

### The search for state-of-the-art technology has landed on energy-savings and environmental protection.

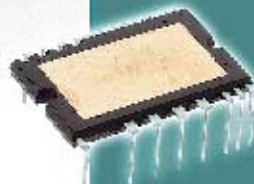
Mitsubishi Power Devices meets demands for energy-saving and eco-friendly semiconductors with advanced technology and a diversified product lineup. Industrial use, Traction, Home appliances ... wherever electric power or motor control is needed, we have the means and tools to oblige including industry-first DIP-IPM (Dual-In-line Package Intelligent Power Module).

Power Modules

High Power Devices

High Voltage Integrated Circuits

Transistor-Array



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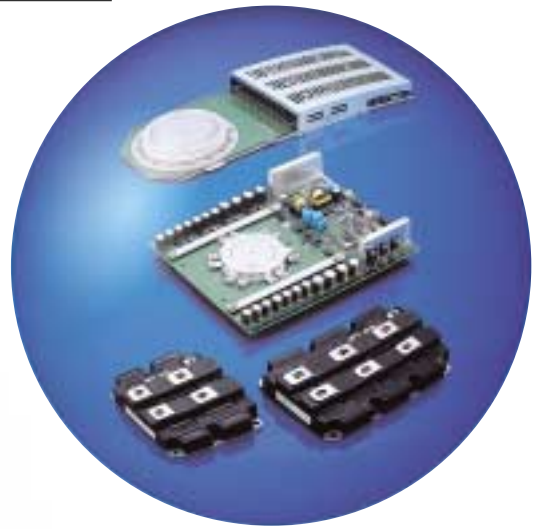
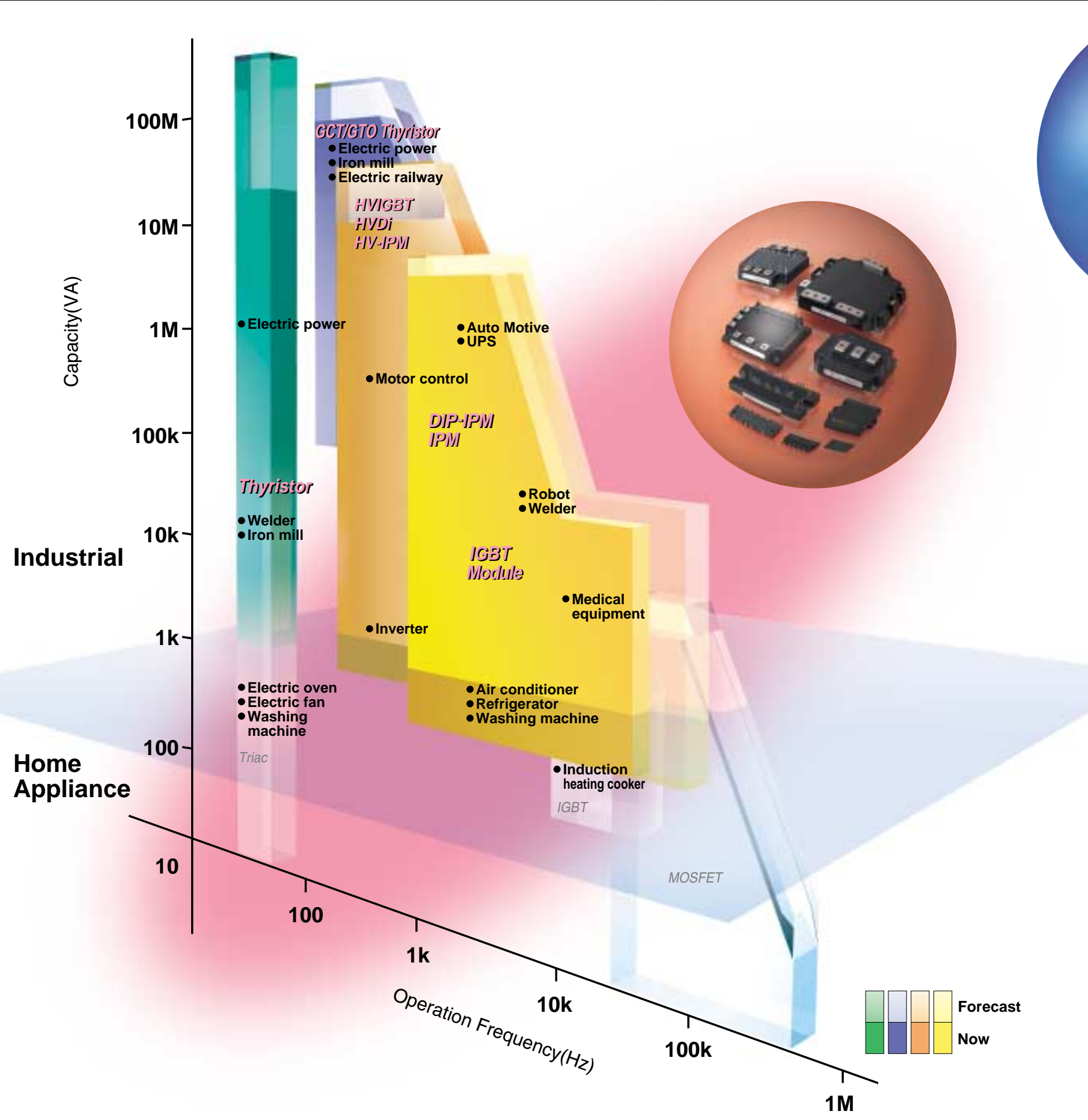
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# Application

# Power Device Offer Unlimited Application Potential.

Mitsubishi Power Devices are widely applied to various fields, such as industrial, electric railway, office automation, household power appliances and motor controls. For the power devices, we also plan to improve energy efficiency, develop the technology for reduction of power consumption and increase the product lineup.



■ Main application & products

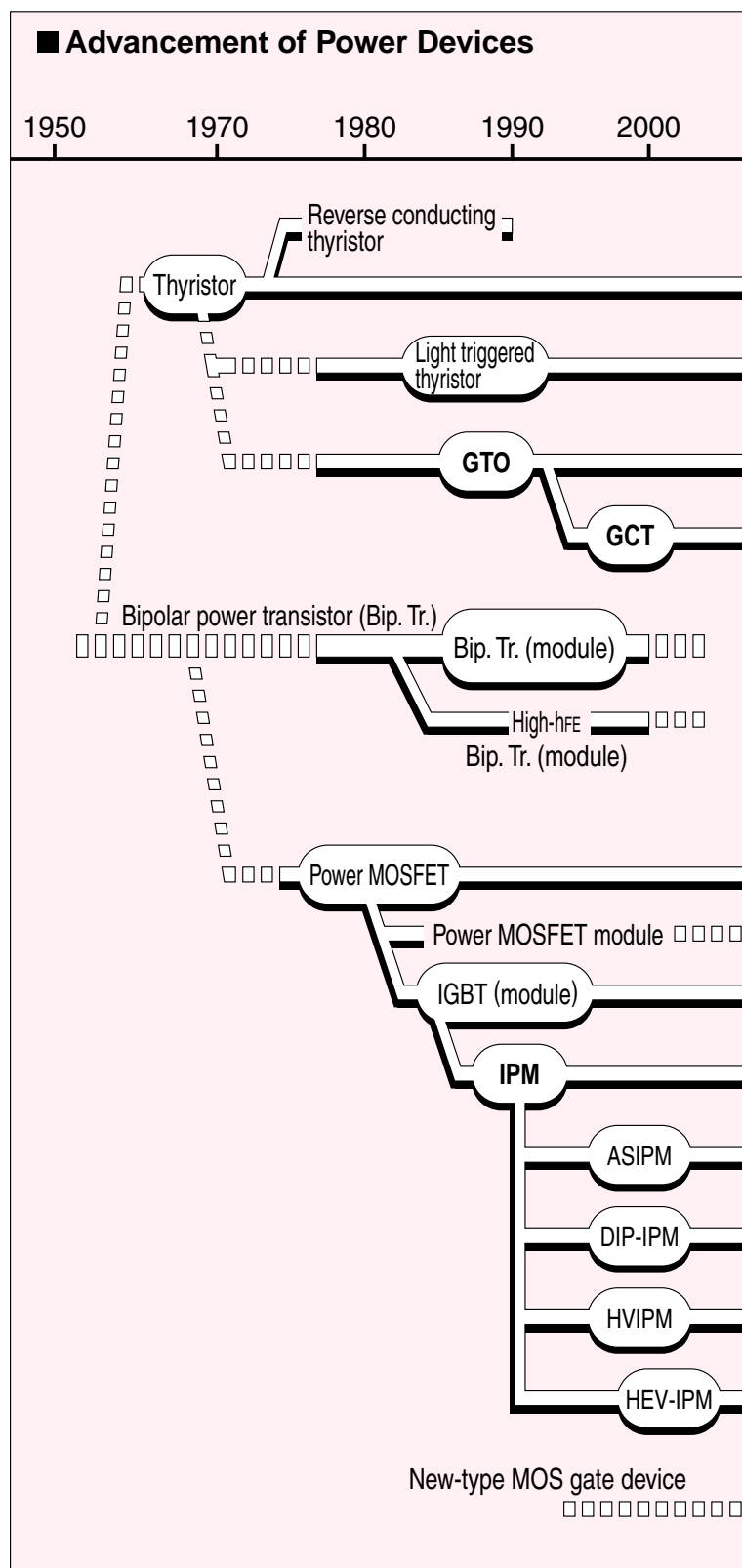
	DIP-IPM	IPM	IGBT Module	GCT/GTO Thyristor	Thyristor	HV IGBT HV IPM
Industrial use	Electric power					
	Iron mill					
	Electric railway *1					
	Auto motive *1					
	UPS					
	Inverter					
	Motor control					
	Welder					
Medical equipment						
Home Appliance	Air conditioner					
	Refrigerator					
	Washing machine					

\*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

Technological progress of power devices has a close relationship with their market needs. That is, they are always required to be less noisy, more efficient, smaller and lighter weight, more advanced in function, more accurate, and larger in capacity.

In order to meet these needs precisely, Mitsubishi is now accelerating the improvement of her existing devices and the research and development of new devices. Mitsubishi is making energetic efforts to develop and commercialize IGBT modules, IPMs, and Power MOSFETs in particular.



## 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 n layer (conservation of charge layer) connected with p base layer is higher than that of n<sup>-</sup> layer, and the internal electric potential difference between p base and n layer is higher than that of p base and n<sup>-</sup> layer.

This high internal electric potential serves as a barrier to prevent holes infused from 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 charge layer, and the n layer controls the shift of holes to the p base layer.

This conservation of charge function drastically improves on-state characteristics of CSTBT™, comparing to the trench structure IGBT. Increasing the carriers density on the emitter side and decreasing the impedance in silicon made on-state voltage reduction possible.

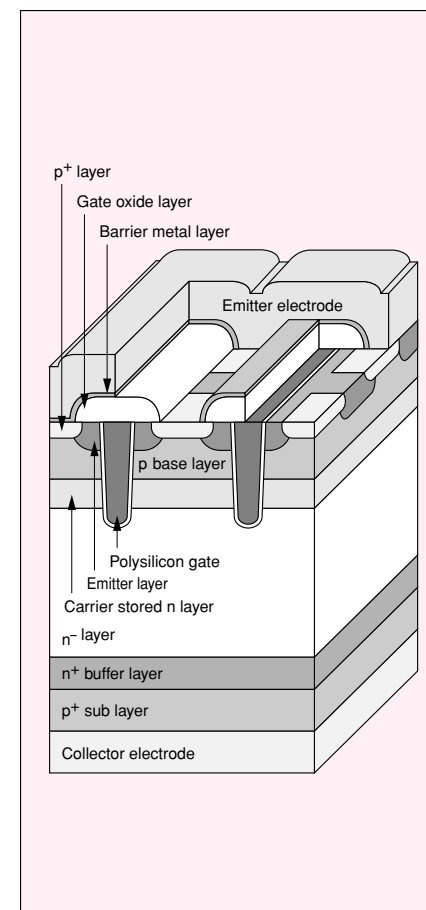
CSTBT™ : Mitsubishi's original IGBT utilizing the novel carrier storage effect

## New Packaging Technology

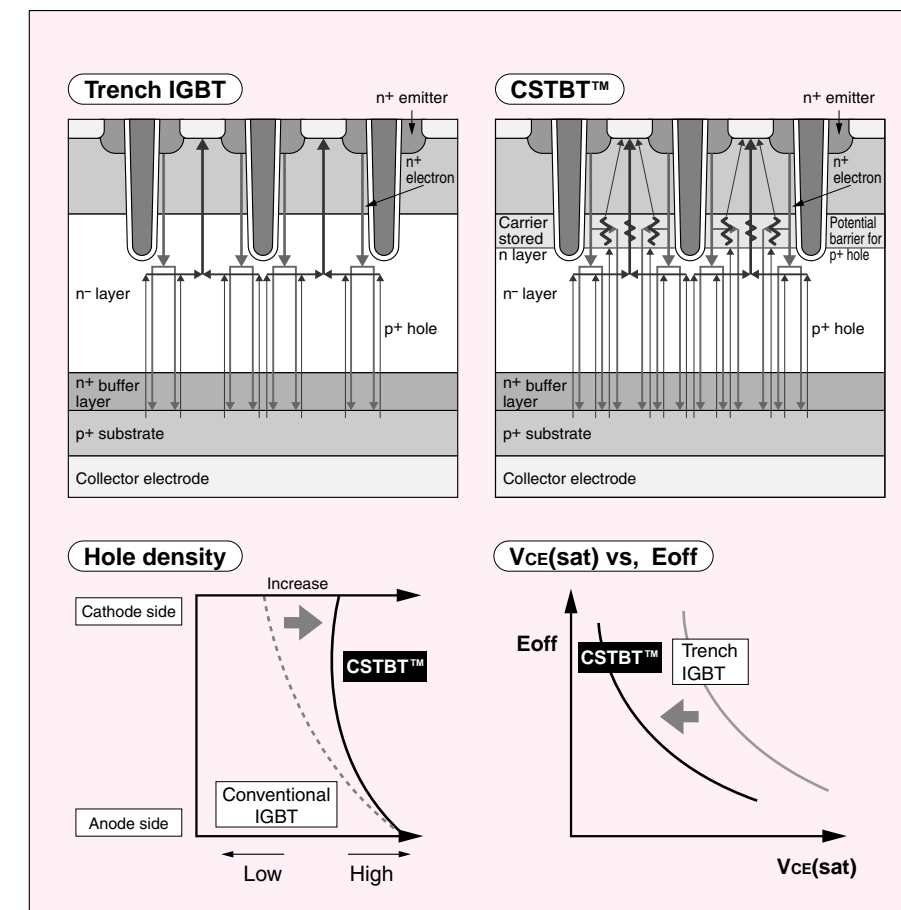
The internal structure of the IGBT module was optimized extensively starting with the U series, and it has achieved a reduction in floating-inductance upon wiring.

This technology has also been applied to the F series and NF series to realize low-inductance.

