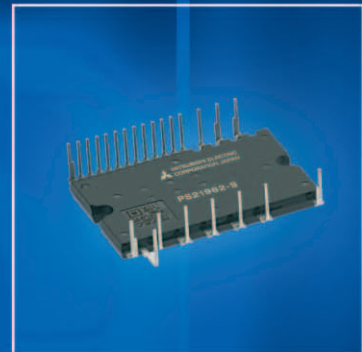
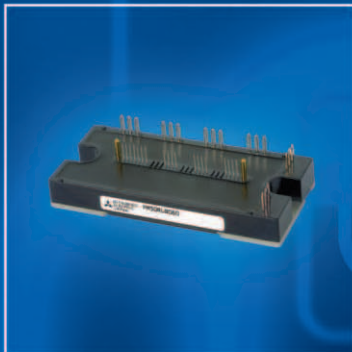
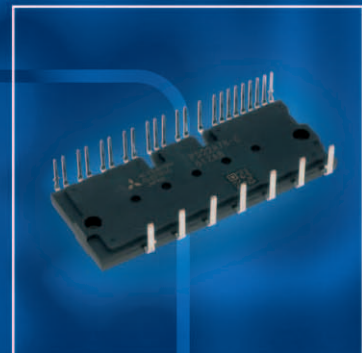


# POWER DEVICES

## Selection Guide 2009





## Mitsubishi Electric Environmental Vision 2021

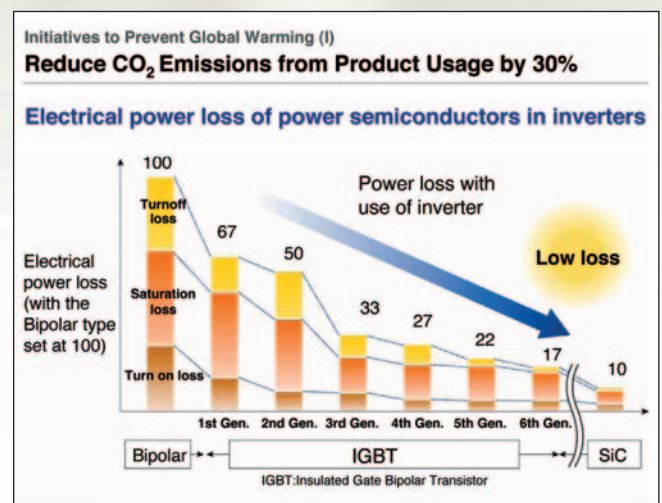
Climate protection is a major issue worldwide and will have a significant impact on our future. The goals for the reduction of climatically harmful greenhouse gas CO<sub>2</sub> are laid down in the Kyoto Protocol. Mitsubishi Electric has had a tradition of reducing CO<sub>2</sub> emissions with advanced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

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

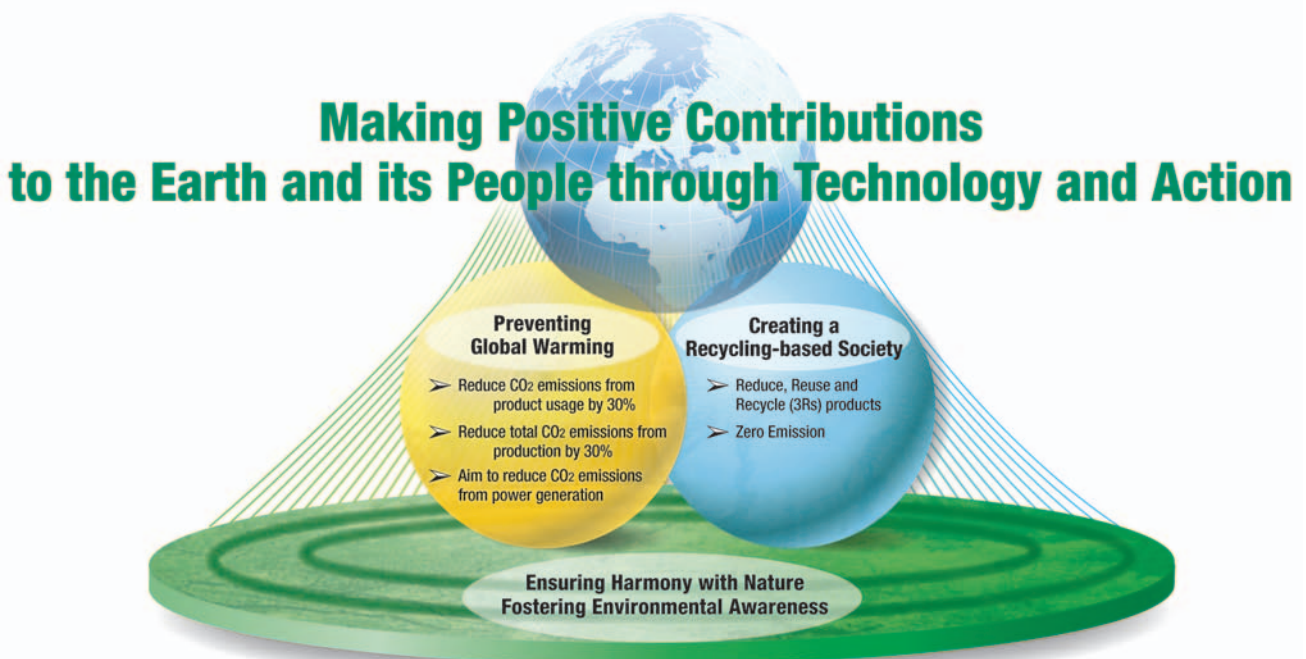
"Environmental Vision 2021" commits Mitsubishi Electric to deliver the following by 2021:

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

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



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





## Mitsubishi Electric

# Global Leader in Semiconductor Technology

### Global Leader in Semiconductor Technology

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

Semiconductors are indispensable components for today's increasingly high performance products, making them vital for an advancing future. Being the quality and innovation leader in many fields, Mitsubishi Electric plays a major role in the semiconductor industry. State-of-the-art technology, modern and high capacity production lines are the key factors to maintain this leading position. Our customers benefit from extensive technical support as well as a widespread sales and distribution network.

Our success is contributed by three divisions: High Frequency-, Power- and Opto-Semiconductors. With regarding quality and reliability as our core values, Mitsubishi Electric Europe B.V. has achieved ISO 9001 certification continuously since 1995.

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

### Power Semiconductors Core Capabilities

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

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

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

The market trend towards more compact modules with high efficiency has been continuously pursued by Mitsubishi Electric. At present some 2 million DIIPM™ modules are manufactured and tested for 100% functionality per month. The compact package of Mini-DIP and Super Mini-DIP proved cost effective products for white goods applications. Newly introduced Single chip Inverter is the smallest inverter (17.5 X 11.93 mm), which reduces the PCB size making attractive for dish washers and air conditioning applications.

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



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## Symbols

## Description

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

## Ordering Information for Mitsubishi IGBT Modules

### NX -Series

NX-Series is the latest development of Mitsubishi Electric's state of the art 6<sup>th</sup> Generation Carrier Stored Trench Gate Bipolar Transistor (CSTBT™) IGBT and diode chip technology, offering flexible package concept using common platform for singles, dual, six- and seven-packs and CIB (Converter-Inverter-Brake). The comprehensive line-up in 600V, 1200V and 1700V NX-Series is UL approved and ensures 175°C as  $T_{j(max)}$ .

### Mega Power Dual (with 6<sup>th</sup> Generation IGBT Chips)

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

### NF- and A-Series

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

### NFH-Series

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

#### 1 IGBT

#### 2 $I_C = 150A$

#### 3 Internal Connection:

- H** = Single IGBT Module
- D** = Dual IGBT Module
- B** = H-Bridge IGBT Module
- T** = Sixpack IGBT Module
- R** = Sevenpack IGBT Module
- E2** = Chopper IGBT Module
- E3** = Chopper IGBT Module
- E4** = Chopper IGBT Module

#### 4 Package Style:

- A** **B** **C** **D** **F** **J** **U** **Y**

#### 5 $V_{CES}$ :

- 5** = 250V      **12** = 600V      **24** = 1200V
- 28** = 1400V    **34** = 1700V    **50** = 2500V
- 66** = 3300V    **90** = 4500V    **130** = 6500V

#### 6 Chip Technology:

- NX** = 6<sup>th</sup> Generation
- NF/A** = 5<sup>th</sup> Generation
- NFH** = 5<sup>th</sup> Generation (Trench High Frequency)

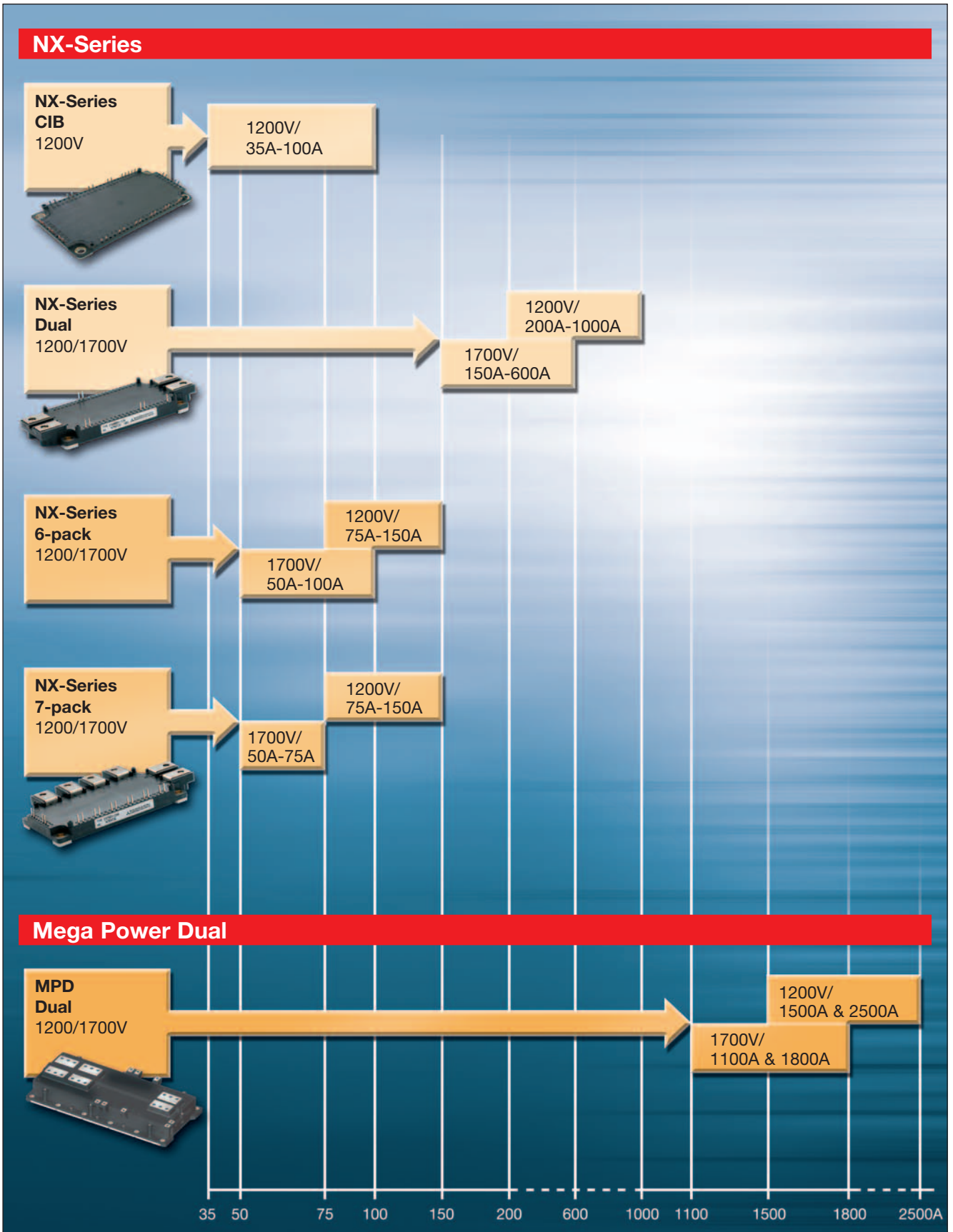
### Example:

<b>CM</b>	<b>150</b>	<b>D</b>	<b>Y</b>	-	<b>24</b>	<b>NF</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>		<b>5</b>	<b>6</b>



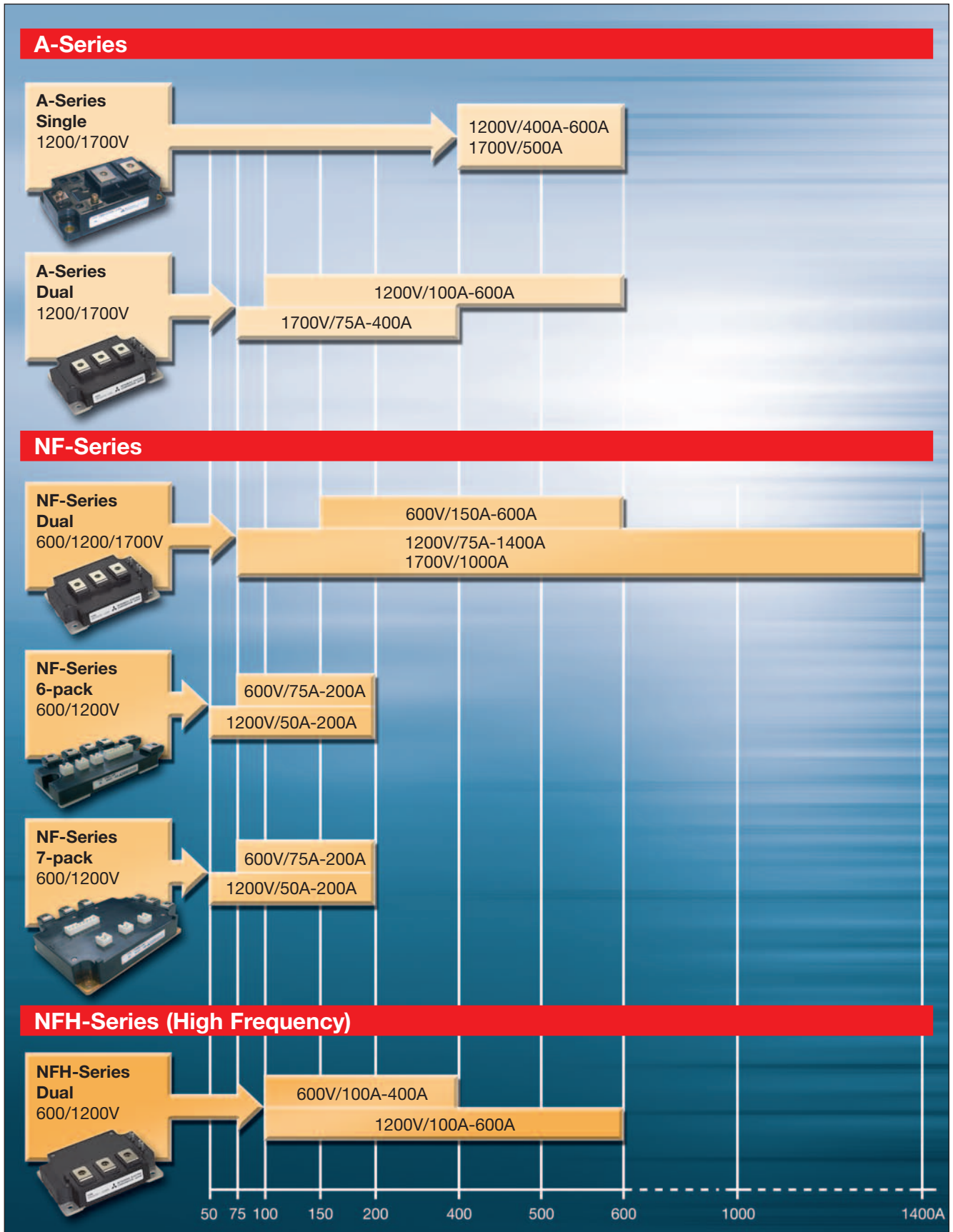
# 1.02

## Overview of IGBT Modules



1

## 1.02 Overview of IGBT Modules



## 6<sup>th</sup> Generation IGBT Modules (NX-Series)



1

### Applications

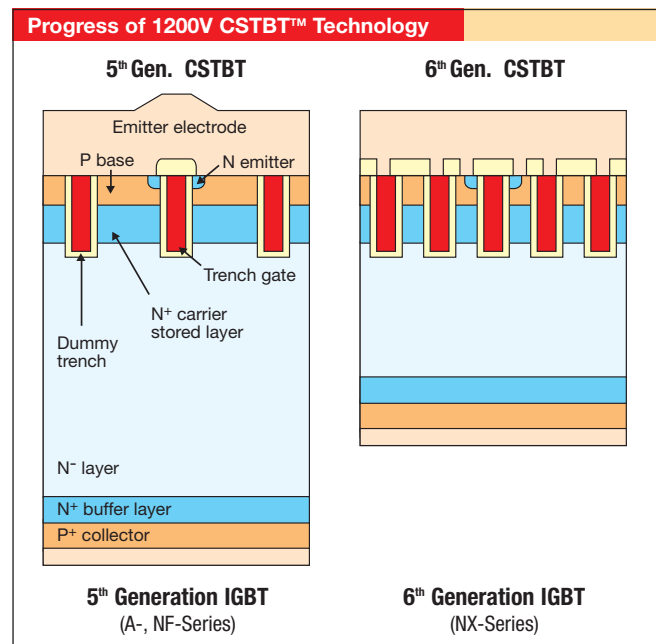
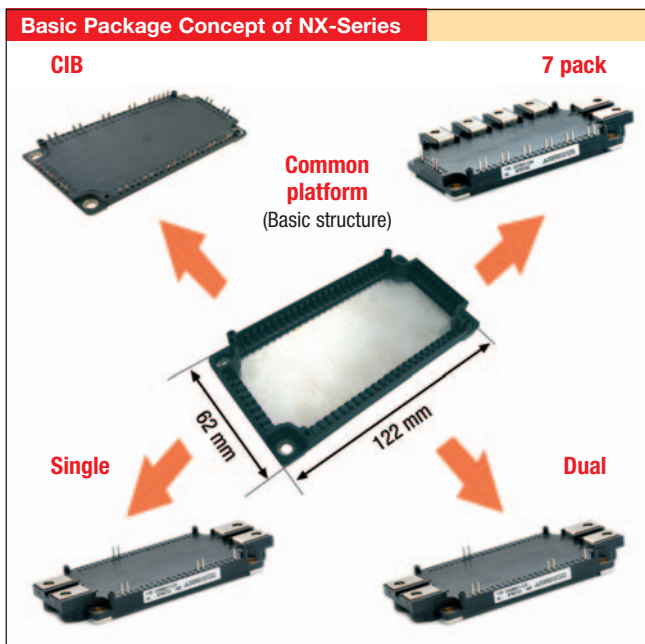
- General Purpose Drives
- Photovoltaic Inverters
- UPS

### Features

- 6<sup>th</sup> Generation IGBT with CSTBT™ Chip Technology
- For 1200V modules:  $V_{CE(sat)} = 1.7V(\text{typ}) @ T_j = 125^\circ\text{C}$ ; wide SOA @  $V_{CC} = 900V$
- For 1700V modules:  $V_{CE(sat)} = 2.2V(\text{typ}) @ T_j = 125^\circ\text{C}$ ; wide SOA @  $V_{CC} = 1200V$
- More than  $10\mu\text{s}$  short circuit capability and excellent paralleling characteristics
- 6<sup>th</sup> Generation Free Wheel Diode Chip with positive temperature coefficient and optimised trade-off between  $V_F$  and  $E_{sw(rec)}$
- $T_{j(max)} = 175^\circ\text{C}$
- High flexibility by using one common platform design for single, dual, six- and seven-packs and CIB (converter-inverter-brake)
- Variety of pin terminals and different sizes of screw terminals
- Solderless contacts on demand
- Comprehensive line-up in 600V, 1200V, 1700V
- UL certification
- Entirely RoHS compliant



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



### Line-up 6<sup>th</sup> Generation NX-Series (1200V)\*

Current	Package				
	NX-M				NX-L
	CIB	7in1	6in1	2in1	2in1
35	CM35MXA-24S				
50	CM50MXA-24S				
75	CM75MXA-24S	CM75RX-24S	CM75TX-24S		
100	CM100MXA-24S	CM100RX-24S	CM100TX-24S		
150		CM150RX-24S	CM150TX-24S		
200				CM200DX-24S	
300				CM300DX-24S	
450				CM450DX-24S	
600					CM600DXL-24S
1000					CM1000DXL-24S

### Line-up 6<sup>th</sup> Generation NX-Series (1700V)\*

Current	Package				
	NX-M				NX-L
	CIB	7in1	6in1	2in1	2in1
50		CM50RX-34S	CM50TX-34S		
75		CM75RX-34S	CM75TX-34S		
100			CM100TX-34S		
150				CM150DX-34S	
200				CM200DX-34S	
300				CM300DX-34S	
400					CM400DXL-34S
600					CM600DXL-34S

\*under development

# 1.04

## Mega Power Dual IGBT Modules (with 6<sup>th</sup> Gen. IGBT Chips)



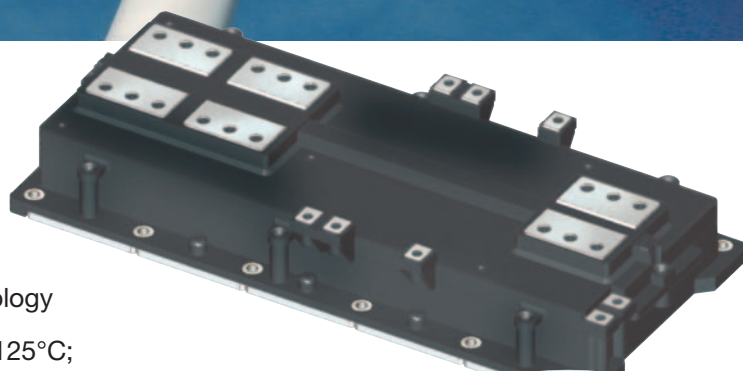
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### Application

High Power Energy Conversion

### Features

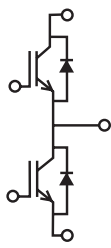
- 6<sup>th</sup> Generation IGBT with CSTBT™ Chip Technology
- For 1200V modules:  $V_{CE(sat)} = 1.7V(\text{typ}) @ T_j = 125^\circ\text{C}$ ; wide SOA @  $V_{cc} = 900V$
- For 1700V modules:  $V_{CE(sat)} = 2.2V(\text{typ}) @ T_j = 125^\circ\text{C}$ ; wide SOA @  $V_{cc} = 1200V$
- $T_{j(max)} = 175^\circ\text{C}$
- New solderless Al-baseplate → high  $\Delta T_c$  temperature cycling capability
- Wide internal chip layout → low  $R_{th(j-f)}$
- Minimized internal package inductance  $L_{int} < 10nH$  (package size B)
- AC and DC main terminals separated → easy DC-bus design
- Multi-hole main terminals → low contact resistance and reliable long-term electrical connection
- Integrated NTC for  $T_c$ -sensing
- Auxiliary C-terminals available for P- and N-side IGBT



For  
Mega Power Dual  
IGBT Modules (NF-Series)  
please refer to  
page 17/18

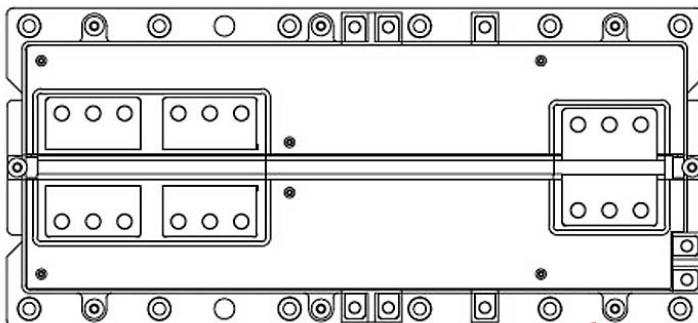
## 1.04 Mega Power Dual IGBT Modules (with 6<sup>th</sup> Gen. IGBT Chips)

### Line-up

Symbol	Package Circuit Diagram	Size $V_{CES}$ (V)	A		B	
			$I_c$ (A)			
			1100	1500	1800	2500
D		1200		CM1500DY-24S		CM2500DY-24S
		1700	CM1100DY-34S		CM1800DY-34S	

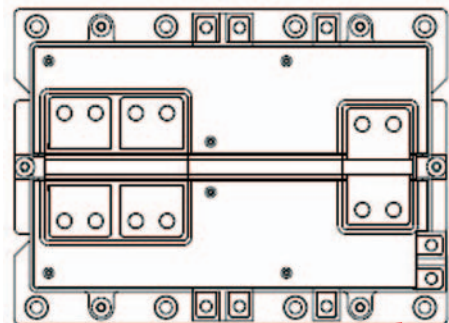
under development

Large Package Type (L 310 x W 142 x H 50mm)



**Tentative!**

Small Package Type (L 194 x W 142 x H 50mm)



**Tentative!**

### Notes



# 1.05

## 5<sup>th</sup> Generation CSTBT™ IGBT Modules (A-Series)

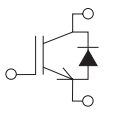
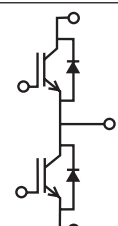
### Features

- Combining 5<sup>th</sup> Generation CSTBT™ (Carrier Stored Trench Gate Bipolar Transistor) chip technology with a LPT (Light Punch-through) wafer for:
  - Low  $V_{CE(sat)}$
  - High Short Circuit Robustness
  - Reduced Gate Capacitance
- About 10% higher inverter output current and about 15% better performance  $\Delta T_{(j-f)}$  at same inverter output current than other Trench IGBTs currently being marketed
- Cost optimised package sizes
- Excellent thermal conductivity by AlN isolation substrate
- Low internal inductance
- Significant improvement of power cycling capability by new wire bonding technology



## 1.05 5<sup>th</sup> Generation CSTBT™ IGBT Modules (A-Series)

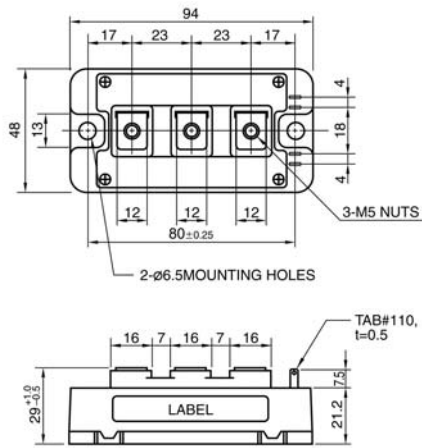
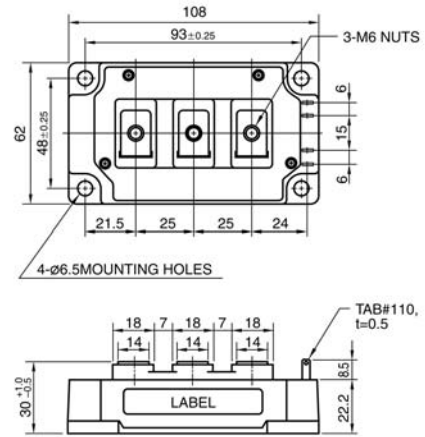
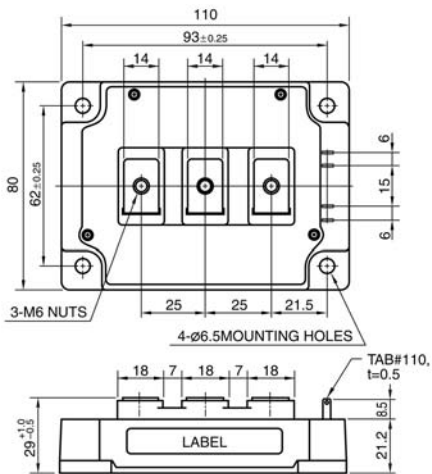
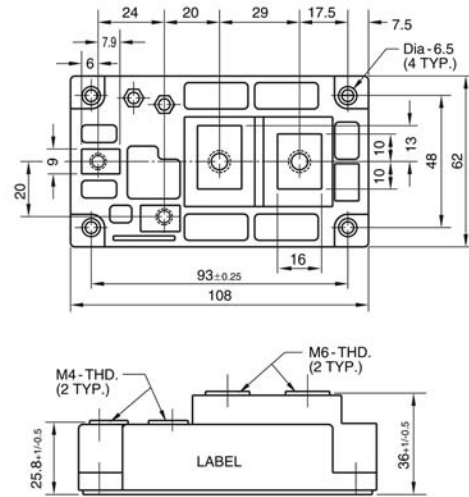
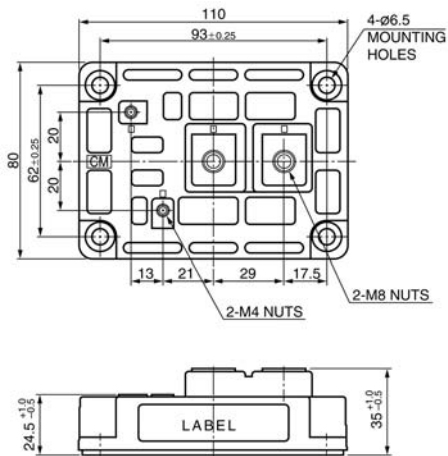
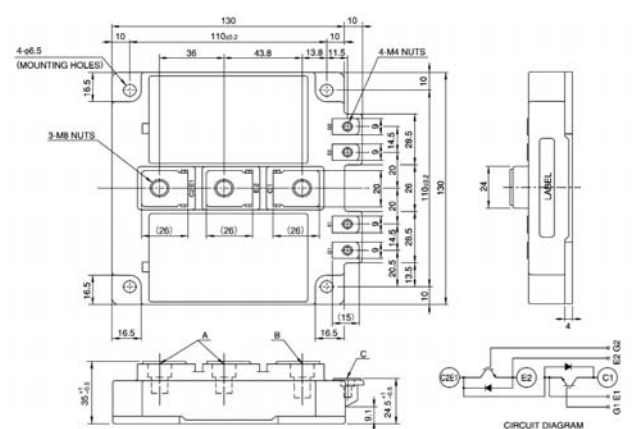
### Line-up A-Series

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

Type Number	Maximum Ratings			Electrical Characteristics									Free Wheel Diode			Thermal & Mechanical Characteristics			Package-No.
	V <sub>CEs</sub> (V)	I <sub>c</sub> (A)	V <sub>iso</sub> (V)	V <sub>CE(sat)</sub> @ T <sub>j</sub> = 25°C (V)		C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>f</sub> (V) Max.	Q <sub>rr</sub> (μC) Typ.	t <sub>rr</sub> (ns) Max.	IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)	R <sub>th(c-f)</sub> (°C/W)	
				Typ.	Max.				t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)							
<b>1200 Volt Dual IGBT Modules A-Series</b>																			
CM100DY-24A	1200	100		2.1	3.0	17.5	1.5	0.34	100	70	400	350	3.8	5.0	150	0.186	0.34	0.022	A1
CM150DY-24A	1200	150		2.1	3.0	23.0	2.0	0.45	130	100	450	350	3.8	6.0	150	0.130	0.23	0.022	A1
CM200DY-24A	1200	200		2.1	3.0	35.0	3.0	0.68	130	100	450	350	3.8	9.0	150	0.093	0.17	0.022	A1
CM300DY-24A	1200	300		2.1	3.0	47.0	4.0	0.90	550	180	600	350	3.8	9.0	250	0.066	0.12	0.020	A2
CM400DY-24A	1200	400		2.1	3.0	70.0	6.0	1.40	550	180	600	350	3.8	16.0	250	0.046	0.085	0.020	A3
CM600DY-24A	1200	600		2.1	3.0	94.0	8.0	1.80	660	190	700	350	3.8	19.0	250	0.034	0.062	0.018	A3
<b>1200 Volt Single IGBT Modules A-Series</b>																			
CM400HA-24A	1200	400		2.1	3.0	70	6	1.40	550	180	600	350	3.8	14.7	250	0.053	0.085	0.020	A4
CM600HA-24A	1200	600		2.1	3.0	105	9	2.00	660	190	700	350	3.8	19.0	250	0.034	0.051	0.020	A4
CM600HB-24A	1200	600		2.1	3.0	105	9	2.00	660	190	700	350	3.8	19.0	250	0.034	0.051	0.020	A5
<b>1700 Volt Dual IGBT Modules A-Series</b>																			
CM75DY-34A	1700	75	3500	2.2	2.8	18.5	2.1	0.4	200	150	550	350	3.0	7.5	300	0.160	0.29		A1
CM100DY-34A	1700	100	3500	2.2	2.8	24.7	2.8	0.5	200	150	550	350	3.0	10	300	0.130	0.21		A1
CM150DY-34A	1700	150	3500	2.2	2.8	37.0	4.2	0.8	550	190	750	350	3.0	15	450	0.078	0.15		A2
CM200DY-34A	1700	200	3500	2.2	2.8	49.4	5.6	1.1	550	190	750	350	3.0	20	450	0.063	0.11		A2
CM300DY-34A	1700	300	3500	2.2	2.8	74.0	8.4	1.6	600	200	850	350	3.0	30	450	0.043	0.072		A3
CM400DY-34A	1700	400	3500	2.2	2.8	98.8	11.2	2.1	800	230	1000	350	3.0	40	500	0.033	0.055		A6
<b>1700 Volt Single IGBT Modules A-Series</b>																			
CM500HA-34A	1700	500	3500	2.2	2.8	120	14	2.6	900.0	500	1200	250	3.2	50	650	0.025	0.042		A4



## 1.05 5<sup>th</sup> Generation CSTBT™ IGBT Modules (A-Series)

**Package A1**

**Package A2**

**Package A3**

**Package A4**

**Package A5**

**Package A6**


Dimensions in mm



# 5<sup>th</sup> Generation CSTBT™ IGBT Modules (NF-Series)



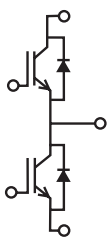
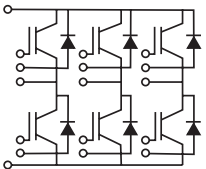
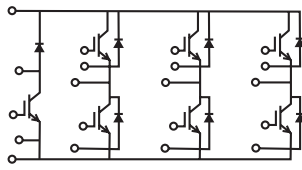
## Features

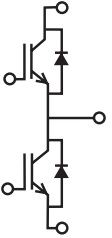
- Combining 5<sup>th</sup> Generation CSTBT™ (Carrier Stored Trench Gate Bipolar Transistor chip technology with a LPT (Light Punch-through) wafer for:
  - Low  $V_{CE(sat)}$   
(Typ. 1.7V @  $T_j = 125^\circ\text{C}$  for 600V and 2V @  $T_j = 125^\circ\text{C}$  for 1200V)
  - High Short Circuit Robustness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



## 1.06 5<sup>th</sup> Generation CSTBT™ IGBT Modules (NF-Series)

### Line-up NF-Series

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

Symbol	Circuit Diagram	V <sub>CES</sub> (V)	I <sub>c</sub> (A)					
			300	400	600	900	1000	1400
D		600	CM300DY-12NF	CM400DY-12NF	CM600DY-12NF			
		1200	CM300DY-24NF	CM400DY-24NF	CM600DU-24NF	CM900DU-24NF*		CM1400DU-24NF*
		1700					CM1000DU-34NF*	

