

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

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



**Transistor Arrays**



**High-voltage  
Integrated Circuits**



**Power Modules**



**High-power Devices**

Applications

1

Trends in Power Device Technology

3

Power Modules

5

High-power Devices

37

High-voltage Integrated Circuits

53

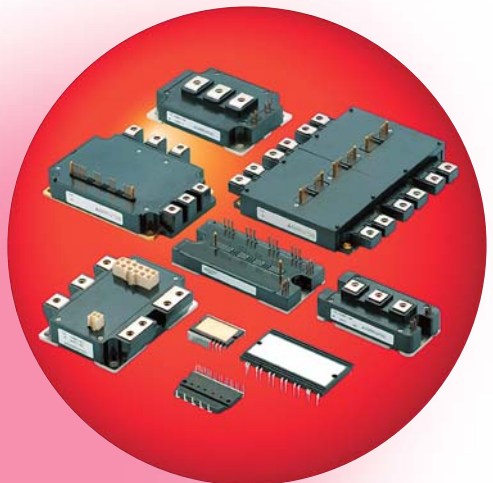
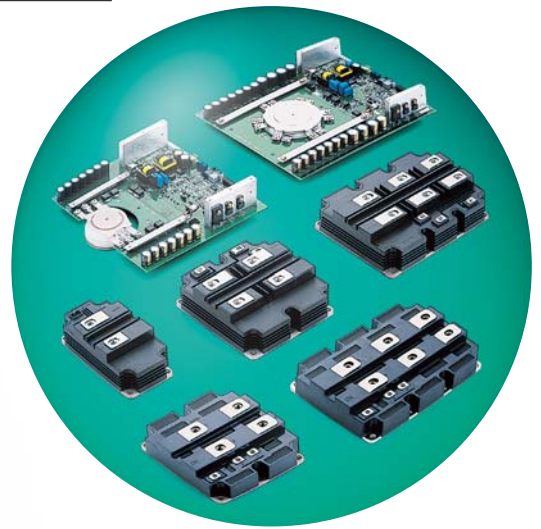
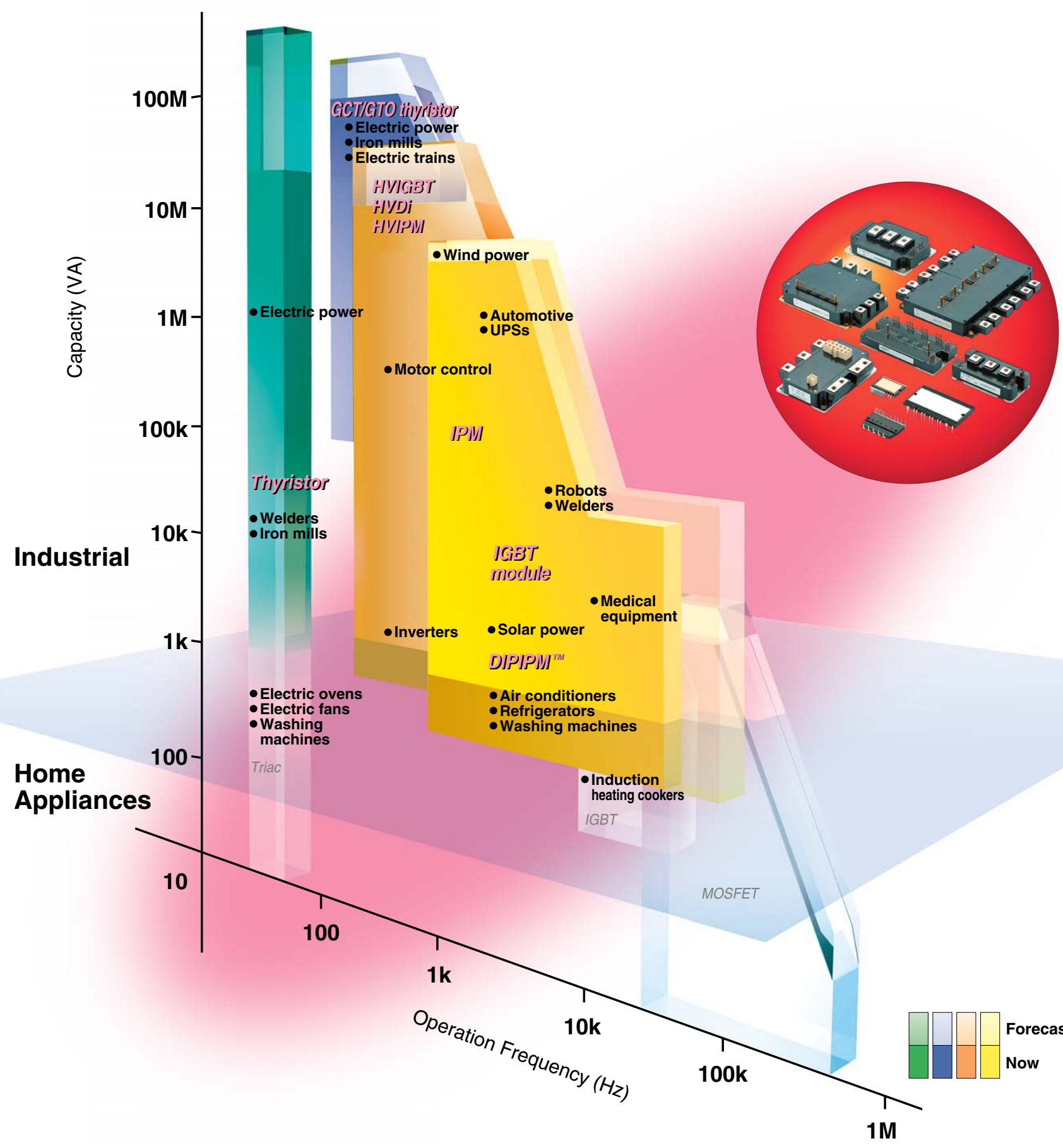
Transistor Arrays

54

# Applications

# Power Devices Offering Unlimited Application Potential

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



■ Main application & products

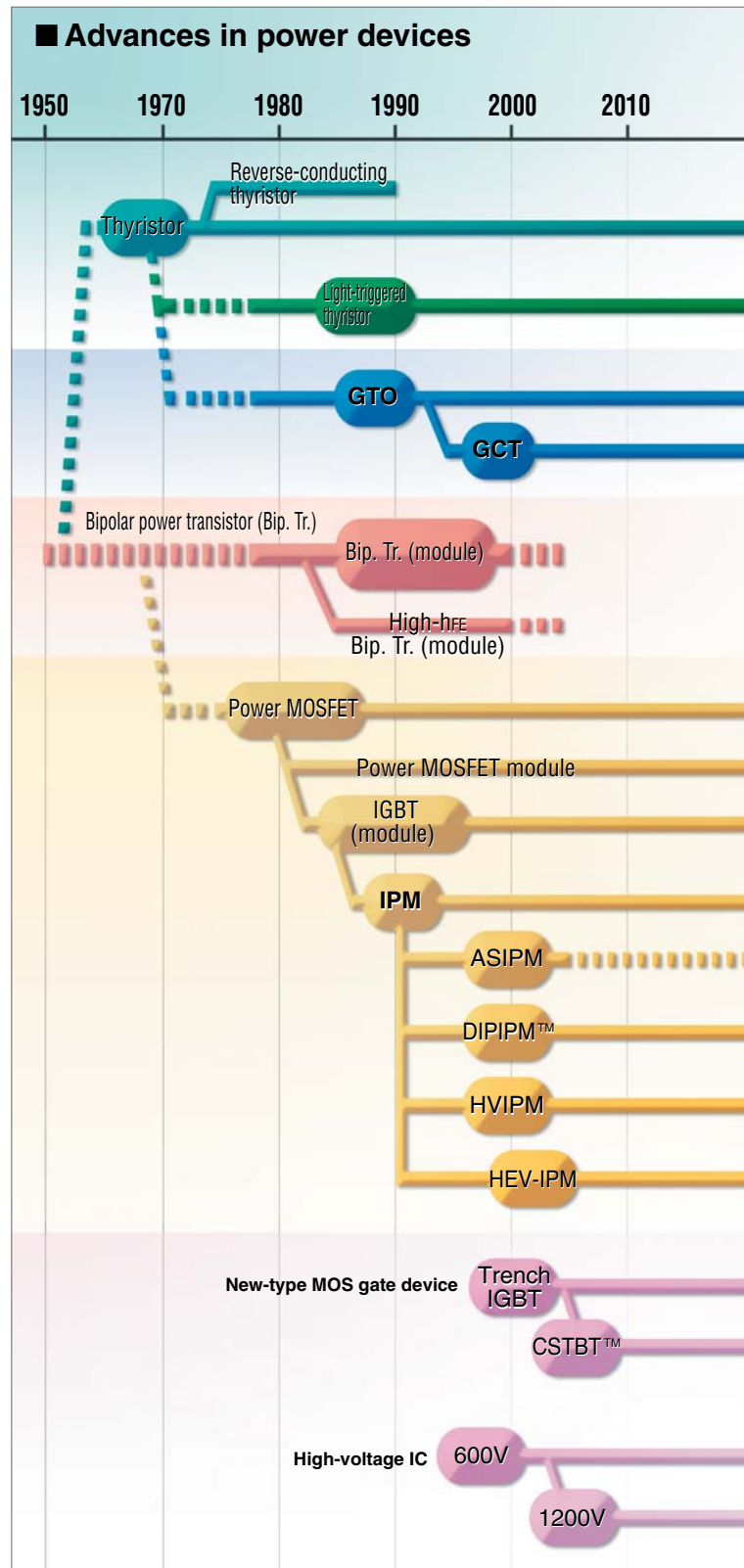
	DIPIPM™	IPM	IGBT module	GCT/GTO thyristor	Thyristor	HVIGBT HVIPM
Industrial use	Electric power					
	Iron mills					
	Electric Trains *1					
	Automotive *1					
	UPSs					
	Inverters					
	Motor control					
	Welders					
	Medical equipment					
Home Appliances	Wind power Solar power					
	Air conditioners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

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

# Trends in Power Device Technology

The technological progress of power devices is closely related to market needs. There is a constant requirement for them to be less noisy, more efficient, smaller, lighter, more advanced in function, more accurate, and have larger capacities.

In order to meet these needs with precision, Mitsubishi Electric is now accelerating the improvement of its existing devices and the research and development of new devices. Energetic efforts are being made to develop and commercialize IGBT modules, and in particular IPMs.



## Actual Principle of CSTBT™

CSTBT™ has achieved an extremely low-loss structure by advancing a conventional trench structure IGBT.

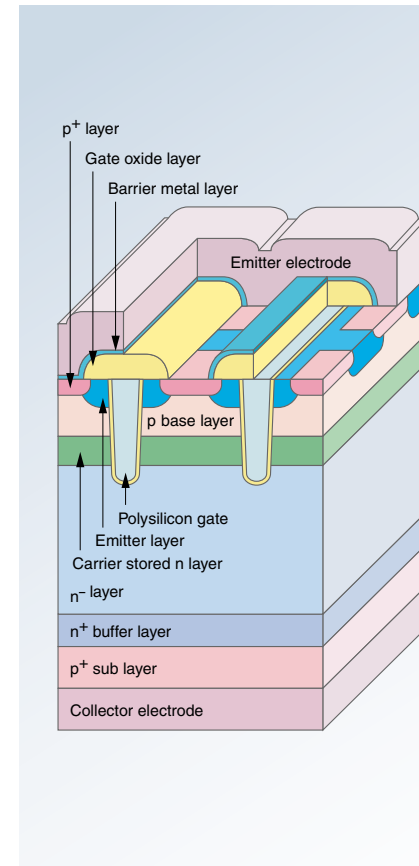
In addition to the conventional trench structure, CSTBT™ has a carrier-stored n layer to accumulate carriers as shown in the diagram on the right. The concentration of the n layer (conservation of charge layer) connected with the p base layer is higher than the n<sup>-</sup> layer, and the internal electric potential difference between the p base and the n layer is higher than that of the p base and the n<sup>-</sup> layer.

This high internal electric potential serves as a barrier to prevent holes infused from the p<sup>+</sup> layer to n<sup>-</sup> layer from going through to the emitter side. In short, holes can be stored on the emitter side of an element by the conservation of a charge layer, and the n layer controls the shift of holes to the p base layer.

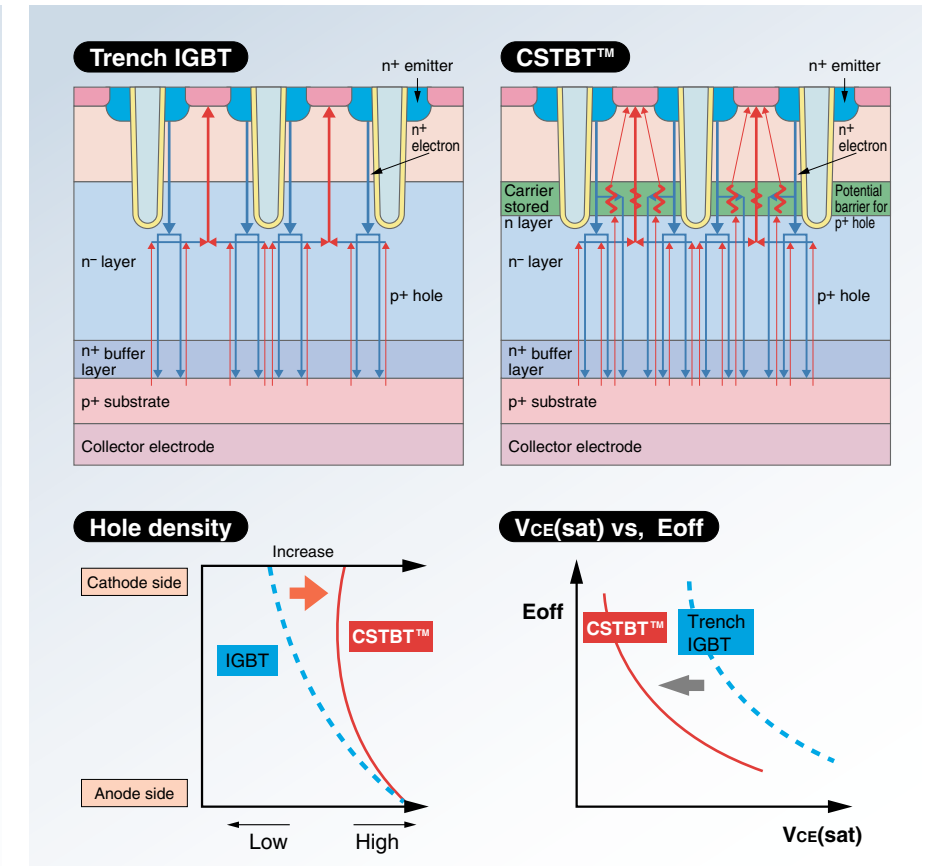
This conservation of charge function drastically improves the on-state characteristics of CSTBT™, compared to the trench structure of IGBTs. Increasing the carrier density on the emitter side and decreasing the impedance in silicon makes on-state voltage reduction possible.

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

## CSTBT™ chip structure



## Comparison of trench IGBT and CSTBT™



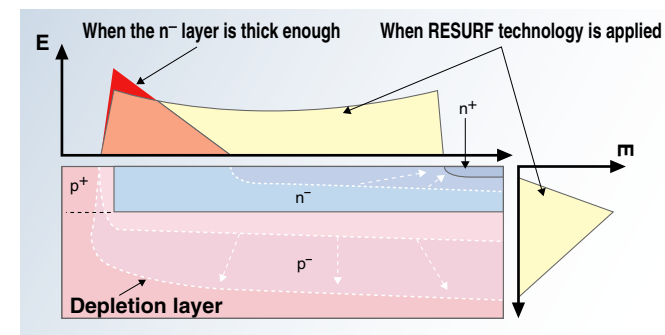
## High-voltage Technology of 1200V HVICs

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

## What is RESURF?

The p<sup>-</sup> substrate depletion layer forcibly extends the p<sup>+</sup>n<sup>-</sup> junction depletion layer underneath the surface. The n<sup>-</sup> layer becomes a complete depletion layer, and the surface electric field is thereby reduced.

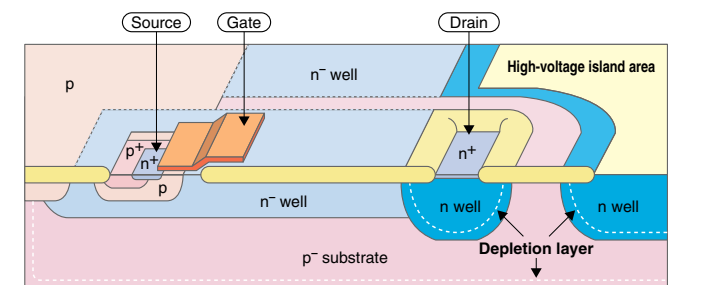
The RESURF structure has the ability to withstand high-voltage in the vertical direction because the p<sup>-</sup> substrate depletion layer extends in the depth direction. The rating of the entire device can therefore be increased significantly.



## What is split-RESURF structure?

The split-RESURF structure is characterized by a narrow p<sup>-</sup> substrate area exposed on the surface between the drain and island areas of the horizontal MOSFET for level shift circuits. When high-voltage is applied across the power supply electrodes, the p<sup>-</sup> substrate becomes a depletion layer between the n-diffusion areas; therefore, the surface potential of this p<sup>-</sup> substrate area is not significantly different from that of the n-diffusion areas.

In the past, HVIC maximum ratings were limited to 600V because, under high-potential wiring, a dielectric film is required to have the ability to withstand the same voltage as semiconductor junctions. The split-RESURF structure enables an HVIC to achieve a rating of 1200V.



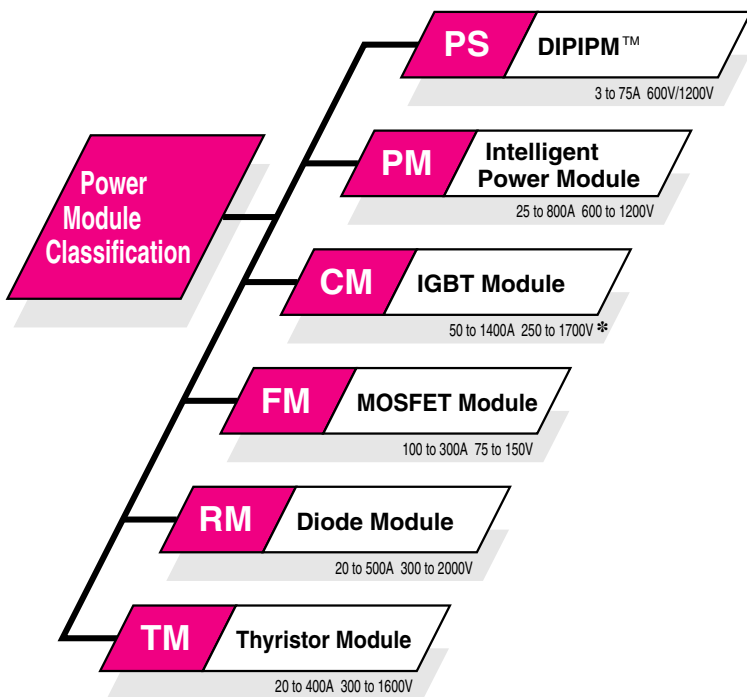
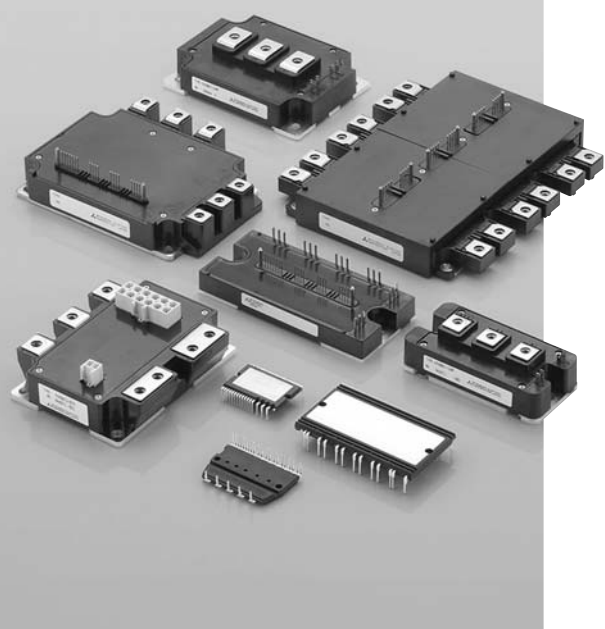
# Power Modules

## Industry-leading Technologies and a Wide Range of Products

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

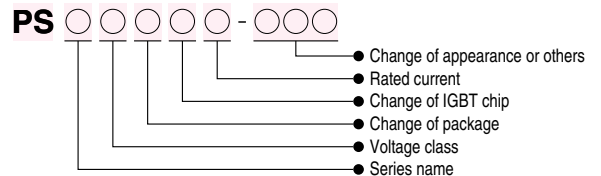
### ■ Features:

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

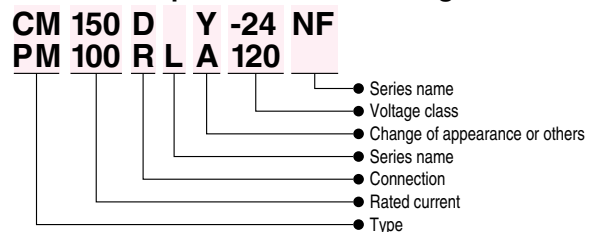


\*: Please refer to high-power device for IGBT modules over 2500V

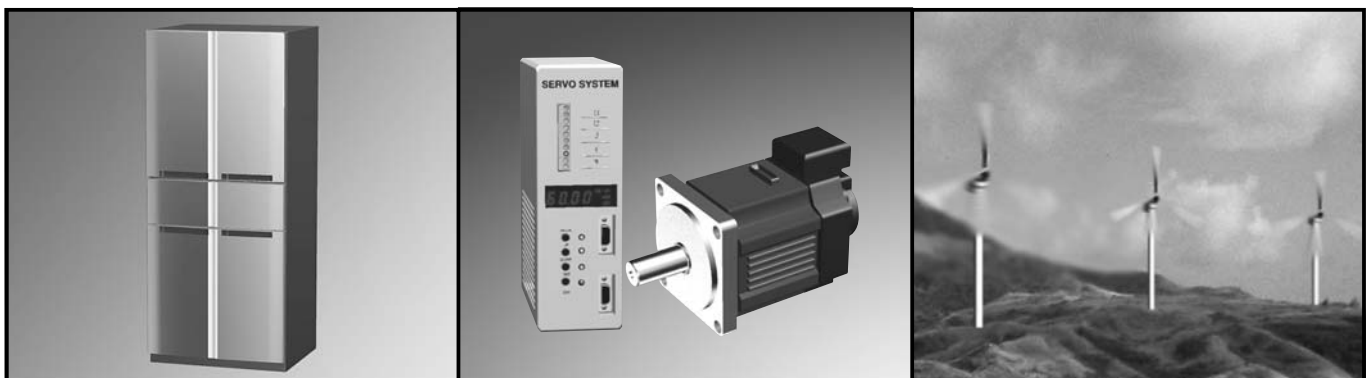
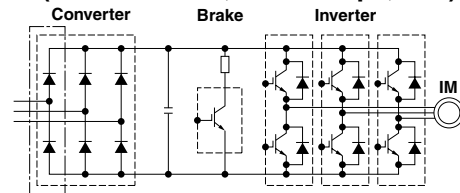
### ■ Codes for DIPIPM™ naming



### ■ Codes for power module naming

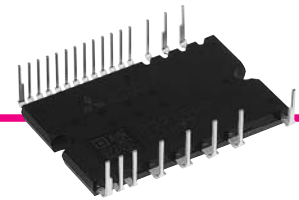


### ■ Application of IPM/IGBT to AC motor controls (VVVF inverter, servo amps, etc.)



# DIPIPM™

## Dual In-line Package Intelligent Power Module



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

DIPIPM™ Series are being used widely in both home appliances such as air conditioners, refrigerators and washing machines, as well as small-capacity industrial equipment such as inverters and servo amplifiers.

They contribute greatly to power-savings and product miniaturization.

In addition to 600V-rated devices, 1200V-rated devices designed for the global market are included in the line-up.