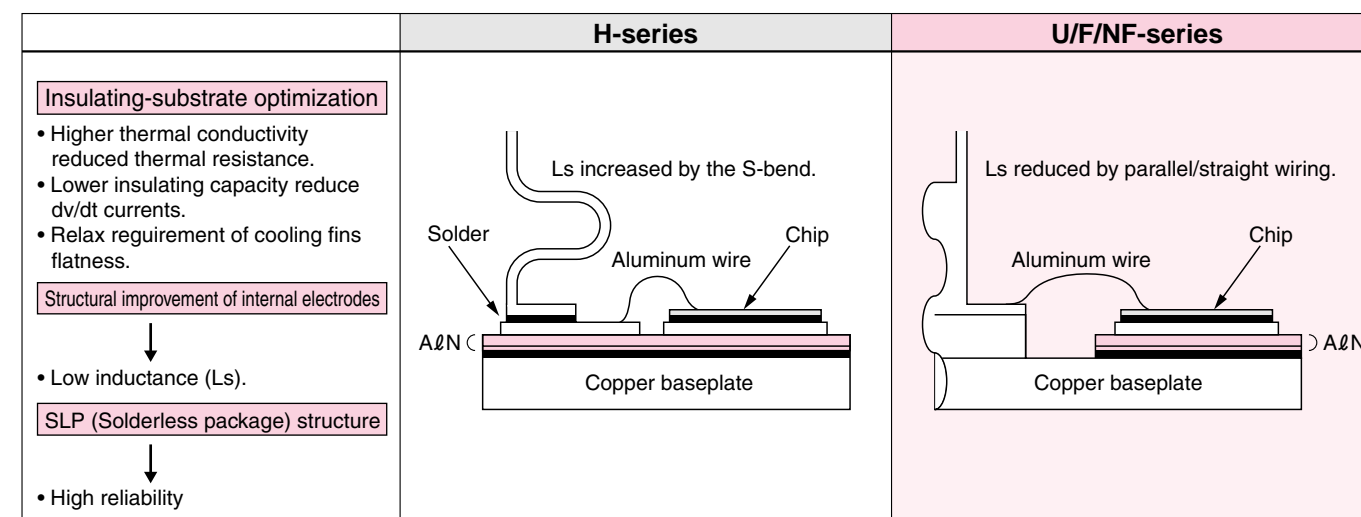
### CSTBT™ chip structure



### Comparison of trench IGBT and CSTBT™



### New packaging technology for the U/F-series IGBT modules



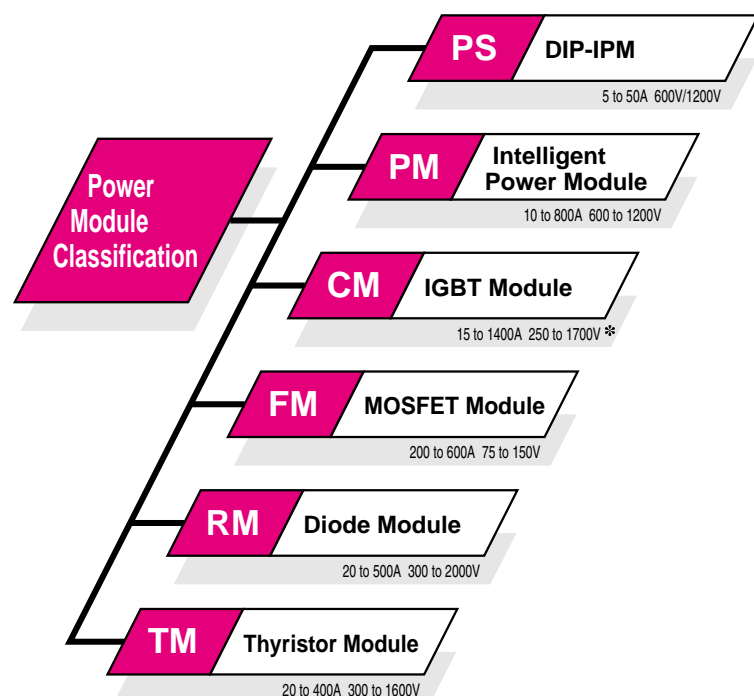
# Power Modules

## The Industry's Leading Technologies and a Wide Range Products

The power module is a compound type semiconductor that is installed in a package after wiring semiconductor chips to meet the application and specifications. Power modules are classified into diodes, thyristors, IGBT and IPM (Intelligent Power Module) according to the type of chips installed. Since 1978, when we placed these power modules in practical use, Mitsubishi 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 exerting ourselves to develop products and improve product characteristics in this field.

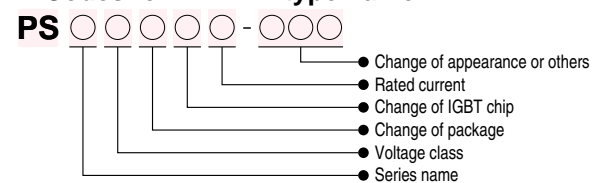
### ■ Features:

- New package-design for less environmental pollution which also contributes to energy savings due to reduced power loss.
- Creeping distance is long and the dielectric strength is high (1500V to 3000V).
- 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 from inverters, choppers and uninterruptible power supplies (UPS's).
- Compliance with international standard (UL1557) has already been certified (Yellow Card No. E80276, File No.E80271)(except apart of products).
- The ease of both installation and wiring due to the design allows application equipment to be reduced in dimensions and weight.

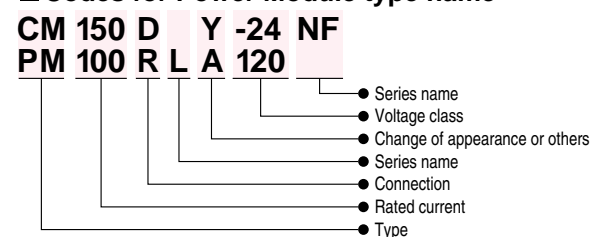


\*: Please refer to High-power device for IGBT Module over 2500V.

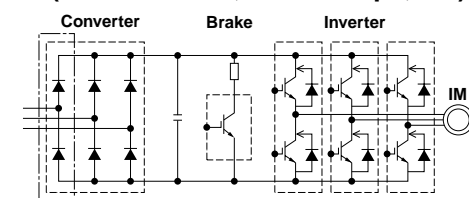
### ■ Codes for DIP-IPM type name



### ■ Codes for Power Module type name



### ■ Application of IPM/IGBT to AC motor controls (VVVF Inverter, Servo Amps, etc)



# DIP-IPM

## Dual In-Line Package Intelligent Power Module

### The miniaturization and the power saving of home electric appliances and small capacity industrial equipments are strongly supported.

As for DIP-IPM, even a small capacity industrial equipment of the inverter servo motor etc. including the home appliance such as air conditioners, refrigerators and washing machines corresponds to a wide field. It is transfer molding type IPM to exercise its power over the power saving and the miniaturization. Moreover, the lineup of 1200V newly joined a past 600V.

### ■ Application

- Air conditioner, refrigerator, washing machine, and package air conditioner.
- Small capacity industrial motor drive.

### ■ Features

- Wide lineup 5A to 50A/600V, 5A to 25A/1200V.
- Using low loss IGBT (CSTBT™ is adopted only by 50A/600V)
- Direct connection form the control unit possible. (non-photocoupler design)
- Single supply scheme simplifies the power supply circuits.
- Achieved lead free. (600V Ver.3·Ver.4, 1200V)

### ■ Dual In-Line Package Intelligent Power Module

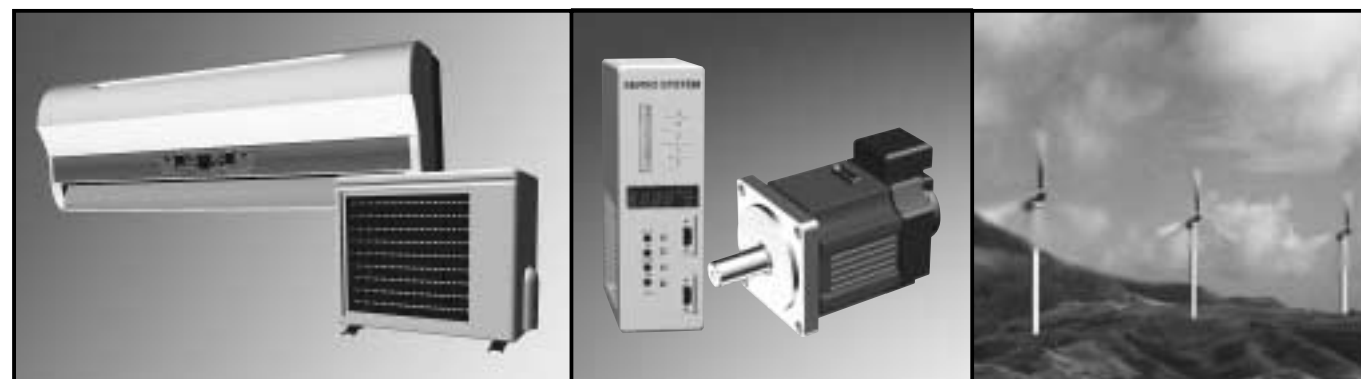
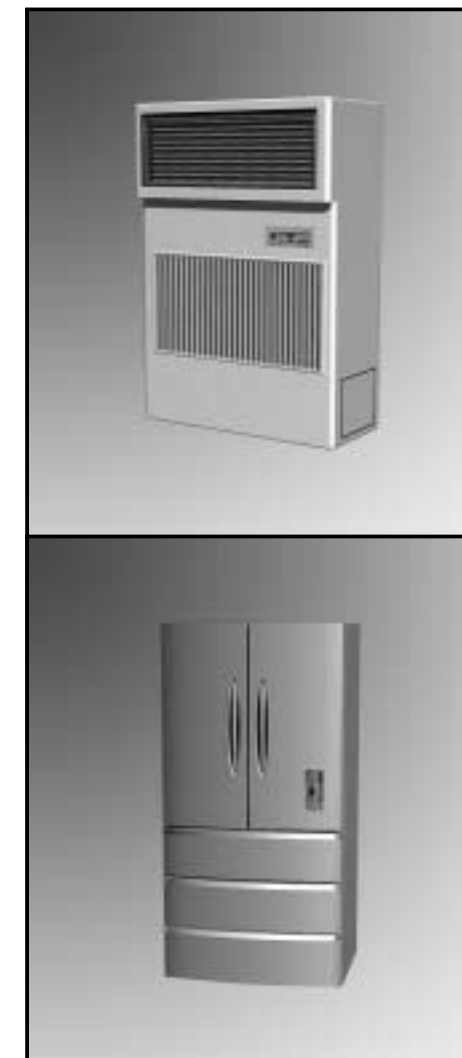
#### 600V DIP-IPM Ver.4

Type name	Rating	Outline drawings No.
PS21962/-A/-C	5A/600V	PS1 PS2
PS21963/-A/-C	10A/600V	
PS21964/-A/-C	15A/600V	

(-A): Long pin type, and (-C): Zigzag pin type

#### 1200V

Type name	Rating	Outline drawings No.
PS22052	5A/1200V	PS6
PS22053	10A/1200V	
PS22054	15A/1200V	
PS22056	25A/1200V	



# DIP-IPM Ver.4 (PS219XX series)

Dual In-Line Package Intelligent Power Module

## Application

- Low power household appliances  
(Air conditioners, washing machines and refrigerators)

## Line up

Type name	Ratings	fc max.(kHz)	Outline drawings No.
Isolation voltage 1500Vrms class			
PS21962/-A/-C	5A/600V	20	PS1 PS2
PS21963/-A/-C	10A/600V		
PS21964/-A/-C	15A/600V		

(-A): Long pin type, and (-C): Zigzag pin type

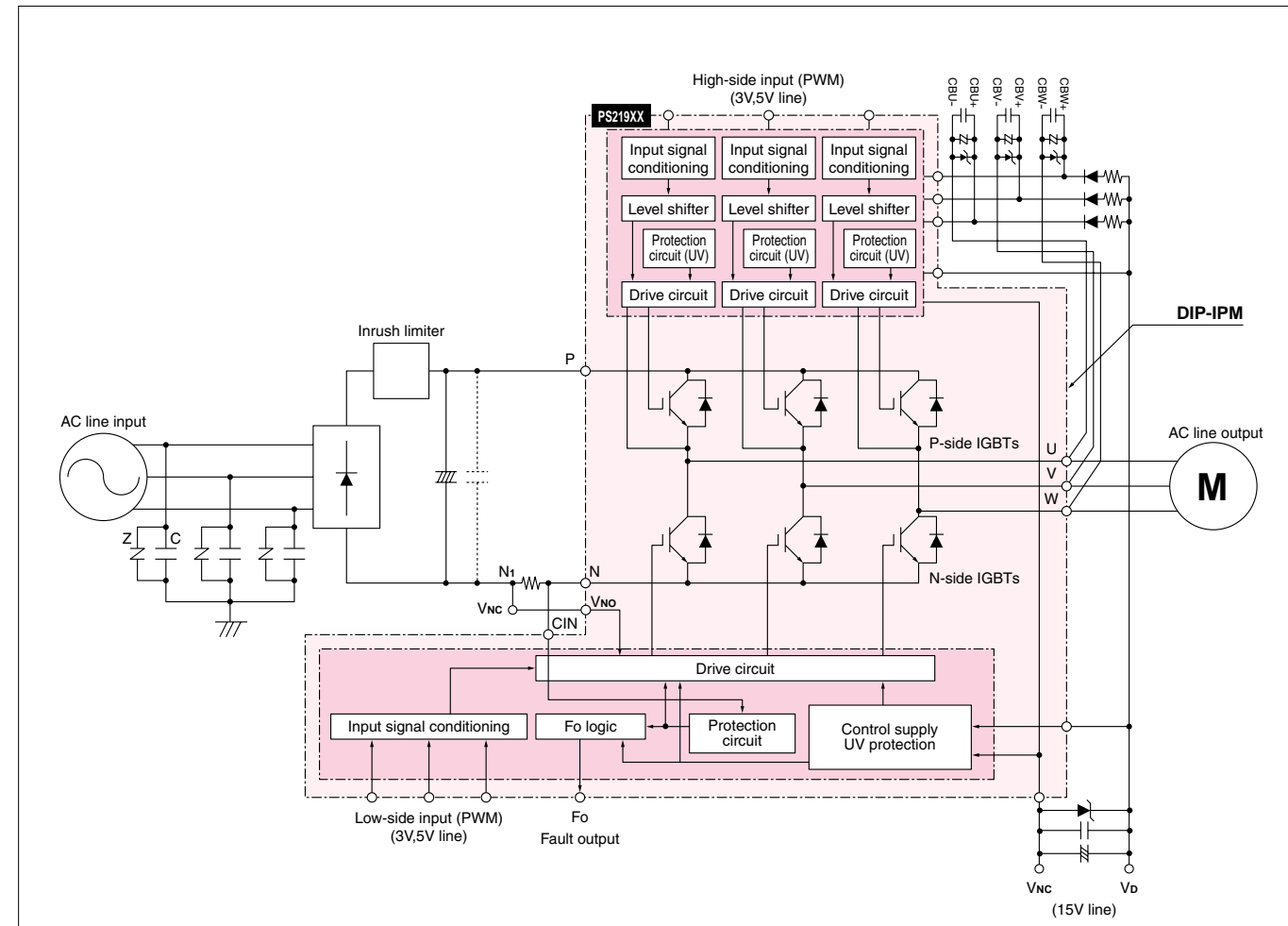
## Internal functions

- 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 protection (SC). The SC protection needs external shunt resistor.
- Error output :  
Corresponds to a Short-circuit fault (SC) or a control supply under-voltage fault (UV) [N-side control supply only]
- IGBT drive power supply :  
DC 15V single power supply (bootstrap supply scheme can be applied).
- Input interface:  
3V,5V compatible, high active logic.

## Features

- Using of new insulation structure realizes a miniaturization.
- Perfect lead free-ization is realized in consideration of earth environment.

## Block diagram



# DIP-IPM Ver.3 (PS21XXX series)

Dual In-Line Package Intelligent Power Module

## Application

- Low power household appliances  
(Air conditioners, washing machines, refrigerators  
General-purpose inverter, AC servo, and etc.)

## Line up

Type name	Ratings	fc max.(kHz)	Outline drawings No.
Isolation voltage 2500Vrms class			
PS21562-P	5A/600V	20	PS3
PS21563-P	10A/600V		
PS21564-P	15A/600V		
PS21562-SP	5A/600V	20	PS4
PS21563-SP	10A/600V		
PS21564-SP	15A/600V		
PS21865-P/-AP	20A/600V	20	PS5
PS21867-P/-AP	30A/600V		
PS21869-P/-AP	50A/600V		
PS21065	20A/600V	20	PS6
PS21067	30A/600V		
PS21069	50A/600V		

(-AP): Long pin type

PS2156X-SP and PS2106X: N-side IGBTs' emitter is divided.

