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

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

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

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

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

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

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

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

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

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

IGBT modules for general-purpose inverters used in various applications

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

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

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

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

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

*MISOP™: Surface mount package IPM

Comparison of power loss
Surface mount package IPM

New Products

Surface mount package IPM MISOP™ SP2SK, SP3SK

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

<Main Features>
- Optimal pin layout realizes easier PCB wiring design and enables smaller PCB size
- Insulation distance between pins ensured, realizing easier board mounting without coating process
- Newly integrated interlock function in addition to conventional protection features for robust operation
- Installing RC-IGBT*1 simultaneously realizes compact package and low loss performance can go together
- Bootstrap diode is integrated for the P-side drive power supply like conventional DIPIPM™ series, reducing the number of peripheral external parts

*1 Reverse-conducting IGBT

<table>
<thead>
<tr>
<th>Type name</th>
<th>Rated current</th>
<th>Rated voltage</th>
<th>Chips</th>
<th>Protection</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP2SK**</td>
<td>2A</td>
<td>600V</td>
<td>RC-IGBT, HVIC, LVIC, BSD</td>
<td>UV, SC, OT</td>
<td>Vor, IL</td>
</tr>
<tr>
<td>SP3SK**</td>
<td>3A</td>
<td></td>
<td></td>
<td></td>
<td>Surface mount package</td>
</tr>
</tbody>
</table>

[Term] UV : Power supply Under Voltage protection
SC : Short Circuit protection
OT : Over Temperature protection
Vor : Analog Temperature Output
IL : Inter Lock

Schematic drawing

Outline Drawing

Unit:mm
**Featured Products**

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

**SLIMDIP™**
SLIMDIP-S, SLIMDIP-L

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

\( \text{*1} \) Reverse conducting IGBT  
\( \text{*2} \) Analog Temperature Output  
\( \text{*3} \) Over Temperature protection

