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каталог, описание, технические, характеристики, [datasheet](#), параметры,
маркировка, габариты, фото, модуль mitsubishi,

КАТАЛОГ

модуль mitsubishi, igbt, мост диодный

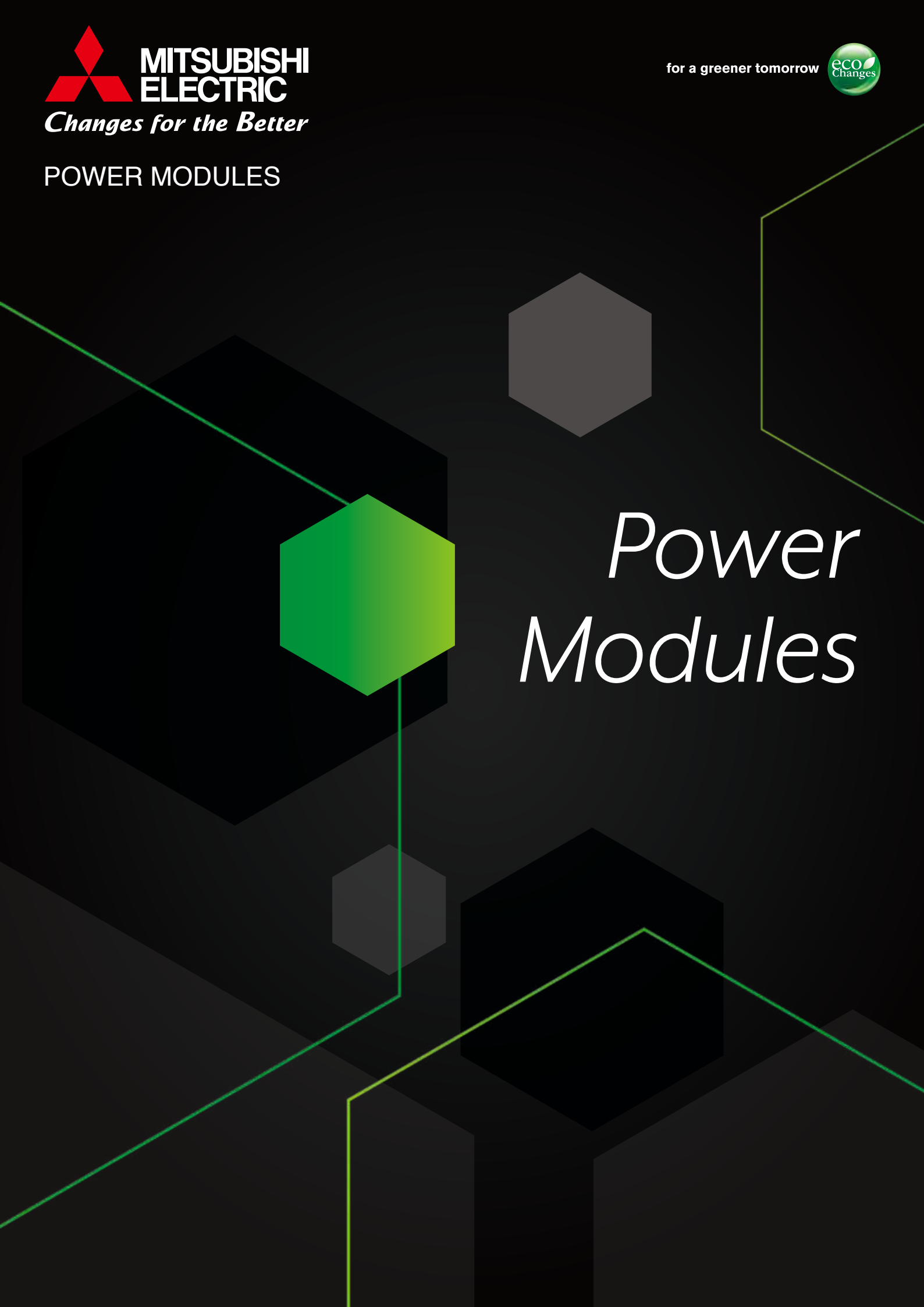
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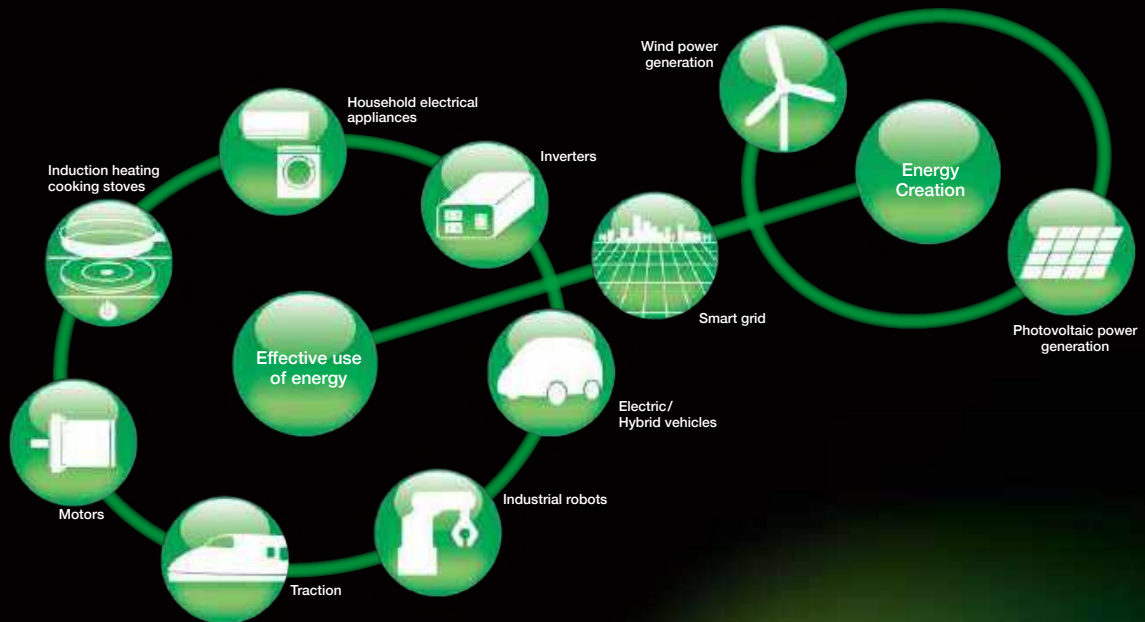
POWER MODULES



*Power
Modules*

Innovative Power Devices for a Sustainable Future

Mitsubishi Electric power modules are at the forefront of the latest energy innovations that seek to solve global environmental issues while creating a more affluent and comfortable society for all. Some of these innovations are photovoltaic (PV) and wind power generation from renewable energy sources, smart grids realizing efficient supply of power, hybrid/electric vehicles (HVs/EVs) that take the next step in reducing carbon emissions and fuel consumption, and home appliances that achieve ground-breaking energy savings. Whether in appliances, railcars, EVs or industrial systems, our power modules are key elements in changing the way energy is used.



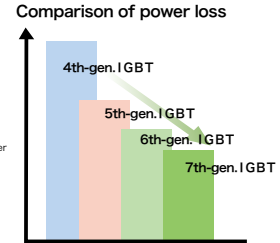
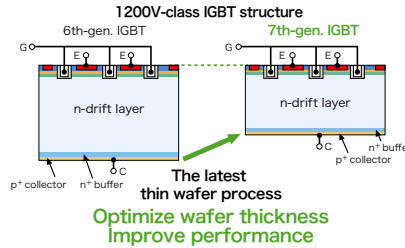


Focus Technology

7th-Generation 1,200V-Class IGBT Chip Technology Cutting-edge technology realizes energy-saving inverter devices

- Latest thin-wafer processing (n-drift layer) achieves thinner wafer than 6th-generation devices
- Performance improved by combining CSTBT™* and light punch-through (LPT) structures
- Inverter system power dissipation minimized by its superior performance (lower V_{CEsat} and E_{off})

*CSTBT: Mitsubishi Electric's unique IGBT that makes use of carrier cumulative effect



A small surface mount package IPM has been newly developed for fan and low-power motor drive applications

Key Features

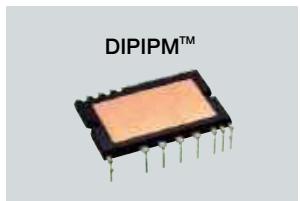
- Optimal pin layout realizes easier PCB wiring design and enables smaller PCB size
- Newly integrated interlock function in addition to conventional protection features for robust operation
- Bootstrap diode is integrated for the P-side drive power supply like conventional DIIPM™ series, reducing the number of peripheral external parts



Modules realizing single-control power supply and photocoupler-less systems for household appliances and low-capacity inverters

Key Features

- Transfer-molded structure incorporating a high thermal conductivity insulation sheet provides heat
- High-voltage IC equipped with drive, protection and level-shift circuits for direct control via input signals from a CPU or microcomputer
- Compact board and highly reliable equipment realized through single power-supply and photocoupler-less systems
- Includes built-in bootstrap diode (BSD)



Modules with built-in control and protection circuits for AC servo robots and PV power generation

Key Features

- Built-in protection circuits for short-circuiting, power supply undervoltage and overheating
- Highly compatible package with simplified printed circuit board (PCB) design
- Special intelligent power modules (IPMs) for power conditioners in PV power generation systems



IGBT modules for general-purpose inverters used in various applications

Key Features

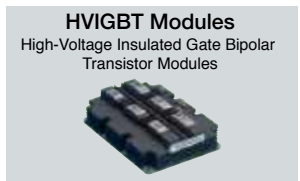
- Various low-inductance packages and power chips available
- Compatible with high-frequency, high-voltage (1,700V) applications
- Large-capacity modules available for renewable energy systems



High voltage, large capacity and high reliability are realized for traction and power transmission application

Key Features

- Two types of package are realized: "std type" with large output power and "LV100/HV100 type" for various inverter capacity by easy parallel connection
- The abundant field experience more than 20 years especially in the application of bullet train
- High reliability due to a long lifetime design and a robust design against severe environment

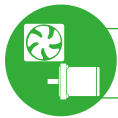


Modules realizing high performance and reliability for propulsion inverters in HVs/EVs

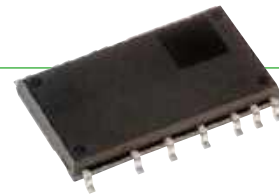
Key Features

- Built-in temperature analog output function realizing highly reliable drive train
- High-power/temperature cycle life ensures high reliability
- Compliant with the End-of-life Vehicles Directive, regulations relating to substances of environmental concern
- High traceability in managing materials/components throughout the entire production process for each product





New Products



Surface mount package IPM MISOP™

SP1SK, SP1SL, SP3SK and SP3SL

A small Surface mount package IPM has been newly developed for fan and low-power motor drive applications

<Main Features>

- Optimal pin layout realizes easier PCB wiring design and enables smaller PCB size
- Insulation distance between pins ensured, realizing easier board mounting without coating process
- Newly integrated interlock function in addition to conventional protection features for robust operation
- Installing RC-IGBT¹ simultaneously realizes compact package and low loss performance can go together
- Bootstrap diode is integrated for the P-side drive power supply like conventional DIPIM™ series, reducing the number of peripheral external parts

*1 Reverse-conducting IGBT

Type name	Rated current	Rated voltage	Chips	BSC	Protection	Shape
SP1SK**	1A	600V	RC-IGBT	-	UV	Surface mount package
SP1SL**			HVIC	Embedded	SC	
SP3SK**	3A		LVIC	-	OT	
SP3SL**			BSD	Embedded	VOT IL	

[Term] VOT: Analog temperature output

UV : Power supply under-voltage protection

SC : Short-circuit protection

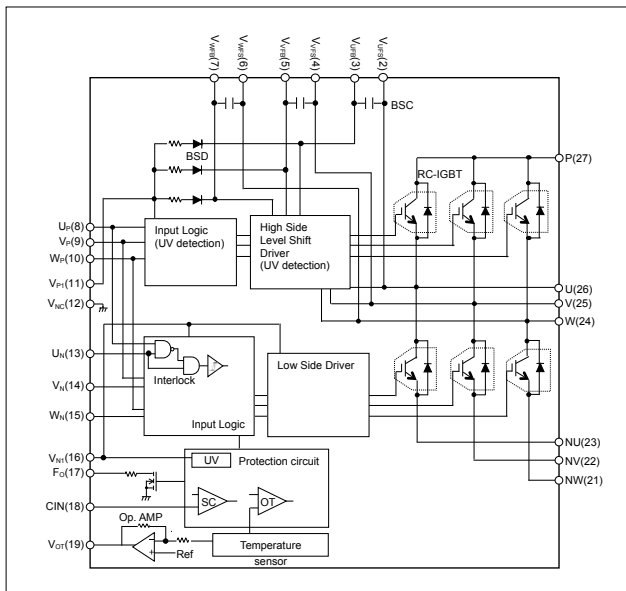
OT : Over Temperature protection

IL : Inter Lock

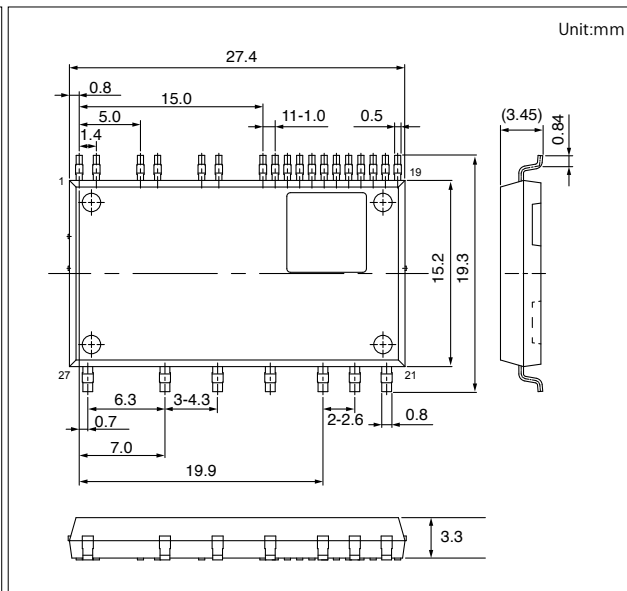
BSC : Bootstrap capacitor

★★:Under development

Schematic drawing



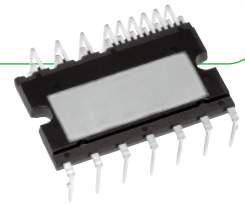
Outline Drawing





Feature Products

Smaller package size realized by integrating newly designed RC-IGBT
Recommended for low-cost inverter and fan controller applications



SLIMDIP™

SLIMDIP-S, SLIMDIP-L

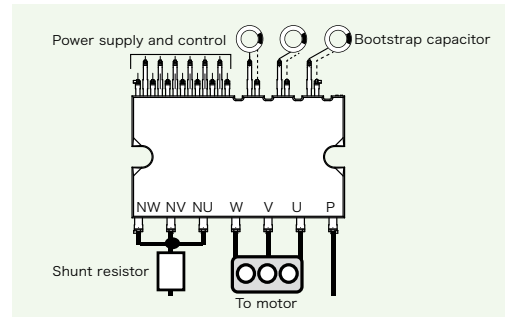
<Main Features>

- RC-IGBT^{*1} incorporated, reducing package size 30% compared to Super-mini DIIPM
- Maximum case temperature increased from 100°C to 115°C, increasing the operating temperature range and leading to easier system design
- Additional terminals for floating supply and built-in bootstrap diodes simplify PCB wiring pattern
- Both VOT^{*2} and OT^{*3} functions integrated for temperature protection

*1 RC-IGBT: Reverse conducting IGBT

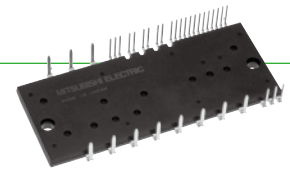
*2 VOT: Temperature information output function

*3 OT: Over-temperature protection function



Feature Products

All-in-one intelligent power modules equipped with 3-phase converter and brake circuit in addition to inverter circuit



DIIPM+™

PSS05MC1FT, PSS10MC1FT, PSS15MC1FT,
 PSS25MC1FT, PSS35MC1FT, PSS50MC1F6

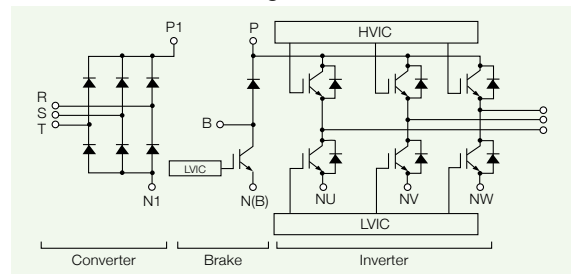
<Main Features>

- Encapsulated with transfer molded resin, integrates three-phase converter, inverter, brake and control IC
- Built-in converter and brake enable system size to be reduced and save design cost, contributing to total cost reduction
- Lower PCB inductance pattern reduces noise, thereby reducing design time and countermeasure parts required for noise reduction
- Built-in BSD^{*1} with 1,200V withstand voltage reduces number of external parts and improves reliability

*1 BSD: Bootstrap diode

*2: Available without brake circuit

Internal circuit diagram



Customer Support

EVA series, evaluation boards for each DIIPM™

Various evaluation boards to easy support system design



SLIMDIP™ evaluation board
 EVA01-SLIM



SLIMDIP™ evaluation board
 EVA15-SLIM



Super mini DIIPM™
 evaluation board
 EVA11-SDIP



DIIPM+™ evaluation board
 EVA14-DIP+



DIIPM+™
 evaluation
 board
 EVA03-DIP+

* For further information, please contact sales office.

Line-up of DIIPM™

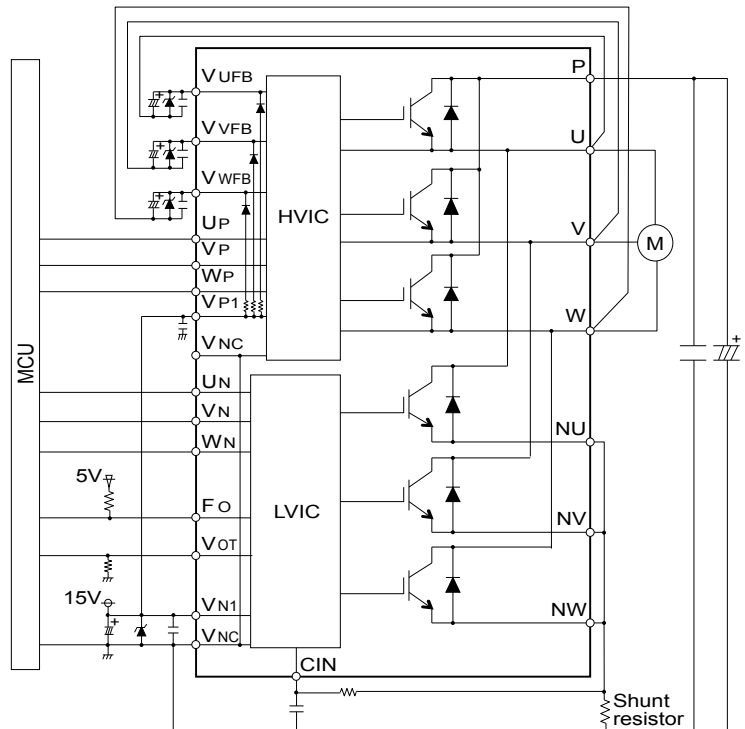
Series Matrix of 600V / 500V DIIPM™

V _{CEs} (V)		600V					500V		
I _c (A)	Series	SLIMDIP	Super mini	Mini	Large	CIB/CI	Super mini		
			Ver.6		Ver.4	DIIPM+	MOSFET		
3	SLIMDIP-S SLIMDIP-L							PSM03S93E5-A	
5		PSS05S92F6-AG PSS05S92E6-AG	PSS05S51F6 PSS05S51F6-C					PSM05S93E5-A	
10		PSS10S92F6-AG PSS10S92E6-AG	PSS10S51F6 PSS10S51F6-C						
15		PSS15S92F6-AG PSS15S92E6-AG	PSS15S51F6 PSS15S51F6-C					PSM15S94H6-A	
20		PSS20S92F6-AG PSS20S92E6-AG	PSS20S51F6 PSS20S51F6-C PSS20S71F6					PSM20S94H6-A	
30		PSS30S92F6-AG PSS30S92E6-AG	PSS30S71F6						
35		PSS35S92F6-AG PSS35S92E6-AG							
50			PSS50S71F6	PS21A79	PSS50MC1F6 PSS50NC1F6 *5				
75				PS21A7A					
Protective Function	Chip	IGBT/MOSFET	RC-IGBT	CSTBT	CSTBT	CSTBT	CSTBT	SJ-MOSFET	MOSFET
	UV	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side/Brake part	P-side/N-side	P-side/N-side
	SC	N-side	N-side	N-side	N-side with sense	N-side	N-side	N-side	N-side
	OT	N-side	N-side*1	—	—	—	—	—	N-side
	V _{OT}	N-side	N-side*1	N-side	N-side	N-side	N-side	N-side	—
Specifications	Active input	High(3/5V)	High(3/5V)	High(3/5V)	High(3/5V)	High(5V)	High(3/5V)	High(3/5V)	High(3/5V)
	Emitter pin of N-side	Open	Open	Open	Open	Open	Open	Open	Open
	Fault output	N-side(UV,SC,OT)	N-side (UV,SC,OT)	N-side (UV,SC)	N-side (UV,SC)	N-side (UV,SC)	N-side (UV,SC)	N-side (UV,SC)	N-side (UV,SC,OT)
	Insulation voltage	2000Vrms*2	1500Vrms*2	2500Vrms	2500Vrms	2500Vrms	1500Vrms*2	1500Vrms*2	
	Insulation structure	Insulation sheet	Insulation sheet	Molding resin*4/Insulation sheet	Insulation sheet	Insulation sheet	Insulation sheet	Insulation sheet	
	RoHS directive	Compliant	Compliant	Compliant *3	Compliant	Compliant	Compliant	Compliant	
	Pin type	Control side of zigzag (Long, Short)	Long	C: Control side of zigzag None: Short	—	—	Long	Long	

- [Notes] *1 : PSSxxS92E6 has OT function, PSSxxS92F6 has V_{OT} function
 *2 : AC60Hz, 1minute. Corresponds to isolation voltage 2500Vrms in the case the convex-shaped heat sink
 *3 : High melting point solder (Lead Over 85%) is used for chip soldering of PSSxxS51F6 only.
 *4 : Molding resin insulation for PSSxxS51F6/-C
 *5 : PSS50NC1F6 is not included brake.

- [Term] CSTBT™: Mitsubishi Electric's unique IGBT that makes use of the carrier cumulative effect
 RC-IGBT: Reverse conducting IGBT
 HVIC: High Voltage IC, LVIC: Low Voltage IC,
 BSD: Bootstrap Diode
 UV: Supply Under Voltage protection,
 OT: Over Temperature protection,
 SC: Short Circuit protection
 V_{OT}: Analog temperature output
 RoHS: Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
 CIB: Converter Inverter Brake,
 CI: Converter Inverter

Application circuit of super mini DIIPM™



Series Matrix of 1200V DIIPM™

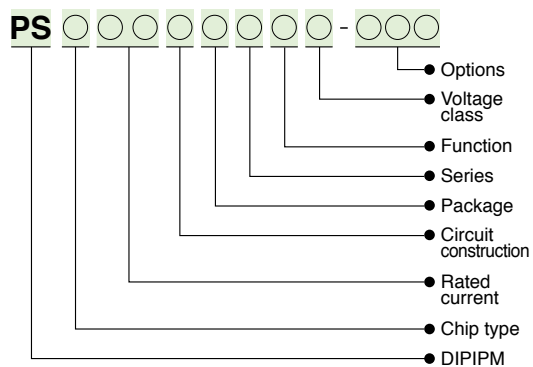
V _{ces} (V)		1200V			
I _c (A)	Series	Mini	Large		DIIPM+
			Ver.6	Ver.4	CIB/CI
5	PSS05S72FT	PSS05SA2FT	PS22A72		PSS05MC1FT PSS05NC1FT*1
10	PSS10S72FT	PSS10SA2FT	PS22A73		PSS10MC1FT PSS10NC1FT*1
15		PSS15SA2FT	PS22A74		PSS15MC1FT PSS15NC1FT*1
25		PSS25SA2FT	PS22A76		PSS25MC1FT PSS25NC1FT*1
35		PSS35SA2FT	PS22A78-E		PSS35MC1FT PSS35NC1FT*1
50		PSS50SA2FT	PS22A79		
75		PSS75SA2FT*			
Chip	IGBT/MOSFET	CSTBT	CSTBT	CSTBT	CSTBT
Protective Function	UV	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side/Brake
	SC	N-side	N-side	N-side	N-side
	OT	—	—	—	—
	V _{OT}	N-side	N-side	N-side	N-side
Specifications	Active input	High(5V)	High(5V)	High(5V)	High(5V)
	Emitter pin of N-side	Open	Open	Open	Open
	Fault output	N-side (UV,SC)	N-side (UV,SC)	N-side (UV,SC)	N-side (UV,SC)
	Insulation voltage	2500Vrms	2500Vrms	2500Vrms	2500Vrms
	Insulation structure	Insulation sheet	Insulation sheet	Insulation sheet	Insulation sheet
	RoHS directive	Compliant	Compliant	Compliant	Compliant
	Pin type	—	—	—	—

★: New Product Non-recommended : Please contact to the sales offices.

[Notes] *1: PSS**NC1FT is not included brake

[Term] BSD: Bootstrap Diode
 CSTBT™: Mitsubishi Electric's unique IGBT that makes use of the carrier cumulative effect.
 HVIC: High Voltage IC, LVIC: Low Voltage IC
 UV: Supply Under Voltage protection, OT: Over Temperature protection, SC: Short Circuit protection
 VOT: Analog temperature output
 RoHS: Restriction of hazardous substances in electrical and electronic equipment
 CIB: Converter Inverter Brake, CI: Converter Inverter

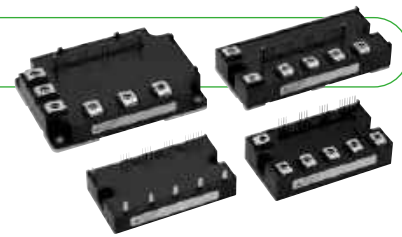
Type Name Definition of DIIPM™





New Products

Loaded with built-in functions, contributing to inverters with enhanced energy savings



G1 Series IPM with 7th-generation IGBT

<Main Features>

- Power loss has been reduced with the introduction of the 7th-generation IGBT produced using CSTBT™¹ and a diode incorporating a RFC² structure that contributes to reducing the power consumed in inverters
- The new resin-insulated metal baseplate, originally introduced in 7th-generation IGBT modules, eliminates the solder-attached section, increasing the thermal cycle lifetime and improving inverter reliability
- In addition to the built-in functions of the previous product,³ automatic switching speed control, error detection function and Bootstrap diode (BSD)⁴ contribute to lowering inverter loss and shortening design time
- The introduction of PC-TIM⁵ contribute to simplifying the inverter assembly process (optional)

*1 CSTBT™: Mitsubishi Electric's unique IGBT that utilizes the carrier cumulative effect

*2 RFC: Relaxed field cathode

*3 Conventional product: IPM L1-Series

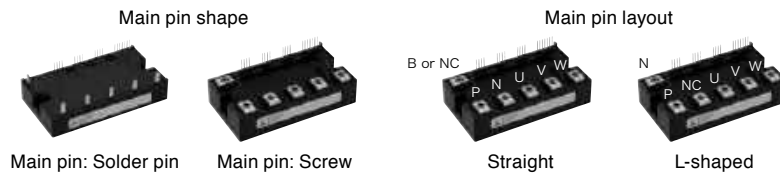
Built-in functions: Supply Undervoltage lock protection (UV), Short-circuit protection (SC), Over-temperature protection (OT)

*4 Bootstrap diode (BSD): Optional products include 50A, 75A, 100A/650V, 25A,35A,50A /1200V

*5 PC-TIM: Phase change-thermal interface material

■ "A" package main pin shape and layout

For the "A" package 6-in-1 (CG1A) main pin shape, select either solder pin or screw type
For the pin layout, select either straight or L-shaped



■ Lineup

V _{CEs} (V)	Package	Main pin shape	Main pin layout	I _c (A)									
				25	35	50	75	100	150	200	300	450	
650V	A package	Screw	Straight			PM50CG1A065* PM50RG1A065*	PM75CG1A065* PM75RG1A065*	PM100CG1A065*					
			L-shaped			PM50CG1AL065*	PM75CG1AL065*	PM100CG1AL065*					
		Solder pin	Straight			PM50CG1AP065* PM50RG1AP065*	PM75CG1AP065* PM75RG1AP065*	PM100CG1AP065*					
			L-shaped			PM50CG1APL065*	PM75CG1APL065*	PM100CG1APL065*					
	B package	Screw	L-shaped			PM50CG1B065* PM50RG1B065*	PM75CG1B065* PM75RG1B065*	PM100CG1B065* PM100RG1B065*	PM150CG1B065* PM150RG1B065*	PM200CG1B065* PM200RG1B065*			
	C package	Screw	L-shaped							PM200CG1C065* PM200RG1C065*	PM300CG1C065* PM300RG1C065*	PM450CG1C065* PM450RG1C065*	
	1200V	A package	Screw	Straight	PM25CG1A120* PM25RG1A120*	PM35CG1A120* PM35RG1A120*	PM50CG1A120*						
				L-shaped	PM25CG1AL120*	PM35CG1AL120*	PM50CG1AL120*						
Solder pin			Straight	PM25CG1AP120* PM25RG1AP120*	PM35CG1AP120* PM35RG1AP120*	PM50CG1AP120*							
			L-shaped	PM25CG1APL120*	PM35CG1APL120*	PM50CG1APL120*							
B package		Screw	L-shaped	PM25CG1B120* PM25RG1B120*	PM35CG1B120* PM35RG1B120*	PM50CG1B120* PM50RG1B120*	PM75CG1B120* PM75RG1B120*	PM100CG1B120* PM100RG1B120*					
C package		Screw	L-shaped					PM100CG1C120* PM100RG1C120*	PM150CG1C120* PM150RG1C120*	PM200CG1C120* PM200RG1C120*			

★: New Product

Representative reference is "A" package with screw terminal and straight layout (CG1A).