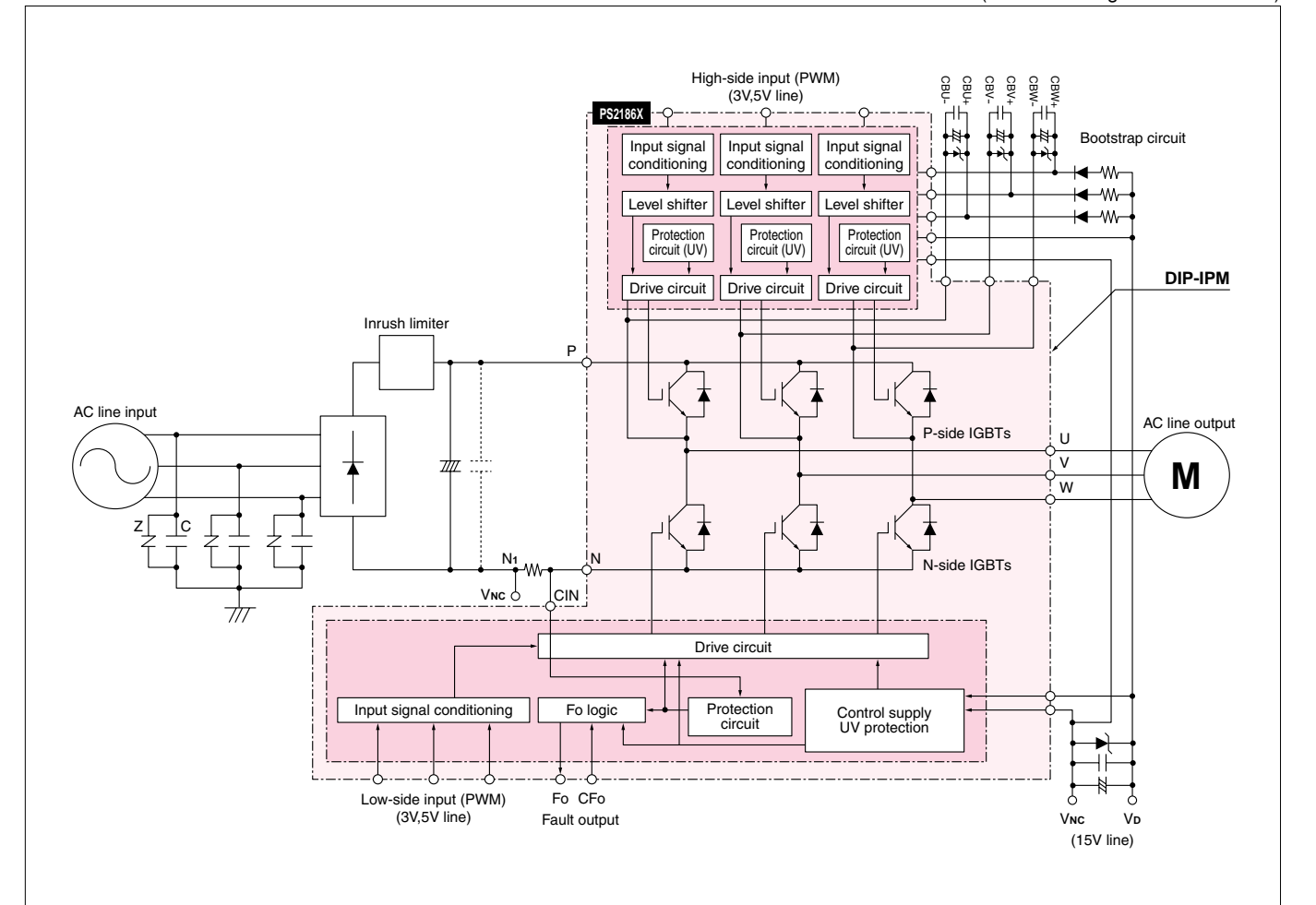
## Internal functions

- 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 protection (UV), and Short-circuit protection (SC). The SC protection needs external shunt resistor.
- Error output :  
Corresponds to a Short-circuit fault(SC) or a Control supply under-voltage fault (UV) [N-side control supply only]
- IGBT drive power supply :  
DC 15V single power supply (Bootstrap supply scheme can be applied).
- Input interface:  
3V,5V compatible, high active logic.

## Features

- Terminals lead free solder plating

## Block diagram



(This block diagram is PS2186X's)

# 1200V DIP-IPM (PS220XX series)

Dual In-Line Package Intelligent Power Module

## Application

- AC400V low power industrial appliances.  
(Air conditioners, General-purpose inverter, AC servo, and etc.)

## Line up

Type name	Ratings	fc max.(kHz)	Outline drawings No.
Isolation voltage 2500Vrms class			
PS22052	5A/1200V	15	PS6
PS22053	10A/1200V		
PS22054	15A/1200V		
PS22056	25A/1200V		

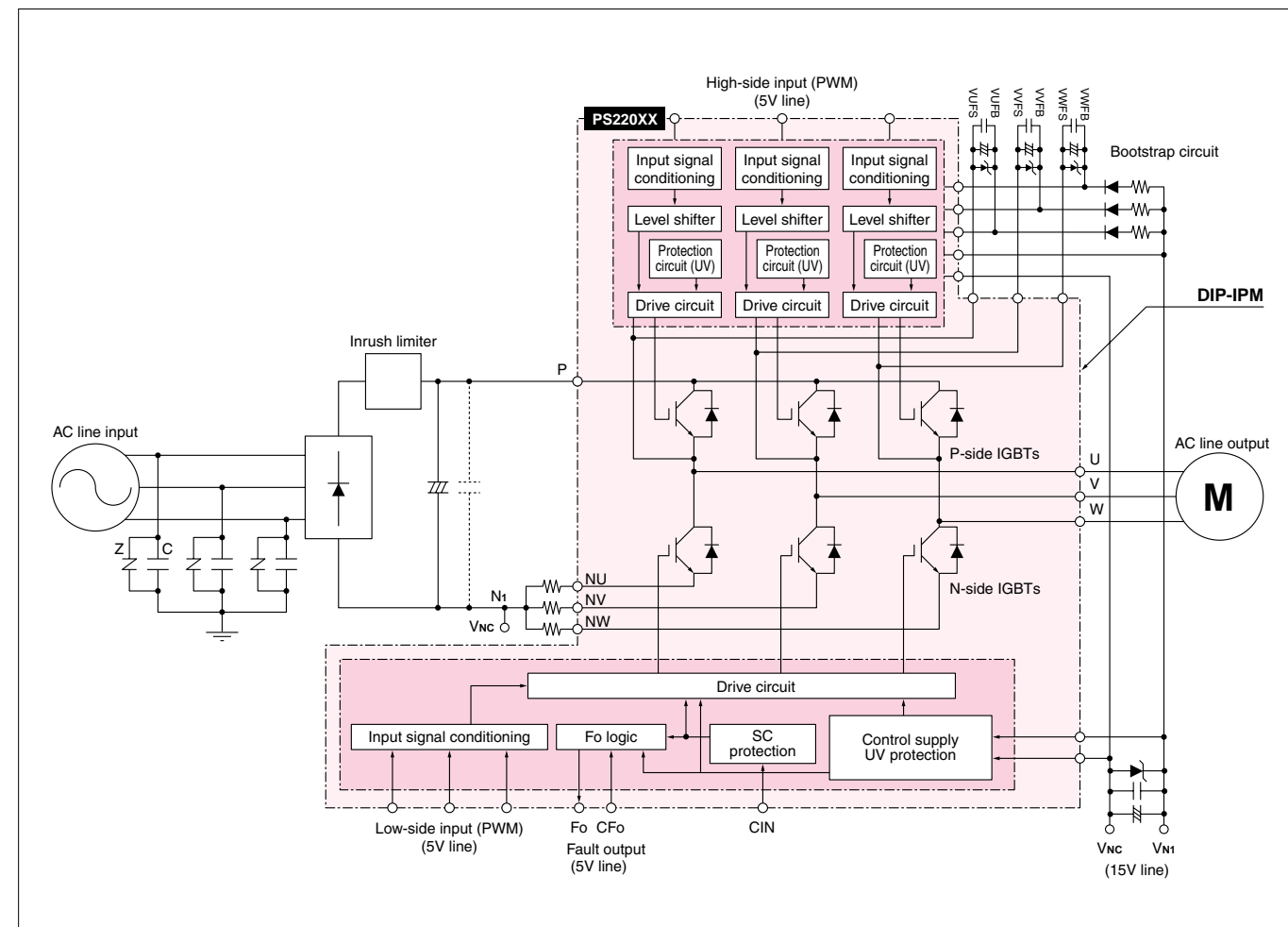
## Internal functions

- 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 protection (UV), and Short-circuit protection (SC).  
The SC protection needs external shunt resistor.
- Error output :  
Corresponds to a Short-circuit fault (SC) or a Control supply under-voltage fault (UV) [N-side control supply only]
- IGBT drive power supply :  
DC 15V single power supply (Bootstrap supply scheme can be applied).
- Input interface:  
5V compatible, high active logic.

## Features

- Terminals lead free solder plating.
- N-side IGBTs' emitter is divided.

## Block diagram



# DIP-PFC

Dual In-Line Package Power Factor Corrector

## Application

- Air conditioner, General purpose inverter, etc.

## Internal functions

- Low-loss IGBT
- IGBT drive circuit and Protection circuit. (Control supply under-voltage protection.)
- AC/DC conversion.

## DIP-PFC

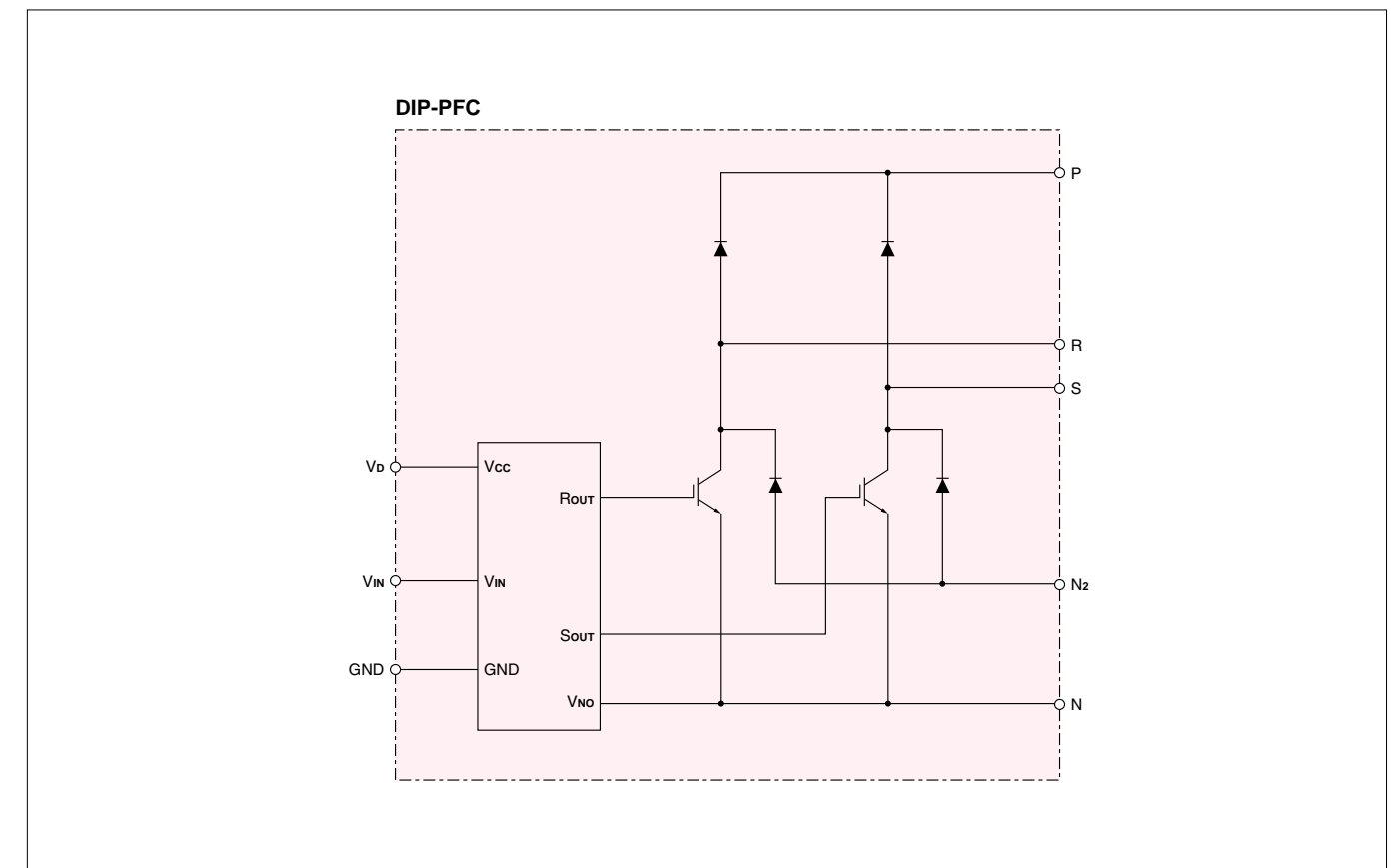
Type name	Rated voltage(V)	Rated input current(Arms)	Switching frequency(kHz)	Protection function (Note1) (Note2) UV	Outline drawings No.
PS51277-A	90 to 264	15	20	○	PS7
PS51259-A		20			

Note1 : UV : Control supply under voltage

○ : Built-in integrated

Note2 : In combination with specially developed control IC, PFC can provide the following functions with fault signal output.  
OV1 : Output voltage repression under light load  
OV2 : Output over voltage protection  
SC : Short-circuit protection

## Block diagram





### AC440V for Line

Type name	Rating		Applicable motor rating(kW)	Output characteristics		Built-in function						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						
<b>L series</b> PM25RLA120	1200	25	3.7	3	440	X	○	○	○	○	○	○	P36						
PM25RLB120						X	○	○	○	○	○	○	○	P37					
PM50RLA120						50	7.5	X	○	○	○	○	○	○	P36				
PM50RLB120								X	○	○	○	○	○	○	P37				
PM75RLA120						75	15	X	○	○	○	○	○	○	P36				
PM75RLB120								X	○	○	○	○	○	○	P37				
PM100RLA120		100	18.5/22			X	○	○	○	○	○	○	P38						
PM150RLA120						150	30	X	○	○	○	○	○	○	P38				
PM25CLA120		25	3.7					3.7	X	○	○	○	X	○	○	P36			
PM25CLB120						X	○		○	○	X	○	○	P37					
PM50CLA120						50	7.5		X	○	○	○	X	○	○	P36			
PM50CLB120									X	○	○	○	X	○	○	P37			
PM75CLA120						75	15		X	○	○	○	X	○	○	P36			
PM75CLB120									X	○	○	○	X	○	○	P37			
PM100CLA120		100	18.5/22			18.5/22	X	○	○	○	X	○	○	P38					
PM150CLA120							150	30	X	○	○	○	X	○	○	P38			
PM200CLA060 *		200	37/45			37/45			X	○	○	○	X	○	○	P39			
PM300CLA060 *							300	55	X	○	○	○	X	○	○				
PM450CLA060 *									450	75	X	○	○	○	X		○	○	
PM50RSD120							1200	50			7.5	3	440	○	○		○	△	○
PM75RSD120		75	15			○			○	○				△	○	○	○	P3	
PM100RSD120						100			18.5/22	○				○	○	△	○	○	○
PM150RSD120		150	30							○				○	○	△	○	○	○
PM50CSD120						50			7.5	○				○	○	△	X	○	○
PM75CSD120		75	15							○				○	○	△	X	○	○
PM100CSD120						100		18.5/22	○	○	○			△	X	○	○	P3	
PM150CSD120		150	30						○	○	○			△	X	○	○	P3	
PM50RSE120						50		7.5	7.5	○	○			○	△	○	X	○	P31
PM75RSE120		75	15							○	○			○	△	○	X	○	
PM100RSE120										100	18.5/22			○	○	○	△	○	
PM150RSE120	150	30	○	○	○									△	○	X	○		
PM50CSE120			50	7.5	○					○	○			△	X	X	○	P31	
PM75CSE120	75	15			○					○	○			△	X	X	○		
PM100CSE120			100	18.5/22	○	○		○	△	X	X			○	P32				
PM150CSE120	150	30			○	○		○	△	X	X			○					
PM75CVA120			75	15	15	○		○	○	△	X			○	○	P26			
PM100CVA120	100	18.5/22				○		○	○	△	X			○	○				
PM150CVA120						150		30	○	○	○			△	X		○	○	
PM50RVA120	50	7.5							○	○	○			△	○		○	○	P25
PM200DVA120						200		30/37	○	○	○			△	X		○	○	
PM300DVA120	300	45/55							○	○	○			△	X		○	○	P29

★ : New product  
 OC : Over-current 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

### For Solar Power

Type name	Rating		Output characteristics		Built-in function						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	X	○	○	○	X	○	○	P36				
PM50B4LB060 **					X	○	○	○	X	○	○	P37				
PM50B5LA060 **					X	○	○	○	○	○	○	○:1	○	○	P36	
PM50B5LB060 **					X	○	○	○	○	○	○	○:1	○	○	P37	
PM50B6LA060 **					X	○	○	○	○	○	○	○:2	○	○	P36	
PM50B6LB060 **					X	○	○	○	○	○	○	○:2	○	○	P37	
PM75B4LA060 **		75			75	X	○	○	○	○	X	○	○	P36		
PM75B4LB060 **						X	○	○	○	○	X	○	○	P37		
PM75B5LA060 **						X	○	○	○	○	○	○	○:1	○	○	P36
PM75B5LB060 **						X	○	○	○	○	○	○	○:1	○	○	P37
PM75B6LA060 **						X	○	○	○	○	○	○	○:2	○	○	P36
PM75B6LB060 **						X	○	○	○	○	○	○	○:2	○	○	P37

\*\* : Under development  
 OC : Over-current 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  
 X : non-integrated  
 ○:1 → Built-in 1 converter  
 ○:2 → Built-in 2 converter

# IGBT Modules

## Insulated Gate Bipolar Transistor Modules

Although about 15 years have passed since the IGBT was developed and industrial power semiconductor switch, performance has improved and applications have increased in that time and now it has replaced the transistor for most electric-powered industrial equipment. The Mitsubishi lineup includes the "F Series", a 4th-generation trench IGBT

module in production 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, combining the characteristics of the popular planar IGBT and the trench IGBT, known for its reduced power loss; and the "NFH Series", compatible with higher-frequency switching.

