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QR код



Power Devices

IGBT Modules

Intelligent Power Modules

MOSFET Modules

High Voltage Devices

High Voltage Integrated Circuits

Power Loss Calculation Tool  
(MELCOSIM)

# Selection Guide 2014



## Mitsubishi Electric

### Environmental Vision 2021

Climate protection is a major issue worldwide and will have a significant impact on our future. The goals for the reduction of climatically harmful greenhouse gas CO<sub>2</sub> are laid down in the Kyoto Protocol. Mitsubishi Electric has had a tradition of reducing CO<sub>2</sub> emissions with advanced technology and highly energy-efficient products, and is extending this commitment into the future through its Environmental Initiative.

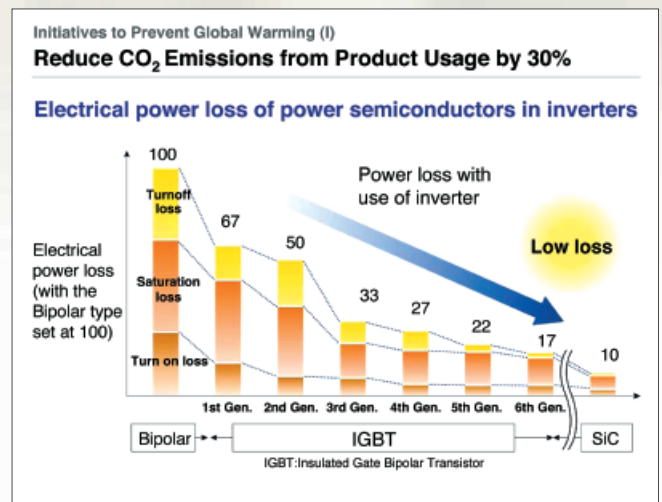
The "Environmental Vision 2021" is Mitsubishi Electric's long-range vision for environmental management, which looks towards the year 2021 – as the 100th anniversary of the company's founding – by which to achieve specific and meaningful results. Based on the principle of "Making Positive Contributions to the Earth and its People through Technology and Action," the Vision defines a set of initiatives for realising a sustainable, recycling-based global society through application of the company's broad range of high-level technologies and the actions of its global workforce of talented individuals.

"Environmental Vision 2021" commits Mitsubishi Electric to deliver the following by 2021:

- Reduction of CO<sub>2</sub> emissions
- Sustain resource cycle by Reducing, Reusing and Recycling (3Rs)
- Run educational/leadership training for employees and children to nurture environmental awareness

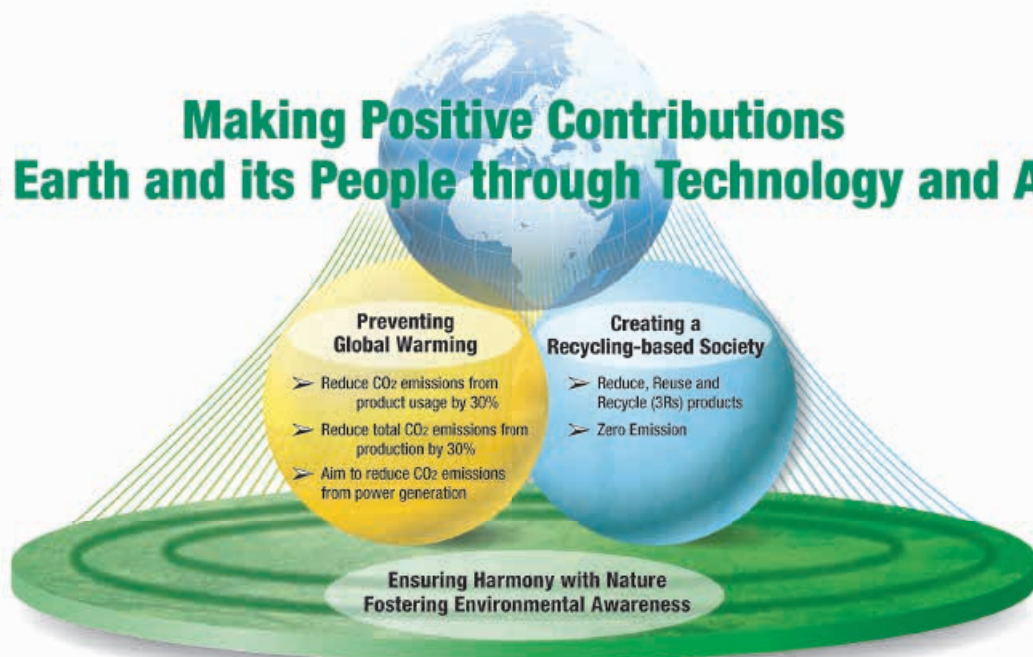


The Semiconductor European Business Group of Mitsubishi Electric is working to realise these goals by producing electronic devices that are more energy efficient, while also working to reduce the amount of lead and other controlled substances being used. As shown in the chart below power losses have been already decreased step by step with the introduction of new Generations of Power Modules.



Every day, the Mitsubishi Electric Group as a whole makes a positive contribution to realising its "Environmental Vision 2021" through its products, activities and technologies.

## Making Positive Contributions to the Earth and its People through Technology and Action



## Mitsubishi Electric

### Global Leader in Semiconductor Technology

Mitsubishi Electric belongs to the world leading companies in Manufacturing, Marketing and Sales of electrical and electronic products. The Semiconductor European Business Group is operating all sales and export activities for Western and Eastern Europe, Russia and South Africa from its headquarters in Ratingen in North Rhine-Westphalia, Germany.

Semiconductors are indispensable components for today's increasingly high performance products, making them equally important to "resources" for a better future. Mitsubishi Electric, a global leader in the field of semiconductors, has secured its top position with continuous innovative research and development and the investment in state-of-the-art production techniques. The worldwide customers of Mitsubishi Electric profit from extensive technical services as well as a broad sales and distribution network.

The success is a result of our expertise in four product areas: High Frequency, Opto and Power Semiconductors as well as TFT-LCD Modules. With regarding quality and reliability as our core values, Mitsubishi Electric Europe B.V. has achieved ISO 9001 and 14001 certification continuously.

Mitsubishi Electric is the first company in Japan, who received the International Railway Industry Standard (IRIS) certification in March 2009. The successful award of IRIS certification reinsures Mitsubishi Electric's high-quality, certified products and services for the railway industry.

#### Power Semiconductors Core Capabilities

Mitsubishi has more than 40 years experience in developing and producing power semiconductors. It has been successfully directed the development of power semiconductor devices starting from current controlled GTO and Bipolar Darlington transistor to the first voltage controlled IGBT. With its constant

innovative research and development in this field, Mitsubishi Electric has secured its top position.

As the first company worldwide Mitsubishi Electric, which mastered all required techniques in chip and package technologies, developed the concept of the Intelligent Power Module (IPM). IPM concept is widely accepted on the market, making Mitsubishi Electric market leader in this field. An integrated solution of inverter, driver and protection circuit reduce the size, cost and development time of the system.

Well proved CSTBT (Carrier Stored Trench Bipolar Transistor) chip technology for IGBT (Insulated Gate Bipolar Transistor) shows better trade-off of saturation voltage and turn-off losses providing suitable modules for a broad spectrum of application fields including motor control, traction, elevators, welding, UPS, white goods, pumps and medical technology. Dedicated IGBT & IPM modules have also attracted renewable energy applications such as wind and solar energy. Mitsubishi Electric power semiconductors ensure greater efficiency and lower power consumption. With better process and chip technology, the highest level of reliability is achieved in high voltage IGBT modules used for traction and Power Transmission & Distribution applications.

The market trend towards more compact modules with high efficiency has been continuously pursued by Mitsubishi Electric. The compact package of Mini-DIP and Super Mini-DIP proved cost effective products for white goods applications.

Through eco-products (RoHS confirmed), environmental technologies and activities, Mitsubishi Electric is working together with its global business partners, to make the world a better place to live. A future aim of Mitsubishi Electric emphasizes on the best utilization and development of new materials and process to offer more compact products at an affordable price with environmental features.



for a greener tomorrow

Eco Changes is the Mitsubishi Electric Group's environmental statement and expresses the Group's stance on environmental management. Through a wide range of technologies and businesses for homes, offices, factories, infrastructure and even outer space, Mitsubishi Electric is striving to contribute to a sustainable society.

[www.ecochanges.eu](http://www.ecochanges.eu)



- 1 IGBT Modules**
- 2 IPM (Intelligent Power Modules)**
- 3 MOSFET Modules**
- 4 High Voltage Devices**
- 5 High Voltage Integrated Circuits (HVIC)**
- 6 Power Loss Calculation Tool (MELCOSIM)**



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## Symbols

## Description

$V_{CES}$	Maximum collector emitter voltage
$I_C$	Collector current
$V_{CEsat}$	Collector emitter saturation voltage
$C_{ies}$	Input capacitance
$C_{oes}$	Output capacitance
$C_{res}$	Reverse transfer capacitance
$t_{d(on)}$	Turn-on delay time
$t_r$	Turn-on rise time
$t_{d(off)}$	Turn-off delay time
$t_f$	Turn-off fall time
$t_{on}$	Turn-on time
$t_{c(on)}$	Turn-on crossover time
$t_{off}$	Turn-off time
$t_{c(off)}$	Turn-off crossover time
$V_F$	Diode forward voltage
$Q_{rr}$	Diode reverse recovery charge
$t_{rr}$	Diode reverse recovery time
$R_{th(j-c)}$	Thermal resistance – junction to case
$R_{th(c-s)}$	Contact thermal resistance – case to heat sink
$V_{isol}$	Isolation voltage
$V_{DSS}$	Maximum drain source sustain voltage
$I_{D(rms)}$	Maximum RMS drain current
$r_{DS(on)}$	Drain source on-state resistance
$V_{SD}$	Reverse diode forward voltage
$E_{ON}$	Turn-on switching energy
$E_{OFF}$	Turn-off switching energy
$f_{c(typ)}$	Recommended typical PWM frequency
$f_c / f_{PWM}$	Maximum PWM frequency
$t_{DEAD}$	Minimum dead time
$V_{RRM}$	Repetitive peak reverse voltage
$I_F$	Diode forward current
$I_{FSM}$	Diode surge forward current

# Ordering Information for Mitsubishi IGBT Modules

## S-Series, S1-Series and SA-Series

S-Series, S1-Series and SA-Series are the latest development of Mitsubishi Electric's state of the art 6<sup>th</sup> Generation Carrier Stored Trench Gate Bipolar Transistor (CSTBT™) and diode chip technology, offering flexible package concept using common platform for dual, six- and seven-packs and CIB (Converter-Inverter-Brake). The comprehensive line-up in 1200V and 1700V of the S-Series, S1-Series and SA-Series ensures 175°C as  $T_{j(max)}$ .

## New Mega Power Dual

New Mega Power Dual combines advantages of new 6<sup>th</sup> Generation CSTBT™ IGBT chip performance and mechanical package structure for easy assembly. 1200V and 1700V line-ups are available.

## NF- and A-Series

Combining 5<sup>th</sup> Generation CSTBT™-chip technology with a Light Punch-through (LPT) wafer, low  $V_{CEsat}$ , high short circuit robustness and reduced gate capacitance are achieved.

## NFH-Series

Combines CSTBT™ chip technology with adopted lifetime control providing excellent switching losses optimised for high frequency switching at 50kHz.

### 1 IGBT

### 2 $I_c = 1800A$

### 3 Internal Connection:

**H** = Single IGBT Module

**D** = Dual IGBT Module

**B** = H-Bridge IGBT Module

**T** = Sixpack IGBT Module

**R** = Sevenpack IGBT Module

**E2** = Back Converter IGBT Module

**E3** = Boost Converter IGBT Module

### 4 Package Style:

**A B U X Y**

### 5 $V_{CES}$ :

**12** = 600V

**24** = 1200V

**34** = 1700V

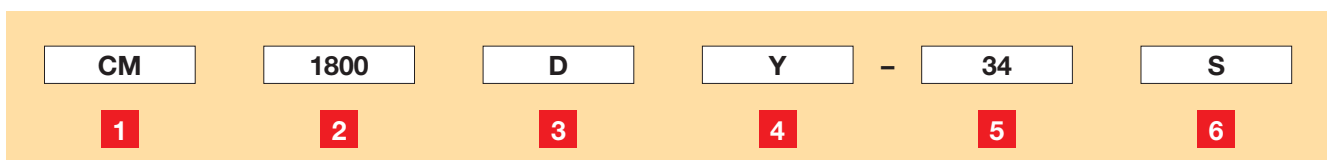
### 6 Chip Technology:

**S/S1/SA** = 6<sup>th</sup> Generation

**NF/A** = 5<sup>th</sup> Generation

**NFH** = 5<sup>th</sup> Generation  
(High Frequency)

## Example:

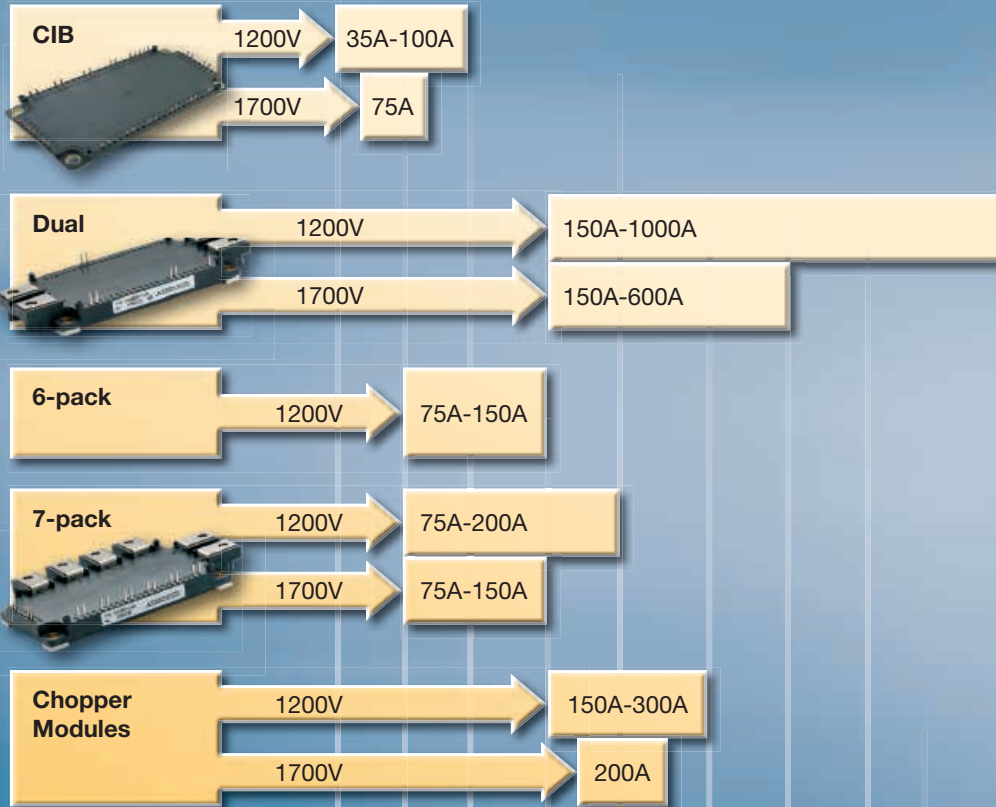




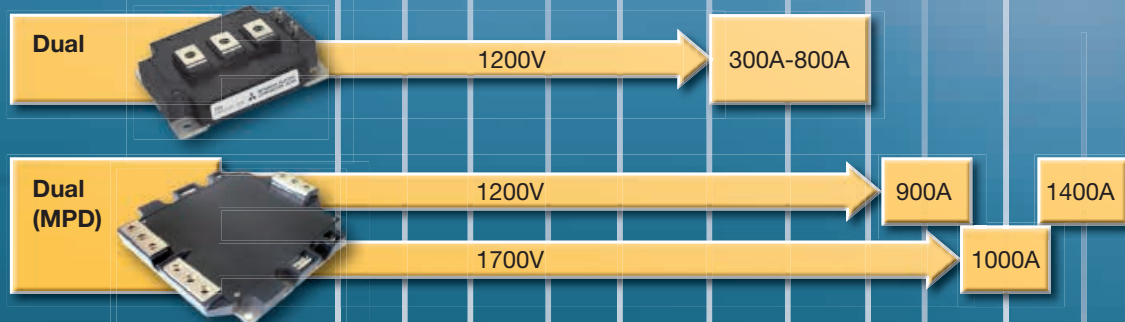
# Overview of IGBT Modules

## 6<sup>th</sup> Generation

### NX-Package (S-Series, S1-Series, SA-Series)



### Standard-Package (S-Series)

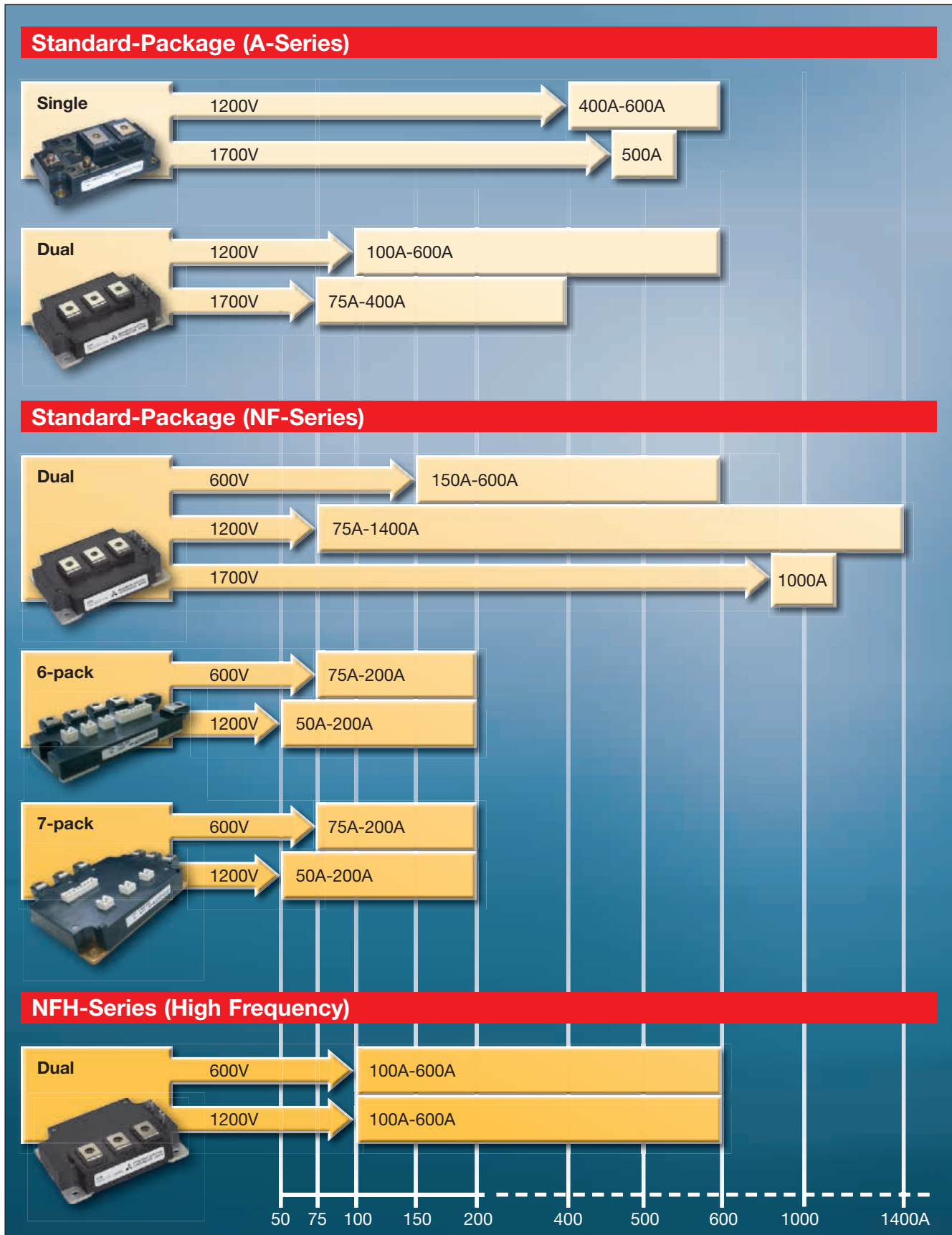


### New Mega Power Dual Package (S-Series)



## 1.02 Overview of IGBT Modules

### 5<sup>th</sup> Generation



## 6<sup>th</sup> Generation IGBT Modules NX-Package (S-Series, S1-Series, SA-Series)



### Applications

- General Purpose Drives
- Photovoltaic Inverters
- UPS

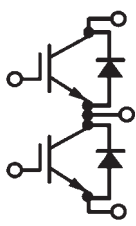
### Features

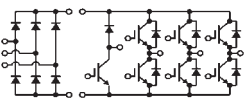
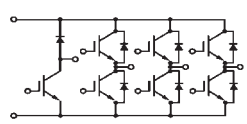
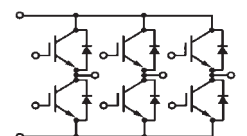
- 6<sup>th</sup> Generation IGBT with CSTBT™ Chip Technology
- Auxiliary C-terminal available for N-side IGBT
- Excellent thermal conductivity by AlN isolation substrate
- For 1200V modules:  $V_{CEsat} (Chip) = 1.7V(typ) @ T_j = 25^{\circ}C$ ; wide SOA @  $V_{CC} = 850V$
- For 1700V modules:  $V_{CEsat} (Chip) = 2.1V(typ) @ T_j = 25^{\circ}C$ ; wide SOA @  $V_{CC} = 1200V$
- More than 10 $\mu s$  short circuit capability and excellent paralleling characteristics
- New Free Wheel Diode Chip with optimised trade-off between  $V_F$  and  $E_{rr}$
- $T_{j(max)} = 175^{\circ}C$
- Comprehensive line-up in 1200V, 1700V

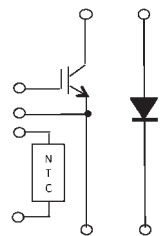


## 1.03 6<sup>th</sup> Generation IGBT Modules NX-Package (S-Series, S1-Series, SA-Series)

### Line-up NX-Package

Symbol	Circuit Diagram	V <sub>CEs</sub> (V)	I <sub>c</sub> (A)					
			150	200/225	300	450	600	1000
D (2 in 1)		1200	CM150DX-24S	CM200DX-24S CM225DX-24S1	CM300DX-24S CM300DX-24S1	CM450DX-24S CM450DX-24S1	CM600DXL-24S* CM600DX-24S1	CM1000DXL-24S*
		1700	CM150DX-34SA	CM200DX-34SA	CM300DX-34SA	CM450DXL-34SA*	CM600DXL-34SA*	

Symbol	Circuit Diagram	V <sub>CEs</sub> (V)	I <sub>c</sub> (A)					
			35	50	75	100	150	200
M (CIB)		1200	CM35MXA-24S	CM50MXA-24S	CM75MXA-24S	CM100MXA-24S		
		1700			CM75MXA-34SA**			
R (7 in 1)		1200			CM75RX-24S	CM100RX-24S CM100RX-24S1	CM150RX-24S CM150RX-24S1	CM200RXL-24S*
		1700			CM75RX-34SA		CM150RXL-34SA*	
T (6 in 1)		1200			CM75TX-24S	CM100TX-24S CM100TX-24S1	CM150TX-24S CM150TX-24S1	
		1700						

Symbol	Circuit Diagram	V <sub>CEs</sub> (V)	I <sub>c</sub> (A)		
			150	200	300
EX		1200	CM150EXS-24S	CM200EXS-24S	CM300EXS-24S
		1700		CM200EXS-34SA	

\*Large package type (122mm x 122mm)

\*\*Rectifier Diode 1800V max.

Extensions Type Number:

-S: S-Series → see page 12

-S1: S1-Series → see page 12

-SA: SA-Series → see page 13

### 1.03A 6<sup>th</sup> Generation IGBT Modules NX-Package (S-Series)

Type Number	Maximum Ratings			Electrical Characteristics (T <sub>j</sub> = 25°C)									Free Wheel Diode (T <sub>j</sub> = 25°C)			Thermal Characteristics			Package- No.
	V <sub>CES</sub> (V)	I <sub>c</sub> (A)	V <sub>isol</sub> (V)	V <sub>CEsat</sub> (Chip) (V)		C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>F</sub> (Chip) (V)	Q <sub>rr</sub> (μC)	t <sub>rr</sub> (ns)	IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)	
				Typ.	Max.	Max.	Max.	Max.	t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)	Typ.	Typ.	Max.	Max.	Max.	Typ.	
<b>1200 Volt Dual IGBT Modules NX6-Series (CIB)</b>																			
CM35MXA-24S	1200	35	2500	1.7	2.15	3.5	0.7	0.06	300	200	600	300	1.7	1.9	300	0.420	0.690	0.015	NX1
CM50MXA-24S	1200	50	2500	1.7	2.15	5.0	1.0	0.08	300	200	600	300	1.7	2.7	300	0.350	0.630	0.015	NX1
CM75MXA-24S	1200	75	2500	1.7	2.15	7.5	1.5	0.13	300	200	600	300	1.7	4.0	300	0.250	0.400	0.015	NX1
CM100MXA-24S	1200	100	2500	1.7	2.15	10	2.0	0.17	300	200	600	300	1.7	5.3	300	0.200	0.290	0.015	NX1
<b>1200 Volt IGBT Modules NX6-Series (7 in 1)</b>																			
CM75RX-24S	1200	75	2500	1.7	2.15	7.5	1.5	0.13	300	200	600	300	1.7	4.0	300	0.250	0.400	0.015	NX2
CM100RX-24S	1200	100	2500	1.7	2.15	10	2.0	0.17	300	200	600	300	1.7	5.3	300	0.200	0.290	0.015	NX2
CM150RX-24S	1200	150	2500	1.7	2.15	15	3.0	0.25	800	200	600	300	1.7	8.0	300	0.130	0.230	0.015	NX2
CM200RX-24S	1200	200	4000	1.8	2.25	20	4.0	0.33	800	200	600	300	1.8	10.7	300	0.100	0.190	7.000	NX9
<b>1200 Volt IGBT Modules NX6-Series (6 in 1)</b>																			
CM75TX-24S	1200	75	2500	1.7	2.15	7.5	1.5	0.13	300	200	600	300	1.7	4.0	300	0.250	0.400	0.015	NX3
CM100TX-24S	1200	100	2500	1.7	2.15	10	2.0	0.17	300	200	600	300	1.7	5.3	300	0.200	0.290	0.015	NX3
CM150TX-24S	1200	150	2500	1.7	2.15	15	3.0	0.25	800	200	600	300	1.7	8.0	300	0.130	0.230	0.015	NX3
<b>1200 Volt IGBT Modules NX6-Series (2 in 1)</b>																			
CM150DX-24S	1200	150	2500	1.7	2.15	15	3.0	0.25	800	200	600	300	1.7	8.0	300	0.130	0.230	0.015	NX4
CM200DX-24S	1200	200	2500	1.7	2.15	20	4.0	0.33	800	200	600	300	1.7	10.7	300	0.100	0.190	0.015	NX4
CM300DX-24S	1200	300	2500	1.7	2.15	30	6.0	0.5	800	200	600	300	1.7	16	300	0.066	0.120	0.015	NX4
CM450DX-24S	1200	450	2500	1.7	2.15	45	9.0	0.75	800	200	600	300	1.7	24	300	0.044	0.078	0.015	NX4
CM600DX-24S	1200	600	2500	1.7	2.15	60	12	1.00	800	200	600	300	1.7	32	300	0.033	0.063	0.007	NX5
CM1000DX-24S	1200	900	2500	1.7	2.15	100	20	1.70	800	200	600	300	1.7	53.3	300	0.020	0.038	0.007	NX5
<b>1200 Volt IGBT Modules (Chopper)</b>																			
CM150EXS-24S	1200	150	4000	1.85	2.25	15	3.0	0.25	800	200	600	300	1.85	8.0	300	0.130	0.230	0.025	NXS
CM200EXS-24S	1200	200	4000	1.85	2.25	20	4.0	0.33	800	200	600	300	1.85	10.7	300	0.100	0.190	0.025	NXS
CM300EXS-24S	1200	300	4000	1.85	2.25	30	6.0	0.50	800	200	600	300	1.85	16.0	300	0.065	0.115	0.025	NXS

### 1.03B 6<sup>th</sup> Generation IGBT Modules NX-Package (S1-Series)

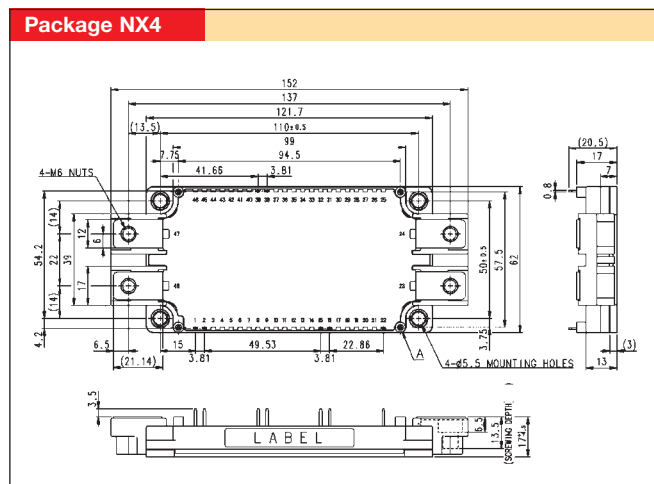
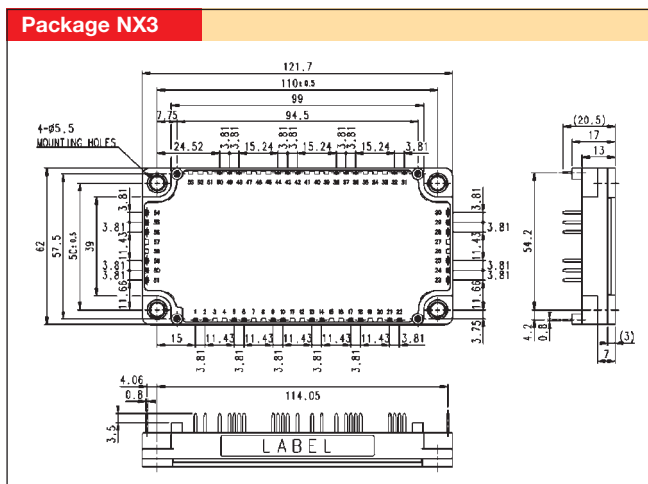
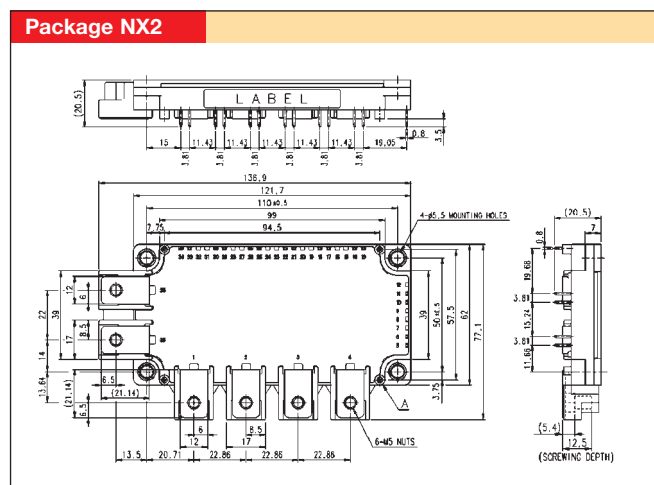
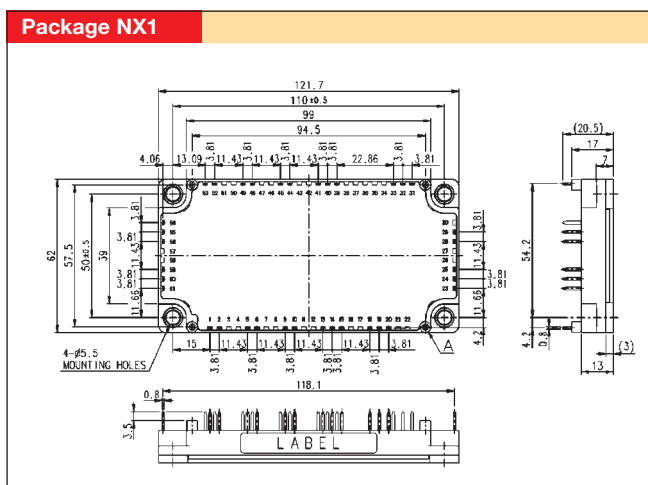
Type Number	Maximum Ratings			Electrical Characteristics (T <sub>j</sub> = 25°C)									Free Wheel Diode (T <sub>j</sub> = 25°C)			Thermal Characteristics			Package- No.
	V <sub>CES</sub> (V)	I <sub>c</sub> (A)	V <sub>isol</sub> (V)	V <sub>CEsat</sub> (Chip) (V)		C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>F</sub> (Chip) (V)	Q <sub>rr</sub> (μC)	t <sub>rr</sub> (ns)	IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)	
				Typ.	Max.	Max.	Max.	Max.	t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)	Typ.	Typ.	Max.	Max.	Max.	Typ.	
<b>1200 Volt IGBT Modules NX6-Series (7 in 1)</b>																			
CM100RX-24S1	1200	100	4000	1.7	2.15	10	2.0	0.17	300	200	600	300	2.50	5.0	300	0.240	0.370	0.015	NX6
CM150RX-24S1	1200	150	4000	1.7	2.15	15	3.0	0.25	800	200	600	300	2.50	6.0	300	0.160	0.260	0.015	NX6
<b>1200 Volt IGBT Modules NX6-Series (6 in 1)</b>																			
CM100TX-24S1	1200	100	4000	1.7	2.15	10	2.0	0.17	300	200	600	300	2.50	5.0	300	0.240	0.370	0.015	NX7
CM150TX-24S1	1200	150	4000	1.7	2.15	15	3.0	0.25	800	200	600	300	2.50	6.0	300	0.160	0.260	0.015	NX7
<b>1200 Volt IGBT Modules NX6-Series (2 in 1)</b>																			
CM225DX-24S1	1200	225	4000	1.8	2.25	20	4.0	0.33	800	200	600	300	2.65	8.0	300	0.120	0.180	0.015	NX8
CM300DX-24S1	1200	300	4000	1.7	2.15	30	6.0	0.50	800	200	600	300	2.50	8.0	300	0.081	0.130	0.015	NX8
CM450DX-24S1	1200	450	4000	1.7	2.15	45	9.0	0.75	800	200	600	300	2.50	14.0	300	0.054	0.086	0.015	NX8
CM600DX-24S1	1200	600	4000	1.9	2.35	50	10.0	0.84	800	200	600	300	2.70	24.0	300	0.045	0.072	0.015	NX8

