

*High Power and High Integration Transfer-mold
Type IPM*

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Mitsubishi Electric transfer-mold type IPM





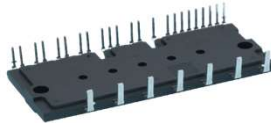
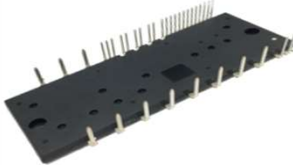

Mitsubishi Electric is the pioneer of transfer-mold type IPM!

Features

- Integrated the latest power chip for matching various applications;
- Satisfy both of good performance and reasonable cost;
- Wide current line up with compact package size;
- Accumulated know-how on design and assembly for long period assures high reliability and low failure rate of IPM.

Line-up of Mitsubishi Electric transfer-mold type IPM

Table.1 Line-up of Mitsubishi Electric transfer-mold type IPM

SOIPM	SLIMDIP	Super Mini DIIPM	Mini DIIPM	Large DIIPM	DIIPM+	Large DIIPM+
						
2A/600V	5,15A/600V	5~35A/600V	5A~50A/600V 5,10A/1200V	50,75A/600V 5~75A/1200V	(CI/CIB) 50A/600V 5~35A/1200V	(CI/CIB*) 50, 75,100A/1200V
15.2x27.4x3.6[mm]	18.8x32.8x3.6[mm]	38x24x3.5[mm]	52.5x31x5.6[mm]	79x31x8[mm]	85x34x5.7[mm]	114.5x43x7[mm]

Concept of Large DIIPM+

Features

- All in one solution: inverter, converter, driver ICs and brake (CIB type) are integrated;
- Adopted Mitsubishi Electric latest 7th gen. IGBT;
- Extended operation temperature: $T_{jmax}=175^{\circ}C^*$, $T_c=125^{\circ}C$.

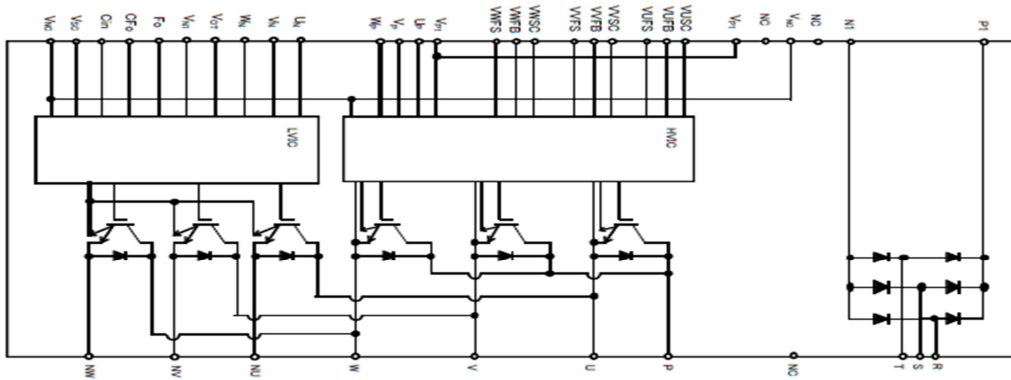


Fig.1 Inner block diagram of Large DIIPM+ (CI type)

*The maximum allowable junction temperature rating (T_{jmax}) is risen to $175^{\circ}C$ which makes it more flexible for larger power system design. For safe operation, it is necessary to limit the average junction temperature (T_{jav}) below $150^{\circ}C$.

Internal structure improvement and Integrated functions

Large DIIPM+'s internal construction has been improved by new method to connect the control ICs and the IGBTs to optimize the compactness of package as shown in Fig.2.