### ■ Applications

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

### ■ Features

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

### ■ Series map

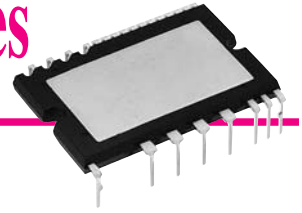
VCES (V)	Ic (A)									
	3A	5A	10A	15A	20A	25A	30A	35A	50A	75A
600V	Super-mini DIPIPM™ Ver. 4 Series • PS2196*-4/-4S/-T/-ST • PS2199*-4/-T									
	Mini DIPIPM™ Ver. 3 Series • PS2156*-P • PS2156*-SP									
							Mini DIPIPM™ Ver. 4 Series • PS2176*			
							Large DIPIPM™ Ver. 3/3.5 Series • PS2126*-P/-AP • PS21869-P/-AP			
					DIPPSCT™ Series • PS81B9*-A/-W					
							DIPPFCT™ Series 1) • PS5178*			
1200V	Large DIPIPM™ Ver. 4 Series • PS22A7*									

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



# Super-mini and Mini DIIPM™ Ver. 4 Series

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



## ■ Applications

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

## ■ Internal functions

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

## ■ Features

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

## ■ Line-up

### Super-mini-package Series

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

\*1: Corresponds to isolation voltage 2500Vrms in the case of using the convex-shaped heat sink

\*2: 3 shunts type is not available for PS21997

-T: Over temperature protection is available

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

(Other 3 terminal forming types are available)

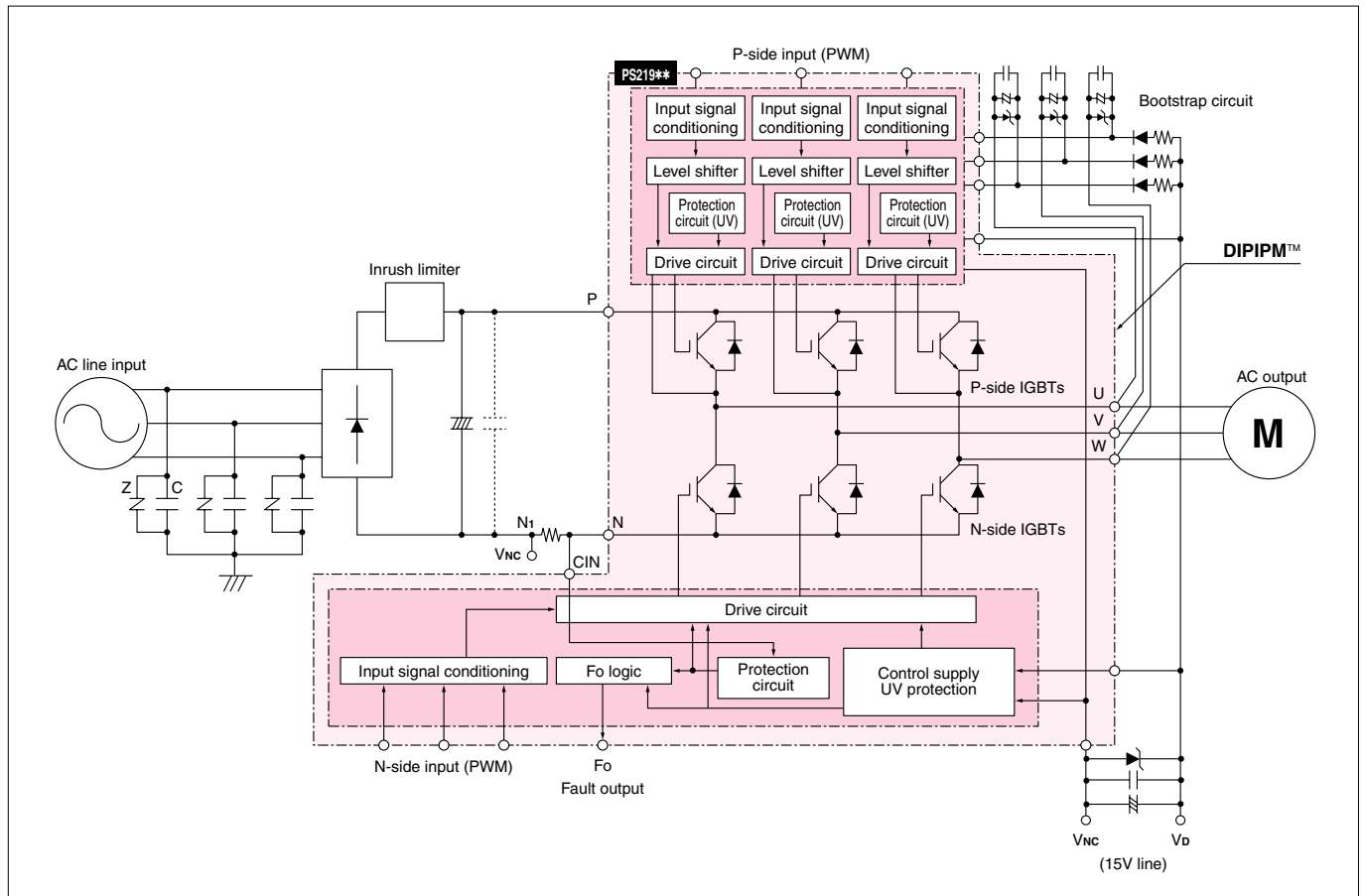
### Mini-package Series

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

-V: Higher switching speed

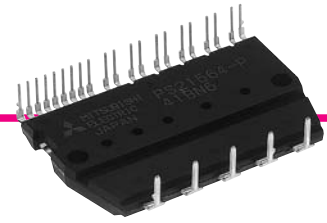
## ■ Block diagram

(PS219\*\* block diagram)



# DIPIPM™ Ver. 3/3.5 Series

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



## ■ Applications

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

## ■ Internal functions

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

## ■ Features

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

## ■ Line-up

### Mini-package Series

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

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

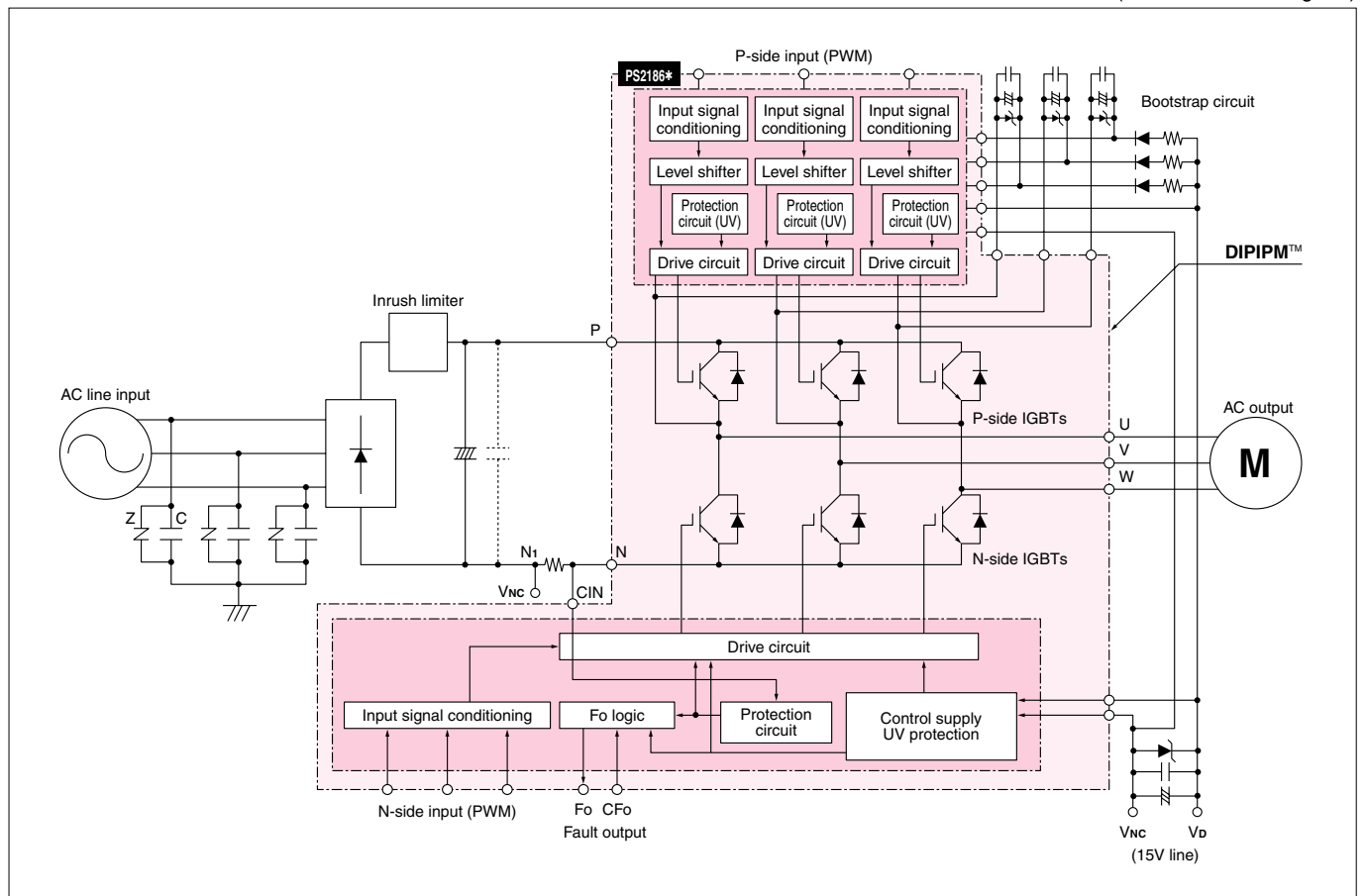
### Large-package Series

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

-AP: Long outer terminal

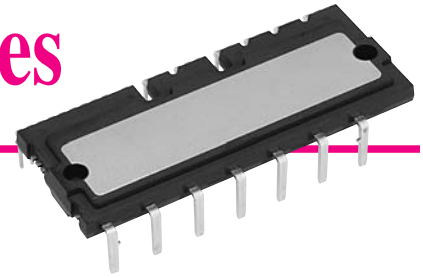
## ■ Block diagram

(PS2186\* block diagram)



# Large DIPIPM™ Ver. 4 Series

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



## ■ Applications

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

## ■ Internal functions

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

## ■ Features

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

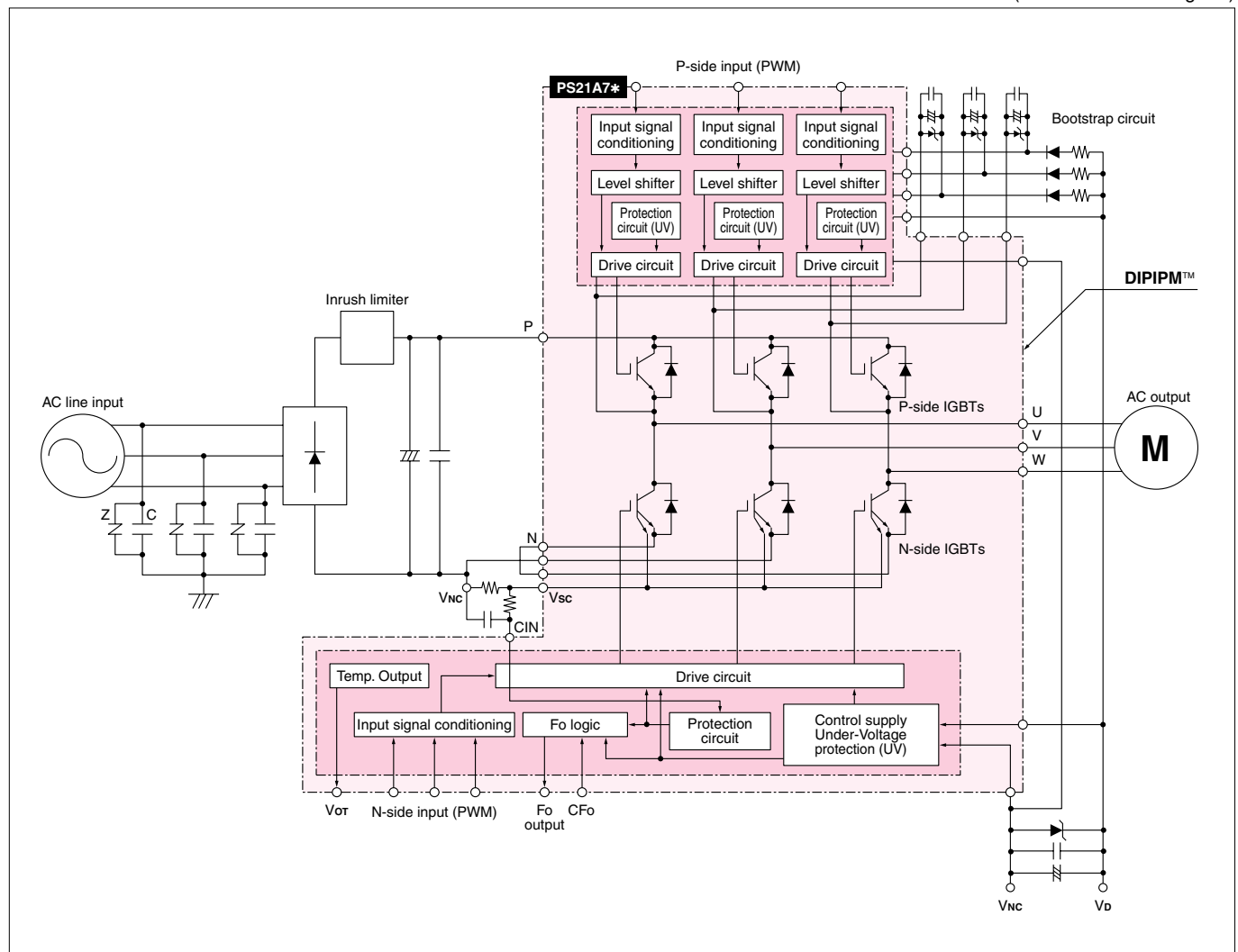
## ■ Line-up

### Large-package Series

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

## ■ Block diagram

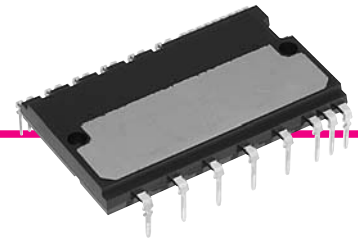
(PS21A7\* block diagram)





# Mini DIPPFCTM Series

Mini Dual In-line Package Power Factor Correction Series



## ■ Applications

- Air conditioners, general purpose inverters, etc.

## ■ Internal functions

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

## ■ Features

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

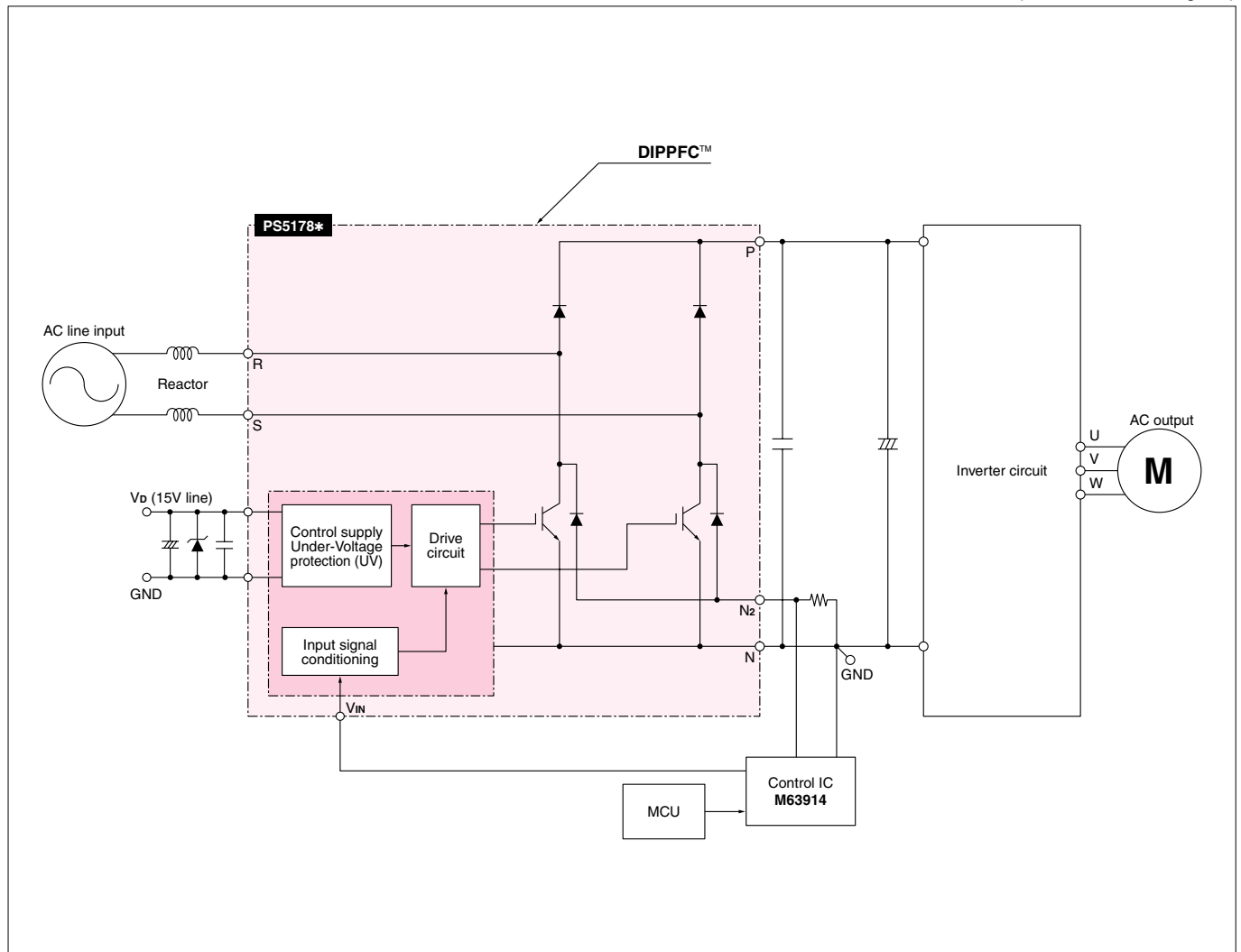
## ■ Line-up

Mini DIPPFCTM Series

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

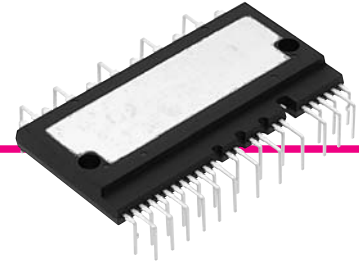
## ■ Block diagram

(PS5178\* block diagram)



# DIPPSC™ Series

## Dual In-line Package Partial Switching Circuit Series



### ■ Applications

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

### ■ Internal functions

#### ● Inverter part

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

#### ● PSC part

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

### ■ Features

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

### ■ Line-up

#### DIPPSC™ Series

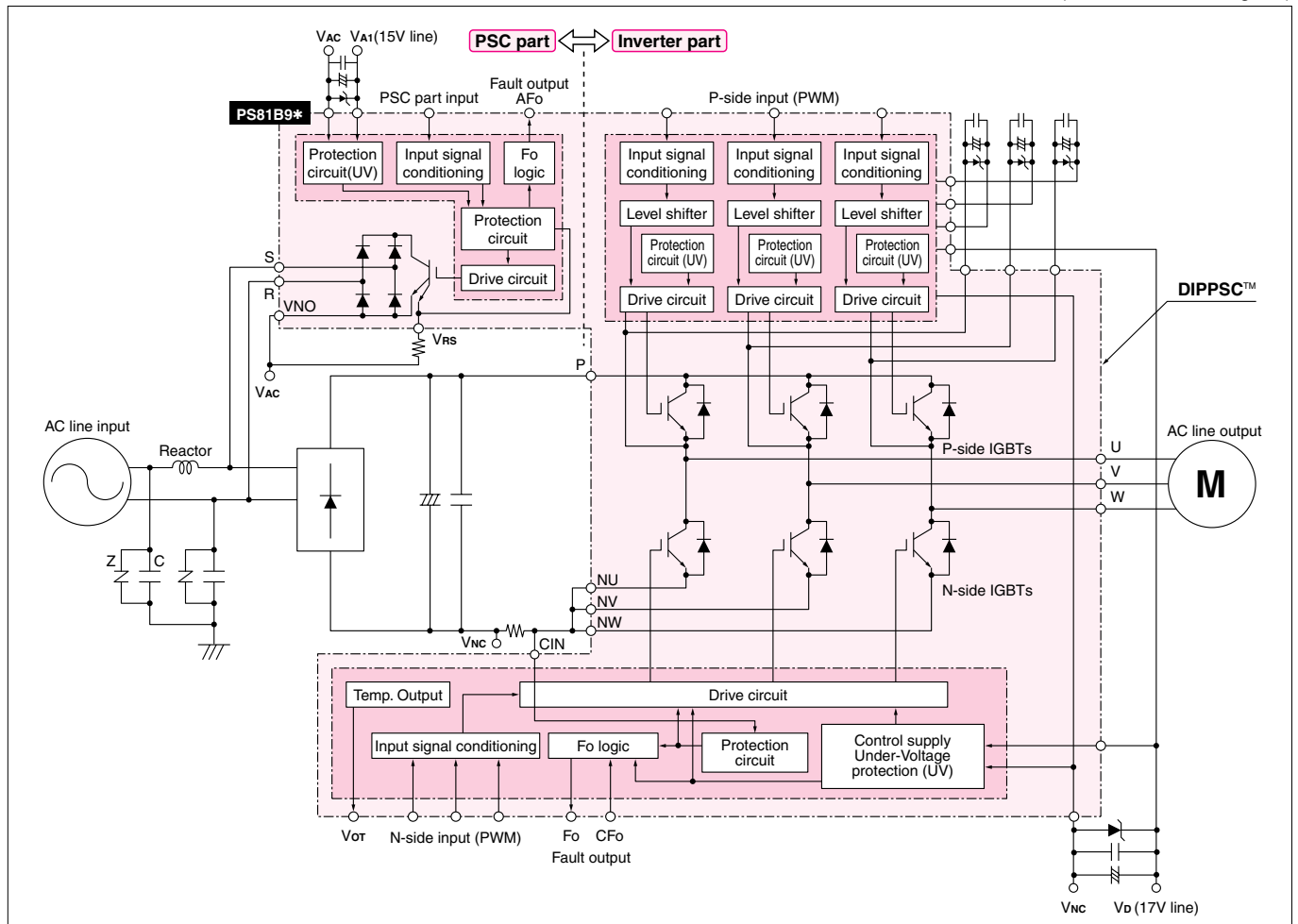
	Type	Ratings		fc max.(kHz)	Outline drawings no.
		Partial SW part	Inverter part		
Isolation voltage 2500Vrms class	PS81B93-AE-EW	15A/600V	8A/600V	20	PS11 PS12
	PS81B93-AJ-W	15A/600V	10A/600V		
	PS81B94-AJ-W	20A/600V	15A/600V		
	PS81B95-AJ-W	20A/600V	20A/600V		

-A : Long outer terminal

-W : Both sides zigzag terminal

### ■ Block diagram

(PS81B9\* block diagram)



# IPM

## Intelligent Power Modules

In recent years, new demands for ease-of-use and environmental concerns have been added to the need for improved performance, miniaturization, compactness and reduced power loss in motor controllers such as general purpose inverters and AC servos for industrial equipment. Mitsubishi Electric is already in production of power modules

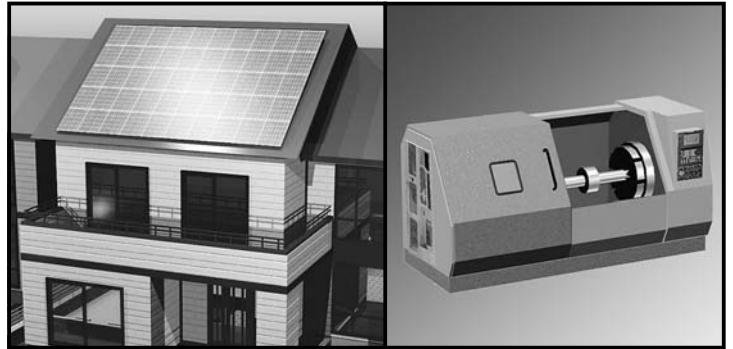
such as the 3rd-generation IPM "S Series" and 4th-generation IPM "S-DASH Series", and now adds the miniaturized and lightweight 5th-generation "L Series" to its line-up. The "L Series" incorporates a CSTBT™ chip for reduced power loss and a new compact package.