## 1.03C 6<sup>th</sup> Generation IGBT Modules NX-Package (SA-Series)

Type Number	Maximum Ratings			Electrical Characteristics (T <sub>j</sub> = 25°C)								Free Wheel Diode (T <sub>j</sub> = 25°C)			Thermal Characteristics			Package- No.	
	V <sub>CES</sub> (V)	I <sub>c</sub> (A)	V <sub>isol</sub> (V)	V <sub>CEsat</sub> (Chip) (V)		C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>F</sub> (Chip) (V)	Q <sub>rr</sub> (μC)	t <sub>rr</sub> (ns)	IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)		R <sub>th(c-s)</sub> (K/W)
				Typ.	Max.				t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)							
<b>1700 Volt IGBT Modules NX6-Series (CIB)</b>																			
CM75MXA-34SA	1700	75	4000	1.9	2.4	20	1.6	0.36	200	100	700	600	4.0	2.0	200	0.180	0.270	15	NX6
<b>1700 Volt IGBT Modules NX6-Series (7 in 1)</b>																			
CM75RX-34SA	1700	75	4000	1.9	2.4	20	1.6	0.36	200	100	700	600	4.0	2.0	200	0.18	0.207	15	NX6
CM150RXL-34SA*	1700	150	4000	1.9	2.4	40	3.3	0.73	400	100	700	600	4.0	5.0	300	0.100	0.160	7	NX9
<b>1700 Volt IGBT Modules NX6-Series (2 in 1)</b>																			
CM150DX-34SA	1700	150	4000	1.9	2.4	40	3.3	0.73	400	100	700	600	4.0	5.0	300	0.100	0.160	15	NX7
CM200DX-34SA	1700	200	4000	1.9	2.4	53	4.3	0.97	400	100	700	600	4.0	8.0	300	0.075	0.120	15	NX7
CM300DX-34SA	1700	300	4000	1.9	2.4	79	6.5	1.50	500	100	800	600	4.0	11.0	300	0.050	0.080	15	NX7
CM450DXL-34SA*	1700	450	4000	1.9	2.4	119	9.8	2.20	900	150	900	400	4.0	17.0	300	0.034	0.052	7	NX5
CM600DXL-34SA*	1700	600	4000	1.9	2.4	158	13	2.90	900	150	900	400	4.0	23.0	300	0.026	0.039	7	NX5
<b>1700 Volt IGBT Modules (Chopper)</b>																			
CM200EXS-34SA	1700	200	4000	2.2	2.7	35	1.5	0.35	400	70	600	600	4.1	10.0	200	0.075	0.120	0.025	NXS

\*Large package type (122mm x 122mm)

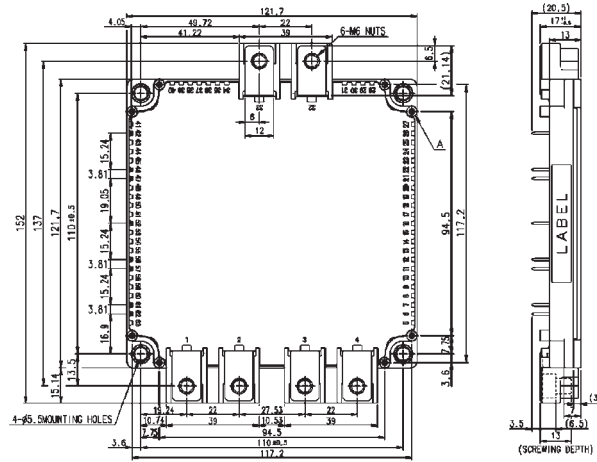
## 1.03 6<sup>th</sup> Generation NX-Package types



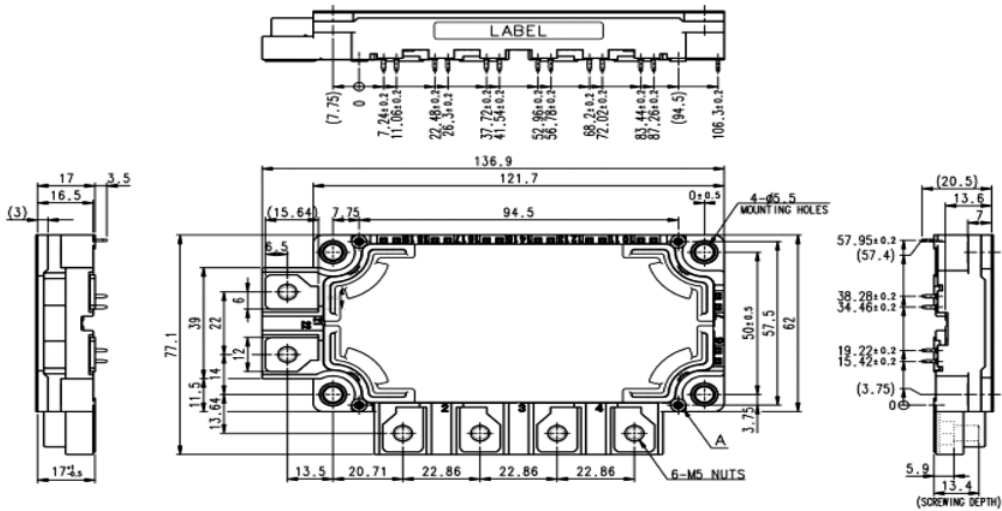
Dimensions in mm

### 1.03 6<sup>th</sup> Generation NX-Package types

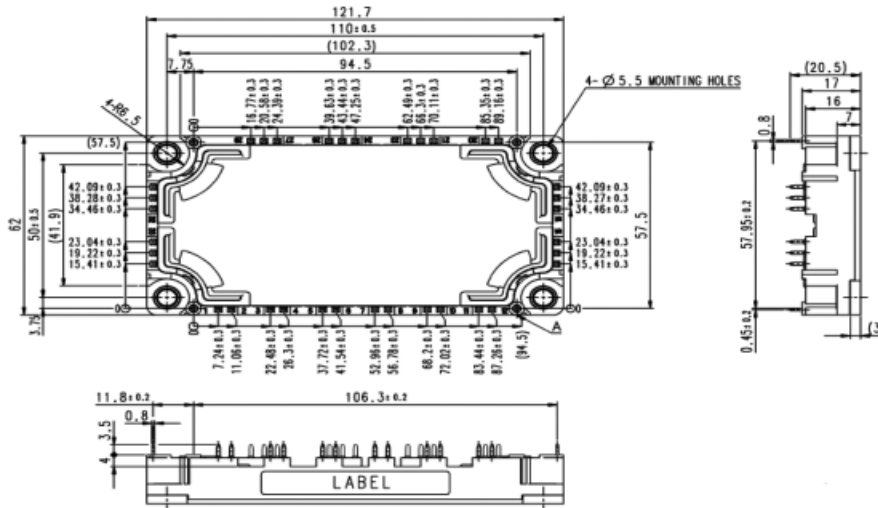
Package NX5



Package NX6

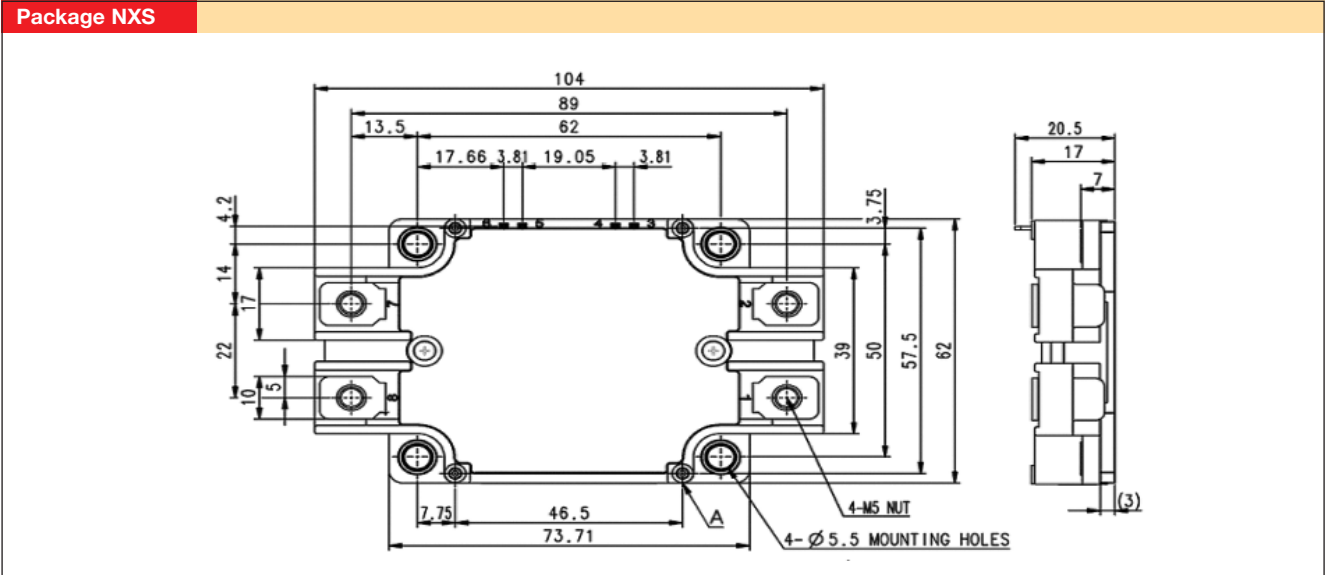
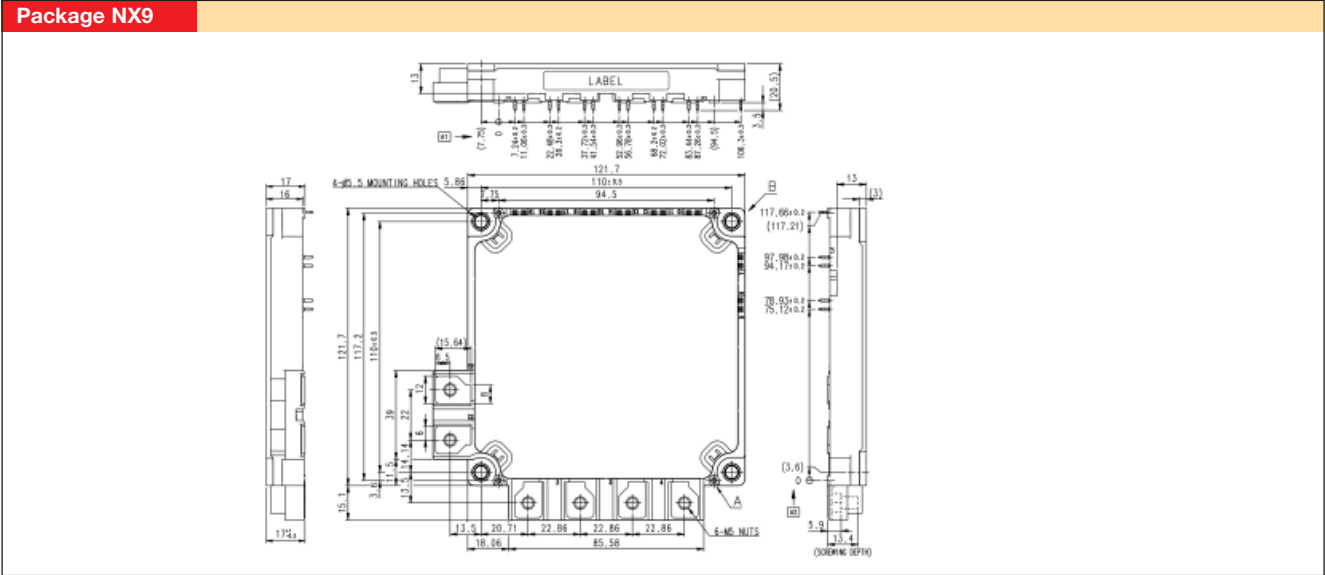
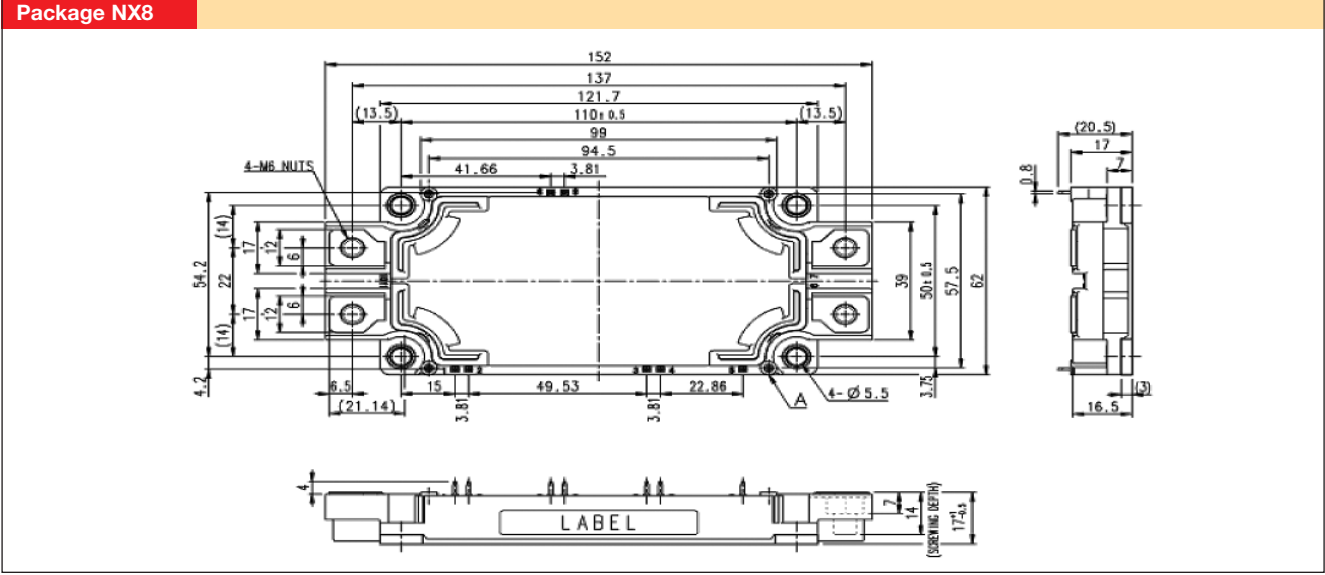


Package NX7



Dimensions in mm

## 1.03 6<sup>th</sup> Generation NX-Package types



Dimensions in mm



# 6<sup>th</sup> Generation IGBT Modules Standard-Package (S-Series) and Mega Power Dual



## Applications

- General Purpose Drives
- Photovoltaic Inverters
- UPS

## Features

- 6<sup>th</sup> Generation IGBT with CSTBT™ Chip Technology
- Excellent thermal conductivity by AlN isolation substrate
- More than 10μs short circuit capability and excellent paralleling characteristics
- New Free Wheel Diode Chip with optimised trade-off between  $V_F$  and  $E_{rr}$
- $T_{j(max)} = 175^\circ\text{C}$

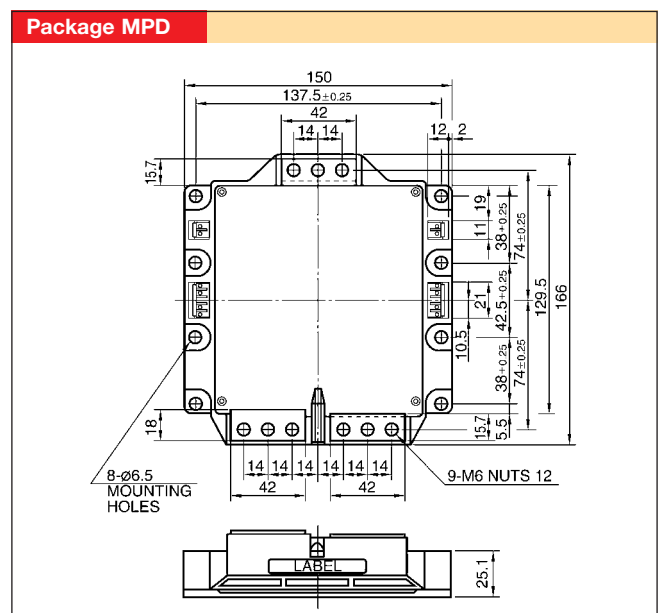
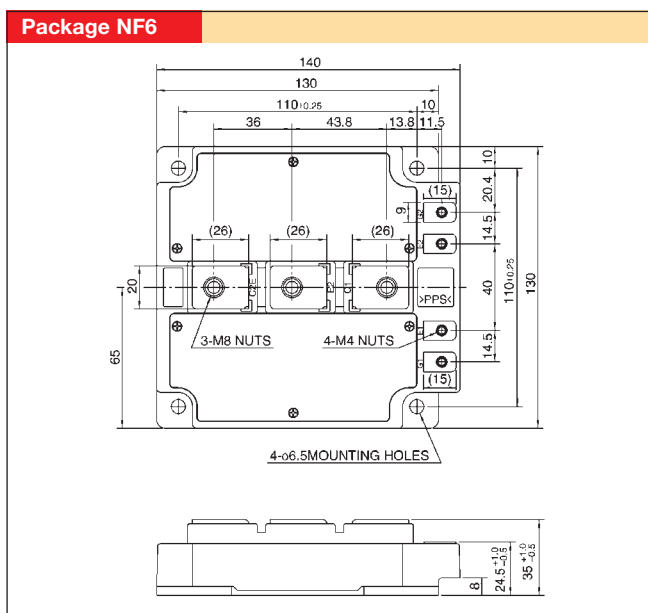
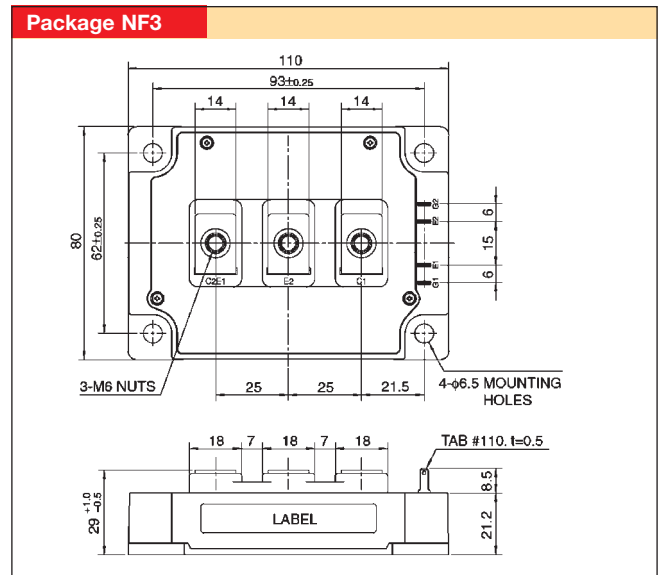
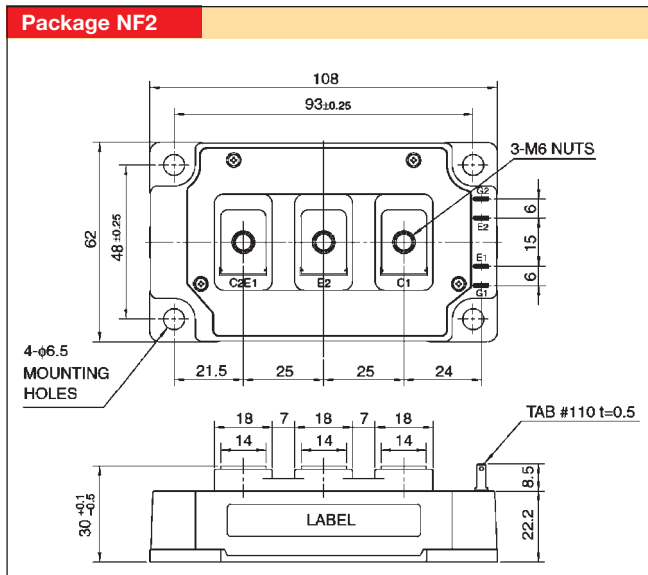


## Line-up Standard-Package

Symbol	Circuit Diagram	$V_{CES}$ (V)	$I_C$ (A)						
			300	400	600	800	900	1000	1400
D (2 in 1)		1200	CM300DY-24S	CM450DY-24S	CM600DY-24S	CM800DY-24S	CM900DUC-24S		CM1400DUC-24S
		1700						CM1000DUC-34S	

## 1.04 6<sup>th</sup> Generation IGBT Modules Standard-Package (S-Series) and MPD

Type Number	Maximum Ratings			Electrical Characteristics (T <sub>j</sub> = 25°C)									Free Wheel Diode (T <sub>j</sub> = 25°C)			Thermal Characteristics			Package- No.
	V <sub>CES</sub> (V)	I <sub>c</sub> (A)	V <sub>isol</sub> (V)	V <sub>CEsat</sub> (Chip) (V)		C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>F</sub> (Chip) (V)	Q <sub>rr</sub> (μC)	t <sub>rr</sub> (ns)	IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)	
				Typ.	Max.				t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)							
<b>1200/1700 Volt IGBT Modules (2 in 1)</b>																			
CM300DY-24S	1200	300	2500	1.85	2.25	30	6.0	0.50	800	200	600	300	1.85	16.0	300	0.066	0.120	0.020	NF2
CM450DY-24S	1200	450	2500	1.85	2.25	45	9.0	0.75	800	200	600	300	1.85	24.0	300	0.045	0.068	0.018	NF3
CM600DY-24S	1200	600	2500	1.85	2.25	60	12.0	1.00	800	200	600	300	1.85	32.0	300	0.037	0.060	0.018	NF3
CM800DY-24S	1200	800	2500	1.95	2.40	80	16.0	1.32	800	200	600	300	1.85	42.8	300	0.028	0.045	0.015	NF6
CM900DUC-24S	1200	900	2500	1.55	1.90	90	18.0	1.50	900	250	950	350	1.65	50.0	450	0.023	0.039	0.006	MPD
CM1400DUC-24S	1200	1400	2500	1.55	1.90	150	30.0	2.50	900	250	950	350	1.65	90.0	450	0.016	0.026	0.006	MPD
CM1000DUC-34SA	1700	1000	4000	1.90	2.40	260	27.0	5.00	900	350	1250	400	4.00	270.0	400	0.015	0.024	0.006	MPD



Dimensions in mm

## 6<sup>th</sup> Generation IGBT Modules New Mega Power Dual Package (S-Series)

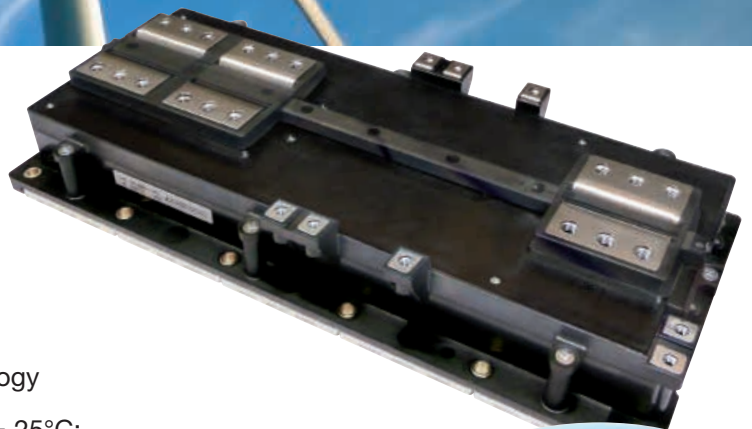


### Applications

- Renewable Energy
- High Power Energy Conversion
- Medium Voltage Drives

### Features

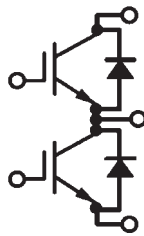
- 6<sup>th</sup> Generation IGBT with CSTBT™ Chip Technology
- For 1200V modules:  $V_{CEsat(Chip)} = 1.7V(\text{typ}) @ T_j = 25^\circ\text{C}$ ;  
wide SOA @  $V_{cc} = 850V$
- For 1700V modules:  $V_{CEsat(Chip)} = 2.1V(\text{typ}) @ T_j = 25^\circ\text{C}$ ;  
wide SOA @  $V_{cc} = 1200V$
- $T_{j(max)} = 175^\circ\text{C}$
- New solderless lightweight Al-baseplate  
→ high  $\Delta T_c$  temperature cycling capability
- Wide internal chip layout → low  $R_{th(j-f)}$
- Minimized internal package inductance  $L_{PN} = 5.25nH$
- AC and DC main terminals separated → easy DC-bus design
- Multi-hole main terminals → low contact resistance and reliable long-term electrical connection
- Integrated NTC for  $T_c$ -sensing
- Auxiliary C-terminals available for P- and N-side IGBT

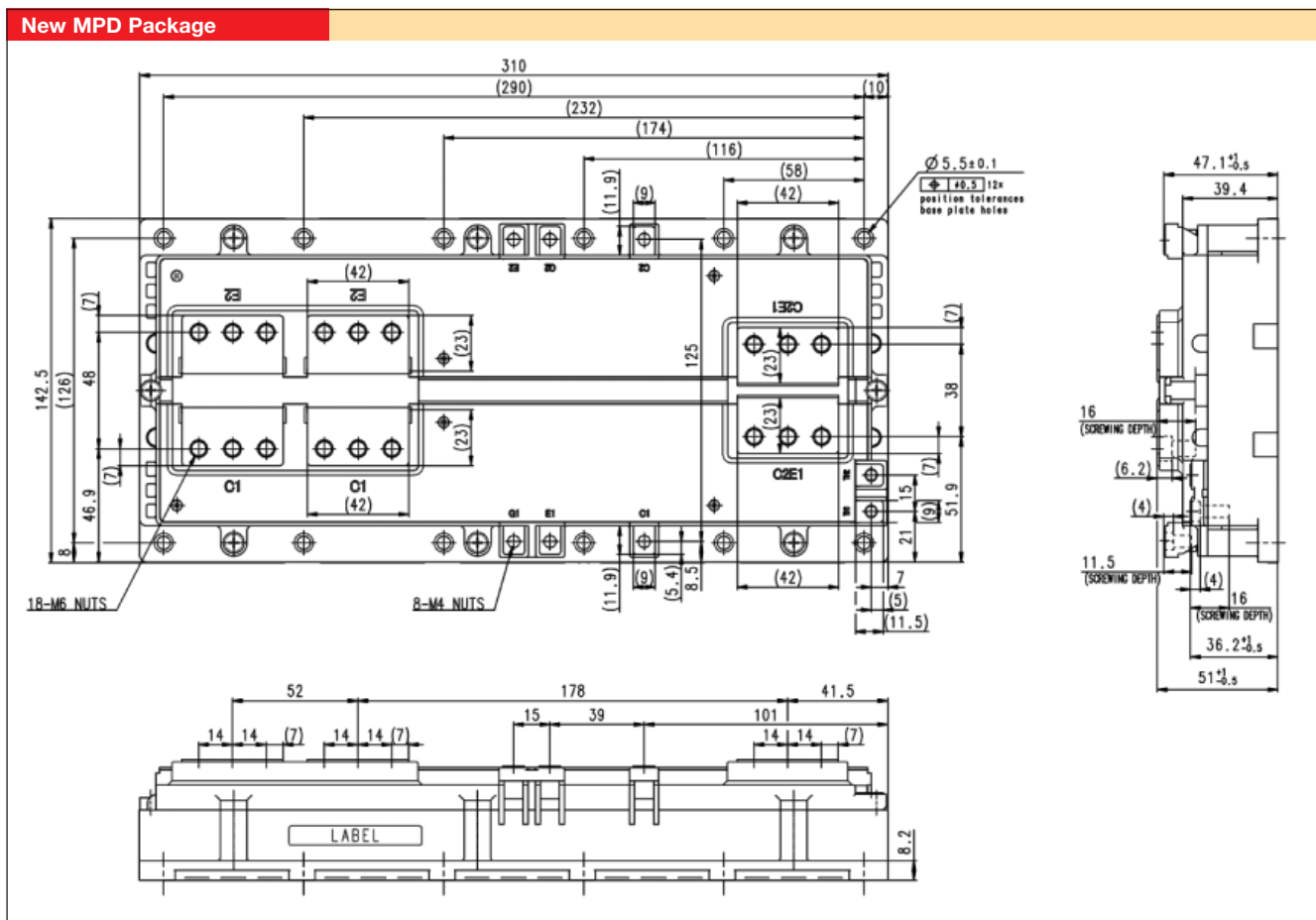


For  
Mega Power Dual  
IGBT Modules (S-Series)  
please refer to  
page 16

## 1.05 6<sup>th</sup> Generation IGBT Modules New MPD Package (S-Series)

### Line-up New MPD

Symbol	Circuit Diagram	V <sub>CE(S)</sub> (V)	I <sub>c</sub> (A)	
			1800	2500
D		1200		CM2500DY-24S
		1700	CM1800DY-34S	



Dimensions in mm

Remark: Mega Power Dual IGBT Modules with 6<sup>th</sup> Gen. IGBT Chips see page 16.

## 5<sup>th</sup> Generation IGBT Modules Standard-Package (A-Series)



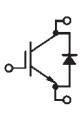
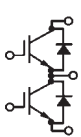
### Features

- Combining 5<sup>th</sup> Generation CSTBT™ (Carrier Stored Trench Gate Bipolar Transistor) chip technology with a LPT (Light Punch-through) wafer for:
  - Low  $V_{CEsat}$
  - High Short Circuit Robustness
  - Reduced Gate Capacitance
- Excellent thermal conductivity by AlN isolation substrate
- Low internal inductance



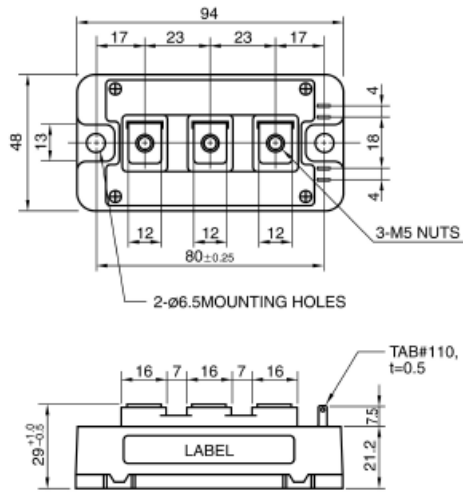
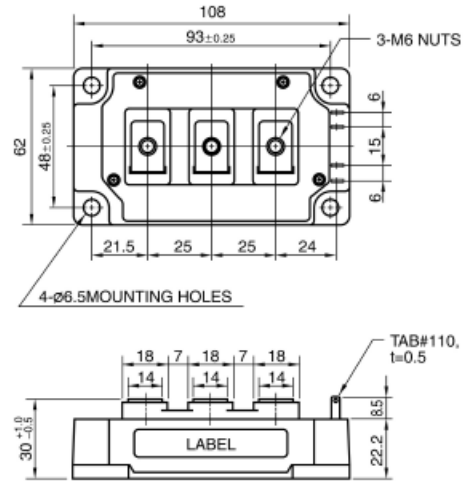
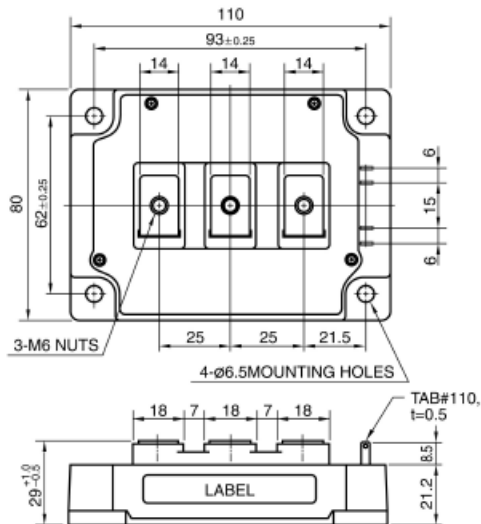
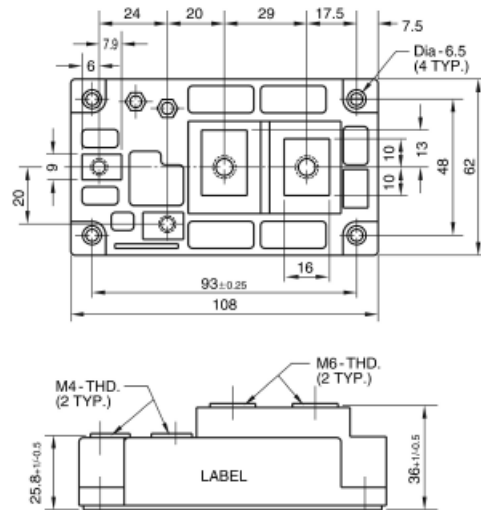
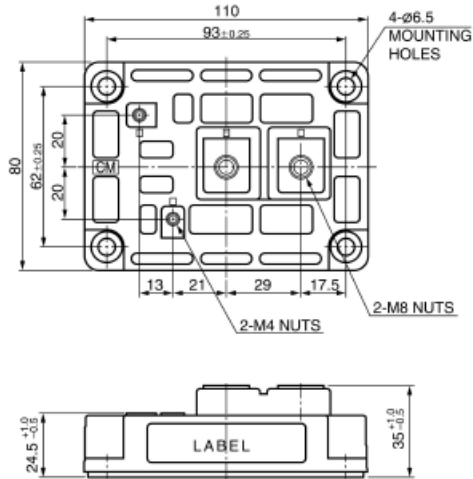
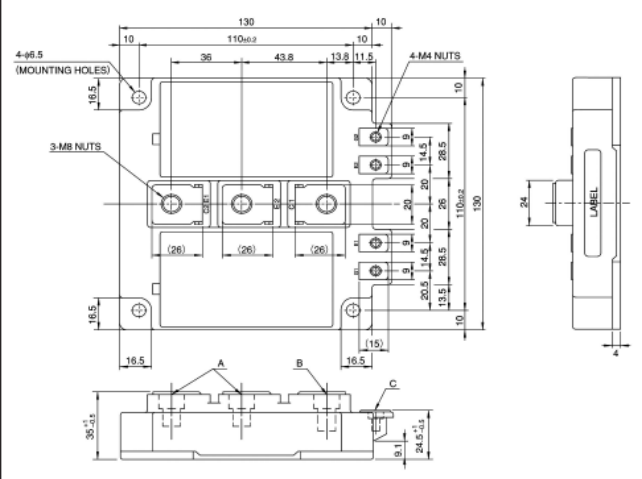
## 1.06 5<sup>th</sup> Generation IGBT Modules Standard-Package (A-Series)

### Line-up A-Series

Symbol	Circuit Diagram	V <sub>CEs</sub> (V)	I <sub>c</sub> (A)														
			75	100	150	200	300	400	500	600	800						
H		1200										CM400HA-24A			CM600HA-24A CM600HB-24A		
		1700													CM500HA-34A		
D		1200		CM100DY-24A	CM150DY-24A	CM200DY-24A	CM300DY-24A	CM400DY-24A							CM600DY-24A		
		1700	CM75DY-34A	CM100DY-34A	CM150DY-34A	CM200DY-34A	CM300DY-34A	CM400DY-34A									

Type Number	Maximum Ratings			Electrical Characteristics (T <sub>j</sub> = 25°C)									Free Wheel Diode (T <sub>j</sub> = 25°C)			Thermal Characteristics			Package-No.
	V <sub>CEs</sub> (V)	I <sub>c</sub> (A)	V <sub>isol</sub> (V)	V <sub>CEsat</sub> (V)		C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>F</sub> (V)	Q <sub>rr</sub> (μC)	t <sub>rr</sub> (ns)	IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)	
				Typ.	Max.				Max.	Max.	Max.	t <sub>d(on)</sub> (ns)							
<b>1200 Volt Dual IGBT Modules A-Series</b>																			
CM100DY-24A	1200	100	2500	2.1	3.0	17.5	1.5	0.34	100	70	400	350	3.8	5.0	150	0.186	0.340	0.022	A1
CM150DY-24A	1200	150	2500	2.1	3.0	23.0	2.0	0.45	130	100	450	350	3.8	6.0	150	0.130	0.230	0.022	A1
CM200DY-24A	1200	200	2500	2.1	3.0	35.0	3.0	0.68	130	100	450	350	3.8	9.0	150	0.093	0.170	0.022	A1
CM300DY-24A	1200	300	2500	2.1	3.0	47.0	4.0	0.90	550	180	600	350	3.8	9.0	250	0.066	0.120	0.020	A2
CM400DY-24A	1200	400	2500	2.1	3.0	70.0	6.0	1.40	550	180	600	350	3.8	16.0	250	0.046	0.085	0.020	A3
CM600DY-24A	1200	600	2500	2.1	3.0	94.0	8.0	1.80	660	190	700	350	3.8	19.0	250	0.034	0.062	0.018	A3
<b>1200 Volt Single IGBT Modules A-Series</b>																			
CM400HA-24A	1200	400	2500	2.1	3.0	70	6.0	1.40	550	180	600	350	3.8	14.7	250	0.053	0.080	0.020	A4
CM600HA-24A	1200	600	2500	2.1	3.0	105	9.0	2.00	660	190	700	350	3.8	19.0	250	0.034	0.053	0.020	A4
CM600HB-24A	1200	600	2500	2.1	3.0	105	9.0	2.00	660	190	700	350	3.8	19.0	250	0.034	0.053	0.015	A5
<b>1700 Volt Dual IGBT Modules A-Series</b>																			
CM75DY-34A	1700	75	3500	2.2	2.8	18.5	2.1	0.4	200	150	550	350	3.0	7.5	300	0.160	0.290	0.022	A1
CM100DY-34A	1700	100	3500	2.2	2.8	24.7	2.8	0.53	200	150	550	350	3.0	10	300	0.130	0.210	0.022	A1
CM150DY-34A	1700	150	3500	2.2	2.8	37.0	4.2	0.8	550	190	750	350	3.0	15	450	0.078	0.150	0.020	A2
CM200DY-34A	1700	200	3500	2.2	2.8	49.4	5.6	1.06	550	190	750	350	3.0	20	450	0.063	0.110	0.020	A2
CM300DY-34A	1700	300	3500	2.2	2.8	74.0	8.4	1.6	600	200	850	350	3.0	30	450	0.043	0.072	0.020	A3
CM400DY-34A	1700	400	3500	2.2	2.8	98.8	11.2	2.12	950	300	1000	350	3.0	40	450	0.033	0.055	0.019	A6
<b>1700 Volt Single IGBT Modules A-Series</b>																			
CM500HA-34A	1700	500	3500	2.3	3.0	120	14	2.6	900	500	1200	350	3.2	50	650	0.025	0.042	0.015	A4

## 1.06 5<sup>th</sup> Generation IGBT Modules Standard-Package (A-Series)

**Package A1**

**Package A2**

**Package A3**

**Package A4**

**Package A5**

**Package A6**


Dimensions in mm

## 5<sup>th</sup> Generation IGBT Modules Standard-Package (NF-Series)



### Features

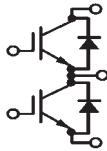
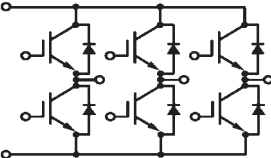
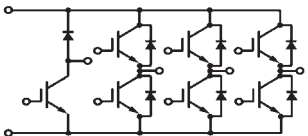
- Combining 5<sup>th</sup> Generation CSTBT™ (Carrier Stored Trench Gate Bipolar Transistor chip technology with a LPT (Light Punch-through) wafer for:
  - Low  $V_{CEsat}$   
(Typ. 1.7V @  $T_j = 125^\circ\text{C}$  for 600V and 2V @  $T_j = 125^\circ\text{C}$  for 1200V)
  - High Short Circuit Robustness
  - Reduced Gate Capacitance
- Standard dual package equal to well accepted H-Series package
- Excellent thermal conductivity by AlN isolation substrate
- Low internal inductance (half of H-Series)
- Also available as Mega Power Dual IGBT Modules 1200V (900 & 1400A) and 1700V (1000A) for High Power UPS, Distributed Power Generation and General Purpose Inverters (Chopper modules on request)

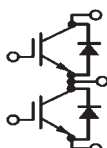




## 1.07 5<sup>th</sup> Generation IGBT Modules Standard-Package (NF-Series)

### Line-up NF-Series

Symbol	Circuit Diagram	V <sub>CES</sub> (V)	I <sub>C</sub> (A)				
			50	75	100	150	200
D		600				CM150DY-12NF	CM200DY-12NF
		1200		CM75DY-24NF	CM100DY-24NF	CM150DY-24NF	CM200DY-24NF
T		600		CM75TL-12NF	CM100TL-12NF	CM150TL-12NF	CM200TL-12NF
		1200	CM50TL-24NF	CM75TL-24NF	CM100TL-24NF	CM150TL-24NF	CM200TL-24NF
R		600		CM75RL-12NF	CM100RL-12NF	CM150RL-12NF	CM200RL-12NF
		1200	CM50RL-24NF	CM75RL-24NF	CM100RL-24NF	CM150RL-24NF	CM200RL-24NF

Symbol	Circuit Diagram	V <sub>CES</sub> (V)	I <sub>C</sub> (A)					
			300	400	600	900	1000	1400
D		600	CM300DY-12NF	CM400DY-12NF	CM600DY-12NF			
		1200	CM300DY-24NF	CM400DY-24NF	CM600DU-24NF	CM900DUC-24NF*		CM1400DUC-24NF*
		1700					CM1000DUC-34NF*	

\*Mega Power Dual IGBT Modules (NF-Series). Chopper Modules for 1000A/1700V and 1400A/1200V available.