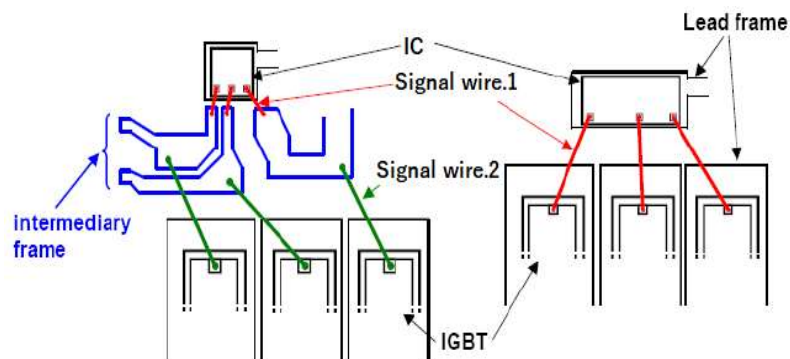


Fig.2 Wire bonding solution for Large DIIPM (Left) and Large DIIPM+ (Right)

The comparisons of inner circuit and protection functions among existing Large DIIPM Ver.6, DIIPM+ and the new Large DIIPM+ are shown in Table.2.

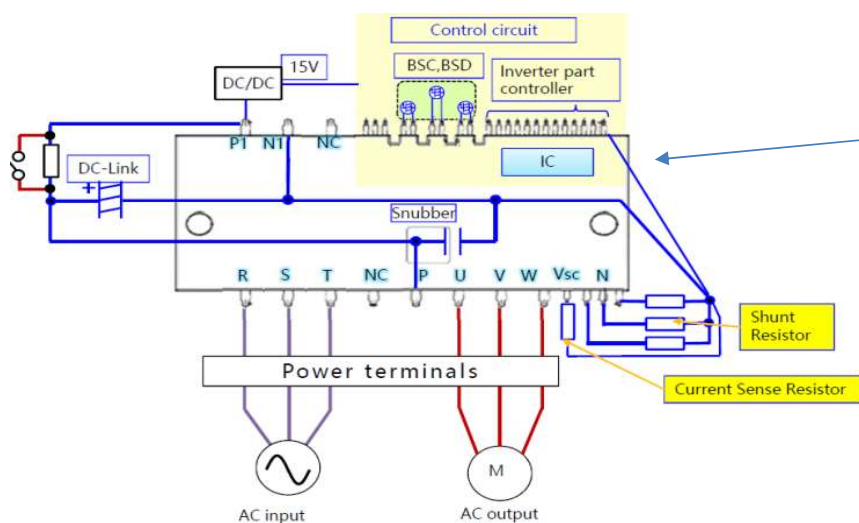
Table.2 Integrated functions comparison

Items	Large DIIPM Ver.6	DIIPM+	Large DIIPM+
Converter	No	Built-in	Built-in
Inverter	Built-in	Built-in	Built-in
Brake	No	Built-in/Selectable	Built-in/Selectable ⁽¹⁾
Control Supply UV protection	Built-in	Built-in	Built-in
SC protection mode (N-side)	Current sense/Shunt resistor	Shunt resistor	Current sense/Shunt resistor
Temperature output (V_{OT})	Built-in	Built-in	Built-in
Fault output (Fo)	Built-in	Built-in	Built-in
Bootstrap Di	Built-in	Built-in	—
N-side IGBT emitter	Open	Open	Open

Note (1) : Under development

PCB layout optimizing

The circuit configuration of a driver system based on Large DIPM+ is shown in Fig.3, there is a clear separation between the control part and the power related part of the module which optimizes and downsizes the driver system design.



- No need use external driver ICs and optocoupler;
- Support bootstrap circuit and reduce isolated control supplies;
- Simplifying PCB layout, reduce the quantity of components and downsizing PCB area.

Fig.3 Example of PCB layout (CI type)

Chip performance

Large DIIPM+ adopts the 7th generation IGBT chip of Mitsubishi Electric and its T_{jmax} is risen to 175° C. The static characteristics of IGBT in comparison between Large DIIPM+ and Large DIIPM Ver.6 1200V/75A modules is shown in Fig.4.