### Applications

#### (NF Series)

- General-purpose inverter
- AC servos/CVCF
- Wind power/solar power

#### (NFH Series)

- CT scanners
- MRIs
- Induction heating equipments

### Features

#### (NF Series)

- Same outer dimensions as 3rd generation H series
- Using low loss CSTBT™
- Same driving power as that of 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 (employing aluminum nitride ceramic substrate)

#### (NFH Series)

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



### IGBT Modules series map

3rd generation (Former)	3rd generation (Latter)	4th generation	5th generation
H series	U series AD series (CIB) KA series	F series DUS series (High frequency)	NF/A series Mega Power Dual NFH series (High frequency)

### 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	CM600DU-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 <NFH series>

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	
	1200	CM100DU-24NFH	CM150DU-24NFH	CM200DU-24NFH	CM300DU-24NFH	CM400DU-24NFH	CM600DU-24NFH

\*: F series (High speed turn-off)

# IGBT Modules

## Insulated Gate Bipolar Transistor Modules

### 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	CM600DU-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	
	1200	CM100DU-24NFH	CM150DU-24NFH	CM200DU-24NFH	CM300DU-24NFH	CM400DU-24NFH	CM600DU-24NFH

### 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 *
D	1200	CM100DY-24A *	CM150DY-24A *	CM200DY-24A *	CM300DY-24A *	CM400DY-24A *	CM600DY-24A *

\*: New product

### IGBT Modules <Mega Power Dual>

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

● Numbers H106, U201 to U203, U205, U206, N201 to N204, NF601, NF602 are recorded with product names to show the outline-drawing numbers.

# IGBT Modules

## Insulated Gate Bipolar Transistor Modules

### 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	CM600HU-24F U102	
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	CM600DU-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-12H*	CM300E3U-12H*
	1200	CM50E3U-24H*	CM75E3U-24H*	CM100E3U-24H*	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
T	1700	CM50TU-34KA	CM75TU-34KA					

● Numbers H105, H106, U101, U102, U111, U112, U201 to U205, U601, U602 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								CM600HU-12H U101
	1200								CM400HU-24H U101
D	600		CM75DU-12H	CM100DU-12H	CM150DU-12H	CM200DU-12H	CM300DU-12H	CM400DU-12H	
	1200	CM50DU-24H	CM75DU-24H	CM100DU-24H	CM150DU-24H	CM200DU-24H	CM300DU-24H		

### 4 arms to 6 arms

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

### IGBT Modules <H series>

Connection	V <sub>CEs</sub> (V)	I <sub>c</sub> (A)													
		10	15	20	30(25)	50	75	100	150	200	300	400	600	1000	
H	600											CM300HA-12H H101	CM400HA-12H H102	CM600HA-12H	
	1200											CM200HA-24H H101	CM300HA-24H H103	CM400HA-24H H102	CM600HA-24H H104
	1400											CM400HA-28H H103	CM600HA-28H H102	CM1000HA-28H H104	
D	600					CM50DY-12H H201	CM75DY-12H H201	CM100DY-12H H201	CM150DY-12H H201	CM200DY-12H H202	CM300DY-12H H202	CM400DY-12H H203			
	1200					CM50DY-24H H201	CM75DY-24H H201	CM100DY-24H H201	CM150DY-24H H202	CM200DY-24H H203	CM300DY-24H H204				
	1400					CM50DY-28H H201	CM75DY-28H H201	CM100DY-28H H202		CM200DY-28H H203	CM300DY-28H H204				
T	600		CM15TF-12H H601	CM20TF-12H H602	CM30TF-12H H603	CM50TF-12H H603	CM75TF-12H H604	CM100TF-12H H604	CM150TF-12H H605						
	1200		CM15TF-24H H602	CM20TF-24H H603	CM30TF-24H H603	CM50TF-24H H604	CM75TF-24H H605	CM100TF-24H H605							
	1400					CM50TF-28H H604	CM75TF-28H H605	CM100TF-28H H605							

● Numbers H101 to H104, H201 to H204, H601 to H605, 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 parallel connection of much a low-voltage IGBT module and discrete MOSFET until now are consisted of by the electric power exchange equipment which drives motors, such as a battery forklift.

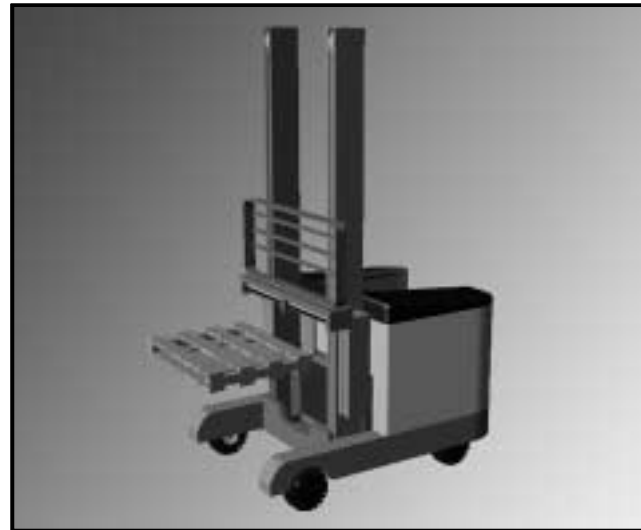
However, the ease of an assembly, the miniaturization of equipment, and the demand of improvement in reliability are becoming strong recently. The lineup of the low-voltage MOSFET module was carried out to such a mass and low-voltage use as a power semiconductor element.

## Application

- Battery forklift
- UPS

## Features

- Using low loss trench MOSFET chip
- Using connector terminal for gate source.
- Built-in temperature sensor



## Power MOSFET Modules

Connection	V <sub>DSS</sub> (V)	I <sub>D</sub> (A)		
		100	200	300
	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. ★: New product

# Diode Modules

## High speed Diode Modules

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

Connection	V <sub>RRM</sub> (V)	I <sub>F(AV)</sub> (A)									
		20	30	40	50	60	100	150	250	500	
	400									RM500HA-M R8	
	800									RM500HA-H R8	
	1200									RM500HA-24 R8	
	1600									RM500HA-2H R8	
	400		RM30DZ-M R9			RM60DZ-M R9	RM100DZ-M R9	RM150DZ-M R9	RM250DZ-M R9	RM500DZ-M R12	
	800		RM30DZ-H R9			RM60DZ-H R9	RM100DZ-H R9	RM150DZ-H R9	RM250DZ-H R9	RM500DZ-H R12	
	1200		RM30DZ-24 R10			RM60DZ-24 R10	RM100DZ-24 R10	RM150DZ-24 R10	RM250DZ-24 R10	RM500DZ-24 R12	
	1600		RM30DZ-2H R10			RM60DZ-2H R10	RM100DZ-2H R10	RM150DZ-2H R10	RM250DZ-2H R10	RM500DZ-2H R12	
	400		RM30CZ-M R9			RM60CZ-M R9	RM100CZ-M R9	RM150CZ-M R9	RM250CZ-M R9		
	800		RM30CZ-H R9			RM60CZ-H R9	RM100CZ-H R9	RM150CZ-H R9	RM250CZ-H R9		
	1200		RM30CZ-24 R10			RM60CZ-24 R10	RM100CZ-24 R10	RM150CZ-24 R10	RM250CZ-24 R10		
	1600		RM30CZ-2H R10			RM60CZ-2H R10	RM100CZ-2H R10	RM150CZ-2H R10	RM250CZ-2H R10		
	400							RM150UZ-M R11	RM250UZ-M × R11	RM500UZ-M R12	
	800							RM150UZ-H R11	RM250UZ-H R11	RM500UZ-H R12	
	1200							RM150UZ-24 R11	RM250UZ-24 R11	RM500UZ-24 R12	
	1600							RM150UZ-2H R11	RM250UZ-2H R11	RM500UZ-2H R12	
	2000										
	2000					RM50DZ-40 R10		RM100DZ-40 R10			
		400	RM10TA-M R13	RM15TA-M R13	RM20TPM-M × R20		RM30TA-M R16 RM30TB-M × R17 RM30TPM-M × R20	RM50TC-M R18	RM75TC-M R19 RM75TPM-M R22		
		800	RM10TA-H R13	RM15TA-H R13	RM20TPM-H R20		RM30TA-H R16 RM30TB-H R17 RM30TPM-H R20	RM50TC-H R18	RM75TC-H R19 RM75TPM-H R22		
		1200	RM10TA-24 R13	RM15TA-24 R13	RM20TA-24 × R15 RM20TPM-24 × R21		RM30TC-24 R18	RM50TC-24 R18	RM75TC-24 R19 RM75TPM-24 R22		
		1600	RM10TA-2H R13	RM15TA-2H R13	RM20TA-2H × R15 RM20TPM-2H × R21		RM30TC-2H R18	RM50TC-2H R18	RM75TC-2H R19 RM75TPM-2H R22		
		2000		RM15TC-40 R14			RM30TC-40 × R14				

Note: Models RM10TB-M, -H and RM15TBM, -H are discontinued.

×: Plan for production discontinue

## New Diode Modules

Connection	V <sub>RRM</sub> (V)	I <sub>F(AV)</sub> (A)			
		10	20	25	30
	800	RM10TNA-H R25	RM20TNA-H R25		RM30TNA-H R25
	1600	RM10TN-2H R26		RM25TN-2H R26	

● Numbers from R1 to R22, R25, R26 are recorded with product names to show the outline-drawing numbers.

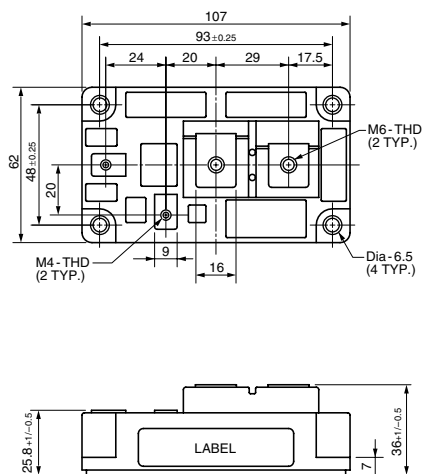




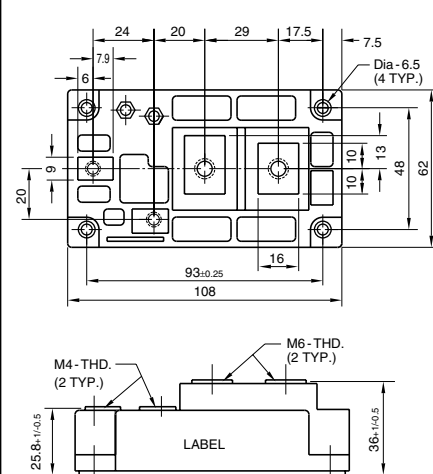
# IGBT Module

Insulated Gate Bipolar Transistor Modules

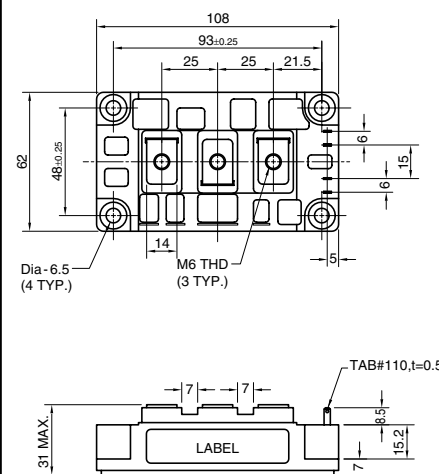
**H103** CM400HA-24H,-28H



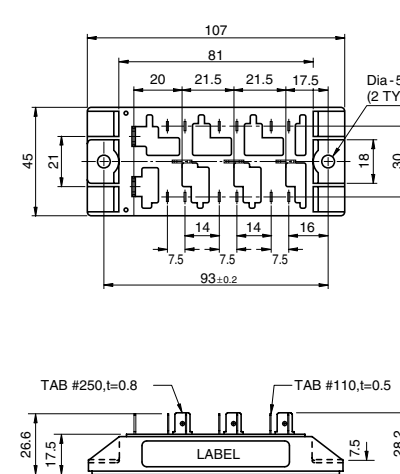
**H106** CM400HA-24A  
CM600HA-24A,-5F  
CM600HN-5F



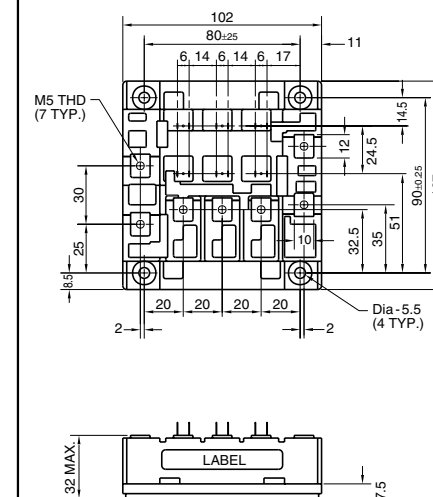
**H203** CM200DY-24H,-28H  
CM400DY-12H



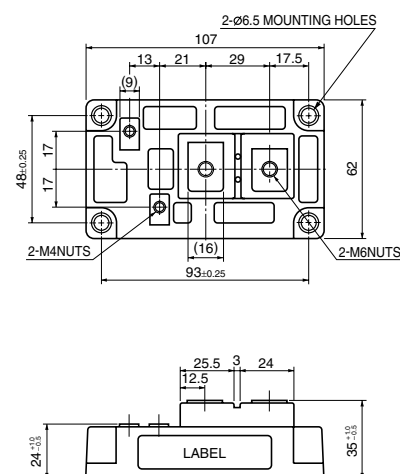
**H602** CM15TF-24H  
CM20TF-24H  
CM30TF-12H



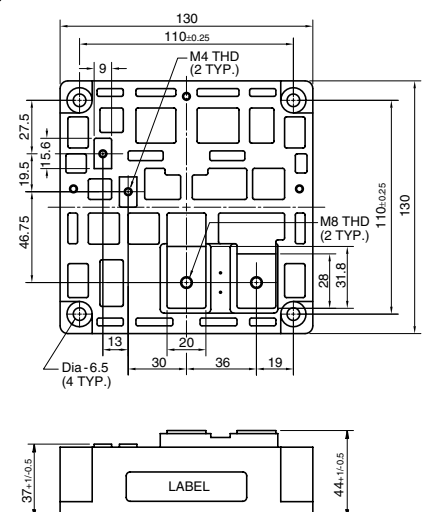
**H605** CM100TF-24H,-28H  
CM75TF-24H,-28H  
CM150TF-12H



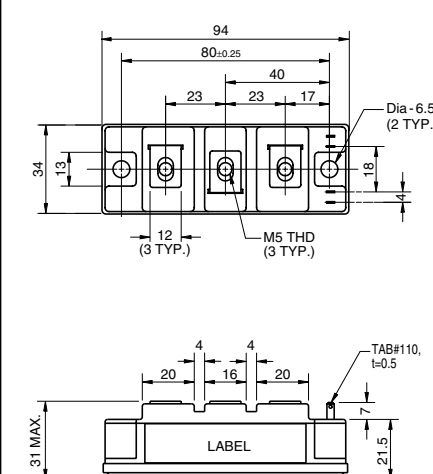
**H101** CM200HA-24H  
CM300HA-12H,-24H  
CM400HA-12H