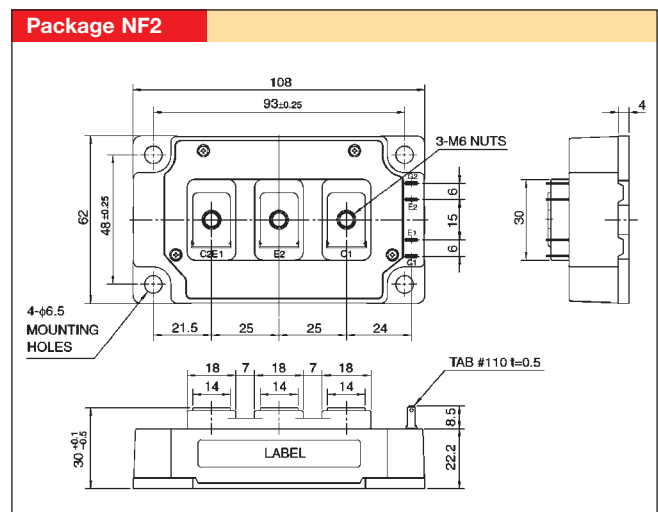
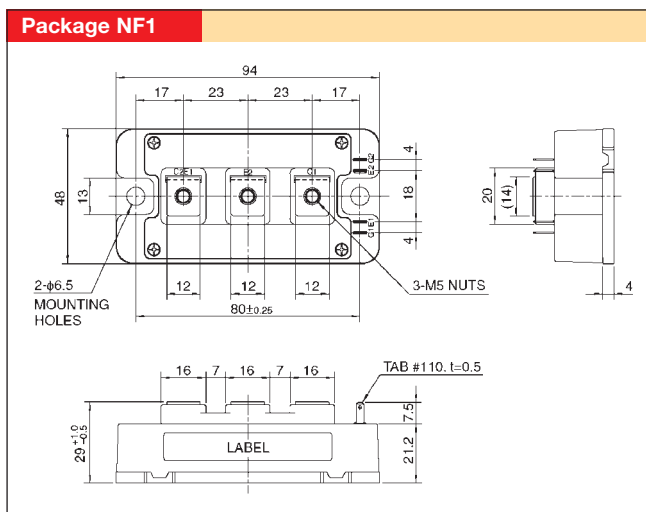
Mega Power Dual IGBT Modules with 6<sup>th</sup> Gen. IGBT chips (S-Series) see page 17.

Type Number	Maximum Ratings			Electrical Characteristics (T <sub>j</sub> = 25°C)									Free Wheel Diode (T <sub>j</sub> = 25°C)			Thermal Characteristics			Package-No.
	V <sub>CES</sub> (V)	I <sub>C</sub> (A)	V <sub>isol</sub> (V)	V <sub>CESat</sub> (V)	C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>F</sub> (V)	Q <sub>rr</sub> (μC)	t <sub>rr</sub> (ns)	IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)		
								t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)							Max.	
<b>600 Volt IGBT Modules NF-Series (2 in 1)</b>																			
CM150DY-12NF	600	150	2500	1.7	2.2	23	2.8	0.9	120	100	300	300	2.6	2.5	150	0.160	0.290	0.02	NF1
CM200DY-12NF	600	200	2500	1.7	2.2	30	3.7	1.2	120	120	300	300	2.6	3.5	150	0.130	0.220	0.02	NF1
CM300DY-12NF	600	300	2500	1.7	2.2	45	5.5	1.8	120	120	350	300	2.6	5.5	150	0.093	0.160	0.02	FN1
CM400DY-12NF	600	400	2500	1.7	2.2	60	7.3	2.4	300	200	450	300	2.6	6.8	250	0.066	0.110	0.02	NF2
CM600DY-12NF	600	600	2500	1.7	2.2	90	11	3.6	500	300	750	300	2.6	8.7	250	0.046	0.078	0.02	NF3
<b>600 Volt IGBT Modules NF-Series (6 in 1)</b>																			
CM75TL-12NF	600	75	2500	1.7	2.2	11.3	1.4	0.45	120	100	300	300	2.8	1.2	100	0.29	0.510	0.085	NF4
CM100TL-12NF	600	100	2500	1.7	2.2	15	1.9	0.6	120	100	300	300	2.8	2.1	120	0.23	0.410	0.085	NF4
CM150TL-12NF	600	150	2500	1.7	2.2	23	2.8	0.9	120	100	300	300	2.8	2.5	150	0.17	0.310	0.085	NF4
CM200TL-12NF	600	200	2500	1.7	2.2	30	3.7	1.2	120	100	300	300	2.8	4.8	150	0.14	0.220	0.051	NF5

## 1.07 5<sup>th</sup> Generation IGBT Modules Standard-Package (NF-Series)

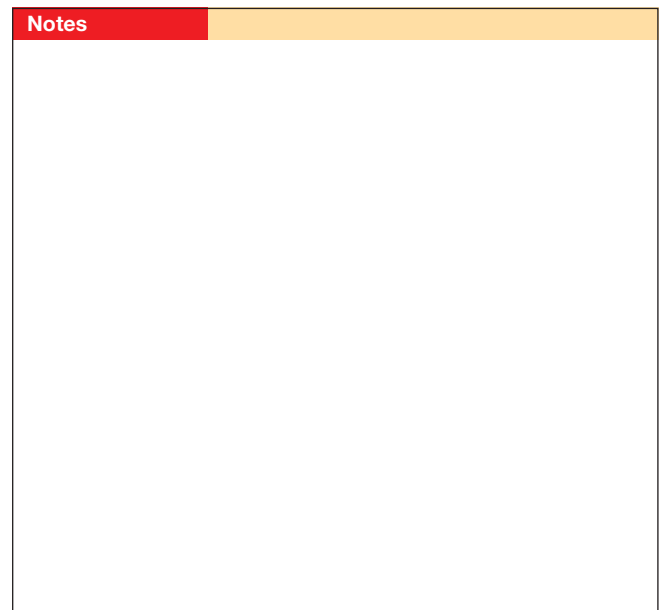
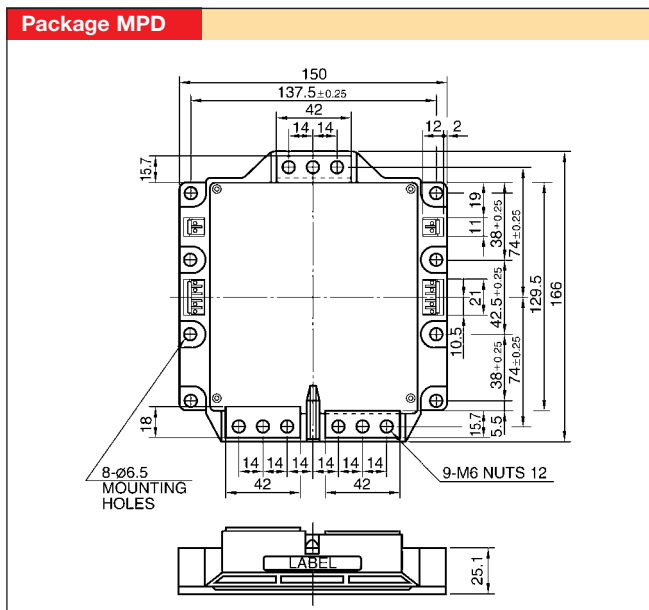
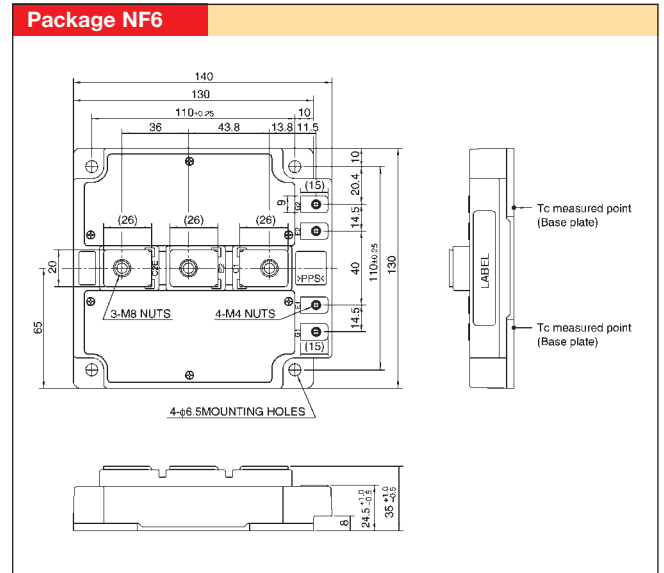
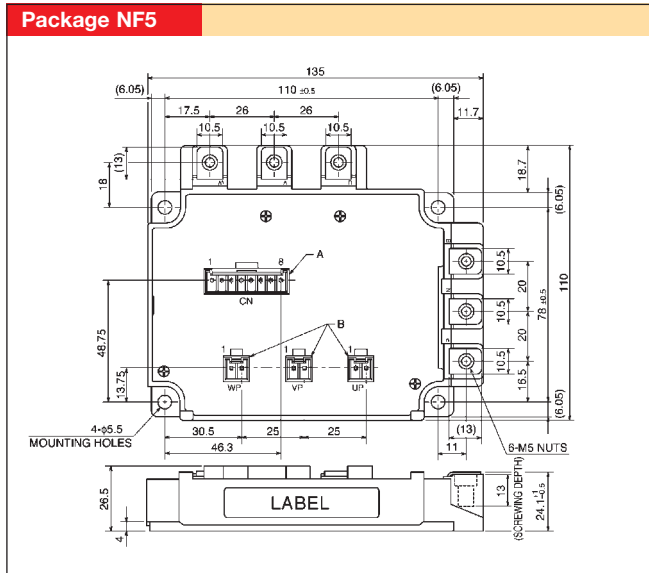
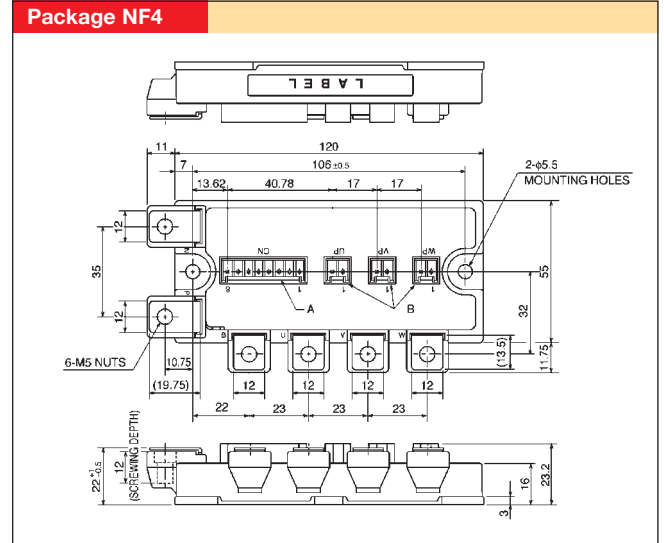
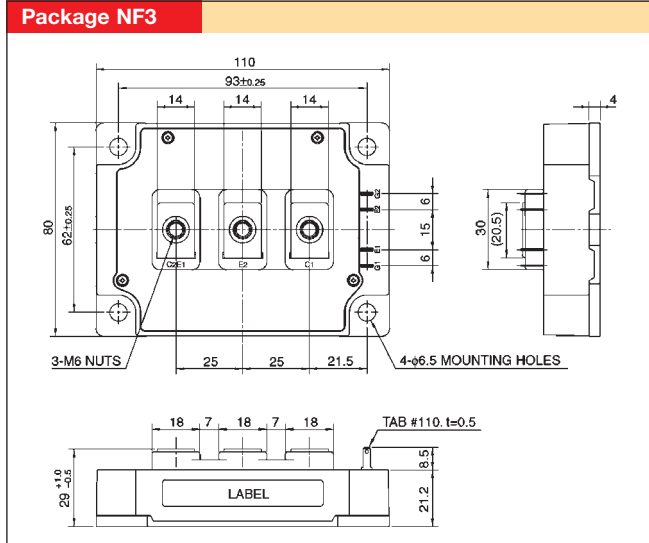
Type Number	Maximum Ratings			Electrical Characteristics (T <sub>j</sub> = 25°C)									Free Wheel Diode (T <sub>j</sub> = 25°C)			Thermal Characteristics			Package- No.
	V <sub>CEs</sub> (V)	I <sub>c</sub> (A)	V <sub>isol</sub> (V)	V <sub>CEsat</sub> (V)		C <sub>ies</sub> (nF)	C <sub>Oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>F</sub> (V)	Q <sub>rr</sub> (μC)	t <sub>rr</sub> (ns)	IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)	
				Typ.	Max.				t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)							
<b>600 Volt IGBT Modules NF-Series (6 in 1)</b>																			
CM75RL-12NF	600	75	2500	1.7	2.2	11.3	1.4	0.45	120	100	300	300	2.8	1.2	100	0.290	0.510	0.085	NF4
CM100RL-12NF	600	100	2500	1.7	2.2	15	1.9	0.6	120	100	300	300	2.8	2.1	120	0.230	0.410	0.085	NF4
CM150RL-12NF	600	150	2500	1.7	2.2	23	2.8	0.9	120	100	300	300	2.8	2.5	150	0.170	0.310	0.085	NF4
CM200RL-12NF	600	200	2500	1.7	2.2	30	3.7	1.2	120	100	300	300	2.8	4.8	150	0.140	0.220	0.051	NF5
<b>1200 Volt Dual IGBT Modules NF-Series (2 in 1)</b>																			
CM75DY-24NF	1200	75	2500	1.8	2.5	17.5	1.5	0.34	120	100	450	350	3.2	5.0	150	0.200	0.300	0.022	NF1
CM100DY-24NF	1200	100	2500	1.8	2.5	23	2.0	0.45	120	80	450	350	3.2	5.0	150	0.130	0.230	0.022	NF1
CM150DY-24NF	1200	150	2500	1.8	2.5	35	3.0	0.68	120	80	450	350	3.2	7.5	150	0.093	0.170	0.022	NF1
CM200DY-24NF	1200	200	2500	1.8	2.5	47	4.0	0.9	500	150	600	350	3.2	7.5	250	0.066	0.120	0.020	NF2
CM300DY-24NF	1200	300	2500	1.8	2.5	70	6.0	1.4	500	150	600	350	3.2	13	250	0.046	0.085	0.018	NF3
CM400DY-24NF	1200	400	2500	1.8	2.5	94	8.0	1.8	600	160	700	350	3.2	16	250	0.034	0.062	0.018	NF3
CM600DU-24NF	1200	600	2500	1.95	2.65	140	12	2.7	800	180	900	350	3.35	28	300	0.025	0.042	0.015	NF6
CM900DUC-24NF	1200	900	2500	1.8	2.5	140	16	3.0	600	200	800	300	3.2	50	500	0.021	0.034	0.012	MPD
CM1400DUC-24NF	1200	1400	2500	1.8	2.5	220	25	4.7	800	300	1000	300	3.2	90	700	0.014	0.023	0.012	MPD
<b>1200 Volt IGBT Modules NF-Series (6 in 1)</b>																			
CM50TL-24NF	1200	50	2500	2.1	3.0	8.5	0.75	0.17	100	50	300	350	3.8	2.0	100	0.320	0.430	0.085	NF4
CM75TL-24NF	1200	75	2500	2.1	3.0	11.5	1.0	0.23	100	50	300	350	3.8	3.0	120	0.240	0.360	0.085	NF4
CM100TL-24NF	1200	100	2500	2.1	3.0	17.5	1.5	0.34	100	70	300	350	3.8	4.8	150	0.200	0.280	0.085	NF4
CM150TL-24NF	1200	150	2500	2.1	3.0	23	2.0	0.45	130	70	400	350	3.8	5.8	150	0.140	0.230	0.051	NF5
CM200TL-24NF	1200	200	2500	2.1	3.1	35	3.0	0.68	130	70	400	350	3.8	9.0	150	0.110	0.170	0.051	NF5
<b>1200 Volt IGBT Modules NF-Series (7 in 1)</b>																			
CM50RL-24NF	1200	50	2500	2.1	3.0	8.5	0.75	0.17	100	50	300	350	3.8	2.0	100	0.320	0.430	0.085	NF4
CM75RL-24NF	1200	75	2500	2.1	3.0	11.5	1.0	0.23	100	50	300	350	3.8	3.0	120	0.240	0.360	0.085	NF4
CM100RL-24NF	1200	100	2500	2.1	3.0	17.5	1.5	0.34	100	70	300	350	3.8	4.8	150	0.200	0.280	0.085	NF4
CM150RL-24NF	1200	150	2500	2.1	3.0	23	2.0	0.45	130	70	400	350	3.8	5.8	150	0.140	0.230	0.051	NF5
CM200RL-24NF	1200	200	2500	2.1	3.1	35	3.0	0.68	130	70	400	350	3.8	9.0	150	0.110	0.170	0.051	NF5
<b>1700 Volt Dual IGBT Modules NF-Series (2 in 1)</b>																			
CM1000DUC-34NF	1700	1000	3500	2.2	2.8	220	25	4.7	600	200	1000	300	3.0	90	500	0.014	0.023	0.012	MPD

\* Measurement point of case temperature (T<sub>c</sub>) is side of base plate. Please refer to package outline.



Dimensions in mm

## 1.07 5<sup>th</sup> Generation IGBT Modules Standard-Package (NF-Series)



Dimensions in mm

## AC Switch for 3-Level Applications (Common Collector Module)



### Applications

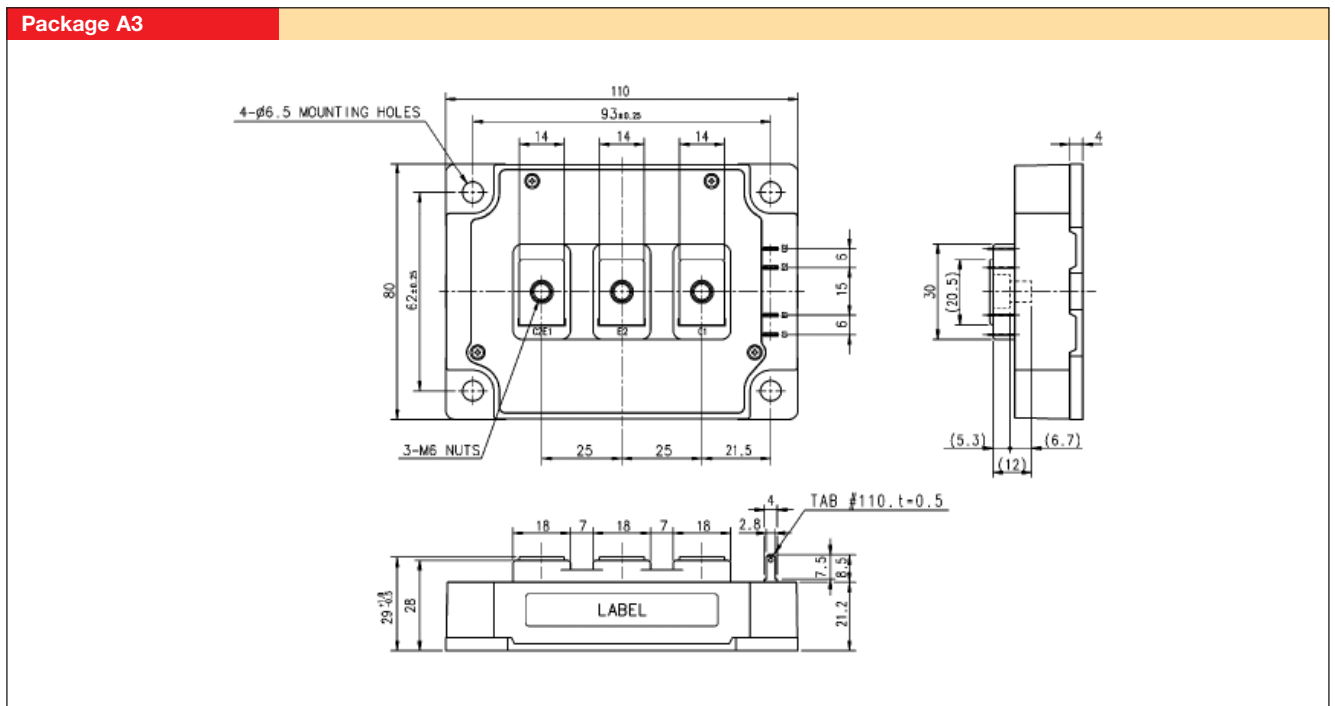
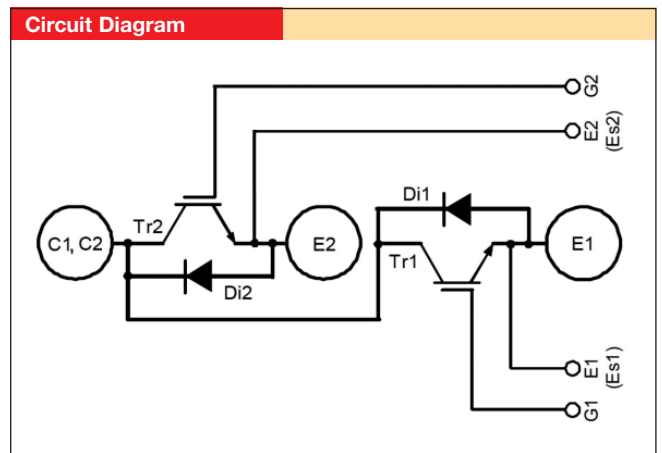
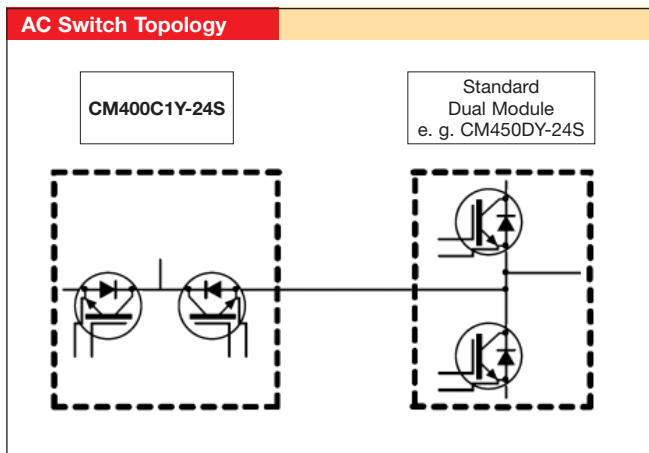
- UPS
- Photovoltaic Inverters
- Motor Control

### Features

- 6<sup>th</sup> Generation IGBT with CSTBT™ Chip Technology
- $V_{CEsat}$  (Chip) = 1.7V(typ) @  $T_j = 25^\circ\text{C}$ ;  
wide SOA @  $V_{cc} = 850\text{V}$
- $T_{j(max)} = 175^\circ\text{C}$
- New Free Wheeling Diode Chip with optimised trade-off  
between  $V_F$  and  $E_{rr}$
- Rating 400A/1200V
- Low internal inductance
- Excellent thermal conductivity by AlN isolation substrate

## 1.08 AC Switch for 3-Level Applications (Common Collector Module)

Type Number	Maximum Ratings			Electrical Characteristics (T <sub>j</sub> = 25°C)									Free Wheel Diode (T <sub>j</sub> = 25°C)			Thermal Characteristics			Package- No.
	V <sub>CES</sub> (V)	I <sub>C</sub> (A)	V <sub>isol</sub> (V)	V <sub>CESat</sub> (Chip) (V)		C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>F</sub> (Chip) (V)	Q <sub>rr</sub> (μC)	t <sub>rr</sub> (ns)	IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)	
				Typ.	Max.				Max.	Max.	Max.	t <sub>d(on)</sub> (ns)							
<b>AC Power Switch for 3-Level Applications</b>																			
CM400C1Y-24S	1200	400	2500	1.7	2.15	40	8.0	0.66	800	200	600	300	1.7	21.4	300	0.056	0.095	0.018	A3



Dimensions in mm

# High Frequency IGBT Modules (NFH-Series)



## Features

- Super low turn-off switching losses by combining Carrier Stored Trench Gate Bipolar Transistor (CSTBT™) chip technology with adopted lifetime control
- Optimised for high frequency switching at 50kHz
- Excellent performance also in soft switching applications (resonant mode)
- Low internal inductance package
- Significant improvement of power cycling capability



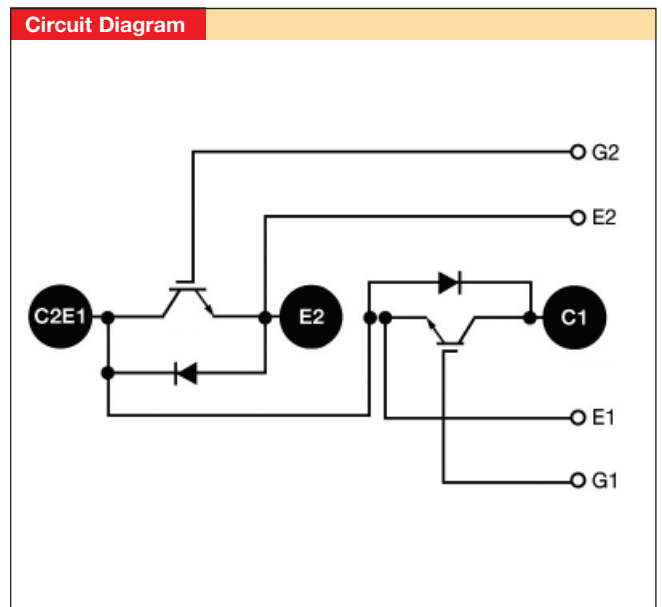
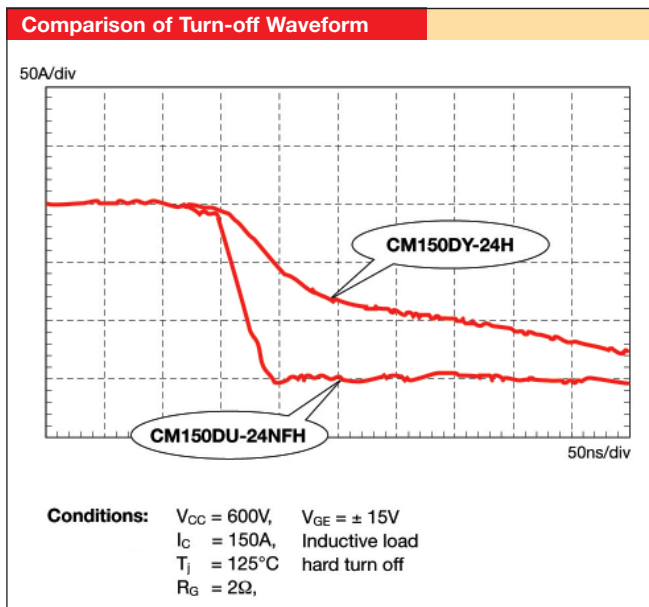
## Line-up NFH-Series

Symbol	Circuit Diagram	V <sub>CES</sub> (V)	I <sub>c</sub> (A)					
			100	150	200	300	400	600
D		600	CM100DUS-12F	CM150DUS-12F	CM200DU-12NFH	CM300DU-12NFH	CM400DU-12NFH	CM600DU-12NFH
		1200	CM100DU-24NFH	CM150DU-24NFH	CM200DU-24NFH	CM300DU-24NFH	CM400DU-24NFH	CM600DU-24NFH

## 1.09 High Frequency IGBT Modules (NFH-Series)

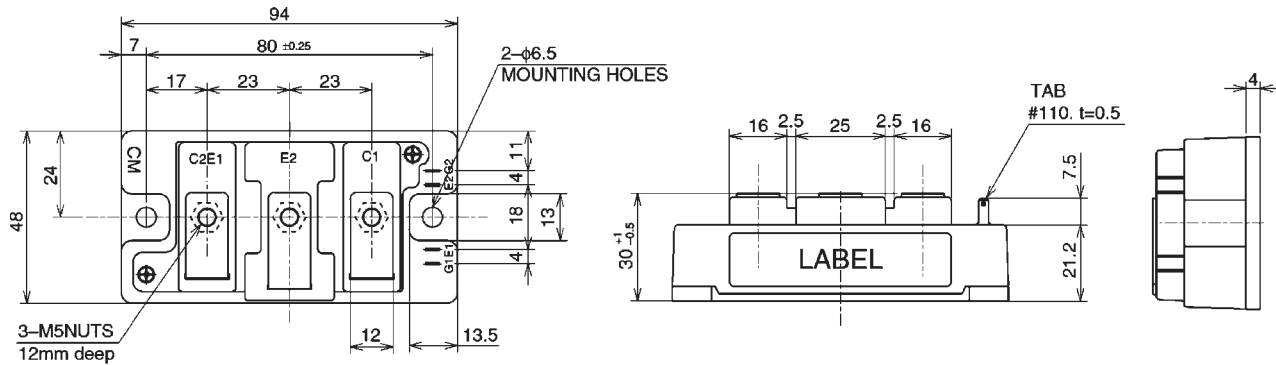
Type Number	Maximum Ratings		Electrical Characteristics (T <sub>j</sub> = 25°C)										Free Wheel Diode (T <sub>j</sub> = 25°C)			Thermal Characteristics*			Package-No.
	V <sub>CES</sub> (V)	I <sub>C</sub> (A)	V <sub>CEsat</sub> (V)		C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>F</sub> (V)	Q <sub>rr</sub> (μC)	t <sub>rr</sub> (ns)	IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)		
			Typ.	Max.				Max.	Max.	t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)							t <sub>d(off)</sub> (ns)	
<b>600 Volt IGBT Modules NFH-Series</b>																			
CM100DUS-12F	600	100	2.0	2.7	27	1.8	1.0	100	80	300	150	2.6	1.9	150	0.350	0.7009	0.022	NFH1	
CM150DUS-12F	600	150	2.0	2.7	41	2.7	1.5	120	100	350	150	2.6	2.8	150	0.240	0.470	0.022	NFH1	
CM200DU-12NFH	600	200	2.0	2.7	55	3.6	2.0	250	150	500	150	2.6	3.5	150	0.210	0.350	0.022	NFH1	
CM300DU-12NFH	600	300	2.0	2.7	83	5.4	3.0	350	150	700	150	2.6	5.5	200	0.160	0.240	0.020	NFH2	
CM400DU-12NFH	600	400	2.0	2.7	110	7.2	4.0	400	200	700	150	2.6	7.7	200	0.130	0.180	0.020	NFH2	
CM600DU-12NFH	600	600	2.0	2.7	166	11	6.0	650	250	800	150	2.6	11	200	0.110	0.120	0.018	NFH3	
<b>1200 Volt IGBT Modules NFH-Series</b>																			
CM100DU-24NFH	1200	100	5.0	6.5	16	1.3	0.3	100	50	250	150	3.5	5.0	150	0.170	0.290	0.022	NFH1	
CM150DU-24NFH	1200	150	5.0	6.5	24	2.0	0.5	150	80	400	150	3.5	7.5	150	0.130	0.210	0.022	NFH1	
CM200DU-24NFH	1200	200	5.0	6.5	32	2.7	0.6	300	80	500	150	3.5	7.5	250	0.095	0.140	0.020	NFH2	
CM300DU-24NFH	1200	300	5.0	6.5	47	4.0	0.9	300	80	500	150	3.5	13	250	0.066	0.100	0.020	NFH2	
CM400DU-24NFH	1200	400	5.0	6.5	63	5.3	1.2	300	100	500	150	3.5	16	250	0.051	0.093	0.018	NFH3	
CM600DU-24NFH	1200	600	5.0	6.5	95	8.0	1.8	400	120	700	150	3.5	28	250	0.034	0.060	0.018	NFH3	

\* Measurement point of case temperature (T<sub>c</sub>) is side of base plate. Please refer to package outline.