Line-up of IPM

Matrix of IPM Modules 650V/600V (No.: Number of outline drawing, see page 11 to 12)

V _{CE} (V)	650V						600V											
	Series	G1 Series		L1 Series		S1 Series		V1 Series		Photovoltaic		L Series						
		Connection	No.	Connection	No.	Connection	No.	Connection	No.	Connection	No.	Connection	No.					
50	PM50CG1A065*	C	12	PM50CL1A060	C	01	PM50CS1D060	C	05	PM50B4LA060	B4	01	PM50CLA060	C				
	PM50RG1A065*	R	12		C	02		PM50B5LA060	B5	01								
	PM50CG1B065*	C	10		PM50CL1B060	C		02	PM50B6LA060	B6	01	PM50CLB060		C				
	PM50RG1B065*	R	10		PM50RL1A060	R		01	PM50B4LB060	B4	02	PM50RLA060		R				
	PM50CG1AL065*	C	12		PM50RL1B060	R		02	PM50B5LB060	B5	02	PM50RLB060		R				
	PM50CG1AP065*	C	09		PM50RL1C060	R		03	PM50B6LB060	B6	02							
	PM50CG1APL065*	C	09						PM50B4L1C060	B4	03							
	PM50RG1AP065*	R	09						PM50B5L1C060	B5	03							
							PM50B6L1C060	B6	03									
75	PM75CG1A065*	C	12	PM75CL1A060	C	01	PM75CS1D060	C	05	PM75B4LA060	B4	01	PM75CLA060	C				
	PM75RG1A065*	R	12		C	02		PM75B5LA060	B5	01								
	PM75CG1B065*	C	10		PM75CL1B060	C		02	PM75B6LA060	B6	01	PM75CLB060		C				
	PM75RG1B065*	R	10		PM75RL1A060	R		01	PM75B4LB060	B4	02	PM75RLA060		R				
	PM75CG1AL065*	C	12		PM75RL1B060	R		02	PM75B5LB060	B5	02	PM75RLB060		R				
	PM75CG1AP065*	C	09						PM75B6LB060	B6	02							
	PM75CG1APL065*	C	09						PM75B4L1C060	B4	03							
	PM75RG1AP065*	R	09						PM75B5L1C060	B5	03							
							PM75B6L1C060	B6	03									
100	PM100CG1A065*	C	12	PM100CL1A060	C	01	PM100CS1D060	C	05				PM100CLA060	C				
	PM100RG1B065*	R	10		PM100CL1B060	C		02										
	PM100CG1B065*	C	10		PM100RL1A060	R		01										
	PM100CG1AL065*	C	12		PM100RL1B060	R		02										
	PM100CG1AP065*	C	09															
	PM100CG1APL065*	C	09															
150	PM150CG1B065*	C	10	PM150CL1A060	C	01	PM150CS1D060	C	05				PM150CLA060	C				
	PM150RG1B065*	R	10	PM150CL1B060	C	02												
				PM150RL1A060	R	01												
				PM150RL1B060	R	02												
200	PM200CG1B065*	C	10	PM200CL1A060	C	04	PM200CS1D060	C	05				PM200CLA060	C				
	PM200RG1B065*	R	10		PM200RL1A060	R		04										
	PM200CG1C065*	C	11															
	PM200RG1C065*	R	11															
300	PM300CG1C065*	C	11	PM300CL1A060	C	04						PM300CLA060	C					
	PM300RG1C065*	R	11	PM300RL1A060	R	04							PM300RLA060	R				
400/450	PM450CG1C065*	C	11						PM400DV1A060	D	06				PM450CLA060	C	08	
	PM450RG1C065*	R	11															
600									PM600DV1A060	D	06				PM600CLA060	C	08	
800									PM800DV1B060	D	07							
IGBT chip	CSTBT*1 Emitter sensor installed Temperature sensor installed		CSTBT*1 Built-in emitter sensor Built-in temperature sensor		CSTBT*1 Built-in emitter sensor Built-in temperature sensor		CSTBT*1 Built-in emitter sensor Built-in temperature sensor		CSTBT*1 Built-in emitter sensor Built-in temperature sensor		CSTBT*1 Built-in emitter sensor Built-in temperature sensor		CSTBT*2 Built-in emitter sensor Built-in temperature sensor					
	UV	P-side/N-side	P-side/N-side	P-side/N-side	N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side					
Fault output	OT	P-side/N-side	P-side/N-side	P-side/N-side	N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side						
	SC	P-side/N-side	P-side/N-side	P-side/N-side	N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side	P-side/N-side						
Identification	P-side/N-side		-		-		-		-		-							
RoHS directive	Compliant		Compliant		Compliant		Compliant		Compliant		Compliant							
Compatibility	-		L Series		S-DASH SERVO		V Series		-		-							
Connection	D			B4			B5			B6			C			R		

★: New Product Non-recommended : Please contact to the sales offices.

[Notes] *1: Full-gate CSTBT™ *2: PCM (Plugged Cell Merged) CSTBT™

[Term] UV: Supply Under Voltage-lock protection, SC: Short-Circuit protection, OT: Over-temperature protection,
 OC: Over-current protection, CSTBT™: Mitsubishi Electric's unique IGBT that makes use of the carrier cumulative effect
 RoHS: Restriction of hazardous substances in electrical and electronic equipment

■ Matrix of IPM Modules 1200V (No.: Number of outline drawing, see page 11 to 12)

V _{CE(S)} (V)		1200V															
I _C (A)	Series	G1 Series			L1 Series			S1 Series			V1 Series			L Series			
		Connection	No.	Connection	No.	Connection	No.	Connection	No.	Connection	No.	Connection	No.				
25	PM25CG1A120*	C	12														
	PM25CG1B120*	C	10														
	PM25RG1A120*	R	12	PM25CL1A120	C	01								PM25CLA120	C		
	PM25RG1B120*	R	10	PM25CL1B120	C	02								PM25CLB120	C		
	PM25CG1AL120*	C	12	PM25RL1A120	R	01	PM25CS1D120	C	05					PM25RLA120	R		
	PM25CG1AP120*	C	09	PM25RL1B120	R	02								PM25RLB120	R		
	PM25CG1APL120*	C	09	PM25RL1C120	R	03											
	PM25RG1AP120*	R	09														
35	PM35CG1A120*	C	12														
	PM35CG1B120*	C	10														
	PM35RG1A120*	R	12														
	PM35RG1B120*	R	10														
	PM35CG1AL120*	C	12														
	PM35CG1AP120*	C	09														
	PM35CG1APL120*	C	09														
	PM35RG1AP120*	R	09														
50	PM50CG1A120*	C	12														
	PM50CG1B120*	C	10	PM50CL1A120	C	01								PM50CLA120	C		
	PM50RG1B120*	R	10	PM50CL1B120	C	02								PM50CLB120	C		
	PM50CG1AL120*	C	12	PM50RL1A120	R	01	PM50CS1D120	C	05					PM50RLA120	R		
	PM50CG1AP120*	C	09	PM50RL1B120	R	02								PM50RLB120	R		
	PM50CG1APL120*	C	09														
75	PM75CG1B120*	C	10	PM75CL1A120	C	01								PM75CLA120	C		
	PM75RG1B120*	R	10	PM75CL1B120	C	02								PM75CLB120	C		
				PM75RL1A120	R	01	PM75CS1D120	C	05					PM75RLA120	R		
				PM75RL1B120	R	02								PM75RLB120	R		
100	PM100CG1B120*	C	10														
	PM100CG1C120*	C	11	PM100CL1A120	C	04								PM100CLA120	C		
	PM100RG1B120*	R	10	PM100RL1A120	R	04	PM100CS1D120	C	05					PM100RLA120	R		
	PM100RG1C120*	R	11														
150	PM150CG1C120*	C	11	PM150CL1A120	C	04								PM150CLA120	C		
	PM150RG1C120*	R	11	PM150RL1A120	R	04								PM150RLA120	R		
200	PM200CG1C120*	C	11									PM200DV1A120	D	06	PM200CLA120	C	08
	PM200RG1C120*	R	11														
300												PM300DV1A120	D	06	PM300CLA120	C	08
450												PM450DV1A120	D	06	PM450CLA120	C	08
IGBT chip	CSTBT*1 Emitter sensor installed Temperature sensor installed			CSTBT*1 Built-in current sensor Built-in temperature sensor			CSTBT*1 Built-in current sensor Built-in temperature sensor			CSTBT*1 Built-in current sensor Built-in temperature sensor			CSTBT*2 Built-in current sensor Built-in temperature sensor				
	UV	P-side/N-side			P-side/N-side			N-side			P-side/N-side			P-side/N-side			
Fault output	OT	P-side/N-side			P-side/N-side			N-side			P-side/N-side			P-side/N-side			
	SC	P-side/N-side			P-side/N-side			N-side			P-side/N-side			P-side/N-side			
Identification	P-side/N-side			—			—			—			—				
RoHS directive	Compliant			Compliant			Compliant			Compliant			Compliant				
Compatibility	—			L Series			S-DASH SERVO			V Series			—				
Connection	D				C				R								

★: New Product Non-recommended : Please contact to the sales offices.

[Notes] *1: Full-gate CSTBT™ *2: PCM (Plugged Cell Merged) CSTBT™

[Term] UV : Supply Under Voltage-lock protection, SC : Short-Circuit Protection, OT : Over-temperature protection, OC : Over-current protection, RoHS : the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment

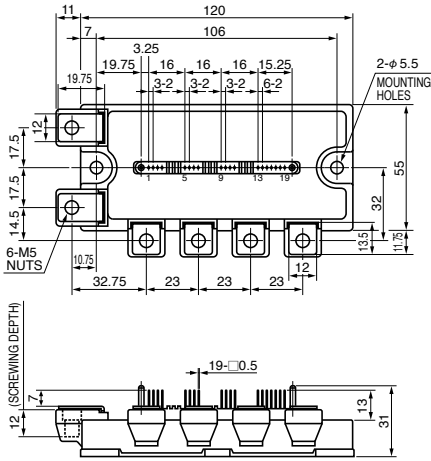
Line-up of IPM

Outline Drawing of IPM

Unit:mm

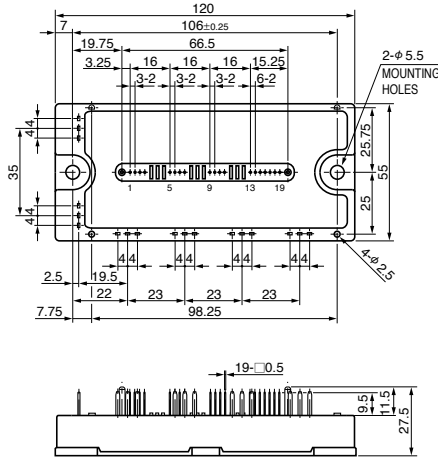
01

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



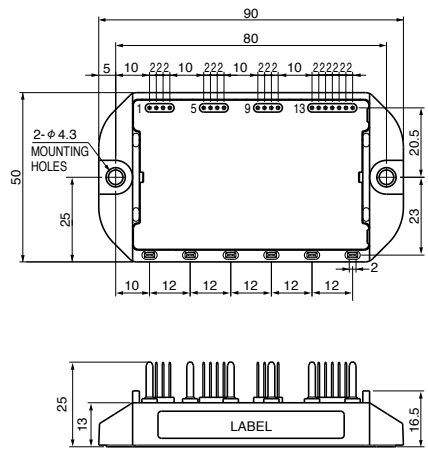
02

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



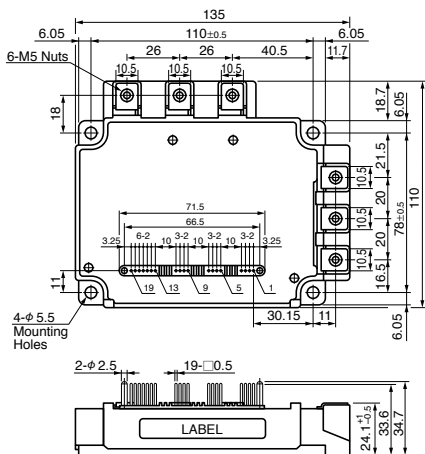
03

PM50RL1C060
PM25RL1C120
PM50,75,B4/B5/B6L1C060



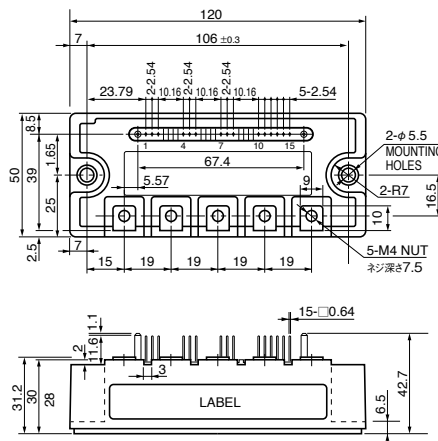
04

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



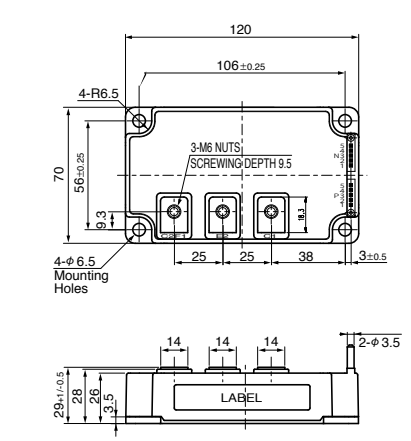
05

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



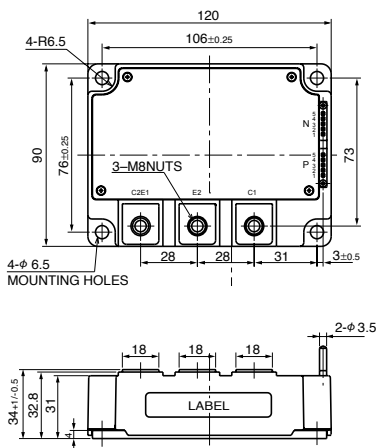
06

PM400,600DV1A060
PM200,300,450DV1A120



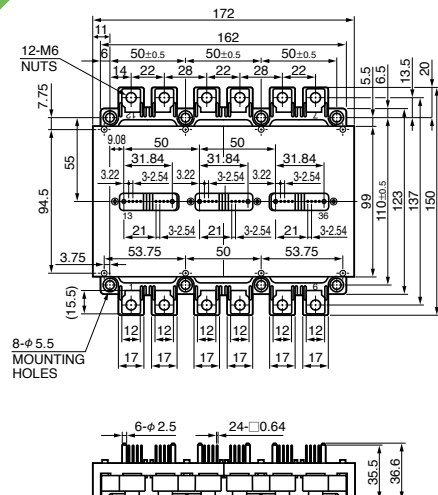
07

PM800DV1B060



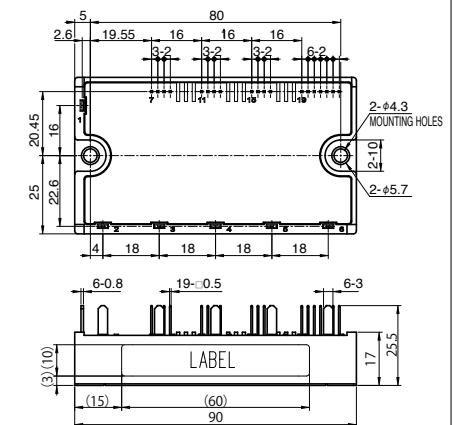
08

PM450,600CLA060
PM200,300,450CLA120



09

PM50,75,100CG1AP/
CG1APL/RG1AP065
PM25/35/50CG1AP/
CG1APL/RG1AP120

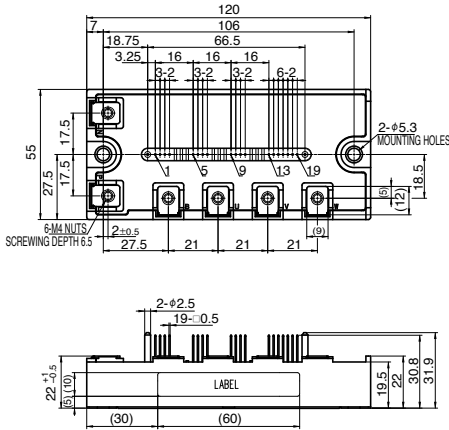


■ Outline Drawing of IPM

Unit:mm

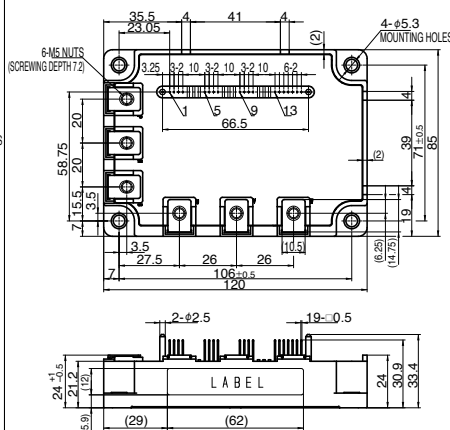
10

PM50,75,100,150,200CG1B/
RG1B065
PM25,35,50,75,100CG1B/
RG1B120



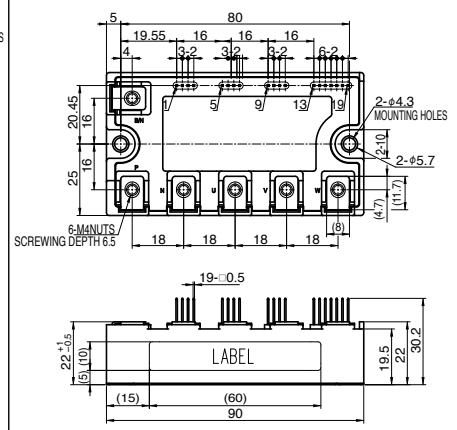
11

PM200,300,400,450CG1C/
RG1C065
PM100,150,200CG1C/
RG1C120



12

PM50,75,100CG1A/CG1AL/
RG1A065
PM25/35/50CG1A/CG1AL/
RG1A120



Line-up of MOSFET Modules

Series Matrix of MOSFET Modules

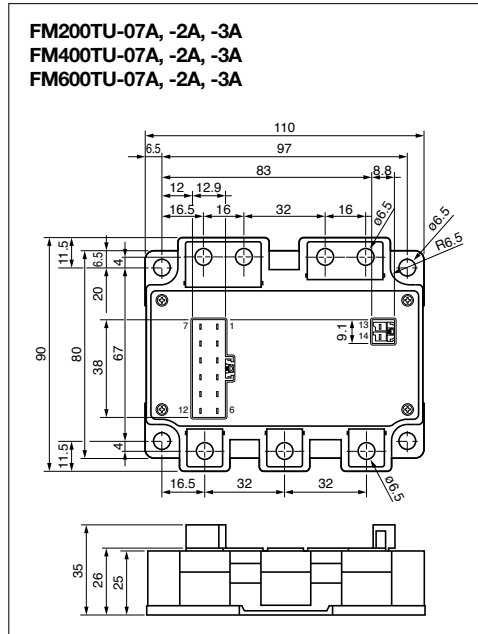
RoHS directive compliant

V _{DS} I _D (A)	75V		100V		150V	
	Part Number	Connection	Part Number	Connection	Part Number	Connection
100	FM200TU-07A	T	FM200TU-2A	T	FM200TU-3A	T
200	FM400TU-07A	T	FM400TU-2A	T	FM400TU-3A	T
300	FM600TU-07A	T	FM600TU-2A	T	FM600TU-3A	T

Connection: T

Outline Drawing of MOSFET Modules

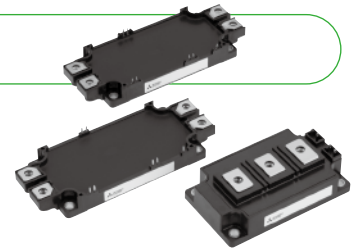
Unit: mm





New Products

New lineup contributes to simplifying design, downsizing, energy-saving of industrial inverters.



IGBT Module T/T1-Series

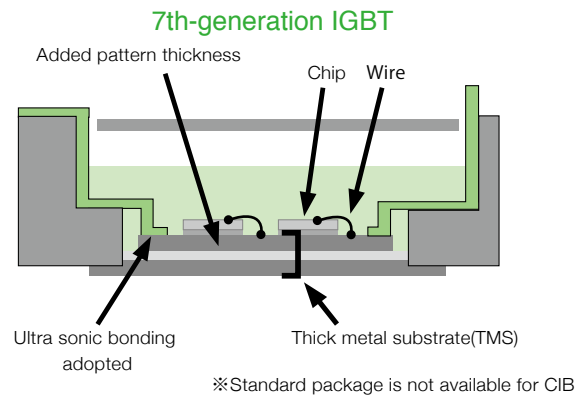
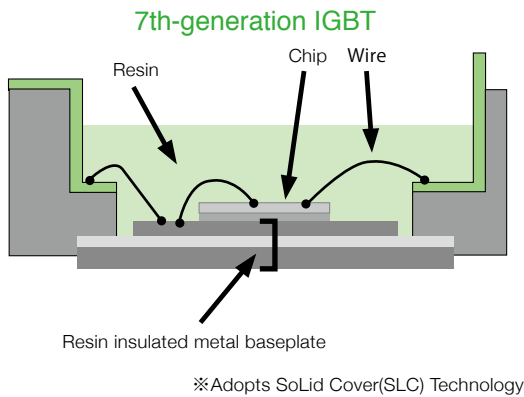
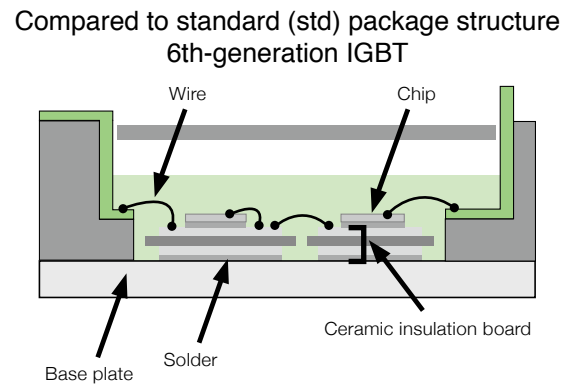
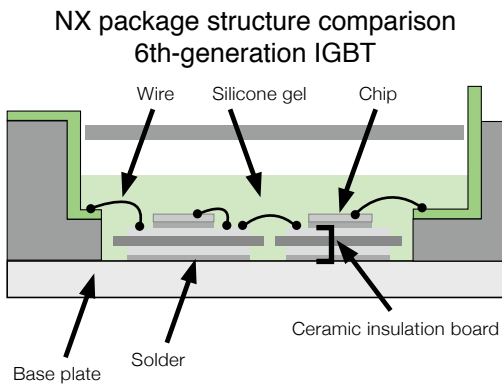
<Main Features>

- New modules equipped with three-phase converter, inverter, and brake circuit(CIB), contributes to simplifying design for inverter systems
- CIB modules contribute to compact inverter systems by reducing package size by 36% compared to the Mitsubishi Electric's existing module.(CIB)
- Power loss has been reduced with the introduction of the 7th-generation IGBT produced using CSTBT™² and a diode incorporating a relaxed field of cathode (RFC) structure
- The new structure introduced eliminates the solder-attached section, increasing the thermal cycle lifetime, which contributes to improving the reliability of inverters
- The introduction of press-fit pins and PC-TIM¹ contribute to simplifying the assembly process for inverters

*1 PC-TIM: Phase change - thermal interface material

*2 CSTBT™: Mitsubishi Electric's unique IGBT that makes use of the carrier cumulative effect

■ New structure realizes improved reliability (improved thermal cycle lifetime)



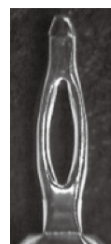
◆ Press-fit terminal support (NX)

- Possible to select the control pin shape (soldered terminals/press-fit terminals)
- Solder attachment process eliminated

■ Press-fit pin



① Main pin



② Signal pin



Feature Products

Contributes to realizing smaller, energy-saving large-capacity inverters

Power Modules for 3-level Inverters

<Main Features>

- Compatible with 3-level inverters, reducing power consumption approx. 30%^{*1}
- New package developed^{*2} contributing to lower inductance and simplified inverter circuit structure
- IGBT specifications optimized^{*3} with development of new compact, low-inductance package
- 4-in-1^{*4} and 1-in-1/2-in-1^{*5} lineup contributes to improved compactness and freedom in inverter design

*1 Comparison between 3-level inverter incorporated in this device and 2-level inverter in conventional device.

*2 1-in-1/2-in-1 type external dimensions of 130x67mm, 4-in-1 type external dimensions of 115x82mm, new package developed with innovative terminal positioning.

*3 IGBT specifications optimized for 3-level inverters, adopting CSTBT™ (Mitsubishi Electric's unique IGBT that makes use of the carrier cumulative effect).

*4 4-in-1 module with one 3-level inverter arm in one package.

*5 Bidirectional switch model as emitter common connection.

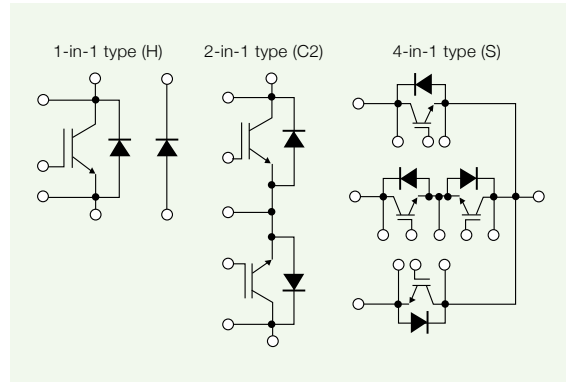


1-in-1 / 2-in-1 type



4-in-1 type

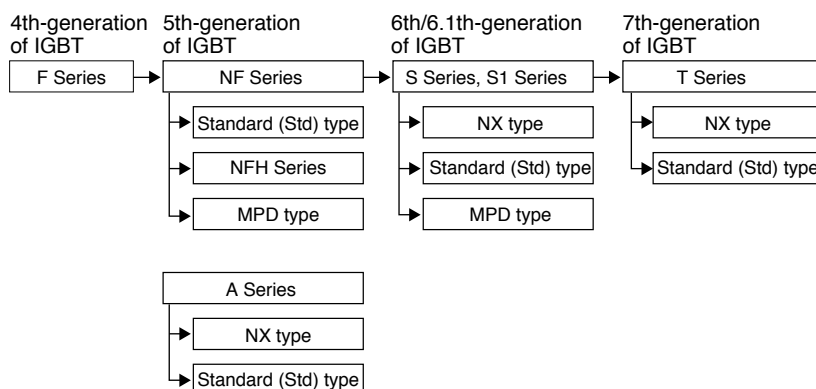
Internal circuit diagram



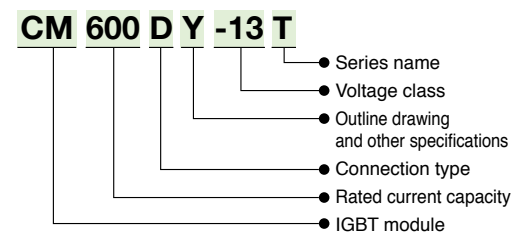
Lineup

Main application	Model	Module type	Rated voltage	Rated current	Circuit structure	External dimensions WxD (mm)
125-500kW inverter	CM400ST-24S1	IGBT	1200V	400A	4-in-1	115x82
500kW - inverter	CM1400HA-24S	IGBT	1200V	1400A	1-in-1	130x67
	RM1400HA-24S	Diode	1200V	1400A	1-in-1	130x67
	CM1000HA-34S	IGBT	1700V	1000A	1-in-1	130x67
	CM500C2Y-24S	IGBT	1200V	500A	2-in-1	130x67

Evolution of IGBT Module Series



Type Name Definition of IGBT Modules



Features of IGBT Module Series

S Series

- Lineup includes various package types
- 6th-generation CSTBT™ delivers low-loss performance
- Thinner package (Height: 17mm) (NX type)
- Suited to large-capacity applications (MPD type)

MPD: Mega power dual

NFH Series

- High-speed CSTBT™ delivers low-loss performance
- Soft switching (resonant) turn-off function (ZVS)
- Enhanced inner wiring (skin effect)

CSTBT™: Mitsubishi Electric's unique IGBT that makes use of the carrier cumulative effect.