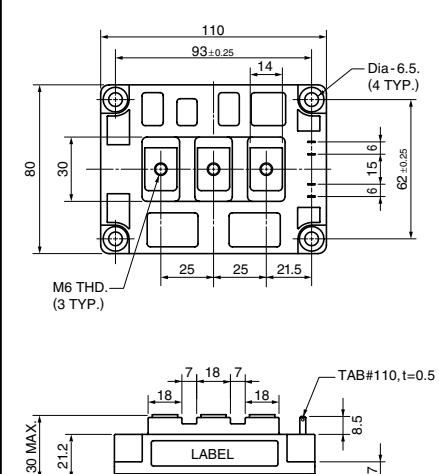
**H104** CM1000HA-24H,-28H



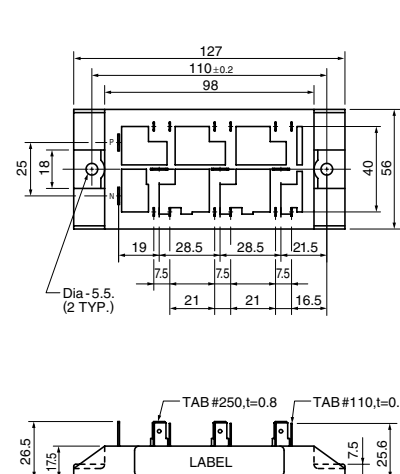
**H201** CM50DY-12H,-24H,-28H  
CM75DY-12H,-24H,-28H  
CM100DY-12H



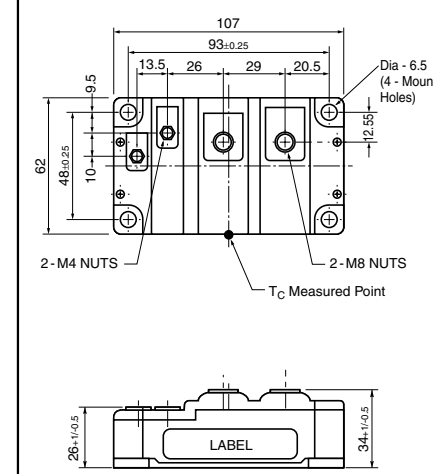
**H204** CM300DY-24H,-28H



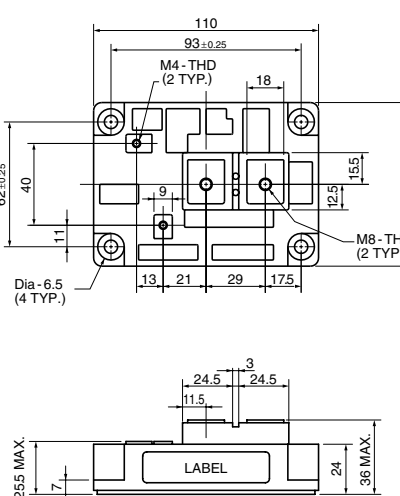
**H603** CM30TF-24H  
CM50TF-12H



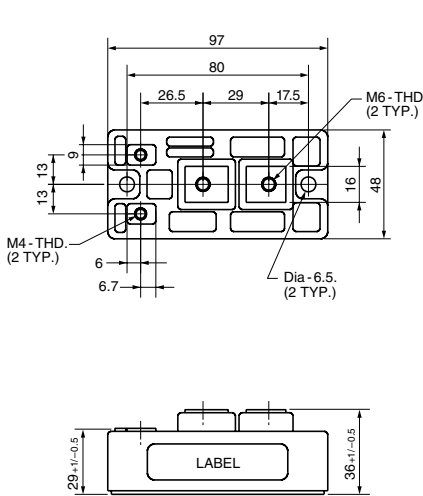
**U101** CM600HU-12H,-12F  
CM400HU-24H,-24F



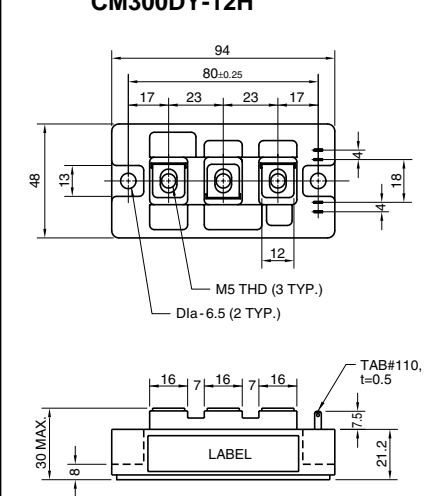
**H102** CM600HA-12H,-24H,-28H



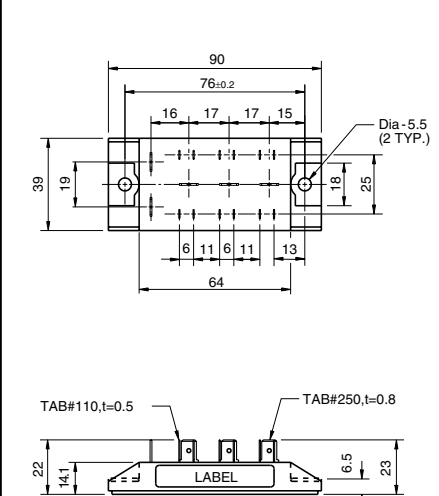
**H105** CM450HA-5F



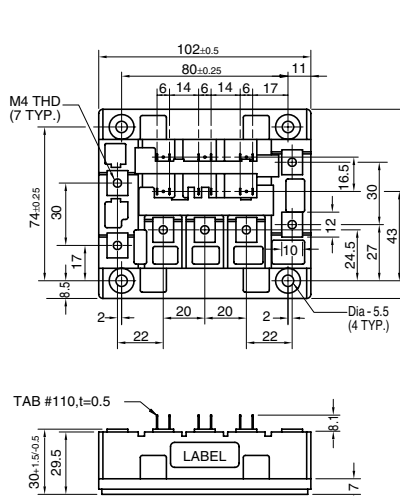
**H202** CM100DY-24H,-28H  
CM150DY-12H,-24H  
CM200DY-12H  
CM300DY-12H



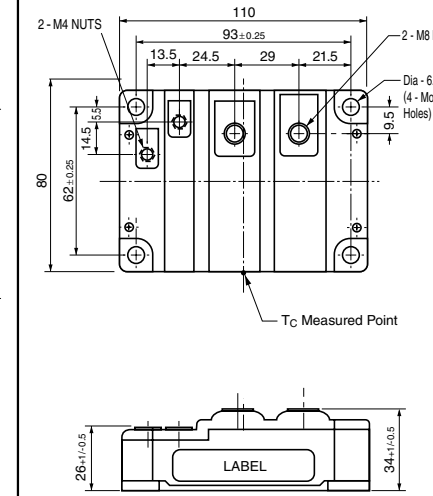
**H601** CM15TF-12H  
CM20TF-12H



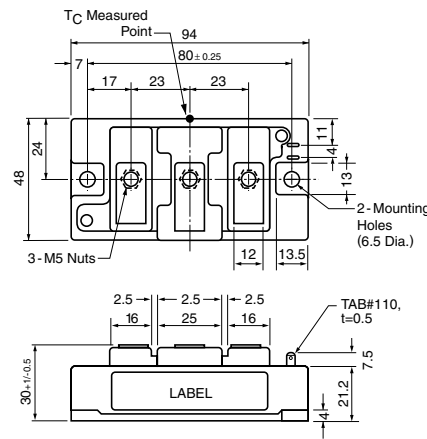
**H604** CM50TF-24H,-28H  
CM75TF-12H  
CM100TF-12H



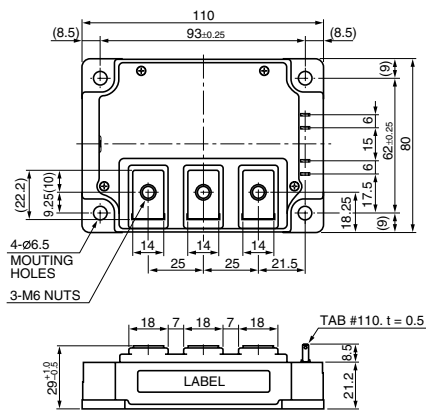
**U102** CM600HU-24H,-24F



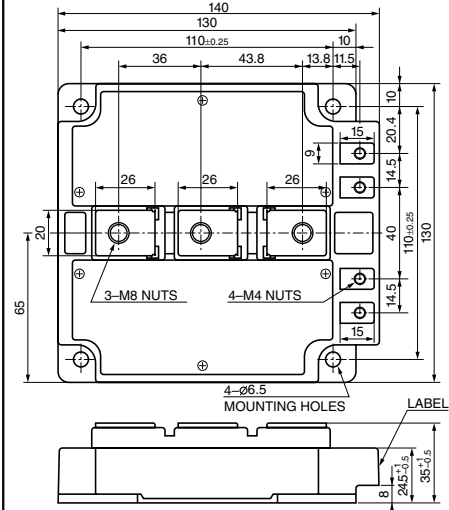
**U111** CM50E3U-24H  
 CM75E3U-12H,-24H  
 CM100E3U-12H,-24H  
 CM150E3U-12H  
 CM200E3U-12H



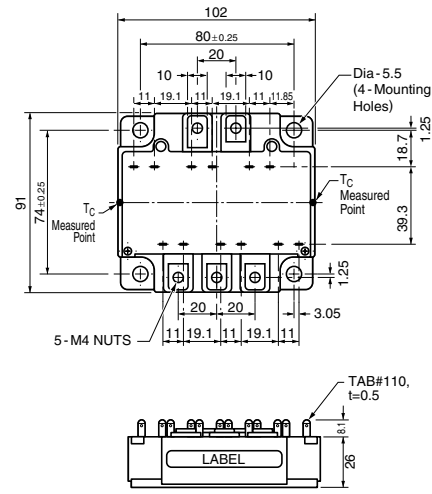
**U202** CM200DU-34KA  
 CM300DU-24H,-24F  
 CM350DU-5F  
 CM600DU-5F



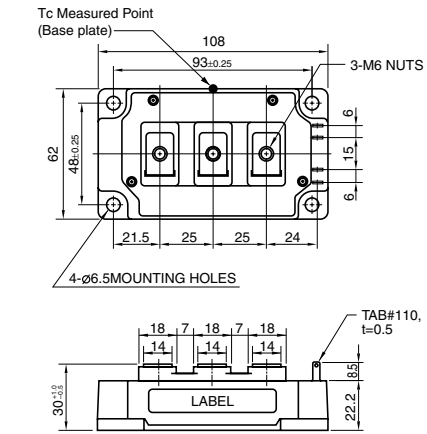
**U205** CM300,400DU-34KA  
 CM600DU-24F  
 CM600DU-24NF



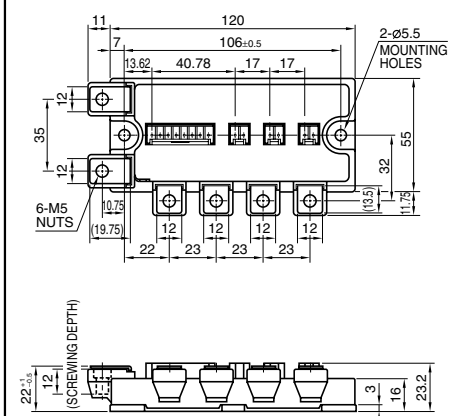
**U601** CM50TU-24H,-24F  
 CM75TU-12H,-12F  
 CM100TU-12H,-12F



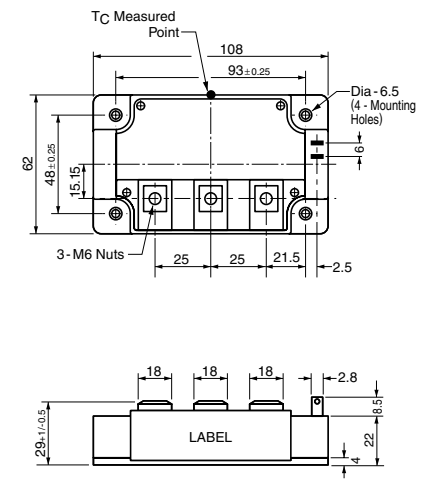
**N202** CM200DY-24NF  
 CM300DY-24A  
 CM400DY-12NF



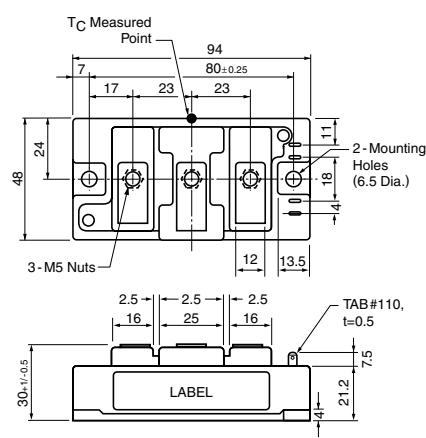
**NF601** CM50TL/RL-24NF  
 CM75TL/RL-12NF,-24NF  
 CM100TL/RL-12NF,-24NF  
 CM150TL/RL-12NF



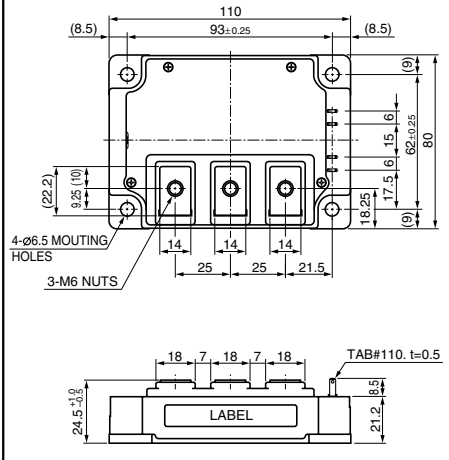
**U112** CM150E3U-24H  
 CM300E3U-12H



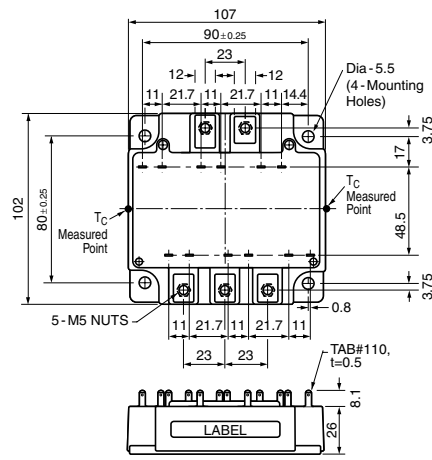
**U203** CM50DU-24H,-24F  
 CM75DU-12H,-24H,-12F,-24F  
 CM100DU-12H,-24H,-12F,-24F,-24NFH  
 CM150DU-12H,-12F,-24NFH CM100DUS-12F  
 CM200DU-12H,-12F,-12NFH CM150DUS-12F



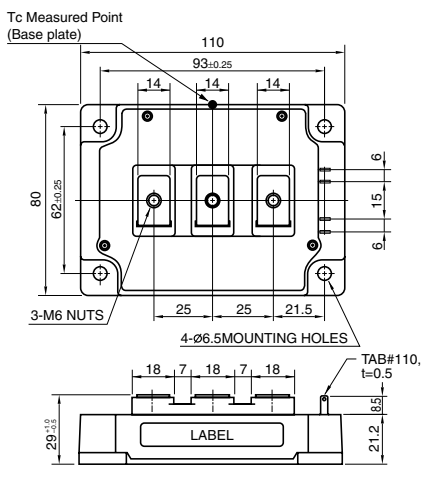
**U206** CM400DU-24NFH  
 CM600DU-24NFH



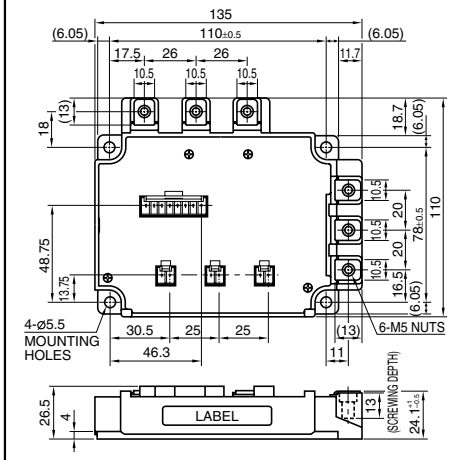
**U602** CM75TU-24H,-24F  
 CM100TU-24H,-24F  
 CM150TU-12H,-12F  
 CM200TU-12H,-12F  
 CM50,75TU-34KA



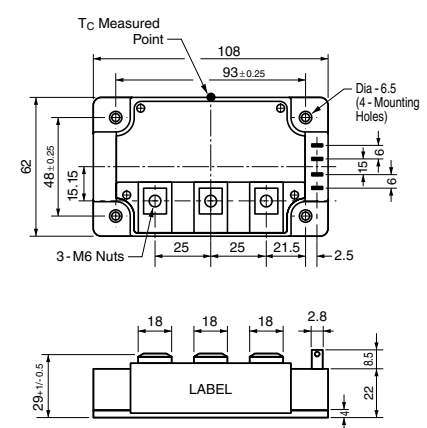
**N203** CM300DY-24NF  
 CM400DY-24NF,-24A  
 CM600DY-12NF,-24A