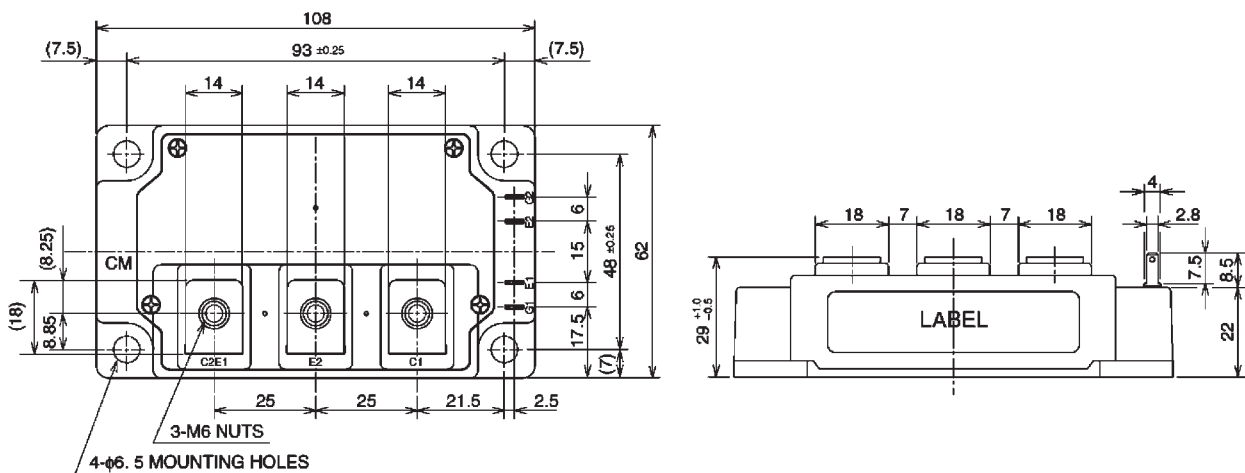


## 1.09 High Frequency IGBT Modules (NFH-Series)

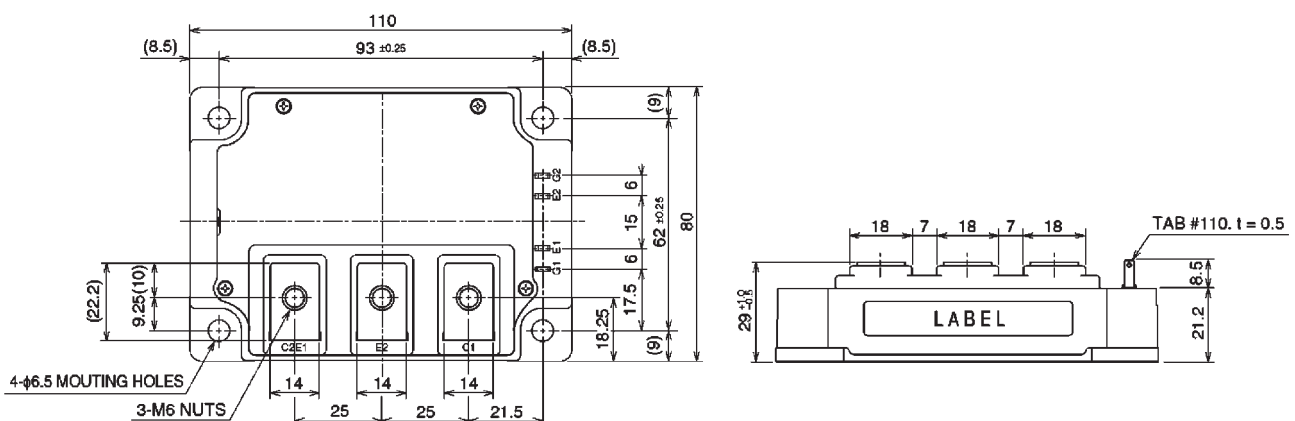
Package NFH1



Package NFH2



Package NFH3



Dimensions in mm



## Ordering Information for Mitsubishi IPMs

### Information:

The Intelligent Power Module was first developed and mass-produced by Mitsubishi Electric assuming the leadership in the industry for this technology. The reliability of our IPMs is proven since many years of experience in volume production.

The latest **L1-Series** IPM incorporates CSTBT™ IGBT chip for loss performance keeping the mechanical compatibility with existing L-Series IPM family. It also introduces a new small S package for 600V and 1200V (Reduced package size by 32% of existing L-Series IPM).

**L-Series:** Employing 5<sup>th</sup> Generation Carrier Stored Trench Gate Bipolar Transistor (CSTBT™) chip technology for good loss performance. Featuring on-chip temperature sensing for all IGBT chips.

**V1-Series** is a new intelligent power module (IPM) family in dual configuration which is mainly developed to increase the inverter efficiency. For this purpose several new technologies have been implemented such as a CSTBT™ chip. Chip technology and structural improvements reduce the effective junction temperature and increase the power and thermal cycling capability while keeping the mechanical compatibility to the existing V-Series.

**DIP and Mini-DIPIPMs** use an ultra compact transfer mold package and include drive and protection ICs.

### 1 IPM

### 2 $I_C = 300A$

### 3 Internal Connection:

**D** = Dual IPM

**B** = H-Bridge

**C** = Sixpack IPM

**R** = Sevenpack IPM

### 4 Series Name:

**V1** = V1-Series

**L** = L-Series

**L1** = L1-Series

**S1** = S1-Series

### 5 Change of Appearance or Other:

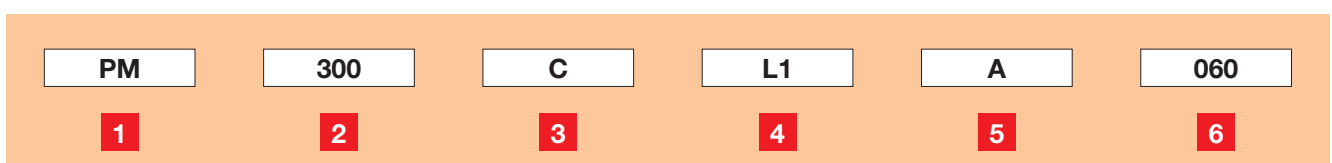
**A B C D S**

### 6 $V_{CES}$ :

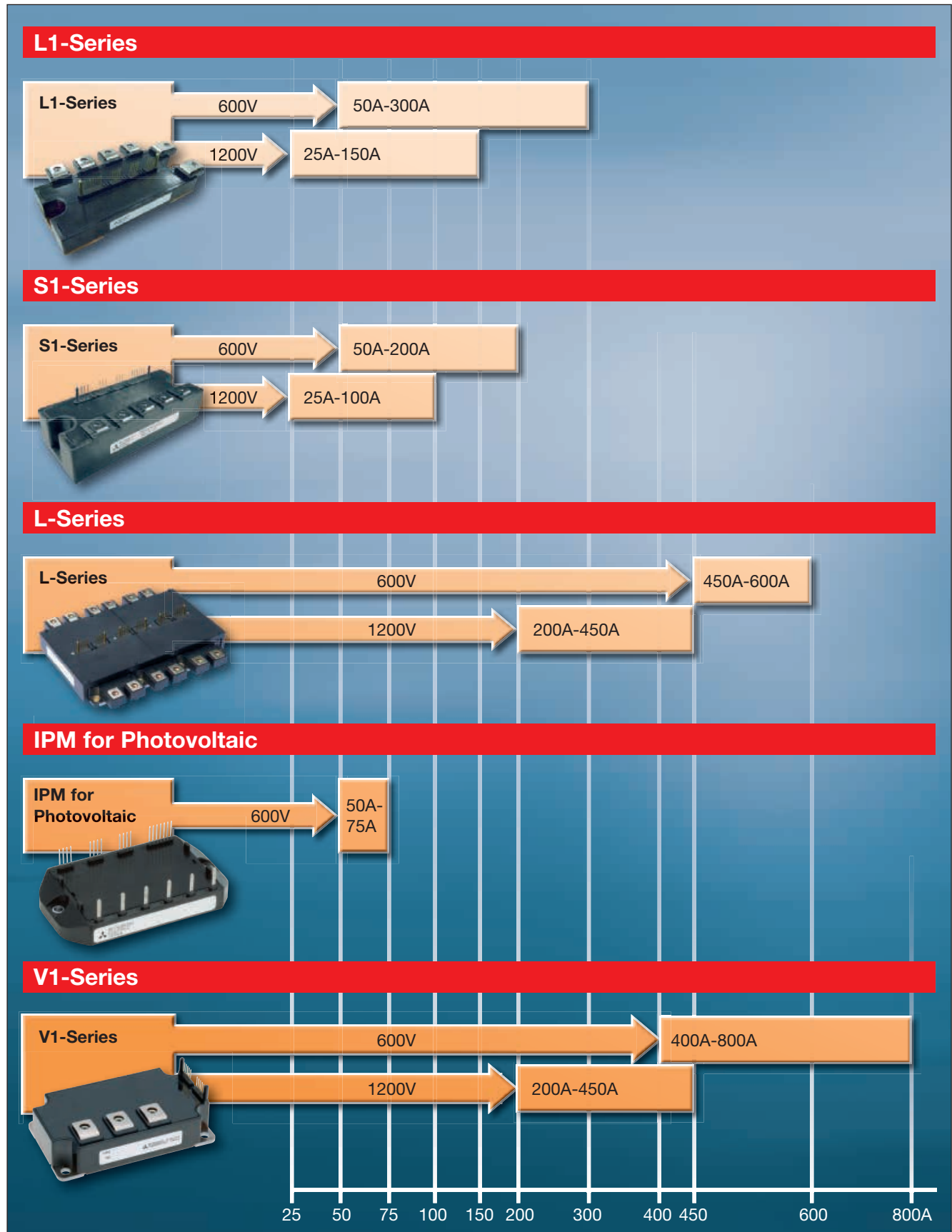
**060** = 600V

**120** = 1200V

### Example:



# Overview of IPM



2

## 5<sup>th</sup> Generation CSTBT™ IPMs (V1-Series)



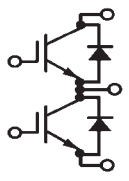
### Features

- Low loss by 5<sup>th</sup> Generation CSTBT™ Chip
  - for 600V modules:
    - $V_{CEsat} (@T_j = 125^{\circ}C) = 1.90V$
  - for 1200V modules:
    - $V_{CEsat} (@T_j = 125^{\circ}C) = 1.85V$
- Optimized thermal sensor on chip
- Mechanical compatibility with previous V-Series Small Package
- Short circuit protection (SC)
- Control supply under voltage protection (UV)
- Over temperature (OT) protection  
(on chip temperature sensor)
- Fault signal output in case of a failure (FO)

2

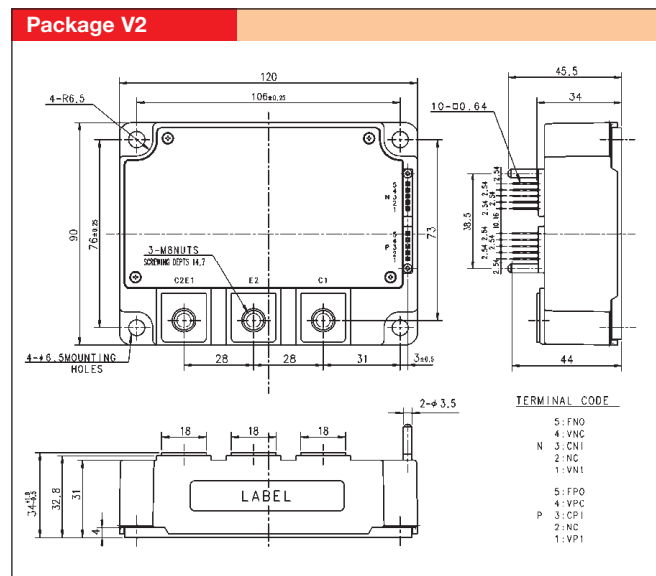
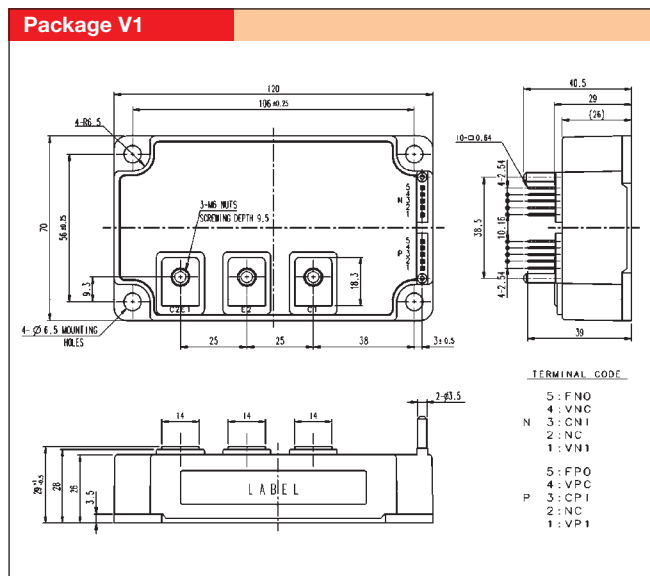
## 2.03 5<sup>th</sup> Generation CSTBT™ IPMs (V1-Series)

### Line-up V1-Series

Symbol	Circuit Diagram	V <sub>CEs</sub> (V)	I <sub>c</sub> (A)					
			200	300	400	450	600	800
D		600			PM400DV1A060		PM600DV1A060	PM800DV1B060
		1200	PM200DV1A120	PM300DV1A120		PM450DV1A120		

Type Number	Maximum Ratings		Electrical Characteristics							Thermal Characteristics			Protection Functions			Package No.
	V <sub>CEs</sub> (V)	I <sub>c</sub> (A)	V <sub>CEsat</sub> @ T <sub>j</sub> = 25°C (V)		Maximum Switching Times @ T <sub>j</sub> = 125°C					IGBT R <sub>th(j-c)</sub> (K/W) Max.	Diode R <sub>th(j-c)</sub> (K/W) Max.	R <sub>th(c-s)</sub> (K/W) Typ.	SC (A) Min.	OT (°C) Min.	UV (V) Typ.	
			Typ.	Max.	t <sub>on</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)	t <sub>rr</sub> (μs)							
<b>600 Volt IPM (V1-Series)</b>																
PM400DV1A060	600	400	1.90	2.35	0.8	0.4	1.0	0.3	0.4	0.099	0.153	0.018	600	135	12	V1
PM600DV1A060	600	600	1.90	2.35	0.8	0.4	1.0	0.3	0.4	0.073	0.109	0.018	1000	135	12	V1
PM800DV1B060	600	800	1.85	2.35	0.8	0.4	1.4	0.3	0.25	0.050	0.090	0.014	1200	135	12	V2
<b>1200 Volt IPM (V1-Series)</b>																
PM200DV1A120	1200	200	1.65	2.15	0.8	0.4	2.4	0.4	0.3	0.090	0.146	0.018	300	135	12	V1
PM300DV1A120	1200	300	1.65	2.15	0.8	0.4	2.4	0.4	0.3	0.070	0.107	0.018	450	135	12	V1
PM450DV1A120	1200	450	1.65	2.15	0.8	0.4	2.4	0.4	0.3	0.056	0.079	0.018	675	135	12	V1

2



Dimensions in mm

## 5<sup>th</sup> Generation CSTBT™ IPMs (L1 & S1-Series)

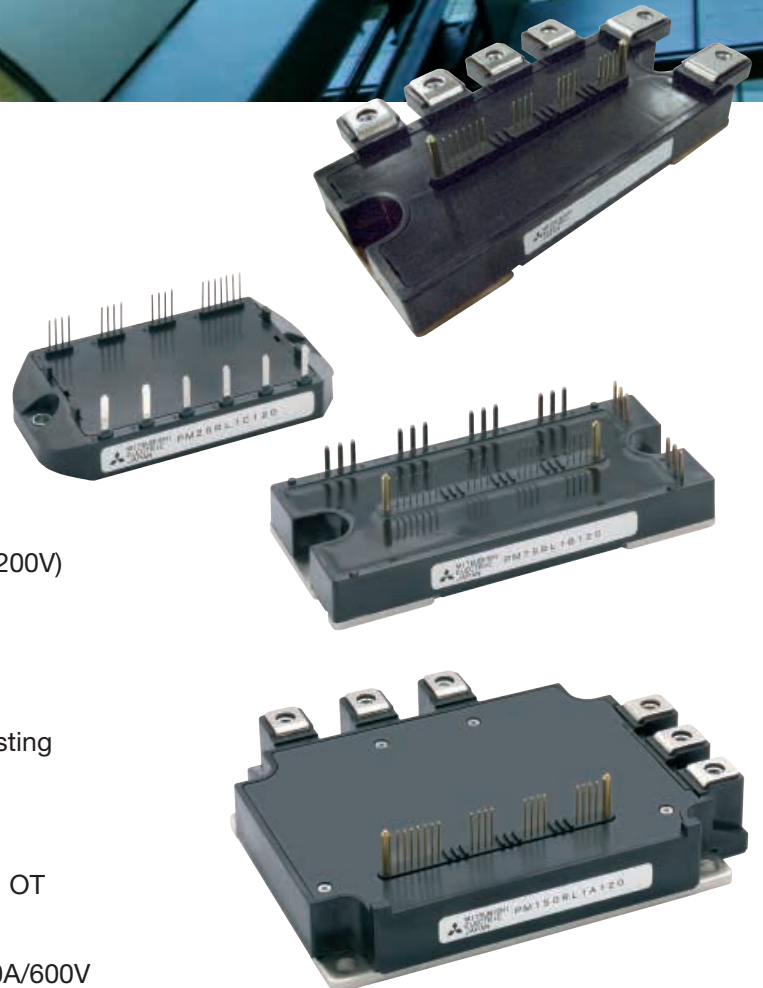


### Applications

- General purpose inverter
- Servo drives
- Other motor controls

### Features

- 5<sup>th</sup> Generation IGBT chip with CSTBT™ resulting low power loss
- Better trade off between  $V_{CEsat}$  and  $E_{off}$   
Typical  $V_{CEsat}$  @ 125°C: 1.75V (600V) and 1.85V (1200V)
- Package compatibility with existing range of L-Series IPM
- New small package for 7 in 1, 50A/600V and 25A/1200V (Reduced package size by 32% of existing L-Series IPM)
- Improved Power cycling capability
- Detection, protection and status indication for SC, OT (with On-chip temperature sensor) & UV
- Available from 25A to 150A/1200V and 50A to 300A/600V
- Up to 75A (1200V) and 150A (600V), Solder pin & screw types with same package foot size
- Newly developed L1-Series evaluation board is available on request



## 2.04 5<sup>th</sup> Generation CSTBT™ IPMs (L1 & S1-Series)

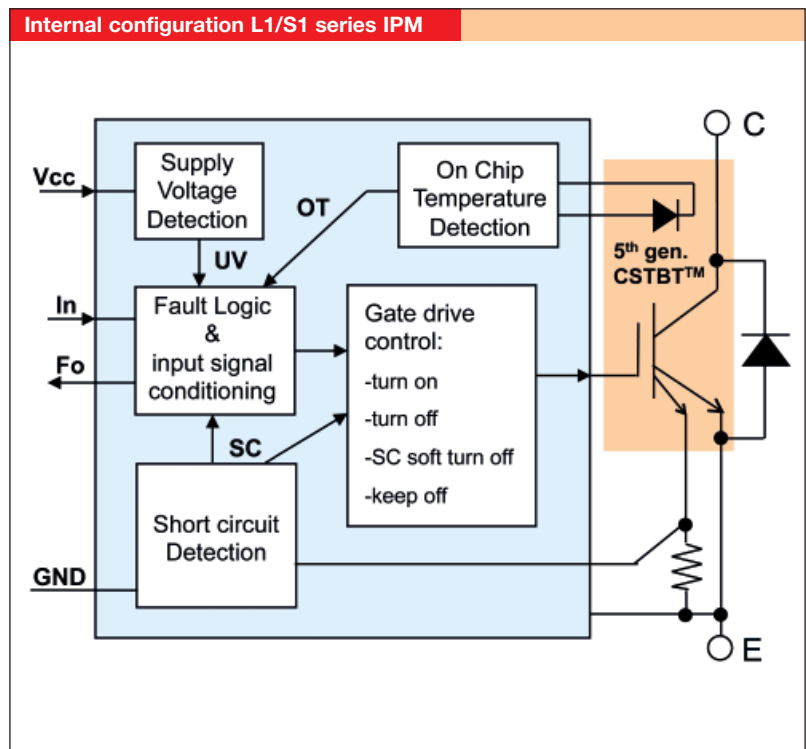
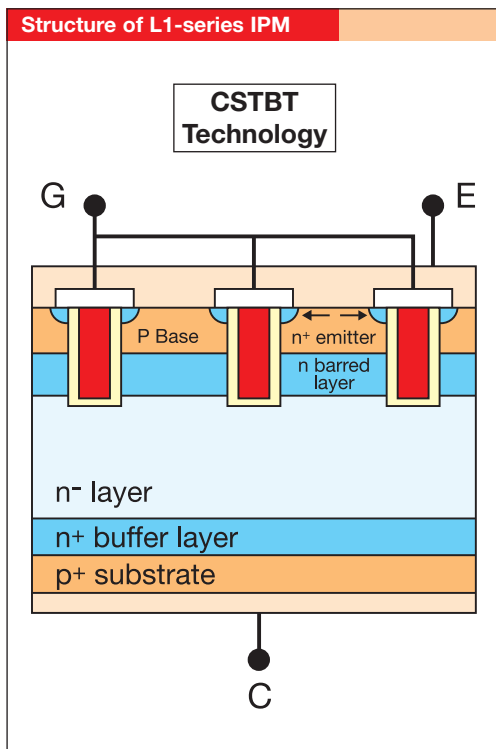
### Line-up L1-Series

Symbol	Internal Function	V <sub>CES</sub> (V)	I <sub>c</sub> (A)						
			25	50	75	100	150	200	300
C	3 ∅ Inverter IGBT Integrated Gate Drive SC / OT / UV	600		PM50CL1A060 PM50CL1B060	PM75CL1A060 PM75CL1B060	PM100CL1A060 PM100CL1B060	PM150CL1A060 PM150CL1B060	PM200CL1A060	PM300CL1A060
		1200	PM25CL1A120 PM25CL1B120	PM50CL1A120 PM50CL1B120	PM75CL1A120 PM75CL1B120	PM100CL1A120	PM150CL1A120		
R	3 ∅ Inverter IGBT Integrated Gate Drive SC / OT / UV	600		PM50RL1A060 PM50RL1B060 PM50RL1C060	PM75RL1A060 PM75RL1B060	PM100RL1A060 PM100RL1B060	PM150RL1A060 PM150RL1B060	PM200RL1A060	PM300RL1A060
		1200	PM25RL1A120 PM25RL1B120 PM25RL1C120	PM50RL1A120 PM50RL1B120	PM75RL1A120 PM75RL1B120	PM100RL1A120	PM150RL1A120		

### Line-up S1-Series

Symbol	Internal Function	V <sub>CES</sub> (V)	I <sub>c</sub> (A)						
			25	50	75	100	150	200	300
C	3 ∅ Inverter IGBT Integrated Gate Drive SC / OT / UV	600		PM50CS1D060	PM75CS1D060	PM100CS1D060	PM150CS1D060	PM200CS1D060	
		1200	PM25CS1D120	PM50CS1D120	PM75CS1D120	PM100CS1D120			

CLA / RLA types with screw terminals; CLB / RLB types with solder pins **SC**: short-circuit prot. / **OT**: over-temperature prot. / **UV**: under-voltage lock prot.

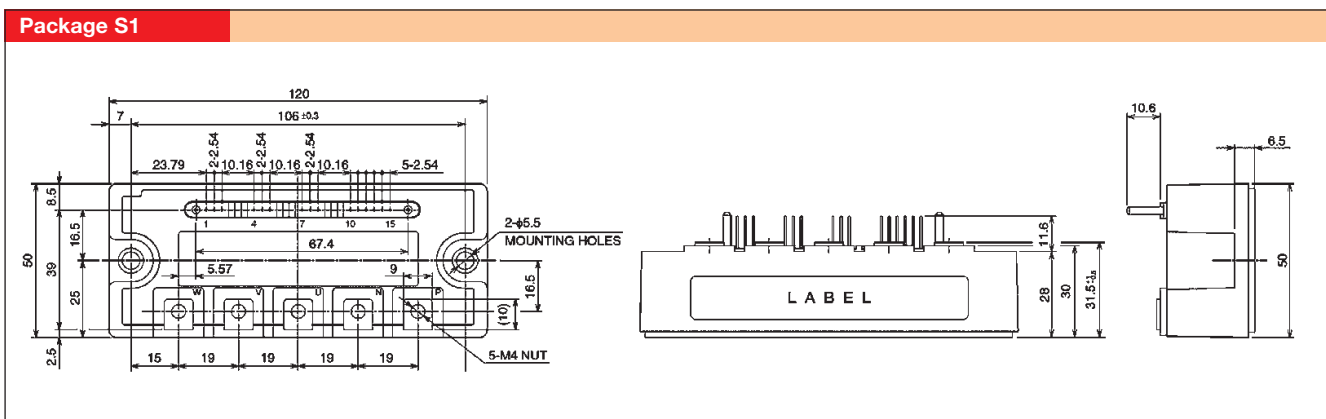
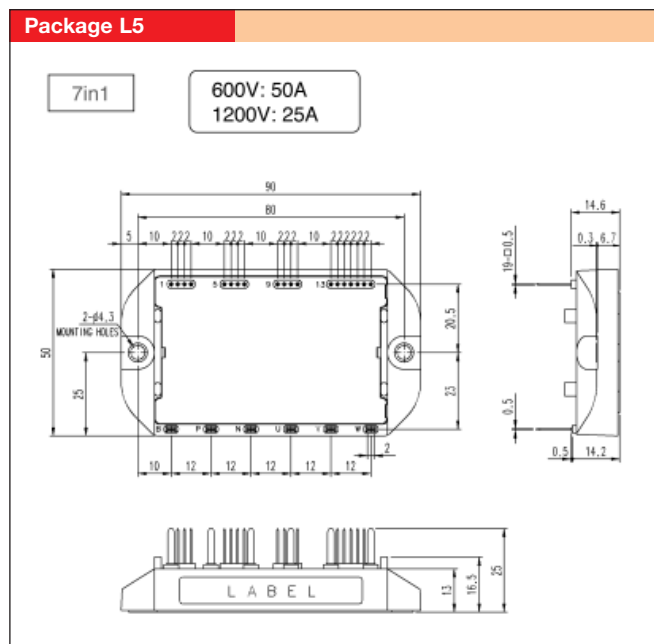
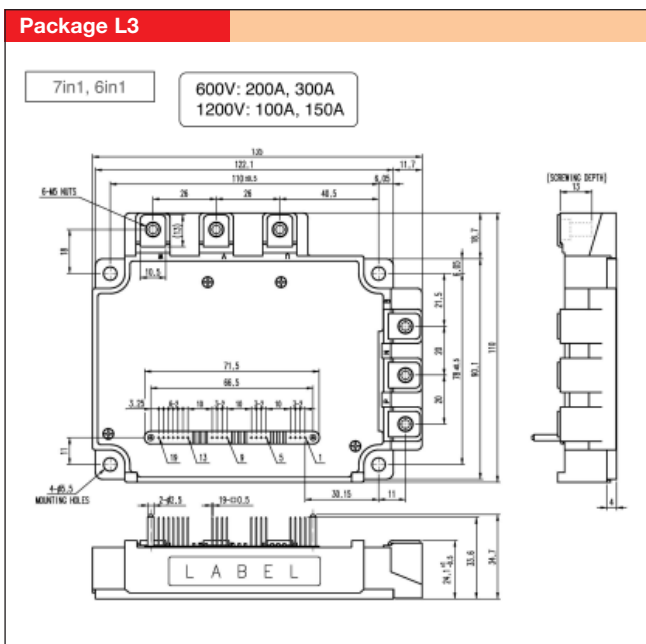
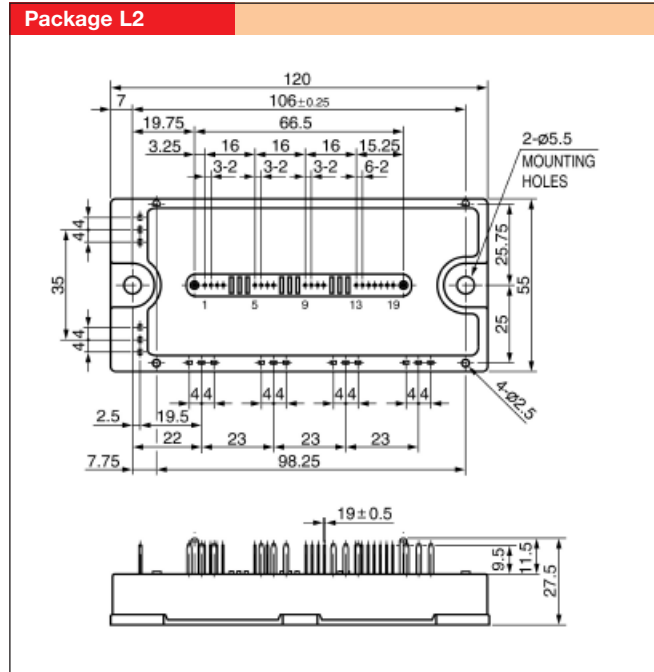
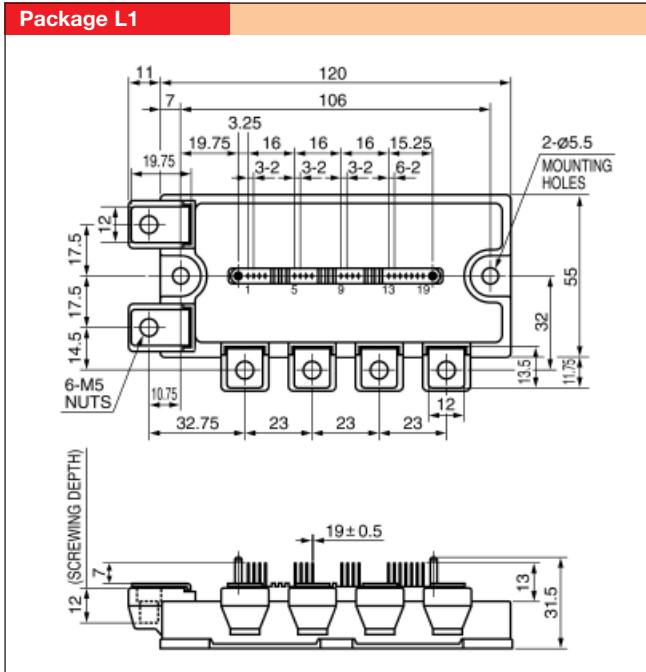


## 2.04 5<sup>th</sup> Generation CSTBT™ IPMs (L1 & S1-Series)

Type Number	Maximum Ratings		Electrical Characteristics							Thermal Characteristics			Protection Functions			Package-No.
	V <sub>CES</sub> (V)	I <sub>C</sub> (A)	V <sub>CEsat</sub> @ T <sub>j</sub> = 25°C (V)		Maximum Switching Times @ T <sub>j</sub> = 125°C					IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)	SC (A)	OT (°C)	UV (V)	
			Typ.	Max.	t <sub>on</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)	t <sub>rr</sub> (μs)							
<b>600 Volt IPM (L1-Series)</b>																
PM50CL1A060	600	50	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.44	0.75	0.038	100	135	12	L1
PM50CL1B060	600	50	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.44	0.75	0.038	100	135	12	L2
PM50RL1A060	600	50	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.44	0.75	0.038	100	135	12	L1
PM50RL1B060	600	50	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.44	0.75	0.038	100	135	12	L2
PM50RL1C060	600	50	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.74	1.28	0.085	100	135	12	L5
PM75CL1A060	600	75	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.37	0.63	0.038	150	135	12	L1
PM75CL1B060	600	75	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.37	0.63	0.038	150	135	12	L2
PM75RL1A060	600	75	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.37	0.63	0.038	150	135	12	L1
PM75RL1B060	600	75	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.37	0.63	0.038	150	135	12	L2
PM100CL1A060	600	100	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.32	0.52	0.038	200	135	12	L1
PM100CL1B060	600	100	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.32	0.52	0.038	200	135	12	L2
PM100RL1A060	600	100	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.32	0.52	0.038	200	135	12	L1
PM100RL1B060	600	100	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.32	0.52	0.038	200	135	12	L2
PM150CL1A060	600	150	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.25	0.41	0.038	300	135	12	L1
PM150CL1B060	600	150	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.25	0.41	0.038	300	135	12	L2
PM150RL1A060	600	150	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.25	0.41	0.038	300	135	12	L1
PM150RL1B060	600	150	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.25	0.41	0.038	300	135	12	L2
PM200CL1A060	600	200	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.20	0.30	0.023	400	135	12	L3
PM200RL1A060	600	200	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.20	0.30	0.023	400	135	12	L3
PM300CL1A060	600	300	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.15	0.23	0.023	600	135	12	L3
PM300RL1A060	600	300	1.75	2.35	0.8	0.4	1.0	0.3	0.4	0.15	0.23	0.023	600	135	12	L3
<b>1200 Volt IPM (L1-Series)</b>																
PM25CL1A120	1200	25	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.97	1.60	0.038	50	135	12	L1
PM25CL1B120	1200	25	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.97	1.60	0.038	50	135	12	L2
PM25RL1A120	1200	25	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.97	1.60	0.038	50	135	12	L1
PM25RL1B120	1200	25	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.97	1.60	0.038	50	135	12	L2
PM25RL1C120	1200	25	1.65	2.15	0.8	0.4	1.5	0.4	0.3	0.70	1.18	0.085	50	135	12	L5
PM50CL1A120	1200	50	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.27	0.47	0.038	100	135	12	L1
PM50CL1B120	1200	50	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.27	0.47	0.038	100	135	12	L2
PM50RL1A120	1200	50	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.27	0.47	0.038	100	135	12	L1
PM50RL1B120	1200	50	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.27	0.47	0.038	100	135	12	L2
PM75CL1A120	1200	75	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.21	0.36	0.038	150	135	12	L1
PM75CL1B120	1200	75	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.21	0.36	0.038	150	135	12	L2
PM75RL1A120	1200	75	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.21	0.36	0.038	150	135	12	L1
PM75RL1B120	1200	75	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.21	0.36	0.038	150	135	12	L2
PM100CL1A120	1200	100	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.19	0.31	0.023	200	135	12	L3
PM100RL1A120	1200	100	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.19	0.31	0.023	200	135	12	L3
PM150CL1A120	1200	150	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.15	0.23	0.023	300	135	12	L3
PM150RL1A120	1200	150	1.65	2.15	0.8	0.4	1.2	0.4	0.3	0.15	0.23	0.023	300	135	12	L3
<b>600 Volt IPM (S1-Series)</b>																
PM50CS1D060	600	50	1.80	2.40	0.8	0.4	1.4	0.3	0.3	0.40	0.68	0.046	75	135	12	S1
PM75CS1D060	600	75	1.80	2.40	0.8	0.4	1.4	0.3	0.3	0.33	0.55	0.046	112	135	12	S1
PM100CS1D060	600	100	1.80	2.40	0.8	0.4	1.4	0.3	0.3	0.28	0.46	0.046	150	135	12	S1
PM150CS1D060	600	150	1.80	2.40	0.8	0.4	1.4	0.3	0.3	0.21	0.35	0.046	225	135	12	S1
PM200CS1D060	600	200	1.90	2.60	0.8	0.4	1.4	0.3	0.3	0.18	0.27	0.046	300	135	12	S1
<b>1200 Volt IPM (S1-Series)</b>																
PM25CS1D120	1200	25	1.65	2.15	0.65	0.35	1.1	0.35	0.2	0.37	0.59	0.046	38	135	12	S1
PM50CS1D120	1200	50	1.65	2.15	0.65	0.35	1.1	0.35	0.2	0.25	0.41	0.046	75	135	12	S1
PM75CS1D120	1200	75	1.65	2.15	0.65	0.35	1.1	0.35	0.2	0.20	0.32	0.046	112	135	12	S1
PM100CS1D120	1200	100	1.65	2.15	0.65	0.35	1.1	0.35	0.2	0.18	0.27	0.046	150	135	12	S1

SC: short-circuit prot. / OT: over-temperature prot. / UV: under-voltage lock prot.

