU-12NFH, CM600DU-24NFH



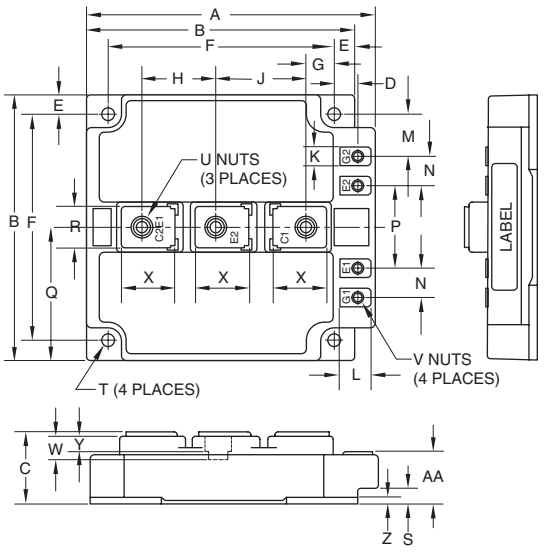
Tolerance Otherwise Specified (mm)

Division of Dimension	Tolerance
0.5 to 3	±0.2
over 3 to 6	±0.3
over 6 to 30	±0.5
over 30 to 120	±0.8
over 120 to 400	±1.2

Dim.	Inches	Millimeters
A	4.33	110.0
B	3.15	80.0
C	1.14+0.04/-0.01	29.0+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	2.44±0.01	62.0±0.25
F	0.83	21.2
G	0.28	7.0
H	0.24	6.0
J	0.59	15.0
K	0.55	14.0
L	0.35	9.0
M	0.33	8.5
N	0.69	17.5
P	0.85	21.5

Dim.	Inches	Millimeters
Q	0.98	25.0
R	1.23	31.4
S	M6 Metric	M6
T	0.26 Dia.	6.5 Dia.
U	0.4	10.0
V	0.16	4.0
W	0.87	22.2
X	0.72	18.25
Y	0.36	9.25
Z	0.71	18.0
AA	0.11	2.8
AB	0.29	7.5
AC	0.21	5.3
AD	0.47	12.0

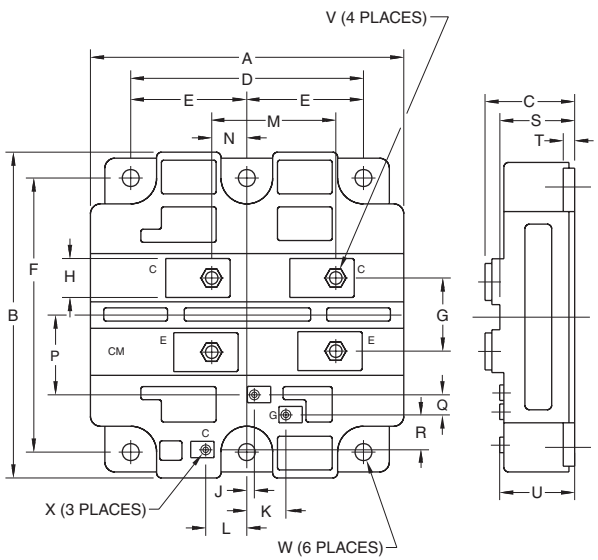
25 CM800DY-24S



Dim.	Inches	Millimeters
A	5.51	140.0
B	5.12	130.0
C	1.38+0.04/-0.02	35.0+1.0/-0.5
D	0.45	11.5
E	0.39	10.0
F	4.33±0.001	110.0±0.25
G	0.54	13.8
H	1.42	36.0
J	1.72	43.8
K	0.35	9.0
L	0.59	15.0
M	0.80	20.4
N	0.57	14.5

Dim.	Inches	Millimeters
P	1.57	40.0
Q	2.56	65.0
R	0.79	20.0
S	0.32	8.0
T	0.26 Dia.	6.5 Dia.
U	M8 Metric	M8
V	M4 Metric	M4
W	0.43	11.1
X	1.02	26.0
Y	0.29	7.3
Z	0.16	4.0
AA	0.96+0.04/-0.02	24.5+1.0/-0.5

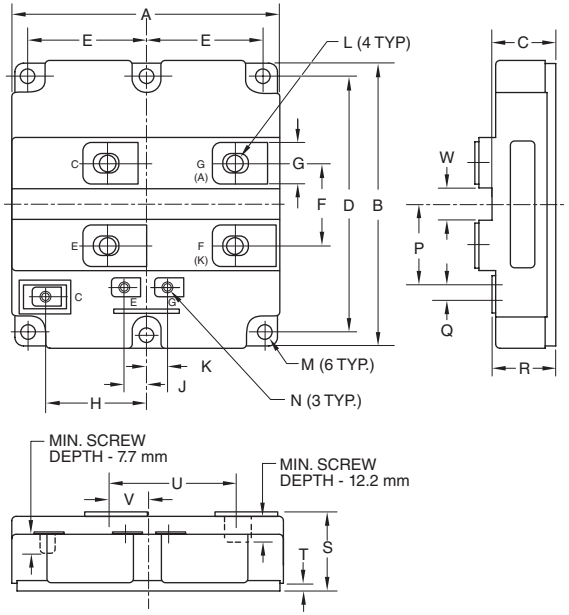
26 CM800HA-34H, CM1200HA-34H



Dim.	Inches	Millimeters
A	5.12	130.0
B	5.51	140.0
C	1.50+0.04/-0	38.0+1.0/-0
D	4.49	114.0
E	2.24±0.01	57.0±0.25
F	4.88±0.01	124.0±0.25
G	1.18	30.0
H	0.79	20.0
J	0.10	2.5
K	0.73	18.5
L	0.65	16.5

Dim.	Inches	Millimeters
M	2.42	61.5
N	0.71	18.0
P	1.38	35.0
Q	0.43	11.0
R	0.57	14.5
S	1.24	31.5
T	0.20	5.0
U	1.10+0.04/-0	28.0+1.0/-0
V	M8 Metric	M8
W	0.28 Dia.	7.0 Dia.
X	M4 Metric	M4

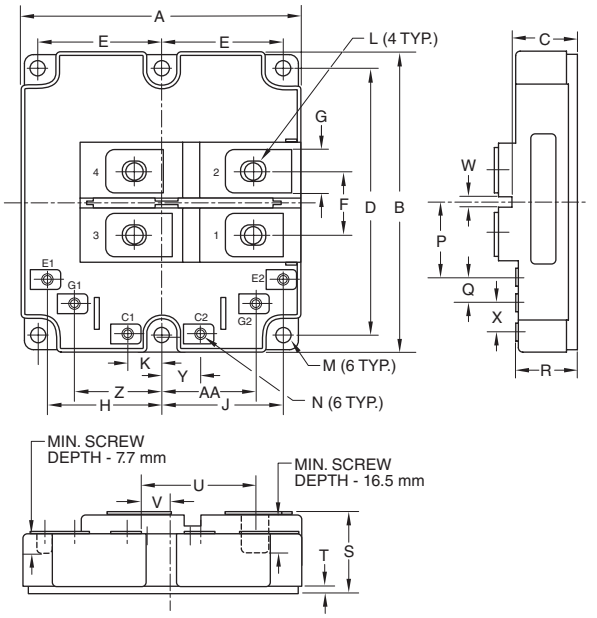
27 CM1200E4C-34N, CM1800HC-34N, CM2400HC-34N



Dim.	Inches	Millimeters
A	5.12±0.02	130.0±0.5
B	5.51±0.02	140.0±0.5
C	1.16±0.02	29.5±0.5
D	4.88±0.004	124.0±0.1
E	2.24±0.004	57.0±0.1
F	1.57±0.008	40.0±0.2
G	0.79±0.004	20.0±0.1
H	1.92±0.008	48.8±0.2
J	0.42±0.008	10.65±0.2
K	0.41±0.008	10.35±0.2
L	M8 Metric	M8

Dim.	Inches	Millimeters
M	0.28 Dia.	7.0 Dia.
N	M4 Metric	M4
P	1.57±0.008	40.0±0.2
Q	0.25±0.008	5.2±0.2
R	0.10+0.039/-0.0	28.0+1.0/-0.0
S	1.45+0.039/-0.0	38.0+1.0/-0.0
T	0.20±0.008	5.0±0.2
U	2.42±0.012	61.5±0.3
V	0.71±0.008	18.0±0.2
W	0.59±0.008	15.0±0.2

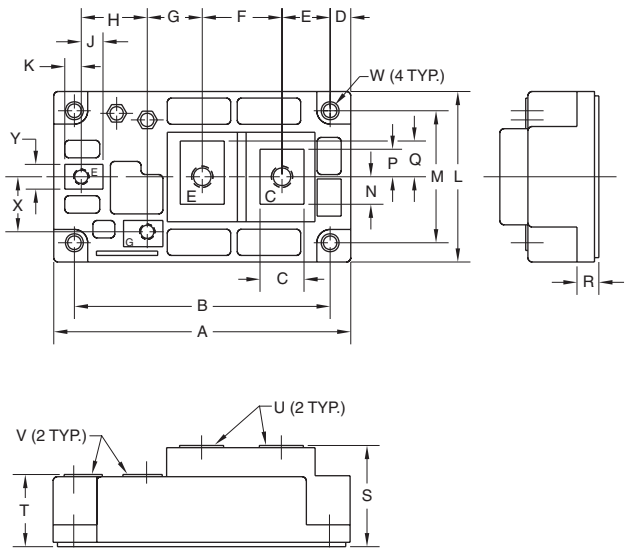
28 CM1200DC-34S, CM1200DB-34N, CM1200DC-34N



Dim.	Inches	Millimeters
A	5.12±0.02	130.0±0.5
B	5.51±0.02	140.0±0.5
C	1.16±0.02	29.5±0.5
D	4.88±0.009	124.0±0.25
E	2.24±0.009	57.0±0.25
F	1.18±0.008	30.0±0.2
G	0.79±0.004	20.0±0.1
H	2.09±0.008	53.0±0.2
J	2.24±0.008	57.0±0.2
K	0.63±0.008	16.0±0.2
L	M8 Metric	M8
M	0.28 Dia.	7.0 Dia.
N	M4 Metric	M4

Dim.	Inches	Millimeters
P	1.38±0.008	35.0±0.2
Q	0.2±0.008	5.0±0.2
R	0.10+0.039/-0.0	28.0+1.0/-0.0
S	1.45+0.039/-0.0	38.0+1.0/-0.0
T	0.20±0.008	5.0±0.2
U	2.17±0.012	55.2±0.3
V	0.466±0.008	11.85±0.2
W	0.2±0.008	5.0±0.2
X	0.55±0.008	14.0±0.2
Y	0.71±0.008	18.0±0.2
Z	1.57±0.008	40.0±0.2
AA	1.73±0.008	44.0±0.2

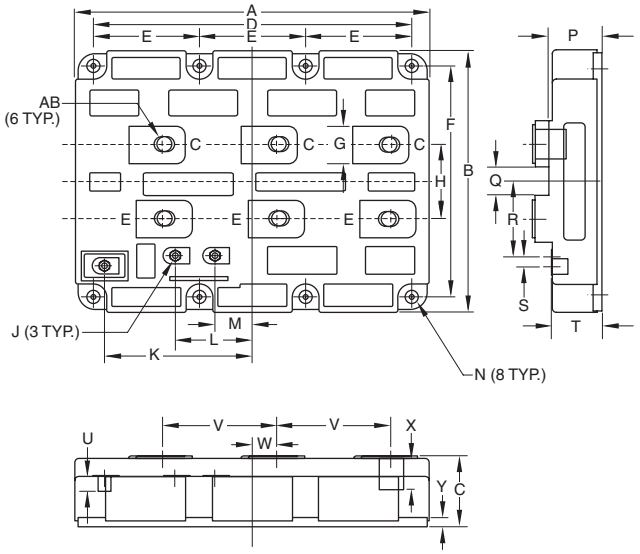
29 CM400HA-24A, CM500HA-34A , CM600HA-24A



Dim.	Inches	Millimeters
A	4.25	108.0
B	3.66	93.0
C	0.63	16.0
D	0.30	7.5
E	0.69	17.5
F	1.14	29.0
G	0.79	20.0
H	0.94	24.0
J	0.31	7.9
K	0.24	62.0
L	2.44	62.0
M	1.89	48.0

Dim.	Inches	Millimeters
N	0.39	10.0
P	0.39	10.0
Q	0.51	13.0
R	0.33	8.5
S	1.42	36.0
T	1.02	25.8
U	M6 Metric	M6
V	M4 Metric	M4
W	0.256 Dia.	6.5 Dia.
X	0.79	20.0
Y	0.35	9.0

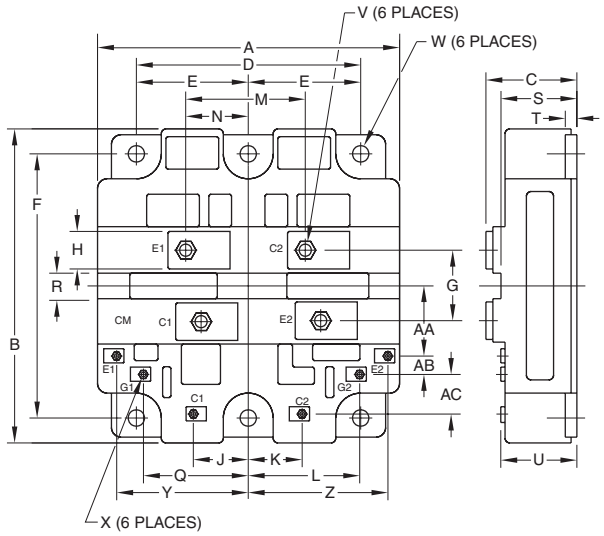
30 CM800E2C-66H, CM800E6C-66H, CM900HB-90H, CM900HC-90H, CM1000E4C-66R, CM1200HC-66H, CM1500HC-66R, CM1800HCB-34N, CM2400HCB-34N



Dim.	Inches	Millimeters
A	7.5±0.02	190.0±0.5
B	5.51±0.02	140.0±0.5
C	1.50+0.04/-0	38.0+1.0/-0
D	6.73	171.0
E	2.24±0.004	57.0±0.1
F	4.88±0.004	124.0±0.1
G	0.79+0.039/-0.008	20.0+1.0/-0.2
H	1.57±0.008	40.0±0.2
J	M4 Metric	M4
K	3.13±0.012	79.4±0.3
L	1.62±0.012	41.25±0.3
M	0.80±0.008	20.25±0.2

Dim.	Inches	Millimeters
N	0.27 Dia.	7.0 Dia.
P	1.16±0.02	29.5±0.5
Q	0.59±0.008	15.0±0.2
R	1.57±0.012	40.0±0.3
S	0.20±0.008	5.2±0.2
T	1.10+0.04/-0	28.0+1.0/-0.0
U	0.30 Min.	7.7 Min.
V	2.42±0.012	61.5±0.3
W	0.51±0.008	13.0±0.2
X	0.65 Min.	16.5 Min.
Y	0.20±0.006	5.0±0.15

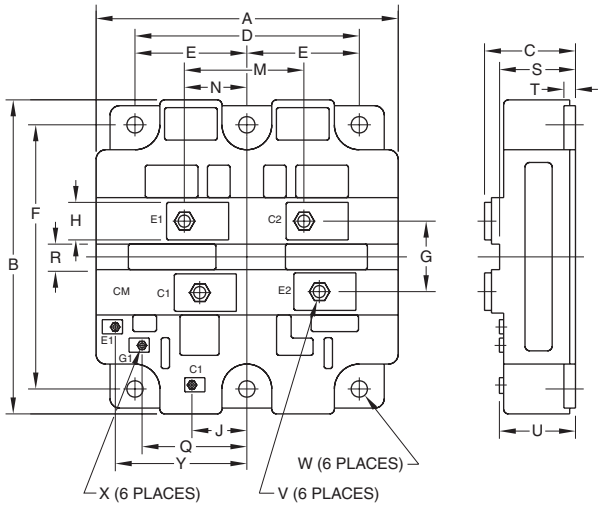
31 CM600DY-34H, CM800DZ-34H



Dim.	Inches	Millimeters
A	5.12	130.0
B	5.51	140.0
C	1.50+0.08/-0	38.0+2.0/-0
D	4.49	114.0
E	2.24±0.01	57.0±0.25
F	4.88±0.01	124.0±0.25
G	1.18	30.0
H	0.79	20.0
J	0.63	16.0
K	0.71	18.0
L	1.73	44.0
M	2.17	55.2
N	0.47	11.85

Dim.	Inches	Millimeters
Q	1.58	40.0
R	0.20	5.0
S	1.24	31.5
T	0.20	5.0
U	1.10+0.08/-0	28.0+2.0/-0
V	M8 Metric	M8
W	0.28 Dia.	7.0 Dia.
X	M4 Metric	M4
Y	2.09	53.0
Z	2.24	57.0
AA	1.38	35.0
AB	0.45	11.5
AC	0.55	14.0

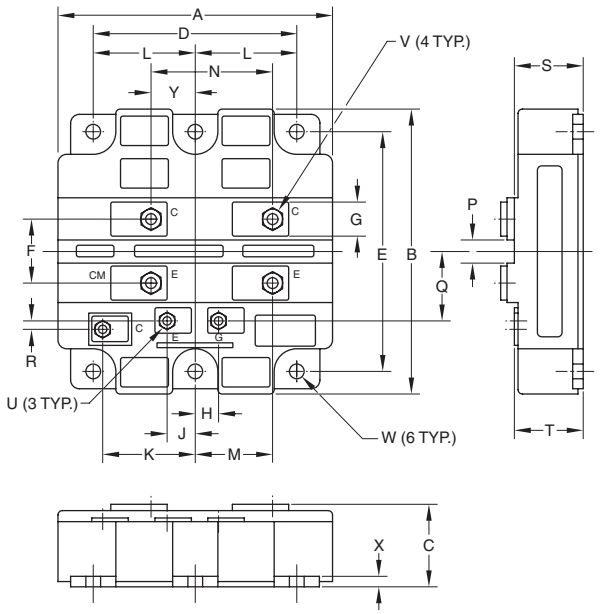
32 CM600E2Y-34H



Dim.	Inches	Millimeters
A	5.12	130.0
B	5.51	140.0
C	1.50+0.04/-0	38.0+1.0/-0
D	4.49	114.0
E	2.24±0.01	57.0±0.25
F	4.88±0.01	124.0±0.25
G	1.18	30.0
H	0.79	20.0
J	0.63	16.0
M	2.17	55.2
N	0.47	11.85
Q	1.58	40.0

Dim.	Inches	Millimeters
R	0.20	5.0
S	1.24	31.5
T	0.20	5.0
U	1.10+0.04/-0	28.0+1.0/-0
V	M8 Metric	M8
W	0.28 Dia.	7.0 Dia.
X	M4 Metric	M4
Y	2.09	53.0
AA	1.38	35.0
AB	0.45	11.5
AC	0.55	14.0

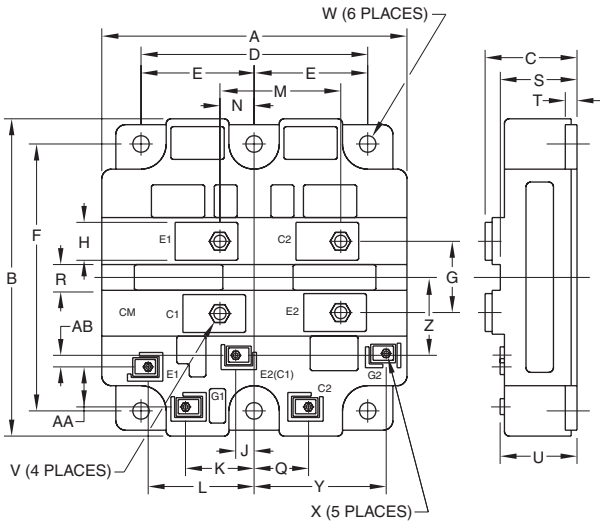
33 CM400HB-90H, CM600HB-90H, CM800HB-66H



Dim.	Inches	Millimeters
A	5.12	130.0
B	5.51	140.0
C	1.50	38.0
D	4.48	114.0
E	4.88±0.01	124.0±0.25
F	1.57	40.0
G	0.79	20.0
H	0.41	10.35
J	0.42	10.65
K	1.92	48.8
L	2.24±0.01	57.0±0.25
M	1.71	43.5

Dim.	Inches	Millimeters
N	2.42	61.5
P	0.59	15.0
Q	1.57	40.0
R	0.20	5.2
S	1.16	29.5
T	1.10	28.0
U	M4 Metric	M4
V	M8 Metric	M8
W	0.28 Dia.	7.0 Dia.
X	0.20	5.0
Y	0.71	18.0

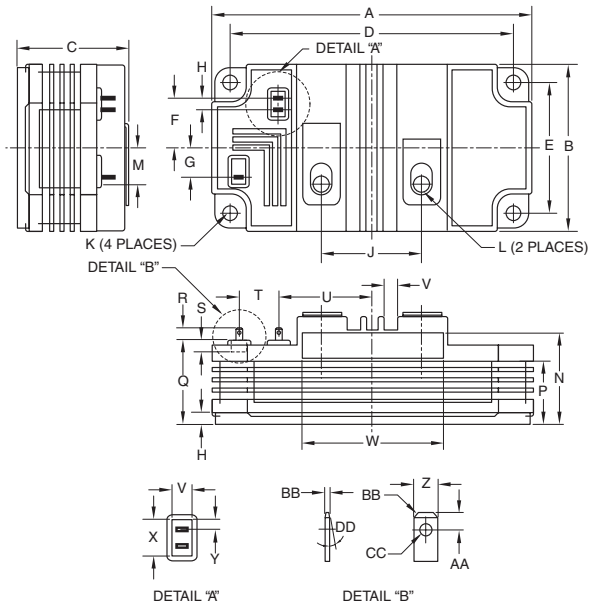
34 CM400DY-66H



Dim.	Inches	Millimeters
A	5.12	130.0
B	5.51	140.0
C	1.50+0.08/-0	38.0+2.0/-0
D	4.49	114.0
E	2.24±0.01	57.0±0.25
F	4.88±0.01	124.0±0.25
G	1.58	40.0
H	0.79	20.0
J	0.28	7.2
K	1.43	36.3
L	1.92	48.8
M	2.42	61.5
N	0.71	18.0

Dim.	Inches	Millimeters
Q	0.97	24.5
R	0.59	15.0
S	1.18	30.0
T	0.20	5.0
U	1.10+0.08/-0	28.0+2.0/-0
V	M8 Metric	M8
W	0.28 Dia.	7.0 Dia.
X	M4 Metric	M4
Y	2.11	53.6
Z	1.56	39.5
AA	0.59	15.0
AB	0.22	5.7

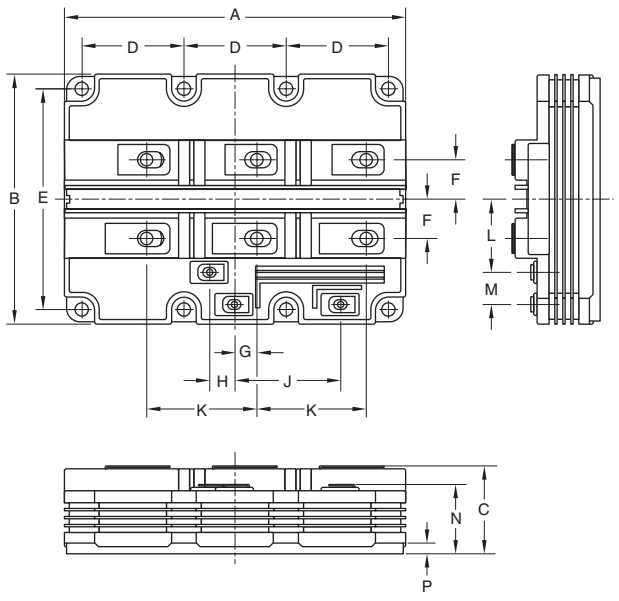
35 CM200HG-130H , CM400HG-66H



Dim.	Inches	Millimeters
A	5.51	140.0
B	2.87	73.0
C	1.89+0.04/-0.0	48.0+1.0/-0.0
D	4.88	124.0
E	2.24	57.0
F	0.85	21.6
G	0.51	12.9
H	0.20	5.0
J	1.73	44.0
K	M6 Metric	M6
L	M8 Metric	M8
M	0.64	16.2
N	1.59	40.4
P	1.10	28.0

Dim.	Inches	Millimeters
R	0.22	5.5
S	0.16	4.0
T	0.68	17.4
U	1.61	41.0
V	0.24	6.0
W	2.44	62.0
X	0.47	12.0
Y	0.14	3.5
Z	0.11	2.8
AA	0.06	1.6
BB	0.02	0.5
CC	0.05 Dia.	1.2 Dia.
DD	10°	10°

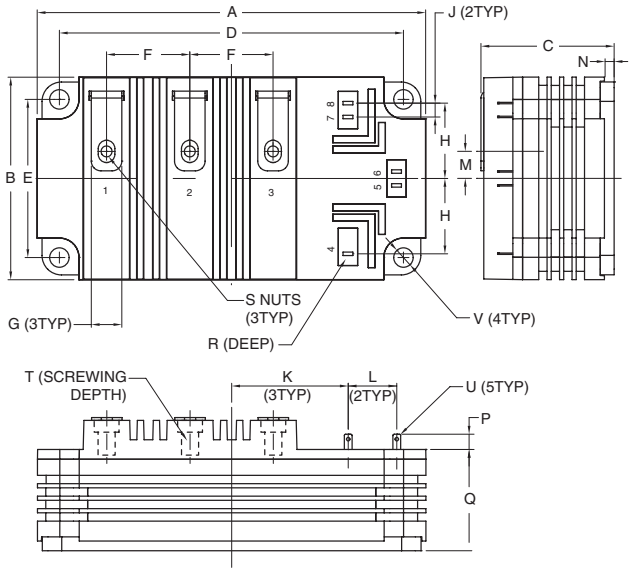
36 CM400E2G-130H, CM400E4G-130H, CM600HG-130H, CM900HG-90H, CM1200HG-66H



Dim.	Inches	Millimeters
A	7.48	190.0
B	5.51	140.0
C	1.89	48.0
D	2.24	57.0
E	4.88±0.01	124.0±0.25
F	0.87	22.0
G	0.47	12.0

Dim.	Inches	Millimeters
H	0.55	14.0
J	2.33	59.2
K	2.41	61.2
L	1.61	41.0
M	0.71	18.0
N	1.50	38.0
P	0.20	5.0

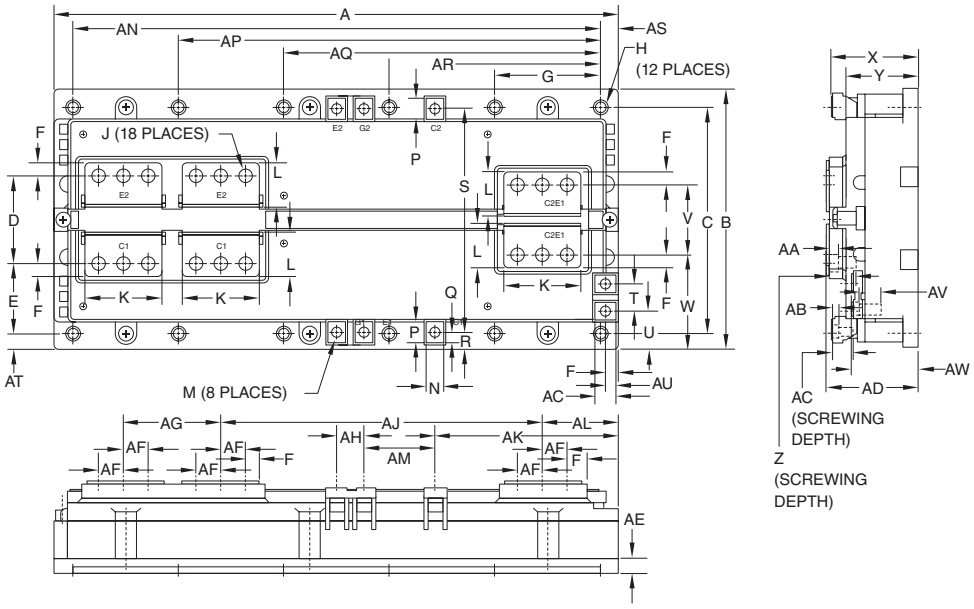
37 QIC6508001, QID3310005, QID3320002, QID4515001, QID4515002, QID4520002, QID6508001, QIF4515002



Dim.	Inches	Millimeters
A	5.51	140.0
B	2.87	73.0
C	1.89	48.0
D	4.88±0.01	124.0±0.25
E	2.24±0.01	57.0±0.25
F	1.18	30.0
G	0.43	11.0
H	1.07	27.15
J	0.20	5.0
K	1.65	42.0

Dim.	Inches	Millimeters
L	0.69±0.01	17.5±0.25
M	0.38	9.75
N	0.20	5.0
P	0.22	5.5
Q	1.44	36.5
R	0.16	4.0
S	M6 Metric	M6
T	0.63 Min.	1.6 Min.
U	0.11 x 0.02	2.8 x 0.5
V	0.28 Dia.	7.0 Dia.

38 CM1800DY-34S, CM2500DY-24S

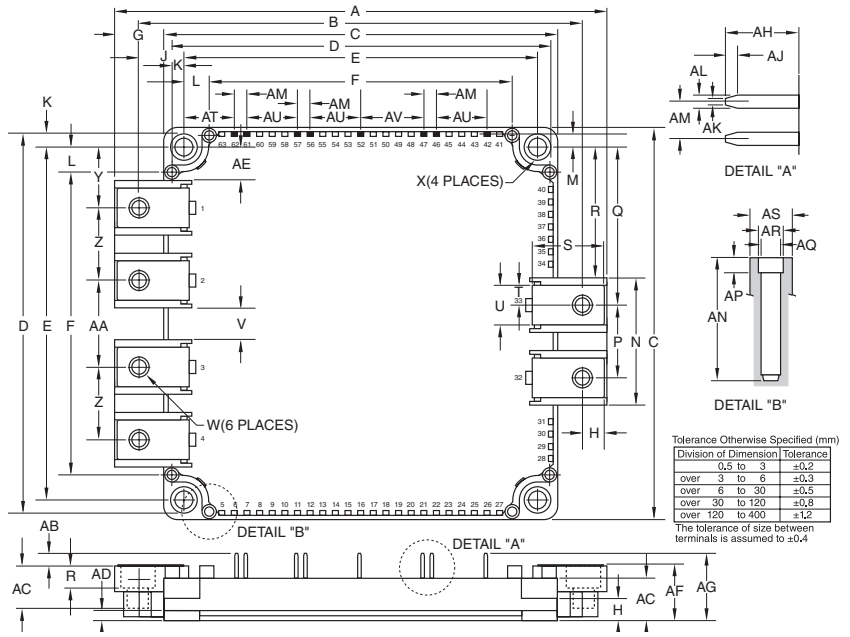


Dim.	Inches	Millimeters
A	12.2	310.0
B	5.6	142.5
C	4.96	126.0
D	1.89	48.0
E	1.85	46.9
F	0.28	7.0
G	2.28	58.0
H	0.21±0.004 Dia.	5.5±0.1 Dia.
J	M6 Metric	M6
K	1.65	42.0
L	0.91	23.0
M	M4 Metric	M4
N	0.35	9.0
P	0.47	11.9
Q	0.21	5.4

Dim.	Inches	Millimeters
R	0.33	8.5
S	4.92	125.0
T	0.6	15.0
U	0.83	21.0
V	1.5	38.0
W	2.04	51.9
X	1.85+0.04/-0.02	47.1+1.0/-0.5
Y	1.55	39.4
Z	0.63	16.0
AA	0.24	6.2
AB	0.16	4.0
AC	0.45	11.5
AD	2.01+0.04/-0.02	51.0+1.0/-0.5
AE	0.32	8.2
AF	0.55	14.0

Dim.	Inches	Millimeters
AG	2.05	52.0
AH	0.59	15.0
AJ	7.01	178.0
AK	3.98	101.0
AL	1.63	41.5
AM	1.54	39.0
AN	11.42	290.0
AP	9.13	232.0
AQ	6.85	174.0
AR	4.56	116.0
AS	0.39	10.0
AT	0.03	8.0
AU	0.02	5.0
AV	0.16	4.0
AW	1.425+0.04/-0.02	36.20+1.0/-0.5

39 CM450DXL-34SA,CM600DXL-24S, CM600DXL-34SA, CM1000DXL-24S

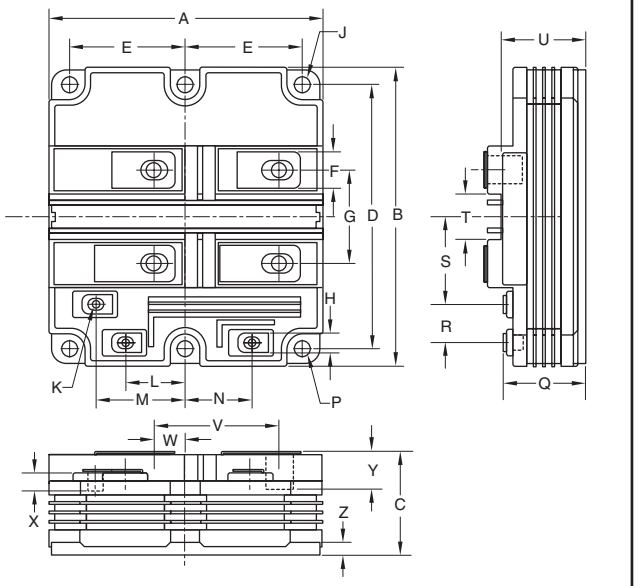


Dim.	Inches	Millimeters
A	5.98	152.0
B	5.39	137.0
C	4.79	121.7
D	4.61	117.2
E	4.33±0.02	110.0±0.5
F	3.72	94.5
G	0.6	15.14
H	0.26	6.5
J	0.53	13.5
K	0.14	3.6
L	0.3	7.75
M	0.016	4.05
N	1.53	39.0
P	0.86	22.0
Q	1.95	49.72

Dim.	Inches	Millimeters
R	1.62	41.22
S	0.83	21.14
T	0.23	6.0
U	0.47	12.0
V	0.41	10.53
W	M6 Metric	M6
X	0.22	5.5 Dia.
Y	0.75	19.24
Z	0.86	22.0
AA	1.08	27.53
AB	0.14	3.5
AC	0.51	13.0
AD	0.19	3.0
AE	0.42	10.74
AF	0.67+0.04/-0.02	17.0+1.0/-0.5

Dim.	Inches	Millimeters
AG	0.81	20.5
AH	0.29	7.4
AJ	0.05	1.2
AK	0.02	0.65
AL	0.04	1.15
AM	0.15	3.81
AN	0.5	12.5
AP	0.12	3.0
AQ	0.088 Dia.	2.25 Dia.
AR	0.102 Dia.	2.6 Dia.
AS	0.16 Dia.	4.3 Dia.
AT	0.67	16.9
AU	0.6	15.24
AV	0.75	19.05

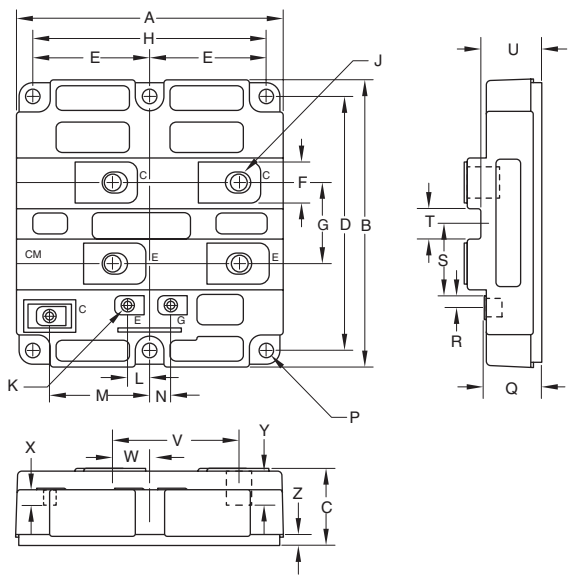
40 CM400HG-130H, CM600HG-90H



Dim.	Inches	Millimeters
A	5.12±0.02	130.0±0.5
B	5.51±0.02	140.0±0.5
C	1.89+0.04/-0.0	48.0+1.0/-0.0
D	4.88±0.01	124.0±0.25
E	2.24±0.01	57.0±0.25
F	0.67±0.004	17.0±0.1
G	1.73±0.012	44.0±0.3
H	0.35±0.04	9.0±0.1
J	M8 Metric	M8
K	M4 Metric	M4
L	1.12±0.02	28.5±0.5
M	1.67±0.02	42.5±0.5

Dim.	Inches	Millimeters
N	1.21±0.02	30.7±0.5
P	0.28 Dia.	7.0 Dia.
Q	1.5+0.04/-0.0	38.0+1.0/-0/0
R	0.71±0.012	18.0±0.3
S	1.61±0.02	41.0±0.5
T	0.87±0.012	22.0±0.3
U	1.59±0.02	40.4±0.5
V	2.41±0.02	61.2±0.5
W	0.65±0.012	16.5±0.3
X	0.30 Min.	7.7 Min.
Y	0.65 Min.	16.5 Min.
Z	0.2±0.006	5.0±0.15

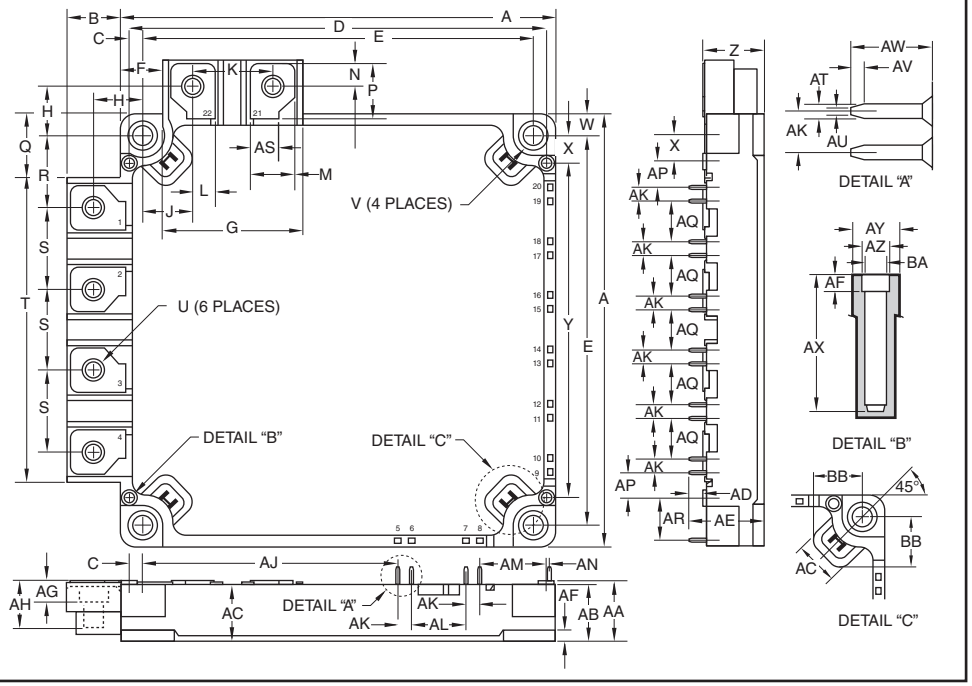
41 CM800HC-66H, CM1000HC-66R



Dim.	Inches	Millimeters
A	5.12±0.02	130.0±0.5
B	5.51±0.02	140.0±0.5
C	1.5+0.04/-0.0	38.0+1.0/-0.0
D	4.88±0.004	124.0±0.1
E	2.24±0.004	57.0±0.1
F	0.79+0.04/-0.008	20.0+0.1/-0.2
G	1.57±0.008	40.0±0.2
H	4.49±0.004	114.0±0.1
J	M8 Metric	M8
K	M4 Metric	M4
L	0.42±0.008	10.65±0.2
M	1.92±0.012	48.8±0.3

Dim.	Inches	Millimeters
N	0.41±0.008	10.35±0.2
P	0.28 Dia.	7.0 Dia.
Q	1.10+0.04/-0.0	28.0+1.0/-0.0
R	0.20±0.008	5.2±0.2
S	1.57±0.012	40.0±0.3
T	0.59±0.008	15.0±0.2
U	1.16±0.02	29.5±0.5
V	2.42±0.012	61.5±0.3
W	0.71±0.008	18.0±0.2
X	0.30 Min.	7.7 Min.
Y	0.65 Min.	16.5 Min.
Z	0.20±0.006	5.0±0.15

42 CM150RXL-34SA

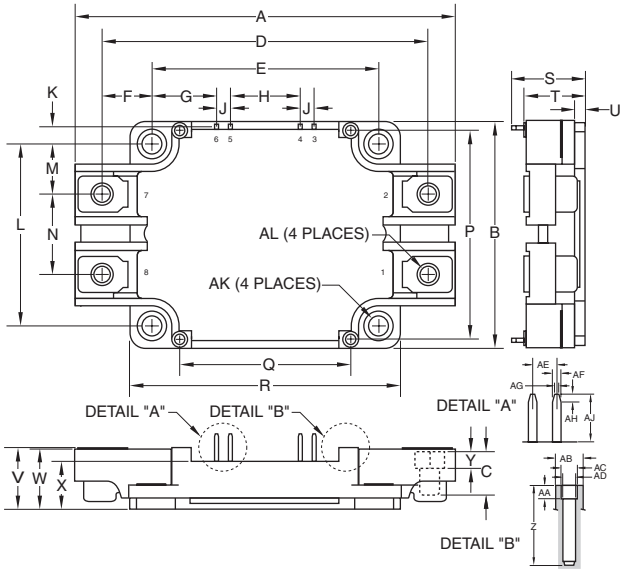


Dim.	Inches	Millimeters
A	4.79	121.7
B	0.59	15.1
C	0.14	3.6
D	4.61	117.2
E	4.33±0.02	110.0±0.5
F	0.45	11.5
G	1.53	39.0
H	0.53	13.5
J	0.55	14.14
K	0.87	22.0
L	0.24	6.0
M	0.47	12.0
N	0.37	6.5
P	0.61	15.64
Q	0.71	18.06
R	0.81	20.71
S	0.9	22.86

Dim.	Inches	Millimeters
T	3.37	85.58
U	M5 Metric	M5
V	0.22 Dia.	5.5 Dia.
W	0.23	5.86
X	0.30	7.75
Y	3.72	94.5
Z	0.67+0.04/-0.02	17.0 +1/-0.5
AA	0.67	17.0
AB	0.63	16.0
AC	0.51	13.0
AD	0.14	3.5
AE	0.81	20.5
AF	0.12	3.0
AG	0.23	5.9
AH	0.53	13.4
AJ	2.81	71.52
AK	0.15	3.81

Dim.	Inches	Millimeters
AL	0.60	15.24
AM	0.75	19.23
AN	0.017	0.45
AP	0.28	7.24
AQ	0.43	11.42
AR	0.43	11.08
AS	0.31	8.0
AT	0.04	1.15
AU	0.02	0.65
AV	0.05	1.2
AW	0.18	4.5
AX	0.49	12.5
AY	0.18 Dia.	4.5 Dia.
AZ	0.102 Dia.	2.6 Dia.
BA	0.088 Dia.	2.25 Dia.
BB	0.54	13.7

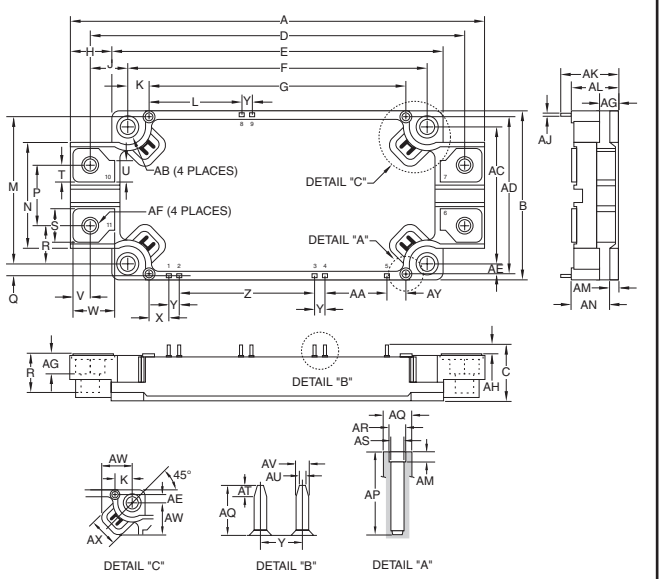
43 CM150EXS-24S, CM200EXS-24S, CM200EXS-34SA, CM300EXS-24S



Dim.	Inches	Millimeters
A	4.09	104.0
B	2.44	62.0
C	0.47	11.9
D	3.5	89.0
E	2.44	62.0
F	0.53	13.5
G	0.69	17.66
H	0.75	19.05
J	0.14	3.8
K	0.16	4.2
L	1.97	50.0
M	0.55	14.0
N	0.87	22.0
P	2.26	57.5
Q	1.83	46.5
R	2.9	73.71
S	0.8	20.5
T	0.67	17.0

Dim.	Inches	Millimeters
U	0.27	7.0
V	0.67	17.0
W	0.64	16.4
X	0.51	13.1
Y	0.17	4.4
Z	0.49	12.5
AA	0.12	3.0
AB	0.17 Dia.	4.3 Dia.
AC	0.102 Dia.	2.6 Dia.
AD	0.088 Dia.	2.25 Dia.
AE	0.15	3.81
AF	0.045	1.15
AG	0.025	0.65
AH	0.05	1.2
AJ	0.29	7.4
AK	0.21 Dia.	5.5 Dia.
AL	M5 Metric	M5

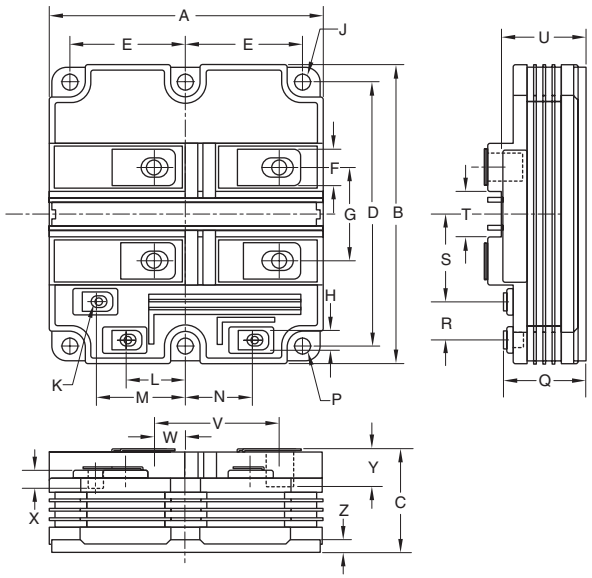
44 CM150DX-34SA, CM200DX-34SA, CM300DX-34SA, CM450DX-34SA



Dim.	Inches	Millimeters
A	5.98	152.0
B	2.44	62.0
C	0.67+0.04/-0.02	17.0+1.0/-0.5
D	5.39	137.0
E	4.79	121.7
F	4.33±0.02	110.0±0.5
G	3.72	94.5
H	0.60	15.14
J	0.53	13.5
K	0.31	7.75
L	1.33±0.012	33.91±0.3
M	2.13	54.2
N	1.54	39.0
P	0.87	22.0
Q	0.17	4.2
R	0.55	14.0
S	0.47	12.0
T	0.24	6.0
U	0.31	8.0
V	0.26	6.5
W	0.62	15.64
X	0.28±0.012	7.24±0.3
Y	0.15	3.81
Z	1.95	49.5

Dim.	Inches	Millimeters
AA	0.9	22.86
AB	0.22 Dia.	5.5 Dia.
AC	1.97±0.02	50.0±0.5
AD	2.26	57.5
AE	0.15	3.75
AF	M6	M6
AG	0.28	7.0
AH	0.14	3.5
AJ	0.03	0.8
AK	0.81	20.5
AL	0.70	17.0
AM	0.12	3.0
AN	0.65	16.5
AP	0.49	12.5
AQ	0.18	4.5
AR	0.102 Dia.	2.6 Dia.
AS	0.089 Dia.	2.25 Dia.
AT	0.05	1.2
AU	0.03	0.65
AV	0.05	1.15
AW	0.54	13.7
AX	0.52	13.0
AY	0.285	7.25

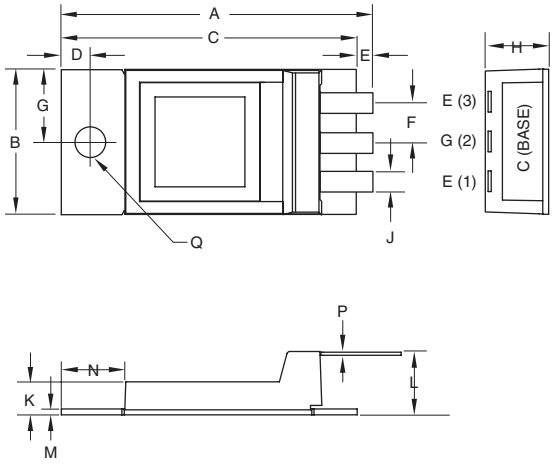
45 CM800HG-90R



Dim.	Inches	Millimeters
A	5.12±0.02	130.0±0.5
B	5.51±0.02	140.0±0.5
C	1.89+0.04/-0.0	48.0+1.0/-0.0
D	4.88±0.01	124.0±0.25
E	2.24±0.01	57.0±0.25
F	0.67±0.004	17.0±0.1
G	1.73±0.012	44.0±0.3
H	0.35±0.04	9.0±0.1
J	M8 Metric	M8
K	M4 Metric	M4
L	1.12±0.02	28.5±0.5
M	1.67±0.02	42.5±0.5

Dim.	Inches	Millimeters
N	1.21±0.02	30.7±0.5
P	0.28 Dia.	7.0 Dia.
Q	1.5+0.04/-0.0	38.0+1.0/-0/0
R	0.71±0.012	18.0±0.3
S	1.61±0.02	41.0±0.5
T	0.87±0.012	22.0±0.3
U	1.59±0.02	40.4±0.5
V	2.41±0.02	61.2±0.5
W	0.65±0.012	16.5±0.3
X	0.30 Min.	7.7 Min.
Y	0.65 Min.	16.5 Min.
Z	0.2±0.006	5.0±0.15

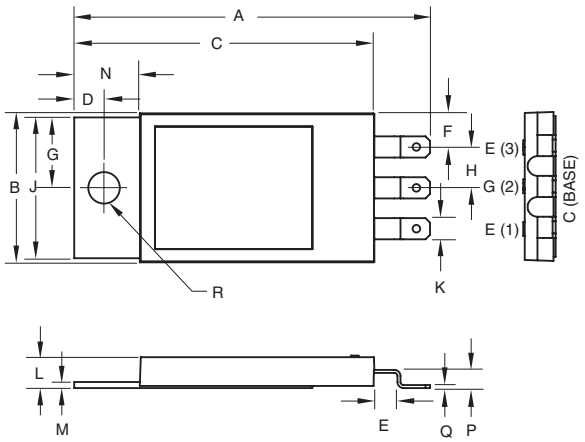
46 QIS2510001, QIS4506001



Dim.	Inches	Millimeters
A	2.31	53.6
B	0.98	25.0
C	2.01	51.0
D	0.2	5.0
E	0.1	2.5
F	0.27	6.9
G	0.49	12.5
H	0.46 Max.	11.8 Max.

Dim.	Inches	Millimeters
J	0.14	3.6
K	0.22	5.7
L	0.43	10.8
M	0.04	1.0
N	0.43	10.9
P	0.02	0.5
Q	0.21 Dia.	5.3 Dia.

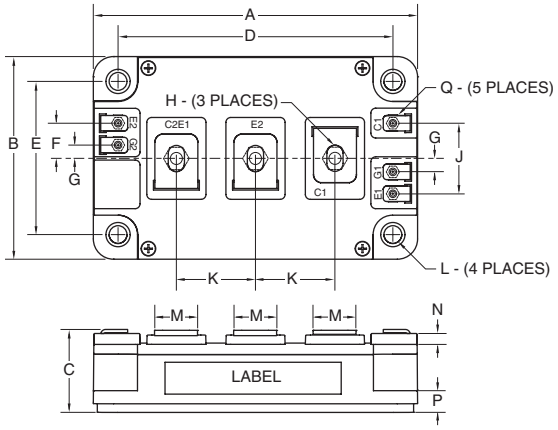
47 QIS4506002, QIS6502002



Dim.	Inches	Millimeters
A	2.35	59.7
B	0.98	25.0
C	1.98	50.3
D	0.197	5.0
E	0.22	5.5
F	0.22	5.6
G	0.465	11.8
H	0.27	6.9

Dim.	Inches	Millimeters
J	0.93	23.6
K	0.14	3.6
L	0.20	5.2
M	0.40	1.0
N	0.43	11.0
P	0.20	0.5
Q	0.12	3.0
R	0.208 Dia.	5.3 Dia.

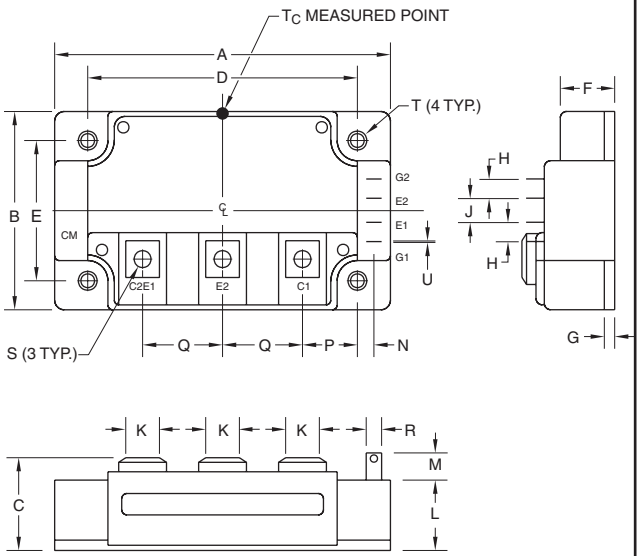
48 QID0660023



Dim.	Inches	Millimeters
A	4.00	101.6
B	2.50	63.5
C	1.00±0.015	25.4±0.4
D	3.39	86.1
E	1.89	48.0
F	0.435	11.0
G	0.165	4.2
H	#10-32 X 0.31 Min.	

Dim.	Inches	Millimeters
J	0.87	22.1
K	0.98	24.9
L	0.22 Dia.	5.6 Dia.
M	0.53	13.5
N	0.09 Min.	2.3 Min.
P	0.27	6.9
Q	#2-56 X 0.17 Min.	

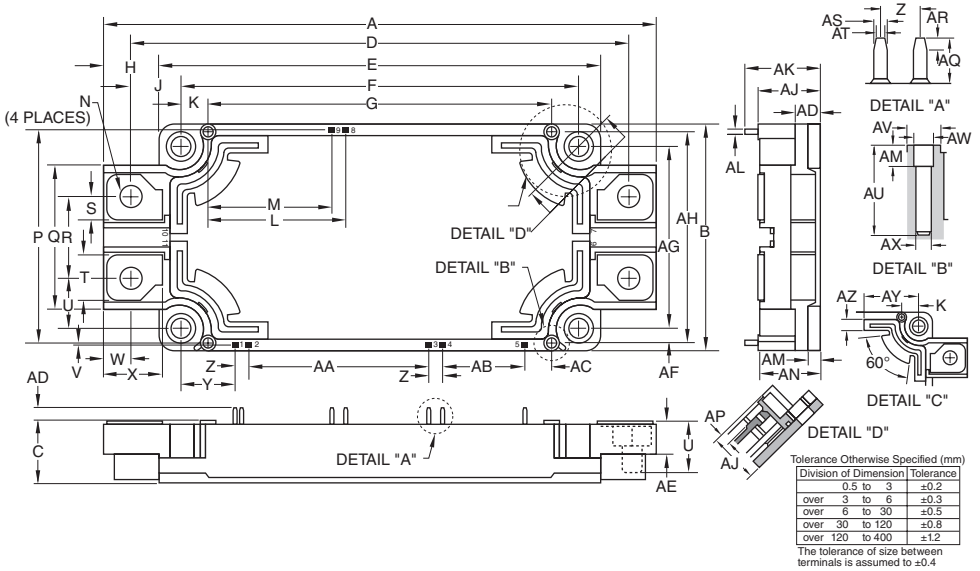
49 QIQ0645001



Dim.	Inches	Millimeters
A	4.25	108.0
B	2.44	62.0
C	1.14+0.04/-0.02	29.0+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	1.88±0.01	48.0±0.25
F	0.67	17.0
G	0.16	4.0
H	0.24	6.0
J	0.59	15.0

Dim.	Inches	Millimeters
K	0.55	14.0
L	0.87	22.0
M	0.33	8.5
N	0.10	2.5
P	0.85	21.5
Q	0.98	25.0
R	0.11	2.8
S	M6 Metric	M6
T	0.25 Dia.	6.5 Dia.

50 CM225DX-24S1, CM300DX-24S1, CM450DX-24S1, CM600DX-24S1

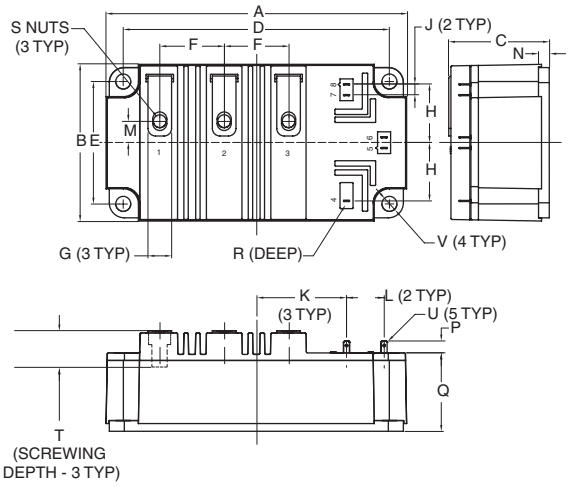


Dim.	Inches	Millimeters
A	5.98	152.0
B	2.44	62.0
C	0.67+0.04/-0.02	17.0+1/-0.5
D	5.39	137.0
E	4.79	121.7
F	4.33±0.02	110±0.5
G	3.72	94.5
H	0.60	15.14
J	0.53	13.5
K	0.30	7.75
L	1.48±0.019	37.72±0.3
M	1.33±0.019	33.91±0.3
N	M6 Metric	M6
P	2.28±0.019	57.95±0.3
Q	1.53	39.0
R	0.86	22.0

Dim.	Inches	Millimeters
S	0.23	6.0
T	0.47	12.0
U	0.55	14.0
V	0.04±0.019	0.95±0.3
W	2.56	65.0
X	0.61	15.64
Y	0.284±0.019	7.24±0.3
Z	0.15±0.019	3.81±0.3
AA	1.95±0.019	49.53±0.3
AB	0.9±0.019	22.86±0.3
AC	0.285±0.019	7.25±0.3
AD	0.14	3.5
AE	0.27	7.0
AF	0.15	3.75
AG	1.97±0.02	50.0±0.5
AH	2.26	57.5

Dim.	Inches	Millimeters
AJ	0.67	17.0
AK	0.81	20.5
AL	0.03	0.8
AM	0.12	3.0
AN	0.65	16.5
AP	0.13	3.4
AQ	0.17	4.5
AR	0.05	1.2
AS	0.05	1.15
AT	0.025	0.65
AU	0.49	12.5
AV	0.17 Dia.	4.5 Dia.
AW	0.102 Dia.	2.6 Dia.
AX	0.088 Dia.	2.25 Dia.
AY	0.95	24.2
AZ	0.19	5.0

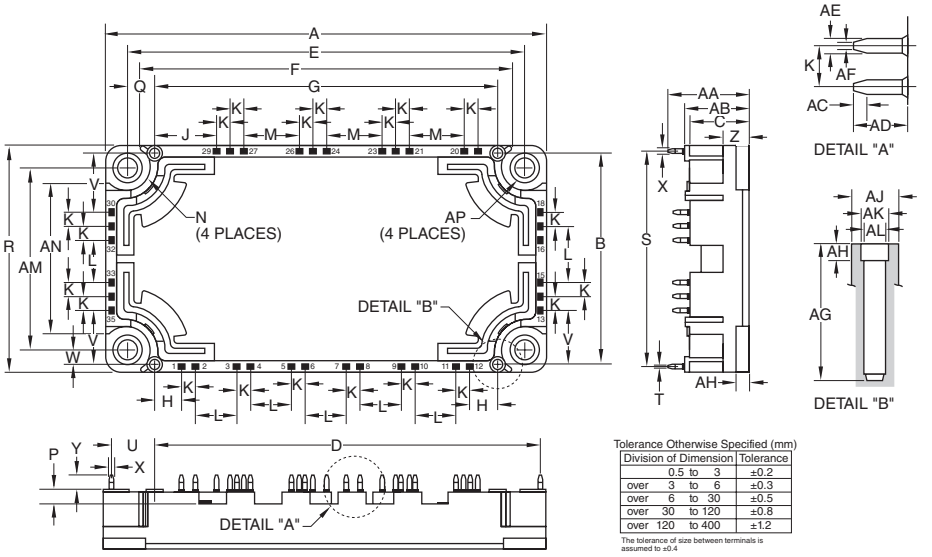
51 QID3320004, QID4515004



Dim.	Inches	Millimeters
A	5.51	140.0
B	2.87	73.0
C	1.50	38.0
D	4.88±0.01	124.0±0.25
E	2.24±0.01	57.0±0.25
F	1.18	30.0
G	0.43	11.0
H	1.07	27.15
J	0.20	5.0
K	1.65	42.0

Dim.	Inches	Millimeters
L	0.69±0.01	17.5±0.25
M	0.38	9.75
N	0.20	5.0
P	0.22	5.5
Q	1.04	26.5
R	0.16	4.0
S	M5 Metric	M5
T	0.63 Min.	16.0 Min.
U	0.11 x 0.02	2.8 x 0.5
V	0.28 Dia.	7.0 Dia.

52 CM100TX-24S1, CM150TX-24S1



Tolerance Otherwise Specified (mm)

Division of Dimension	Tolerance
0.5 to 3	±0.2
over 3 to 6	±0.3
over 6 to 30	±0.5
over 30 to 120	±0.8
over 120 to 400	±1.2

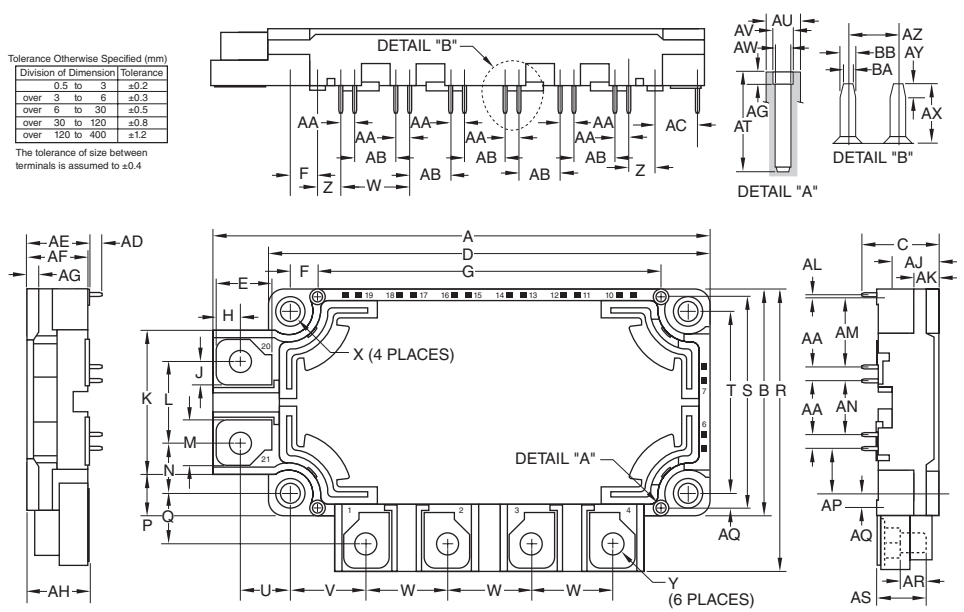
The tolerance of size between terminals is assumed to ±0.4

Dim.	Inches	Millimeters
A	4.79	121.7
B	2.26	57.5
C	0.63	16.0
D	4.18±0.008	106.31±0.2
E	4.33±0.02	110.0±0.5
F	4.027	102.3
G	3.72	94.5
H	0.28	7.24
J	0.66±0.019	16.77±0.3
K	0.15	3.81
L	0.45	11.42
M	0.6	15.24
N	0.26 Rad.	6.5 Rad.