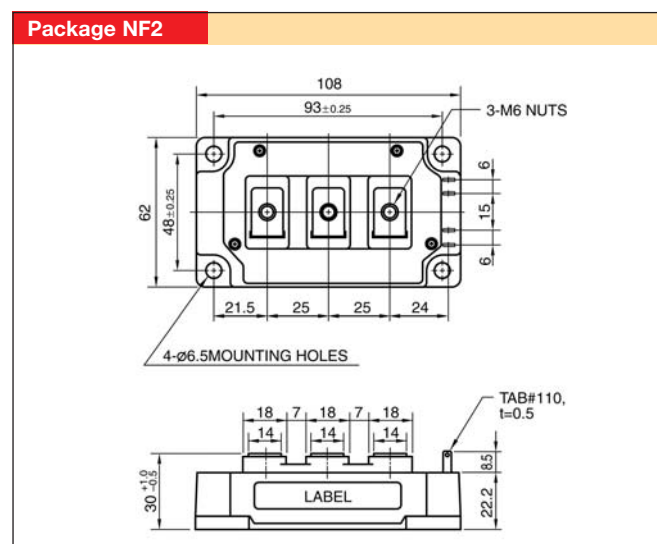
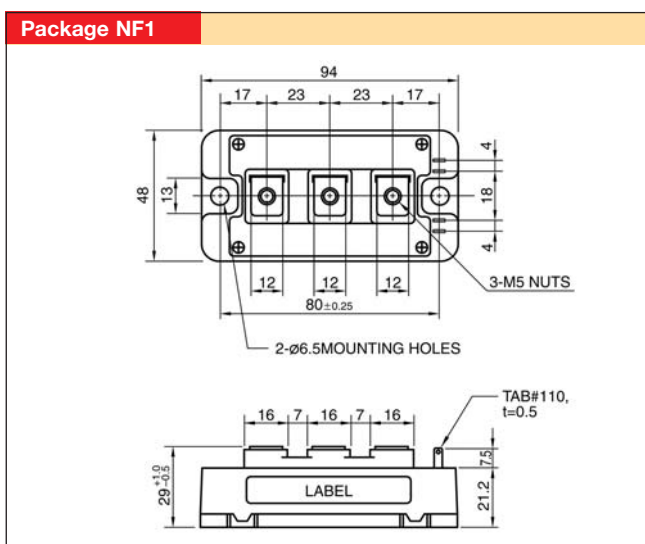
\*Mega Power Dual IGBT Modules (NF-Series)

Type Number	Maximum Ratings		Electrical Characteristics									Free Wheel Diode			Thermal & Mechanical Characteristics			Package-No.
	V <sub>CES</sub> (V)	I <sub>c</sub> (A)	V <sub>CE(sat)</sub> @ T <sub>j</sub> = 25°C (V)		C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>f</sub> (V)	Q <sub>rr</sub> (μC)	t <sub>rr</sub> (ns)	IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)	R <sub>th(c-f)</sub> (°C/W)	
			Typ.	Max.				t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)							
<b>600 Volt Dual IGBT Modules NF-Series</b>																		
CM150DY-12NF	600	150	1.7	2.2	23.0	2.8	0.9	120	100	300	300	2.6	2.5	150	0.21	0.47	0.07	NF1
CM200DY-12NF	600	200	1.7	2.2	30.0	3.7	1.2	120	120	300	300	2.6	3.5	150	0.19	0.35	0.07	NF1
CM300DY-12NF	600	300	1.7	2.2	45.0	5.5	1.8	120	120	350	300	2.6	5.5	150	0.16	0.25	0.07	NF1
CM400DY-12NF	600	400	1.7	2.2	60.0	7.3	2.4	300	200	450	300	2.6	6.8	250	0.11	0.19	0.04	NF2
CM600DY-12NF	600	600	1.7	2.2	90.0	11.0	3.6	500	300	750	300	2.6	8.7	250	0.11	0.18	0.02	NF3
<b>600 Volt IGBT Modules NF-Series (6 in 1)</b>																		
CM75TL-12NF	600	75	1.7	2.2	11.3	1.4	0.45	120	100	300	300	2.6	1.2	100	0.29	0.51		NF4
CM100TL-12NF	600	100	1.7	2.2	15.0	1.9	0.60	120	100	300	300	2.6	2.1	120	0.23	0.41		NF4
CM150TL-12NF	600	150	1.7	2.2	23.0	2.8	0.90	120	100	300	300	2.6	2.5	150	0.17	0.31		NF4
CM200TL-12NF	600	200	1.7	2.2	30.0	3.7	1.20	120	100	300	300	2.6	4.8	150	0.14	0.22		NF5

## 1.06 5<sup>th</sup> Generation CSTBT™ IGBT Modules (NF-Series)

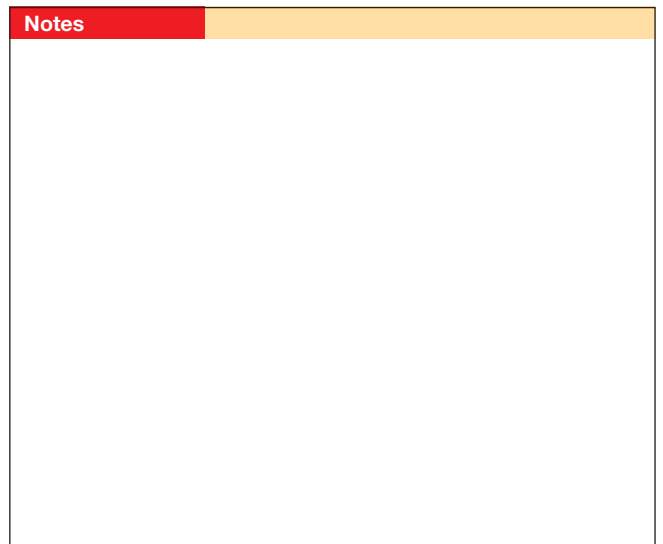
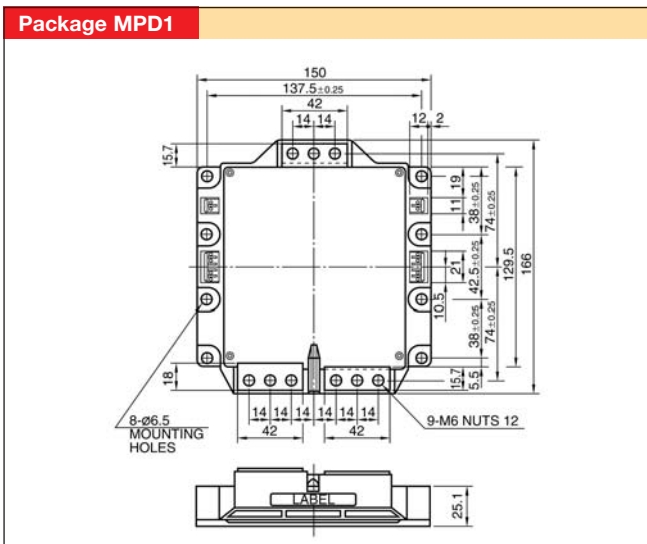
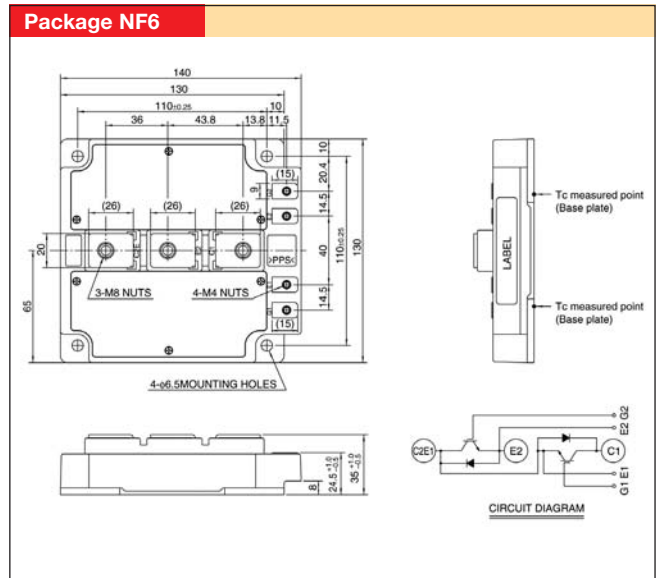
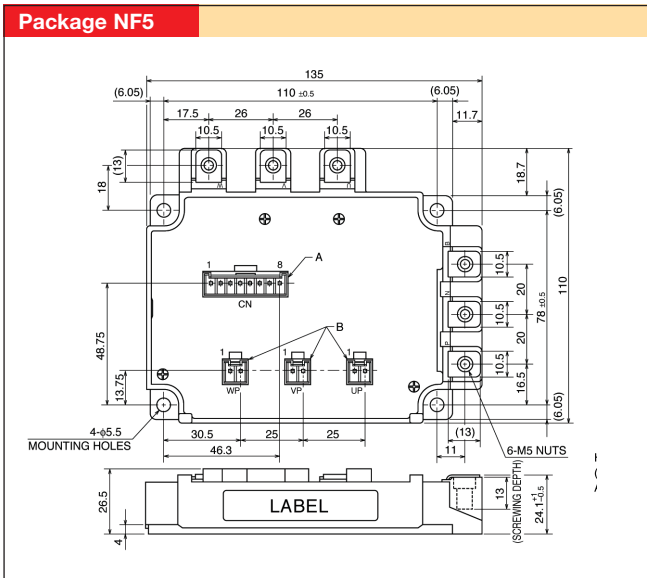
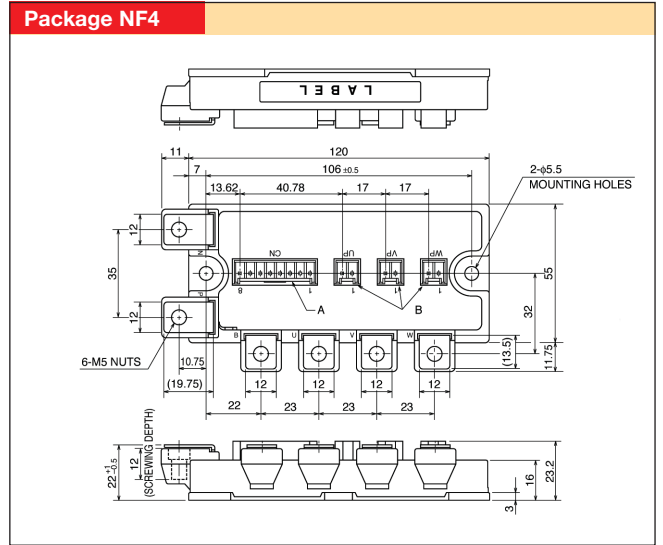
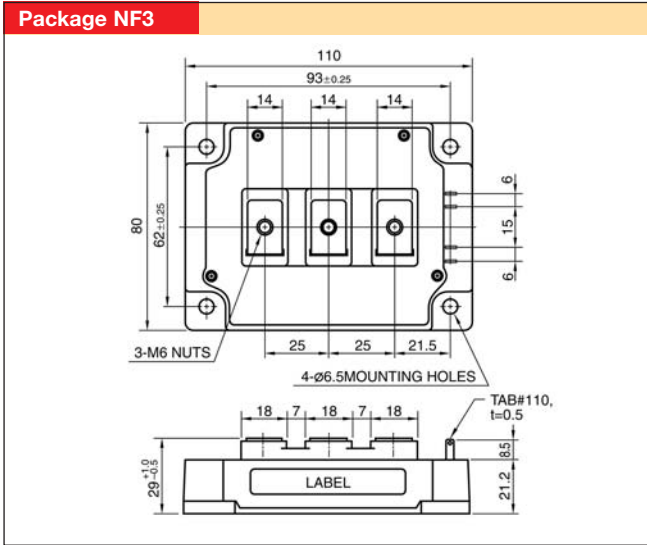
Type Number	Maximum Ratings			Electrical Characteristics								Free Wheel Diode			Thermal & Mechanical Characteristics			Package No.	
	V <sub>CE(S)</sub> (V)	I <sub>c</sub> (A)	V <sub>ISO</sub> (V)	V <sub>CE(sat)</sub> @ T <sub>j</sub> = 25°C (V)		C <sub>ies</sub> (nF)	C <sub>Oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>f</sub> (V) Typ.	Q <sub>rr</sub> (μC) Typ.	t <sub>rr</sub> (ns) Max.	IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)		R <sub>th(c-f)</sub> (°C/W)
				Typ.	Max.				t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)							
<b>600 Volt IGBT Modules NF-Series (7 in 1)</b>																			
CM75RL-12NF	600	75		1.7	2.2	11.3	1.4	0.45	120	100	300	300	2.6	1.2	100	0.29	0.51		NF4
CM100RL-12NF	600	100		1.7	2.2	15.0	1.9	0.60	120	100	300	300	2.6	2.1	120	0.23	0.41		NF4
CM150RL-12NF	600	150		1.7	2.2	23.0	2.8	0.90	120	100	300	300	2.6	2.5	150	0.17	0.31		NF4
CM200RL-12NF	600	200		1.7	2.2	30.0	3.7	1.20	120	100	300	300	2.6	4.8	150	0.14	0.22		NF5
<b>1200 Volt Dual IGBT Modules NF-Series</b>																			
CM75DY-24NF	1200	75	2500	1.8	2.5	17.5	1.5	0.3	120	100	450	350	3.0	6.0	120	0.290	0.470	0.020	NF1
CM100DY-24NF	1200	100		1.8	2.5	23.0	2.0	0.45	120	80	450	350	3.2	5.0	150	0.190	0.350	0.070	NF1
CM150DY-24NF	1200	150		1.8	2.5	35.0	3.0	0.68	120	80	450	350	3.2	7.5	150	0.160	0.250	0.070	NF1
CM200DY-24NF	1200	200		1.8	2.5	47.0	4.0	0.9	500	150	600	350	3.2	7.5	250	0.110	0.190	0.040	NF2
CM300DY-24NF	1200	300		1.8	2.5	70.0	6.0	1.4	500	150	600	350	3.2	13.0	250	0.110	0.180	0.020	NF3
CM400DY-24NF	1200	400		1.8	2.5	94.0	8.0	1.8	600	160	700	350	3.2	16.0	250	0.085	0.150	0.020	NF3
CM600DU-24NF	1200	600		1.95	2.65	140.0	12.0	2.7	800	180	900	350	3.34	28.0	300	0.060	0.110	0.019	NF6
CM900DU-24NF	1200	900		1.8	2.5	140.0	16.0	3.0	600	200	800	300	3.4	50.0	500	0.049	0.078	0.016	MPD1
CM1400DU-24NF	1200	1400		1.8	2.5	220.0	25.0	4.7	800	300	1000	300	3.4	90.0	700	0.032	0.053	0.016	MPD1
<b>1700 Volt Dual IGBT Modules NF-Series</b>																			
CM1000DU-34NF	1700	1000		2.2	2.8	220.0	25.0	4.7	600	150	900	200	3.0	90.0	450	0.014	0.023	0.016	MPD1
<b>1200 Volt IGBT Modules NF-Series (6 in 1)</b>																			
CM50TL-24NF	1200	50		2.1	3.0	8.5	0.75	0.17	100	50	300	350	3.8	2.0	100	0.32	0.43		NF4
CM75TL-24NF	1200	75		2.1	3.0	11.5	1.00	0.23	100	50	300	350	3.8	3.0	120	0.24	0.36		NF4
CM100TL-24NF	1200	100		2.1	3.0	17.5	1.50	0.34	100	70	300	350	3.8	4.8	150	0.20	0.28		NF4
CM150TL-24NF	1200	150		2.1	3.0	23.0	2.00	0.45	130	70	400	350	3.8	5.8	150	0.14	0.23		NF5
CM200TL-24NF	1200	200		2.1	3.1	35.0	3.00	0.68	130	70	400	350	3.8	9.0	150	0.11	0.17		NF5
<b>1200 Volt IGBT Modules NF-Series (7 in 1)</b>																			
CM50RL-24NF	1200	50		2.1	3.0	8.5	0.75	0.17	100	50	300	350	3.8	2.0	100	0.32	0.43		NF4
CM75RL-24NF	1200	75		2.1	3.0	11.5	1.00	0.23	100	50	300	350	3.8	3.0	120	0.24	0.36		NF4
CM100RL-24NF	1200	100		2.1	3.0	17.5	1.50	0.34	100	70	300	350	3.8	4.8	150	0.20	0.28		NF4
CM150RL-24NF	1200	150		2.1	3.0	23.0	2.00	0.45	130	70	400	350	3.8	5.8	150	0.14	0.23		NF5
CM200RL-24NF	1200	200		2.1	3.1	35.0	3.00	0.68	130	70	400	350	3.8	9.0	150	0.11	0.17		NF5

1





# 1.06 5<sup>th</sup> Generation CSTBT™ IGBT Modules (NF-Series)



Dimensions in mm

# 1.07

## High Frequency IGBT Modules (NFH-Series)



### Features

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



1

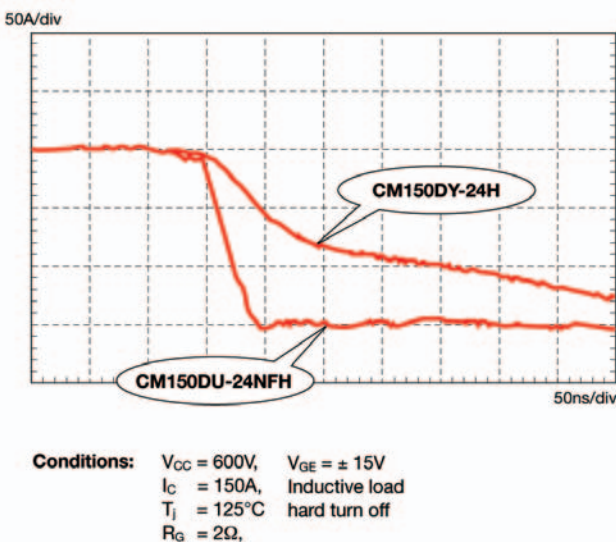
### Line-up NFH-Series

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

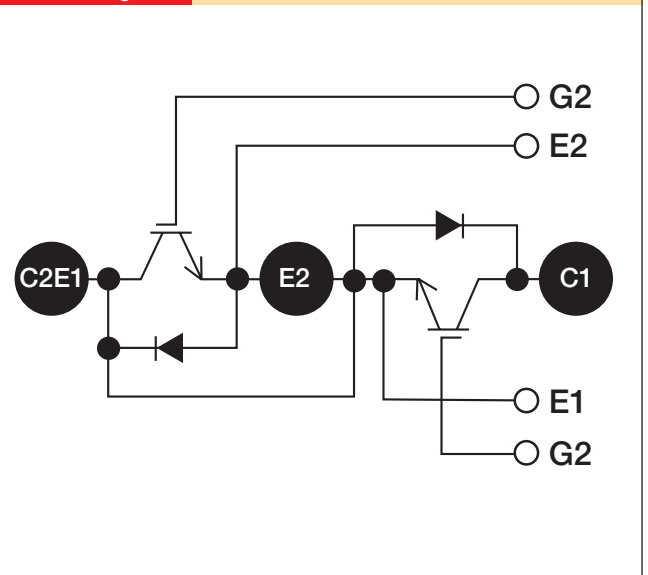
## 1.07 High Frequency IGBT Modules (NFH-Series)

Type Number	Maximum Ratings		Electrical Characteristics								Free Wheel Diode			Thermal & Mechanical Characteristics			Package-No.	
	V <sub>CE(s)</sub> (V)	I <sub>C</sub> (A)	V <sub>CE(sat)</sub> @ T <sub>j</sub> = 25°C (V)		C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>f</sub> (V)	Q <sub>rr</sub> (μC)	t <sub>rr</sub> (ns)	IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)		R <sub>th(c-f)</sub> (°C/W)
			Typ.	Max.				t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)							
<b>600 Volt IGBT Modules NFH-Series</b>																		
CM100DUS-12F	600	100	2.0	2.7	27	1.8	1.0	100	80	300	150	2.6	1.9	150	0.35	0.70	0.07	NFH3
CM150DUS-12F	600	150	2.0	2.7	41	2.7	1.5	120	100	350	150	2.6	2.8	150	0.24	0.47	0.07	NFH3
CM200DU-12NFH	600	200	2.0	2.7	55	3.6	2.0	250	150	500	150	2.6	3.5	150	0.21	0.35	0.07	NFH3
CM300DU-12NFH	600	300	2.0	2.7	83	5.4	3.0	350	150	700	150	2.6	5.5	200	0.16	0.24	0.04	NFH1
CM400DU-12NFH	600	400	2.0	2.7	110	7.2	4.0	400	200	700	150	2.6	7.7	200	0.13	0.18	0.04	NFH1
<b>1200 Volt IGBT Modules NFH-Series</b>																		
CM100DU-24NFH	1200	100	5.0	6.5	16	1.3	0.3	100	50	250	150	3.5	5.0	150	0.22	0.47	0.07	NFH3
CM150DU-24NFH	1200	150	5.0	6.5	24	2.0	0.45	150	80	400	150	3.5	7.5	150	0.19	0.35	0.07	NFH3
CM200DU-24NFH	1200	200	5.0	6.5	32	2.7	0.6	300	80	500	150	3.5	7.5	250	0.15	0.24	0.04	NFH1
CM300DU-24NFH	1200	300	5.0	6.5	47	4.0	0.9	300	80	500	150	3.5	13.0	250	0.11	0.18	0.04	NFH1
CM400DU-24NFH	1200	400	5.0	6.5	63	5.3	1.2	300	100	500	150	3.5	16.0	250	0.12	0.23	0.02	NFH2
CM600DU-24NFH	1200	600	5.0	6.5	95	8.0	1.8	400	120	700	150	3.5	28.0	250	0.083	0.15	0.02	NFH2

Comparison of Turn-off Waveform



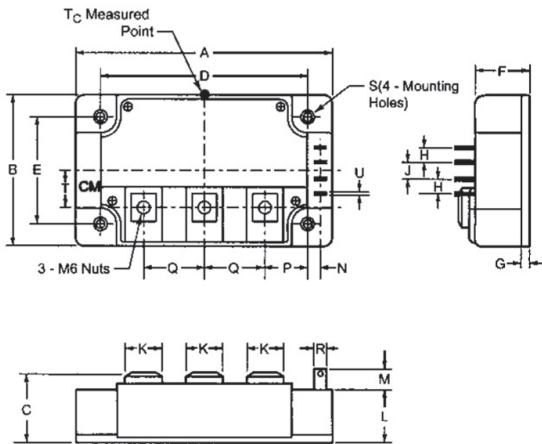
Circuit Diagram





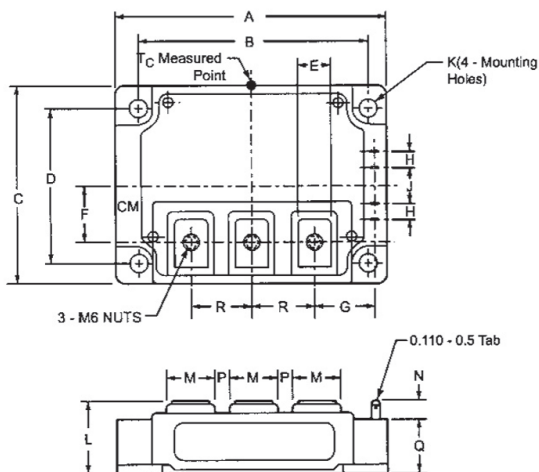
## 1.07 High Frequency IGBT Modules (NFH-Series)

### Package NFH1



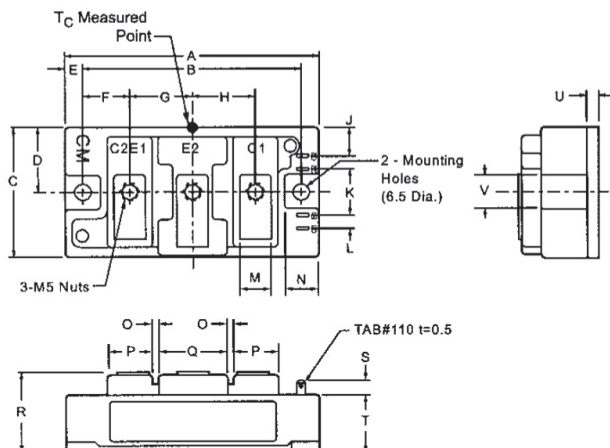
Dimensions	Inches	Millimeters
A	4.25	108.0
B	2.44	62.0
C	1.14+0.04/-0.02	29+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	1.88±0.01	48.0±0.25
F	0.87	22.0
G	0.16	4.0
H	0.24	6.0
J	0.59	15.0
K	0.71	18.0
L	0.87	22.0
M	0.33	8.5
N	0.10	2.5
P	0.85	21.5
Q	0.98	25.0
R	0.11	2.8
S	0.25 Dia.	6.5 Dia.
T	0.6	15.15

### Package NFH2



Dimensions	Inches	Millimeters
A	4.33	110.0
B	3.66±0.01	93.0±0.25
C	3.15	80.0
D	2.44±0.01	62.0±0.25
E	0.55	14.0
F	0.86	21.75
G	0.94	24.0
H	0.24	6.0
J	0.59	15.0
K	0.26 Dia.	6.5 Dia.
L	1.14+0.04/-0.02	29+1.0/-0.5
M	0.71	18.0
N	0.33	8.5
P	0.28	7.0
Q	0.83	21.0
R	0.98	25.0

### Package NFH3



Dimensions	Inches	Millimeters
A	3.7	94.0
B	3.15±0.01	80.0±0.25
C	1.89	48.0
D	0.94	24.0
E	0.28	7.0
F	0.67	17.0
G	0.91	23.0
H	0.91	23.0
J	0.43	11.0
K	0.71	18.0
L	0.16	4.0
M	0.47	12.0
N	0.53	13.5
O	0.1	2.5
P	0.63	16.0
Q	0.98	25.0
R	1.18+0.04/-0.02	30.0+1.0/-0.5
S	0.3	7.5
T	0.83	21.2
U	0.16	4.0
V	0.51	13.0

Dimensions in mm

# 2.01

## Ordering Information for Mitsubishi IPMs

### Information:

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

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

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

Mitsubishi's **S-Series** has low losses at high frequencies due to 3<sup>rd</sup> Generation IGBT chips (typ. saturation voltage is 1.8V for a 600V device, and 2.3V for a 1200V device).

**V-Series'** internal inductance was reduced by 50%. Higher reliability due to solderless connections.

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

### 1 IPM

### 2 $I_C = 300A$

### 3 Internal Connection:

**H** = Single IPM

**D** = Dual IPM

**B** = H-Bridge

**C** = Sixpack IPM

**R** = Sevenpack IPM

### 4 Series Name:

**S** = S-Series

**V** = V-Series

**L** = L-Series

**L1** = L1-Series

**S1** = S1-Series

### 5 Change of Appearance or Other:

**A D F H J K S**

### 6 $V_{CES}$ :

**060** = 600V

**120** = 1200V

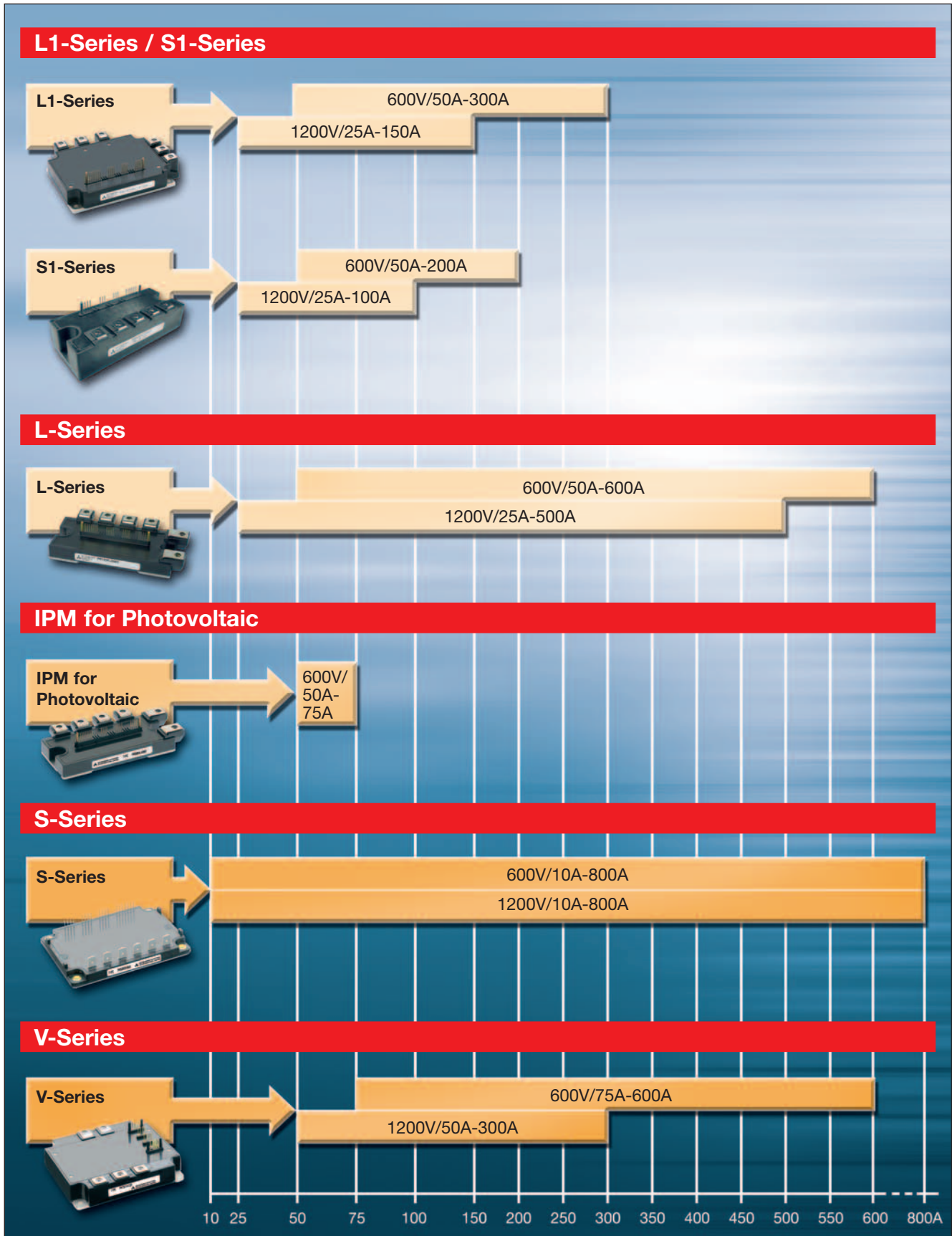
2

### Example:

PM	300	C	L	A	120
1	2	3	4	5	6

# 2.02

## Overview of IPM



## 2.03

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

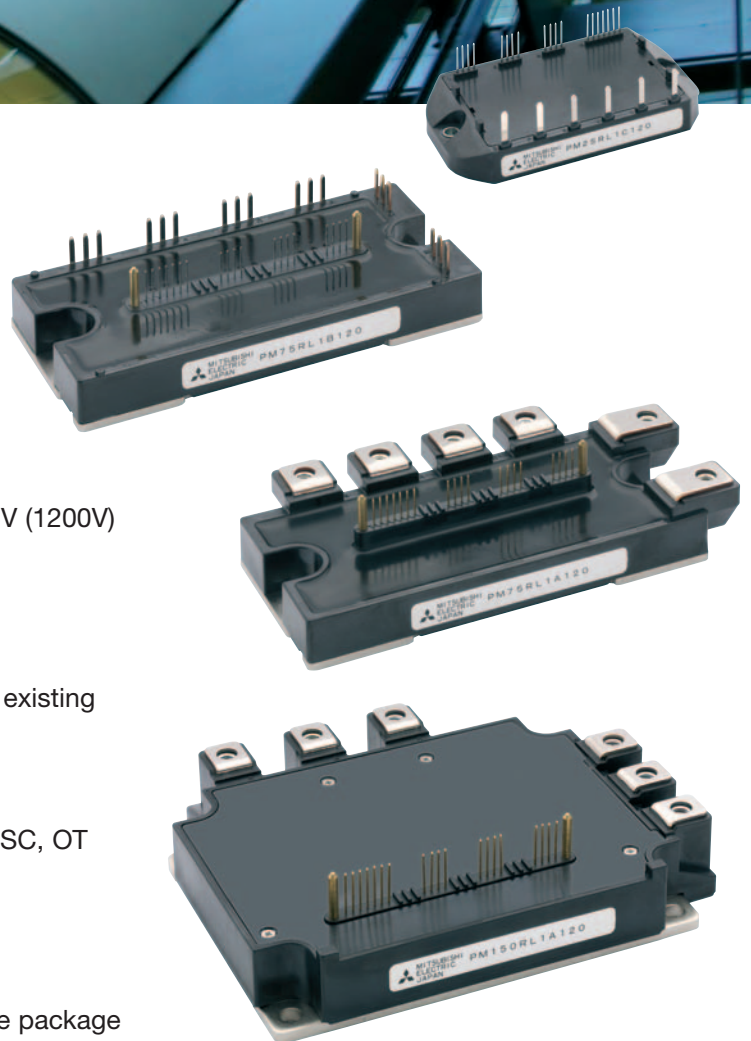


### Applications

UPS, Commercial Air-Conditioner,  
General Purpose Drives, Solar Inverter

### Features

- 5<sup>th</sup> Generation IGBT chip with Full Gate CSTBT™ resulting low power loss
- Better trade off between  $V_{CE(sat)}$  and  $E_{off}$   
Typical  $V_{CE(sat)}$  @ 125°C: 1.65V (600V) and 1.75V (1200V)
- Package compatibility with existing range of L-Series IPM (Type A, B and C)
- New small package for 7 in 1, 50A/600V and 25A/1200V (Reduced package size by 32% of existing L-Series IPM)
- Improved Power cycling capability
- Detection, protection and status indication for SC, OT (with On-chip temperature sensor) & UV
- Available from 25A to 150A/1200V and 50A to 300A/600V
- Up to 75A, Solder pin & screw types with same package foot size
- Newly developed L1-Series evaluation board is available on request