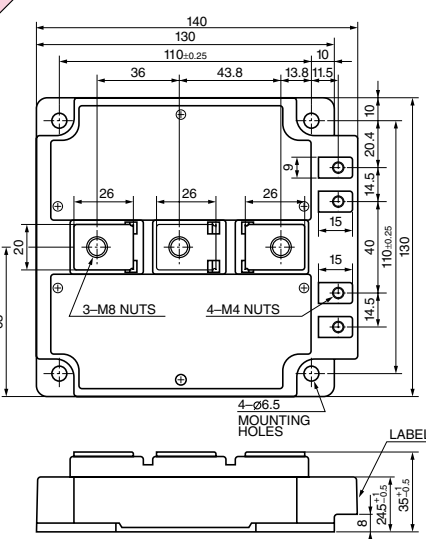
**NF602** CM150TL/RL-24NF  
 CM200TL/RL-12NF,-24NF



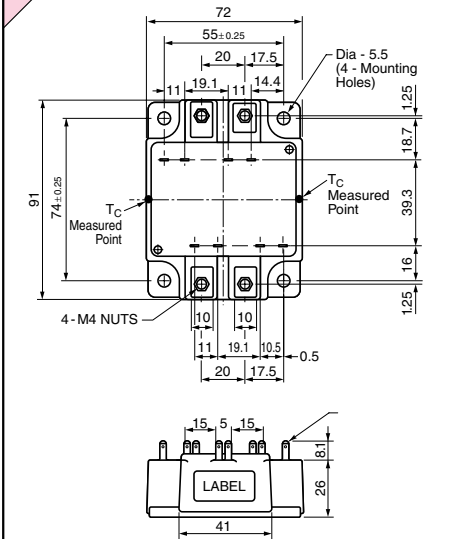
**U201** CM100DU-34KA  
 CM150DU-24H,-24F,-34KA  
 CM200DU-24H,-24F,-24NFH  
 CM300DU-12H,-12F,-12NFH,-24NFH  
 CM400DU-5F,-12H,-12F,-12NFH



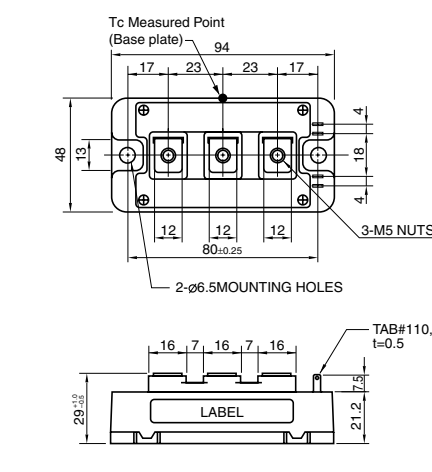
**U204** CM400DU-24F



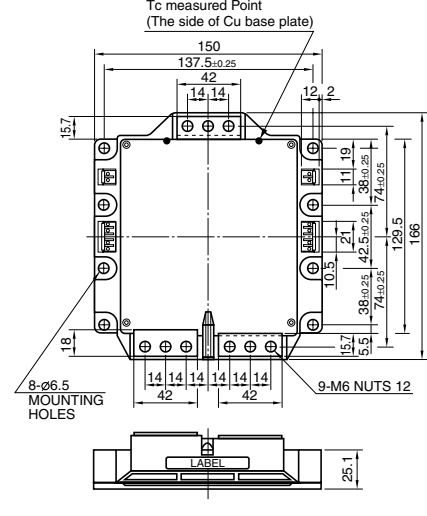
**U401** CM75,100BU-12H



**N201** CM100DY-24NF,-24A  
 CM150DY-12NF,-24NF,-24A  
 CM200DY-12NF,-24A  
 CM300DY-12NF



**N204** CM900,1400DU-24NF  
 CM1000DU-34NF





**R9** RM30CZ-M,-H  
RM30DZ-M,-H  
RM60CZ-M,-H,-24,-2H  
RM60DZ-M,-H,-24,-2H  
RM100CZ-M,-H,-24,-2H  
RM100DZ-M,-H,-24,-2H

**R10** RM30CZ-24,-2H  
RM30DZ-24,-2H  
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** RM10TNA-H  
RM20TNA-H  
RM30TNA-H

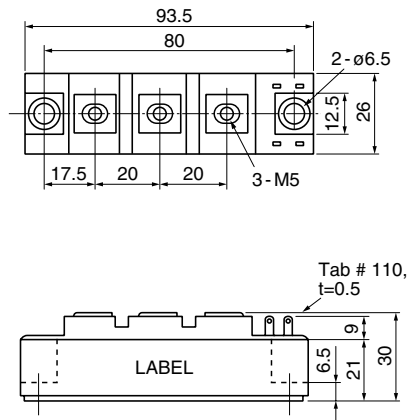
**R20** RM20TPM-H,-M  
RM30TPM-H,-M

**R23** RM450HA-5H

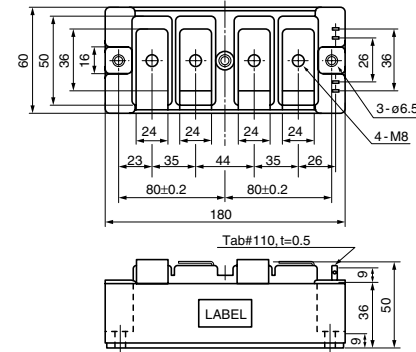
**R26** RM10TN-2H  
RM25TN-2H

# Thyristor Modules

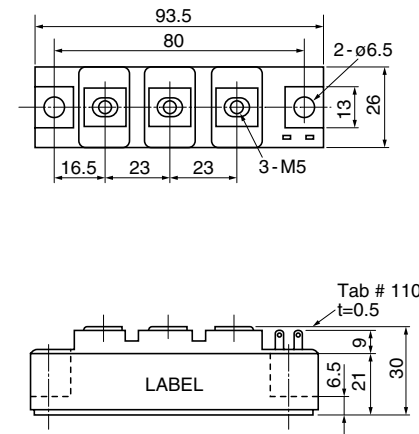
**T3**  
TM25CZ/DZ-M,-H  
TM55CZ/DZ-M,-H  
TM90CZ/DZ-M,-H



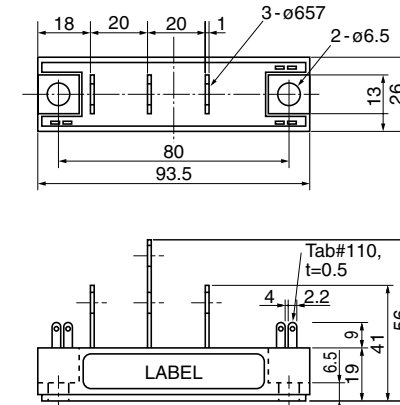
**T6**  
TM400CZ/DZ/PZ/UZ-M,-H,-24,-2H



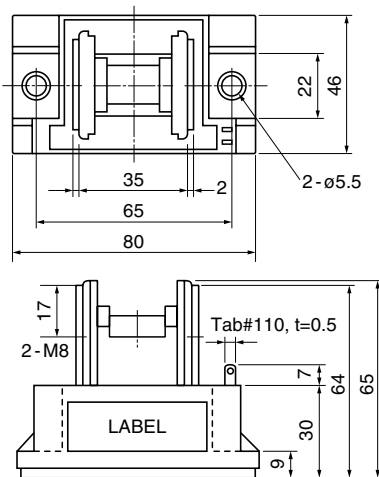
**T9**  
TM25EZ/RZ-24,-2H  
TM55EZ/RZ-24,-2H  
TM90EZ/RZ-24,-2H



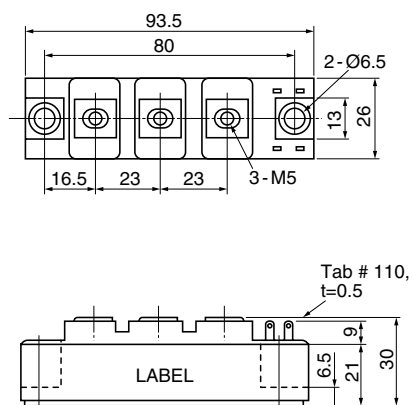
**T12**  
TM60SA-6  
TM90SA-6



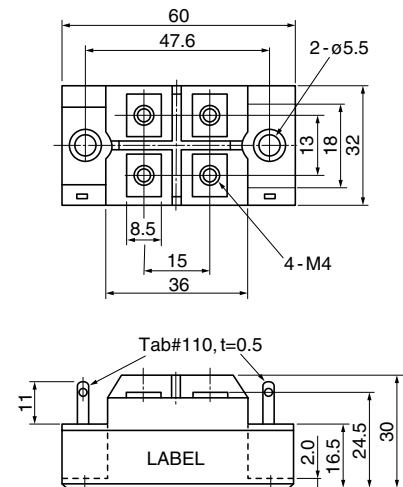
**T1**  
TM400HA-M,-H,-24,-2H



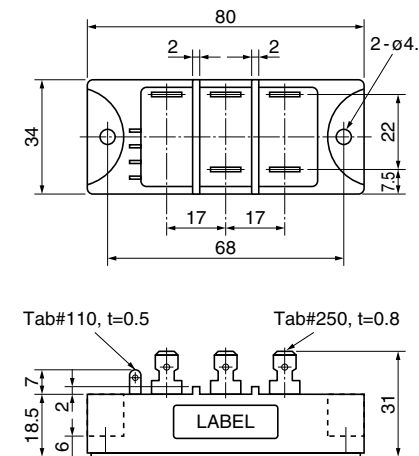
**T4**  
TM25CZ/DZ-24,-2H  
TM55CZ/DZ-24,-2H  
TM90CZ/DZ-24,-2H



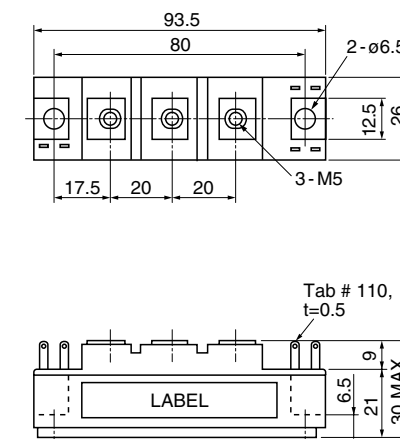
**T7**  
TM20RA-M,-H



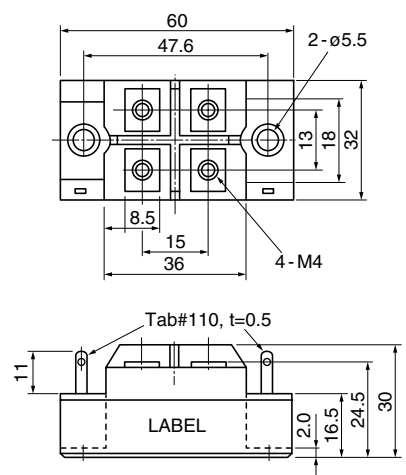
**T10**  
TM10T3B-M,-H



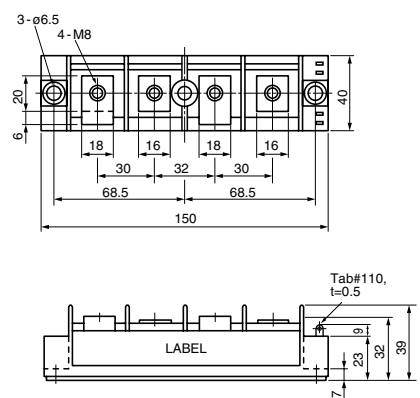
**T13**  
TM60SZ-M  
TM100SZ-M



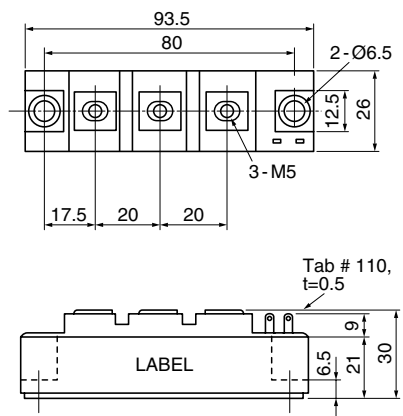
**T2**  
TM20DA-M,-H



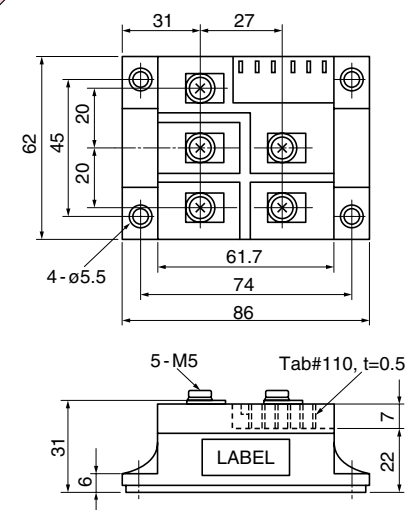
**T5**  
TM130CZ/DZ/EZ/GZ/PZ/RZ-M,-H,-24,-2H  
TM200CZ/DZ/EZ/GZ/PZ/RZ-M,-H,-24,-2H



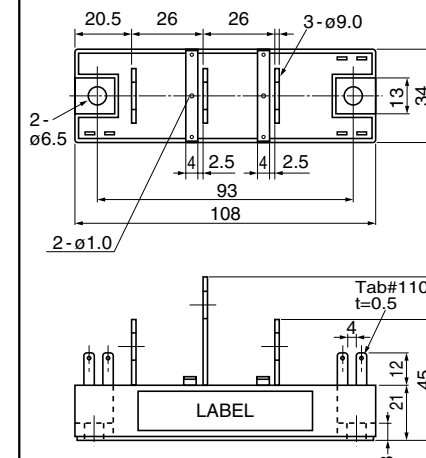
**T8**  
TM25EZ/RZ-M,-H  
TM55EZ/RZ-M,-H  
TM90EZ/RZ-M,-H



**T11**  
TM15T3A-M,-H  
TM25T3A-M,-H



**T14**  
TM150SA-6



# High Power Devices

## Variety of Products Apply for Wide Range Needs

High power devices are semiconductor devices represented by GCT thyristors and HVIGBT Modules, and these devices are now used in equipment designed for tractions, including Shinkansen 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 (Gate Commutated Turn-off) thyristors, HVIGBT (High-Voltage Insulated Gate Bipolar Transistor) modules, HVIPM (High-Voltage Intelligent Power Modules), etc.