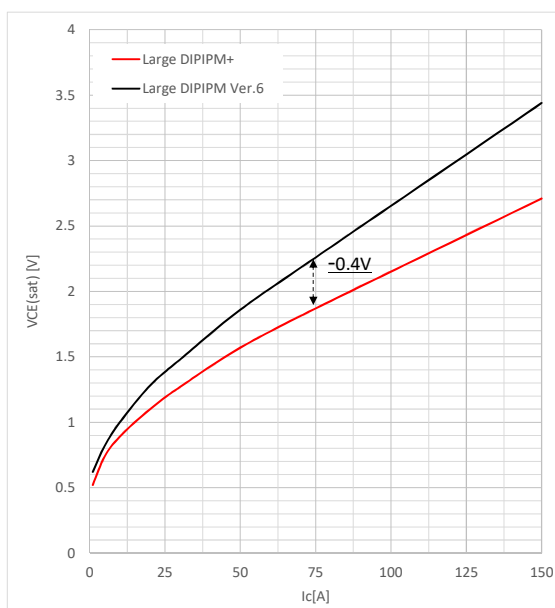


Fig.4 Typical static characteristic comparison
 (N-side, $T_j=125^\circ\text{C}$, $V_D=V_{DB}=15\text{V}$, $I_c=75\text{A}$ and $V_{IN}=0 \leftrightarrow 5\text{V}$.)

The switching waveforms of 1200V/50A Large DIIPM+ are shown in Fig.5 and the test conditions are $V_{cc}=540\text{V}$, $I_o=50\text{A}$, $T_j=150^\circ\text{C}$ and $V_D=V_{DB}=15\text{V}$, there are no oscillations during the turn on and turn off operation process, declining of the tail current is smoothly and duration is shortly.

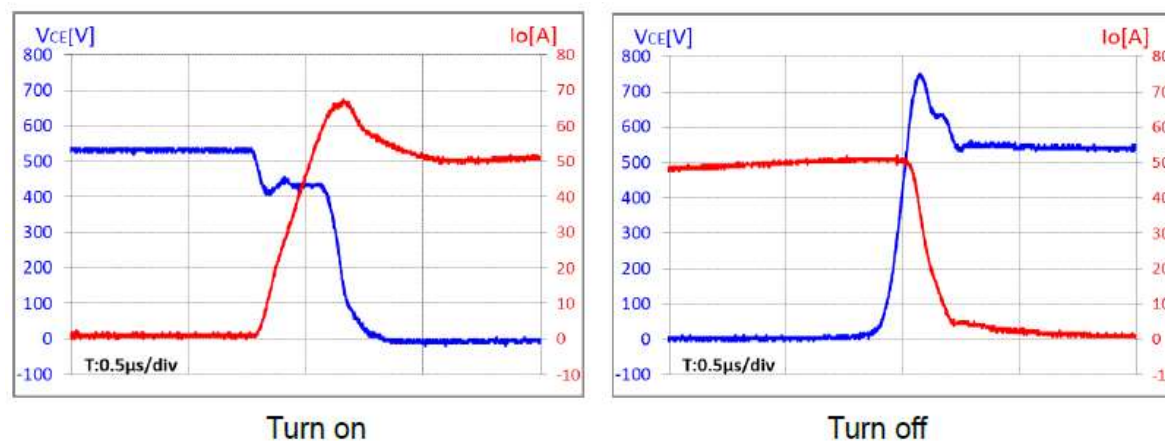


Fig.5 Switching waveforms of Large DIIPM+ (50A device)

EMI performance

The comparison test on noise level has been done for Large DIIPM+ and 1200V Large DIIPM Ver.6 under similar condition from 30MHz to 300MHz frequency spectrum, Large DIIPM+ has better EMI performance as shown in Fig.6 due to superior switching performance.