Dim.	Inches	Millimeters
P	0.16	4.0
Q	0.29	7.75
R	2.44	62.0
S	2.28±0.008	57.95±0.2
T	0.17±0.008	0.45±0.2
U	0.46±0.008	11.8±0.2
V	0.60	15.41
W	0.15	3.75
X	0.03	0.8
Y	0.14	3.5
Z	0.27	7.0
AA	0.81	20.5
AB	0.67	17.0

Dim.	Inches	Millimeters
AC	0.05	1.2
AD	0.18	4.5
AE	0.05	1.15
AF	0.02	0.65
AG	0.49	12.5
AH	0.12	3.0
AJ	0.18 Dia.	4.5 Dia.
AK	0.102 Dia.	2.6 Dia.
AL	0.088 Dia.	2.25 Dia.
AM	1.97±0.0	50.0±0.5
AN	1.65	41.9
AP	0.22 Dia.	5.5 Dia.

53 CM100RX-24S1, CM150RX-24S1



Tolerance Otherwise Specified (mm)

Division of Dimension	Tolerance
0.5 to 3	±0.2
over 3 to 6	±0.3
over 6 to 30	±0.5
over 30 to 120	±0.8
over 120 to 400	±1.2

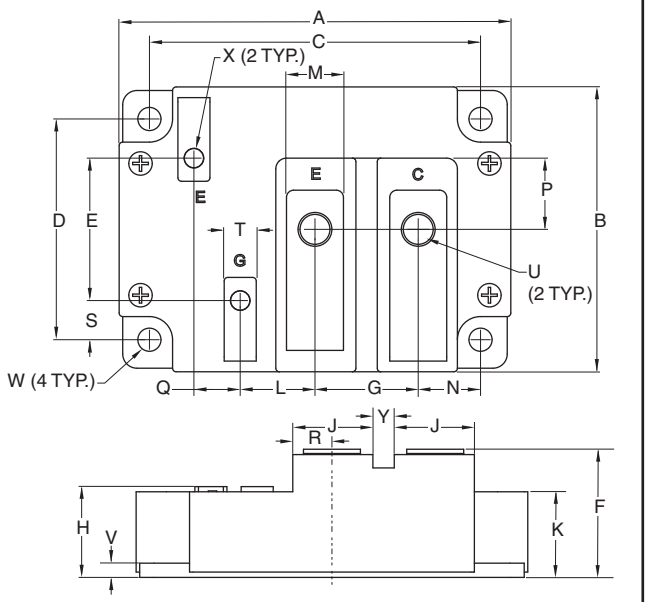
The tolerance of size between terminals is assumed to ±0.4

Dim.	Inches	Millimeters
A	5.39	136.9
B	2.44	62.0
C	0.81	20.5
D	4.79	121.7
E	0.61	15.64
F	0.30	7.75
G	3.72	94.5
H	0.26	6.5
J	0.24	6.0
K	1.53	39.0
L	.87	22.0
M	0.48	12.0
N	0.55	14.0
P	0.45	11.5
Q	0.54	13.64
R	3.03	77.1
S	2.26	57.5

Dim.	Inches	Millimeters
T	1.97±0.02	50.0±0.5
U	0.53	13.5
V	0.81	20.71
W	0.9	22.86
X	0.22 Dia.	5.5 Dia.
Y	M5 Metric	M5
Z	0.28	7.24
AA	0.15	3.82
AB	0.45	11.42
AC	0.46±0.008	11.8±0.2
AD	0.14	3.5
AE	0.67	17.0
AF	0.65	16.5
AG	0.12	3.0
AH	0.67+0.04/-0.0	17.0+1.0/-0.5
AJ	0.53	13.6
AK	0.27	7.0

Dim.	Inches	Millimeters
AL	0.02	0.55
AM	0.75	19.12
AN	0.6	15.24
AP	0.46	11.67
AQ	0.15	3.75
AR	0.23	5.9
AS	0.53	13.4
AT	0.49	12.5
AU	0.18 Dia.	4.5 Dia.
AV	0.102 Dia.	2.6 Dia,
AW	0.088 Dia.	2.25 Dia.
AX	0.18	4.5
AY	0.05	1.2
AZ	0.15	3.81
BA	0.02	0.65
BB	0.05	1.15

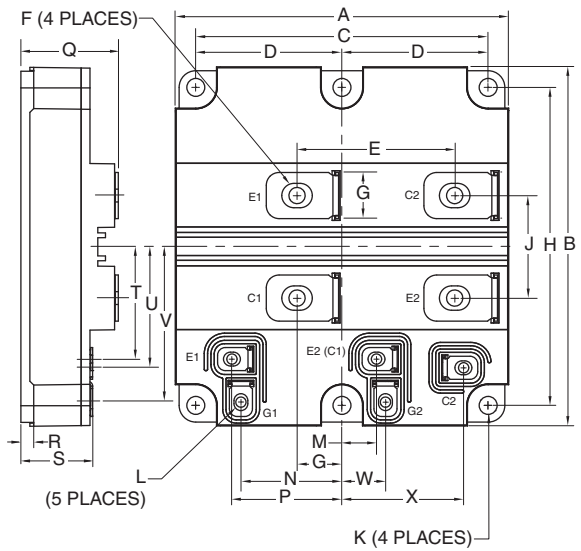
56 QIS176002, QIS1790001



Dim.	Inches	Millimeters
A	4.33	110.0
B	3.15	80.0
C	3.66±0.008	93.0±0.25
D	2.44±0.008	62.0±0.25
E	1.57	40.0
F	1.42 Max.	36.0 Max.
G	1.14	29.0
H	1.00 Max.	25.5 Max.
J	0.89	22.5
K	0.93	23.5
L	0.83	21.0
M	0.63	16.0

Dim.	Inches	Millimeters
N	0.69	17.5
P	0.79	20.0
Q	0.51	13.0
R	0.43	11.0
S	0.43	11.0
T	0.35	9.0
U	M8 Metric	M8
V	0.16	4.0
W	0.256 Dia.	6.5 Dia.
X	M4 Metric	M4
Y	0.24	6.0

57 QID3340001, QID3350001



Dim.	Inches	Millimeters
A	5.11	130.0
B	5.51	140.0
C	4.49	114.0
D	2.24	57.0
E	2.42	61.5
F	M8	M8 Metric
G	0.71	18.0
H	4.88	124.0
J	1.57	40.0
K	0.27	7.0 Dia.
L	M4	M4 Metric

Dim.	Inches	Millimeters
M	0.51	13.0
N	1.57	39.9
P	1.71	43.4
Q	1.49	38.0
R	0.20	5.0
S	1.10	28.0
T	1.72	43.8
U	1.86	47.2
V	2.39	60.6
W	0.65	16.5
X	1.85	47.0

HYBRID & SiC MODULES

Hybrid Si / SiC IGBT Modules

Combining the industry's fastest power IGBT of the Powerex NFH-Series with a Zero Recovery® Schottky diode, Powerex hybrid split dual Si / SiC IGBT modules are designed for use in high frequency applications; upwards of 30kHz for hard switching applications and 60 to 80 kHz for soft switching applications.

Applications Include:

- Energy Saving Power Systems (fans, pumps and consumer appliances)
- High Frequency Type Power Systems (UPS, high speed motor drives, induction heating, welder and robotics)
- High Temperature Power Systems(power electronics in electric vehicle and aviation systems)

SiC MOSFET Modules

Powerex also offers SiC (silicon carbide) MOSFET (Metal Oxide Semiconductor Field Effect Transistor) modules.

SiC Schottky Diode Modules

Powerex also offers SiC (silicon carbide) Schottky diode modules.

Applications:

- High Efficiency Inverters
- High Frequency Power Supplies
- High Temperature Environment

Circuit Configurations:

- Single
- Dual
- In-Parallel
- Common Collector (Drain)
- Common Emitter (Source)

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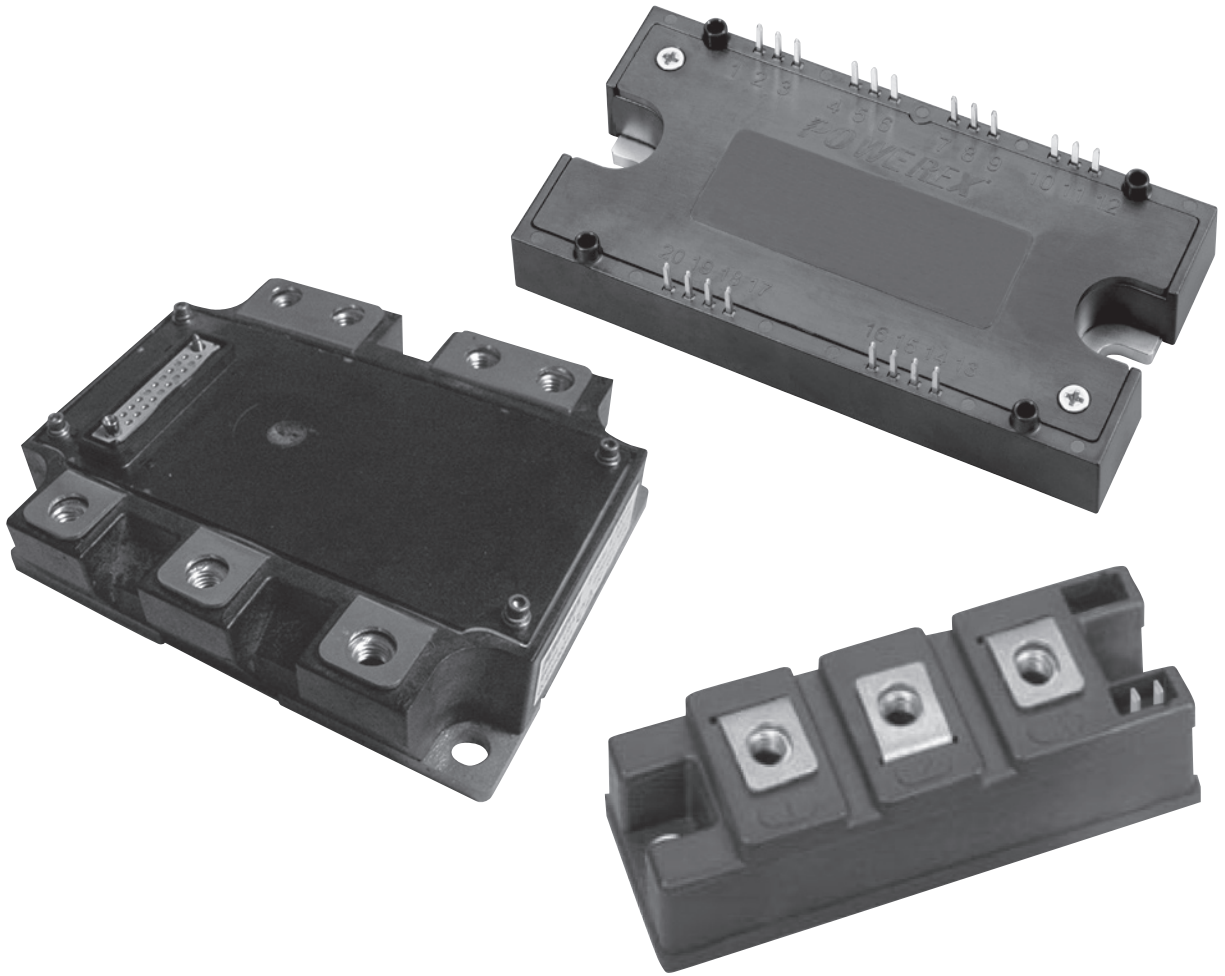
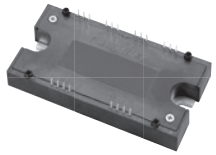


VOLTAGE: 100V TO 1200V
CURRENT: 100A TO 300A

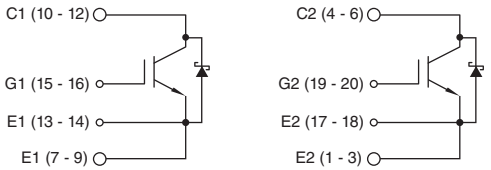
Split Dual Si / SiC Hybrid IGBT Modules,
(Refer to device datasheets at www.pwrx.com for test conditions.)



QID1210005, QID1210007,
QID1210006, QID1215003

MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS										
						Static Test Conditions		T_j = 25°C		Dynamic						
								Typ.	Max.	V_{GE} = 0V, V_{CE} = 10V, f = 1KHz			Resistive Load Switching Times			
Type	V_{CES} Volts	I_C Amperes	I_{CM} Amperes	$T_{j(MAX)}$ °C	V_{RMS} Isolation Volts	I_C Amperes	V_{GE} Volts	$V_{CES\ (SAT)}$ Volts	$V_{CES\ (SAT)}$ Volts	C_{ies} nF	C_{oes} nF	C_{res} nF	$t_{d(on)}$ ns	t_r ns	$t_{d(off)}$ ns	t_f ns
QID1210005	1200	100	200	150	2500	100	15	5.0	6.5	16	1.3	0.3	TBD	TBD	TBD	TBD
QID1210006	1200	100	200	150	2500	100	15	5.0	6.5	16	1.3	0.3	TBD	TBD	TBD	TBD
QID1210007	1200	100	200	150	2500	100	15	5.0	6.5	16	1.3	0.3	TBD	TBD	TBD	TBD
QID1215003	1200	100	300	150	2500	150	15	5.0	6.5	24	2.0	0.45	TBD	TBD	TBD	TBD

	FREE WHEEL DIODE			THERMAL CHARACTERISTICS					
				IGBT (Max.)	Diode (Max.)	Interface Per Module (Typ.)		Outline Drawings	
Type	I_{FM} Amperes	V_{FM} Volts	t_{rr} ns	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(c-f)}$ °C/W	Weight Grams	Number	Page
QID1210005	80	2.0	—	0.17	0.304	0.04	270	1	B-5
QID1210006	80	2.0	—	0.21	0.39	0.04	130	1	B-5
QID1210007	75	1.75	—	0.17	0.5	0.04	270	1	B-5
QID1215003	150	1.75	—	0.13	0.25	0.04	270	1	B-5



Numbering System

QID1210005 is a 1200V, 100A
Split Dual Si / SiC Hybrid IGBT Module

Q	I	D	12	10	0	0	5
(1)	(2)	(3)	(4,5)	(6,7)	(8)	(9)	(10)

Serial Designation (SPECIAL)

(1) Product Line

(2) Device:
I = IGBT

(3) Configuration:
D = Double / Dual

(4,5) Voltage:
12 = 1200

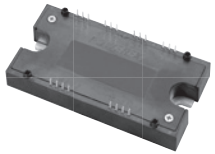
(6,7) Current:
10 = 100

Serial Designation

SPECIAL:
(8) 0 – 9 (Numbered from 001 – 999 for
(9) 0 – 9 each individual combination of
(10) 0 – 9 7 previous digits.)

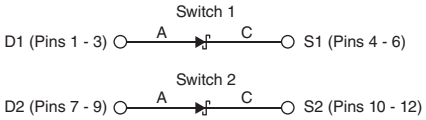
Split Dual SiC Super Fast Diode Modules,

(Refer to device datasheets at www.pwrx.com for test conditions.)



QRD1210004,
QRD1210005

MAXIMUM RATINGS							ELECTRICAL AND THERMAL CHARACTERISTICS					
Type	V_{RRM} Volts	$I_{F(DC)}$ Amperes	I_{FSM} Amperes	$T_{j(MAX)}$ °C	V_{RMS} Isolation Volts	i^2t A^2 sec (8.3ms, $T_{j(max)}$, 100% V_{RRM} Reapplied)	V_{FM}/I_F Volts/Amperes (T_j = 175°C)	$R_{th(j-c)}$ °C/W	$R_{th(c-s)}$ °C/W	Weight Grams	Outline Drawings Number	Page
QRD1210004	1200	100	TBD	175	2500	TBD	3.0 / 100	0.26	0.04	270	3	B-5
QRD1210005	1200	100	TBD	175	2500	TBD	3.0 / 100	0.26	0.04	140	3	B-5



Numbering System

QRD1210005 is a 1200V, 100A Split Dual SiC Super Fast Diode Module

Q	R	D	12	10	0	0	5
(1)	(2)	(3)	(4,5)	(6,7)	(8)	(9)	(10)

Serial Designation (SPECIAL)

(1) Product Line

(2) Device:
R = Rectifier

(3) Configuration:
D = Double / Dual

(4,5) Voltage:
12 = 1200

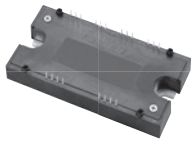
(6,7) Current:
10 = 100

Serial Designation

SPECIAL:
(8) 0 – 9 (Numbered from 001 – 999 for
(9) 0 – 9 each individual combination of
(10) 0 – 9 7 previous digits.)

SiC and Si MOSFET Modules, (Refer to device datasheets at www.pwrx.com for test conditions.)

QJS0512001



QJD1210010, QJD1210011, QJD1210SA1, QJD1210SA2

QJE0130018, QJE0130021

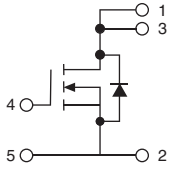
MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS					THERMAL CHARACTERISTICS				
					Static									
Type	V_{DS} Volts	I_D Amperes T_j = 25°C (Typ.)	$T_{j(MAX)}$ °C	V_{RMS} Isolation Volts	$R_{DS(on)}$ (mΩ) (Typ.)	V_{DSS} Volts (Min.)	I_{DSS} (μA) (Max.)	V_{SD} Volts (Max.)	Q_C (nC) (Typ.)	MOSFET (Typ.) $R_{th(j-c)}$ °C/W	Module (Max.) $R_{th(c-f)}$ °C/W	Weight Grams	Outline Drawings Number	Page
Single Si MOSFET Module														
QJS0512001	500	120	150	2500	22	500	20	1.5	380	0.1	0.075	220	4	B-6

MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS					THERMAL CHARACTERISTICS					
								V_{GS} = 0V			Interface Per Module (Typ.)	MOSFET (Max.)	Diode (Max.)			
Type	V_{DSS} Volts	I_D Amperes	$I_{D(1)}$ Amperes	P_d Watts	V_{RMS} Isolation Volts	$R_{DS(on)}$ mΩ	V_{SD} Volts	C_{iss} nF	C_{rss} nF	Q_G nC	$R_{th(c-s)}$ °C/W	$R_{th(j-c)}$ °C/W	$R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawings Number	Page
Split Dual SiC 1200V Modules																
QJD1210010	1200	100*	250	1080	3000	15	4.0	10.2	0.1	550	0.04	0.138	0.243	270	2	B-5
QJD1210011	1200	100*	250	900	3000	15	4.0	10.2	0.1	550	0.04	0.167	0.294	140	2	B-5
QJD1210SA1	1200	100*	200	520	3000	18	1.45	8.2	0.1	300	0.04	0.24	0.39	270	2	B-5
QJD1210SA2	1200	100*	200	415	3000	17	1.45	8.2	0.1	300	0.04	0.29	0.47	140	2	B-5
6-Pack SiC High Power Modules																
QJE0130018	100	300	—	960	2500	1.8	1.3	110	15	1800	0.1	0.13	—	430	5	B-6
QJE0130021	100	300	—	960	2500	1.8	1.3	110	15	1800	—	0.13	—	430	5	B-6

* Current rating when wired as a Dual

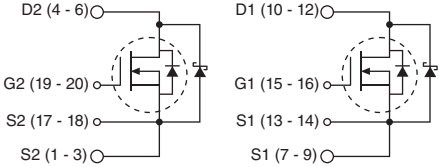
Single MOSFET Module

QJS0512001



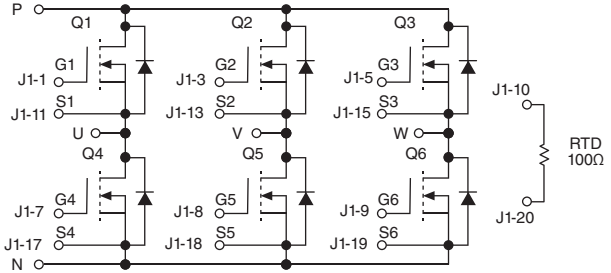
Split Dual MOSFET Module

QJD1210010, QJD1210011, QJD1210SA1, QJD1210SA2



6-Pack MOSFET Module

QJE0130018, QJE0130021



Numbering System

QJD1210010 is a 1200V, 100A, Split Dual SiC MOSFET Module

Q	J	D	12	10	0	1	0
(1)	(2)	(3)	(4,5)	(6,7)	(8)	(9)	(10)

Serial Designation (SPECIAL)

(1) Product Line

(2) Device:
- J = MOSFET

(3) Configuration:
- D = Split Dual
- E = 6-Pack
- S = Single

(4,5) Voltage:
- 01 = 100V
- 05 = 500V
- 12 = 1200V

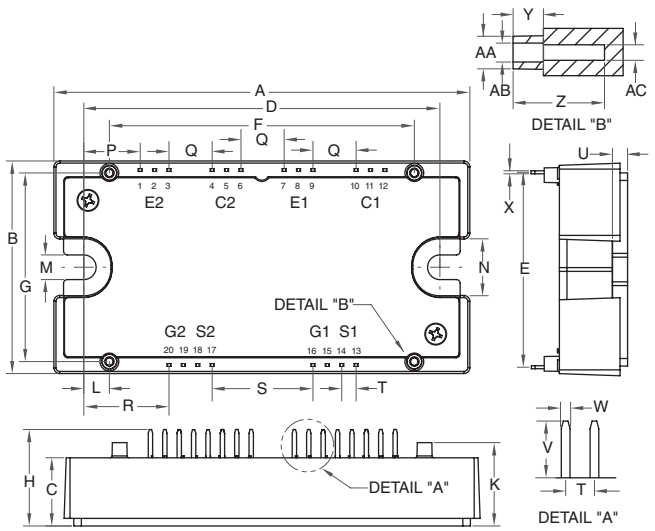
(6,7) Current:
- 10 = 100
- 12 = 120
- 30 = 300

Serial Designation

SPECIAL:
- (8) 0 – 9
- (9) 0 – 9
- (10) 0 – 9

(Numbered from 001 – 999 for each individual combination of 7 previous digits.)

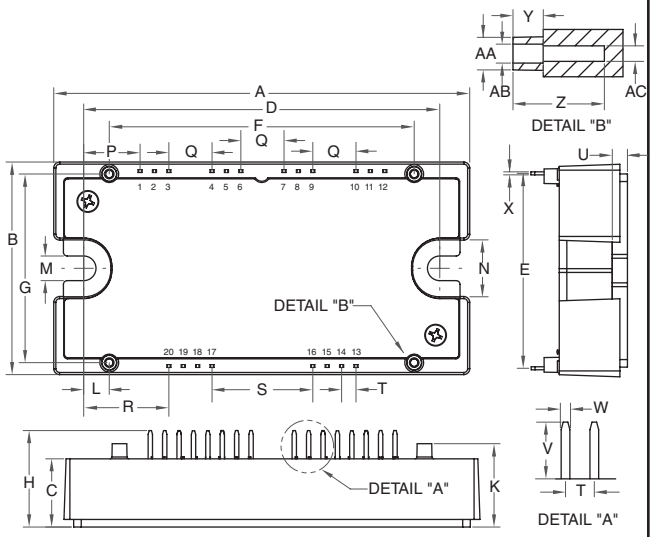
1 QID1210005, QID1210006, QID1210007, QID1215003



Dim.	Inches	Millimeters
A	4.32	109.8
B	2.21	56.1
C	0.71	18.0
D	3.70±0.02	94.0±0.5
E	2.026	51.46
F	3.17	80.5
G	1.96	49.8
H	1.00	25.5
K	0.87	22.0
L	0.266	6.75
M	0.26	6.5
N	0.59	15.0
P	0.586	14.89

Dim.	Inches	Millimeters
Q	0.449	11.40
R	0.885	22.49
S	1.047	26.6
T	0.15	3.80
U	0.16	4.0
V	0.30	7.5
W	0.045	1.15
X	0.03	0.8
Y	0.16	4.0
Z	0.47	12.1
AA	0.17 Dia.	4.3 Dia.
AB	0.10 Dia.	2.5 Dia.
AC	0.08 Dia.	2.1 Dia.

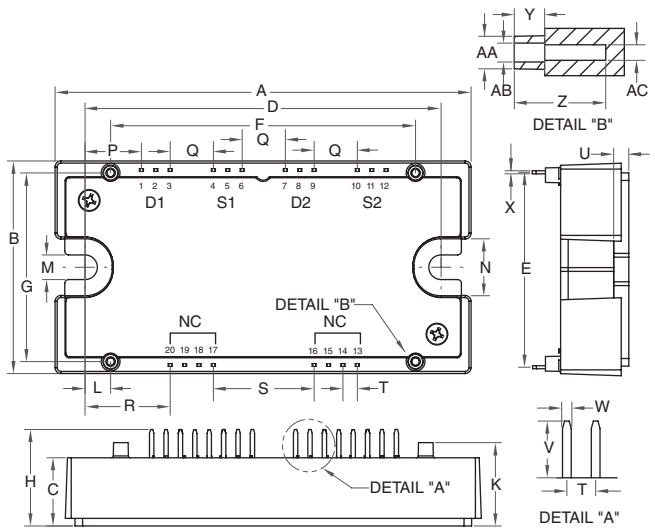
2 QJD1210010, QJD1210011, QJD1210SA1, QJD1210SA2



Dim.	Inches	Millimeters
A	4.32	109.8
B	2.21	56.1
C	0.71	18.0
D	3.70±0.02	94.0±0.5
E	2.026	51.46
F	3.17	80.5
G	1.96	49.8
H	1.00	25.5
K	0.87	22.0
L	0.266	6.75
M	0.26	6.5
N	0.59	15.0
P	0.586	14.89

Dim.	Inches	Millimeters
Q	0.449	11.40
R	0.885	22.49
S	1.047	26.6
T	0.15	3.80
U	0.16	4.0
V	0.30	7.5
W	0.045	1.15
X	0.03	0.8
Y	0.16	4.0
Z	0.47	12.1
AA	0.17 Dia.	4.3 Dia.
AB	0.10 Dia.	2.5 Dia.
AC	0.08 Dia.	2.1 Dia.

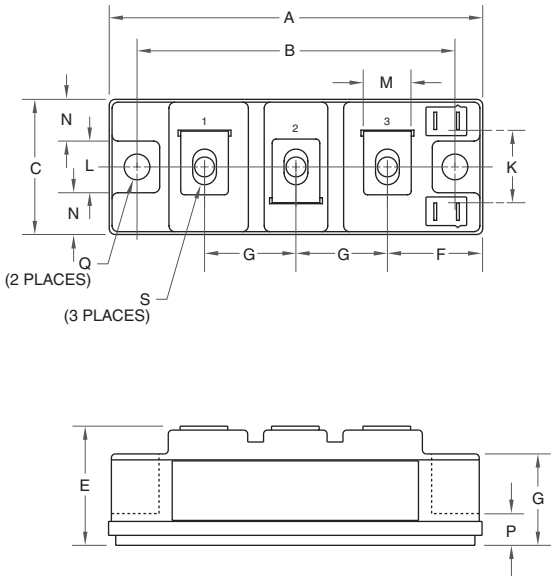
3 QRD1210004, QRD1210005



Dim.	Inches	Millimeters
A	4.32	109.8
B	2.21	56.1
C	0.71	18.0
D	3.70±0.02	94.0±0.5
E	2.026	51.46
F	3.17	80.5
G	1.96	49.8
H	1.00	25.5
K	0.87	22.0
L	0.266	6.75
M	0.26	6.5
N	0.59	15.0
P	0.586	14.89

Dim.	Inches	Millimeters
Q	0.449	11.40
R	0.885	22.49
S	1.047	26.6
T	0.15	3.80
U	0.16	4.0
V	0.30	7.5
W	0.045	1.15
X	0.03	0.8
Y	0.16	4.0
Z	0.47	12.1
AA	0.17 Dia.	4.3 Dia.
AB	0.10 Dia.	2.5 Dia.
AC	0.08 Dia.	2.1 Dia.

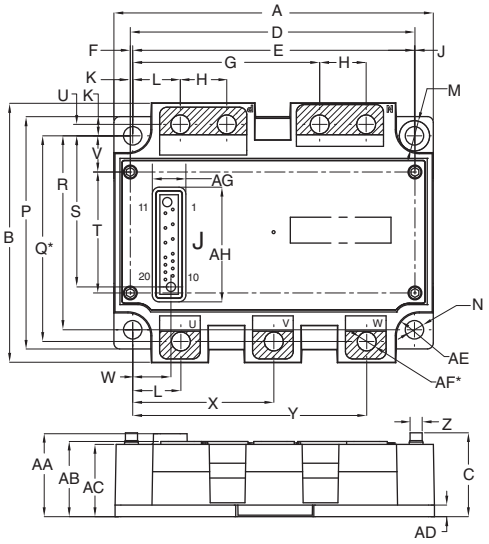
4 QJS0512001



Dim.	Inches	Millimeters
A	3.70	94.0
B	1.34	34.0
C	1.18	30.0
D	3.15	80.0
E	0.50	12.7
F	0.28	7.0
G	0.67	17.0
H	0.91	23.0
J	0.91	23.0

Dim.	Inches	Millimeters
K	M6 Metric	M6
L	0.31	8.0
M	0.256 Dia.	6.5 Dia.
N	0.47	12.0
P	1.13	28.7
Q	0.10	2.5
R	0.84	21.3
S	0.21	5.3
T	0.24	6.1

5 QJE0130018, QJE0130021



Dim.	Inches	Millimeters
A	4.33	109.98
B	3.54	89.91
C	1.17 Max.	29.72 Max.
D	3.86	98.04
E	3.82	97.03
F	0.03	0.76
G	2.54	64.52
H	0.63	16.0
J	0.01	0.254
K	0.26	6.604
L	0.65	16.51
M	0.41 Dia.	10.414 Dia.
N	0.25 Dia.	6.35
P	3.15	80.01
Q	2.80	71.12
R	2.63	66.802

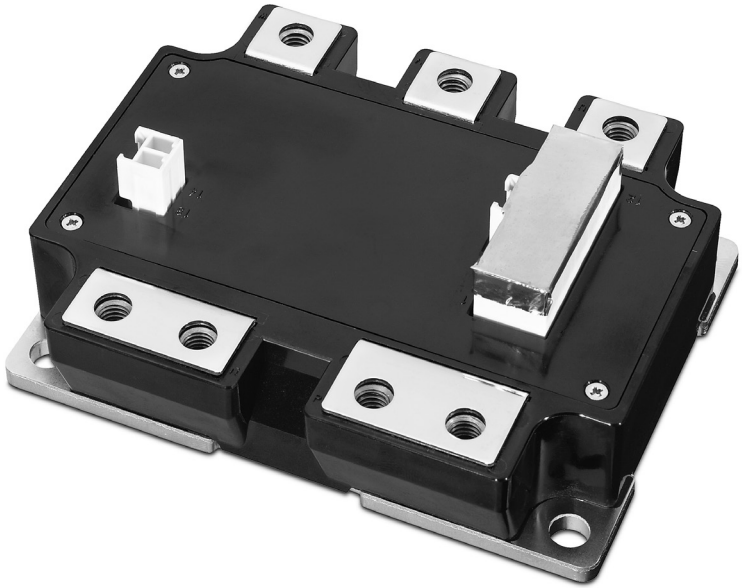
Dim.	Inches	Millimeters
S	2.06	51.816
T	1.64	41.656
U	0.16	4.0
V	0.49	12.446
W	0.52	13.208
X	1.91	48.514
Y	3.17	80.518
Z	0.14 Dia.	3.556 Dia.
AA	1.12	28.448
AB	1.04 ±0.25	26.416 ±6.35
AC	0.98	24.892
AD	0.157 ±0.006	3.9878 ±0.152
AE	0.36 Rad.	9.144 Rad.
AF	0.30 Dia.	7.62
AG	0.46	11.684
AH	1.58	40.132

All dimensions are ±0.02 inches unless otherwise specified.

MOSFET Modules

Applications Include:
- Chopper
- Forklifts
- Off-Road Electric Vehicles
- Power Supplies

Circuit Configurations:
- 6-Pac
- Chopper (By Paralleling Legs)
- Dual (By Paralleling Legs)



VOLTAGE: 75V TO 150V
CURRENT: 200A TO 600A

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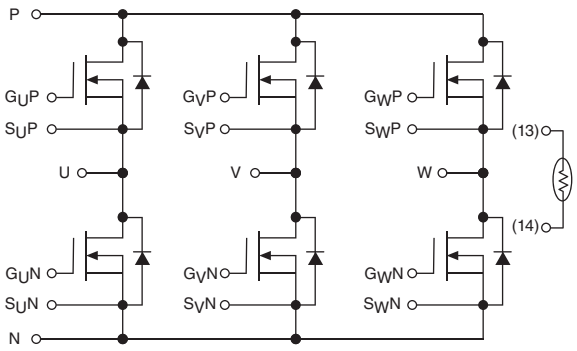
MOSFET Modules, (Refer to device datasheets at www.pwrx.com for test conditions.)

MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS							THERMAL CHARACTERISTICS			
								V_{DS} = 10V, V_{GS} = 0V								
Type	V_{DSS} Volts	I_D Amperes	$I_{D(1)}$ Amperes	P_d Watts	V_{RMS} Isolation Volts	$R_{DS(on)}$ mΩ	V_{SD} Volts	C_{iss} nF	C_{rss} nF	Q_G nC	Q_{rr} µC	t_{rr} ns	Interface Per Module $R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawings Number	Page
75V Modules																
FM200TU-07A	75	200	600	560	2500	1.2	1.3	50	4.0	700	2.0	200	0.22	600	1	C-3
FM400TU-07A	75	400	1200	650	2500	0.8	1.3	75	6.0	1100	4.5	200	0.142	600	1	C-3
FM600TU-07A	75	600	1800	1300	2500	0.53	1.3	110	10.0	1650	4.8	200	0.096	600	1	C-3
100V Modules																
FM200TU-2A	100	200	600	560	2500	2.4	1.3	50	4.0	760	3.6	250	0.22	600	1	C-3
FM400TU-2A	100	400	1200	880	2500	1.45	1.3	75	6.0	1200	6.0	250	0.142	600	1	C-3
FM600TU-2A	100	600	1800	1300	2500	0.8	1.3	110	10.0	1800	6.2	250	0.096	600	1	C-3
150V Modules																
FM200TU-3A	150	200	600	560	2500	4.8	1.3	50	4.0	820	6.5	200	0.22	600	1	C-3
FM400TU-3A	150	400	1200	880	2500	2.6	1.3	75	6.0	1300	7.0	200	0.142	600	1	C-3
FM600TU-3A	150	600	1800	1300	2500	1.6	1.3	110	10.0	1950	8.0	200	0.096	600	1	C-3

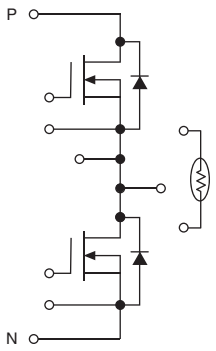
(1) Current rating when wired as a Dual or Chopper

6-Pac MOSFET Modules



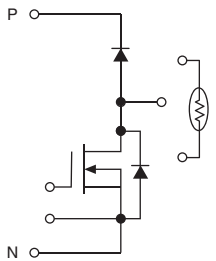
OR

Dual MOSFET Module (By Paralleling)



OR

Chopper MOSFET Module (By Paralleling)



Numbering System

FM400TU-2A is a 400 Ampere, 100 Volt, 6-Pac MOSFET Module

FM 400 TU – 2A

(1) (2) (3) (4)

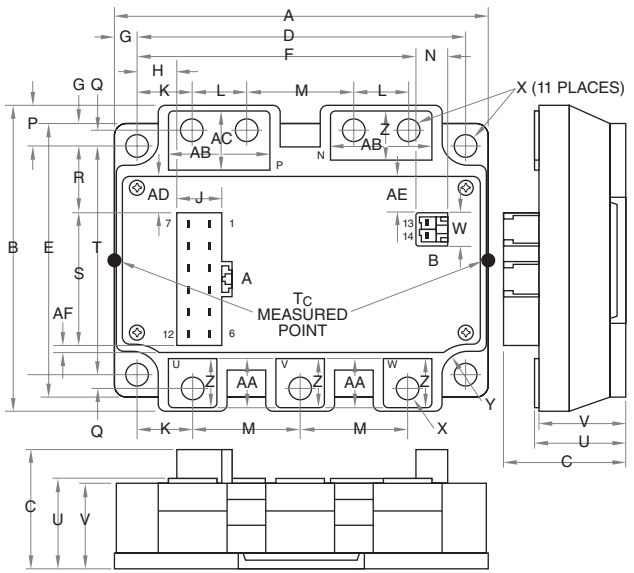
(1) FM = MOSFET

(2) Current Rating: I_D (Amperes)

(3) TU = 6-Pac

(4) Drain Source Voltage, V_{DSS}:
07A = 75V
2A = 100V
3A = 150V

1 FM200TU-07A, FM200TU-2A, FM200TU-3A, FM400TU-07A, FM400TU-2A, FM400TU-3A, FM600TU-07A, FM600TU-2A, FM600TU-3A



Dim.	Inches	Millimeters
A	4.33	110.0
B	3.54	90.0
C	1.38	35.0
D	3.82	97.0
E	3.15	80.0
F	3.27	83.0
G	0.26	6.5
H	0.48	12.0
J	0.51	12.9
K	0.65	16.5
L	0.63	16.0
M	1.26	32.0
N	0.35	8.8
P	0.45	11.5
Q	0.16	4.0

Dim.	Inches	Millimeters
R	0.79	20.0
S	1.50	38.0
T	2.64	67.0
U	1.02	26.0
V	0.98	25.0
W	0.36	9.1
X	Dia. 0.25	Dia. 6.5
Y	Rad. 0.25	Rad. 6.5
Z	0.57	14.5
AA	0.55	14.0
AB	1.18	30.0
AC	0.69	17.5
AD	0.47	12.0
AE	0.61	15.5
AF	0.18	4.5

Housing Types (Tyco Amp)

A 917354-1
B 177898-1

IPMs

Applications Include:
- Hybrid Electric Vehicles (HEV / EV)
- Motor Drives
- Photovoltaic (PV) Inverters
- Power Supplies
- Servo Drives
- UPS

Circuit Configurations:
- Dual
- H-Bridge [+ Chopper(s)]
- 6-Pac
- 7-Pac

Features:
- Integrated Gate Drive
- Gate Drive Undervoltage (UV) Lockout
- Over Temperature Protection
- Short Circuit (SC) Protection Using On-Chip Current Sensor

Development Kits available for some types.
(See Section N, DC-DC Converters)

VOLTAGE: 600V TO 1200V
CURRENT: 25A TO 800A

TABLE OF CONTENTS

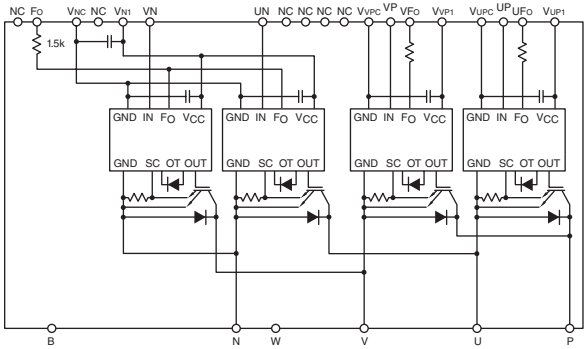
Photovoltaic 600V L1-Series Intelligent Power Modules,

(Refer to device datasheets at www.pwrx.com for test conditions.)

MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS (IGBT Inverter Sector)										PROTECTION TRIP LEVELS			THERMAL CHARACTERISTICS					
										Inductive Load Switching Times													
Type	V_{CES} Volts	I_C Amperes	P_d Watts	V_{RMS} Isolation Volts	Typ. $V_{CE(SAT)}$ Volts	V_{EC} Volts	I_{CES} mA	$V_{CC(PROT)}$ Volts	Brake I_C Amperes	$t_{(on)}$ µsec	t_{rr} µsec	$t_{c(on)}$ µsec	$t_{(off)}$ µsec	$t_{c(off)}$ µsec	SC Amperes	OT °C	UV Volts	$R_{th(c-f)}$ °C/W	IGBT $R_{th(j-c)}$ °C/W	DIODES $R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawings Number	Page
PM50B4L1C060	600	50	168	2500	1.9	1.7	1.0	400	–	0.8	0.4	0.4	1.0	0.3	75	135	12	0.06	0.74	1.28	135	3	D-6
PM50B5L1C060	600	50	168	2500	1.9	1.7	1.0	400	50	0.8	0.4	0.4	1.0	0.3	75	135	12	0.06	0.74	1.28	135	3	D-6
PM50B6L1C060	600	50	168	2500	1.9	1.7	1.0	400	50	0.8	0.4	0.4	1.0	0.3	75	135	12	0.06	0.74	1.28	135	3	D-6
PM75B4L1C060	600	75	337	2500	1.9	1.7	1.0	400	–	0.8	0.4	0.4	1.0	0.3	112	135	12	0.06	0.37	0.63	135	3	D-6
PM75B5L1C060	600	75	337	2500	1.9	1.7	1.0	400	75	0.8	0.4	0.4	1.0	0.3	112	135	12	0.06	0.37	0.63	135	3	D-6
PM75B6L1C060	600	75	337	2500	1.9	1.7	1.0	400	75	0.8	0.4	0.4	1.0	0.23	112	135	12	0.06	0.37	0.63	135	3	D-6

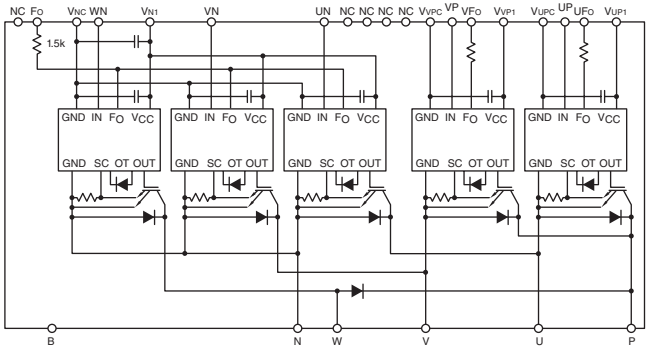
H-Bridge Module

PM50B4L1C060, PM75B4L1C060



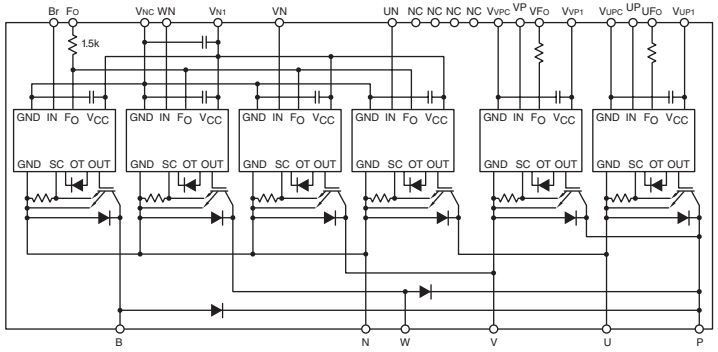
H-Bridge + 1 Chopper Module

PM50B5L1C060, PM75B5L1C060



H-Bridge + 2 Choppers Module

PM50B6L1C060, PM75B6L1C060



Numbering System

PM150RL1A120 is a 150 Ampere, 1200 Volt, 7-Pac L1-Series IPM

PM 150 R L1 A 120

(1) (2) (3) (4) (5) (6)

(1) PM = Intelligent Power Module (IPM)

(2) Current Rating: I_C (Amperes)

(3) C = 6-Pac
R = 7-Pac
B4 = H-Bridge
B5 = H-Bridge + 1 Chopper
B6 = H-Bridge + 2 Choppers
H = Single
D = Dual

(4) L = L-Series
L1 = L1-Series
C = HVIPM
V1 = V1-Series

(5) Package Outline

(6) Voltage V_{CES} Volts (x10)

L1-Series & L-Series 6-Pac & 7-Pac 600V Intelligent Power Modules,

(Refer to device datasheets at www.pwrx.com for test test conditions.)

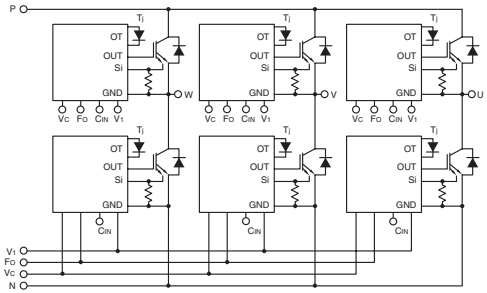
PM50RL1C060

PM50CL1A060, PM50RL1A060, PM75CL1A060, PM75RL1A060, PM100CL1A060, PM100RL1A060, PM150CL1A060, PM150RL1A060

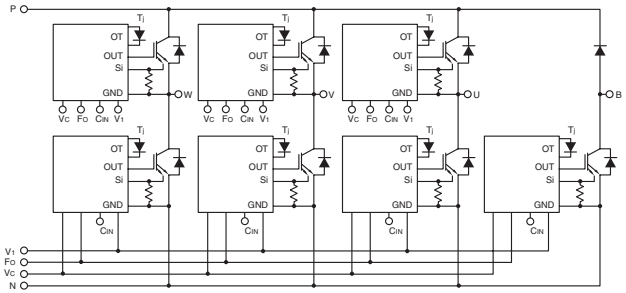
PM50CL1B060, PM50RL1B060, PM75CL1B060, PM75RL1B060, PM100CL1B060, PM100RL1B060, PM150CL1B060, PM150RL1B060

MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS (IGBT Inverter Sector)										PROTECTION TRIP LEVELS			THERMAL CHARACTERISTICS				Outline Drawings	
										Inductive Load Switching Times													
Type	V_{CES} Volts	I_C Amperes	P_d Watts	V_{RMS} Isolation Volts	Typ. $V_{CE(SAT)}$ Volts	V_{EC} Volts	I_{CES} mA	$V_{CC(PROT)}$ Volts	Brake I_C Amperes	$t_{(on)}$ µsec	t_{rr} µsec	$t_{c(on)}$ µsec	$t_{(off)}$ µsec	$t_{c(off)}$ µsec	SC Amperes	OT °C	UV Volts	$R_{th(c-f)}$ °C/W	IGBT $R_{th(j-c)}$ °C/W	DIODES $R_{th(j-c)}$ °C/W	Weight Grams	Number	Page
L1-Series Modules																							
PM50CL1A060	600	50	284	2500	1.75	1.70	1.0	400	–	0.8	0.4	0.4	1.0	0.3	100	135	12	0.038	0.44	0.75	380	1	D-6
PM50CL1B060	600	50	284	2500	1.75	1.70	1.0	400	–	0.8	0.4	0.4	1.0	0.3	100	135	12	0.038	0.44	0.75	340	2	D-6
PM50RL1A060	600	50	284	2500	1.75	1.70	1.0	400	50	0.8	0.4	0.4	1.0	0.3	100	135	12	0.038	0.44	0.75	380	1	D-6
PM50RL1B060	600	50	284	2500	1.75	1.70	1.0	400	50	0.8	0.4	0.4	1.0	0.3	100	135	12	0.038	0.44	0.75	340	2	D-6
PM50RL1C060	600	50	168	2500	1.75	1.70	1.0	400	50	0.8	0.4	0.4	1.0	0.3	100	135	12	0.085	0.74	1.28	135	3	D-6
PM75CL1A060	600	75	337	2500	1.75	1.70	1.0	400	–	0.8	0.4	0.4	1.0	0.3	150	135	12	0.038	0.37	0.63	380	1	D-6
PM75CL1B060	600	75	337	2500	1.75	1.70	1.0	400	–	0.8	0.4	0.4	1.0	0.3	150	135	12	0.038	0.37	0.63	340	2	D-6
PM75RL1A060	600	75	337	2500	1.75	1.70	1.0	400	50	0.8	0.4	0.4	1.0	0.3	150	135	12	0.038	0.37	0.63	380	1	D-6
PM75RL1B060	600	75	337	2500	1.75	1.70	1.0	400	50	0.8	0.4	0.4	1.0	0.3	150	135	12	0.038	0.37	0.63	340	2	D-6
PM100CL1A060	600	100	390	2500	1.75	1.70	1.0	400	–	0.8	0.4	0.4	1.0	0.3	200	135	12	0.038	0.32	0.52	380	1	D-6
PM100CL1B060	600	100	390	2500	1.75	1.70	1.0	400	–	0.8	0.4	0.4	1.0	0.3	200	135	12	0.038	0.32	0.52	340	2	D-6
PM100RL1A060	600	100	390	2500	1.75	1.70	1.0	400	50	0.8	0.4	0.4	1.0	0.3	200	135	12	0.038	0.32	0.52	380	1	D-6
PM100RL1B060	600	100	390	2500	1.75	1.70	1.0	400	50	0.8	0.4	0.4	1.0	0.3	200	135	12	0.038	0.32	0.52	340	2	D-6
PM150CL1A060	600	150	500	2500	1.75	1.70	1.0	400	–	0.8	0.4	0.4	1.0	0.3	300	135	12	0.038	0.25	0.41	380	1	D-6
PM150CL1B060	600	150	500	2500	1.75	1.70	1.0	400	–	0.8	0.4	0.4	1.0	0.3	300	135	12	0.038	0.25	0.41	340	2	D-6
PM150RL1A060	600	150	500	2500	1.75	1.70	1.0	400	75	0.8	0.4	0.4	1.0	0.3	300	135	12	0.038	0.25	0.41	380	1	D-6
PM150RL1B060	600	150	500	2500	1.75	1.70	1.0	400	75	0.8	0.4	0.4	1.0	0.3	300	135	12	0.038	0.25	0.41	340	2	D-6
PM200CL1A060	600	200	625	2500	1.75	1.70	1.0	400	–	0.8	0.4	0.4	1.0	0.3	400	135	12	0.023	0.2	0.3	800	4	D-7
PM200RL1A060	600	200	625	2500	1.75	1.70	1.0	400	100	0.8	0.4	0.4	1.0	0.3	400	135	12	0.023	0.2	0.3	800	4	D-7
PM300CL1A060	600	300	833	2500	1.75	1.70	1.0	400	–	0.8	0.4	0.4	1.0	0.3	600	135	12	0.023	0.15	0.23	800	4	D-7
PM300RL1A060	600	300	833	2500	1.75	1.70	1.0	400	150	0.8	0.4	0.4	1.0	0.3	600	135	12	0.023	0.15	0.23	800	4	D-7
L-Series Modules																							
PM450CLA060	600	450	1041	2500	1.70	2.60	1.0	400	–	1.0	0.2	0.4	2.2	0.6	900	135	12	0.014	0.12	0.19	1250	5	D-7
PM600CLA060	600	600	1785	2500	1.70	2.60	1.0	400	–	1.0	0.2	0.4	2.2	0.6	1200	135	12	0.014	0.07	0.11	1250	5	D-7

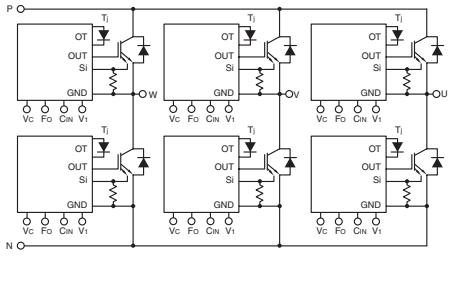
PM50CL1A060, PM50CL1B060, PM75CL1A060, PM75CL1B060, PM100CL1A060, PM100CL1B060, PM150CL1A060, PM150CL1B060, PM200CL1A060, PM300CL1A060



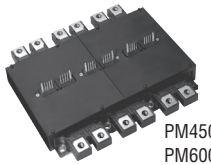
PM50RL1A060, PM50RL1B060, PM50RL1C060, PM75RL1A060, PM75RL1B060, PM100RL1A060, PM100RL1B060, PM150RL1A060, PM150RL1B060, PM200RL1A060, PM300RL1A060



PM450CLA060, PM600CLA060



PM200CL1A060, PM200RL1A060, PM300CL1A060, PM300RL1A060



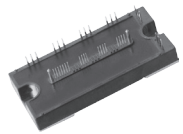
PM450CLA060, PM600CLA060

L1-Series & L-Series 6-Pac & 7-Pac 1200V Intelligent Power Modules,

(Refer to device datasheets at www.pwrx.com for test test conditions.)

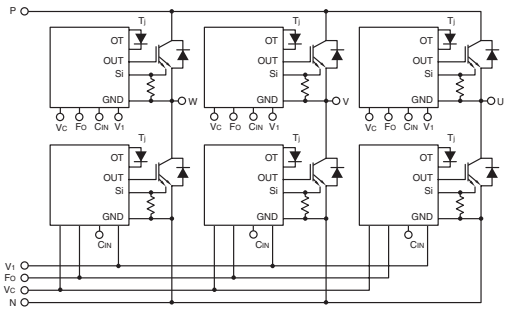

PM25RL1A120


PM25CL1A120, PM25RL1A120, PM50CL1A120, PM50RL1A120, PM75CL1A120, PM75RL1A120

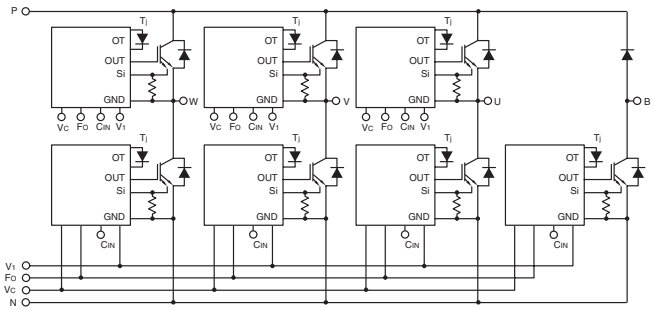

PM25CL1B120,PM25RL1B120, PM50CL1B120, PM50RL1B120, PM75CL1B120, PM75RL1B120

MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS (IGBT Inverter Sector)										PROTECTION TRIP LEVELS			THERMAL CHARACTERISTICS				Outline Drawings	
										Inductive Load Switching Times													
Type	V_{CES} Volts	I_C Amperes	P_d Watts	V_{RMS} Isolation Volts	Typ. $V_{CE(SAT)}$ Volts	V_{EC} Volts	I_{CES} mA	$V_{CC(PROT)}$ Volts	Brake I_C Amperes	$t_{(on)}$ µsec	t_{rr} µsec	$t_{c(on)}$ µsec	$t_{(off)}$ µsec	$t_{c(off)}$ µsec	SC Amperes	OT °C	UV Volts	$R_{th(c-f)}$ °C/W	IGBT $R_{th(j-c)}$ °C/W	DIODES $R_{th(j-c)}$ °C/W	Weight Grams	Number	Page
L1-Series Modules																							
PM25CL1A120	1200	25	128	2500	1.65	2.30	1.0	800	-	0.8	0.3	0.4	1.2	0.4	50	135	12	0.038	0.97	1.6	380	1	D-6
PM25CL1B120	1200	25	128	2500	1.65	2.30	1.0	800	-	0.8	0.3	0.4	1.2	0.4	50	135	12	0.038	0.97	1.6	340	2	D-6
PM25RL1A120	1200	25	128	2500	1.65	2.30	1.0	800	25	0.8	0.3	0.4	1.2	0.4	50	135	12	0.038	0.97	1.6	380	1	D-6
PM25RL1B120	1200	25	128	2500	1.65	2.30	1.0	800	25	0.8	0.3	0.4	1.2	0.4	50	135	12	0.038	0.97	1.6	340	2	D-6
PM25RL1C120	1200	25	178	2500	1.65	2.30	1.0	800	25	0.8	0.3	0.4	1.5	0.4	50	135	12	0.085	0.7	1.18	135	3	D-6
PM50CL1A120	1200	50	462	2500	1.65	2.30	1.0	800	-	0.8	0.3	0.4	1.2	0.4	100	135	12	0.038	0.27	0.47	380	1	D-6
PM50CL1B120	1200	50	462	2500	1.65	2.30	1.0	800	-	0.8	0.3	0.4	1.2	0.4	100	135	12	0.038	0.27	0.47	340	2	D-6
PM50RL1A120	1200	50	462	2500	1.65	2.30	1.0	800	25	0.8	0.3	0.4	1.2	0.4	100	135	12	0.038	0.27	0.47	380	1	D-6
PM50RL1B120	1200	50	462	2500	1.65	2.30	1.0	800	25	0.8	0.3	0.4	1.2	0.4	100	135	12	0.038	0.27	0.47	340	2	D-6
PM75CL1A120	1200	75	595	2500	1.65	2.30	1.0	800	-	0.8	0.3	0.4	1.2	0.4	150	135	12	0.038	0.21	0.36	380	1	D-6
PM75CL1B120	1200	75	595	2500	1.65	2.30	1.0	800	-	0.8	0.3	0.4	1.2	0.4	150	135	12	0.038	0.21	0.36	340	2	D-6
PM75RL1A120	1200	75	595	2500	1.65	2.30	1.0	800	50	0.8	0.3	0.4	1.2	0.4	150	135	12	0.038	0.21	0.36	380	1	D-6
PM75RL1B120	1200	75	595	2500	1.65	2.30	1.0	800	50	0.8	0.3	0.4	1.2	0.4	150	135	12	0.038	0.21	0.36	340	2	D-6
PM100CL1A120	1200	100	657	2500	1.65	2.30	1.0	800	-	0.8	0.3	0.4	1.2	0.4	200	135	12	0.023	0.19	0.31	800	4	D-7
PM100RL1A120	1200	100	657	2500	1.65	2.30	1.0	800	50	0.8	0.3	0.4	1.2	0.4	200	135	12	0.023	0.25	0.41	800	4	D-7
PM150CL1A120	1200	150	833	2500	1.65	2.30	1.0	800	-	0.8	0.3	0.4	1.2	0.4	300	135	12	0.023	0.19	0.31	800	4	D-7
PM150RL1A120	1200	150	833	2500	1.65	2.30	1.0	800	75	0.8	0.3	0.4	1.2	0.4	300	135	12	0.023	0.19	0.31	800	4	D-7
L-Series Modules																							
PM200CLA120	1200	200	1041	2500	1.80	2.80	1.0	800	-	1.0	0.5	0.4	2.3	0.7	400	135	12	0.014	0.12	0.2	1250	5	D-7
PM300CLA120	1200	300	1562	2500	1.80	2.80	1.0	800	-	1.0	0.5	0.4	2.3	0.7	600	135	12	0.014	0.08	0.13	1250	5	D-7
PM450CLA120	1200	450	2500	2500	1.80	2.80	1.0	800	-	1.0	0.5	0.4	2.3	0.7	900	135	12	0.014	0.05	0.09	1250	5	D-7

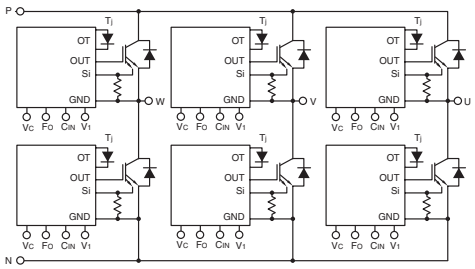
PM25CL1A120, PM25CL1B120, PM50CL1A120, PM50CL1B120, PM75CL1A120, PM75CL1B120, PM100CL1A120, PM150CL1A120



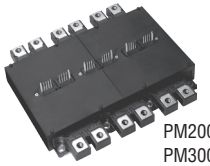
PM25RL1A120, PM25RL1B120, PM25RL1C120, PM50RL1A120, PM50RL1B120, PM75RL1A120, PM75RL1B120. PM100RL1A120, PM150RL1A120



PM200CLA120, PM300CLA120, PM450CLA120




PM100CL1A120, PM100RL1A120, PM150CL1A120, PM150RL1A120


PM200CLA120, PM300CLA120, PM450CLA120

V1-Series Dual Intelligent Power Modules,

(Refer to device datasheets at www.pwrx.com for test test conditions.)

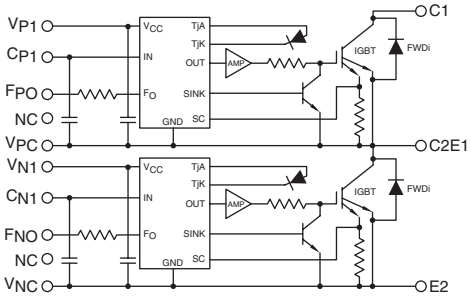
PM400DV1A060, PM600DV1A060,
PM200DV1A120, PM300DV1A120,
PM450DV1A120

PM800DV1B060

MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS (IGBT Inverter Sector)									PROTECTION TRIP LEVELS			THERMAL CHARACTERISTICS				Outline Drawings	
									Inductive Load Switching Times									IGBT				
Type	V_{CES} Volts	I_C Amperes	P_d Watts	V_{RMS} Isolation Volts	Typ. $V_{CE(SAT)}$ Volts	V_{EC} Volts	I_{CES} mA	$V_{CC(PROT)}$ Volts	$t_{(on)}$ µsec	t_{rr} µsec	$t_{c(on)}$ µsec	$t_{(off)}$ µsec	$t_{c(off)}$ µsec	SC Amperes	OT °C	UV Volts	$R_{th(c-f)}$ °C/W	$R_{th(j-c)}$ °C/W	DIODES $R_{th(j-c)}$ °C/W	Weight Grams	Number	Page
600V Dual Modules																						
PM400DV1A060	600	400	1262	2500	1.75	1.75	1.0	400	0.8	0.4	0.4	1.0	0.3	600	135	12	0.016	0.099	0.153	510	6	D-7
PM600DV1A060	600	600	1712	2500	1.75	1.70	1.0	400	0.8	0.3	0.4	1.0	0.3	900	135	12	0.016	0.073	0.109	510	6	D-7
PM800DV1B060	600	800	2500	2500	1.85	1.70	1.0	400	0.8	0.25	0.4	1.4	0.3	1200	135	12	0.014	0.05	0.09	720	7	D-8
1200V Dual Modules																						
PM200DV1A120	1200	200	1388	2500	1.65	2.30	1.0	800	0.8	0.3	0.4	1.2	0.4	300	135	12	0.016	0.09	0.146	510	6	D-7
PM300DV1A120	1200	300	1785	2500	1.65	2.30	1.0	800	0.8	0.3	0.4	1.2	0.4	450	135	12	0.016	0.07	0.11	510	6	D-7
PM450DV1A120	1200	450	2232	2500	1.65	2.30	1.0	800	0.8	0.3	0.4	1.2	0.4	675	135	12	0.016	0.056	0.079	510	6	D-7

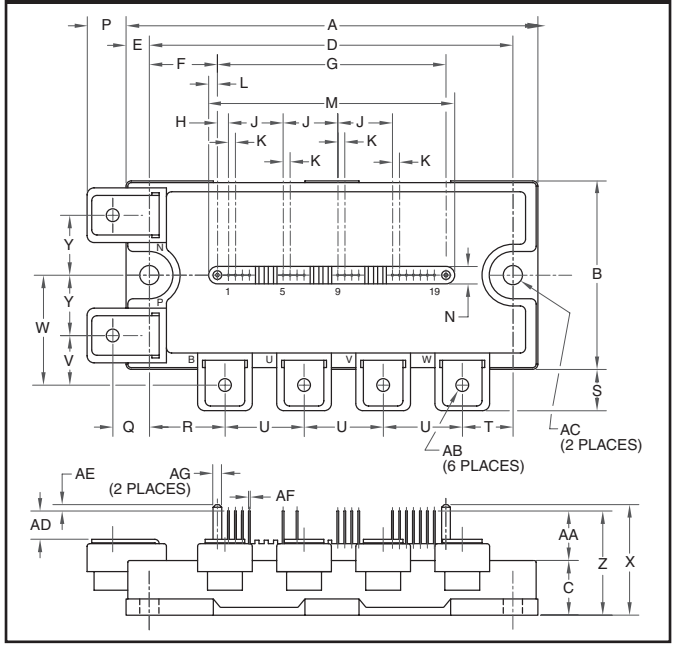
V1-Series, Duals

PM400DV1A060, PM600DV1A060, PM800DV1B060,
PM200DV1A120, PM300DV1A120, PM450DVIA120



1

PM25CL1A120, PM25RL1A120, PM50CL1A060, PM50CL1A120, PM50RL1A060, PM50RL1A120, PM75CL1A060, PM75CL1A120, PM75RL1A060,PM75RL1A120,PM100CL1A060, PM100RL1A060, PM150CL1A060, PM150RL1A060

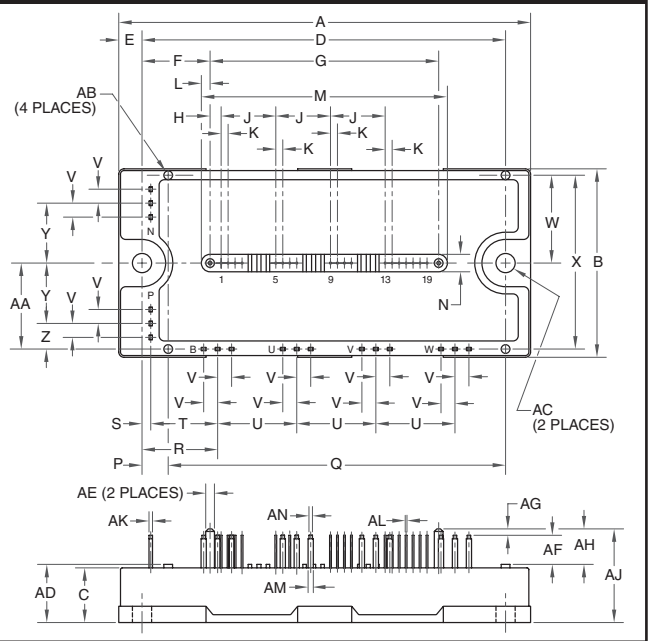


Dim.	Inches	Millimeters
A	4.72	120.0
B	2.17	55.0
C	0.63	16.0
D	4.17	106.0
E	0.28	7.0
F	0.78	19.75
G	2.62	66.5
H	0.13	3.25
J	0.63	16.0
K	0.08	2.0
L	0.10	2.5
M	2.81	71.5
N	0.20	5.0
P	0.43	11.0
Q	0.42	10.75
R	0.87	22.0

Dim.	Inches	Millimeters
S	0.46	11.75
T	0.59	15.0
U	0.91	23.0
V	0.57	14.5
W	1.26	32.0
X	1.22	31.0
Y	0.69	17.5
Z	1.14	29.0
AA	0.51	13.0
AB	M5 Metric	M5
AC	0.22 Dia.	5.5 Dia.
AD	0.28	7.0
AE	0.08	2.0
AF	0.02 Sq.	0.5 Sq.
AG	0.10 Dia.	2.5 Dia.