## 2.03 5<sup>th</sup> Generation Full Gate CSTBT™ IPMs (L1 & S1-Series)

### Line-up L1-Series

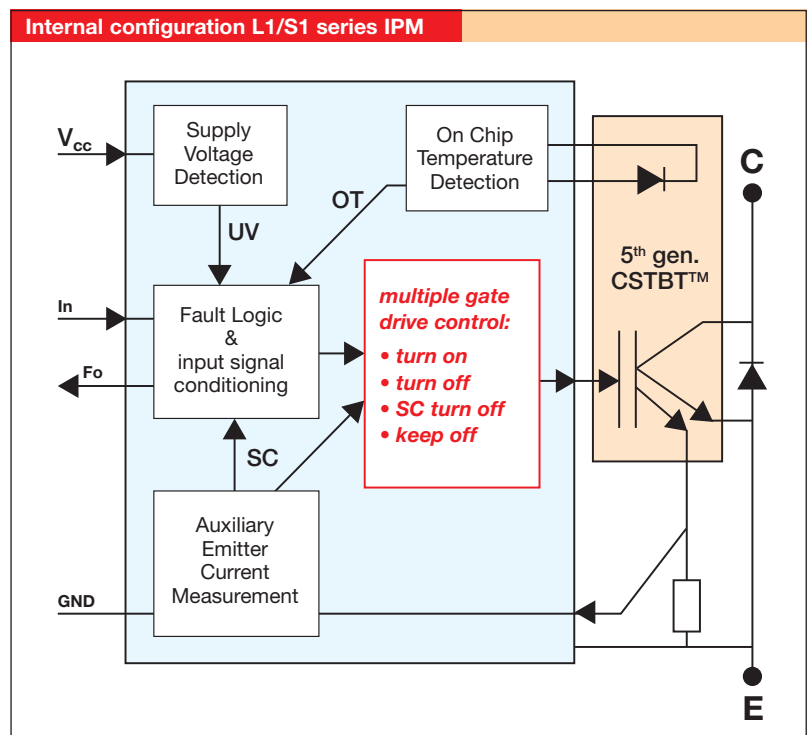
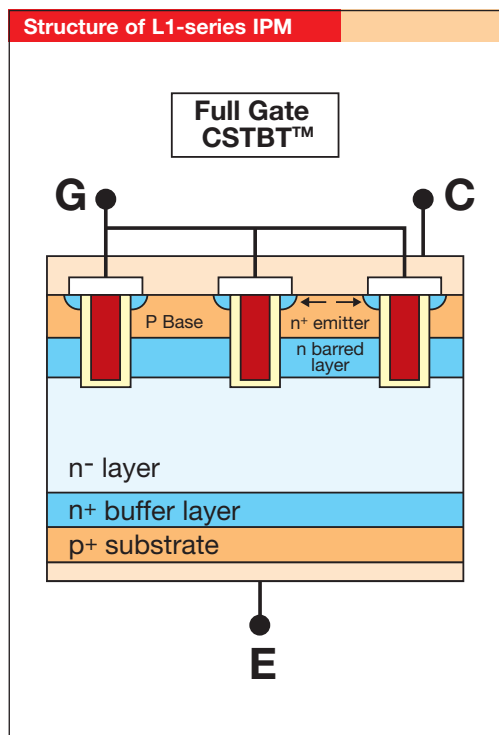
Symbol	Internal Function	V <sub>CES</sub> (V)	I <sub>c</sub> (A)						
			25	50	75	100	150	200	300
<b>C</b>	3 ∅ Inverter IGBT Integrated Gate Drive SC / OT / UV	600		PM50CL1A060 PM50CL1B060	PM75CL1A060 PM75CL1B060	PM100CL1A060 PM100CL1B060	PM150CL1A060 PM150CL1B060	PM200CL1A060	PM300CL1A060
		1200	PM25CL1A120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

### Line-up S1-Series

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

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

2



## 2.03 5<sup>th</sup> Generation Full Gate CSTBT™ IPMs (L1 & S1-Series)

Type Number	Maximum Ratings		Electrical Characteristics							Thermal Characteristics			Protection Functions			Package-No.
	V <sub>CES</sub> (V)	I <sub>C</sub> (A)	V <sub>CE(sat)</sub> @ T <sub>J</sub> = 125°C (V)		Typical Switching Times					IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)	R <sub>th(c-f)</sub> (°C/W)	SC* (A) Min.	OT (°C) Min.	UV (V) Typ.	
			Typ.	Max.	t <sub>on</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)	t <sub>rr</sub> (μs)							
<b>600 Volt IPM (L1-Series)</b>																
PM50CL1A060	600	50	1.65		1.0	0.4	1.0	0.3	0.2	0.44	0.75	0.038	100	135	12	L1
PM50CL1B060	600	50	1.65		1.0	0.4	1.0	0.3	0.2	0.44	0.75	0.038	100	135	12	L2
PM50RL1A060	600	50	1.65		1.0	0.4	1.0	0.3	0.2	0.44	0.75	0.038	100	135	12	L1
PM50RL1B060	600	50	1.65		1.0	0.4	1.0	0.3	0.2	0.44	0.75	0.038	100	135	12	L2
PM50RL1C060	600	50	1.65		1.0	0.4	1.0	0.3	0.2	0.74	1.28	0.09	100	135	12	L5
PM75CL1A060	600	75	1.65		1.0	0.4	1.0	0.3	0.2	0.37	0.63	0.038	150	135	12	L1
PM75CL1B060	600	75	1.65		1.0	0.4	1.0	0.3	0.2	0.37	0.63	0.038	150	135	12	L2
PM75RL1A060	600	75	1.65		1.0	0.4	1.0	0.3	0.2	0.37	0.63	0.038	150	135	12	L1
PM75RL1B060	600	75	1.65		1.0	0.4	1.0	0.3	0.2	0.37	0.63	0.038	150	135	12	L2
PM100CL1A060	600	100	1.65		1.0	0.4	1.0	0.3	0.2	0.32	0.52	0.038	200	135	12	L1
PM100CL1B060	600	100	1.65		1.0	0.4	1.0	0.3	0.2	0.32	0.52	0.038	200	135	12	L2
PM100RL1A060	600	100	1.65		1.0	0.4	1.0	0.3	0.2	0.32	0.52	0.038	200	135	12	L1
PM100RL1B060	600	100	1.65		1.0	0.4	1.0	0.3	0.2	0.32	0.52	0.038	200	135	12	L2
PM150CL1A060	600	150	1.65		1.0	0.4	1.0	0.3	0.2	0.25	0.41	0.038	300	135	12	L1
PM150CL1B060	600	150	1.65		1.0	0.4	1.0	0.3	0.2	0.25	0.41	0.038	300	135	12	L2
PM150RL1A060	600	150	1.65		1.0	0.4	1.0	0.3	0.2	0.25	0.41	0.038	300	135	12	L1
PM150RL1B060	600	150	1.65		1.0	0.4	1.0	0.3	0.2	0.25	0.41	0.038	300	135	12	L2
PM200CL1A060	600	200	1.65		1.0	0.4	1.0	0.3	0.2	0.20	0.30	0.023	400	135	12	L3
PM200RL1A060	600	200	1.65		1.0	0.4	1.0	0.3	0.2	0.20	0.30	0.023	400	135	12	L3
PM300CL1A060	600	300	1.65		1.0	0.4	1.0	0.3	0.2	0.15	0.23	0.023	600	135	12	L3
PM300RL1A060	600	300	1.65		1.0	0.4	1.0	0.3	0.2	0.15	0.23	0.023	600	135	12	L3
<b>1200 Volt IPM (L1-Series)</b>																
PM25CL1A120	1200	25	1.55		1.0	0.4	2.0	0.7	0.5	0.98	1.63	0.038	50	135	12	L1
PM25CL1B120	1200	25	1.55		1.0	0.4	2.0	0.7	0.5	0.98	1.63	0.038	50	135	12	L2
PM25RL1A120	1200	25	1.55		1.0	0.4	2.0	0.7	0.5	0.98	1.63	0.038	50	135	12	L1
PM25RL1B120	1200	25	1.55		1.0	0.4	2.0	0.7	0.5	0.98	1.63	0.038	50	135	12	L2
PM25RL1C120	1200	25	1.55		1.0	0.4	2.0	0.7	0.5	0.70	1.80	0.085	50	135	12	L5
PM50CL1A120	1200	50	1.55		1.0	0.4	2.0	0.7	0.5	0.27	0.47	0.038	100	135	12	L1
PM50CL1B120	1200	50	1.55		1.0	0.4	2.0	0.7	0.5	0.27	0.47	0.038	100	135	12	L2
PM50RL1A120	1200	50	1.55		1.0	0.4	2.0	0.7	0.5	0.27	0.47	0.038	100	135	12	L1
PM50RL1B120	1200	50	1.55		1.0	0.4	2.0	0.7	0.5	0.27	0.47	0.038	100	135	12	L2
PM75CL1A120	1200	75	1.55		1.0	0.4	2.0	0.7	0.5	0.21	0.36	0.038	150	135	12	L1
PM75CL1B120	1200	75	1.55		1.0	0.4	2.0	0.7	0.5	0.21	0.36	0.038	150	135	12	L2
PM75RL1A120	1200	75	1.55		1.0	0.4	2.0	0.7	0.5	0.21	0.36	0.038	150	135	12	L1
PM75RL1B120	1200	75	1.55		1.0	0.4	2.0	0.7	0.5	0.21	0.36	0.038	150	135	12	L2
PM100CL1A120	1200	100	1.55		1.0	0.4	1.0	0.3	0.2	0.19	0.31	0.023	200	135	12	L3
PM100RL1A120	1200	100	1.55		1.0	0.4	1.0	0.3	0.2	0.19	0.31	0.023	200	135	12	L3
PM150CL1A120	1200	150	1.55		1.0	0.4	1.0	0.3	0.2	0.15	0.23	0.027	300	135	12	L3
PM150RL1A120	1200	150	1.55		1.0	0.4	1.0	0.3	0.2	0.15	0.23	0.027	300	135	12	L3
<b>600 Volt IPM (S1-Series)</b>																
PM50CS1D060	600	50	1.80		1.8	1.0	2.8	0.6	0.6	0.40	0.68	0.046	75	135	12	S1
PM75CS1D060	600	75	1.80		1.8	1.0	2.8	0.6	0.6	0.33	0.55	0.046	112	135	12	S1
PM100CS1D060	600	100	1.80		1.8	1.0	2.8	0.6	0.6	0.28	0.46	0.046	150	135	12	S1
PM150CS1D060	600	150	1.80		1.8	1.0	2.8	0.6	0.6	0.21	0.35	0.046	225	135	12	S1
PM200CS1D060	600	200	1.90		1.8	1.0	2.8	0.6	0.6	0.18	0.27	0.046	300	135	12	S1
<b>1200 Volt IPM (S1-Series)</b>																
PM25CS1D120	1200	25	1.65		2.0	1.0	2.8	1.2	0.8	0.27	0.59	0.046	38	135	12	S1
PM50CS1D120	1200	50	1.65		2.0	1.0	2.8	1.2	0.8	0.25	0.41	0.046	75	135	12	S1
PM75CS1D120	1200	75	1.65		2.0	1.0	2.8	1.2	0.8	0.20	0.32	0.046	112	135	12	S1
PM100CS1D120	1200	100	1.65		2.0	1.0	2.8	1.2	0.8	0.18	0.27	0.046	150	135	12	S1

\*minimum trip values

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



# 2.04

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

### Features

- 5<sup>th</sup> Generation IGBT chip with CSTBT™ technology and 1μm design rule process
- Typical  $V_{CE(sat)}$  =  
1.5V @  $T_j = 125^\circ\text{C}$  for 600V and  
1.9V @  $T_j = 125^\circ\text{C}$  for 1200V
- Integrated turn-on speed controller circuit optimises EMI performance
- On-chip temperature sensor for  $T_j$  detection of CSTBT™ chip
- Package size reduced by 32% compared to previous generation
- Detection, protection and status indication circuits for short-circuit, over-temperature, and under-voltage (fault output available from upper arm devices)
- Monolithic gate drive & protection logic
- Up to 75A, solder pin & screw types with same base plate dimension



### Line-up L-Series

Symbol	Internal Function	$V_{CES}$ (V)	$I_c$ (A)								
			25	50	75	100	150	200	300	400	600
C	3 $\emptyset$ Inverter IGBT Integrated Gate Drive SC / OT / UV	600		PM50CLA060 PM50CLB060	PM75CLA060 PM75CLB060	PM100CLA060	PM150CLA060	PM200CLA060	PM300CLA060	PM450CLA060	PM600CLA060
			1200	PM25CLA120 PM25CLB120	PM50CLA120 PM50CLB120	PM75CLA120 PM75CLB120	PM100CLA120	PM150CLA120	PM200CLA120	PM300CLA120	PM450CLA120
		600			PM50RLA060 PM50RLB060	PM75RLA060 PM75RLB060	PM100RLA060	PM150RLA060	PM200RLA060	PM300RLA060	
			1200	PM25RLA120 PM25RLB120	PM50RLA120 PM50RLB120	PM75RLA120 PM75RLB120	PM100RLA120	PM150RLA120			

CLA / RLA types with screw terminals; CLB / RLB types with solder pins

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



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

Type Number	Maximum Ratings		Electrical Characteristics							Thermal Characteristics			Typical Protection Functions			Package-No.
	V <sub>CE(S)</sub> (V)	I <sub>c</sub> (A)	V <sub>CE(sat)</sub> @ T <sub>j</sub> = 125°C (V)		Typical Switching Times					IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)	R <sub>th(c-f)</sub> (°C/W)	SC* (A)	OT (°C)	UV (V)	
			Typ.	Max.	t <sub>on</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)	t <sub>rr</sub> (μs)							
<b>600 Volt IPM (L-Series)</b>																
PM50CLA060	600	50	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.95	1.61	0.038	100	145	12	L1
PM50CLB060	600	50	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.95	1.61	0.038	100	145	12	L2
PM50RLA060	600	50	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.95	1.61	0.038	100	145	12	L1
PM50RLB060	600	50	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.95	1.61	0.038	100	145	12	L2
PM75CLA060	600	75	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.32	0.53	0.038	150	145	12	L1
PM75CLB060	600	75	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.32	0.53	0.038	150	145	12	L2
PM75RLA060	600	75	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.32	0.53	0.038	150	145	12	L1
PM75RLB060	600	75	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.32	0.53	0.038	150	145	12	L2
PM100CLA060	600	100	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.27	0.43	0.038	200	145	12	L1
PM100RLA060	600	100	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.27	0.43	0.038	200	145	12	L1
PM150CLA060	600	150	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.20	0.33	0.038	300	145	12	L1
PM150RLA060	600	150	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.20	0.33	0.038	300	145	12	L1
PM200CLA060	600	200	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.16	0.24	0.023	400	145	12	L3
PM200RLA060	600	200	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.16	0.24	0.023	400	145	12	L3
PM300CLA060	600	300	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.12	0.18	0.023	600	145	12	L3
PM300RLA060	600	300	1.5	2.0	1.0	0.4	1.2	0.5	0.2	0.12	0.18	0.023	600	145	12	L3
PM450CLA060	600	450	1.8	2.3	1.0	0.4	2.2	0.6	0.2	0.12	0.19	0.014	900	145	12	L4
PM600CLA060	600	600	1.8	2.3	1.0	0.4	2.2	0.6	0.2	0.07	0.11	0.014	1200	145	12	L4
<b>1200 Volt IPM (L-Series)</b>																
PM25CLA120	1200	25	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.83	1.36	0.038	50	145	12	L1
PM25CLB120	1200	25	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.83	1.36	0.038	50	145	12	L2
PM25RLA120	1200	25	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.83	1.36	0.038	50	145	12	L1
PM25RLB120	1200	25	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.83	1.36	0.038	50	145	12	L2
PM50CLA120	1200	50	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.26	0.39	0.038	100	145	12	L1
PM50CLB120	1200	50	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.26	0.39	0.038	100	145	12	L2
PM50RLA120	1200	50	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.26	0.39	0.038	100	145	12	L1
PM50RLB120	1200	50	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.26	0.39	0.038	100	145	12	L2
PM75CLA120	1200	75	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.21	0.30	0.038	150	145	12	L1
PM75CLB120	1200	75	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.21	0.30	0.038	150	145	12	L2
PM75RLA120	1200	75	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.21	0.30	0.038	150	145	12	L1
PM75RLB120	1200	75	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.21	0.30	0.038	150	145	12	L2
PM100CLA120	1200	100	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.16	0.26	0.023	200	145	12	L3
PM100RLA120	1200	100	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.16	0.26	0.023	200	145	12	L3
PM150CLA120	1200	150	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.12	0.20	0.023	300	145	12	L3
PM150RLA120	1200	150	1.9	2.4	1.0	0.4	2.0	0.7	0.5	0.12	0.20	0.023	300	145	12	L3
PM200CLA120	1200	200	1.9	2.4	1.0	0.4	2.3	0.7	0.5	0.12	0.20	0.014	400	145	12	L4
PM300CLA120	1200	300	1.9	2.4	1.0	0.4	2.3	0.7	0.5	0.08	0.13	0.014	600	145	12	L4
PM450CLA120	1200	450	1.9	2.4	1.0	0.4	2.3	0.7	0.5	0.05	0.09	0.014	900	145	12	L4

\*minimum trip values

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



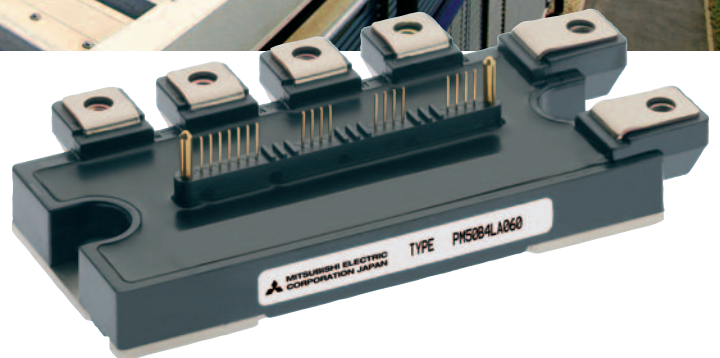
## 2.05

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



### Features

- 5<sup>th</sup> Generation trench chip (CSTBT™) for lower saturation voltage  
 $V_{CE(sat)} = 1.55V$  at rated current and  $T_j = 125^\circ C$
- Integrated high speed control ICs for switching frequencies up to 30kHz
- Low noise (controlled di/dt)
- On-chip temperature sensing and individual OT protection
- Compact L-Series IPM package with screw and pin terminals
- 0, 1 or 2 boost converters built in for multi-string operation
- 50A / 600V modules good for approximately 7.5kW (16kHz) fed to mains
- Rated currents of 50A and 75A with a rated voltage of 600V

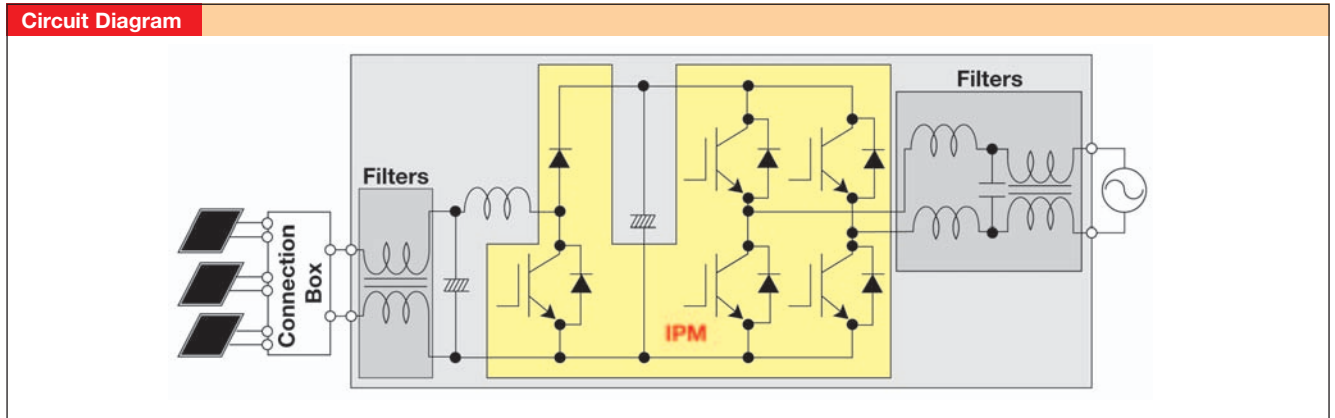


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### Line-up (600V)

I <sub>c</sub> (A)	Circuit	Terminal	Package	Type name
50	1 Inverter	Screw	L1	PM50B4LA060
		Pin	L2	PM50B4LB060
	1 Inverter & 1 Chopper	Screw	L1	PM50B5LA060
		Pin	L2	PM50B5LB060
	1 Inverter & 2 Chopper	Screw	L1	PM50B6LA060
		Pin	L2	PM50B6LB060
75	1 Inverter	Screw	L1	PM75B4LA060
		Pin	L2	PM75B4LB060
	1 Inverter & 1 Chopper	Screw	L1	PM75B5LA060
		Pin	L2	PM75B5LB060
	1 Inverter & 2 Chopper	Screw	L1	PM75B6LA060
		Pin	L2	PM75B6LB060

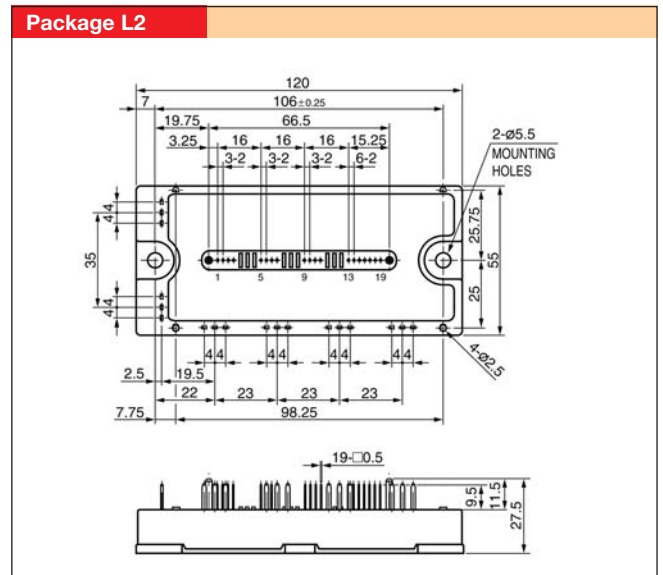
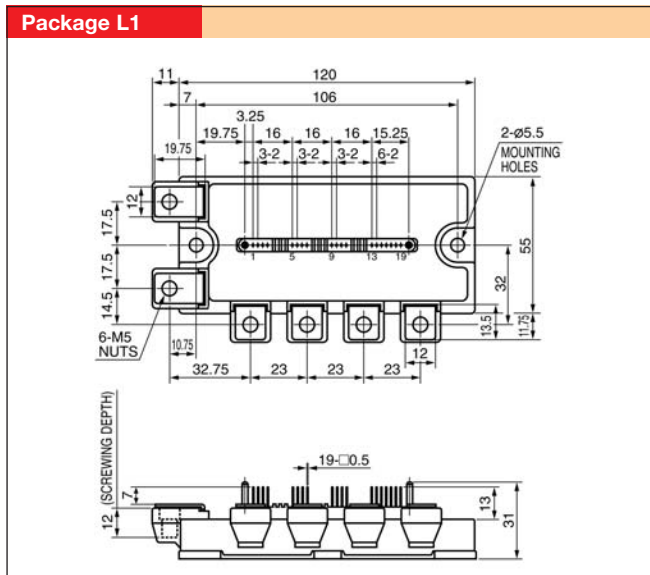
## 2.05 5<sup>th</sup> Generation IPMs for Photovoltaic Application



Type Number	Maximum Ratings		Electrical Characteristics							Thermal Characteristics			Typical Protection Functions			Package-No.
	V <sub>CE(S)</sub> (V)	I <sub>C</sub> (A)	V <sub>CE(sat)</sub> @ T <sub>J</sub> = 125°C (V)		Typical Switching Times					IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)	R <sub>th(c-f)</sub> (°C/W)	SC* (A)	OT (°C)	UV (V)	
			Typ.	Max.	t <sub>on</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)	t <sub>rr</sub> (μs)							
<b>600 Volt IPM for Solar Power</b>																
PM50B4LA060	600	50	1.55		0.7	0.2	0.9	0.2	0.1	0.95	1.61	0.038	100	145	12	L1
PM50B4LB060	600	50	1.55		0.7	0.2	0.9	0.2	0.1	0.95	1.61	0.038	100	145	12	L2
PM50B5LA060	600	50	1.55		0.7	0.2	0.9	0.2	0.1	0.95	1.61	0.038	100	145	12	L1
PM50B5LB060	600	50	1.55		0.7	0.2	0.9	0.2	0.1	0.95	1.61	0.038	100	145	12	L2
PM50B6LA060	600	50	1.55		0.7	0.2	0.9	0.2	0.1	0.95	1.61	0.038	100	145	12	L1
PM50B6LB060	600	50	1.55		0.7	0.2	0.9	0.2	0.1	0.95	1.61	0.038	100	145	12	L2
PM75B4LA060	600	75	1.55		0.7	0.2	0.9	0.2	0.1	0.32	0.53	0.038	150	145	12	L1
PM75B4LB060	600	75	1.55		0.7	0.2	0.9	0.2	0.1	0.32	0.53	0.038	150	145	12	L2
PM75B5LA060	600	75	1.55		0.7	0.2	0.9	0.2	0.1	0.32	0.53	0.038	150	145	12	L1
PM75B5LB060	600	75	1.55		0.7	0.2	0.9	0.2	0.1	0.32	0.53	0.038	150	145	12	L2
PM75B6LA060	600	75	1.55		0.7	0.2	0.9	0.2	0.1	0.32	0.53	0.038	150	145	12	L1
PM75B6LB060	600	75	1.55		0.7	0.2	0.9	0.2	0.1	0.32	0.53	0.038	150	145	12	L2

\*minimum trip values

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

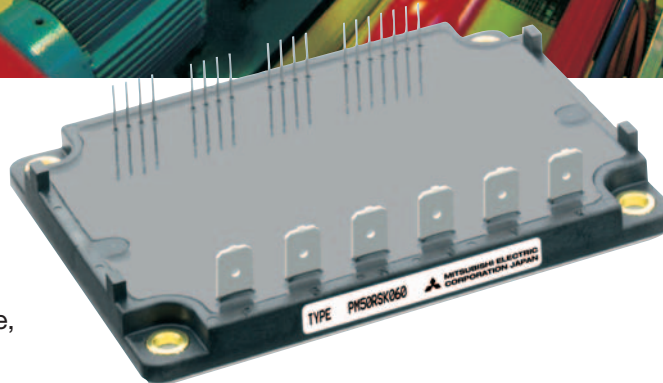


Dimensions in mm



## 2.06

### 3<sup>rd</sup> Generation IPMs (S-Series)



#### Features

- **High Efficiency:**  
Low losses at high frequencies due to 3<sup>rd</sup> Generation IGBT chips (typ. saturation voltage is 1.8V for a 600V device, and 2.3V for a 1200V device).
- **High Frequency:**  
Reduced EMI noise level and recovery losses due to the integrated fast and soft recovery diode.
- **Direct Logic Drive**
- **Ruggedness:**  
Improved reliability ensured by integrated protection such as over-current, over-temperature and under-voltage. Moreover, Real Time Controls short-circuit protection suppresses high temperature rise and excessive surge voltage.

## 2.06 3<sup>rd</sup> Generation IPMs (S-Series)

### Line-up S-Series

Symbol	Internal Function	V <sub>CES</sub> (V)	I <sub>c</sub> (A)						
			10	15	20 (25)	30	50	75	100
H-	1/2 Ø Inverter IGBT Integrated Gate Drive OC / UV	600							
		1200							
D	1 Ø Inverter IGBT Integrated Gate Drive OC / OT / UV	600							
		1200						PM75DSA120	PM100DSA120
C	3 Ø Inverter IGBT Integrated Gate Drive OC / SC / OT / UV	600	PM10CSJ060	PM15CSJ060	PM20CSJ060	PM30CSJ060			PM100CSA060
		1200	PM10CZF120	PM15CZF120				PM75CSA120	PM100CSA120
R	3 Ø Inverter IGBT Integrated Gate Drive Brake-Control OC / SC / OT / UV	600				PM30RSF060	PM50RSA060 PM50RSK060	PM75RSA060 PM75RSK060	PM100RSA060
		1200	PM10RSH120	PM15RSH120	PM25RSB120 PM25RSK120		PM50RSA120		

2

Symbol	Internal Function	V <sub>CES</sub> (V)	I <sub>c</sub> (A)					
			150	200	300	400	600	800
H	1/2 Ø Inverter IGBT Integrated Gate Drive OC / UV	600						PM800HSA060
		1200				PM400HSA120	PM600HSA120	PM800HSA120
D	1 Ø Inverter IGBT Integrated Gate Drive OC / OT / UV	600		PM200DSA060	PM300DSA060	PM400DSA060	PM600DSA060	
		1200	PM150DSA120	PM200DSA120	PM300DSA120			
C	3 Ø Inverter IGBT Integrated Gate Drive OC / SC / OT / UV	600	PM150CSA060	PM200CSA060				
		1200						
R	3 Ø Inverter IGBT Integrated Gate Drive Brake-Control OC / SC / OT / UV	600	PM150RSA060	PM200RSA060				
		1200						

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

## 2.06 3<sup>rd</sup> Generation IPMs (S-Series)

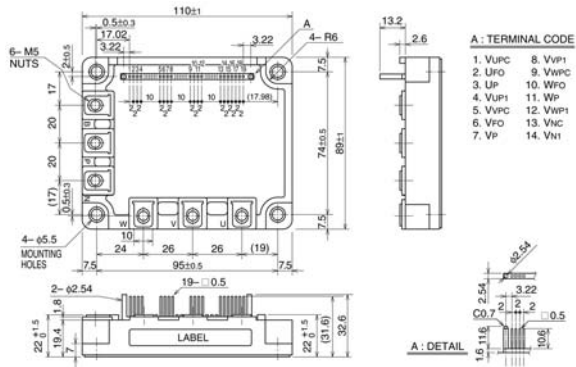
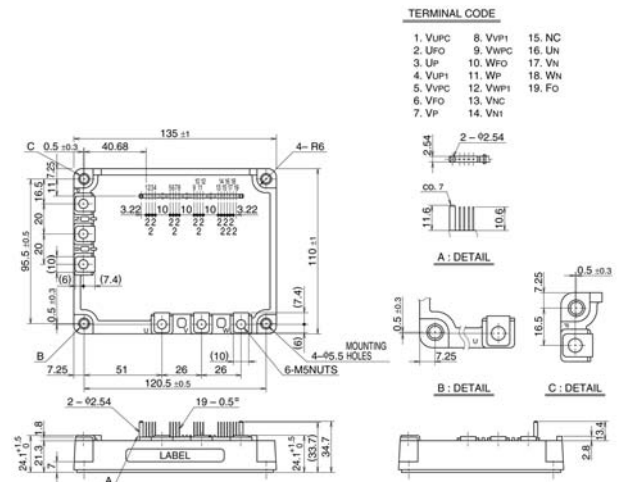
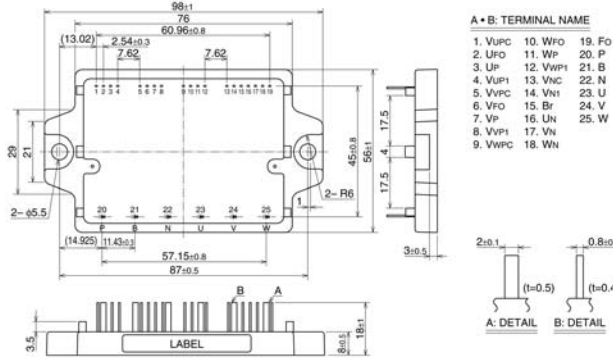
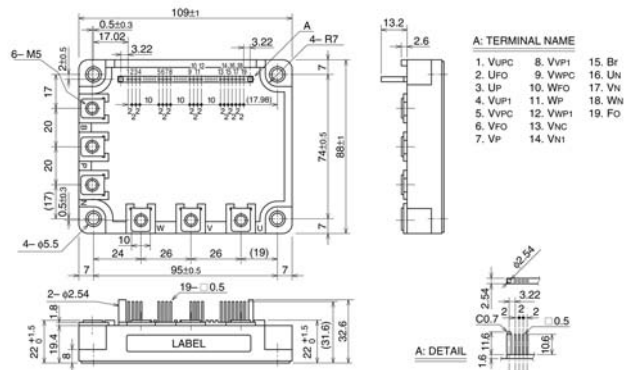
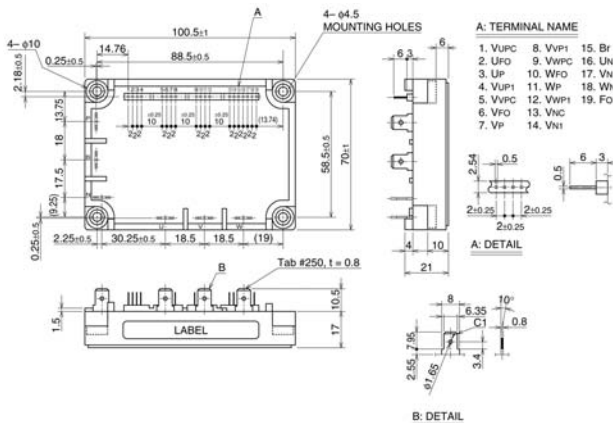
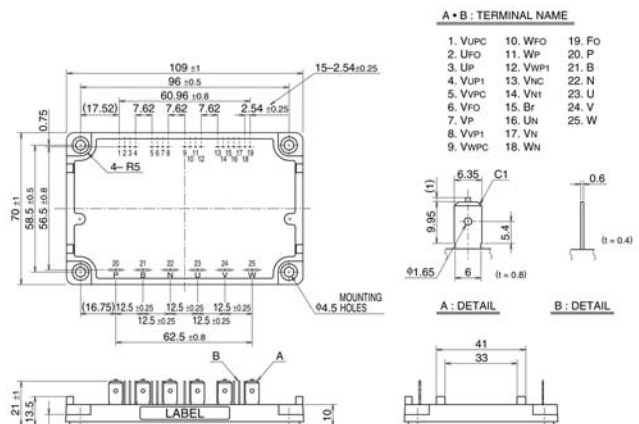
Type Number	Maximum Ratings		Electrical Characteristics							Thermal Characteristics			Typical Protection Functions				Package-No.
	V <sub>CE(S)</sub> (V)	I <sub>c</sub> (A)	V <sub>CE(sat)</sub> @ T <sub>j</sub> = 25°C (V)		Typical Switching Times					IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)	R <sub>th(c-f)</sub> (°C/W)	OC (A)	SC (A)	OT (°C)	UV (V)	
			Typ.	Max.	t <sub>on</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)	t <sub>rr</sub> (μs)								
<b>600 Volt IPM Modules</b>																	
PM10CSJ060	600	10	1.8	2.5	0.5	0.2	1.5	0.4	0.12	3.2	4.5	0.083	18	27	110	12	S6
PM15CSJ060	600	15	1.8	2.5	0.5	0.2	1.5	0.4	0.12	2.9	4.5	0.083	26	39	110	12	S6
PM20CSJ060	600	20	1.8	2.5	0.6	0.2	1.5	0.5	0.12	2.2	4.5	0.083	38	57	110	12	S6
PM30CSJ060	600	30	1.8	2.5	0.6	0.3	2.0	0.6	0.12	1.5	3.0	0.083	53	80	110	12	S6
PM30RSF060	600	30	1.8	2.5	0.6	0.3	2.0	0.6	0.12	1.5	3.0	0.067	53	80	110	12	S9
PM50RSA060	600	50	1.8	2.7	0.8	0.4	2.0	0.5	0.15	0.9	2.5	0.027	88	132	118	12	S10
PM50RSK060	600	50	1.8	2.7	0.8	0.4	2.0	0.5	0.15	1.25	3.0	0.038	88	132	110	12	S11
PM75RSA060	600	75	1.8	2.7	0.8	0.4	2.0	0.5	0.15	0.4	1.0	0.027	161	241	118	12	S10
PM75RSK060	600	75	1.8	2.7	0.8	0.4	2.0	0.5	0.15	1.0	0.95	0.036	161	241	110	12	S12
PM100CSA060	600	100	1.8	2.7	0.8	0.4	2.0	0.6	0.15	0.31	0.70	0.027	240	360	118	12	S7
PM100RSA060	600	100	1.8	2.7	0.8	0.4	2.0	0.6	0.15	0.31	0.70	0.027	240	360	118	12	S7
PM150CSA060	600	150	1.8	2.7	0.8	0.4	2.0	0.6	0.15	0.25	0.47	0.027	300	420	118	12	S7
PM150RSA060	600	150	1.8	2.7	0.8	0.4	2.0	0.6	0.15	0.25	0.47	0.027	300	420	118	12	S7
PM200CSA060	600	200	1.8	2.7	0.8	0.4	2.0	0.6	0.15	0.21	0.35	0.018	400	560	118	12	S8
PM200DSA060	600	200	1.8	2.6	1.4	0.4	2.0	0.5	0.15	0.21	0.35	0.060	400	560	110	12	S2
PM300DSA060	600	300	1.8	2.6	1.4	0.4	2.0	0.5	0.15	0.13	0.25	0.048	540	760	110	12	S3
PM400DSA060	600	400	1.8	2.6	1.4	0.4	2.0	0.5	0.15	0.11	0.18	0.038	650	910	110	12	S4
PM600DSA060	600	600	1.8	2.6	1.4	0.4	2.0	0.5	0.15	0.07	0.13	0.030	1000	1400	110	12	S5
PM800HSA060	600	800	2.0	2.7	1.4	0.4	2.5	0.5	0.15	0.06	0.09	0.038	1350	1870	110	12	S1
<b>1200 Volt IPM Modules</b>																	
PM10CZF120	1200	10	2.7	3.7	0.6	0.3	1.8	0.8	0.15	2.0	5.5	0.067	27	41	110	12	S16
PM10RSH120	1200	10	2.3	3.3	0.7	0.3	1.7	0.6	0.15	2.0	5.5	0.044	27	41	110	12	S17
PM15CZF120	1200	15	2.7	3.7	0.6	0.3	1.8	0.8	0.15	1.5	4.5	0.067	37	56	110	12	S16
PM15RSH120	1200	15	2.3	3.3	0.7	0.3	1.7	0.7	0.15	1.5	4.5	0.044	37	56	110	12	S17
PM25RSB120	1200	25	2.5	3.5	1.0	0.4	2.0	0.7	0.15	0.95	2.5	0.036	62	101	118	12	S18
PM25RSK120	1200	25	2.5	3.5	1.0	0.4	2.0	0.7	0.15	1.25	3.0	0.038	58	81	110	12	S19
PM50RSA120	1200	50	2.5	3.5	1.0	0.4	2.0	0.7	0.15	0.36	1.0	0.027	112	183	118	12	S7
PM75CSA120	1200	75	2.5	3.5	1.0	0.4	2.5	0.7	0.15	0.25	0.51	0.027	170	250	118	12	S7
PM75DSA120	1200	75	2.3	3.2	1.4	0.4	2.5	0.6	0.20	0.27	0.51	0.060	170	250	110	12	S2
PM100CSA120	1200	100	2.5	3.5	1.0	0.4	2.5	0.7	0.15	0.21	0.35	0.018	230	340	118	12	S8
PM100DSA120	1200	100	2.3	3.2	1.4	0.4	2.5	0.6	0.20	0.21	0.35	0.060	230	340	110	12	S2
PM150DSA120	1200	150	2.3	3.2	1.4	0.4	2.5	0.6	0.20	0.13	0.25	0.048	320	450	110	12	S3
PM200DSA120	1200	200	2.3	3.2	1.4	0.4	2.0	0.6	0.20	0.11	0.18	0.038	360	540	110	12	S4
PM300DSA120	1200	300	2.3	3.2	1.4	0.4	2.5	0.6	0.20	0.07	0.13	0.030	560	840	110	12	S5
PM400HSA120	1200	400	2.3	3.2	1.4	0.4	2.5	0.6	0.20	0.054	0.10	0.038	650	930	110	12	S13
PM600HSA120	1200	600	2.3	3.2	1.4	0.4	3.0	0.6	0.20	0.036	0.06	0.025	1000	1400	110	12	S14
PM800HSA120	1200	800	2.5	3.5	1.4	0.4	3.0	0.6	0.20	0.027	0.045	0.022	1300	1700	110	12	S15