Line-up of IGBT Modules

Matrix of IGBT Modules 650V/600V (No.: Number of outline drawing, see page 19 to 20)

RoHS directive (2011/65/EU) compliant

V _{CEs} (V)	650V						600V									
	T/T1-Series NX Type		Connection	No.	T-Series std Type		Connection	No.	A-Series NX Type		NF-Series		NF-Series NFH Type		Connection	No.
I _c (A)																
50	CM50MXUB-13T** CM50MXUB-13T1** CM50MXUBP-13T** CM50MXUBP-13T1**	M M M M	42 42 - -													
75	CM75MXUB-13T** CM75MXUB-13T1** CM75MXUBP-13T** CM75MXUBP-13T1**	M M M M	42 42 - -					CM75MX-12A	M	01	CM75TL-12NF CM75RL-12NF	T R	07 07			
100	CM100TX-13T* CM100XP-13T* CM100MXUB-13T** CM100MXUB-13T1** CM100MXUBP-13T** CM100MXUBP-13T1** CM100MXUD-13T** CM100MXUD-13T1** CM100MXUDP-13T** CM100MXUDP-13T1**	T T M M M M M M M M	33 37 42 42 - - 44 44 - -		CM100DY-13T*	D	30	CM100MX-12A CM100RX-12A	M R	01 02	CM100TL-12NF CM100RL-12NF	T R	07 07	CM100DUS-12F	D	13
150	CM150TX-13T* CM150XP-13T* CM150RX-13T* CM150RXP-13T* CM150MXUD-13T** CM150MXUD-13T1** CM150MXUDP-13T** CM150MXUDP-13T1**	T T R R M M M M	33 37 34 38 44 44 - -		CM150DY-13T*	D	30	CM150RX-12A	R	02	CM150DY-12NF CM150TL-12NF CM150RL-12NF	D T R	08 07 07	CM150DUS-12F	D	13
200	CM200TX-13T* CM200XP-13T* CM200RX-13T* CM200RXP-13T*	T T R R	33 37 34 38		CM200DY-13T*	D	30	CM200RX-12A	R	02	CM200DY-12NF CM200TL-12NF CM200RL-12NF	D T R	08 09 09	CM200DU-12NFH	D	13
225																
300	CM300DX-13T* CM300DXP-13T*	D D	28 39		CM300DY-13T*	D	31	CM300DX-12A	D	03	CM300DY-12NF	D	08	CM300DU-12NFH	D	14
400					CM400DY-13T*	D	31	CM400DX-12A	D	03	CM400DY-12NF	D	10	CM400DU-12NFH	D	14
450	CM450DX-13T* CM450DXP-13T*	D D	28 39													
600	CM600DX-13T* CM600DXP-13T*	D D	28 39		CM600DY-13T*	D	32				CM600DY-12NF	D	11	CM600DU-12NFH	D	15
1000																
Connection																

★★: Under Development ★: New Product Non-recommended : Please contact to the sales offices.

Matrix of Power Modules for 3-level Inverter (No.: Number of outline drawing, see page 22 to 23)

RoHS directive (2011/65/EU) compliant

V _{CEs} /V _{RRM}	1200 V IGBT Module			1700 V IGBT Module			1200 V Diode Module			1700 V Diode Module		
	T/S/S1-Series std Type		Connection	No.	S/S1-Series std Type		Connection	No.	S/S1-Series std Type		Connection	No.
I _c /I _F												
400	CM400ST-24S1* CM400C1Y-24S	S C1	35 11									
450	CM450C1Y-24T**	C1	32									
500	CM500C2Y-24S*	C2	36									
600	CM600C1Y-24T*	C1	32	CM600HA-34S*	H	36				RM600DY-34S*	D	32
800				CM800HA-34S*	H	36				RM800DY-34S*	D	32
1000				CM1000HA-34S*	H	36						
1400	CM1400HA-24S*	H	36					RM1400HA-24S*	H	36		
Connection												

*Connection of diode module and IGBT module are different.

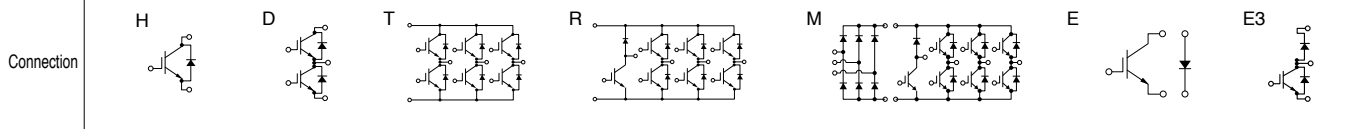
★★: Under Development ★: New Product

Line-up of IGBT Modules

Matrix of IGBT Modules 1200V (No.: Number of Outline Drawing, see page 19 to 23)

RoHS directive (2011/65/EU) compliant

V _{CEs} (V)	1200V																			
	Series	T/T1-Series			T-Series			S/S1-Series			S/S1-Series			S/S1-Series			A-Series ^{*1}			
		NX Type	Connection	No.	std Type	Connection	No.	NX Type	Connection	No.	std Type	Connection	No.	MPD Type	Connection	No.	NF-Series ^{*1}	Connection	No.	
35	CM35MXUA-24T**	M	41																	
	CM35MXUA-24T1**	M	41				CM35MXA-24S	M	04											
	CM35MXUAP-24T**	M	-																	
	CM35MXUAP-24T1**	M	-																	
50	CM50MXUA-24T**	M	41														CM50RL-24NF	R	07	
	CM50MXUA-24T1**	M	41				CM50MXA-24S	M	04								CM50TL-24NF	T	07	
	CM50MXUAP-24T**	M	-																	
	CM50MXUAP-24T1**	M	-																	
75	CM75MXUB-24T**	M	42																	
	CM75MXUB-24T1**	M	42																	
	CM75MXUBP-24T**	M	-				CM75MXA-24S	M	04								CM75RL-24NF	R	07	
	CM75MXUBP-24T1**	M	-				CM75TX-24S	T	05									CM75TL-24NF	T	07
	CM75MXUC-24T**	M	43				CM75RX-24S	R	02											
	CM75MXUC-24T1**	M	43																	
	CM75MXUCP-24T**	M	-																	
	CM75MXUCP-24T1**	M	-																	
100	CM100TX-24T*	T	33														CM100DY-24A	D	08	
	CM100TXP-24T*	T	37														CM100DY-24NF	D	08	
	CM100RX-24T*	R	34				CM100MXA-24S	M	04								CM100E3Y-24NF	E3	08	
	CM100RXP-24T*	R	38	CM100DY-24T*	D	30	CM100TX-24S1	T	25								CM100RL-24NF	R	07	
	CM100MXUC-24T**	M	43				CM100RX-24S1	R	26								CM100TL-24NF	T	07	
	CM100MXUC-24T1**	M	43														CM100DU-24NFH	D	13	
	CM100MXUCP-24T**	M	-																	
	CM100MXUCP-24T1**	M	-																	
150	CM150TX-24T*	T	33														CM150DY-24A	D	08	
	CM150TXP-24T*	T	37														CM150DY-24NF	D	08	
	CM150RX-24T*	R	34				CM150DX-24S	D	03								CM150E3Y-24NF	E3	08	
	CM150RXP-24T*	R	38	CM150DY-24T*	D	30	CM150EXS-24S	E	24								CM150RL-24NF	R	09	
	CM150MXUD-24T**	M	44				CM150TX-24S1	T	25								CM150TL-24NF	T	09	
	CM150MXUD-24T1**	M	44				CM150RX-24S1	R	26								CM150DU-24NFH	D	13	
	CM150MXUDP-24T**	M	-																	
	CM150MXUDP-24T1**	M	-																	
200	CM200TX-24T*	T	33	CM200DY-24T*	D	31	CM200EXS-24S	E	24								CM200DY-24A	D	08	
	CM200TXP-24T*	T	37				CM200RXL-24S	R	21								CM200DY-24NF	D	10	
225	CM225DX-24T*	D	28																	
	CM225DXP-24T*	D	39				CM225DX-24S1	D	27											
300	CM300DX-24T*	D	28	CM300DY-24T*	D	31	CM300DX-24S1	D	27			CM300DY-24S	D	10			CM300DY-24A	D	10	
	CM300DXP-24T*	D	39				CM300EXS-24S	E	24								CM300DY-24NF	D	11	
400							CM300RXL-24S1*	R	21								CM300DU-24NFH	D	14	
																	CM400DY-24A	D	11	
																	CM400HA-24A	H	16	
																	CM400DY-24NF	D	11	
450	CM450DX-24T*	D	28	CM450DY-24T*	D	32	CM450DX-24S1	D	27			CM450DY-24S	D	11						
	CM450DXP-24T*	D	39																	
600	CM600DX-24T*	D	28	CM600DY-24T*	D	32	CM600DX-24S1	D	27			CM600DY-24S	D	11			CM600DY-24A	D	11	
	CM600DXP-24T*	D	39				CM600DXL-24S	D	6								CM600HA-24A	H	16	
800																	CM600DU-24NF	D	12	
																	CM600DU-24NFH	D	15	
900																				
														CM900DUC-24S	D	17				
1000	CM1000DX-24T*	D	29				CM1000DXL-24S	D	06											
	CM1000DXP-24T*	D	40																	
1400											CM1400HA-24S*	H	36	CM1400DUC-24S	D	17				



*1: A-Series have model name ending with A, NF-Series have model name ending with NF/NFH

★★: Under Development ★: New Product

Matrix of IGBT Modules 1700V

RoHS directive (2011/65/EU) compliant

V _{CEs} (V)	1700V																	
	Series	T-Series NX Type			T-Series std Type			S/S1-Series NX Type			S/S1-Series std Type			S/S1-Series MPD Type			A-Series std Type	
I _c		Connection	No.		Connection	No.		Connection	No.		Connection	No.		Connection	No.		Connection	No.
35																		
50																		
75				CM75DY-34T**	D	30		CM75MXA-34SA CM75RX-34SA	M R	23 19						CM75DY-34A	D	08
100	CM100TX-34T** CM100TXP-34T**	T T	33 37	CM100DY-34T**	D	30										CM100DY-34A	D	08
150	CM150TX-34T** CM150TXP-34T**	T T	33 37	CM150DY-34T**	D	31		CM150DX-34SA CM150RXL-34SA	D R	20 21						CM150DY-34A	D	10
200				CM200DY-34T**	D	31		CM200DX-34SA CM200EXS-34SA	D E	20 24						CM200DY-34A	D	10
225	CM225DX-34T** CM225DXP-34T**	D D	28 39															
300	CM300DX-34T** CM300DXP-34T**	D D	28 39	CM300DY-34T**	D	32		CM300DX-34SA	D	20						CM300DY-34A	D	11
400				CM400DY-34T**	D	32										CM400DY-34A	D	18
450	CM450DX-34T** CM450DXP-34T**	D D	28 39					CM450DXL-34SA	D	22								
500																CM500HA-34A	H	16
600	CM600DX-34T** CM600DXP-34T**	D D	28 39					CM600DXL-34SA	D	22	CM600HA-34S*	H	36					
800											CM800HA-34S*	H	36					
900																		
1000											CM1000HA-34S*	H	36	CM1000DUC-34SA	D	17		
1400																		
Connection	H		D		T		R		M		E							

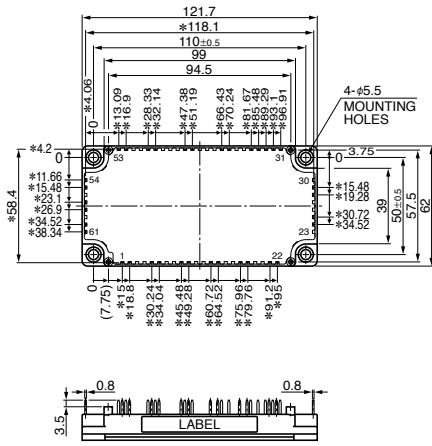
★★: Under Development ★: New Product

Line-up of IGBT Modules

Outline Drawing of IGBT Modules

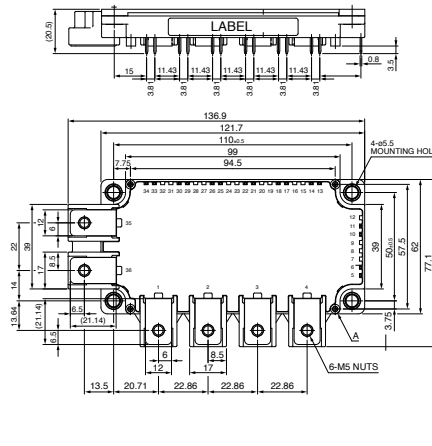
Unit:mm

01 CM75,100MX-12A



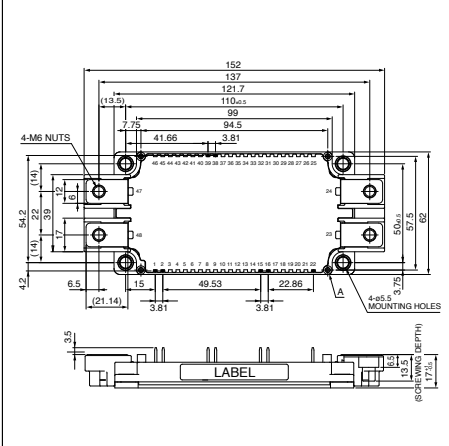
*All dimensions with a tolerance of ± 0.5

02 CM100,150,200RX-12A
CM75RX-24S



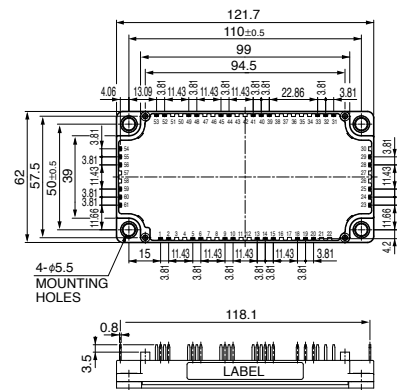
*All dimensions with a tolerance of ± 0.5

03 CM300,400DX-12A
CM150,200DX-24S

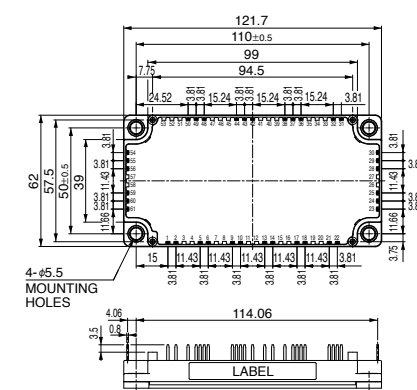


*All dimensions with a tolerance of ± 0.5

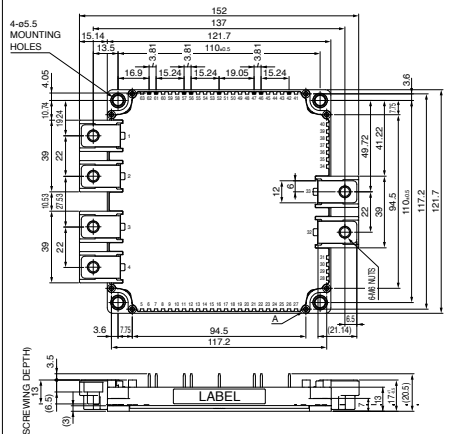
04 CM35,50,75,100MXA-24S



05 CM75TX-24S

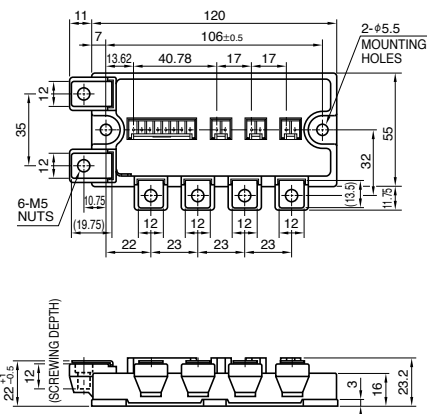


06 CM600,1000DXL-24S

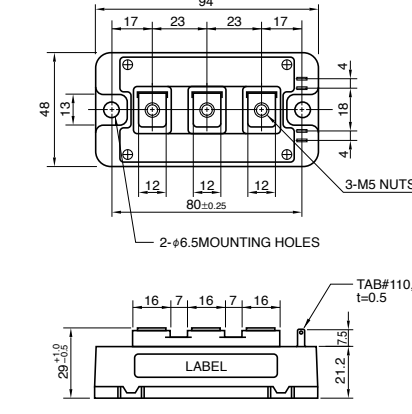


*All dimensions with a tolerance of ± 0.5

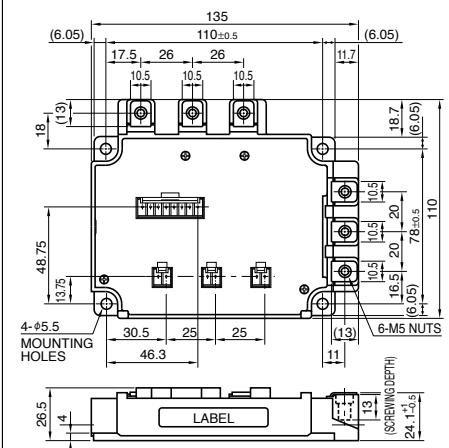
07 CM75,100,150TL/RL-12NF
CM50,75,100TL/RL-24NF



08 CM150,200,300DY-12NF
CM100,150DY-24NF
CM100,150,200DY-24A
CM75,100DY-34A
CM100,150E3Y-24NF

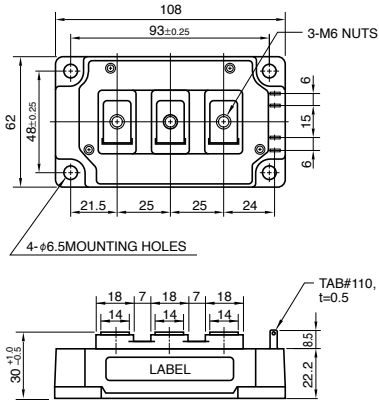


09 CM200TL/RL-12NF
CM150,200TL/RL-24NF



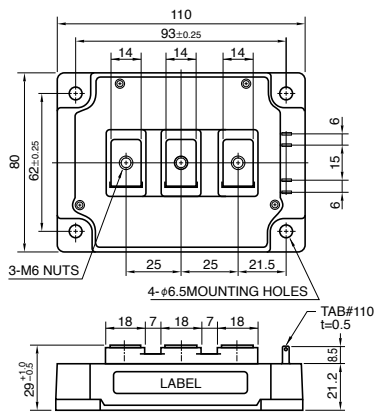
10

CM400DY-12NF
CM200DY-24NF
CM300DY-24A
CM300DY-24S
CM150,200DY-34A



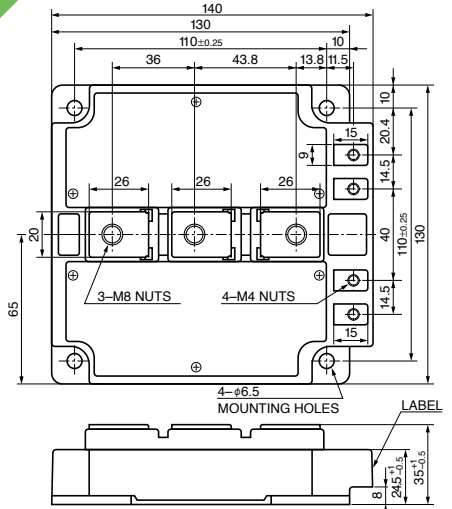
11

CM600DY-12NF CM400C1Y-24S
CM400DY-24NF CM450DY-24S
CM400,600DY-24A CM600DY-24S
CM300DY-34A CM300DY-24NF



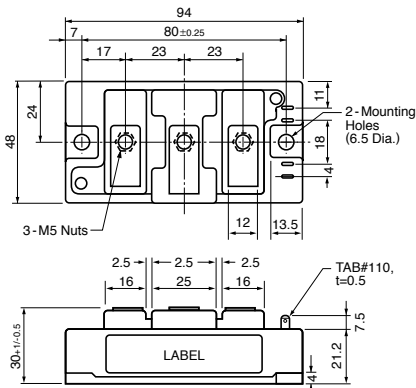
12

CM600DU-24NF
CM800DY-24S



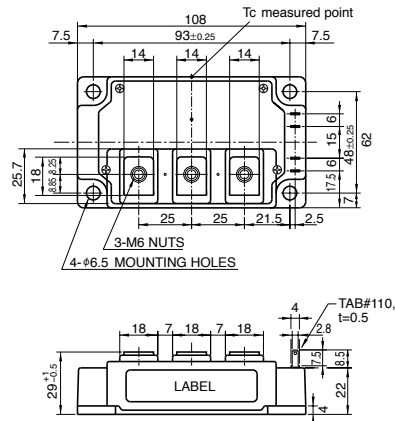
13

CM100,150DUS-12F
CM200DU-12NFH
CM100,150DU-24NFH



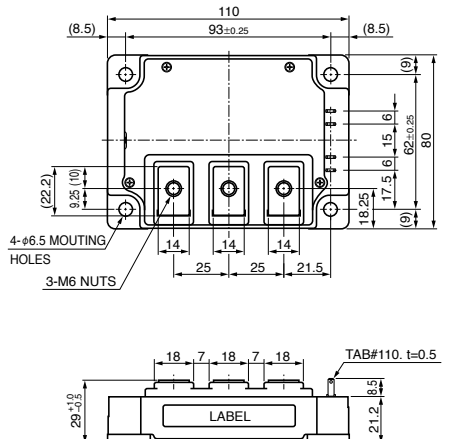
14

CM300,400DU-12NFH
CM200,300DU-24NFH



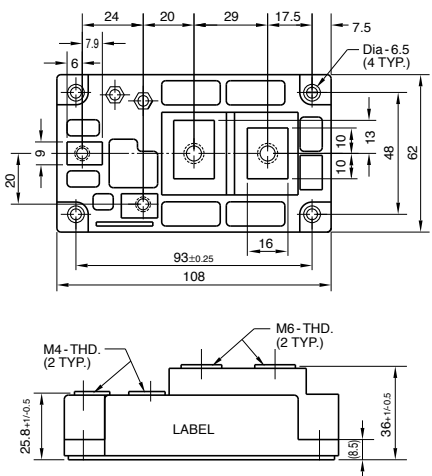
15

CM600DU-12NFH
CM400,600DU-24NFH



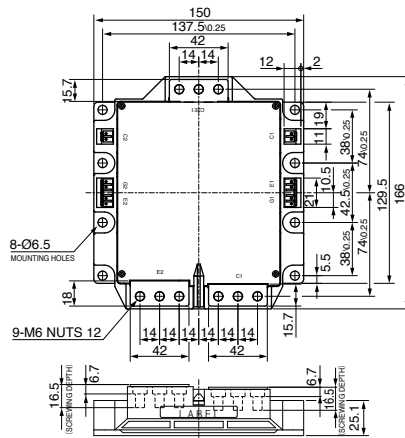
16

CM400,600HA-24A
CM500HA-34A



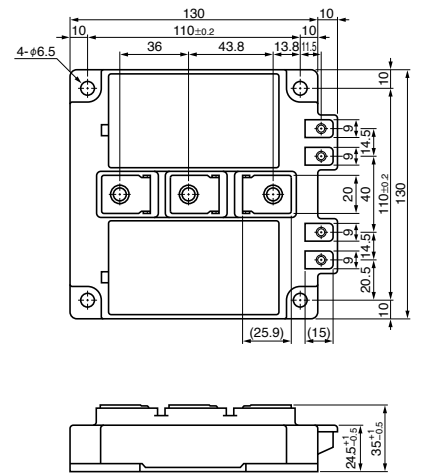
17

CM900,1400DUC-24S
CM1000DUC-34SA



18

CM400DY-34A

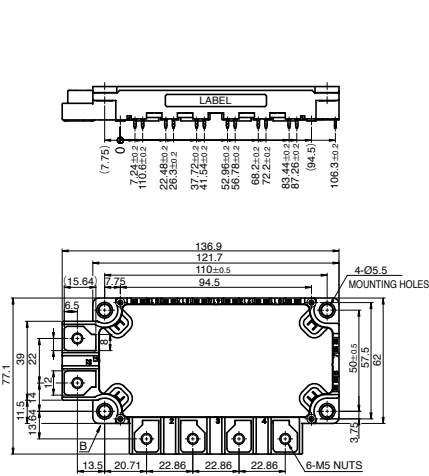


Line-up of IGBT Modules

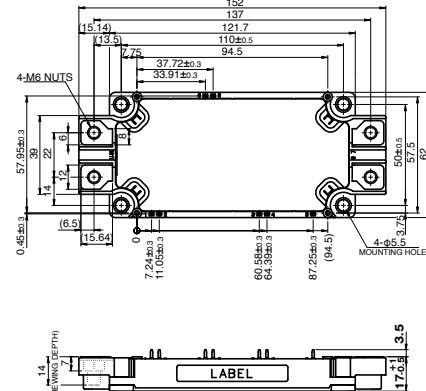
Outline Drawing of IGBT Modules

Unit:mm

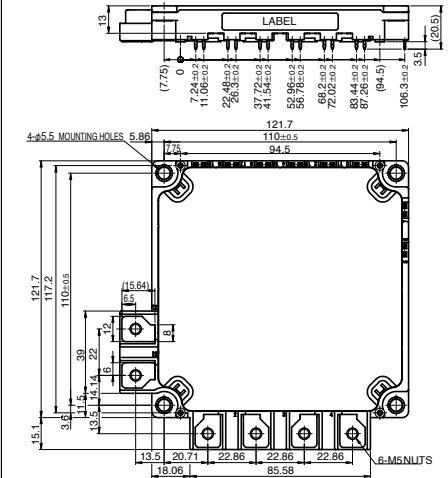
19 CM75RX-34SA



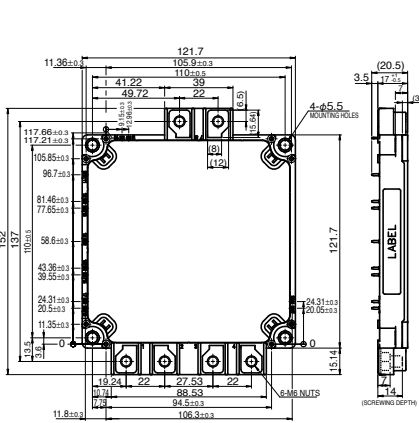
20 CM150DX-34SA
CM200DX-34SA
CM300DX-34SA



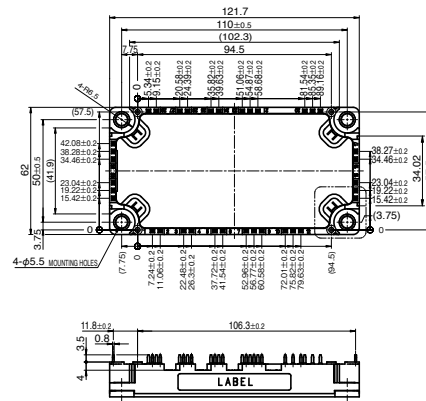
21 CM200RXL-24S
CM300RXL-24S1
CM150RXL-34SA