2

PM25CL1B120, PM25RL1B120, PM50CL1B060, PM50CL1B120, PM50RL1B060, PM50RL1B120, PM75CL1B060, PM75CL1B120, PM75RL1B060,PM75RL1B120,PM100CL1B060, PM100RL1B060, PM150CL1B060, PM150RL1B060

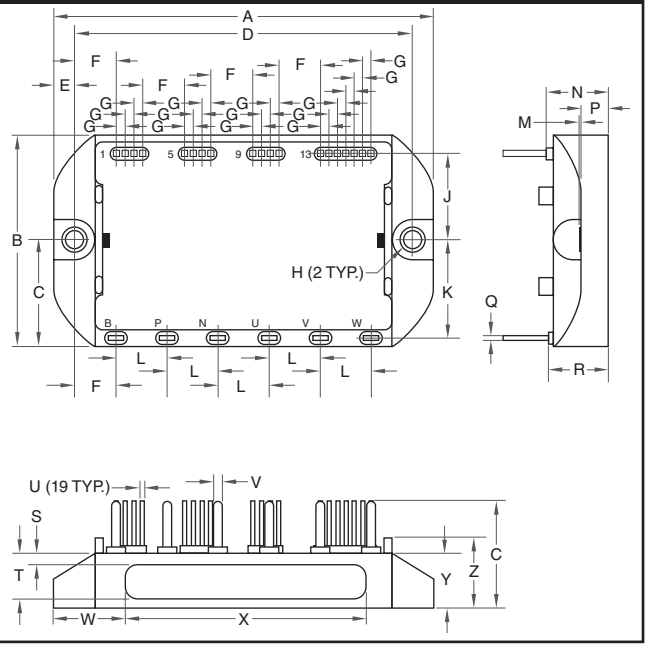


Dim.	Inches	Millimeters
A	4.72	120.0
B	2.17	55.0
C	0.63	16.0
D	4.17	106.0
E	0.28	7.0
F	0.78	19.75
G	2.62	66.5
H	0.13	3.25
J	0.63	16.0
K	0.08	2.0
L	0.10	2.5
M	2.81	71.5
N	0.20	5.0
P	0.31	7.75
Q	3.87	98.25
R	0.87	22.0
S	0.10	2.5
T	0.77	19.5
U	0.91	23.0

Dim.	Inches	Millimeters
V	0.16	4.0
W	1.01	25.75
X	2.00	50.75
Y	0.69	17.5
Z	0.30	7.5
AA	0.98	25.0
AB	0.10 Dia.	2.5 Dia.
AC	0.22 Dia.	5.5 Dia.
AD	0.67	17.0
AE	0.10 Dia.	2.5 Dia.
AF	0.33	8.5
AG	0.08	2.0
AH	0.41	10.5
AJ	1.08	27.5
AK	0.04	1.0
AL	0.02 Sq.	0.5 Sq.
AM	0.06	1.5
AN	0.04	1.0

3

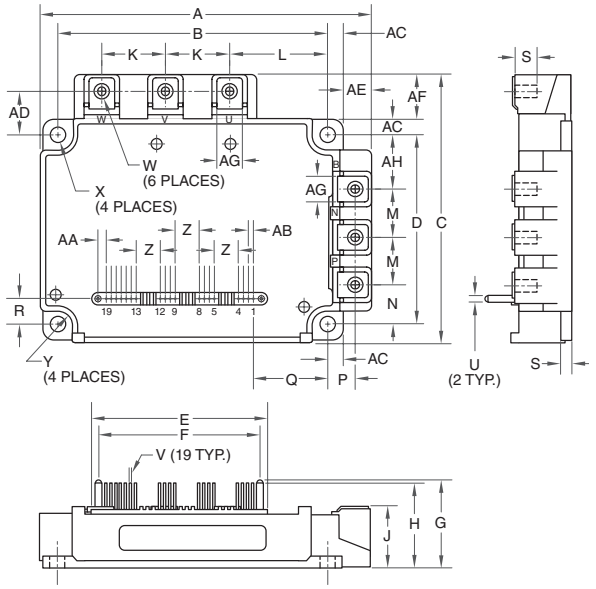
PM25RL1C120, PM50B4L1C060, PM50B5L1C060, PM50B6L1C060, PM50RL1C060, PM75B4L1C060, PM75B5L1C060, PM75B6L1C060



Dim.	Inches	Millimeters
A	3.54	90.0
B	1.97	50.0
C	0.98	25.0
D	3.5	80.0
E	0.2	5.0
F	0.4	10.0
G	0.08	2.0
H	0.17 Dia.	4.3 Dia.
J	0.8	20.5
K	0.9	23.0
L	0.5	12.0
M	0.012	0.3

Dim.	Inches	Millimeters
N	0.58	14.6
P	0.26	6.7
Q	0.02	0.5
R	0.56	14.2
S	0.1±0.02	2.5±0.5
T	0.31	8.0
U	0.02 Sq.	0.5 Sq.
V	0.08	2.0
W	0.69±0.02	17.5±0.5
X	0.22	5.5
Y	0.52	13.0
Z	0.65	16.5

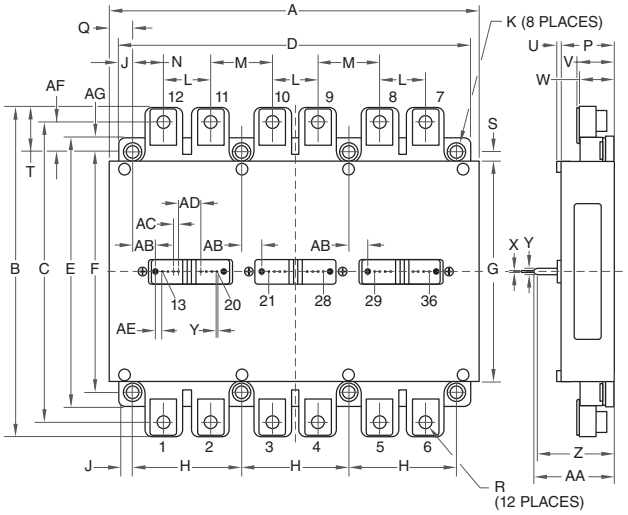
4 PM100CL1A120, PM100RL1A120, PM150CL1A120, PM150RL1A120 PM200CL1A060, PM200RL1A060, PM300CL1A060, PM300RL1A060,



Dim.	Inches	Millimeters
A	5.31	135.0
B	4.33±0.02	110±0.5
C	4.33	110.0
D	3.07	78.0±0.5
E	2.81	71.5
F	2.62	66.5
G	1.37	34.7
H	1.32	33.6
J	0.95+0.04/-0.01	24.1+1.0/-0.5
K	1.02	26.0
L	1.59	40.5
M	0.79	20.0
N	0.65	16.5
P	0.43±0.01	11.0±0.3
Q	1.19	30.15
R	0.43	11.0

Dim.	Inches	Millimeters
S	0.51	13.0
T	0.16	4.0
U	0.1 Dia.	2.5 Dia.
V	0.02 Sq.	0.5 Sq.
W	M5 Metric	M5
X	0.22 Dia.	5.5 Dia.
Y	0.24 Rad.	6.0 Rad.
Z	0.39	10.0
AA	0.13	3.25
AB	0.08	2.0
AC	0.24	6.05
AD	0.71	18.0
AE	0.46	11.7
AF	0.74	18.7
AG	0.41	10.5
AH	0.85	21.5

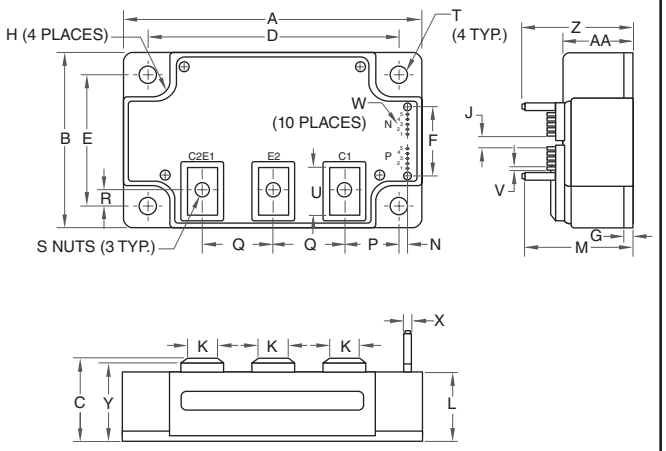
5 PM200CLA120, PM300CLA120, PM450CLA060, PM450CLA120, PM600CLA060



Dim.	Inches	Millimeters
A	6.77	172.0
B	5.90	150.0
C	5.39	137.0
D	6.38	162.0
E	4.84	123.0
F	4.33	110.0
G	3.90	99.0
H	1.97	50.0
J	0.236	6.0
K	5.5 Metric	M5.5
L	0.866	22.0
M	1.10	28.0
N	0.55	14.0
P	0.945	24.0
Q	0.43	11.0
R	M6 Metric	M6

Dim.	Inches	Millimeters
S	0.217	5.5
T	0.79	20.0
U	0.08	2.0
V	0.67	17.0
W	0.62	15.8
X	0.025 Sq.	0.64 Sq.
Y	0.1 Dia.	2.5 Dia.
Z	1.40	35.5
AA	1.44	36.6
AB	0.36	9.08
AC	0.10	2.54
AD	0.40	10.16
AE	0.127	3.22
AF	0.53	13.5
AG	0.256	6.5

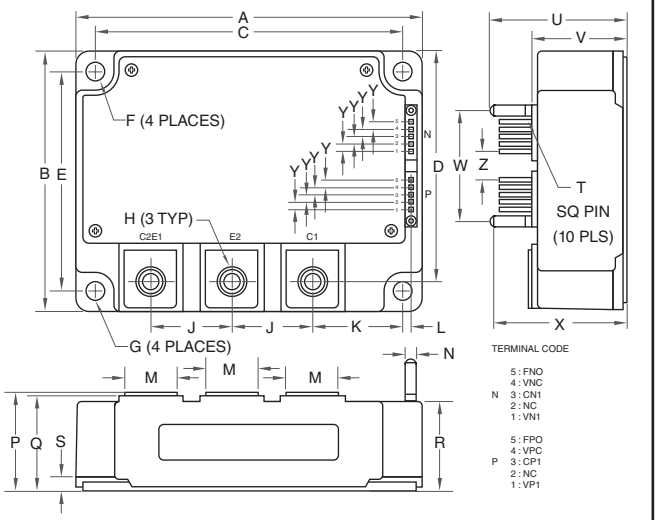
6 PM200DV1A120, PM300DV1A120, PM400DV1A060, PM450DV1A120, PM600DV1A060,



Dim.	Inches	Millimeters
A	4.72	120.0
B	2.76	70.0
C	1.14+0.04/-0.02	29.0+1.0/-0.5
D	4.17±0.01	106.0±0.3
E	2.20±0.01	56.0±0.3
F	1.52	38.5
G	0.16	4.0
H	0.26 Rad.	6.5 Rad.
J	0.40	10.16
K	0.55	14.0
L	1.02	26.0
M	1.53	39.0
N	0.12±0.02	3.0±0.5

Dim.	Inches	Millimeters
P	1.50	38.0
Q	0.98	25.0
R	0.37	9.3
S	M6 Metric	M6
T	0.26 Dia.	6.5 Dia.
U	0.72	18.3
V	0.10	2.54
W	0.025 Sq.	0.64 Sq.
X	0.14 Dia.	3.5 Dia.
Y	1.10	28.0
Z	1.59	40.5
AA	1.14	29.0

7 PM800DV1B060



Dim.	Inches	Millimeters
A	4.72	120.0
B	3.54	90.0
C	4.17±0.010	106.0±0.25
D	2.87	73.0
E	2.99±0.010	76.0±0.25
F	0.26 Rad.	6.5 Rad.
G	0.26 Dia.	6.5 Dia.
H	M8 Metric	M8
J	1.10	28.0
K	1.22	31.0
L	0.12±0.02	3.0±0.5
M	0.71	18.0

Dim.	Inches	Millimeters
N	0.14 Dia.	3.5 Dia.
P	1.34+0.04/-0.02	34.0+1.0/-0.5
Q	1.29	32.8
R	1.22	31.0
S	0.16	4.0
T	0.025 Sq.	0.64 Sq.
U	1.79	45.5
V	1.34	34.0
W	1.52	38.5
X	1.73	44.0
Y	0.10	2.54
Z	0.40	10.16

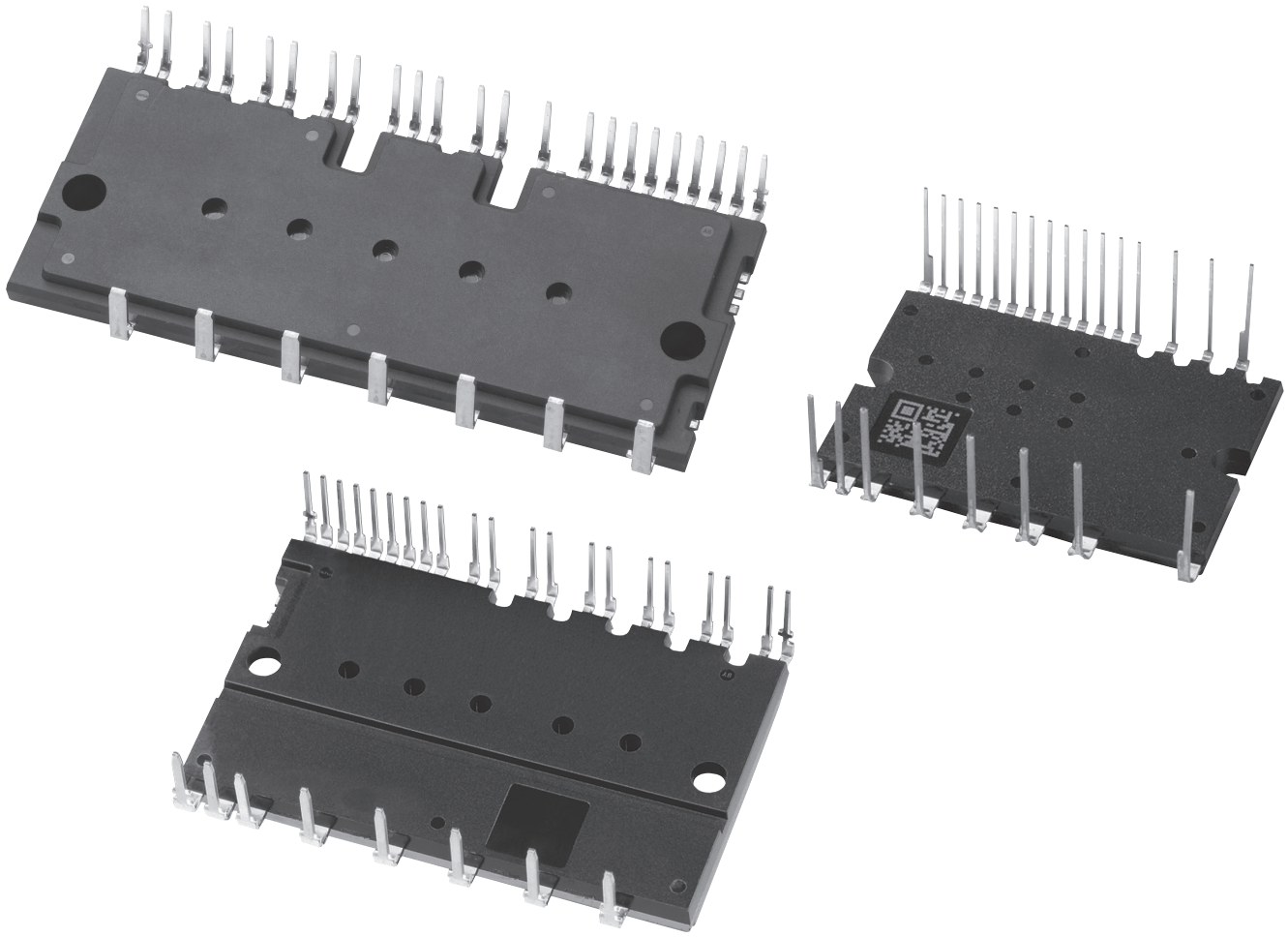
DIPIPM™

Applications Include:
- Servo / Motion Controls
- HVAC
- Home Appliances
- Pumps
- Low-capacity Industrial Inverters

Packages:
- Super Mini DIPIPM
- Super Mini MOSFET DIPIPM
- Mini DIPIPM
- Large DIPIPM

Circuit Configuration:
- 6-Pac
- PFC

Features:
- Gate Drive
- Gate Drive Undervoltage (UV) Lockout
- Short Circuit (SC) Protection



VOLTAGE: 500V TO 1200V
CURRENT: 3A TO 75A

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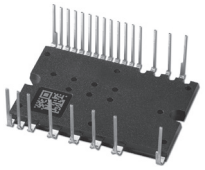
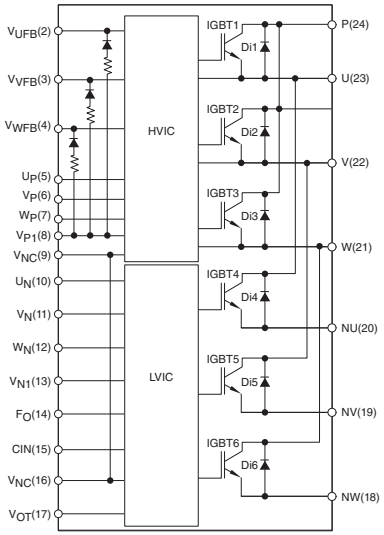
Super Mini DIPIPM 600V Modules - Version 6 Numbering System

(Refer to device datasheets at www.pwrx.com for test conditions.)



MAXIMUM RATINGS (IGBT Inverter Sector)					ELECTRICAL CHARACTERISTICS (IGBT Inverter Sector)					THERMAL CHARACTERISTICS				
Type	V_{CES} Volts	I_C/I_{CP} Amperes	P_D Watts	V_{RMS} Isolation Volts	Typ. $V_{CE(SAT)}$ Volts	V_{EC} Volts	I_{CES} mA	$V_{CC(PROT)}$ Volts	$t_{DEAD(Min)}$ usec	IGBT $R_{th(j-c)}$ °C/W	Diode $R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawing Number	Outline Drawing Page
PSS05S92F6-AG	600	5 / 10	20.0	1500*	1.50	1.70	1.0	400	1.0	5.0	5.7	8.5	1	E-6
PSS10S92F6-AG	600	10 / 20	21.3	1500*	1.75	2.50	1.0	400	1.0	4.7	5.4	8.5	1	E-6
PSS15S92F6-AG	600	15 / 30	27.0	1500*	1.75	2.50	1.0	400	1.0	3.7	4.5	8.5	1	E-6
PSS20S92F6-AG	600	20 / 40	33.3	1500*	1.65	2.50	1.0	400	1.0	3.0	3.9	8.5	1	E-6
PSS30S92F6-AG	600	30 / 60	47.6	1500*	1.65	2.30	1.0	400	2.0	2.1	3.0	8.5	1	E-6
PSS35S92F6-AG	600	35 / 70	66.6	1500*	1.40	1.80	1.0	400	2.0	1.5	2.8	8.5	1	E-6

* 2500V with convex heatsink



Version 4 Numbering System

PS21A79 is a DIPIPM Version 4 transfer mold IPM rated at 600 Volts and 50 Amperes.

PS2 1 A 7 9

(1) (2) (3) (4) (5)

(1) Device:
PS2 = Transfer Mold Type IPM
PS5 = DIPPFC

(2) Voltage (V_{CES})
1 = 600V
2 = 1200V

(3) Package Style
7 = Mini DIPIPM Version 4
A = DIPIPM Version 4

(4) Factory Information

(5) Current Rating (I_C)
1 = 3A
2 = 5A
3 = 10A
4 = 15A
5 = 20A
7 = 30A
8 = 35A
9 = 50A
A = 75A

Version 6 Numbering System

PSS15S92F6-AG is a Super Mini DIPIPM Version 6 transfer mold IPM rated at 600 Volts and 15 Amperes.

PSS15S92F6-XXXX

(1) (2) (3) (4) (5) (6) (7) (8)

(1) Device:
PSF = Full SiC Chips
PSH = Si IGBT, SiC Diode
PSS = Si IGBT, Si Diode
PSM = Si MOSFET

(2) Rated Current

(3) Circuit
3-Phase (6-in-1)
C = Common Emitter
S = Open Emitter
H-Bridge (4-in-1)
B = Common Emitter
Y = Open Emitter
PFC
L = Interleaved

(4) Package:
7 = Mini
9 = Super Mini
A = Large

(5) Series

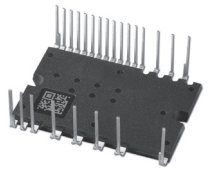
(6) Built-in Functions
A = None
B = OT
C = VOT (Analog)
D = BSD
E = BSD, OT
F = BSD, VOT

(7) V_{CES}, V_{DDS}
5 = 500V
6 = 600V
T = 1200V

(8) Factory Options

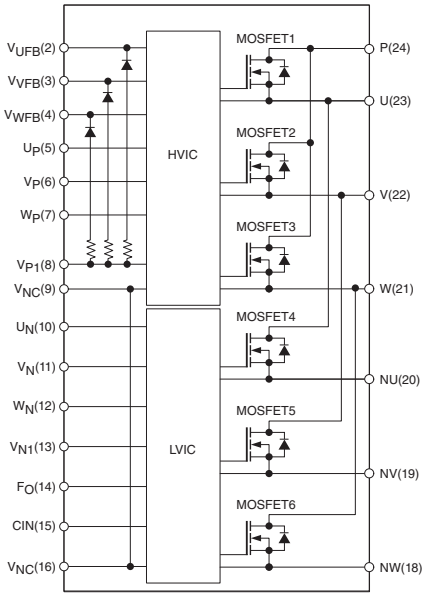
Super Mini MOSFET DIPIPM 500V Modules - Version 6 Numbering System

(Refer to device datasheets at www.pwrx.com for test conditions.)



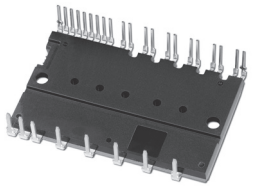
MAXIMUM RATINGS (MOSFET Inverter Sector)					ELECTRICAL CHARACTERISTICS (MOSFET Inverter Sector)					THERMAL CHARACTERISTICS MOSFET			
Type	V_{DSS} Volts	I_D/I_{DP} Amperes	P_D Watts	V_{RMS} Isolation Volts	Typ. $R_{DS(ON)}$ Ω	V_{SD} Volts	I_{DSS} mA	$V_{DD(PROT)}$ Volts	$t_{DEAD(Min)}$ usec	$R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawing Number	Page
PSM03S93E5-A	500	3 / 6	29.4	1500*	1.50	0.90	1.0	400	1.3	3.4	8.5	1	E-6
PSM05S93E5-A	500	5 / 10	44.6	1500*	0.60	0.90	1.0	400	1.3	2.8	8.5	1	E-6

* 2500V with convex heatsink



Mini DIPIPM 600V Modules - Version 6 Numbering System

(Refer to device datasheets at www.pwrx.com for test conditions.)



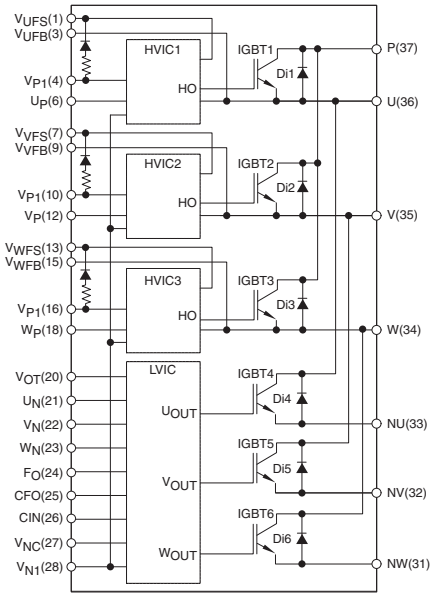
MAXIMUM RATINGS (IGBTInverter Sector)					ELECTRICAL CHARACTERISTICS (IGBT Inverter Sector)					THERMAL CHARACTERISTICS				
Type	V_{CES} Volts	I_C/I_{CP} Amperes	P_D Watts	V_{RMS} Isolation Volts	Typ. $V_{CE(SAT)}$ Volts	V_{EC} Volts	I_{CES} mA	$V_{CC(PROT)}$ Volts	$t_{DEAD(Min)}$ usec	IGBT $R_{th(j-c)}$ °C/W	Diode $R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawing Number	Page
PSS20S71F6	600	20 / 40	76.9	2500	1.40	1.50	1.0	400	1.5	1.3	3.0	21	2	E-6
PSS30S71F6	600	30 / 60	90.9	2500	1.40	1.50	1.0	400	1.5	1.1	2.8	21	2	E-6
PSS50S71F6	600	50 / 100	TBD	2500	TBD	TBD	1.0	400	1.5	TBD	TBD	21	2	E-6

DIPPFC 600V Modules - Version 4 Numbering System

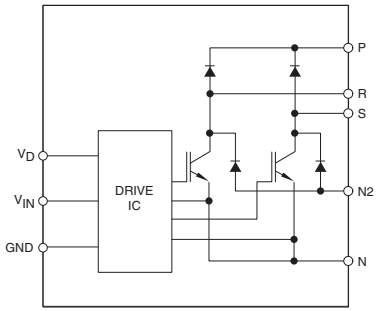
(Refer to device datasheets at www.pwrx.com for test conditions.)

MAXIMUM RATINGS (MOSFET Inverter Sector)				ELECTRICAL CHARACTERISTICS (MOSFET Inverter Sector)				THERMAL CHARACTERISTICS				
Type	V_{CES} Volts	$I_{i(RMS)}$ Amperes	V_{RMS} Isolation Volts	Typ. $V_{CES(SAT)}$ Volts	Typ. $V_{EC(H)}$ Volts	Typ. $V_{EC(L)}$ Volts	I_{CES} mA	IGBT $R_{th(j-c)}$ °C/W	Diode $R_{th(j-c)}$ °C/W	Weight Grams	Outline Drawing Number	Page
PS51787	600	20	2500	2.05	2.2	1.2	1.0	0.96	1.35	54	5	E-8
PS51789	600	20	2500	2.10	2.2	1.2	1.0	0.68	0.90	54	5	E-8

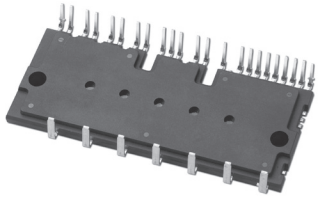
PSS20S71F6, PSS30S71F6, PSS50S71F6



PS51787, PS51789

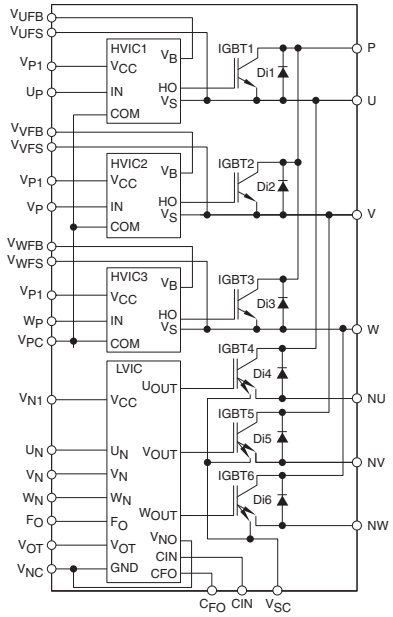


Large DIPIPM 600V & 1200V Modules (Refer to device datasheets at www.pwrx.com for test conditions.)

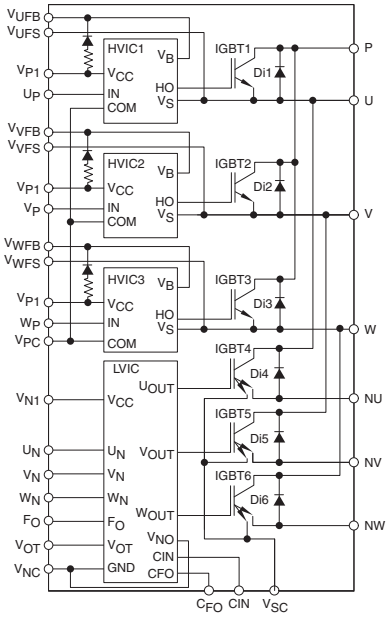


MAXIMUM RATINGS (IGBTInverter Sector)					ELECTRICAL CHARACTERISTICS (IGBT Inverter Sector)					THERMAL CHARACTERISTICS			Outline Drawing	
Type	V_{CES} Volts	I_C/I_{CP} Amperes	P_D Watts	V_{RMS} Isolation Volts	Typ. $V_{CE(SAT)}$ Volts	V_{EC} Volts	I_{CES} mA	$V_{CC(PROT)}$ Volts	$t_{DEAD(Min)}$ usec	IGBT $R_{th(j-c)}$ °C/W	Diode $R_{th(j-c)}$ °C/W	Weight Grams	Number	Page
600V - Version 4 Numbering System														
PS21A79	600	50 / 100	142	2500	1.55	1.7	1.0	400	2.0	0.88	1.78	65	3	E-7
PS21A7A	600	75 / 150	162	2500	1.55	1.7	1.0	400	2.0	0.77	1.25	65	3	E-7
1200V - Version 6 Numbering System														
PSS05SA2FT	1200	5 / 10	TBD	2500	TBD	TBD	1.0	800	TBD	TBD	TBD	TBD	4	E-7
PSS10SA2FT	1200	10 / 20	TBD	2500	TBD	TBD	1.0	800	TBD	TBD	TBD	TBD	4	E-7
PSS15SA2FT	1200	15 / 30	TBD	2500	TBD	TBD	1.0	800	TBD	TBD	TBD	TBD	4	E-7
PSS25SA2FT	1200	25 / 50	TBD	2500	TBD	TBD	1.0	800	TBD	TBD	TBD	TBD	4	E-7
PSS35SA2FT	1200	35 / 70	TBD	2500	TBD	TBD	1.0	800	TBD	TBD	TBD	TBD	4	E-7
PSS50SA2FT	1200	50 / 100	TBD	2500	TBD	TBD	1.0	800	TBD	TBD	TBD	TBD	4	E-7

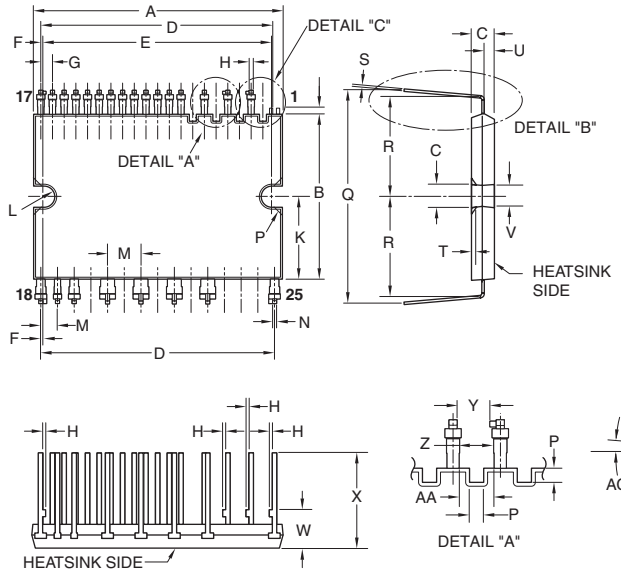
PS21A79, PS21A7A



PSS05SA2FT, PSS10SA2FT, PSS15SA2FT, PSS25SA2FT, PSS35SA2FT, PSS50SA2FT



1 PSM03S93E5-A, PSM05S93E5-A , PSS05S92F6-AG, PSS10S92F6-AG, PSS15S92F6-AG, PSS20S92F6-AG, PSS30S92F6-AG, PSS35S92F6-AG



TERMINAL CODE

1-A	NC(V_{NC})	13	V_{N1}
1-B	NC(V_{P1})	14	F_O
2	V_{UFB}	15	CIN
3	V_{VFB}	16	V_{NC}*1
4	V_{WFB}	17	V_{OT}*2
5	U_P	18	NW
6	V_P	19	NV
7	W_P	20	NU
8	V_{P1}	21	W
9	V_{NC}*1	22	V
10	U_N	23	U
11	V_N	24	P
12	W_N	25	NC

*1 - Pin 9 & Pin 16 are connected inside the DIPIPM, use either Pin 9 or Pin 16 for the ground connection and leave the other one open.

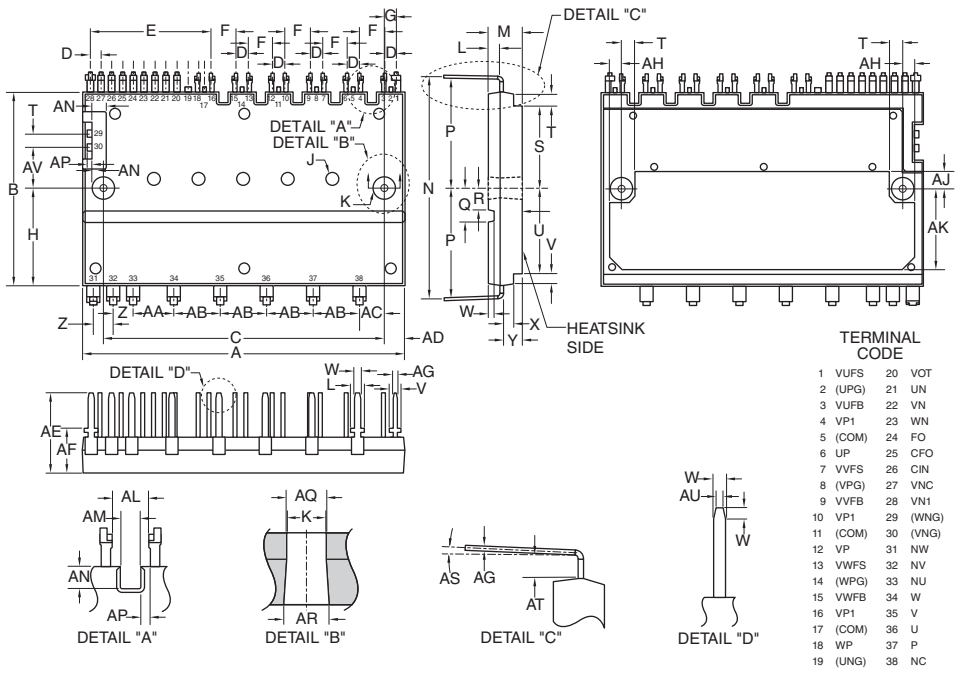
*2 - For MOSFET devices #17 is NC

Dim.	Inches	Millimeters
A	1.50±0.02	38.0±0.5
B	0.94±0.02	24.0±0.5
C	0.14	3.5
D	1.40	35.56
E	0.07±0.008	35.0±0.2
F	0.011	0.28
G	0.07±0.008	1.778±0.2
H	0.02	0.5
J	0.04	1.0

Dim.	Inches	Millimeters
K	0.47	12.0
L	0.063 Rad.	1.6 Rad.
M	0.1±0.008	2.54±0.2
N	0.024	0.6
P	0.05	1.2
Q	1.16±0.02	29.4±0.5
R	0.57±0.02	14.4±0.5
S	0.016	0.4
T	0.031	0.8

Dim.	Inches	Millimeters
U	0.06±0.02	1.5±0.05
V	0.13	3.3
W	0.22±0.02	5.5±0.5
X	0.55±0.02	14.0±0.5
Y	0.098 Min.	2.5 Min.
Z	0.1046	2.656
AA	0.1085	2.756
AB	0.06 Min.	1.5 Min.
AC	0 ~ 5°	0 ~ 5°

2 PSS20S71F6, PSS30S71F6, PSS50S71F6



TERMINAL CODE

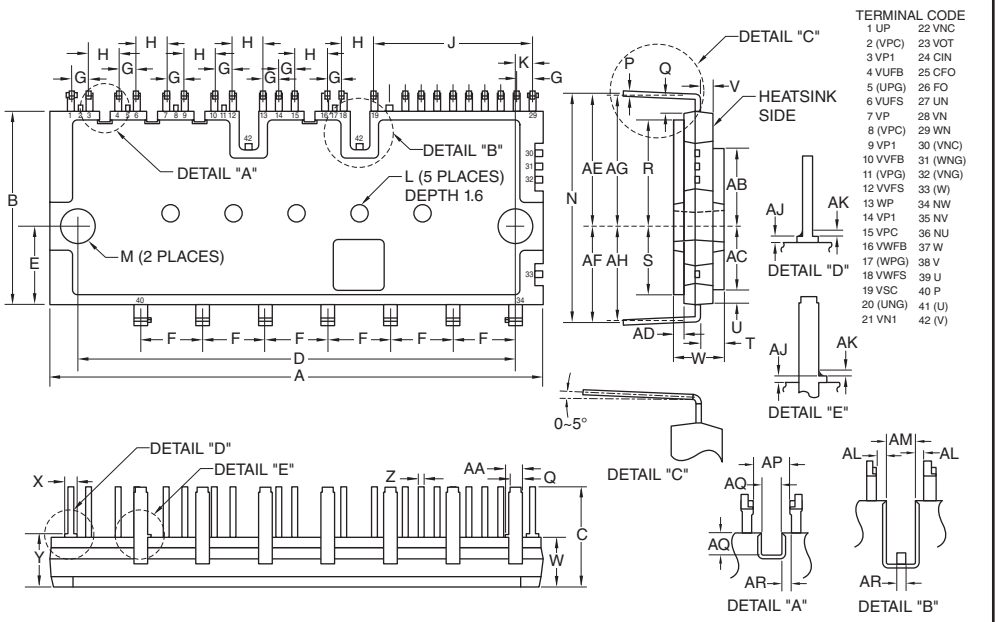
1	VUFS	20	VOT
2	(UPG)	21	UN
3	VUFB	22	VN
4	VP1	23	WN
5	(COM)	24	FO
6	UP	25	CFO
7	VVFS	26	CIN
8	(VPG)	27	VNC
9	VVFB	28	VN1
10	VP1	29	(WNG)
11	(COM)	30	(VNG)
12	VP	31	NW
13	VWFS	32	NV
14	(WPG)	33	NU
15	VWFB	34	W
16	VP1	35	V
17	(COM)	36	U
18	WP	37	P
19	(UNG)	38	NC

Dim.	Inches	Millimeters
A	2.07	52.5
B	1.22	31.0
C	1.81±0.008	46.0±0.2
D	0.07±0.008	1.78±0.2
E	0.77	19.58
F	0.17±0.008	4.32±0.2
G	0.08±0.019	2.04±0.3
H	0.61	15.5
J	0.09 Dia. x 0.1 Depth	2.2 Dia. x 2.6 Depth
K	0.13 Dia.	3.3 Dia.
L	0.08	2.0
M	0.22	5.6
N	1.41±0.02	35.9±0.5
P	0.69	17.7

Dim.	Inches	Millimeters
Q	0.216	5.5
R	0.14	3.5
S	0.503	12.78
T	0.09	2.2
U	0.53	13.5
V	0.06	1.5
W	0.04	1.0
X	0.06	1.55
Y	0.12	3.1±0.1
Z	0.13±0.019	3.3±0.3
AA	0.26±0.019	6.6±0.3
AB	0.3±0.019	7.62±0.3
AC	0.15±0.019	3.95±0.3
AD	0.13	3.25
AE	0.5	12.7

Dim.	Inches	Millimeters
AF	0.28	7.1
AG	0.02	0.5
AH	0.067	1.7
AJ	0.11	2.8
AK	0.51	13.0
AL	0.114	2.9
AM	0.063	1.6
AN	0.068	1.75
AP	0.03	0.75
AQ	0.14 Dia.	3.5 Dia.
AR	0.145 Dia.	3.7 Dia.
AS	0° ~ 5°	
AT	0.078	1.96
AU	0.023	0.6
AU	0.26	6.55

3 PS21A79, PS21A7A



TERMINAL CODE

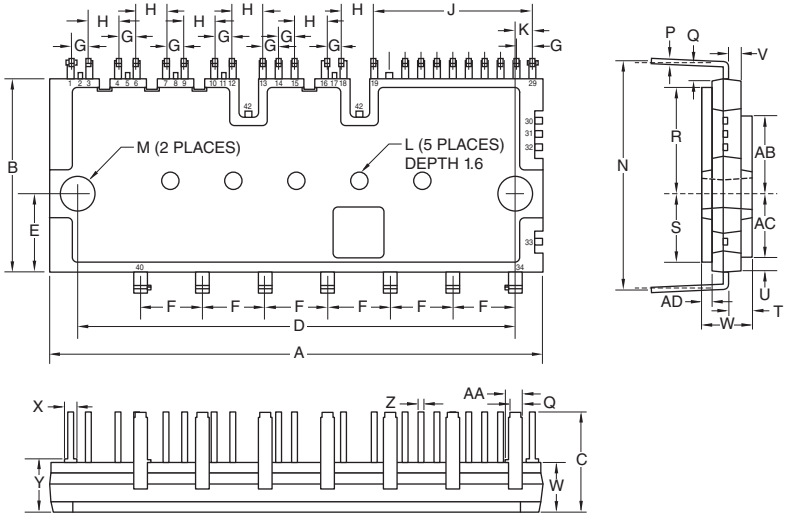
1	UP	22	VNC
2	(VPC)	23	VOT
3	VP1	24	CIN
4	VUFB	25	CFO
5	(UPG)	26	FO
6	VUFS	27	UN
7	VP	28	VN
8	(VPC)	29	WN
9	VP1	30	(VNC)
10	VVFB	31	(WNG)
11	(VPG)	32	(VNG)
12	VVFS	33	(W)
13	WP	34	NW
14	VP1	35	NV
15	VPC	36	NU
16	VWFB	37	W
17	(WPG)	38	V
18	VWFS	39	U
19	VSC	40	P
20	(UNG)	41	(U)
21	VN1	42	(V)

Dim.	Inches	Millimeters
A	3.11±0.02	79.0±0.5
B	1.22±0.02	31.0±0.5
C	0.63	16.0
D	2.76±0.01	70.0±0.3
E	0.5	12.7
F	0.39±0.01	10.0±0.3
G	0.1±0.01	2.54±0.3
H	0.2±0.01	5.08±0.3
J	1.0	25.4
K	0.11	2.8
L	0.12 Dia.	2.9 Dia.
M	0.18±0.01 Dia.	4.5±0.2 Dia.
N	1.42±0.02	36.2±0.5
P	0.03	0.7

Dim.	Inches	Millimeters
Q	0.08	2.0
R	0.66	16.73
S	0.44	11.13
T	0.15±0.04	3.8±1.0
U	0.082	2.1
V	0.086	2.2
W	0.31	8.0
X	0.07	1.8
Y	0.34	8.6
Z	0.03	0.8
AA	0.106	2.7
AB	0.48	12.33
AC	0.39	10.12
AD	0.068	1.75

Dim.	Inches	Millimeters
AE	0.82	20.9
AF	0.60	15.3
AG	0.81	20.64
AH	0.59	15.03
AJ	0.23	0.6
AK	0.02	0.5
AL	0.021	0.55
AM	0.11	2.9
AN	0.23	5.95
AP	0.14	3.52
AQ	0.063	1.6
AR	0.04	1.06

4 PSS05SA2FT, PSS10SA2FT, PSS15SA2FT, PSS25SA2FT, PSS35SA2FT, PSS50SA2FT



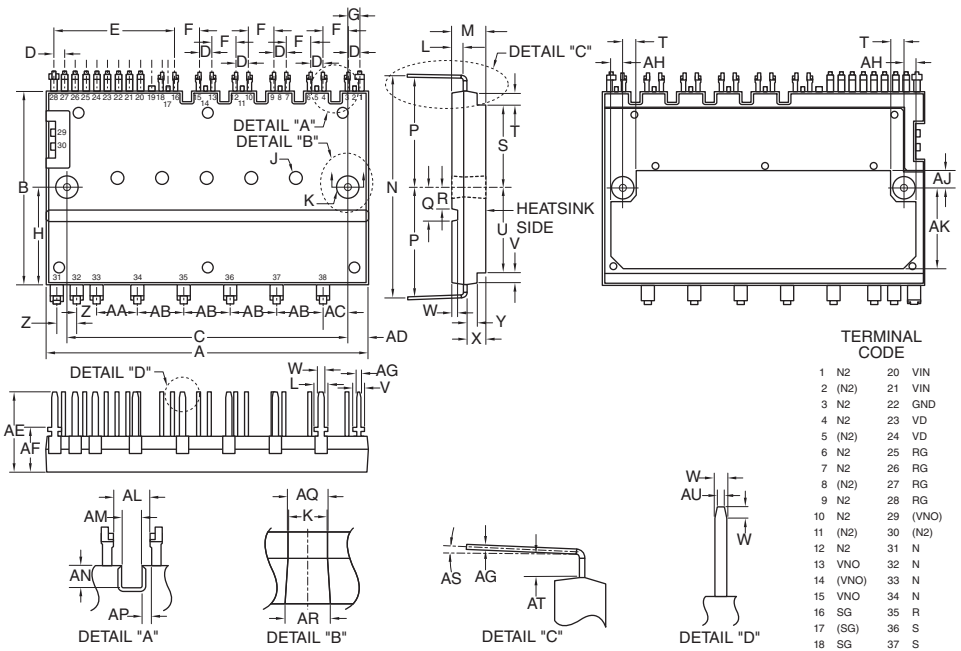
TERMINAL CODE

1	UP	22	VNC
2	(VPC)	23	VOT
3	VP1	24	CIN
4	VUFB	25	CFO
5	(UPG)	26	FO
6	VUFS	27	UN
7	VP	28	VN
8	(VPC)	29	WN
9	VP1	30	(VNC)
10	VVFB	31	(WNG)
11	(VPG)	32	(VSC)
12	VVFS	33	(NW)
13	WP	34	NW
14	VP1	35	NV
15	VPC	36	NU
16	VWFB	37	W
17	(WPG)	38	V
18	VWFS	39	U
19	VSC	40	P
20	(UNG)	41	(VPC)
21	VN1	42	(UNG)

Dim.	Inches	Millimeters
A	3.11±0.02	79.0±0.5
B	1.22±0.02	31.0±0.5
C	0.63	16.0
D	2.76±0.01	70.0±0.3
E	0.5	12.7
F	0.39±0.01	10.0±0.3
G	0.1±0.01	2.54±0.3
H	0.2±0.01	5.08±0.3
J	1.0	25.4
K	0.11	2.8
L	0.12 Dia.	2.9 Dia.
M	0.18±0.01 Dia.	4.5±0.2 Dia.
N	1.42±0.02	36.2±0.5
P	0.03	0.7

Dim.	Inches	Millimeters
Q	0.08	2.0
R	0.66	16.73
S	0.44	11.13
T	0.15±0.04	3.8±1.0
U	0.082	2.1
V	0.086	2.2
W	0.31	8.0
X	0.07	1.8
Y	0.34	8.6
Z	0.03	0.8
AA	0.106	2.7
AB	0.48	12.33
AC	0.39	10.12
AD	0.068	1.75

5 PS51787, PS51789



Dim.	Inches	Millimeters
A	2.07	52.5
B	1.22	31.0
C	1.81±0.008	46.0±0.2
D	0.07±0.008	1.78±0.2
E	0.77	19.58
F	0.17±0.008	4.32±0.2
G	0.08±0.019	2.04±0.3
H	0.61	15.5
J	0.09 Dia. x 0.1 Depth	2.2 Dia. x 2.6 Depth
K	0.13 Dia.	3.3 Dia.
L	0.08	2.0
M	0.22	5.6
N	1.41±0.02	35.9±0.5
P	0.69	17.7

Dim.	Inches	Millimeters
Q	0.216	5.5
R	0.14	3.5
S	0.503	12.78
T	0.09	2.2
U	0.53	13.5
V	0.06	1.5
W	0.04	1.0
X	0.06	1.55
Y	0.12	3.1±0.1
Z	0.13±0.019	3.3±0.3
AA	0.26±0.019	6.6±0.3
AB	0.3±0.019	7.62±0.3
AC	0.15±0.019	3.95±0.3
AD	0.13	3.25
AE	0.5	12.7

Dim.	Inches	Millimeters
AF	0.28	7.1
AG	0.02	0.5
AH	0.067	1.7
AJ	0.11	2.8
AK	0.51	13.0
AL	0.114	2.9
AM	0.063	1.6
AN	0.068	1.75
AP	0.03	0.75
AQ	0.14 Dia.	3.5 Dia.
AR	0.145 Dia.	3.7 Dia.
AS	0° ~ 5°	
AT	0.078	1.96
AU	0.023	0.6

DISCRETE THYRISTORS

Phase Control SCR / Inverter Grade SCR

Applications Include:
- Battery Chargers
- Flexible AC Transmissions
- HVDC
- Induction Heating
- Medical Equipment
- Medium Voltage Inverters
- Motor Controls
- Power Supplies
- Soft Starters
- Traction Inverters
- Transportation
- UPS
- VAR Generators
- Welding

Packages:
- Discrete Discs
- Discrete Studs

Features:
- Nickel Plating Finish
- Hermetic Encapsulation for Long-Term Reliability to 1 x 10^{-6} cc/He/sec

TABLE OF CONTENTS

Phase Control SCRs:
VOLTAGE: 100V TO 6500V
CURRENT: 40A TO 5000A
Inverter Grade SCRs:
VOLTAGE: 200V TO 2000V
CURRENT: 40A TO 2100A

Numbering System

T7S0246504DN is a 650 Ampere, 2400 Volt, Phase Control SCR

T7S0 | 24 | 65 | 0 | 4 | DN

(1) (2) (3) (4) (5) (6)

(1) Type Number

(2) Voltage Rating (x 100)

(3) Current Rating:

T5	(x 1)
T6, T7, T8	(x 10)
T9, TA, TB, TC, TD	(x 100)

(4) Turn-off Time (T_q) Codes for SCR Part Numbers

Code	Time (μsec)	Code	Time (μsec)
0	Phase Control	2	60
9	8	C	70
8	10	1	80
7	15	K	100
6	20	M	125
B	25	N	150
5	30	P	175
L	35	Q	200
4	40	R	250
3	50		

T627122064DN is a 200 Ampere, 1200 Volt, Inverter Grade SCR

T627 | 12 | 20 | 6 | 4 | DN

(1) (2) (3) (4) (5) (6)

(5) Maximum Gate Current to Trigger (I_{gt}) Codes for SCR Part Numbers

Code	I_{gt} (mA)
7	70
K	75
6	80
5	100
F	120
4	150
G	180
3	200
H	250
2	300
1	500
X	Not Applicable

(6) Lead Code - Refer to Standard Lead Table

C712L is a 1000 Ampere, 2000 Volt, Inverter Grade SCR

C712 | L

(1) (2)

(1) Type Number

(2) Voltage Code

PB	=	1200V
PD	=	1400V
PM	=	1600V
PN	=	1800V
L	=	2000V

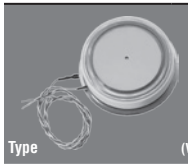
Standard Leads

Device Type	Lead Code	Description
Disc		
Disc	DN	Gate leads: 8” with #6 ring terminals
Disc	DH	Gate leads: 12” with #6 ring terminals
Disc	HE	Gate leads: 20” with #6 ring terminals
Stud		
T5	AQ	Power Lead: 6.04” from seating plane to center of 0.266” diameter hole in terminal lug, Gate leads: 7.34” with #6 ring terminals
T6	BT	Power Lead: 7.85” from seating plane to center of 0.281” diameter hole in terminal lug, Gate leads: 7.86” with #6 ring terminals
T7	BY	Power Lead: 9.66” from seating plane to center of 0.343” diameter hole in terminal lug, Gate leads: 10.03” with #6 ring terminals (Note: High Voltage T7 studs with convoluted seal will have power lead 9.88” from seating plane to center of 0.343” diameter hole in terminal lug, Gate leads: 10.03” with #6 ring terminals)

Phase Control SCRs - Disc/Hockey Puk (Refer to device datasheets at www.pwrx.com for test conditions.)

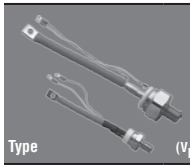
Type	V_{DRM} / V_{RRM} Volts (V_{RSM} = V_{RRM} + 100V)	$I_{t(av)}/T_C$ Amperes/°C (180° sin)	$I_{T(RMS)}$ Amperes (180° sin)	EUROPEAN I_{TSM} Amperes (10ms, $T_{j(max)}$), No V_{RRM} Reapplied)	EUROPEAN i^2t A^2 sec (10ms, $T_{j(max)}$), No V_{RRM} Reapplied)	NORTH AMERICAN i_{TSM} Amperes (8.3ms, $T_{j(max)}$), 100% V_{RRM} Reapplied)	NORTH AMERICAN I^2t A^2 sec (8.3ms, $T_{j(max)}$), 100% V_{RRM} Reapplied)	V_{TM}/I_{TM} Volts/Amperes ($T_{j(max)}$)	V_{TO} Volts ($T_{j(max)}$)	R_T mΩ ($T_{j(max)}$)	di/dt Amperes/µsec (Non-Repetitive)	T_q µsec (Typical)	dV/dt Volts/µsec	$R_{th(j-c)}$ °C/W	$R_{th(c-s)}$ °C/W	$T_{j(max)}$ °C	Outline Drawings Number	Outline Drawings Page
Up to 1800V																		
T620--2004DN	200 – 1600	200 / 88	315	6,000	180,000	4,000	64,000	1.98 / 500	1.13	1.72	800	100	300	0.08	0.02	125	1	F-8
T620--3004DN	200 – 1600	300 / 80	470	8,250	340,313	5,500	120,000	1.49 / 500	0.99	1.05	800	100	300	0.08	0.02	125	1	F-8
T625--4004DN	200 – 1200	400 / 80	625	7,500	281,250	5,000	100,000	1.1 / 200	0.77	1.24	800	150	300	0.08	0.02	150	1	F-8
T7H8--6504DN	200 – 1600	650 / 65	1,020	13,500	911,250	9,000	338,000	1.38 / 500	1.034	0.629	600	150	300	0.04	0.02	125	2	F-8
T7M8--6504DN	200 – 1600	650 / 65	1,020	13,500	911,250	9,000	338,000	1.38 / 500	1,034	0.629	600	1500	300	0.04	0.02	125	3	F-8
T7H8--7504DN	200 – 1600	750 / 62	1,180	15,750	1.2×10^6	10,500	460,000	1.50 / 1000	0.972	0.482	600	150	300	0.04	0.02	125	2	F-8
T7M8--7504DN	200 – 1600	750 / 62	1,180	15,750	1.2×10^6	10,500	460,000	1.50 / 1000	0.972	0.482	600	1500	300	0.04	0.02	125	3	F-8
T820--9004DH	200 – 1600	900 / 70	1,410	22,500	2.5×10^6	15,000	935,000	1.20 / 1000	0.785	0.351	400	300	300	0.037	0.02	125	5	F-9
T820--1404DH	400 –800	1450 / 70	5,419	17,253	1.4×10^6	12,200	620,000	1.20 / 1500 (25°C)	0.79	0.12	200	400	600	0.037	0.0085	140	5	F-9
T9G0--1603DH	1200 – 1800	1660 / 70	2,600	27,400	3.75×10^6	20,000	1.67×10^6	1.25 / 1500 (25°C)	0.834	0.164	1,000	150	400	0.023	0.006	125	7	F-10
T9S0--2003DH	1200 – 1800	2000 / 70	3,142	25,456	3.24×10^6	18,500	1.44×10^6	1.15 / 1500	0.755	0.226	200	400	1,000	0.015	0.0025	125	6	F-9
TAS0--2603DH	1400 – 1800	2635 / 70	4,139	35,826	6.42×10^6	26,174	2.85×10^6	0.99 / 1500	0.735	0.16	300	550	800	0.01	0.003	125	8	F-10
T9S0--2803DH	400 – 800	2850 / 70	4477	34,884	6.08×10^6	25,400	2.71×10^6	1.15 / 1500 (25°C)	0.722	0.0883	200	400	1000	0.015	0.0025	125	6	F-9
TBK7--300HHE	200 – 600	3000 / 70	4,710	72,000	25.9×10^6	48,000	9.6×10^6	0.97 / 3000	0.692	0.087	600	400	300	0.012	0.002	125	10	F-11
TBK5--3203DH	800 – 1600	3200 / 74	5,027	58,454	1.71×10^6	42,700	7.60×10^6	1.05 / 2000	0.826	0.107	200	400	1000	0.01	0.002	125	10	F-11
T9S0--3403DH	400 – 800	3450 / 70	5,419	33,469	5.60×10^6	24,450	2.49×10^6	1.15 / 1500 (25°C)	0.722	0.0883	200	600	600	0.015	0.0025	125	6	F-9
TBS7--350HHE	200 – 1600	3500 / 72	5,600	72,000	25.9×10^6	48,000	9.6×10^6	0.97 / 3000	0.692	0.087	600	400	300	0.010	0.002	125	11	F-11
Up to 2400V																		
T720--3504DN	200 – 2400	350 / 77	550	10,500	551,250	7,000	205,000	1.61 / 500	1.040	1.09	600	150	300	0.06	0.02	125	5	F-9
T720--4504DN	200 – 2400	450 / 65	700	12,600	793,800	8,400	295,000	1.25 / 300	0.93	0.90	600	150	300	0.06	0.02	125	5	F-9
T720--5504DN	200 – 2400	550 / 65	850	15,000	1.1×10^6	10,000	416,000	1.0 / 200	0.99	0.47	600	150	300	0.06	0.02	125	5	F-9
T7S0--6504DN	1800 – 2400	650 / 70	1,020	13,500	911,250	9,000	338,000	1.38 / 500	1.00	0.701	600	150	300	0.035	0.02	125	4	F-9
T7S0--7504DN	1800 – 2400	750 / 73	1,180	15,750	1.2×10^6	10,500	460,000	1.50 / 1000	0.972	0.482	600	150	300	0.035	0.02	125	4	F-9
T820--7504DH	200 – 2400	750 / 70	1,175	18,000	1.6×10^6	12,000	600,000	1.52 / 1000	0.927	0.495	400	200	300	0.037	0.020	125	5	F-9
T9G0--1003DH	200 – 2400	1000 / 82	1,590	25,500	3.2×10^6	17,000	1.2×10^6	1.0 / 300	0.904	0.491	600	250	1000	0.023	0.006	125	7	F-10
T9G0--1203DH	200 – 2400	1200 / 85	1,880	40,500	8.2×10^6	27,000	3.0×10^6	0.97 / 1000	0.606	0.268	300	350	300	0.023	0.008	125	7	F-10
TA20--1603DH	200 – 2200	1600 / 80	2,500	44,250	9.7×10^6	29,500	3.63×10^6	1.12 / 1000	0.891	0.215	400	250	300	0.015	0.007	125	9	F-10
T9S0--1803DH	1600 – 2200	1800 / 70	2,827	19,422	1.89×10^6	13,735	1.77×10^6	1.38 / 1500	1.025	0.23	200	400	1000	0.015	0.0025	125	6	F-9
TA20--1803DH	200 – 2200	1800 / 85	2,820	60,000	18.0×10^6	40,000	6.67×10^6	0.89 / 1000	0.719	0.167	400	250	300	0.015	0.007	125	9	F-10
TBK7--250HHE	1200 – 2100	2500 / 72	3,925	67,500	22.7×10^6	45,000	8.5×10^6	1.35 / 2000	0.95	0.123	600	250	500	0.012	0.002	125	10	F-11
TDS5--5003DH	1200 – 2000	5000 / 68	7,854	84,852	3.60×10^7	62,000	1.6×10^7	1.15 / 4000	0.85	0.0658	300	500	500	0.0065	0.0015	125	16	F-13

Phase Control SCRs - Disc/Hockey Puk (Continued) (Refer to device datasheets at www.pwrx.com for test conditions.)



Type	V_{DRM} / V_{RRM} Volts (V_{RSM} = V_{RRM} + 100V)	$I_{t(av)}/T_C$ Amperes/°C (180° sin)	$I_{T(RMS)}$ Amperes (180° sin)	EUROPEAN I_{TSM} Amperes (10ms, $T_{j(max)}$), No V_{RRM} Reapplied)	EUROPEAN i^2t A^2 sec (10ms, $T_{j(max)}$), No V_{RRM} Reapplied)	NORTH AMERICAN i_{TSM} Amperes (8.3ms, $T_{j(max)}$), 100% V_{RRM} Reapplied)	NORTH AMERICAN I^2t A^2 sec (8.3ms, $T_{j(max)}$), 100% V_{RRM} Reapplied)	V_{TM}/I_{TM} Volts/Amperes ($T_{j(max)}$)	V_{TO} Volts ($T_{j(max)}$)	R_T mΩ ($T_{j(max)}$)	di/dt Amperes/μsec (Non-Repetitive)	T_q μsec (Typical)	dV/dt Volts/μsec	$R_{th(j-c)}$ °C/W	$R_{th(c-s)}$ °C/W	$T_{j(max)}$ °C	Outline Drawings Number	Outline Drawings Page
Up to 4500V																		
T8K7--3503DH	3600 – 4500	350 / 76	550	8,250	340,313	5,500	100,000	3.50 / 1000	1.562	2.141	500	250	1000	0.040	0.020	125	5	F-9
T9K7--0802DH	3600 – 4500	800 / 79	1,250	13,500	911,250	9,000	337,500	1.79 / 1000	1.213	0.602	200	500	800	0.023	0.008	125	7	F-10
TAK7--1202DH	3600 – 4400	1200 / 82	1,700	60,000	18.0×10^6	40,000	6.67×10^6	1.90 / 1500	1.262	0.397	400	500	1000	0.015	0.007	125	9	F-10
TAS7--1603DH	3200 – 4400	1650 / 70	2,592	20,742	2.15×10^6	15,154	956,845	2.00 / 1500	0.881	0.374	300	550	800	0.01	0.003	125	8	F-10
TBK7--1702HE	3600 – 4500	1650 / 70	2,590	39,000	7.6×10^6	26,000	2.75×10^6	1.85 / 2000	1.033	0.358	600	400	1000	0.012	0.002	125	10	F-11
TAK7--1803DH	2400 – 3200	1800 / 70	2,827	22,156	2.45×10^6	16,180	1.09×10^6	1.40 / 1500	0.881	0.374	300	550	800	0.15	0.007	125	9	F-10
TBKD--190HDH	3600 – 4500	1890 / 70	2,969	31,678	5.02×10^6	23,000	2.23×10^6	1.70 / 2000	1.13	0.275	200	600	1000	0.012	0l002	125	10	F-11
TC20--2402DH	3600 – 4400	2450 / 74	3,848	28,284	4.00×10^6	20,664	1.78×10^6	1.80 / 3000	0.99	0.271	300	500	400	0.009	0.003	125	13	F-12
TBS4--250HDH	3000 – 3600	2500 / 70	3,927	32,055	5.14×10^6	23,400	2.29×10^6	1.50 / 2000	1.026	0.233	200	600	1000	0.0085	0.002	125	11	F-11
TBSX33300HDH	3300	3000 / 70	4,712	62,750	1.97×10^7	45,800	8.76×10^6	1.27 / 2000	0.909	0.15	200	600	1000	0.0085	0.002	125	11	F-11
TCU4--320HDH	2400 – 2800	3200 / 70	5,027	72,000	2.59×10^7	52,600	1.15×10^7	1.45 / 3000	1.062	0.121	400	400	1000	0.008	0.002	125	12	F-11
TCU4--340HDH	2400 – 2800	3400 / 70	5,341	75,424	2.84×10^7	55,000	1.27×10^7	1.35 / 3000	0.978	0.112	400	400	1000	0.008	0.002	125	12	F-11
TDK4--3302DH	3600 – 4400	3300 / 72	5,184	47,140	1.11×10^7	31,427	1.04×10^7	1.60 / 3000	0.991	0.196	300	400	2000	0.005	0.001	125	15	F-12
TCS4--340HDH	1800 – 2800	3400 / 70	5,341	56,568	1.60×10^7	37,712	1.50×10^7	1.34 / 3000	0.915	0.14	600	400	1000	0.007	0.001	125	14	F-12
TDS4--3402DH	3000 - 3600	3475 / 70	5,459	67,200	2.26×10^7	49,000	2.26×10^7	1.50 / 4000	0.914	0.15	300	600	800	0.007	0.0015	125	16	F-13
Up to 6500V																		
T8KC--3203DH	6000 – 6500	325 / 75	511	4,243	9×10^4	2,950	36,260	4.40 / 1000	1.17	3.26	200	450	1000	0.038	0.007	125	5	F-9
T9KC--0603DH	6000 – 6500	600 / 73	942	7,307	2.67×10^5	5,040	105,840	3.70 / 1500	1.32	1.58	300	600	1000	0.023	0.006	125	7	F-10
TBKC--1203DH	6000 – 6500	1250 / 70	1,963	20,742	2.15×10^6	14,300	852,042	2.70 / 2000	1.153	0.744	200	800	1000	0.011	0.001	125	10	F-11

Phase Control SCRs - Studs (Refer to device datasheets at www.pwrx.com for test conditions.)