**Internal circuit diagram**

```
<table>
<thead>
<tr>
<th>Type name</th>
<th>Rated current</th>
<th>Rated voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>2A</td>
<td>3A</td>
</tr>
<tr>
<td>SP2SK</td>
<td>600V</td>
<td></td>
</tr>
<tr>
<td>★★</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP3SK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>★★</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

Recommended for low-cost inverter and fan controller applications

---

**Featured Products**

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

**DIPIPM™**
PSS05MC1FT, PSS10MC1FT, PSS15MC1FT, PSS25MC1FT, PSS35MC1FT, PSS50MC1F6

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

\( \text{*1} \) Bootstrap diode  
\( \text{*2} \) Without brake circuit types are also line-up

---

**Customer Support**

EVA series, evaluation boards for each DIPIPM™
Various evaluation boards to easy support system design

Super mini DIPIPM™ evaluation board EVA11-SDIP

DIPIPM+™ evaluation board EVA14-DIP+

SLIMDIP™ evaluation board EVA01-SLIM

SLIMDIP™ evaluation board EVA15-SLIM

DIPIPM+™ evaluation board EVA03-DIP+

* For further information, please contact sales office.
### Line-up of DIPIPM™

#### Series Matrix of 600V / 500V DIPIPM™

<table>
<thead>
<tr>
<th><strong>V\text{cc}(V)</strong></th>
<th><strong>600V</strong></th>
<th><strong>Large</strong></th>
<th><strong>DIPIPM+</strong></th>
<th><strong>500V</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I\text{c}(A)</strong></td>
<td><strong>Series</strong></td>
<td><strong>SLIMDIP</strong></td>
<td><strong>Super mini</strong></td>
<td><strong>Mini</strong></td>
</tr>
<tr>
<td>3</td>
<td>SLIMDIP-S</td>
<td>PSS05S92F6-AG</td>
<td>PSS05S92E6-AG</td>
<td>PSS05S91F6</td>
</tr>
<tr>
<td>5</td>
<td>SLIMDIP-S</td>
<td>PSS10S92F6-AG</td>
<td>PSS10S92E6-AG</td>
<td>PSS10S91F6</td>
</tr>
<tr>
<td>10</td>
<td>SLIMDIP-L</td>
<td>PSS15S92F6-AG</td>
<td>PSS15S92E6-AG</td>
<td>PSS15S91F6</td>
</tr>
<tr>
<td>15</td>
<td>SLIMDIP-L</td>
<td>PSS20S92F6-AG</td>
<td>PSS20S92E6-AG</td>
<td>PSS20S91F6</td>
</tr>
<tr>
<td>20</td>
<td>SLIMDIP-L</td>
<td>PSS30S92F6-AG</td>
<td>PSS30S92E6-AG</td>
<td>PSS30S71F6</td>
</tr>
<tr>
<td>35</td>
<td>SLIMDIP-L</td>
<td>PSS50S71F6</td>
<td>PS21A79</td>
<td>PSS50MC1F6</td>
</tr>
<tr>
<td>50</td>
<td>SLIMDIP-L</td>
<td>PS21A79</td>
<td>PS21A79</td>
<td>PSS50MC1F6</td>
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<tr>
<td>75</td>
<td>SLIMDIP-L</td>
<td>PS21A79</td>
<td>PS21A79</td>
<td>PSS50MC1F6</td>
</tr>
</tbody>
</table>

#### Application circuit of super mini DIPIPM™

![DIPIPM Application Circuit](image-url)

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

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

### Protective Function

<table>
<thead>
<tr>
<th>Series Matrix of 1200V DIPIPM™</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Ic (A)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td>35</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>75</td>
</tr>
</tbody>
</table>

### Type Name Definition of DIPIPM™

- **PS**: Options
- **Options**: Voltage class
- **Function**: Series
- **Series**: Package
- **Package**: Circuit
- **Circuit**: Construction
- **Construction**: Rated current
- **Rated current**: Chip type
- **Chip type**: DIPIPM

---

**Chip**
- IGBT/MOSFET: CSTBT
- CSTBT: P-side/N-side
- CSTBT: N-side
- CSTBT: N-side
- CSTBT: N-side

**Protective Function**
- **Function**
  - UV: P-side/N-side
  - SC: P-side/N-side
  - OT: N-side
  - Active input: High(3/5V)
  - Fault output: N-side (UV, SC, OT)
  - Insulation voltage: 2500Vrms
  - Insulation structure: Insulation sheet
  - RoHS directive: Compliant
  - Pin type: —

**Notes**
- *1: PSS**NC1FT is not included brake

---

**Terms**
- **BID**: Bootstrap Diode
- **CSTBT**: Mitsubishi Electric's unique IGBT that makes use of the carrier cumulative effect
- **HVIC**: High Voltage IC
- **LVIC**: Low Voltage IC
- **UV**: Power supply Under Voltage protection
- **OT**: Over Temperature protection
- **SC**: Short Circuit protection
- **VOT**: Analog Temperature Output
- **RoHS**: Restriction of hazardous substances in electrical and electronic equipment