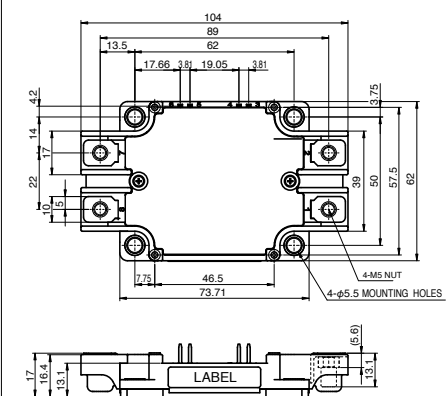
22 CM450DXL-34SA
CM600DXL-34SA



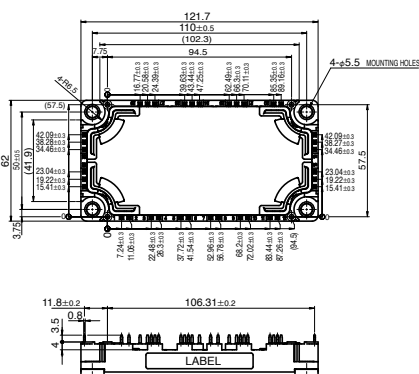
23 CM75MXA-34SA



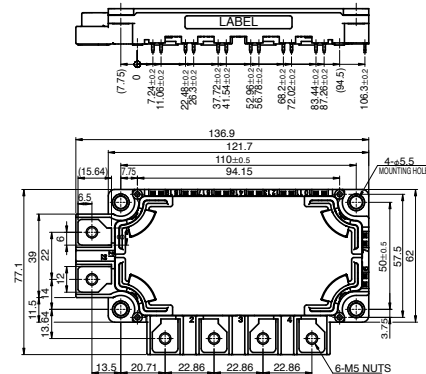
24 CM150EXS-24S
CM200EXS-24S
CM300EXS-24S
CM200EXS-34SA



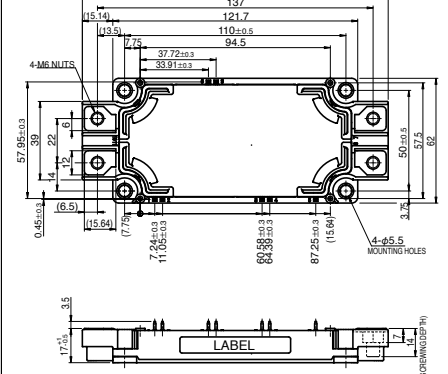
25 CM100TX-24S1
CM150TX-24S1



26 CM100RX-24S1
CM150RX-24S1



27 CM225DX-24S1
CM300DX-24S1
CM450DX-24S1
CM600DX-24S1



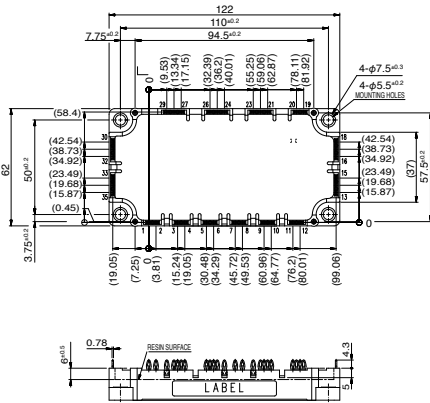
Line-up of IGBT Modules

Outline Drawing of IGBT Modules

Unit:mm

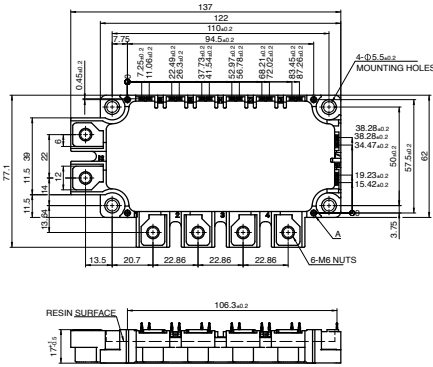
37

CM100,150,200TXP-13T
CM100,150,200TXP-24T
CM100,150TXP-34T



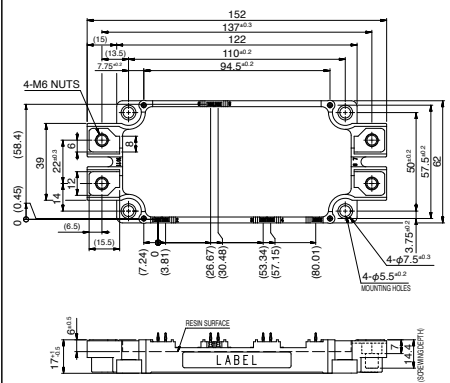
38

CM150,200RXP-13T
CM100,150RXP-24T



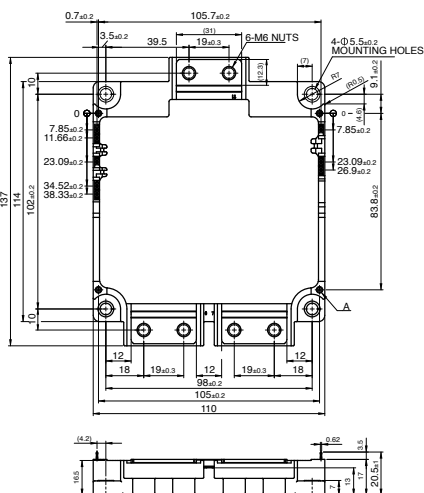
39

CM300,450,600DXP-13T
CM225,300,450,600DXP-24T



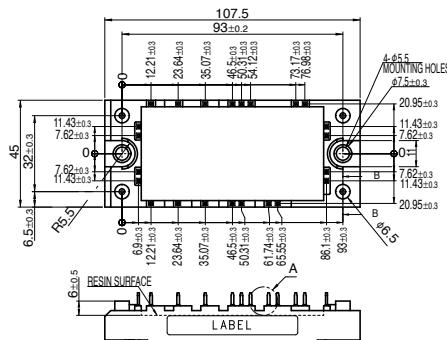
40

CM1000DXP-24T



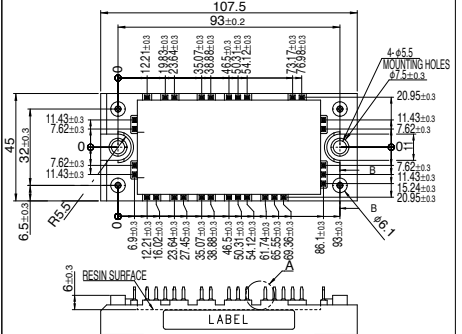
41

CM35,50MXUA-24T/24T1



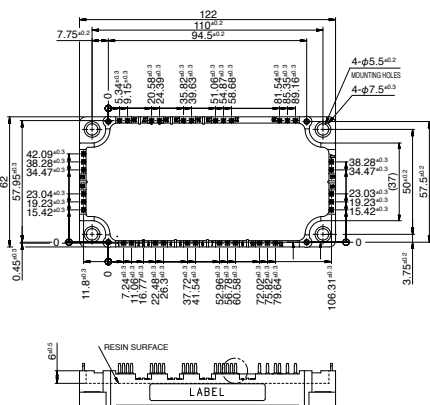
42

CM50,75,100MXUB-13T/13T1
CM75MXUB-24T/24T1



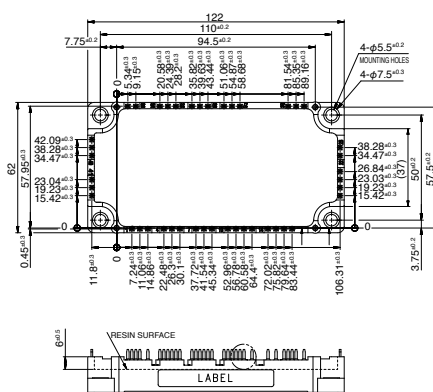
43

CM75,100MXUC-24T/24T1



44

CM100/150MXUD-13T/T1
CM150MXUD-24T/T1

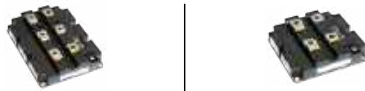




New Products

X Series HVIGBT Modules

Existing compatible package: Standard type
Contributes to smaller, higher-capacity inverter systems by expanding lineup



	std. Type	
1.7kV	2400A/3600A	1600A/2400A
3.3kV	1200A/1800A	1200A
4.5kV	900A/1350A/1500A	900A/1000A
6.5kV	600A/900A/1000A	600A

<Main Features>

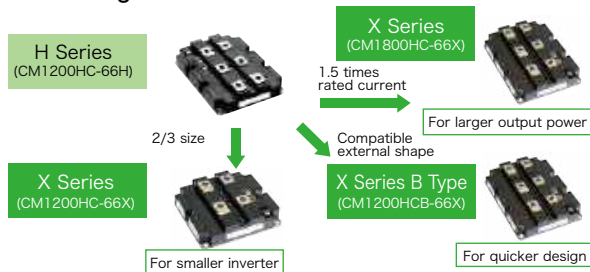
- Power loss reduced by incorporating 7th-generation IGBT and RFC¹ diode
- Industry-leading power² for increased inverter capacity
- External size reduced 33% while maintaining the same voltage resistance and rated current as conventional products,³ contributing to inverter downsizing
- Optimal package internal structure realizes improved heat dissipation, humidity resistance and flame retardance, increasing product life

*1 RFC : Relaxed field of cathode

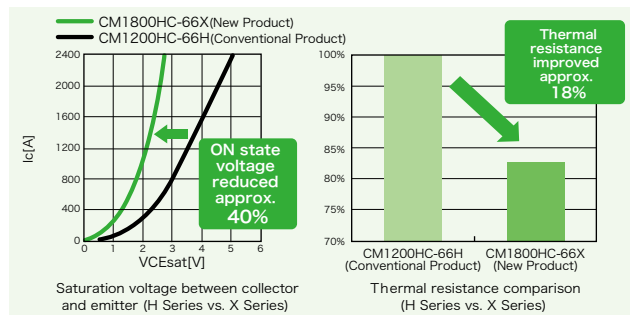
*2 3.3kV - 6.5kV (as of Apr. 5, 2018 based on Mitsubishi Electric research)

*3 Comparison of X Series CM1200HC-66X and H Series CM1200HC-66H

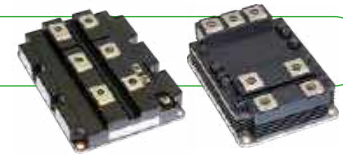
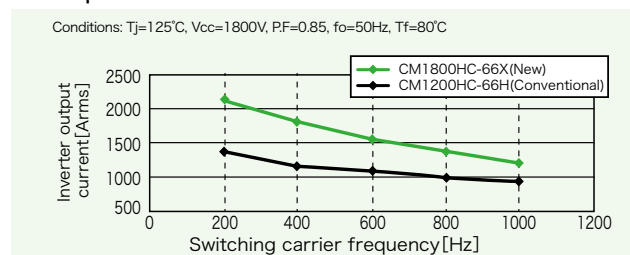
Positioning from conventional series



Characteristics graph



Output current characteristics



New common frame package: LV100/HV100 type
Class-leading current density contributes to increased power output in inverter systems



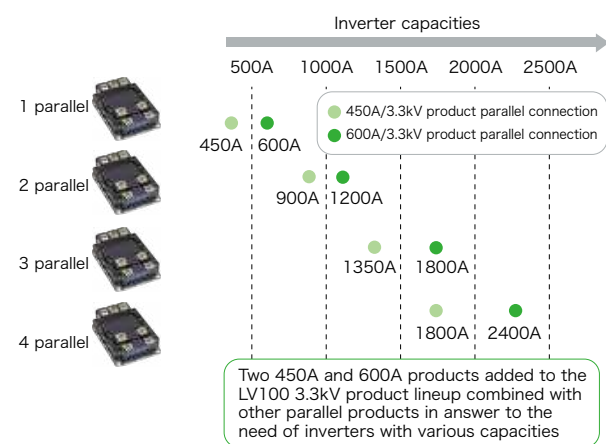
	LV100 Type	HV100 Type
1.7kV	1000A/1200A	
3.3kV	450A/600A	450A/600A
6.5kV		225A/300A

<Main Features>

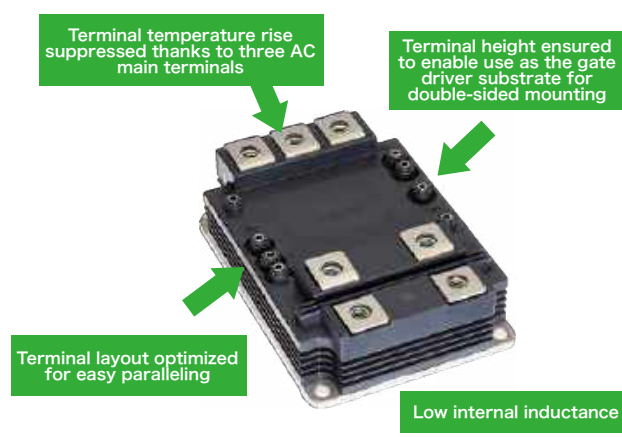
- Power loss reduced by incorporating 7th-generation IGBT and RFC¹ diode
- Industry's highest 3.3kV/600A Si module power density of 8.57A/cm² *4 contributes to increased power output and efficiency
- Terminal layout optimized for easy paralleling and flexible inverter configurations and capacities
- New package structure offers extra reliability

*4 As of Apr. 5, 2018, based on Mitsubishi Electric research

Various current ratings for optimal system design



Package features (LV100 type)



Line-up of HVIGBT Modules

Series Matrix of HVIGBT/HVIPM (No.: Number of outline drawing, see page 26 and 28)

Vces	1700V				2500V				3300V				4500V				6500V				
	Model Number				Model Number				Model Number				Model Number				Model Number				
Ic(A)	Series	Connection	Type	No.	Series	Connection	Type	No.	Series	Connection	Type	No.	Series	Connection	Type	No.	Series	Connection	Type	No.	
200																					
225																					
300																					
400					H																
450																					
600	H	CM600DY-34H	D1	B	01																
	H	CM600E2Y-34H	E2	B	01																
750																					
800	N	CM800DZB-34N	D1	C	01																
	H	CM800DZ-34H	D1	C	01	H	CM800HB-50H	H	B	03											
	H	CM800HA-34H	H	B	-																
900																					
1000	X	CM1000DA-34X**	D2	A	20																
	H	CM1200HC-34H	H	C	02																
	N	CM1200HCB-34N	H	C	03																
	N	CM1200E4C-34N	E4	C	05																
	N	CM1200DC-34N	D1	C	04																
	S	CM1200DC-34S	D1	C	04																
	X	CM1200DA-34X**	D2	A	20																
1350																					
1500																					
	H	CM1600HC-34H	H	C	02																
	X	CM1600HC-34X**	H	C	16																
1800	H	CM1800HC-34H	H	C	06																
	N	CM1800HC-34N	H	C	05																
	N	CM1800HCB-34N	H	C	06																
2400	H	CM2400HC-34H	H	C	06																
	X	CM2400HC-34X**	H	C	16																
	N	CM2400HC-34N	H	C	05																
	N	CM2400HCB-34N	H	C	06																
	X	CM2400HCB-34X**	H	C	17																
2400		CM3600HC-34X**	H	C	17																
Connection	H		E2/E6		E4		D1		D2												

[Type] A: Al base plate / 6 kViso B:Cu base plate C:AISiC base plate / 6 kViso D:AISiC base plate / 10kViso E:Al base plate / 10kViso
 *There are possibility to change the type of auxiliary terminals.

★★: Under Development

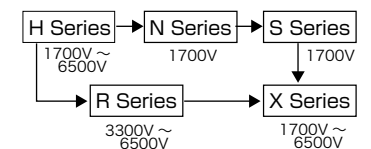
Series Matrix of HVDIODE Modules (No.: Number of outline drawing, see page 28)

VPRM	1700V			3300V			4500V			6500V		
Ic(A)	Connection	Type	No.	Connection	Type	No.	Connection	Type	No.	Connection	Type	No.
200												
250												
300												
400												
450												
600												
800												
900												
1000												
1200												
1500												
1800												
Connection	H		D									

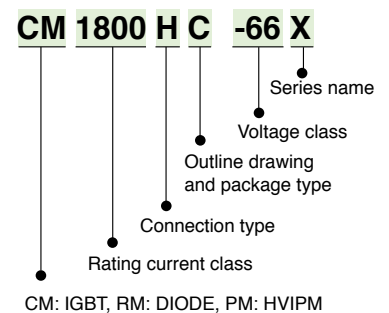
[Type] B:Cu base plate C:AISiC base plate / 6 kViso D:AISiC base plate / 10kViso

★★: Under Development

Evolution of HVIGBT Module Series

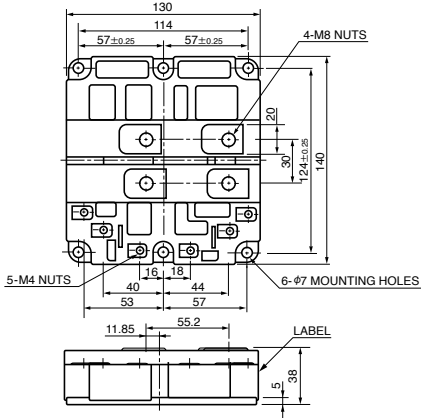


Type Name Definition of IGBT Modules



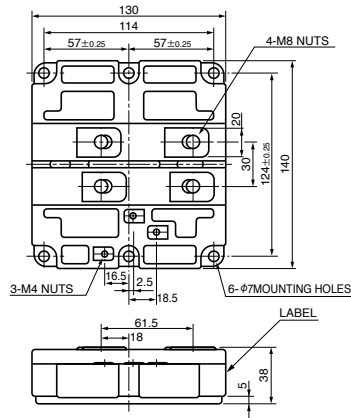
01

CM600DY-34H
CM600E2Y-34H
CM800DZ-34H
CM800DZB-34H



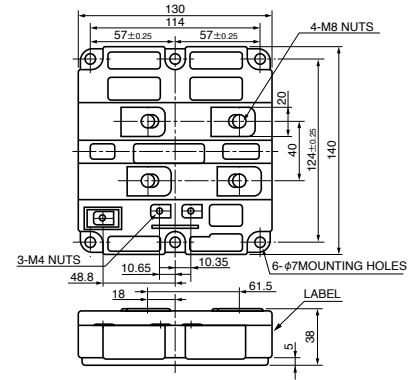
02

CM1200,1600HC-34H



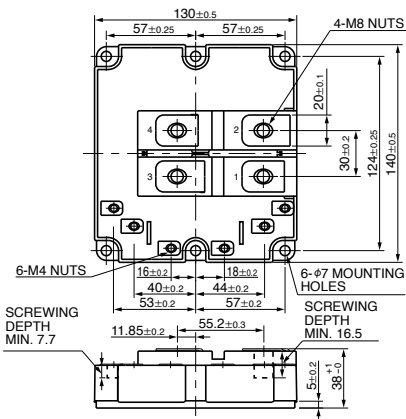
03

CM1200HCB-34N
CM800HB-50H,-66H
CM800HC-66H



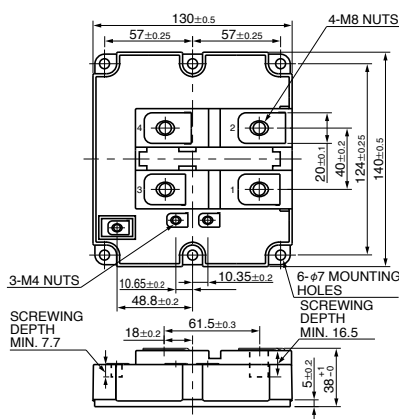
04

CM1200DB/DC-34N
CM1200DC-34S



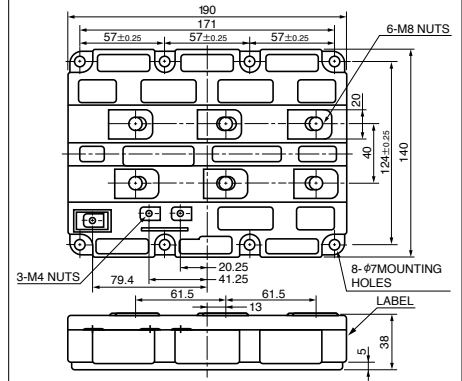
05

CM1200E4C-34N
CM1800,2400HC-34N



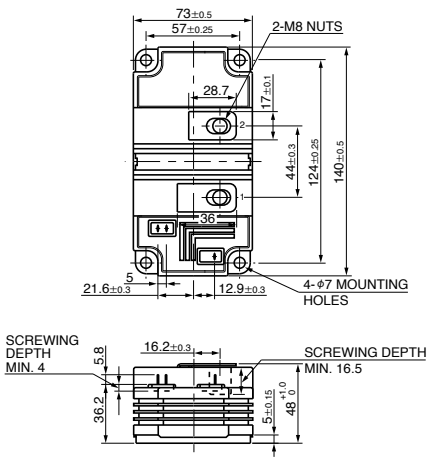
06

CM1800,2400HCB-34N
CM1800,2400HC-34H
CM1200HB/HC-50H,-66H
CM800E4C/E6C-66H
CM900HB/HC-90H



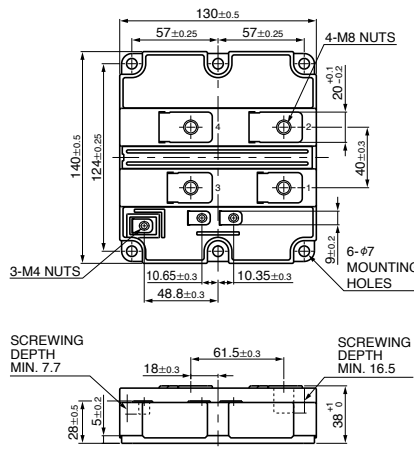
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CM400HG-66H
CM200HG-130H



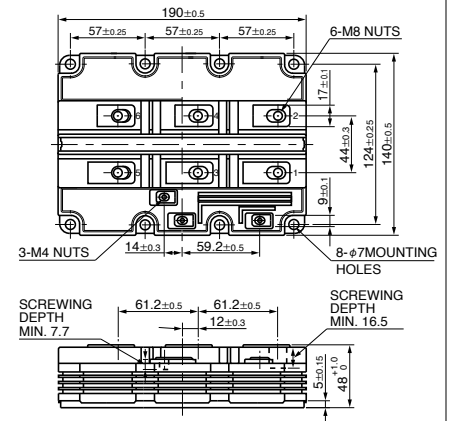
08

CM1000HC-66R
CM800HC-90R



09

CM1200HG-66H
CM900HG-90H
CM400E2G/E4G-130H
CM600HG-130H



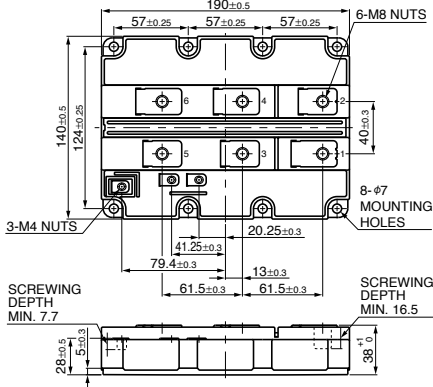
Line-up of HVIGBT Modules

Outline Drawing of HVIGBT Modules

Unit:mm

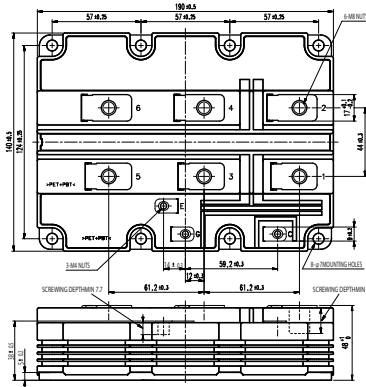
10

CM1000E4C-66R
CM1500HC-66R
CM1200HC-90R
CM1200HC-90RA



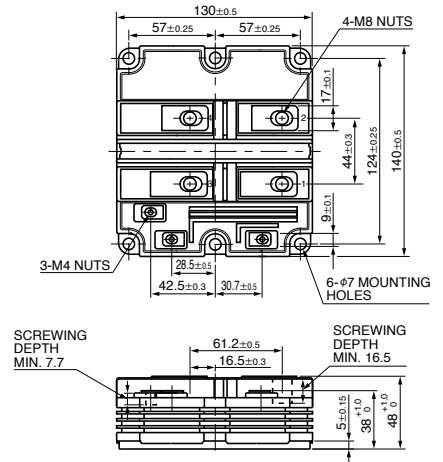
11

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



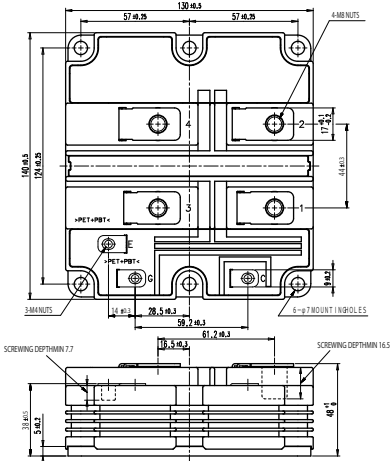
12

CM600HG-90H
CM400HG-130H



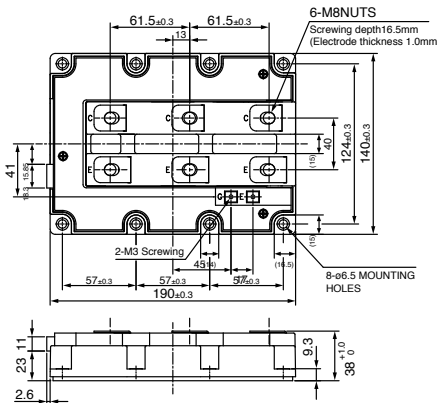
13

CM800HG-90R



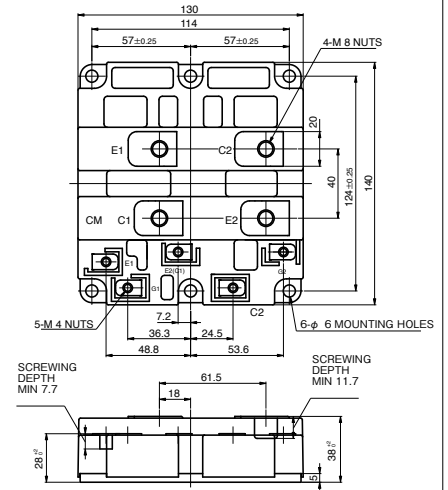
14

PM1200HCE330-1



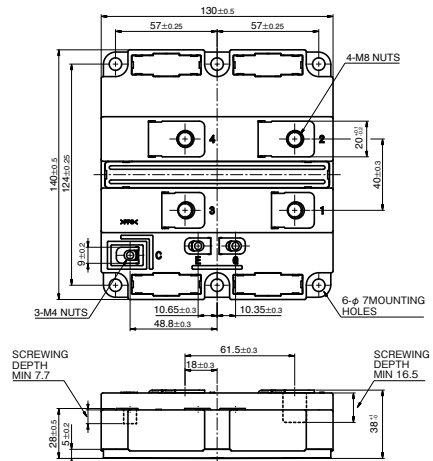
15

CM400DY-50H/66H



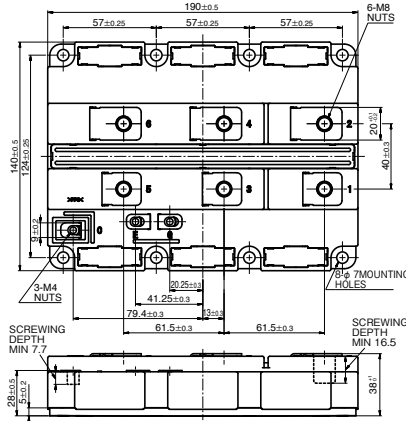
16

CM1600HC-34X
CM2400HC-34X
CM1200HC-66X
CM1200E4C-66X



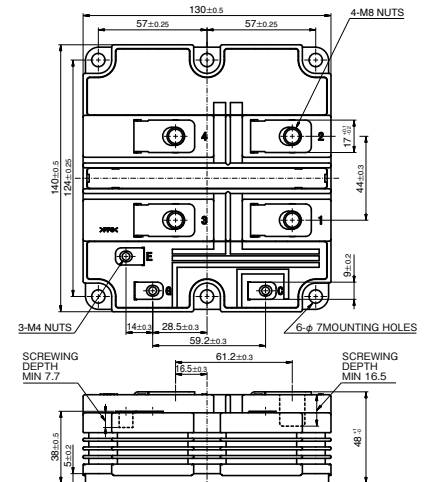
17

CM2400HCB, CM3600HC-34X
CM1200HCB, CM1800HC-66X
CM1350HC-90X
CM1500HC-90XA



18

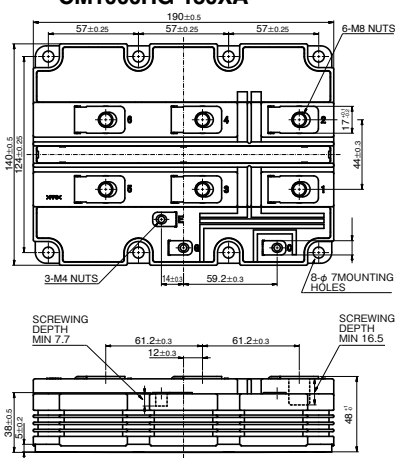
CM900HG-90X
CM1000HG-90X
CM600HG-130X



*There are possibility to change the type of auxiliary terminals.