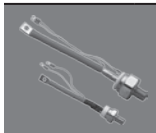


Type	V_{DRM} / V_{RRM} Volts (V_{RSM} = V_{RRM} + 100V)	$I_{t(av)}/T_C$ Amperes/°C (180° sin)	$I_{T(RMS)}$ Amperes (180° sin)	EUROPEAN I_{TSM} Amperes (10ms, $T_{j(max)}$), No V_{RRM} Reapplied)	EUROPEAN I^2t A^2 sec (10ms, $T_{j(max)}$), No V_{RRM} Reapplied)	NORTH AMERICAN i_{TSM} Amperes (8.3ms, $T_{j(max)}$), 100% V_{RRM} Reapplied)	NORTH AMERICAN i^2t A^2 sec (8.3ms, $T_{j(max)}$), 100% V_{RRM} Reapplied)	V_{TM}/I_{TM} Volts/Amperes ($T_{j(max)}$)	V_{TO} Volts ($T_{j(max)}$)	R_T mΩ ($T_{j(max)}$)	di/dt Amperes/µsec (Non-Repetitive)	T_q µsec (Typical)	dV/dt Volts/µsec	$R_{th(j-c)}$ °C/W	$R_{th(c-s)}$ °C/W	$T_{j(max)}$ °C	Outline Drawings Number	Outline Drawings Page
Up to 1600V																		
T500--4004AQ	200 – 1600	40 / 97	63	1,800	16,200	1,200	6,000	2.02 / 100	0.91	11.85	800	100	300	0.28	0.12	125	17	F-13
T500--8004AQ	200 – 1600	80 / 75	125	2,700	36,450	1,800	13,500	1.43 / 100	0.99	3.57	800	100	300	0.28	0.12	125	17	F-13
T600--1504BT	200 – 1600	150 / 90	235	6,000	180,000	4,000	66,000	1.41 / 200	1.07	1.46	800	100	300	0.13	0.075	125	19	F-14
T650--1504BT	200 – 1600	150 / 90	235	6,000	180,000	4,000	66,000	1.41 / 200	1.07	1.46	800	100	300	0.13	0.075	125	18	F-13
T600--1804BT	200 – 1600	175 / 88	275	8,250	340,313	5,500	120,000	1.20 / 200	0.90	1.26	800	100	300	0.13	0.075	125	19	F-14
T650--1804BT	200 – 1600	175 / 88	275	8,250	340,313	5,500	120,000	1.20 / 200	0.90	1.26	800	100	300	0.13	0.075	125	18	F-13
T700--2504BY	200 – 1600	250 / 75	400	10,500	551,250	7,000	205,000	1.16 / 100	1.06	1.01	800	150	300	0.10	0.05	125	21	F-14
T750--2504BY	200 – 1600	250 / 75	400	10,500	551,250	7,000	205,000	1.16 / 100	1.06	1.01	800	150	300	0.10	0.05	125	20	F-14
Up to 2400V																		
T700--3004BY	200 – 2400	300 / 65	470	12,600	793,800	8,400	295,000	0.98 / 100	0.88	0.92	800	150	300	0.10	0.05	125	21	F-14
T750--3005BY	200 – 2400	300 / 65	470	12,600	793,800	8,400	295,000	0.98 / 100	0.88	0.92	800	150	300	0.10	0.05	125	20	F-14
T700--3504BY	200 – 2400	350 / 80	550	15,000	1.1×10^6	10,000	416,000	0.98 / 200	0.83	0.61	800	150	300	0.10	0.05	125	21	F-14
T750--3504BY	200 – 2400	350 / 80	550	15,000	1.1×10^6	10,000	416,000	0.98 / 200	0.83	0.61	800	150	300	0.10	0.05	125	20	F-14

Inverter Grade Disc/Hockey Puk SCRs (Refer to device datasheets at www.pwrx.com for test conditions.)

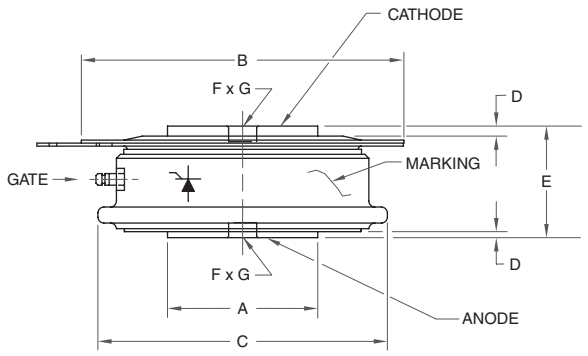
Type	V_{DRM} / V_{RRM} Volts (V_{RSM} = V_{RRM} + 100V)	$I_{t(av)}/T_C$ Amperes/°C (180° sin)	$I_{T(RMS)}$ Amperes (180° sin)	EUROPEAN I_{TSM} Amperes (10ms, $T_{j(max)}$), No V_{RRM} Reapplied	EUROPEAN I^2t A^2 sec (10ms, $T_{j(max)}$), No V_{RRM} Reapplied	NORTH AMERICAN i_{TSM} Amperes (8.3ms, $T_{j(max)}$), No V_{RRM} Reapplied	NORTH AMERICAN i^2t A^2 sec (8.3ms, $T_{j(max)}$), No V_{RRM} Reapplied	V_{TM}/I_{TM} Volts/Amperes ($T_{j(max)}$)	V_{TO} Volts ($T_{j(max)}$)	R_T mΩ ($T_{j(max)}$)	di/dt Amperes/μsec (Non-Repetitive)	T_q μsec (Typical)	dV/dt Volts/μsec	$R_{th(j-c)}$ °C/W	$R_{th(c-s)}$ °C/W	$T_{j(max)}$ °C	Outline Drawings Number	Outline Drawings Page
Up to 1200V																		
T727--35*4DN	100 – 1200	350 / 70	550	10,500	551,250	7,000	205,000	1.70 / 600	1.27	0.71	800	15 – 60	300	0.06	0.02	125	5	F-9
T72H--35*4DN	100 – 1200	350 / 70	550	10,500	551,250	7,000	205,000	2.09 / 500	1.77	0.68	1200	10 – 50	300	0.06	0.02	125	5	F-9
T727--40*4DN	100 – 800	400 / 70	625	10,500	551,250	7,000	205,000	1.55 / 500	1.40	0.34	800	10 – 50	300	0.06	0.02	125	5	F-9
T72H--40*4DN	100 – 800	400 / 70	625	10,500	551,250	7,000	205,000	1.49 / 500	1.19	0.55	1200	10 – 20	300	0.06	0.02	125	5	F-9
T7SH--40*4DN	100 – 1200	400 / 70	700	12,000	720,000	8,000	267,000	2.11 / 500	1.76	0.73	1200	10 – 50	300	0.045	0.02	125	4	F-9
T727--48*4DN	100 – 800	475 / 70	750	12,000	720,000	8,000	265,000	1.37 / 500	1.35	0.44	800	15 – 50	300	0.06	0.02	125	5	F-9
T72H--48*4DN	100 – 800	475 / 70	750	12,000	720,000	8,000	265,000	1.37 / 500	1.14	0.44	1200	20 – 40	300	0.06	0.02	125	5	F-9
T7S7--50*4DN	100 – 1200	500 / 70	786	12,000	720,000	8,000	267,000	1.62 / 500	1.29	0.65	800	15 – 60	300	0.035	0.02	125	2	F-8
T7SH--50*4DN	100 – 800	500 / 70	780	12,750	812,813	8,500	301,000	1.44 / 500	1.18	0.43	1200	10 – 20	300	0.045	0.02	125	4	F-9
T7S7--55*4DN	100 – 800	550 / 70	864	12,750	812,813	8,500	301,000	1.53 / 500	1.36	0.34	800	10 – 50	300	0.035	0.02	125	2	F-8
T7SH--60*4DN	100 – 800	600 / 70	950	13,500	911,250	9,000	338,000	1.04 / 500	0.90	0.28	1200	20 – 40	300	0.045	0.02	125	4	F-9
T7S7--65*4DN	100 – 800	650 / 70	1,026	14,250	1.0×10^6	9,500	376,000	1.36 / 500	1.15	0.40	800	10 – 50	300	0.035	0.02	125	2	F-8
Up to 1600V																		
T627--15*4DN	100 – 1600	150 / 70	235	5,250	137,813	3,500	50,000	1.64 / 100	1.41	1.80	800	10 – 50	300	0.08	0.02	125	1	F-8
T627--20*4DN	100 – 1600	200 / 70	315	6,000	180,000	4,000	65,000	1.48 / 100	1.27	1.50	800	10 – 50	300	0.08	0.02	125	1	F-8
T627--25*4DN	100 – 1600	250 / 70	400	6,750	227,813	4,500	84,000	1.38 / 100	1.22	1.12	800	10 – 50	300	0.08	0.02	125	1	F-8
T727--45*4DN	100 – 1600	450 / 70	700	12,000	720,000	8,000	265,000	1.42 / 500	1.14	0.57	800	15 – 60	300	0.06	0.02	125	5	F-9
T72H--45*4DN	100 – 1600	450 / 70	700	11,250	632,813	7,500	234,000	1.55 / 500	1.08	0.79	1200	15 – 50	300	0.06	0.02	125	5	F-9
T7SH--45*4DN	100 – 1600	450 / 70	700	12,750	812,813	8,500	301,000	1.80 / 800	1.05	0.96	1200	15 – 50	300	0.045	0.02	125	4	F-9
T7S7--60*4DN	100 – 1600	600 / 70	943	13,500	911,250	9,000	338,000	1.44 / 500	1.16	0.56	800	15 – 60	300	0.035	0.02	125	2	F-8
T82F--65*3DN	100 – 1400	650 / 70	1,000	12,750	812,813	8,500	300,000	1.75 / 1000	1.46	0.30	1000	10 – 50	400	0.037	0.02	125	5	F-9
T82F--75*3DN	100 – 1400	750 / 70	1,180	15,000	1.1×10^6	10,000	416,000	1.52 / 1000	1.21	0.29	1200	25 – 60	400	0.037	0.02	125	5	F-9
T9GH--08*2DH	100 – 1600	800 / 70	1,250	15,000	1.1×10^6	10,000	416,000	1.98 / 1000	1.58	0.41	1000	20 – 100	400	0.023	0.075	125	7	F-10
T9GH--09*2DH	100 – 1600	900 / 70	1,400	19,500	1.9×10^6	13,000	700,000	1.73 / 1000	1.32	0.40	1000	20 – 100	400	0.023	0.075	125	7	F-10
T9GH--10*2DH	100 – 1600	1000 / 70	1,570	22,500	2.5×10^6	15,000	937,000	1.70 / 1000	1.29	0.40	1000	20 – 60	400	0.023	0.075	125	7	F-10
T9GH--11*2DH	100 – 1600	1100 / 70	1,725	25,500	3.2×10^6	17,000	1.2×10^6	1.39 / 1000	1.12	0.25	1000	40 – 60	100	0.023	0.075	125	7	F-10
Up to 2000V																		
T7SH--36*4DN	1400 – 1800	360 / 70	565	9,000	405,000	6,000	297,000	2.19 / 500	1.81	0.81	800	40 – 60	300	0.045	0.02	125	4	F-9
T72H--42*4DN	100 – 1800	420 / 70	650	10,200	520,200	6,800	205,000	1.67 / 700	1.27	0.57	1200	15 – 100	300	0.06	0.02	125	5	F-9
T7SH--46*4DN	100 – 1800	460 / 70	720	10,200	520,200	6,800	301,000	1.47 / 500	1.22	0.58	800	15 – 70	300	0.045	0.02	125	4	F-9
C712	100 – 2000	1000 / 70	1,570	30,000	4.5×10^6	20,000	1.6×10^6	1.50 / 1000	1.13	0.35	800	55	500	0.023	0.075	125	7	F-10
C770	100 – 2000	2100 / 70	3,300	57,000	16.2×10^6	38,000	6.0×10^6	1.55 / 1000	1.27	0.26	800	80	500	0.012	0.002	125	10	F-11

Inverter Grade Stud SCRs (Refer to device datasheets at www.pwrx.com for test conditions.)



Type	V_{DRM} / V_{RRM} Volts (V_{RSM} = V_{RRM} + 100V)	$I_{t(av)}$/T_C Amperes/°C (180° sin)	$I_{T(RMS)}$ Amperes (180° sin)	EUROPEAN		NORTH AMERICAN		V_{TM}/I_{TM} Volts/Amperes ($T_{j(max)}$)	V_{TO} Volts ($T_{j(max)}$)	R_T mΩ ($T_{j(max)}$)	di/dt Amperes/µsec (Non-Repetitive)	T_q µsec (Typical)	dV/dt Volts/µsec	$R_{th(j-c)}$ °C/W	$R_{th(c-s)}$ °C/W	$T_{j(max)}$ °C	Outline Drawings	
				I^2t A^2 sec (10ms, $T_{j(max)}$), No V_{RRM} Reapplied)	I_{TSM} Amperes (10ms, $T_{j(max)}$), No V_{RRM} Reapplied)	i^2t A^2 sec (8.3ms, $T_{j(max)}$), No V_{RRM} Reapplied)	i_{TSM} Amperes (8.3ms, $T_{j(max)}$), No V_{RRM} Reapplied)										Number	Page
Up to 1200V																		
T607--13*4BT	100 – 1200	125 / 70	200	5,250	137,813	3,500	50,000	1.63 / 100	1.37	2.10	800	10 – 50	300	0.13	0.08	125	19	F-14
T707--25*4BY	100 – 1200	250 / 70	400	10,500	551,250	7,000	205,000	1.46 / 500	1.29	0.43	800	25 – 60	300	0.10	0.05	125	21	F-14
T707--28*4BY	100 – 1000	275 / 70	430	10,500	551,250	7,000	205,000	1.58 / 700	1.34	0.33	800	10 – 50	300	0.10	0.05	125	21	F-14
Up to 1600V																		
T507--40*4AQ	100 – 1600	40 / 70	63	1,500	11,250	1,000	4,000	2.36 / 100	1.00	14.81	800	10 – 50	200	0.28	0.12	125	17	F-13
T507--80*4AQ	100 – 1600	80 / 70	125	2,100	22,050	1,400	8,150	1.88 / 100	0.95	9.87	800	10 – 50	200	0.28	0.12	125	17	F-13
T607--15*4BT	100 – 1600	150 / 70	235	6,000	180,000	4,000	65,000	1.47 / 100	1.25	1.67	800	10 – 50	300	0.13	0.08	125	19	F-14
T607--18*4BT	100 – 1600	175 / 70	275	6,750	227,813	4,500	84,000	1.28 / 100	1.13	1.23	800	10 – 50	300	0.13	0.08	125	19	F-14
T707--30*4BY	100 – 1600	300 / 70	475	12,000	720,000	8,000	265,000	1.45 / 800	1.05	0.53	800	25 – 60	300	0.10	0.05	125	21	F-14
T707--33*4BY	100 – 800	325 / 70	500	12,000	720,000	8,000	265,000	1.52 / 1000	1.17	0.32	800	10 – 50	300	0.10	0.05	125	21	F-14

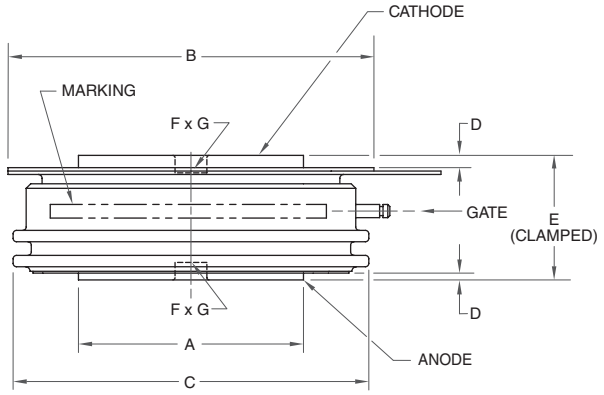
1 T620, T625, T627



Dim.	Inches	Millimeters
A	0.752 Max.	19.1 Max.
B	1.6575 Dia.	42.1 Dia.
C	1.461 Dia.	37.1 Dia.
D	0.0197 Min.	0.5 Min.

Dim.	Inches	Millimeters
E	0.565 Max.	14.4 Max.
F	0.142 Dia.	3.6 Dia.
G	0.079 Deep	2.0 Deep

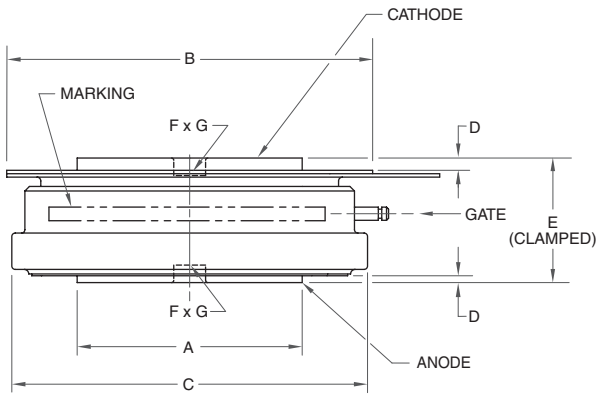
2 T7H8, T7S7



Dim.	Inches	Millimeters
A	0.996 Dia.	25.3 Dia.
B	1.6496 Dia.	41.9 Dia.
C	1.5866 Dia.	40.3 Dia.
D	0.028 Min.	0.7 Min.

Dim.	Inches	Millimeters
E	0.606 Max.	15.4 Max.
F	0.142 Dia.	3.6 Dia.
G	0.0787 Deep	2.0 Deep

3 T7M8



Dim.	Inches	Millimeters
A	0.996 Dia.	25.3 Dia.
B	1.6496 Dia.	41.9 Dia.
C	1.5866 Dia.	40.3 Dia.
D	0.028 Min.	0.7 Min.

Dim.	Inches	Millimeters
E	0.606 Max.	15.4 Max.
F	0.142 Dia.	3.6 Dia.
G	0.0787 Deep	2.0 Deep

MITSUBISHI ELECTRIC

Power Devices General Catalog

Changes for the Better

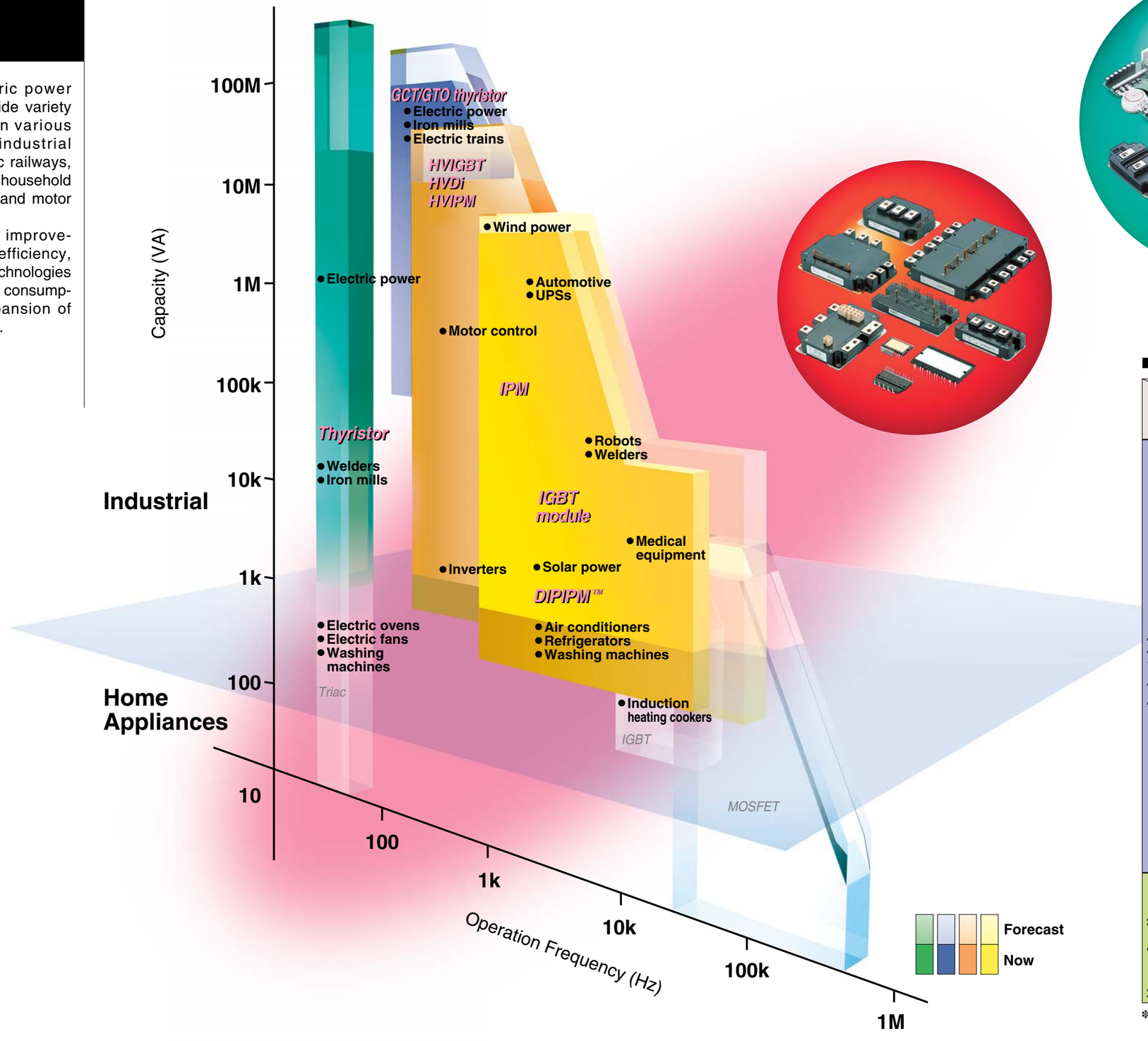
State-of-the-art technology pursuing energy-savings and environmental protection.

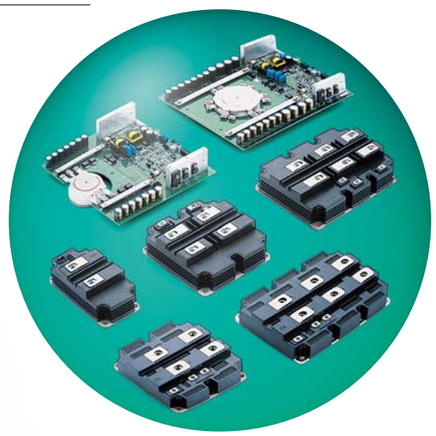
Mitsubishi Electric power devices meet demands for energy-saving and eco-friendly semiconductors with advanced technology and a diversified product line-up. Industrial use, traction, home appliances ... wherever electric power or motor control is needed, we have the means and tools to respond, including the industry's first DIPIPMs™ (Dual-In-line Package Intelligent Power Modules), and the HVIPMs (High-voltage Intelligent Power Modules).

Applications

Power Devices Offering Unlimited Application Potential

Mitsubishi Electric power devices have a wide variety of applications in various fields, such as industrial machinery, electric railways, office automation, household power appliances and motor control.
We are pursuing improvements in energy efficiency, development of technologies that reduce power consumption, and the expansion of our product line-up.





■ Main application & products

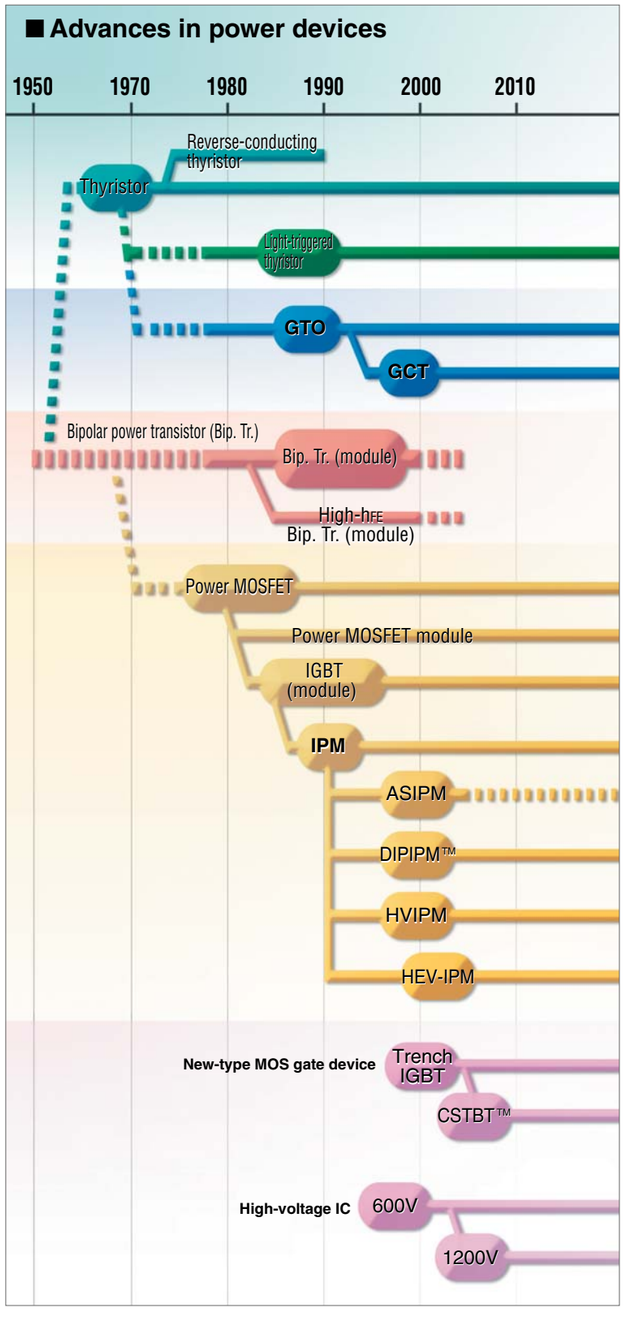
		DIPIPM™	IPM	IGBT module	GCT/ GTO thyristor	Thyristor	HVIGBT HVIPM
Industrial use	Electric power						
	Iron mills						
	Electric Trains ※1						
	Automotive ※1						
	UPSs						
	Inverters						
	Motor control						
	Welders						
	Medical equipment						
	Wind power Solar power						
Home Appliances	Air conditioners						
	Refrigerators						
	Washing machines						

※1: This is limited to the case when the relevant mutual parties can confirm and agree with the operating conditions, quality control and guarantee system

Trends in Power Device Technology

The technological progress of power devices is closely related to market needs. There is a constant requirement for them to be less noisy, more efficient, smaller, lighter, more advanced in function, more accurate, and have larger capacities.
In order to meet these needs with precision, Mitsubishi Electric is now accelerating the improvement of its existing devices and the research and development of new devices. Energetic efforts are being mode to develop and commercialize IGBT modules, and in particular IPMs.

■ Advances in power devices

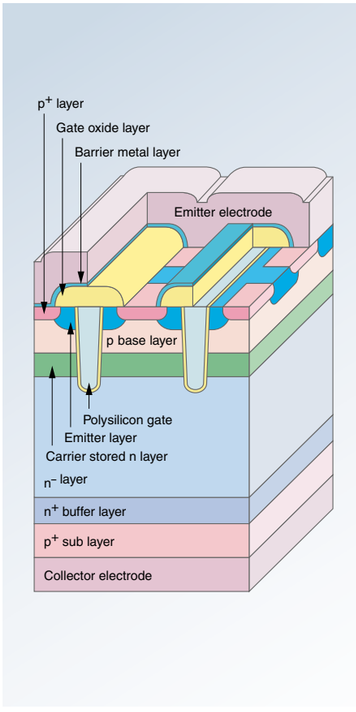


Actual Principle of CSTBT™

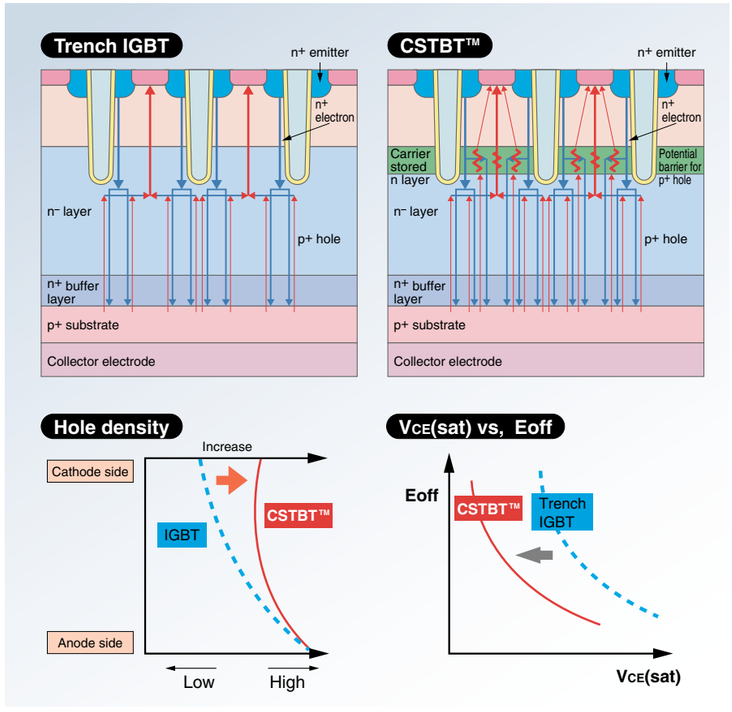
CSTBT™ has achieved an extremely low-loss structure by advancing a conventional trench structure IGBT.
In addition to the conventional trench structure, CSTBT™ has a carrier-stored n layer to accumulate carriers as shown in the diagram on the right. The concentration of the n layer (conservation of charge layer) connected with the p base layer is higher than the n^- layer, and the internal electric potential difference between the p base and the n layer is higher than that of the p base and the n^- layer.
This high internal electric potential serves as a barrier to prevent holes infused from the p^+ layer to n^- layer from going through to the emitter side. In short, holes can be stored on the emitter side of an element by the conservation of a charge layer, and the n layer controls the shift of holes to the p base layer.
This conservation of charge function drastically improves the on-state characteristics of CSTBT™, compared to the trench structure of IGBTs. Increasing the carrier density on the emitter side and decreasing the impedance in silicon makes on-state voltage reduction possible.

CSTBT™: Mitsubishi Electric's original IGBT, utilizing a novel carrier storage effect

■ CSTBT™ chip structure



■ Comparison of trench IGBT and CSTBT™

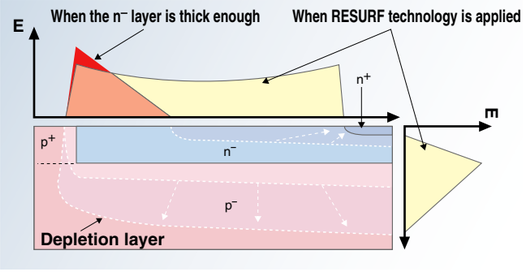


High-voltage Technology of 1200V HVICs

Utilizing reduced surface field (RESURF) technology, Mitsubishi Electric Corporation has developed a 1200V horizontal MOSFET for level shift circuits.
We have further developed a split-RESURF structure for level shift technology without high-potential wiring. Our high-voltage integrated circuits (HVICs) have a high-rating of 1200V.

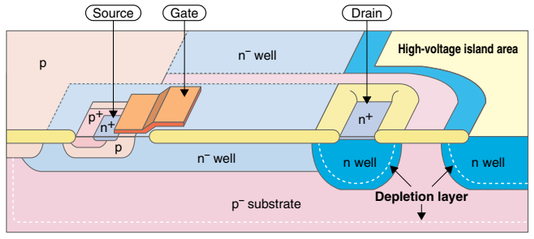
■ What is RESURF?

The p^- substrate depletion layer forcibly extends the p^+n^- junction depletion layer underneath the surface. The n^- layer becomes a complete depletion layer, and the surface electric field is thereby reduced.
The RESURF structure has the ability to withstand high-voltage in the vertical direction because the p^- substrate depletion layer extends in the depth direction. The rating of the entire device can therefore be increased significantly.

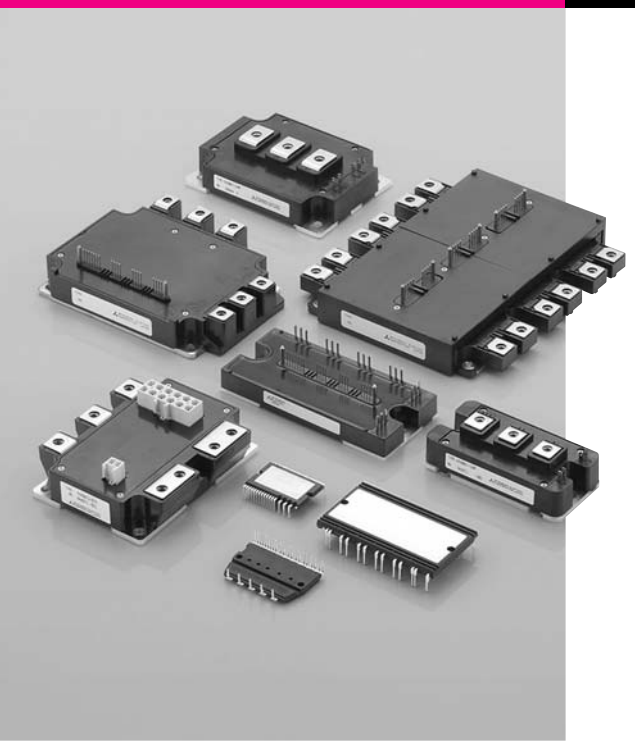


■ What is split-RESURF structure?

The split-RESURF structure is characterized by a narrow p^- substrate area exposed on the surface between the drain and island areas of the horizontal MOSFET for level shift circuits.
When high-voltage is applied across the power supply electrodes, the p^- substrate becomes a depletion layer between the n-diffusion areas; therefore, the surface potential of this p^- substrate area is not significantly different from that of the n-diffusion areas.
In the past, HVIC maximum ratings were limited to 600V because, under high-potential wiring, a dielectric film is required to have the ability to withstand the same voltage as semiconductor junctions. The split-RESURF structure enables an HVIC to achieve a rating of 1200V.



Power Modules

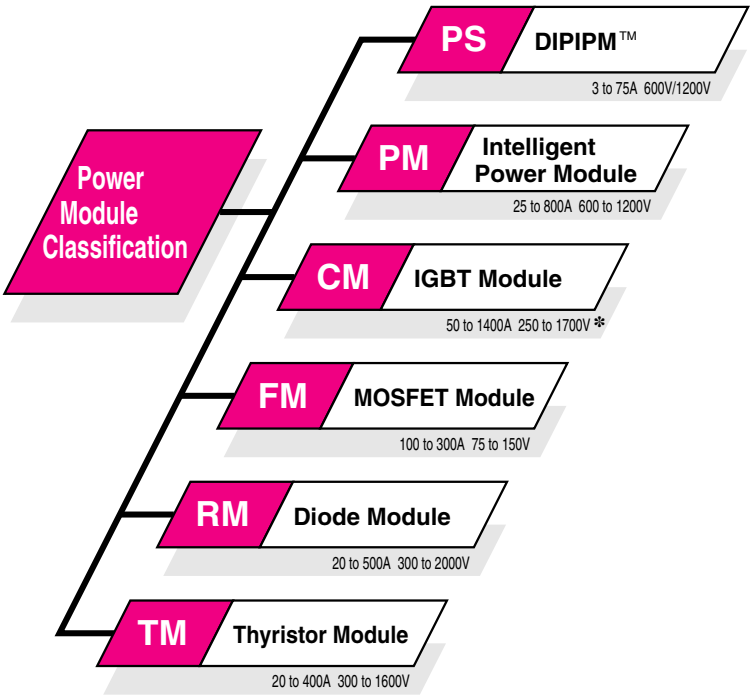


Industry-leading Technologies and a Wide Range of Products

The power module is a compound-type semiconductor that is installed in a package after wiring semiconductor chips to meet the application needs and specifications. Power modules are classified into diodes, thyristors, IGBTs and intelligent power modules (IPMs) according to the type of chips installed. Since 1978, when we placed these power modules in practical use, Mitsubishi Electric has always been endeavoring to extend the corresponding market through developing new devices. In recent years, the demand for IGBT modules and IPMs has rapidly increased and we are doing our utmost to develop products and improve product characteristics in this field.

■ Features:

- New package design for less environmental pollution, which also contributes to energy savings due to reduced power loss
- Long creeping distance and high dielectric strength (1500V to 3500V)
- Since we offer a variety of models in terms of voltage, current, wiring pattern, etc., our power modules can be used in a wide range of applications such as inverters, choppers and uninterruptible power supplies (UPSs)
- Compliance with international standards (UL1557) has been certified (Yellow Card No. E80276, File No.E80271) (excluding some products)
- The ease of both installation and wiring due to the design allows application equipment to be reduced in size and weight



❇: Please refer to high-power device for IGBT modules over 2500V

■ Codes for DIPIPM™ naming

PS ○ ○ ○ ○ ○ - ○ ○ ○

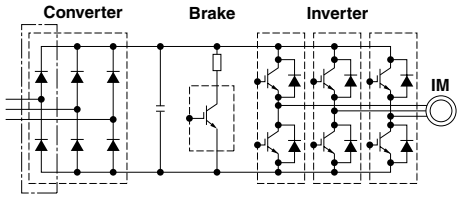
- Change of appearance or others
- Rated current
- Change of IGBT chip
- Change of package
- Voltage class
- Series name

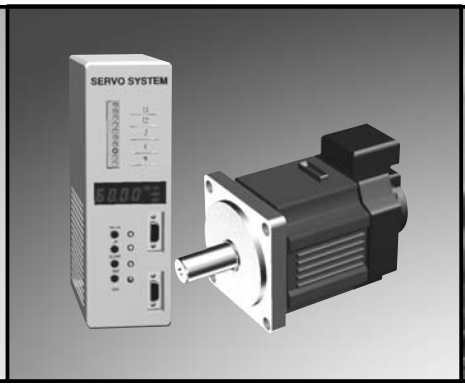
■ Codes for power module naming

CM 150 D Y -24 NF
PM 100 R L A 120

- Series name
- Voltage class
- Change of appearance or others
- Series name
- Connection
- Rated current
- Type

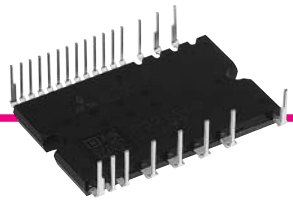
■ Application of IPM/IGBT to AC motor controls (VVVF inverter, servo amps, etc.)





DIPIPM™

Dual In-line Package Intelligent Power Module



Strongly supporting smaller and more energy-saving electric home appliances and low-power industrial equipment.

DIPIPM™ Series are being used widely in both home appliances such as air conditioners, refrigerators and washing machines, as well as small-capacity industrial equipment such as inverters and servo amplifiers.
They contribute greatly to power-savings and product miniaturization.
In addition to 600V-rated devices, 1200V-rated devices designed for the global market are included in the line-up.

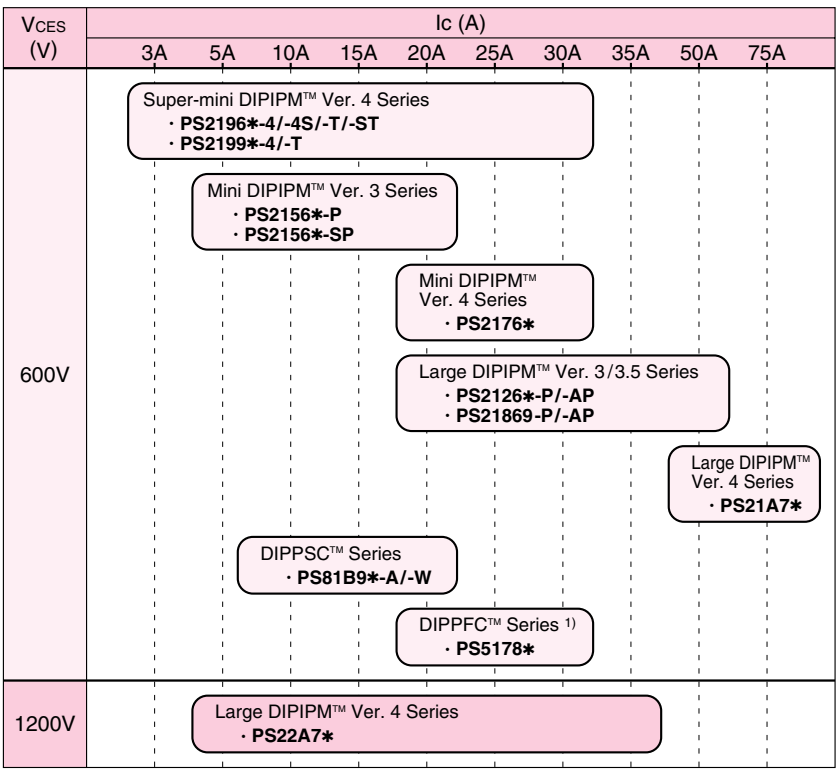
■ Applications

- Air conditioners, refrigerators, washing machines, and package air conditioners
- Low-power industrial motor drives

■ Features

- Wide line-up from 3A to 75A/600V, and 5A to 35A/1200V
- Use of low-loss IGBT or CSTBT™
- Direct drive by control unit possible (non-optocoupler interface)
- Single supply scheme simplifies the power supply circuits
- External-terminal plating using a lead-free solder in compliance with the RoHS directive
  The lead-free solder is used for soldering the power chips in the DIPIPM™ Ver. 4 series

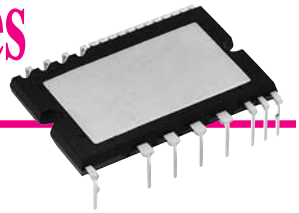
■ Series map



1) **PS5178∗** correspond to input current 20Arms and 30Arms

Super-mini and Mini DIPIPM™ Ver. 4 Series

Super-mini and Mini Dual In-line Package Intelligent Power Module Ver. 4 Series



■ Applications

- Low-power home appliances
  (air conditioners, washing machines and refrigerators)
- Small-capacity industrial motor drives

■ Internal functions

- For P-side IGBTs:
  Drive circuit, high-voltage, high-speed level shifting, and control supply under-voltage (UV) protection
- For N-side IGBTs:
  Drive circuit, control supply under-voltage (UV) protection, and short-circuit (SC) protection
  Over-temperature (OT) protection [-T series only]
- Error output:
  Corresponds to SC, UV (N-side only), and OT protection
- IGBT drive power supply:
  15VDC single power supply (bootstrap supply scheme can be applied)
- Input interface:
  3V, 5V compatible, high active logic

■ Features

- Use of an insulated thermal radiating sheet structure realizes low thermal resistance
- A lead-free solder is used in terminal plating and power chip soldering (RoHS directive compliance)

■ Line-up

Super-mini-package Series

PS2196✻ Series	Type	Ratings	fc max.(kHz)	Outline drawings no.
Isolation voltage 1500Vrms class (✻1)	**PS21961-4/-4S/-T/-ST**	3A/600V	20	PS1 PS2 PS3 (✻2) PS4
	PS21962-4/-4S/-T/-ST	5A/600V		
	PS21963-4E/-4ES/-ET/-EST	8A/600V		
	PS21963-4/-4S/-T/-ST	10A/600V		
	PS21964-4/-4S/-T/-ST	15A/600V		
	PS21965-4/-4S/-T/-ST	20A/600V		
	PS21997-4/-T	30A/600V		

✻1: Corresponds to isolation voltage 2500Vrms in the case of using the convex-shaped heat sink
✻2: 3 shunts type is not available for **PS21997**
-T: Over temperature protection is available
-S: N-side open emitter (3 shunts)
(Other 3 terminal forming types are available)

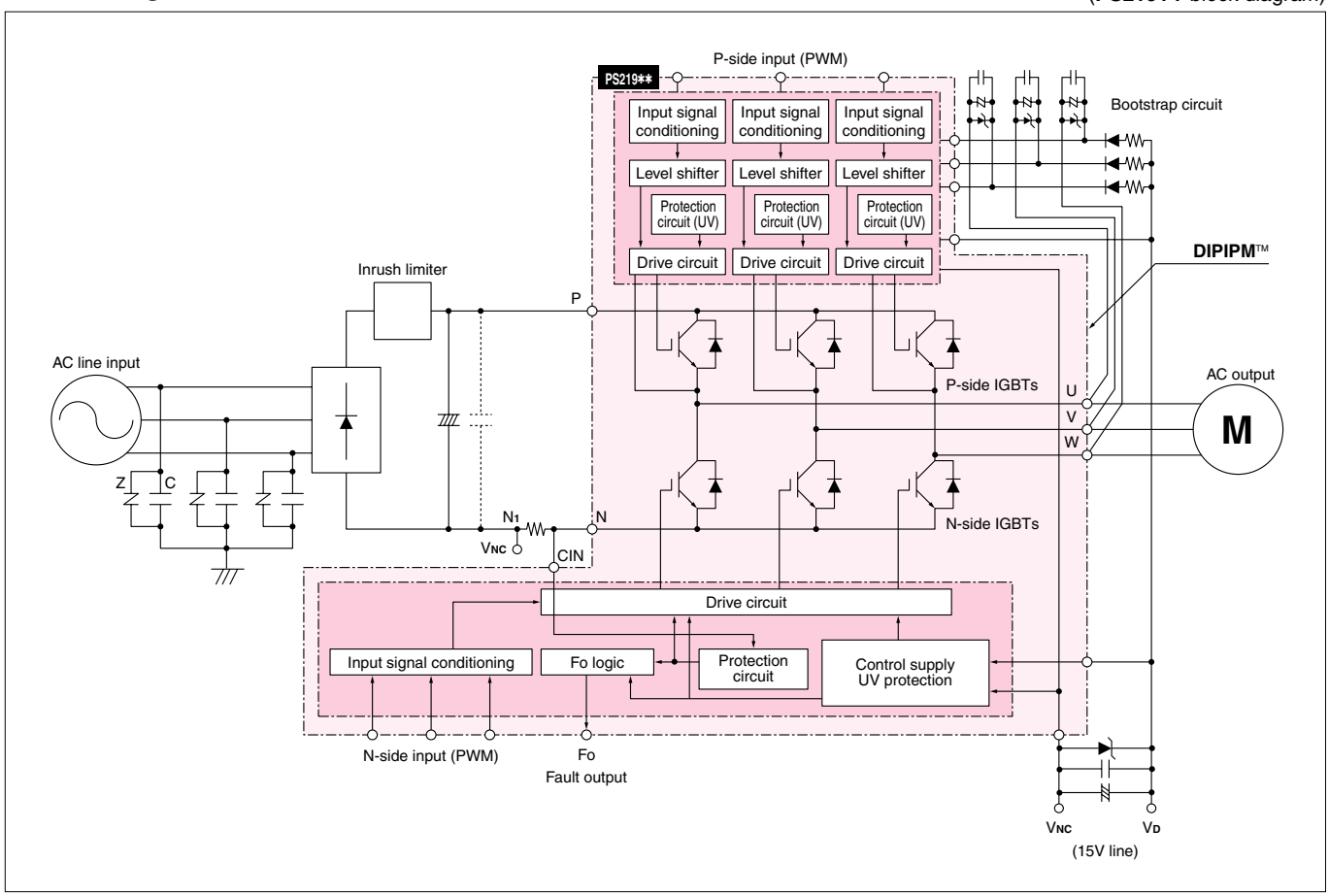
Mini-package Series

	Type	Ratings	fc max.(kHz)	Outline drawings no.
Isolation voltage 2500Vrms class	**PS21765**	20A/600V	20	PS10
	PS21767/-V	30A/600V		

-V: Higher switching speed

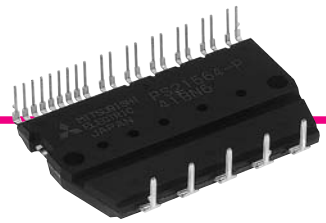
■ Block diagram

(**PS219✻✻** block diagram)



DIPIPM™ Ver. 3/3.5 Series

Dual In-line Package Intelligent Power Module Ver. 3/3.5 Series



■ Applications

- Low-power home appliances
  (air conditioners, washing machines, refrigerators)
- Small-capacity industrial motor drives

■ Internal functions

- For P-side IGBTs:
  Drive circuit, high-voltage, high-speed level shifting, and control supply under-voltage (UV) protection
- For N-side IGBTs:
  Drive circuit, control supply under-voltage (UV) protection, and short-circuit (SC) protection
- Error output:
  Corresponds to SC and UV (N-side only) protection
- IGBT drive power supply:
  15VDC single power supply (bootstrap supply scheme can be applied)
- Input interface:
  3V, 5V compatible, high active logic

■ Features

- A lead-free solder is used in terminal plating
  (RoHS directive compliance)

■ Line-up

Mini-package Series

	Ver.	Type	Ratings	fc max.(kHz)	Outline drawings no.
Isolation voltage 2500Vrms class	3	**PS21562-P/-SP**	5A/600V	20	PS5 PS6
		PS21563-P/-SP	10A/600V		
		PS21564-P/-SP	15A/600V		
		PS21565-P/-SP	20A/600V		

-SP: N-side open emitter (3 shunts)

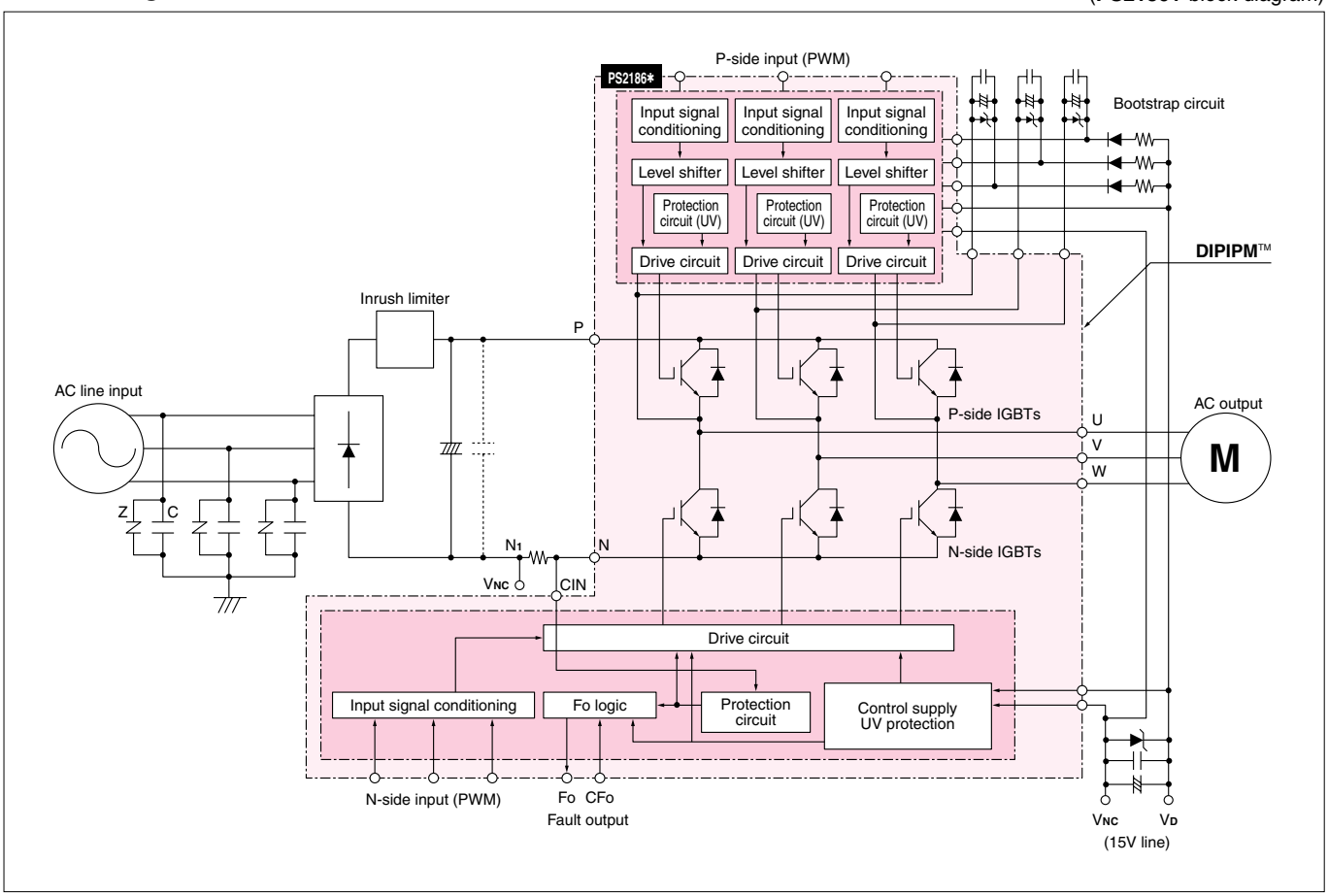
Large-package Series

	Ver.	Type	Ratings	fc max.(kHz)	Outline drawings no.
Isolation voltage 2500Vrms class	3.5	**PS21265-P/-AP**	20A/600V	20	PS9
		PS21267-P/-AP	30A/600V		
	3	**PS21869-P/-AP**	50A/600V	20	PS7

-AP: Long outer terminal

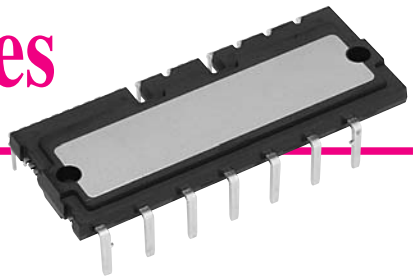
■ Block diagram

(**PS2186∗** block diagram)



Large DIPIPM™ Ver. 4 Series

Large Dual In-line Package Intelligent Power Module Ver. 4 Series



■ Applications

- Low-power appliances
  (air conditioners, general-purpose inverter, AC servo amplifier, etc.)

■ Internal functions

- For P-side IGBTs:
  Drive circuit, high-voltage, high-speed level shifting, and control supply under-voltage (UV) protection
- For N-side IGBTs:
  Drive circuit, control supply under-voltage (UV) protection, and short-circuit (SC) protection
- Error output:
  Corresponds to SC and UV (N-side only) protection
- IGBT drive power supply:
  15VDC single power supply (bootstrap supply scheme can be applied)
- Input interface:
  5V compatible, high active logic

■ Features

- Outputting LVIC temperature by analog signal
- Use of an insulated thermal radiating sheet structure realizes low thermal resistance
- A lead-free solder is used in terminal plating and power chip soldering (RoHS directive compliance)

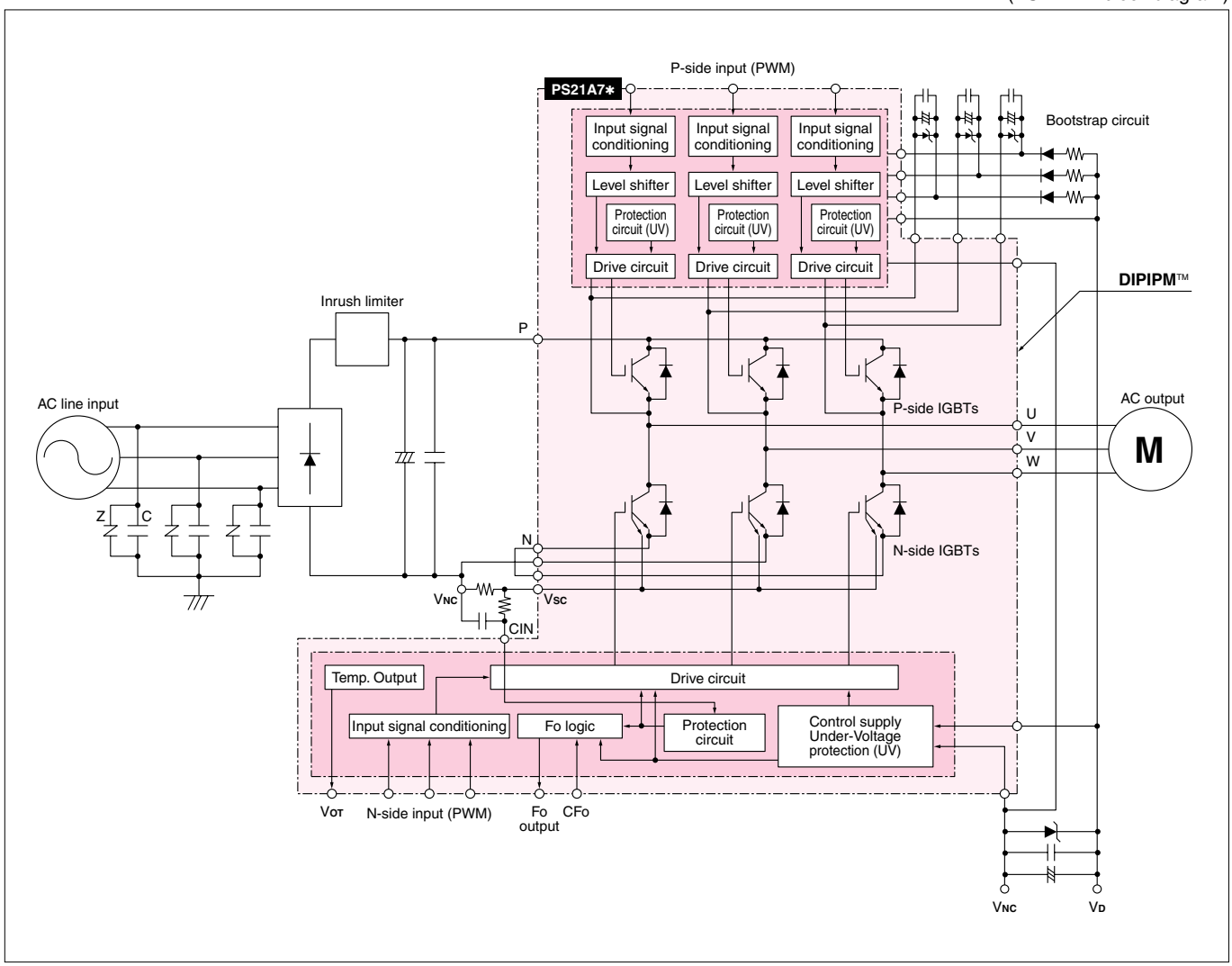
■ Line-up

Large-package Series

	Type	Ratings	fc max.(kHz)	Outline drawings no.
Isolation voltage 2500Vrms class	**PS21A79**	50A/600V	20	PS8
	PS21A7A	75A/600V		
	PS22A72	5A/1200V	20	PS8
	PS22A73	10A/1200V		
	PS22A74	15A/1200V		
	PS22A76	25A/1200V		
	PS22A78-E	35A/1200V		

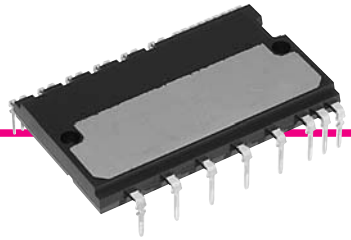
■ Block diagram

(**PS21A7∗** block diagram)



Mini DIPPFC™ Series

Mini Dual In-line Package Power Factor Correction Series



■ Applications

- Air conditioners, general purpose inverters, etc.