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



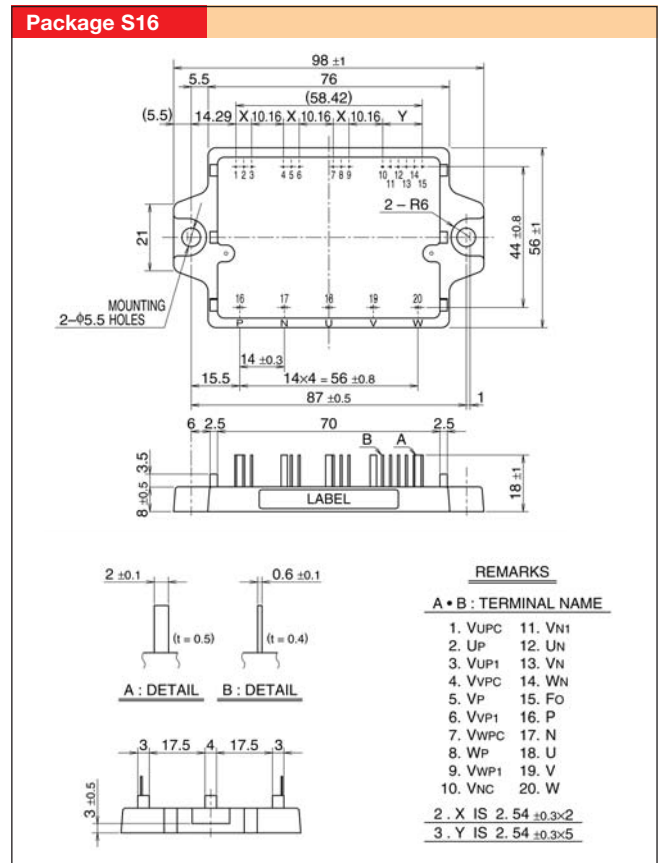
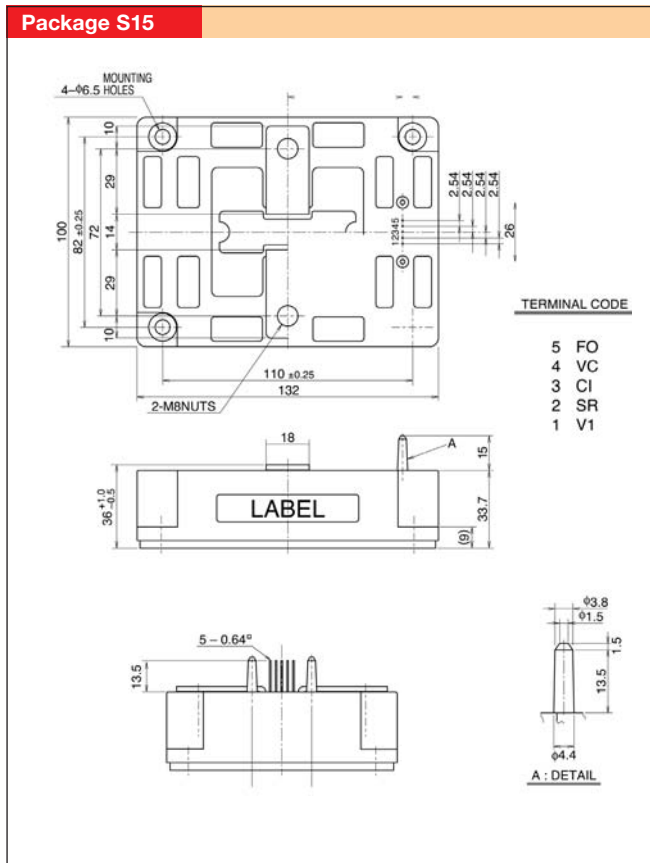
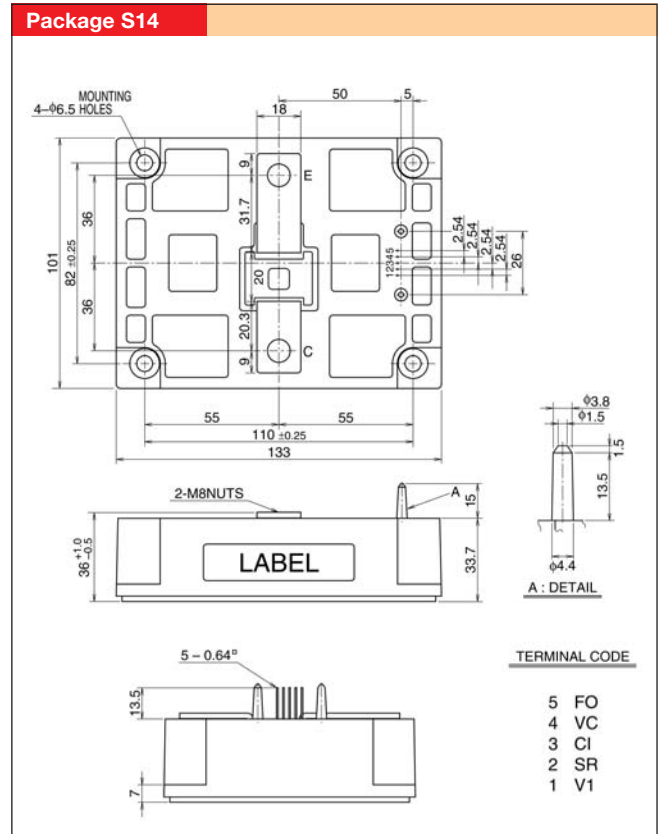
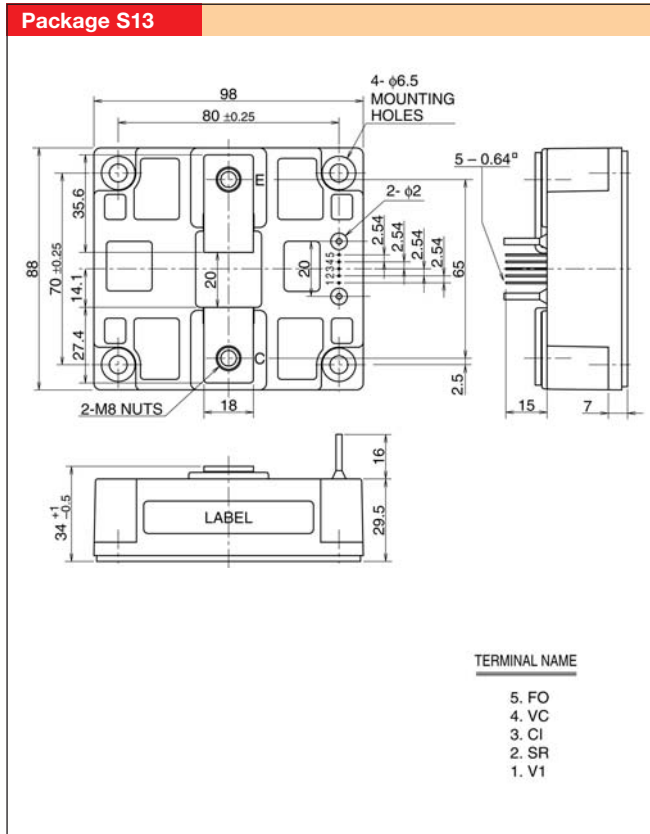


## 2.06 3<sup>rd</sup> Generation IPMs (S-Series)

**Package S7**

**Package S8**

**Package S9**

**Package S10**

**Package S11**

**Package S12**


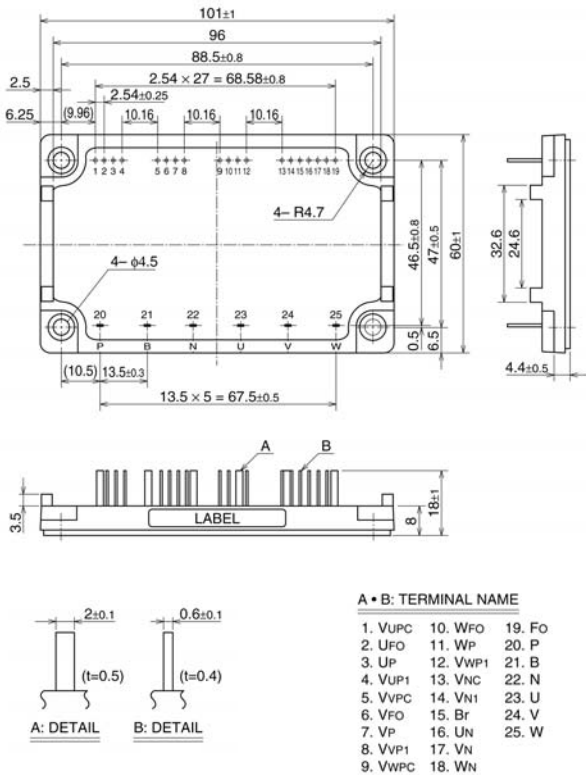
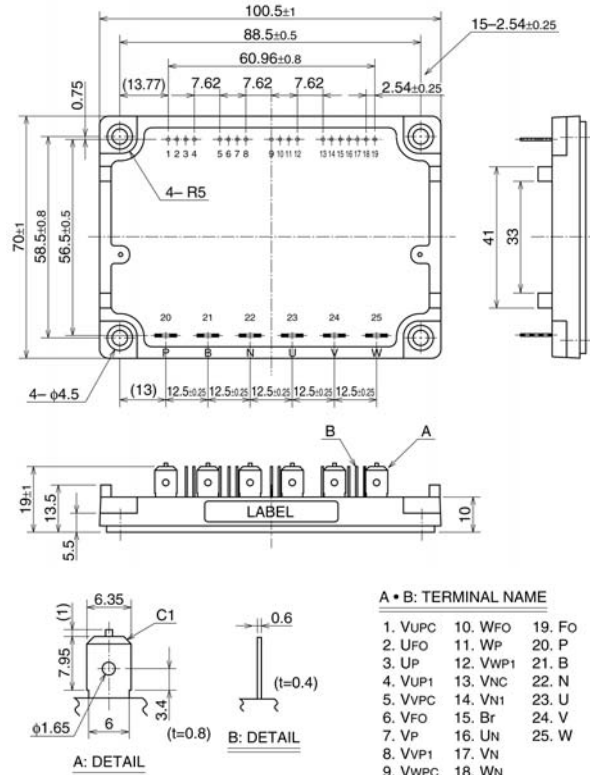
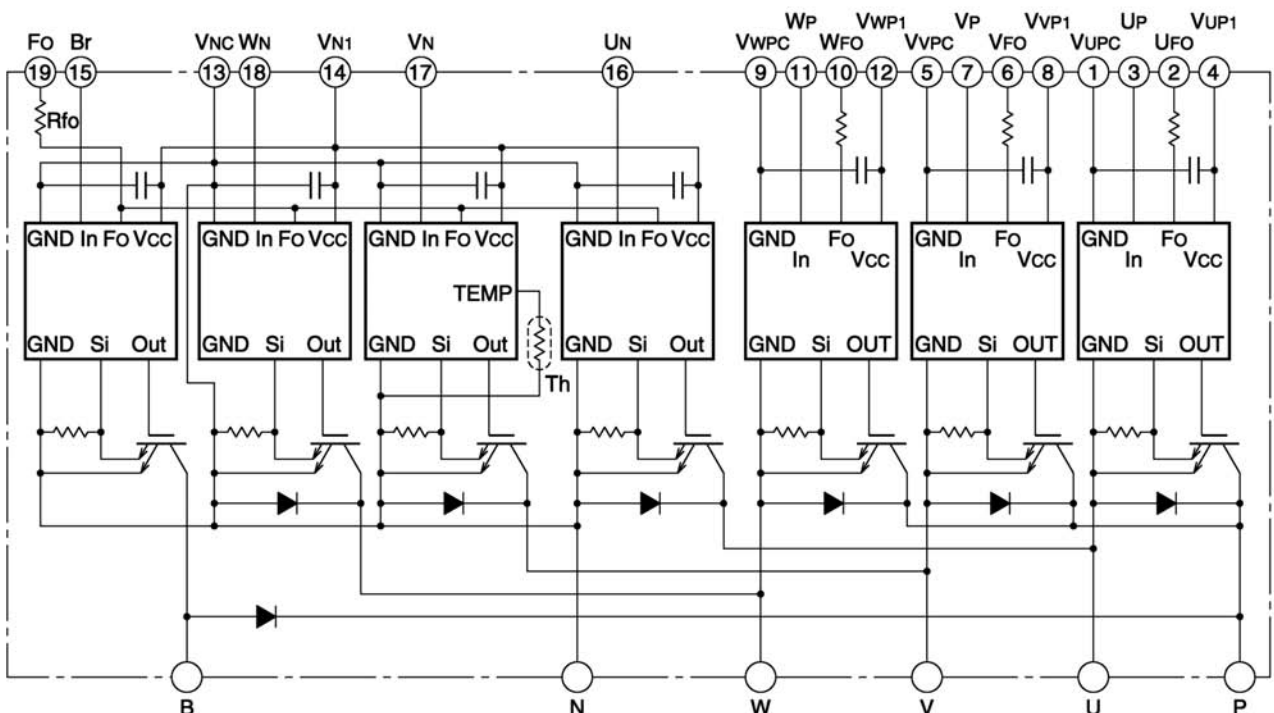
Dimensions in mm

## 2.06 3<sup>rd</sup> Generation IPMs (S-Series)



Dimensions in mm

## 2.06 3<sup>rd</sup> Generation IPMs (S-Series)

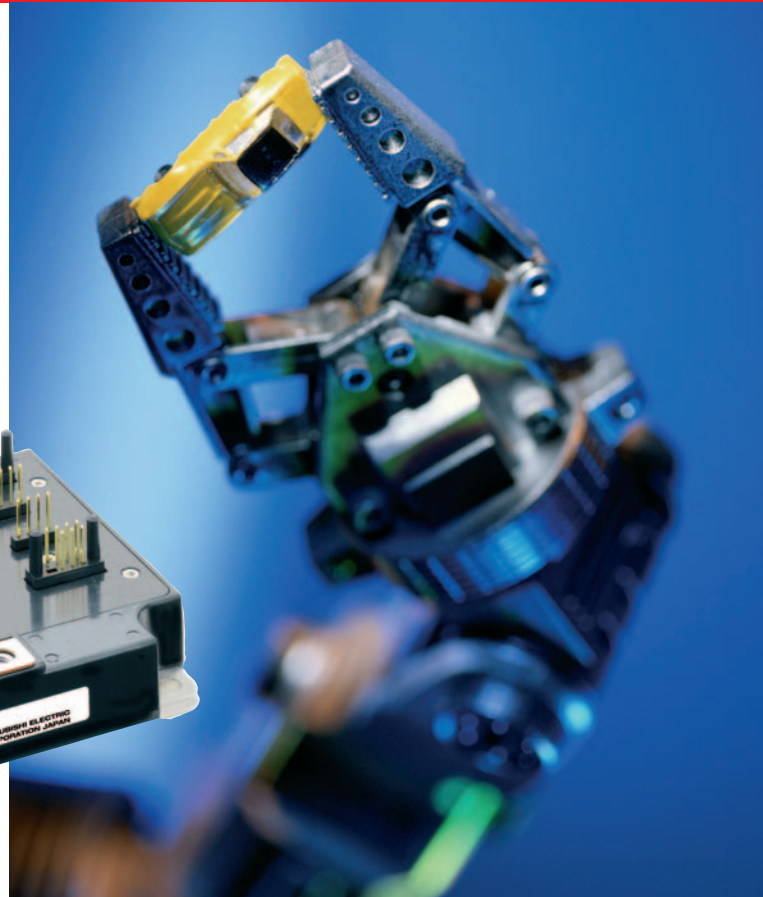
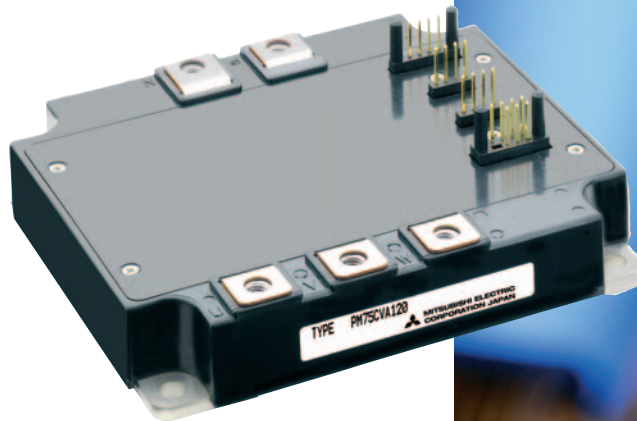
**Package S17**

**Package S19**

**Package S18**


Dimensions in mm

## 3<sup>rd</sup> Generation IPMs (V-Series)

### Features

- Internal inductance reduced by 50%
- Higher reliability due to solderless connections
- Integrates IGBT bridge, drive, self protection functions



### Line-up V-Series

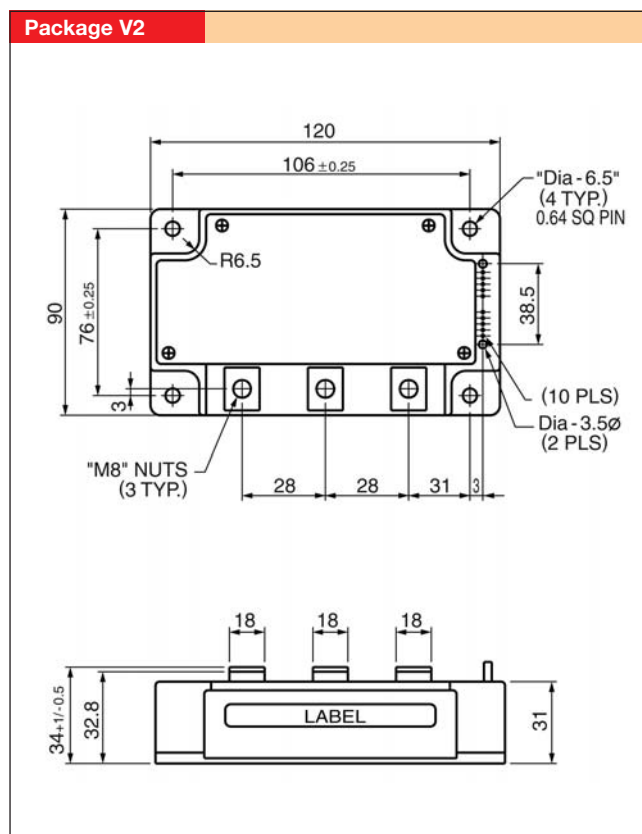
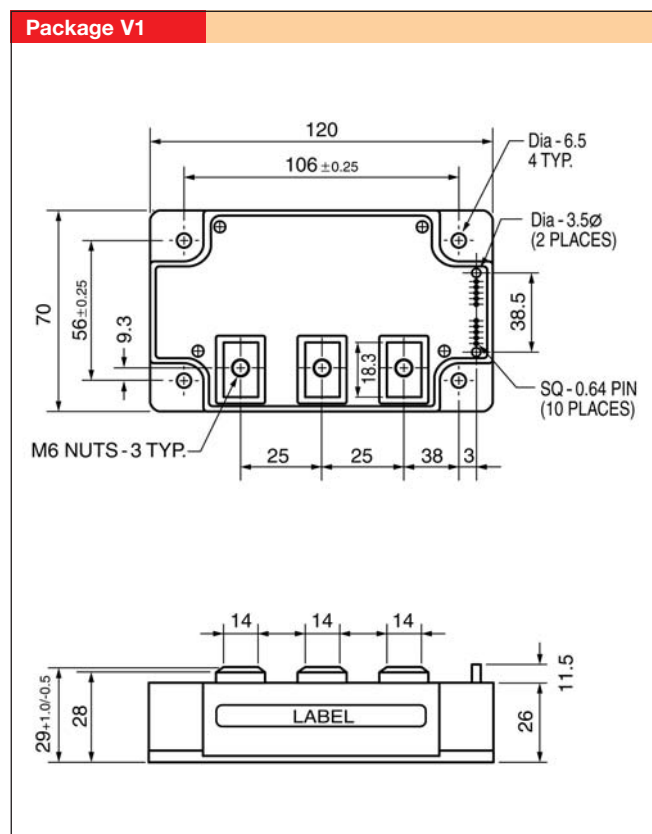
Symbol	Internal Function	V <sub>CES</sub> (V)	I <sub>c</sub> (A)								
			50	75	100	150	200	300	400	600	
D	1 Ø Inverter IGBT Integrated Gate Drive OT / UV	600								PM400DVA060	PM600DVA060
		1200					PM200DVA120	PM300DVA120			
C	3 Ø Inverter IGBT Integrated Gate Drive SC / OT / UV	600			PM100CVA060	PM150CVA060	PM200CVA060	PM300CVA060			
		1200		PM75CVA120	PM100CVA120	PM150CVA120					
R	3 Ø Inverter IGBT Integrated Gate Drive Brake-Control OC / SC / OT / UV	600		PM75RVA060							
		1200	PM50RVA120								

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



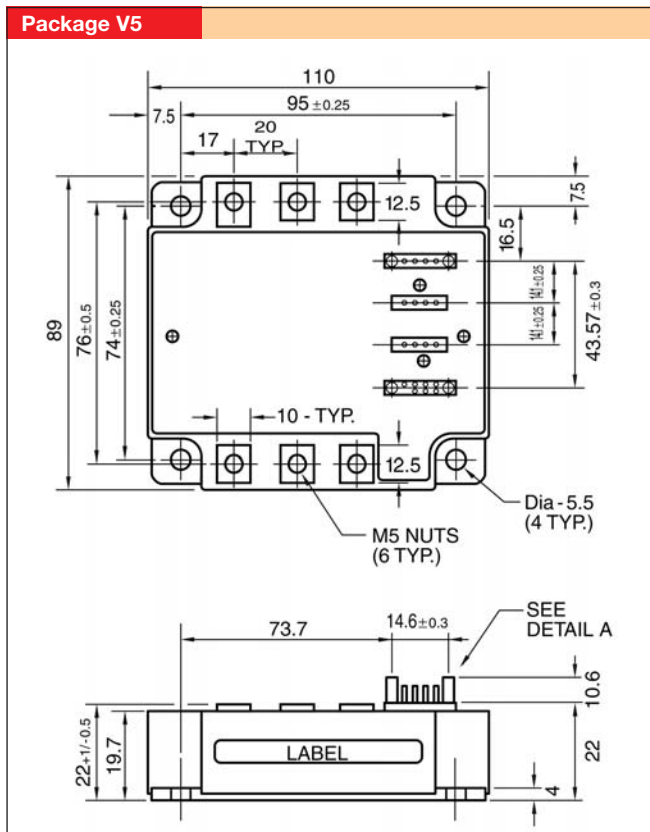
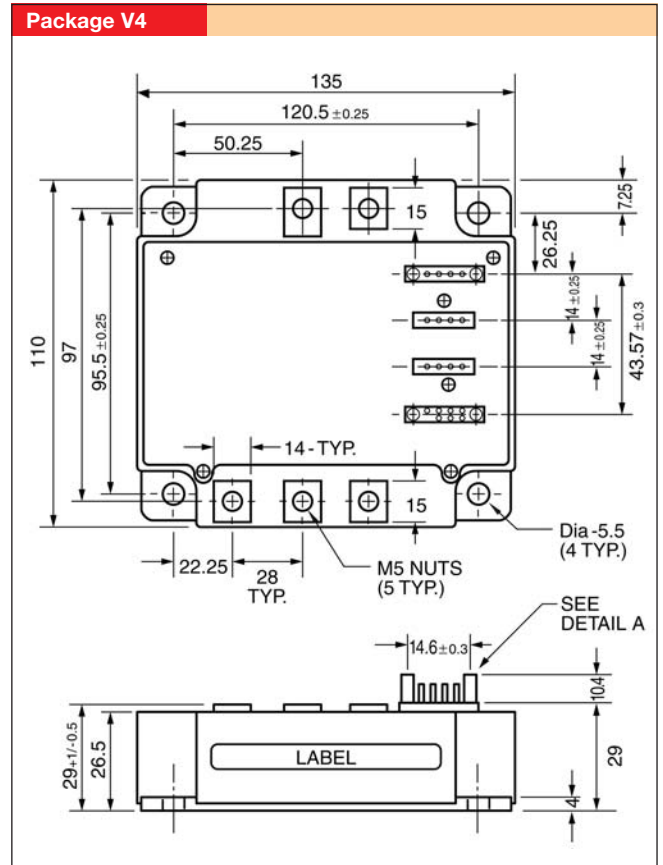
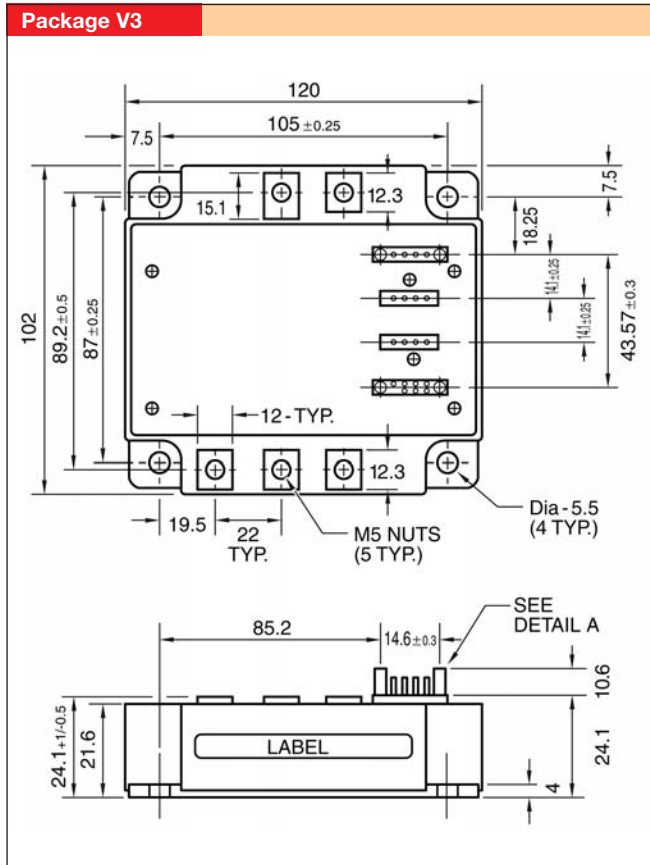
## 2.07 3<sup>rd</sup> Generation IPMs (V-Series)

Type Number	Maximum Ratings		Electrical Characteristics							Thermal Characteristics			Typical Protection Functions			Package-No.
	V <sub>CE(S)</sub> (V)	I <sub>C</sub> (A)	V <sub>CE(sat)</sub> @ T <sub>J</sub> = 25°C (V)		Typical Switching Times					IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)	R <sub>th(c-f)</sub> (°C/W)	SC (A)	OT (°C)	UV (V)	
			Typ.	Max.	t <sub>on</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)	t <sub>rr</sub> (μs)							
<b>600 Volt IPM Modules</b>																
PM75RVA060	600	75	2.35	2.80	0.8	0.3	1.8	0.6	0.2	0.44	1.0	0.027	115	110	12	V5
PM100CVA060	600	100	2.35	2.80	0.8	0.3	1.8	0.6	0.2	0.37	0.70	0.027	158	110	12	V5
PM150CVA060	600	150	2.35	2.80	0.8	0.3	1.8	0.6	0.2	0.28	0.47	0.022	210	110	12	V3
PM200CVA060	600	200	2.35	2.80	0.8	0.3	1.8	0.6	0.2	0.21	0.35	0.022	310	110	12	V3
PM300CVA060	600	300	2.35	2.80	1.4	0.4	2.0	0.5	0.15	0.17	0.26	0.018	396	110	12	V4
PM400DVA060	600	400	2.35	2.80	1.4	0.4	2.0	0.5	0.15	0.11	0.18	0.081	910	110	12	V1
PM600DVA060	600	600	2.35	2.80	1.4	0.4	2.0	0.5	0.15	0.09	0.13	0.065	1400	110	12	V2
<b>1200 Volt IPM Modules</b>																
PM50RVA120	1200	50	2.65	3.30	0.9	0.4	2.4	0.7	0.2	0.37	0.70	0.027	59	118	12	V5
PM75CVA120	1200	75	2.65	3.30	0.9	0.4	2.4	0.7	0.2	0.25	0.51	0.025	105	110	12	V3
PM100CVA120	1200	100	2.65	3.30	0.9	0.4	2.4	0.7	0.2	0.21	0.35	0.025	145	110	12	V3
PM150CVA120	1200	150	2.65	3.30	0.9	0.4	2.4	0.7	0.2	0.16	0.26	0.018	200	110	12	V4
PM200DVA120	1200	200	2.65	3.30	0.9	0.4	2.4	0.7	0.2	0.11	0.18	0.081	240	110	12	V1
PM300DVA120	1200	300	2.65	3.30	0.9	0.4	2.4	0.7	0.2	0.09	0.13	0.065	380	110	12	V2