### ■ Applications

- Motor control devices  
(220VAC/440VAC inverters, servos, etc.)
- DC power supplies such as UPS
- \* IPMs for photovoltaic generation using solar devices series

### ■ Features (L1/S1 Series)

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



### ■ Intelligent Power Modules (L1 Series)

#### 600V

V <sub>CEs</sub> (V)	Connection	Main terminal	I <sub>c</sub> (A)					
			50	75	100	150	200	300
600	3∅	Screw	PM50CL1A060	PM75CL1A060	PM100CL1A060	PM150CL1A060	PM200CL1A060	PM300CL1A060
		Pin	PM50CL1B060	PM75CL1B060	PM100CL1B060	PM150CL1B060	—	—
	3∅ + Brake	Screw	PM50RL1A060	PM75RL1A060	PM100RL1A060	PM150RL1A060	PM200RL1A060	PM300RL1A060
		Pin	PM50RL1B060 PM50RL1C060	PM75RL1B060	PM100RL1B060	PM150RL1B060	—	—

#### 1200V

V <sub>CEs</sub> (V)	Connection	Main terminal	I <sub>c</sub> (A)				
			25	50	75	100	150
1200	3∅	Screw	PM25CL1A120	PM50CL1A120	PM75CL1A120	PM100CL1A120	PM150CL1A120
		Pin	PM25CL1B120	PM50CL1B120	PM75CL1B120	—	—
	3∅ + Brake	Screw	PM25RL1A120	PM50RL1A120	PM75RL1A120	PM100RL1A120	PM150RL1A120
		Pin	PM25RL1B120 PM25RL1C120	PM50RL1B120	PM75RL1B120	—	—

### ■ IPM series map

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

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

### High-speed intelligent power modules

#### 220VAC for Line

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

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

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

o: Built-in integrated  
 x: Non-integrated

# IPM

## Intelligent Power Modules

### High-speed intelligent power modules

#### 220VAC for Line

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

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

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

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

### 440VAC for Line

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

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

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

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

# IPM

## Intelligent Power Modules

### For Solar Power

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

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

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

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

# IGBT Modules

## Insulated Gate Bipolar Transistor Modules

In the past 15 years since the development of the IGBT as the industrial power semiconductor switch, performance has been improved and applications have increased, and now it has replaced transistors in most electric powered industrial equipment. Mitsubishi Electric developed the "F Series", a 4th-generation trench IGBT module that delivers power-savings and noise reduction at the same time. The "NF/A

Series", a 5th-generation IGBT module that adopts the CSTBT™ chip, combines the characteristics of the popular planar IGBT and the trench IGBT, and is known for reducing power loss. The "NFH Series", suitable for higher-frequency switching-use, has been newly-developed and put into mass production.

### (NF Series)

#### ■ Applications

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

#### ■ Features

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

### (NFH Series)

#### ■ Applications

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

#### ■ Features

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



### ■ IGBT modules series map



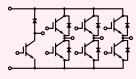
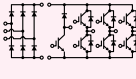
3rd-generation (former)	3rd-generation (latter)	4th-generation	5th-generation
H Series	U Series KA Series	F Series DUS Series (high-frequency)	NX Series NF/A Series Mega Power Dual NFH Series (high-frequency)



# IGBT Modules


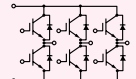
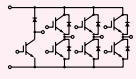
## Insulated Gate Bipolar Transistor Modules

### IGBT modules <NX Series>


Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)									
		35	50	75	100	150	200	300	400(450)	600	1000
H 	600										CM600HX-12A *
	1200									CM400HX-24A *	CM600HX-24A *
D 	600								CM300DX-12A *	CM400DX-12A *	
	1200				CM150DX-24A *	CM200DX-24A *	CM300DX-24A *	CM450DX-24A *	CM600DXL-24A	CM1000DXL-24A	
R 	600				CM100RX-12A *	CM150RX-12A *	CM200RX-12A *				
	1200			CM75RX-24A *	CM100RX-24A *						
M 	600			CM75MX-12A *	CM100MX-12A *						
	1200	CM35MX-24A *	CM50MX-24A *	CM75MX-24A *							

\*: Built-in NTC thermistor

### IGBT modules <NF Series>



Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)							
		50	75	100	150	200	300	400	600
D 	600				CM150DY-12NF	CM200DY-12NF	CM300DY-12NF	CM400DY-12NF	CM600DY-12NF
	1200			CM100DY-24NF	CM150DY-24NF	CM200DY-24NF	CM300DY-24NF	CM400DY-24NF	CM600DY-24NF
T 	600		CM75TL-12NF	CM100TL-12NF	CM150TL-12NF	CM200TL-12NF			
	1200	CM50TL-24NF	CM75TL-24NF	CM100TL-24NF	CM150TL-24NF	CM200TL-24NF			
R 	600		CM75RL-12NF	CM100RL-12NF	CM150RL-12NF	CM200RL-12NF			
	1200	CM50RL-24NF	CM75RL-24NF	CM100RL-24NF	CM150RL-24NF	CM200RL-24NF			

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

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

\*: High-speed turn-off F Series

### IGBT modules <A Series>

Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)					
		100	150	200	300	400	600
H 	1200					CM400HA-24A *	CM600HA-24A *
							CM600HB-24A *
D 	1200	CM100DY-24A	CM150DY-24A	CM200DY-24A	CM300DY-24A	CM400DY-24A	CM600DY-24A


\*: Not RoHS directive compliant

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

# IGBT Modules


## Insulated Gate Bipolar Transistor Modules

### ■ IGBT modules <Mega Power Dual>

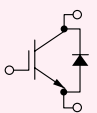
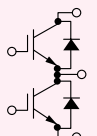
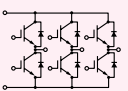
Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)		
		900	1000	1400
D		1200	CM900DU-24NF * N204	CM1400DU-24NF * N204
		1700	CM1000DU-34NF * N204	

\*: Not RoHS directive compliant


### ■ IGBT modules <1700V Dual>

Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)						
		75	100	150	200	300	400	
D		1700	CM75DY-34A N201	CM100DY-34A	CM150DY-34A	CM200DY-34A	CM300DY-34A N203	CM400DY-34A N205
			N202					

### ■ IGBT modules <F Series>


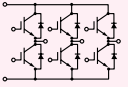
Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)							
		50	75	100	150	200	300(350)	400(450)	600
H		250						CM450HA-5F H105	CM600HA-5F CM600HN-5F H106
		600							CM600HU-12F U101
		1200							CM400HU-24F U101
D		250					CM350DU-5F U202	CM400DU-5F U201	CM600DU-5F U202
		600	CM75DU-12F	CM100DU-12F	CM150DU-12F	CM200DU-12F	CM300DU-12F	CM400DU-12F	
		1200	CM50DU-24F	CM75DU-24F	CM100DU-24F	CM150DU-24F	CM200DU-24F	CM300DU-24F	CM400DU-24F
T		600		CM75TU-12F	CM100TU-12F	CM150TU-12F	CM200TU-12F		
		1200	CM50TU-24F	CM75TU-24F	CM100TU-24F				

### ■ IGBT modules <For brake systems>

Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)						
		50	75	100	150	200	300	
E3		600		CM75E3U-12H *	CM100E3U-12H *	CM150E3U-12H *	CM200E3U-12NF *	CM300E3U-12H *
		1200	CM50E3U-24H *	CM75E3U-24H *	CM100E3U-24NF *	CM150E3U-24H *		

\*: Production on orders

### ■ IGBT modules <KA Series>

Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)							
		50	75	100	150	200	300	400	
D		1700			CM100DU-34KA	CM150DU-34KA	CM200DU-34KA	CM300DU-34KA	CM400DU-34KA
					U201		U202	U205	
T		1700	CM50TU-34KA	CM75TU-34KA					
			U602						



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

# IGBT Modules

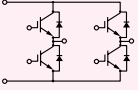
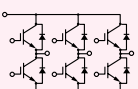
## Insulated Gate Bipolar Transistor Modules

### ■ IGBT modules <U Series>

#### 1 arm to 2 arms

Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)							
		50	75	100	150	200	300	400	600
H 	600								<b>CM600HU-12H</b> U101
	1200							<b>CM400HU-24H</b> U101	<b>CM600HU-24H</b> U102
D 	600		<b>CM75DU-12H</b>	<b>CM100DU-12H</b>	<b>CM150DU-12H</b>	<b>CM200DU-12H</b>	<b>CM300DU-12H</b>	<b>CM400DU-12H</b>	
	1200		U203			U201			
		<b>CM50DU-24H</b>	<b>CM75DU-24H</b>	<b>CM100DU-24H</b>	<b>CM150DU-24H</b>	<b>CM200DU-24H</b>	<b>CM300DU-24H</b>		
		U203			U201		U202		

#### 4 arms to 6 arms

Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)					
		50	75	100	150	200	
B 	600		<b>CM75BU-12H</b>	<b>CM100BU-12H</b>			
			U401				
T 	600		<b>CM75TU-12H</b>	<b>CM100TU-12H</b>	<b>CM150TU-12H</b>	<b>CM200TU-12H</b>	
	1200		U601		U602		
		<b>CM50TU-24H</b>	<b>CM75TU-24H</b>	<b>CM100TU-24H</b>			
		U601		U602			

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

# Power MOSFET Modules

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

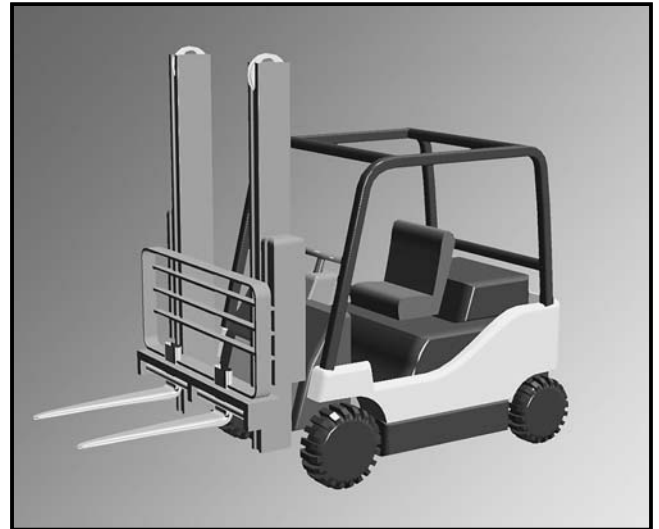
However, the ease of an assembly, the miniaturization of equipment, and the improvement in reliability are being strongly required recently. The line-up of the low-voltage MOSFET module has been realized corresponding to such a large-capacity and low-voltage use.

## ■ Applications

- Battery forklift
- UPS

## ■ Features

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



## ■ Power MOSFET modules

Connection	V <sub>DSS</sub> (V)	I <sub>D</sub> (A)		
		100	200	300
T	75	FM200TU-07A	FM400TU-07A	FM600TU-07A
			F601	
	100	FM200TU-2A	FM400TU-2A	FM600TU-2A
			F601	
	150	FM200TU-3A	FM400TU-3A	FM600TU-3A
			F601	

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

# Diode Modules

## High-speed diode modules

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

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

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

\*1: For the snubber circuit of IGBT modules and IPMs

\*2: Exclusive use for welder

×: Plan for production discontinue

## Diode modules

RoHS directive compliant

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

×: Plan for production discontinue

## New diode modules

RoHS directive compliant

Connection	V <sub>RRM</sub> (V)	I <sub>o</sub> (A)							
		7		24		12		36	
TN	800			RM20TNA-H	R25			RM30TNA-H	R25
	1600	RM10TN-2H	R25			RM25TN-2H	R25		

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

# Thyristor Modules

## Thyristor modules

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

\*1: DC output current \*2: Non-isolation \*3: I<sub>T</sub>=30A \*4: I<sub>T</sub>=60A \*5: I<sub>T</sub>=100A

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

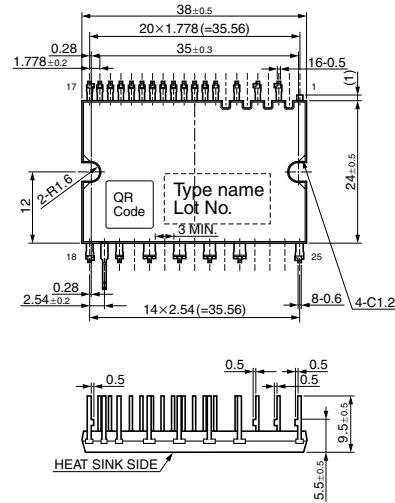
×: Plan for production discontinue

Power modules outline drawings

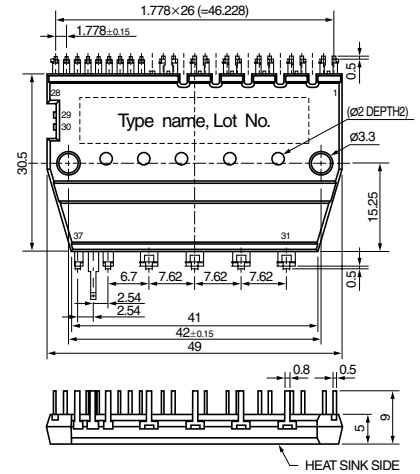
(unit: mm)

**DIIPM™**  
Dual In-Line Package  
Intelligent Power Modules

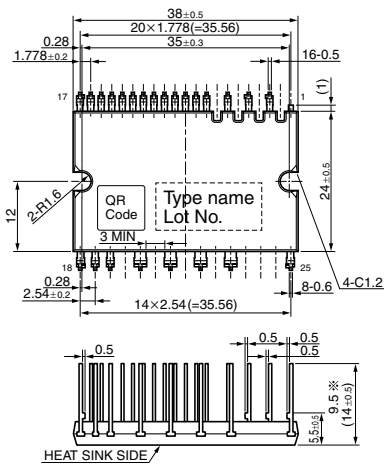
**PS3 Super-mini DIIPM™ Ver. 4**  
PS2196\*-4S/-ST  
PS21963-4ES/-EST



**PS6 Mini DIIPM™ Ver. 3**  
PS2156\*-SP

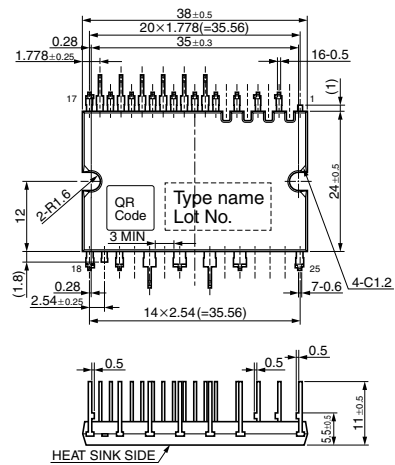


**PS1 Super-mini DIIPM™ Ver. 4**  
PS219\*\*-4/-4A/-T/-AT  
PS219\*3-4E/-4AE/-ET/-AET

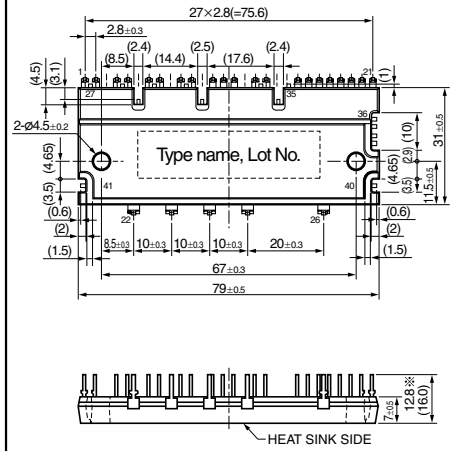


※ In the case of -A, this length is 14.0mm

**PS4 Super-mini DIIPM™ Ver. 4**  
PS219\*\*-4W/-TW  
PS219\*3-4EW/-ETW

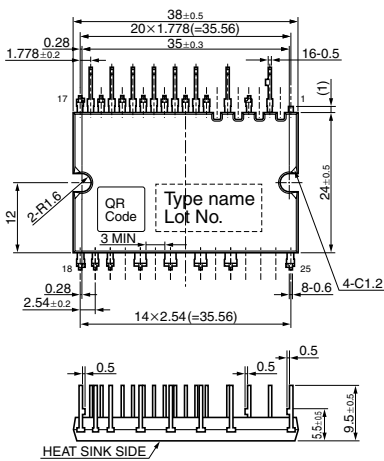


**PS7 Large DIIPM™ Ver. 3**  
PS21869-P/-AP

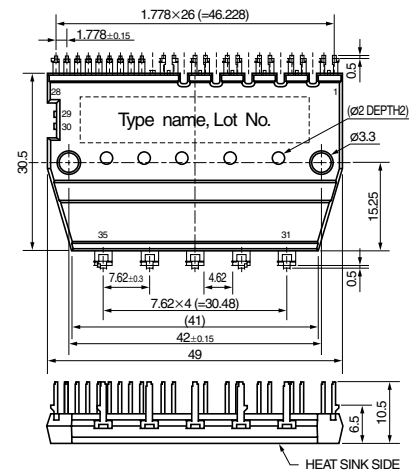


※ In the case of -AP, this length is 16.0mm

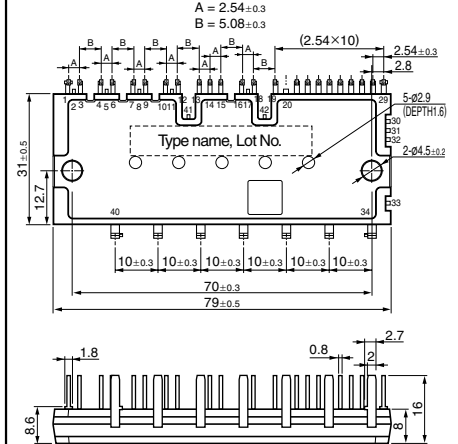
**PS2 Super-mini DIIPM™ Ver. 4**  
PS219\*\*-4C/-CT  
PS219\*3-4CE/-CET



**PS5 Mini DIIPM™ Ver. 3**  
PS2156\*-P



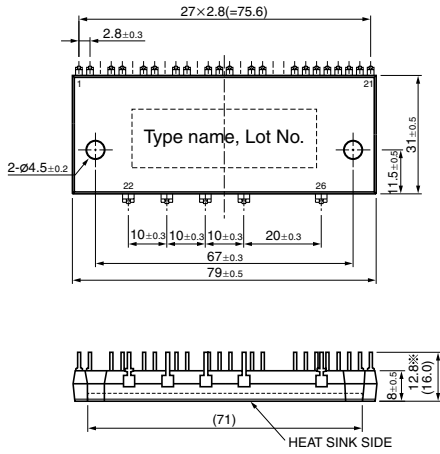
**PS8 Large DIIPM™ Ver. 4**  
PS21A79 PS22A72 PS22A74  
PS21A7A PS22A73 PS22A76  
PS22A78-E



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**PS9**

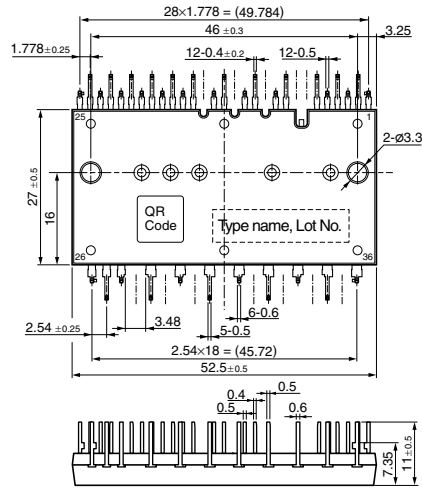
**Large DIPIPM™ Ver. 3.5**  
**PS21265-P/-AP**  
**PS21267-P/-AP**



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

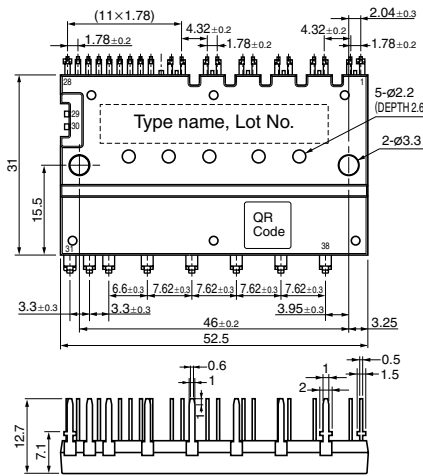
**PS12**

**DIPPSCTM**  
**PS81B93-EW PS81B94-W**  
**PS81B93-W PS81B95-W**



**PS10**

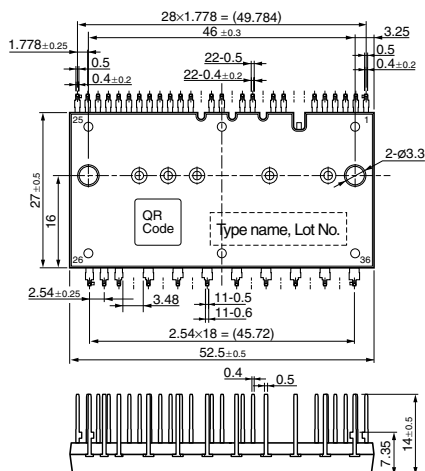
**Mini DIPIPM™ Ver. 4** **DIPPFCTM**  
**PS21765 PS51787**  
**PS21767/-V PS51789**



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

**PS11**

**DIPPSCTM**  
**PS81B93-AE PS81B94-A**  
**PS81B93-A PS81B95-A**

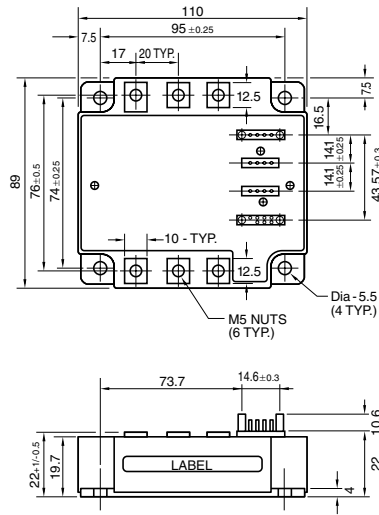




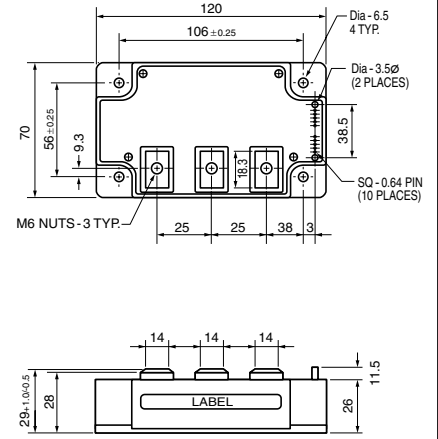
# IPM

Intelligent Power Modules

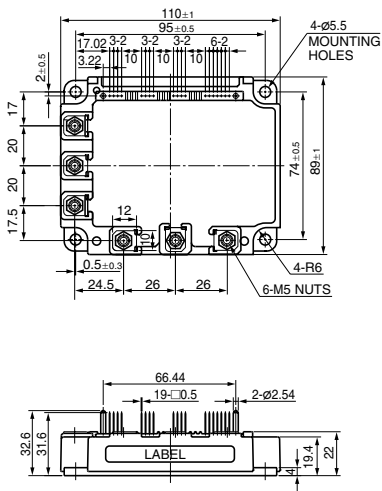
**P25**  
**PM50RVA120**  
**PM75RVA060**  
**PM100CVA060**



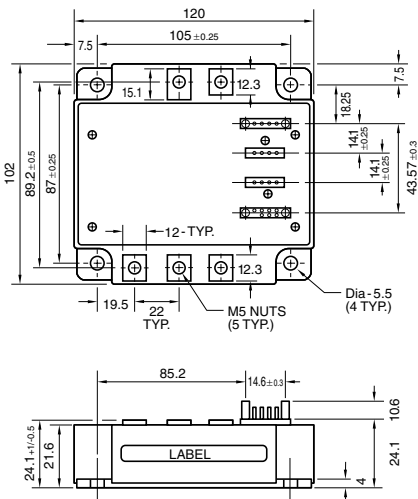
**P28**  
**PM200DVA120**  
**PM400DVA060**