■ Internal functions

- Low-loss IGBT
- Rectifier circuit
- IGBT drive circuit
- Control supply under-voltage protection (UV)

■ Features

- A lead-free solder is used in terminal plating (RoHS directive compliance)
- Special IC **M63914FP** for DIPPFC™ control is available. The combination with the IC can offer short circuit and over voltage protection

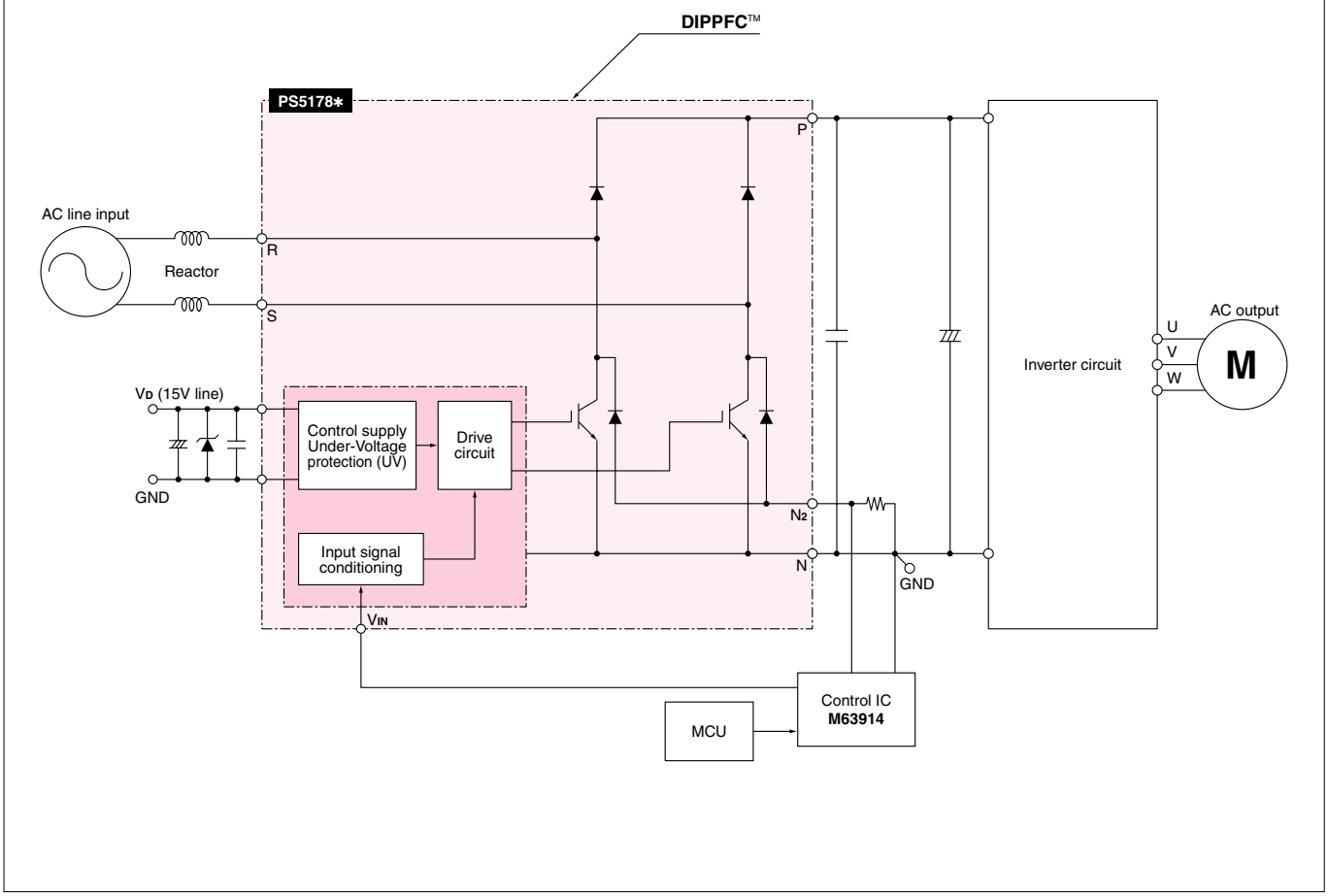
■ Line-up

Mini DIPPFC™ Series

	Type	Ratings		fc typ.(kHz)	Outline drawings no.
		Input voltage	Input current		
Isolation voltage 2500Vrms class	**PS51787**	90 to 264Vrms	20Arms	20	PS10
	PS51789		30Arms		

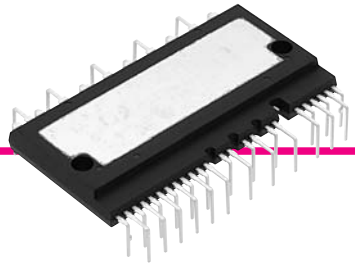
■ Block diagram

(**PS5178∗** block diagram)



DIPPSC™ Series

Dual In-line Package Partial Switching Circuit Series



■ Applications

- Low-power home appliances
  (air conditioners, washing machines and refrigerators)
- Small-capacity industrial motor drive

■ Internal functions

- **Inverter part**
  - For P-side IGBTs:
    Drive circuit, high-voltage, high-speed level shifting, and control supply under-voltage (UV) protection
  - For N-side IGBTs:
    Drive circuit, control supply under-voltage (UV) protection, .and short-circuit (SC) protection
  - Error output:
    Corresponds to SC and UV (N-side only) protection
  - IGBT drive power supply:
    17VDC single power supply (bootstrap supply scheme can be applied)
  - Input interface: 3, 5V compatible, high active logic
- **PSC part**

  Drive circuit, control supply under-voltage (UV) protection, and Short-circuit (SC) protection
  Error output for SC and UV protection

■ Features

- Built-in PSC (Partial Switching Circuit) for power factor corrector
- Outputting LVIC temperature by analog signal
- Use of an insulated thermal radiating sheet structure realizes low thermal resistance.
- A lead-free solder is used in terminal plating
  (RoHS directive compliance)

■ Line-up

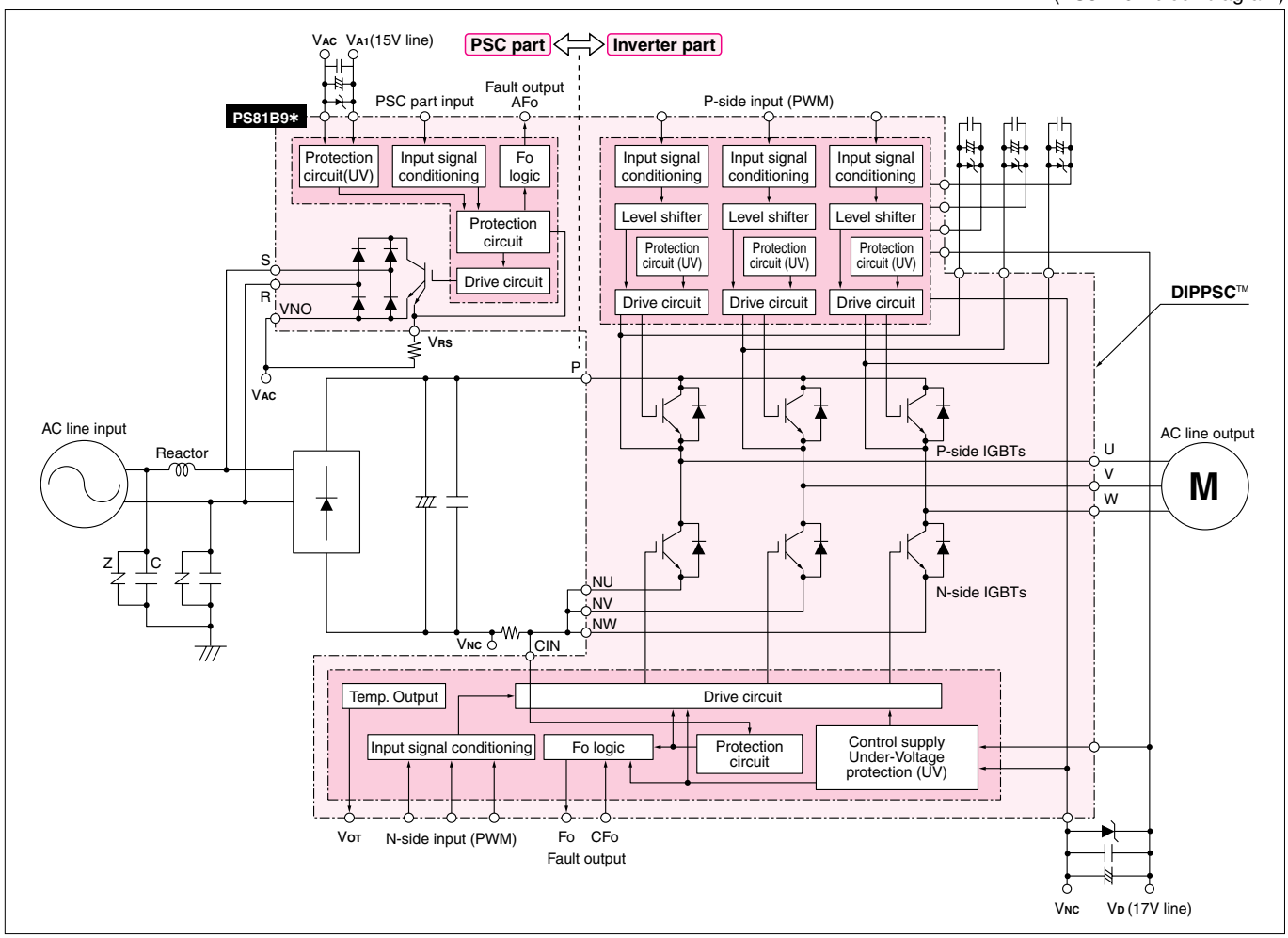
DIPPSC™ Series

	Type	Ratings		fc max.(kHz)	Outline drawings no.
		Partial SW part	Inverter part	Inverter part	
Isolation voltage 2500Vrms class	PS81B93-AE/-EW	15A/600V	8A/600V	20	PS11 PS12
	PS81B93-A/-W	15A/600V	10A/600V		
	PS81B94-A/-W	20A/600V	15A/600V		
	PS81B95-A/-W	20A/600V	20A/600V		

-A : Long outer terminal
-W: Both sides zigzag terminal

■ Block diagram

(**PS81B9∗** block diagram)



IPM

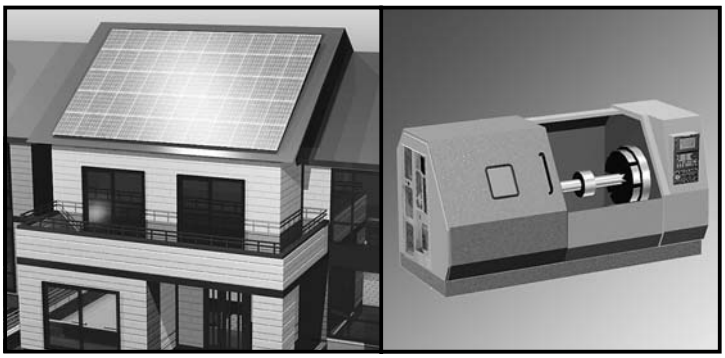
Intelligent Power Modules

In recent years, new demands for ease-of-use and environmental concerns have been added to the need for improved performance, miniaturization, compactness and reduced power loss in motor controllers such as general purpose inverters and AC servos for industrial equipment. Mitsubishi Electric is already in production of power modules such as the 3rd-generation IPM "S Series" and 4th-generation IPM "S-DASH Series", and now adds the miniaturized and lightweight 5th-generation "L Series" to its line-up. The "L Series" incorporates a CSTBT™ chip for reduced power loss and a new compact package.

■ Applications

- Motor control devices (220VAC/440VAC inverters, servos, etc.)
- DC power supplies such as UPS

❇ IPMs for photovoltaic generation using solar devices series



■ Features (L1/S1 Series)

- Low-loss by new CSTBT™ chip optimized V_{CE}(sat) vs Eoff trade-off
- Optimized thermal sensor on chip (Tj sensor)
- Improved of power cycle capability
- Completely lead-free (RoHS directive compliance)
- The package compatible to the L-Series IPM ·····L1 Series
- Adoption of new small-package (50A/600V and 25A/1200V Pin type) ·····L1 Series

■ Intelligent Power Modules (L1 Series)

600V

V_{CES} (V)	Connection	Main terminal	Ic (A)					
			50	75	100	150	200	300
600	3ø	Screw	PM50CL1A060	PM75CL1A060	PM100CL1A060	PM150CL1A060	PM200CL1A060	PM300CL1A060
		Pin	PM50CL1B060	PM75CL1B060	PM100CL1B060	PM150CL1B060	—	—
	3ø +Brake	Screw	PM50RL1A060	PM75RL1A060	PM100RL1A060	PM150RL1A060	PM200RL1A060	PM300RL1A060
		Pin	PM50RL1B060 PM50RL1C060	PM75RL1B060	PM100RL1B060	PM150RL1B060	—	—

1200V

V_{CES} (V)	Connection	Main terminal	Ic (A)				
			25	50	75	100	150
1200	3ø	Screw	PM25CL1A120	PM50CL1A120	PM75CL1A120	PM100CL1A120	PM150CL1A120
		Pin	PM25CL1B120	PM50CL1B120	PM75CL1B120	—	—
	3ø +Brake	Screw	PM25RL1A120	PM50RL1A120	PM75RL1A120	PM100RL1A120	PM150RL1A120
		Pin	PM25RL1B120 PM25RL1C120	PM50RL1B120	PM75RL1B120	—	—

■ IPM series map

3rd-generation (former)	3rd-generation (latter)	4th-generation	5th-generation
S Series	V Series	S-DASH Series S-DASH Servo Series	L Series L1 Series S1 Series

V Series, S-DASH Series, S-DASH Servo Series, L Series, L1 Series, S1 Series are RoHS directive compliance.
S Series are not RoHS directive compliance.

IPM
Intelligent Power Modules

■ High-speed intelligent power modules

220VAC for Line

	Type	Rating		Applicable motor rating(kW)	Output characteristics		Built-in functions							Outline drawings no.
		V_{CES}(V)	I_C(A)		Phase	Vac	OC	SC	UV	OT	BR	PFo	NFo	
L1 Series	PM50RL1A060	600	50	3.7	3	220	×	○	○	○	○	○	○	P35
	PM50RL1B060						×	○	○	○	○	○	○	P36
	PM75RL1A060		75	5.5/7.5			×	○	○	○	○	○	○	P35
	PM75RL1B060						×	○	○	○	○	○	○	P36
	PM100RL1A060		100	11			×	○	○	○	○	○	○	P35
	PM100RL1B060						×	○	○	○	○	○	○	P36
	PM150RL1A060		150	15/18.5			×	○	○	○	○	○	○	P35
	PM150RL1B060						×	○	○	○	○	○	○	P36
	PM200RL1A060		200	22			×	○	○	○	○	○	○	P37
	PM300RL1A060		300	30			×	○	○	○	○	○	○	
	PM50CL1A060		50	3.7			×	○	○	○	×	○	○	P35
	PM50CL1B060						×	○	○	○	×	○	○	P36
	PM75CL1A060		75	5.5/7.5			×	○	○	○	×	○	○	P35
	PM75CL1B060						×	○	○	○	×	○	○	P36
	PM100CL1A060		100	11			×	○	○	○	×	○	○	P35
	PM100CL1B060						×	○	○	○	×	○	○	P36
	PM150CL1A060		150	15/18.5			×	○	○	○	×	○	○	P35
	PM150CL1B060						×	○	○	○	×	○	○	P36
	PM200CL1A060		200	22			×	○	○	○	×	○	○	P37
	PM300CL1A060		300	30			×	○	○	○	×	○	○	
	PM50RL1C060		50	3.7			×	○	○	○	○	○	○	P39
S1 Series	PM50CS1D060		50	3.7			×	○	○	○	×	×	○	P40
	PM75CS1D060		75	5.5/7.5			×	○	○	○	×	×	○	
	PM100CS1D060		100	11			×	○	○	○	×	×	○	
	PM150CS1D060		150	15/18.5			×	○	○	○	×	×	○	
	PM200CS1D060		200	22			×	○	○	○	×	×	○	
L Series	PM200CLA060		200	22			×	○	○	○	×	○	○	P37
	PM300CLA060		300	30			×	○	○	○	×	○	○	
	PM450CLA060		450	37/45			×	○	○	○	×	○	○	P38
	PM600CLA060		600	55			×	○	○	○	×	○	○	

OC: Overcurrent protection
SC: Short-circuit protection
UV: Control supply under-voltage
OT: Over-temperature protection

BR : Elements for braking control
PFo: P-side fault output
NFo: N-side fault output

○: Built-in integrated
×: Non-integrated

IPM
Intelligent Power Modules

■ High-speed intelligent power modules

220VAC for Line

	Type	Rating		Applicable motor rating(kW)	Output characteristics		Built-in functions							Outline drawings no.
		V_{CES}(V)	I_C(A)		Phase	Vac	OC	SC	UV	OT	BR	PFo	NFo	
S-DASH Series	PM50RSD060	600	50	3.7	3	220	○	○	○	△	○	○	○	P2
	PM75RSD060		75	5.5/7.5			○	○	○	△	○	○	○	
	PM100RSD060		100	11			○	○	○	△	○	○	○	
	PM150RSD060		150	15/18.5			○	○	○	△	○	○	○	
	PM200RSD060		200	22			○	○	○	△	○	○	○	P3
	PM300RSD060		300	30			○	○	○	△	○	○	○	
	PM50CSD060		50	3.7			○	○	○	△	×	○	○	P2
	PM75CSD060		75	5.5/7.5			○	○	○	△	×	○	○	
	PM100CSD060		100	11			○	○	○	△	×	○	○	
	PM150CSD060		150	15/18.5			○	○	○	△	×	○	○	
	PM200CSD060		200	22			○	○	○	△	×	○	○	P3
	PM300CSD060		300	30			○	○	○	△	×	○	○	
	PM50RSE060		50	3.7			○	○	○	△	○	×	○	P31
	PM75RSE060		75	5.5/7.5			○	○	○	△	○	×	○	
	PM100RSE060		100	11			○	○	○	△	○	×	○	
	PM150RSE060		150	15/18.5			○	○	○	△	○	×	○	
	PM200RSE060		200	22			○	○	○	△	○	×	○	P32
	PM300RSE060		300	30			○	○	○	△	○	×	○	
	PM50CSE060		50	3.7			○	○	○	△	×	×	○	P31
	PM75CSE060		75	5.5/7.5			○	○	○	△	×	×	○	
	PM100CSE060		100	11			○	○	○	△	×	×	○	
	PM150CSE060		150	15/18.5			○	○	○	△	×	×	○	
	PM200CSE060		200	22			○	○	○	△	×	×	○	P32
	PM300CSE060		300	30			○	○	○	△	×	×	○	
V Series	PM75RVA060		75	5.5/7.5			○	○	○	△	○	○	○	P25
	PM100CVA060		100	11			○	○	○	△	×	○	○	
	PM150CVA060		150	15			○	○	○	△	×	○	○	P26
	PM200CVA060		200	22			○	○	○	△	×	○	○	
	PM300CVA060		300	30			○	○	○	△	×	○	○	P27
	PM400DVA060		400	37	1		○	○	○	△	×	○	○	P28
	PM600DVA060		600	45/55			○	○	○	△	×	○	○	P29

OC: Overcurrent protection
SC: Short-circuit protection
UV: Control supply under-voltage
OT: Over-temperature protection

BR : Elements for braking control
PFo: P-side fault output
NFo: N-side fault output

○: Built-in integrated
△: Installed only with N-side
×: Non-integrated

IPM

Intelligent Power Modules

440VAC for Line

	Type	Rating		Applicable motor rating(kW)	Output characteristics		Built-in functions							Outline drawings no.
		V_{CES}(V)	I_C(A)		Phase	Vac	OC	SC	UV	OT	BR	PFo	NFo	
L1 Series	PM25RL1A120	1200	25	3.7	3	440	×	○	○	○	○	○	○	P35
	PM25RL1B120						×	○	○	○	○	○	○	P36
	PM50RL1A120		50	7.5			×	○	○	○	○	○	○	P35
	PM50RL1B120						×	○	○	○	○	○	○	P36
	PM75RL1A120		75	15			×	○	○	○	○	○	○	P35
	PM75RL1B120						×	○	○	○	○	○	○	P36
	PM100RL1A120		100	18.5/22			×	○	○	○	○	○	○	P37
	PM150RL1A120		150	30			×	○	○	○	○	○	○	
	PM25CL1A120		25	3.7			×	○	○	○	×	○	○	P35
	PM25CL1B120						×	○	○	○	×	○	○	P36
	PM50CL1A120		50	7.5			×	○	○	○	×	○	○	P35
	PM50CL1B120						×	○	○	○	×	○	○	P36
	PM75CL1A120		75	15			×	○	○	○	×	○	○	P35
	PM75CL1B120						×	○	○	○	×	○	○	P36
	PM100CL1A120		100	18.5/22			×	○	○	○	×	○	○	P37
	PM150CL1A120		150	30			×	○	○	○	×	○	○	
	PM25RL1C120		25	3.7			×	○	○	○	×	○	○	P39
S1 Series	PM25CS1D120		25	3.7			×	○	○	○	×	×	○	P40
	PM50CS1D120		50	7.5			×	○	○	○	×	×	○	
	PM75CS1D120		75	15			×	○	○	○	×	×	○	
	PM100CS1D120		100	18.5/22			×	○	○	○	×	×	○	
L Series	PM100CLA120		100	18.5/22			×	○	○	○	×	○	○	P37
	PM150CLA120		150	30			×	○	○	○	×	○	○	
	PM200CLA120		200	37/45			×	○	○	○	×	○	○	P38
	PM300CLA120		300	55			×	○	○	○	×	○	○	
	PM450CLA120		450	75			×	○	○	○	×	○	○	
S-DASH Series	PM50RSD120		50	7.5			○	○	○	△	○	○	○	P2
	PM75RSD120		75	15			○	○	○	△	○	○	○	
	PM100RSD120		100	18.5/22			○	○	○	△	○	○	○	P3
	PM150RSD120		150	30			○	○	○	△	○	○	○	
	PM50CSD120		50	7.5			○	○	○	△	×	○	○	P2
	PM75CSD120		75	15			○	○	○	△	×	○	○	
	PM100CSD120		100	18.5/22			○	○	○	△	×	○	○	P3
	PM150CSD120		150	30			○	○	○	△	×	○	○	
	PM50RSE120		50	7.5			○	○	○	△	○	×	○	P31
	PM75RSE120		75	15			○	○	○	△	○	×	○	
	PM100RSE120		100	18.5/22			○	○	○	△	○	×	○	P32
	PM150RSE120		150	30			○	○	○	△	○	×	○	
	PM50CSE120		50	7.5			○	○	○	△	×	×	○	P31
	PM75CSE120		75	15			○	○	○	△	×	×	○	
	PM100CSE120		100	18.5/22			○	○	○	△	×	×	○	P32
	PM150CSE120		150	30			○	○	○	△	×	×	○	
V Series	PM50RVA120		50	7.5			○	○	○	△	○	○	○	P25
	PM75CVA120		75	15			○	○	○	△	×	○	○	P26
	PM100CVA120		100	18.5/22			○	○	○	△	×	○	○	
	PM150CVA120		150	30			○	○	○	△	×	○	○	P27
	PM200DVA120		200	30/37	1		○	○	○	△	×	○	○	P28
	PM300DVA120		300	45/55			○	○	○	△	×	○	○	P29

OC: Overcurrent protection
SC: Short-circuit protection
UV: Control supply under-voltage
OT: Over-temperature protection

BR : Elements for braking control
PFo: P-side fault output
NFo: N-side fault output

○: Built-in integrated
△: Installed only with N-side
×: Non-integrated

IPM
Intelligent Power Modules

For Solar Power

Type	Rating		Output characteristics		Built-in functions							Outline drawings no.
	V_{CES}(V)	I_C(A)	Phase	Vac	OC	SC	UV	OT	Con	PFo	NFo	
PM50B4LA060	600	50	2	220	×	○	○	○	×	○	○	P35
PM50B4LB060					×	○	○	○	×	○	○	P36
PM50B5LA060					×	○	○	○	○:1	○	○	P35
PM50B5LB060					×	○	○	○	○:1	○	○	P36
PM50B6LA060					×	○	○	○	○:2	○	○	P35
PM50B6LB060					×	○	○	○	○:2	○	○	P36
PM75B4LA060		75			×	○	○	○	×	○	○	P35
PM75B4LB060					×	○	○	○	×	○	○	P36
PM75B5LA060					×	○	○	○	○:1	○	○	P35
PM75B5LB060					×	○	○	○	○:1	○	○	P36
PM75B6LA060					×	○	○	○	○:2	○	○	P35
PM75B6LB060					×	○	○	○	○:2	○	○	P36

OC: Overcurrent protection
SC: Short-circuit protection
UV: Control supply under-voltage
OT: Over-temperature protection

Con: Step up converter
PFo: P-side fault output
NFo: N-side fault output

○: Built-in integrated
×: Non-integrated
○:1→ Built-in 1 converter
○:2→ Built-in 2 converter

IGBT Modules

Insulated Gate Bipolar Transistor Modules

In the past 15 years since the development of the IGBT as the industrial power semiconductor switch, performance has been improved and applications have increased, and now it has replaced transistors in most electric powered industrial equipment. Mitsubishi Electric developed the "F Series", a 4th-generation trench IGBT module that delivers power-savings and noise reduction at the same time. The "NF/A Series", a 5th-generation IGBT module that adopts the CSTBT™ chip, combines the characteristics of the popular planar IGBT and the trench IGBT, and is known for reducing power loss. The "NFH Series", suitable for higher-frequency switching-use, has been newly-developed and put into mass production.

(NF Series)

■ Applications

- General-purpose inverters
- AC servo amplifiers
- Wind power/solar power
- UPS

■ Features

- Same outer dimensions as 3rd-generation H Series
- Uses low-loss CSTBT™
- Same driving power as the H Series
- High-speed soft recovery free-wheel diode
- Low-inductance (half the value of the H Series)
- High-power cycle lifetime
- Low thermal resistance (Utilizes an aluminum nitride ceramic substrate)
- Compliant with RoHS directives

(NFH Series)

■ Applications

- CT scanners
- MRIs
- Induction heating equipment
- Welding machines

■ Features

- 5th-generation CSTBT™
- Low turn-off losses (below 20% standard 1200V NFH Series)
- Soft switching turn-off function
- Enhanced inner wiring (skin effect)
- High-power cycle lifetime
- Compliant with RoHS directives

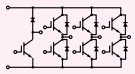
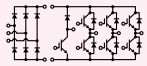
■ IGBT modules series map

3rd-generation (former)	3rd-generation (latter)	4th-generation	5th-generation
H Series	U Series KA Series	F Series DUS Series (high-frequency)	NX Series NF/A Series Mega Power Dual NFH Series (high-frequency)

IGBT Modules

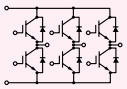
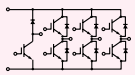
Insulated Gate Bipolar Transistor Modules

■IGBT modules <NX Series>

Connection		VCES (V)	Ic (A)									
			35	50	75	100	150	200	300	400(450)	600	1000
H		600									CM600HX-12A ✻ NX101	
		1200								CM400HX-24A ✻	CM600HX-24A ✻ NX101	
D		600							CM300DX-12A ✻	CM400DX-12A ✻ NX201		
		1200					CM150DX-24A ✻	CM200DX-24A ✻	CM300DX-24A ✻	CM450DX-24A ✻ NX201	CM600DXL-24A	CM1000DXL-24A NXL21
R		600				CM100RX-12A ✻	CM150RX-12A ✻	CM200RX-12A ✻ NX701				
		1200			CM75RX-24A ✻ NX701	CM100RX-24A ✻						
M		600			CM75MX-12A ✻	CM100MX-12A ✻ NXM01						
		1200	CM35MX-24A ✻	CM50MX-24A ✻	CM75MX-24A ✻ NXM01							

✻: Built-in NTC thermistor

■IGBT modules <NF Series>

Connection		VCES (V)	Ic (A)							
			50	75	100	150	200	300	400	600
D		600				CM150DY-12NF	CM200DY-12NF N201	CM300DY-12NF	CM400DY-12NF N202	CM600DY-12NF N203
		1200			CM100DY-24NF N201	CM150DY-24NF	CM200DY-24NF N202	CM300DY-24NF N203	CM400DY-24NF	CM600DU-24NF U205
T		600		CM75TL-12NF	CM100TL-12NF NF601	CM150TL-12NF	CM200TL-12NF NF602			
		1200	CM50TL-24NF	CM75TL-24NF NF601	CM100TL-24NF	CM150TL-24NF NF602				
R		600		CM75RL-12NF	CM100RL-12NF NF601	CM150RL-12NF	CM200RL-12NF NF602			
		1200	CM50RL-24NF	CM75RL-24NF NF601	CM100RL-24NF	CM150RL-24NF NF602				

■IGBT modules <For high-frequency switching use (NFH Series / F Series DUS)>

Connection		VCES (V)	Ic (A)					
			100	150	200	300	400	600
D		600	CM100DUS-12F ✻ U203	CM150DUS-12F ✻	CM200DU-12NFH	CM300DU-12NFH U201	CM400DU-12NFH	CM600DU-12NFH U206
		1200	CM100DU-24NFH U203	CM150DU-24NFH	CM200DU-24NFH U201	CM300DU-24NFH	CM400DU-24NFH U206	CM600DU-24NFH

✻: High-speed turn-off F Series

■IGBT modules <A Series>

Connection		VCES (V)	Ic (A)					
			100	150	200	300	400	600
H		1200					CM400HA-24A ✻ H106	CM600HA-24A ✻ H106
								CM600HB-24A ✻ H107
D		1200	CM100DY-24A N201	CM150DY-24A	CM200DY-24A	CM300DY-24A N202	CM400DY-24A N203	CM600DY-24A

✻: Not RoHS directive compliant

● Numbers H106, H107, U201, U203, U205, U206, N201 to N203, NF601, NF602, NX101, NX201, NX701, NXM01, NXL21 are recorded with product names to show the outline drawing numbers

IGBT Modules

Insulated Gate Bipolar Transistor Modules

■ IGBT modules <Mega Power Dual>

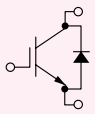
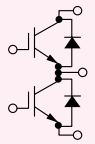
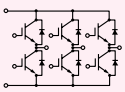
Connection		VCES (V)	Ic (A)		
			900	1000	1400
D		1200	CM900DU-24NF ✻		CM1400DU-24NF ✻
			N204		N204
		1700		CM1000DU-34NF ✻	
				N204	

✻: Not RoHS directive compliant

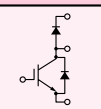
■ IGBT modules <1700V Dual>

Connection		VCES (V)	Ic (A)					
			75	100	150	200	300	400
D		1700	CM75DY-34A	CM100DY-34A	CM150DY-34A	CM200DY-34A	CM300DY-34A	CM400DY-34A
			N201		N202		N203	N205

■ IGBT modules <F Series>

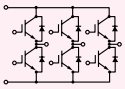
Connection		VCES (V)	Ic (A)							
			50	75	100	150	200	300(350)	400(450)	600
H		250							CM450HA-5F	CM600HA-5F CM600HN-5F
									H105	H106
		600								CM600HU-12F
										U101
		1200							CM400HU-24F	CM600HU-24F
									U101	U102
D		250						CM350DU-5F	CM400DU-5F	CM600DU-5F
								U202	U201	U202
		600		CM75DU-12F	CM100DU-12F	CM150DU-12F	CM200DU-12F	CM300DU-12F	CM400DU-12F	
				U203				U201		
		1200	CM50DU-24F	CM75DU-24F	CM100DU-24F	CM150DU-24F	CM200DU-24F	CM300DU-24F	CM400DU-24F	CM600DU-24F
			U203			U201		U202	U204	U205
T		600		CM75TU-12F	CM100TU-12F	CM150TU-12F	CM200TU-12F			
				U601		U602				
		1200	CM50TU-24F	CM75TU-24F	CM100TU-24F					
			U601	U602						

■ IGBT modules <For brake systems>

Connection		VCES (V)	Ic (A)					
			50	75	100	150	200	300
E3		600		CM75E3U-12H ✻	CM100E3U-12H ✻	CM150E3U-12H ✻	CM200E3U-12NF ✻	CM300E3U-12H ✻
				U111				U112
		1200	CM50E3U-24H ✻	CM75E3U-24H ✻	CM100E3U-24NF ✻	CM150E3U-24H ✻		
			U111			U112		

✻: Production on orders

■ IGBT modules <KA Series>

Connection		VCES (V)	Ic (A)						
			50	75	100	150	200	300	400
D		1700			CM100DU-34KA	CM150DU-34KA	CM200DU-34KA	CM300DU-34KA	CM400DU-34KA
					U201		U202	U205	
T		1700	CM50TU-34KA	CM75TU-34KA					
			U602						

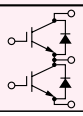
● Numbers H105, H106, U101, U102, U111, U112, U201 to U205, U601, U602, N201 to N205 are recorded with product names to show the outline drawing numbers

IGBT Modules

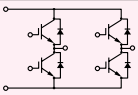
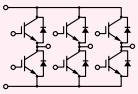
Insulated Gate Bipolar Transistor Modules

■IGBT modules <U Series>

1 arm to 2 arms

Connection		V_{CES} (V)	Ic (A)							
			50	75	100	150	200	300	400	600
H		600								**CM600HU-12H** U101
		1200							**CM400HU-24H** U101	**CM600HU-24H** U102
D		600		**CM75DU-12H**	**CM100DU-12H**	**CM150DU-12H**	**CM200DU-12H**	**CM300DU-12H**	**CM400DU-12H**	
				U203				U201		
		1200	**CM50DU-24H**	**CM75DU-24H**	**CM100DU-24H**	**CM150DU-24H**	**CM200DU-24H**	**CM300DU-24H**		
			U203			U201		U202		

4 arms to 6 arms

Connection		V_{CES} (V)	Ic (A)				
			50	75	100	150	200
B		600		**CM75BU-12H**	**CM100BU-12H**		
				U401			
T		600		**CM75TU-12H**	**CM100TU-12H**	**CM150TU-12H**	**CM200TU-12H**
				U601		U602	
		1200	**CM50TU-24H**	**CM75TU-24H**	**CM100TU-24H**		
			U601	U602			

● Numbers U101, U102, U201 to U203, U401, U601 and U602 are recorded with product names to show the outline drawing numbers

Power MOSFET Modules

Circuits which made from parallel connection of low-voltage IGBT module and discrete MOSFET up to now are mainly used by the electric power conversion equipment for drives motors, typically like a battery drive forklift.

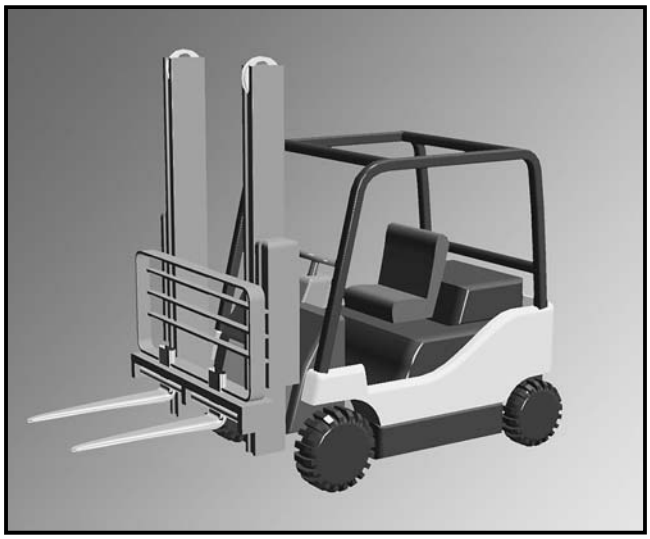
However, the ease of an assembly, the miniaturization of equipment, and the improvement in reliability are being strongly required recently. The line-up of the low-voltage MOSFET module has been realized corresponding to such a large-capacity and low-voltage use.

■ Applications

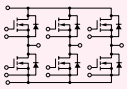
- Battery forklift
- UPS

■ Features

- Using low-loss trench MOSFET chip
- Using connector terminal for gate source
- Built-in temperature sensor
- Completely lead-free
  (RoHS directive compliance)



■ Power MOSFET modules

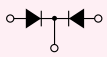
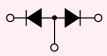
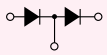
Connection		V_{DSS} (V)	I_D (A)		
			100	200	300
T		75	**FM200TU-07A**	**FM400TU-07A**	**FM600TU-07A**
			F601		
		100	**FM200TU-2A**	**FM400TU-2A**	**FM600TU-2A**
			F601		
		150	**FM200TU-3A**	**FM400TU-3A**	**FM600TU-3A**
			F601		

● Numbers F601 is recorded with product names to show the outline drawing number

Diode Modules

■ High-speed diode modules

Not RoHS directive compliant (Except. RM25HG-24S, RM50HG-12S, RM35HG-34S)

Connection		V_{RRM} (V)	I_{DC} (A) 20(25)		50(35)		100		200		250		300		400/450	
H		250/500									RM250HA-10F	R1			RM450HA-5H	R23
		600	RM20HA-12F	R2	RM50HA-12F RM50HG-12S※1	R3 R4	RM100HA-12F									
		1000	RM20HA-20F		RM50HA-20F		RM100HA-20F	R3	RM200HA-20F							
		1200	RM20HA-24F RM25HG-24S※1	R2 R4	RM50HA-24F	R3	RM100HA-24F		RM200HA-24F	R5			RM300HA-24F	R1	RM400HA-24S	R6
		1700			RM35HG-34S※1	R4										
C		300	RM20CA-6S ×	R5	RM50CA-6S ×	R5										
		450											RM300CA-9W ※2	R24		
		600	RM20CA-12F RM20CA-12S		RM50CA-12F RM50CA-12S		RM100CA-12F	R5								
		1000	RM20CA-20F		RM50CA-20F RM50CA-20S		RM100CA-20F									
		1200	RM20CA-24F		RM50CA-24F		RM100CA-24F									
C1		300	RM20C1A-6S ×	R5	RM50C1A-6S ×	R5										
		600	RM20C1A-12F RM20C1A-12S		RM50C1A-12F RM50C1A-12S		RM100C1A-12F	R5								
		1000	RM20C1A-20F		RM50C1A-20F RM50C1A-20S		RM100C1A-20F									
		1200	RM20C1A-24F		RM50C1A-24F		RM100C1A-24F									
D		600	RM20DA-12F RM20DA-12S	R5	RM50DA-12F RM50DA-12S	R5										
		1000	RM20DA-20F						RM200DA-20F	R7						
		1200	RM20DA-24F						RM200DA-24F							

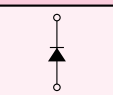
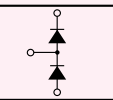
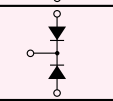
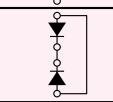
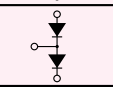
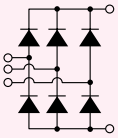
Note: "F" at the end of type name means the high-speed diode module for the transistor modules
"H" or "S" at the end of type name means the super high-speed diode module for the MOSFET or IGBT modules

※1: For the snubber circuit of IGBT modules and IPMs
※2: Exclusive use for welder

×: Plan for production discontinue

■ Diode modules

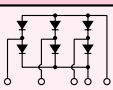
RoHS directive compliant

Connection		V_{RRM} (V)	$I_{F(AV)}$ (A) / Io (A) 20		30		40		50		60		100		150		250		500	
H		400																	RM500HA-M	R8
		800																	RM500HA-H	
		1200																	RM500HA-24	
		1600																	RM500HA-2H	
D		400			RM30DZ-M	R9					RM60DZ-M	R9	RM100DZ-M	R9	RM150DZ-M	R11	RM250DZ-M	R11	RM500DZ-M	R12
		800			RM30DZ-H						RM60DZ-H		RM100DZ-H		RM150DZ-H		RM250DZ-H		RM500DZ-H	
		1200			RM30DZ-24	R10					RM60DZ-24		RM100DZ-24		RM150DZ-24		RM250DZ-24		RM500DZ-24	
		1600			RM30DZ-2H						RM60DZ-2H		RM100DZ-2H		RM150DZ-2H		RM250DZ-2H		RM500DZ-2H	
C		400			RM30CZ-M	R9					RM60CZ-M		RM100CZ-M		RM150CZ-M		RM250CZ-M			
		800			RM30CZ-H						RM60CZ-H		RM100CZ-H		RM150CZ-H		RM250CZ-H			
		1200			RM30CZ-24	R10					RM60CZ-24		RM100CZ-24		RM150CZ-24		RM250CZ-24			
		1600			RM30CZ-2H						RM60CZ-2H		RM100CZ-2H		RM150CZ-2H		RM250CZ-2H			
U		400													RM150UZ-M		RM250UZ-M ×		RM500UZ-M	R12
		800													RM150UZ-H		RM250UZ-H		RM500UZ-H	
		1200													RM150UZ-24		RM250UZ-24		RM500UZ-24	
		1600													RM150UZ-2H		RM250UZ-2H		RM500UZ-2H	
D_2		2000							RM50D2Z-40	R10			RM100D2Z-40	R10						
T (DC output current)		400	RM10TA-M	R13	RM15TA-M	R13	RM20TPM-M ×	R20			RM30TA-M RM30TB-M × RM30TPM-M ×	R16 R17 R20	RM50TC-M	R18	RM75TC-M RM75TPM-M	R19 R22				
		800	RM10TA-H		RM15TA-H		RM20TPM-H				RM30TA-H RM30TB-H RM30TPM-H	R16 R17 R20	RM50TC-H		RM75TC-H RM75TPM-H	R19 R22				
		1200	RM10TA-24		RM15TA-24		RM20TA-24 × RM20TPM-24 ×	R15 R21			RM30TC-24	R18	RM50TC-24		RM75TC-24 RM75TPM-24	R19 R22				
		1600	RM10TA-2H		RM15TA-2H		RM20TA-2H RM20TPM-2H	R15 R21			RM30TC-2H		RM50TC-2H		RM75TC-2H RM75TPM-2H	R19 R22				
		2000			RM15TC-40	R14					RM30TC-40 ×	R14								

×: Plan for production discontinue

■ New diode modules

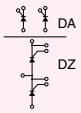
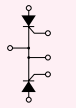
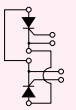
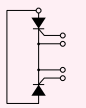
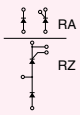
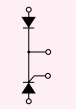
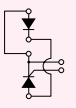
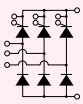
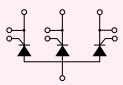
RoHS directive compliant

Connection		V_{RRM} (V)	Io (A) 7		24		12		36	
TN		800			RM20TNA-H	R25			RM30TNA-H	R25
		1600	RM10TN-2H	R25			RM25TN-2H	R25		

● Numbers from R1 to R25 are recorded with product names to show the outline drawing numbers

Thyristor Modules

■ Thyristor modules

Connection		V_{RRM} (V)	$I_{T(AV)}$ (A) 20		25		55		90		130		150		200		400	
H		400															TM400HA-M	T1
		800															TM400HA-H	
		1200															TM400HA-24	
		1600															TM400HA-2H	
D		400	TM20DA-M	T2	TM25DZ-M	T3	TM55DZ-M	T3	TM90DZ-M	T3	TM130DZ-M	T5			TM200DZ-M	T5	TM400DZ-M	T6
		800	TM20DA-H		TM25DZ-H		TM55DZ-H		TM90DZ-H		TM130DZ-H				TM200DZ-H		TM400DZ-H	
		1200			TM25DZ-24	T4	TM55DZ-24	T4	TM90DZ-24	T4	TM130DZ-24				TM200DZ-24		TM400DZ-24	
		1600			TM25DZ-2H		TM55DZ-2H		TM90DZ-2H		TM130DZ-2H				TM200DZ-2H		TM400DZ-2H	
C		400			TM25CZ-M	T3	TM55CZ-M	T3	TM90CZ-M	T3	TM130CZ-M ×				TM200CZ-M		TM400CZ-M	
		800			TM25CZ-H		TM55CZ-H		TM90CZ-H		TM130CZ-H				TM200CZ-H		TM400CZ-H	
		1200			TM25CZ-24	T4	TM55CZ-24	T4	TM90CZ-24	T4	TM130CZ-24				TM200CZ-24		TM400CZ-24	
		1600			TM25CZ-2H		TM55CZ-2H		TM90CZ-2H		TM130CZ-2H				TM200CZ-2H		TM400CZ-2H	
P		400									TM130PZ-M				TM200PZ-M ×		TM400PZ-M	
		800									TM130PZ-H				TM200PZ-H		TM400PZ-H	
		1200									TM130PZ-24				TM200PZ-24		TM400PZ-24	
		1600									TM130PZ-2H				TM200PZ-2H		TM400PZ-2H	
U		400															TM400UZ-M	
		800															TM400UZ-H	
		1200															TM400UZ-24	
		1600															TM400UZ-2H	
R		400	TM20RA-M	T7	TM25RZ-M	T8	TM55RZ-M	T8	TM90RZ-M	T8	TM130RZ-M	T5			TM200RZ-M ×	T5		
		800	TM20RA-H		TM25RZ-H		TM55RZ-H		TM90RZ-H		TM130RZ-H				TM200RZ-H			
		1200			TM25RZ-24	T9	TM55RZ-24	T9	TM90RZ-24	T9	TM130RZ-24				TM200RZ-24			
		1600			TM25RZ-2H		TM55RZ-2H		TM90-RZ-2H		TM130RZ-2H				TM200RZ-2H			
E		400			TM25EZ-M	T8	TM55EZ-M	T8	TM90EZ-M	T8	TM130EZ-M ×				TM200EZ-M ×			
		800			TM25EZ-H		TM55EZ-H		TM90EZ-H		TM130EZ-H ×				TM200EZ-H			
		1200			TM25EZ-24	T9	TM55EZ-24	T9	TM90EZ-24	T9	TM130EZ-24 ×				TM200EZ-24			
		1600			TM25EZ-2H		TM55EZ-2H		TM90EZ-2H		TM130EZ-2H ×				TM200EZ-2H			
G		400									TM130GZ-M ×				TM200GZ-M ×			
		800									TM130GZ-H				TM200GZ-H			
		1200									TM130GZ-24				TM200GZ-24			
		1600									TM130GZ-2H				TM200GZ-2H			
T3		400	TM10T3B-M ※1	T10	TM15T3A-M ※1 ※3 ×	T11	TM25T3A-M ※1 ※4	T11										
		800	TM10T3B-H ※1		TM15T3A-H ※1 ※3		TM25T3A-H ※1 ※4											
S		300					TM60SA-6 ※1 ※4	T12	TM90SA-6 ※2	T12			TM150SA-6 ※2	T14				
		400					TM60SZ-M ※1 ※4	T13	TM100SZ-M ※2 ※5	T13								

※1: DC output current ※2: Non-isolation ※3: I_T=30A ※4: I_T=60A ※5: I_T=100A

×: Plan for production discontinue

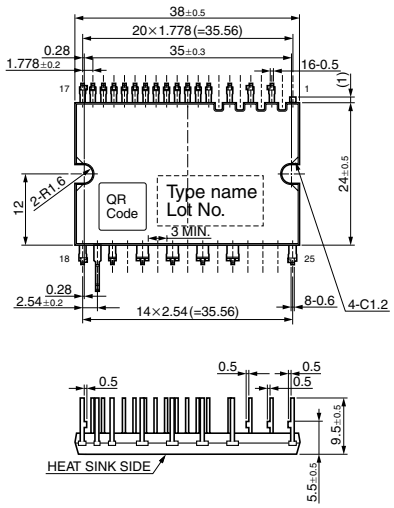
● Numbers from T1 to T14 are recorded with product names to show the outline drawing numbers

■ Power modules outline drawings

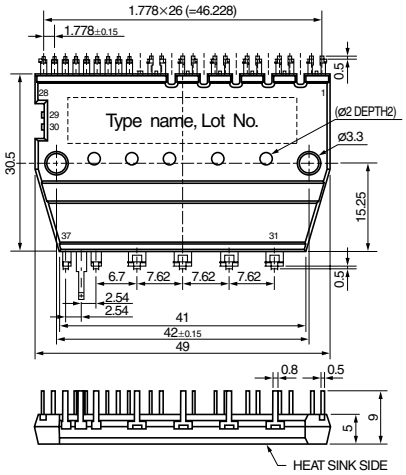
(unit: mm)

DIPIPM™
Dual In-Line Package
Intelligent Power Modules

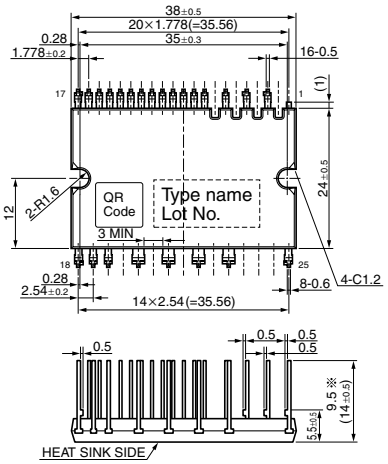
PS3
Super-mini DIPIPM™ Ver. 4
PS2196∗-4S/-ST
PS21963-4ES/-EST



PS6
Mini DIPIPM™ Ver. 3
PS2156∗-SP

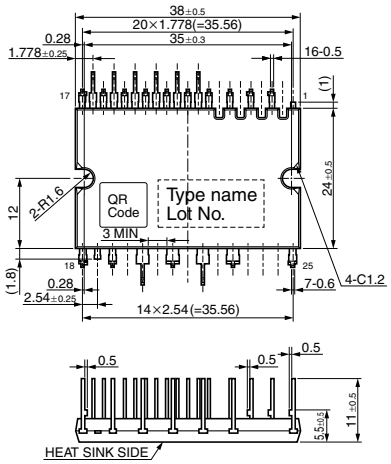


PS1
Super-mini DIPIPM™ Ver. 4
PS219∗∗-4/-4A/-T/-AT
PS219∗3-4E/-4AE/-ET/-AET

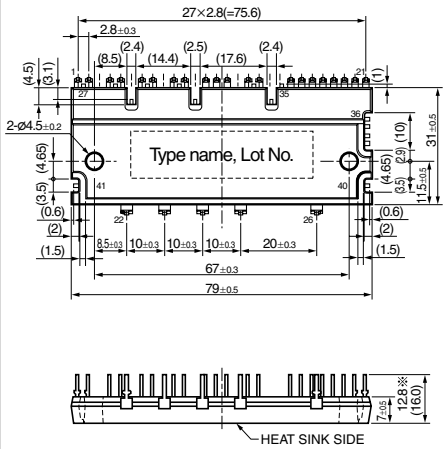


※In the case of -A, this length is 14.0mm

PS4
Super-mini DIPIPM™ Ver. 4
PS219∗∗-4W/-TW
PS219∗3-4EW/-ETW

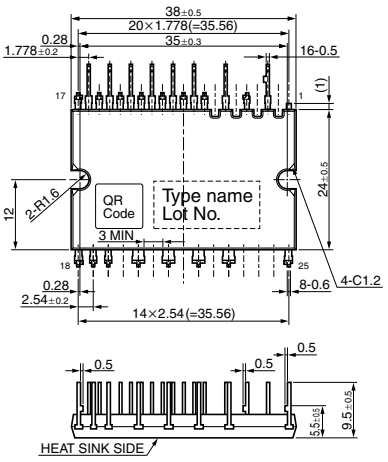


PS7
Large DIPIPM™ Ver. 3
PS21869-P/-AP

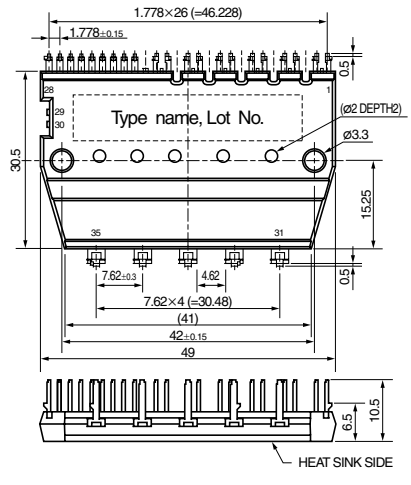


※In the case of -AP, this length is 16.0mm

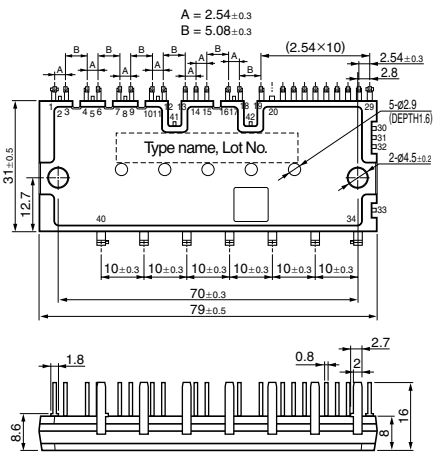
PS2
Super-mini DIPIPM™ Ver. 4
PS219∗∗-4C/-CT
PS219∗3-4CE/-CET



PS5
Mini DIPIPM™ Ver. 3
PS2156∗-P



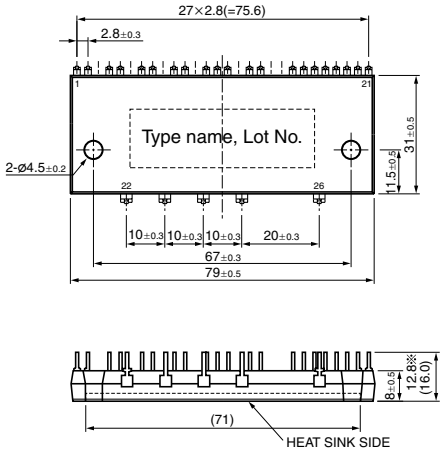
PS8
Large DIPIPM™ Ver. 4
PS21A79 PS22A72 PS22A74
PS21A7A PS22A73 PS22A76
PS22A78-E



QR Code: QR Code is registered trademarks of DENSO WAVE INCORPORATED in JAPAN and other countries

PS9

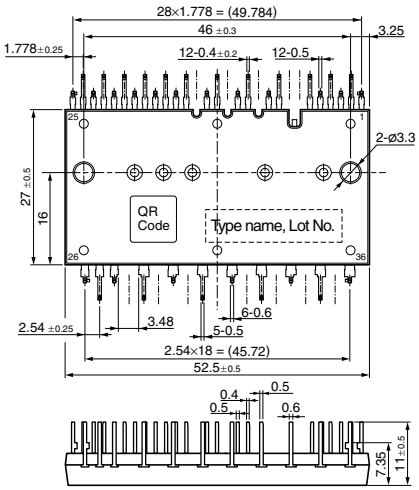
Large DIPIPM™ Ver. 3.5
PS21265-P/-AP
PS21267-P/-AP



※ In the case of -AP, this length is 16.0mm

PS12

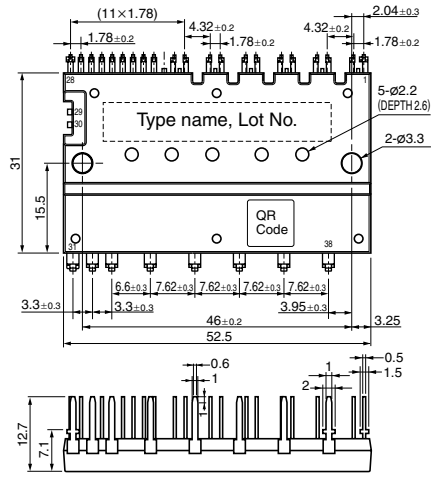
DIPPSC™
PS81B93-EW PS81B94-W
PS81B93-W PS81B95-W



PS10

Mini DIPIPM™ Ver. 4
PS21765
PS21767/-V

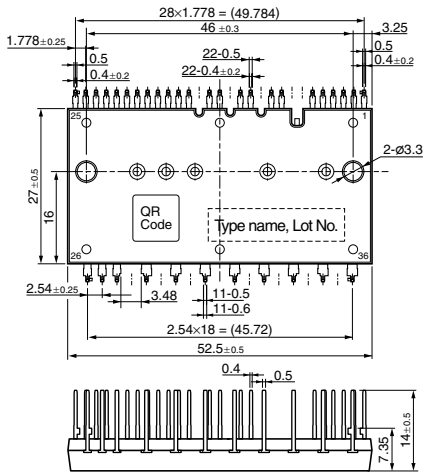
DIPPFC™
PS51787
PS51789



Note: All outer lead terminals are with lead free solder (Sn-Cu) plating

PS11

DIPPSC™
PS81B93-AE PS81B94-A
PS81B93-A PS81B95-A



QR Code: QR Code is registered trademarks of DENSO WAVE INCORPORATED in JAPAN and other countries

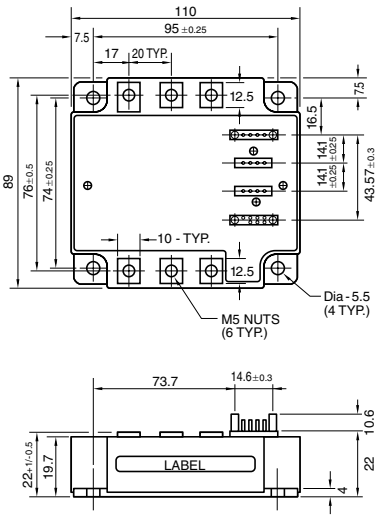
(unit: mm)

IPM

Intelligent Power Modules

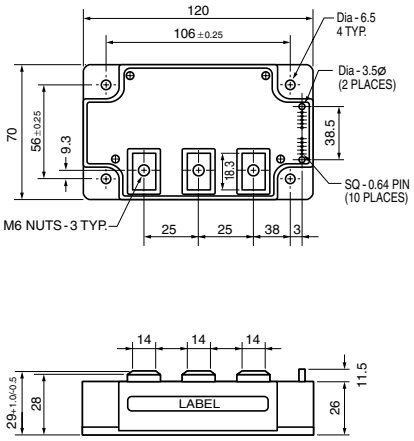
P25

PM50RVA120
PM75RVA060
PM100CVA060



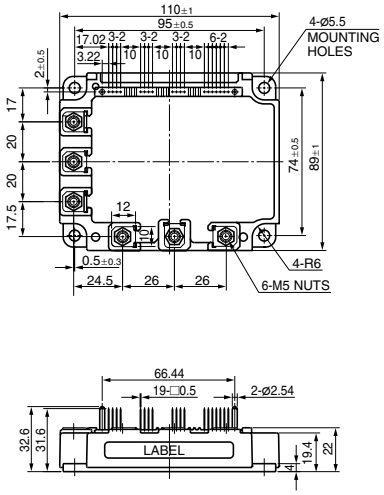
P28

PM200DVA120
PM400DVA060



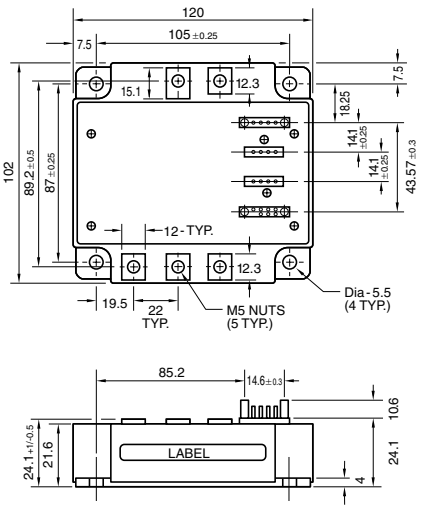
P2

PM50,75,100,150CSD/RSD060
PM50,75CSD/RSD120



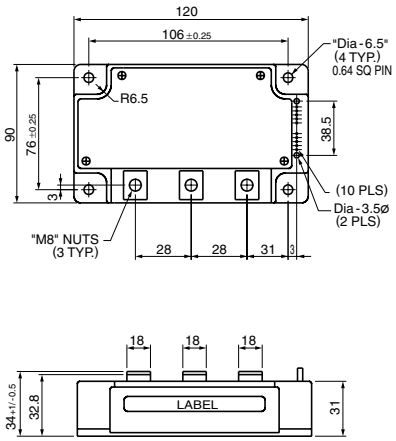
P26

PM75,100CVA120
PM150,200CVA060



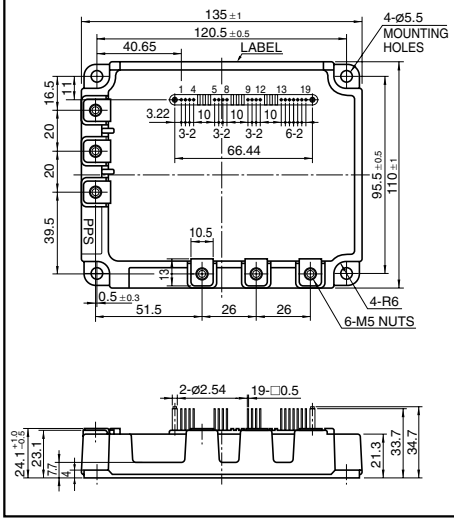
P29

PM300DVA120
PM600DVA060



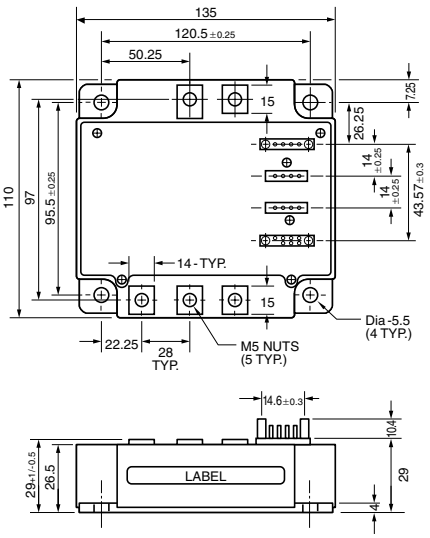
P3

PM200,300CSD/RSD060
PM100,150CSD/RSD120



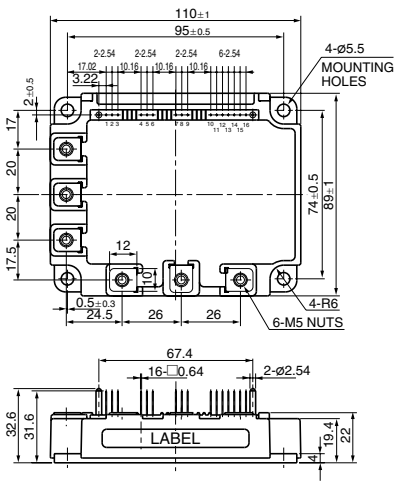
P27

PM150CVA120
PM300CVA060



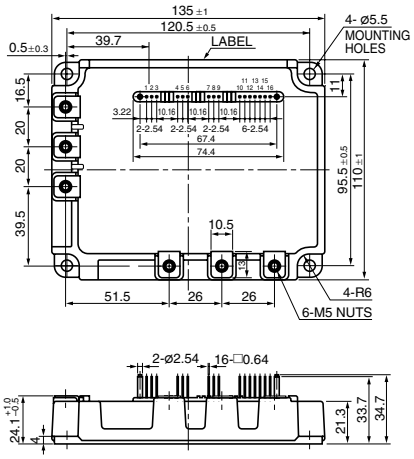
P31

PM50,75,100,150CSE/RSE060
PM50,75CSE/RSE120



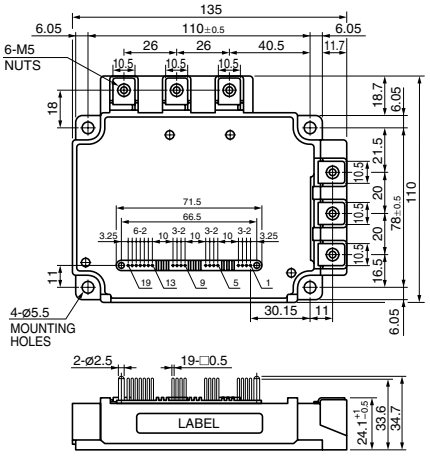
P32

PM200,300CSE/RSE060
PM100,150CSE/RSE120



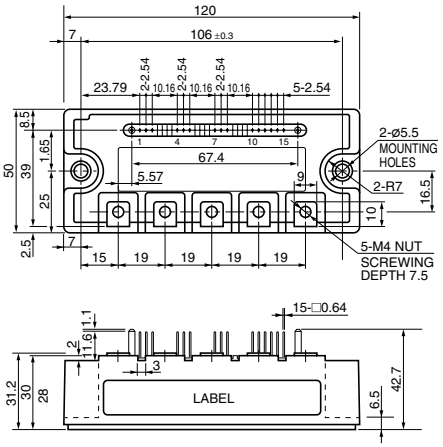
P37

PM200,300CLA/CL1A/RL1A060
PM100,150CLA/CL1A/RL1A120



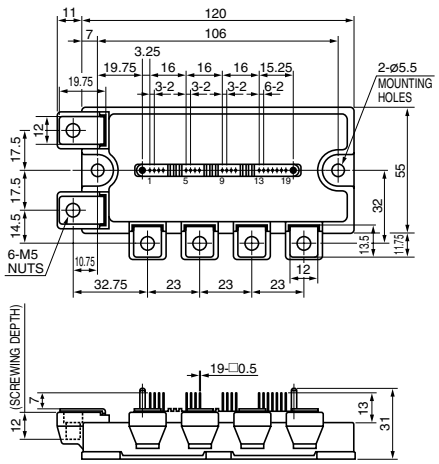
P40

PM50,75,100,150,200CS1D060
PM25,50,75,100CS1D120



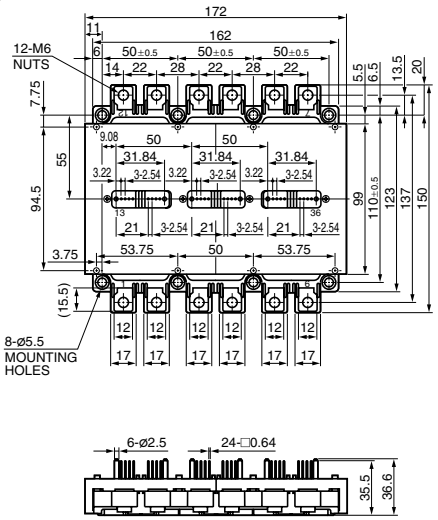
P35

PM50,75,100,150CL1A/RL1A060
PM25,50,75CL1A/RL1A120
PM50,75B4/B5/B6LA060



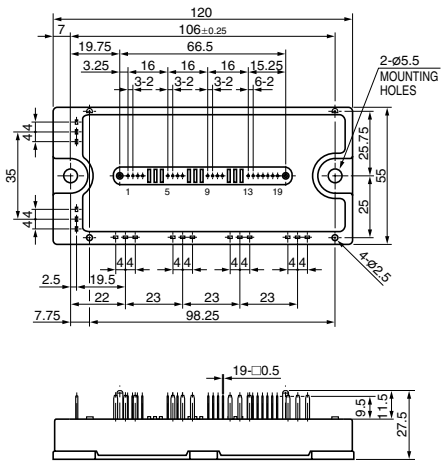
P38

PM200,300,450CLA120
PM450,600CLA060



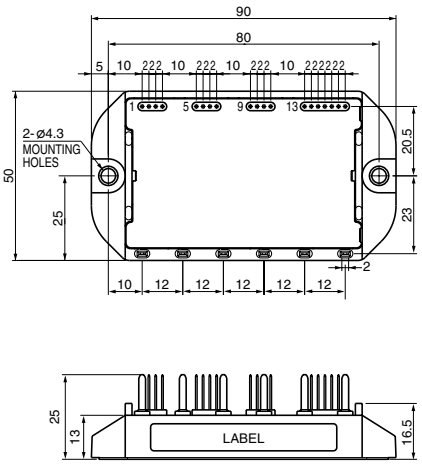
P36

PM50,75,100,150CL1B/RL1B060
PM25,50,75CL1B/RL1B120
PM50,75B4/B5/B6LB060



P39

PM50RL1C060
PM25RL1C120

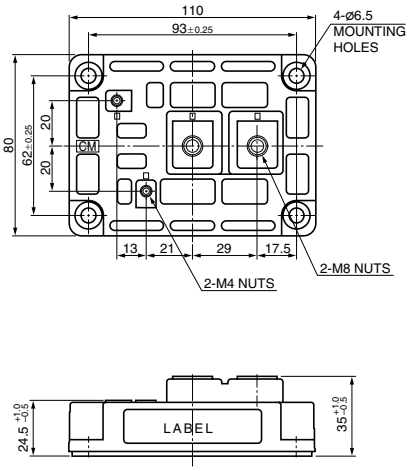


(unit: mm)