Dimensions in mm

## 2.07 3<sup>rd</sup> Generation IPMs (V-Series)

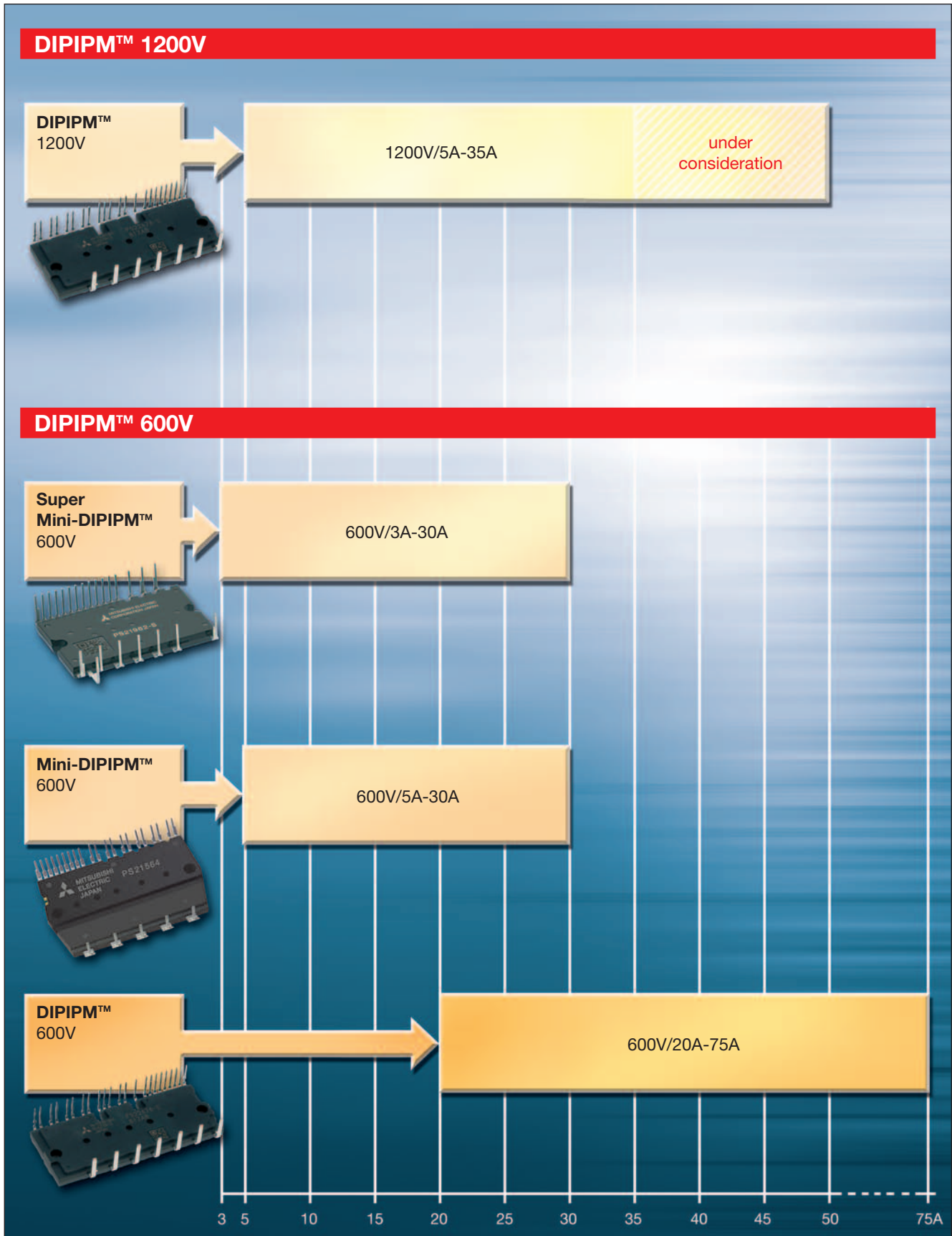


**Notes**

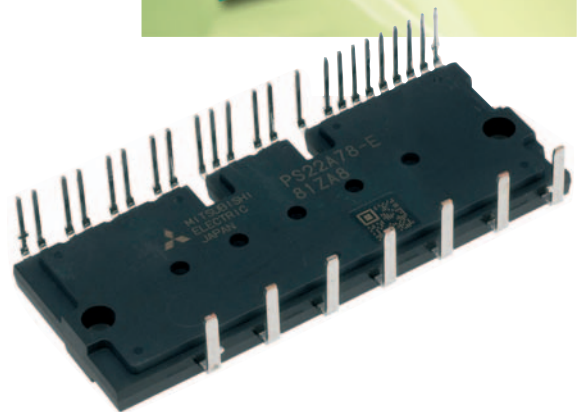
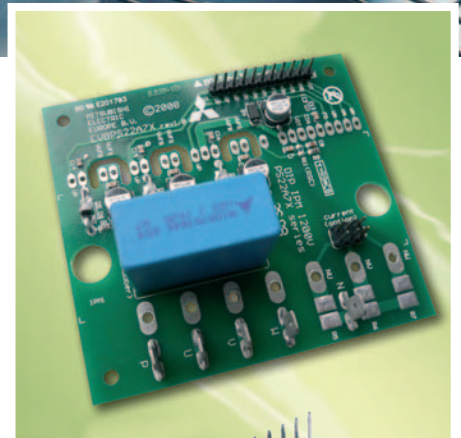
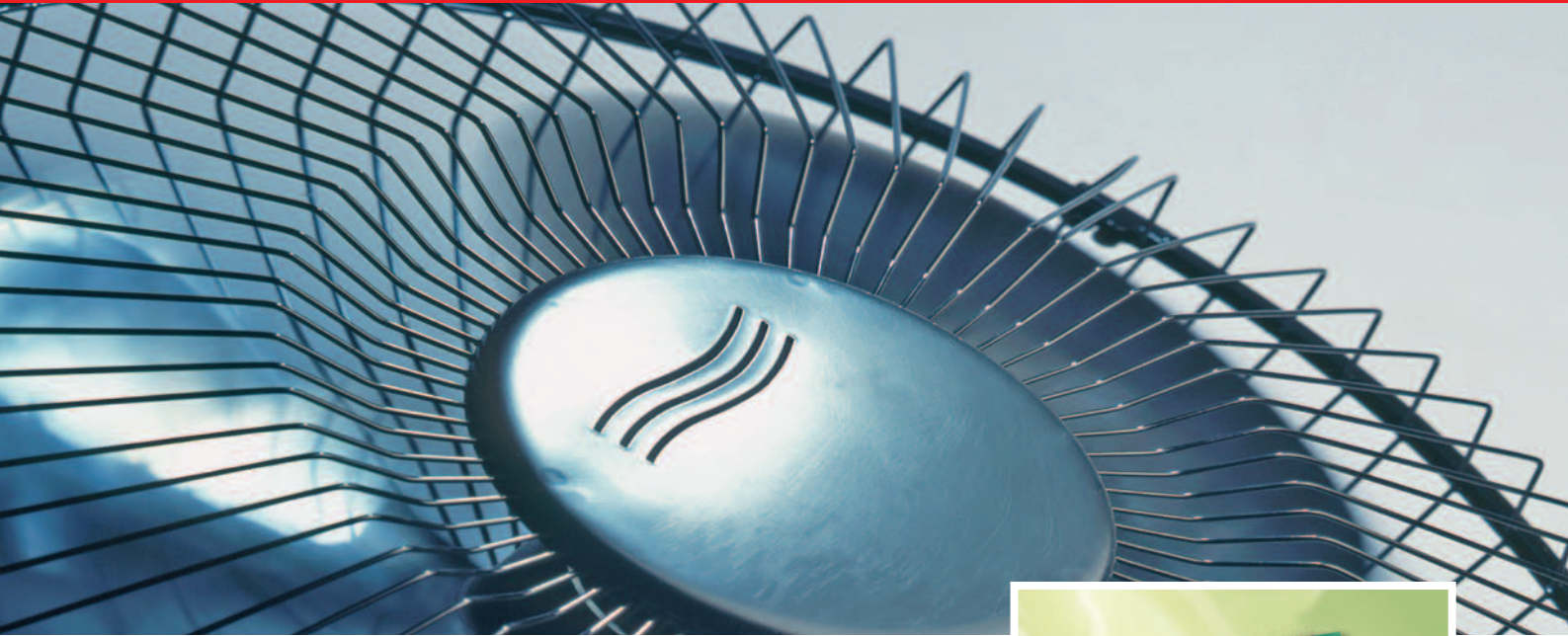
Dimensions in mm

# 2.08

## Overview of DIIPM™



## 1200V DIIPM™ Ver. 4 (Dual-in-line Package Intelligent Power Modules)



### Features

- Designed for low power motor control (0.4kW-5.5kW at 400V AC line voltage)
- Lead free compact dual-in-line transfer mold package
- Rated currents ranging from 5A-35A and  $V_{CES} = 1200V$
- **Protection functions:**
  - UV: Control supply under voltage (P, N)
  - On-chip current sense for short circuit protection
  - Analog temperature sensor output ( $T_c$ )
- 2500V<sub>rms</sub> isolation voltage
- N-side open emitter structure
- RoHS compliant
- Evaluation board EVBPS2XA7X available



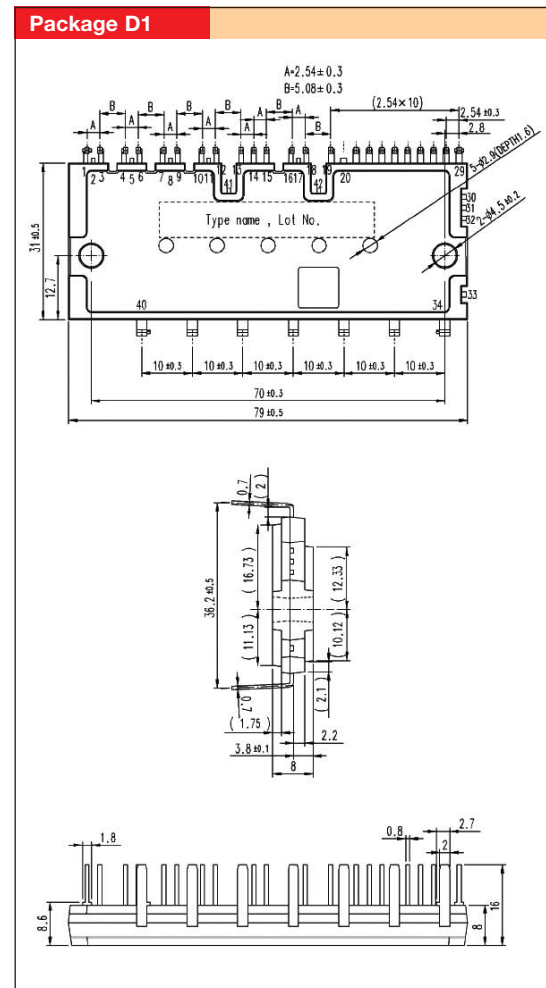
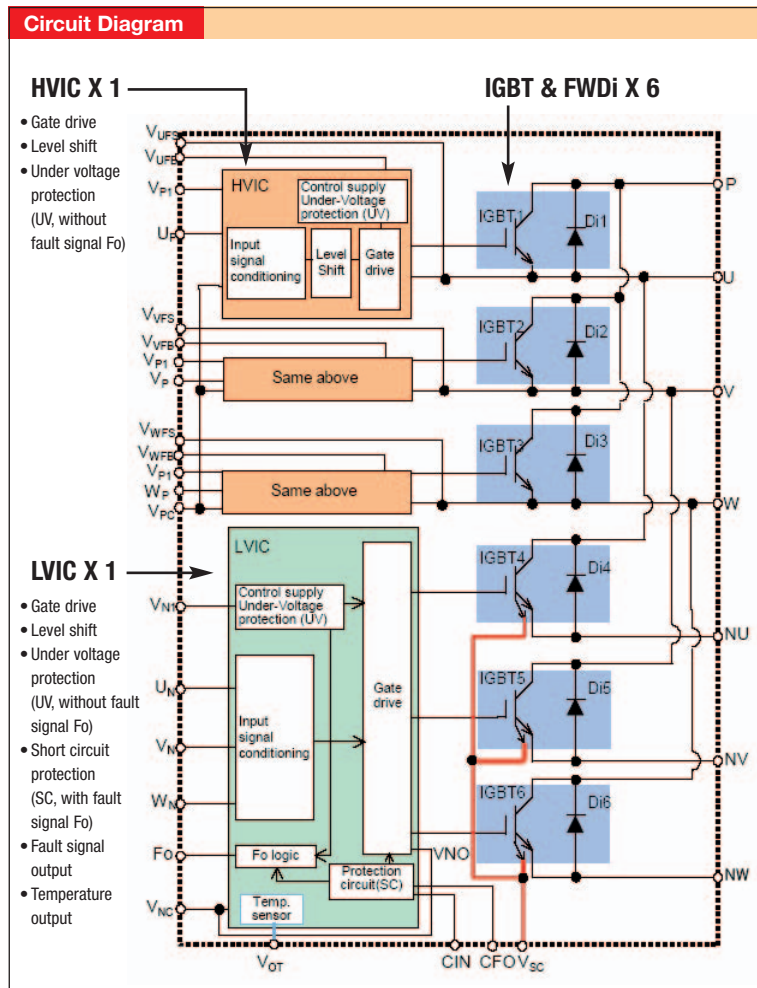
## 2.09 1200V DIIPM™ Ver. 4 (Dual-in-line Package Intelligent Power Modules)

### Line-up 1200V DIIPM™ Ver. 4

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>CES</sub> (V)	I <sub>c</sub> (A)					Package No.	
			5	10	15	25	35		50
DIIPM	2500	1200	PS22A72	PS22A73	PS22A74	PS22A76	PS22A78-E	PS22A79*	D1

\*Under consideration

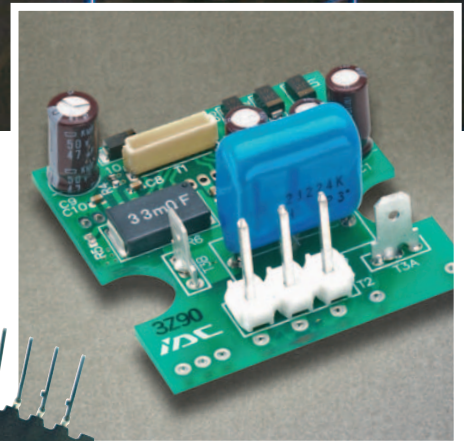
Type Number	Electrical Characteristics											Thermal & Mechanical Characteristics		
	V <sub>CES</sub> (V)	Applicable Motor Ratings (kW)	I <sub>c</sub> (A)	f <sub>c</sub> (kHz)	Isolation Voltage (V <sub>rms</sub> )	V <sub>CE(sat)</sub> @ T <sub>j</sub> = 25°C (V)		Typical Switching Times					IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)
						Typ.	Max.	t <sub>on</sub> (μs)	t <sub>rr</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)		
<b>1200V DIIPM</b>														
PS22A72	1200	0.7	5	15	2500	1.9	2.6	1.5	0.3	0.6	2.8	0.7	2.24	2.74
PS22A73	1200	1.5	10	15	2500	1.9	2.6	1.5	0.3	0.6	2.8	0.7	1.51	1.78
PS22A74	1200	2.2	15	15	2500	1.9	2.6	1.5	0.3	0.6	2.8	0.7	1.15	1.36
PS22A76	1200	3.7	25	15	2500	1.9	2.6	1.5	0.3	0.6	2.8	0.7	0.88	1.78
PS22A78-E	1200	5.5	35	15	2500	1.9	2.6	1.5	0.3	0.6	2.8	0.7	0.77	1.25



2

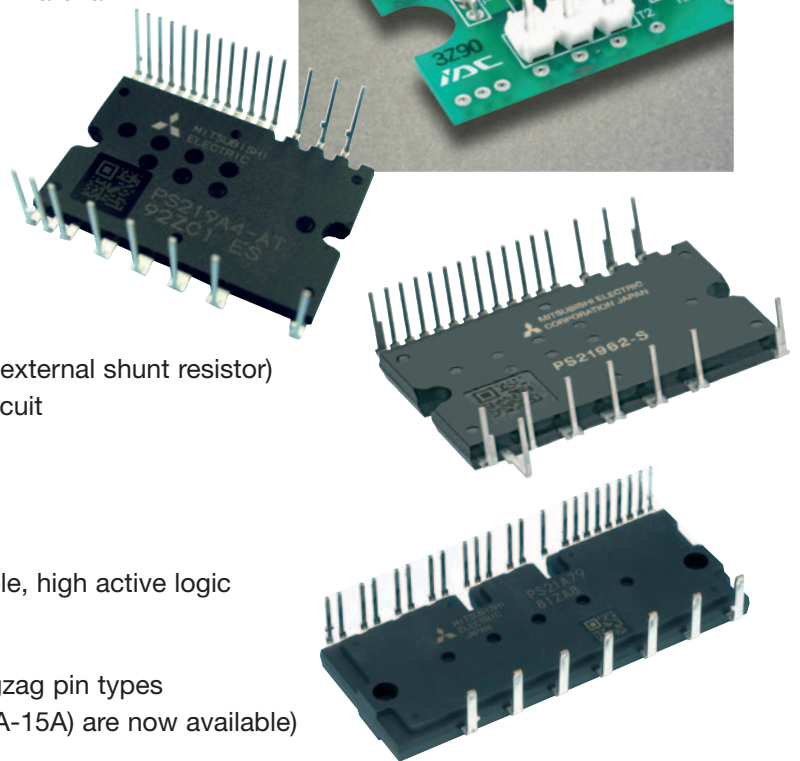
## 2.10

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



### Features

- Low thermal resistance by innovative insulation material
- RoHS compliant
- For P-side IGBTs:
  - Drive circuit
  - High voltage level shift circuit
  - Control supply under voltage (UV) lockout circuit
- For N-side IGBTs:
  - Drive circuit
  - Short circuit (SC) protection circuit (by using external shunt resistor)
  - Control supply under voltage (UV) lockout circuit
- IGBT Drive Supply
  - Single DC 15V power supply required
- Control Input interface
  - Schmitt-triggered 3V, 5V, 15V input compatible, high active logic
- Open emitter topology available
- 3A to 30A / 600V as short pin, long pin and zigzag pin types (New versions with built-in bootstrap diodes (5A-15A) are now available)
- Large DIIPM™ available in 50A and 75A
- For the time and cost effective performance evaluation of 4<sup>th</sup> Generation Super Mini-DIIPM™ a dedicated evaluation board (EVBPS21965) with in-built interface devices (shunt resistor, the snubber capacitor and the bootstrap circuit) is available.  
A newly developed evaluation board EVBPS2XA7X for large DIIPM™ (50A/75A) is also available on request (compatible to 1200V DIIPM™ Ver. 4)



## 2.10 600V DIIPM™ (Dual-in-line Package Intelligent Power Modules)

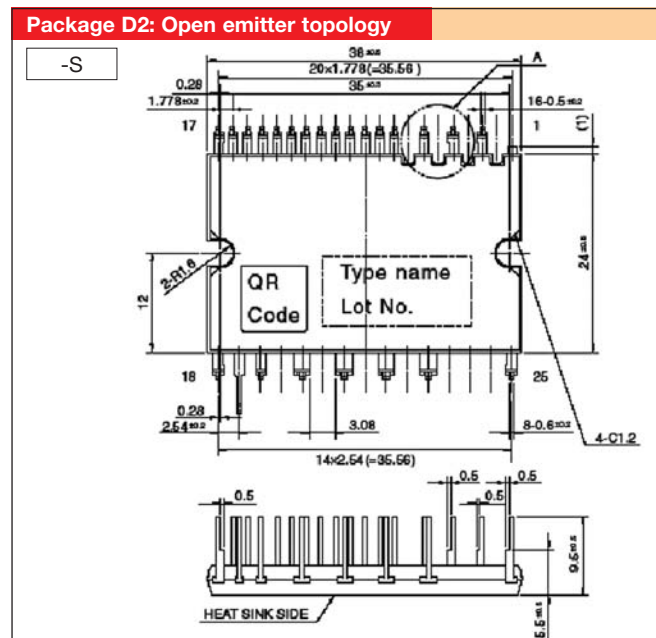
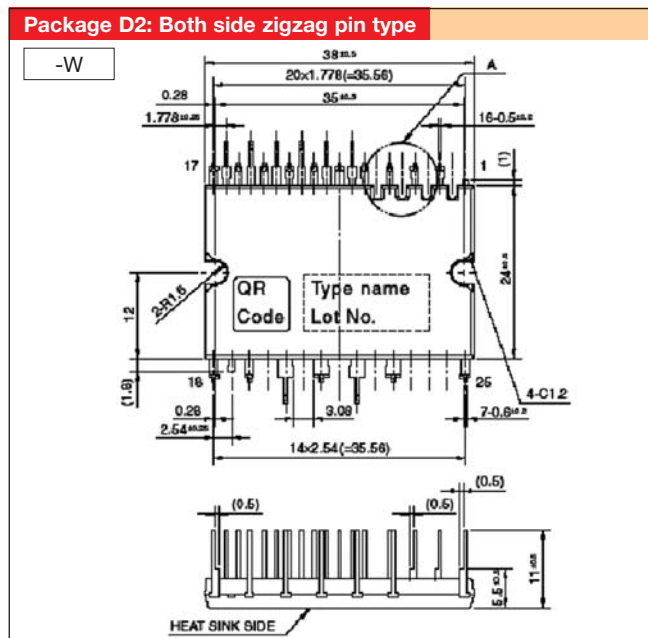
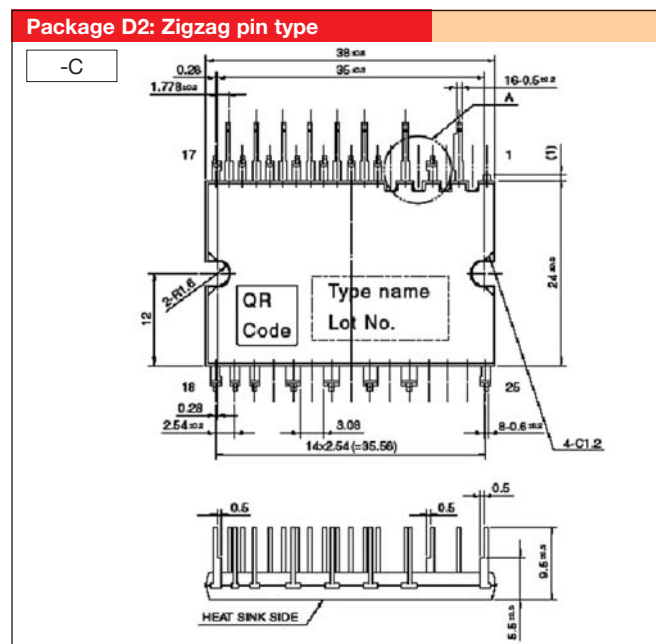
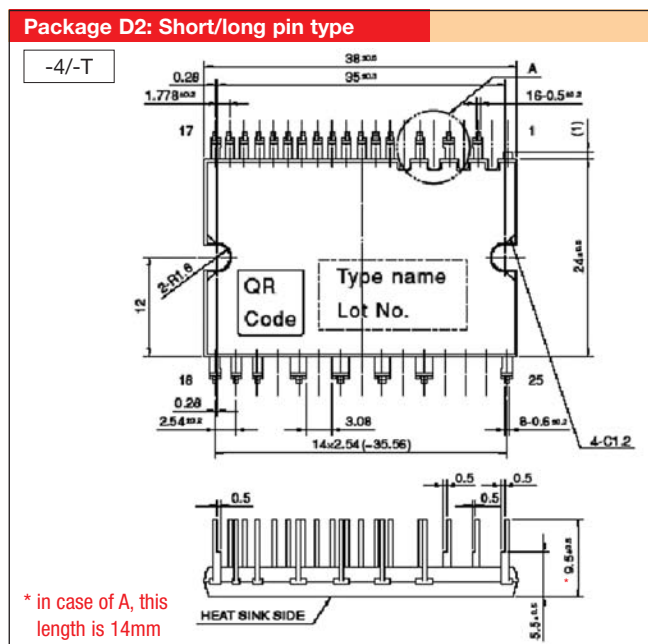
### Super Mini-DIIPM™ Ver. 4

#### Line-up Super Mini-DIIPM™

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>CES</sub> (V)	Motor Rating (kW)						Package-No.	
			0.1	0.2	0.3	0.4	0.75	1.5		2.2
			I <sub>c</sub> (A)							
			3	5	8	10	15	20	30	
Super Mini-DIIPM (1)	1500	600	PS21961-4/ -T/-S (2)	PS21962-4/ -T/-S	PS21963-4E/ -ET/-ES	PS21963-4/ -T/-S	PS21964-4/ -T/-S	PS21965-4/ -T/-S		D2
					PS21993-4E/ -ET (3)	PS21993-4/ -T (3)	PS21994-4/ -T (3)		PS21997-4/ -T (3)	

(1): Available in Short- (-4)-, Long- (-A)-, Zigzag- (-C)-, Both sides zigzag- (-W) pin type (2): With RC-IGBT Technology (3): Lower loss full gate CSTBT

-T: Over Temp. protection / -S: N-side open Emitter / -E: 8A



2



## 2.10 600V DIIPM™ (Dual-in-line Package Intelligent Power Modules)

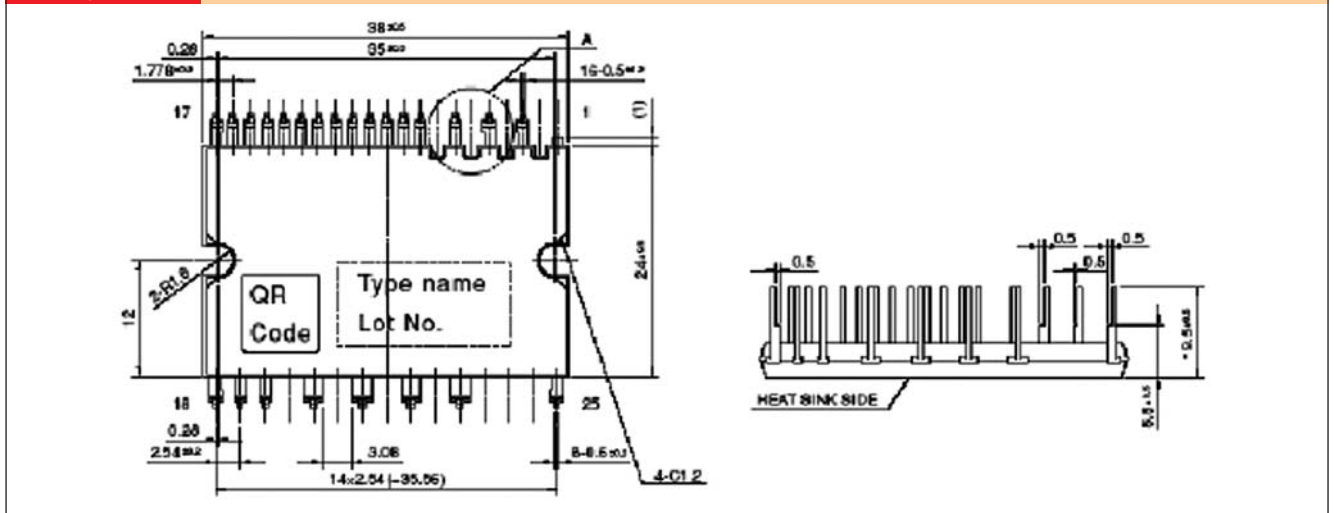
### Super Mini-DIIPM™ Ver. 4 Built-in Boot Strap Diode

#### Line-up Super Mini-DIIPM™ Built-in BSD

Type	Isolation Voltage ( $V_{rms}$ )	$V_{CES}$ (V)	Motor Rating (kW)				Package-No.
			0.2	0.3	0.4	0.75	
			$I_c$ (A)				
Super Mini-DIIPM Built-In-BSD	1500	600	5	8	10	15	D2
			PS219A2	PS219A3-E	PS219A3	PS219A4	
			PS219A2-T	PS219A3-ET	PS219A3-T	PS219A4-T	

-T or -ET: Over Temp. protection

#### Package D2



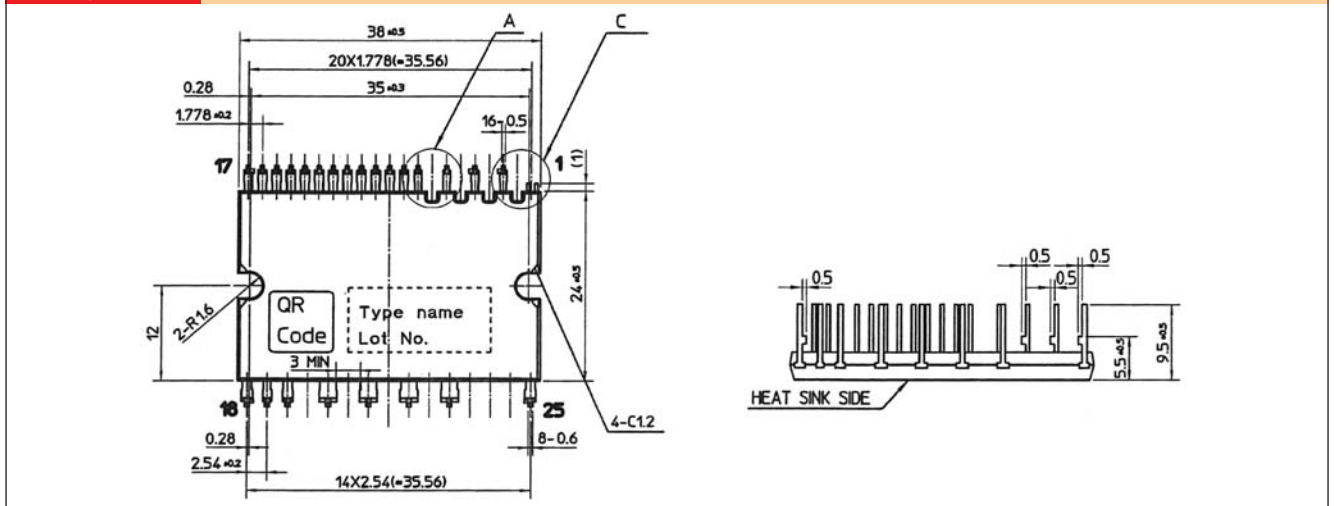
### Mini-DIIPM™ Ver. 4

#### Line-up Mini-DIIPM™

Type	Isolation Voltage ( $V_{rms}$ )	$V_{CES}$ (V)	Motor Rating (kW)		Package-No.
			1.5	2.5	
			$I_c$ (A)		
Mini-DIIPM	2500	600	20	30	D3
			PS21765	PS21767/-V	

-V: Faster SW off type

#### Package D3





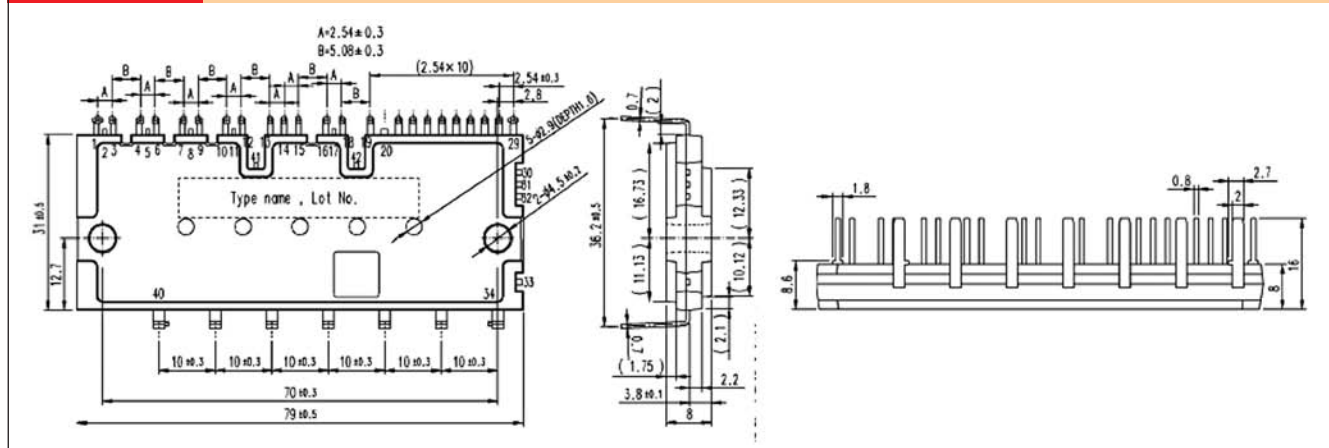
## 2.10 600V DIIPM™ (Dual-in-line Package Intelligent Power Modules)

### Large DIIPM™ Ver. 4

#### Line-up Large DIIPM™ Ver. 4

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

#### Package D1



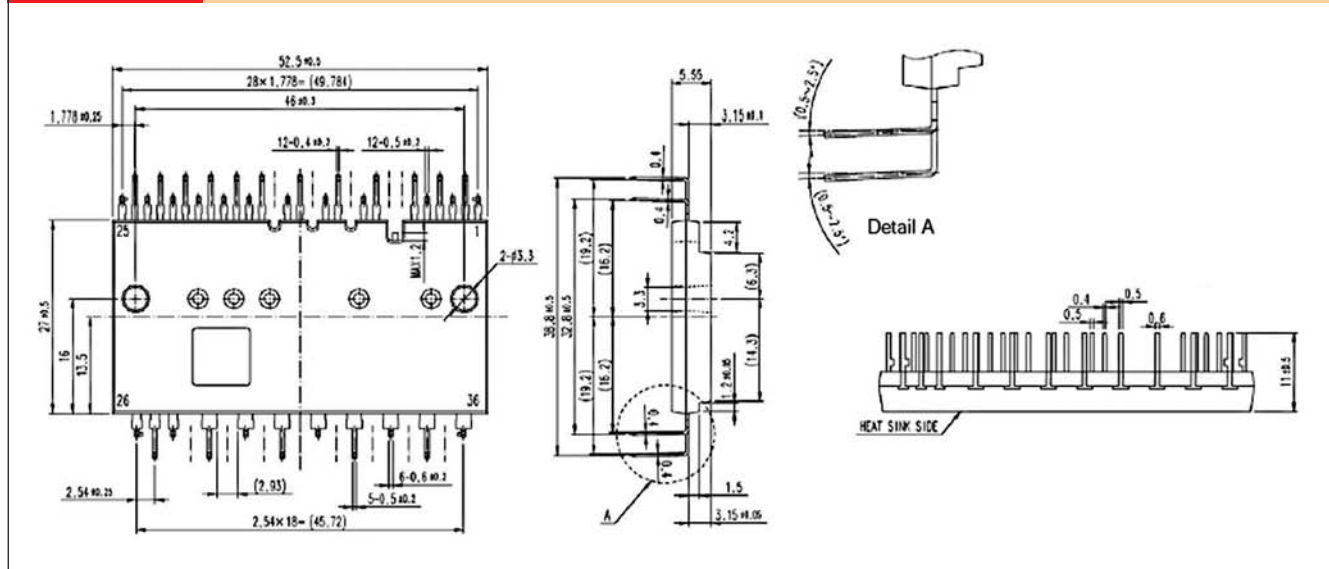
### DIPPSC™ Built-in partial SW circuit

#### Line-up DIPPSC™ Built-in partial SW circuit

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>GES</sub> (V)	Motor Rating (kW)				Package-No.
			0.3	0.4	0.75	1.5	
			I <sub>c</sub> (A)				
			8	10	15	20	
DIPPSC Built-In partial SW circuit	2500	600	PS81B93-AE, -EW	PS81B93-A, -W	PS81B94-A, -W	PS81B95-A, -W	D4

-A: Long Terminal / -W: Zigzag Terminal / -E: 8A

#### Package D4



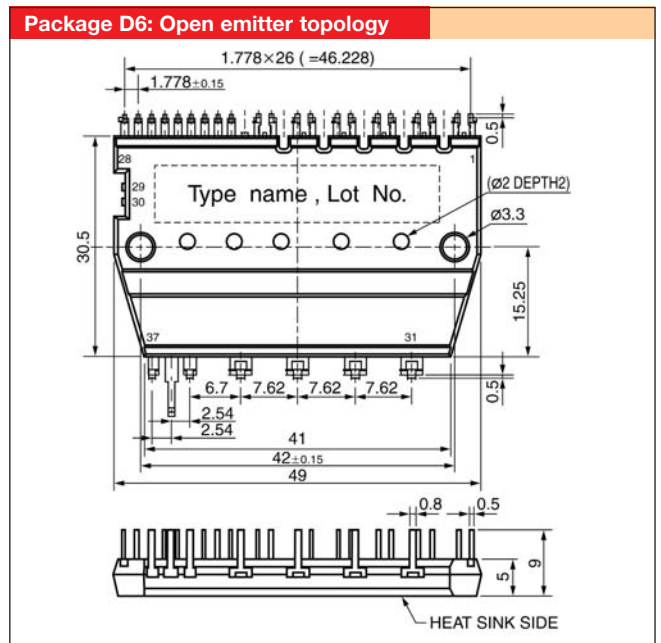
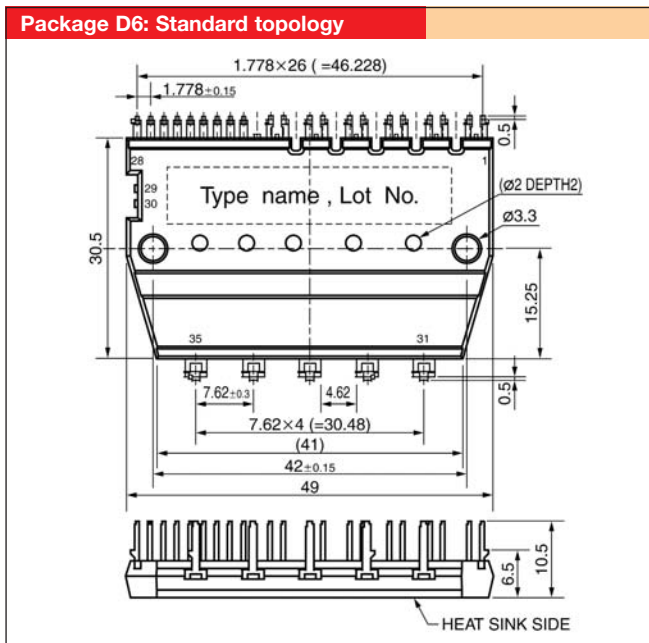
## 2.10 600V DIIPM™ (Dual-in-line Package Intelligent Power Modules)