- **CIB**: Converter Inverter Brake
- **CI**: Converter Inverter
Line-up of DIPIPM™

Outline Drawing of DIPIPM™

Super mini DIPIPM Ver.6
MOSFET Super mini DIPIPM
Long

Mini DIPIPM (PSSxxS71F6)
1200V Mini DIPIPM

Mini DIPIPM (PSSxxS51F6)

Small DIPIPM

Large DIPIPM

DIPIPM+

SLIMDIP
Normal

SLIMDIP
Short

Power loss has been reduced with the introduction of the 7th-generation IG BT produced using CSTBT™. In addition to the built-in functions of the previous product, automatic switching speed control, and error detection function contribute to lowering inverter loss and shortening design time.

*2 RFC: Relaxed field cathode
*1 CSTBT™: Mitsubishi Electric’s unique IGBT that utilizes the carrier cumulative effect.
**Featured Products**

**G1 Series IPM with 7th-generation IGBT**

**Main Features**
- Power loss has been reduced with the introduction of the 7th-generation IGBT produced using CSTBT™ and a diode incorporating a RFC™ structure that contributes to reducing the power consumed in inverters.
- The new resin-insulated metal baseplate, originally introduced in 7th-generation IGBT modules, eliminates the solder-attached section, increasing the thermal cycle lifetime and improving inverter reliability.
- In addition to the built-in functions of the previous product, automatic switching speed control, and error detection function contribute to lowering inverter loss and shortening design time.

1. CSTBT™: Mitsubishi Electric’s unique IGBT that utilizes the carrier cumulative effect.
2. RFC: Relaxed field cathode.

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

### "A" package main pin shape and layout

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

#### For the pin layout, select either straight or L-shaped

<table>
<thead>
<tr>
<th>Package</th>
<th>Main pin shape</th>
<th>Main pin layout</th>
<th>ic(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A package</td>
<td>Screw</td>
<td>Straight</td>
<td>25 35 50 75 100 150 200 300 450</td>
</tr>
<tr>
<td>650V</td>
<td>Solder pin</td>
<td>Straight</td>
<td>PM50CG1A120 PM50CRG1A120 PM50CG1A120 PM50CRG1A120 PM50CG1A120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L-shaped</td>
<td>PM50CG1A1L20 PM50CRG1A1L20 PM50CG1A1L20 PM50CRG1A1L20 PM50CG1A1L20</td>
</tr>
<tr>
<td>B package</td>
<td>Screw</td>
<td>L-shaped</td>
<td>PM50CG1A1B065 PM50CRG1A1B065 PM50CG1A1B065 PM50CRG1A1B065 PM50CG1A1B065</td>
</tr>
<tr>
<td>C package</td>
<td>Screw</td>
<td>L-shaped</td>
<td>PM50CG1AL065 PM50CRG1AL065 PM50CG1AL065 PM50CRG1AL065 PM50CG1AL065</td>
</tr>
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</table>

### Lineup

<table>
<thead>
<tr>
<th>Vcc(V)</th>
<th>Package</th>
<th>Main pin shape</th>
<th>Main pin layout</th>
<th>ic(A)</th>
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</thead>
<tbody>
<tr>
<td>1200V</td>
<td>A package</td>
<td>Screw</td>
<td>Straight</td>
<td>PM50CG1A120 PM50CRG1A120 PM50CG1A120 PM50CRG1A120 PM50CG1A120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L-shaped</td>
<td>PM50CG1A1L20 PM50CRG1A1L20 PM50CG1A1L20 PM50CRG1A1L20 PM50CG1A1L20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soldier pin</td>
<td>Straight</td>
<td>PM50CG1A1P120 PM50CRG1A1P120 PM50CG1A1P120 PM50CRG1A1P120 PM50CG1A1P120</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>L-shaped</td>
<td>PM50CG1A1P1L20 PM50CRG1A1P1L20 PM50CG1A1P1L20 PM50CRG1A1P1L20 PM50CG1A1P1L20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B package</td>
<td>Screw</td>
<td>L-shaped</td>
<td>PM50CG1B120 PM50CRG1B120 PM50CG1B120 PM50CRG1B120 PM50CG1B120</td>
</tr>
<tr>
<td></td>
<td>C package</td>
<td>Screw</td>
<td>L-shaped</td>
<td>PM50CG1C120 PM50CRG1C120 PM50CG1C120 PM50CRG1C120 PM50CG1C120</td>
</tr>
</tbody>
</table>

Representative reference is "A" package with screw terminal and straight layout (CG1A).
### Matrix of IPM Modules 650V/600V

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>650V</th>
<th>600V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series (A)</td>
<td>G1 Series</td>
<td>L1 Series</td>
</tr>
<tr>
<td>50</td>
<td>PM50CG1A065 C 12</td>
<td>PM50CL1A060 C 01</td>
</tr>
<tr>
<td></td>
<td>PM50CG1B065 R 10</td>
<td>PM50CL1B060 C 02</td>
</tr>