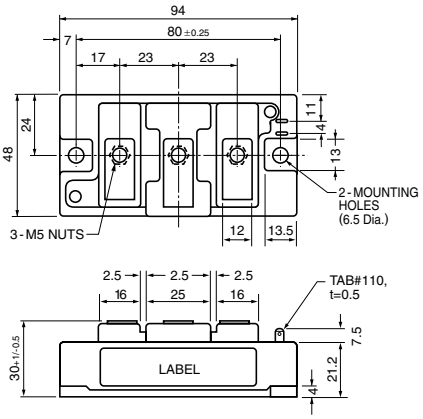
IGBT Module

Insulated Gate Bipolar Transistor Modules

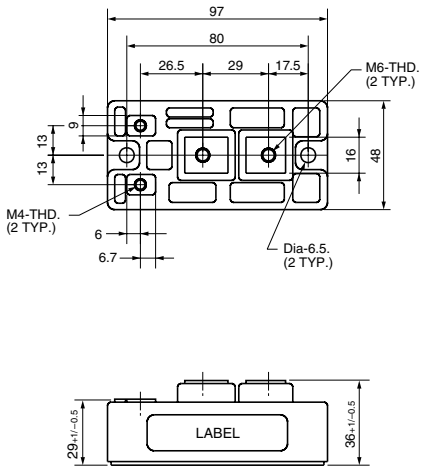
H107 CM600HB-24A



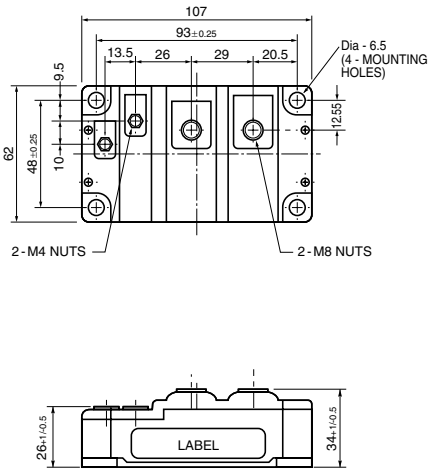
U111 CM50E3U-24H, CM75E3U-12H,-24H, CM100E3U-12H,-24NF, CM150E3U-12H, CM200E3U-12NF



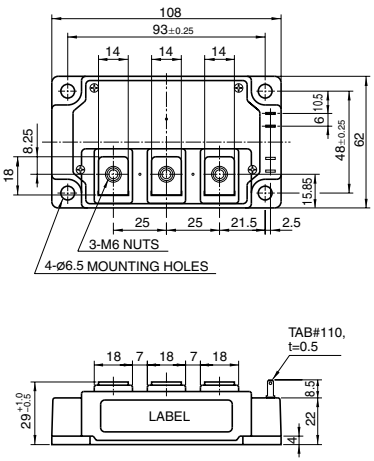
H105 CM450HA-5F



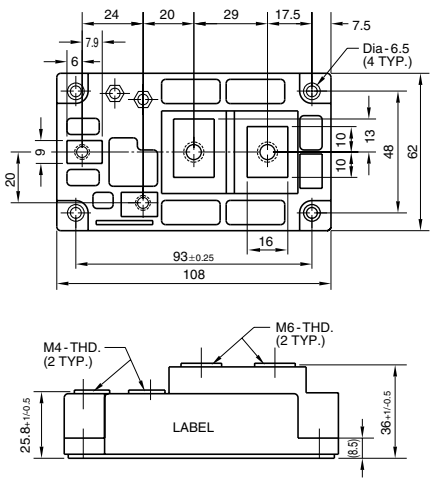
U101 CM600HU-12H,-12F, CM400HU-24H,-24F



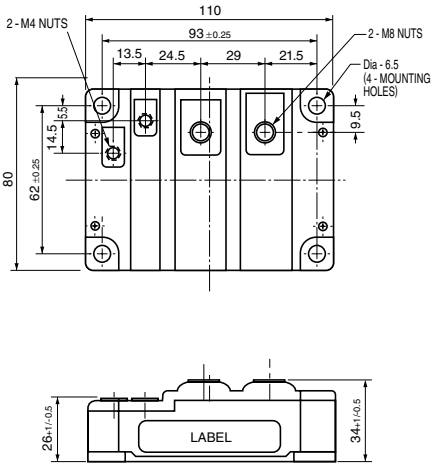
U112 CM150E3U-24H, CM300E3U-12H



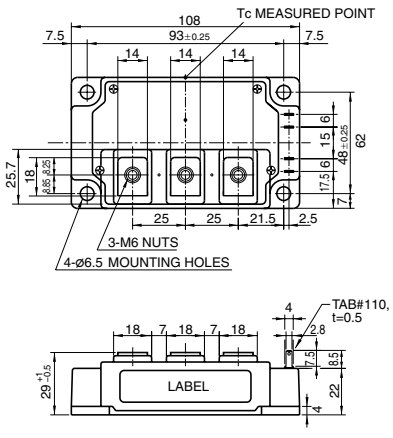
H106 CM400HA-24A, CM600HA-24A,-5F, CM600HN-5F



U102 CM600HU-24H,-24F

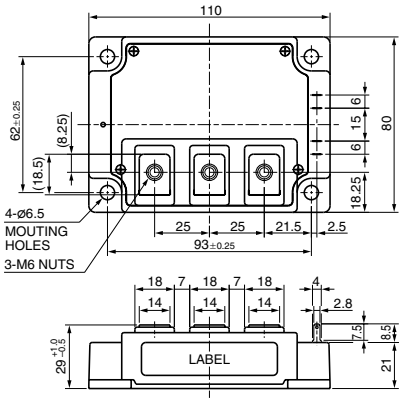


U201 CM100DU-34KA, CM150DU-24H,-24F,-34KA, CM200DU-24H,-24F,-24NFH, CM300DU-12H,-12F,-12NFH,-24NFH, CM400DU-5F,-12H,-12F,-12NFH



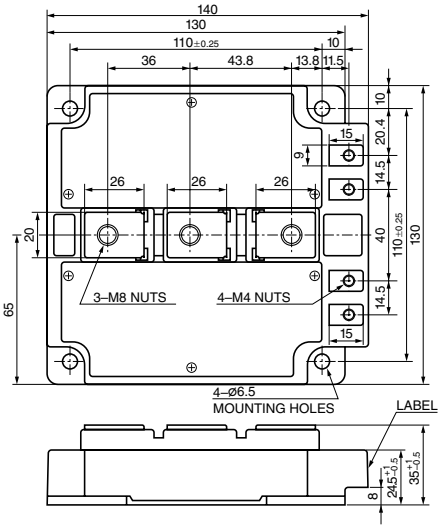
U202

CM200DU-34KA
CM300DU-24H,-24F
CM350DU-5F
CM600DU-5F



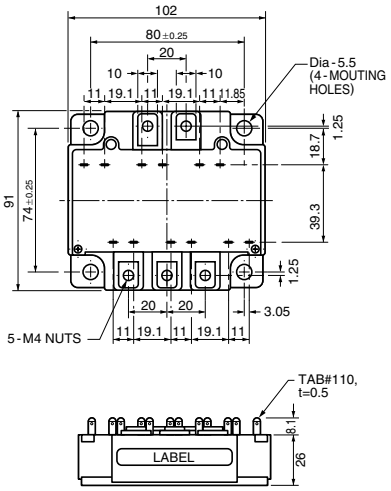
U205

CM300,400DU-34KA
CM600DU-24F,-24NF



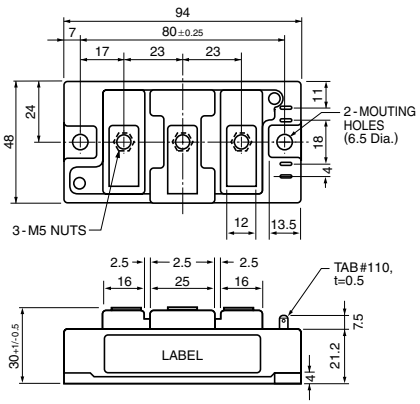
U601

CM50TU-24H,-24F
CM75TU-12H,-12F
CM100TU-12H,-12F



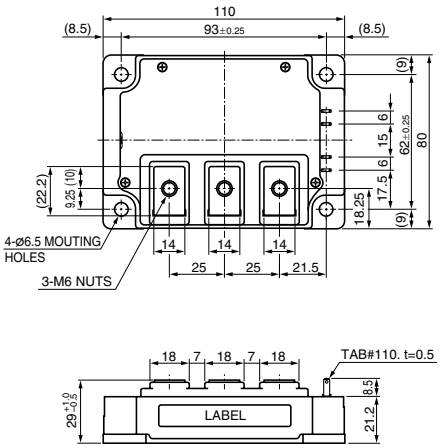
U203

CM50DU-24H,-24F
CM75DU-12H,-24H,-12F,-24F
CM100DU-12H,-24H,-12F,-24F,-24NFH
CM150DU-12H,-12F,-24NFH **CM100DUS-12F**
CM200DU-12H,-12F,-12NFH **CM150DUS-12F**



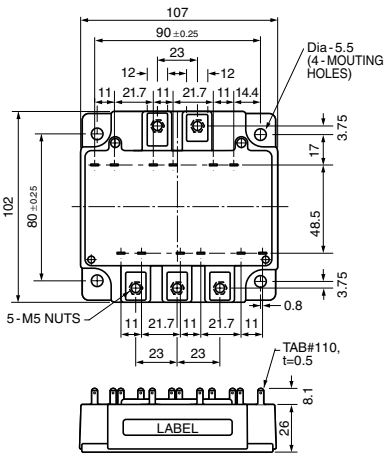
U206

CM600DU-12NFH
CM400DU-24NFH
CM600DU-24NFH



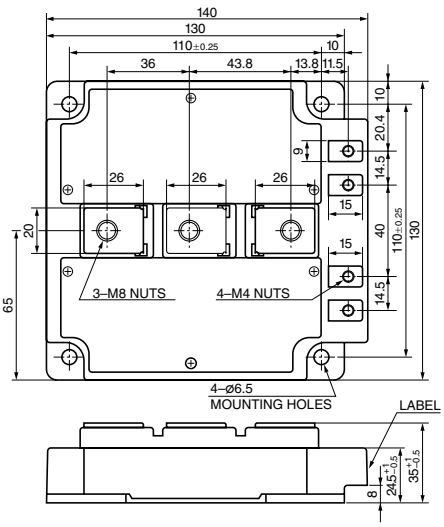
U602

CM75TU-24H,-24F
CM100TU-24H,-24F
CM150TU-12H,-12F
CM200TU-12H,-12F
CM50,75TU-34KA



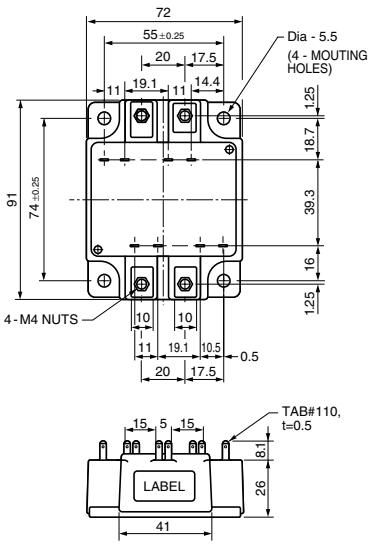
U204

CM400DU-24F



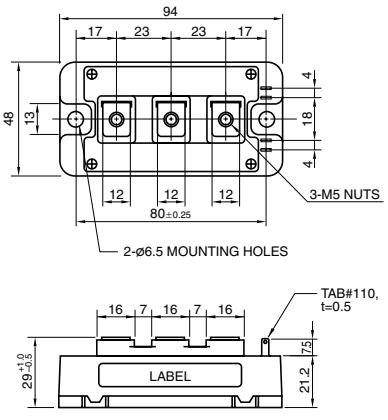
U401

CM75,100BU-12H



N201

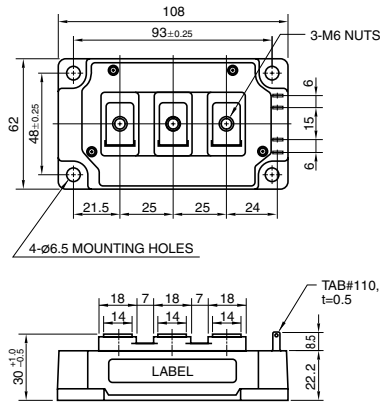
CM75DY-34A
CM100DY-24NF,-24A,-34A
CM150DY-12NF,-24NF,-24A
CM200DY-12NF,-24A
CM300DY-12NF



(unit: mm)

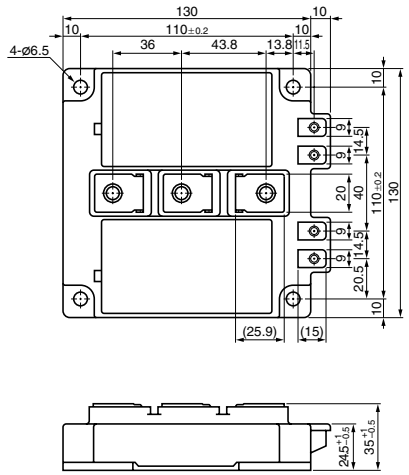
N202

CM150DY-34A
CM200DY-24NF,-34A
CM300DY-24A
CM400DY-12NF



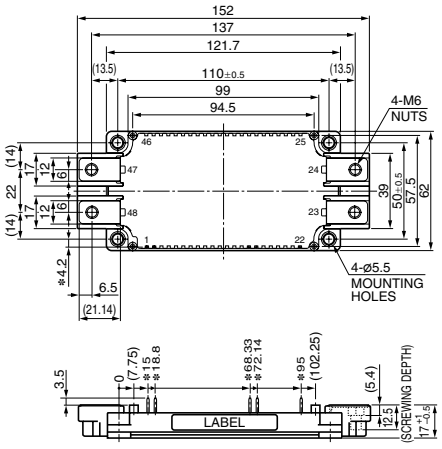
N205

CM400DY-34A



NX101

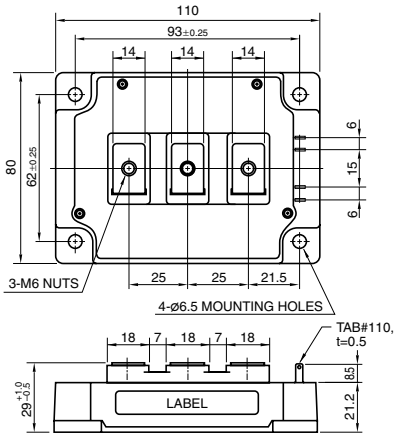
CM400HX-24A
CM600HX-12A,-24A



∗All dimensions with a tolerance of ⊕ø0.5

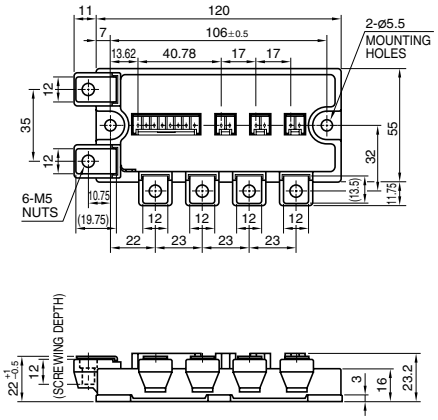
N203

CM300DY-24NF,-34A
CM400DY-24NF,-24A
CM600DY-12NF,-24A



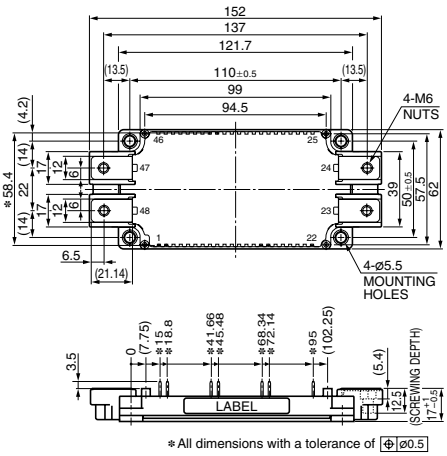
NF601

CM50TL/RL-24NF
CM75TL/RL-12NF,-24NF
CM100TL/RL-12NF,-24NF
CM150TL/RL-12NF



NX201

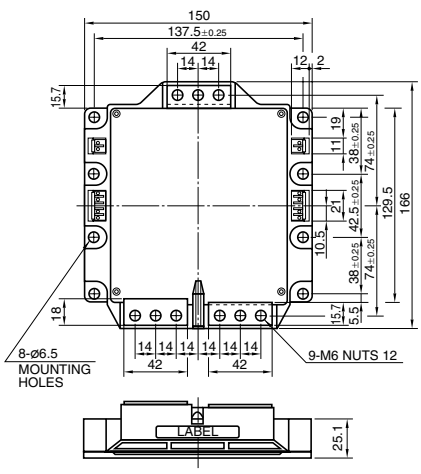
CM150DX-24A
CM200DX-24A
CM300DX-12A,-24A
CM400DX-12A
CM450DX-24A



∗All dimensions with a tolerance of ⊕ø0.5

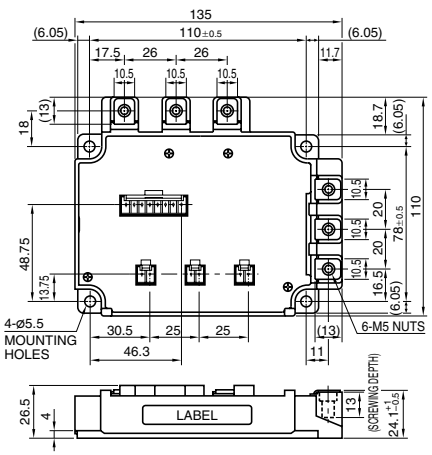
N204

CM900,1400DU-24NF
CM1000DU-34NF



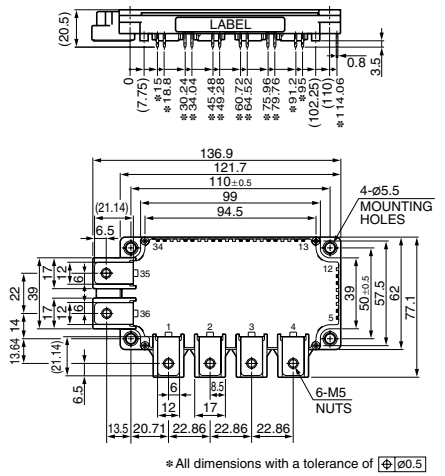
NF602

CM150TL/RL-24NF
CM200TL/RL-12NF,-24NF



NX701

CM75RX-24A
CM100RX-12A,-24A
CM150RX-12A
CM200RX-12A

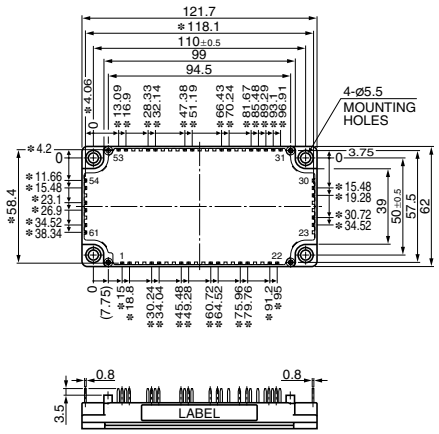


∗All dimensions with a tolerance of ⊕ø0.5

Power MOSFET Modules

NXM01

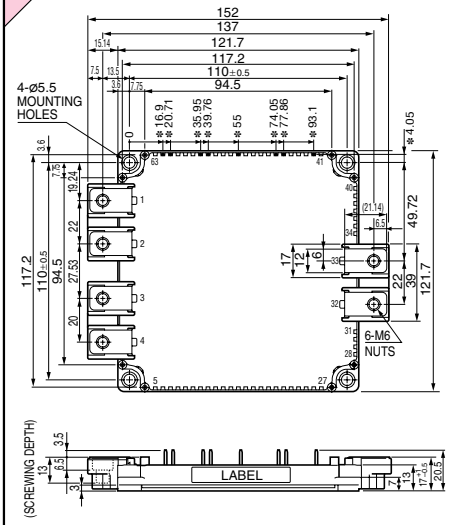
CM35MX-24A
CM50MX-24A
CM75MX-12A,-24A
CM100MX-12A



*All dimensions with a tolerance of ⊕ø0.5

NXL21

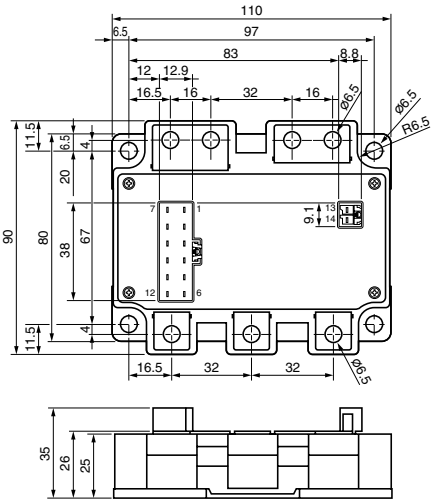
CM600DXL-24A
CM1000DXL-24A



*All dimensions with a tolerance of ⊕ø0.5

F601

FM200TU-07A,-2A,-3A
FM400TU-07A,-2A,-3A
FM600TU-07A,-2A,-3A

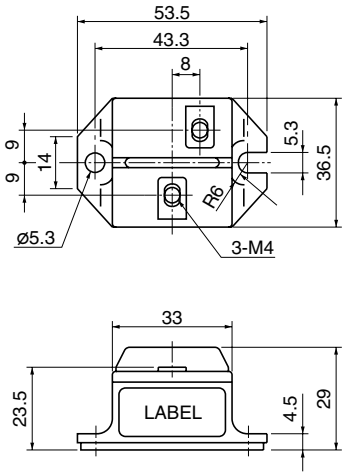


(unit: mm)

Diode Modules

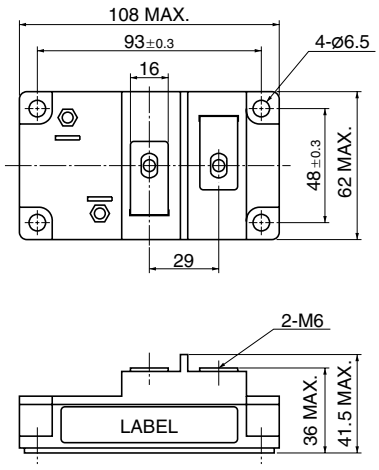
R3

RM50HA-12F,-20F,-24F
RM100HA-12F,-20F,-24F



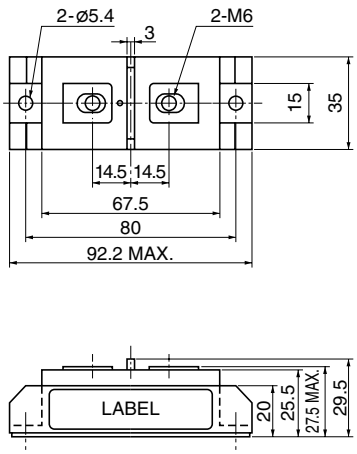
R6

RM400HA-24S



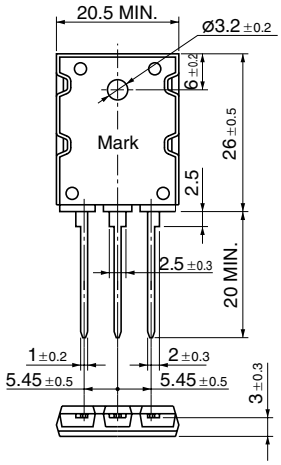
R1

RM250HA-10F
RM300HA-24F



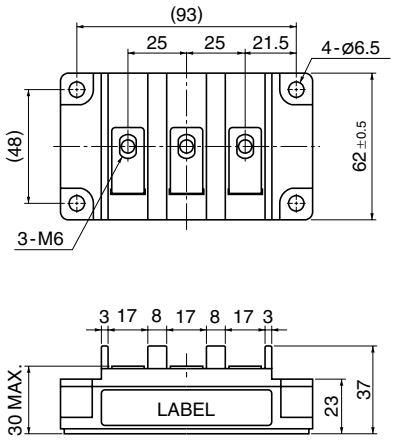
R4

RM25HG-24S
RM50HG-12S
RM35HG-34S



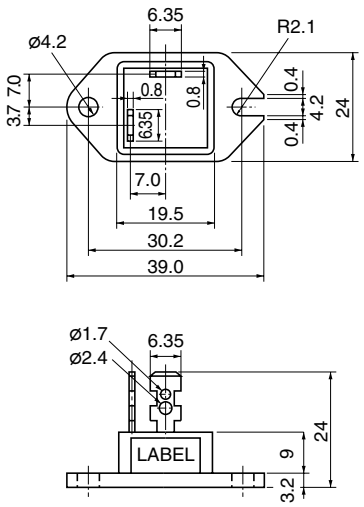
R7

RM200DA-20F,-24F



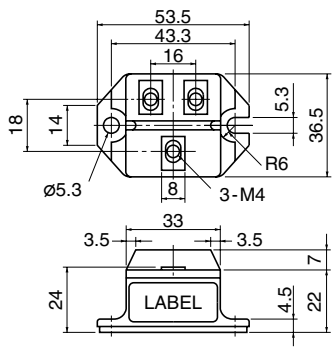
R2

RM20HA-12F,20F,-24F



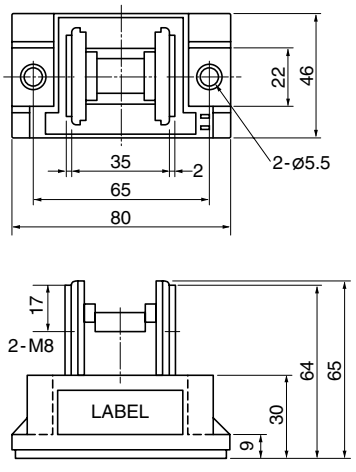
R5

RM100C1A-12F,-20F,-24F
RM100CA-12F,-20F,-24F
RM200HA-20F,-24F
RM20C1A-6S,-12F,-12S,-20F,-24F
RM20CA-6S,-12F,-12S,-20F,-24F
RM20DA-12F,-12S,-20F,-24F
RM50C1A-6S,-12F,-12S,-20F,-20S,-24F
RM50CA-6S,-12F,-12S,-20F,-20S,-24F
RM50DA-12F,-12S



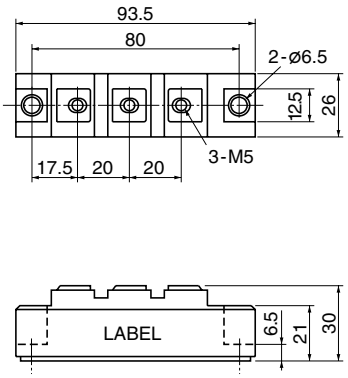
R8

RM500HA-M,-H,-24,-2H



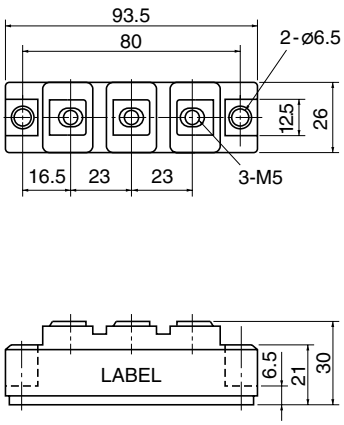
R9

RM30CZ-M,-H
RM30DZ-M,-H
RM60CZ-M,-H,-24,-2H
RM60DZ-M,-H,-24,-2H
RM100CZ-M,-H,-24,-2H
RM100DZ-M,-H,-24,-2H



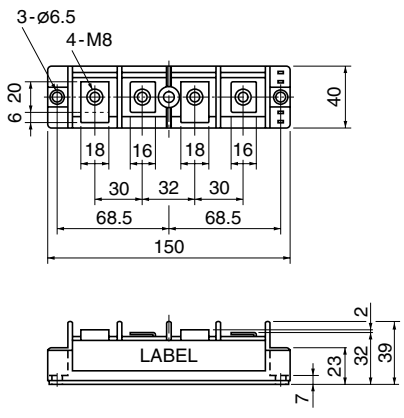
R10

RM30CZ-24,-2H
RM30DZ-24,-2H
RM50D2Z-40
RM100D2Z-40



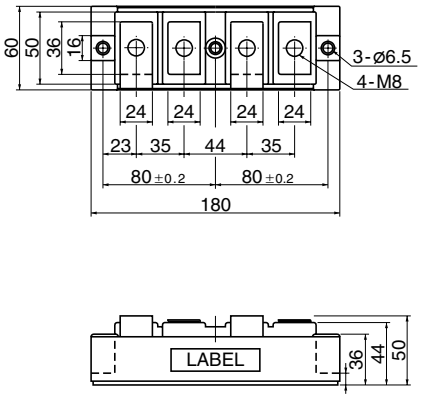
R11

RM150CZ-M,-H,-24,-2H
RM150DZ-M,-H,-24,-2H
RM150UZ-M,-H,-24,-2H
RM250CZ-M,-H,-24,-2H
RM250DZ-M,-H,-24,-2H
RM250UZ-M,-H,-24,-2H



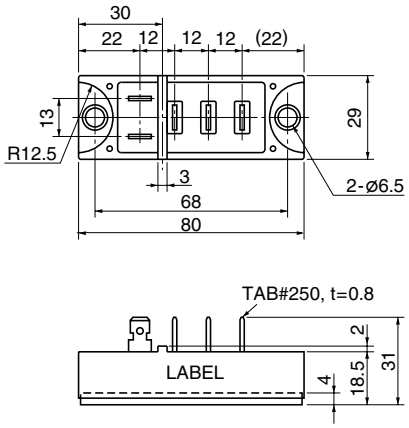
R12

RM500DZ-M,-H,-24,-2H
RM500UZ-M,-H,-24,-2H



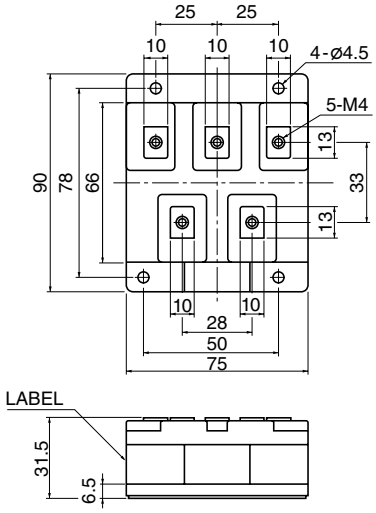
R13

RM10TA-M,-H,-24,-2H
RM15TA-M,-H,-24,-2H



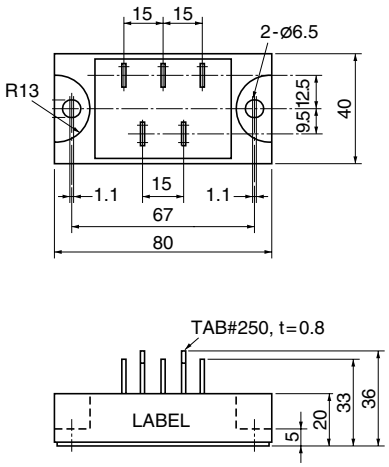
R14

RM15TC-40
RM30TC-40



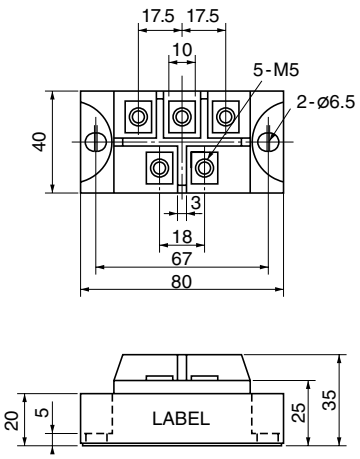
R15

RM20TA-24,-2H



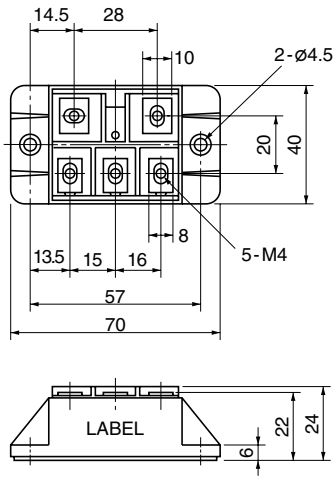
R16

RM30TA-M,-H



R17

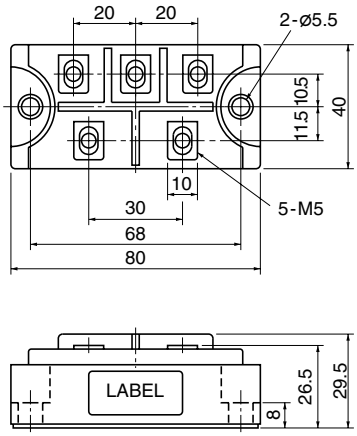
RM30TB-M,-H



(unit : mm)

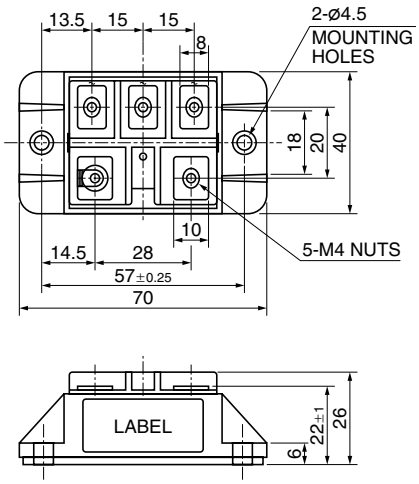
R18

RM30TC-24,-2H
RM50TC-M,-H,-24,-2H



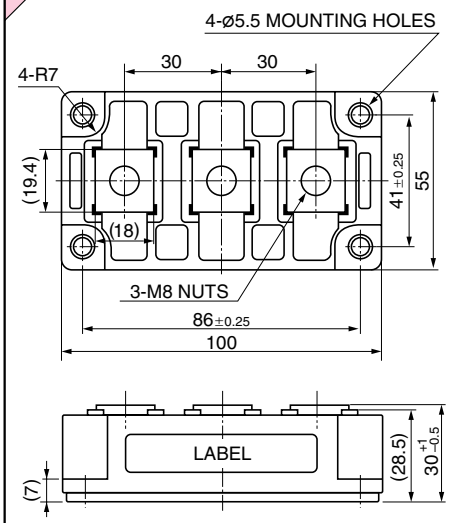
R21

RM20TPM-2H,-24



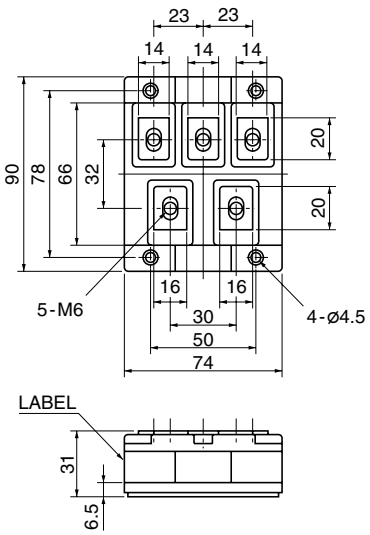
R24

RM300CA-9W



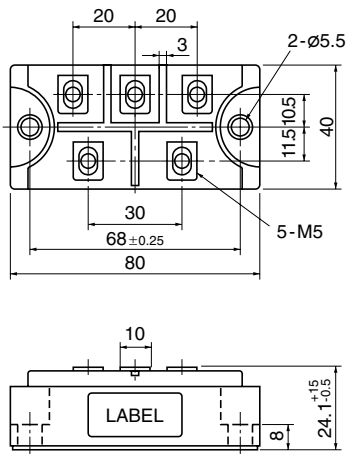
R19

RM75TC-M,-H,-24,-2H



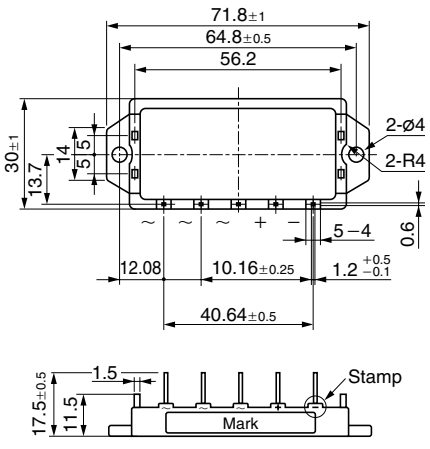
R22

RM75TPM-M,-H,-24,-2H



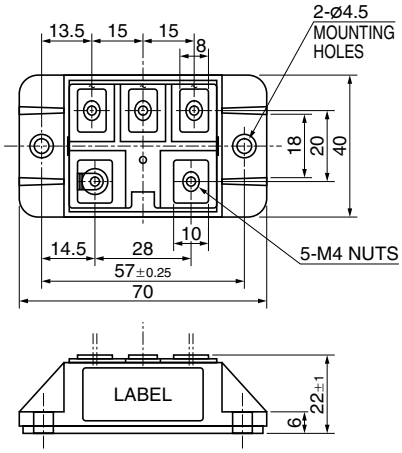
R25

RM10TN-2H
RM20TNA-H
RM25TN-2H
RM30TNA-H



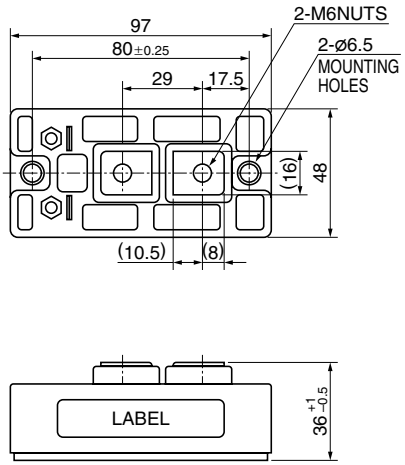
R20

RM20TPM-H,-M
RM30TPM-H,-M



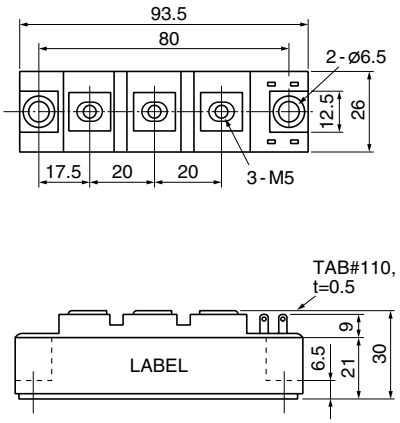
R23

RM450HA-5H

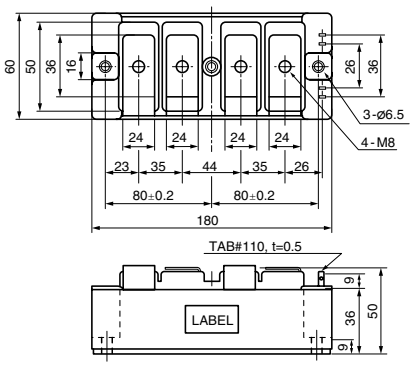


Thyristor Modules

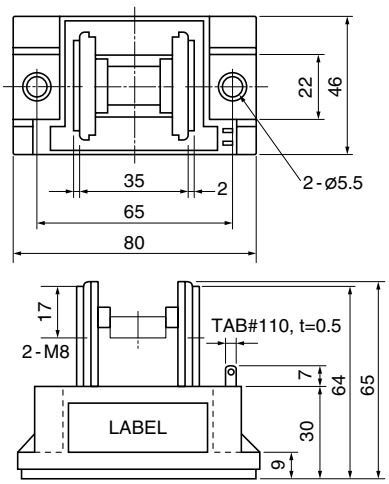
T3
TM25CZ/DZ-M,-H
TM55CZ/DZ-M,-H
TM90CZ/DZ-M,-H



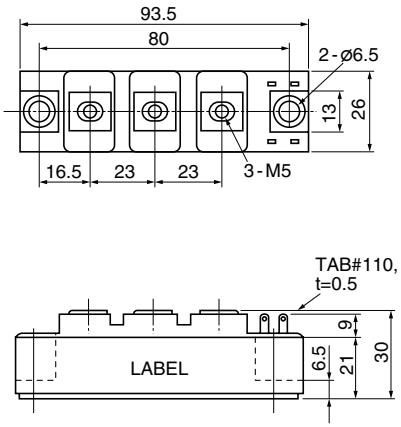
T6
TM400CZ/DZ/PZ/UZ-M,-H,-24,-2H



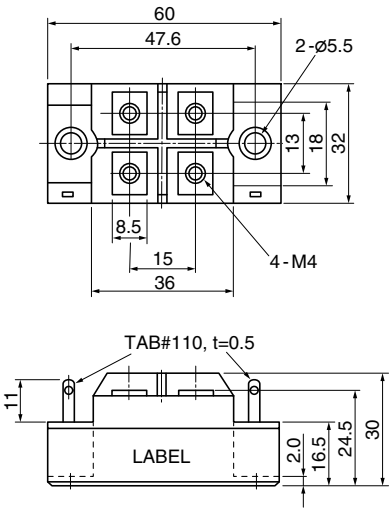
T1
TM400HA-M,-H,-24,-2H



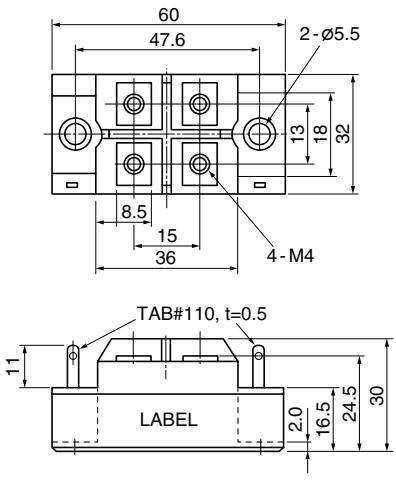
T4
TM25CZ/DZ-24,-2H
TM55CZ/DZ-24,-2H
TM90CZ/DZ-24,-2H



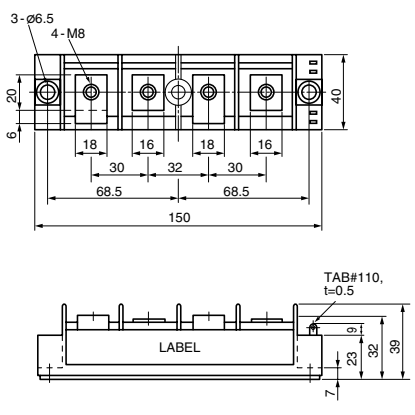
T7
TM20RA-M,-H



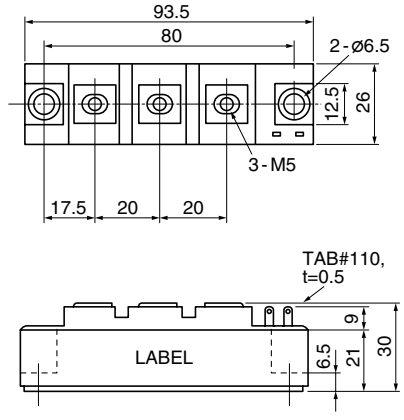
T2
TM20DA-M,-H



T5
TM130CZ/DZ/EZ/GZ/PZ/RZ-M,-H,-24,-2H
TM200CZ/DZ/EZ/GZ/PZ/RZ-M,-H,-24,-2H



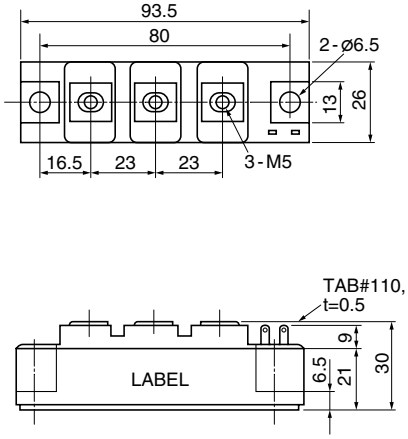
T8
TM25EZ/RZ-M,-H
TM55EZ/RZ-M,-H
TM90EZ/RZ-M,-H



(unit: mm)

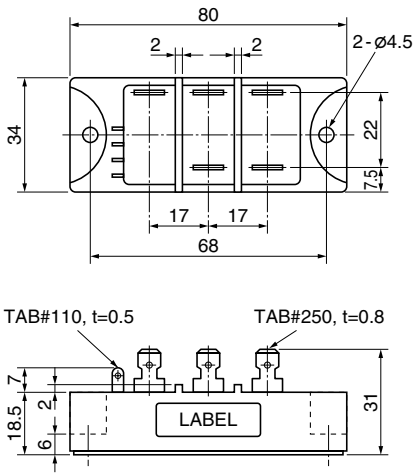
T9

TM25EZ/RZ-24,-2H
TM55EZ/RZ-24,-2H
TM90EZ/RZ-24,-2H



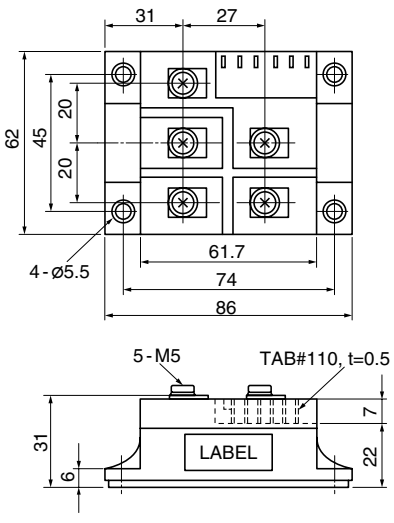
T10

TM10T3B-M,-H



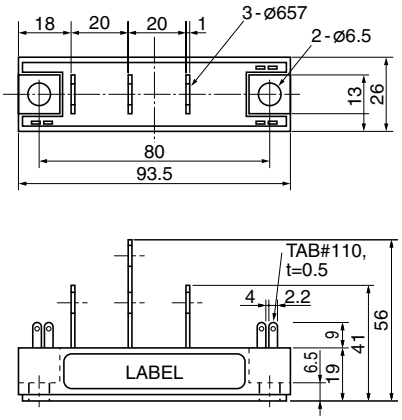
T11

TM15T3A-M,-H
TM25T3A-M,-H



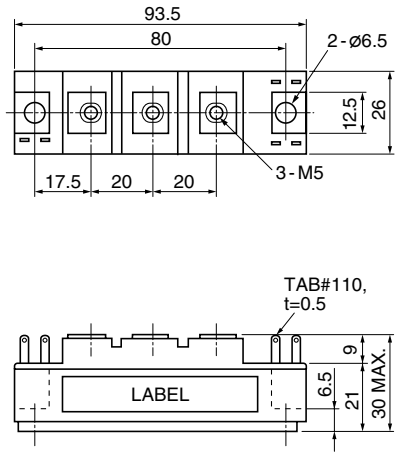
T12

TM60SA-6
TM90SA-6



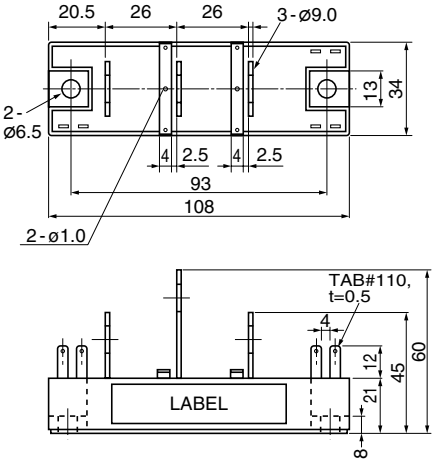
T13

TM60SZ-M
TM100SZ-M

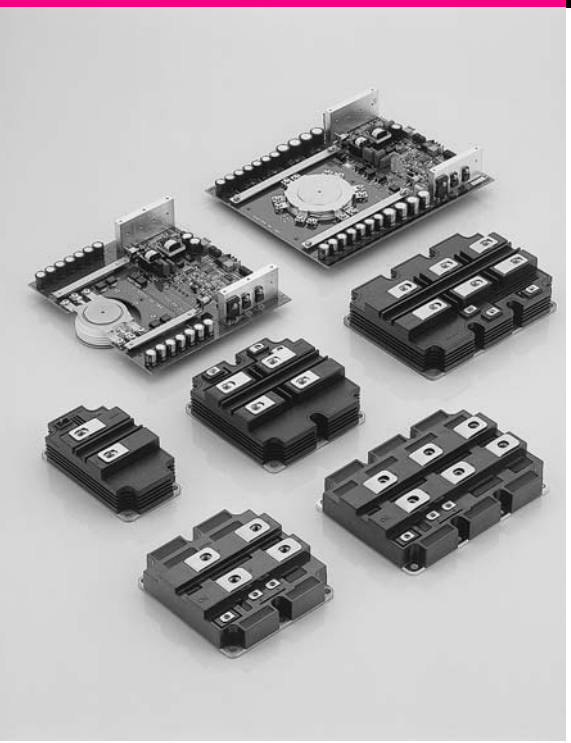


T14

TM150SA-6

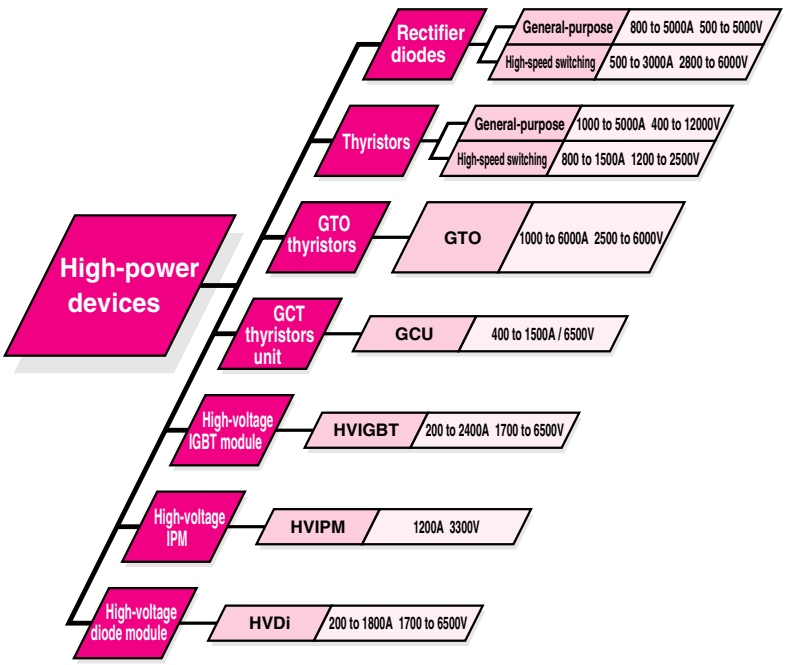


High-power Devices



Large Product Variety for Wide-Ranging Needs

High-power devices are semiconductor devices represented by gate commutated turn-off (GCT) thyristors and high-voltage insulated-gate bipolar transistor (HVIGBT) modules, and these devices are now used in equipment designed for traction, including high-speed express trains, and in power system equipment.
We offer a variety of high-power devices to suit diversified applications. These devices include diodes, thyristors, GTO thyristors, GCT thyristors, HVIGBT modules, and high-voltage intelligent power modules (HVIPM).



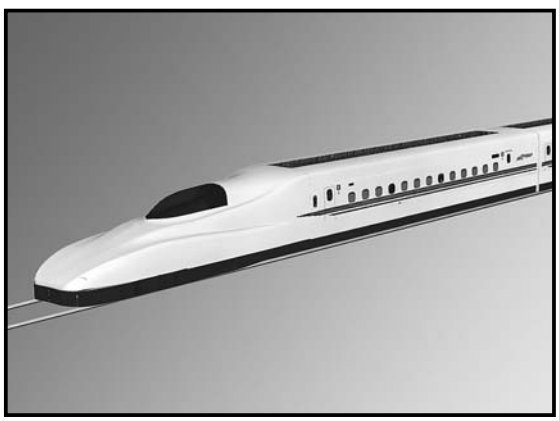
■ Naming system

PM	1200	H	CE		330	-1	(TYPE 1)
CM	1200	H	C		-66	H	(TYPE 2)
FG	4000		G	X	-90	DA	(TYPE 3)
GCU	15		CA		-130		(TYPE 3)

- Series code
- Voltage class
  For TYPE 1:
  Withstand voltage class × 10 = V_{CES}
  Example: 330 × 10 = 3,300 V
  For TYPE 2:
  Withstand voltage class × 50 = V_{CES}
  Example: 66 × 50 = 3,300 V
  For TYPE 3:
  Withstand voltage class × 50 = V_{DRM} or V_{RRM}
  Example: 90 × 50 = 4,500 V
- Voltage classification or turn-off time or high-frequency type in case of "x"
- Auxiliary number (denotes the type of outline or manufacturing process)
- Connection
- Rated current capacity (however, the GCT thyristor unit is shown as a value multiplied by 1/100.)
- Type of device

■ Types and symbols

Type of device \ Symbol	Outline			
	Stud or flat base	Flat	Module	Type
General-purpose rectifier diode / High-speed switching rectifier diode	**SR**	**FD**	—	3
General-purpose thyristor / High-speed switching thyristor	**CR**	**FT**	—	3
GTO thyristor	—	**FG**	—	3
GCT thyristor unit	—	**GCU**	—	3
HVIGBT module	—	—	**CM**	2
HVIPM	—	—	**PM**	1
HVDi module	—	—	**RM**	2



GTO / GCT Thyristors and HVIGBT Module Series

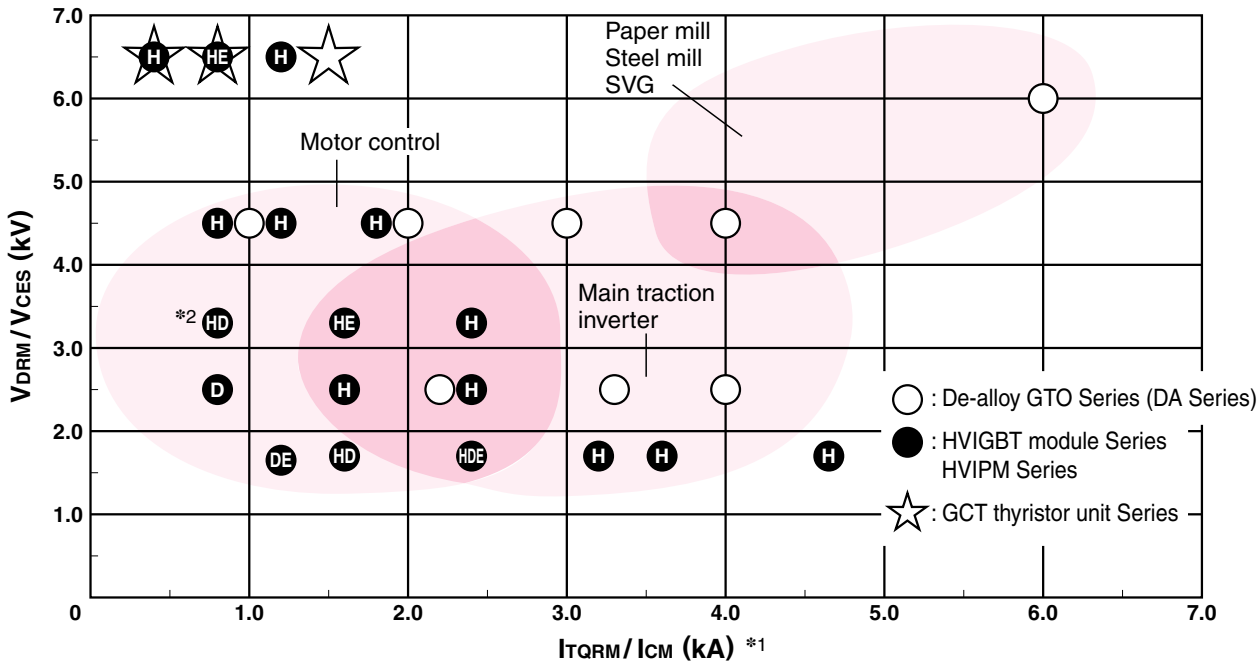
High-power modules are used in various installations, such as tractions, power supply systems, and other large-capacity industrial equipment.
In today's market, there are increasing demands for these modules to have enhanced withstand voltage and capacity together with lower power loss.
The established series of Mitsubishi Electric diodes, general-purpose thyristors, GTO thyristors, GCT thyristor units, and high-voltage insulated-gate bipolar transistor (HVIGBT) modules meet a variety of customer needs. We are also actively engaged in improving existing modules and developing new products.

■ GCT thyristor Series (Gate Commutated Turn-off thyristor)

The GCT thyristor is high-power device that takes the place of existing GTO thyristors. Because the turn-off capability has rapidly improved, and the turn-off time shortened to about 1/10 of GTO thyristors, it is most suitable for applications which require series connection.
Because the GCT thyristor can be turned-off using only the clamping circuit, even if there is no snubber circuit like that required by the GTO thyristor, low-loss, small size and lighter equipment are achieved.

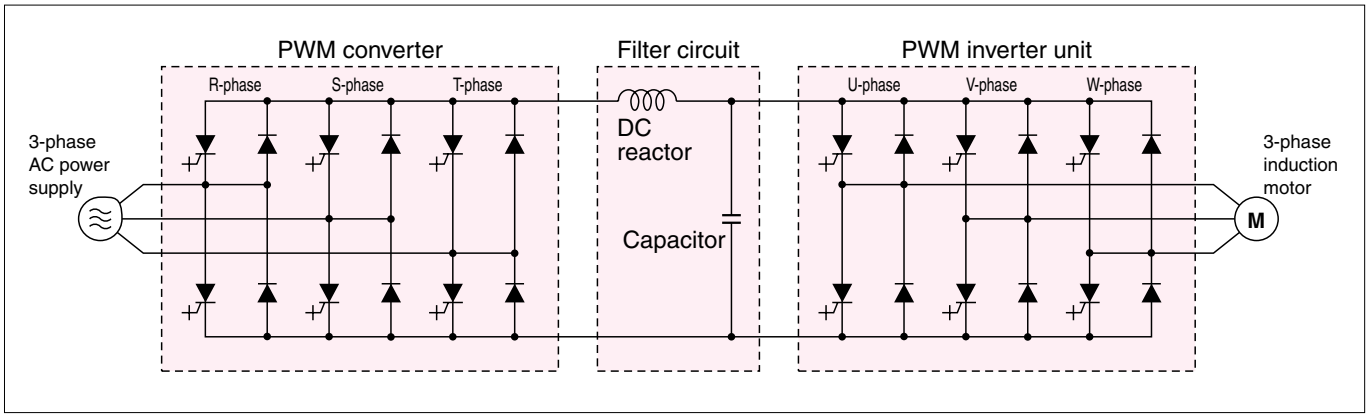
■ HVIGBT modules (High Voltage Insulated Gate Bipolar Transistor module)

HVIGBT modules are manufactured in an exclusive assembly lines under strict quality control. Use of aluminum silicon carbide (AlSiC) base plates enables improved reliability and extended service life for these modules.
With a line-up of high withstand voltage modules in the voltage range of 1.7kV to 6.5kV, the highest level in the world, Mitsubishi Electric is ready to meet various customer needs for applications in tractions and other large-scale industrial installations.
The newly-developed N Series HVIGBT modules are equipped with CSTBT™ chip that allows lower power loss and the minimization of package size.
Mitsubishi Electric has also produced a series of "HG" modules that are housed in a well-insulated packages and demonstrate an insulating performance as high as 10.2kV.



*1: $I_{CM} = I_C \times 2$
*2: "H" denotes the single type, "D" denotes the dual type, and "E" denotes the chopper type

■ Main circuit of PWM converter/inverter system



Rectifier Diodes

■ Rectifier diodes for general use

Type	Voltage (V) / Current (A)*1	500	600	2800	3000	4000	5000	Shape
FD1000A-56	800			●				Flat type ø45
FD1000D-56				●				Flat type ø35
FD1600CP-10	1600	●						Flat type ø35
FD1600A-60					●			Flat type ø50
FD1600CV-80						●		Flat type ø60
FD3500BP-12	3500		●					Flat type ø60
FD3500AH-56				●				Flat type ø80
FD5000AV-100DA	5000						●	Flat type ø85

*1: Shown by the average forward current

■ Rectifier diodes for fast switching

Type	Voltage (V) / Current (A)*1	2800	4500	6000	Shape
FD1000FV-90	800		●		Flat type ø60
FD1000FX-90			●		Flat type ø60
FD1000FH-56	1000	●			Flat type ø50
FD1500AV-90	1500		●		Flat type ø70
FD2000DU-120	1700			●	Flat type ø130

*1: Shown by the average forward current

■ Rectifier diodes for fast switching (Soft recovery type)

Type	Voltage (V) / Current (A)*1	4500	6000	Shape
FD500JV-90DA	500	●		Flat type ø47
FD1500CV-90DA	1500	●		Flat type ø85
FD1500AU-120DA	1500		●	Flat type ø85
FD3000AU-120DA	3000		●	Flat type ø130

*1: Shown by the average forward current

Thyristors / GTO Thyristors

Thyristors / Gate Turn-off Thyristors

■ Thyristors for general use

Type	Voltage (V) / Current (A)*1	400	1200	1400	2500	2700	2800	4000	12000	Shape
FT1000A-50	1000				●					Flat type ø50
FT1000BV-80								●		Flat type ø60
FT1500DL-28	1500			●						Flat type ø50
FT1500CH-54						●				Flat type ø60
FT1500DV-80								●		Flat type ø80
FT1500GV-80 *2								●		Flat type ø80
FT1500AU-240									●	Flat type ø105
FT2500CL-24	2500		●							Flat type ø60
FT2500BH-56							●			Flat type ø80
FT5000AP-8	5000	●								Flat type ø80

*1: Shown by the average ON current
*2: Current type inverter thyristor

■ Fast switching thyristors

Type	Voltage (V) / Current (A)*1	1200	1800	2500	Shape
FT1000CY-24	800	● (15)			Flat type ø50
FT1000CX-36			● (30)		Flat type ø50
FT1000AX-50	1000			● (35)	Flat type ø60
FT1500EX-24	1500	● (30)			Flat type ø60
FT1500EY-24		● (20)			Flat type ø60

*1: Shown by the average ON current
Note: Numerical values in ( ) indicate the maximum shut-off time [μs]

■ GTO thyristors

Type	Voltage (V) / Current (A)*1	2500	4500	6000	Shape
FG1000BV-90DA	1000		●		Flat type ø47
FG2000JV-90DA	2000		●		Flat type ø63
FG2000FX-50DA	2200	●			Flat type ø63
FG3000DV-90DA	3000		●		Flat type ø70
FG3000GX-90DA			●		Flat type ø75
FG4000BX-90DA			●		Flat type ø85
FG3300AH-50DA	3300	●			Flat type ø70
FG4000EX-50DA	4000	●			Flat type ø85
FG4000CX-90DA			●		Flat type ø85
FG4000GX-90DA			●		Flat type ø85
FG6000AU-120D	6000			●	Flat type ø130

*1: Shown by the repeatable control ON current

GCT Thyristor Unit

Gate-commutated Turn-off Thyristor Unit

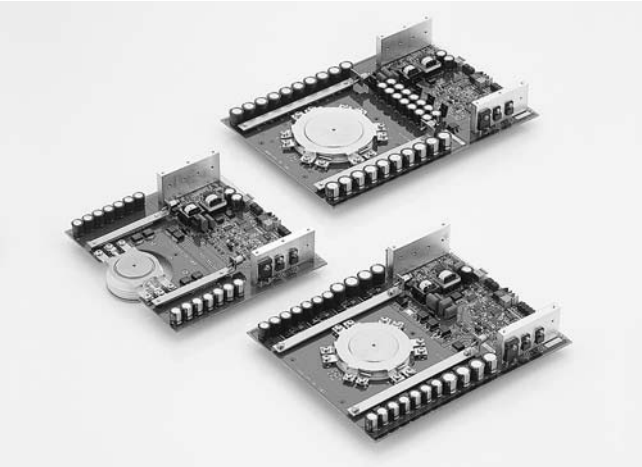


Image of the GCT Thyristor Unit Series

■ Features

GCT thyristor units are a new product which combine the a GCT thyristor and a gate driver.
The GCT thyristor is operated by an optimally designed gate driver to obtain the highest performance based on its performance characteristics.

■ Applications

The handling of GCT thyristor units is easy because the GCT thyristor and gate driver are combined into a single unit.
The GCT thyristor unit is most suitable for high-power electronic applications.