### ■ Features

- The appropriate outline (flat base, flat, or moduled) selectable according to the particular mounting requirements.
- General-purpose thyristor and diode series for specifications from 400V to 12kV and from 60A to 5,000A
- GTO Series for ratings from 4.5kV/1kA to 6kV/6kA
- Easy series/parallel connection and snubberless turn-off capability (GCT thyristors)
- GCT thyristor-use gate drivers that promise the optimum driving parameters
- Long creeping distance and high insulation voltage (4kVrms to 6kVrms) (HVIGBT module, HVDi module)
- Since a variety of models in terms of voltage, current, circuit connection, etc. are available, our products can be used in a range of applications such as inverters. (HVIGBT module, HVDi module)
- The ease of both installation and connection allows application equipment to be reduced in dimensions and weight. (HVIGBT module, HVDi module)

### ■ Naming system

PM 1200 H CE 330 -1 (TYPE 1)  
 CM 1200 H A -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 x 10 = V<sub>ces</sub>  
 Example: 330 x 10 = 3,300 V  
 For TYPE 2:  
 Withstand voltage class x 50 = V<sub>ces</sub>  
 Example: 66 x 50 = 4,500 V  
 For TYPE 3:  
 Withstand voltage class x 50 = V<sub>DRM</sub> or V<sub>RRM</sub>  
 Example: 90 x 50 = 4,500 V
- Voltage classification or turn-off time or high frequency type in case of "x"
- Auxiliary number (denotes the type of outline or manufacturing process)
- Connection
- Rated current capacity (However, the GCT Thyristor Unit is shown as a value multiplied by 1/100.)
- Type of device



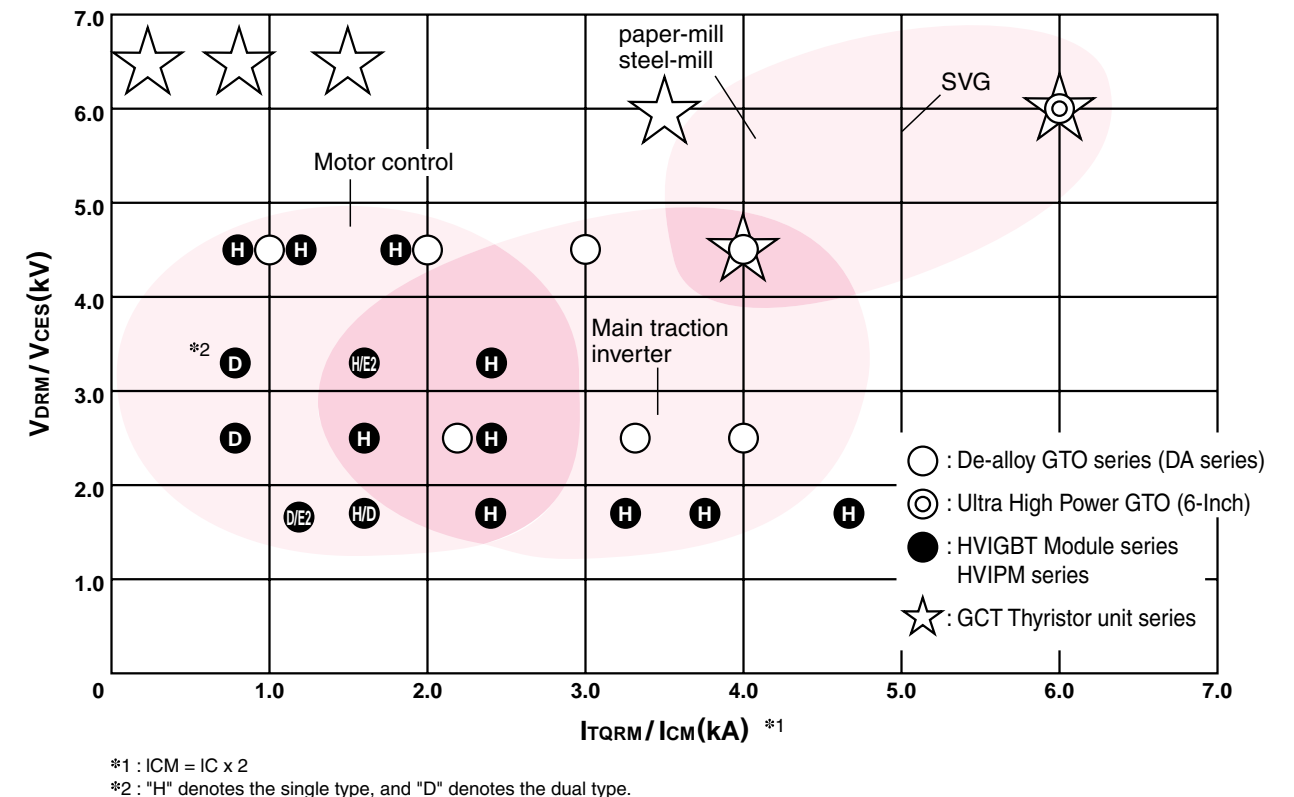
### ■ Types and symbols

Type of device	Symbol	Outline			Type
		Stud or flat base	Flat	Moduled	
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	

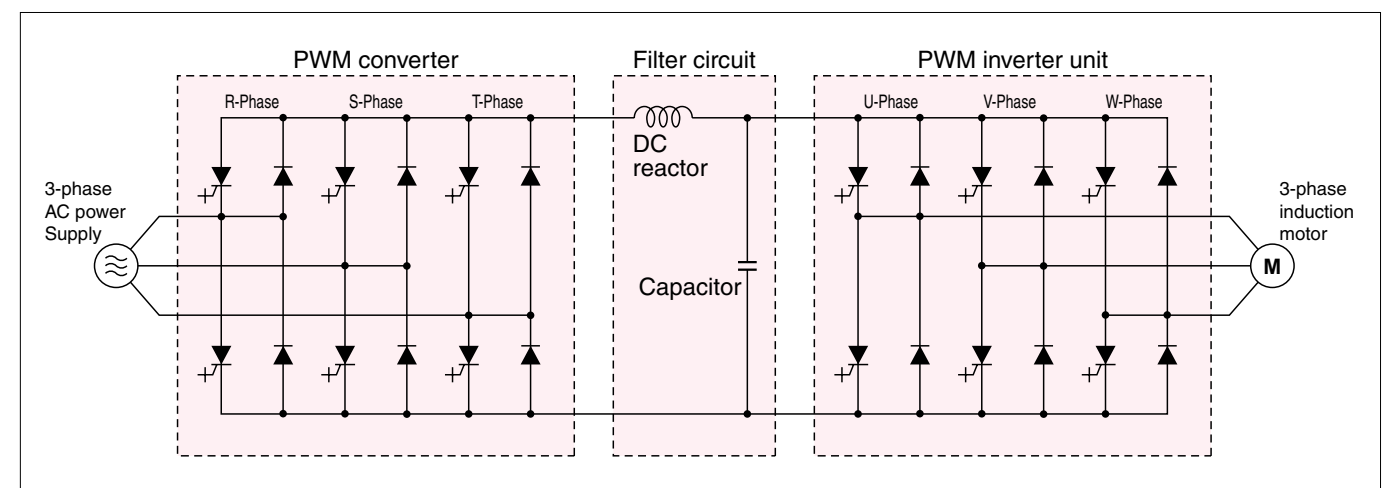
## GTO / GCT Thyristors and HVIGBT Module Series

High-power devices are used in a wide range of fields such as electric railway, electric power utilities, and the iron and steel industry. Improvement of these devices in capacity, power loss, dimensions, and weight, is being demanded as market needs. We have increased the number of de-alloy types of GTO Series (DA Series) products and added the GCT Thyristor Series, GCT Thyristor Unit Series, HVIGBT Module Series and HVIPM to our existing product line-up to meet a range of user needs. The HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Module Series have a capacity of 4.5kV withstand voltage, which is of the world's largest class and a high insulation voltage of AC 6kVrms for 1min. These modules, that are MOS

devices can reduce their circuits in size and weight. The GCT thyristors are new-type large-capacity power devices that turn-off by commutating all major currents into the gate circuit. The inductance of this gate circuit is reduced to about 1/100 of our conventional GTO product and allows the rise of the turn-off gate current to be increased. Since the storage time can be reduced to about 1/10 of our conventional GTO product, the GCT thyristors are best suited for the applications that require series/parallel connection. Compared with the GTO thyristors, these devices can be improved in turn-off capability significantly and allow turn-off, even without a snubber.



### ■ Main circuit of PWM converter/inverter system



# Rectifier Diodes

## ■ Rectifier Diodes for general use

Type name	Voltage (V) current (A)*1	500	600	800	1200	1600	2000	2800	3000	4000	4400	5000	Shape
		SR60L-10S(R)	60	●									
SR100L-10S(R)	100	●											Flat base type
SR130L-10S(R)	130	●											Flat base type
SR150L-10S(R)	150	●											Flat base type
SR170L-10S(R)	170	●											Flat base type
SR200L-10S(R)	200	●											Flat base type
SR202AM-40S(R)							●						Stud type M12
FD252AM-40	240						●						Flat type ø19
SR250L-10S(R)	250	●											Flat base type
SR252AM-40S(R)							●						Stud type M20
SR302AL-24S(R)	300				●								Stud type M20
FD402AL-16	375			●									Flat type ø19
FD402AM-32	400					●							Flat type ø25.1
SR402AH-60									●				Stud type M24
FD602AH-60	600								●				Flat type ø29.5
FD602AV-88										●			Flat type ø34
FD1000A-56	800									●			Flat type ø45
FD1000D-56											●		Flat type ø35
FD1600CP-10	1600	●											Flat type ø35
FD1600A-60										●			Flat type ø50
FD1600CV-80											●		Flat type ø60
FD3500BP-12	3500		●										Flat type ø60
FD3500AH-56								●					Flat type ø80
FD5000AV-100DA **	5000											●	Flat type ø85

\*1 : Shown by the average forward current.

\*\* : Under development

## ■ Rectifier Diodes for fast switching

Type name	Voltage (V) current (A)*1	2500	2800	4500	6000	Shape
		SR202AH-50S(R)	150	●		
SR202AV-90	230			●		Stud type M24
FD252AV-90	440			●		Flat type ø34
FD452AH-50	610	●				Flat type ø29.5
FD602BV-90	800			●		Flat type ø47
FD1000FV-90	1000			●		Flat type ø60
FD1000FX-90	1500			●		Flat type ø60
FD1000FH-56	1700		●			Flat type ø50
FD1500AV-90				●		Flat type ø70
FD2000DU-120					●	Flat type ø130

\*1 : Shown by the average forward current.

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

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

\*1 : Shown by the average forward current.

\*\* : Under development

# Thyristors

## ■ Thyristors for general use

Type name	Voltage (V) current (A)*1	400	600	1200	1400	1600	1800	2200	2500	2700	2800	4000	4500	12000	Shape
		CR152AL-24	150			●									
CR202AM-36	175														Stud type M20
CR252AP-12	250		●												Stud type M20
CR252AM-36							●								Stud type M24
FT302AM-36	300						●								Flat type ø19
FT502AH-80	320											●			Flat type ø34
CR402AM-36	350														Stud type M24
FT402AL-32	400						●								Flat type ø25.1
FT402AM-36								●							Flat type ø25.1
FT502AL-32	500							●							Flat type ø25.1
FT502BH-44										●					Flat type ø34
FT802AL-24	800			●											Flat type ø34
FT802AV-90													●		Flat type ø47
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 ø60
FT1500GV-80	2500														Flat type ø80
FT1500AU-240														●	Flat type ø80
FT2500CL-24	5000			●											Flat type ø105
FT2500BH-56															Flat type ø60
FT5000AP-8		●													Flat type ø80

\*1 : Shown by the average ON current.

\*2 : Current type inverter thyristor

## ■ Fast switching Thyristors

Type name	Voltage (V) current (A)*1	1200	1800	2500	Shape
		CR152AY-24	150	● (15)	
FT502AY-24	410	● (20)			Flat type ø34
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 [μs].

# GTO Thyristors

Gate Turn-off Thyristors

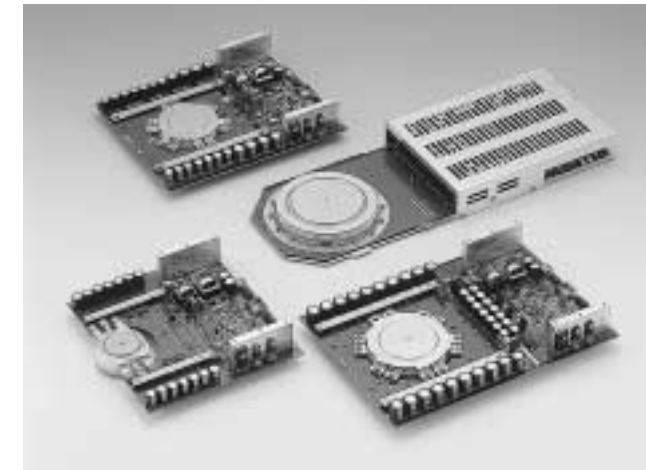
## ■ GTO Thyristors

Type name	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		●	

\*1 : Shown by the repeatable control ON current.

# GCT Thyristors Unit

Gate Commutated Turn-off Thyristors Unit



Photograph of the GCT Thyristor Unit Series

## ■ Features

GCT thyristor unit is the new product which combine GCT thyristor and gate driver.

GCT thyristor is operated by optimized designed gate driver and get highest performance on its characteristics.

## ■ Application

The handling of GCT thyristor unit is easy because GCT thyristor and gate driver are combined in the unit.

GCT thyristor unit is most suitable for following high power electronics application.

- SVG (Static Var Generator)
- Frequency changer
- BTB (Back to back)
- Motor drives for steel mill and paper mill

## ■ GCT Units

Type name	V <sub>DRM</sub> (V)	V <sub>RRM</sub> (V)	I <sub>TORM</sub> (A)	T <sub>J</sub> (°C)	Power supply		Status signal from LED		Status signal from Transmitter		Frequency	Structure
	Repetitive peak off state vottage	Repetitive peak reverse vottage	Repetitive controllible on state current	Junction temperature	V <sub>c</sub> (V)	Remarks	Status signal	Fault signal	Status signal	Fault signal	f (Hz)	
GCU04AA-130	6500	6500	400	125	20	DC power supply	●	●	●	●	780	Symmetrical
GCU08BA-130			800									
GCU15CA-130			1500									
GCU35AC-120 ★	6000	21	3500	125	24~40	AC rectangular input (15kHz~100kHz) or DC power supply	●	●	●	●	1000	Asymmetrical
GCU40BC-90 ★	4500		4000									

Note: Control signal: Optical fiber data link

★: New product



# HVIGBT Modules

High Voltage Insulated Gate Bipolar Transistor Modules

## ■ HVIGBT Modules <HA series> : Copper base plate

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

## ■ HVIGBT Modules <HB series> : Copper base plate

Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)				
		400	600	800	900	1200
H	2500			CM7 CM800HB-50H		CM8 CM1200HB-50H
	3300			CM7 CM800HB-66H		CM8 CM1200HB-66H
	4500	CM7 CM400HB-90H	CM7 CM600HB-90H		CM8 CM900HB-90H	CM8
E2	3300			CM8 CM800E2Z-66H		

## ■ HVIGBT Modules <HC series> : AISiC base plate

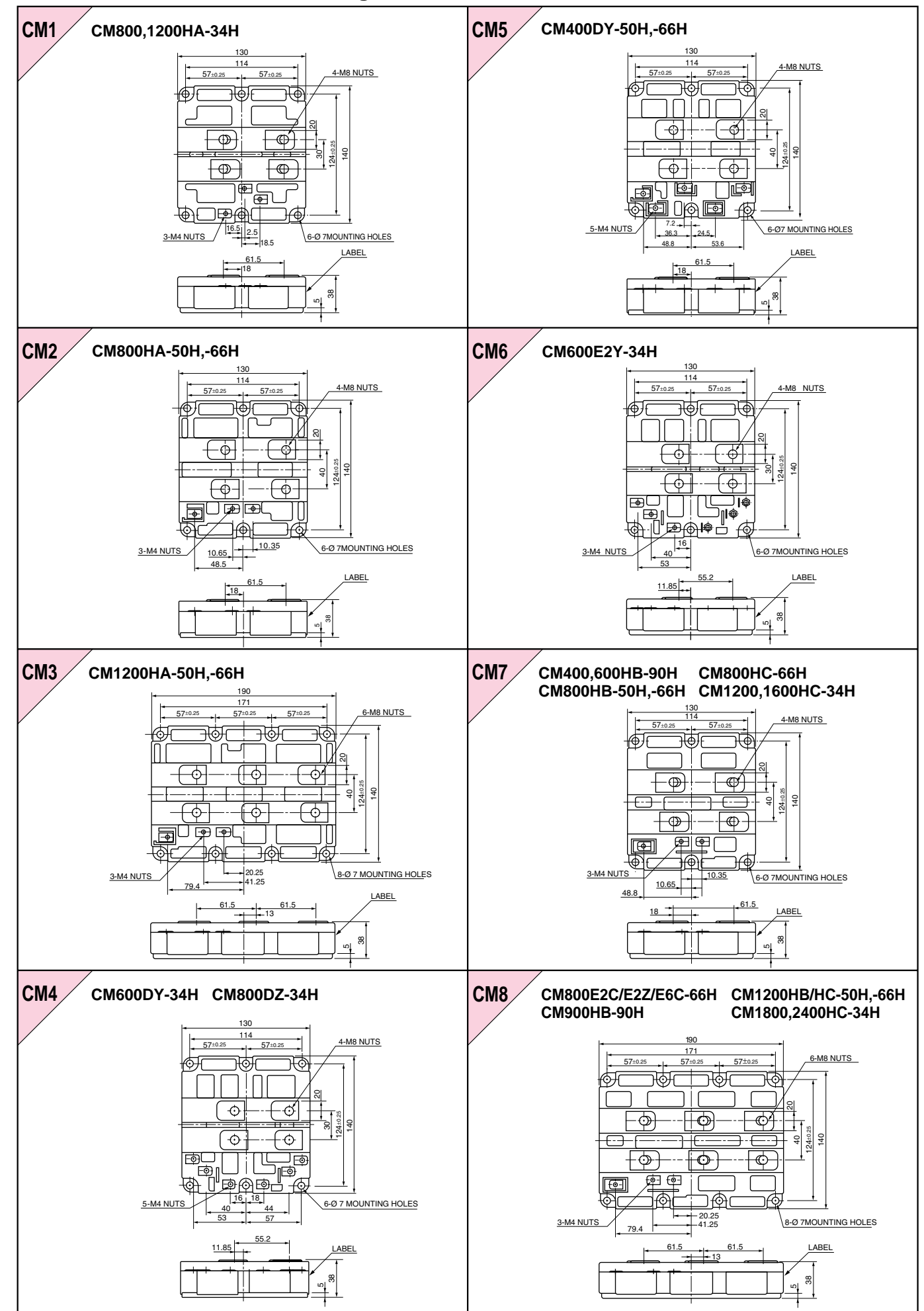
Connection	V <sub>CES</sub> (V)	I <sub>c</sub> (A)				
		800	1200	1600	1800	2400
H	1700		CM7 CM1200HC-34H	CM7 CM1600HC-34H	CM8 CM1800HC-34H*	CM8 CM2400HC-34H*
	2500		CM8 CM1200HC-50H			
	3300	CM7 CM800HC-66H*	CM8 CM1200HC-66H			
D	1700	CM4 CM800DZ-34H				
	3300	CM8 CM800E2C-66H CM800E6C-66H*				