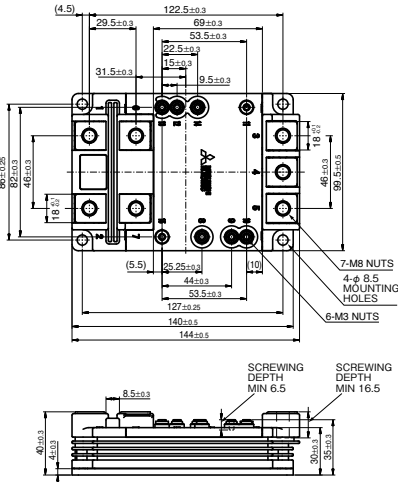
19

CM1800HG-66X, CM900HGB-90X
CM1350, 1500HG-90X
CM600HGB-130X
CM900HG-130X
CM1000HG-130XA



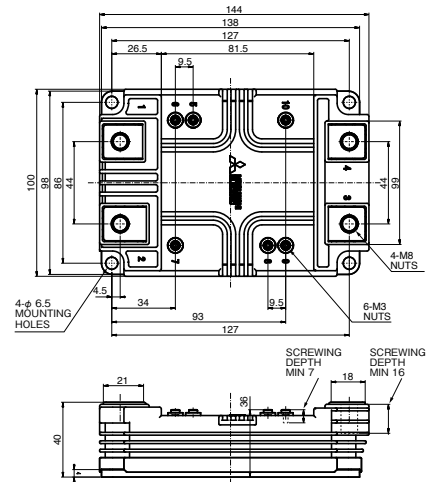
20

CM1000DA-34X
CM1200DA-34X
CM450DA-66X
CM600DA-66X



21

CM450DE-66X
CM600DE-66X
CM225DE-130XA
CM300DE-130XA

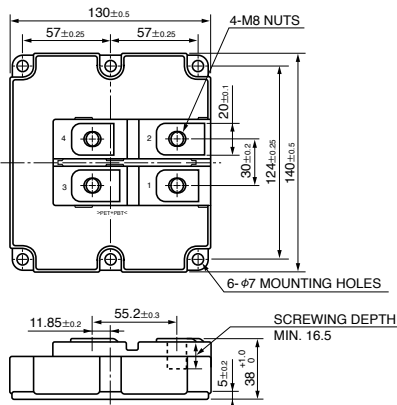


Outline Drawing of HVDIODE Modules

Unit:mm

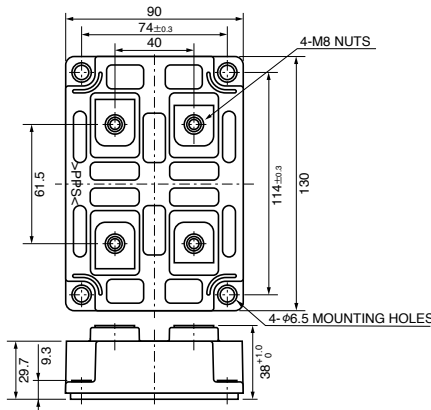
22

RM1200DB-34S



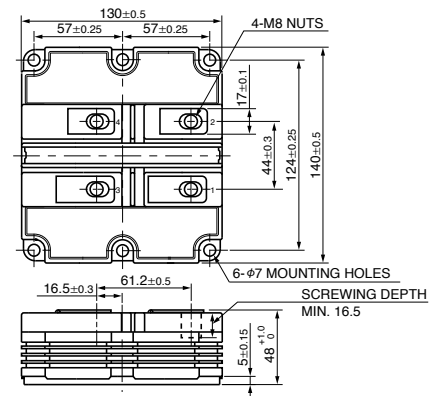
23

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



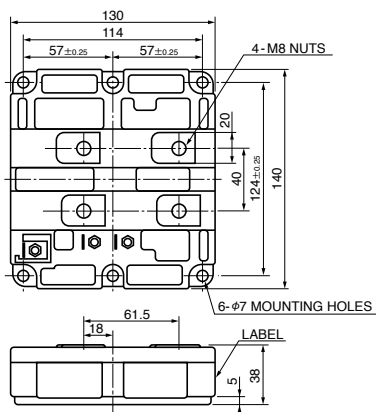
24

RM400,1200DG-66S
RM1200DG-66X
RM300DG-90S
RM400,800,1200DG-90F
RM450DG-90X
RM200,600DG-130S
RM300DG-130X
RM1000DG-130XA



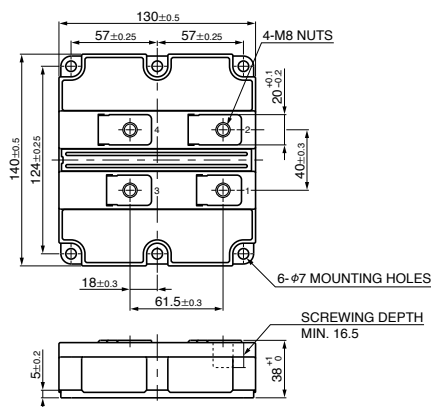
25

RM400,600DY-66S



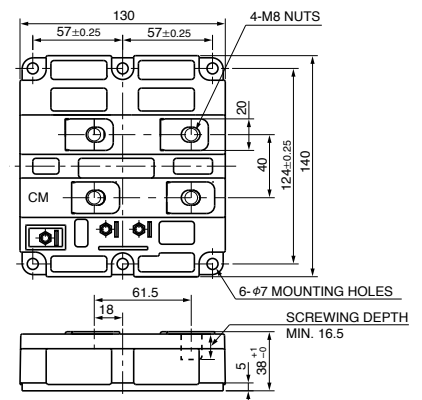
26

RM1000,1500DC-66F



27

RM1200DB-66S
RM900DB/HC-90S

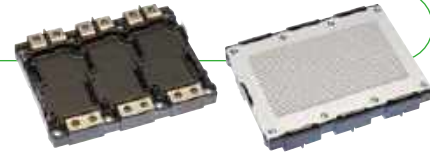


Power Modules for Electric and Hybrid Vehicles



New Products

Package with 6-in-1 connection and integrated water-cooled fin contributes to more compact, high-power inverters for EVs/HEVs



High Power J1 Series Power Modules for EVs/HEVs

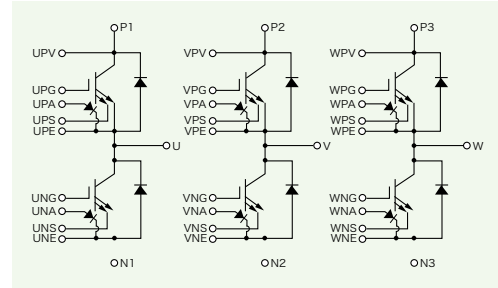
CT1000CJ1B060,
CT600CJ1B120

<Main Features>

- Integrated direct water-cooling structure with cooling fins and 6-in-1 connection contribute to more compact inverters for EVs/HEVs
- Direct lead bonding (DLB) structure ensures high reliability
- Loss further reduced by incorporating 7th-generation IGBT built with a CSTBT™* structure
- Completely lead-free, conforms to RoHS directives (2011/65/EU)
- Suitable for a variety of electric and hybrid vehicle inverters

*CSTBT™: Mitsubishi Electric's unique IGBT that utilizes the carrier cumulative effect.

Block Diagram



Features

Common

- Long power/temperature cycle life
- High-precision on-chip temperature sensor
- High traceability in managing materials/components for each product throughout the entire production process

- Package structure compliant with the End-of-Life-Vehicles Directive, regulations relating to substances of environmental concern

J Series T-PM (Transfer-molded Power Module)

- Structure incorporates transfer molding and original direct lead bonding(DLB) technique
- DLB structure reduces internal wiring resistance and inductance
- Completely Pb-free (including the pins)

J1 Series (6-in-1)

- Cooling fin integrated direct water-cooled structure and 6-in-1 configuration contribute to minimize the automobile inverter
- DLB structure realizes high reliability
- Installation of the 7th generation IGBT adapting the CSTBT™* structure realizes a further reduction in loss
- On-chip current sensor that enables high-speed current-cutoff protection is installed

Matrix of 650V Power Modules (No. : Number of outline drawing, please refer to page 30)

V _{CEs} (V)	650V						
	Series	J1 Series			J Series		
I _C (A)		Power Module with pin fin	Connection	No.	T-PM	Connection	No.
300		-	-	-	CT300DJG060**	D	02
600		CT600CJ1A060	C	01	CT600DJH060**	D	03
700		CT700CJ1A060*	C	01	-	-	-
1000		CT1000CJ1B060*	C	04	-	-	-
Connection							

★: New Product ★★: Under Development

Matrix of 1200V Power Modules

(No. : Number of Outline Drawing, please refer to page 30)

V _{CEs} (V)	1200V			
	Series	J1 Series		
I _C (A)		Power Module with pin fin	Connection	No.
300		CT300CJ1A120**	C	01
600		CT600CJ1B120*	C	04
Connection				

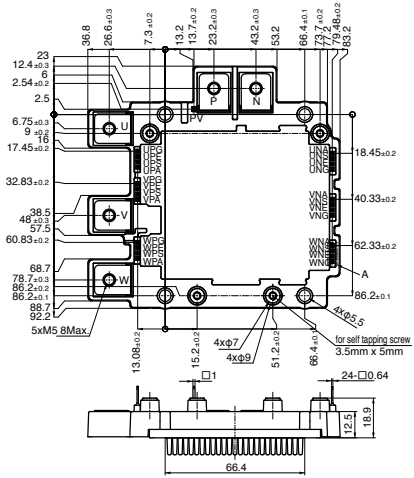
★: New Product ★★: Under Development

Type Name Definition of Power Modules for Electric and Hybrid Vehicles

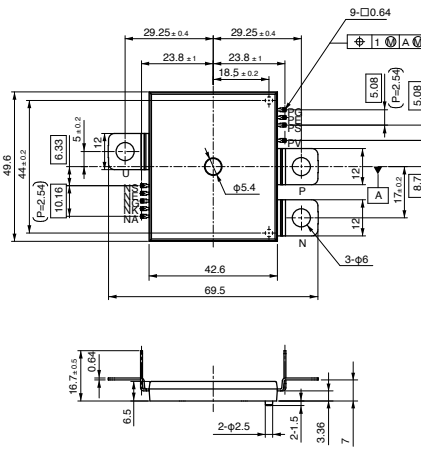
CT 600 C J1B 120

- Voltage class
- Series name and structure
- Connection type
- Rating current class
- CT: IGBT

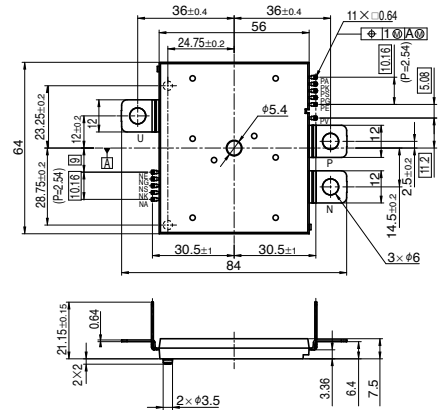
01
CT600CJ1A060
CT700CJ1A060
CT300CJ1A120



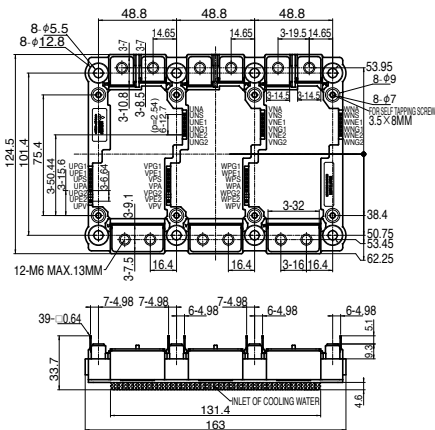
02
CT300DJG060



03
CT600DJH060



04
CT1000CJ1B060
CT600CJ1B120



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www.MitsubishiElectric.com

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- Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material or (iii) prevention against any malfunction or mishap.

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for a greener tomorrow

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MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: TOKYO BLDG., 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
www.MitsubishiElectric.com

SiC POWER DEVICES



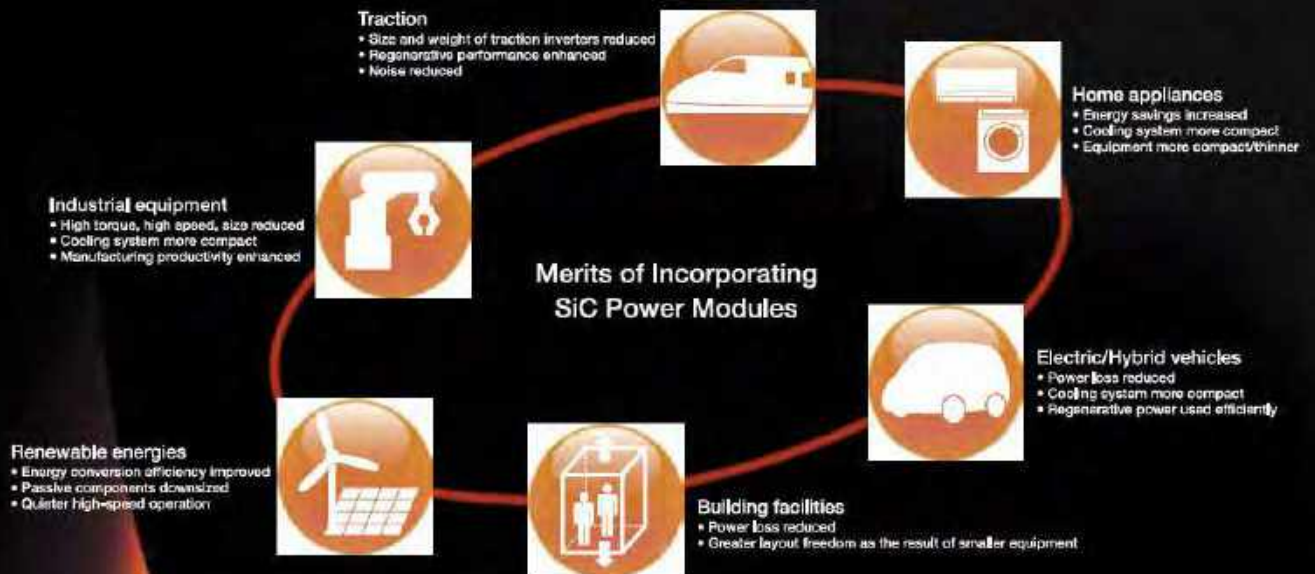
SiC Power Devices

Innovative Power Devices for a Sustainable Future

Traction, Industrial equipment, building facilities, electric vehicles, renewable energies, home appliances...

Power devices are a key component in power electronics products for contributing to the realization of a low-carbon society. Attracting attention as the most energy-efficient power device is one made using new material, silicon-carbide (SiC). The material characteristics of SiC have led to a dramatic reduction in power loss and significant energy savings for power electronics devices. Mitsubishi Electric began the development of elemental SiC technologies in the early 1990s and has since introduced them to achieve practical energy-saving effects for products manufactured using SiC. Innovative SiC power modules are contributing to the realization of a low-carbon society and more affluent lifestyles.

*SiC: Silicon Carbide-Compound that fuses silicon and carbon at a ratio of one-to-one.



SiC with superior characteristics



Power loss reduced

SiC has approximately 10 times the critical breakdown strength of silicon. Furthermore, the drift layer that is a main cause of electrical resistance is one-tenth of the thickness. This allows a large reduction in electrical resistance and, in turn, reduces power loss. This SiC characteristic enables dramatic reductions in conductivity loss and switching loss in power devices.



High-temperature operation

When the temperature increases, electrons are excited to the conduction band and the leakage current increases. At times, this results in abnormal operation. However, SiC has three times the band gap width of silicon, preventing the flow of leakage current and enabling operation at high temperatures.



High-speed switching operation

With SiC, owing to the high dielectric breakdown, power loss is reduced and high-voltage is easier to achieve, it is possible to use Schottky Barrier Diodes (SBDs), which cannot be used with Si. SBDs can realize high-speed switching motion because they don't have accumulation carriers. As a result, high-speed switching can be realized.



Heat dissipation

SiC has three times the heat conductivity of silicon, which improves heat dissipation.

SiC power modules appropriated by application

Application	Product name	Model	Rating		Connection	Status	Insert pages	
			Voltage[V]	Current[A]				
Home appliances Industrial equipment	SiC-SBD	BD20060T	600	20	-	Connectivity available	P3	
		BD20060S			-	Sample available		
		BD20060A			-	-		
		BD10120S	1200	10	-	Under development		
		BD20120S		20	-			
		BD20120SJ		-	-			
Industrial equipment	Hybrid SiC-IPM	PMH200CS1D060	600	200	6 in 1	Connectivity available	P4	
	Full SiC-IPM	PMH75CL1A120	1200	75	6 in 1	Sample available		
		PMF75CL1A120						
	Full SiC Power Modules	FMF400BX-24A	1200	100	400	2 in 1		Under development
		FMF800DX-24A			800			
		FMF600DX2-24A			600			
		FMF800DX2-24A			800			
		CMH100DY-24NFH			100			
	Hybrid SiC Power Modules for High-frequency Switching Applications	CMH150DY-24NFH	1200	150	150	2 in 1		Connectivity available
		CMH200DU-24NFH			200			
		CMH300DU-24NFH			300			
		CMH400DU-24NFH			400			
CMH600DU-24NFH		600						
CMH600DU-24NFH		600						
Traction	Large Hybrid SiC DIPIM™ for PV Application	PSH50YA2A6	600	50	4 in 1	Connectivity available	P6	
Hybrid SiC Power Modules	CMH1200DC-34S	1700	1200	2 in 1				
Home appliances	Super-mini Full SiC DIPIM™	PSF15S92F6	600	15	6 in 1	Connectivity available	P7	
	Super-mini Hybrid SiC DIPFFC™	PSF25S92F6		25				
	Super-mini Full SiC DIPFFC™	PSF20L91A6-A		20Arms				Interleaved

Terminology

SiC.....Silicon Carbide

IPM.....Intelligent Power Module

DIPIM™.....Dual-In-Line Package Intelligent Power Module

DIPFFC™.....Dual-In-Line Package Power Factor Correction

SBD.....Schottky Barrier Diode

MOSFET.....Metal Oxide Semiconductor Field Effect Transistor

IGBT.....Insulated Gate Bipolar Transistor

Tr.....Transistor

FW-SW.....Freewheeling switching loss

FW-DC.....Freewheeling DC loss

Tr-SW.....Transistor switching loss

Tr-DC.....Transistor DC loss

IGBT-SW.....IGBT switching loss

IGBT-DC.....IGBT DC loss

PV.....Photovoltaics

CSTBT™.....Mitsubishi Electric's unique IGBT that makes use of the carrier cumulative effect

JBS.....Junction Barrier Schottky



600V/20A SiC-SBD for power supply systems

BD20060T **Commercially available** /BD20060S /BD20060A
/BD10120S/BD20120S/BD20120SJ **Under development**

Contribute to reducing power loss and the size of power supply systems

■ Features

- Power loss is reduced by approx. 21% compared to silicon (Si) products, contributing to energy conversion.
- The SiC-SBD allows high frequency switching and contributes to downsizing the reactor, heat sink and other peripheral components
- JBS structure allows high forward surge capability and contributes to improving reliability

■ Product lineup

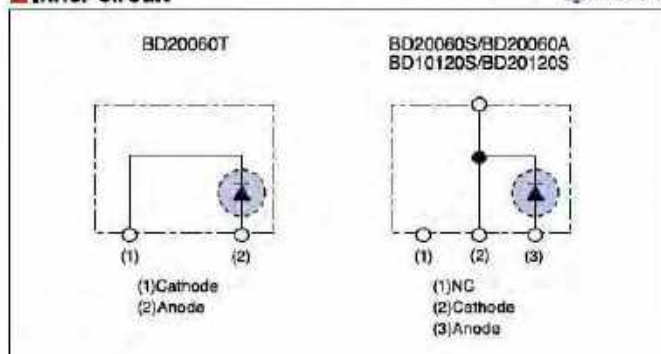
Model	Rated voltage	Rated current	Package
BD20060T	600V	20A	TO-220-2L
BD20060S**			TO-247-3L
BD20060A**			TO-263S-3L
BD10120S**	1200V	10A	TO-247-3L
BD20120S**		20A	
BD20120SJ**			

**Under development



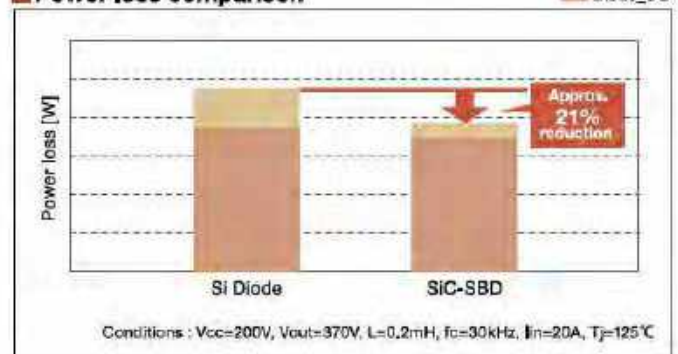
■ Inner circuit

: SiC-SBD



■ Power loss comparison

Diode_SW
 Diode_DC



600V/200A Hybrid SiC-IPM for Industrial Equipment

PMH200CS1D060 **Commercially available**

SiC-SBD incorporated in an IPM with a built-in drive circuit and protection functions

Power loss reduction of approx. 20% contributes to enhancing the performance of industrial machinery

■ Features

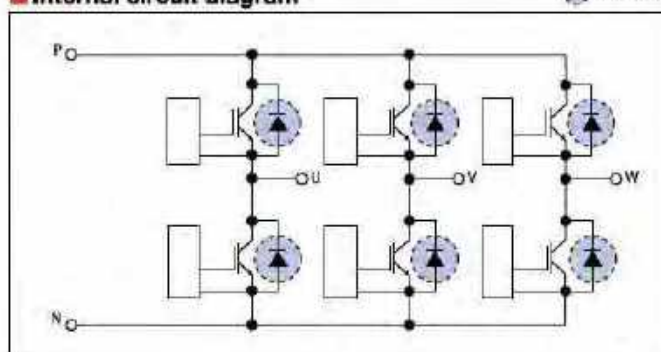
- Hybrid combination of SiC-SBD and IGBT with current and temperature sensors implemented for IPM supplies high functionality and low loss enabling high torque and motor speed
- Recovery loss (Err) reduced by 95% compared to the conventional product*
- Package compatible with the conventional product* making replacement possible

* Conventional product: Mitsubishi Electric S1 Series PM200SC1D060



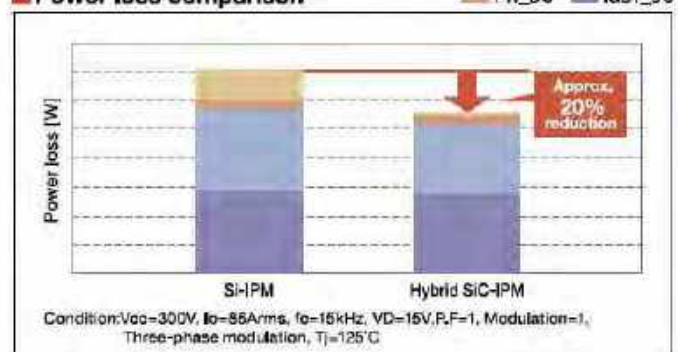
■ Internal circuit diagram

: SiC-SBD



■ Power loss comparison

FW_SW IGBT_SW
 FW_DC IGBT_DC





1200V/75A Hybrid/Full SiC-IPM for Industrial Equipment

PMH75CL1A120/PMF75CL1A120 Sample available

Built-in drive circuit and protection functions realize high functionality

■ Features

- Incorporates SiC-MOSFET with current sensor and built-in drive circuit and protection functions to deliver high functionality
- Significant reduction in power loss compared to the conventional product*
- Package compatible with the conventional product*

* Conventional product: Mitsubishi Electric IPM L1 Series PM75CL1A120

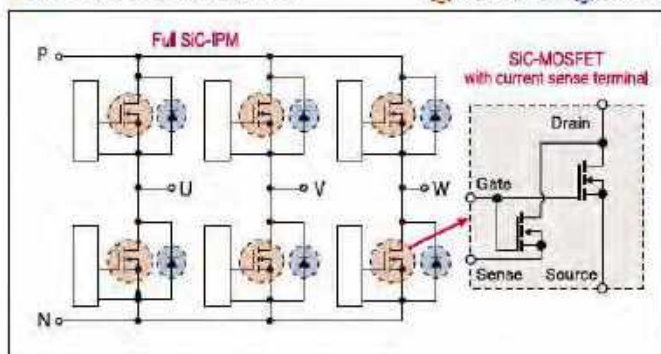
■ Main specifications

Rating	1200V/75A 6in1
Mounted Functions	<ul style="list-style-type: none"> • Built-in drive circuit • Under-voltage protection • Short-circuit protection • Over-temperature protection (Monitoring IGBT chip surface)



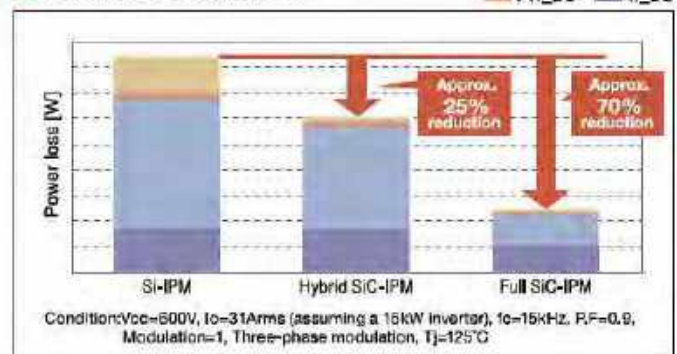
■ Internal circuit diagram

● SiC-MOSFET ● SiC-SBD



■ Power loss comparison

FW_SW Tr_SW
FW_DC Tr_DC



1200V/400A · 1200V/800A Full SiC Power Modules for Industrial Equipment

FMF400BX-24A/FMF800DX-24A Commercially available

Contributes to reducing size/weight of industrial-use inverters with the mounting area reduced by approx. 60%

■ Features

- Power loss reduced approx. 70% compared to the conventional product*
- Low-inductance package adopted to deliver full SiC performance
- Contributes to realizing smaller/lighter inverter equipment by significantly reducing the package size and realizing a mounting area approx. 60% smaller compared to the conventional product*

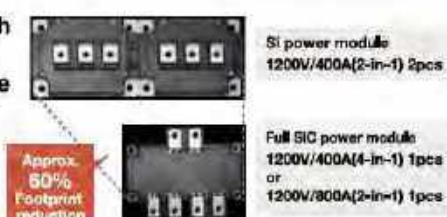
* Conventional product: Mitsubishi Electric CM400DY-24NF(1200V/400A 2in1) 2pcs



■ Product lineup

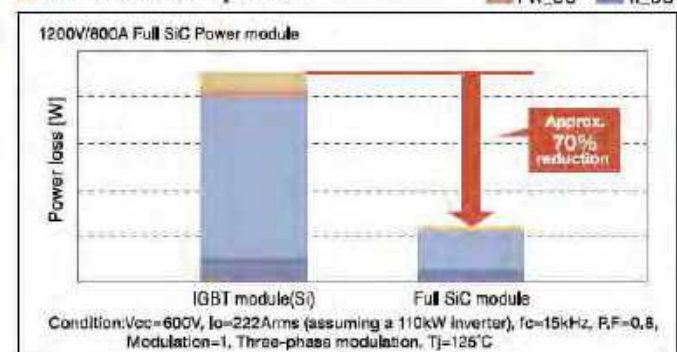
Applications	Rated voltage	Rated current	Circuit configuration	Package size (D x W)
Industrial equipment	1200V	400A	4-in-1	92.3 x 121.7mm
		800A	2-in-1	

■ Comparison with conventional product package



■ Power loss comparison

FW_SW Tr_SW
FW_DC Tr_DC





1200V/600A · 1200V/800A Full SiC Power Modules for Industrial Equipment

FMF600DX2-24A/FMF800DX2-24A **Under development**

Contributes to enhancing the performance of industrial-use inverters thanks to built-in protection function for short circuit

Features

- By using short circuit monitoring circuit in the module it is possible to transfer a short circuit detection signal to the system side
- Power loss reduced approx.70% compared to the conventional product*
- Low-inductance package adopted to deliver full SiC performance