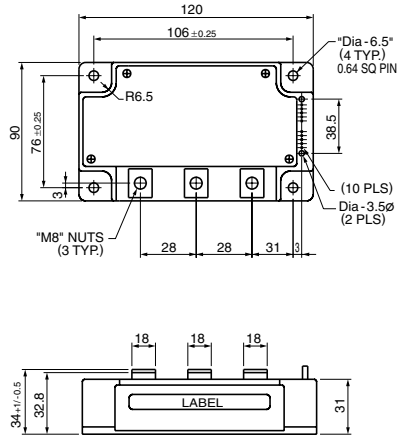
**P2**  
**PM50,75,100,150CSD/RSD060**  
**PM50,75CSD/RSD120**



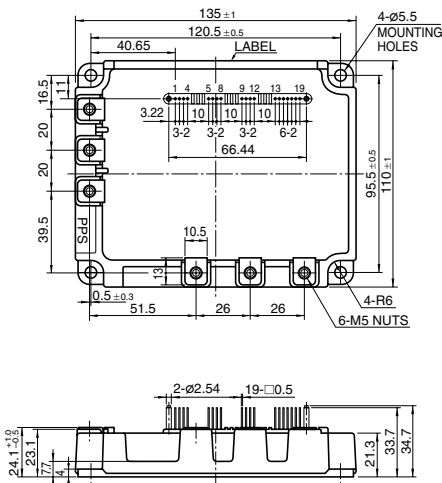
**P26**  
**PM75,100CVA120**  
**PM150,200CVA060**



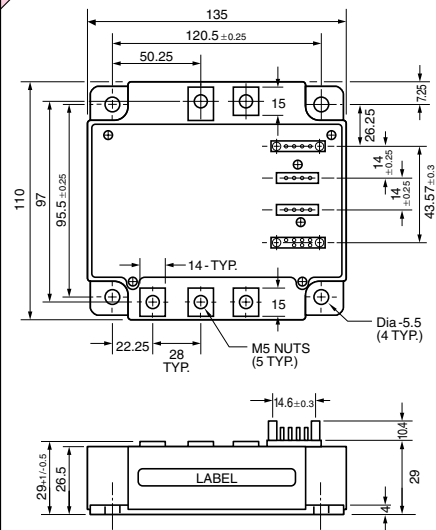
**P29**  
**PM300DVA120**  
**PM600DVA060**



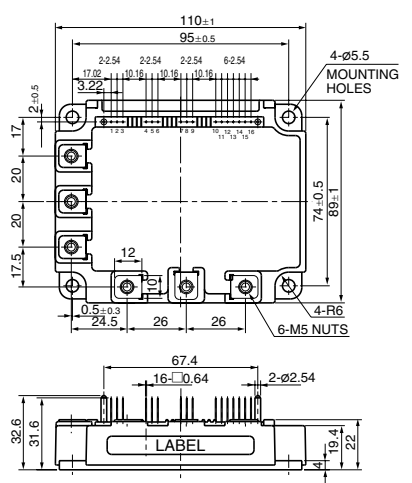
**P3**  
**PM200,300CSD/RSD060**  
**PM100,150CSD/RSD120**



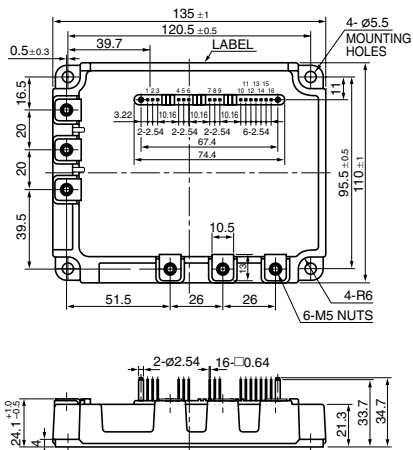
**P27**  
**PM150CVA120**  
**PM300CVA060**



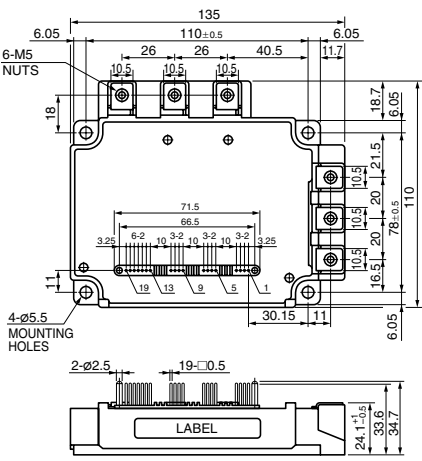
**P31**  
**PM50,75,100,150CSE/RSE060**  
**PM50,75CSE/RSE120**



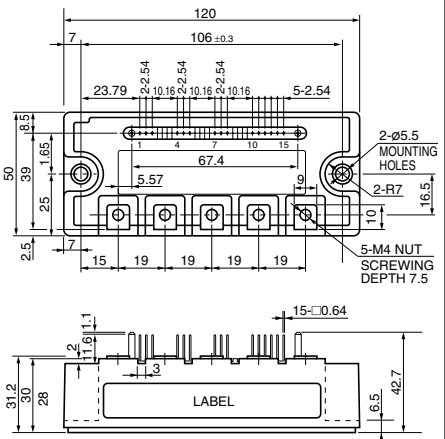
**P32** PM200,300CSE/RSE060  
PM100,150CSE/RSE120



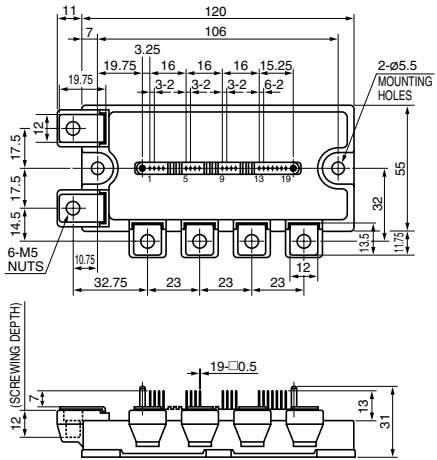
**P37** PM200,300CLA/CL1A/RL1A060  
PM100,150CLA/CL1A/RL1A120



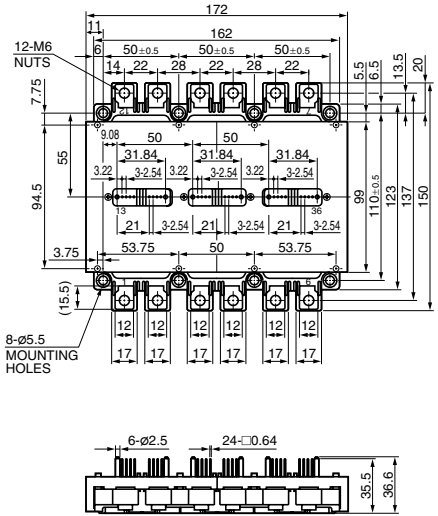
**P40** PM50,75,100,150,200CS1D060  
PM25,50,75,100CS1D120



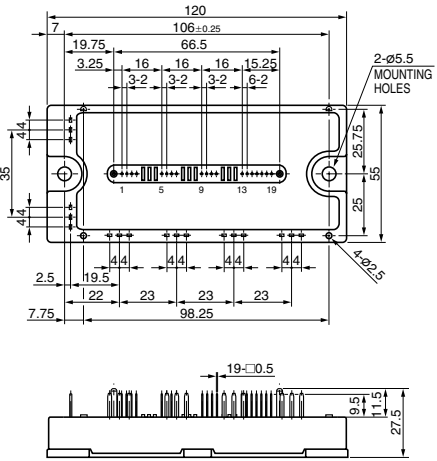
**P35** PM50,75,100,150CL1A/RL1A060  
PM25,50,75CL1A/RL1A120  
PM50,75B4/B5/B6LA060



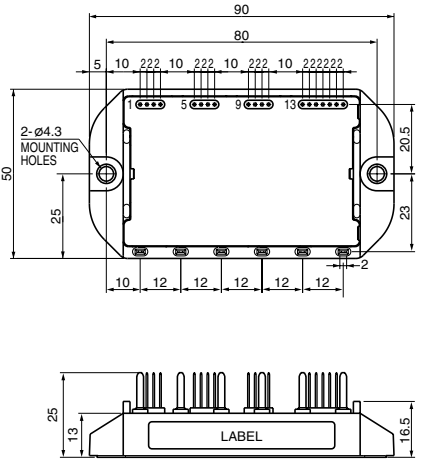
**P38** PM200,300,450CLA120  
PM450,600CLA060



**P36** PM50,75,100,150CL1B/RL1B060  
PM25,50,75CL1B/RL1B120  
PM50,75B4/B5/B6LB060



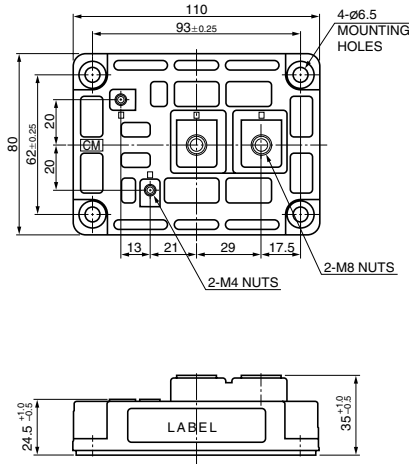
**P39** PM50RL1C060  
PM25RL1C120



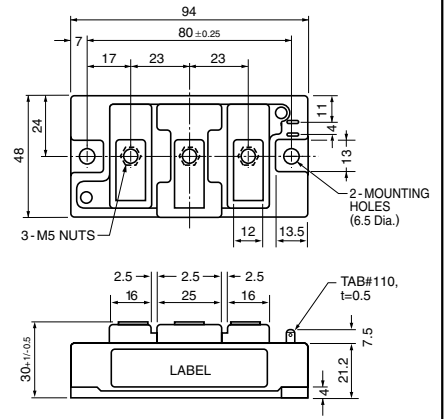
# IGBT Module

Insulated Gate Bipolar Transistor Modules

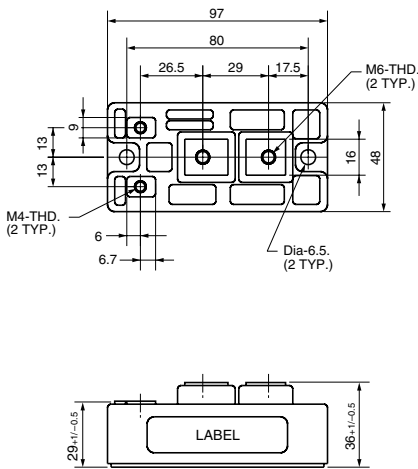
**H107 CM600HB-24A**



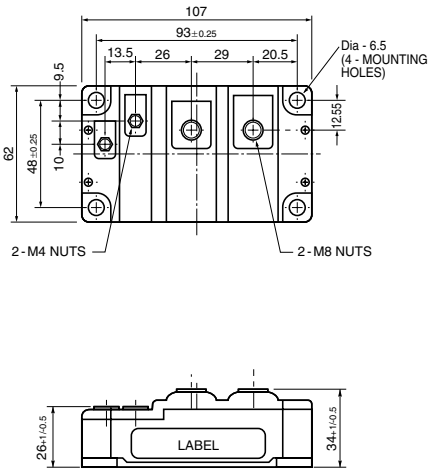
**U111 CM50E3U-24H  
CM75E3U-12H,-24H  
CM100E3U-12H,-24NF  
CM150E3U-12H  
CM200E3U-12NF**



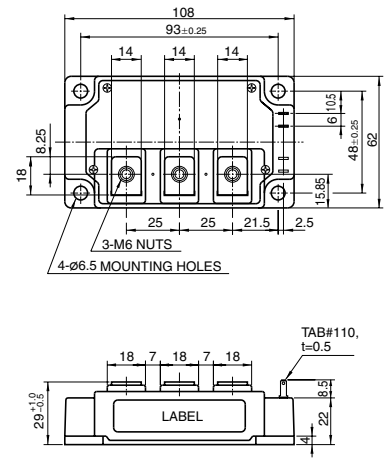
**H105 CM450HA-5F**



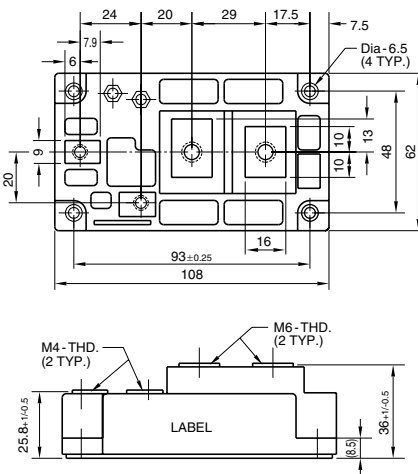
**U101 CM600HU-12H,-12F  
CM400HU-24H,-24F**



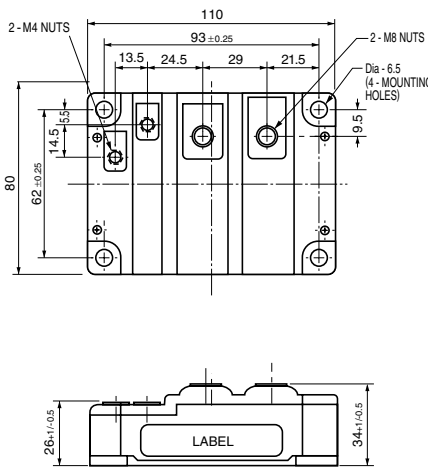
**U112 CM150E3U-24H  
CM300E3U-12H**



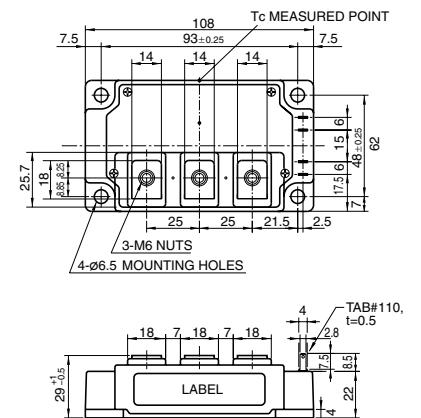
**H106 CM400HA-24A  
CM600HA-24A,-5F  
CM600HN-5F**



**U102 CM600HU-24H,-24F**

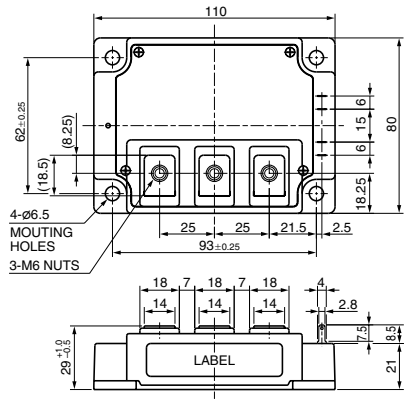


**U201 CM100DU-34KA  
CM150DU-24H,-24F,-34KA  
CM200DU-24H,-24F,-24NFH  
CM300DU-12H,-12F,-12NFH,-24NFH  
CM400DU-5F,-12H,-12F,-12NFH**



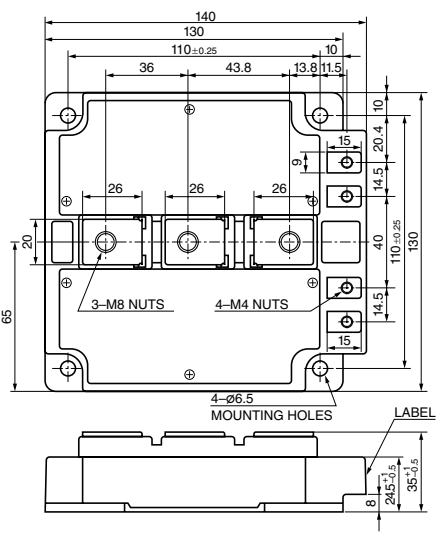
**U202**

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



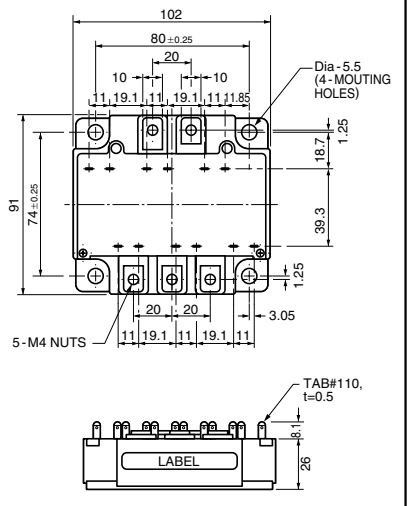
**U205**

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



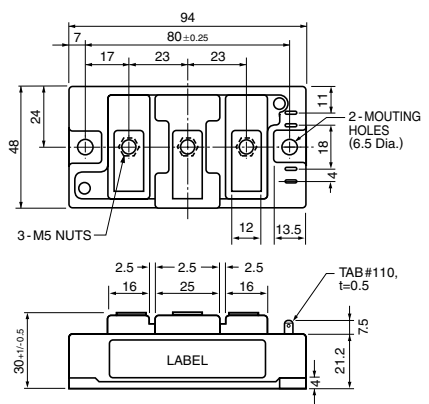
**U601**

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



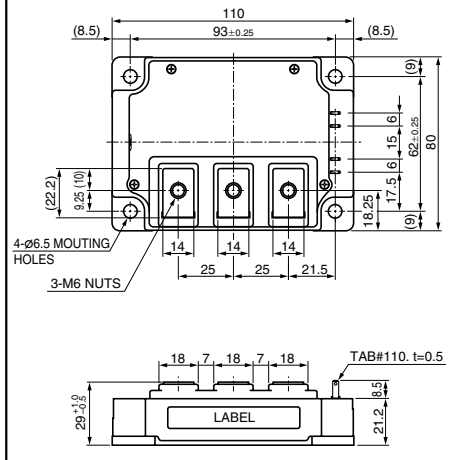
**U203**

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



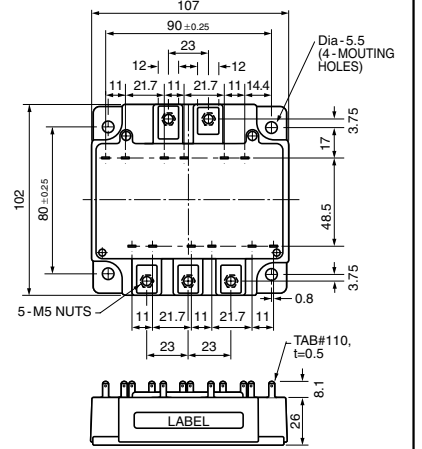
**U206**

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



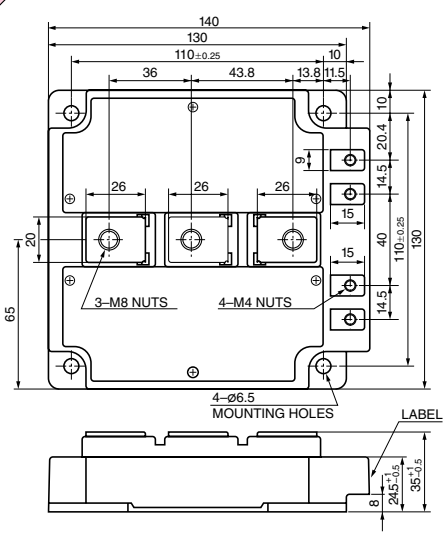
**U602**

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



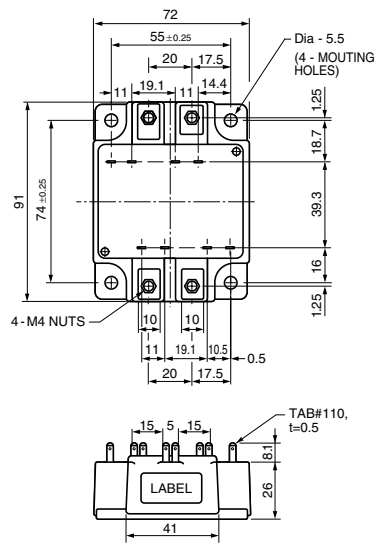
**U204**

**CM400DU-24F**



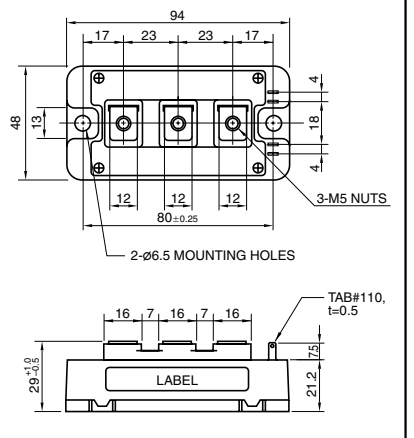
**U401**

**CM75,100BU-12H**



**N201**

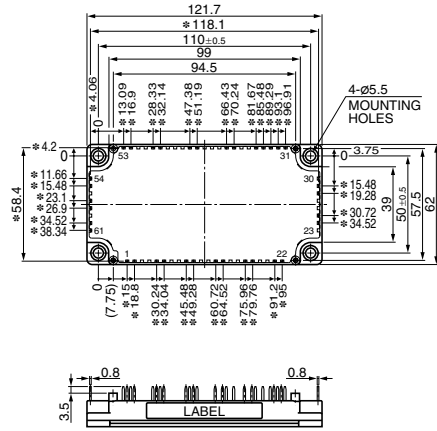
**CM75DY-34A  
CM100DY-24NF,-24A,-34A  
CM150DY-12NF,-24NF,-24A  
CM200DY-12NF,-24A  
CM300DY-12NF**





**NXM01**

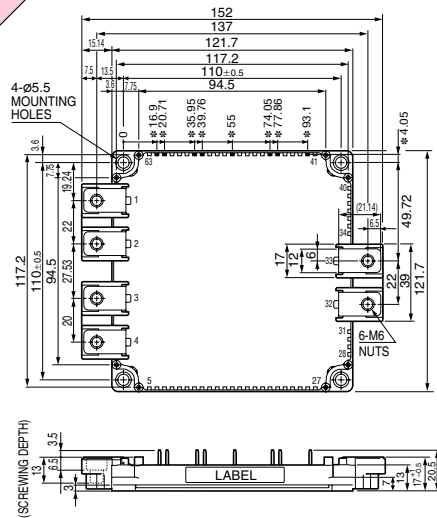
**CM35MX-24A  
CM50MX-24A  
CM75MX-12A,-24A  
CM100MX-12A**



# Power MOSFET Modules

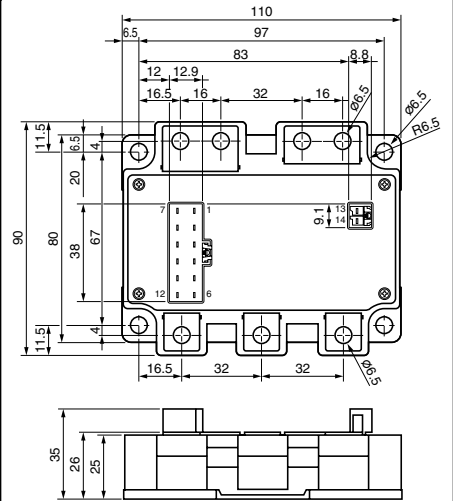
**NXL21**

**CM600DXL-24A  
CM1000DXL-24A**



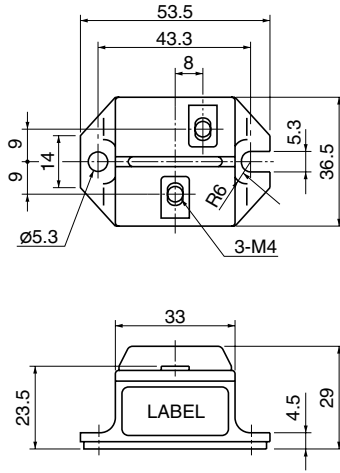
**F601**

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

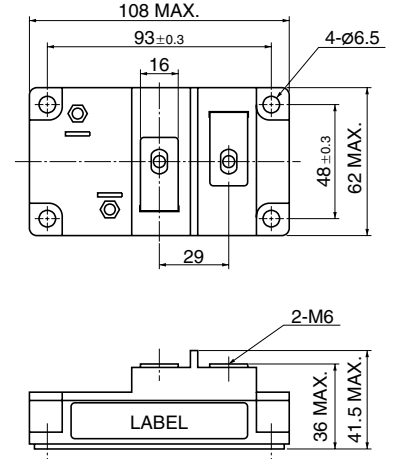


# Diode Modules

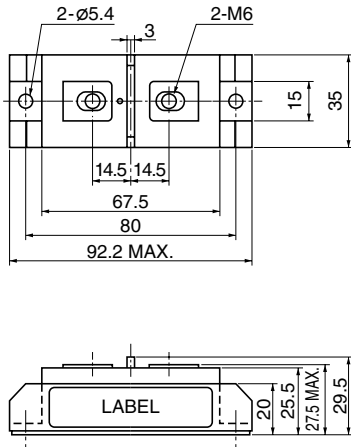
**R3**  
RM50HA-12F,-20F,-24F  
RM100HA-12F,-20F,-24F