## 2.04 5<sup>th</sup> Generation CSTBT™ IPMs (L1 & S1-Series)



Dimensions in mm



## 5<sup>th</sup> Generation CSTBT™ IPMs (L-Series)



### Features

- 5<sup>th</sup> Generation IGBT chip with CSTBT™ Technology
- Typical  $V_{CEsat} =$   
1.8V @  $T_j = 125^\circ\text{C}$  for 600V and  
1.9V @  $T_j = 125^\circ\text{C}$  for 1200V
- Integrated turn-on speed controller circuit optimises EMI performance
- On-chip temperature sensor for  $T_j$  detection of CSTBT™ chip
- Detection, protection and status indication circuits for short-circuit, over-temperature, and under-voltage
- Monolithic gate drive & protection logic



## 2.05 5<sup>th</sup> Generation CSTBT™ IPMs (L-Series)

### Line-up L-Series

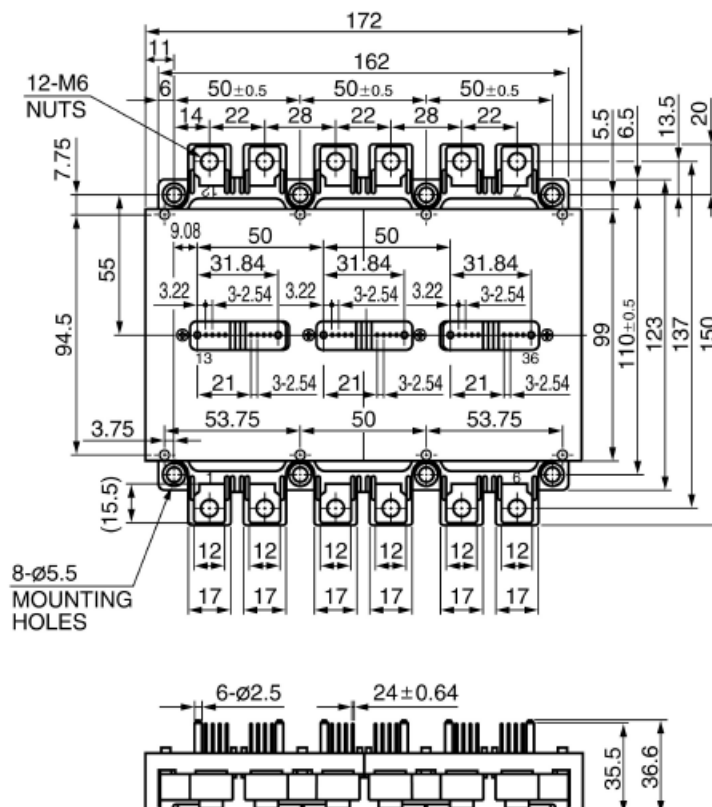
Symbol	Internal Function	V <sub>CES</sub> (V)	I <sub>c</sub> (A)			
			200	300	450	600
C	3 Ø Inverter IGBT Integrated Gate Drive SC / OT / UV	600			PM450CLA060	PM600CLA060
		1200	PM200CLA120	PM300CLA120	PM450CLA120	

SC: short-circuit prot. / OT: over-temperature prot. / UV: under-voltage lock prot.

Type Number	Maximum Ratings		Electrical Characteristics							Thermal Characteristics			Typical Protection Functions			Package No.
	V <sub>CES</sub> (V)	I <sub>c</sub> (A)	V <sub>CESat</sub> @ T <sub>J</sub> = 25°C (V)		Typical Switching Times @ T <sub>J</sub> = 125°C					IGBT R <sub>th(j-c)</sub> (K/W) Max.	Diode R <sub>th(j-c)</sub> (K/W) Max.	R <sub>th(c-s)</sub> (K/W) Max.	SC (A) Min.	OT (°C) Min.	UV (V) Typ.	
			Typ.	Max.	t <sub>on</sub> (µs)	t <sub>c(on)</sub> (µs)	t <sub>off</sub> (µs)	t <sub>c(off)</sub> (µs)	t <sub>rr</sub> (µs)							
<b>600 Volt IPM (L-Series)</b>																
PM450CLA060	600	450	1.7	2.2	1.0	0.4	2.2	0.6	0.2	0.12	0.19	0.014	900	135	12	L4
PM600CLA060	600	600	1.7	2.2	1.0	0.4	2.2	0.6	0.2	0.07	0.11	0.014	1200	135	12	L4
<b>1200 Volt IPM (L-Series)</b>																
PM200CLA120	1200	200	1.8	2.3	1.0	0.4	2.3	0.7	0.5	0.12	0.20	0.014	400	135	12	L4
PM300CLA120	1200	300	1.8	2.3	1.0	0.4	2.3	0.7	0.5	0.08	0.13	0.014	600	135	12	L4
PM450CLA120	1200	450	1.8	2.3	1.0	0.4	2.3	0.7	0.5	0.05	0.09	0.014	900	135	12	L4

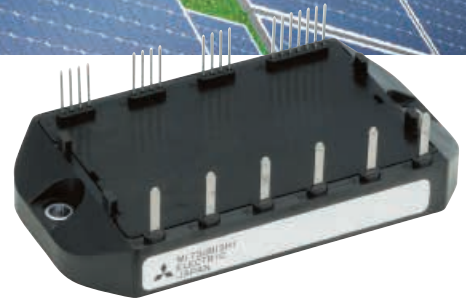
SC: short-circuit prot. / OT: over-temperature prot. / UV: under-voltage lock prot.

### Package L4



Dimensions in mm

## 5<sup>th</sup> Generation IPMs for Photovoltaic Application



### Features

- 5<sup>th</sup> Generation trench chip (CSTBT™)
- On-chip temperature sensing and individual OT protection
- Compact L1-Series IPM package with pin terminals
- 0, 1 or 2 boost converters built in for multi-string operation
- 50A/600V modules good for approximately 7.5kW (16kHz) fed to mains
- Rated currents of 50A and 75A with a rated voltage of 600V

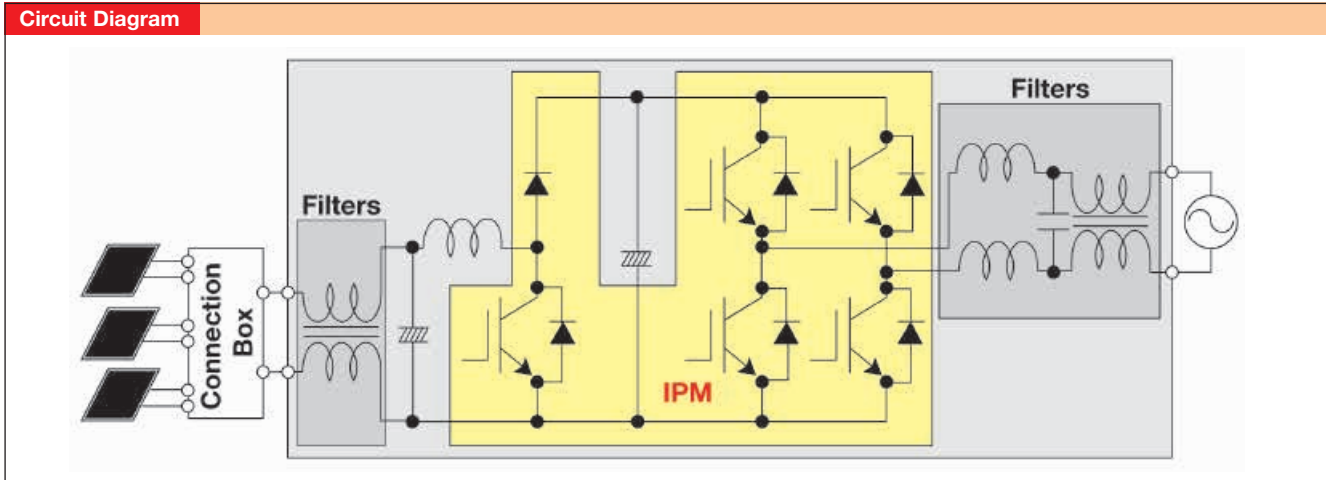
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### Line-up (600V)

I <sub>c</sub> (A)	Circuit	Package	Type name
50	1 Inverter	L5	PM50B4L1C060
	1 Inverter & 1 Chopper	L5	PM50B5L1C060
	1 Inverter & 2 Chopper	L5	PM50B6L1C060
75	1 Inverter	L5	PM75B4L1C060
	1 Inverter & 1 Chopper	L5	PM75B5L1C060
	1 Inverter & 2 Chopper	L5	PM75B6L1C060

## 2.06 5<sup>th</sup> Generation IPMs for Photovoltaic Application

**Circuit Diagram**

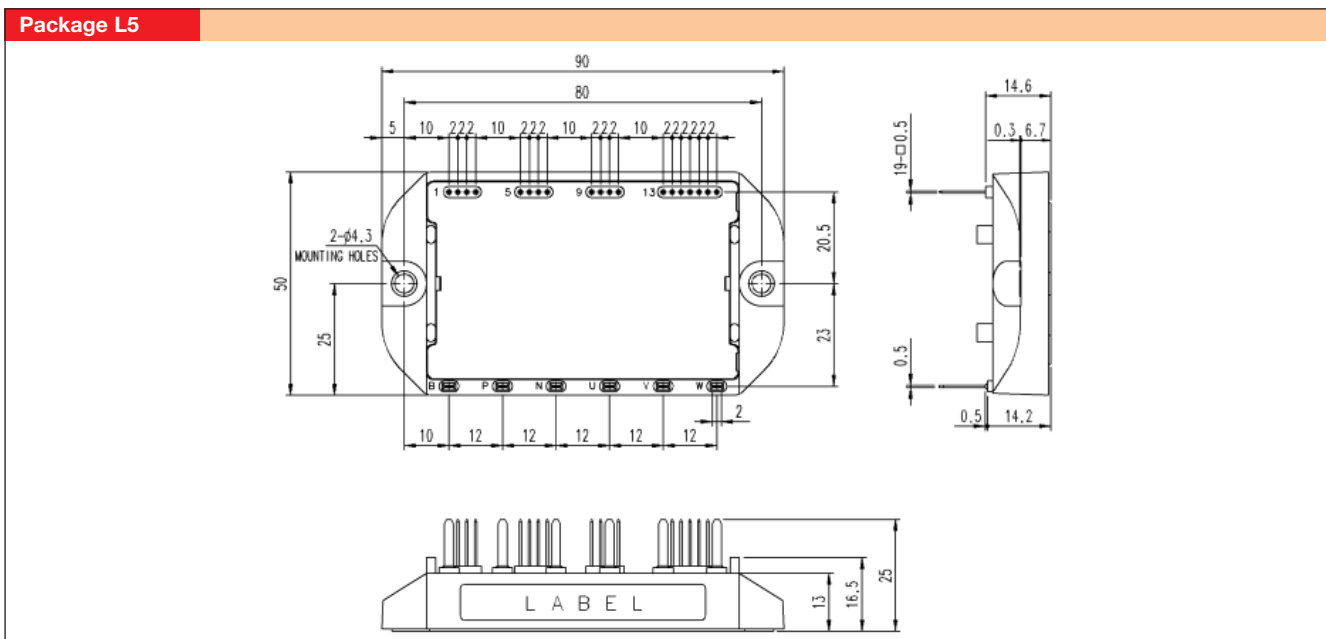


Type Number	Maximum Ratings		Electrical Characteristics						Thermal Characteristics			Typical Protection Functions			Package-No.
	V <sub>CEsat</sub> (V)	I <sub>c</sub> (A)	V <sub>CEsat</sub> @ T <sub>j</sub> = 125°C (V)	Typical Switching Times					IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)	SC* (A)	OT (°C)	UV (V)	
				t <sub>on</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)	t <sub>rr</sub> (μs)							
<b>600 Volt IPM for Solar Power</b>															
PM50B4L1C060	600	50	2.2	0.5	0.15	1.1	0.2	0.1	0.74	1.28	0.06	75	135	12	L5
PM50B5L1C060	600	50	2.2	0.5	0.15	1.1	0.2	0.1	0.74	1.28	0.06	75	135	12	L5
PM50B6L1C060	600	50	2.2	0.5	0.15	1.1	0.2	0.1	0.74	1.28	0.06	75	135	12	L5
PM75B4L1C060	600	75	2.2	0.5	0.15	1.1	0.2	0.1	0.62	1.06	0.06	112	135	12	L5
PM75B5L1C060	600	75	2.2	0.5	0.15	1.1	0.2	0.1	0.62	1.06	0.06	112	135	12	L5
PM75B6L1C060	600	75	2.2	0.5	0.15	1.1	0.2	0.1	0.62	1.06	0.06	112	135	12	L5

\*minimum trip values

**OC:** over-current prot. / **SC:** short-circuit prot. / **OT:** over-temperature prot. / **UV:** under-voltage lock prot.

**Package L5**



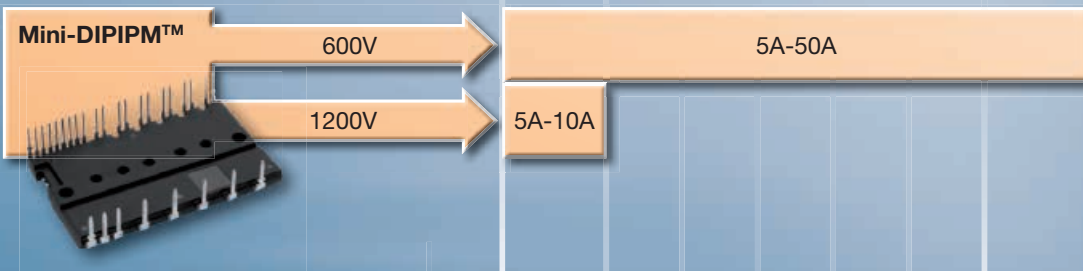
Dimensions in mm

# Overview of DIIPM™ (Dual-in-line Package Intelligent Power Modules)

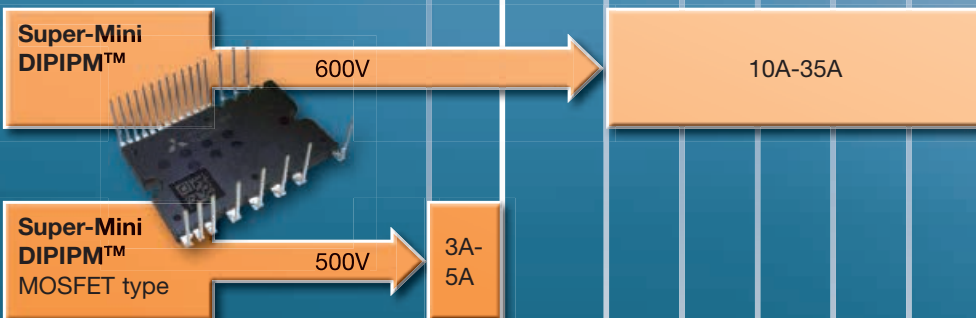
## Large DIIPM™



## Mini DIIPM™



## Super-Mini DIIPM™



3 5 10 15 20 25 30 35 50 75A

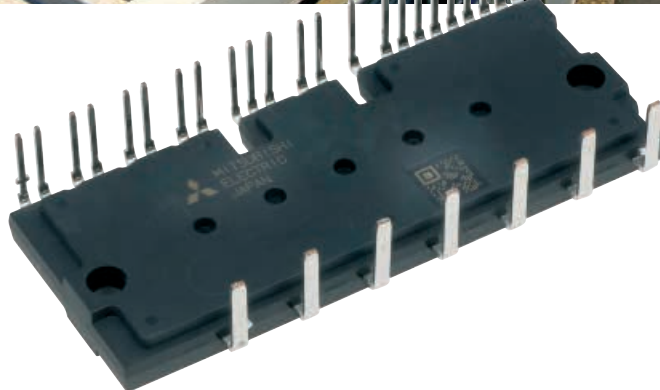
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## Large DIIPM™ Ver. 4 for Photovoltaic Application



### Features

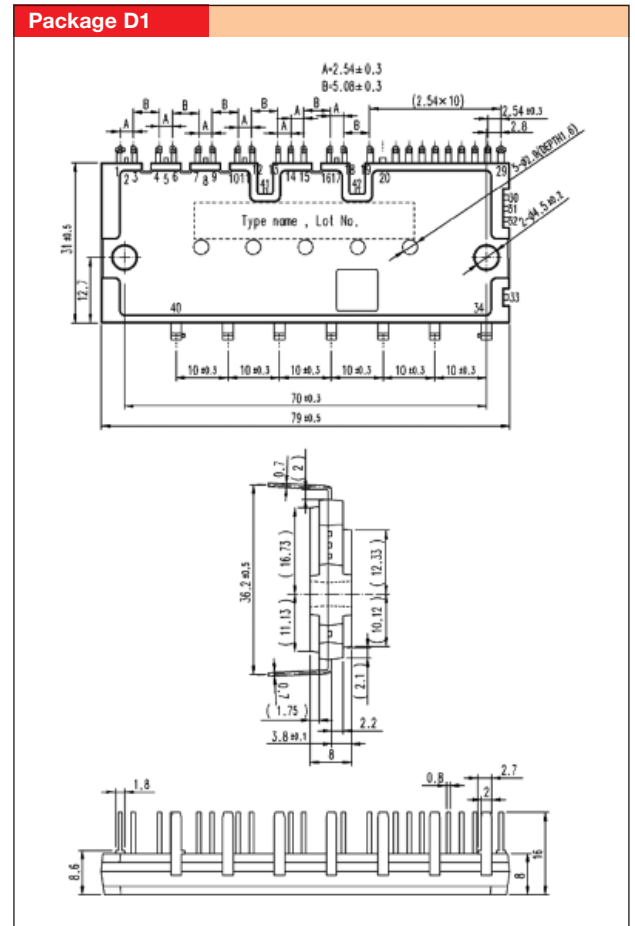
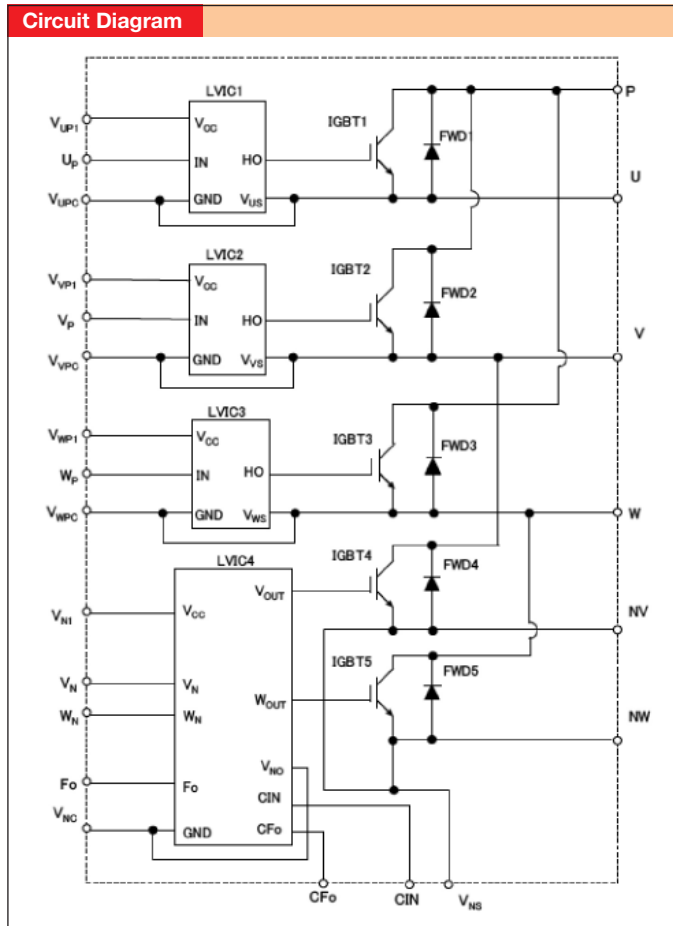
- 5<sup>th</sup> Generation fast Full-gate CSTBT™
- Rating: 50A/600V
- High performance Driver IC for high frequency switching
- Optional IGBT/FWDi channel for improving total efficiency
- Low thermal resistance by innovative insulation material
- Single phase DC/AC conversion
- Under voltage protection of control voltage supply
- 5V/3V input compatible high active logic
- Fault signal output in case of a failure
- Short circuit protection
- 2500V<sub>rms</sub> isolation voltage
- N-side open emitter
- RoHS directive compliance



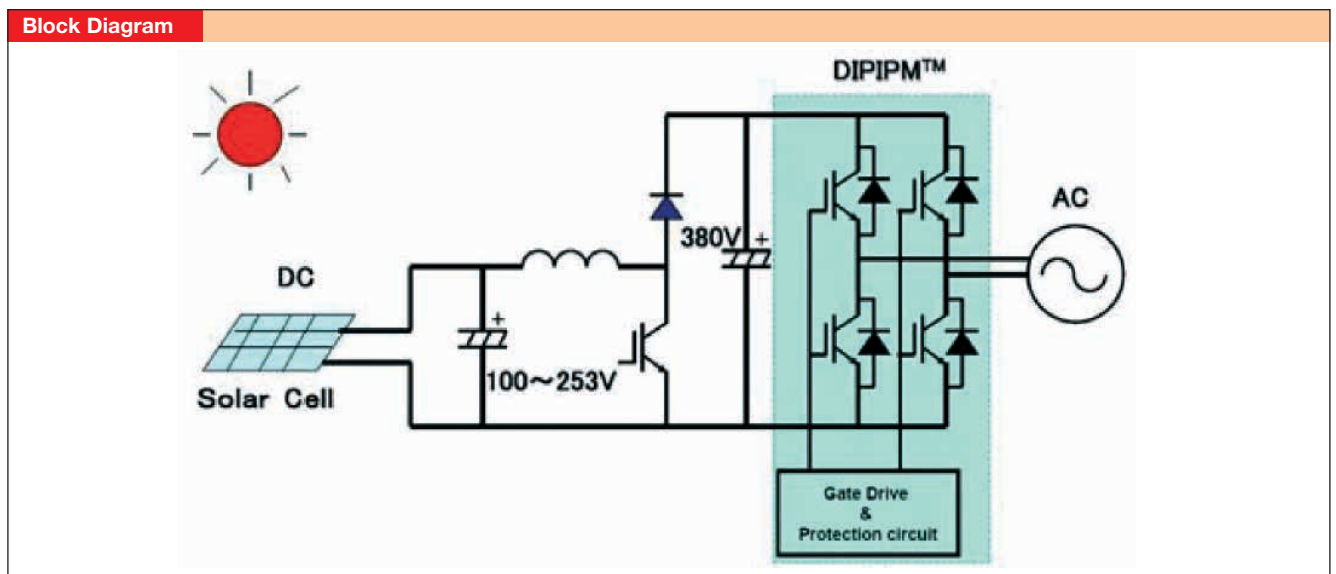
## 2.08 Large DIIPM™ Ver. 4 for Photovoltaic Application

### Line-up Large DIIPM™ for Photovoltaic Application

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>CES</sub> (V)	I <sub>c</sub> (A)	Package No.
Large DIIPM	2500	600	50	
			PS61A99	D1

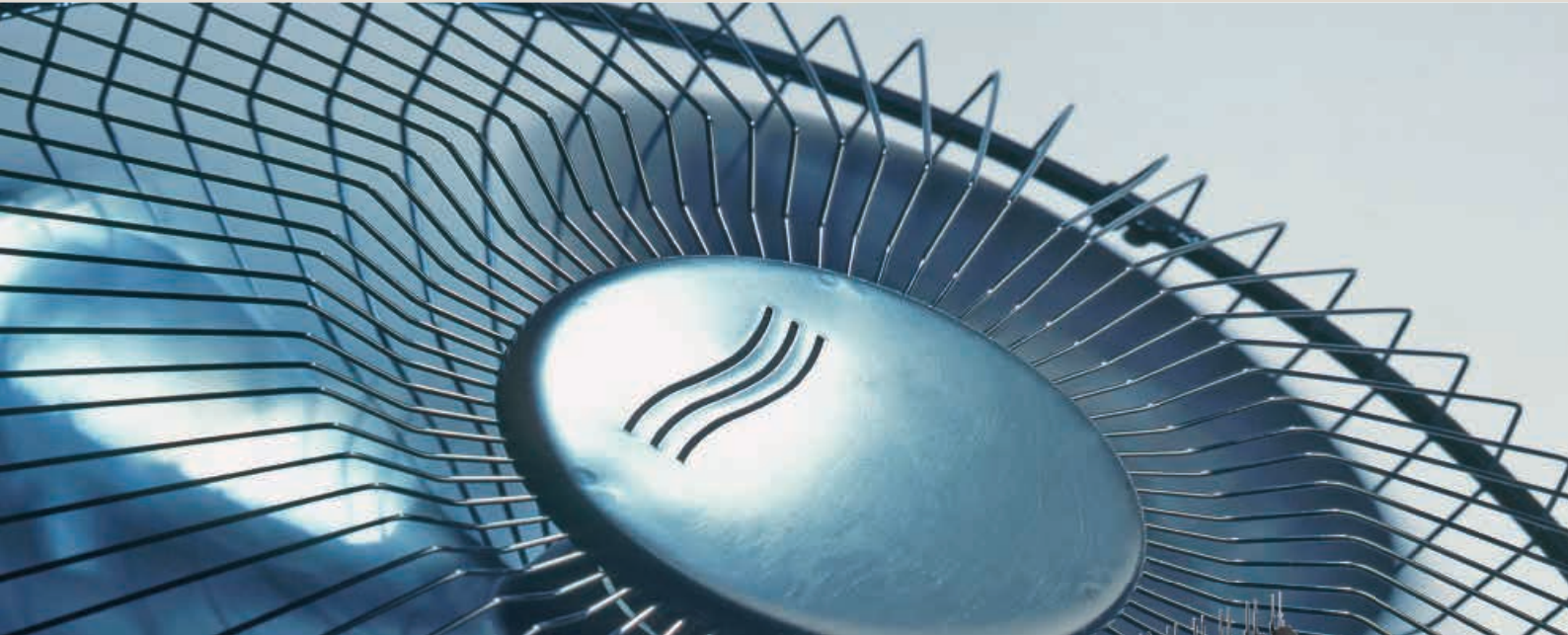


Dimensions in mm



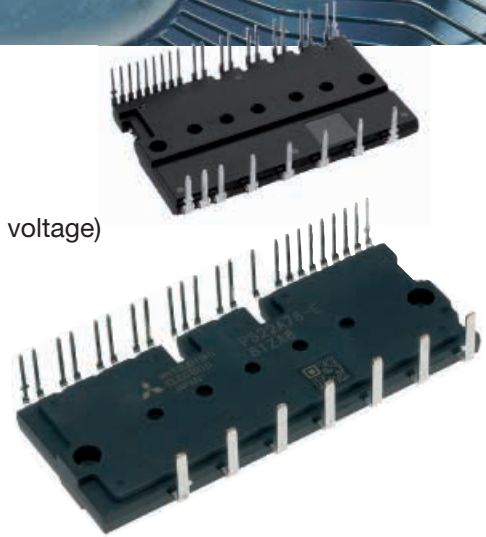
# 1200V DIIPM™

(Dual-in-line Package Intelligent Power Modules)



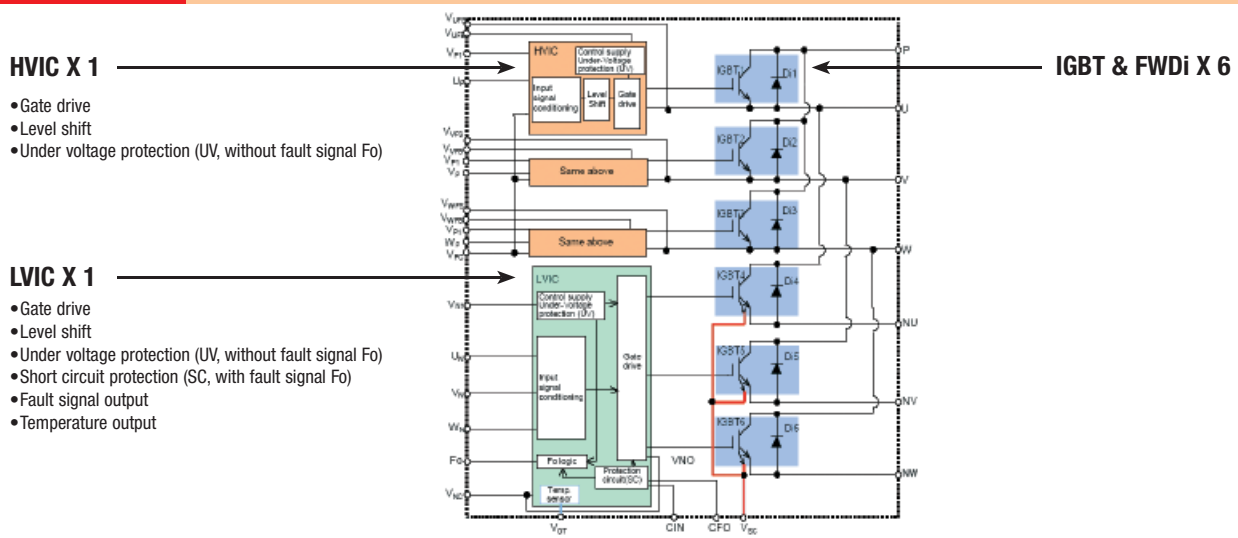
## Features

- 6.1 Generation IGBT with CSTBT™ chip technology (in Ver. 6)
- Designed for low power motor control (0.4kW-7.5kW at 400V AC line voltage)
- Lead free compact dual-in-line transfer mold package
- Rated currents ranging from 5A-50A and  $V_{CES} = 1200V$
- Protection functions:
  - UV: Control supply under voltage (P, N)
  - On-chip current sense for short circuit protection
  - Analog temperature sensor output ( $T_c$ )
- 2500V<sub>rms</sub> isolation voltage
- N-side open emitter structure
- RoHS compliant



2

### Circuit Diagram





## 2.09 1200V DIIPM™ (Dual-in-line Package Intelligent Power Modules)

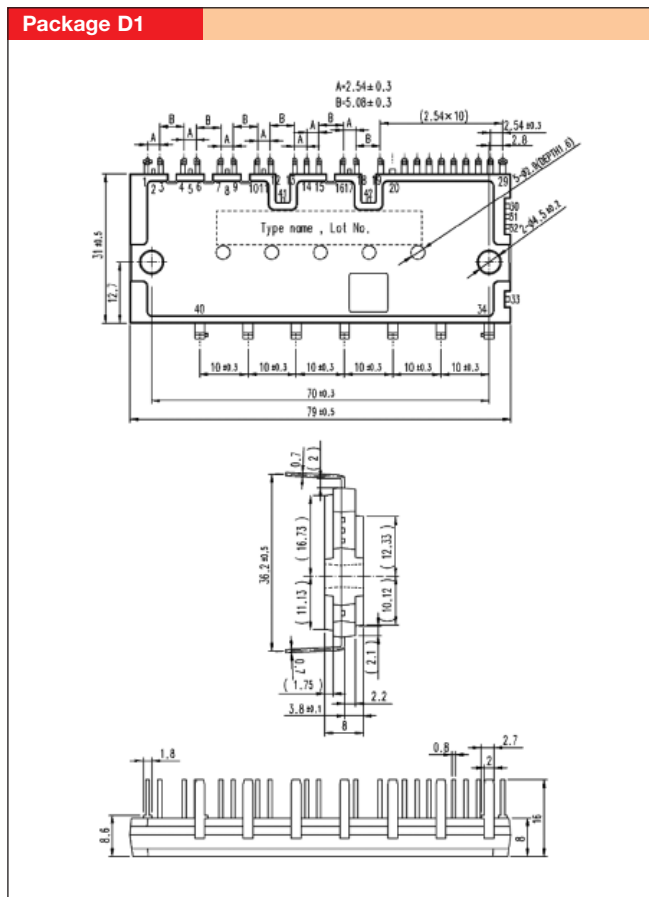
### Line-up 1200V DIIPM™

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>CES</sub> (V)	I <sub>c</sub> (A)						Package- No.
			5	10	15	25	35	50	
Large DIIPM Ver. 4	2500	1200	PS22A72	PS22A73	PS22A74	PS22A76	PS22A78-E	PS22A79	D1
Large DIIPM Ver. 6	2500	1200	PSS05SA2FT	PSS10SA2FT	PSS15SA2FT	PSS25SA2FT	PSS35SA2FT	PSS50SA2FT	D1
Mini DIIPM Ver. 6	2500	1200	PSS05S72FT	PSS10S72FT					D5

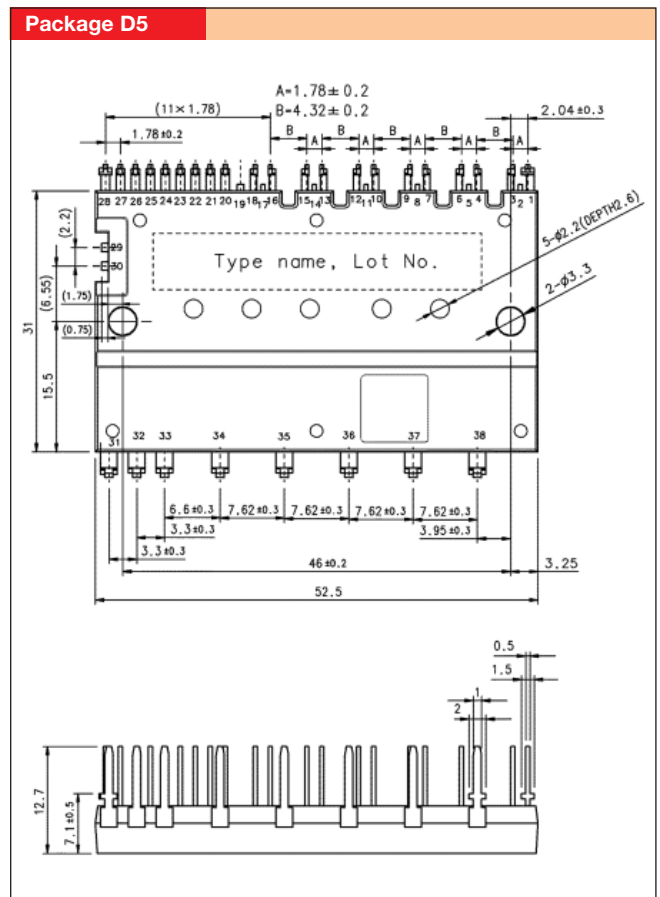
under development

Type Number	Electrical Characteristics											Thermal & Mechanical Characteristics		
	V <sub>CES</sub> (V)	Applicable Motor Ratings (kW)	I <sub>c</sub> (A)	f <sub>c</sub> (kHz) Max.	Isolation Voltage (V <sub>rms</sub> )	V <sub>CESat</sub> @ T <sub>j</sub> = 25°C (V)		Typical Switching Times @ T <sub>j</sub> = 125°C					IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)
						Typ.	Max.	t <sub>on</sub> (μs)	t <sub>rr</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)		
<b>1200V Large DIIPM</b>														
PS22A72	1200	0.7	5	20	2500	1.9	2.6	1.2	0.5	0.6	2.4	0.6	2.24	2.74
PS22A73	1200	1.5	10	20	2500	1.9	2.6	1.2	0.5	0.6	2.4	0.6	1.51	1.78
PS22A74	1200	2.2	15	20	2500	1.9	2.6	1.2	0.5	0.6	2.4	0.6	1.15	1.60
PS22A76	1200	3.7	25	20	2500	1.9	2.6	1.2	0.5	0.6	2.4	0.6	0.88	1.40
PS22A78-E	1200	5.5	35	20	2500	1.9	2.6	1.2	0.5	0.6	2.4	0.6	0.77	1.25
PS22A79	1200	7.5	50	20	2500	1.9	2.6	1.2	0.5	0.6	2.4	0.6	0.77	1.25