Product lineup

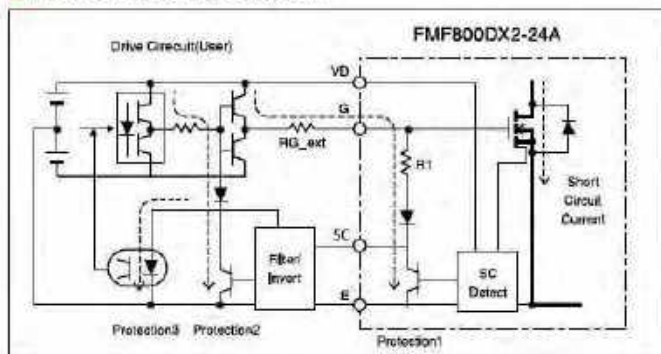
Model	Rated voltage	Rated current	External size (D x W)
FMF600DX2-24A**	1200V	600A	75.6 x 122mm
FMF800DX2-24A**		800A	

**Under development

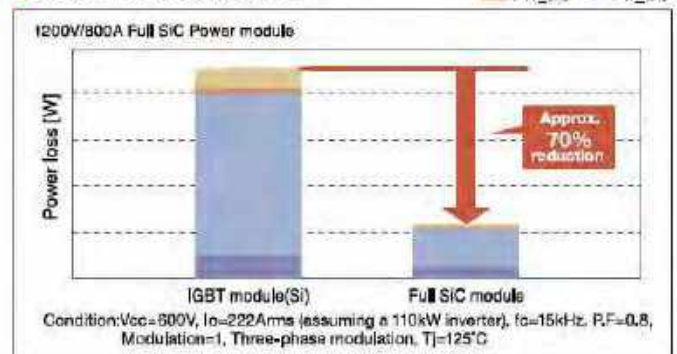


* Conventional product : Mitsubishi Electric CMH00DY-24NF (1200V/400A 2in1) 2pcs

Protection circuit diagram



Power loss comparison



FW_SW Tr_SW
FW_DC Tr_DC



Hybrid SiC Power Modules for High-frequency Switching Applications **Commercially available**

For optimal operation of power electronics devices that conduct high-frequency switching

Features

- Power loss reduction of approx. 40% contributes to higher efficiency, smaller size and weight reduction of total system
- Suppresses surge voltage by reducing internal inductance
- Package compatible with the conventional product*

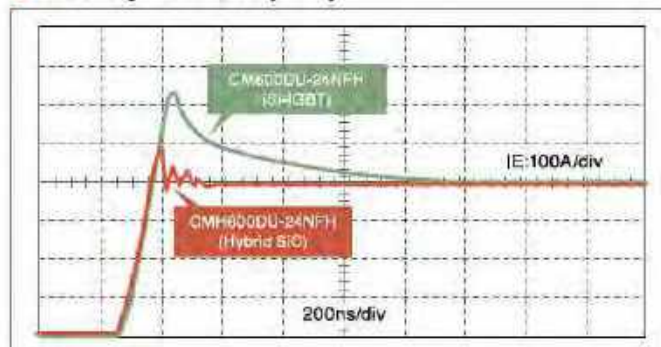
* Conventional product: Mitsubishi Electric NFH Series IGBT Modules

Product lineup

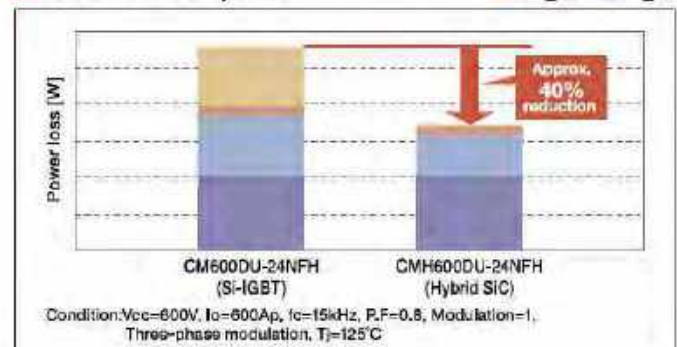
Applications	Model	Rated voltage	Rated current	Circuit configuration	External size (D x W)
Industrial equipment	CMH100DU-24NFH	1200V	100A	2in1	48 x 94mm
	CMH150DU-24NFH		150A		48 x 94mm
	CMH200DU-24NFH		200A		52 x 108mm
	CMH300DU-24NFH		300A		52 x 108mm
	CMH400DU-24NFH		400A		80 x 110mm
	CMH600DU-24NFH		600A		80 x 110mm



Recovery waveform (FWD)



Power loss comparison



FW_SW Tr_SW
FW_DC Tr_DC



1700V/1200A Hybrid SiC Power Modules for Traction Inverters

CMH1200DC-34S **Commercially available**

High-power/low-loss/highly reliable modules appropriate for use in traction inverters

Features

- Power loss reduced approximately 30% compared to the conventional product*
- Highly reliable design appropriate for use in traction
- Package compatible with the conventional product*

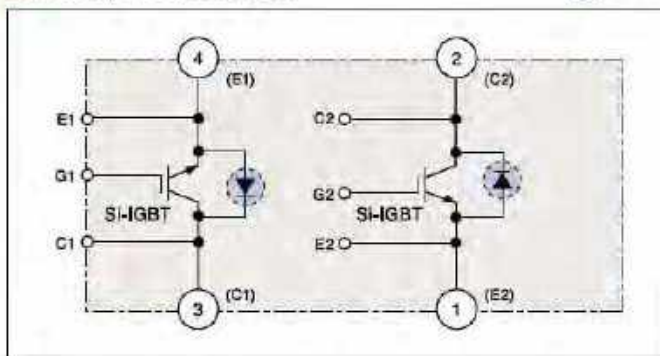
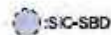
* Conventional product: Mitsubishi Electric Power Module CM1200DC-34N

Main specifications

Module	Max. operating temperature	150°C	
	Isolation voltage	4000Vrms	
Si-IGBT @150°C	Collector-emitter saturation voltage	2.3V	
	Switching loss 850V/1200V	turn-on	140mJ
		turn-off	390mJ
SiC-SBD @150°C	Emitter-collector voltage	2.3V	
	Capacitive charge	9.0μC	

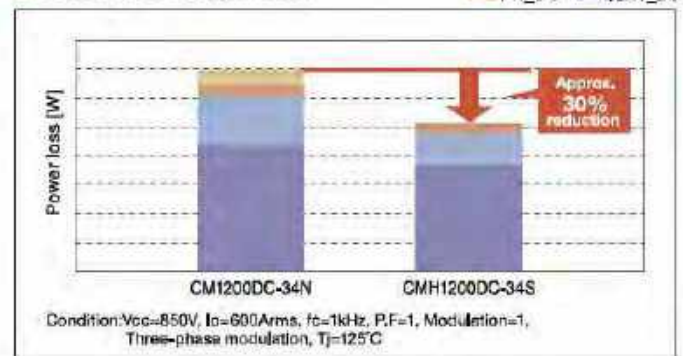


Internal circuit diagram



Power loss comparison

FW_SW IGBT_SW
FW_DC IGBT_DC



600V/50A Large Hybrid SiC DIPIPM™ for PV Applications

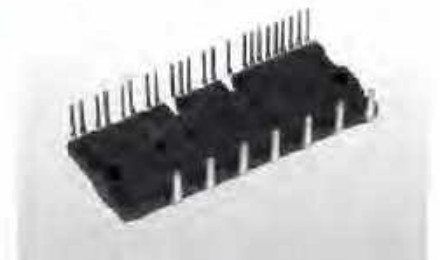
PSH50YA2A6 **Commercially available**

More efficient power modules for PV power conditioner applications

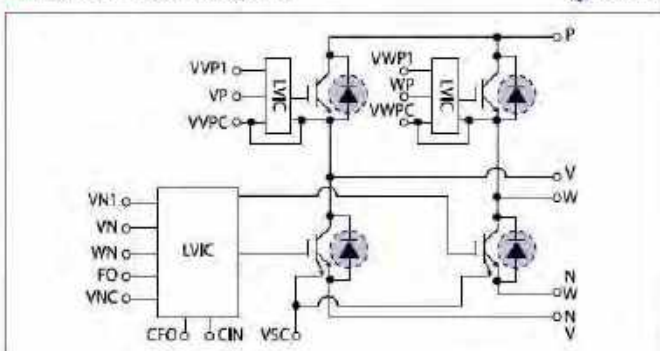
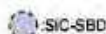
Features

- Hybrid structure achieved with SiC Schottky barrier diode and 7th-generation IGBT chips
- Power loss reduction of approx. 25% compared to the conventional product*
- Helps downsize PV inverter system thanks to modified short-circuit protection scheme

* Conventional product: Mitsubishi Electric Large DIPIPM™ PS61A99

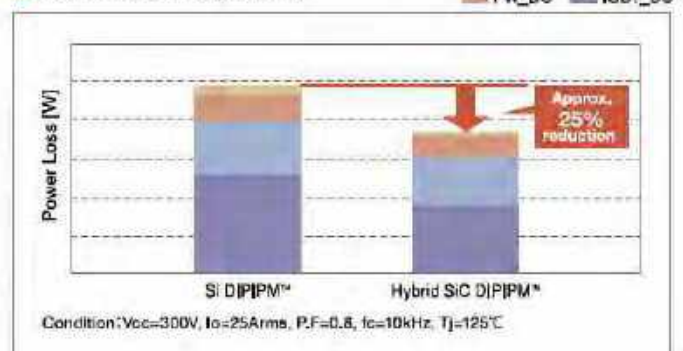


Internal circuit diagram



Power loss comparison

FW_SW IGBT_SW
FW_DC IGBT_DC





15A/25A Super-mini Full SiC DIIPM™ for Home Appliances

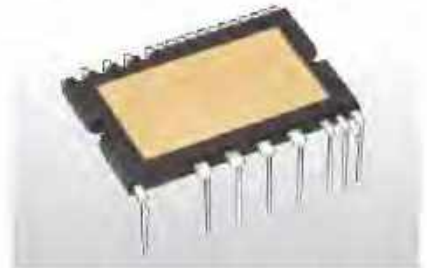
PSF15S92F6-A/PSF25S92F6-A **Commercially available**

**Contributes to extremely high power-efficiency in air conditioners,
and easily applicable to industrial equipment**

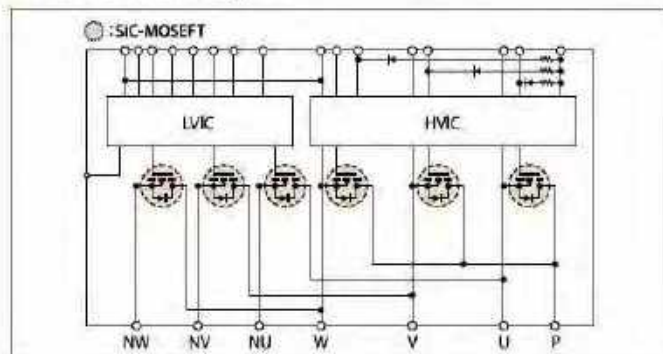
■ Features

- SiC-MOSFET achieves reduction in ON resistance, power loss reduced approx. 70% compared to conventional product*
- Construct low-noise system by reducing recovery current
- Numerous built-in functions: Bootstrap diode for power supply to drive P-side, temperature information output, etc.
- Unnecessary minus-bias gate drive circuit using original high V_{th} SiC-MOSFET technology
- As package and pin layout compatibility with conventional products* is ensured, simply replace with this product to improve performance

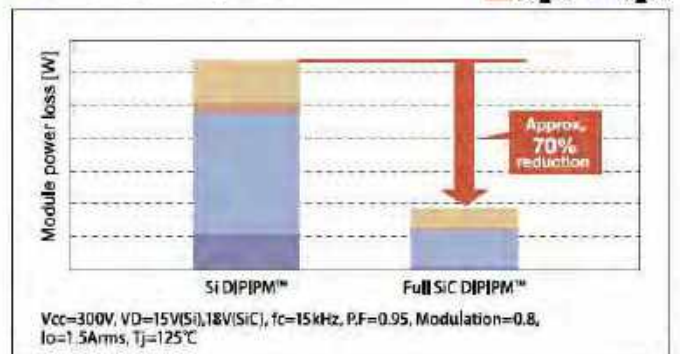
*Conventional product: Mitsubishi Electric Super-mini DIIPM™ Series



■ Internal block diagram



■ Power loss comparison



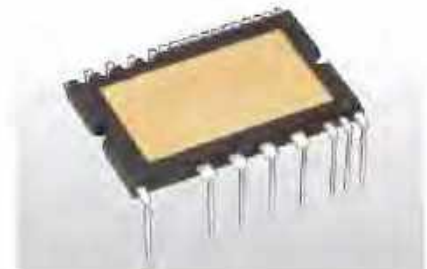
Super-mini Hybrid / Full SiC DIPPFM™ for Home Appliances

PSH20L91A6-A / PSF20L91A6-A **Commercially available**

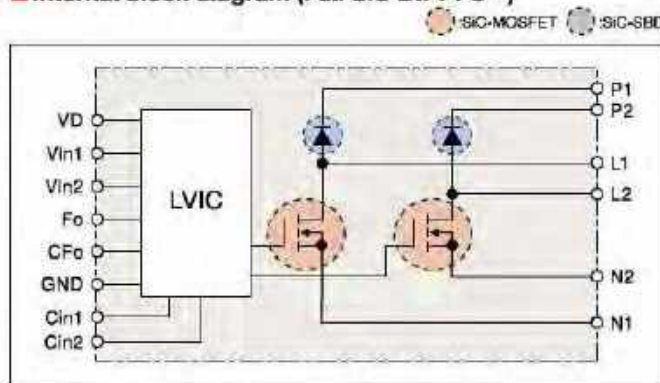
**Utilizing SiC enables high-frequency switching and contributes to
reducing the size of peripheral components**

■ Features

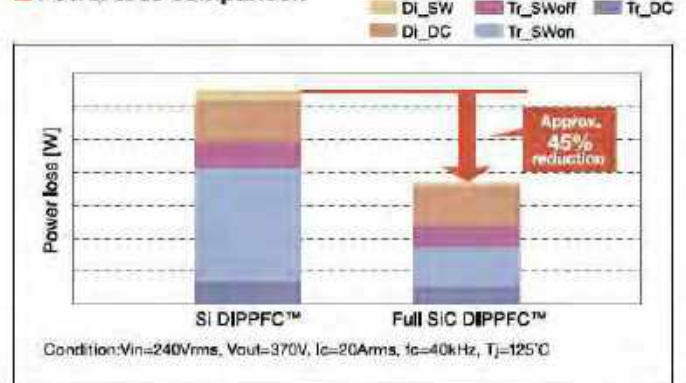
- Incorporating SiC chip in the Super-mini package widely used in home appliances
- The SiC chip allows high-frequency switching (up to 40kHz) and contributes to downsizing the reactor, heat sink and other peripheral components
- Adopts the same package as the Super mini DIIPM™ to eliminate the need for a spacer between the inverter and heat sink, and to facilitate its implementation



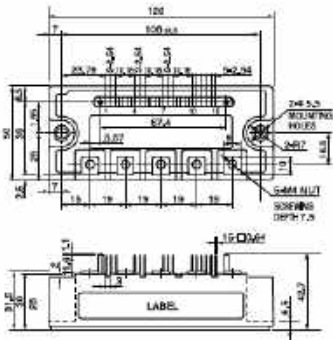
■ Internal block diagram (Full SiC DIPPFM™)



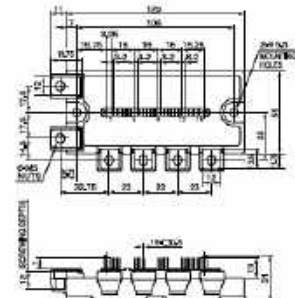
■ Power loss comparison



600V/200A Hybrid SiC-IPM
for Industrial Use
PMH200CS1D060

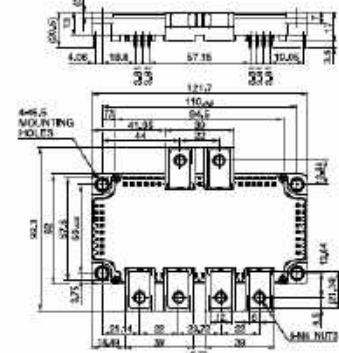


1200V/75A Hybrid/Full SiC-IPM
for Industrial Equipment
PMH75CL1A120/PMF75CL1A120
600V/75A Full SiC-IPM for PV Applications
PMF75B4L1A060

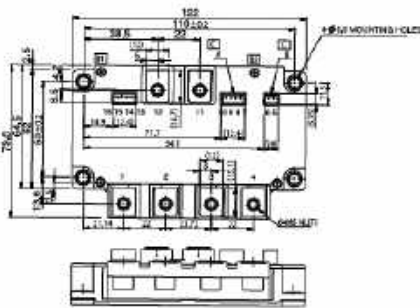


*Tentative No.

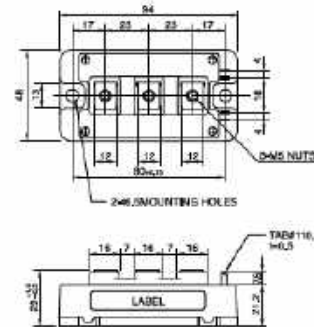
1200V/400A, 1200V/800A
Full SiC Power Modules for Industrial Use
FMF400BX-24A
FMF800DX-24A



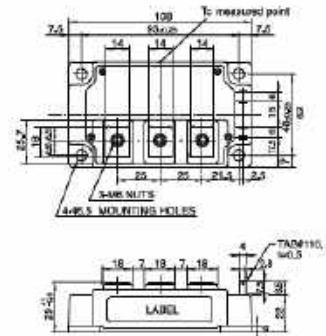
Full SiC Power Modules for
Industrial Equipment
FMF600DX2-24A
FMF800DX2-24A



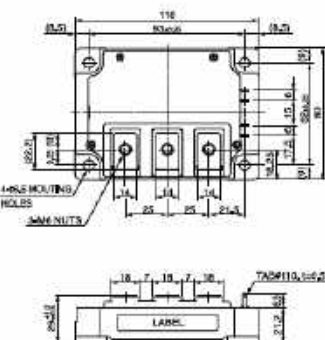
Hybrid SiC Power Modules for
High-frequency Switching Applications
CMH100DY-24NFH
CMH150DY-24NFH



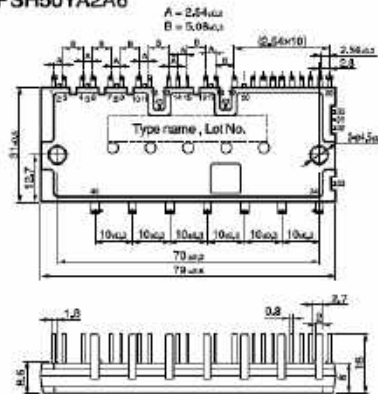
Hybrid SiC Power Modules for
High-frequency Switching Applications
CMH 200DU-24NFH
CMH 300DU-24NFH



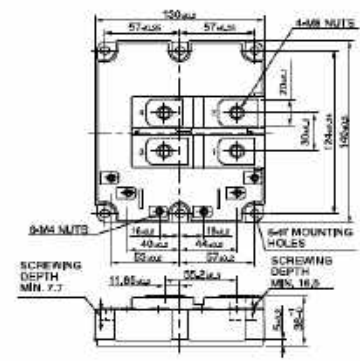
Hybrid SiC Power Modules for
High-frequency Switching Applications
CMH 400DU-24NFH
CMH 600DU-24NFH



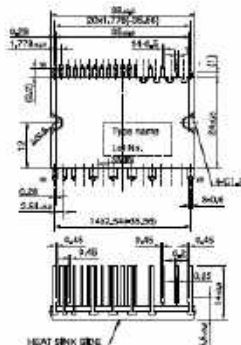
600V/50A Large Hybrid SiC DIIPM™
for PV Applications
PSH50YA2A6



1700V/1200A Hybrid SiC Power Modules
for Traction Inverters
CMH1200DC-34S



Super-mini Full SiC DIIPM™
PSF15S92F6-A / PSF25S92F6-A
Super-mini Hybrid / Full SiC DIPFPC™
PSH20L91A6-A / PSF20L91A6-A
Long



Development of Mitsubishi Electric SiC Power Devices and Power Electronics Equipment Incorporating Them

Mitsubishi Electric began developing SiC as a new material in the early 1990s. Pursuing special characteristics, we succeeded in developing various elemental technologies.

In 2010, we commercialized the first air conditioner in the world equipped with a SiC power device.

Furthermore, substantial energy-saving effects have been achieved for traction and FA machinery.

We will continue to provide competitive SiC power modules with advanced development and achievements from now on.

Early 1990s

Developed new material, silicon-carbide (SiC) power semiconductor, maintaining a lead over other companies

2006

January 2006
Successfully developed SiC inverter for driving motor rated at 3.7kW

2010

January 2010
Developed large-capacity power module equipped with SiC diode



October 2010
Launched "Kirigamine" inverter air conditioner



2011

January 2011
Verified highest power conversion efficiency*1 for solar power generation system power conditioner (domestic industry)



October 2011
Commercialized SiC inverter for use in railcars



2000s

Developed various elemental technologies

2009

February 2009
Verified 11kW SiC inverter, world's highest value*1 with approx. 70% reduction in power loss



November 2009
Verified 20kW SiC inverter, world's highest value*1 with approx. 90% reduction in power loss



2012

March 2012
Developed motor system with built-in SiC inverter*2



September 2012
Verified built-in main circuit system for railcars



July 2012
Began shipping samples of hybrid SiC power modules



December 2012
Launched CNC drive unit equipped with SiC power module



2013

February 2013
Developed SiC for application in elevator control systems*2

March 2013
Delivered auxiliary power supply systems for railcars



Contributing to the realization of a low-carbon society and more affluent lifestyles

2014

February 2014
Developed EV motor drive system with built-in SiC inverter*2



May 2014
Began shipping samples of hybrid SiC power modules for high-frequency switching applications



November 2014
Launched Large Hybrid SiC DIPIPM™ for PV Applications



2018

January 2018
New 6.5kV Full-SiC Power Semiconductor Module Achieves World's Highest Power Density

2017

March 2017
Launched SiC-SBD



March 2017
Develops World's smallest SiC Inverter for HEVs.



September 2017
Develops SiC Power Device with Record Power Efficiency

December 2017
Mitsubishi Electric and the University of Tokyo Quantify Factors for Reducing SiC Power Semiconductor Resistance by Two-Thirds

2015

January 2015
Launched power conditioner for PV equipped with full SiC-IPM



June 2015
Railcar traction system with full SiC power modules installed in Shinkansen bullet trains



2016

April 2016
Launched Super-mini Full SiC DIPIPM™



October 2016
Launched package air conditioners with full SiC DIPIPM™ in Japan



May 2016
Launched room air conditioners with full SiC DIPIPM™ in Japan



February 2013
Developed technologies to increase capacities of SiC power modules*2



May 2013
Launched SiC power modules



December 2013
Launched railcar traction inverter with full SiC power module



*1 Researched in press releases by Mitsubishi Electric. *2 Currently under development, as of April 2018.

* The year and month listed are based on press releases or information released during the product launch month in Japan.

г.Минск www.tiristor.by email: minsk17@tut.by viber и тел.+375447584780

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www.fotorele.net www.tiristor.by радиодетали, электронные компоненты
email minsk17@tut.by tel.+375 29 758 47 80 МТС

каталог, описание, технические, характеристики, [datasheet](#), параметры,
маркировка, габариты, фото, модуль mitsubishi,

КАТАЛОГ

модуль mitsubishi, igbt, мост диодный

купить, продажа

электронные компоненты

[где и как купить в Минске?](#)



J1-Series for Automotive Applications

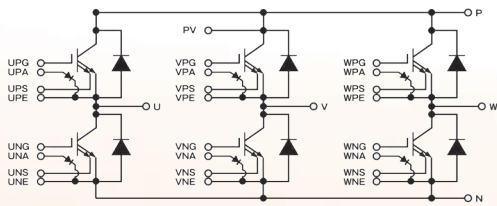
New Lightweight Compact Power Modules for xEV Inverters
Enhancing Efficiency and Reliability

Features

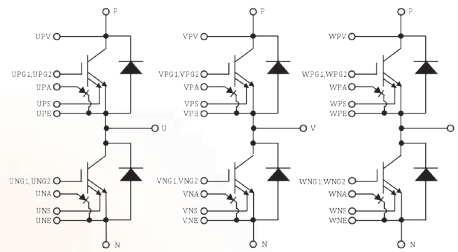
- Compact highly reliable light weight 6in1 package for automotive inverters
- Direct water-cooling structure with Aluminum cooling fins
- Direct Lead Bonding (DLB) package (wire bond less) ensures high reliability
- Low power loss 7th-Generation CSTBT™* chip technology
- On-chip temperature and current sensors
- Pb-free, RoHS-compliant structure
- Lineup suitable for a wide range of power-ratings in electric and hybrid vehicle applications

* CSTBT™: Carrier Stored Trench-Gate Bipolar Transistor

Circuit Diagrams J1-series



Medium Power 6in1 Package



High Power 6in1 Package

Medium Power Package



High Power Package



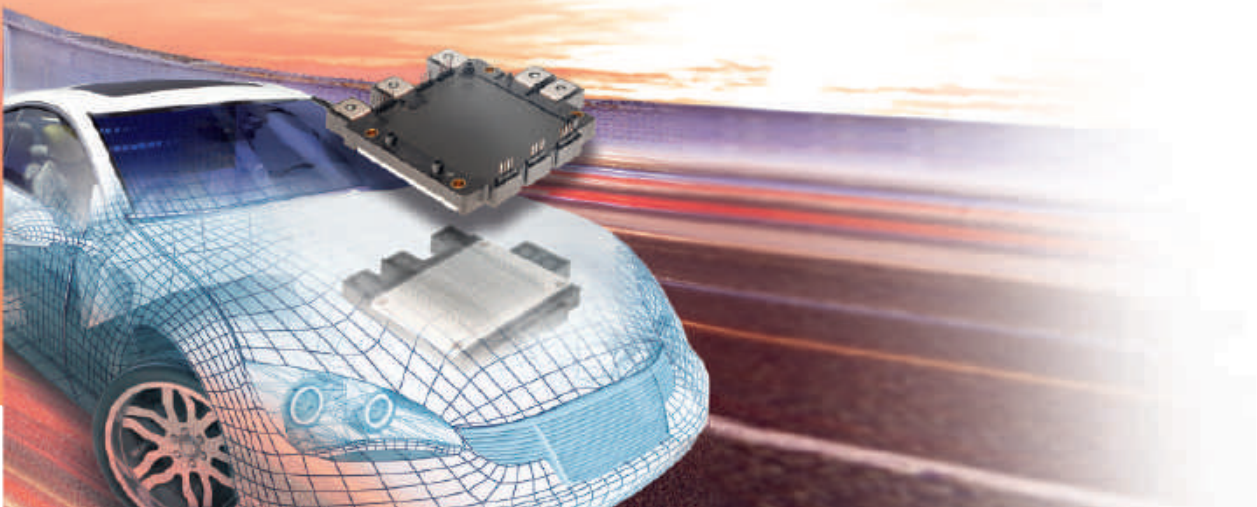
Automotive Power Modules (J1-Series) Lineup

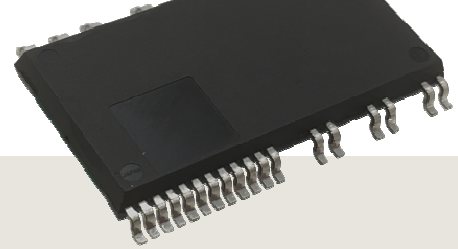
I_c (A)				
V_{CES} (V) [$@T_j = -40^\circ\text{C}$]	300	600	700	1000
650	CT300CJ1A060*	CT600CJ1A060	CT700CJ1A060*	CT1000CJ1B060*
1200		CT600CJ1B120*		

Medium Power 6in1 Package

* under development

High Power 6in1 Package



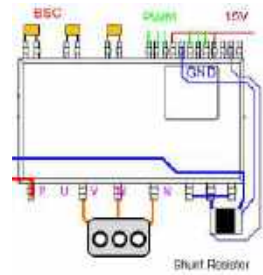


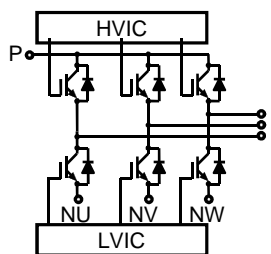
MISOP™ with Reverse Conducting IGBT - Saves your design & development time -

Mitsubishi Electric has added a new transfer molded SMD type Intelligent Power Module to its line-up – the MISOP™ (**M**itsubishi **E**lectric **I**ntelligent **S**mall **O**utline **P**ower Module). Applications with small power inverters like pump, fan or low servos are requesting compactness, easy assembling, reliability and high performance. The new MISOP™ SMD type IPM combines all the attractive features of Mitsubishi Electric DIIPM family with the high efficiency RC-IGBT technology (based on Mitsubishi Electric 7th Chip technology). The integration of driver ICs (HVIC and LVIC), bootstrap diodes & capacitors, and protection functions conveniently reduces the inverter design & development time.