<tr>
<td></td>
<td>PM50CG1B065 C 12</td>
<td>PM50RL1A060 R 01</td>
</tr>
<tr>
<td></td>
<td>PM50CG1A065 C 09</td>
<td>PM50RL1B060 R 02</td>
</tr>
<tr>
<td></td>
<td>PM50CG1A065 C 09</td>
<td>PM50RL1C060 R 03</td>
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<td>PM100CG1B065 C 12</td>
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<td>PM100RL1A060 R 01</td>
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<td>PM100CG1B065 C 09</td>
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<td>PM200RL1A060 R 01</td>
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<td>PM300CG1C065 C 11</td>
<td>PM300CL1B060 C 02</td>
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<td>PM300RG1C065 R 11</td>
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<tr>
<td></td>
<td>PM300RG1C065 R 11</td>
<td>PM300RL1B060 R 02</td>
</tr>
<tr>
<td>400/450</td>
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<td>PM400DV1A060 D 06</td>
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<td></td>
<td>PM450CG1C065 C 11</td>
<td>PM400DV1A060 D 06</td>
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<tr>
<td>600</td>
<td>PM600DV1A060 D 06</td>
<td>PM600DV1A060 D 06</td>
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<tr>
<td>800</td>
<td>PM800DV1B060 D 07</td>
<td>PM800DV1B060 D 07</td>
</tr>
</tbody>
</table>

### IGBT chip

- **CSTBT**
  - Emitter sensor installed
  - Built-in emitter sensor
  - Built-in temperature sensor

- **SCSTBT**
  - Built-in emitter sensor
  - Built-in temperature sensor

### Connection

- **D**: P-side/N-side
- **B4**: P-side/N-side
- **B5**: P-side/N-side
- **B6**: P-side/N-side
- **C**: P-side/N-side
- **R**: P-side/N-side

### Notes

1. Full-gate CSTBT
2. PCM (Plugged Cell Merged) CSTBT

### Terms

- **UV**: Power supply Under Voltage protection
- **OT**: Over Temperature protection
- **SC**: Short Circuit protection
- **OC**: Over current protection
- **RoHS**: Restriction of hazardous substances in electrical and electronic equipment

### Compliant

- L Series
- S-DASH SERVO
- V Series

---

Please contact to the sales offices.
<table>
<thead>
<tr>
<th>IGBT chip</th>
<th>CSTBT*1 Emitter sensor installed Temperature sensor installed</th>
<th>CSTBT*1 Built-in current sensor</th>
<th>CSTBT*1 Built-in temperature sensor</th>
<th>CSTBT*2 Built-in current sensor</th>
<th>CSTBT*2 Built-in temperature sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault output</td>
<td>P-side/N-side</td>
<td>P-side/N-side</td>
<td>N-side</td>
<td>P-side/N-side</td>
<td>P-side/N-side</td>
</tr>
<tr>
<td>SC</td>
<td>P-side/N-side</td>
<td>P-side/N-side</td>
<td>N-side</td>
<td>P-side/N-side</td>
<td>P-side/N-side</td>
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<tr>
<td>Verification</td>
<td>P-side/N-side</td>
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<td>Compatibility</td>
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<td>L Series</td>
<td>S-DASH SERVO</td>
<td>V Series</td>
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<table>
<thead>
<tr>
<th>Connection</th>
<th>D</th>
<th>C</th>
<th>R</th>
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</table>

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

[Term]  
UV: Power supply Under Voltage protection  
SC: Short Circuit protection  
OT: Over Temperature protection  
OC: Over current protection  
RoHS: The Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
Line-up of IPM

Outline Drawing of IPM

01
PM50,75,100,150CL1A/RL1A060
PM25,50,75CL1A/RL1A120
PM50,75B4/B5/B6LA060

02
PM50,75,100,150CL1B/RL1B060
PM25,50,75CL1B/RL1B120
PM50,75B4/B5/B6LB060

03
PM50RL1C060
PM25RL1C120
PM50,75,84/B5/B6L1C060

04
PM200,300CL1A/RL1A060
PM100,150CL1A/RL1A120

05
PM50,75,100,150,200CS1D060
PM25,50,75,100CS1D120

06
PM400,600DV1A060
PM200,300,450DV1A120

07
PM800DV1B060

08
PM450,600CLA060
PM200,300,450CLA120

09
PM50,75,100CG1AP/CG1APL065
PM50,75RG1AP065
PM25,35,50CG1AP/CG1APL120
PM25,35RG1AP120

Unit: mm
Featured Products

New lineup contributes to simple design downsizing, energy-savings of industrial inverters.

IGBT Module T/T1-Series

New structure realizes improved reliability (improved thermal cycle lifetime)