Package D1



Package D5



Dimensions in mm

## 500V Super Mini MOS DIIPM™

(Dual-in-line Package Intelligent Power Modules)

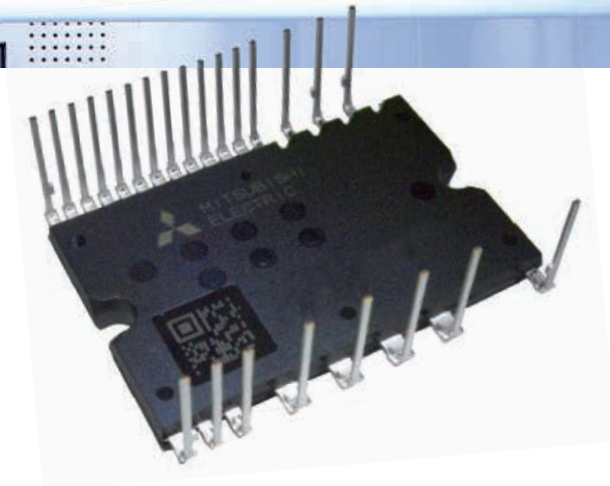


### Applications

- Refrigerator

### Features

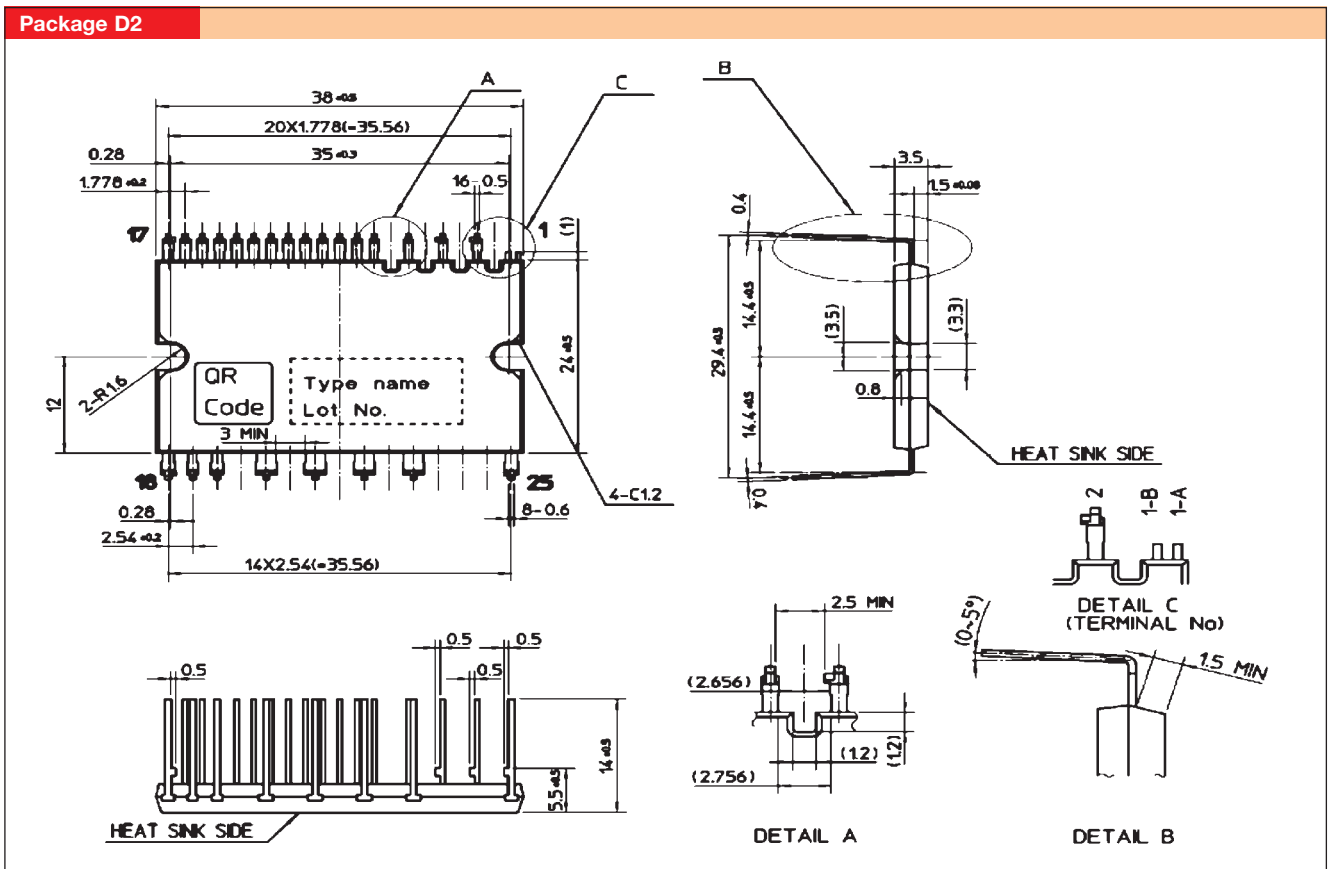
- 3-phase DC/AC conversion
- Junction Temp.  $T_j$ :  $-20^{\circ}\text{C}$  -  $150^{\circ}\text{C}$
- Protection functions:  
Short Circuit (SC),  
Under Voltage (UV),  
Over Temperature (OT)
- Fault signal output in case of a failure
- Built-in Bootstrap diode with current limiting resistor
- 3-15V input compatible high active logic
- Pin compatible with Ver. 4 and 5 PS219xx series (38mm x 24mm)
- N-side open Emitter
- Isolation voltage: AC  $1500V_{\text{rms}}$



## 2.10 500V Super Mini MOS DIIPM™ (Dual-in-line Package Intelligent Power Modules)

### Line-up 500V Super Mini MOS DIIPM™

	Type	$V_{CES}$ (V)	$I_C$ (A)	Package- No.
Built-in Over Temp. Protection	PSM03S93E5-A	500	3	D2
	PSM05S93E5-A	500	5	D2



## 600V Super Mini DIIPM™ Ver. 6

(Dual-in-line Package Intelligent Power Modules)

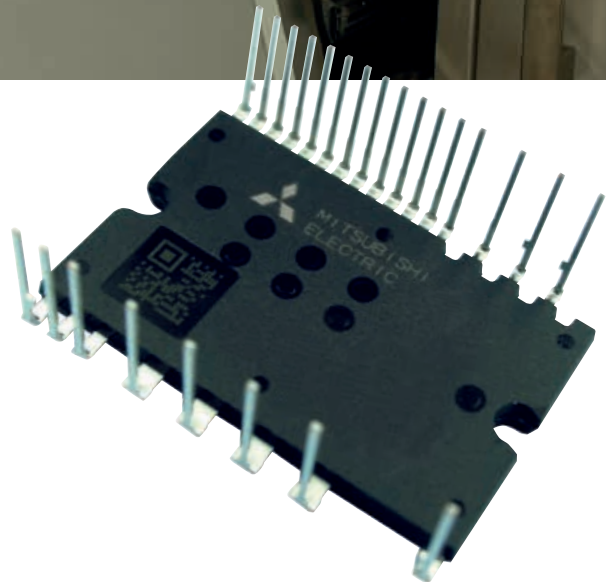


### Applications

- Air-Conditioner
- Washing Machine
- Refrigerator
- Small Power Drives

### Features

- 7<sup>th</sup> Generation IGBT with CSTBT™ chip technology
- 3-phase DC/AC conversion
- Junction Temp.  $T_j$ : -30°C - 150°C
- Protection functions:  
Short Circuit (SC), Under Voltage (UV), Over Temperature (OT)
- Analog output of LVIC temp. (optional)
- Fault signal output in case of a failure
- Built-in Bootstrap diode with current limiting resistor
- 3-15V input compatible high active logic
- Pin compatible with Ver. 4 and 5 PS219xx series (38mm x 24mm)
- N-side open Emitter
- Isolation voltage: AC 1500V<sub>rms</sub>

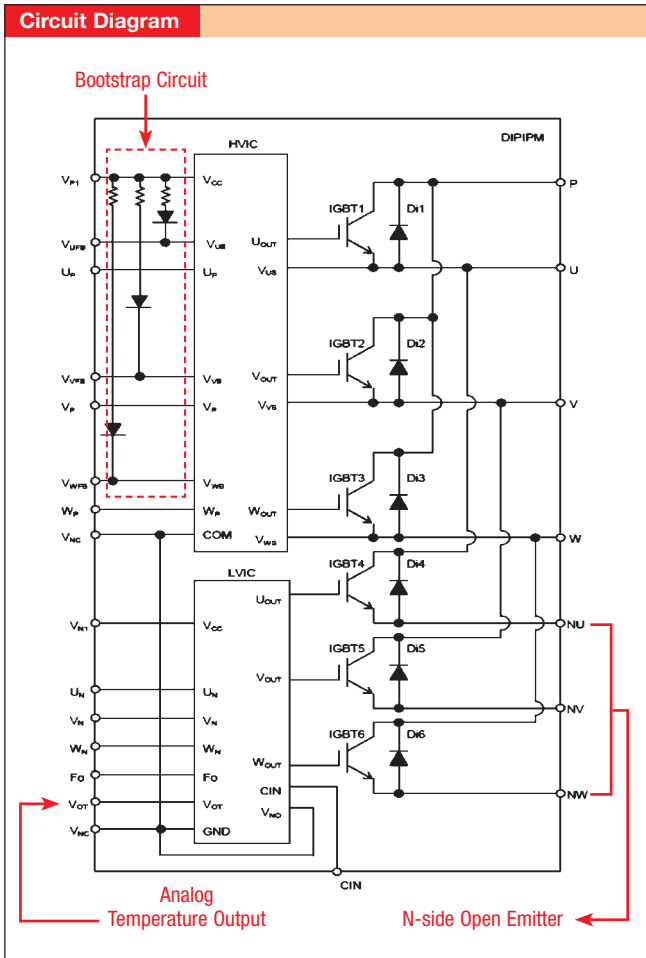


## 2.11 600V Super Mini DIIPM™ Ver. 6 (Dual-in-line Package Intelligent Power Modules)

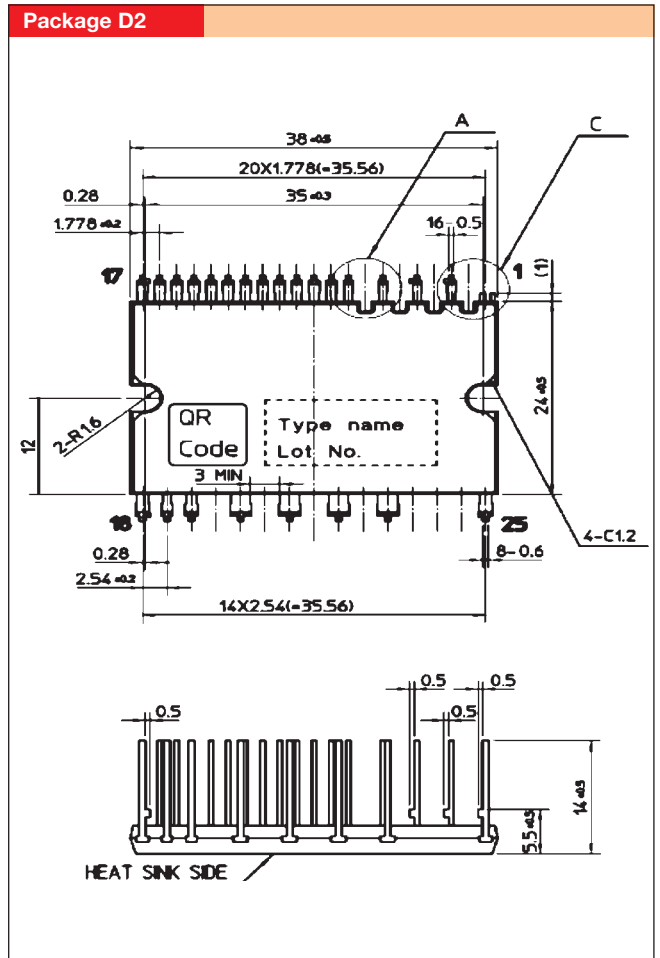
### Line-up 600V Super Mini DIIPM™ Ver. 6

	Type	$V_{CES}$ (V)	$I_c$ (A)	Package- No.
<b>Built-in Over Temp. Protection</b>	PSS10S92E6-AG	600	10	D2
	PSS15S92E6-AG	600	15	D2
	PSS20S92E6-AG	600	20	D2
	PSS30S92E6-AG	600	30	D2
	PSS35S92E6-AG	600	35	D2
<b>Built-in Analog Output of Temp.</b>	PSS10S92F6-AG	600	10	D2
	PSS15S92F6-AG	600	15	D2
	PSS20S92F6-AG	600	20	D2
	PSS30S92F6-AG	600	30	D2
	PSS35S92F6-AG	600	35	D2

#### Circuit Diagram



#### Package D2



Dimensions in mm

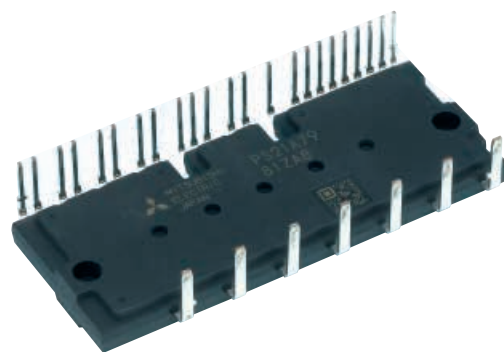
## 600V Large DIIPM™ Ver. 4

(Dual-in-line Package Intelligent Power Modules)



### Features

- Low thermal resistance by innovative insulation material
- RoHS compliant
- For P-side IGBTs:
  - Drive circuit
  - High voltage level shift circuit
  - Control supply under voltage (UV) lockout circuit
- For N-side IGBTs:
  - Drive circuit
  - Short circuit (SC) protection circuit  
(by using external sense resistor)
  - Control supply under voltage (UV) lockout circuit
- IGBT Drive Supply
  - Single DC 15V power supply required
- Control Input interface
  - Schmitt-triggered 3V, 5V, 15V input compatible, high active logic
- Open emitter topology available
- DIIPM™ available in 50A and 75A/600V

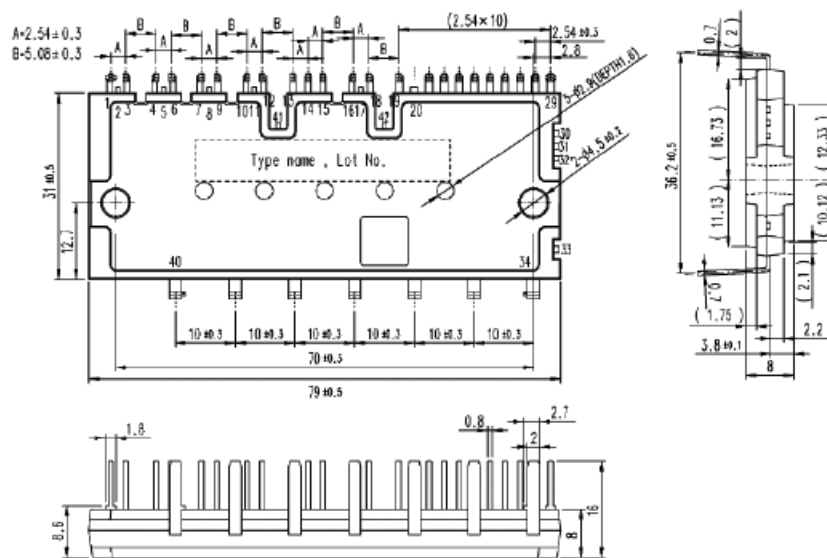


## 2.12 600V Large DIIPM™ Ver. 4 (Dual-in-line Package Intelligent Power Modules)

### Line-up 600V Large DIIPM™ Ver. 4

Type	Series	V <sub>ces</sub> (V)	I <sub>c</sub> (A)	Isolation Voltage (V <sub>rms</sub> )	Motor Rating (kW)	Package- No.
PS21A79	Large DIIPM Ver. 4	600	50	2500	4.0	D1
PS21A7A	Large DIIPM Ver. 4	600	75	2500	5.5	D1

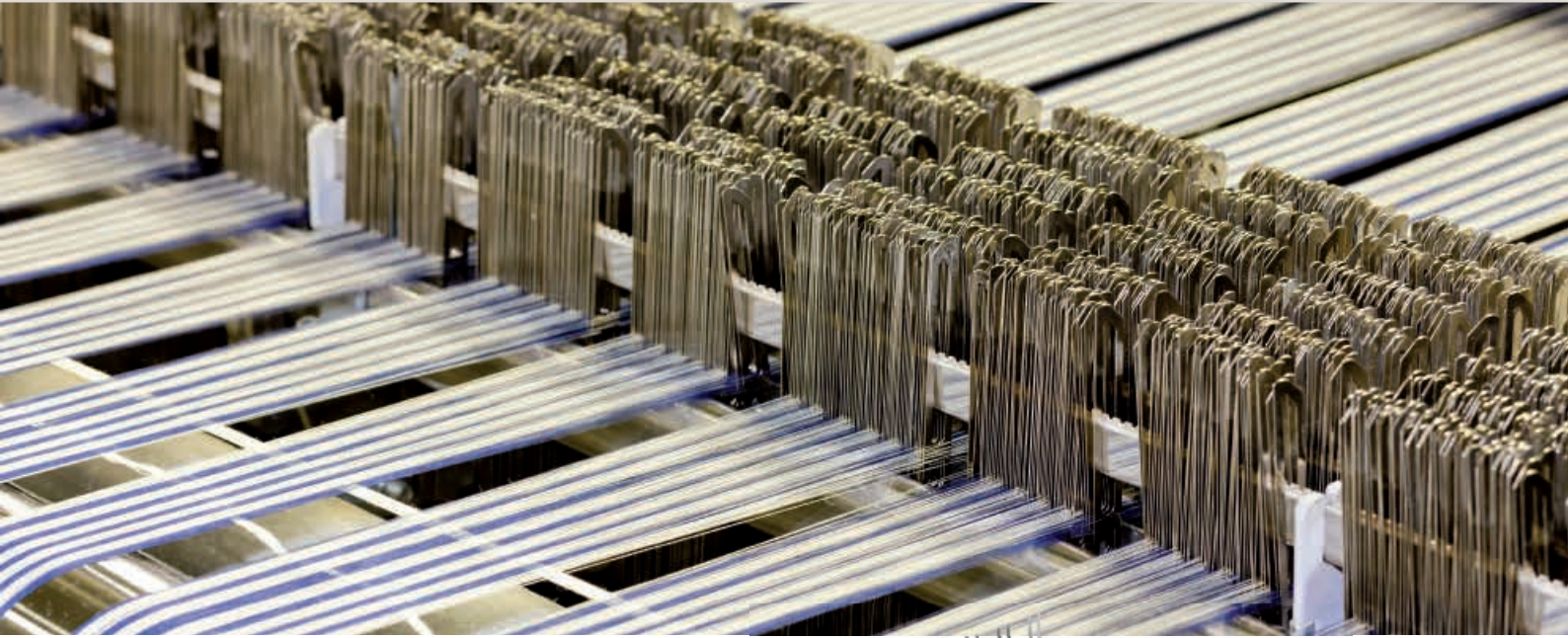
#### Package D1: DIIPM Ver. 4 PS21A7x



#### Notes

## 600V Industrial Mini DIIPM™

(Dual-in-line Package Intelligent Power Modules)

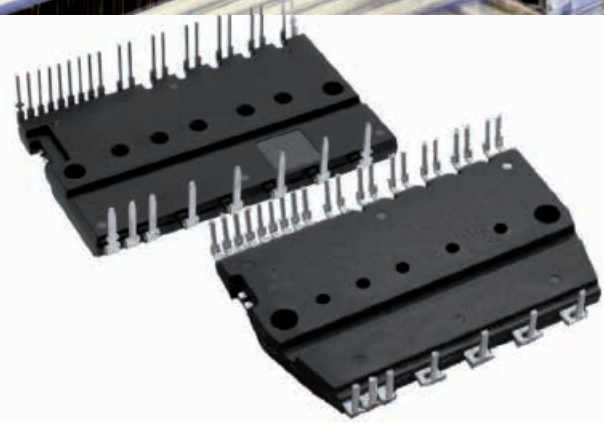


### Applications

- Small Motor Drives
- Textile Machines
- Automatic Doors

### Features

- 6<sup>th</sup> Generation CSTBT™
- Designed for low power motor control (0.2kW-3.7kW at 240V AC line voltage)
- Lead free compact dual-in-line transfer mold package
- Rated currents ranging from 5A-50A and  $V_{CES} = 600V$
- Built-in Bootstrap diode with current limiting resistor
- Protection functions:
  - SC: Short circuit (N) with external shunt resistor
  - UV: Control supply under voltage (P, N)
  - Analog temperature sensor output ( $T_c$ )
- 2500V<sub>rms</sub> isolation voltage
- N-side open emitter structure
- RoHS compliant
- Two type package (Mini DIIPM™ Ver. 3 package\* for 5-20A / Mini DIP Ver. 4 package\* for 20-50A)



\* A part of terminal assignment and shape is different from current Mini DIIPM™ Ver. 3 and 4

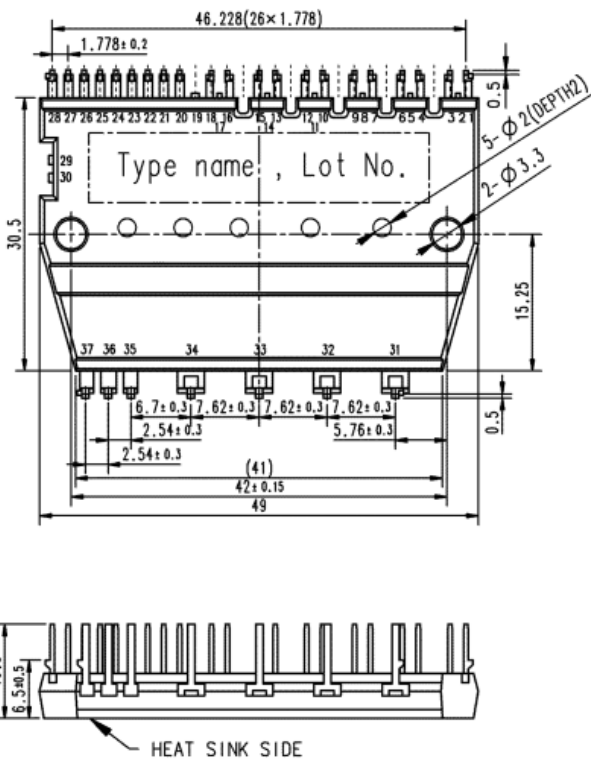


## 2.13 600V Industrial Mini DIIPM™ (Dual-in-line Package Intelligent Power Modules)

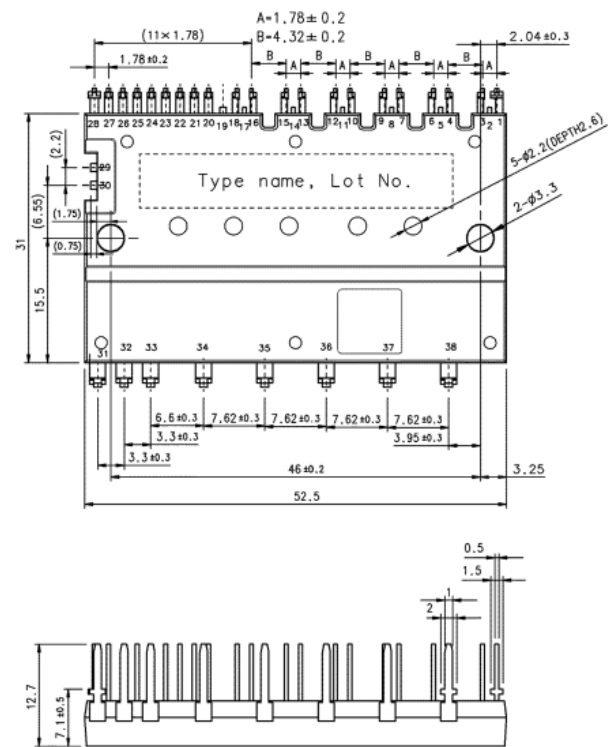
### Line-up 600V Industrial Mini DIIPM™

	Type	V <sub>ces</sub> (V)	I <sub>c</sub> (A)	Package- No.
Built-in Analog Output of Temp.	PSS05S51F6/-C	600	5	D3
	PSS10S51F6/-C	600	10	D3
	PSS15S51F6/-C	600	15	D3
	PSS20S51F6/-C	600	20	D3
	PSS20S71F6	600	20	D5
	PSS30S71F6	600	30	D5
	PSS50S71F6	600	50	D5

Package D3: Mini DIP Ver. 3



Package D5: Mini DIP Ver. 4



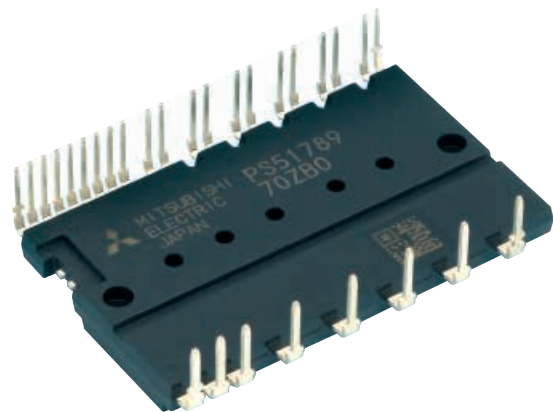
Dimensions in mm

## Mini DIPPFCTM (Dual-in-line Package Power Factor Correction)



### Features

- Employing low loss & high speed Trench IGBTs for total loss reduction at high frequencies
- High reliability (long power life cycle)
- Low thermal resistance by innovative insulation material
- Low noise by optimization of gate driver
- RoHS compliant
- Under voltage (UV) protection



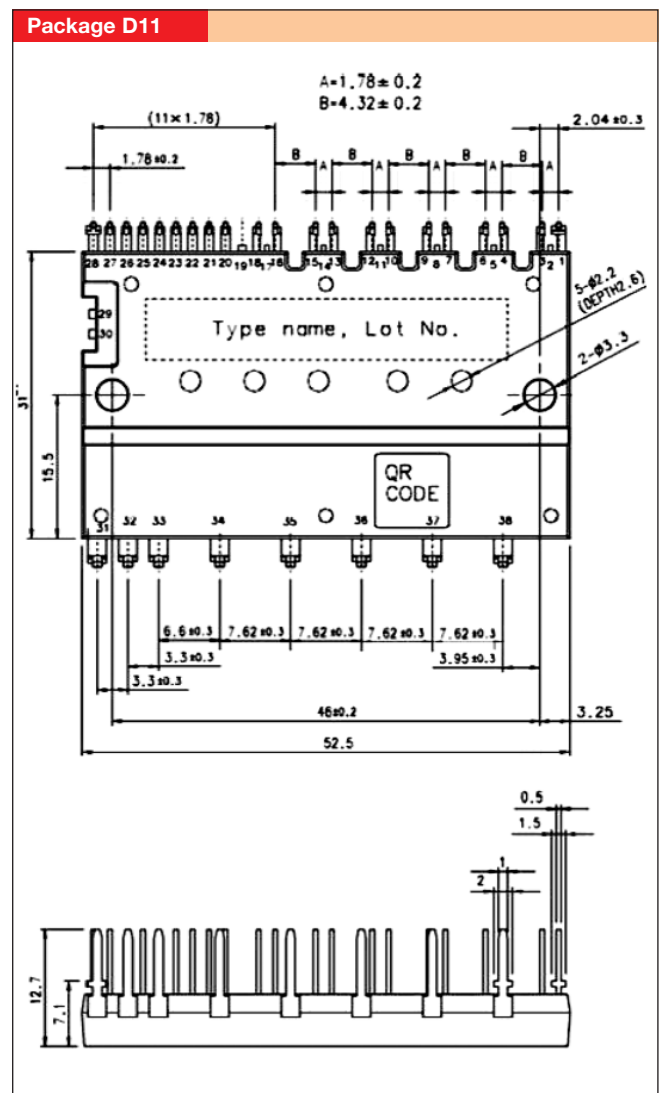
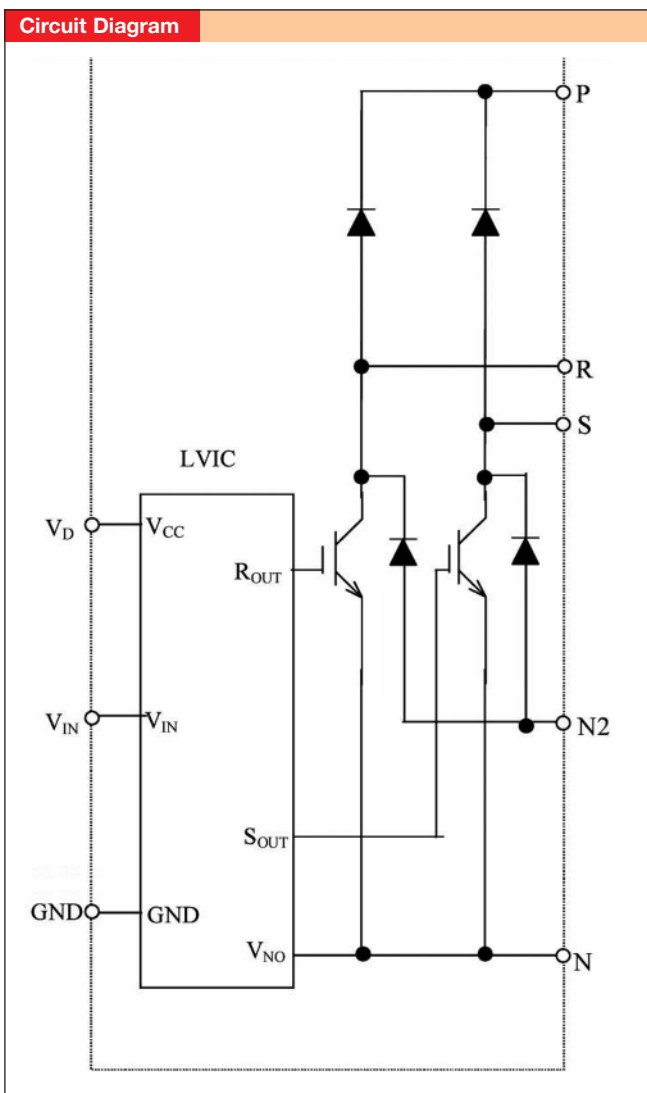
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## 2.14 Mini DIPPFCTM (Dual-in-line Package Power Factor Correction)

### Line-up DIPPFCTM

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>CES</sub> (V)	Input AC current (A <sub>rms</sub> )		Package-No.
			20	30	
Mini DIPPFCTM	2500	600	PS51787	PS51789	D11

Type Number	Electrical Characteristics										Thermal & Mechanical Characteristics		
	Input AC Line Voltage (V <sub>rms</sub> )	Input AC current (A <sub>rms</sub> )	f <sub>c</sub> (kHz)	Isolation Voltage (V <sub>rms</sub> )	V <sub>CESat</sub> @ T <sub>j</sub> = 25°C (V)		Typical Switching Times					IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)
					Typ.	Max.	t <sub>on</sub> (μs)	t <sub>rr</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)		
PS51787	264	20	20	2500	1.9	2.5	0.25	0.11	0.14	0.40	0.18	0.96	1.35
PS51789	264	30	20	2500	2	2.6	0.25	0.11	0.14	0.40	0.18	0.68	0.90



Dimensions in mm

## MOSFET Modules

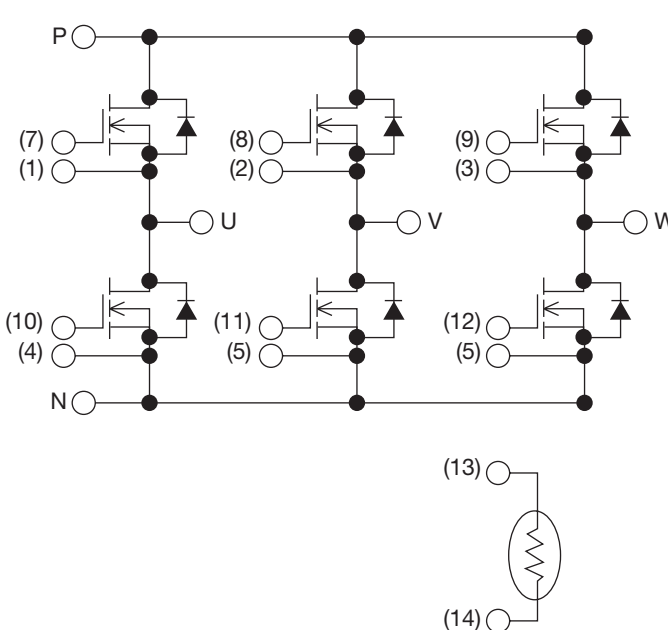


### Features

- Low  $V_{DS(ON)}$  and Low  $V_{SD}$
- Trench gate MOSFET chip technology
- $R_{DS(ON)} = 0.8m\Omega$  (FM400TU-07A @ 25°C)
- Operation without snubber circuit possible
- Avalanche capability is guaranteed at turn-off
- Control terminals for standard connector
- Inbuilt Thermal sensor (NTC)
- High reliability
- 100A<sub>(rms)</sub>, 200A<sub>(rms)</sub>, 300A<sub>(rms)</sub> available in 75V, 100V and 150V in a 6 in 1 compact package