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

★ : New product

## ■ HVIGBT Modules outline drawings

(Unit : mm)



# HVDi Modules

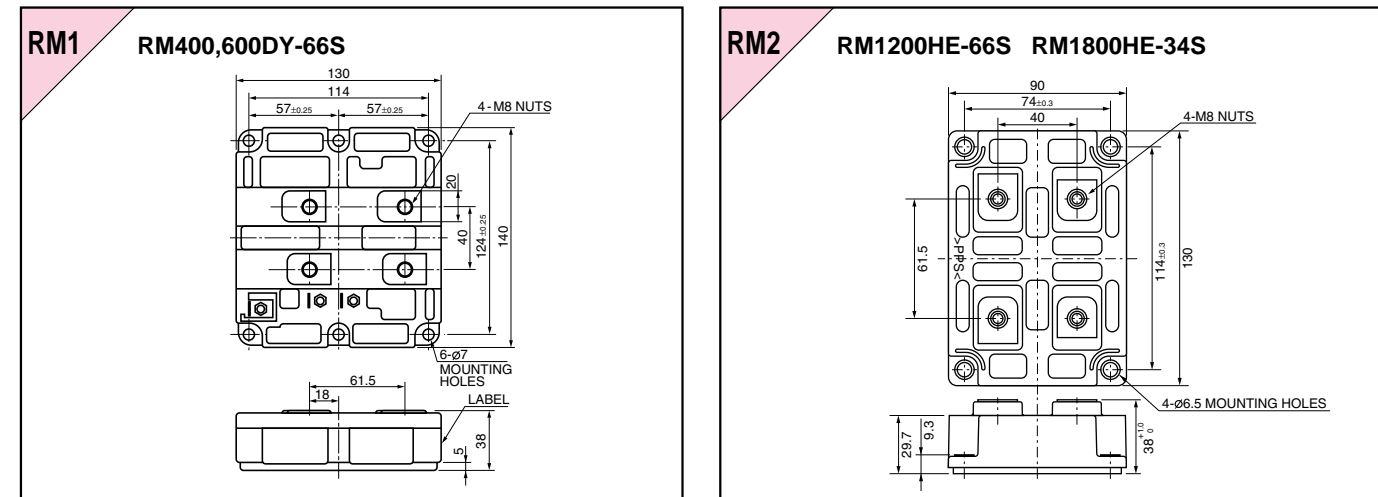
High Voltage Diode Modules

## ■ HVDi Modules

connection	V <sub>RRM</sub> (V)	I <sub>F</sub> (A)	
		400	600
D	3300	RM400DY-66S	RM600DY-66S
RM1			

connection	V <sub>RRM</sub> (V)	I <sub>F</sub> (A)	
		1200	1800
H	1700	RM1200HE-66S	RM1800HE-34S
	3300		RM2
RM2			

## ■ Outline drawing



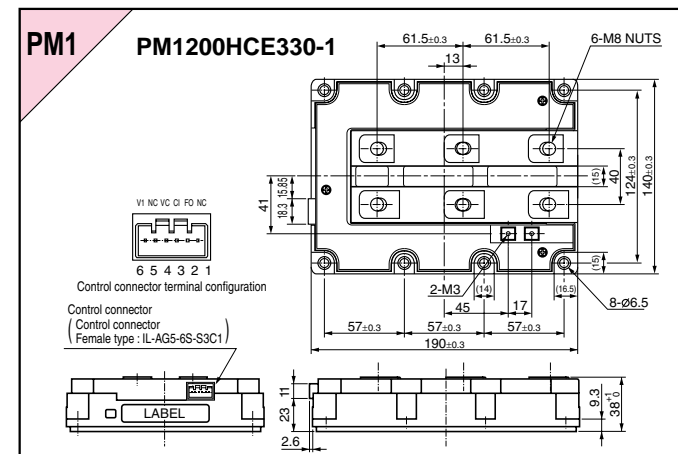
# HVIPM

High Voltage Intelligent Power Modules

## ■ High Voltage Intelligent Power Modules

connection	V <sub>RRM</sub> (V)	I <sub>C</sub> (A)
		1200
H	3300	PM1200HCE330-1
PM1		

## ■ Outline drawing



# High Voltage Integrated Circuits

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

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

## ■ Application

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

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

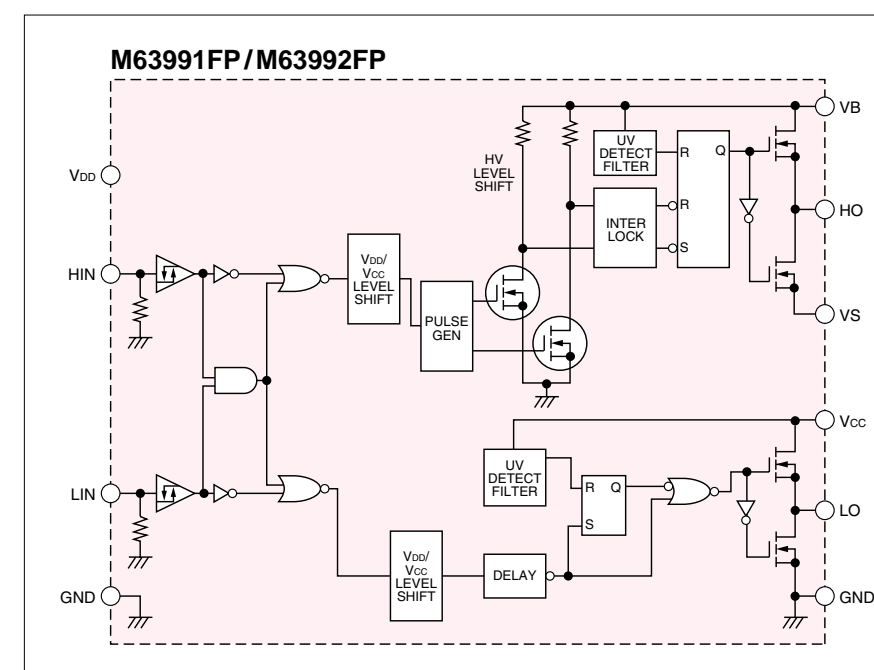


## ■ Reference by function

Type name	Floating supply voltage [V]	Output current [A]	Driving method	Number of input-signal	Dead-time control	Remarks	Package outline	Outlines drawings
M63954P	600	0.5	Half bridge	—	Inside	Built-in oscillator	16P4	②
M63975FP	20		Low side	1	—	—	10P2N	⑫
M63991FP	600	2.0	Half bridge	2	Input-signal	With interlock function	16P2N	⑤
M63992FP			0.3	3φ bridge			2×3 (6)	36P2R
M63993FP		0.5	Half bridge	1	Inside	—	8P2S	⑪
M63994FP (Lead free)				—	—	—	—	—
M63996FP		2.0	Half bridge	2	Input-signal	SD/With interlock function	16P2N	⑤
M81700FP						With interlock function		
M81701FP						With SD function		
M81702FP		+0.15/-0.125	High side	1	—	—	8P2S	⑪
M81703FP								
M81705FP		+0.12/-0.25	Half bridge	2	Input-signal	With interlock function	16P2N	⑤
M81706AFP								
M81707FP		0.1	Dual high side	2	Input-signal	—	36P2R	⑩
M81708FP		+0.12/-0.25	Half bridge	1	Input-signal	With interlock function	16P2N	⑤
M81709FP								
M81712FP ★★	1200	0.3	3φ bridge	2×3 (6)	—	8P2S	⑪	
M81713FP ★★								0.5
M81019FP ★★	24	0.6	Half bridge	2	Input-signal	24P2Q	⑰	
M81711FP ★★								—
M81716FP ★★	—	0.4	Dual low side	1×2	—	8P2S	⑪	

★★ : Under development

## ■ Block diagram



# Transistor-Array



## Wide Products Range Help Reduce Product Size and Weight

Transistor array is the semiconductor integrated circuit in which a minute input current enables a big current drive. They are used in a wide range of fields due to its abundant product series (30mA to 1.5A/20V to 80V). Application of the surface mounting package also enables the compact, lightweight and high density mounting of set.

### Application

- 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 type name

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 per product's series
- Application and the range of ambient temperature for operation
- Abbreviation shows the Mitsubishi Integrated Circuit

### Quick reference

Current	Voltage	20V	35V	40V	50V	80V	
50mA		◇◇M54514AP/AFP		◇◇M54513P/FP			
150mA				◇◇M54527P △△M54560P		△△M54580P/FP	
200mA				◇◇M81016P/FP/KP ★			
300mA			◇◇M63802P/FP/GP/KP ◇◇M63803P/FP/GP/KP ◇◇M63804P/FP/GP/KP ◇◇M63805P/FP/KP ◇◇M63806P/FP/KP ◇◇M63807P/FP/KP ◇◇M63812P/FP/GP/KP ◇◇M63813P/FP/GP/KP ◇◇M63814P/FP/GP/KP ◇◇M63815P/FP/KP ◇◇M63816P/FP/KP ◇◇M63817P/FP/KP	△△M54561P			
320mA		◇◇M54534P/FP					
350mA				◇◇M54571P			
400mA				◇◇M54519P/FP ◇◇M54522P/FP ◇◇M54530P/FP ◇◇M54531P/FP	◇◇M54566P/FP ◇◇M54583P/FP	◇◇M54667P	
500mA				△△M63840P/FP/KP **	◇◇M54523P/FP ◇◇M54525AGP ◇◇M54526P/FP △△M54562P/FP △△M54563P/FP △△M54564P/FP ◇◇M54585P/FP/KP ◇◇M54587P/FP △△M63800FP ◇◇M63820P/FP/KP ◇◇M63823P/FP/GP ◇◇M63824P/FP/KP ◇◇M63826P/FP/GP ◇◇M63827WP/DP ★ ◇◇M63828WP/DP ★ ◇◇M63832GP/KP ◇◇M63834P/FP/KP ◇◇M63836P/FP/KP		
700mA		◇◇M54539P					
1.5A					◇◇M54532P/FP ◇◇M54567P/FP ◇◇M63830P/FP	◇◇M54661P/FP ◇◇M54666P	

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

★ : New product  
★★ : Under development



### Reference by function

Type name.	Unit	Io max [mA]	Vo max [V]	Input-function voltage	Output current	Darlington transistor	With output clamp-diode	Low collector-emitter voltage	High input threshold voltage	Mini-frat package	Package outlines	Outlines drawings
M54513FP	8	50	40	H	Sink			●		●	20P2N	⑥
M54513P											18P4G	③
M54514AFP	7	50	20	H	Sink			●		●	16P2N	⑤
M54514AP											16P4	②
M54519FP	7	400	40	H	Sink	●				●	16P2N	⑤
M54519P											16P4	②
M54522FP	8	400	40	H	Sink	●	●			●	20P2N	⑥
M54522P											18P4G	③
M54523FP	7	500	50	H	Sink	●	●			●	16P2N	⑤
M54523P											16P4	②
M54525AGP	7	500	50	H	Sink	●	●		●	●	16P2S	⑦
M54526FP	7	500	50	H	Sink	●	●			●	16P2N	⑤
M54526P											16P4	②
M54527P	6	150	40	H	Sink	●	●				14P4	①
M54530FP	7	400	40	H	Sink	●	●			●	16P2N	⑤
M54530P											16P4	②
M54531FP	7	400	40	H	Sink	●	●			●	16P2N	⑤
M54531P											16P4	②
M54532FP	4	1500	50	H	Sink	●	●			●	16P2N	⑤
M54532P											16P4	②
M54534FP	6	320	20	H	Sink		●	●		●	16P2N	⑤
M54534P											16P4	②
M54539P	6	700	20	H	Sink		●	●			16P4	②
M54560P	7	150	40	L	Source	●	●				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
M54566P											16P4	②
M54567FP	4	1500	50	L	Sink	●	●			●	16P2N	⑤
M54567P											16P4	②
M54571P	6	350	40	H	Sink		●	●			20P4	④
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
M54585P											18P4G	③
M54587FP	8	500	50	L	Sink	●	●			●	20P2N	⑥
M54587P											20P4	④
M54661FP	4	1500	80	L	Sink	●	●			●	16P2N	⑤
M54661P											16P4	②
M54666P	4	1500	80	H	Sink		●	●			16P4	②
M54667P	8	500	80	L	Source	●	●				20P4	④

■ Reference by function

Type name.	Unit	Io max [mA]	Vo max [V]	Input-function voltage	Output current	Darlington transistor	With output clamp-diode	Low collector-emitter voltage	High input threshold voltage	Mini-frat package	Package outlines	Outlines drawings
M63800FP	7	500	50	H	Source	●	●			●	16P2N	⑤
M63802FP										●	16P2N	⑤
M63802GP										●	16P2S	⑦
M63802KP										●	16P2Z	⑧
M63802P											16P4	②
M63803FP										●	16P2N	⑤
M63803GP										●	16P2S	⑦
M63803KP										●	16P2Z	⑧
M63803P											16P4	②
M63804FP										●	16P2N	⑤
M63804GP										●	16P2S	⑦
M63804KP										●	16P2Z	⑧
M63804P											16P4	②
M63805FP										●	20P2N	⑥
M63805KP										●	20P2E	⑨
M63805P											18P4G	③
M63806FP										●	20P2N	⑥
M63806KP										●	20P2E	⑨
M63806P											18P4G	③
M63807FP										●	20P2N	⑥
M63807KP										●	20P2E	⑨
M63807P											18P4G	③
M63812FP										●	16P2N	⑤
M63812GP										●	16P2S	⑦
M63812KP										●	16P2Z	⑧
M63812P											16P4	②
M63813FP										●	16P2N	⑤
M63813GP										●	16P2S	⑦
M63813KP										●	16P2Z	⑧
M63813P											16P4	②
M63814FP										●	16P2N	⑤
M63814GP										●	16P2S	⑦
M63814KP										●	16P2Z	⑧
M63814P											16P4	②
M63815FP										●	20P2N	⑥
M63815KP										●	20P2E	⑨
M63815P											18P4G	③
M63816FP										●	20P2N	⑥
M63816KP										●	20P2E	⑨
M63816P											18P4G	③
M63817FP										●	20P2N	⑥
M63817KP										●	20P2E	⑨
M63817P											18P4G	③
M63820FP										●	20P2N	⑥
M63820KP										●	20P2E	⑨
M63823FP										●	16P2N	⑤
M63823GP										●	16P2S	⑦
M63823P											16P4	②
M63824GP										●	16P2S	⑦
M63824KP										●	16P2E	⑭
M63826FP										●	16P2N	⑤
M63826GP										●	16P2S	⑦
M63826P											16P4	②
M63827WP ★											16P4X	⑮
M63827DP ★										●	16P2X	⑯
M63828WP ★											16P4X	⑮
M63828DP ★										●	16P2X	⑯
M63830FP										●	16P2N	⑤
M63830P											16P4	②
M63832GP										●	16P2S	⑦
M63832KP										●	16P2E	⑭
M63834FP										●	20P2N	⑥
M63834KP										●	20P2E	⑨
M63836FP										●	20P2N	⑥
M63836KP										●	20P2E	⑨
M63840FP ★★										●	20P2N	⑥
M63840KP ★★										●	20P2E	⑨
M63840P ★★											18P4G	③

★ : New product  
★★ : Under development

■ CMOS-ARRAY

Type name.	Unit	Io max [mA]	Vo max [V]	Output current	Function	Mini-frat package	Package outlines	Outlines drawings
M81016P ★	8	200	40	Sink	OUTAL D-TYPE FLIP-FLOP DRIVER WITH CLEAR		20P4B	⑬
●						20P2N	⑥	
●						20P2E	⑨	

★ : New product

High Voltage Integrated Circuits and Transistor-Array outline drawings

(Unit : mm)