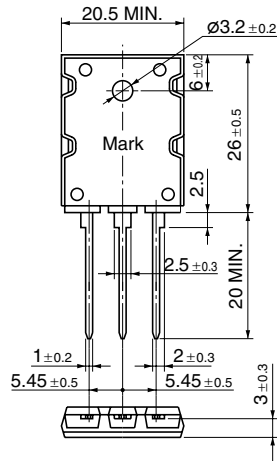
**R6**  
RM400HA-24S



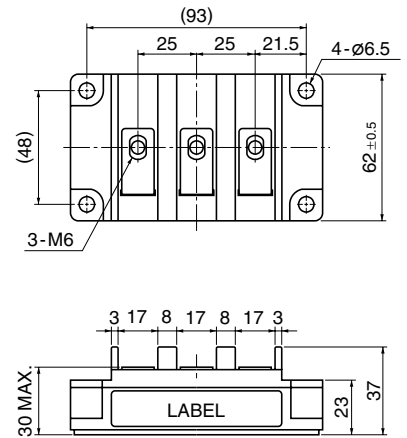
**R1**  
RM250HA-10F  
RM300HA-24F



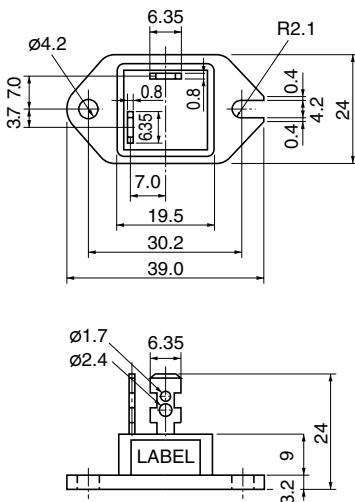
**R4**  
RM25HG-24S  
RM50HG-12S  
RM35HG-34S



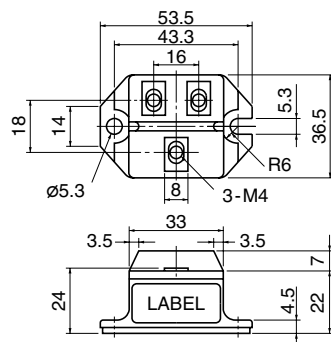
**R7**  
RM200DA-20F,-24F



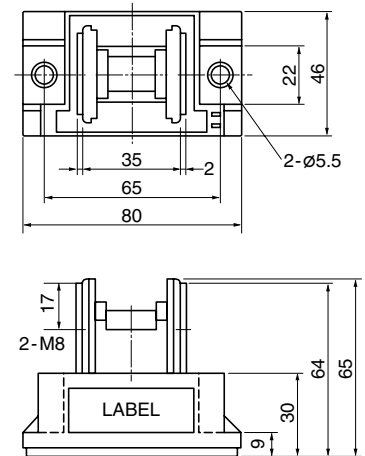
**R2**  
RM20HA-12F,20F,-24F



**R5**  
RM100C1A-12F,-20F,-24F  
RM100CA-12F,-20F,-24F  
RM200HA-20F,-24F  
RM20C1A-6S,-12F,-12S,-20F,-24F  
RM20CA-6S,-12F,-12S,-20F,-24F  
RM20DA-12F,-12S,-20F,-24F  
RM50C1A-6S,-12F,-12S,-20F,-20S,-24F  
RM50CA-6S,-12F,-12S,-20F,-20S,-24F  
RM50DA-12F,-12S

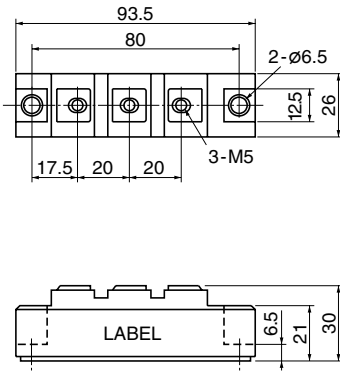


**R8**  
RM500HA-M,-H,-24,-2H

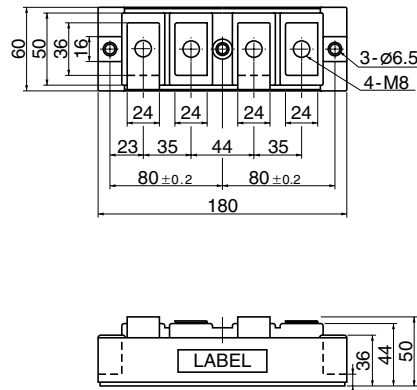


**R9**

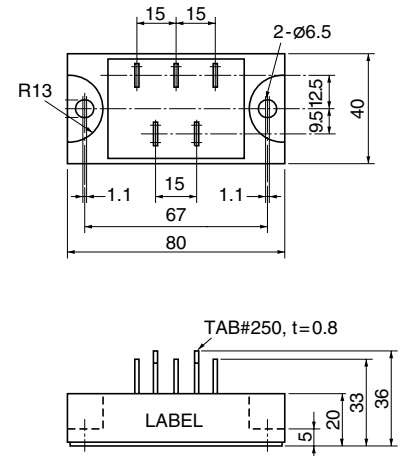
RM30CZ-M,-H  
 RM30DZ-M,-H  
 RM60CZ-M,-H,-24,-2H  
 RM60DZ-M,-H,-24,-2H  
 RM100CZ-M,-H,-24,-2H  
 RM100DZ-M,-H,-24,-2H

**R12**

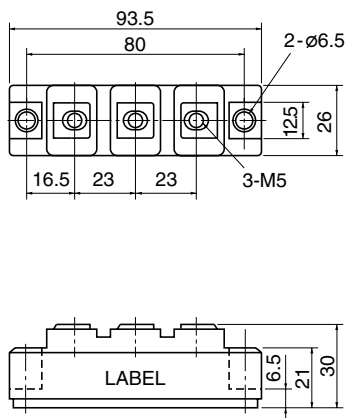
RM500DZ-M,-H,-24,-2H  
 RM500UZ-M,-H,-24,-2H

**R15**

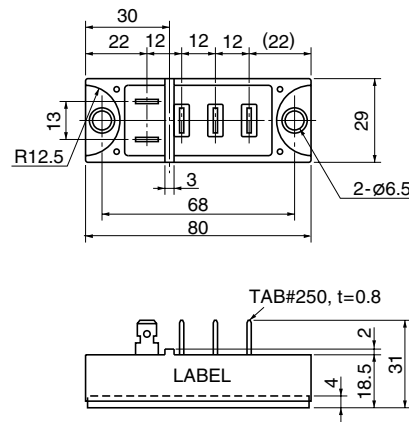
RM20TA-24,-2H

**R10**

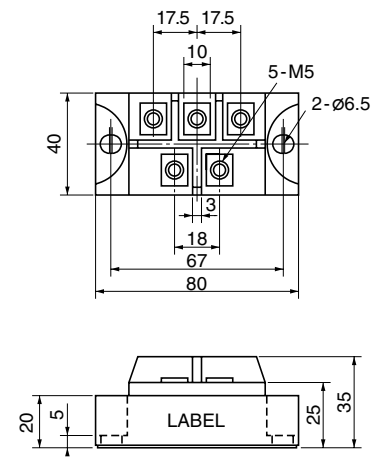
RM30CZ-24,-2H  
 RM30DZ-24,-2H  
 RM50DZ-40  
 RM100DZ-40

**R13**

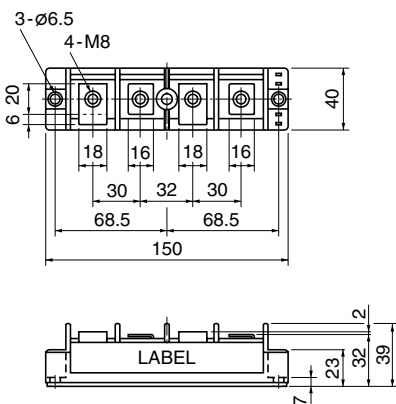
RM10TA-M,-H,-24,-2H  
 RM15TA-M,-H,-24,-2H

**R16**

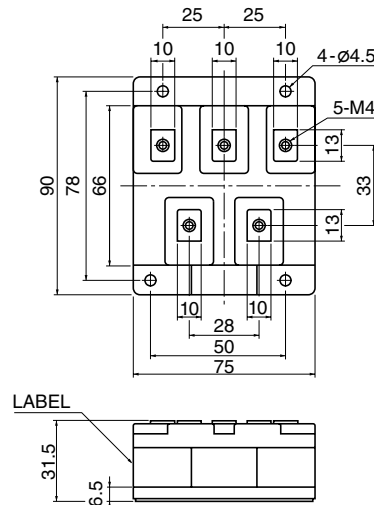
RM30TA-M,-H

**R11**

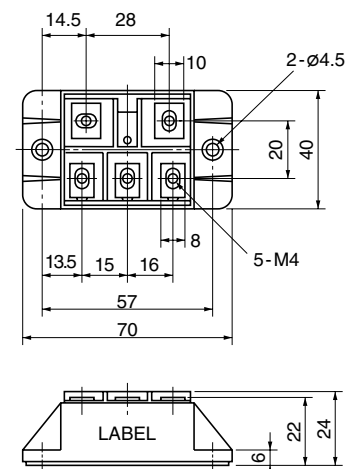
RM150CZ-M,-H,-24,-2H  
 RM150DZ-M,-H,-24,-2H  
 RM150UZ-M,-H,-24,-2H  
 RM250CZ-M,-H,-24,-2H  
 RM250DZ-M,-H,-24,-2H  
 RM250UZ-M,-H,-24,-2H

**R14**

RM15TC-40  
 RM30TC-40

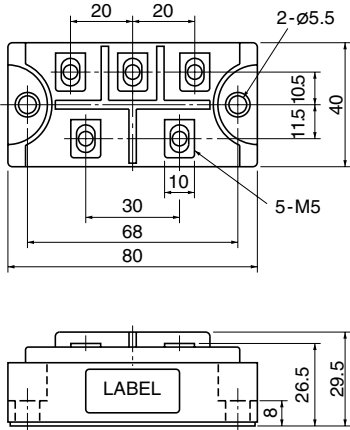
**R17**

RM30TB-M,-H

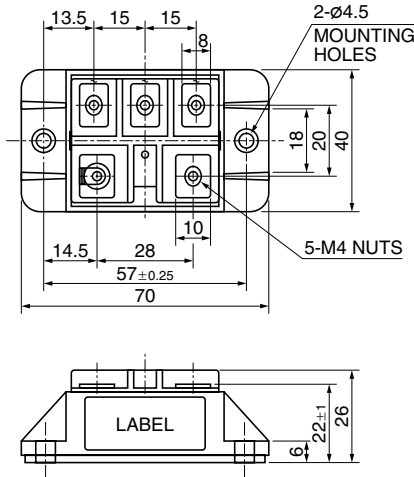




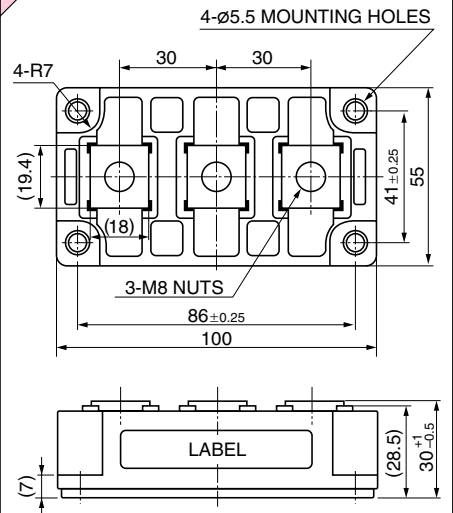
**R18** RM30TC-24,-2H  
RM50TC-M,-H,-24,-2H



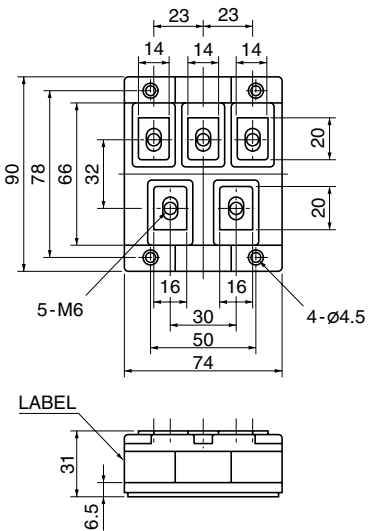
**R21** RM20TPM-2H,-24



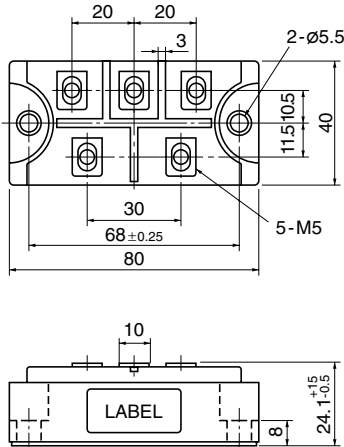
**R24** RM300CA-9W



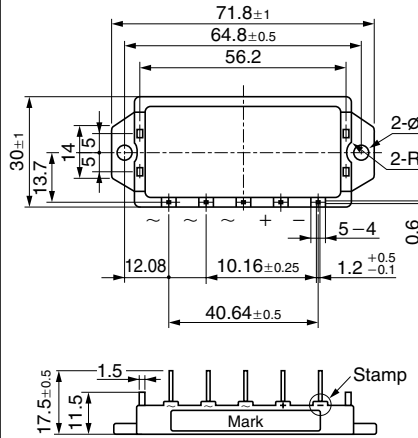
**R19** RM75TC-M,-H,-24,-2H



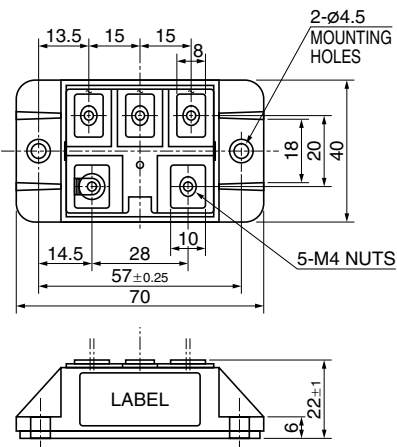
**R22** RM75TPM-M,-H,-24,-2H



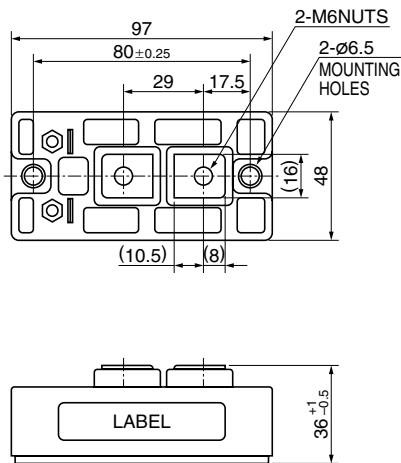
**R25** RM10TN-2H  
RM20TNA-H  
RM25TN-2H  
RM30TNA-H



**R20** RM20TPM-H,-M  
RM30TPM-H,-M

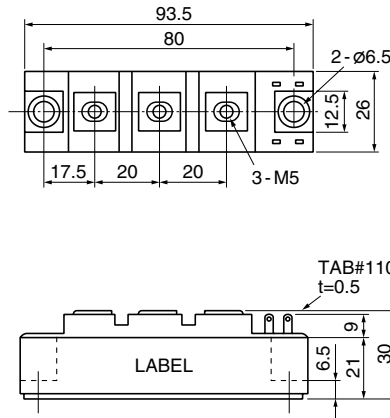


**R23** RM450HA-5H

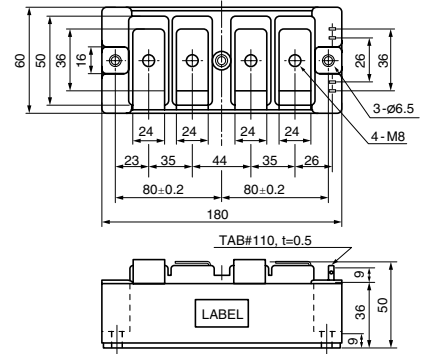


# Thyristor Modules

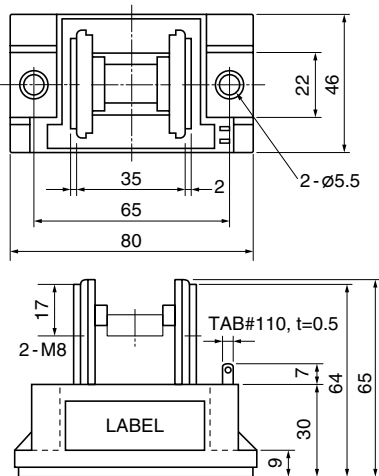
**T3**  
**TM25CZ/DZ-M,-H**  
**TM55CZ/DZ-M,-H**  
**TM90CZ/DZ-M,-H**



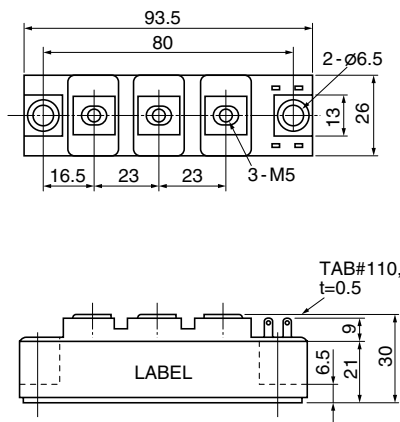
**T6**  
**TM400CZ/DZ/PZ/UZ-M,-H,-24,-2H**



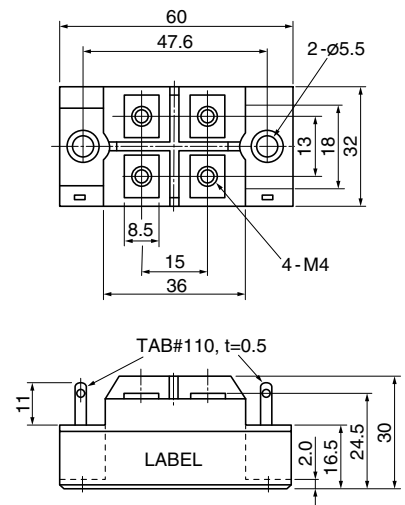
**T1**  
**TM400HA-M,-H,-24,-2H**



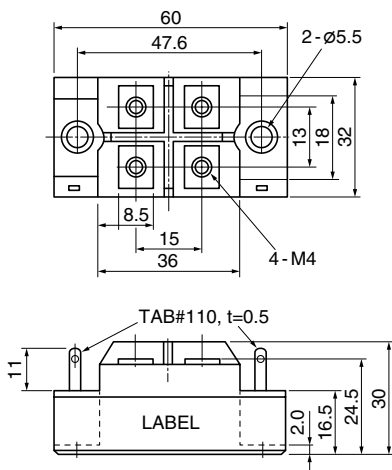
**T4**  
**TM25CZ/DZ-24,-2H**  
**TM55CZ/DZ-24,-2H**  
**TM90CZ/DZ-24,-2H**