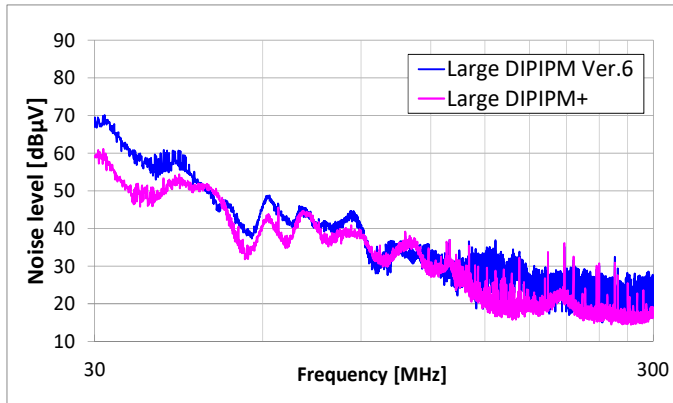


Fig.6. Radiated noise emission comparison

Power loss performance

The power loss comparison result between 75A products of Large DIIPM Ver.6 and Large DIIPM+ is shown in Fig.7, Large DIIPM+ extended the output peak current (I_{opeak}) from 36A to 54A comparing with Large DIIPM Ver.6 when ΔT_{j-c} is 25° C.

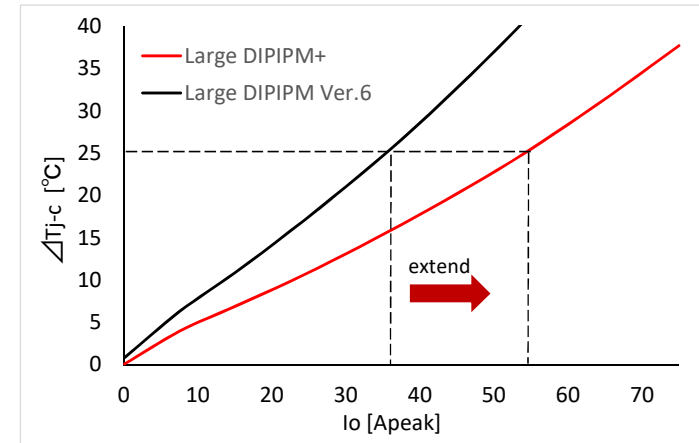


Fig.7 Typical power loss comparison
 ($V_{cc}=600V$, $f_c=8kHz$, $f_o=60Hz$, P.F=0.8, M=1 and $T_j=150^\circ C$)

The Line-up and target application of Large DIIPM+ series is shown in Table.3.

Table.3 Line-up and target application

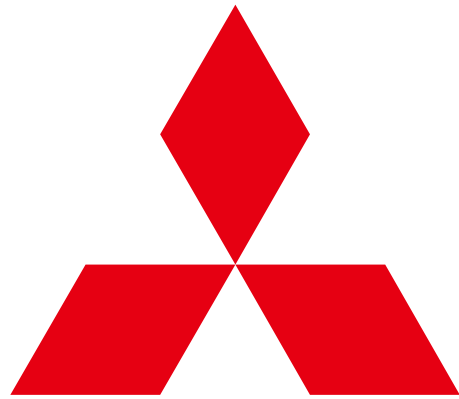
Type No. ⁽¹⁾	Rating	Target application
PSS50NE1CT	50A/1200V	Commercial air conditioner
PSS75NE1CT	75A/1200V	
PSS100NE1CT	100A/1200V	
PSS50ME1CT ⁽²⁾	50A/1200V	Industrial inverter
PSS75ME1CT ⁽²⁾	75A/1200V	
PSS100ME1CT ⁽²⁾	100A/1200V	

Note: (1) N means CI type and M means CIB type;

(2) Under development.

Merits for customer

- System cost improvement;
- Easy/simple design and save design time;
- Better noise performance····.



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