Product Advantages

- SMD type IPM with RC-IGBT Chip technology
- Integrated bootstrap diode (BSD) & capacitors (BSC)*
- Short circuit protection through external shunt resistor
- Power supply under-voltage protection : Fo output on N-side
- Over Temperature protection
- Analog temperature voltage signal output
- Interlock function

	MISOP™
Power chip	RC-IGBT
Tj max	150deg C
Tc max	115deg C
Package	surface mounting 15.2x27.4x3.3mm
Viso	1500Vrms
Terminal	

Circuit	Circuit Diagram	Package Size	Product Name	Application
6in1		15.2 mm X 27.4 mm X 3.3 mm	SP1SK *SP1SL (1A / 600V) SP3SK *SP3SL (3A / 600V)	Refrigerators Pumps Fans Small AC Drives

*Included Bootstrap Capacitor (BSC) under development



MISOP™ Package

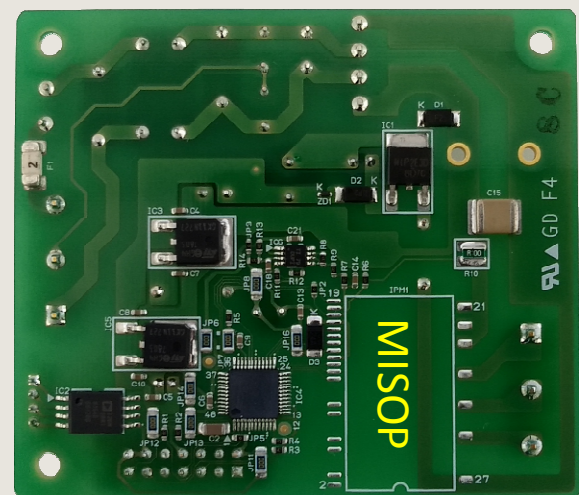
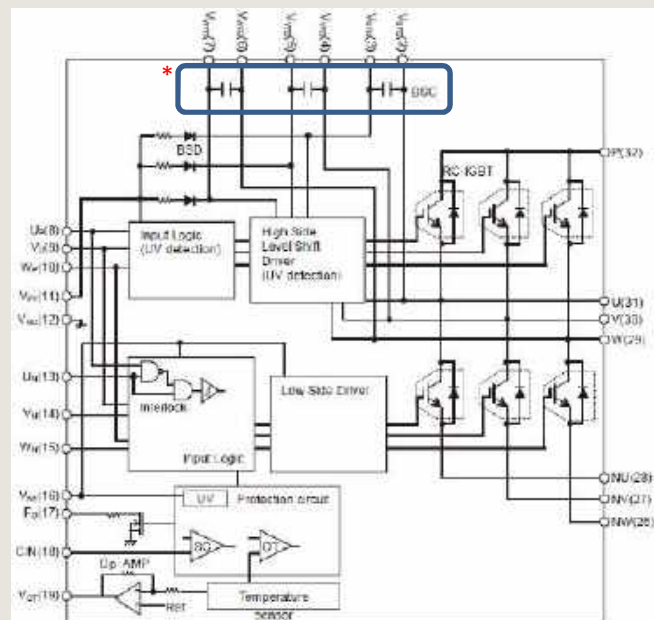
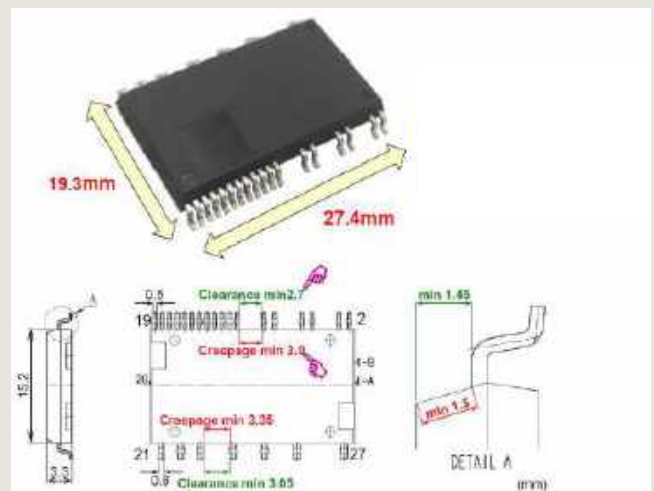
The MISOP™ Reverse Conduction (RC) IGBT is based on Mitsubishi Electric 7th generation chip technology. The 7th generation chip technology is a low loss thin wafer IGBT technology which allows an optimization of the balance between performance and IGBT chip size. In addition to the inherent benefits of the 7th generation chip technology, the RC technology enables a significant level of optimization of the power module's surface area requirement since the IGBT and the diode are effectively integrated into a single die.

Protection via Mitsubishi

The device offers the possibility to implement a short circuit protection via external shunt resistances which can be connected to each of the open emitter pins. To avoid the risk of overheating during operation, there is a built-in over-temperature protection (OT), and the functionality to monitor the module temperature with an accurate linear analog voltage output signals (VOT), which helps to define the derating points to use the module with high power density. The availability of the "interlock-protection" is an important implementation, this protection function prevents the simultaneous turn-on of both high side and low side switches (such a turn-on would lead to an arm-shoot through short circuit). In addition, the ability to detect and indicate a failure in the control supply voltage is also included in the MISOP™.

Simplified PCB Pattern

Bootstrap circuits, which require external capacitors, are generally used to provide the high-side power supply in conventional DIPIPM circuits. In a conventional DIPIPM circuit, the pins used for bootstrap capacitor connection are located on opposite sides of the module. In the MISOP™, the ground pins are placed next to the high voltage supply pins, simplifying the PCB wiring design and thus utilizing more efficient available space.



Size 70x80

*Included Bootstrap Capacitor (BSC) under development

Mitsubishi Electric Europe B.V. (European Headquarters)

- Semiconductor European Business Group -

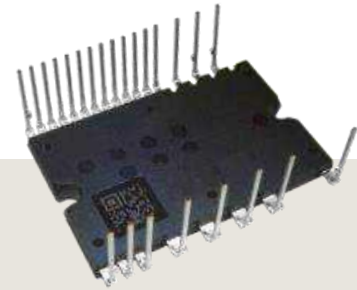
Mitsubishi-Electric-Platz 1 / D-40882 Ratingen

Phone +49 (0) 2102 486 0

Fax +49 (0) 2102 486 7220

for a greener tomorrow





Super Mini Full SiC DIIPM™ Series for high efficiency

Mitsubishi Electric has developed New Super Mini Full SiC DIIPM (hereinafter called Full SiC DIP) for Consumer Goods Applications. Full SiC DIP is an ultra-small compact transfer molded intelligent power module integrating SiC MOSFET chip which is the next generation high efficiency power chips. Power chips, drive and protection circuits are integrated in the module with transfer molding resin.

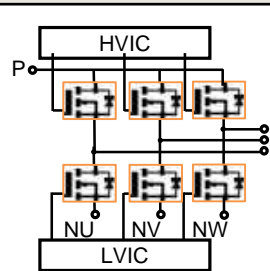
Full SiC DIP can improve inverter efficiency drastically by embedding SiC MOSFET chips, and additionally the Full SiC DIP package is 100% compatible with conventional Super Mini DIIPM Ver.6 series. This compatibility enables to utilize the existing conventional inverter boards easily and to expand the lineup of installed systems.

Features

- ❑ Integrated newly developed SiC MOSFET for improving efficiency
- ❑ NO requirement of negative bias by mounting MOSFET with high threshold voltage V_{Gsth} .
- ❑ Single DC 18V power supply drive with bootstrapping scheme.
- ❑ Safety operating SiC MOSFET by protection functions.
- ❑ Easy to replace from conventional Ver.6 due to pin and function compatibility.

The difference between conventional Ver.6 and Full SiC DIP

Items	Super Mini DIIPM Ver.6	Super Mini Full SiC DIIPM
P-side control supply voltage V_{DB}	Typ. 15V (13~18.5V)	Typ. 18V (15~22V)
N-side control supply voltage V_D	Typ. 15V (13~16.5V)	Typ. 18V (17~19V)
Built-in bootstrap diodes	Built-in with current limiting resistor	←
Temperature protection	OT or VOT	VOT
N-side IGBT emitter terminal	Open	←
Terminal shape	Long	←

Circuit	Circuit Diagram	Package Size	Product Name	Application
6in1		24 mm X 38 mm	PSF15S92F6 (15A / 600V)	AC 100-240Vrms class low power motor control
			PSF25S92F6 (25A / 600V)	



Home Appliance



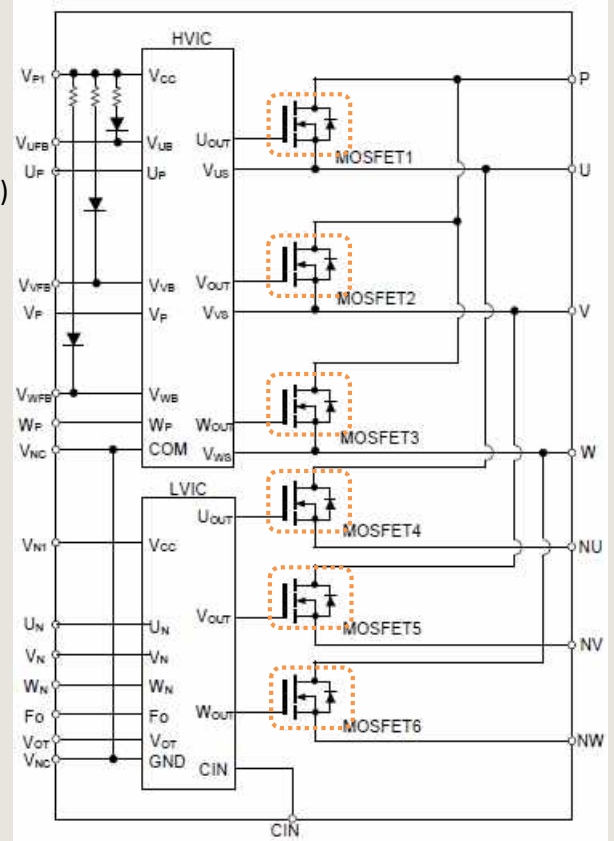
Industrial

for a greener tomorrow



Functions

- For P-side MOSFETs:
 - Drive circuit, high voltage level shift circuit;
 - Control supply under voltage lockout circuit (without fault signal output)
 - Built-in bootstrap diode with current resistor
- For N-side MOSFETs:
 - Drive circuit;
 - Short circuit protection circuit (by inserting external shunt resistor into main current path)
 - Control supply under voltage lockout circuit (with fault signal output)
 - Outputting LVIC temperature by analog signal
- Fault Signal Output
 - Corresponding to N-side MOSFET SC and N-side UV
- MOSFET Drive Supply
 - Single DC18V power supply (in case of using bootstrap method)
- Control Input Interface
 - Schmitt-triggered 3V, 5V input compatible, high active logic
- UL recognized
 - UL 1557 File E323585



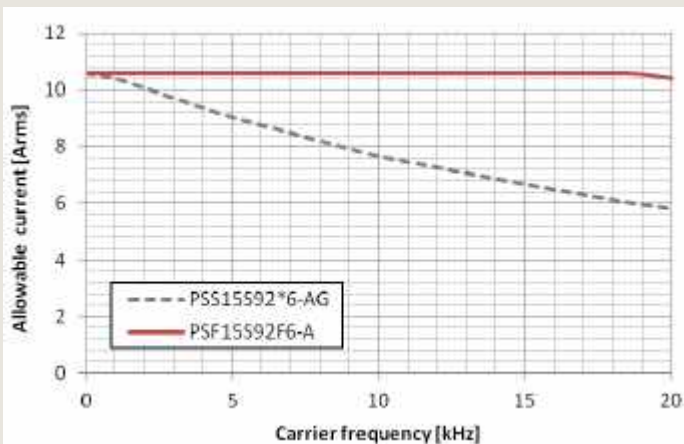
Increased Performance

[Condition]

Simulation model: 3 phase PWM

$V_{CC}=V_{DD}=300V$, $M=1$, $P.F=0.8$, $f_o=60Hz$,

$T_j=T_{ch}=125\text{degree C}$, $T_c=100\text{degree C}$, $\Delta T(ch-c)=25K$

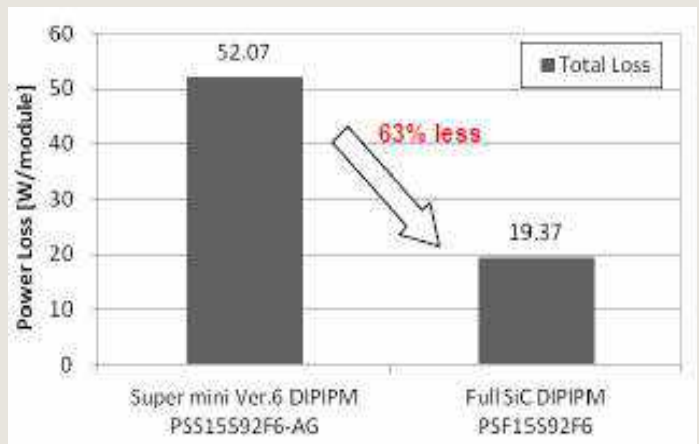


[Condition]

Simulation model: 3 phase PWM

$V_{CC}=V_{DD}=300V$, $M=1$, $P.F=0.8$, $I_o=7\text{rms}$,

$f_c=15\text{kHz}$, $f_o=60\text{Hz}$, $T_j=T_{ch}=125\text{degree C}$



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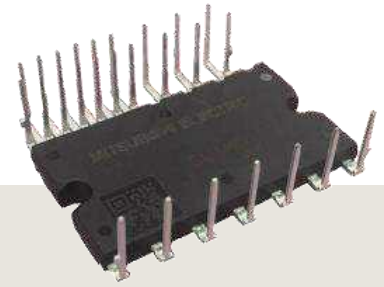
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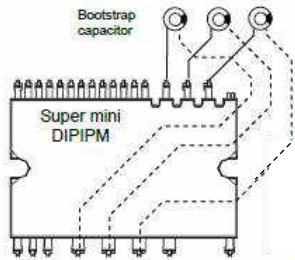
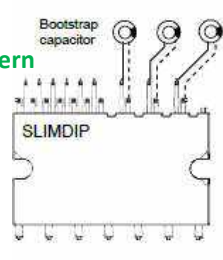
SLIMDIP™ with Reverse Conducting IGBT

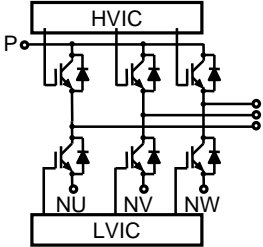
- Slim your cost -

Mitsubishi Electric has developed a new SLIM package Intelligent Power Module (SLIMDIP™) for Consumer Goods Applications. Power chips, drive and protection circuits are all integrated into the module, which makes it a simple choice for AC100-200V class motor inverter control. SLIMDIP™ utilizes reverse conducting RC-IGBT technology, which applies MITSUBISHI's latest 7th generation IGBT chip design, enabling the use of a smaller package by reducing number of internal component when compared to MITSUBISHI's Super Mini DIPIPM series. By virtue of these features SLIMDIP™ is especially suitable for low cost inverterized home appliances and can contribute to system cost reduction.

Product Advantages

- ❑ Smaller package (30% smaller than Super Mini DIPIPM)
- ❑ Integrated bootstrap diode eliminates the need for external diode, simplifying design & PCB layout
- ❑ Dedicated protection functions: short circuit, over temperature, under voltage lockout
- ❑ Robust package for high temperature operation, $T_{C,max}$ of 115°C for switching operation
- ❑ UL recognized, isolation voltage $V_{iso} = 2000V$ AC RMS

	Super Mini DIPIPM	SLIMDIP
Power chip	7 th Gen. IGBT	RC-IGBT
Tj max	150deg C	150deg C
Tc max	100deg C	115deg C
Package	Super Mini 24x38	SLIM 18.8x32.8
Viso	1500Vrms	2000Vrms
Terminal		

Circuit	Circuit Diagram	Package Size	Product Name	Application
6in1		18.8 mm X 32.8 mm	SLIMDIP-S (5A / 600V)	Air Conditioners Washing Machine Refrigerators Pumps Fans Small AC Drives
			SLIMDIP-L (15A / 600V)	



Home Appliance



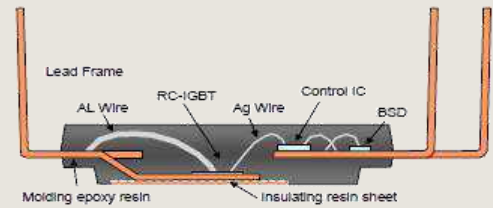
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SLIMDIP™ Package

- The SLIMDIP™ package has roughly a 30% smaller footprint area than the conventional Super Mini DIIPIM. The package and power semiconductors are optimized to provide the smallest 3-phase IPM for motor drive applications up to 1.5kW.
- The conventional DIIPIM package contains 6 IGBTs and 6 FWDs, but the new RC-IGBTs used in the SLIMDIP™ allows a 50% reduction in the number of power chips, thus shrinking the internal space requirement.



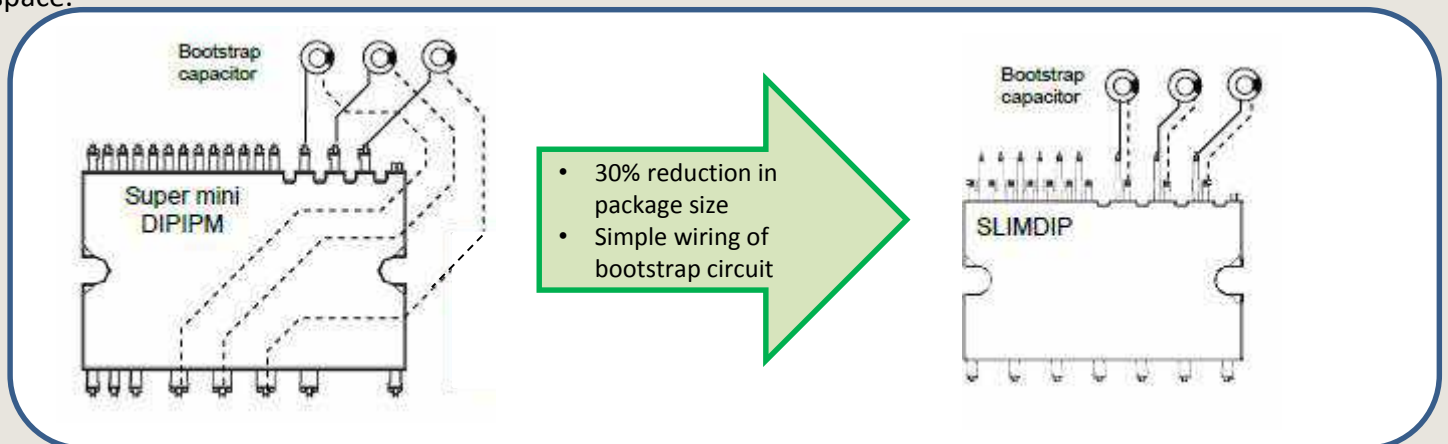
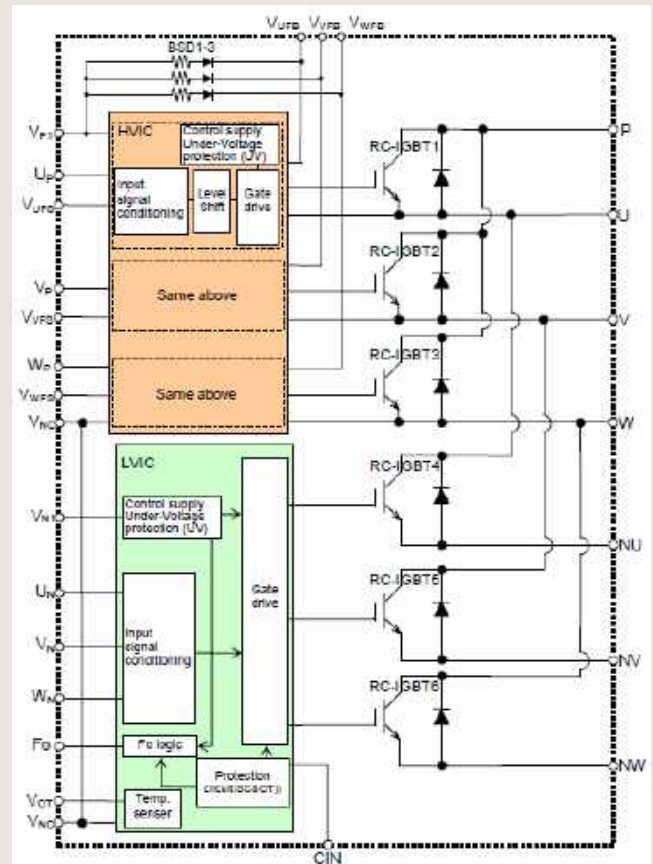
Ease of Use

The SLIMDIP™ shows an improvement in the following areas compared to the Super Mini DIIPIM, making it easier to use.

- An increased maximum case temperature specification, $T_c \text{ max } 100 \rightarrow 115 \text{ deg C}$
- Both temperature protection tripping OT and analog temperature information are IC functions.

Simplified PCB Pattern

Bootstrap circuits, which require external capacitors, are generally used to provide the high-side power supply in conventional DIIPIM circuits. In a conventional DIIPIM circuit, the pins used for bootstrap capacitor connection are located on opposite sides of the module. In the SLIMDIP, the ground pins are placed next to the high voltage supply pins, simplifying the PCB wiring design and thus utilizing less space.



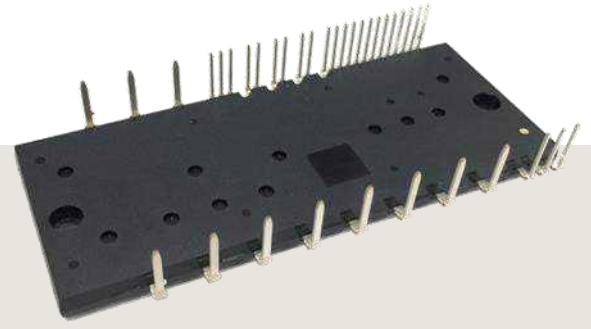
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„All-In-One“ DIIPM+™ Series for Compact Inverter Designs

Mitsubishi Electric has developed a novel family of compact Intelligent Converter-Inverter-Brake modules. This new DIIPM+™ series incorporates optimized IGBT- and FWDi-chips, low voltage and high voltage driver ICs in a compact transfer molded dual-inline package. The new DIIPM+™ series provides smart answers to the two key questions a designer faces when developing a new inverter: How to reduce the system cost? How to reduce the inverter size using compact design?

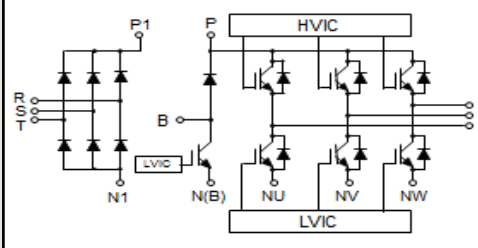
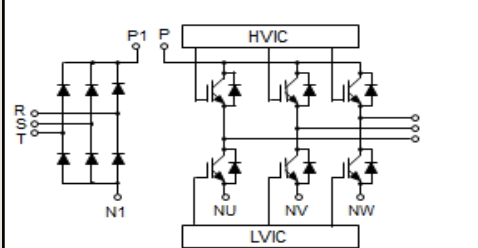
Product Advantages

- ❑ Compact design with integrated Converter, Inverter and Brake
- ❑ Integrated HVIC & LVIC
- ❑ Dedicated protection functions: short circuit, over temperature, under voltage lockout
- ❑ Operation at $T_{C,Max} = 110^{\circ}C$
- ❑ High Isolation Voltage $V_{iso} = 2500V$
- ❑ Same Package size for 6 different power ratings

User Benefits

Achieved by

Inverter Cost Reduction	Manufacturing Cost	- Easy assembly: only one power module to be soldered to the PCB - Reduced assembly cost by lower part count
	Development Cost	- Easy test setup with the DIIPM+™ Evaluation Board - Reduced engineering efforts & shorter dev. time
	Material Cost	- Reduced PCB-cost - Reduced EMI filter cost - No AC-output current sensors needed
Inverter Size Reduction	- Reduced heat sink size - Reduced EMI Filter size - Very compact PCB design	
Increasing Inverter Performance	- Increased robustness to endure harsh environmental conditions - Accurate analog temperature-output VOT for adaptive inverter control	

Circuit	Circuit Diagram	Package Size	Product Name	600V	1200V
Converter + 7in1		85 mm X 34 mm	PSS05MC1FT		5A
			PSS10MC1FT		10A
			PSS15MC1FT		15A
			PSS25MC1FT		25A
			PSS35MC1FT		35A
			PSS50MC1F6	50A	
Converter + 6in1		85 mm X 34 mm	PSS05NC1FT		5A
			PSS10NC1FT		10A
			PSS15NC1FT		15A
			PSS25NC1FT		25A
			PSS35NC1FT		35A
			PSS50NC1F6	50A	



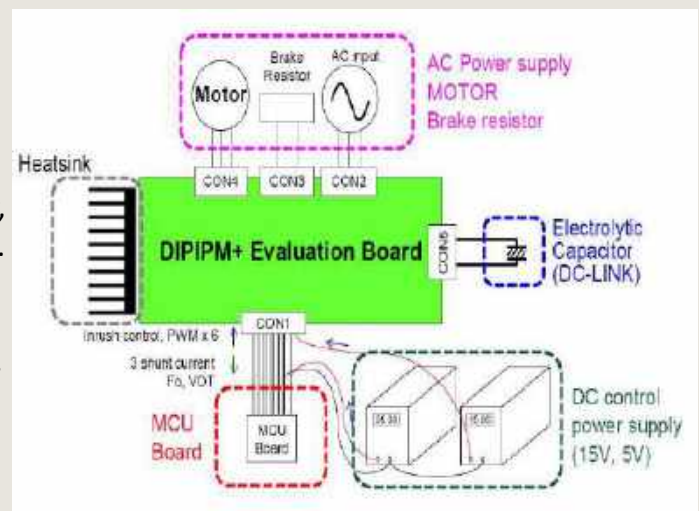
Cost Reduction

When developing a new general purpose inverter, optimizing the system costs is an important necessity. Basically three cost factors must be considered:

Development cost, material cost and manufacturing cost.

All three factors are addressed by the new DIPIPM+™ series.

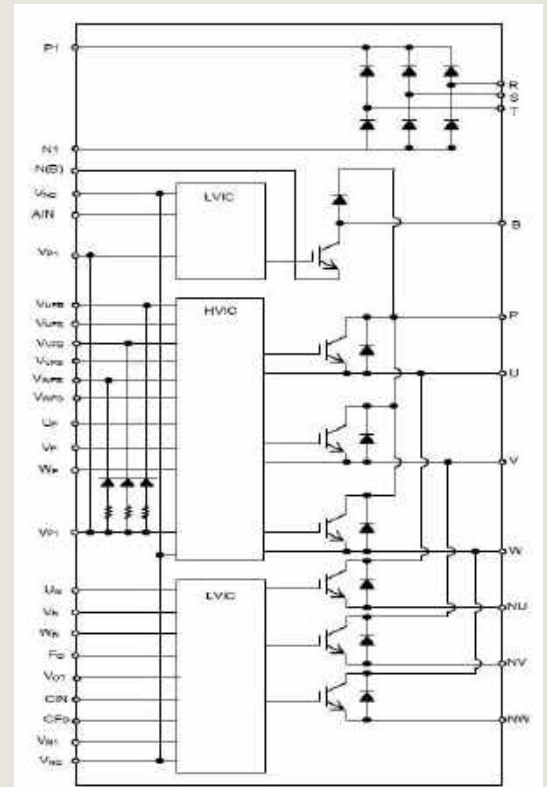
- Availability of a plug-and-play Evaluation board
- Integrated functionalities
- Reduced part count on the PCB-Board



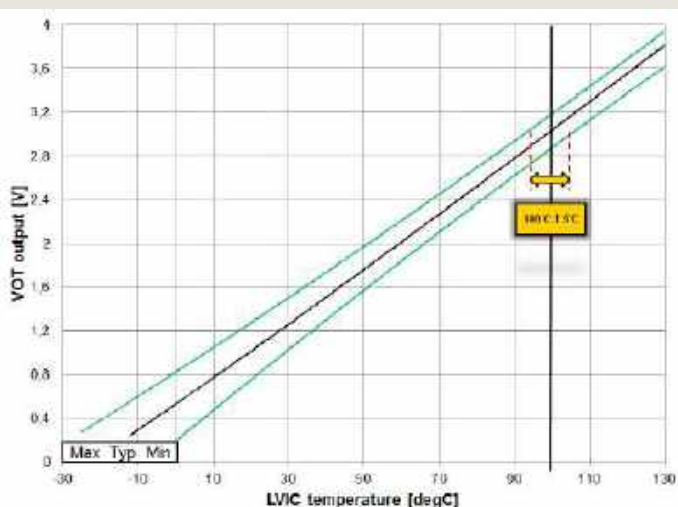
Size Reduction

Inverter compactness is an important objective when establishing a new inverter design since power density (kVA/dm³) is a key benchmarking criteria for comparing general purpose inverters. DIPIPM+™ offers the following advantages for increasing the inverter power density:

- Using the bootstrap-technology for control power supply
- Substituting the inverter output current sensors by emitter shunts
- Converter, Inverter and Brake in the same module package
- Reducing the EMI-filter size
- Very compact PCB design
- Reducing the heat sink size



Increased Inverter Performance



The analog Voltage-Over-Temperature signal (VOT) of DIPIPM+™ can be used to enhance the robustness of the inverter against harsh environmental conditions. Usually the inverter specification is provided at maximum ambient temperature of $T_a = +40^\circ\text{C}$. For higher ambient temperatures an inverter de-rating has to be considered when installing the drive. By using the accurate VOT-signal of DIPIPM+™ an adaptive inverter de-rating can be activated during operation for avoiding an OT-trip of the drive.