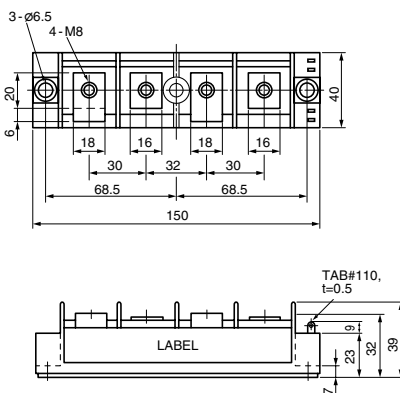
**T7**  
**TM20RA-M,-H**



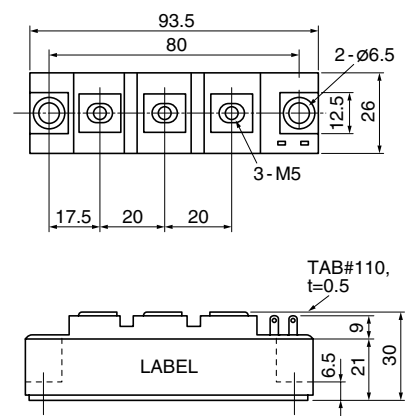
**T2**  
**TM20DA-M,-H**



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

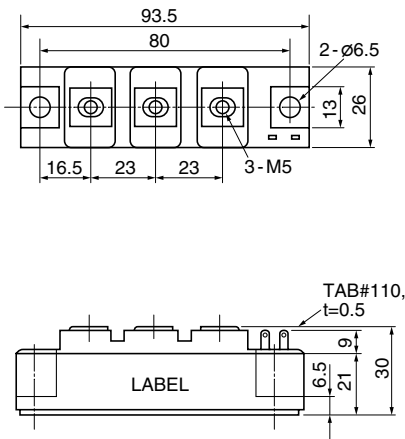


**T8**  
**TM25EZ/RZ-M,-H**  
**TM55EZ/RZ-M,-H**  
**TM90EZ/RZ-M,-H**



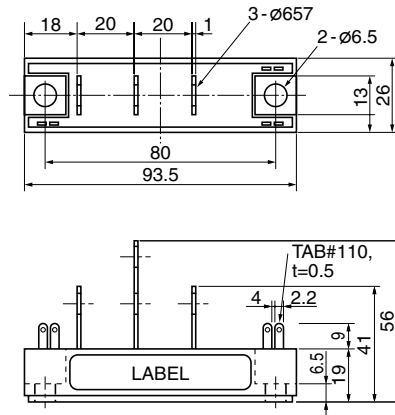
**T9**

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



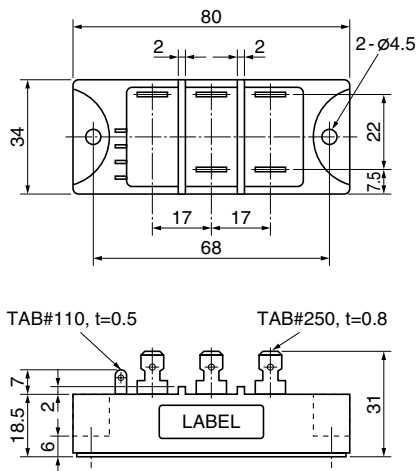
**T12**

**TM60SA-6**  
**TM90SA-6**



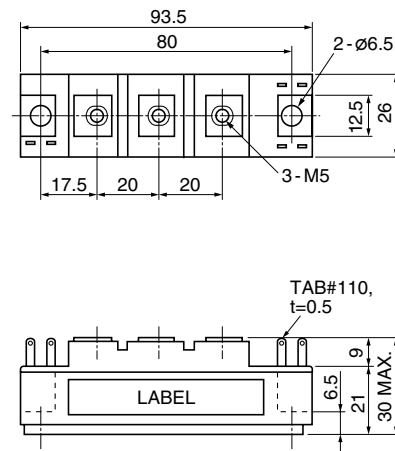
**T10**

**TM10T3B-M,-H**



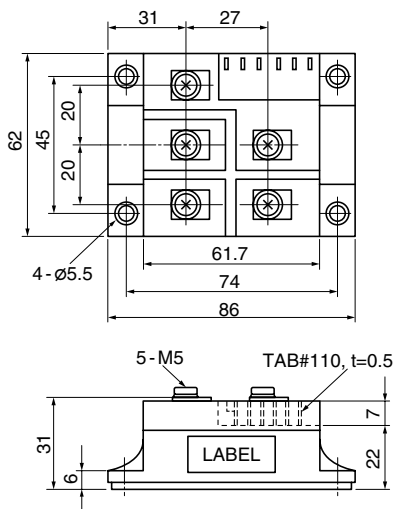
**T13**

**TM60SZ-M**  
**TM100SZ-M**



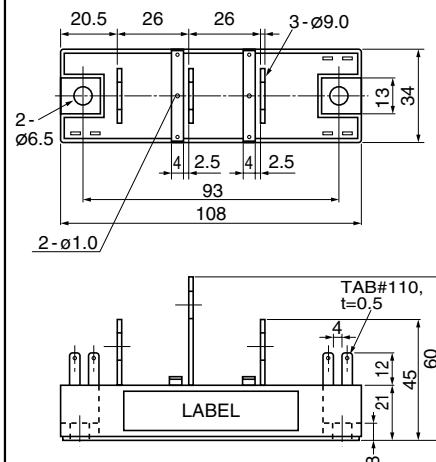
**T11**

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



**T14**

**TM150SA-6**

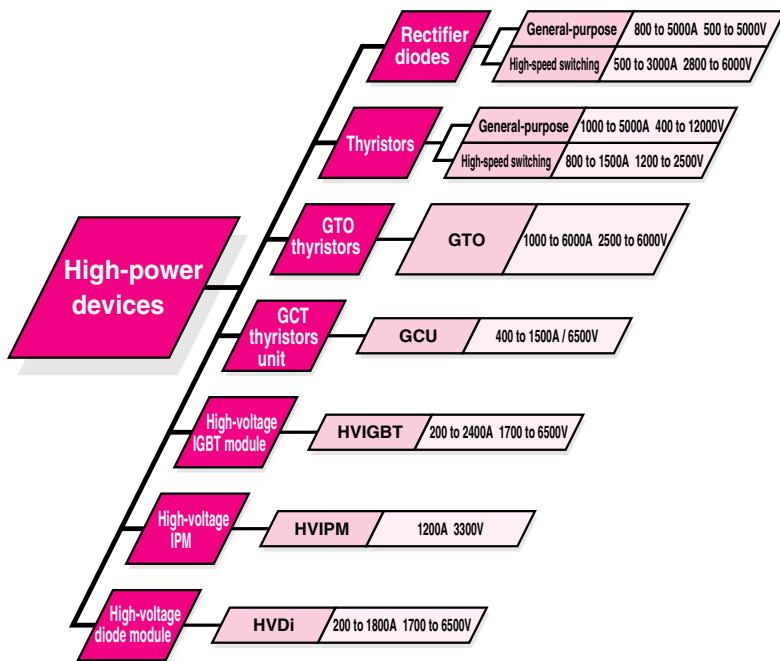
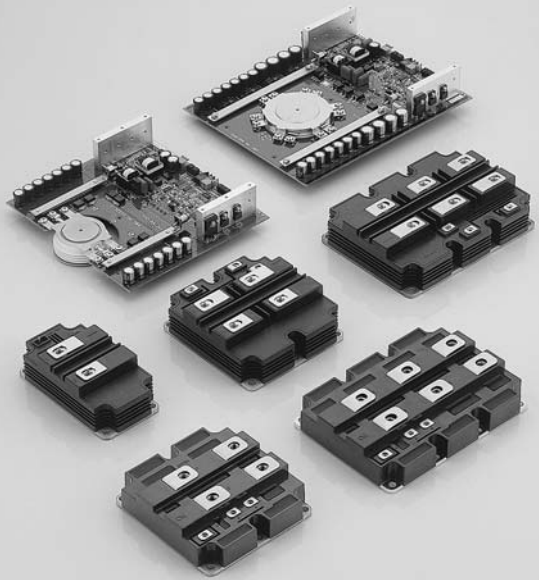


# High-power Devices

## Large Product Variety for Wide-Ranging Needs

High-power devices are semiconductor devices represented by gate commutated turn-off (GCT) thyristors and high-voltage insulated-gate bipolar transistor (HVIGBT) modules, and these devices are now used in equipment designed for traction, including high-speed express trains, and in power system equipment.

We offer a variety of high-power devices to suit diversified applications. These devices include diodes, thyristors, GTO thyristors, GCT thyristors, HVIGBT modules, and high-voltage intelligent power modules (HVIPM).



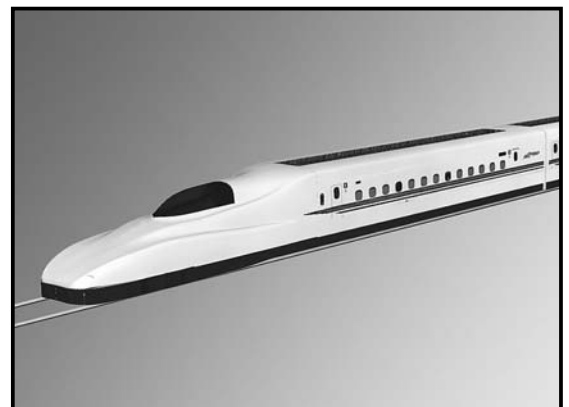
## ■ Naming system

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

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

## ■ Types and symbols

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



# GTO/GCT Thyristors and HVIGBT Module Series

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

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

The GCT thyristor is high-power device that takes the place of existing GTO thyristors. Because the turn-off capability has rapidly improved, and the turn-off time shortened to about 1/10 of GTO thyristors, it is most suitable for applications which require series connection.

Because the GCT thyristor can be turned-off using only the clamping circuit, even if there is no snubber circuit like that required by the GTO thyristor, low-loss, small size and lighter equipment are achieved.

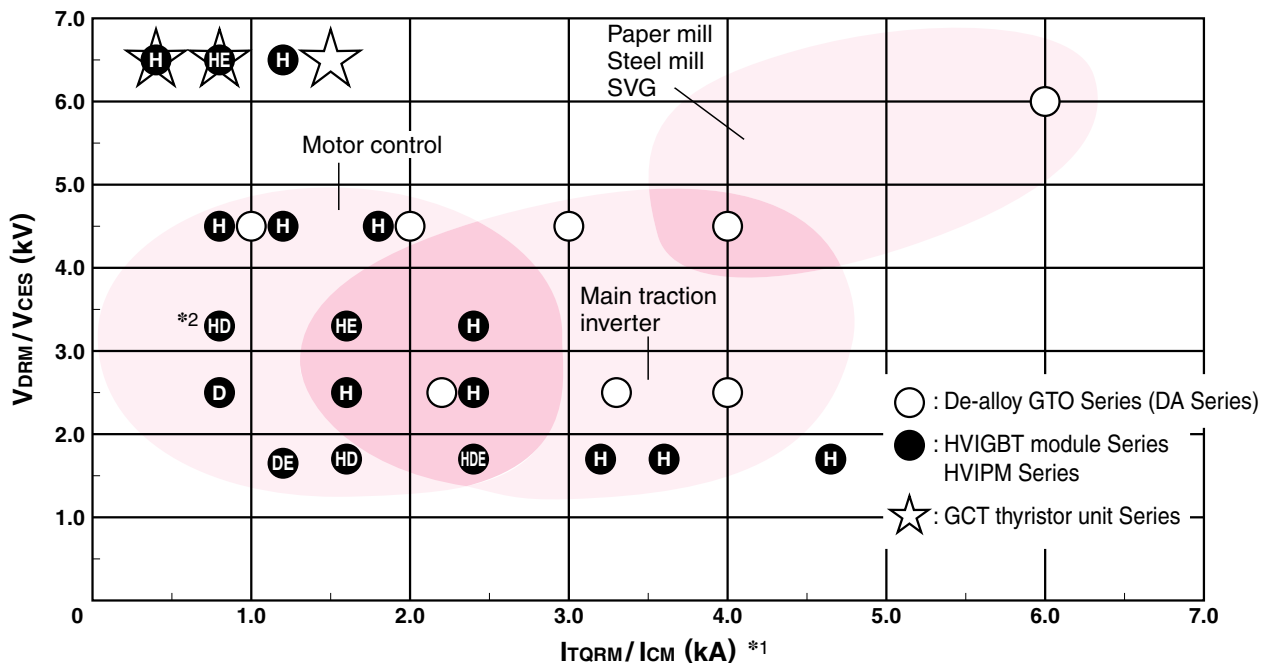
## ■ HVIGBT modules (High Voltage Insulated Gate Bipolar Transistor module)

HVIGBT modules are manufactured in an exclusive assembly lines under strict quality control. Use of aluminum silicon carbide (AlSiC) base plates enables improved reliability and extended service life for these modules.

With a line-up of high withstand voltage modules in the voltage range of 1.7kV to 6.5kV, the highest level in the world, Mitsubishi Electric is ready to meet various customer needs for applications in tractions and other large-scale industrial installations.

The newly-developed N Series HVIGBT modules are equipped with CSTBT™ chip that allows lower power loss and the minimization of package size.

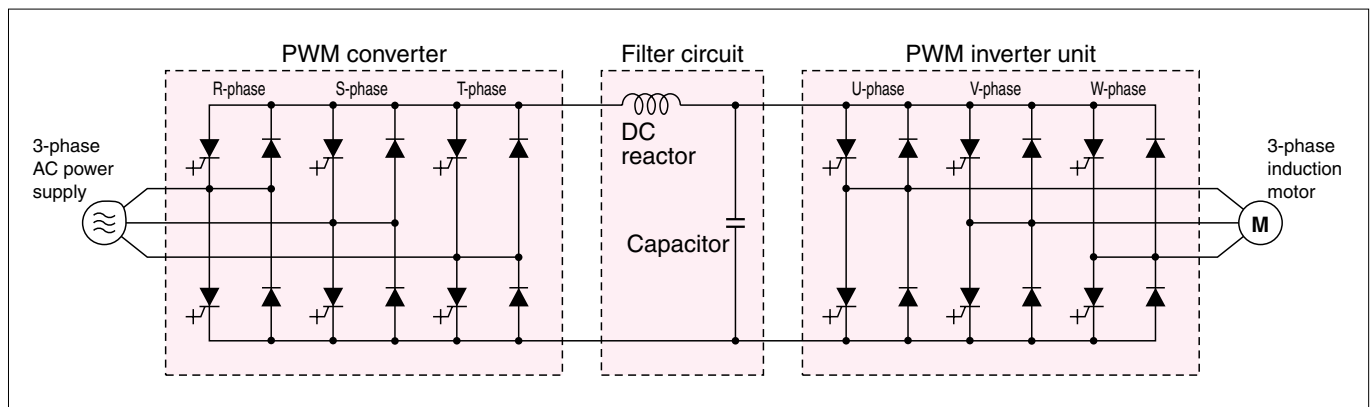
Mitsubishi Electric has also produced a series of "HG" modules that are housed in a well-insulated packages and demonstrate an insulating performance as high as 10.2kV.



\*1:  $I_{CM} = I_C \times 2$

\*2: "H" denotes the single type, "D" denotes the dual type, and "E" denotes the chopper type

## ■ Main circuit of PWM converter/inverter system



# Rectifier Diodes

## ■ Rectifier diodes for general use

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

\*1: Shown by the average forward current

## ■ Rectifier diodes for fast switching

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

\*1: Shown by the average forward current

## ■ Rectifier diodes for fast switching (Soft recovery type)

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

\*1: Shown by the average forward current

# Thyristors / GTO Thyristors

## Thyristors / Gate Turn-off Thyristors

### ■ Thyristors for general use

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

\*1: Shown by the average ON current

\*2: Current type inverter thyristor

### ■ Fast switching thyristors

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

\*1: Shown by the average ON current

Note: Numerical values in ( ) indicate the maximum shut-off time [ $\mu$ s]

### ■ GTO thyristors

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

\*1: Shown by the repeatable control ON current

# GCT Thyristor Unit

## Gate-commutated Turn-off Thyristor Unit

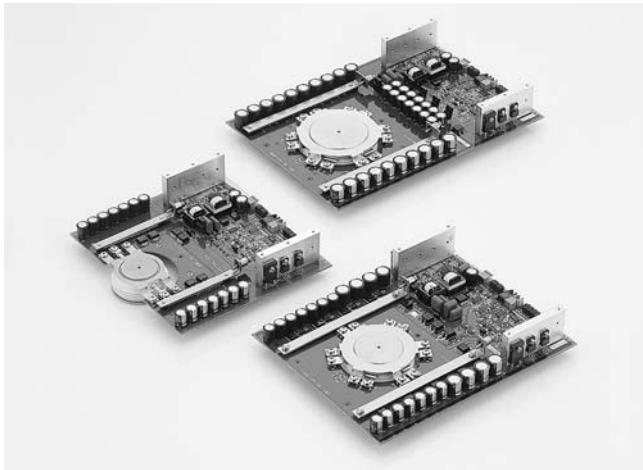


Image of the GCT Thyristor Unit Series

### ■ Features

GCT thyristor units are a new product which combine the a GCT thyristor and a gate driver.

The GCT thyristor is operated by an optimally designed gate driver to obtain the highest performance based on its performance characteristics.

### ■ Applications

The handling of GCT thyristor units is easy because the GCT thyristor and gate driver are combined into a single unit.

The GCT thyristor unit is most suitable for high-power electronic applications.

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

### ■ GCT units

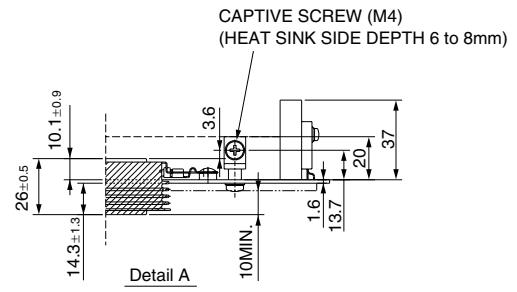
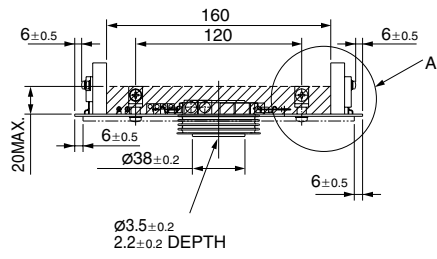
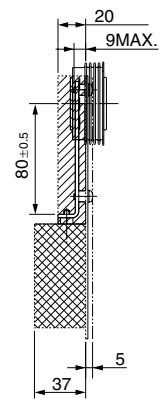
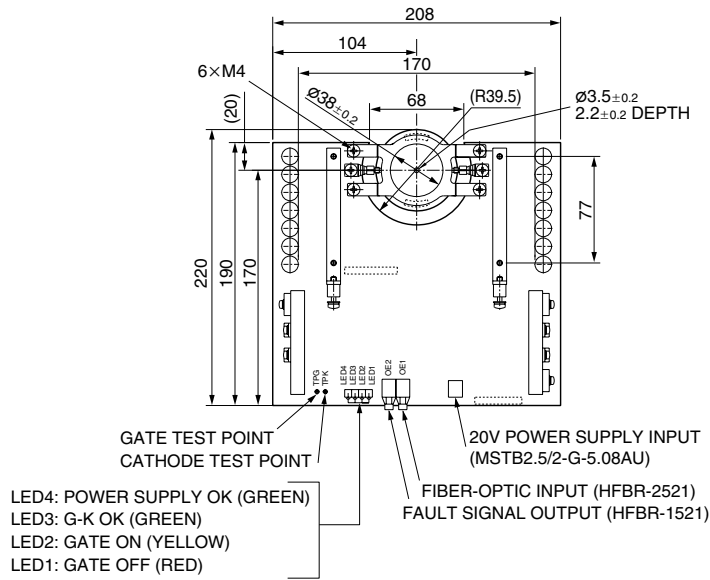
Type	Structure	V <sub>DRM</sub> (V)	V <sub>RRM</sub> (V)	I <sub>TORM</sub> (A)	T <sub>J</sub> (°C)	Frequency	Gate driver supply		Control input signal
		Repetitive peak off-state voltage	Repetitive peak reverse voltage	Repetitive controllable on-state current	Junction temperature	f (Hz)	V <sub>c</sub>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



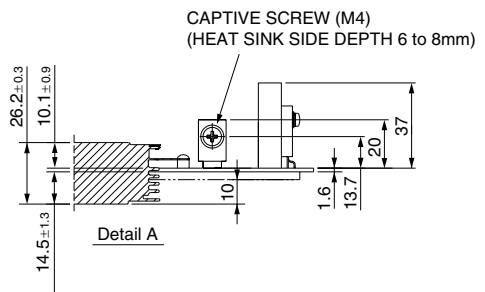
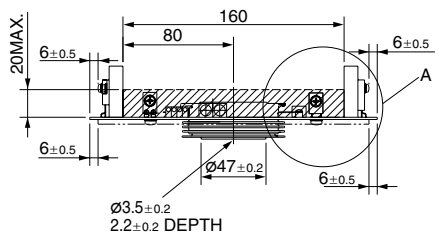
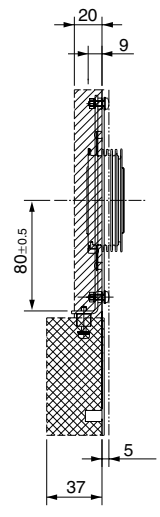
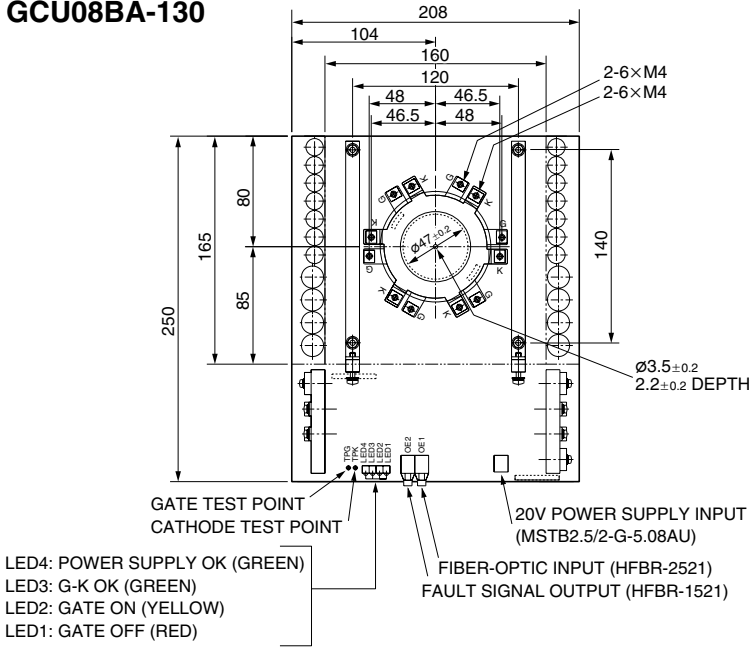
# GCT thyristor outline drawings

(Unit: mm)

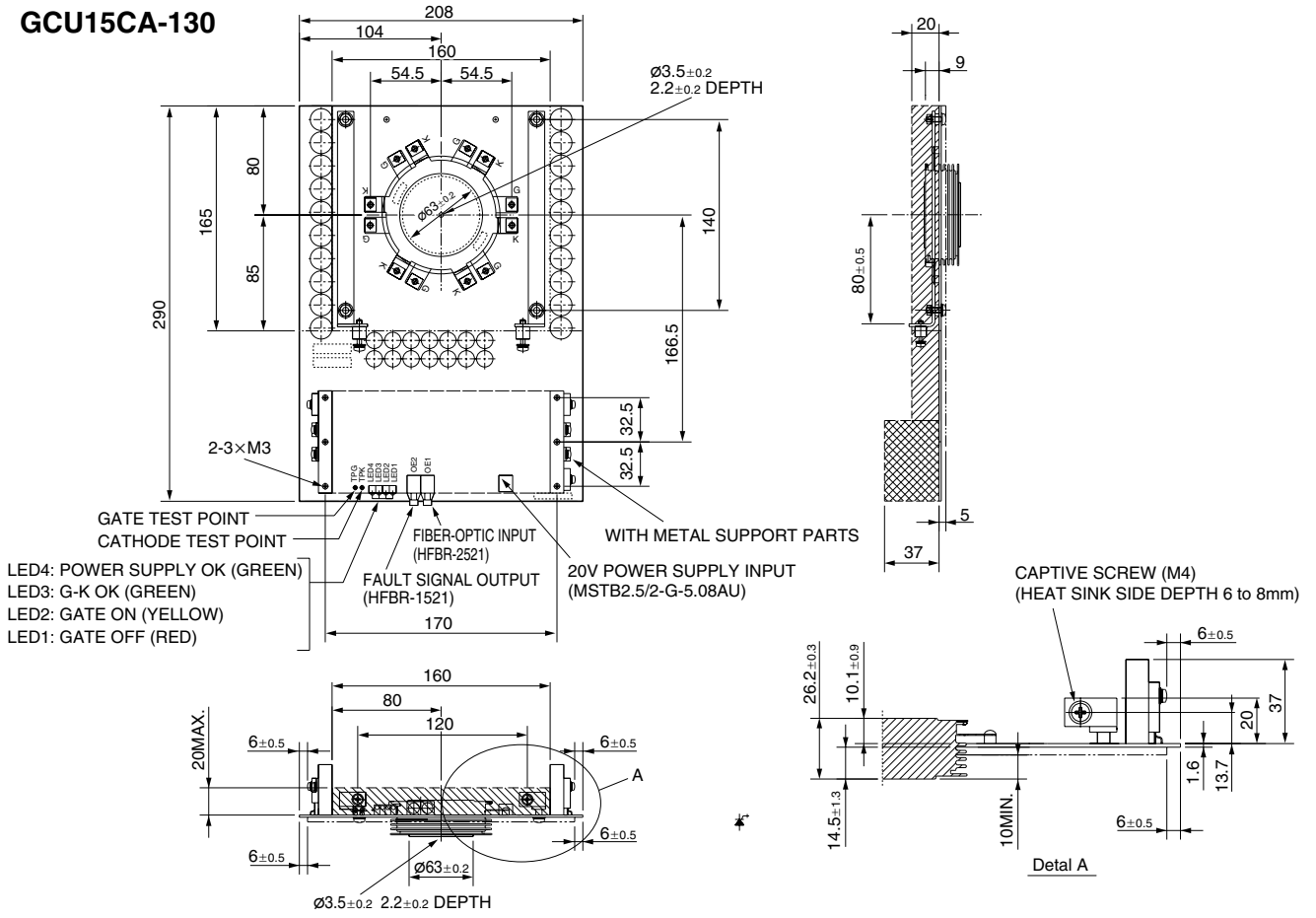
## GCU04AA-130



## GCU08BA-130



# GCU15CA-130



# HVIGBT Modules

## High-voltage Insulated-gate Bipolar Transistor Modules



Image of HVIGBT modules Series

### ■ Features

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

### ■ Applications

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

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

Connection	V <sub>CES</sub> (V)	Isolation voltage (kV)	I <sub>c</sub> (A)			
			750	1000	1200	1500
H	3300	6.0		CM1000HC-66R**		CM1500HC-66R*
				CM13		CM11
H	4500	6.0			CM1200HC-90R**	
					CM11	
E4	3300	6.0		CM1000E4C-66R**		
				CM12		
H	3300	10.2				CM1500HG-66R**
	4500					CM1200HG-90R**
	6500					CM17


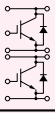

● Numbers CM11 to CM13, CM17 are recorded with product names to show the outline drawing numbers

★: New product  
★★: Under development

# HVIGBT Modules


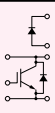

## High-voltage Insulated-gate Bipolar Transistor Modules

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

Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)			
		800	1200	1800	2400
H 	1700		CM1200HCB-34N*	CM1800HC-34N	CM2400HC-34N
				CM10	
				CM1800HCB-34N*	CM2400HCB-34N*
		CM7	CM8		
D 	1700	CM800DZB-34N*	CM1200DB-34N CM1200DC-34N		
		CM4	CM9		
E4 	1700		CM1200E4C-34N		
			CM10		

★: New product

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

Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)				
		200	400	600	900	1200
H 	3300		CM400HG-66H*			CM1200HG-66H*
			CM14			CM16
	4500				CM600HG-90H*	CM900HG-90H*
				CM15	CM16	
6500		CM200HG-130H*		CM600HG-130H*		
		CM14		CM16		
E2 	6500		CM400E2G-130H**			
			CM16			
E4 	6500		CM400E4G-130H**			
			CM16			