- New modules equipped with three-phase converter, inverter, and brake circuit (CIB), contributes to simplifying design for inverter systems
- CIB modules contribute to compact inverter systems by reducing package size by 36% compared to the Mitsubishi Electric’s existing module (CIB)
- Power loss has been reduced with the introduction of the 7th-generation IGBT produced using CSTBT™ and a diode incorporating a relaxed field of cathode (RFC) structure
- The new structure introduced eliminates the solder-attached section, increasing the thermal cycle lifetime, which contributes to improving the reliability of inverters
- The introduction of press-fit pins and PC-TIM™1 contribute to simplifying the assembly process for inverters

*1 PC-TIM: Phase change - thermal interface material
*2 CSTBT™: Mitsubishi Electric’s unique IGBT that makes use of the carrier cumulative effect

Press-fit terminal support (NX)

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

Press-fit pin

Main pin

Signal pin

New Products

Industrial IGBT module with new standard package "LV100" for high power density inverter, have been developed for the application that high-density inverter is required.

IGBT module 2in1 type

Lineup
800A/1700V, 800A/1700V (with enhanced FWD), 1200A/1700V

(Main Features)
- Next generation high capacity standard package for industrial use
- Improved ease of use by applying low impedance package
- Reducing the switching loss and optimal for the applications that are used in 1 to 5KHz
- Isolation voltage 4kV

IGBT module T-series (LV100 for industrial)
Featured Products

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

Power Modules for 3-level Inverters

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

*1 Comparison between 3-level inverter incorporated in this device and 2-level inverter in conventional device.
*2 1-in-1/2-in-1 type external dimensions of 130x67mm, 4-in-1 type external dimensions of 115x82mm, new package developed with innovative terminal positioning.
*3 IGBT specifications optimized for 3-level inverters, adopting CSTBT™ (Mitsubishi Electric’s unique IGBT that makes use of the carrier cumulative effect).
*4 4-in-1 module with one 3-level inverter arm in one package.
*5 Bidirectional switch model as emitter common connection.

### Lineup

<table>
<thead>
<tr>
<th>Circuit topology</th>
<th>Inverter range</th>
<th>Function</th>
<th>Model type</th>
<th>Rated voltage</th>
<th>Rated current</th>
<th>Circuit structure</th>
<th>External dimensions W×D (mm)</th>
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### Features of IGBT Module Series

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

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

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

### Type Name Definition of IGBT Modules

**CM 600 D Y -13 T**

- **Series name**
- **Voltage class**
- **Outline drawing and other specifications**
- **Connection type**
- **Rated current capacity**
- **IGBT module**
### Matrix of IGBT Modules 650V/600V

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<th>Voltage (V)</th>
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<td><strong>A-Series</strong></td>
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### Matrix of Power Modules for 3-Level Inverter

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*RoHS directive (2011/65/EU, (EU)2015/863) compliant

**New Product**

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*Connection of diode module and IGBT module are different.*
### Matrix of IGBT Modules 1200V

(No.: Number of Outline Drawing, see page 18 to 23)

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<td>D 29</td>
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<td>D 32</td>
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<td></td>
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<td>D 30</td>
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</table>

[1]: A-Series have model names ending with A, NF-Series have model name ending with NF/NFH

**New Product**

*Connection of diode module and IGBT module are different.*

![Connection Diagram](image)
<table>
<thead>
<tr>
<th>V_{ce}(V)</th>