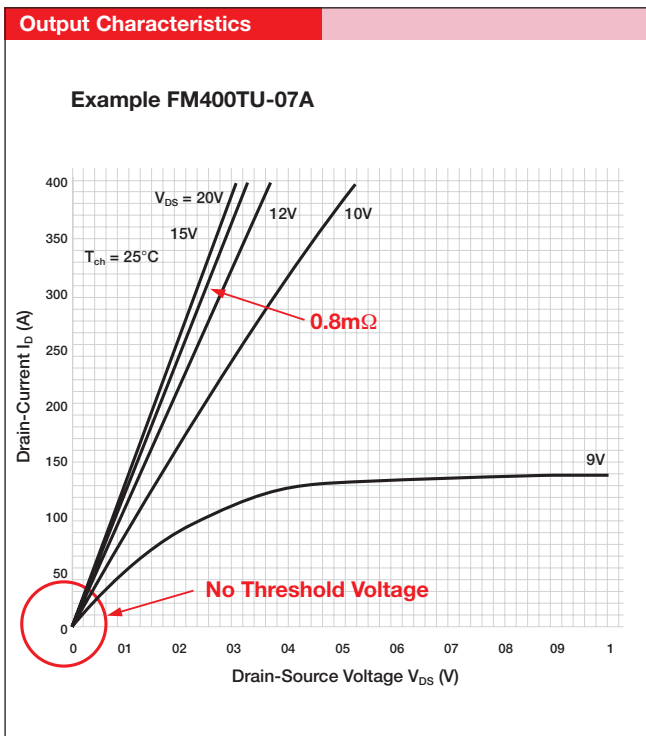
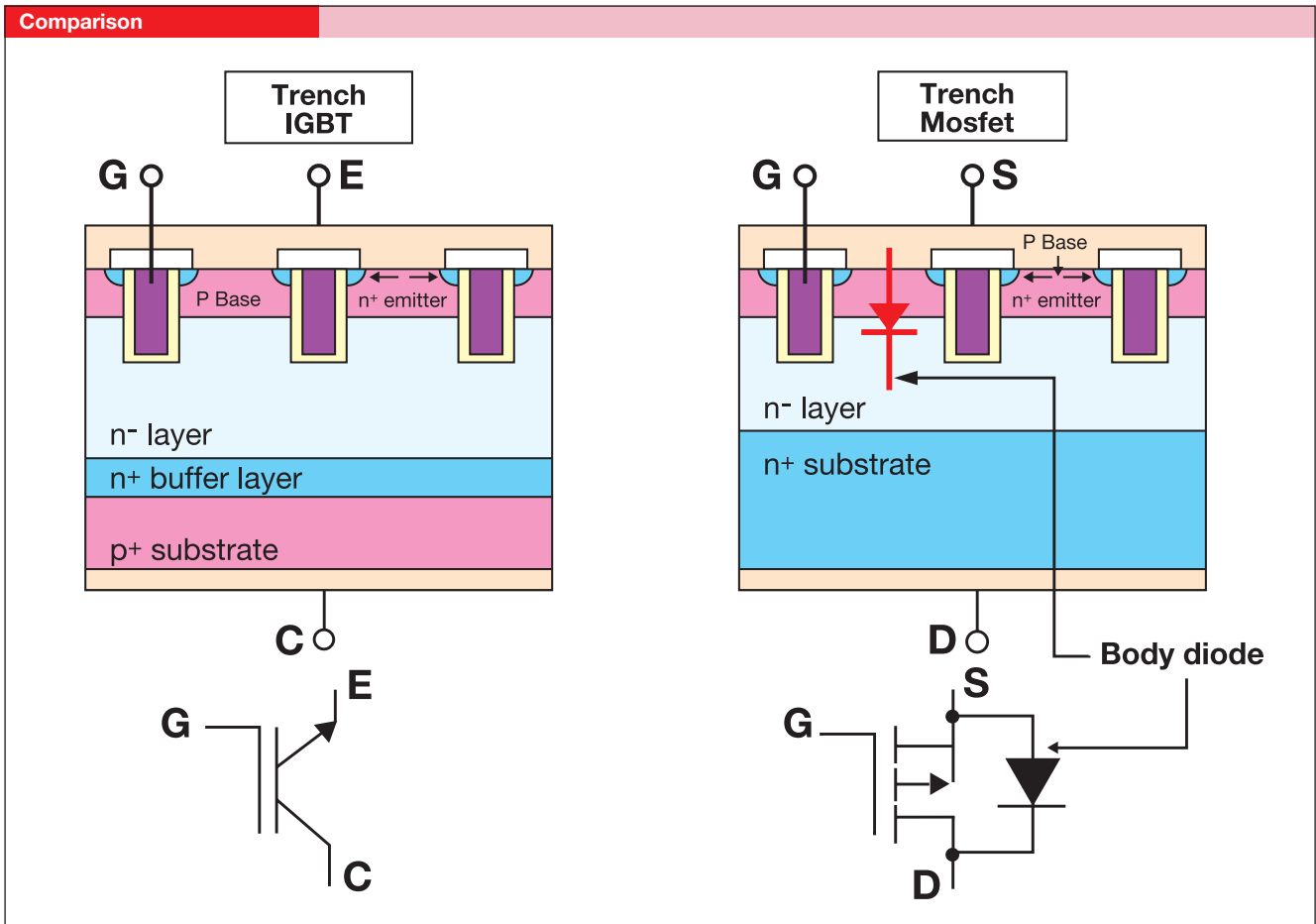


### 3. MOSFET Modules

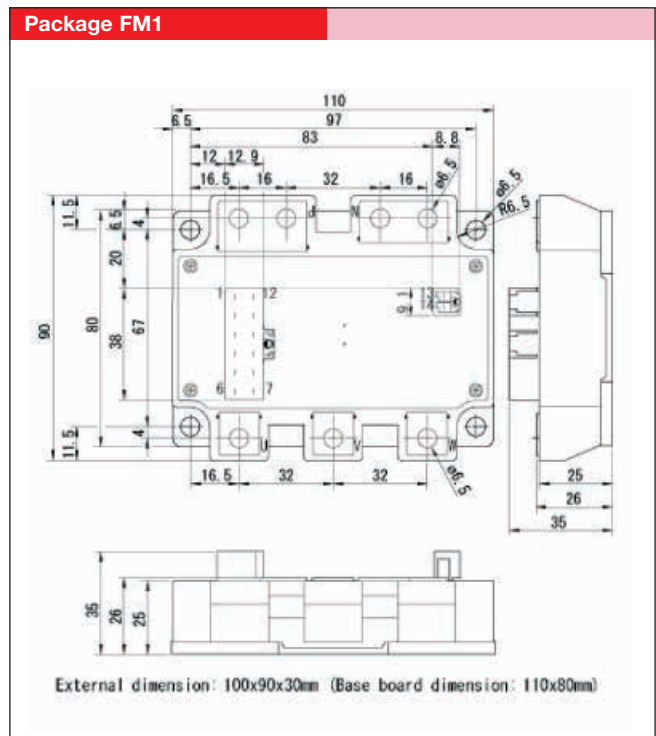
Circuit Diagram	Rated Current (A)	Voltage (V)	Type Number
 <p>(1) S<sub>UP</sub>    (5) S<sub>VN</sub>    (9) G<sub>WP</sub>  (2) S<sub>VP</sub>    (6) S<sub>VN</sub>    (10) G<sub>UN</sub>  (3) S<sub>WP</sub>    (7) G<sub>UP</sub>    (11) G<sub>VN</sub>    (13) TH1  (4) S<sub>UN</sub>    (8) G<sub>VP</sub>    (12) G<sub>VN</sub>    (14) TH2</p>	100	75	FM200TU-07A
		100	FM200TU-2A
		150	FM200TU-3A
	200	75	FM400TU-07A
		100	FM400TU-2A
		150	FM400TU-3A
	300	75	FM600TU-07A
		100	FM600TU-2A
		150	FM600TU-3A

Type Number	Maximum Ratings		Electrical Characteristics										Thermal & Mechanical Characteristics				Package No.
	V <sub>DSS</sub> (V)	I <sub>D</sub> (A)	r <sub>DS(ON)</sub> @ T <sub>ch</sub> = 25°C (mΩ)		C <sub>ISS</sub> (nF)	C <sub>OSS</sub> (nF)	C <sub>RSS</sub> (nF)	Maximum Switching Times					Q <sub>rr</sub> (μC)	V <sub>SD</sub> (V)	MOSFET R <sub>th(j-c)</sub> (K/W) Max.	R <sub>th(c-f)</sub> (K/W) Typ.	
			Typ.	Max.				Max.	Max.	t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)					
FM200TU-07A	75	100	1.20	1.65	50	7	4	450	400	600	400	200	2.0	1.3	0.220	0.1	FM1
FM400TU-07A	75	200	0.80	1.10	75	10	6	450	500	450	400	200	4.5	1.3	0.142	0.1	FM1
FM600TU-07A	75	300	0.53	0.73	110	15	10	450	600	600	600	200	4.8	1.3	0.096	0.1	FM1
FM200TU-2A	100	100	2.40	3.30	50	7	4	400	300	450	300	250	3.6	1.3	0.220	0.1	FM1
FM400TU-2A	100	200	1.45	2.00	75	10	6	400	400	450	300	250	6.0	1.3	0.142	0.1	FM1
FM600TU-2A	100	300	0.80	1.10	110	15	10	400	600	600	400	250	6.2	1.3	0.096	0.1	FM1
FM200TU-3A	150	100	4.80	6.60	50	7	4	400	250	450	200	200	6.5	1.3	0.220	0.1	FM1
FM400TU-3A	150	200	2.60	3.55	75	10	6	400	300	450	200	200	7.0	1.3	0.142	0.1	FM1
FM600TU-3A	150	300	1.60	2.20	110	15	10	400	400	500	400	200	8.0	1.3	0.096	0.1	FM1

### 3. MOSFET Modules



Dimensions in mm

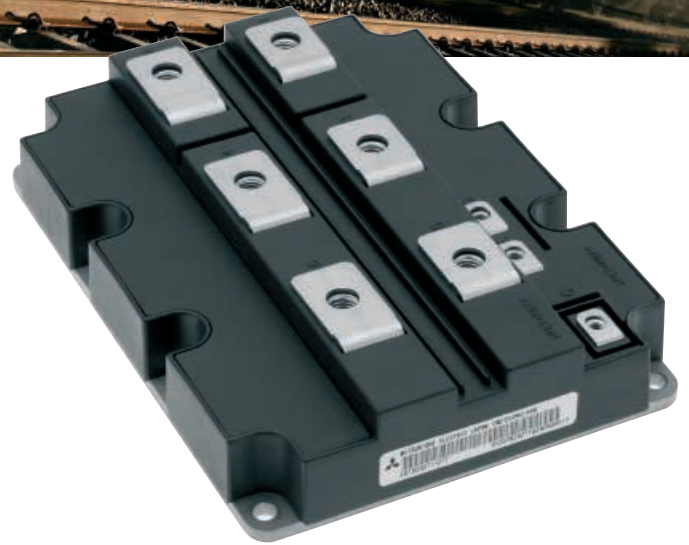


## High Voltage IGBT Modules (HVIGBT)



### Features

- Highest Reliability in Material and Processes: Improvement of power cycling capability
- High robust design
- Highest Quality Controls:
  - Static and switching tests
  - 100% shipping inspection
- HVIGBT and HVDIODE modules are available in rated voltages of 1.7kV, 2.5kV, 3.3kV, 4.5kV, 6.5kV and rated currents ranging from 200A to 2400A
- 4 • 1.7kV HVIGBT modules with Light Punch Through Carrier Stored Trench Gate Bipolar Transistor (LPT-CSTBT™) technology and a new free-wheel diode design for reduced IGBT losses and suppressed diode oscillation
- 3.3kV, 4.5kV & 6.5kV HVIGBT modules and diodes with 10.2kV isolated package available
- New 3.3kV, 4.5kV, 6.5kV R-Series IGBT Modules
  - Increased rated current and low loss performance
  - Increased terminal torque capability to 22Nm
  - 10.2kV high isolation package available on request
  - Extended maximum operating temperature and minimum storage temperature up to 150°C and -55°C respectively
  - High Robustness (Wide SOA)
- New 1.7kV 1200A Dual Hybrid SiC Module
  - New 6<sup>th</sup> Generation IGBT chip, CSTBT™ (III)
  - Extended maximum operation temperature and minimum storage temperature up to 150°C and -50°C respectively
  - SiC Schottky-Barrier Diode



## 4.01 High Voltage IGBT Modules (HVIGBT)

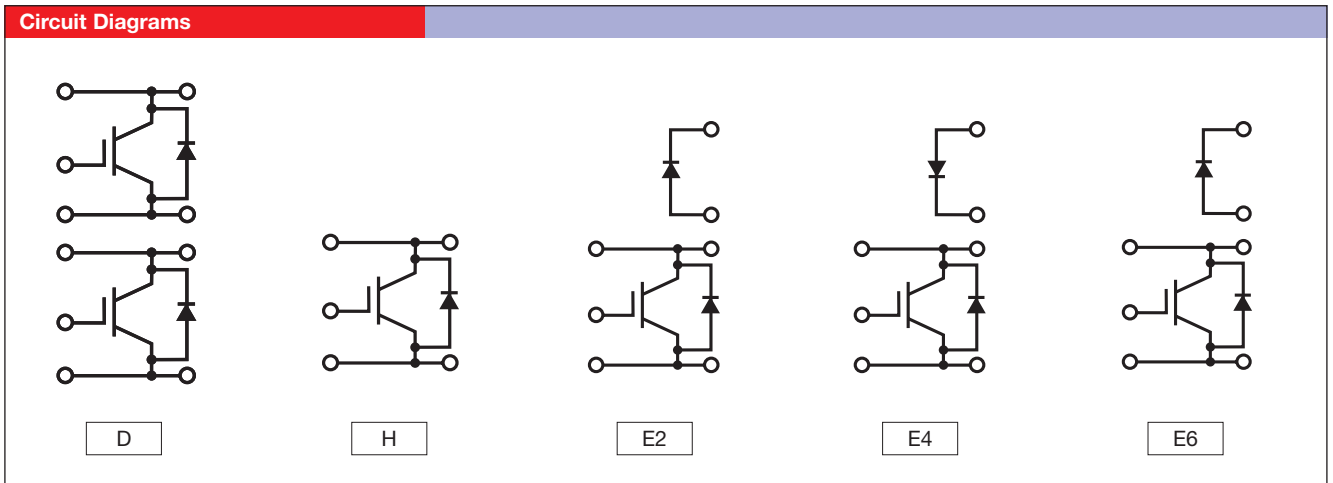
### Line-up HVIGBTs

V <sub>CEs</sub> (V)	Generation & Base Plate Material	Configu- ration	I <sub>c</sub> (A)																	
			200	400	600	750	800	900	1000	1200	1500	1600	1800	2400						
1700	G1 (Cu)	Single					CM800HA-34H					CM1200HA-34H								
		Dual			CM600DY-34H															
		Chopper			CM600E2Y-34H															
	G3 (AlSiC)	Single										CM1200HC-34H			CM1600HC-34H			CM2400HC-34H		
		Dual					CM800DZ-34H CM800DZB-34N <sup>1</sup>													
		Dual										CM1200DB-34N <sup>1</sup>								
2500	G4 (Cu)	Single										CM1200HC-34N <sup>1</sup>						CM2400HC-34N <sup>1</sup>		
		Dual																	CM1800HC-34N <sup>1</sup> CM1800HCB-34N <sup>1</sup>	
		Chopper																		
	G5 (AlSiC)	Dual																		
		Single																		
		Dual																		
3300	G1 (Cu)	Single																		
		Dual			CM400DY-50H															
		Single																		
	G2 (Cu)	Single																		
		Single																		
		Single																		
G3 (AlSiC)	Single																			
	Dual																			
	Single																			
4500	G2 (Cu)	Single																		
		Single																		
		Single																		
	G3 (AlSiC)	Single																		
		Single																		
		Chopper																		
6500	G2 (Cu)	Single																		
		Single																		
		Single																		
	G3 (AlSiC)	Single																		
		Single																		
		Chopper																		

<sup>1</sup> CSTBT™ Chip Technology    <sup>2</sup> High Isolation Package (10.2kV<sub>rms</sub>)    <sup>3</sup> New R-Series    <sup>4</sup> CSTBT™ (III) Chip Technology    <sup>5</sup> SiC Schottky-Barrier Diode



## 4.01 High Voltage IGBT Modules (HVIGBT)



For detailed connections please refer data sheet.

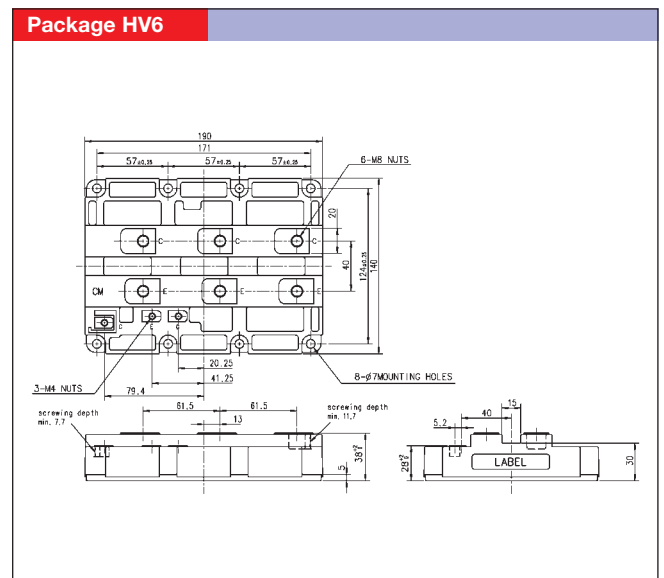
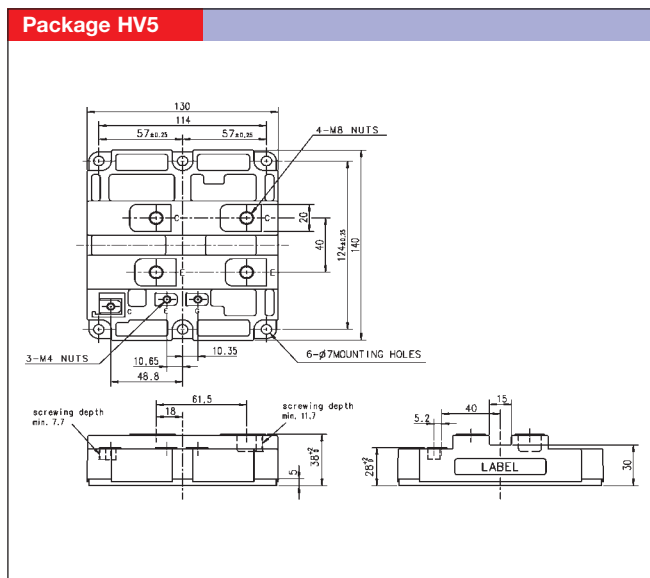
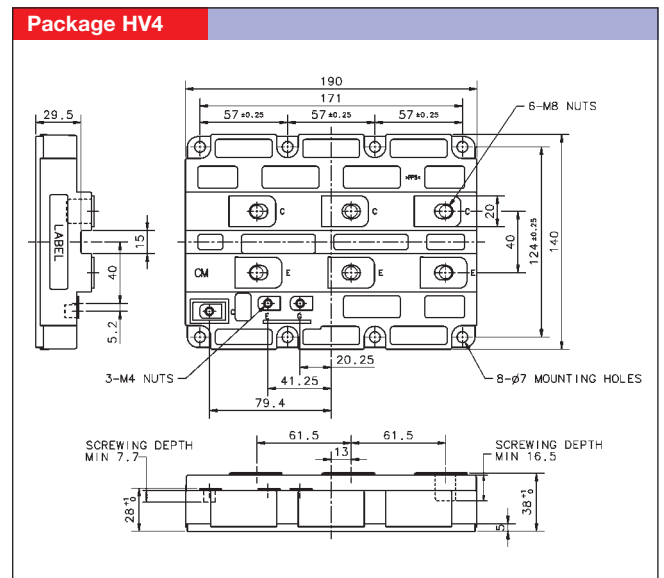
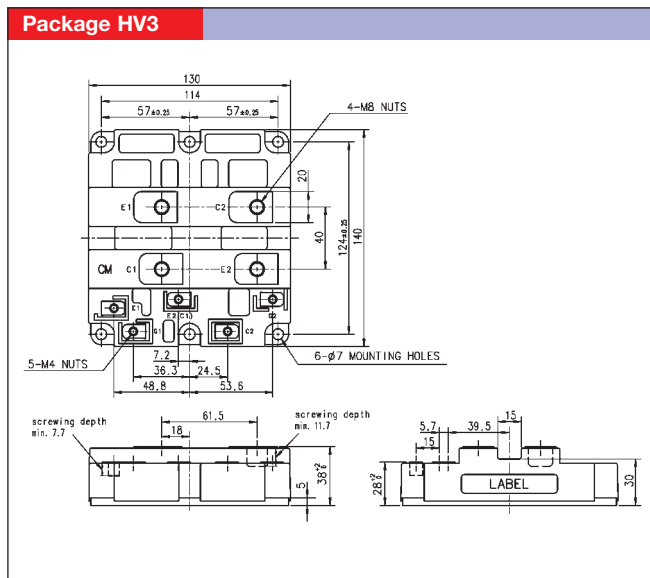
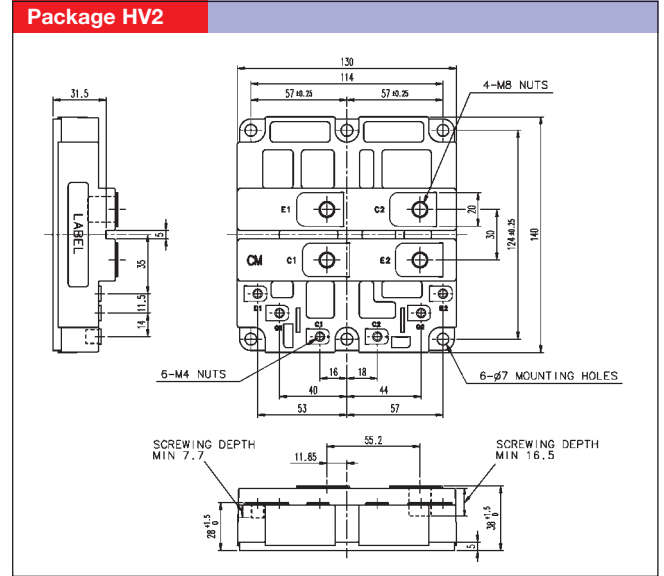
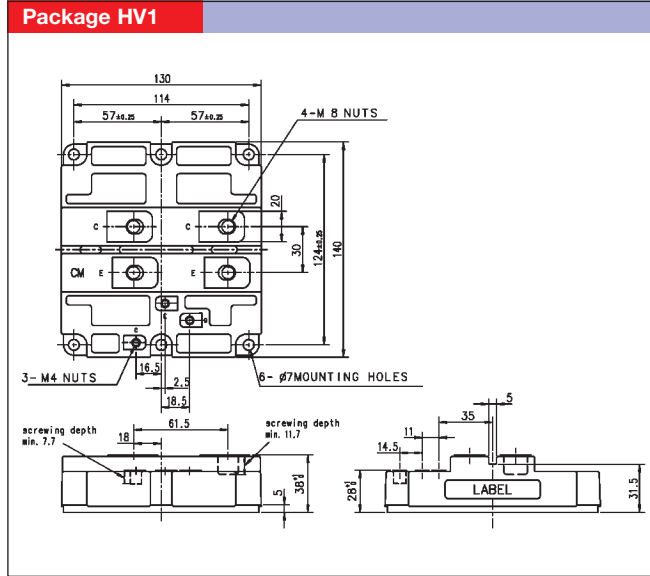
Package Symbol	Type Number	Maximum Ratings			Electrical Characteristics			Free Wheel Diode		Thermal & Mechanical Characteristics			Package-No.
		V <sub>CES</sub> (V)	I <sub>c</sub> (A)	V <sub>isol</sub> (V)	V <sub>CEsat</sub> @ T <sub>j</sub> = 25°C (V)	E <sub>on</sub> @ T <sub>j</sub> = 125°C (J/P)	E <sub>off</sub> @ T <sub>j</sub> = 125°C (J/P)	V <sub>F</sub> @ T <sub>j</sub> = 25°C (V)	E <sub>rr</sub> @ T <sub>j</sub> = 125°C (J/P)	IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)	
					Typ.	Typ.	Typ.	Typ.	Typ.	Max.	Max.	Max.	
<b>1700 Volt HVIGBT Modules</b>													
D	CM600DY-34H	1700	600	4000	2.75	0.28	0.15	2.40	0.09	0.0180	0.056	0.016	HV2
	CM800DZ-34H	1700	800	4000	2.60	0.35	0.26	2.30	0.12	0.0200	0.034	0.016	HV2
	CM800DZB-34N	1700	800	4000	2.10	0.30	0.20	2.20	0.18	0.0240	0.036	0.018	HV2
	CM1200DC-34N	1700	1200	4000	2.15	0.38	0.36	2.60	0.22	0.0190	0.042	0.016	HV10
	CM1200DB-34N	1700	1200	4000	2.15	0.38	0.36	2.60	0.22	0.0180	0.04	0.016	HV10
	CM1200DC-34S	1700	1200	4000	1.95	0.34	0.28	2.60	0.17	0.0185	0.042	0.016	HV10
	CMH1200DC-34S	1700	1200	4000	1.95	0.15	0.28	1.60	–	0.0185	0.036	0.016	HV10
H	CM800HA-34H	1700	800	4000	2.75	0.30	0.30	2.40	0.15	0.0135	0.042	0.012	HV1
	CM1200HA-34H	1700	1200	4000	2.75	0.45	0.45	2.40	0.22	0.0090	0.028	0.008	HV1
	CM1200HC-34H	1700	1200	4000	2.50	0.40	0.44	2.25	0.18	0.0120	0.020	0.010	HV1
	CM1200HCB-34N	1700	1200	4000	2.05	0.43	0.32	2.20	0.29	0.0140	0.021	0.010	HV7
	CM1600HC-34H	1700	1600	4000	2.60	0.54	0.58	2.30	0.22	0.0100	0.017	0.008	HV1
	CM1800HC-34H	1700	1800	4000	2.40	0.59	0.67	2.20	0.26	0.0080	0.013	0.007	HV4
	CM1800HC-34N	1700	1800	4000	2.15	0.55	0.56	2.60	0.28	0.0125	0.028	0.011	HV12
	CM1800HCB-34N	1700	1800	4000	2.00	0.56	0.50	2.10	0.44	0.0090	0.013	0.007	HV4
	CM2400HC-34H	1700	2400	4000	2.60	0.81	0.87	2.30	0.33	0.0070	0.012	0.006	HV4
	CM2400HC-34N	1700	2400	4000	2.15	0.64	0.84	2.60	0.38	0.0095	0.021	0.008	HV12
CM2400HCB-34N	1700	2400	4000	2.10	0.65	0.70	2.20	0.50	0.0080	0.012	0.006	HV4	
E2	CM600E2Y-34H	1700	600	4000	2.75	0.28	0.15	2.40	0.09	0.0180	0.056	0.016	HV13
E4	CM1200E4C-34N	1700	1200	4000	2.15	0.38	0.36	2.60	0.22	0.0190	0.042	0.016	HV12
<b>2500 Volt HVIGBT Modules</b>													
D	CM400DY-50H	2500	400	6000	3.20	0.50	0.40	2.90	0.11	0.036	0.072	0.016	HV3
H	CM800HA-50H	2500	800	6000	3.20	1.00	0.80	2.90	0.21	0.018	0.036	0.008	HV5
	CM800HB-50H	2500	800	6000	2.80	0.80	0.86	2.50	0.33	0.012	0.024	0.008	HV7
	CM1200HA-50H	2500	1200	6000	3.20	1.50	1.20	2.90	0.31	0.012	0.024	0.006	HV6
	CM1200HB-50H	2500	1200	6000	2.80	1.20	1.29	2.50	0.45	0.008	0.016	0.006	HV4
	CM1200HC-50H	2500	1200	6000	2.80	1.30	1.20	2.50	0.45	0.0085	0.017	0.006	HV4

## 4.01 High Voltage IGBT Modules (HVIGBT)

Package Symbol	Type Number	Maximum Ratings			Electrical Characteristics			Free Wheel Diode		Thermal & Mechanical Characteristics			Package-No.
		V <sub>CES</sub> (V)	I <sub>C</sub> (A)	V <sub>isol</sub> (V)	V <sub>CESat</sub> @ T <sub>j</sub> = 25°C (V)	E <sub>on</sub> @ T <sub>j</sub> = 125°C (J/P)	E <sub>off</sub> @ T <sub>j</sub> = 125°C (J/P)	V <sub>F</sub> @ T <sub>j</sub> = 25°C (V)	E <sub>rr</sub> @ T <sub>j</sub> = 125°C (J/P)	IGBT R <sub>th(j-c)</sub> (K/W)	Diode R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)	
					Typ.	Typ.	Typ.	Typ.	Typ.	Max.	Max.	Max.	
<b>3300 Volt HVIGBT Modules</b>													
<b>D</b>	CM400DY-66H	3300	400	6000	4.40	0.67	0.40	3.30	0.17	0.036	0.072	0.016	HV3
<b>H</b>	CM400HG-66H	3300	400	10200	3.30	0.59	0.52	2.80	0.30	0.027	0.0525	0.018	HV9
	CM800HA-66H	3300	800	6000	4.40	1.60	0.80	3.30	0.33	0.018	0.036	0.008	HV5
	CM800HB-66H	3300	800	6000	3.80	1.20	0.96	2.80	0.47	0.012	0.024	0.008	HV7
	CM800HC-66H	3300	800	6000	3.30	1.10	1.05	2.80	0.60	0.013	0.025	0.008	HV7
	CM1000HC-66R	3300	1000	6000	2.45	1.85	1.65	2.15	1.20	0.012	0.0225	0.009	HV14
	CM1200HA-66H	3300	1200	6000	4.40	2.00	1.20	3.30	0.50	0.012	0.024	0.006	HV6
	CM1200HB-66H	3300	1200	6000	3.80	1.80	1.44	2.80	0.70	0.008	0.016	0.006	HV4
	CM1200HC-66H	3300	1200	6000	3.30	1.60	1.55	2.80	0.90	0.0085	0.017	0.006	HV4
	CM1200HG-66H	3300	1200	10200	3.30	1.60	1.55	2.80	0.90	0.009	0.0175	0.006	HV8
	CM1500HC-66R	3300	1500	6000	2.45	2.75	2.45	2.15	1.75	0.008	0.015	0.006	HV15
CM1500HG-66R	3300	1500	10200	2.45	2.75	2.45	2.15	1.75	0.0085	0.0155	0.006	HV16	
<b>E2</b>	CM800E2C-66H	3300	800	6000	3.80	1.20	0.96	2.80	0.47	0.013	0.025	0.008	HV4
<b>E4</b>	CM800E4C-66H	3300	800	6000	3.30	1.10	1.05	2.80	0.60	0.013	0.025	0.006	HV4
	CM1000E4C-66R	3300	1000	6000	2.45	1.85	1.65	2.15	1.20	0.012	0.0225	0.007	HV15
<b>E6</b>	CM800E6C-66H	3300	800	6000	3.30	1.10	1.05	2.80	0.60	0.013	0.025	0.008	HV4
<b>4500 Volt HVIGBT Modules</b>													
<b>H</b>	CM400HB-90H	4500	400	6000	3.00	2.00	1.20	4.00	0.28	0.021	0.042	0.015	HV7
	CM600HB-90H	4500	600	6000	3.00	2.80	1.80	4.00	0.42	0.0135	0.027	0.010	HV7
	CM600HG-90H	4500	600	10200	3.45	2.80	1.70	4.80	0.67	0.0165	0.033	0.009	HV11
	CM800HC-90R	4500	800	6000	3.50	3.15	2.60	2.60	1.50	0.015	0.0285	0.009	HV14
	CM800HG-90R	4500	800	10200	3.50	3.15	2.60	2.60	1.50	0.016	0.0295	0.009	HV17
	CM900HB-90H	4500	900	6000	3.00	4.00	2.70	4.00	0.88	0.009	0.018	0.007	HV4
	CM900HC-90H	4500	900	6000	3.45	4.20	2.50	4.80	1.00	0.0105	0.021	0.006	HV4
	CM900HG-90H	4500	900	10200	3.45	4.20	2.50	4.80	1.00	0.011	0.022	0.006	HV8
	CM1200HC-90R	4500	1200	6000	3.50	4.70	3.85	2.60	2.25	0.010	0.019	0.006	HV15
	CM1200HG-90R	4500	1200	10200	3.50	4.70	3.85	2.60	2.25	0.0105	0.0195	0.006	HV16
	CM1200HC-90RA	4500	1200	6000	2.80	5.40	5.20	2.25	3.00	0.0095	0.0185	0.006	HV15
<b>6500 Volt HVIGBT Modules</b>													
<b>H</b>	CM200HG-130H	6500	200	10200	4.50	1.50	1.20	4.0	0.70	0.042	0.066	0.018	HV9
	CM400HG-130H	6500	400	10200	4.50	3.00	2.70	4.0	1.40	0.021	0.033	0.009	HV11
	CM600HG-130H	6500	600	10200	4.50	4.50	4.30	4.0	2.00	0.014	0.022	0.006	HV8
	CM750HG-130R	6500	750	10200	3.90	4.10	4.60	3.0	1.85	0.012	0.022	0.006	HV16
<b>E4</b>	CM400E4G-130H	6500	400	10200	4.50	3.00	2.70	3.8	1.40	0.021	0.033	0.009	HV8

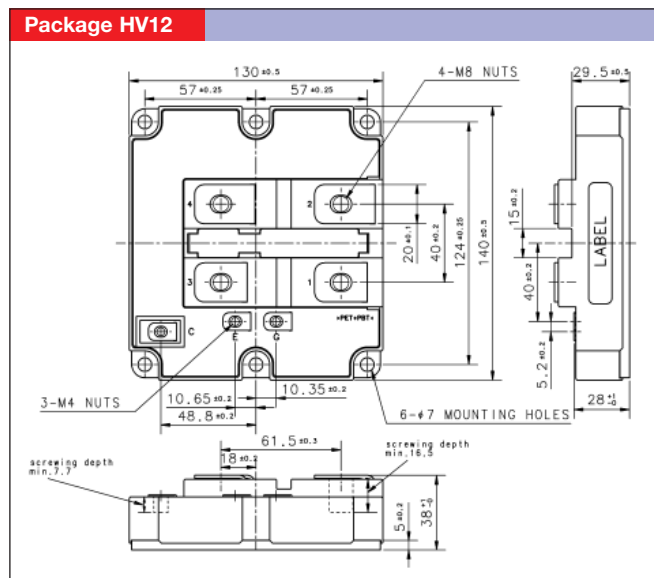
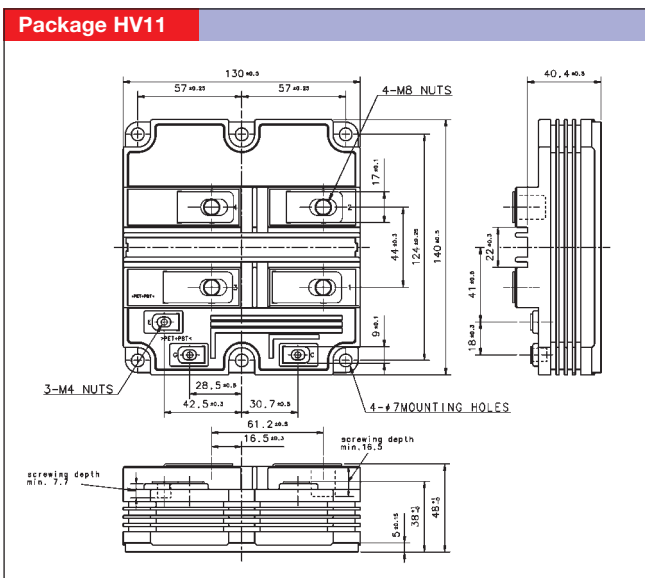
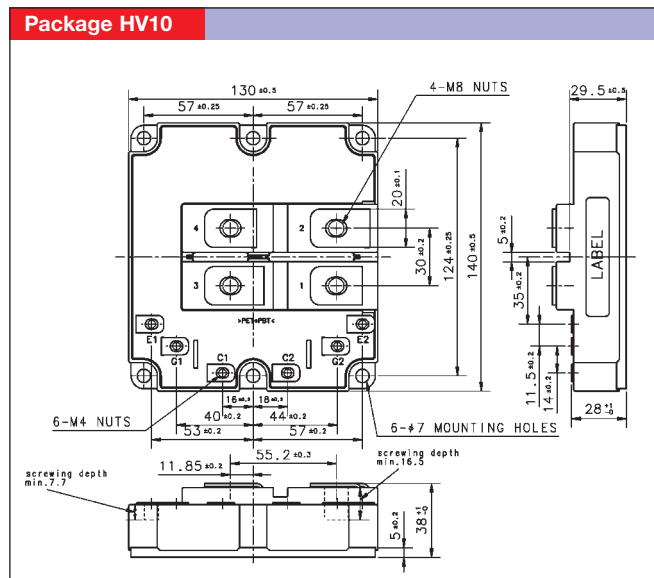
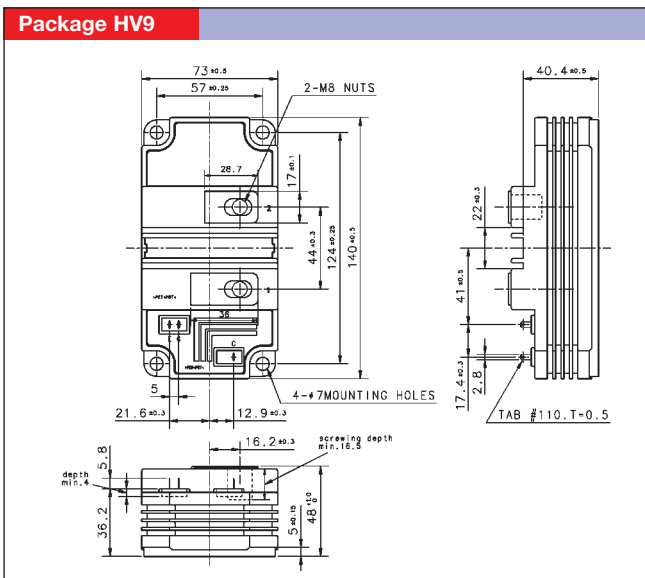
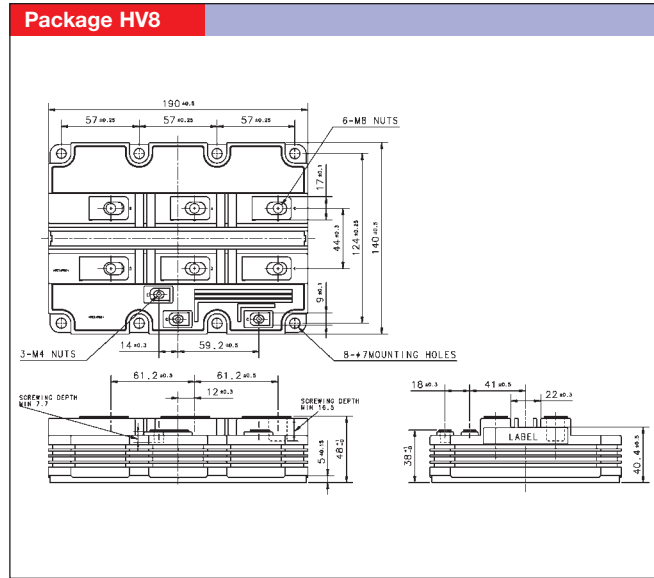
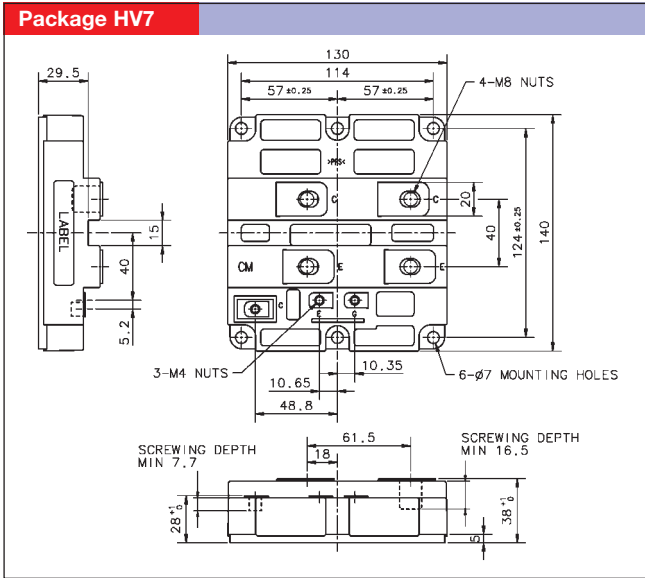
For detail test conditions please refer to data sheets.