★: New product


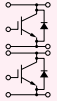


★★: Under development

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


# HVIGBT Modules

## High-voltage Insulated-gate Bipolar Transistor Modules


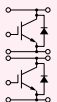

### High-voltage insulated-gate bipolar transistor modules <HC Series>: Low-loss, AlSiC baseplate

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

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

Connection		V <sub>CES</sub> (V)	I <sub>c</sub> (A)					
			400	600	800	900	1200	
H		2500			CM800HB-50H		CM1200HB-50H	
					CM7		CM8	
		3300			CM800HB-66H		CM1200HB-66H	
					CM7		CM8	
		4500	CM400HB-90H	CM600HB-90H		CM900HB-90H		
			CM7		CM8			

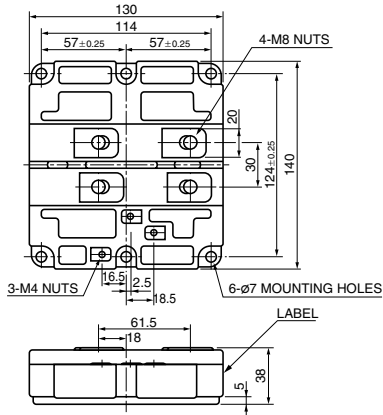
### High-voltage insulated-gate bipolar transistor modules <HA Series>: Cu baseplate

Connection		V <sub>CES</sub> (V)	I <sub>c</sub> (A)					
			400	600	800	1200		
H		1700			CM800HA-34H	CM1200HA-34H		
					CM1			
		2500			CM800HA-50H	CM1200HA-50H		
					CM2		CM3	
		3300			CM800HA-66H	CM1200HA-66H		
					CM2		CM3	
D		1700		CM600DY-34H				
				CM4				
		2500	CM400DY-50H					
			CM5					
		3300	CM400DY-66H					
			CM5					
E2		1700		CM600E2Y-34H				
			CM6					

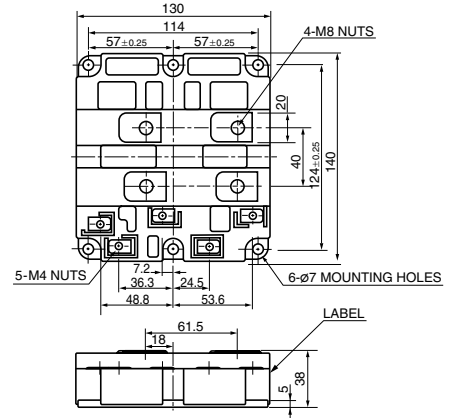
● Numbers CM1 to CM8 are recorded with product names to show the outline drawing numbers

# ■ HVIGBT modules outline drawings

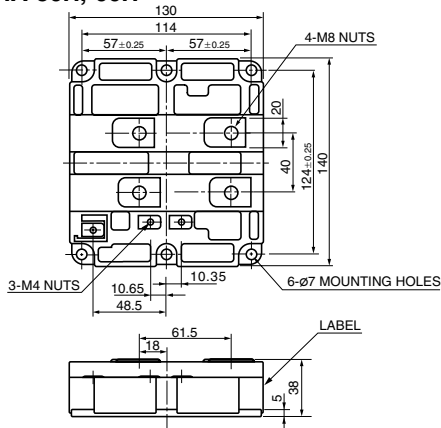
**CM1** CM800,1200HA-34H CM1200,1600HC-34H



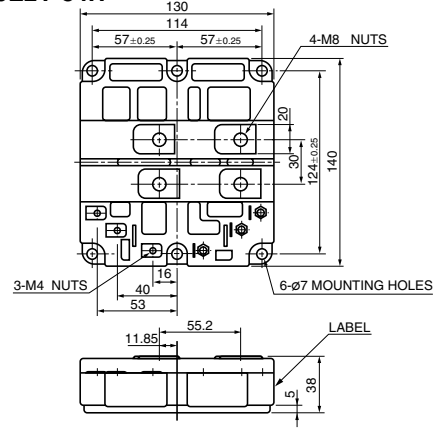
**CM5** CM400DY-50H,-66H



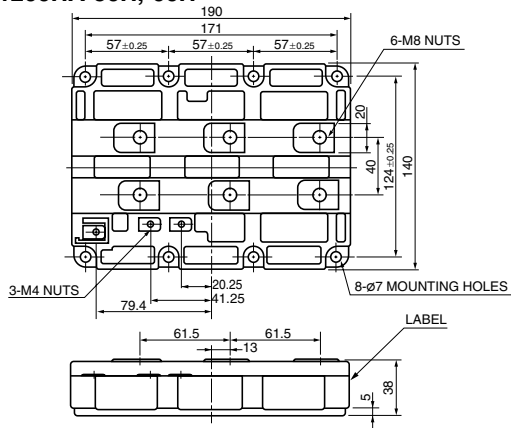
**CM2** CM800HA-50H,-66H



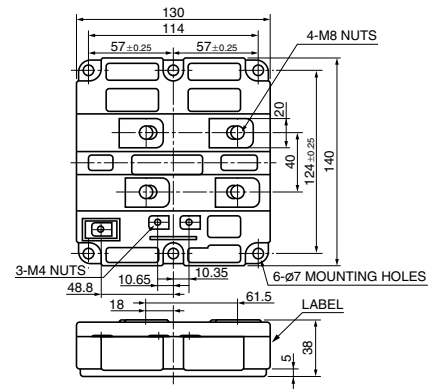
**CM6** CM600E2Y-34H



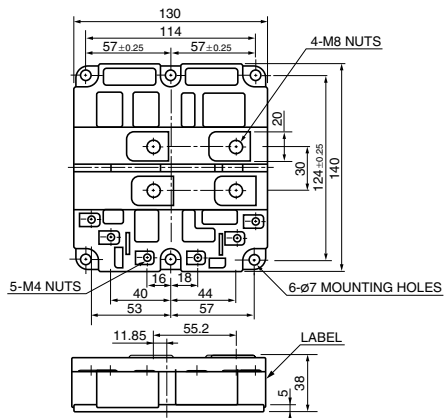
**CM3** CM1200HA-50H,-66H



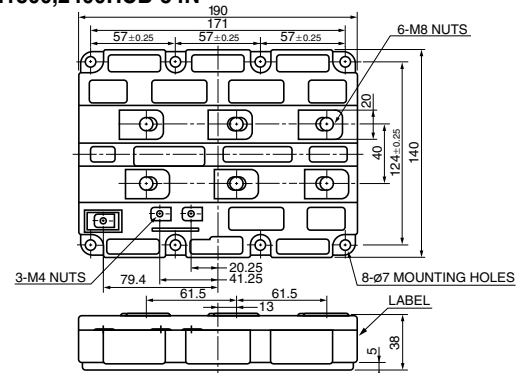
**CM7** CM400,600HB-90H CM1200HCB-34N  
CM800HB-50H,-66H CM800HC-66H



**CM4** CM600DY-34H CM800DZ-34H CM800DZB-34N

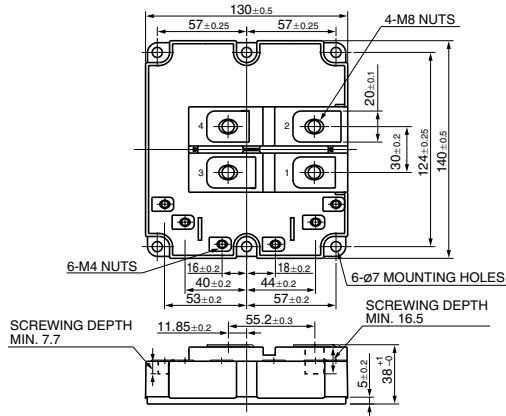


**CM8** CM800E2C/E4C/E6C-66H CM1200HB/HC-50H,-66H  
CM900HB/HC-90H CM1800,2400HC-34H  
CM1800,2400HCB-34N



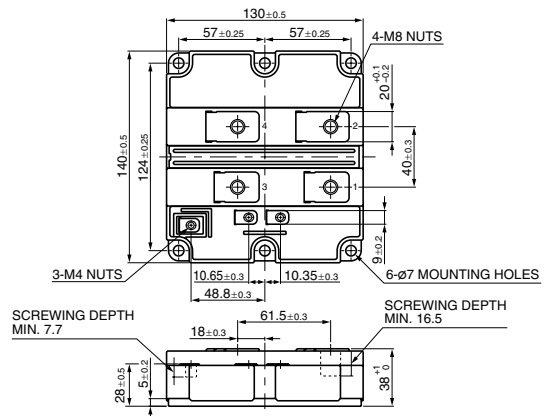
CM9

CM1200DB-34N CM1200DC-34N



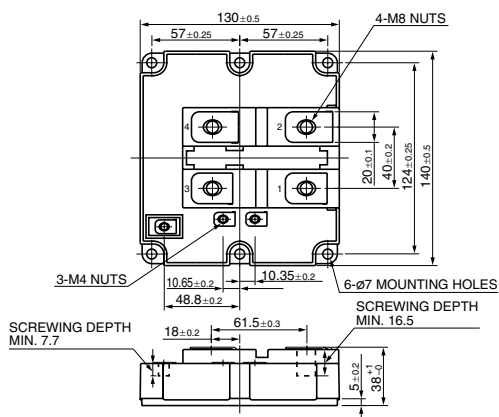
CM13

CM1000HC-66R



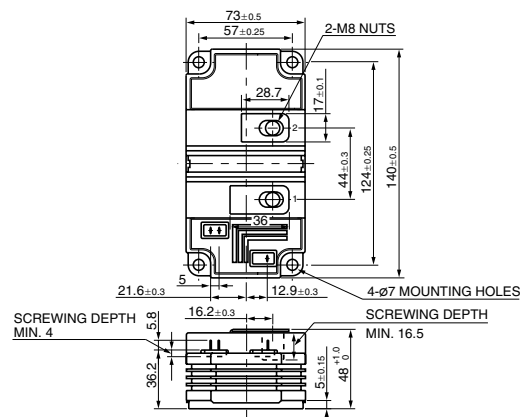
CM10

CM1200E4C-34N CM1800,2400HC-34N



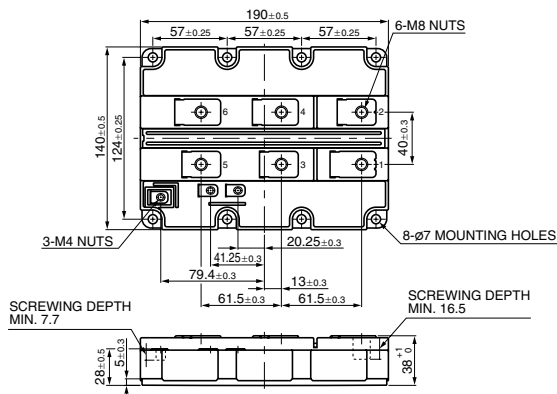
CM14

CM200HG-130H CM400HG-66H



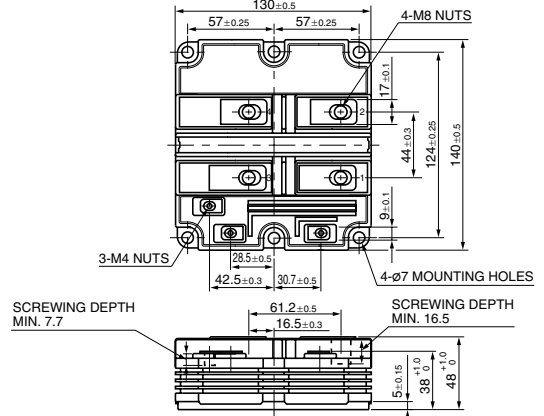
CM11

CM1200HC-90R CM1500HC-66R



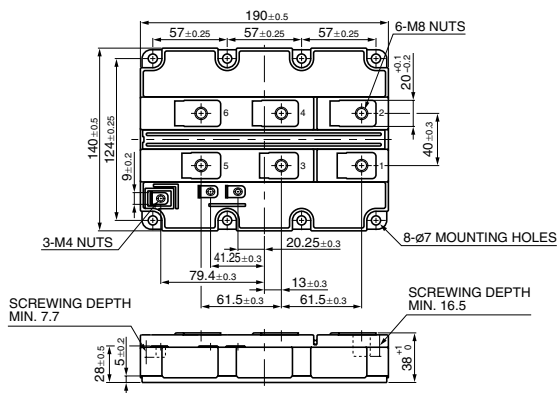
CM15

CM600HG-90H



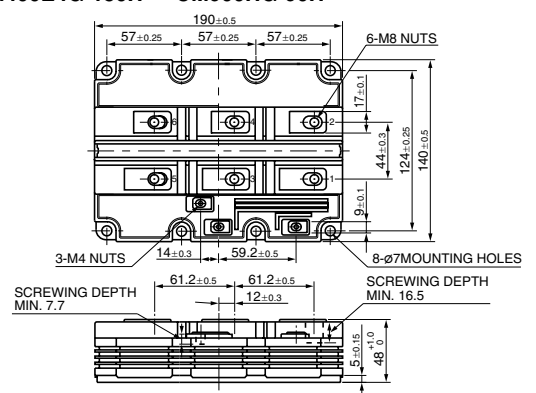
CM12

CM1000E4C-66R



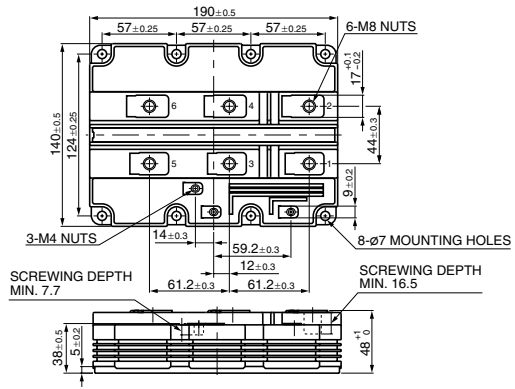
CM16

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



CM17

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





# HVDi Modules

## High-voltage Diode Modules

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

Connection		V <sub>RRM</sub> (V)	I <sub>c</sub> (A)	
			1000	
D		3300	<b>RM1000DC-66F**</b>	
			RM6	

\*\* : Under development

### ■ HVDi modules: High-isolation, AISiC baseplate

Connection		V <sub>RRM</sub> (V)	I <sub>c</sub> (A)				
			200	300	400	600	1200
D		3300			<b>RM400DG-66S*</b> RM4		<b>RM1200DG-66S*</b> RM4
		4500		<b>RM300DG-90S*</b> RM4			
		6500	<b>RM200DG-130S*</b> RM4			<b>RM600DG-130S*</b> RM4	

\* : New product

### ■ HVDi modules: AISiC baseplate

Connection		V <sub>RRM</sub> (V)	I <sub>c</sub> (A)			
			600	900	1200	1800
H		1700				<b>RM1800HE-34S</b> RM2
		3300			<b>RM1200HE-66S</b> RM2	
		4500	<b>RM600HE-90S</b> RM2	<b>RM900HC-90S*</b> RM3		

\* : New product

### ■ HVDi modules: Cu baseplate

Connection		V <sub>RRM</sub> (V)	I <sub>c</sub> (A)			
			400	600	900	1200
D		1700				<b>RM1200DB-34S*</b> RM5
		3300	<b>RM400DY-66S</b> RM1	<b>RM600DY-66S</b>		<b>RM1200DB-66S*</b> RM3
		4500			<b>RM900DB-90S*</b> RM3	

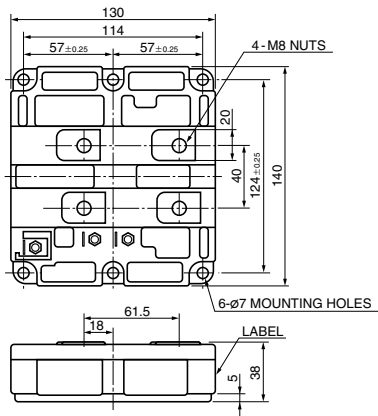
\* : New product

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

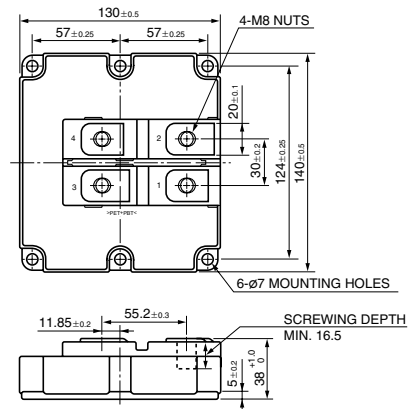
# HVDi modules outline drawings

(Unit: mm)

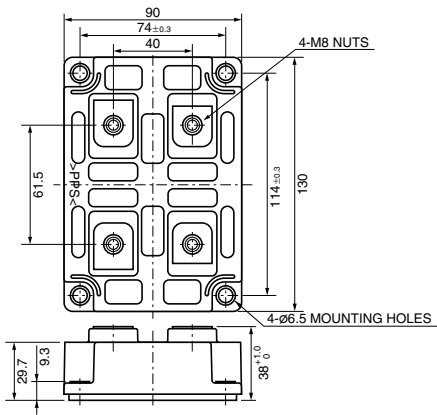
**RM1 RM400,600DY-66S**



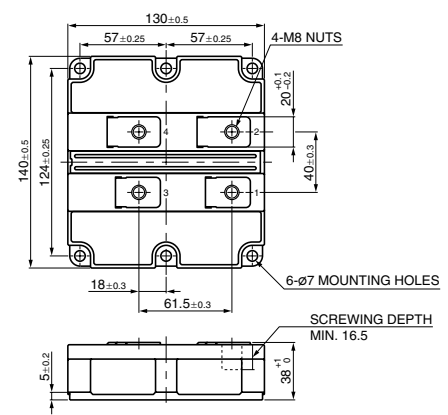
**RM5 RM1200DB-34S**



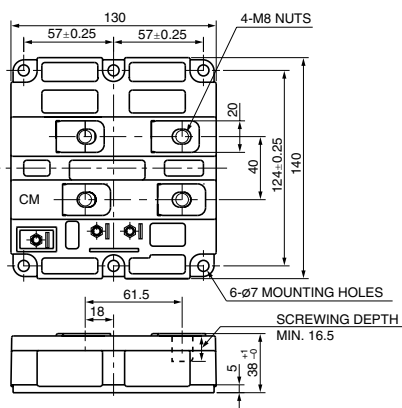
**RM2 RM600HE-90S RM1200HE-66S RM1800HE-34S**



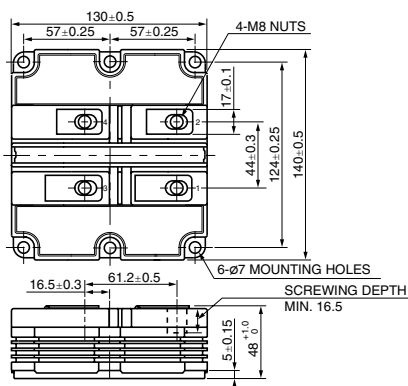
**RM6 RM1000DC-66F**



**RM3 RM900DB/HC-90S RM1200DB-66S**




**RM4 RM200,600DG-130S RM1200DG-66S RM300DG-90S RM400DG-66S**



# HVIPM

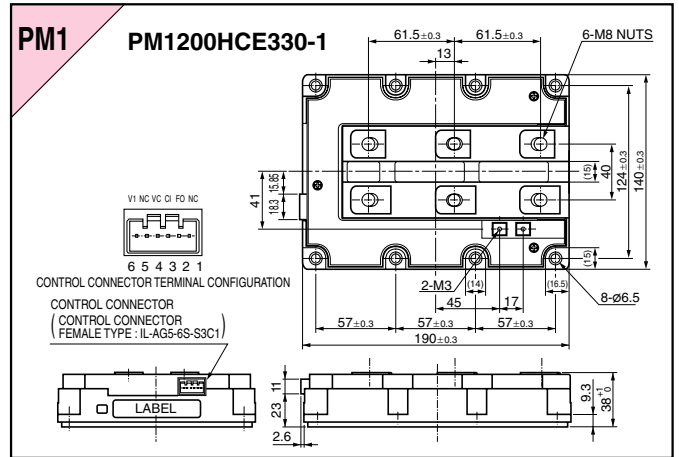
## High-voltage Intelligent Power Modules

### High-voltage intelligent power modules

Connection	$V_{RRM}$ (V)	$I_C$ (A) 1200
H 	3300	<b>PM1200HCE330-1</b> PM1

### Outline drawing

(Unit: mm)



# High-voltage Integrated Circuits

## 600V and 1200V Half-bridge Driver HVIC

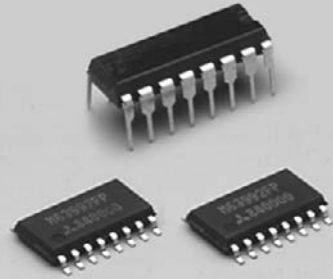
This product is a semiconductor integrated circuit designed to directly drive the power MOS/IGBT modules of half-bridge composition by integrating the 600V (1200V) and 8/24V dielectric elements onto one chip.

The internal installation of high-side/low-side driver circuits, protective circuits against power supply voltage drop and interlocking circuits enables a devices to drive/control the power elements without using the photocoupler from a logic circuit such as a microcomputer.