### Mini-DIIPM™ Ver. 3

#### Line-up Mini-DIIPM™ Ver. 3

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>CES</sub> (V)	Motor Rating (kW)				Package-No.
			0.2	0.4	0.75	1.5	
			I <sub>c</sub> (A)				
Mini-DIIPM Ver. 3	2500	600	5	10	15	20	D6

-S: N-side open Emitter / -P: Pb-free

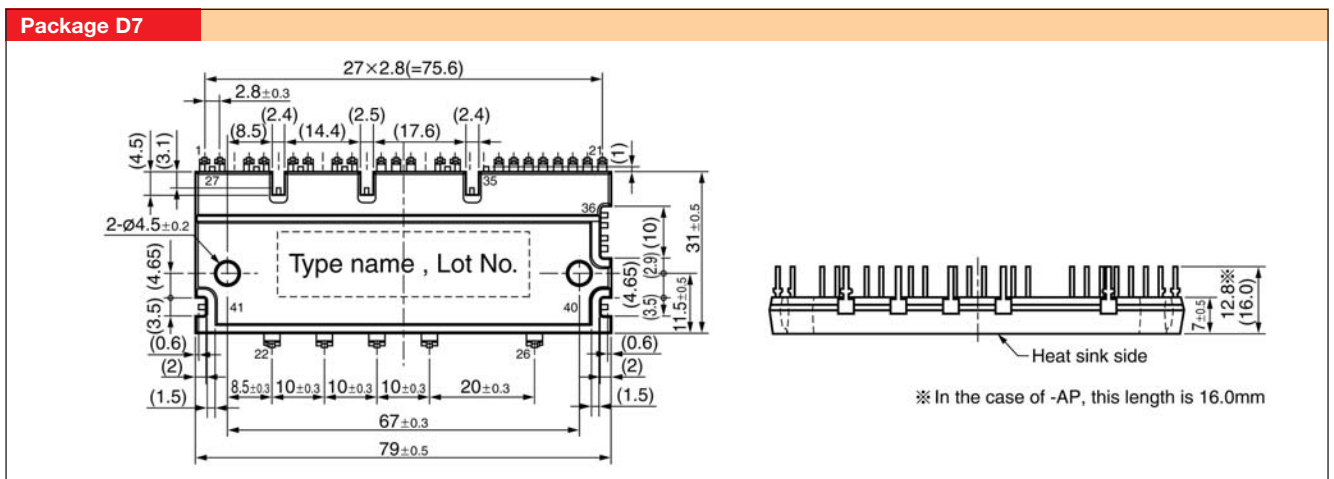


### Large DIIPM™ Ver. 3

#### Line-up Large DIIPM™ Ver. 3

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>CES</sub> (V)	Motor Rating (kW)		Package-No.
			3.7		
			I <sub>c</sub> (A)		
Large DIIPM Ver. 3	2500	600	50		D7

-A: Long terminal type / -P: Pb-free



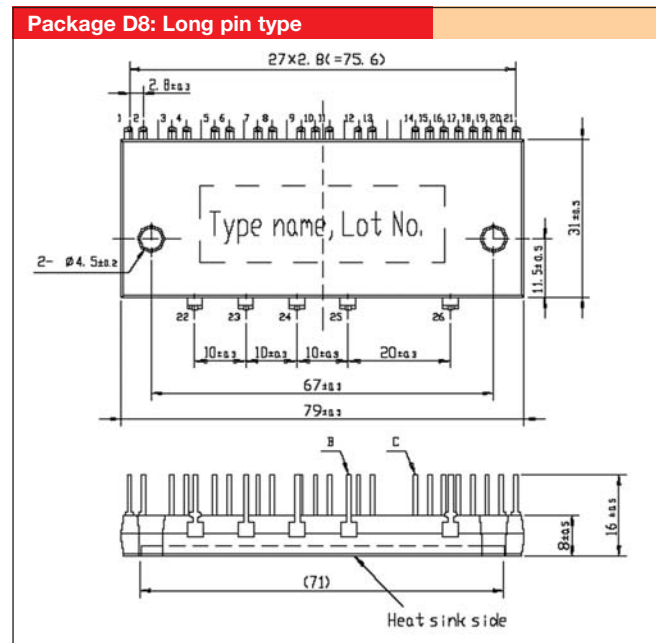
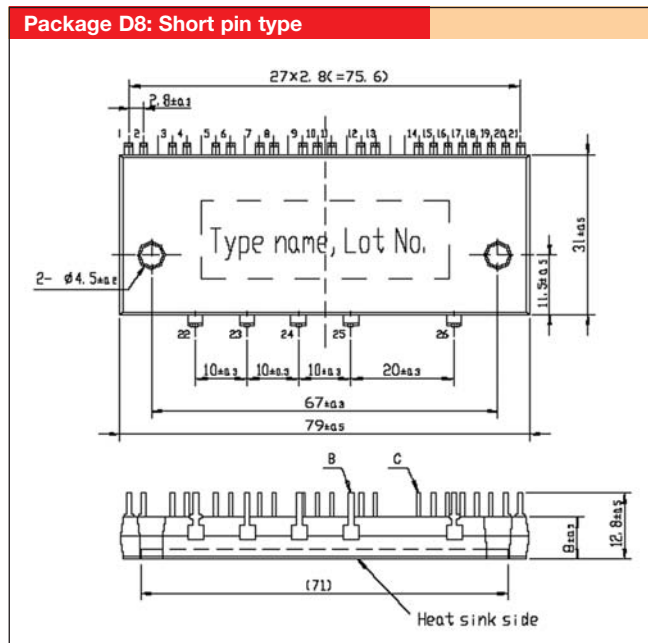
## 2.10 600V DIIPM™ (Dual-in-line Package Intelligent Power Modules)

### Large DIIPM™ Ver. 3.5

#### Line-up Large DIIPM™ Ver. 3.5

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>CEs</sub> (V)	Motor Rating (kW)		Package-No.
			1.5	2.5	
			I <sub>c</sub> (A)		
Large DIIPM Ver. 3.5	2500	600	20	30	D8
			PS21265-P/-AP	PS21267-P/-AP	

-A: Long terminal type / -P: Pb-free

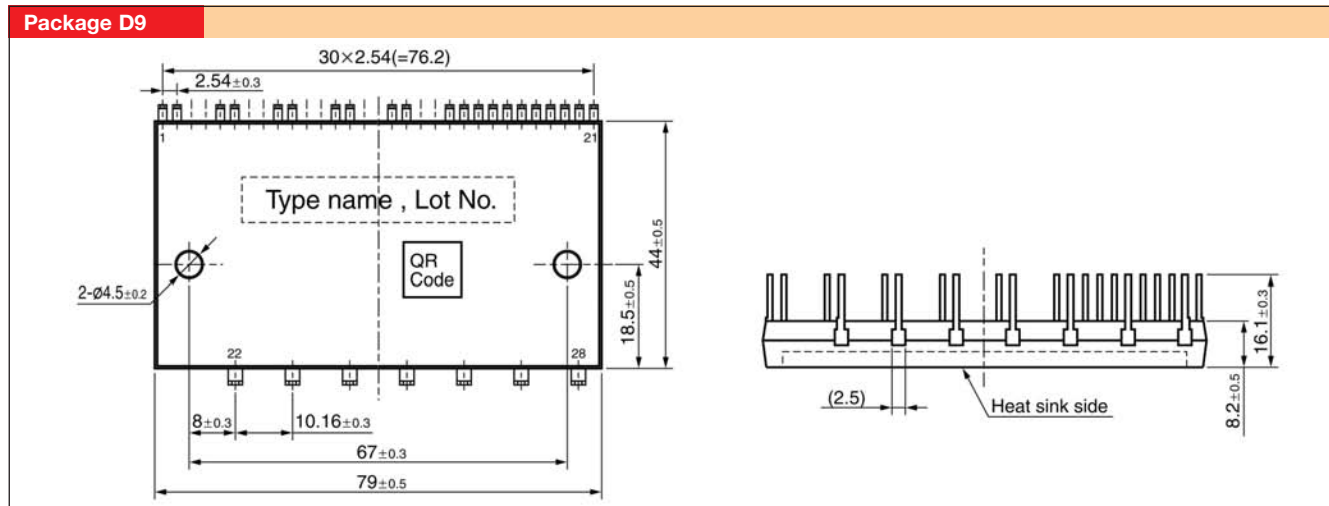


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### Large DIIPM™ Open Emitter

#### Line-up Large DIIPM™ Open Emitter

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>CEs</sub> (V)	Motor Rating (kW)			Package-No.
			1.5	2.5	3.7	
			I <sub>c</sub> (A)			
Large DIIPM Open Emitter	2500	600	20	30	50	D9
			PS21065	PS21067	PS21069	



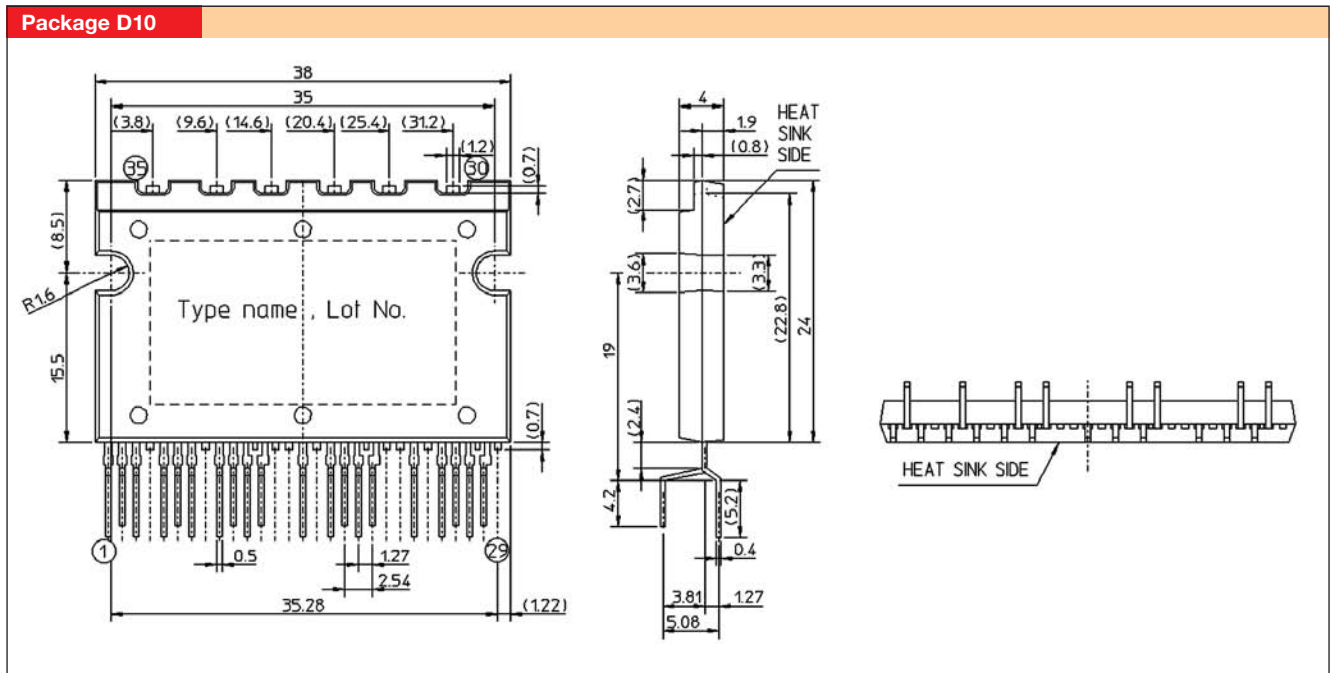
## 2.10 600V DIIPM™ (Dual-in-line Package Intelligent Power Modules)

### SIIPM™

#### Line-up SIIPM™

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>CES</sub> (V)	Motor Rating (kW)		Package-No.
			0.1	I <sub>c</sub> (A)	
				3	
SIIPM	2500	600	PS21661-RZ/-FR		D10

#### Package D10



Dimensions in mm

#### Notes

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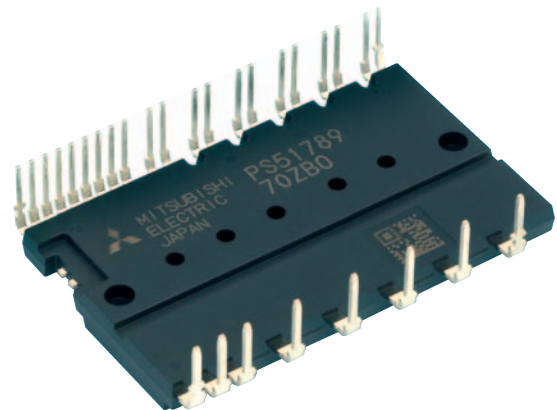
## 2.11

# DIPPFC™ (Dual-in-line Package Power Factor Correction)



### Features

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

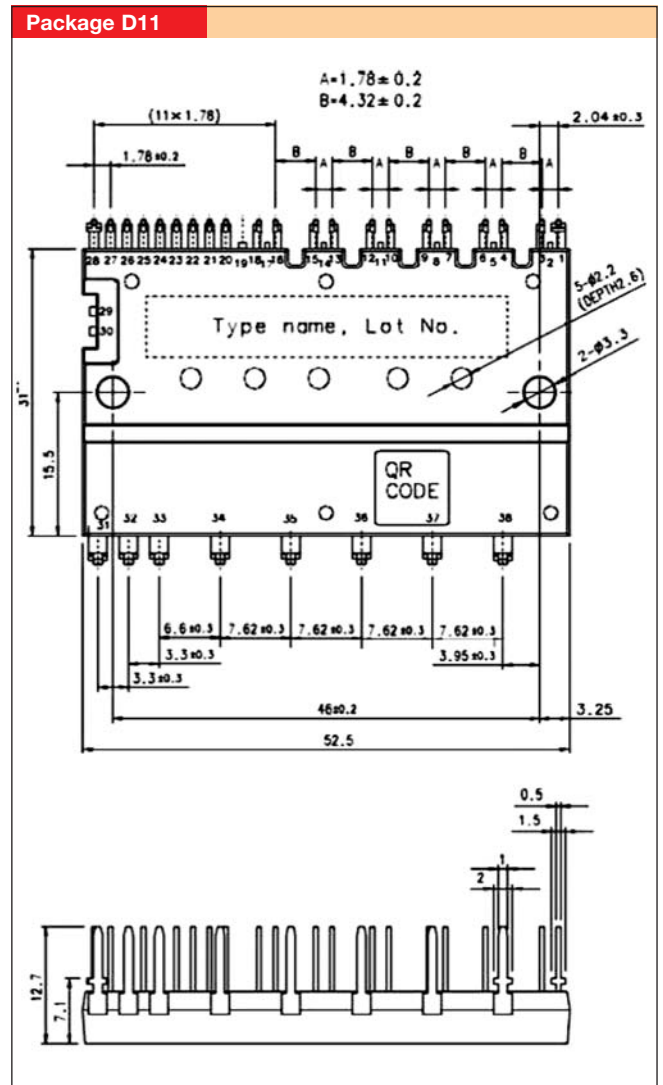
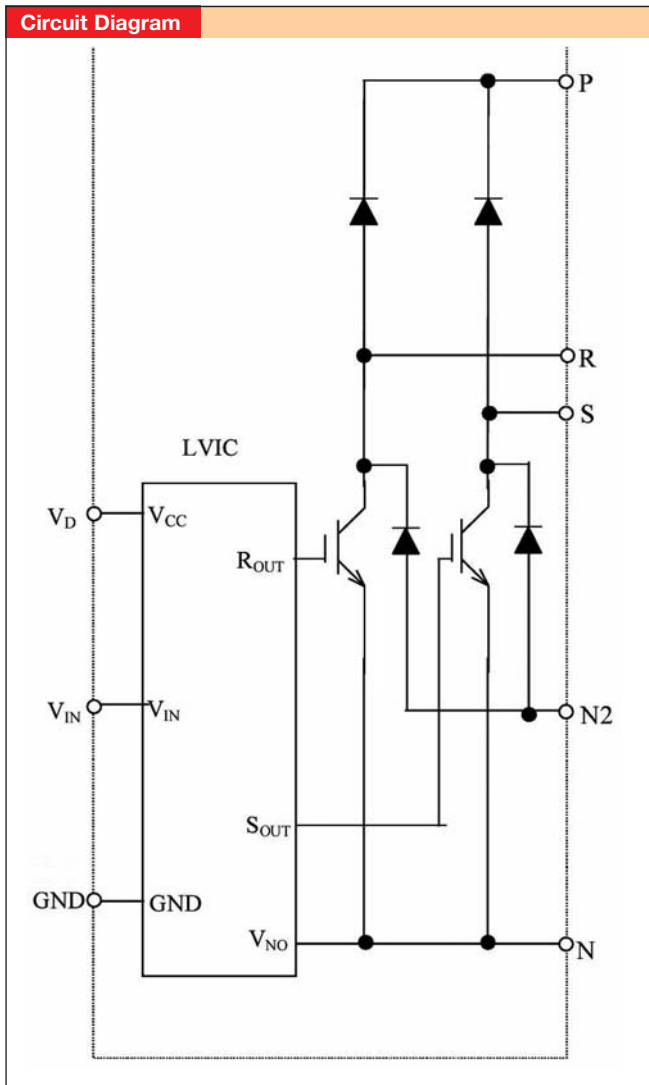


## 2.11 DIPPFCT™ (Dual-in-line Package Intelligent Power Modules)

### Line-up DIPPFCT™

Type	Isolation Voltage (V <sub>rms</sub> )	V <sub>CES</sub> (V)	I <sub>C</sub> (A)		Package- No.
			30	50	
DIPPFCT	2500	600	PS51787	PS51789	D11

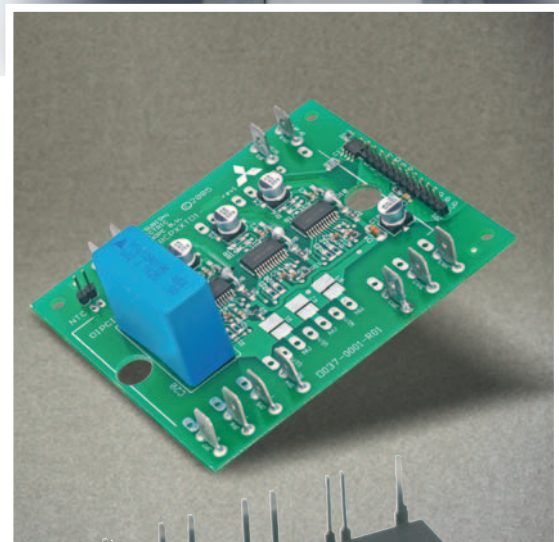
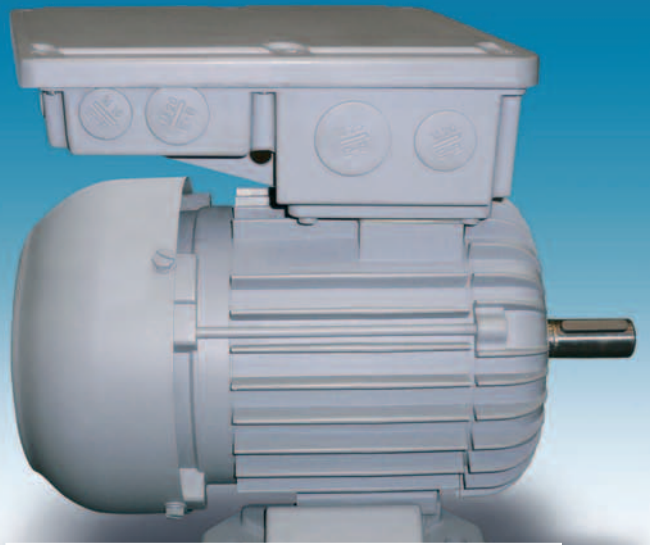
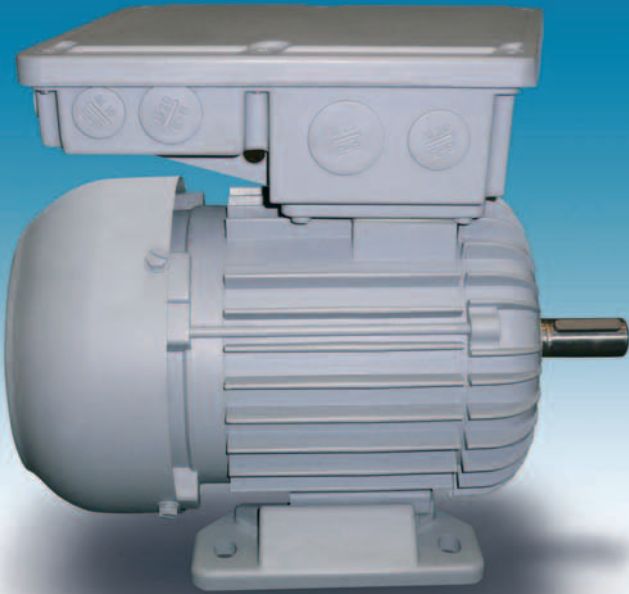
Type Number	Electrical Characteristics										Thermal & Mechanical Characteristics		
	Input AC Line Voltage (V <sub>rms</sub> )	I <sub>C</sub> (A)	f <sub>C</sub> (kHz)	Isolation Voltage (V <sub>rms</sub> )	V <sub>CE(sat)</sub> @ T <sub>J</sub> = 25°C (V)		Typical Switching Times					IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)
					Typ.	Max.	t <sub>on</sub> (μs)	t <sub>rr</sub> (μs)	t <sub>c(on)</sub> (μs)	t <sub>off</sub> (μs)	t <sub>c(off)</sub> (μs)		
PS51787	264	30	20	2500	1.9	2.5	0.25	0.11	0.14	0.40	0.18	0.96	1.35
PS51789	264	50	20	2500	2	2.6	0.25	0.11	0.14	0.4	0.18	0.68	0.9



Dimensions in mm

# 3.

## DIPCIB™ Modules (Dual-in-line Package Converter-Inverter-Brake)



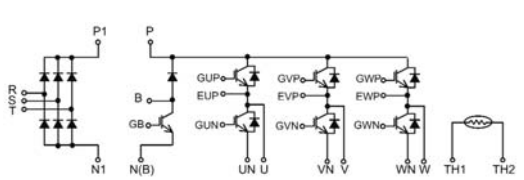
### Features

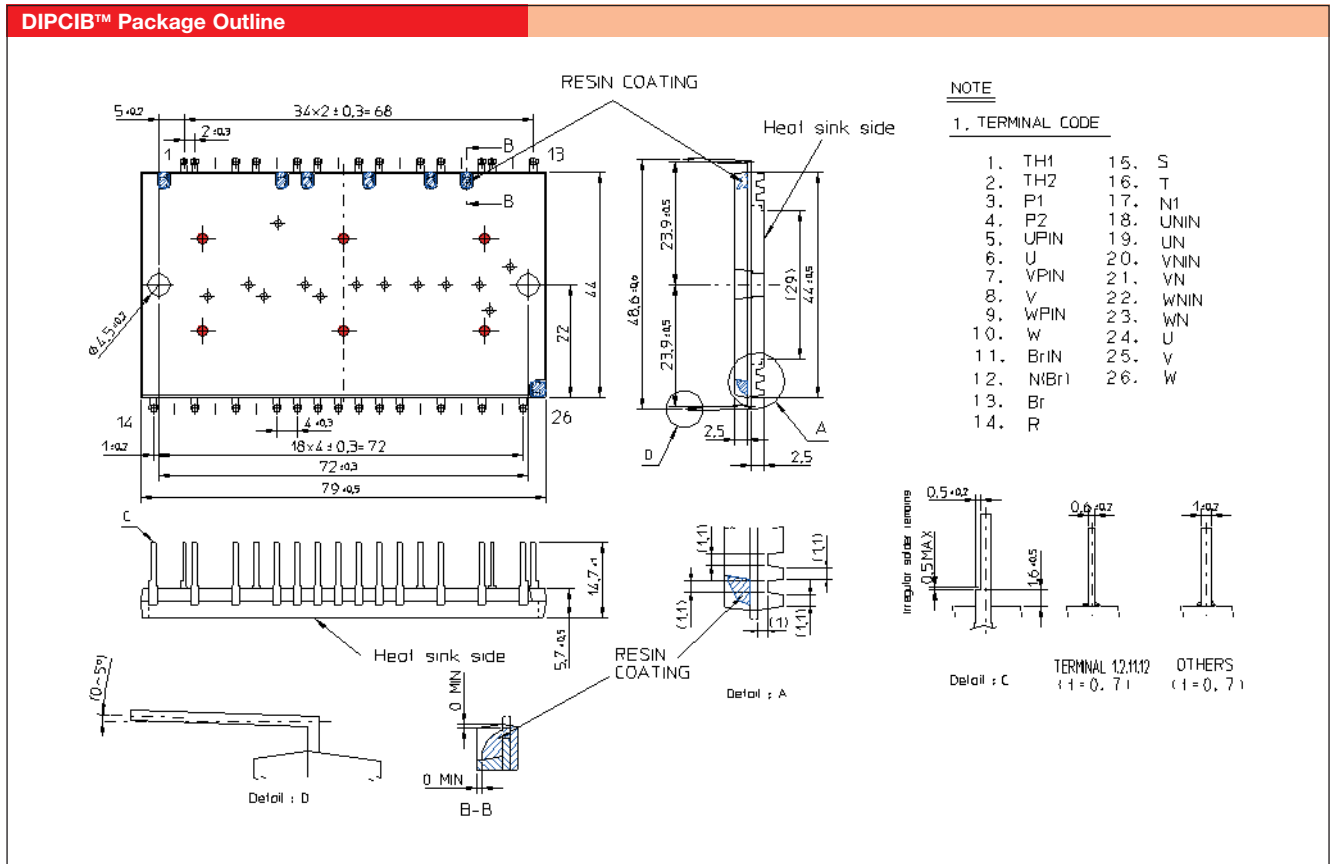
- Converter, inverter and brake IGBTs in one space efficient transfer mold housing well respecting UL creepage and clearance distances
- Latest CSTBT™ trench gate technology (1µm)
- "Open Emitter" topology
- Low thermal resistance
- Isolated temperature sensor (NTC)
- Line-up 10A, 15A and 25A / 1200V and 20A, 30A / 600V
- Suitable for up to 5.5kW class drive
- Dedicated control ICs available
- For easy performance evaluation of entire line up of DIPCIB™'s demo board (EVBCP25TD1-24) is available on request.



### 3. DIPICIB™ Modules (Dual-in-line Package Converter-Inverter-Brake)

#### Line-up DIPICIB™

Circuit Diagram	V <sub>CES</sub> (V)	I <sub>c</sub> (A)					
		5	10	15	20	25	30
	600				CP20TD1-12A <sup>1</sup>		CP30TD1-12A
	1200	CP05TD1-24A	CP10TD1-24A	CP15TD1-24A		CP25TD1-24A	





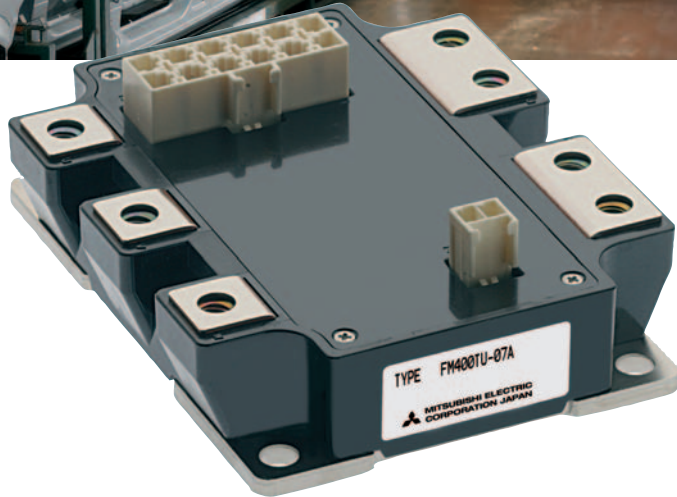
# 4.

## MOSFET Modules

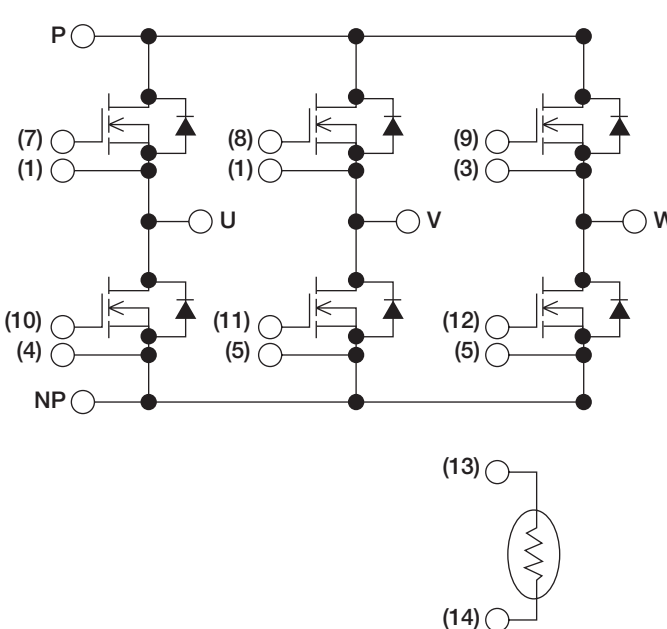


### Features

- Low  $V_{DS(ON)}$  and Low  $V_{SD}$
- Advanced 0.35 $\mu$ m trench gate MOSFET chip technology
- $R_{DS(ON)} = 0.8m\Omega$  (FM400TU-07A @ 25°C)
- Operation without snubber circuit possible
- Avalanche capability is guaranteed at turn-off & recovery
- Control terminals for standard connector
- Inbuilt Thermal sensor (NTC)
- High reliability
- 100A<sub>(rms)</sub>, 200A<sub>(rms)</sub>, 300A<sub>(rms)</sub> available in 75V, 100V and 150V in a 6 in 1 compact package

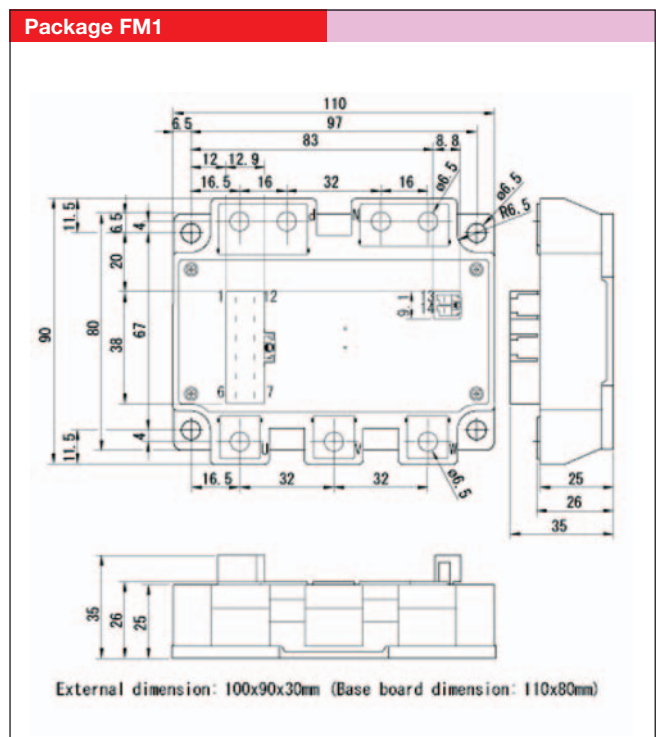
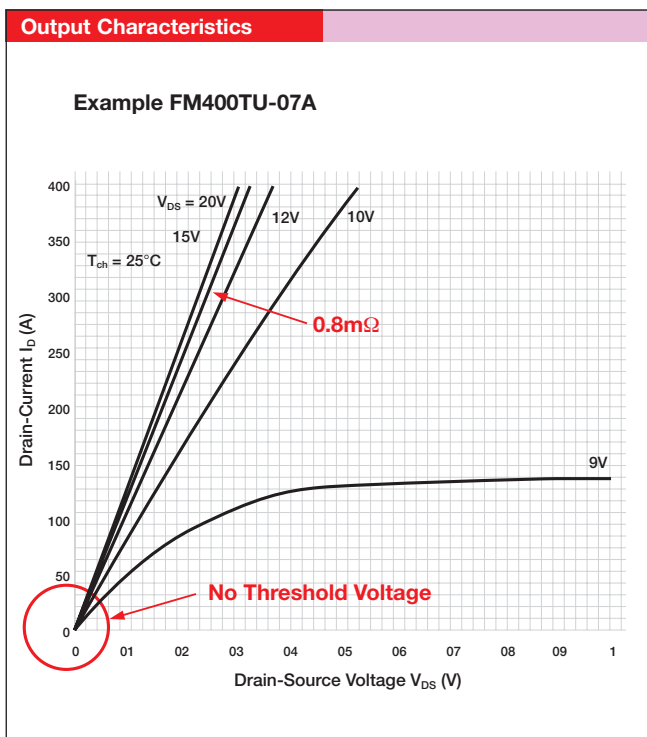
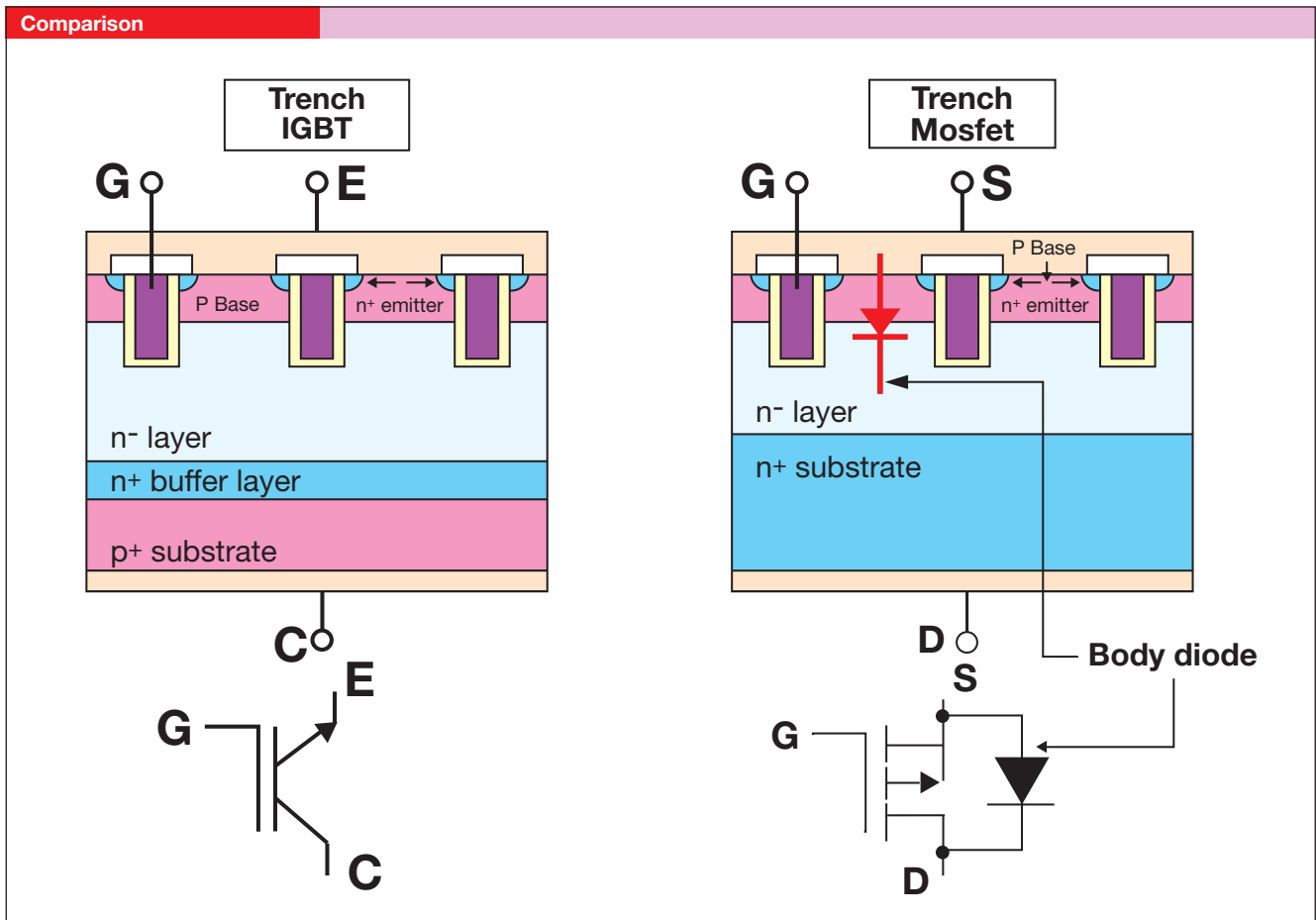