<th>T-Series LV100 Type</th>
<th>T-Series NX Type</th>
<th>T-Series std Type</th>
<th>S/S1-Series NX Type</th>
<th>S/S1-Series std Type</th>
<th>S/S1-Series MPD Type</th>
<th>A-Series std Type</th>
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<td>CM100HJ-34T*</td>
<td>CM100MK-34SA</td>
<td>CM100MK-34SA</td>
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<td>CM100MK-34SA</td>
<td>CM100DY-34A</td>
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<td>CM150MK-34SA</td>
<td>CM150MK-34SA</td>
<td>CM150MK-34SA</td>
<td>CM150MK-34SA</td>
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<td>CM400HJX-34T*</td>
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<td>CM1200MK-34SA</td>
<td>CM1200MK-34SA</td>
<td>CM1200MK-34SA</td>
<td>CM1200DY-34A</td>
</tr>
</tbody>
</table>

* Under Development  ★: New Product

RoHS directive (2011/65/EU, (EU)2015/863) compliant
Line-up of IGBT Modules

Outline Drawing of IGBT Modules

Unit:mm

- 5-MI NUTS
- 4-4.5 MOUNTING HOLES
- TAP#110, 10.5

10. CM400DY-12NF
   CM200DY-24NF
   CM300DY-24A
   CM300DY-24S
   CM100,200DY-34A

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

12. CM600DU-24NF
    CM800DY-24S

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

14. CM300,400DU-12NFH
    CM200,300DU-24NFH
    CM200DY-24NF

15. CM600DU-12NFH
    CM400,600DU-24NFH

16. CM400,600HA-24A
    CM500HA-34A

17. CM900,1400DUC-24S
    CM1000DUC-34SA

18. CM400DY-34A
Outline Drawing of IGBT Modules

19. CM75RX-34SA

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

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

22. CM450DXL-34SA
CM600DXL-34SA

23. CM75MXA-34SA

24. CM150EXS-24S
CM200EXS-24S
CM300EXS-24S
CM200EXS-34SA
CM200EXS-24S
CM300EXS-24S
CM450DX-24S1
CM450DX-24S
CM600DX-24S1

25. CM100TX-24S1
CM150TX-24S1

26. CM100RX-24S1
CM150RX-24S1

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

Unit: mm
Line-up of IGBT Modules

Outline Drawing of IGBT Modules

28  CM300,450,600DX-13T
    CM225,300,450,600DX-24T
    CM800DX-24T1

29  CM1000DX-24T

30  CM100,150,200TY-13T
    CM100,150DY-24T

31  CM300,400DY-13T
    CM200,300DY-24T

32  CM600DY-13T
    CM450,600DY-24T
    CM450,600C1Y-24T

33  CM100,150,200TX-13T
    CM100,150,200TX-24T
    CM100,150TX-34T

34  CM150,200RX-13T
    CM100,150RX-24T

35  CM400ST-24S1

36  CM500C2Y-24S
    CM1400HA-24S
    CM1000HA-34S
    RM1400HA-24S

Unit:mm
Line-up of IGBT Modules

Outline Drawing of IGBT Modules

Unit:mm

CM50/75/100MXUBP-13T/T1
CM75/100MXUBP-24T/T1

CM75/100MXUCP-24T/T1

CM100/150MXUDP-13T/T1
CM150MXUDP-24T/T1

*1 RFC : Relaxed field of cathode
*2 3.3kV - 6.5kV (as of Apr. 5, 2018 based on Mitsubishi Electric research)
*3 Comparison of X Series CM1200HC-66X and H Series CM1200HC-66H
*4 Power loss reduced by incorporating 7th-generation IGBT and RFC diode
*4 Industry's highest 3.3kV/600A Si module power density of 8.57A/cm²
*4 Most suitable for increased power output and efficiency
*4 Terminal layout optimized for easy paralleling and flexible inverter configurations and capacities
*4 New package structure offers extra reliability
*4 As of Apr. 5, 2018, based on Mitsubishi Electric research

H Series
X Series
X Series B Type
X Series

1.5 times rated current
Compatible external shape
2/3 size
For smaller inverter
For smaller inverter
For quicker design
For quicker design
For larger output power
For larger output power

Inverter capacities

500A 1000A 1500A 2000A 2500A
450A 600A
900A 1200A
1350A 1800A
1800A 2400A

Two 450A and 600A products added to the LV100 3.3kV product lineup combined with other parallel products in answer to the need of inverters with various capacities

1 parallel
2 parallel
3 parallel
4 parallel

■ Inverter capacities

1200A 1600A 2400A
1200A 900A
1000A 600A
2400A 3600A
1200A 1800A
900A 1350A
1500A 600A
900A 1000A
3.3kV 4.5kV 6.6kV

■ Inverter capacities

LV100 1.7kV
LV100 3.3kV
LV100 4.5kV 6.6kV

std type
dual type
C type/G type
C type/G type
E4 type
(190mm×140mm)
LV100 1.7kV 1000A
LV100 3.3kV 450A
LV100 4.5kV 350A
LV100 6.6kV 225A
HVIGBT Modules

New Products

X Series HVIGBT Modules  std type

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

<Main Features>