### ■ Applications

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

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

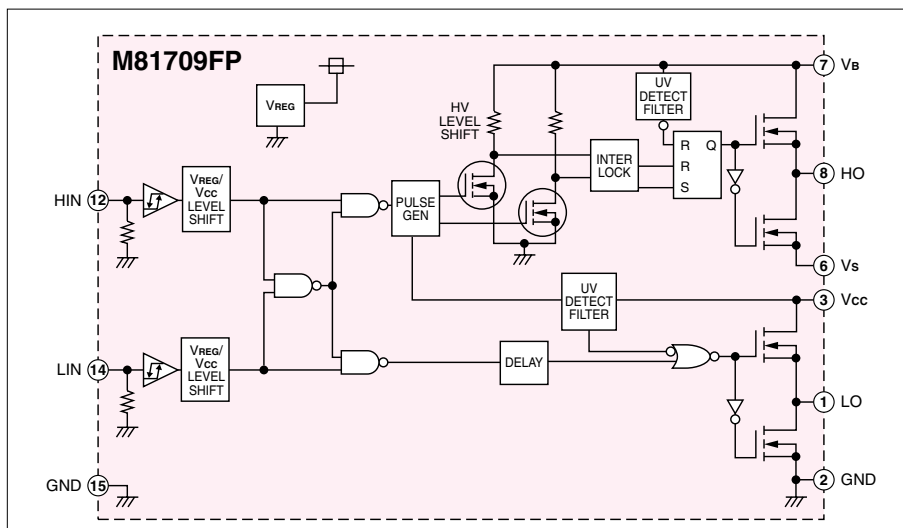


### ■ Reference by function

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

★★: Under development

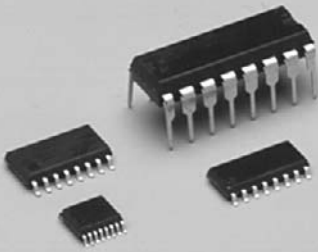
### ■ Block diagram



# Transistor Array

## Wide Product Range Helps Reduce Product Size and Weight

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



### ■ Applications

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

### ■ Codes for transistor array naming

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

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

### ■ Quick reference

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

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

★: New product  
★★: Under development



# Transistor Array

## Reference by function

Type	Unit	I <sub>o</sub> max [mA]	V <sub>o</sub> max [V]	Input-function voltage	Output current	Darlington transistor	With output clamp-diode	Low collector-emitter voltage	High-input threshold voltage	Mini-frat package	Package outlines	Outline drawings
M54513FP	8	50	40	H	Sink			●		●	20P2N	⑥
M54513P											18P4G	③
M54522FP	8	400	40	H	Sink	●	●			●	20P2N	⑥
M54522P											18P4G	③
M54523FP	7	500	50	H	Sink	●	●			●	16P2N	⑤
M54523P											16P4	②
M54530FP	7	400	40	H	Sink	●	●			●	16P2N	⑤
M54530P											16P4	②
M54531FP	7	400	40	H	Sink	●	●			●	16P2N	⑤
M54531WP **											16P4X	⑮
M54532FP	4	1500	50	H	Sink	●	●			●	16P2N	⑤
M54532P											16P4	②
M54561P	7	300	40	L	Source	●	●				16P4	②
M54562FP	8	500	50	H	Source	●	●			●	20P2N	⑥
M54562P											18P4G	③
M54563FP	8	500	50	H	Source	●	●			●	20P2N	⑥
M54563P											18P4G	③
M54564FP	8	500	50	H	Source	●				●	20P2N	⑥
M54564P											18P4G	③
M54566FP	7	400	50	L	Sink	●				●	16P2N	⑤
M54566WP **											16P4X	⑮
M54567FP	4	1500	50	L	Sink	●	●			●	16P2N	⑤
M54567P											16P4	②
M54580FP	7	150	50	L	Source	●				●	16P2N	⑤
M54580P											16P4	②
M54583FP	8	400	50	L	Sink	●				●	20P2N	⑥
M54583P											18P4G	③
M54585FP	8	500	50	H	Sink	●	●			●	20P2N	⑥
M54585KP										●	20P2E	⑨
M54585WP **											18P4X	⑰
M54585P											18P4G	③
M54587FP	8	500	50	L	Sink	●	●			●	20P2N	⑥
M54587P											20P4	④

★★: Under development

# Transistor Array

## Reference by function

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

★: New product

# Transistor Array

## ■ CMOS array

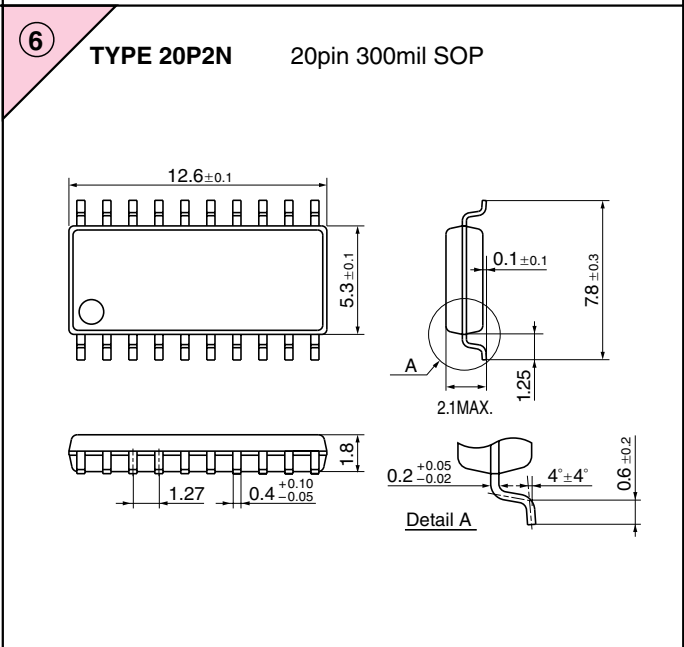
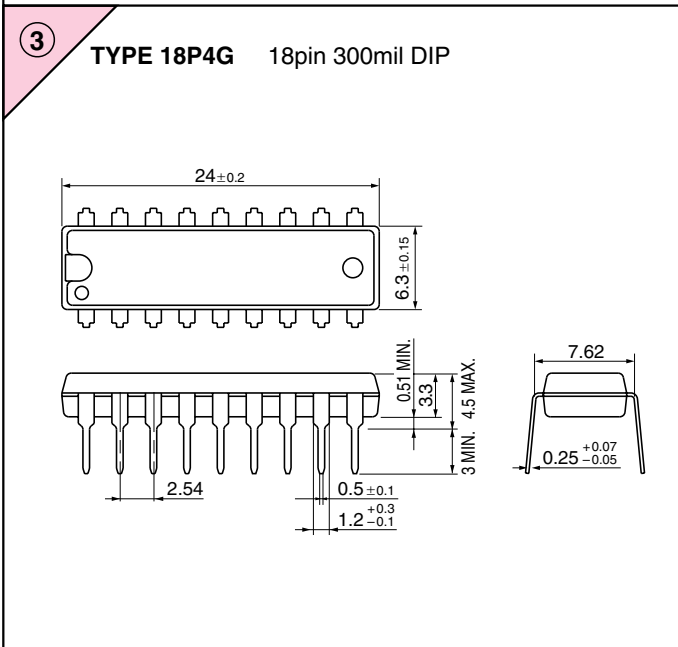
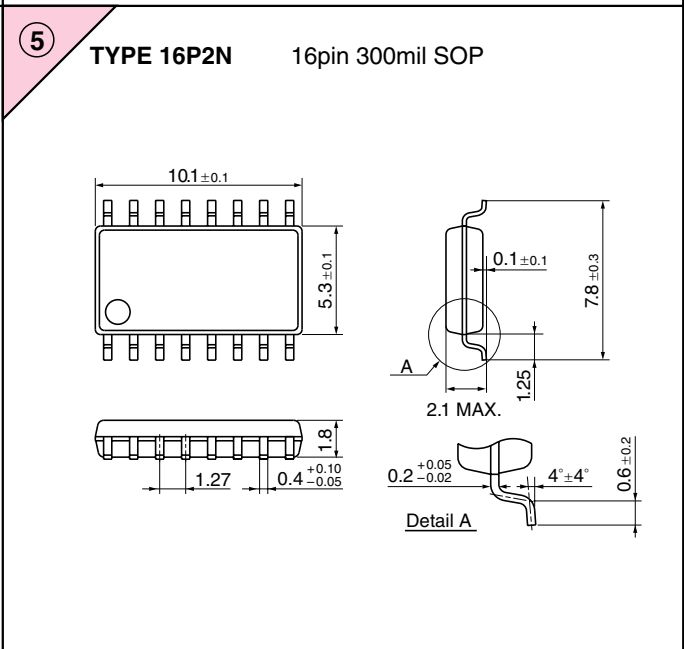
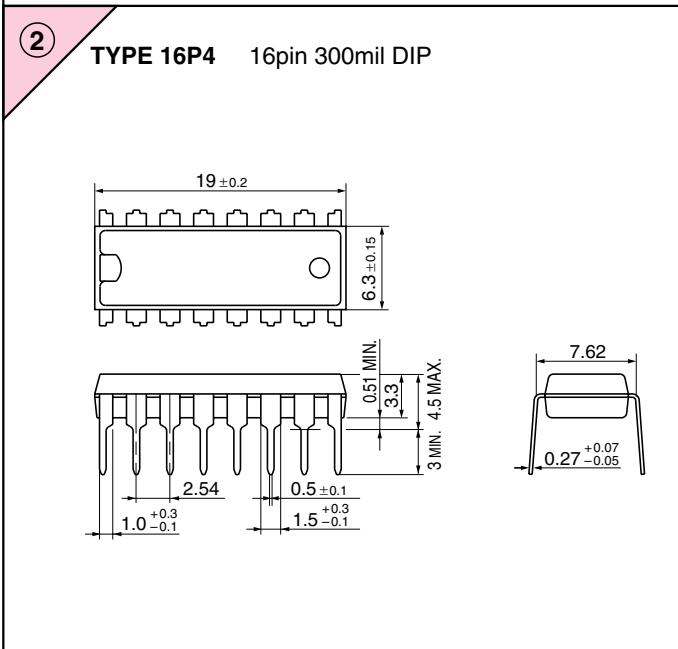
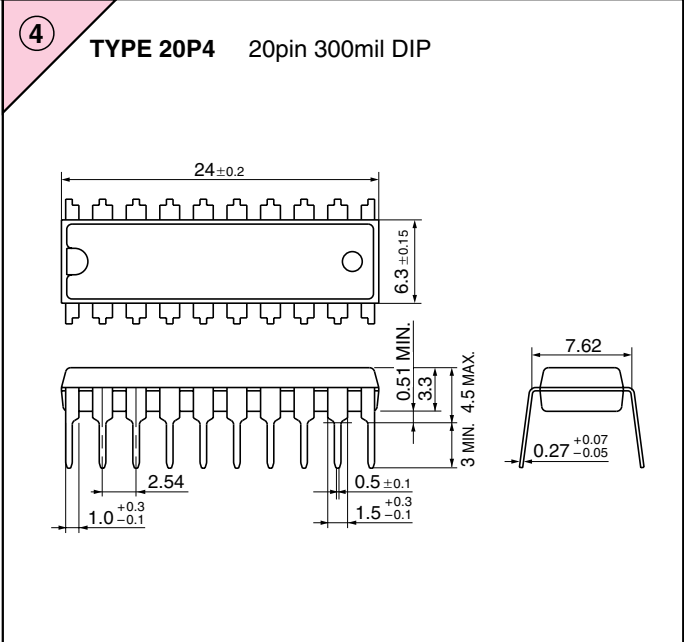
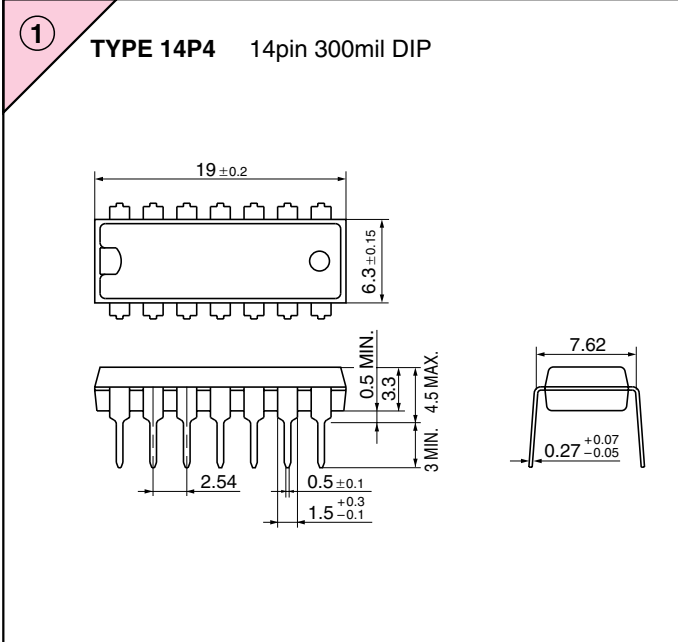
Type	Unit	I <sub>o</sub> max [mA]	V <sub>o</sub> max [V]	Output current	Function	Mini-frat package	Package outlines	Outline drawings
M81016P	8	200	40	Sink	OCTAL D-TYPE, FLIP-FLOP DRIVER WITH CLEAR		20P4B	⑬
M81016FP						●	20P2N	⑥
M81016KP						●	20P2E	⑨
M81049P							20P4	④
M81049FP						●	20P2N	⑥
M81049SP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

★★: Under development



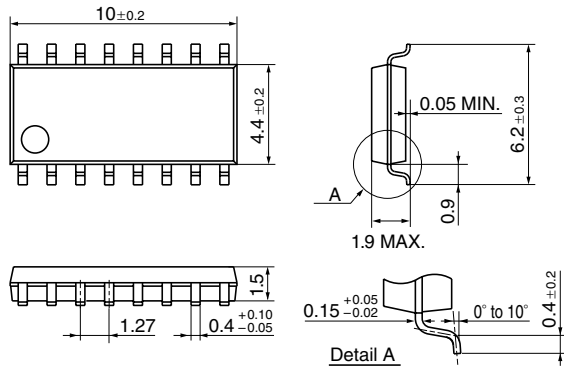
# High-voltage integrated circuits and transistor array outline drawings

(Unit: mm)



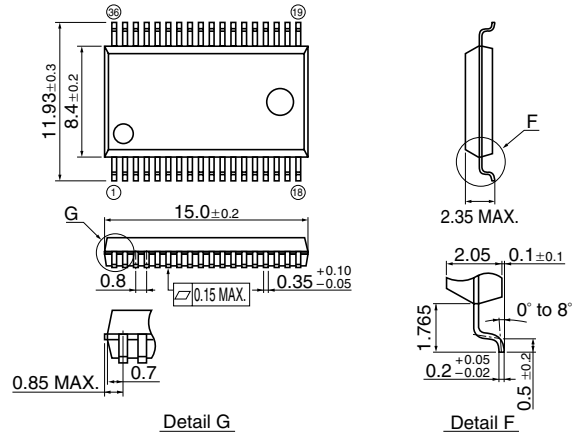
7

**TYPE 16P2S** 16pin 225mil SOP



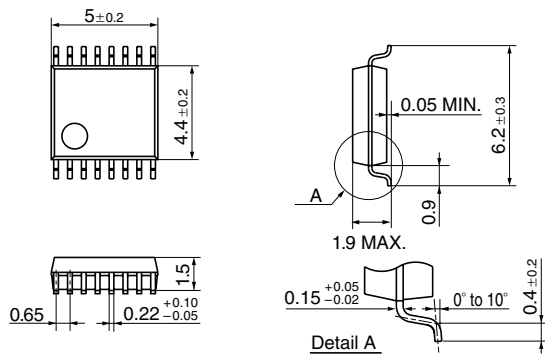
10

**TYPE 36P2R-D** 36pin 450mil SSOP



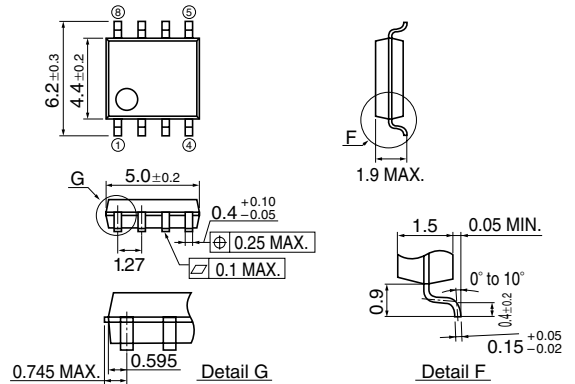
8

**TYPE 16P2Z** 16pin 225mil SSOP



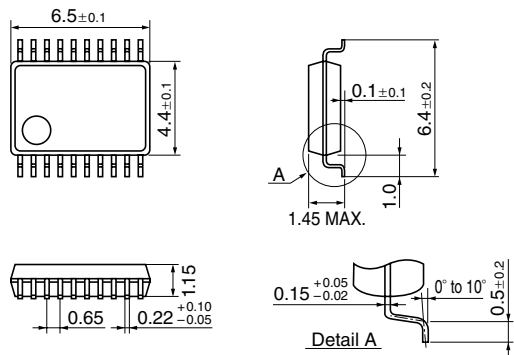
11

**TYPE 8P2S-A** 8pin 225mil SOP



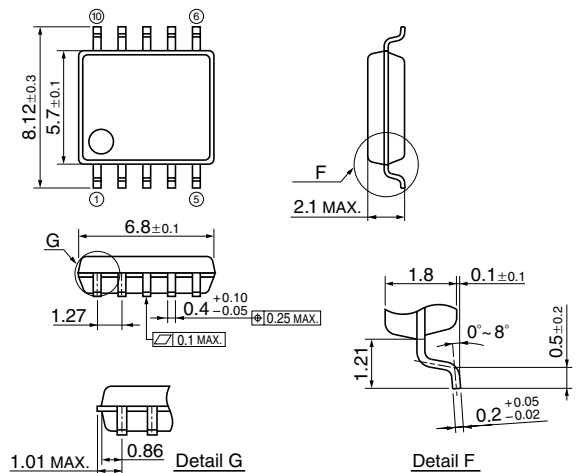
9

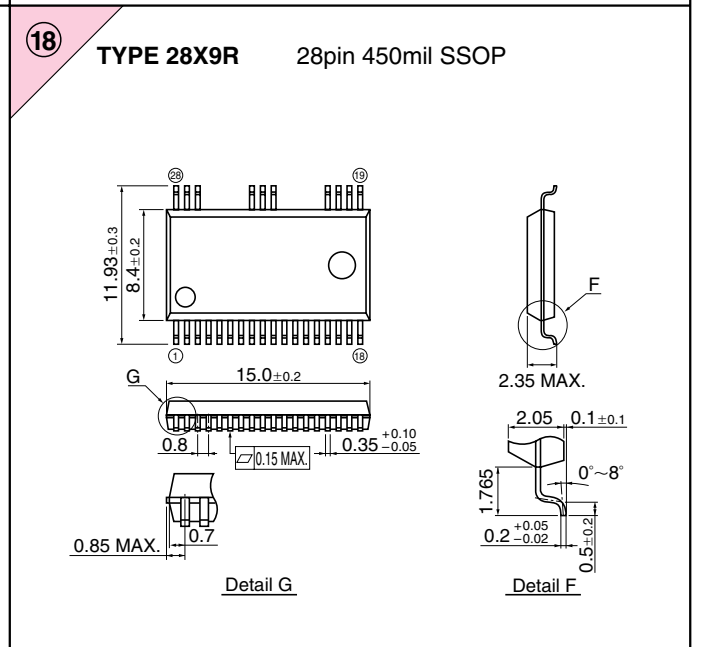
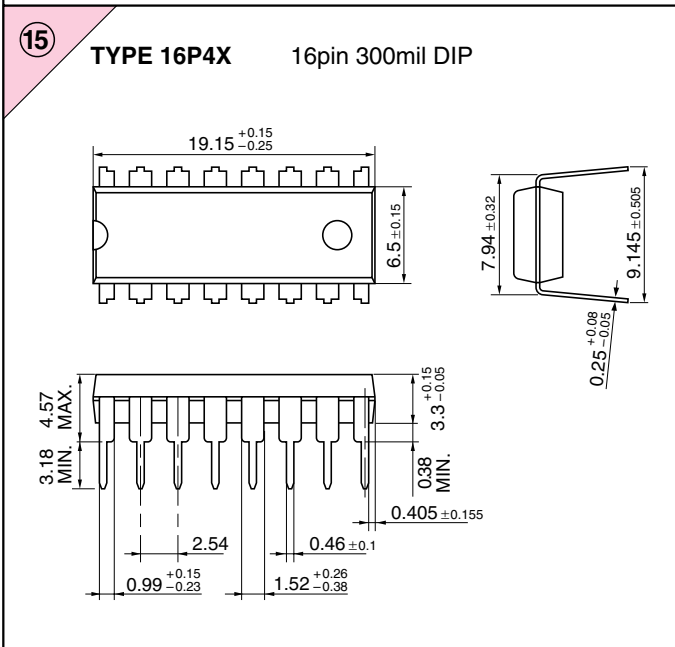
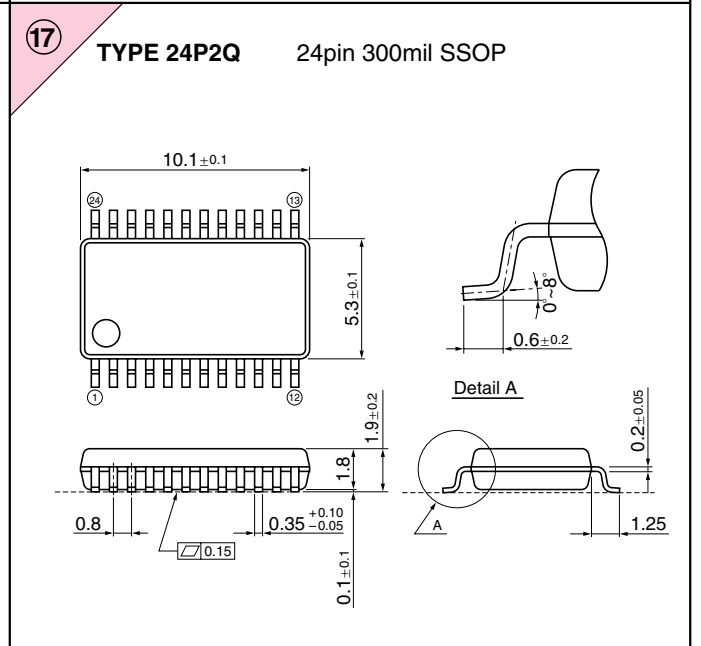
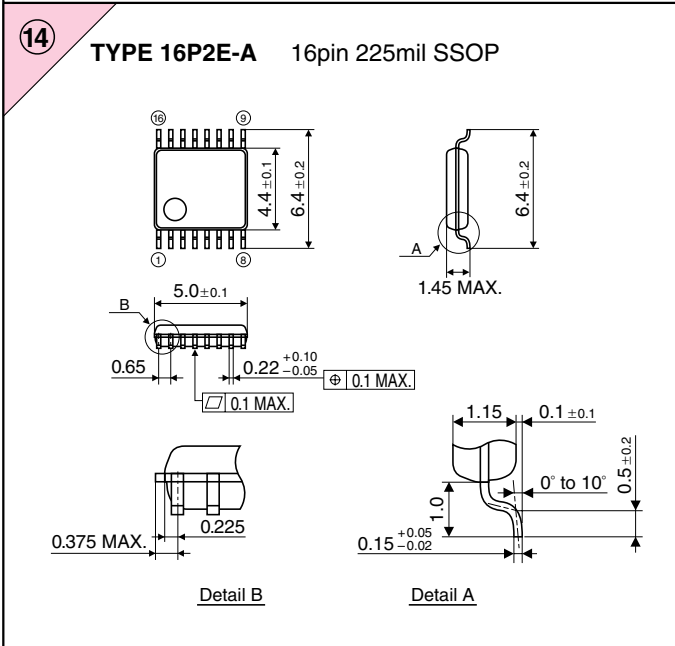
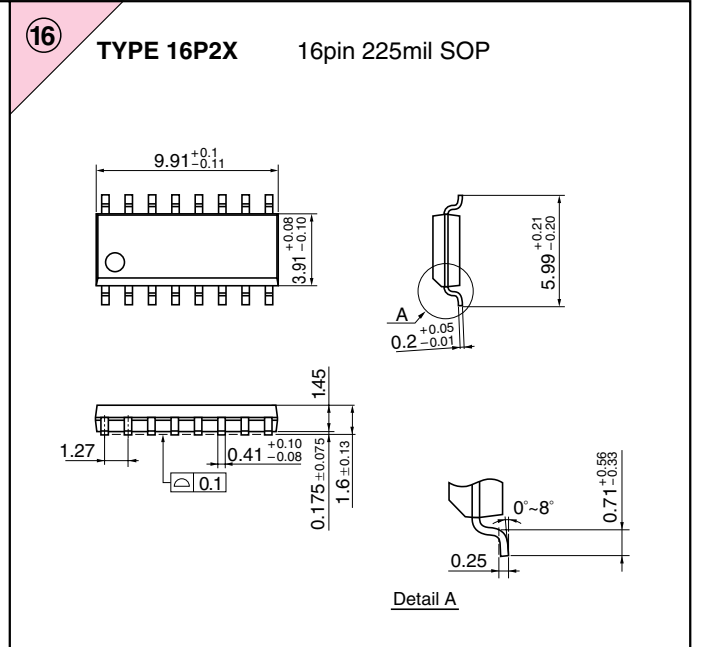
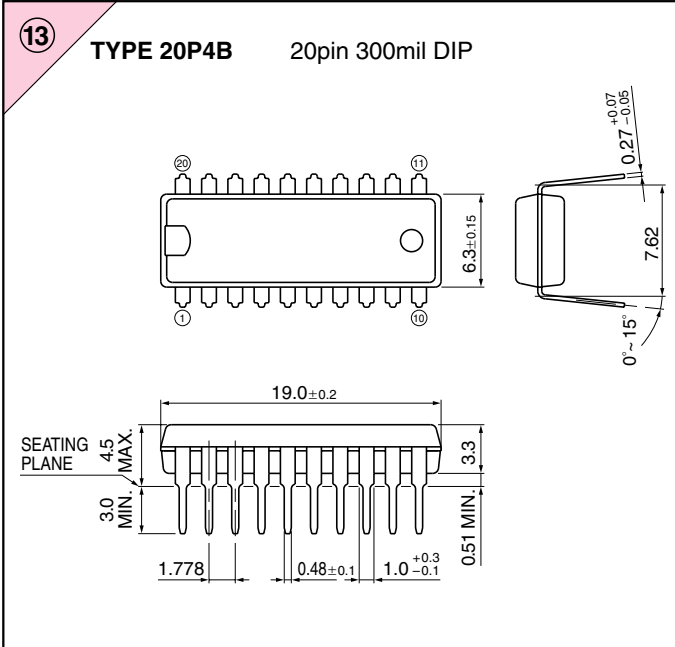
**TYPE 20P2E-A** 20pin 225mil SSOP  
**TYPE 20P2F-A**



12

**TYPE 10P2N-A** 10pin 300mil SOP





19

**TYPE 18P4X** 16pin 300mil DIP