## 4. MOSFET Modules

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

Type Number	Maximum Ratings		Electrical Characteristics										Thermal & Mechanical Characteristics				Package-No.
	$V_{DS}$ (V)	$I_D$ (rms) (A(rms))	$r_{DS(on)}$ @ $T_j = 25^\circ\text{C}$ ( $m\Omega$ )		$C_{iss}$ (nF)	$C_{oss}$ (nF)	$C_{rss}$ (nF)	Maximum Switching Times					$Q_{rr}$ ( $\mu\text{C}$ )	$V_{SD}$ (V)	MOSFET $R_{th(j-c)}$ ( $^\circ\text{C/W}$ )	$R_{th(j-c)}$ ( $^\circ\text{C/W}$ )	
			Typ.	Max.				$t_{d(on)}$ (ns)	$t_r$ (ns)	$t_{d(off)}$ (ns)	$t_f$ (ns)	$t_{rr}$ (ns)					
FM200TU-07A	75	100	1.20	1.65	50	7	4	450	400	600	400	200	2.0	1.3	0.220	0.1	FM1
FM400TU-07A	75	200	0.80	1.10	75	10	6	450	500	450	400	200	4.5	1.3	0.142	0.1	FM1
FM600TU-07A	75	300	0.53	0.73	110	15	10	450	600	600	400	200	4.8	1.3	0.096	0.1	FM1
FM200TU-2A	100	100	2.40	3.30	50	7	4	400	300	450	300	250	3.6	1.3	0.220	0.1	FM1
FM400TU-2A	100	200	1.45	2.00	75	10	6	400	400	450	300	250	6.0	1.3	0.142	0.1	FM1
FM600TU-2A	100	300	0.80	1.10	110	15	10	400	600	600	300	250	6.2	1.3	0.096	0.1	FM1
FM200TU-3A	150	100	4.80	6.60	50	7	4	400	250	450	200	200	6.5	1.3	0.220	0.1	FM1
FM400TU-3A	150	200	2.60	3.55	75	10	6	400	300	450	200	200	7.0	1.3	0.142	0.1	FM1
FM600TU-3A	150	300	1.60	2.20	110	15	10	400	400	500	200	200	8.0	1.3	0.096	0.1	FM1

## 4. MOSFET Modules



Dimensions in mm





### Features

- Highest Reliability in Material and Processes:  
Improvement of power cycling capability
- Highest Quality Controls:
  - Static and switching tests
  - 100% shipping inspection
- HV-IGBT modules and complementary HV-Diodes are available in rated voltages of 1.7kV, 2.5kV, 3.3kV, 4.5kV, 6.5kV and rated currents ranging from 200A to 2400A
- 1.7kV HV-IGBT modules with Light Punch Through Carrier Stored Trench Gate Bipolar Transistor (LPT-CSTBT™) technology and a new free-wheel diode design for reduced IGBT losses and suppressed diode oscillation
- 4.5kV, 6.5kV class HV-IGBTs with LPT chip structure to provide low loss performance and wide RBSOA
- 3.3kV, 4.5kV & 6.5kV HV-IGBT modules and diodes with 10.2kV isolated package available
- New 3.3kV, 4.5kV, 6.5kV R-Series IGBT Modules
  - Low loss performance
  - Increased terminal torque capability to 22 Nm
  - 10.2kV high isolation package available on request
  - Extended maximum operating temperature and minimum storage temperature up to 150°C and -55°C respectively





## 5.01 High Voltage IGBT Modules (HV-IGBT)

### Line-up HV-IGBTs

V <sub>ces</sub> (V)	Generation & Base Plate Material	Configu- ration	I <sub>c</sub> (A)																
			200	400	600	750	800	900	1000	1200	1500	1600	1800	2400					
1700	G1 (Cu)	Single			CM800HA-34H							CM1200HA-34H							
		Dual		CM600DY-34H															
		Chopper		CM600EY-34H															
	G3 (AlSiC)	Single											CM1200HC-34H		CM1600HC-34H				CM2400HC-34H
		Dual			CM800DZ-34H CM800DZB-34N														
		Dual										CM1200DB-34N <sup>2</sup>							
	G4 (AlSiC)	Single											CM1200HCB-34N <sup>1,2,4</sup>						CM2400HC-34N <sup>2</sup> CM1800HCB-34N <sup>1,2,4</sup> CM2400HCB-34N <sup>1,2,4</sup>
		Dual										CM1200DC-34N <sup>2</sup>							
		Chopper										CM1200E4C-34N <sup>2</sup>							
	2500	G1 (Cu)	Single						CM800HA-50H										
Dual				CM400DY-50H															
G2 (Cu)		Single					CM800HB-50H						CM1200HB-50H						
		Single											CM1200HC-50H						
G3 (AlSiC)		Single							CM800HA-66H										
		Dual			CM400DY-66H														
3300	G2 (Cu)	Single						CM800HB-66H					CM1200HB-66H						
		Single					CM800HC-66H						CM1000HC-66R <sup>1,5</sup>					CM1500HC-66R <sup>1,5</sup> CM1500HG-66R <sup>1,5</sup>	
	G3 (AlSiC)	Single							CM800E2Z-66H CM800E2C-66H CM800E4C-66H <sup>1</sup> CM800E6C-66H					CM1000E4C-66R <sup>1,5</sup>					
		Chopper																	
	G2 (Cu)	Single			CM400HB-90H														
		Single																	
4500	G3 (AlSiC)	Single																	
		Single			CM600HG-90H <sup>3</sup>														
6500	G3 (AlSiC)	Single																	
		Single			CM200HG-130H <sup>1,5</sup>														
	Chopper			CM400E4G-130H <sup>2</sup>															

Preliminary Data

<sup>1</sup> Under Development <sup>2</sup> CSTBT™ Chip Technology

<sup>3</sup> High Isolation Package (10.2kV<sub>rms</sub>)

<sup>4</sup> 190 x 140 mm Package

<sup>5</sup> New 3.3kV R-Series

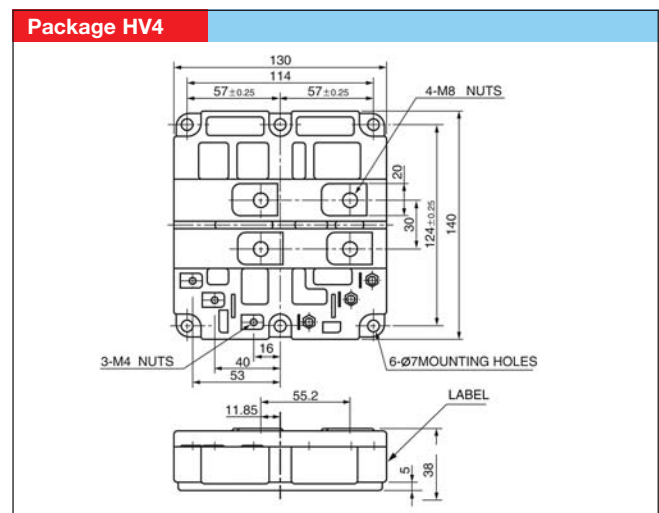
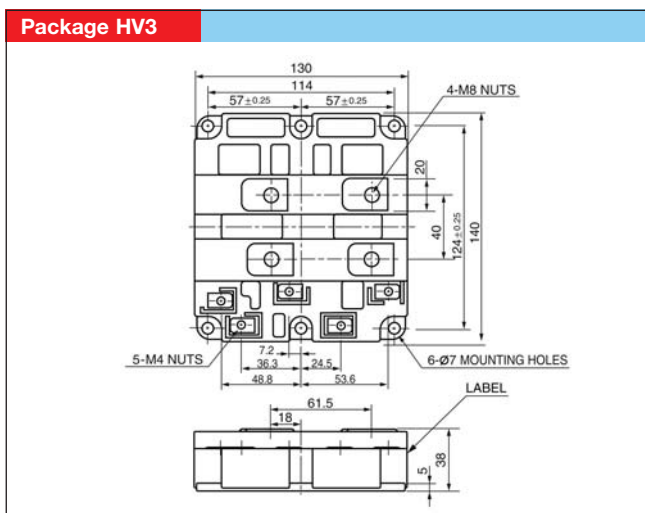
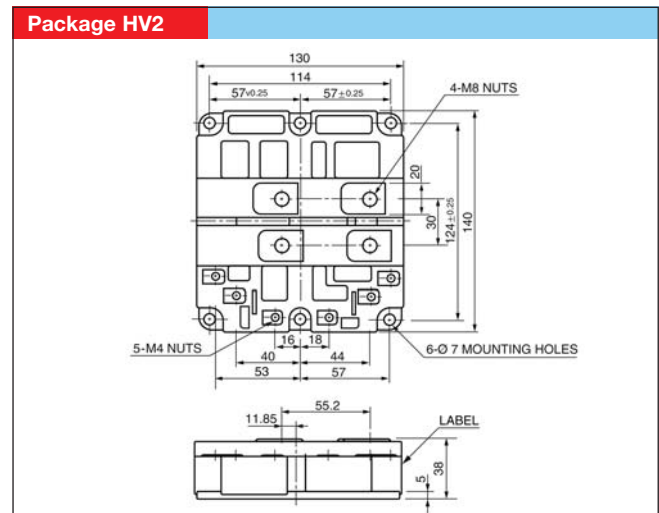
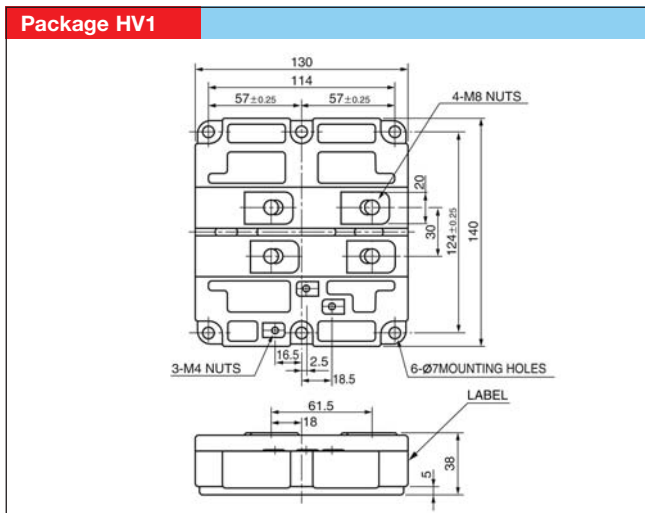
## 5.01 High Voltage IGBT Modules (HV-IGBT)

Type Number	Maximum Ratings			Electrical Characteristics									Free Wheel Diode			Thermal & Mechanical Characteristics			Package- No.
	V <sub>CES</sub> (V)	I <sub>C</sub> (A)	V <sub>ISO</sub> (V)	V <sub>CE(sat)</sub> @ T <sub>J</sub> = 25°C (V)		C <sub>ies</sub> (nF)	C <sub>oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>f</sub> (V) Typ.	Q <sub>rr</sub> (μC) Typ.	t <sub>rr</sub> (ns) Max.	IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)	R <sub>th(c-f)</sub> (°C/W)	
				Typ.	Max.				t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)							
<b>1700 Volt HV-IGBT Modules</b>																			
CM600DY-34H	1700	600	4000	2.75	3.58	70	10.0	3.8	1.2	1.5	2.0	0.6	2.4	100	2.0	0.0180	0.056	0.016	HV2
CM600E2Y-34H	1700	600	4000	2.75	3.58	70	10.0	3.8	1.2	1.5	2.0	0.6	2.4	100	2.0	0.0180	0.056	0.016	HV4
CM800HA-34H	1700	800	4000	2.75	3.58	93	13.3	5.1	1.2	1.5	2.0	0.6	2.4	135	2.0	0.0135	0.042	0.012	HV1
CM800DZ-34H	1700	800	4000	2.60	3.38	72	9.0	3.6	1.60	2.00	2.7	0.8	2.6	150	2.7	0.0200	0.034	0.016	HV2
<b>CM800DZB-34N</b>	<b>1700</b>	<b>800</b>	<b>4000</b>	<b>2.10</b>	<b>2.35</b>	<b>132</b>	<b>7.2</b>	<b>2.1</b>	<b>0.90</b>	<b>0.25</b>	<b>1.5</b>	<b>0.2</b>	<b>2.5</b>	<b>260</b>	<b>1.2</b>	<b>0.0240</b>	<b>0.034</b>	<b>0.016</b>	<b>HV2</b>
CM1200HA-34H	1700	1200	4000	2.75	3.58	140	20.0	7.6	1.20	1.50	2.0	0.6	2.4	200	2.0	0.0090	0.028	0.008	HV1
CM1200HC-34H	1700	1200	4000	2.50		120	15.0	6.0	1.60	2.00	2.7	0.8	2.55	250	2.7	0.0120	0.021	0.008	HV1
CM1200DB-34N	1700	1200	4000	2.15		176	9.6	2.8	1.00	0.40	1.2	0.3	2.6	300	1.0	0.0180	0.04	0.016	HV10
CM1200DC-34N	1700	1200	4000	2.15		176	9.6	2.8	1.00	0.40	1.2	0.3	2.6	300	1.0	0.0190	0.042	0.016	HV10
CM1200E4C-34N	1700	1200	4000	2.15		176	9.6	2.8	1.00	0.40	1.2	0.3	2.6	300	1.0	0.0190	0.042	0.016	HV5
CM1200HCB-34N	1700	1200	4000	2.05		220	12.0	3.5	0.95	0.30	1.6	0.25	2.4	900	1.2	0.0145	0.0205	0.011	HV5
CM1600HC-34H	1700	1600	4000	2.60		144	18.0	7.2	1.60	2.00	2.7	0.8	2.6	300	2.7	0.0100	0.017	0.008	HV1
CM1800HC-34H	1700	1800	4000	2.40		168	21.0	8.4	1.60	2.00	2.7	0.8	2.5	700	2.7	0.0080	0.013	0.006	HV6
CM1800HC-34N	1700	1800	4000	2.15		264	14.4	4.2	1.00	0.35	2.0	0.25	2.4	540	1.0	0.0130	0.028	0.011	HV5
<b>CM1800HCB-34N</b>	<b>1700</b>	<b>1800</b>	<b>4000</b>	<b>2.00</b>		<b>352</b>	<b>19.2</b>	<b>5.6</b>	<b>0.95</b>	<b>0.30</b>	<b>1.6</b>	<b>0.25</b>	<b>2.35</b>	<b>900</b>	<b>1.2</b>	<b>0.0090</b>	<b>0.013</b>	<b>0.007</b>	<b>HV6</b>
CM2400HC-34H	1700	2400	4000	2.60		210	27.0	10.8	1.60	2.00	2.7	0.8	2.6	900	2.7	0.0070	0.012	0.006	HV6
CM2400HC-34N	1700	2400	4000	2.15		352	19.2	5.6	1.00	0.35	2.0	0.25	2.4	720	1.0	0.0098	0.021	0.008	HV5
<b>CM2400HCB-34N</b>	<b>1700</b>	<b>2400</b>	<b>4000</b>	<b>2.10</b>		<b>396</b>	<b>21.6</b>	<b>6.3</b>	<b>0.95</b>	<b>0.30</b>	<b>1.6</b>	<b>0.25</b>	<b>2.5</b>	<b>900</b>	<b>1.2</b>	<b>0.0080</b>	<b>0.012</b>	<b>0.006</b>	<b>HV6</b>
<b>2500 Volt HV-IGBT Modules</b>																			
CM400DY-50H	2500	400	6000	3.2	4.16	40	4.4	1.3	1.0	2.0	2.0	1.0	2.9	85	1.2	0.036	0.072	0.016	HV3
CM800HA-50H	2500	800	6000	3.2	4.16	80	8.8	2.7	1.6	2.0	2.5	1.0	2.9	170	1.2	0.018	0.036	0.008	HV5
CM800HB-50H	2500	800	6000	2.8	3.64	120	13.2	4.0	1.6	2.0	2.5	1.0	2.5	230	1.2	0.012	0.024	0.008	HV7
CM1200HA-50H	2500	1200	6000	3.2	4.16	120	13.2	4.0	1.6	2.0	2.5	1.0	2.9	250	1.2	0.012	0.024	0.006	HV6
CM1200HB-50H	2500	1200	6000	2.8	3.64	180	19.8	6.0	1.6	2.0	2.5	1.0	2.5	350	1.2	0.008	0.016	0.006	HV6
CM1200HC-50H	2500	1200	6000	2.8	3.64	180	19.8	6.0	1.6	2.0	2.5	1.0	2.5	350	1.2	0.0085	0.017	0.006	HV6
<b>3300 Volt HV-IGBT Modules</b>																			
CM400DY-66H	3300	400	6000	4.4	5.72	40	4	1.2	1.0	2.0	2.0	1.0	3.3	100	1.2	0.036	0.072	0.016	HV3
CM400HG-66H	3300	400	10200	3.3	4.20	60	6	5.4	1.6	1.0	2.5	1.0	2.8	270	1.4	0.030	0.060	0.018	HV9
CM800E2Z-66H	3300	800	6000	3.8	4.94	120	12	3.6	1.6	2.0	2.5	1.0	2.8	270	1.4	0.013	0.025	0.008	HV6
CM800E2C-66H	3300	800	6000	3.8	4.94	120	12	3.6	1.6	2.0	2.5	1.0	2.8	270	1.4	0.012	0.024	0.008	HV6
<b>CM800E4C-66H</b>	<b>3300</b>	<b>800</b>	<b>6000</b>	<b>3.8</b>	<b>4.94</b>	<b>120</b>	<b>12</b>	<b>3.6</b>	<b>1.6</b>	<b>2.0</b>	<b>2.5</b>	<b>1.0</b>	<b>2.8</b>	<b>270</b>	<b>1.4</b>	<b>0.013</b>	<b>0.025</b>	<b>0.006</b>	<b>HV6</b>
CM800E6C-66H	3300	800	6000	3.3	4.20	120	12	3.6	1.6	1.0	2.5	1.0	2.8	540	1.4	0.013	0.025	0.008	HV6
CM800HA-66H	3300	800	6000	4.4	5.72	80	8	2.4	1.6	2.0	2.5	1.0	3.3	200	1.2	0.018	0.036	0.008	HV5
CM800HB-66H	3300	800	6000	3.8	4.94	120	12	3.6	1.6	2.0	2.5	1.0	2.8	270	1.4	0.012	0.024	0.008	HV7
CM800HC-66H	3300	800	6000	3.3		120	12	3.6	1.6	1.0	2.5	1.0	2.8	270	1.4	0.013	0.025	0.008	HV7
CM1200HA-66H	3300	1200	6000	4.4	5.72	120	12	3.6	1.6	2.0	2.5	1.0	3.3	300	1.2	0.012	0.024	0.006	HV6
CM1200HB-66H	3300	1200	6000	3.8	4.94	180	18	5.4	1.6	2.0	2.5	1.0	2.8	400	1.4	0.008	0.016	0.006	HV6
CM1200HC-66H	3300	1200	6000	3.3	4.29	180	18	5.4	1.6	2.0	2.5	1.0	2.8	400	1.4	0.0085	0.017	0.006	HV6
CM1200HG-66H	3300	1200	10200	3.3	4.29	180	18	5.4	1.6	2.0	2.5	1.0	2.8	400	1.4	0.010	0.020	0.006	HV8
<b>CM1000HC-66R</b>	<b>3300</b>	<b>1000</b>	<b>6000</b>	<b>under development</b>															
<b>CM1000E4C-66R</b>	<b>3300</b>	<b>1000</b>	<b>6000</b>	<b>under development</b>															
<b>CM1500HC-66R</b>	<b>3300</b>	<b>1500</b>	<b>10200</b>	<b>under development</b>															
<b>CM1500HG-66R</b>	<b>3300</b>	<b>1500</b>	<b>10200</b>	<b>under development</b>															

Preliminary Data

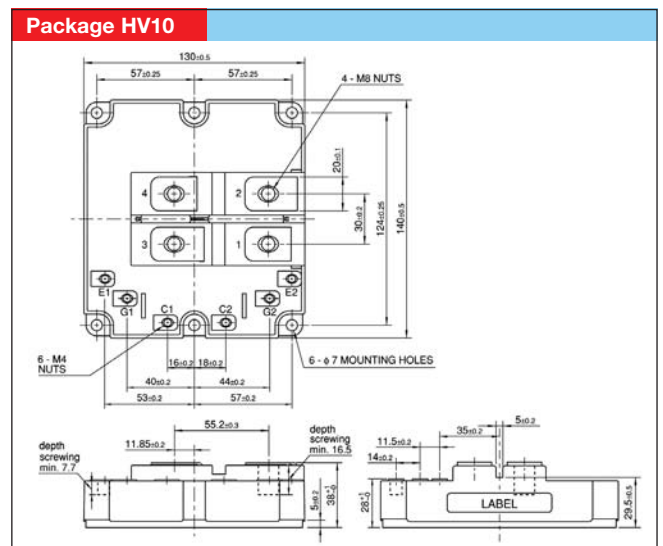
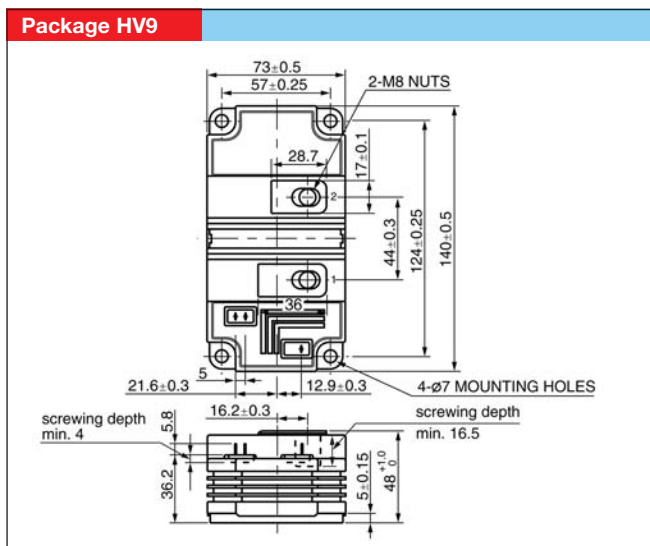
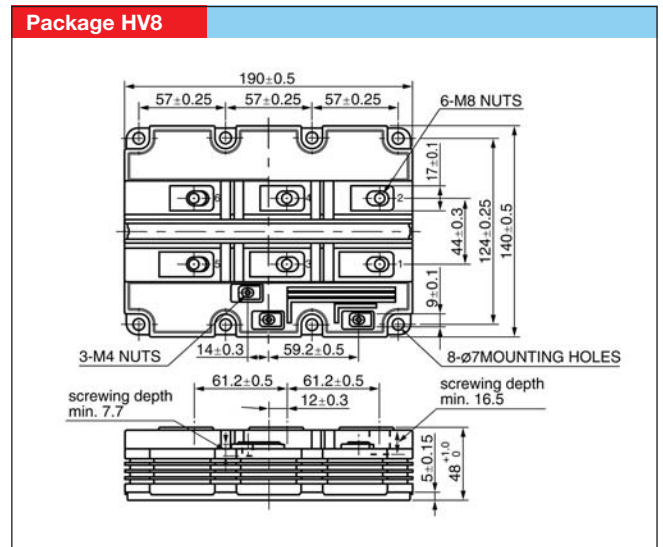
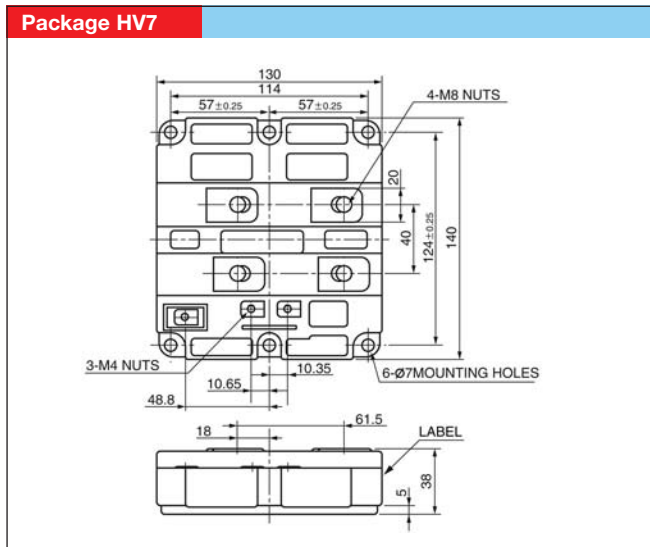
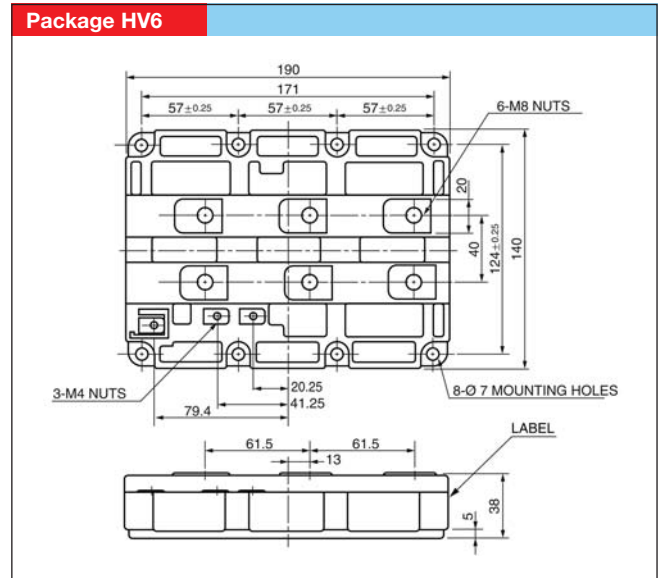
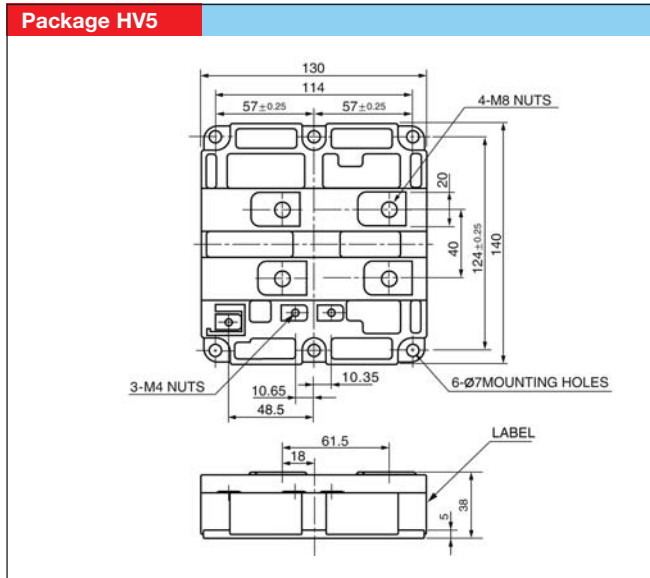
## 5.01 High Voltage IGBT Modules (HV-IGBT)

Type Number	Maximum Ratings			Electrical Characteristics									Free Wheel Diode			Thermal & Mechanical Characteristics			Package-No.
	V <sub>CE(S)</sub> (V)	I <sub>c</sub> (A)	V <sub>iso</sub> (V)	V <sub>CE(sat)</sub> @ T <sub>j</sub> = 25°C (V)		C <sub>ies</sub> (nF)	C <sub>Oes</sub> (nF)	C <sub>res</sub> (nF)	Maximum Switching Times				V <sub>f</sub> (V) Typ.	Q <sub>rr</sub> (μC) Typ.	t <sub>rr</sub> (ns) Max.	IGBT R <sub>th(j-c)</sub> (°C/W)	Diode R <sub>th(j-c)</sub> (°C/W)	R <sub>th(c-f)</sub> (°C/W)	
				Typ.	Max.				t <sub>d(on)</sub> (ns)	t <sub>r</sub> (ns)	t <sub>d(off)</sub> (ns)	t <sub>f</sub> (ns)							
<b>4500 Volt HV-IGBT Modules</b>																			
CM400HB-90H	4500	400	6000	3.0	3.9	72	5.3	1.6	2.4	2.4	6.0	1.2	4.0	160	1.8	0.021	0.042	0.015	HV7
CM600HB-90H	4500	600	6000	3.0	3.9	108	8.0	2.4	2.4	2.4	6.0	1.2	4.0	240	1.8	0.0135	0.027	0.010	HV7
CM600HG-90H	4500	600	10200	under development															
CM900HB-90H	4500	900	6000	3.0	3.9	162	12.0	3.6	2.4	2.4	6.0	1.2	4.0	360	1.8	0.009	0.018	0.007	HV6
CM900HC-90H	4500	900	6000	3.4	4.2	162	12.0	3.6	2.4	1.2	6.0	1.2	4.0	750	1.8	0.011	0.022	0.007	
CM900HG-90H	4500	900	10200	under development															
CM1200HC-90R	4500	1200	6000	under development															
CM1200HG-90R	4500	1200	10200	under development															
<b>6500 Volt HV-IGBT Modules</b>																			
CM200HG-130H	6500	200	10200	5.1		41	2.5	0.7	1.2	0.35	6.6	0.5	4.0	370	1.0	0.042	0.066	0.018	HV9
CM400E4G-130H	6500	400	10200	5.1		82	5.0	1.4	1.2	0.35	4.5	0.5	4.0	600	1.0	0.021	0.036	0.012	HV8
CM400HG-130H	6500	400	10200	under development															
CM600HG-130H	6500	600	10200	5.1		124	7.6	2.2	1.2	0.35	6.6	0.5	4.0	1100	1.0	0.014	0.022	0.006	HV8
CM750HG-130R	6500	750	10200	under development															



Dimensions in mm

## 5.01 High Voltage IGBT Modules (HV-IGBT)





## 5.02

# High Voltage Diode Modules



### Features

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



## 5.02 High Voltage Diode Modules

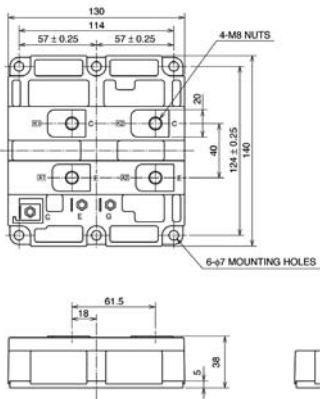
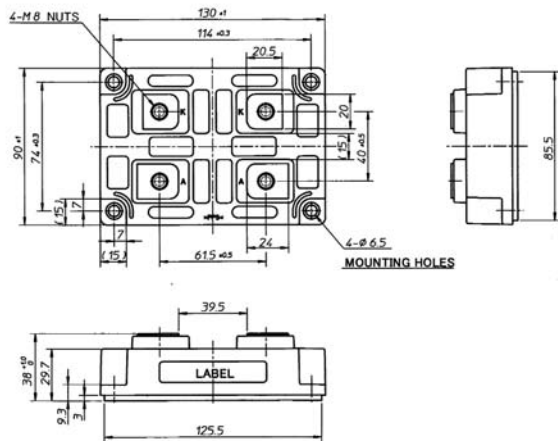
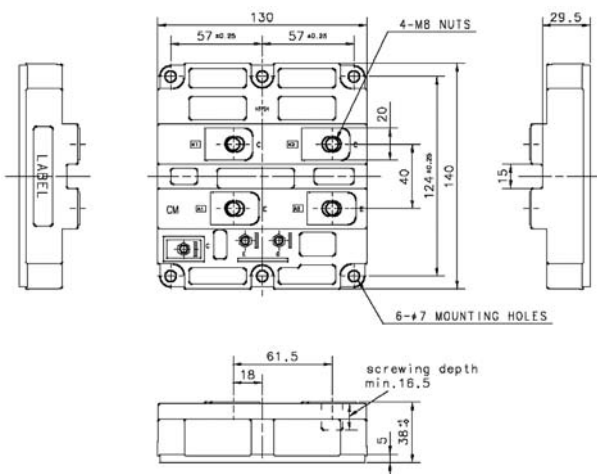
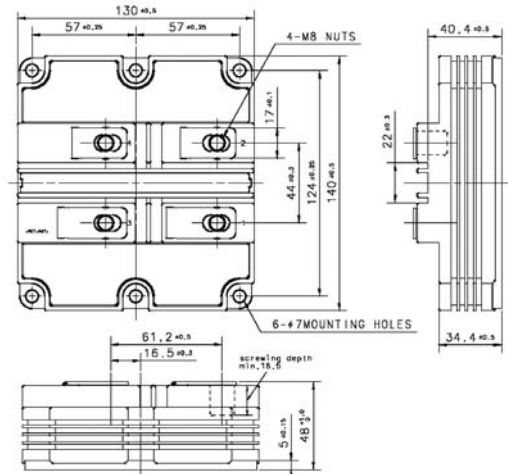
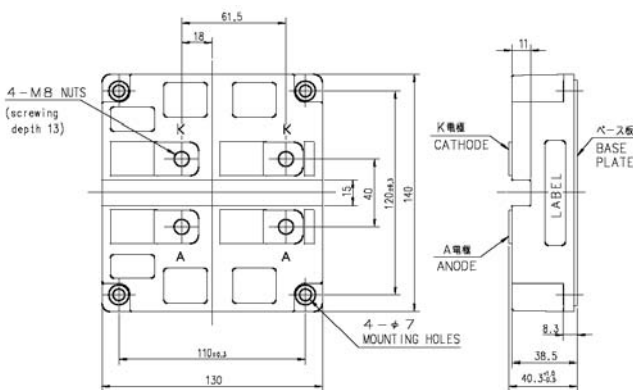
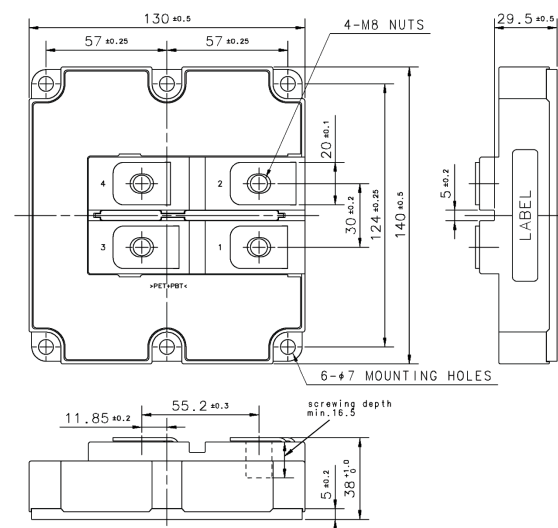
### Line-up HV-Diode Modules