• Power loss reduced by incorporating 7th-generation IGBT and RFC\(^1\) diode
• Industry-leading power\(^2\) for increased inverter capacity
• External size reduced 33% while maintaining the same voltage resistance and rated current as conventional products,\(^3\) contributing to inverter downsizing
• Optimal package internal structure realizes improved heat dissipation, humidity resistance and flame retardance, increasing product life

\(^1\) RFC : Relaxed field of cathode
\(^2\) 3.3kV - 6.5kV (as of Apr. 5, 2018 based on Mitsubishi Electric research)
\(^3\) Comparison of X Series CM1200HC-66X and H Series CM1200HC-66H

■ Product lineup

<table>
<thead>
<tr>
<th>std Type</th>
<th>1.7kV</th>
<th>3.3kV</th>
<th>4.5kV</th>
<th>6.6kV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1200A</td>
<td>1600A</td>
<td>2000A</td>
<td>2400A</td>
</tr>
<tr>
<td></td>
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<tr>
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<td>1200A</td>
<td>1800A</td>
<td>1500A</td>
<td>1000A</td>
</tr>
</tbody>
</table>

■ Internal circuit diagram

Positioning from conventional series

H Series (CM1200HC-66H) X Series (CM1200HC-66X)

X Series C type/G type (130mm×140mm) X Series B Type (CM1200HC-66X)

For larger output power For smaller inverter

■ X Series HVIGBT Modules  dual type

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

<Main Features>
• Power loss reduced by incorporating 7th-generation IGBT and RFC\(^1\) diode
• Industry’s highest 3.3kV/600A Si module power density of 8.57A/cm\(^2\)\(^4\) contributes to increased power output and efficiency
• Terminal layout optimized for easy paralleling and flexible inverter configurations and capacities
• New package structure offers extra reliability

\(^4\) As of Apr. 5, 2018, based on Mitsubishi Electric research

■ Product lineup

<table>
<thead>
<tr>
<th>LV100 1.7kV</th>
<th>3.3kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000A</td>
<td>450A</td>
</tr>
<tr>
<td>1200A</td>
<td>600A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HV100 3.3kV</th>
<th>4.5kV</th>
<th>6.6kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>450A</td>
<td>350A</td>
<td>225A</td>
</tr>
<tr>
<td>600A</td>
<td>450A</td>
<td>300A</td>
</tr>
</tbody>
</table>

■ Internal circuit diagram

Various current ratings for optimal system design

Inverter capacities

500A 1000A 1500A 2000A 2500A

1 parallel
450A 600A
2 parallel
900A 1200A
3 parallel
1350A 1800A
4 parallel
1800A 2400A

Two 450A and 600A products added to the LV100 3.3kV product lineup combined with other parallel products in answer to the need of inverters with various capacities
Line-up of HVIGBT Modules

Series Matrix of HVIGBT/HVIPM (No.: Number of Outline Drawing, see page 29 to 31)

<table>
<thead>
<tr>
<th>Vces (V)</th>
<th>lce (A)</th>
<th>X-Series</th>
<th>S-Series</th>
<th>H-Series</th>
<th>R-Series</th>
<th>H-Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700V</td>
<td></td>
<td>CM400DY-50H</td>
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<tr>
<td>2500V</td>
<td></td>
<td>CM800DY-50H</td>
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<td></td>
</tr>
<tr>
<td>3300V</td>
<td></td>
<td>CM1200DY-50H</td>
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<td></td>
</tr>
</tbody>
</table>

- ★★: Under Development
- ★: New Product

Connection

[Type]
B: Cu base plate 6kV Isolation
C: AlSiC base plate 6kV Isolation
G: AlSiC base plate 10kV Isolation
### Series Matrix of HVIGBT/HVIPM

(No.: Number of Outline Drawing, see page 29 to 31)

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>4500V</th>
<th>6500V</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC (A)</td>
<td>X-Series</td>
<td>R-Series</td>
</tr>
<tr>
<td>200A</td>
<td>CM350DG-90X**</td>
<td>CM300DG-130X**</td>
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<tr>
<td>225A</td>
<td>CM350DG-90X**</td>
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<td>900A</td>
<td>CM900HG-130H</td>
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<td>CM1200HC-90H</td>
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<td>CM1350HG-90X**</td>
<td>CM1350HG-90X**</td>
</tr>
<tr>
<td>1500A</td>
<td>CM1500HC-90X**</td>