- Electric power applications
  - SVG (Static Var Generator)
  - BTB (Back to Back)
  - Frequency exchanger
- Heavy industrial applications
  - Motor drive for fans, pumps, steel mills and paper mills
- AC switch applications

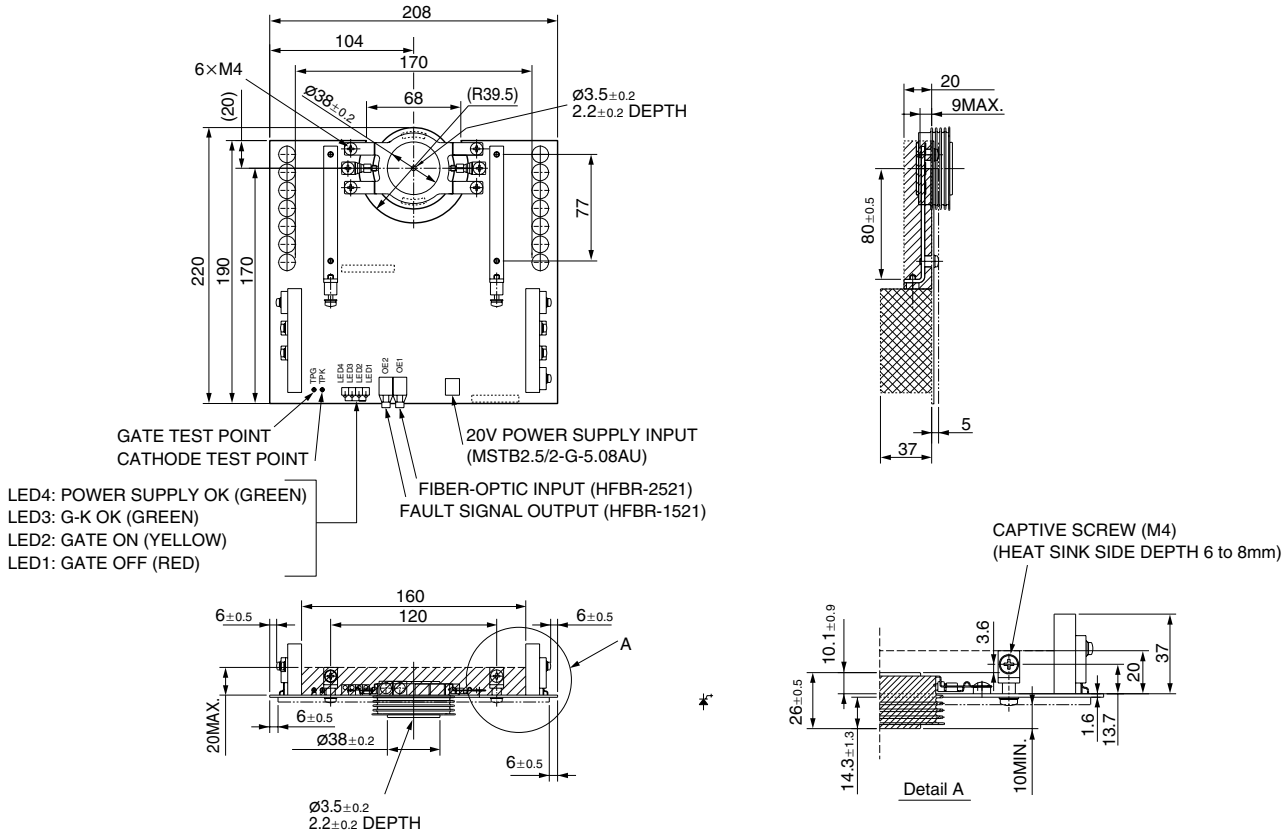
■ GCT units

Type	Structure	V_{DRM} (V)	V_{RRM} (V)	I_{TQRM} (A)	Tj (°C)	Frequency	Gate driver supply		Control input signal
		Repetitive peak off-state voltage	Repetitive peak reverse voltage	Repetitive controllable on-state current	Junction temperature	f (Hz)	Vc	Supply connector	
GCU04AA-130	Symmetrical	6500	6500	400	125	780	20V DC	Made by Phoenix Contact Co.,Ltd. Type name: MSTB2.5/2-G-5.08AU	Optical fiber data link Transmitter: HFBR-1521: Made by Agilent Co.,Ltd. Receiver: HFBR-2521: Made by Agilent Co.,Ltd.
GCU08BA-130				800					
GCU15CA-130				1500					

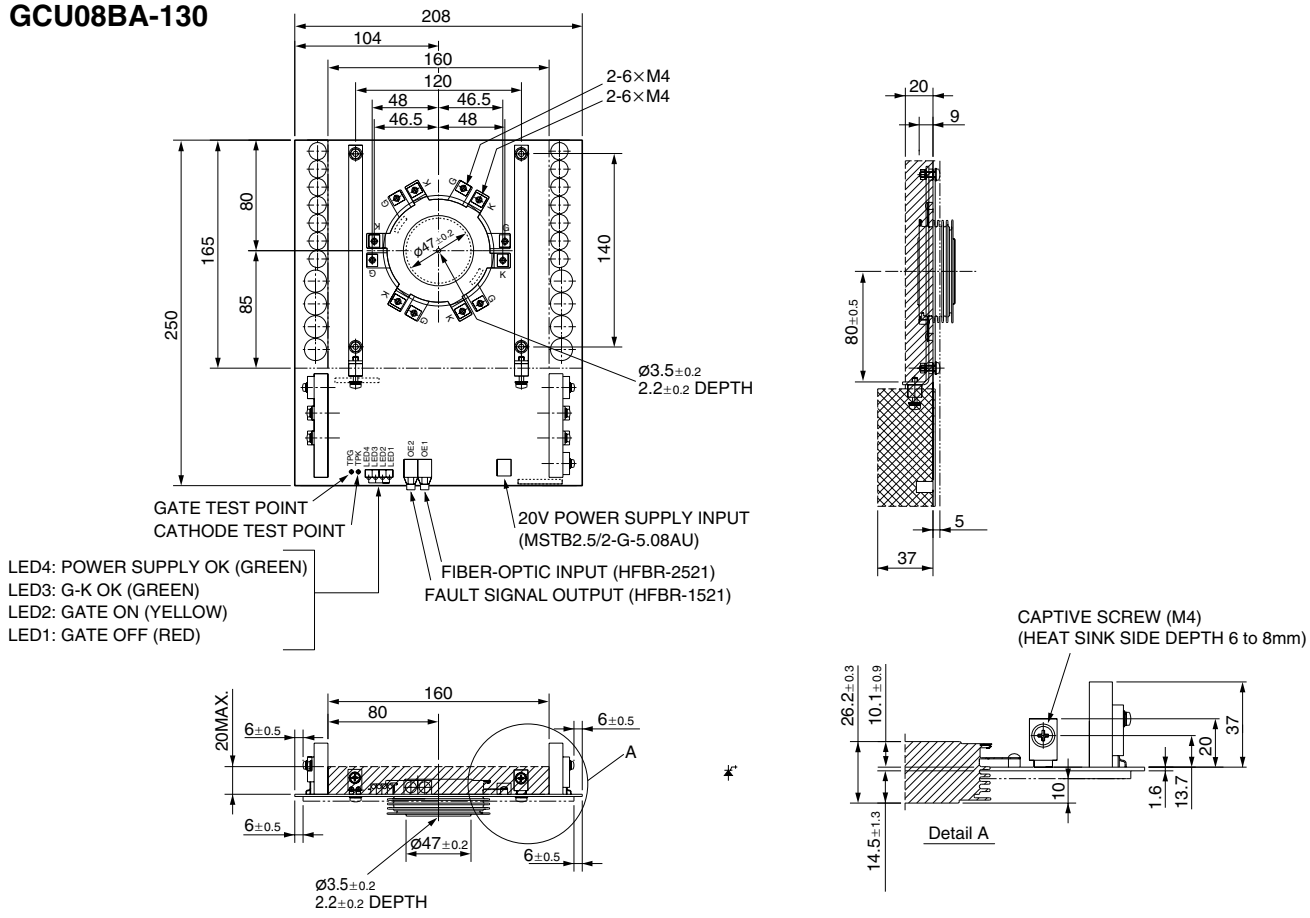
■ GCT thyristor outline drawings

(Unit: mm)

GCU04AA-130

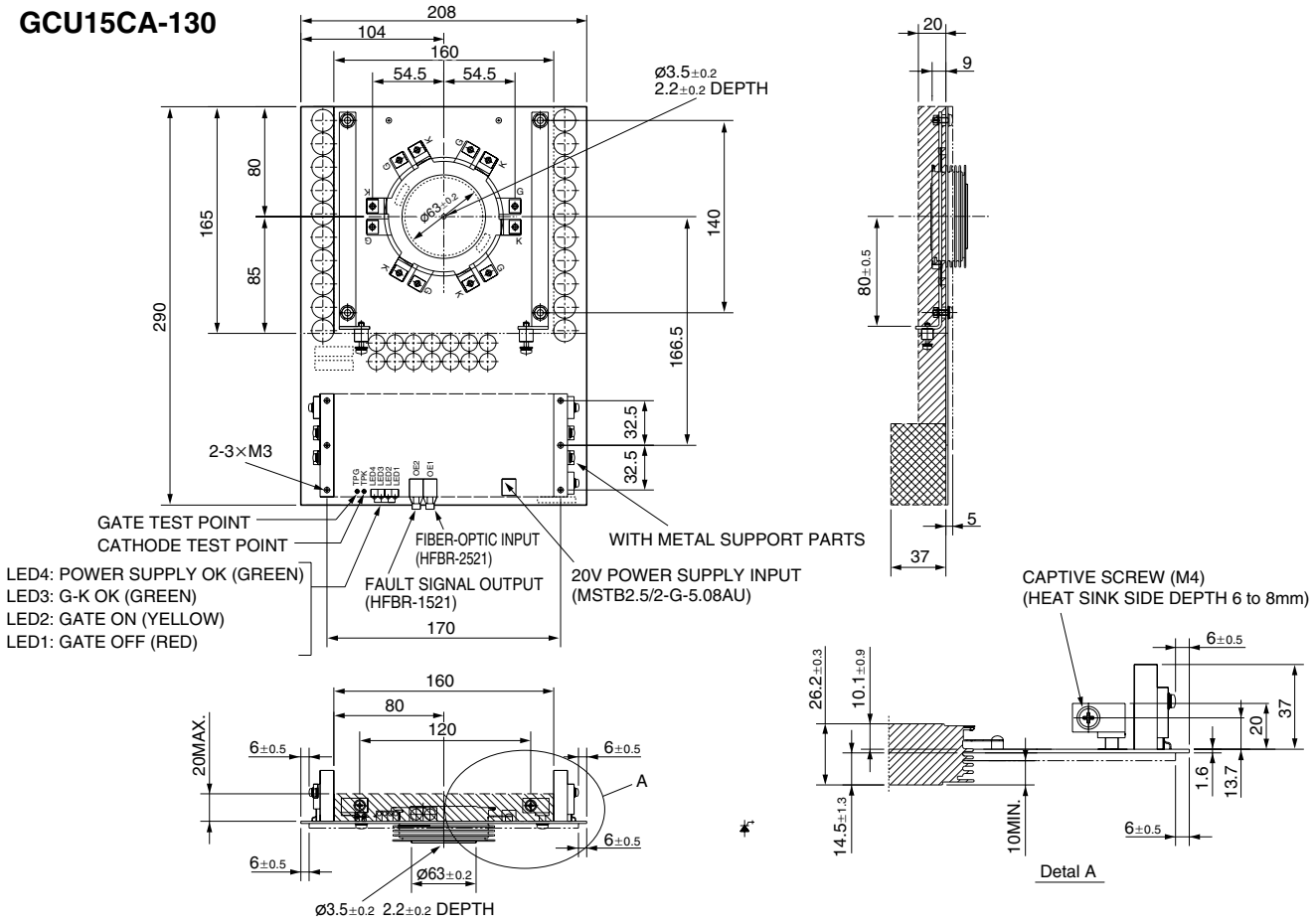


GCU08BA-130



(Unit: mm)

GCU15CA-130



HVIGBT Modules

High-voltage Insulated-gate Bipolar Transistor Modules

Image of HVIGBT modules Series

■ Features

- R Series was added to the line-up.
- High-isolation voltage (10.2kVrms, AC 1min.)
- High-voltage/Large-capacity (6.5kV/600A, 1.7kV/2.4kA)
- High-heat cycle capability
- Abundant line-up with various connecting

■ Applications

- Traction applications
  - Inverter, converter, chopper, SIV (Static inverter)
- Heavy industrial applications
  - Motor drive for fans, pumps, steel mills and paper mills
- Electric power applications
  - SVG (Static Var Generator)
  - Frequency exchanger

■ High-voltage insulated-gate bipolar transistor modules <R Series>: Low-loss, AlSiC baseplate

Connection		V_{CES} (V)	Isolation voltage (kV)	Ic (A)			
				750	1000	1200	1500
H		3300	6.0		**CM1000HC-66R★★** CM13		**CM1500HC-66R★** CM11
		4500				**CM1200HC-90R★★** CM11	
E4		3300	6.0		**CM1000E4C-66R★★** CM12		
H		3300	10.2				**CM1500HG-66R★★** CM17
		4500				**CM1200HG-90R★★** CM17	
		6500		**CM750HG-130R★★** CM17			

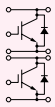
★: New product
★★: Under development

● Numbers CM11 to CM13, CM17 are recorded with product names to show the outline drawing numbers

HVIGBT Modules

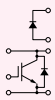
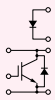
High-voltage Insulated-gate Bipolar Transistor Modules

■ High-voltage insulated-gate bipolar transistor modules <N Series / N Series B Type>: Low-loss, CSTBT™ chip

Connection		V_{CES} (V)	Ic (A)			
			800	1200	1800	2400
H		1700		**CM1200HCB-34N★** CM7	**CM1800HC-34N** CM10 **CM1800HCB-34N★** CM8	**CM2400HC-34N** CM10 **CM2400HCB-34N★** CM8
D		1700	**CM800DZB-34N★** CM4	**CM1200DB-34N** **CM1200DC-34N** CM9		
E4		1700		**CM1200E4C-34N** CM10		

★: New product

■ High-voltage insulated-gate bipolar transistor modules <HG Series>: High-isolation, AlSiC baseplate

Connection		V_{CES} (V)	Ic (A)				
			200	400	600	900	1200
H		3300		**CM400HG-66H★** CM14			**CM1200HG-66H★** CM16
		4500			**CM600HG-90H★** CM15	**CM900HG-90H★** CM16	
		6500	**CM200HG-130H★** CM14		**CM600HG-130H★** CM16		
E2		6500		**CM400E2G-130H★★** CM16			
E4		6500		**CM400E4G-130H★★** CM16			

★: New product

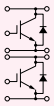
★★: Under development

● Numbers CM4, CM7 to CM10, CM14 to CM16 are recorded with product names to show the outline drawing numbers

HVIGBT Modules

High-voltage Insulated-gate Bipolar Transistor Modules

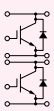
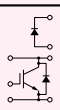
■ High-voltage insulated-gate bipolar transistor modules <HC Series>: Low-loss, AlSiC baseplate

Connection		V_{CES} (V)	Ic (A)					
			800	900	1200	1600	1800	2400
H		1700			**CM1200HC-34H**	**CM1600HC-34H**	**CM1800HC-34H**	**CM2400HC-34H**
					CM1		CM8	
		2500			**CM1200HC-50H**			
					CM8			
		3300	**CM800HC-66H**		**CM1200HC-66H**			
			CM7		CM8			
		4500		**CM900HC-90H**				
				CM8				
D		1700	**CM800DZ-34H**					
			CM4					
E2 / E6		3300	**CM800E2C-66H** **CM800E6C-66H**					
			CM8					
E4		3300	**CM800E4C-66H**					
			CM8					

■ High-voltage insulated-gate bipolar transistor modules <HB Series>: Low-loss, Cu baseplate

Connection		V_{CES} (V)	Ic (A)				
			400	600	800	900	1200
H		2500			**CM800HB-50H**		**CM1200HB-50H**
					CM7		CM8
		3300			**CM800HB-66H**		**CM1200HB-66H**
					CM7		CM8
		4500	**CM400HB-90H**	**CM600HB-90H**		**CM900HB-90H**	
			CM7			CM8	

■ High-voltage insulated-gate bipolar transistor modules <HA Series>: Cu baseplate

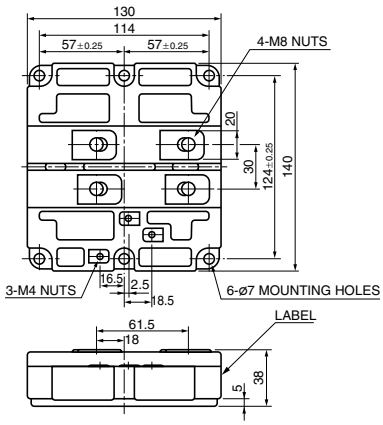
Connection		V_{CES} (V)	Ic (A)			
			400	600	800	1200
H		1700			**CM800HA-34H**	**CM1200HA-34H**
					CM1	
		2500			**CM800HA-50H**	**CM1200HA-50H**
					CM2	CM3
		3300			**CM800HA-66H**	**CM1200HA-66H**
					CM2	CM3
D		1700		**CM600DY-34H**		
				CM4		
		2500	**CM400DY-50H**			
			CM5			
		3300	**CM400DY-66H**			
			CM5			
E2		1700		**CM600E2Y-34H**		
				CM6		

● Numbers CM1 to CM8 are recorded with product names to show the outline drawing numbers

■ HVIGBT modules outline drawings

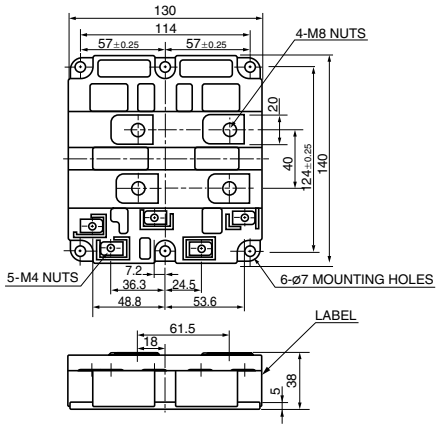
CM1

CM800,1200HA-34H CM1200,1600HC-34H



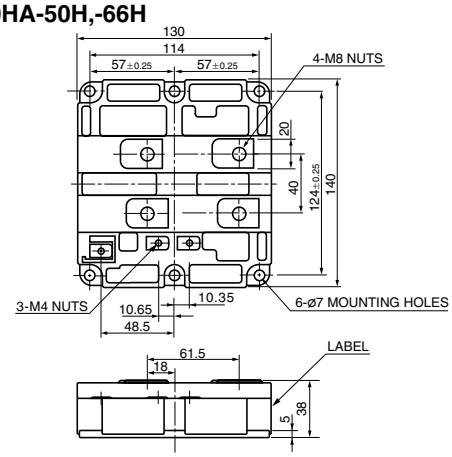
CM5

CM400DY-50H,-66H



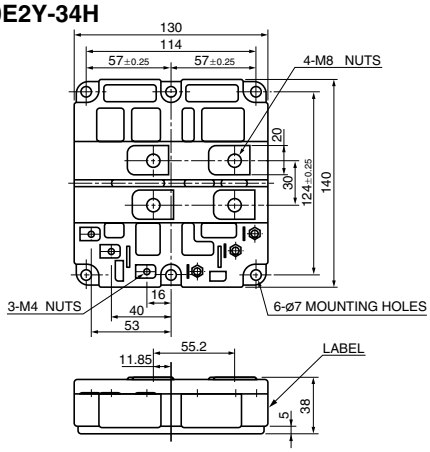
CM2

CM800HA-50H,-66H



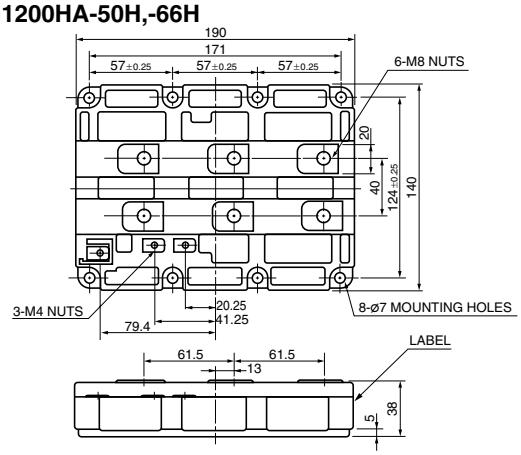
CM6

CM600E2Y-34H



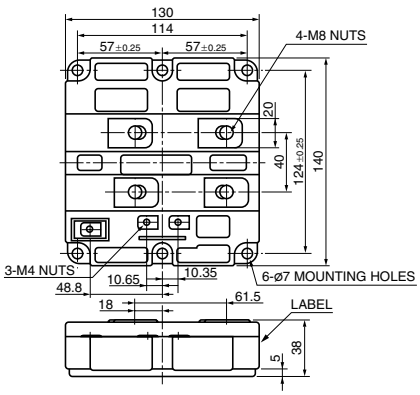
CM3

CM1200HA-50H,-66H



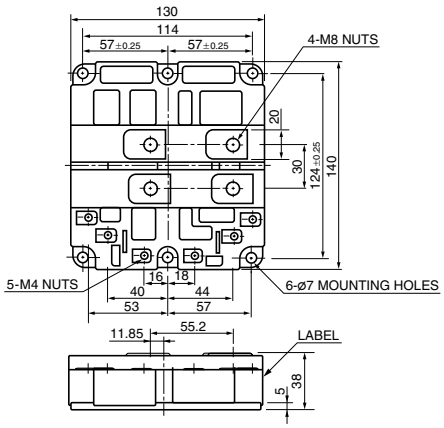
CM7

CM400,600HB-90H CM1200HCB-34N
CM800HB-50H,-66H CM800HC-66H



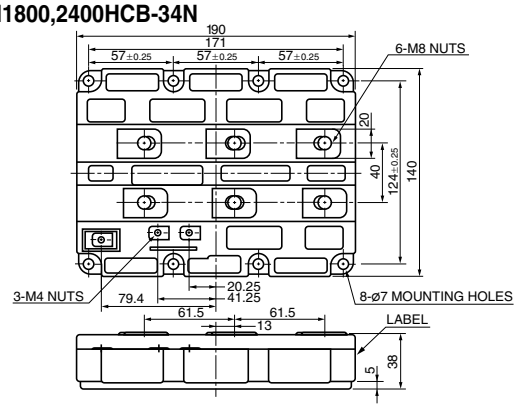
CM4

CM600DY-34H CM800DZ-34N CM800DZB-34N



CM8

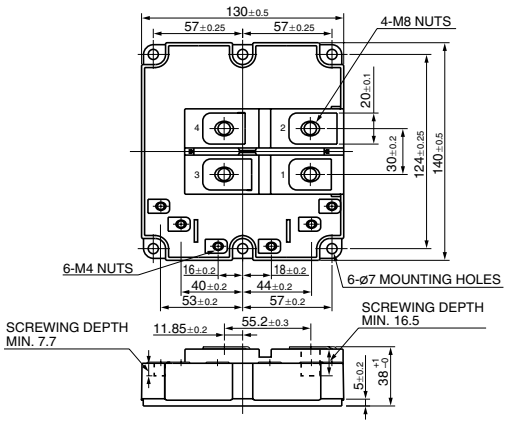
CM800E2C/E4C/E6C-66H CM1200HB/HC-50H,-66H
CM900HB/HC-90H CM1800,2400HC-34H
CM1800,2400HCB-34N



(Unit: mm)

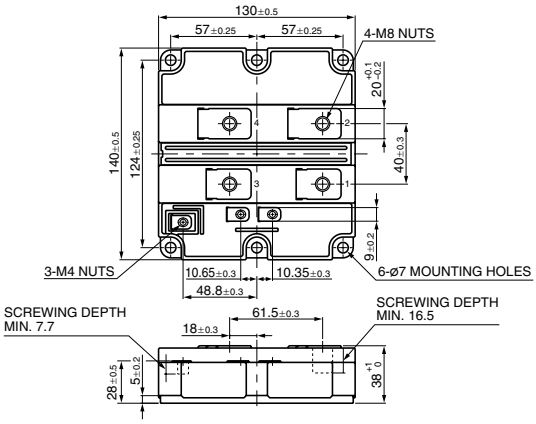
CM9

CM1200DB-34N CM1200DC-34N



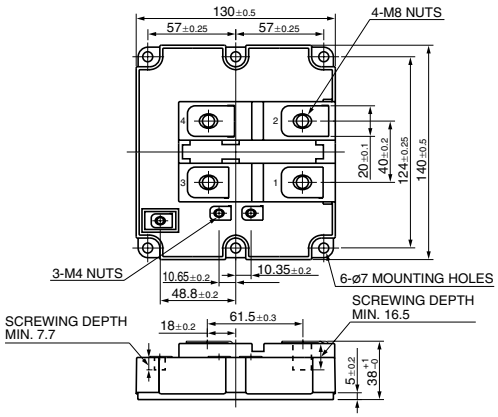
CM13

CM1000HC-66R



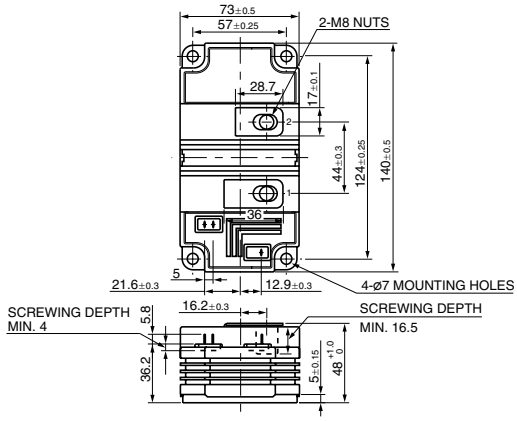
CM10

CM1200E4C-34N CM1800,2400HC-34N



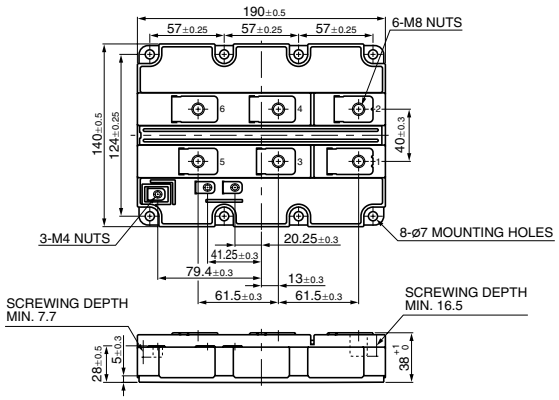
CM14

CM200HG-130H CM400HG-66H



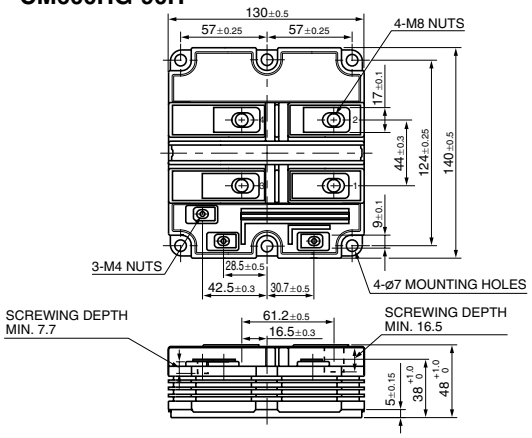
CM11

CM1200HC-90R CM1500HC-66R



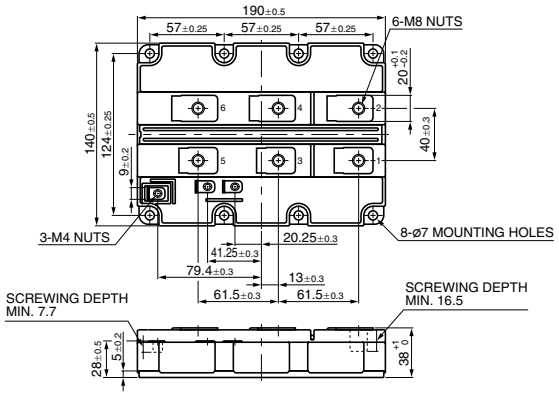
CM15

CM600HG-90H



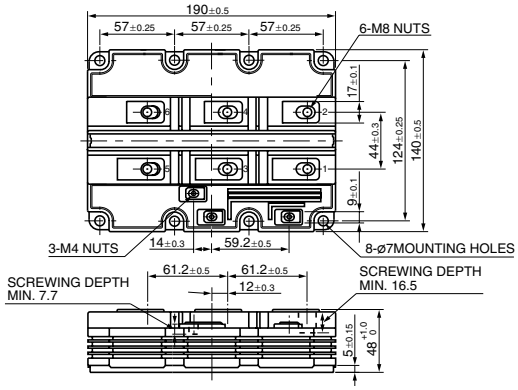
CM12

CM1000E4C-66R



CM16

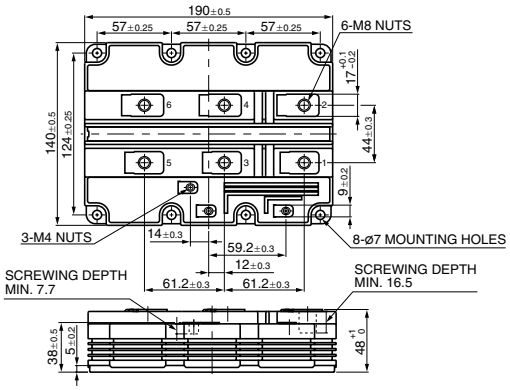
CM400E2G-130H CM600HG-130H CM1200HG-66H CM400E4G-130H CM900HG-90H



(Unit: mm)

CM17

CM750HG-130R CM1200HG-90R CM1500HG-66R



HVDi Modules

High-voltage Diode Modules

■ HVDi modules <R Series>: Low-loss, AlSiC baseplate

Connection		V_{RRM} (V)	Ic (A)
			1000
D		3300	**RM1000DC-66F★★** RM6

★★: Under development

■ HVDi modules: High-isolation, AlSiC baseplate

Connection		V_{RRM} (V)	Ic (A)				
			200	300	400	600	1200
D		3300			**RM400DG-66S★** RM4		**RM1200DG-66S★** RM4
		4500		**RM300DG-90S★** RM4			
		6500	**RM200DG-130S★** RM4			**RM600DG-130S★** RM4	

★: New product

■ HVDi modules: AlSiC baseplate

Connection		V_{RRM} (V)	Ic (A)			
			600	900	1200	1800
H		1700				**RM1800HE-34S** RM2
		3300			**RM1200HE-66S** RM2	
		4500	**RM600HE-90S** RM2	**RM900HC-90S★** RM3		

★: New product

■ HVDi modules: Cu baseplate

Connection		V_{RRM} (V)	Ic (A)			
			400	600	900	1200
D		1700				**RM1200DB-34S★** RM5
		3300	**RM400DY-66S**	**RM600DY-66S**		**RM1200DB-66S★** RM3
			RM1			
		4500			**RM900DB-90S★** RM3	

★: New product

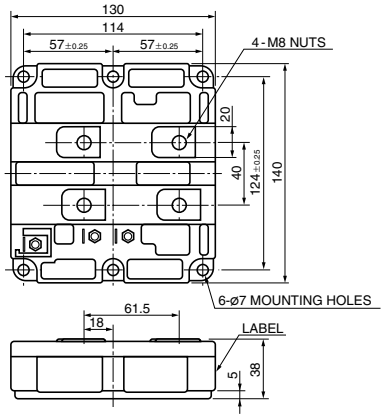
● Numbers RM1 to RM6 are recorded with product names to show the outline drawing numbers

■ HVDi modules outline drawings

(Unit: mm)

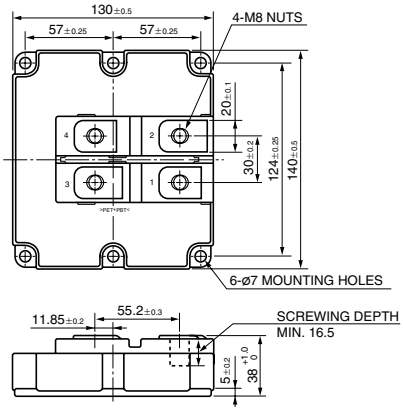
RM1

RM400,600DY-66S



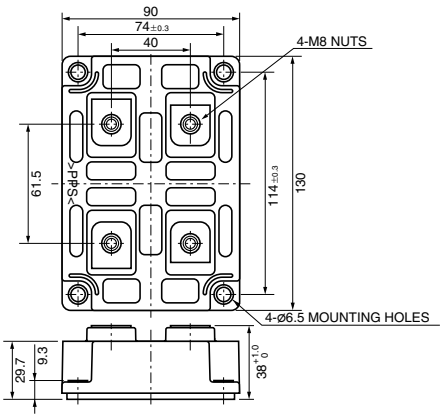
RM5

RM1200DB-34S



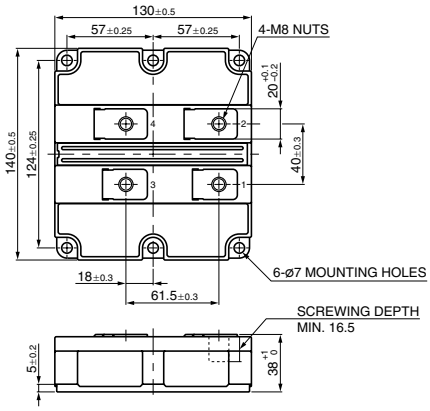
RM2

RM600HE-90S RM1200HE-66S RM1800HE-34S



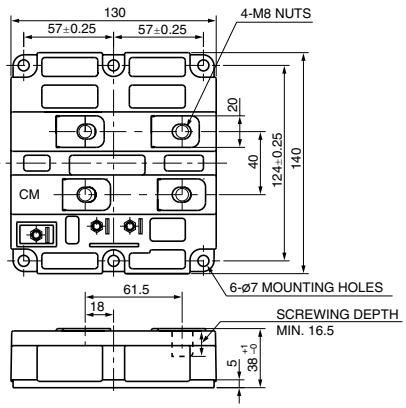
RM6

RM1000DC-66F



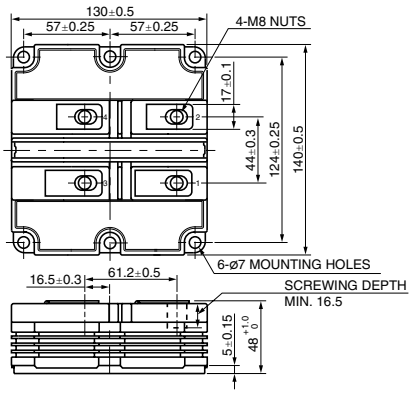
RM3

RM900DB/HC-90S RM1200DB-66S



RM4

RM200,600DG-130S RM1200DG-66S
RM300DG-90S RM400DG-66S



HVIPM

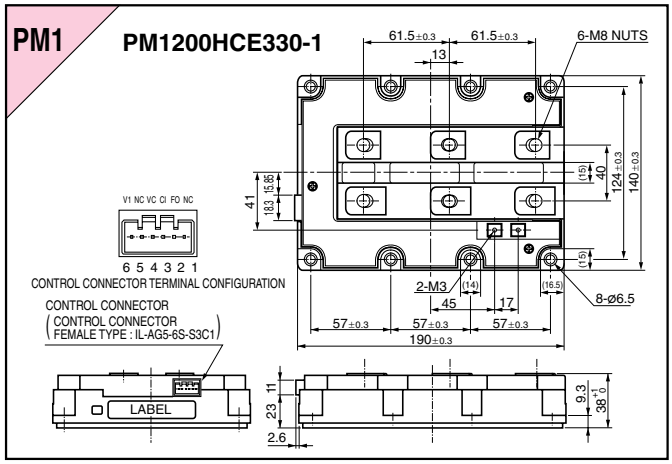
High-voltage Intelligent Power Modules

■ High-voltage intelligent power modules

Connection		V_{RRM} (V)	Ic (A)
			1200
H		3300	**PM1200HCE330-1**
			PM1

■ Outline drawing

(Unit: mm)



High-voltage Integrated Circuits

600V and 1200V Half-bridge Driver HVIC

This product is a semiconductor integrated circuit designed to directly drive the power MOS/IGBT modules of half-bridge composition by integrating the 600V (1200V) and 8/24V dielectric elements onto one chip.
The internal installation of high-side/low-side driver circuits, protective circuits against power supply voltage drop and interlocking circuits enables a devices to drive/control the power elements without using the photocoupler from a logic circuit such as a microcomputer.

■ Applications

Most suitable for the following, applied in products to drive the power MOS/IGBT modules for inverters.

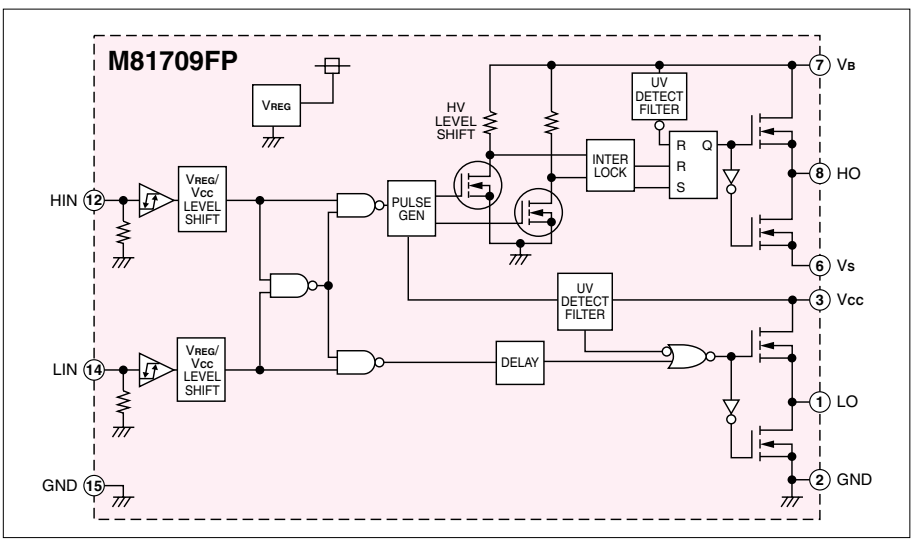
- General inverters
- Air conditioners, refrigerators and washing machines
- AC servo motors
- Brushless DC motors
- Plasma display panels
- Illumination machinery

■ Reference by function

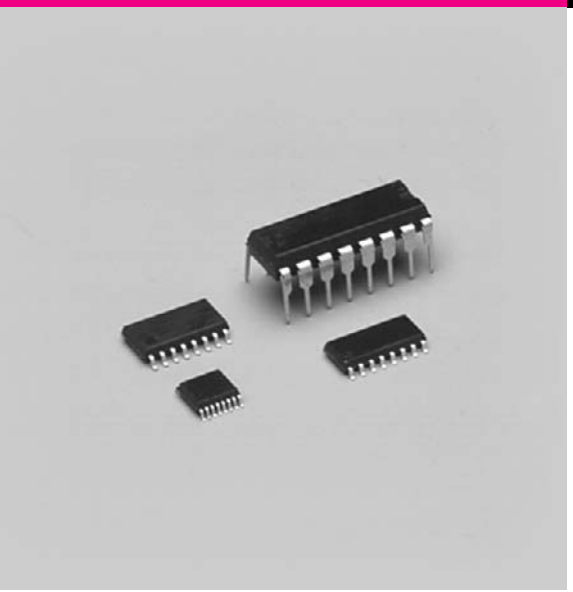
Type	Floating supply voltage [V]	Output current [A]	Driving method	Number of input-signals	Dead-time control	Remarks	Package outline	Outline drawings
M63975FP (Lead-free)	24	±0.5	Low-side	1	—	—	10P2N	⑫
M63991FP (pb-free)	600	±0.5	Half-bridge	2	Input-signal	With interlock function	16P2N	⑤
M63992FP (pb-free)	600	±2.0	Half-bridge	2	Input-signal	With interlock function	16P2N	⑤
M63993FP (Lead-free)	600	±0.3	3ø bridge	2×3 (6)	Input-signal	With interlock function	36P2R	⑩
M63994FP (Lead-free)	600	±0.5	Half-bridge	1	Inside	—	8P2S	⑪
M63996FP (pb-free)	600	±2.0	Half-bridge	2	Input-signal	—	16P2N	⑤
M81700FP (Lead-free)	600	±2.0	Half-bridge	2	Input-signal	SD/With interlock function	16P2N	⑤
M81701FP (Lead-free)	600	±2.0	Half-bridge	2	Input-signal	With interlock function	16P2N	⑤
M81702FP (Lead-free)	600	±2.0	Half-bridge	2	Input-signal	With SD function	16P2N	⑤
M81703FP (Lead-free)	600	±2.0	Half-bridge	2	Input-signal	—	16P2N	⑤
M81705FP (Lead-free)	600	+0.15/−0.125	High-side	1	—	—	8P2S	⑪
M81706AFP (pb-free)	600	+0.12/−0.25	Half-bridge	2	Input-signal	With interlock function	16P2N	⑤
M81707FP (pb-free)	600	±0.1	Dual high-side	2	Input-signal	—	16P2N	⑤
M81708FP (pb-free)	600	+0.12/−0.25	Half-bridge	2	Input-signal	With interlock function	16P2N	⑤
M81709FP (pb-free)	600	±2.0	Half-bridge	2	Input-signal	With interlock function	16P2N	⑤
M81713FP (pb-free)	600	±0.5	Half-bridge	1	Inside	—	8P2S	⑪
M81019FP (pb-free)	1200	±1.0	Half-bridge	2	Input-signal	With interlock function	24P2Q	⑰
M81711FP (pb-free)	24	±0.5	Dual low-side	1×2	—	—	8P2S	⑪
M81716FP (pb-free)	24	±0.5	Dual low-side	1×2	—	—	8P2S	⑪
M81712FP (pb-free)	600	+0.2/−0.35	3ø bridge	2×3 (6)	Input-signal	With interlock function	28X9R	⑱
M81719FP (pb-free)	600	+0.12/−0.25	Half-bridge	2	Input-signal	—	8P2S	⑪
M81721FP (pb-free)	600	±1.0	Half-bridge	2	Input-signal	With interlock function	24P2Q	⑰
M81722FP (pb-free)	600	±3.0	Half-bridge	2	Input-signal	With interlock function	8P2S	⑪
M81723FP (pb-free)	600	±0.1	Dual high-side	1×2	—	—	16P2N	⑤
M81725FP (pb-free)	600	±3.0	High-side	1	—	—	8P2S	⑪
M81731FP (pb-free)	600	±3.0	Dual high-side	1×2	—	—	16P2N	⑤
M81734FP ★★ (pb-free)	600	±0.5	Half-bridge	1	Inside	—	8P2S	⑪
M81735FP ★★ (pb-free)	600	±0.5	Half-bridge	2	Input-signal	With interlock function	16P2N	⑤
M81737FP ★★ (pb-free)	600	±0.2	Dual high-side	1×2	—	—	16P2N	⑤
M63958FP (pb-free)	600	+0.5/−0.25	Half-bridge	—	Inside	—	16P2N	⑤

★★: Under development

■ Block diagram



Transistor Array



Wide Product Range Helps Reduce Product Size and Weight

Transistor arrays are semiconductor integrated circuits in which a minute input current enables a big current drive. The abundant product line-up enables them to be used in a wide range of fields. (50mA to 1.5A/35V to 50V) Application of the surface mounting package also enables compact, lightweight and high-density mounting of sets.

■ Applications

- Drivers for stepping motors of printers and facsimile machines
- Thermal head drivers for handheld word processors and thermal printers
- Hammer head drivers for calculators with a printer and ECRs
- Drivers for relays, solenoids, lamps, LEDs and fluorescent display tubes

■ Codes for transistor array naming

M 5 4523 P
M 6 3823 FP
M 6 3803 KP

- Package type
  P/WP: DIP type
  FP/GP/DP: SOP type
  KP: SSOP type
- Circuit type and circuit kind for product series
- Application and range of ambient temperature for operation
- Abbreviation shows the Mitsubishi Electric Integrated Circuit

■ Quick reference

Current \ Voltage	35V	40V	50V
50mA		◇⑧**M54513P/FP**	
150mA			△⑦**M54580P/FP**
200mA		◇⑧**M81016P/FP/KP** ◇⑧**M81049P/FP/SP** ◇⑧**M81302SP/FP** ★★	
300mA	◇⑦**M63802P/FP/GP/KP** ◇⑦**M63803P/FP/GP/KP** ◇⑧**M63805P/FP/KP** ◇⑧**M63806P/FP/KP** ◇⑧**M63807P/FP/KP** ◇⑦**M63813P/FP/GP/KP** ◇⑧**M63816P/FP/KP**	△⑦**M54561P**	
400mA		◇⑧**M54522P/FP** ◇⑦**M54530P/FP** ◇⑦**M54531FP** ◇⑦**M54531WP** ★★	◇⑦**M54566WP** ★★ ◇⑦**M54566FP** ◇⑧**M54583P/FP**
500mA		△⑧**M63840P/FP/KP** ★	◇⑦**M54523P/FP** △⑧**M54562P/FP** △⑧**M54563P/FP** △⑧**M54564P/FP** ◇⑧**M54585WP** ★★ ◇⑧**M54585P/FP/KP** ◇⑧**M54587P/FP** △⑦**M63800FP** ◇⑧**M63820FP/KP** ◇⑦**M63823P/FP/GP** ◇⑦**M63824GP/KP** ◇⑦**M63826P/FP/GP** ◇⑦**M63827WP/DP** ◇⑦**M63828WP/DP** ◇⑦**M63832GP/KP** ◇⑧**M63834FP/KP** ◇⑧**M63836FP/KP**
1.5A			◇④**M54532P/FP** ◇④**M54567P/FP** ◇④**M63830P/FP**

◇: Output current-synchronized type
△: Output current-sourcing type
○: Circled numbers indicate the number of circuits

★: New product
★★: Under development

Transistor Array

■ Reference by function

Type	Unit	Io max [mA]	Vo max [V]	Input-function voltage	Output current	Darlington transistor	With output clamp-diode	Low collector-emitter voltage	High-input threshold voltage	Mini-frat package	Package outlines	Outline drawings
M54513FP	8	50	40	H	Sink			●		●	20P2N	⑥
M54513P											18P4G	③
M54522FP	8	400	40	H	Sink	●	●			●	20P2N	⑥
M54522P											18P4G	③
M54523FP	7	500	50	H	Sink	●	●			●	16P2N	⑤
M54523P											16P4	②
M54530FP	7	400	40	H	Sink	●	●			●	16P2N	⑤
M54530P											16P4	②
M54531FP	7	400	40	H	Sink	●	●			●	16P2N	⑤
M54531WP ★★											16P4X	⑮
M54532FP	4	1500	50	H	Sink	●	●			●	16P2N	⑤
M54532P											16P4	②
M54561P	7	300	40	L	Source	●	●				16P4	②
M54562FP	8	500	50	H	Source	●	●			●	20P2N	⑥
M54562P											18P4G	③
M54563FP	8	500	50	H	Source	●	●			●	20P2N	⑥
M54563P											18P4G	③
M54564FP	8	500	50	H	Source	●				●	20P2N	⑥
M54564P											18P4G	③
M54566FP	7	400	50	L	Sink	●				●	16P2N	⑤
M54566WP ★★											16P4X	⑮
M54567FP	4	1500	50	L	Sink	●	●			●	16P2N	⑤
M54567P											16P4	②
M54580FP	7	150	50	L	Source	●				●	16P2N	⑤
M54580P											16P4	②
M54583FP	8	400	50	L	Sink	●				●	20P2N	⑥
M54583P											18P4G	③
M54585FP	8	500	50	H	Sink	●	●			●	20P2N	⑥
M54585KP										●	20P2E	⑨
M54585WP ★★											18P4X	⑲
M54585P											18P4G	③
M54587FP	8	500	50	L	Sink	●	●			●	20P2N	⑥
M54587P											20P4	④

★★: Under development

Transistor Array

■ Reference by function

Type	Unit	Io max [mA]	Vo max [V]	Input-function voltage	Output current	Darlington transistor	With output clamp-diode	Low collector-emitter voltage	High-input threshold voltage	Mini-frat package	Package outlines	Outline drawings
M63800FP	7	500	50	H	Source	●	●	●		●	16P2N	⑤
M63802FP	7	300	35	H	Sink			●	●	●	16P2N	⑤
M63802GP										●	16P2S	⑦
M63802KP										●	16P2Z	⑧
M63802P											16P4	②
M63803FP	7	300	35	H	Sink			●		●	16P2N	⑤
M63803GP										●	16P2S	⑦
M63803KP										●	16P2Z	⑧
M63803P											16P4	②
M63805FP	8	300	35	H	Sink			●	●	●	20P2N	⑥
M63805KP										●	20P2E	⑨
M63805P											18P4G	③
M63806FP	8	300	35	H	Sink			●		●	20P2N	⑥
M63806KP										●	20P2E	⑨
M63806P											18P4G	③
M63807FP	8	300	35	H	Sink			●		●	20P2N	⑥
M63807KP										●	20P2E	⑨
M63807P											18P4G	③
M63813FP	7	300	35	H	Sink		●	●		●	16P2N	⑤
M63813GP										●	16P2S	⑦
M63813KP										●	16P2Z	⑧
M63813P											16P4	②
M63816FP	8	300	35	H	Sink		●	●		●	20P2N	⑥
M63816KP										●	20P2E	⑨
M63816P											18P4G	③
M63820FP	8	500	50	H	Sink	●	●			●	20P2N	⑥
M63820KP										●	20P2E	⑨
M63823FP	7	500	50	H	Sink	●	●			●	16P2N	⑤
M63823GP										●	16P2S	⑦
M63823P											16P4	②
M63824GP	7	500	50	H	Sink	●	●			●	16P2S	⑦
M63824KP										●	16P2E	⑭
M63826FP	7	500	50	H	Sink	●	●			●	16P2N	⑤
M63826GP										●	16P2S	⑦
M63826P											16P4	②
M63827WP	7	500	50	H	Sink	●	●				16P4X	⑮
M63827DP										●	16P2X	⑯
M63828WP	7	500	50	H	Sink	●	●				16P4X	⑮
M63828DP										●	16P2X	⑯
M63830FP	4	1500	50	L	Sink	●	●			●	16P2N	⑤
M63830P											16P4	②
M63832GP	7	500	50	L	Sink	●				●	16P2S	⑦
M63832KP										●	16P2E	⑭
M63834FP	8	500	50	L	Sink	●				●	20P2N	⑥
M63834KP										●	20P2E	⑨
M63836FP	8	500	50	L	Sink	●	●			●	20P2N	⑥
M63836KP										●	20P2E	⑨
M63840FP ★	8	500	40	H	Source	●	●			●	20P2N	⑥
M63840KP ★										●	20P2F	⑨
M63840P ★											18P4G	③

★: New product

Transistor Array

■ CMOS array

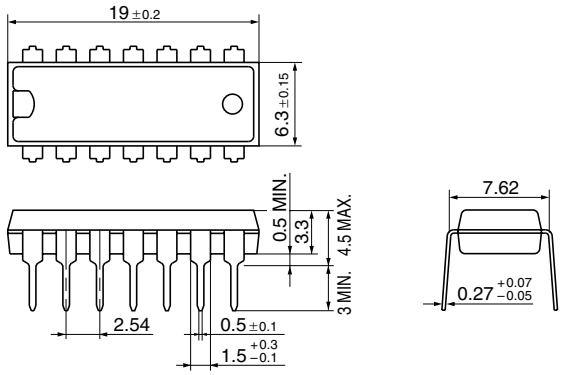
Type	Unit	Io max [mA]	Vo max [V]	Output current	Function	Mini-frat package	Package outlines	Outline drawings
M81016P	8	200	40	Sink	OCTAL D-TYPE, FLIP-FLOP DRIVER WITH CLEAR		20P4B	⑬
M81016FP						●	20P2N	⑥
M81016KP						●	20P2E	⑨
M81049P							20P4	④
M81049FP						●	20P2N	⑥
M81049SP							20P4B	⑬
M81302SP ★★					OCTAL INVERTER WITH OPEN-DREIN OUTPUTS		20P4B	⑬
M81302FP ★★						●	20P2N	⑥

★★: Under development

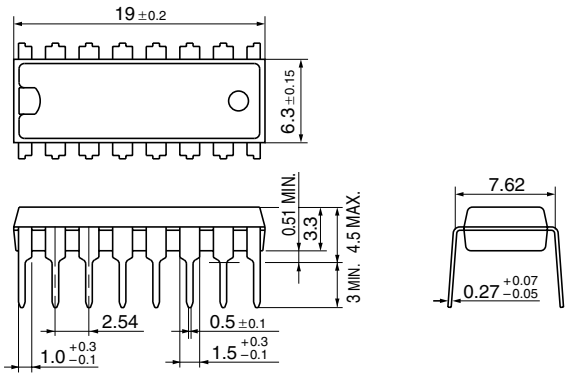
■ High-voltage integrated circuits and transistor array outline drawings

(Unit: mm)

① TYPE 14P4 14pin 300mil DIP



② TYPE 16P4 16pin 300mil DIP



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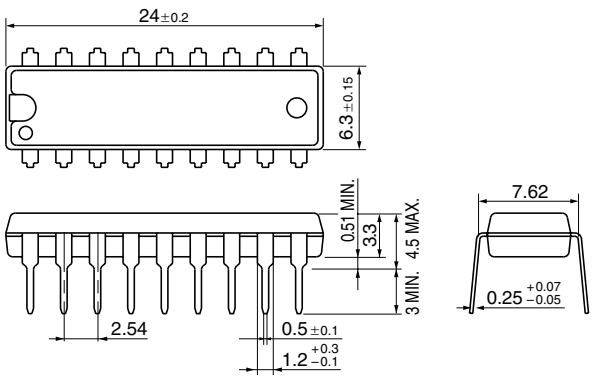
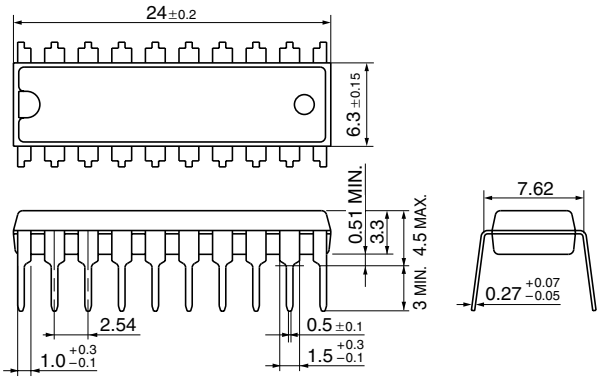


④ TYPE 20P4 20pin 300mil DIP



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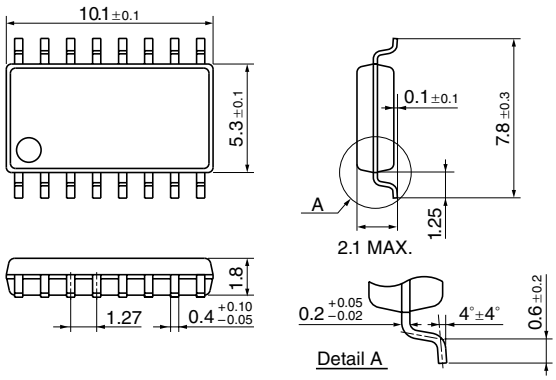
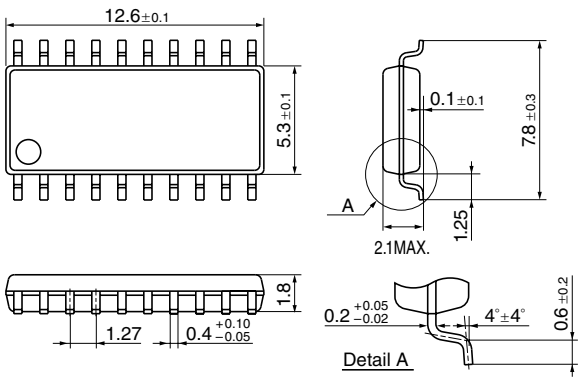
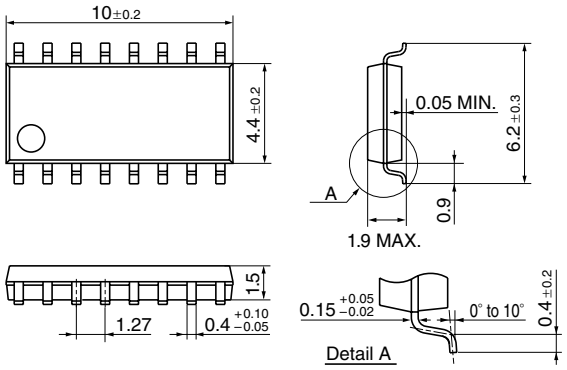


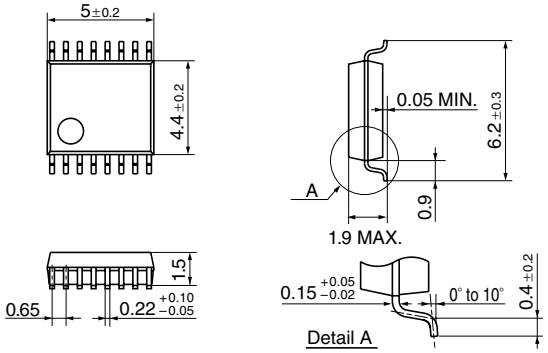
⑥ TYPE 20P2N 20pin 300mil SOP



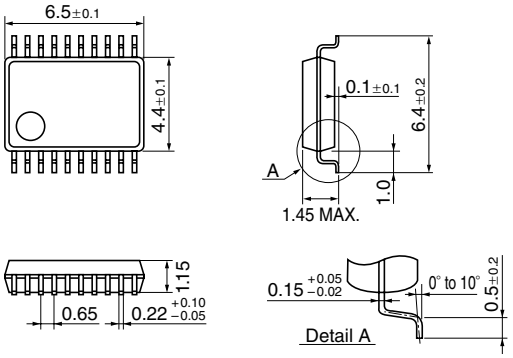
⑦ TYPE 16P2S 16pin 225mil SOP



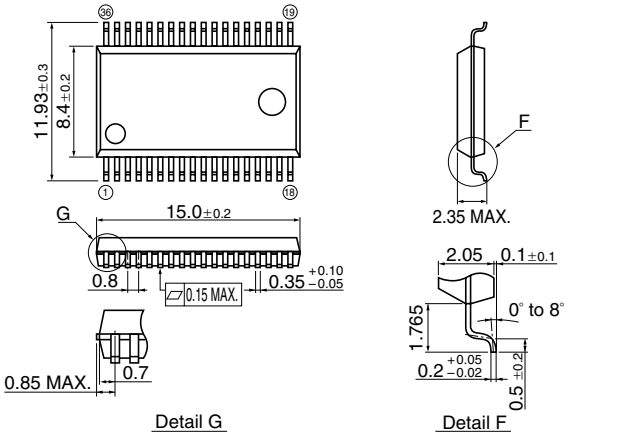
⑧ TYPE 16P2Z 16pin 225mil SSOP



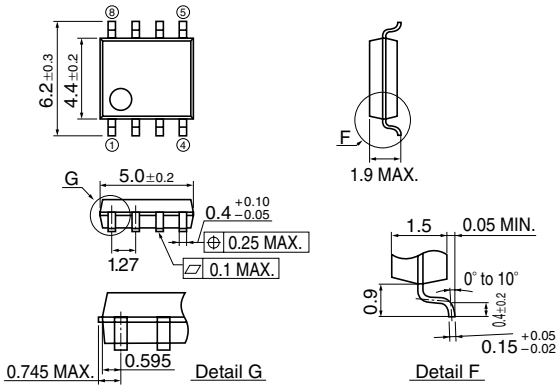
⑨ TYPE 20P2E-A TYPE 20P2F-A 20pin 225mil SSOP



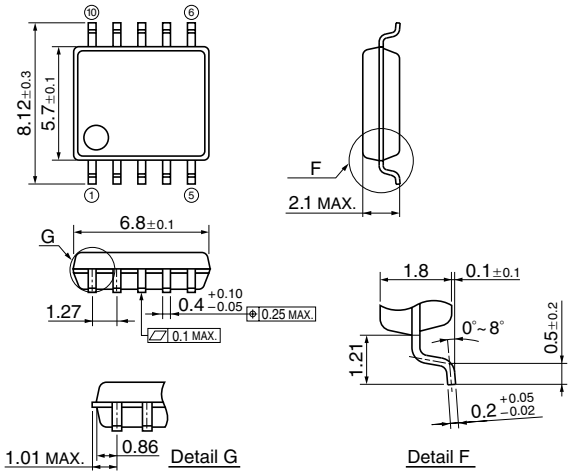
⑩ TYPE 36P2R-D 36pin 450mil SSOP



⑪ TYPE 8P2S-A 8pin 225mil SOP

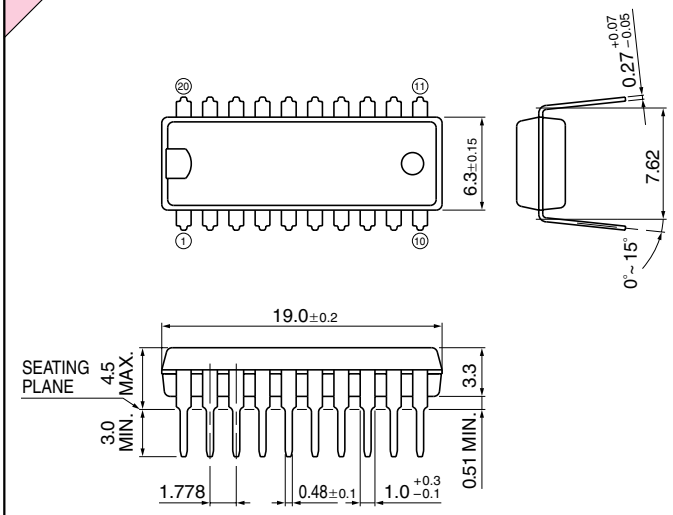


⑫ TYPE 10P2N-A 10pin 300mil SOP

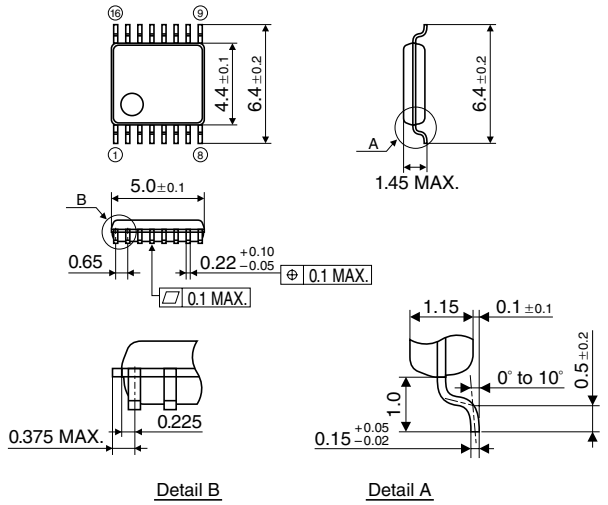


(Unit: mm)

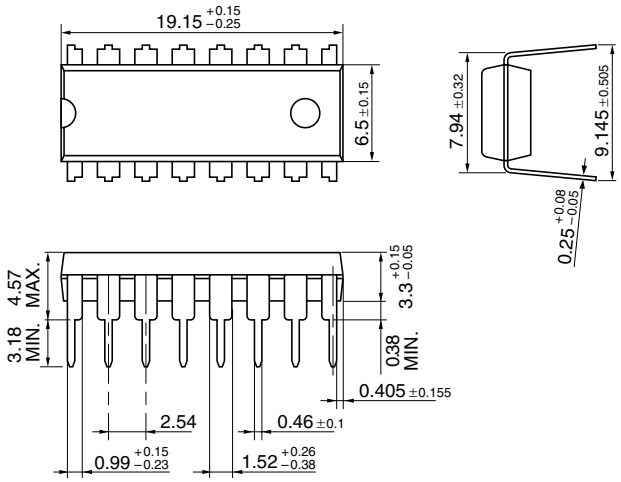
⑬ TYPE 20P4B 20pin 300mil DIP



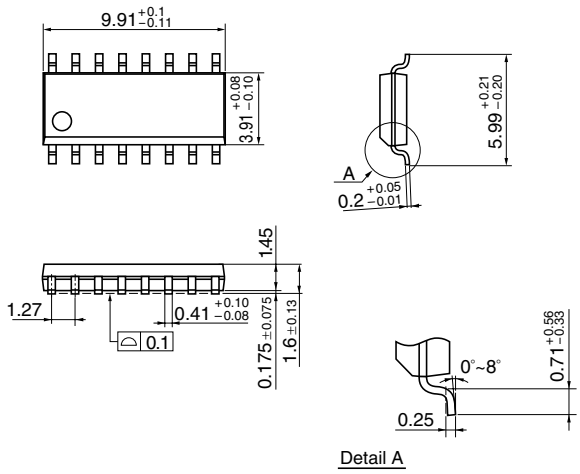
⑭ TYPE 16P2E-A 16pin 225mil SSOP



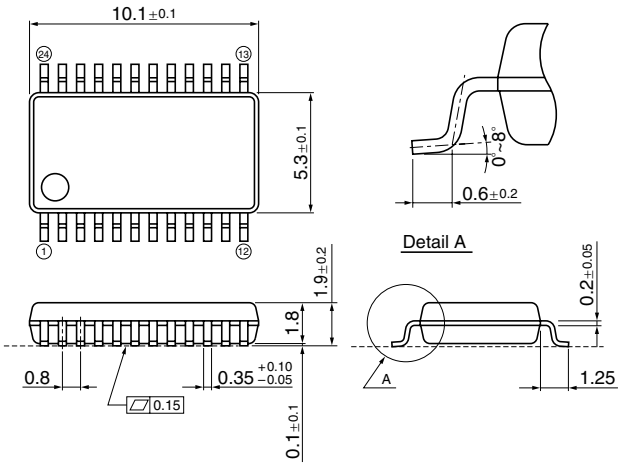
⑮ TYPE 16P4X 16pin 300mil DIP



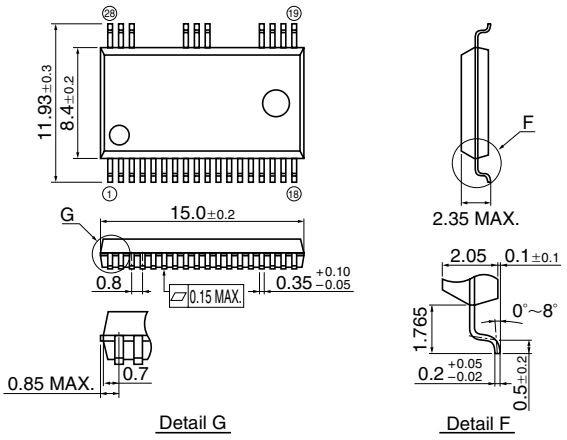
⑯ TYPE 16P2X 16pin 225mil SOP



⑰ TYPE 24P2Q 24pin 300mil SSOP

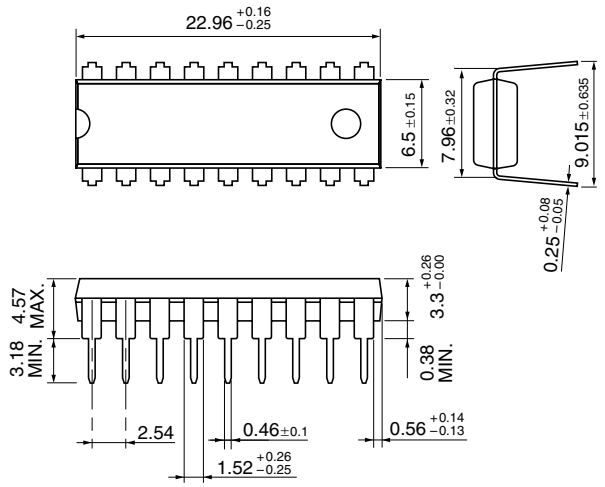


⑱ TYPE 28X9R 28pin 450mil SSOP



(Unit: mm)

⑲ **TYPE 18P4X** 16pin 300mil DIP



GENERAL CONSIDERATIONS FOR IGBT AND INTELLIGENT POWER MODULES

3.0 General Considerations for IGBT and Intelligent Power Modules

H-Series IGBT and Intelligent Power Modules are based on advanced third generation IGBT and free-wheel diode technologies. The general guidelines for power circuit, snubber and thermal system design are essentially the same for both product families. This section will cover these general application issues. The sections that follow will give specific details for each product family.