V <sub>CES</sub> (V)	Generation & Base Plate Material	Con- figu- ration	I <sub>c</sub> (A)									
			200	300	400	600	900	1000	1200	1600	1800	
1700	G3 (AlSiC)	Single										RM1800HE-34S
	G3 (Cu)	Dual								RM1200DB-34S		
2500	G1 (Cu)	Single								RM1200HA-50S		
3300	G1 (Cu)	Single								RM1200HA-66S		
		Dual			RM400DY-66S	RM600DY-66S						
	G2 (Cu)	Dual								RM1200DB-66S		
	G3 (AlSiC)	Single									RM1200HE-66S	
Dual								RM1000DC-66F <sup>1</sup>	RM1200DG-66S <sup>2</sup>	RM1500DC-66F <sup>1</sup>		
4500	G2 (Cu)	Dual						RM900DB-90S				
	G3 (AlSiC)	Single					RM600HE-90S					
		Dual		RM300DG-90S								
6500	G3 (AlSiC)	Dual	RM200DG-130S <sup>2</sup>		RM400DG-130S <sup>1,2</sup>	RM600DG-130S <sup>2</sup>						

<sup>1</sup> Under Development    <sup>2</sup> High Isolation Package (10.2kV<sub>rms</sub>)

Type Number	Maximum Ratings				Electrical Characteristics			Thermal & Mechanical Characteristics		Package- No.
	V <sub>RRM</sub> (V)	I <sub>DC</sub> (A)	V <sub>iso</sub> (V)	I <sub>FSM</sub> (A)	V <sub>FM</sub> (V) T <sub>j</sub> = 25°C	Q <sub>rr</sub> (μC) Typ.	t <sub>rr</sub> (μs) Max.	R <sub>th(j-c)</sub> (°C/W)	R <sub>th(c-f)</sub> (°C/W)	
<b>1700 Volt HV-Diode Modules</b>										
RM1200DB-34S	1700	1200	4000	20800	1.9	520	1.0	0.020	0.024	RM6
RM1800HE-34S	1700	1800	6000	9600	2.9	600	1.8	0.022	0.017	RM2
<b>2500 Volt HV-Diode Modules</b>										
RM1200HA-50S	2500	1200	6000	9600	2.9	500	1.2	0.026	0.017	RM5
<b>3300 Volt HV-Diode Modules</b>										
RM400DY-66S	3300	400	6000	3200	3.5	100	1.2	0.072	0.036	RM1
RM600DY-66S	3300	600	6000	4800	3.5	150	1.2	0.048	0.024	RM1
RM1000DC-66F	under development									
RM1200HA-66S	3300	1200	6000	9600	3.3	600	1.2	0.026	0.017	RM5
RM1200DB-66S	3300	1200	6000	9600	2.85	850	0.75	0.018	0.016	RM3
RM1200DG-66S	3300	1200	10200	9600	2.8	780	0.8	0.018	0.016	RM4
RM1200HE-66S	3300	1200	6000	9600	3.2	900	1.4	0.020	0.015	RM2
RM1500DC-66F	under development									
<b>4500 Volt HV-Diode Modules</b>										
RM300DG-90S	4500	300	8400	2550	3.5	250	0.5	0.052	0.048	RM4
RM600HE-90S	4500	600	6000	4800	4.8	600	1.8	0.039	0.015	RM2
RM900DB-90S	4500	900	6000	6400	4.0	650	1.8	0.020	0.016	RM3
<b>6500 Volt HV-Diode Modules</b>										
RM200DG-130S	6500	200	10200	9600	4.0	360	1.0	0.066	0.048	RM4
RM400DG-130S	under development									
RM600DG-130S	6500	600	10200	4800	4	900	1.0	0.022	0.016	RM4

## 5.02 High Voltage Diode Modules

**Package RM1**

**Package RM2**

**Package RM3**

**Package RM4**

**Package RM5**

**Package RM6**


Dimensions in mm

## 5.03

# High Voltage Intelligent Power Modules



### Features

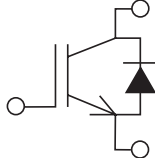
- Highest Reliability in Material and Processes
- Highest Quality Controls:
  - Static and switching tests
  - 100% shipping inspection
- Low  $V_{CE(sat)}$  (Typ. 3.05V)
- Combining gate drive and protection circuitry (Over Current, Short Circuit, Over Temperature)
- Optimised isolation design to satisfy 6kV AC
- Designed for high power converters and inverters, medium voltage drives, and traction drives



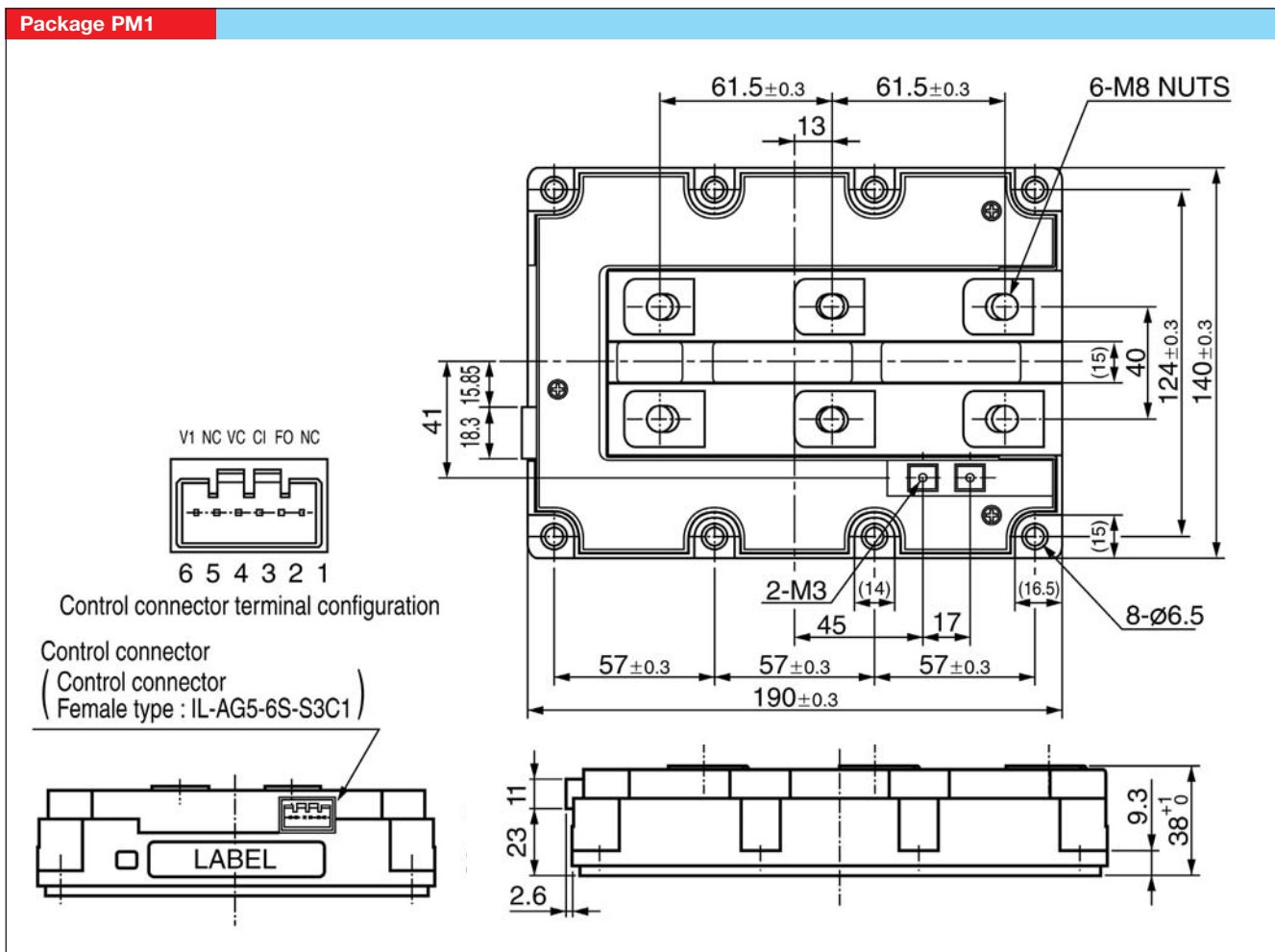


## 5.03 High Voltage Intelligent Power Modules

### Line-up HV-IPM

Configuration	$V_{RRM}$ (V)	$I_{dc}$ (A)
		1200
H 	3300	PM1200HCE330-1

Type Number	Maximum Ratings			Electrical Characteristics					Typical Protection Functions			Thermal Characteristics			Package-No.
	$V_{CES}$ (V)	$I_c$ (A)	$V_{iso}$ (V)	$V_{CE(sat)}$ @ $T_j = 25^\circ\text{C}$ (V)		$V_f$ (V) Typ.	$f_{PWM}$ (kHz) Max.	$t_{DEAD}$ ( $\mu\text{s}$ ) Min.	SC* (A)	OT ( $^\circ\text{C}$ )	UV (V)	IGBT $R_{th(j-c)}$ ( $^\circ\text{C}/\text{W}$ )	Diode $R_{th(j-c)}$ ( $^\circ\text{C}/\text{W}$ )	$R_{th(c-f)}$ ( $^\circ\text{C}/\text{W}$ )	
				Typ.	Max.										
<b>HV-IPM</b>															
PM1200HCE330-1	3300	1200	6000	3.05	3.97	2.9	2.0	8.0	2200	113	20	0.0083	0.0167	0.0075	PM1



# 6.

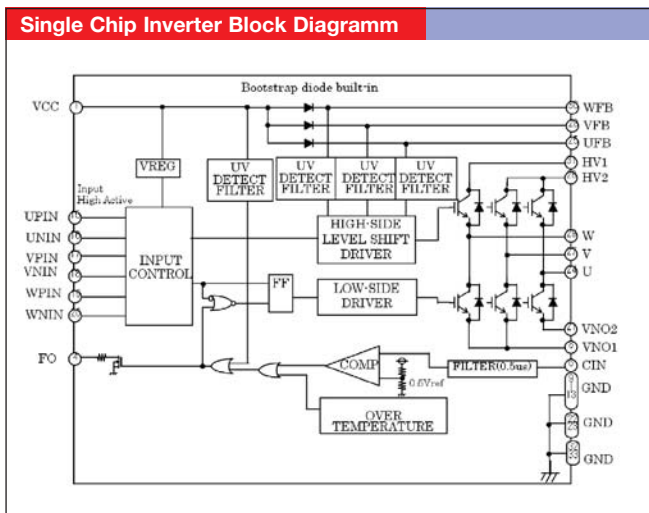
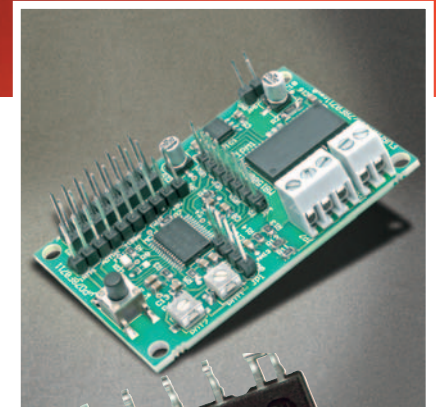
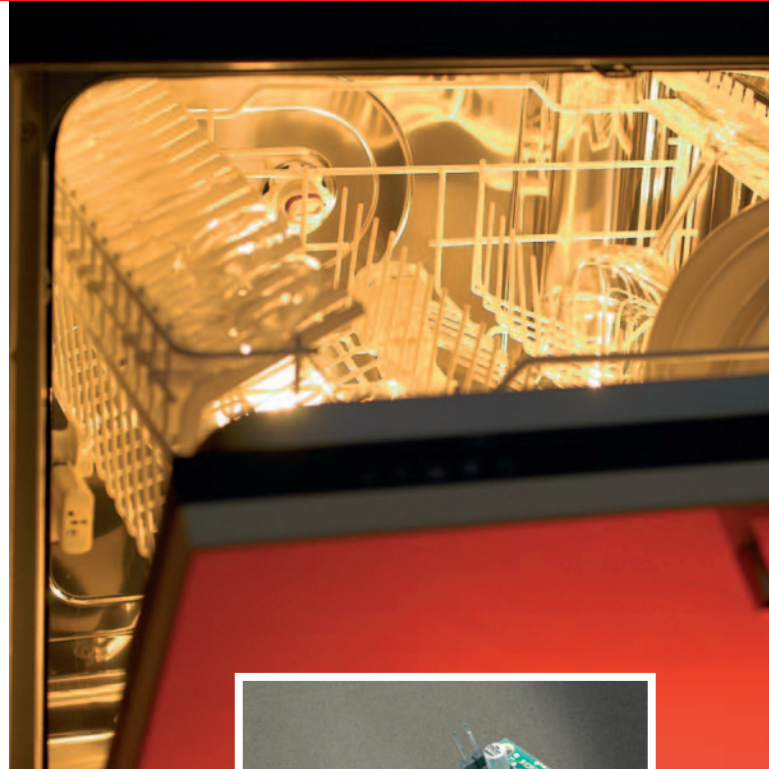
## Single Chip Inverter (M81500FP)

### Applications

- Dish Washer
- Compressors for Refrigerator
- Small Pumps for Heating

### Features

- Smallest IPM in the world (17.5 X 11.93 mm) for drive range of typically 90W reducing the PCB size
- A single silicon chip integrating control, drive, protection functions (under voltage, interlock, short circuit, over temperature) with IGBT's and free-wheeling diode and bootstrap diodes
- Single supply voltage of 15V, Control input 3V compatible
- Open drain fault output (FO)
- Excellent short circuit robustness
- Very first SMD package on the market for single chip inverter concept simplifying the production process
- Terminal shapes optimized for better thermal contact to the PCB
- Available rating: 500V/1A
- Evaluation demo-board (EVBM81500FP) for easy performance evaluation of single chip inverter is available on request



# 7.

## High Voltage Integrated Circuits



### Half Bridge Driver HVIC

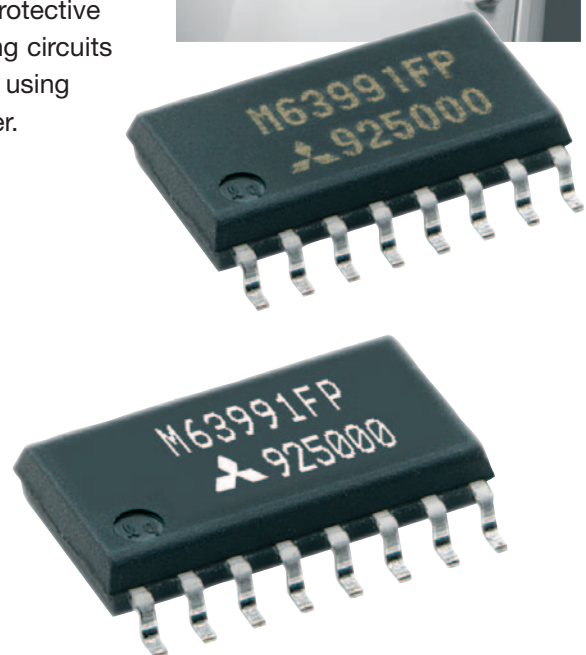
This product is a semiconductor integrated circuit designed to directly drive the power MOS/IGBT modules of half bridge composition by integrating the 1200V, 600V and 8/24V dielectric elements onto one chip.

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

### Applications

Most suitable for the following applied products to drive 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



## 7. High Voltage Integrated Circuits

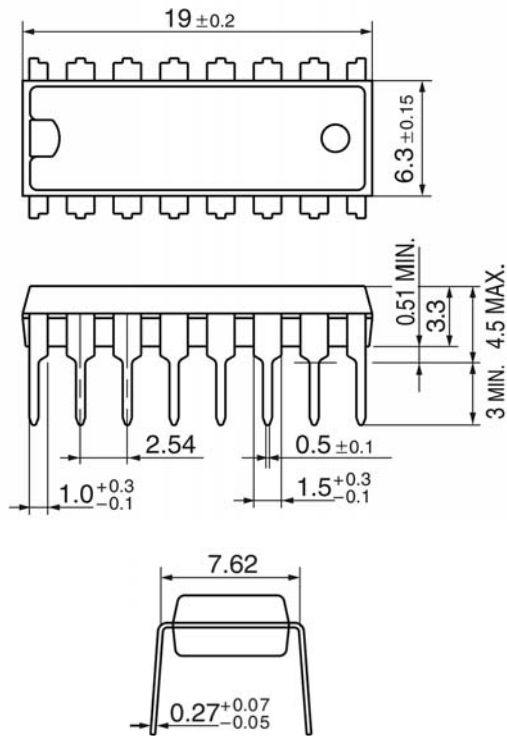
Type name	Floating supply voltage (V)	Output current (A)	Driving method	Number of input-signal	Dead-time control	Remarks	Package outline
M63975FP	24	±0.6	Low side	1			10P2N
M63991FP	600	±0.5	Half bridge	2	Input signal	With interlock function	16P2N
M63992FP	600	±2.0	Half bridge	2	Input signal	With interlock function	16P2N
M63993FP	600	±0.3	3 ∅ bridge	2x3 (6)	Input signal	With interlock function	36P2R
M63994FP	600	±0.5	Half bridge	1	Inside		8P2S
M63996FP	600	±2.0	Half bridge	2	Input signal		16P2N
M81700FP	600	±2.0	Half bridge	2	Input signal	SD/With interlock function	16P2N
M81701FP	600	±2.0	Half bridge	2	Input signal	With interlock function	16P2N
M81702FP	600	±2.0	Half bridge	2	Input signal	With SD function	16P2N
M81703FP	600	±2.0	Half bridge	2	Input signal		16P2N
M81705FP	600	-0.15/-0.125	High side	1			8P2S
M81706AFP	600	+0.12/-0.25	Half bridge	2	Input signal	With interlock function	8P2S
M81707FP	600	±0.1	Dual high side	2	Input signal		16P2N
M81708FP	600	+0.12/-0.25	Half bridge	2	Input signal	With interlock function	16P2N
M81709FP	600	±2	Half bridge	2	Input signal	With interlock function	16P2N
M81711FP	24	±0.4	Dual low side	2			8P2S
M81712FP	600	+0.2/-0.35	3 ∅ bridge	2x3 (6)	Input signal	With interlock function	28x9R
M81713FP	600	±0.5	Half bridge	1	Inside		8P2S
M81716FP	24	±0.4	Dual low side	1x2			8P2S
M81721FP	600	±0.6	Half bridge	2	Input signal	With interlock function	24P2Q
M81731FP	600	±0.1	Dual high side	1x2			16P2N
M81019FP	1200	±0.6	Half bridge	2	Input signal	With interlock function	24P2Q
M81719FP*	600	+0.12/-0.25	Half bridge	2	Input signal		8P2S
M81722FP	600	±3.0	Half bridge	2	Input signal		8P2S
M81725FP	600	±3.0	High side	1			8P2S
M63958P/FP*	600	+0.5/-0.25	Half bridge		Inside		16P4/16P2N

The complete HVIC line-up is RoHS compliant (except M63954P). \*Under development

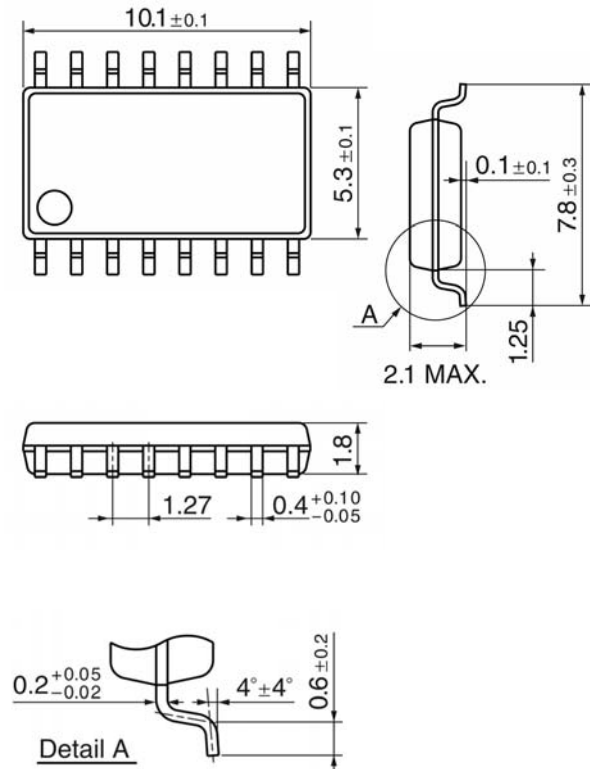


## 7. High Voltage Integrated Circuits

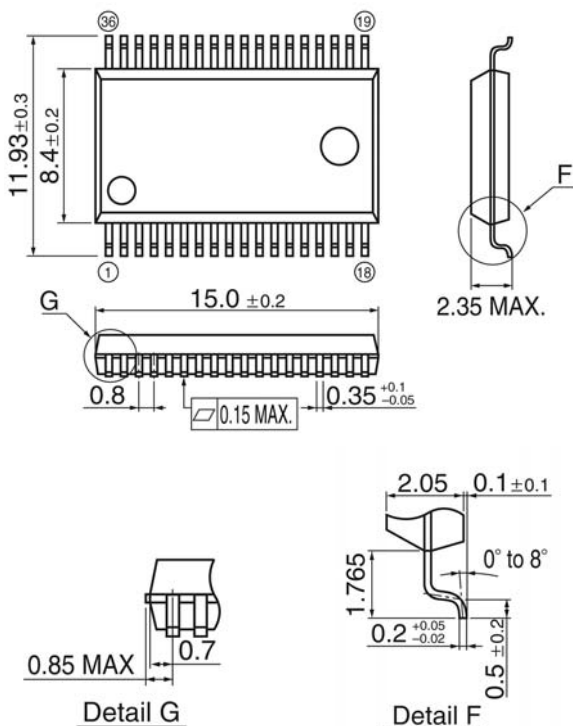
Package 16P4 (16pin 300mil DIP)



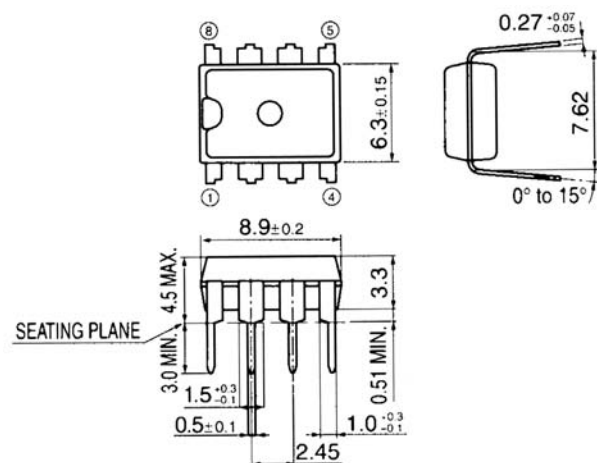
Package 16P2N (16pin 300mil SOP)



Package 36P2R (36pin 450mil SSOP)

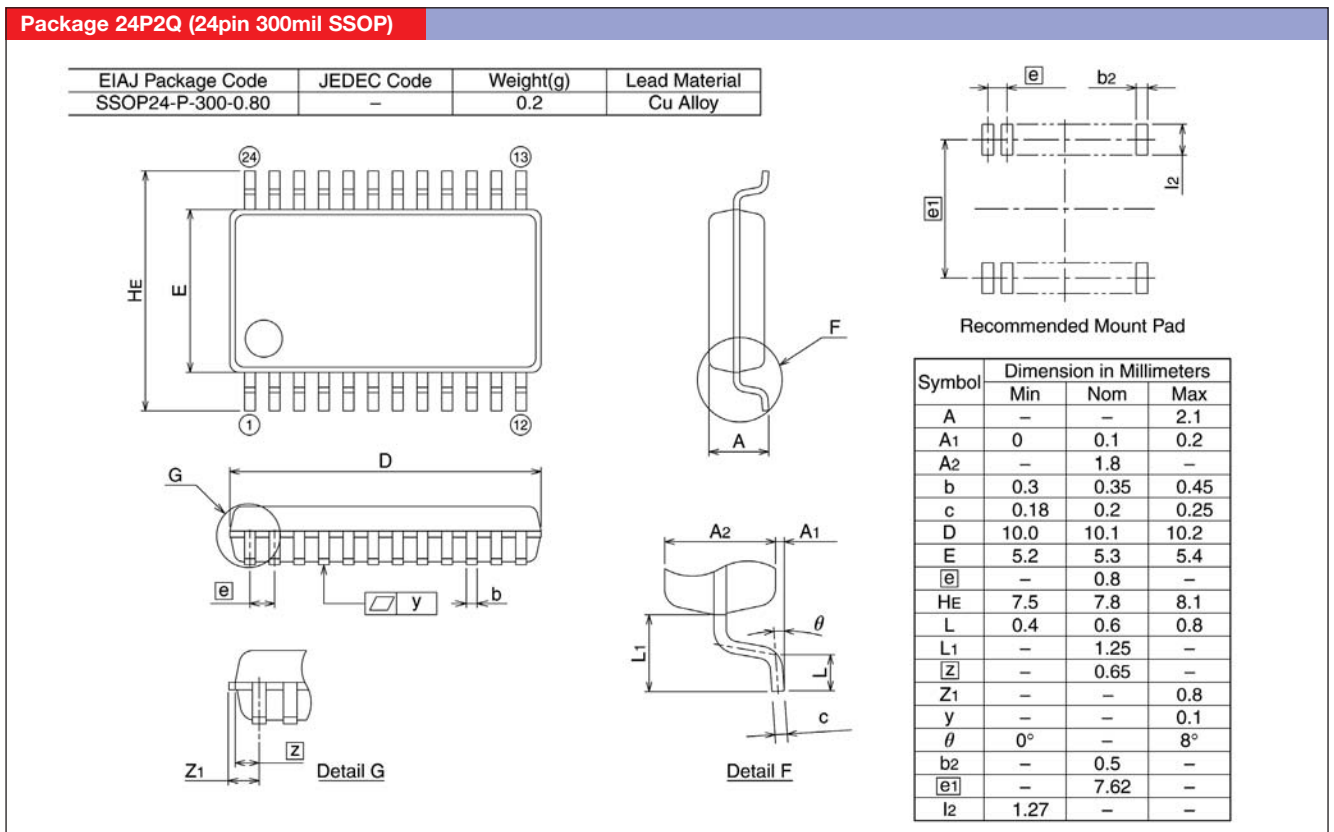
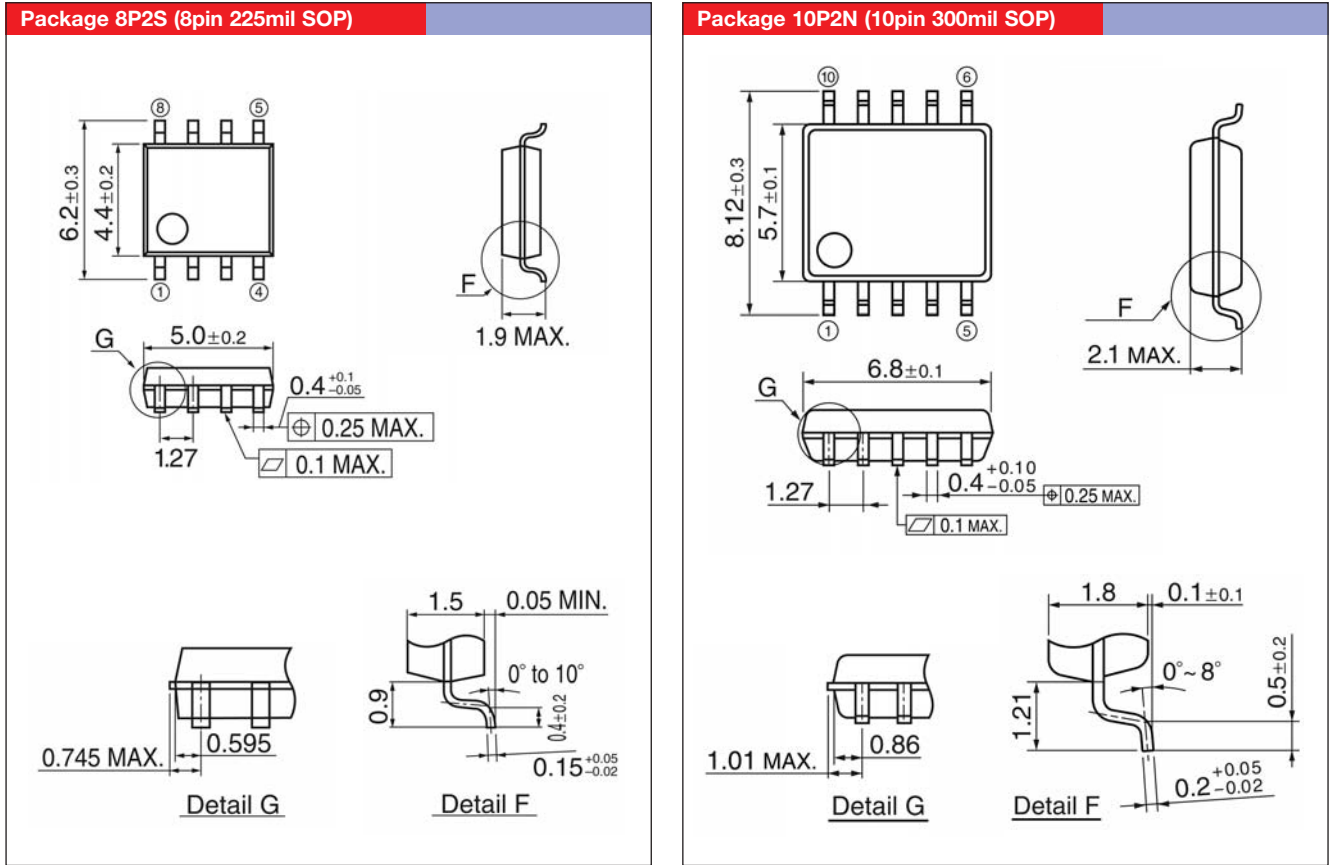


Package 8P4 (8pin 300mil DIP)



Dimensions in mm

## 7. High Voltage Integrated Circuits



# Power Loss Calculation Tool (MELCOSIM)

## MELCOSIM 4.0

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

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

Since the first version MELCOSIM 1.0 has been issued in the year 2001, four versions of this software were introduced through the Mitsubishi Electric website to our customers. We are very pleased for all comments and suggestion we have received in order to develop and improve the current version MELCOSIM 4.0.

The main modification in the version 4.0 compared to the version 3.0 is the possibility to calculate the maximum junction temperature. This calculation feature is essential to determine the junction temperature at relative low output inverter frequency  $f_o$ . The temperature swing caused by power loss and thermal equivalent RC elements of the power module will become significant if the output frequency  $f_o$  is less than  $f_o = 30\text{Hz}$ . Above this output frequency the consideration of average junction temperature is sufficient for thermal design of MITSUBISHI ELECTRIC power modules. Below  $f_o = 30\text{Hz}$  the consideration of the maximum junction temperature is essential for a professional inverter design.

The new version kept such properties of the previous versions like fast algorithms, structured in-output window and the possibility to bring graphical output.

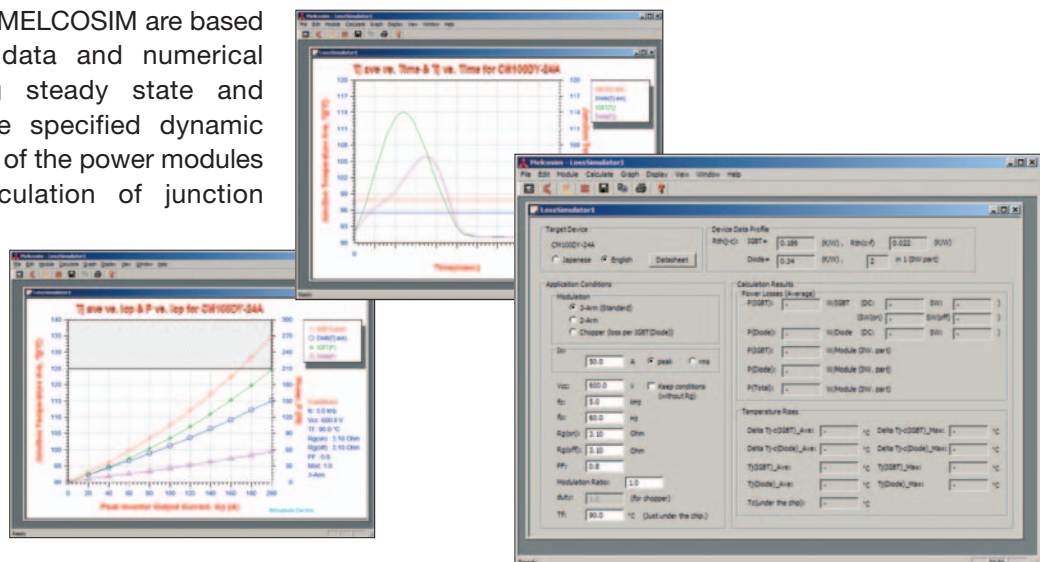
The algorithms used in MELCOSIM are based on typical specified data and numerical approach for getting steady state and dynamical losses. The specified dynamic thermal resistance data of the power modules is used for the calculation of junction temperature rise.

The input-output view is divided into the four sections: module type number, the specified property of the module, input field for the application conditions and output field for calculation results. MELCOSIM is expecting nine inputs so called „application conditions“ in order to be able to calculate power loss and junction temperature: modulation strategy, output current, DC-link voltage, switching frequency, output frequency, on and off gate resistances, power factor, modulation factor or duty and the heat sink temperature measured directly under the chip. The field of the calculation result is giving the following information: average power loss for IGBT and free wheel diode divided into static and dynamic parts, the total power loss for the power module, case temperature, the average and maximum junction temperature in transistor and in the free wheeling diode.

The graphical output provides the possibility to analyse the power losses and junction temperature by changing one of the application conditions parameter within the specification limits.

All calculation results can be exported into a text formatted file.

The latest version of MELCOSIM is available at [www.mitsubishichips.com/Global](http://www.mitsubishichips.com/Global)



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