## 4.01 High Voltage IGBT Modules (HVIGBT)



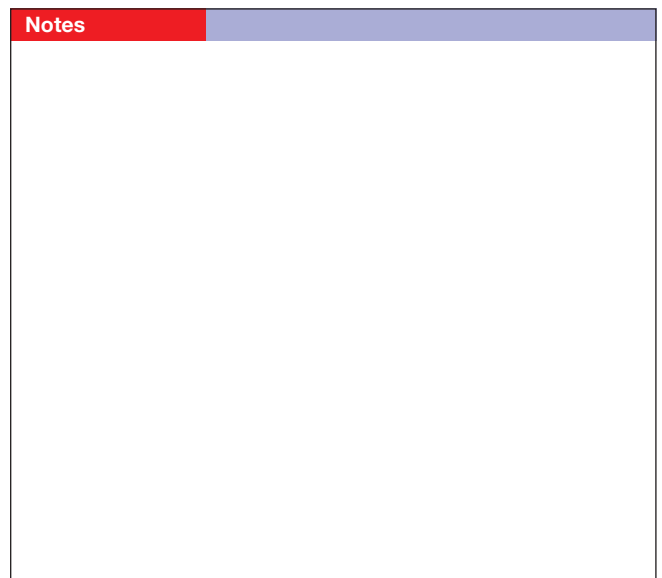
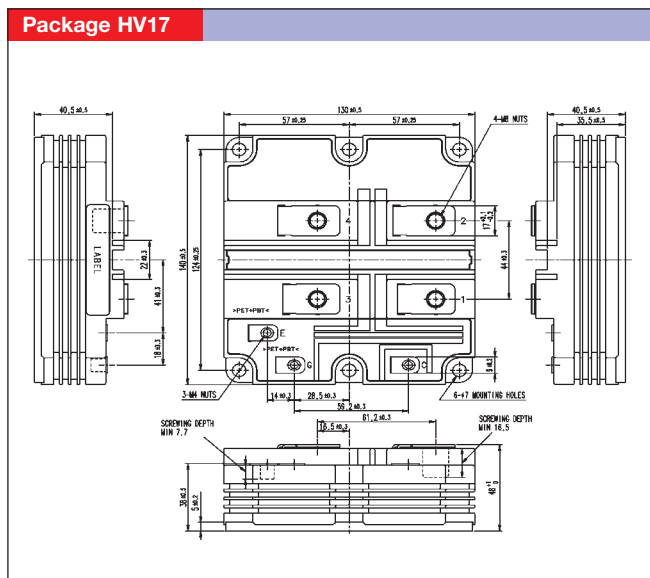
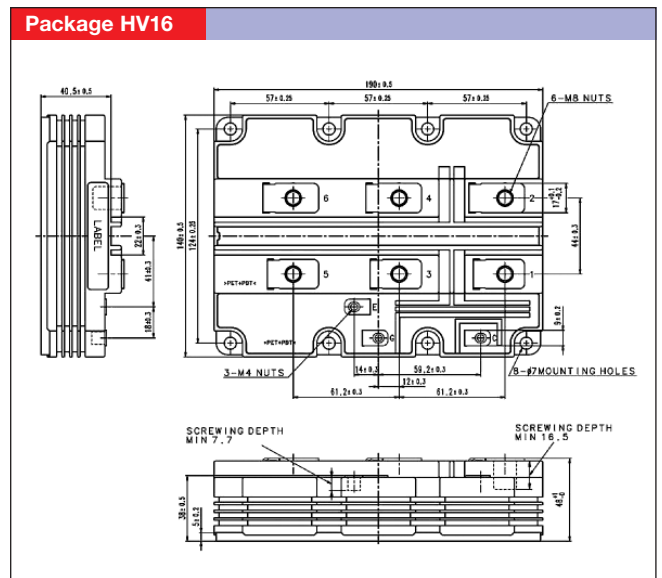
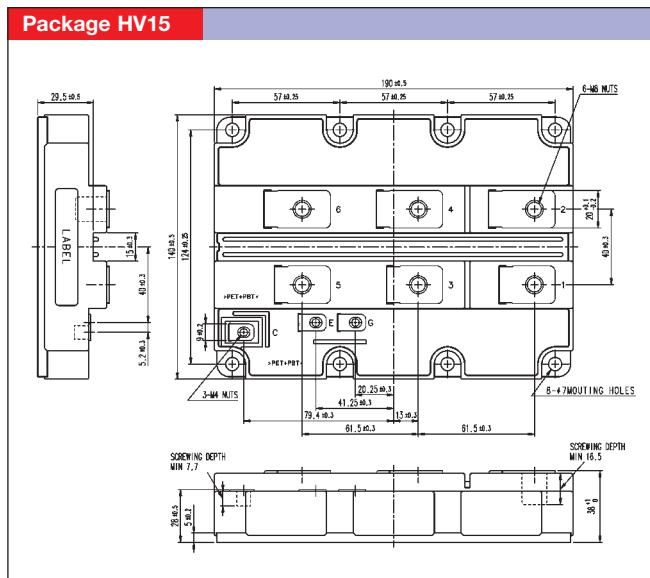
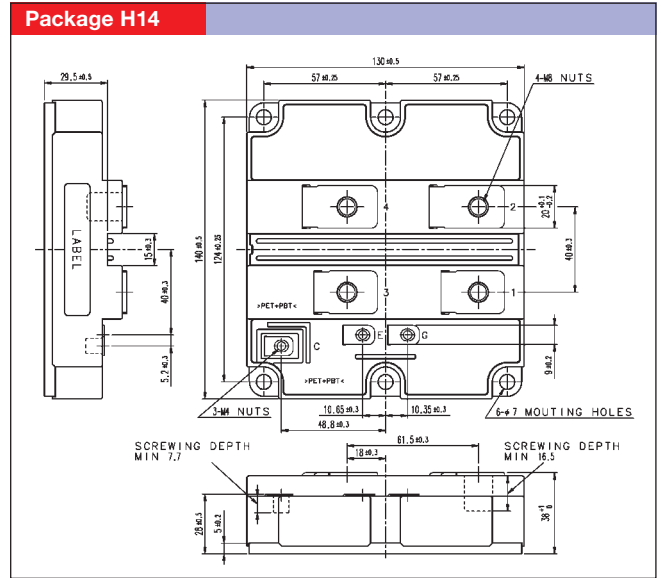
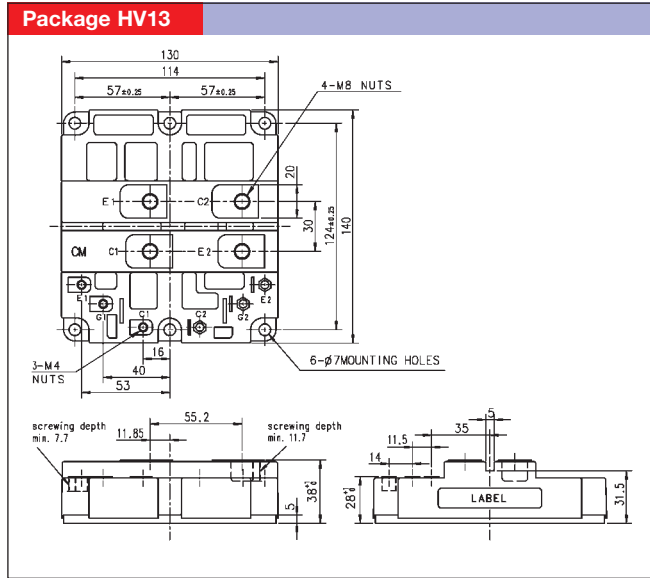
Dimensions in mm

## 4.01 High Voltage IGBT Modules (HVIGBT)



Dimensions in mm

## 4.01 High Voltage IGBT Modules (HVIGBT)



4

## High Voltage Diode Modules



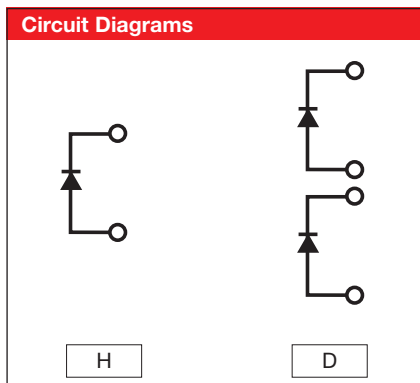
### Features

- Complementary to HVIGBT modules for multilevel inverter designs
- Wide creepage distance between main terminals
- Ease of both installation and connection allows application equipment to be reduced in dimensions and weight



4

### Circuit Diagrams



For detailed connections please refer data sheets.

## 4.02 High Voltage Diode Modules

### Line-up HVDIODE Modules

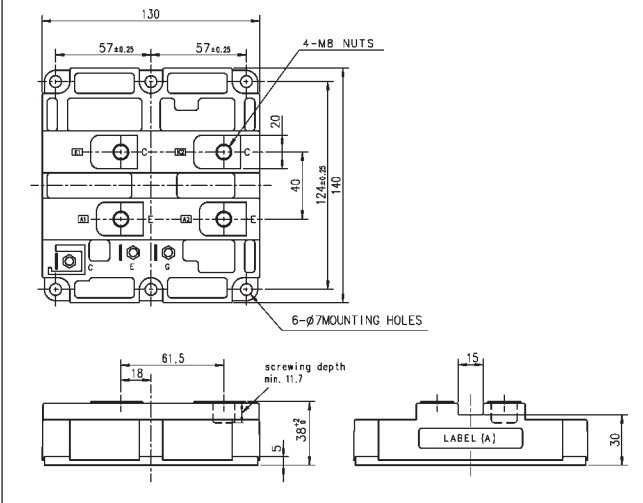
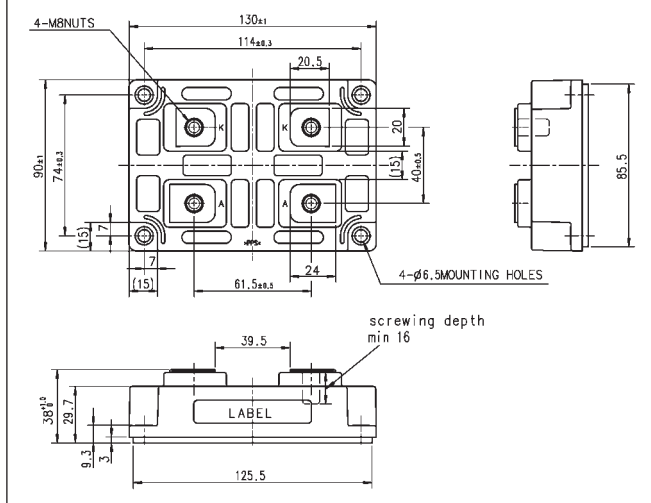
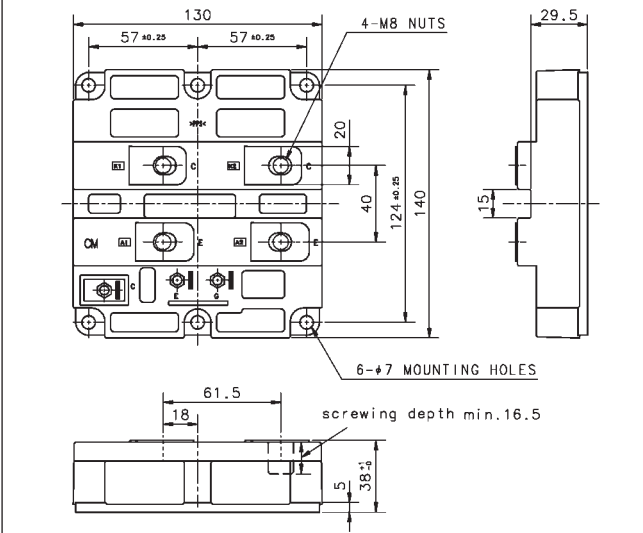
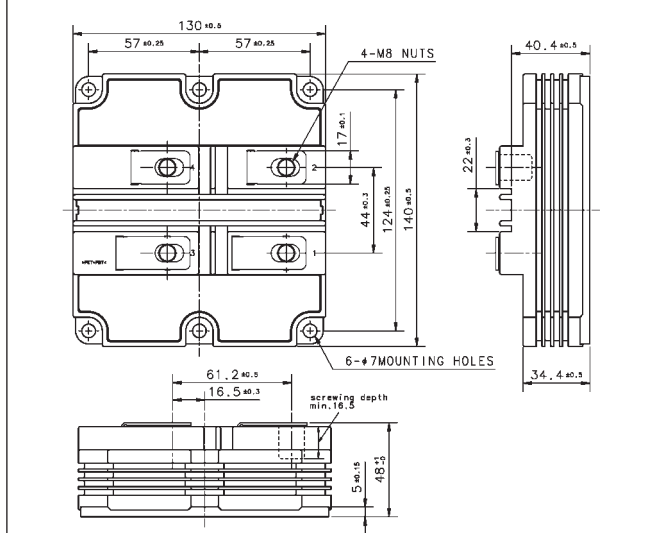
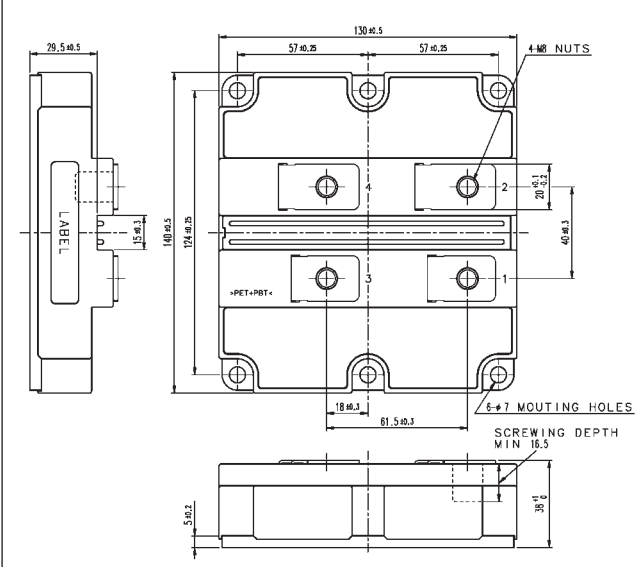
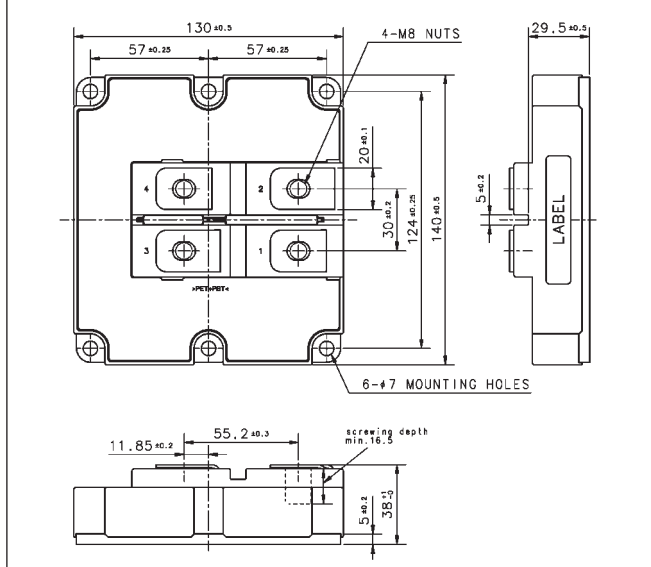
V <sub>CES</sub> (V)	Generation & Base Plate Material	Con- figu- ration	I <sub>c</sub> (A)										
			200	250	300	400	600	800/900	1000	1200	1500	1800	
1700	G3 (AlSiC)	Single											RM1800HE-34S
	G3 (Cu)	Dual									RM1200DB-34S		
3300	G1 (Cu)	Dual				RM400DY-66S	RM600DY-66S						
	G2 (Cu)	Dual									RM1200DB-66S		
	G3 (AlSiC)	Single									RM1200HE-66S		
		Dual				RM400DG-66S <sup>1</sup>				RM1000DC-66F <sup>2</sup>	RM1200DG-66S <sup>1</sup>	RM1500DC-66F <sup>2</sup>	
4500	G2 (Cu)	Dual							RM900DB-90S				
	G3 (AlSiC)	Single						RM600HE-90S					
		Dual			RM300DG-90S <sup>1</sup>	RM400DG-90F <sup>1,2</sup>			RM800DG-90F <sup>1,2</sup>		RM1200DG-90F <sup>1,2</sup>		
6500	G3 (AlSiC)	Dual	RM200DG-130S <sup>1</sup>	RM250DG-130F <sup>1,2</sup>			RM600DG-130S <sup>1</sup>						

<sup>1</sup> High Isolation Package (10.2kV<sub>rms</sub>)    <sup>2</sup> New F-Series

Package Symbol	Type Number	Maximum Ratings				Electrical Characteristics				Thermal & Mechanical Characteristics		Package- No.
		V <sub>RRM</sub> (V)	I <sub>F</sub> (A)	V <sub>isol</sub> (V)	I <sub>FSM</sub> (A)	V <sub>F</sub> (V) @ T <sub>j</sub> = 25°C	E <sub>rr</sub> (J/P) Typ.	Q <sub>rr</sub> (μC) Typ.	t <sub>rr</sub> (μs) Max.	R <sub>th(j-c)</sub> (K/W)	R <sub>th(c-s)</sub> (K/W)	
<b>1700 Volt HVDIODE Modules</b>												
<b>D</b>	RM1200DB-34S	1700	1200	4000	20800	2.10	0.30	420	0.85	0.020	0.024	RM6
<b>H</b>	RM1800HE-34S	1700	1800	6000	9600	2.90	0.40	600	0.80	0.022	0.017	RM2
<b>3300 Volt HVDIODE Modules</b>												
<b>D</b>	RM400DY-66S	3300	400	6000	3200	3.75	0.15	200	0.75	0.0720	0.0360	RM1
	RM400DG-66S	3300	400	10200	3200	2.80	0.30	270	1.00	0.0540	0.0480	RM4
	RM600DY-66S	3300	600	6000	4800	3.75	0.23	300	0.75	0.0480	0.0240	RM1
	RM1000DC-66F	3300	1000	6000	9400	2.20	1.20	1150	0.75	0.0240	0.0260	RM5
	RM1200DB-66S	3300	1200	6000	9600	3.00	0.75	850	0.75	0.0180	0.0160	RM3
	RM1200DG-66S	3300	1200	10200	9600	3.00	0.90	800	1.00	0.0180	0.0160	RM4
<b>H</b>	RM1500DC-66F	3300	1500	6000	14000	2.20	1.85	1700	0.75	0.0160	0.0175	RM5
<b>H</b>	RM1200HE-66S	3300	1200	6000	9600	3.20	0.85	900	1.40	0.0200	0.0150	RM2
<b>4500 Volt HVDIODE Modules</b>												
<b>D</b>	RM300DG-90S	4500	300	10200	2400	4.80	0.33	250	1.00	0.0660	0.0480	RM4
	RM400DG-90F	4500	400	10200	3400	2.55	0.75	580	0.90	0.0585	0.0480	RM4
	RM900DB-90S	4500	900	6000	6400	4.00	0.70	650	0.90	0.0200	0.0160	RM3
	RM800DG-90F	4500	800	10200	6500	2.55	1.50	1040	0.90	0.0300	0.0240	RM4
	RM1200DG-90F	4500	1200	10200	9800	2.55	2.25	1560	0.90	0.0200	0.0160	RM4
<b>H</b>	RM600HE-90S	4500	600	6000	4800	4.80	0.62	600	0.90	0.0390	0.0150	RM2
	RM900HC-90S	4500	900	6000	7200	4.80	1.00	750	1.00	0.0210	0.0160	RM3
<b>6500 Volt HVDIODE Modules</b>												
<b>D</b>	RM200DG-130S	6500	200	10200	1600	4.00	0.70	300	1.00	0.0660	0.0480	RM4
	RM250DG-130F	6500	200	10200	2350	3.30	0.80	340	0.60	0.0675	0.0480	RM4
	RM600DG-130S	6500	600	10200	4800	4.00	2.00	900	1.00	0.0220	0.0160	RM4

For detail test conditions please refer to data sheets.

## 4.02 High Voltage Diode Modules

**Package RM1**

**Package RM2**

**Package RM3**

**Package RM4**

**Package RM5**

**Package RM6**


Dimensions in mm



## High Voltage Integrated Circuits (HVIC)



### 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 1200V, 600V and 8/24V dielectric elements onto one chip.

The internal installation of high side/low side driver circuits, protective circuits against the power supply voltage drop and interlocking circuits enables a device 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 products to drive power MOS/discrete IGBTs or IGBT modules for inverters:

- General inverters
- Air conditioners, refrigerators and washing machines
- AC servo motors
- DC brushless motors
- Automotive
- Illumination systems



## 5. High Voltage Integrated Circuits (HVIC)

### 1200V

Driving method	Number of input-signals	Generation	Typename	Floating supply voltage (V)	Output current (A)	Dead-time control	Functions	Package outline
Half Bridge	2	3rd	M81738FP	1200	1.0	Input Signal	UV, NF, SC, FO, FORST, FOIN	24P2Q

### 600V

Driving method	Number of input-signals	Generation	Typename	Floating supply voltage (V)	Output current (A)	Dead-time control	Functions	Package outline
3 Phase	2x3Ø	3rd	M81712FP	600	0.2/-0.5	Input Signal	UV, IL, NF	28X9R
Half Bridge	2	3rd	M81706AFP	600	0.2/-0.35	Input Signal	UV, IL	8P2S
			M81708FP	600	0.2/-0.35	Input Signal	UV, IL	16P2N
			M81719FP	600	0.2/-0.35	Input Signal	UV, NF	8P2S
			M81720FP	600	0.2/-0.35	Input Signal	UV, IL, NF	8P2S
			M81721FP	600	1.0	Input Signal	UV, NF, SC, FO, FORST, FOIN	24P2Q
			M81700FP	600	2.5	Input Signal	UV, IL, SD	16P2N
			M81701FP	600	2.5	Input Signal	UV, IL	16P2N
			M81702FP	600	2.5	Input Signal	UV, SD	16P2N
			M81703FP	600	2.5	Input Signal	UV	16P2N
			M81709FP	600	2.5	Input Signal	UV, IL	16P2N
			M81722FP	600	3.0	Input Signal	UV, NF	8P2S
			M81729JFP	600	0.2/-0.35	Input Signal	UV, IL	8P2S
	2	4th	M81736FP	600	0.2/-0.35	Input Signal	UV, IL compatible with M81706AFP	8P2S
			M81735FP	600	0.5	Input Signal	UV, IL	16P2N
	1	3rd	M81713FP	600	0.5	Internal	UV	8P2S
	1	4th	M81734FP	600	0.5	Internal	UV compatible with M81713FP	8P2S
M81740FP			600	3.25	Internal	UV, SD	8P2S	
Dual Half Bridge	1x2	3rd	M81707FP	600	0.1	Input Signal	UV	16P2N
			M81731FP	600	3.0	Input Signal	UV, NF	16P2N
	1x2	4th	M81723FP	600	0.13/-0.1	Input Signal	UV compatible with M81707FP	16P2N
			M81737FP	600	0.2	Input Signal	UV	16P2N
Single High side	1	2nd	M81705FP	600	0.15/-0.13		UV	8P2S
	1	3rd	M81725FP	600	3.0		UV, NF	8P2S

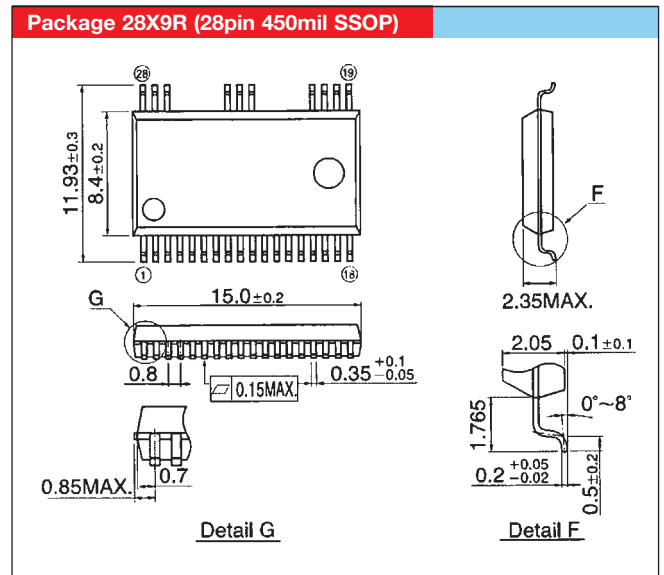
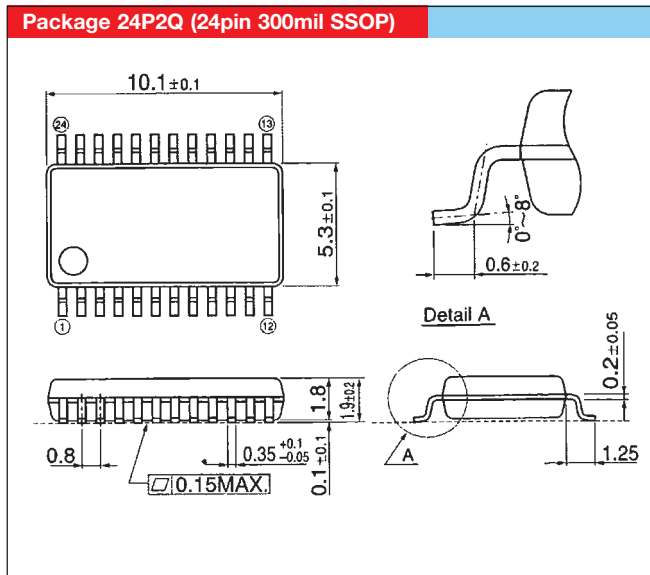
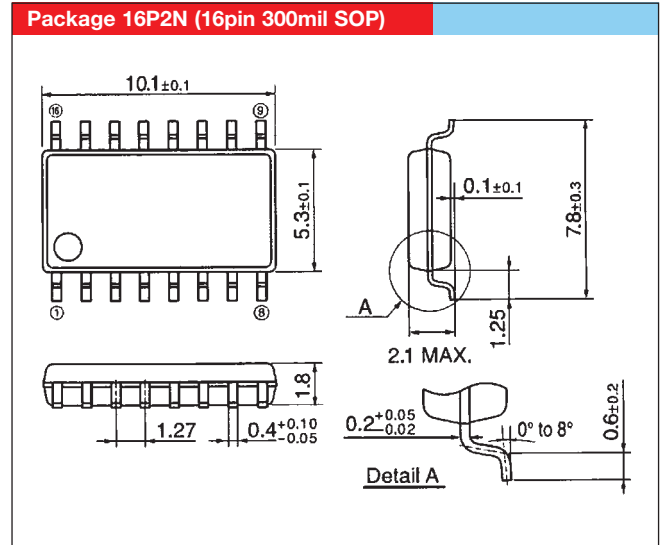
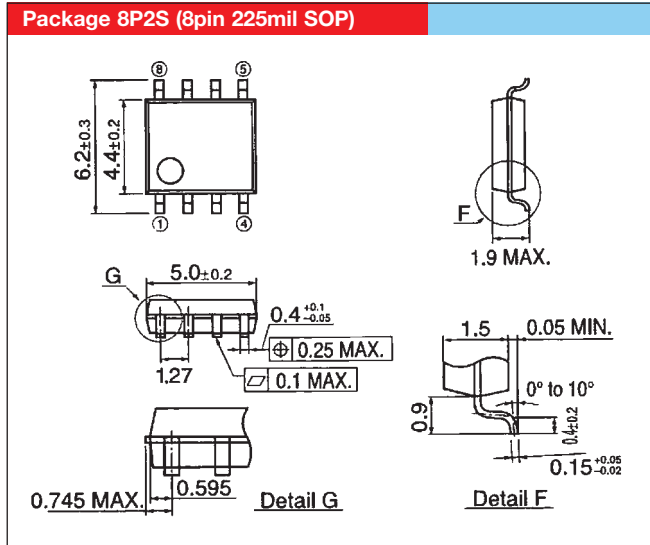
### 24V

Driving method	Number of input-signals	Generation	Typename	Floating supply voltage (V)	Output current (A)	Dead-time control	Functions	Package outline
Dual Low side	1x2	3rd	M81711FP	24	1.01/-0.8		Low active	8P2S
			M81716FP	24	1.01/-0.8		High active	8P2S

UV: Under Voltage / IL: Inter Lock / NF: Input Noise Filter / SC: Short Current / SD: Shut Down /  
SS: Soft Shutdown / FO: Failure Output / FOIN: FO Input / FORST: FO reset / CFO: Capacitor FO

All IC's are RoHS compliant.

## 5. High Voltage Integrated Circuits (HVIC)



Dimensions in mm

# Power Loss Calculation Tool (MELCOSIM)

## MELCOSIM 5

**MELCOSIM is a software tool for a proper selection of MITSUBISHI ELECTRIC power modules based on fast power loss and junction temperature calculation.**

MELCOSIM is software designed for the power loss calculation occurring in power modules under specific user application conditions and for junction temperature rises as a consequence of power loss.

The latest version of MELCOSIM is available at [www.mitsubishielectric.com/semiconductors/](http://www.mitsubishielectric.com/semiconductors/)  
→ **Power modules** → **Simulation Software**

Since the first version MELCOSIM 1.0 has been issued in the year 2001, five versions of this software were introduced through the Mitsubishi Electric website to our customers. We are very pleased for all comments and suggestion we have received in order to develop and improve the current version MELCOSIM 5.

The image displays three overlapping screenshots of the MELCOSIM 5 software interface. The top screenshot shows the 'Device & Conditions Input' window with a 'Sinusoidal' graph and a circuit diagram of a three-phase inverter. The middle screenshot shows the 'Select Topology' window with two NPC (Neutral Point Clamped) circuit diagrams. The bottom screenshot shows the 'Result' window with a 'Current - Angle' graph and a table of simulation results.

**Common Conditions (from top screenshot):**

Voc	800 V
Io	800 Apeak
PF	0.85
M	1
Fc	1 MHz
Fs	60 Hz
Ts	80 °C
Tj max	150 °C

**Simulation Results (from top screenshot):**

Tr1	Tj2
P_Tr1	376.67 WIGBT
SW	136.18
DC	240.39
SW(on)	62.37
SW(off)	83.80
$\Delta T_j = t(Tr1)_{Ave}$	9.96 K
$T_j(Tr1)_{Ave}$	94.89 °C
$\Delta T_j = t(Tr1)_{Max}$	8.44 K
$T_j(Tr1)_{Max}$	96.08 °C

**Simulation Results (from bottom screenshot):**

DI1	DI2
P_DI1	109.48 WDIODE
SW	59.29
DC	41.19
$\Delta T_j = t(DI1)_{Ave}$	4.22 K
$T_j(DI1)_{Ave}$	91.38 °C
$\Delta T_j = t(DI1)_{Max}$	4.98 K
$T_j(DI1)_{Max}$	92.61 °C

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