3.1 Numbering System

(1) Devices:
CM = IGBT Module
PM = IPM

(2) Current Rating I_C (Amperes)

(3) For IPM:
H = Single
D = Dual
C = Six in one
R = Seven in one

(4) IGBT Module:
H = Single
D = Dual
T = Six
E3 = Brake

(5) Outline or Minor Change
U = U-Series

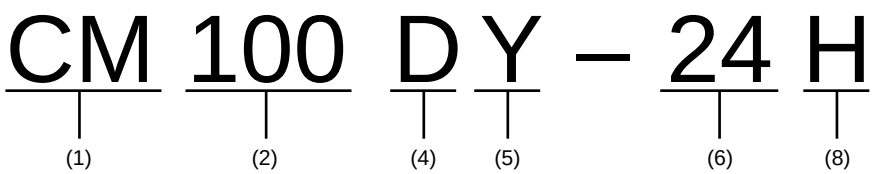
(6) For IGBT Module:
Voltage, V_{CES} Volts (x50)

(7) For IPM:
Voltage V_{CES} Volts (x10)

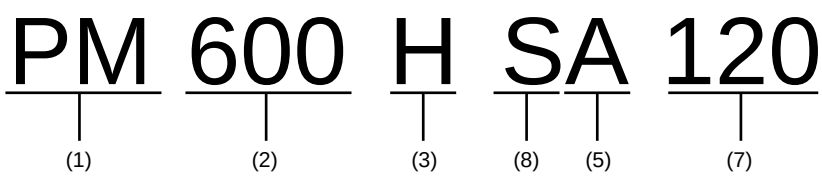
(8) For IGBT Module:
F = 250V Trench Gate
H = Total Performance H-Series IGBT Module

For IPM
S = Third Generation
V = V-Series

Examples:



CM100DY-24H is a 100 Ampere, 1200 Volt, Dual IGBT Module



PM600HSA120 is a 600 Ampere, 1200 Volt, Single IPM

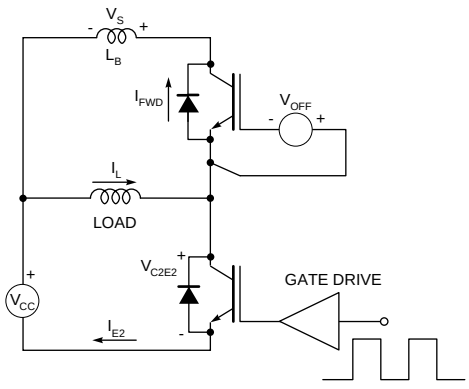
3.2 Power Circuit Design

In high power systems rapid turn-on and turn-off operations produce harsh dynamic conditions. The power circuit, snubbers, and gate drive must be designed to deal with extreme di/dt and dv/dt stresses. Excessive transient voltages can occur if leakage inductance in the power circuit and snubbers is not minimized. Ground loops and capacitive coupling can cause serious noise problems. An appropriate mechanical and electrical layout is essential for reliable and efficient operation of IGBT and Intelligent Power Modules.

3.2.1 Turn-off Surge Voltage

Turn-off surge voltage is the transient voltage that occurs when the current through the IGBT is interrupted at turn-off. To examine this, consider the inductive load half-bridge circuit shown in Figure 3.1. In this test circuit the top IGBT is biased off and the bottom device is switched on and off with a burst of pulses. Each time the lower device is turned on, the current in the inductive load (I_L) will increase. When the lower device is turned off, the current in the inductive load cannot change instantly. It must circulate through the free-wheel diode of the upper device. When the lower device turns back on, the load current will commutate back to the lower device and begin to ramp up again. If the circuit was ideal and had no parasitic inductance, the voltage across the lower device (V_{C2E2}) at turn-off would increase until it reached one diode drop above the bus voltage (V_{CC}). The upper device's free-wheel diode would then turn on stopping the voltage from increasing further. Unfortunately real power circuits have parasitic leakage inductance. In Figure 3.1 a lump inductance (L_B) has been added to the half-bridge circuit to simulate the effect of parasitic bus inductance. When the lower device turns off the inductance L_B resists the commutation of the load current to the free-wheel diode of the upper device. A voltage (V_S) equal to L_B x di/dt appears across L_B in opposition to increasing current in the bus. The polarity of this voltage is such that it adds to the DC bus voltage and appears across the lower IGBT as a surge voltage. In extreme cases, the surge voltage can exceed the IGBT's V_{CES} rating and cause it to fail. In a real application the parasitic inductance (L_S) is distributed throughout the power circuit but the effect is the same.

Figure 3.1 Half-Bridge Circuit with Parasitic Bus Inductance



3.2.2 Free-Wheel Diode Recovery Surge

A surge voltage similar to the turn-off surge can occur when the free-wheel diode recovers. Assume that the lower IGBT in Figure 3.1 is off and that the load current (I_L) is circulating through the free-wheel diode of the upper IGBT. When the lower device turns on, the current in the free-wheel diode of the upper device (I_{FWD}) decreases as the load current begins to commutate to the lower device and becomes negative during reverse recovery of the free-wheel diode. When the free-wheel diode recovers, the current in the bus is quickly decreased to zero. The situation is similar to the turn-off operation described in Section 3.2.1. The parasitic bus inductance (L_B) develops a surge voltage equal to L_B x di/dt in opposition to the decreasing current. In this case, the di/dt is related to the recovery characteristic of the free-wheel diode. Some fast recovery diodes can develop extremely high recovery di/dt when they are hard recovered by the rapid turn on of the lower IGBT. This condition, commonly referred to as "snappy" recovery, can cause very high transient voltages. Mitsubishi third

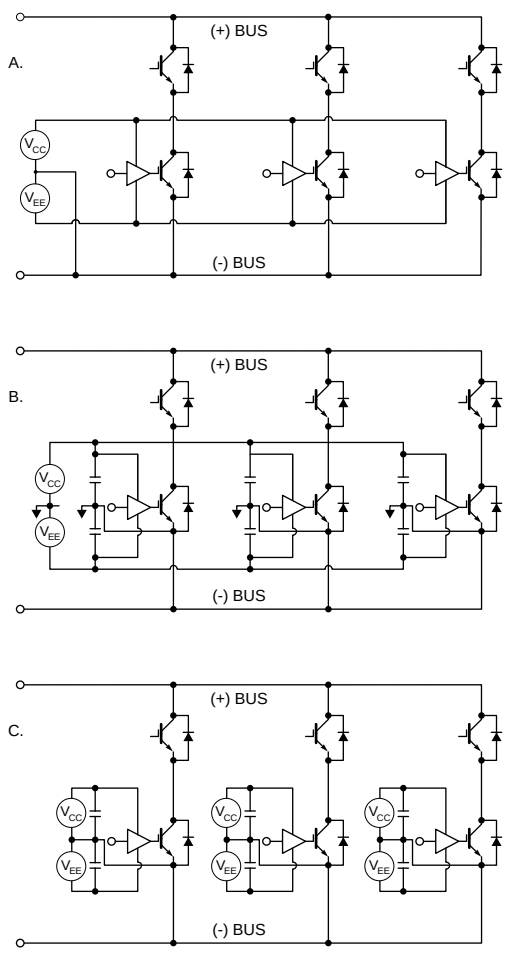
generation H-Series IGBT modules have a new, ultra fast, soft recovery free-wheel diode that virtually eliminates problems with snappy recovery.

3.2.3 Ground Loops

Ground loops are caused when gate drive or control signals share a return current path with the main current. During switching, voltage is induced in power circuit leakage inductance by the high di/dt of the main current. When this happens, points in the circuit that should be at “ground” potential may in fact be several volts above ground. This voltage can appear on the gates of devices that are supposed to be biased off causing them to turn on. In order to avoid this problem, careful referencing of gate drive and control circuits is required. In applications using large IGBT modules high di/dts make it increasingly difficult to avoid ground loop problems.
Figure 3.2A shows a circuit with potential ground loop problems. In this circuit the ground return for the gate drive passes through the main power bus. This circuit is suitable for use with low current six-pack devices because they have minimal inductance in the negative bus and a relatively low power circuit di/dt. However, even in this case a strong off-bias of -5 to -15V is recommended. [Note 1] At higher operating currents, voltages induced in the bus during switching are likely to cause ground loop noise problems in the circuit of Figure 3.2A. Figure 3.2B shows the recommended connection of low side drivers using a single gate drive power supply. In this circuit, ground loop noise is minimized through the use of auxiliary emitters and local power supply decoupling capacitors. This circuit is suitable for use with modules rated up to about 200A. Figure 3.2C shows the recommended circuit for IGBT modules rated 300 amps or more. In this circuit separate isolated power supplies are used for each low side gate driver in order to eliminate ground loop problems.

Note 1. *In the case of the IPM a negative bias is not necessary.*

Figure 3.2 Avoiding Ground Loop Noise

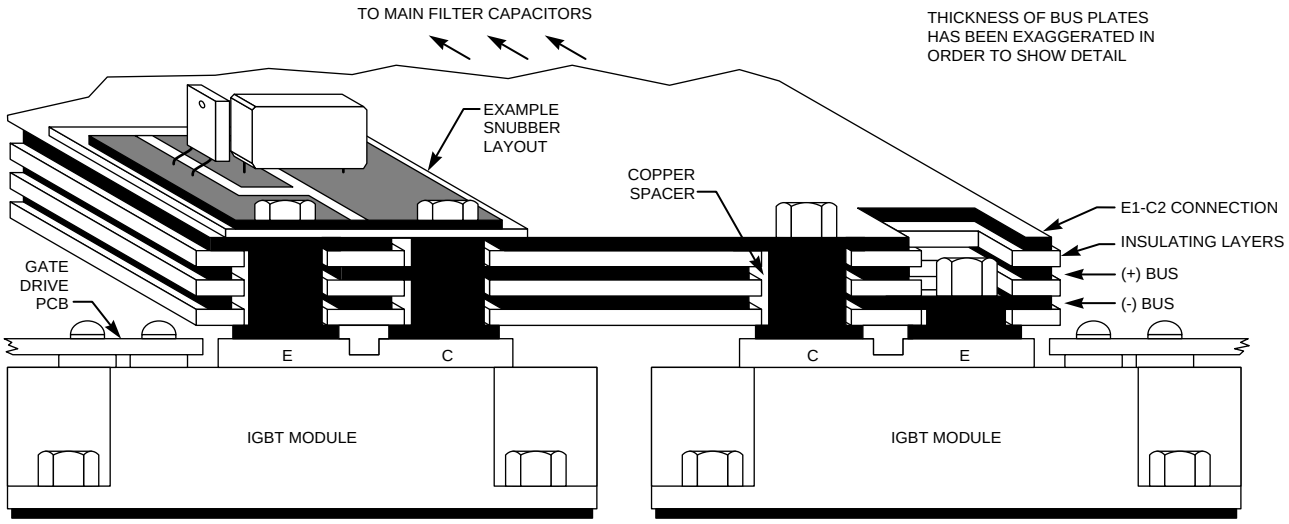


3.2.4 Reducing Power Circuit Inductance

The energy that causes transient voltages in IGBT power circuits is proportional to $1/2L_Si^2$. Here, L_S is the parasitic bus inductance and i is the operating current.

An important fact to remember is that this energy is proportional to the square of the operating current. Therefore, high current devices will require much lower power circuit inductance.

Figure 3.3 Cross-Section of a Laminated Bus Structure



This presents a challenge to the IGBT circuit designer because the physical size and thermal requirements of these devices make longer power circuit connections necessary. With conventional buswork, these longer connections will cause more parasitic inductance making snubber design very difficult.

In order to obtain the low bus inductance recommended for high current applications, special bus structures are required. Laminated busses consisting of alternate copper plates and insulating layers can be designed with very low inductance. In a laminated bus, wide plates separated by insulating layers are used for the positive and negative bus connections. The wide plates act to cancel parasitic inductance in the power circuit. For absolute minimum bus inductance wide positive and negative bus plates are used to connect the IGBTs to the main capacitor bank.

Figure 3.3 shows the cross section of an inverter pole constructed using a laminated bus. In this structure the inductance in the E1 to C2 connection is minimized using another wide plate in the stack. Figure 3.4 shows an example layout for a large three phase inverter. This drawing also shows a large plate being used to make the series connection of the main bus capacitors for 460VAC applications.

3.3 Snubber Design

Snubber circuits are usually used to control turn-off and free-wheel diode recovery surge voltages. In some applications snubber circuits are used to reduce switching losses in the power device. General recommendations for snubbers are not possible to make because the type of snubber needed and component values required are highly dependent on the power circuit layout. In addition factors such as cost and operating frequency must be considered when selecting the best snubber for a given application.

The function of IGBT snubbers is different from classical bipolar transistor snubbers in two ways. First, Mitsubishi IGBTs have strong switching SOAs. The snubber is not required to protect against RBSOA violations to the extent that it was with Darlington transistors. It is only necessary for the snubber to control transient voltages. Second, IGBTs are often operated at considerably higher frequencies than Darlingtons. Snubbers that are discharged through the device on every switching cycle dissipate too much power for these applications.

3.3.1 Snubber Types

Figure 3.5 shows four common IGBT snubber circuits. Snubber circuit “A” consists of a single low inductance film capacitor connected from C1 to E2 on a dual

Figure 3.4 Example Layout for a High Current 3-Phase Inverter

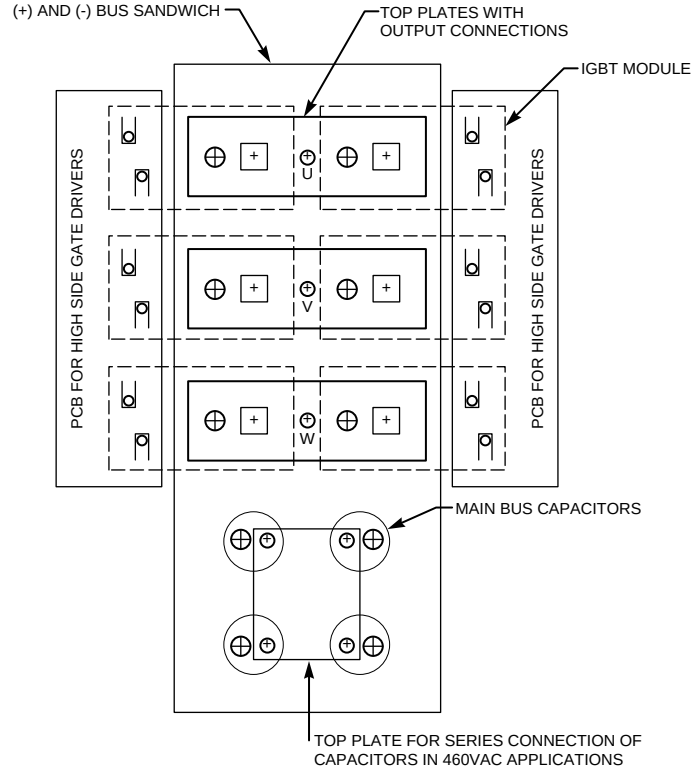
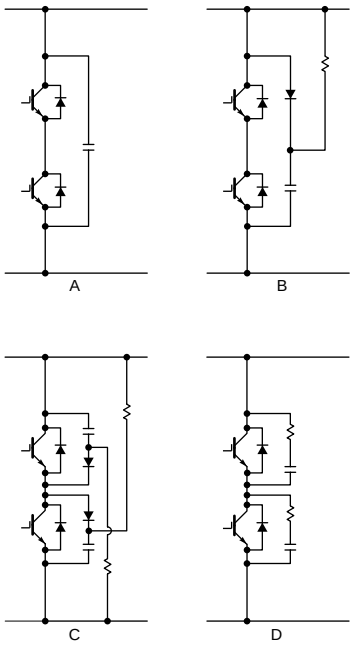


Figure 3.5 Common IGBT Snubber Circuits



IGBT module or from P to N on a six pack module. In low power designs this snubber will often provide effective, low cost control of transient voltages. As power levels increase, snubber “A” may begin to ring with parasitic bus inductance, Snubber “B” solves this problem by using a fast recovery diode to catch the transient voltage and block oscillations. The RC time constant of snubber “B” should be approximately one third of the switching period ($\tau = T/3 = 1/3f$). With large IGBTs operating at high power levels, the parasitic loop inductance of snubber “B” may become too high for it to effectively control transient voltages. In these high current applications snubber “C” is usually used. This snubber functions similarly to “B” but it has lower loop inductance because it is connected directly to the collector and emitter of each IGBT. Snubber “D” is useful for controlling transient voltages, parasitic oscillations, and dv/dt noise. Unfortunately its losses are quite high and it is generally not suitable for high frequency applications. In very high power IGBT circuits, it is often helpful to use a small snubber “D” in conjunction with a main snubber “C” in order to help control parasitic oscillations in the main snubber loop. In very high power applications it may be helpful to combine types “A” and “C” in order to reduce the stresses on the snubber diode.

3.3.2 Effect of Snubber Inductance

Figure 3.6 shows a typical turn-off voltage waveform using snubber “C” of Figure 3.5. The initial voltage spike (ΔV_1) is caused by a combination of the parasitic inductance in the snubber circuit and the forward recovery of the snubber diode. If a fast IGBT snubber diode is used the majority of this spike will be due to the inductance of the snubber. In this case, we can compute the magnitude of ΔV_1 using Equation 3.1.

Equation 3.1

$$\Delta V_1 = L_S \times di/dt$$

Where:

L_S = Parasitic Snubber Inductance
di/dt = Turn-off or diode recovery di/dt

In a typical IGBT power circuit the di/dt will approach 0.01A/ns x I_C. If a limit value for ΔV_1 is established then this di/dt can be used to estimate the maximum allowable snubber inductance. For example, assume that we have an IGBT power circuit that will operate at a peak current of 400A and that ΔV_1 must be limited to 100V. The worst case di/dt is approximately:

$$di/dt = 0.01A/ns \times 400A = 4A/ns$$

Solving Equation 3.1 for L_S we get:

$$L_S = \Delta V_1 \div di/dt = 100V \div 4A/ns = 25nH$$

From the computations above, it is clear that high power IGBT circuits will require very low inductance snubbers. Snubbers must be connected as close as possible to the IGBT module. Parasitic inductance inside snubber diode packages and in the leads of snubber capacitors must be considered when designing snubbers. Often smaller paralleled capacitors and diodes will yield lower inductance than single larger ones. Designing an IGBT power circuit with minimum bus inductance will also help because smaller lower inductance snubber components can be used.

3.3.3 Effect of Bus Inductance

After the initial surge in Figure 3.6 the transient voltage begins to rise again as the snubber capacitor charges. The peak of this second rise (ΔV_2) is a function of the snubber capacitor value and the parasitic bus inductance. In order to estimate the magnitude of ΔV_2 we can apply the Law of Conservation of Energy to obtain Equation 3.2.

Equation 3.2

$$1/2\ L_B i^2 = 1/2\ C\Delta V_2{}^2$$

Where:

L_B = Parasitic Bus Inductance
i = Operating Current
C = Value of Snubber Capacitor
ΔV_2 = Peak Snubber Voltage

If we establish a limit for ΔV_2, then we can calculate the value of snubber capacitor that will be needed for a given power circuit by solving Equation 3.2 for C.

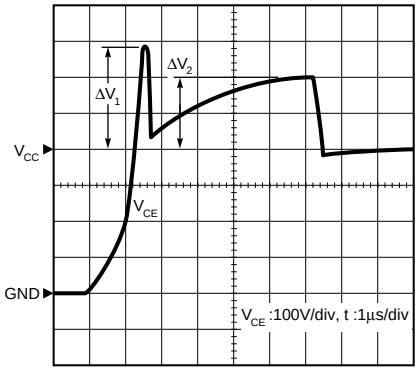
Equation 3.3

$$C = L_B i^2 \div \Delta V_2{}^2$$

Analysis of Equation 3.3 reveals that the value of the required capacitor is directly proportional to the value of the parasitic bus inductance. The methods to reduce bus inductance described in Section 3.2.4 therefore permit a reduction in the required snubber capacitor.

A second consideration is that the value of the capacitor is directly proportional to the square of the current being turned off. This is significant as this current can be very high during short circuit unless the limitation techniques described in Section 4.7.2 are employed. The suggested snubber design values given in Table 3.1 assume that these techniques have been used and that only normal current requirements up to maximum overload have to be handled.

Figure 3.6 Typical Turn-Off Voltage Waveform Using a Snubber



A final consideration is that the value of snubber capacitance is inversely proportional to the square of the magnitude of the allowed spike voltage over the bus voltage. Therefore, allowing a reduced margin between the peak of the voltage spike and the V_{CES} rating may permit a significant reduction in the required value of snubber capacitor. The suggested snubber design values given in Table 3.1 are based on 100 Volt overshoot.

3.3.4 Power Circuit and Snubber Recommendations

Table 3.1 lists suggested targets for the main DC bus inductance. These values are chosen in order to allow design of manageable snubbers while maintaining good control over transient voltages.

Assuming that the target bus inductance has been met, it is possible to suggest snubber types and assign values to the snubber capacitors. In applications using six-in-one or seven-in-one (6-pack or 7-pack) type modules, it is

usually possible to use a single low inductance capacitor connected across the P and N terminals as the snubber shown in Figure 3.5A. Similarly, on dual type modules a low inductance capacitor connected between the C1 and E2 terminals is usually sufficient for control of transient voltages. These configurations are shown in Figure 3.7. The capacitance needed in a given application is difficult to estimate. The capacitor must be made large enough to avoid sympathetic oscillations in the LC circuit formed by the capacitor and the parasitic DC bus inductance. Usually a capacitance of about 1µF per 100A of collector current is sufficient. The capacitor should be polypropylene film or a similar low loss dielectric and be mounted as close to the module's terminals as possible. Total snubber loop inductance including the capacitor's internal inductance should be minimized. If parasitic oscillations are a problem in the application, it may be necessary to use the snubber shown in Figure 3.5B.

With high current single IGBT modules a single bus decoupling capacitor alone is usually insufficient for control of transient voltages. In these applications a clamp type RCD circuit like the one shown in Figure 3.5C is usually used. In this circuit the snubber capacitors are charged to the DC bus voltage through the resistors. When the IGBT turns off, parasitic inductance in the DC bus causes a transient voltage across the IGBT. As soon as the voltage exceeds the DC bus voltage the snubber diode turns on and diverts the energy stored in the parasitic bus inductance into the snubber capacitor. This snubber controls transient voltages better than the snubbers shown in Figure 3.7 since it eliminates the inductance of the opposite IGBT package and the E1 to C2 connection from the snubber loop. This clamp type snubber circuit is typically constructed on a small printed circuit board using axial or radial leaded capacitors along with the fast recovery snubber diodes and power resistors. The circuit board is then mounted to the bus bars directly above the IGBT module. (See Figure 3.3) Capacitor and diode recommendations for this type of snubber are shown in Table 3.1. In this case the capacitor values are derived using Equation 3.3 and assuming a transient voltage of 100V with the IGBT

Figure 3.7 Snubber Circuits for Six Pack, Seven Pack, and Dual Type Modules

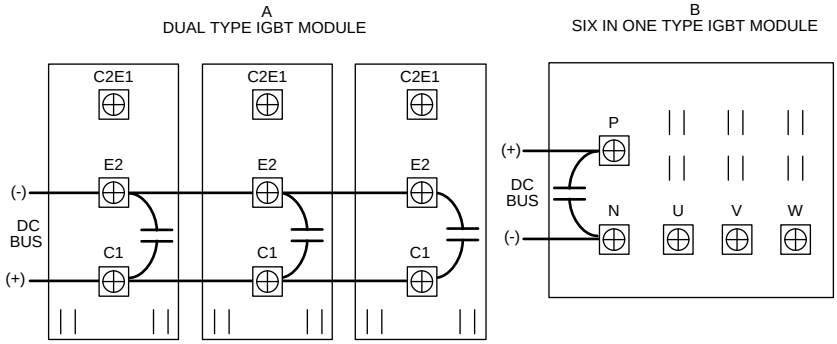


Table 3.1 Snubber and Power Circuit Design Recommendations

Module Type	Suggested Design Values				
	Main Bus	Snubber Type (Figure)	Snubber Loop Inductance	Snubber Capacitor Value	Snubber Diode
10A-50A 6-Pack and 7-Pack Types	200nH	3.7B	20nH	0.1-0.47µF	n/a
75A-200A 6-Pack and 7-Pack Types	100nH	3.7B	20nH	0.6-2.0µF	n/a
50A-200A Dual Types	100nH	3.7A	20nH	0.47-2.0µF	n/a
300A-600A Dual Types*	50nH	3.7A	20nH	3.0-6.0µF	n/a
200-300A Single Types	50nH	3.5C	30nH-15nH	0.47µF	600V: RM50HG-12S 1200V: RM25HG-24S
400A Single Type	50nH	3.5C	12nH	1.0µF	600V: RM50HG-12S 1200V: RM25HG-24S (2 Parallel) 1400V, 1700V: RM35HG-34S (2 Parallel)
600A-1000A Single Type	50nH	3.5C	8nH	2.0µF	600V: RM50HG-12S (2 Parallel) 1200V: RM25HG-24S (3 Parallel) 1400V: RM35HG-34S (3 Parallel)

*At high DC bus voltages it may be necessary to use the snubber shown in Figure 3.5C for these high current dual types. In this case use the recommendations given for single types.

switching at rated current. In order to be effective the snubber must have low inductance. The effect of snubber inductance is covered in Section 3.3.2. Target values for snubber loop inductance based on a surge voltage of 100V are also given in Table 3.1.

3.4 Thermal Considerations

When operating the power devices contained in IGBT and Intelligent Power Modules will have conduction and switching power losses. The heat generated as a result of these losses must be conducted away from the power chips and into the environment using a heatsink. If an appropriate thermal system is not used the power devices will overheat which could result in failure. In many applications the maximum usable power output of the module will be limited by the systems thermal design.

3.4.1 Estimating Power Losses

The first step in thermal design is the estimation of total power loss. In power electronic circuits using IGBTs the two most important sources of power dissipation that must be considered are conduction losses and switching losses.

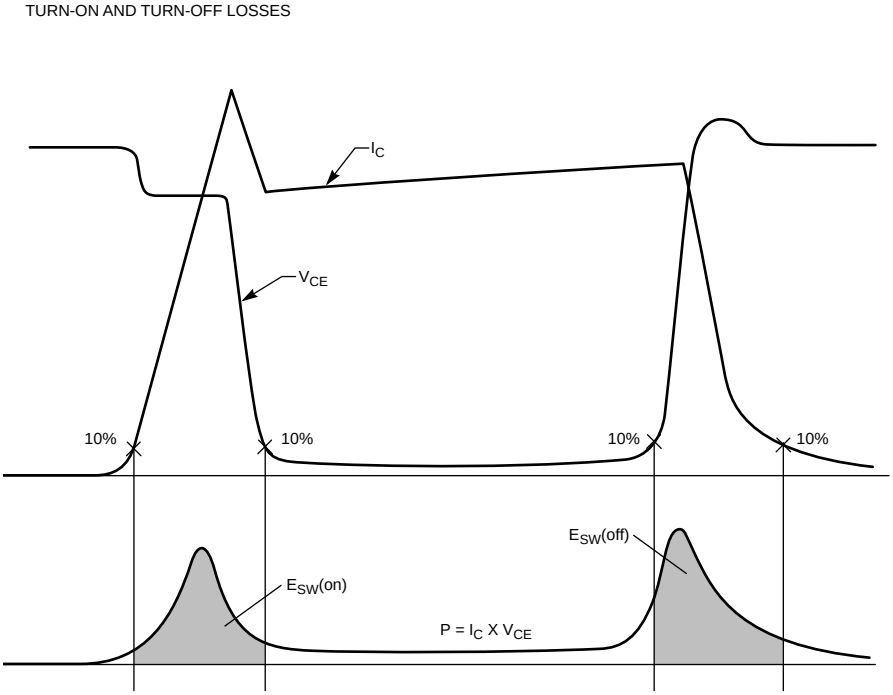
CONDUCTION LOSSES

Conduction losses are the losses that occur while the IGBT is on and conducting current. The total power dissipation during conduction is computed by multiplying the on-state saturation voltage by the on-state current. In PWM applications the conduction loss should be multiplied by the duty factor to obtain the average power dissipated. A first approximation of conduction losses can be obtained by multiplying the IGBT's rated V_{CE}(SAT) by the expected average device current. In most applications the actual losses will be less because V_{CE}(SAT) is lower than the data sheet value at currents less than rated I_C. When switching inductive loads the conduction losses for the free-wheel diode must be considered. Free-wheel diode losses can be approximated by multiplying the data sheet V_{FM} by the expected average diode current.

SWITCHING LOSSES

Switching loss is the power dissipated during the turn-on and turn-off switching transitions. In high frequency PWM switching losses can be substantial and must be considered in thermal design. The most accurate method of determining switching losses is to plot the I_C and V_{CE} waveforms during the switching transition. Multiply the waveforms point by point to get an instantaneous power waveform. The area under the power waveform is the switching energy expressed in watt-seconds/pulse or J/pulse. The standard definitions of turn-on ($E_{SW(on)}$) and turn-off ($E_{SW(off)}$) switching energy is given in Figure 3.8. The waveform shown is typical of the hard switched clamped inductive load test that is used to generate all published switching energy data. The area is usually computed by graphic integration. Digital oscilloscopes

Figure 3.8 Switching Losses



with waveform processing capability will greatly simplify switching loss calculations. From Figure 3.8 it can be observed that there are pulses of power loss at turn-on and turn-off of the IGBT. The instantaneous junction temperature rise due to these pulses is not normally a concern because of their extremely short duration. However, the sum of these power losses in an application where the device is repetitively switching on and off can be significant. In cases where the operating current and applied DC bus voltage are constant and therefore $E_{SW(on)}$ and $E_{SW(off)}$ are the same for every turn-on and turn-off event the average switching power loss can be computed by taking the sum of $E_{SW(on)}$ and $E_{SW(off)}$ and dividing by the switching period T. Noting that dividing by the switching period is the same as multiplying by the frequency results in the most basic equation for average switching power loss:

$$P_{SW} = f_{SW} \times (E_{SW(on)} + E_{SW(off)})$$

Where:
f_{SW} is Switching Frequency
$E_{SW(on)}$ is turn-on switching energy
$E_{SW(off)}$ is turn-off switching energy

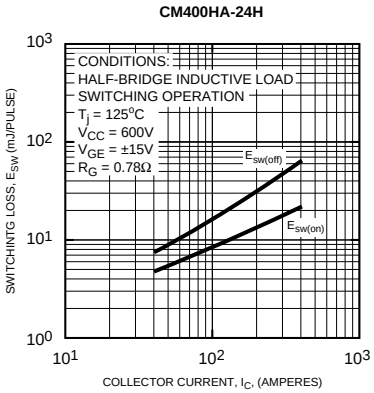
Figure 3.9 shows switching energy versus collector current for a 400A 1200V H-Series IGBT Module (CM400HA-24H). This curve is made using a half bridge test circuit with an inductive load. The turn-on loss includes the losses caused by the hard recovery of the opposite free-wheel diode. The critical conditions including junction temperature (T_j), DC bus voltage (V_{CC}), gate drive voltage V_{GE}, and series gate resistance (R_G) are given on the curve. Switching energy curves like this one are available for all Mitsubishi IGBT and Intelligent Power Modules and most can be found in Sections 4.4.8 and 6.5.2 of this application note. Switching energy curves are very useful for initial loss estimation. In applications where the operating current and applied DC bus voltage are constant the average switching power loss can be computed by reading $E_{SW(on)}$ and $E_{SW(off)}$ from the curve at the operating current and using the equation given above. In applications where the current is changing such as in a sinusoidal output inverter the loss computation becomes more complex. In these cases it is necessary to consider the change in switching energy at each switching event over a fundamental cycle. A method for loss estimation in a sinusoidal output PWM inverter is given in Section 3.4.2. Final switching loss analysis should always be done with actual waveforms taken under worst case operating conditions.

The main use of the estimated power loss calculation is to provide a starting point for preliminary device selection. The final selection must be based on rigorous power and temperature rise calculations.

3.4.2 VVVF Inverter Loss Calculation

One common application of Power Modules is the variable voltage variable frequency (VVVF) inverter. In VVVF inverters, PWM modulation is used to synthesize sinusoidal output currents. In this application the IGBT current and duty cycle are constantly changing making loss estimation very difficult. The following equations can be used for initial loss estimation in VVVF applications. Actual losses will depend on temperature, sinusoidal output frequency, output current ripple and other factors. Figure 3.10 is a typical VVVF inverter circuit and output waveform.

Figure 3.9 Switching Energy Versus Collector Current



GENERAL CONSIDERATIONS FOR IGBT AND INTELLIGENT POWER MODULES

Equations for Power Loss Calculation for Sinusoidal Inverters

IGBT Loss

(1) Steady-state loss per switching IGBT

$$P_{SS} = I_{CP} \bullet V_{CE}(SAT) \bullet \frac{1}{2p}\int_0^p \sin^2 X \bullet \frac{1 + \sin(x+q)\bullet D}{2}\, dx = I_{CP} \bullet V_{CE(SAT)} \bullet \left(\frac{1}{8} + \frac{D}{3p}\cos q\right)$$

(P.F. = cosq)

(2) Switching Loss per switching IGBT

$$P_{SW} = (E_{SW(on)} + E_{SW(off)}) \bullet f_{SW} \frac{1}{2p}\int_0^p \sin x\, dx = (E_{SW(on)} + E_{SW(off)}) \bullet f_{SW} \frac{1}{p}$$

(3) Total loss per IGBT

$$P_Q = P_{SS} + P_{SW}$$

Diode Loss

(1) Steady-state loss per diode

$$P_{DC} = I_{EP} \bullet V_{EC} \bullet \left(\frac{1}{8} - \frac{D}{3p}\cos q\right)$$

(2) Recovery Loss per Diode

$$P_{rr} = 0.125 \bullet I_{rr} \bullet t_{rr} \bullet V_{CE}(pk) \bullet f_{SW}$$

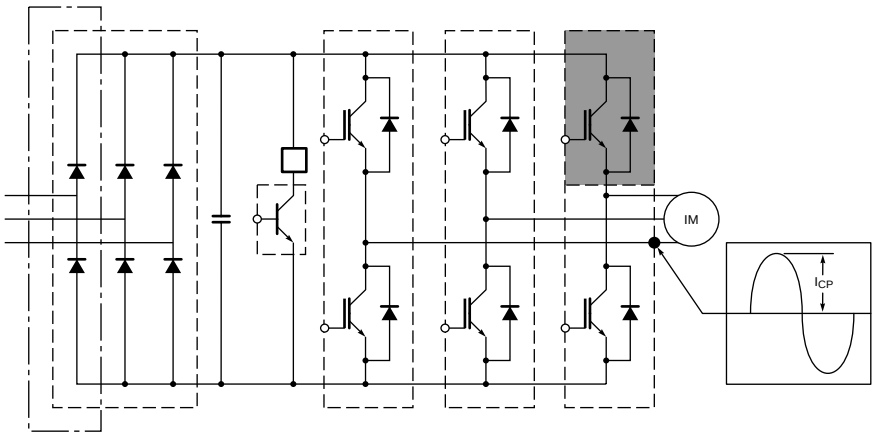
Loss per Arm (shaded part)

$$P_A = P_Q + P_D = P_{SS} + P_{SW} + P_{DC} + P_{rr}$$

Symbology:

$E_{SW(on)}$:	IGBT‘s turn-on switching energy per pulse at peak current, I_{CP} and T = 125∞C
$E_{SW(off)}$:	IGBT‘s turn-off switching energy per pulse at peak current, I_{CP} and T = 125∞C
f_{SW}:	PWM switching frequency for every inverter arm-switch (normally, $f_{SW} = f_C$)
I_{CP}:	Peak value of sinusoidal output current ($I_{CP} = I_{EP}$)
V_{CE}(sat):	IGBT saturation voltage drop @I_{CP} and T = 125∞C
V_{EC}:	FWD forward voltage drop @ I_{EP}
D:	PWM duty factor (modulation depth)
q:	Phase angle between output voltage and current
I_{rr}:	Diode peak recovery current
t_{rr}:	Diode reverse recovery time
V_{CE}(pk):	Peak voltage across the diode at recovery

Figure 3.10 Typical VVVF Inverter Circuit and Output Waveform



3.4.3 Loss Estimation by Calibrated Heat Sink Method

In many applications it is difficult to make the precision measurements of voltage and current that are necessary to accurately calculate switching losses. It can also be difficult to make these measurements without disturbing low inductance power circuits to the point of making the accuracy suspect. In some cases the operating voltage, gate resistance, drive voltage, power circuit configuration or snubber design is significantly different from standard conditions making use of published switching energy data impossible. For all of the above cases the following alternate method of power loss estimation should be used:

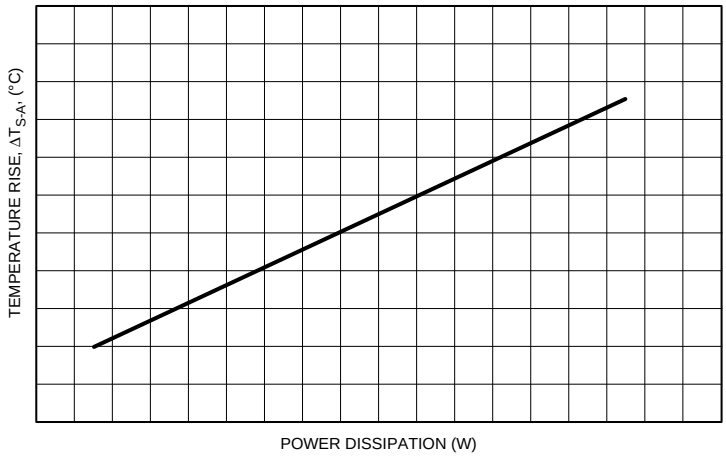
(1) Mount IGBT module in the thermal system (fan, heatsink, cabinet etc.) exactly as it will be used in the final design.
(2) Bias device on by applying isolated +15V DC power to the gate emitter or in the case of IPM apply control power and pull the control input signal low.
(3) Connect the IGBT to a low voltage current regulated DC power supply and operate at several different DC currents gradually increasing until the current is approximately equal to the expected average operating current. Be careful not to exceed the IGBT junction temperature ratings while performing this test.
(4) For each test current allow the system to reach thermal equilibrium and record the temperature rise of the heat sink above ambient temperature near the IGBT module. At the same time, using an accurate DMM measure and record the voltage drop across the IGBT and the DC current. Power dissipation in the IGBT can be easily calculated by multiplying the DC current by the voltage drop across the device.

The data gathered in the above test can be used to make a thermal system calibration curve like the one shown in Figure 3.11. Now, when the IGBT is operated normally the total power dissipation including both switching and conduction components can be determined simply by measuring the heat sink temperature rise and reading from the calibration curve. This technique for loss estimation is very effective for estimating operating junction temperature. The power determined from the curve can be multiplied by the devices thermal impedances as outlined in Section 3.4.4 to determine the junction temperature. Even in cases where published loss curves can be used this method of loss estimation is often a valuable tool for refining the thermal system design.

3.4.4 Estimating Average Junction Temperature

The IGBT chips in the Power Module have a maximum rated junction temperature of 150°C. This rating should not be exceeded under any normal operating condition. Good design practice is to limit the worst case maximum junction temperature to 125°C or less. Reliability can be enhanced by operating the semiconductor junction at lower temperatures. If the total average power dissipated in the semiconductor device and the module base plate temperature are known, the junction temperature can be estimated using thermal resistance concepts. (See Figure 3.12) Thermal resistance (R_{th}) is specified on the

Figure 3.11 Typical Heat Sink Calibration Curve



Power Module data sheet for use in thermal calculations. Junction temperature is estimated using the following equation.

$T_j = T_C + P_T \times R_{th(j-c)}$

Where:

$R_{th(j-c)}$ = Specified junction to case thermal resistance
T_j = Semiconductor junction temperature
P_T = Total average power dissipated in device ($P_{SW} + P_{cond}$)
T_C = Module base plate temperature

By using the appropriate values of $R_{th(j-c)}$ and P_T the above equation can be used to estimate the junction temperature of either the IGBT or the free-wheel diode.

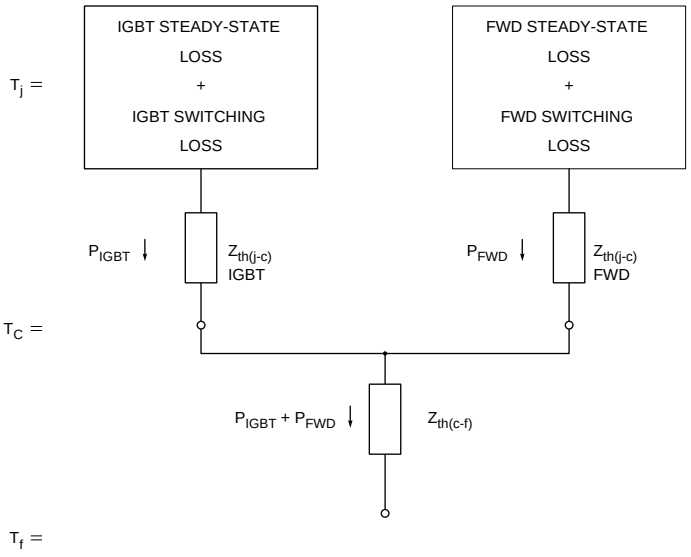
For initial design of heatsink systems, contact thermal resistance is specified on the Power Module data sheet. Contact thermal resistance is the thermal resistance of the module to heatsink interface. The specified value assumes that a thermal interface compound such as white grease is used. A uniform layer of non-volatile silicon thermal grease with a nominal thickness of approximately 6 mills will give the best results. The module base plate temperature can be estimated using the following equation.

$T_C = T_a + P_T \times (R_{th(c-f)} + R_{th(f-a)})$

Where:

P_T = Total power dissipated in an IGBT FWD pair.
$R_{th(c-f)}$ = The interface thermal resistance.

Figure 3.12 Thermal Calculation Model



$R_{th(f-a)}$ = The heatsink to ambient thermal resistance specified by the heatsink manufacturer.
T_a = Ambient temperature

The value of $R_{th(c-f)}$ is specified for the entire module. Final thermal analysis should be done using measured base plate temperature and total power loss under worst case conditions.

3.4.5 Estimating Junction Temperature Rise

For short or low duty cycle power pulses, using the steady state thermal resistance will give conservative junction temperatures. In addition, using the average value of power dissipation will underestimate the peak junction temperature. The solution is use of the transient thermal impedance curves (Figure 3.13 illustrates typical transient thermal impedance curves). For a power device subjected to a single or very low duty cycle, short duration power pulses, the maximum allowable power dissipation during the transient period can be substantially greater than the steady state dissipation capability.

Calculation of the peak transient junction temperature rise depends on the duty factor and repetition rate of the power pulses. Figure 3.14 describes the application of the transient thermal impedance curve to a variety of power pulse situations. Please consult Mitsubishi Application Engineering for guidance in the use of the equations contained in this figure as well as their application to irregular and overload power pulses.

3.4.6 Heatsink Mounting

When mounting IGBT modules on a heatsink avoid uneven mounting stress. Heatsink flatness requirements are shown in Figure 3.15. Avoid one sided tightening stress. Figure 3.18 shows the recommended torque order for mounting screws. Uneven mounting can cause the modules ceramic isolation to crack.

Do not over torque terminal or mounting screws. Maximum torque specifications are provided in device data sheets. Mounting screws should be tightened to the prescribed torque in progressive stages in a cross pattern to prevent unbalanced tightening, uneven contact, or mechanical bending stress.

(A) Use a torque wrench to tighten the screws in the prescribed cross pattern.

(B) Tighten the screws first with just enough torque to bring the screw head into contact with the device, then to 50% of the prescribed maximum value, and finally to 90 to 100% of the prescribed maximum torque.

The heatsink should have a surface finish of 64 microinches or less. Use a uniform 4 to 8 mil coating of thermal interface compound. Select a compound which has stable characteristics over the whole operating temperature range and does not change its properties over the life of the equipment. See Table 3.2 for suggested types.

Table 3.2 Heatsink Compounds

Manufacturer	Type
Shinetsu Silicon	G746
Dow Corning	DC340

3.4.7 Power Cycling Considerations

A final thermal design consideration is the temperature range, ΔT_j, through which the junction will cycle as the equipment operates in actual application. The concern here is what is called thermal fatigue. That is, as the component parts of the module heat and cool due to collector power dissipation there are mechanical stresses caused by the different coefficients of expansion of the various component materials. This differential expansion puts the intermediate layers under bending and shear stress. With the accumulation of these stress cycles the assembly structure can deteriorate causing eventual failure. Studies of this phenomenon involve tests at multiple operating points to create curves that indicate cycling life as a

Figure 3.13 Transient Thermal Impedance Curves

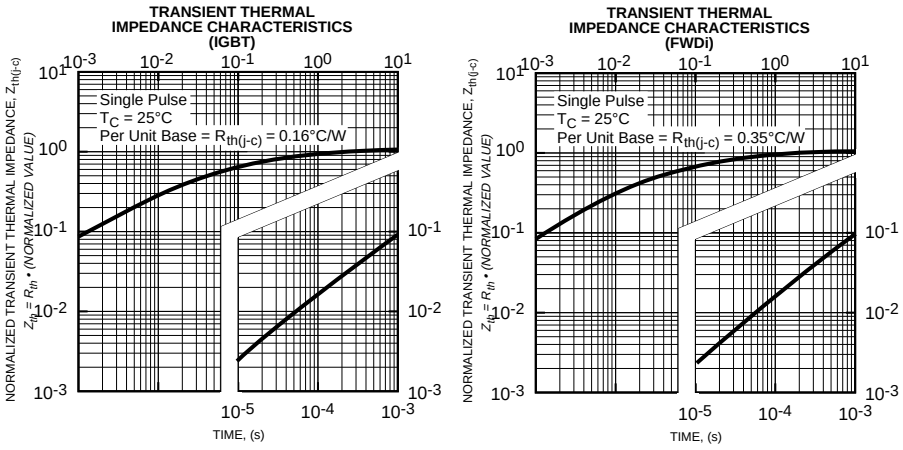
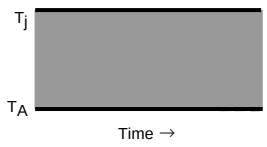
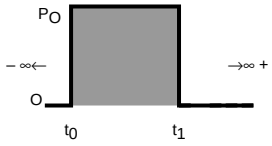
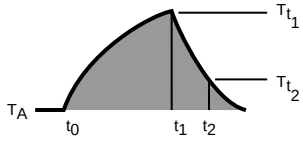
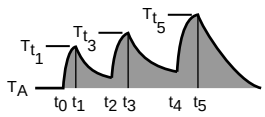
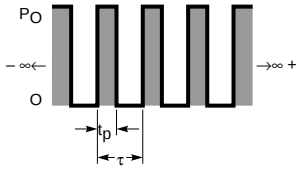
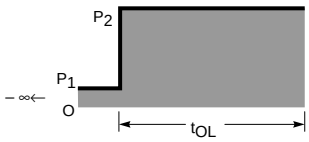
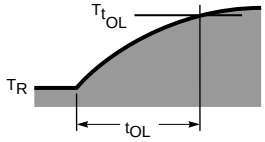
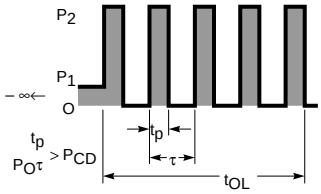
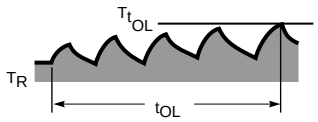


Figure 3.14 Junction Temperature Calculations Using Transient Thermal Impedance

Load Condition	Waveform of Power Loss at Junction	Solution for Juction Temperature θ = Steady-State Thermal Resistance θ (t_1) = Transient Thermal Impedance at Time T_1 θ ($t_2 - t_1$) = Transient Thermal Impedance at Time ($t_2 - t_1$), etc.	Waveform of Junction Temperature Rise (T_A = Reference Temp.)
Continuous Load		$T_j - T_A = P_O\theta$	
Single Load Pulse		$T_{t_1} - T_A = P_O\theta(t_1)$ $T_{t_2} - T_A = P_O[\theta(t_2) - \theta(t_2 - t_1)]$	
Short Train of Load Pulses (Equal Amplitude)		$T_{t_1} - T_A = P_O\theta(t_1)$ $T_{t_3} - T_A = P_O[\theta(t_3) - \theta(t_3 - t_1)] \tau\, \theta(t_3 - t_2)]$ $T_{t_5} - T_A = P_O[\theta(t_5) - \theta(t_5 - t_1)] + \theta(t_5 - t_2)]$, etc.	
Long Train of Equal Amplitude Load Pulses (Approx. Solution)		$T_j - T_A = P_O[\frac{t_p\theta}{\tau} + (1 - \frac{t_p}{\tau})\,\theta(\tau + t_p) - \theta(\tau) + \theta(t_p)]$	
Overload Following Continuous Duty (Non-Pulsed)		$T_{t_{OL}} - T_A = P_1\theta + (P_2 - P_1)\theta(t_{OL})$	
Overload Following Continuous Duty (Pulsed) (Approx. Solution)		$T_{t_{OL}} - T_A = P_1\theta + P_2\left\{\left[\frac{t_p}{\tau} - \frac{P_{CD}}{P_O}\right]\theta(t_{OL})\right.$ $\left. + (1 - \frac{t_p}{\tau})\theta(\tau + t_p) - \theta(\tau) + \theta(t_p)\right\}$	

function of the ΔT_j excursion. These curves are specific to particular temperature, time, and operating ranges, so that a general curve cannot be generated and published. The curve in Figure 3.16 is representative of the worst case test result for ALN ceramic isolated modules. Experimental studies have shown that a relatively long heating and cooling cycle of the order of two minutes that causes the base plate temperature of the module to change along with the junction temperature is usually the worst case. The curve in Figure 3.16 should not be confused with the commonly published “power cycle” curves that are derived using a short heating cycle of 10 seconds or less. Under such short cycle conditions Mitsubishi modules can be expected to have five to ten times the life indicated in Figure 3.16. Figure 3.16 is an example curve taken for modules using the test setup shown in Figure 3.17. All available information has indicated that thermal fatigue is not an issue when ΔT_j is kept below 30°C. For applications involving a large number of power cycles in conjunction with junction temperature excursions greater than 30°C the application should be reviewed in detail with Mitsubishi Application Engineers.

Figure 3.15

HEAT SINK FLATNESS REQUIREMENTS

MODULE BASE PLATE MATERIAL	HEAT SINK FLATNESS
COPPER TYPE MODULE	-100μm ~ +100μm
ALUMINUM TYPE MODULE	-50μm ~ +100μm

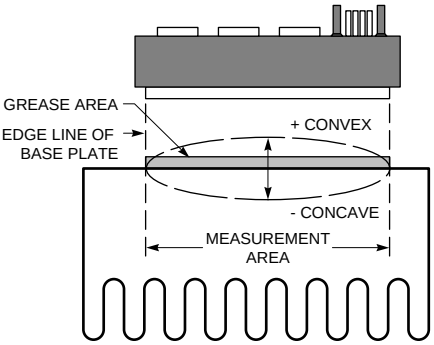


Figure 3.16 Intermittent Operation Life Curve (Example)

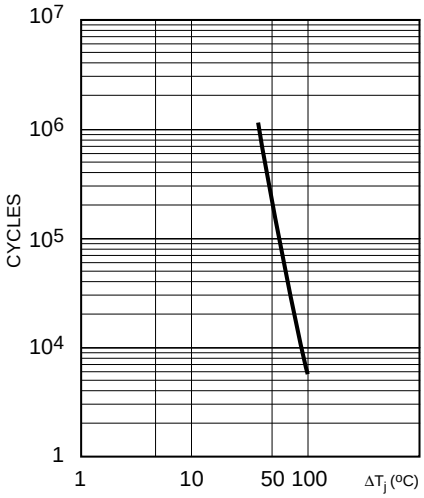
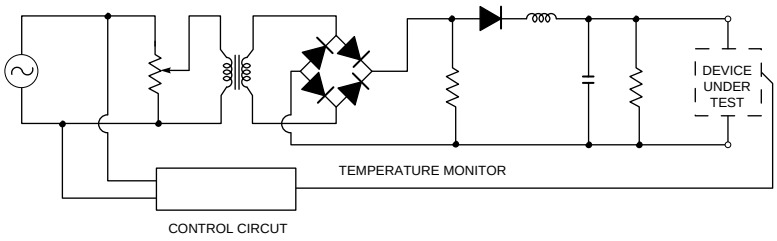


Figure 3.17 The Power-Cycle Test Circuit



3.5 Reliability

High reliability standards are assured with Mitsubishi semiconductor devices through the rigorous quality control inspections which the devices are subjected to in the design and manufacturing stages. The quality assurance inspections run on each production lot and numerous reliability tests have been implemented in order to maintain this standard of reliability.

Table 3.3 shows the result of reliability tests of a typical IGBT Module. Figure 3.19 shows the results of several reliability tests illustrating the typical changes as a function of time. Table 3.4 shows the failure criteria.

3.5.1 Test Results

Following are the results of semiconductor reliability tests on a typical IGBT Module.

SEMICONDUCTOR RELIABILITY TESTS

Semiconductor reliability tests are intended to simulate or accelerate all the possible stresses that semiconductor devices might be subjected to at the various phases of its life, including mounting on equipment, performance, aging, and field installation and operation. They are composed of environmental tests and separate endurance tests. Each set of test conditions and results are shown in Table 3.3, and time dependent characteristics of some test items are shown in Figure 3.19.

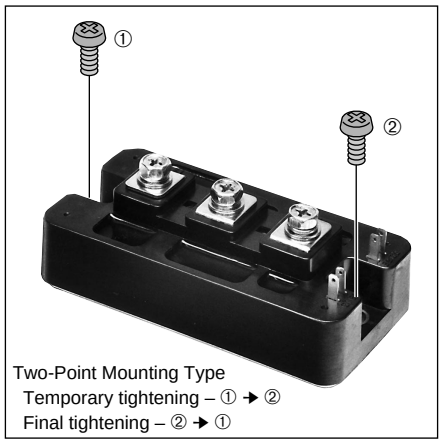
FAILURE CRITERIA

Failure criteria are shown in Table 3.4. The characteristics of a failed device are verified based on these criteria and the device status (good or bad) is determined. Before measurement, each device is kept at room temperature for two hours. After performing such tests as temperature humidity test, in which water is used, the devices are dried at 125°C for 2 hours before measurement.

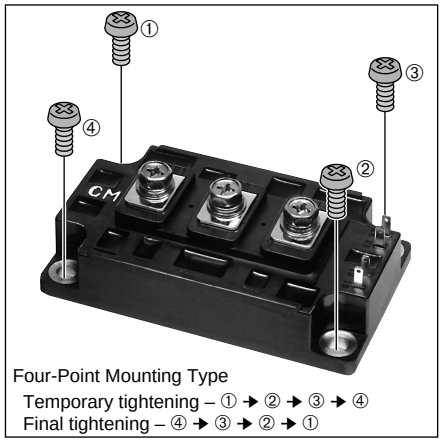
RESULTS

Results of each test performed on the above mentioned IGBT modules are satisfactory. The reliability aspects of the module are confirmed as determined in the following pages.

Figure 3.18 Recommended Torquing Order for Mounting Screws



Two-Point Mounting Type
Temporary tightening – ① → ②
Final tightening – ② → ①



Four-Point Mounting Type
Temporary tightening – ① → ② → ③ → ④
Final tightening – ④ → ③ → ② → ①

Table 3.3 Reliability Test Results

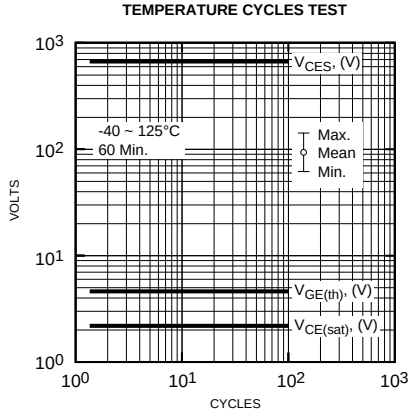
Test Category	Test Conditions	Conforms to JIS C 7021	Sample Size	Number of Failures	Remarks
Temperature Cycling	-40 ~ 125°C 60 minutes each 100 Cycles	A-4	5	0	See Figure 3.18 (A)
Thermal Shock	0 ~ 100°C 5 minutes 100 Cycles	A-3	5	0	
Free Fall	Dropping from the height of 75CM wooden board, 3 times	A-8	5	0	
Variable Frequency Vibration	10 ~ 500 HZ/15 minutes 10G XYZ 2 hours each	A-10	5	0	
Terminal Strength	4.5kg 30 seconds	A-10	5	0	
Tightening Strength	M6: 30kg/cm M5: 20kg/cm	A-10	5	0	
High Temperature Life	T_a = 125°C 1,000 hours	A-10	5	0	
Low Temperature Life	T_a = 40°C 1,000 hours	A-10	5	0	
Moisture Resistance	T_a = 60°C, 90% RH 1,000 hours	A-10	5	0	See Figure 3.18 (B)
High Temperature Reverse Bias	T_a = 125°C V_{CE} = 510V, V_{GE} = 0V 1,000 hours	A-10	5	0	See Figure 3.18 (C)
High Temperature Gate Bias	T_a = 125°C V_{GE} = 20V, V_{CE} = 0V 1,000 hours	A-10	5	0	See Figure 3.18 (D)
Intermittent Operation Life	I_C = 50A T_C = 50 ~ 80°C On-time: 53 seconds Off-time: 62 seconds 10,000 cycles	B-6	5	0 Figure	See 3.18 (E)

Table 3.4 Failure Criteria for the Reliability Test

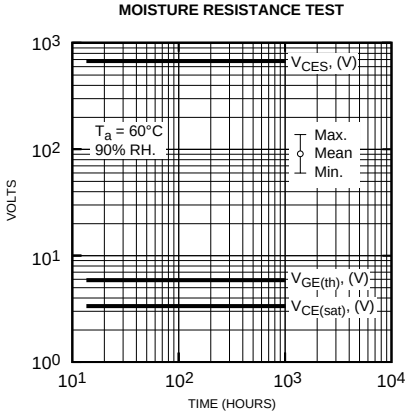
Parameter	Test Conditions	Criteria for Failure	Remarks
V_{CES}	I_C = 1mA, V_{GE} = 0V	Rating x 0.8	
I_{CES}	V_{CE} = 600V, V_{GE} = 0V	Rating x 2.0	
I_{GES}	V_{GE} = ±20V, V_{CE} = 0V	Rating x 2.0	
$V_{GE(th)}$	I_C = 10mA, V_{CE} = 10V	Rating x 1.2 Rating x 0.8	
V_{CE}(SAT)	I_C = 100A, V_{GE} = 15V	Rating x 1.2	
V_{EC}	I_E = 100A	Rating x 1.2	
Dielectric Withstand	AC 2500V, 1 minute	Breakdown	

Figure 3.19 The Results of Reliability Test of a 600V/100A IGBT Module

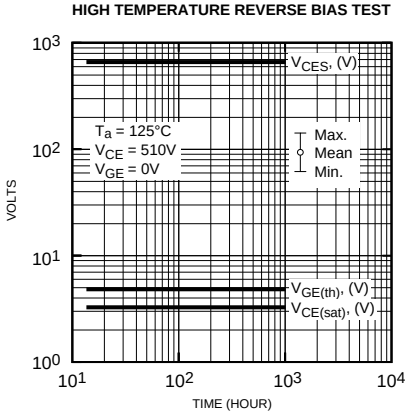
(A) Temperature Cycles Test (-40 ~ 125°C, 60 minutes)



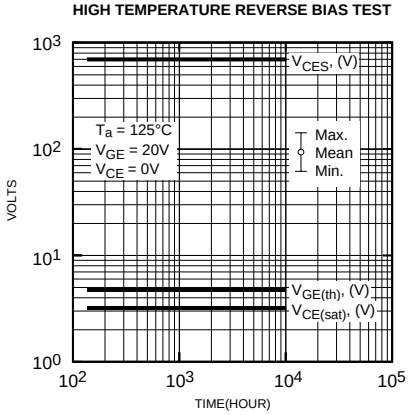
(B) Moisture Resistance Test (T_a = 60°C, 90% RH)



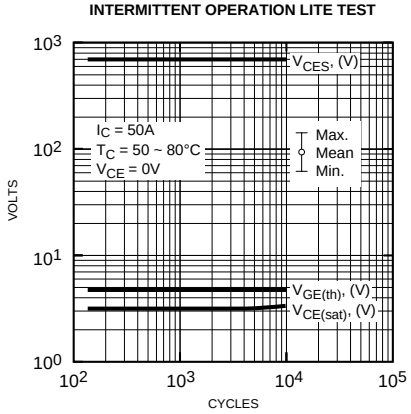
(C) High Temperature Reverse Bias Test (T_a = 60°C, V_{CE} = 510, V_{GE} = 0V)



(D) High Temperature Gate Bias Test (T_a = 125°C, V_{CE} = 510V, V_{GE} = 0V)



(E) Intermittent Operation Life Test (I_C = 50A, T_C = 50 ~ 80°C)



NOTE:

Sample: 600V/100A IGBT Module
: 5 pieces

Parameter Condition

V_{CES} : at I_C = 1mA, V_{GE} = 0V
$V_{CE(sat)}$: at I_C = 100A, V_{GE} = 15V
$V_{GE(th)}$: at I_C = 10mA, V_{CE} = 10V