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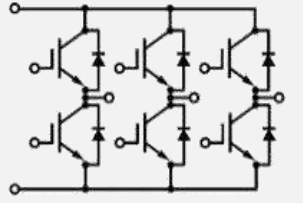
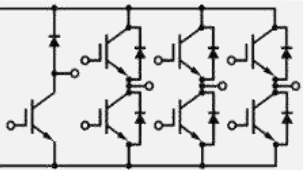
G1 Series IPM Modules

The new Mitsubishi Electric G1 series was developed in order to achieve higher efficiency, easy system design and superior reliability. The Intelligent Power Modules have been developed in the 650V and 1200V categories in the 6 in 1 and the 7 in 1 configurations.

Product Advantages

- ❑ Low-loss 7th generation Full Gate IGBT
- ❑ Advanced internal drive circuit with integrated protection functions
- ❑ High reliability using a new package technology
- ❑ Line-up with multiple packages, voltage levels and current levels

Unique Benefits	Solutions Employed
Advanced low loss chip technology	A new 7th generation Full Gate IGBT is employed with an integrated sense-emitter
Best EMI vs Loss trade-off	An innovative switching speed control is established using the integrated sense-emitter component.
Integrated driver with multiple functionalities	Protection functions are already integrated into the module (short circuit protection using sense-emitter, control supply under voltage detection and on-chip over-temperature sensor at IGBT). A failure output signal with identification of fault type is available.

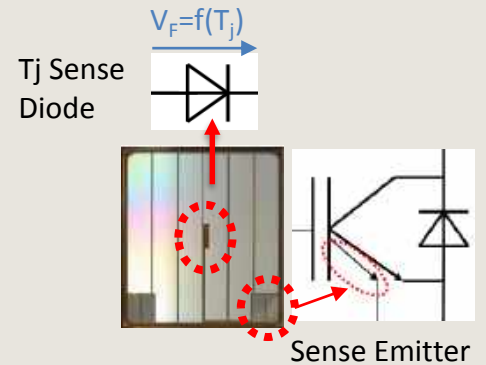
Vces	Topology*	Small-Pkg. (A-Pkg.)	Middle-Pkg. (B-Pkg.)	Large-Pkg. (C-Pkg.)
				
650V		50A, 75A, 100A	50A, 75A, 100A, 150A, 200A	200A, 300A, 450A ^{NEW}
1200V		25A, 50A	25A, 50A, 75A, 100A	100A, 150A, 200A ^{NEW}
650V		50A, 75A	50A, 75A, 100A, 150A, 200A	200A, 300A, 450A ^{NEW}
1200V		25A	25A, 50A, 75A, 100A	100A, 150A, 200A ^{NEW}

* The topologies presented here represent only the power electronic components. The driver IC is not represented here.

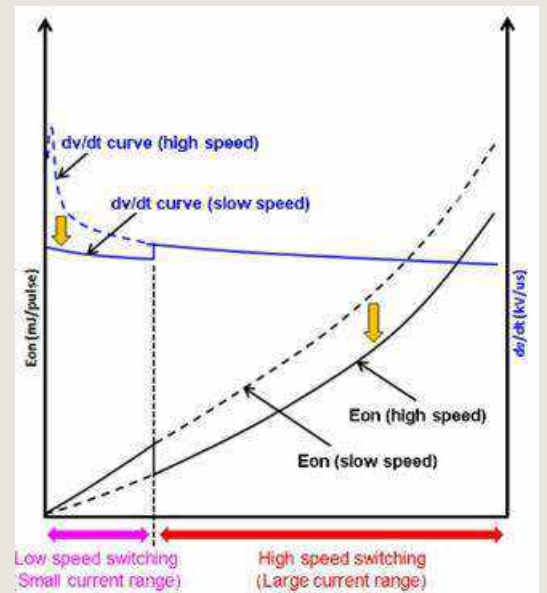


G1 series IPMs – Chip Technology and benefits

- Full Gate IGBT with an integrated current sense mirror emitter : The G1 IPM utilizes a 7th generation Full Gate IGBT which consists of a monolithically integrated sense-emitter component. The Full Gate chip structure is utilized to reduce losses. SC (Short Circuit) protection is established using the sense-emitter which aids in detecting the collector current (accordingly an appropriate trip level is assigned). An on-chip T_j sense diode is integrated to detect an over-temperature event on each IGBT chip.

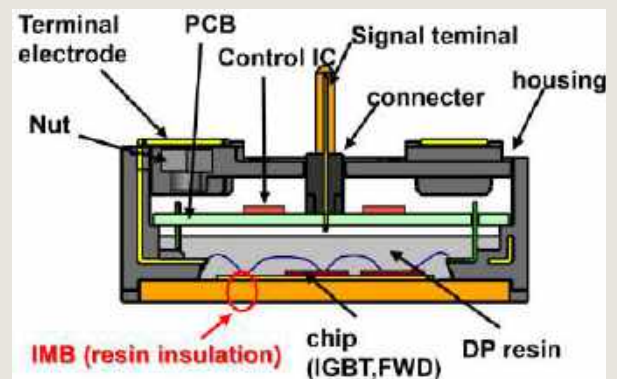


- Switching speed control using the sense-emitter : An innovative switching speed control can be established depending on the actual value of the collector current I_c . This means - a reduced speed (for Low EMI) turn-on at low I_c values and a high speed turn-on (low turn-on loss) at high I_c values can be achieved. This approach delivers a higher inverter efficiency while simultaneously ensuring good EMI performance during operation.



Innovative Module Concept :

- Built-in failure detection and Fo output signal.
- Robust packaging using IMB (Insulated Metal Baseplate) structure and SLC (Solid Cover) technology to ensure superior thermal cycling behavior while providing low thermal resistance.
- Flexibility in busbar design in the small pkg (A Pkg) : The straight terminal and L shape terminal layout are possible.



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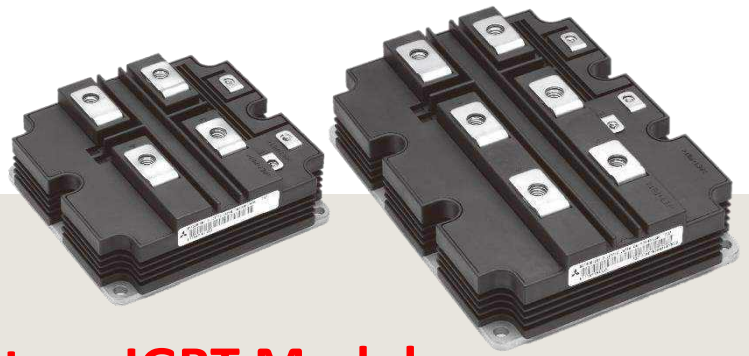
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X Series: High-Voltage IGBT Modules

Industrial-Leading Power and Operating Temperature Range

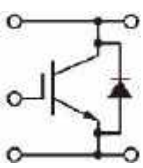
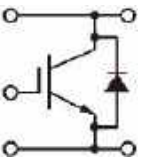
High-power modules are essential for power systems that require large capacity, high reliability and maximum efficiency. Mitsubishi Electric's first HVIGBT module, which was commercialized in 1997, enabled the development of larger capacity and smaller sized high-voltage converter systems. The X-Series HVIGBT modules feature 7th-generation insulated gate bipolar transistors (IGBT) and relaxed field of cathode (RFC) diodes.



Besides state-of-the-art chip technology, the new X Series offers two packages. A small 130 mm package allows compact converter design and a 190 mm package is compatible to the previous H and R Series. As key technologies the X Series provides a 1.5-times higher current rating than H Series and, as world's first for the 6.5 kV class, 150°C maximal junction temperature.

Product Advantages

- ❑ Power loss reduced by incorporating 7th-generation IGBT and RFC diode
- ❑ Current rating increased by 50 % compared to conventional package
- ❑ Latest package technology enhances power cycle lifetime
- ❑ Package compatible to previous H and R series for simplified design and easy replacement
- ❑ 150 °C maximal operation temperature

Circuit	Circuit Diagram	Package Size	1700 V	3300 V	4500 V	6500 V
1in1		130mm x 140mm		CM1200HC-66X 1200 A	CM900HG-90X 900 A	CM600HG-130X 600 A
1in1		190mm x 140mm		CM1800HC-66X CM1800HG-66X 1800 A	CM1350HG-90X 1350 A	CM900HG-130X 900 A
					CM1500HC-90XA 1500 A	CM1000HG-130XA 1000 A



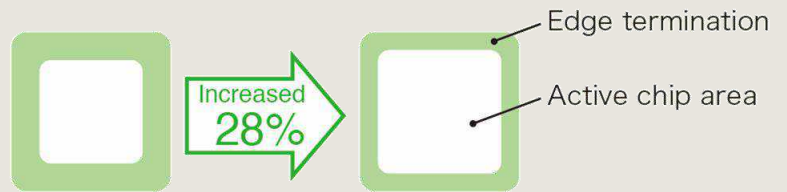
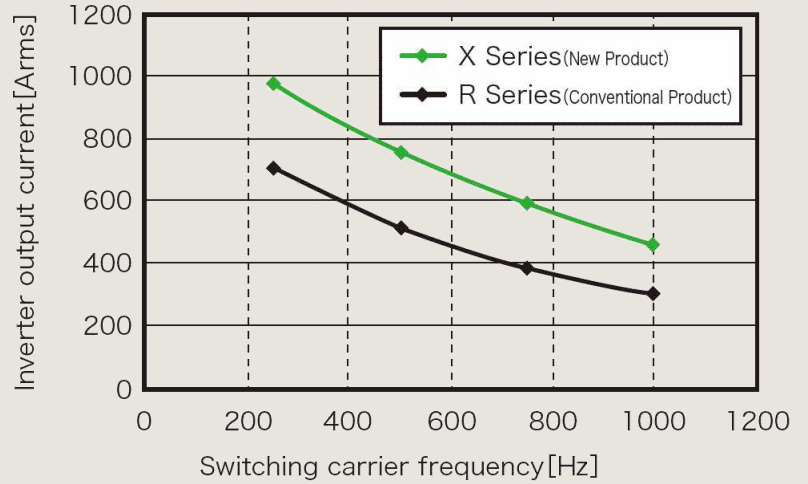
Chip Technology

The 7th-generation IGBT with carrier-store effect and RFC diode reduce the power loss by about 20 %. This leads to either a higher output power or a more compact converter through higher switching frequency. Moreover, the optimized edge termination structure LNFLR (Linearly-Narrowed Field Limiting Ring) allows an increased active chip area of 28 % compared to previous product. Furthermore, as first in the world, Mitsubishi Electric achieves 150 °C junction temperature for the 6.5 kV class.

Package Technology

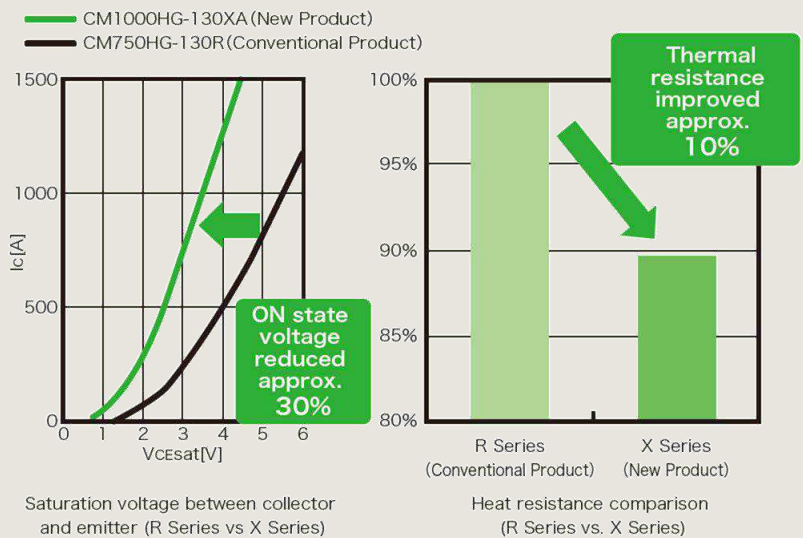
The X Series offers two different package sizes. A compact 130 mm x 140 mm package allows compact converter design. Furthermore, another larger package with a footprint of 190 mm x 140 mm is compatible with the previous H and R Series. For this package, the current rating can be increase by 50 % compared to the previous series. This is achieved through the improved chip technology and a reduction of the thermal resistance by approximately 10 % compared to the R Series. Moreover, the power cycle lifetime is improved by an optimized wire bonding approach and improved packaging technology.

Condition: $T_j=125^{\circ}\text{C}$, $V_{cc}=3600\text{V}$, $P.F=0.85$, $f_o=50\text{Hz}$, $T_f=80^{\circ}\text{C}$



Compared to previous product*, active chip area is increased 28% by optimizing edge termination.

* CM750HG-130R



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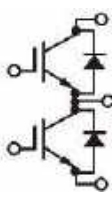
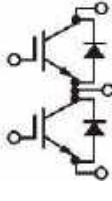
LV100 type X Series : High-Voltage IGBT Modules More Flexibility through Standardized Package

The newly developed next-generation power module called LV100-type X-Series HVIGBT module for traction and electric power applications in heavy industries features higher power density and efficiency for inverters. Moreover, it offers a standardized package that allows a flexible design of inverter systems. Samples of the 3.3kV version of the LV100-type X-Series HVIGBT module (CM450DA-66X & CM600DA-66X) are available. The line-up will be extended by 1.7kV, 3.3kV (HV100), 4.5kV and 6.5kV versions from 2018 onwards.



Product Advantages

- ❑ Power loss reduced by incorporating 7th-generation IGBT and RFC diode
- ❑ Contributing to high energy efficiency and high power density by improving package technology for low parasitic inductance and thermal resistance
- ❑ LV100 and HV100 modules have a common package foot print
- ❑ Simple, standard connections allow for optimal system design and a range of current ratings

Circuit	Circuit Diagram	Package Type	1700 V	3300 V	4500 V	6500 V
2in1		LV100 $V_{iso} = 6 \text{ kV}$	900 A	CM450DA-66X 450 A CM600DA-66X 600 A		
2in1		HV100 $V_{iso} = 10 \text{ kV}$		450 A	330 A	225 A



Chip Technology

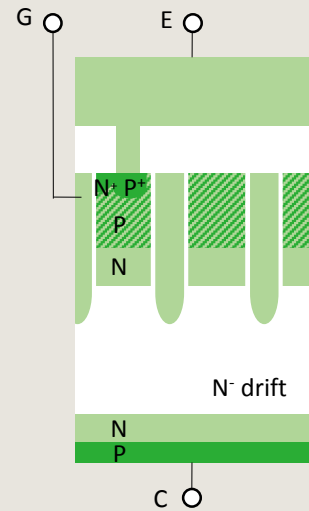
LV100-type X-Series HVIGBT module use the same 7th-generation IGBT and diode as the new X Series including carrier-store layer and RFC.

The optimized N buffer achieves the operation at higher temperatures of 150 °C. Moreover, the optimized edge termination structure LNFLR (Linearly-Narrowed Field Limiting Ring) allows an increased active chip area of up to 28 % compared to previous products.



Compared to previous product*, active chip area is increased 28 % by optimizing edge termination.

* CM750HG-130R



Chip structure improving maximal temperature range

Package Technology

LV100 and HV100 modules have a standardized package design with a size of 100 mm x 140 mm x 40 mm. This allows manufacturers of industrial electronics simplified design, improved scalability for system configuration and secure multiple sources for inverters.

For the first time, aluminum is used as base-plate material in HV modules. It offers compared to classical materials, like AlSiC, a higher thermal conductivity and less weight. A new insulating material is introduced which increases the power-dissipation capability of the package further. Overall, this allows converter designs with increased output power and higher power density while the stress on thermal cycling is reduced.



New base plate results in higher thermal conductivity between junction and case and an increased thermal-cycling performance

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T-Series IGBT Modules – Standard-Type

The new Mitsubishi Electric 7th Generation Standard-Type IGBTs for 650V, 1200V and 1700V have been developed for the purpose of highest power density inverters and best-in-class thermal behavior. The new 7th Generation CSTBT™ and diode chip set provides high efficiency by reducing both dynamic and static losses. The innovative TMS packaging technology provides very low thermal impedance, low package inductance and high thermal cycling capacity. The new Mitsubishi Standard-Type modules facilitate a high performance and reliability and compact inverter design.


The well established 34mm and 62mm package styles greatly simplify the design of medium power inverters for various applications like industrial drives, wind power, solar power and UPS. The newly introduced 48mm package for 300A and 400A rated currents enables a more compact inverter size than with comparable modules in 62mm outline.

The 62mm package is a defacto standard in the market since many years. The 7th Generation extends the rated current range of this 62mm standard package, pushing its limits from previously 450A/1200V to 600A/1200V. This gives advantages in terms of operational inverter power, efficiency, reliability and even switching frequency.

Product Advantages

- ❑ Low-loss 7th generation CSTBT™
- ❑ Low package inductance
- ❑ Low internal electrical resistance
- ❑ High thermal conductivity
- ❑ Compact size
- ❑ Wide power range
- ❑ Light weight

User benefits	Achieved by
Extended module life time	High thermal cycling capability by new TMS-Technology reduced "pump-out"-effect by symmetric TMS construction
Reduction of assembly costs	PC-TIM (pre-applied Phase Change Thermal Interface Material) production lot-independant paralleling capability
Increased power density for - less cooling effort - higher load conditions	Low loss 7th gen. Chipset increased active area by common substrate layer Low thermal resistance $R_{th(j-c)}$
high energy efficiency	Low losses by reduced package inductance due to laminated main terminals
Scalable platform concepts	full power rating line-up of 650V and 1200V modules up to 600A

Circuit	Topology	Package outline	Package size	650V	1200V	1700V
2in1	D 		34mm x 94mm	100A	100A	75A
				150A	150A	100A
				200A		
			48mm x 94mm	300A	200A	150A
				400A	300A	200A
					450A	300A
	62mm x 118mm	600A	600A	400A		
2in1 AC switch	C1 		62mm x 118mm		450A	
	600A					



Industrial



Wind



Solar

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TMS (Thick-Metal-Substrate)-Technology

The newly introduced TMS-Technology is a packaging technology developed for realizing low inductance and very high thermal conductivity. Instead of the conventional package structure with several ceramic substrates soldered to a copper baseplate, the Thick-Metal-Substrate contains a high thermal conductive **silicon nitride ceramic** with thick copper layers brazed directly to the top and bottom sides.

The **thick copper layer** underneath the IGBT chip provides low lead resistance and thus allows a higher current density. At the same time, it enables a better heat spreading directly next to the chip. This, in combination with the elimination of the substrate solder, means that both the thermal resistance and temperature cycling capacity are improved.

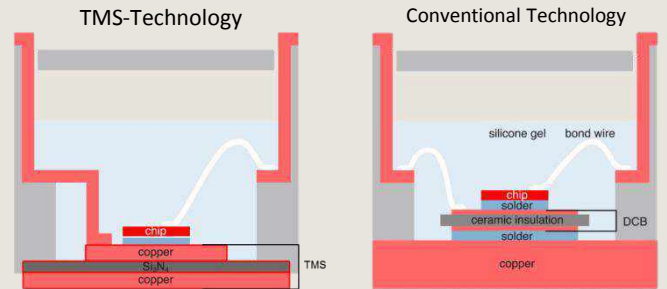
The **symmetrically stacked structure** of the TMS- Technology prevents the typical bending of baseplates in operation. This improves the thermal interface between the module and the heatsink.

Finally the total thermal resistance from junction to heatsink is reduced by more than half compared to conventional modules.

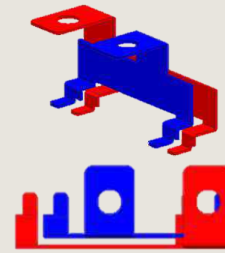
The TMS contains **one common substrate** instead of multi substrate arrangements as used in conventional modules. This expands the effective mounting area for chips and by eliminating wire bond interconnections - the internal stray inductance and lead resistance are reduced.

The main terminals are connected to the TMS by laminated internal bus bar with **increased laminated area** and **ultrasonic bonding**. This reduces the package inductance by 30% and contributes to low lead resistance .

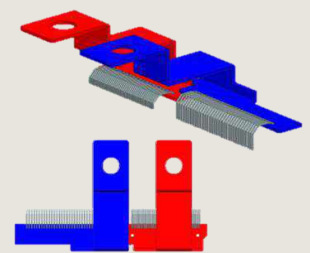
new



7th Generation main terminal Connection Technology



Conventional Technology



User-friendly by PC-TIM

The Standard-Type of 7th Generation IGBT modules is also available with Pre-applied Phase Change Thermal Interface Material (PC-TIM).

The structure and consistency of Mitsubishi PC-TIM compliments the advantages of TMS-technology and removes the need for applying thermal grease. By PC-TIM a very low thermal contact resistance is achieved.

This feature enables a highly reliable mounting process even in harsh environments and easy maintenance in the field.



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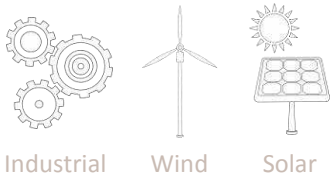
T-Series IGBT Modules – NX-Type

The Mitsubishi Electric 7th Generation NX-Type IGBTs greatly simplify the design of medium power inverters for various applications like industrial drives, wind power, solar power and UPS. Features such as an industry standard low profile package, significantly improved thermal impedance and very low loss, 7th Generation CSTBT™ technology facilitate a very efficient, economical and robust inverter design.

The NX-Type line-up has been expanded up to 1000A/1200V and all new 1700V and 650V line-up of dual modules to suit a wider power range of applications. Design effort is minimized as the 7th Generation NX-Type employs the same standard packaging and features previously introduced for the 5th and 6th Generation NX-Type. The newly developed SLC-Technology of the 7th Generation NX-Type enables the design of inverters with higher output current, higher power density and improved reliability in both power and temperature cycling.

Product Advantages	User benefits	Achieved by
<ul style="list-style-type: none"> ❑ Low-loss 7th generation CSTBT™ ❑ SLC assembly technology ❑ Warpage suppression ❑ $T_{j,max}$ of 175°C for switching operation ❑ Low-profile package ❑ Integral Thermistor 	Extended module life time	High thermal cycling capability by Insulated Metal Baseplate (IMB) pump-out free by matched thermal expansion coefficients
	Reduction of assembly costs	PressFit terminals PC-TIM (pre-applied Phase Change Thermal Interface Material) production lot-independent paralleling capability
	Compactness and extended power range	Low loss 7th gen. Chipset Low thermal resistance $R_{th(j-c)}$ Reduced package inductance by single pattern layout
	scalable platform concepts	full power rating line-up of 650V, 1200V and 1700V modules

Circuit	Topology	Package outline	Package size	650V	1200V	1700V
2in1	D		62mm x 152mm	225A	225A	
				300A	300A	
6in1	T		62mm x 122mm	450A	450A	450A
				600A	600A	600A
				800A	800A	800A
7in1	R		62mm x 122mm	1000A	1000A	
				100A	100A	
CIB	M		45mm x 107.5mm	150A	150A	
				200A	200A	
				200A	200A	
			62mm x 122mm	50A	50A	50A
				75A	75A	75A
				100A	100A	100A
					75A	
				100A	100A	
				150A	150A	



SLC (Solid Cover)-Technology

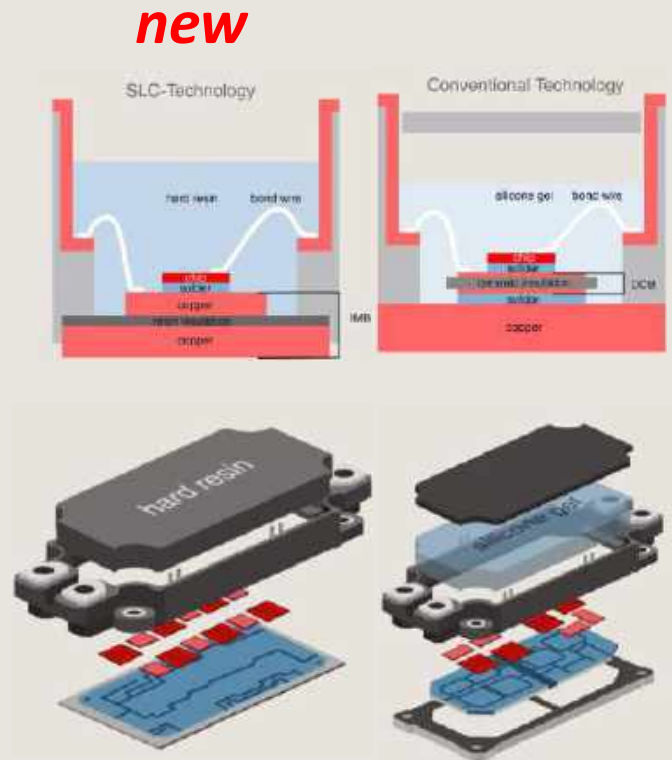
SLC-Technology is a newly developed package technology combining a resin-insulated metal baseplate and hard direct potting resin.

The **IMB** (Insulated Metal Baseplate) combines an electrically insulating resin layer with a top and bottom side copper layer by direct bonding, thus eliminating the substrate solder layer and the baseplate.

Less layers and matched thermal expansion coefficients lead to high thermal cycling capability, exceeding several times the conventional capability. At the same time, the thermal resistance at same chip size is reduced by 30% compared to conventional modules having Aluminium-Oxide insulation.

The SLC concept utilizes one common substrate instead of multiple ceramic substrates. This approach expands the effective area available for mounting chips and eliminates wire bond interconnections. Hence, the IMB is a key element of the SLC-Technology for high power density and low stray inductance.

The new NX-package has been developed with **direct potting resin** instead of silicone gel. This hard mold was designed to match the CTE (Coefficient of Thermal Expansion) of the copper as well as the insulation material of the IMB. Therefore the bi-metall effect is suppressed and the module offers warpage-free behavior effectively preventing the pump-out effect of the thermal interface material. This enables a long term reliable thermal connection to the heatsink.

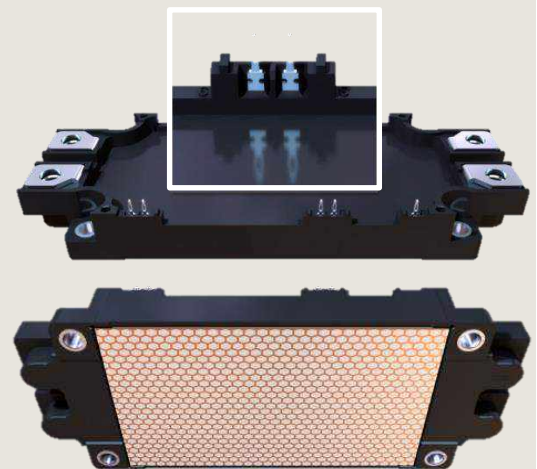


User-friendly design features

The NX-Type of 7th Generation IGBT modules line-up contains press-fit as well as solder pin types. The newly developed “needle eye”-pintype has a self adjusting shape for easy assembly.

The light weight package is also available as an option with applied PC-TIM. This removes the need to apply grease and achieves lower thermal contact resistance.

Both features enable a highly reliable mounting process even in harsh environments and easy maintenance in the field.



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