<td>CM1500HG-90X**</td>
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</tbody>
</table>

**Connection**

- **H**: Copper base plate 6kV isolation
- **C**: AlSiC base plate 6kV isolation
- **G**: AlSiC base plate 10kV isolation

- **CM** indicates the series abbreviation.

- **No.** indicates the number of the outline drawing, see page 29 to 31.

- **Connection** (H, E2/E6, E4, D2) refers to the terminal connections.
### Line-up of HVDIODE Modules

#### Series Matrix of HVDIODE Modules

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>1700V</th>
<th>3300V</th>
<th>4500V</th>
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<tr>
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<tr>
<td>200</td>
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<td>RM200DG-130S</td>
<td>D G 24</td>
</tr>
<tr>
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<tr>
<td>300</td>
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<td></td>
<td>RM300DG-90S</td>
<td>D G 24</td>
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<tr>
<td>400</td>
<td></td>
<td>RM400DG-66S</td>
<td>D G 24</td>
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</tr>
<tr>
<td>450</td>
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<tr>
<td>800</td>
<td>RM800DC-34X**</td>
<td>D C 22</td>
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<td>900</td>
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<td>RM900DG-66X**</td>
<td>D G 24</td>
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</tr>
<tr>
<td>1000</td>
<td></td>
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<td>D C 26</td>
<td>RM1000DG-130X**</td>
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<tr>
<td>1200</td>
<td>RM1200DB-34S</td>
<td>D B 22</td>
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<td></td>
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<tr>
<td></td>
<td>RM1200DC-34X**</td>
<td>D C 22</td>
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<td></td>
</tr>
<tr>
<td>1500</td>
<td>RM1500HE-66F</td>
<td>H C 23</td>
<td>RM1500DC-90X**</td>
<td>D C 26</td>
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<tr>
<td>1800</td>
<td>RM1800HE-34S</td>
<td>H C 23</td>
<td>RM1500DG-90X**</td>
<td>D G 24</td>
</tr>
</tbody>
</table>

**Notes:**
- ![Series Matrix of HVDIODE Modules](image)
- **Type:**
  - B: Cu base plate 6kV isolation
  - C: AlSiC base plate 6kV isolation
  - G: AlSiC base plate 10kV isolation
- **★**: Under Development

#### Evolution of HVIGBT Module Series

- **1.7kV**
  - H Series (std type)
  - N Series (std type)
  - S Series (std type)
  - X Series (std type)

- **2.5kV**
  - H Series (std type)

- **3.3kV**
  - H Series (std type)

- **4.5kV**
  - R Series (std type)

- **6.5kV**
  - X Series (std type)

#### Evolution of HVDIODE Module Series

- **1.7kV**
  - S Series (X Series)

- **3.3kV**
  - S Series (X Series)

- **4.5kV**
  - S Series (X Series)

- **6.5kV**
  - S Series (X Series)

#### Type Name Definition of IGBT Modules

- CM: IGBT, RM: DIODE, PM: IPM
- ![Type Name Definition of IGBT Modules](image)
Evolution of HVDIODE Module Series
Evolution of HVIGBT Module Series

CM1200HC-34N
CM800HB-50H,-66H
CM800HC-66H

CM1800,2400HC-34N
CM1800,2400HC-34H
CM1200HB/HC-50H,-66H
CM800E4G/E6C-66H
CM900HC-90H

CM400HG-66H
CM200HG-130H
CM1200HG-66H
CM900HG-90H
CM400E2G/E4G-130H
CM600HG-130H
CM600HG-130H

Outline Drawing of HVIGBT Modules
Unit: mm
Line-up of HVIGBT Modules

Outline Drawing of HVIGBT Modules

Unit:mm

10 CM1000E4C-66R
CM1500HG-66R
CM1200HC-90R
CM1200HC-90RA

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

12 CM600HG-90H
CM400HG-130H

13 CM800HG-90R

14 PM1200HC330-1

15 CM400DY-50H/66H

16 CM1200E4C-34X
CM1600HC-34X
CM2400HC-34X
CM1200HC-66X
CM900HC-90X

17 CM2400HC-34X, CM3600HC-34X
CM1200E4C-66X, CM1200HC-66X
CM1800HC-66X
CM1350HC-90X
CM1500HC-90X

18 CM900HG-90X
CM1500HG-90X
CM1000HG-90X
CM600HG-130X
Line-up of HVDIODE Modules

Outline Drawing of HVDIODE Modules

Unit:mm

### 22
- **RM1200DB-34S**
- **RM800DC-34X**
- **RM1200DC-34X**

### 23
- **RM1800HE-34S**
- **RM1200HE-66S**
- **RM600HE-90S**
- **RM1500HE-66F**

### 24
- **RM400/1200DG-66S**
- **RM300DG-90S**
- **RM200/800DG-130S**
- **RM400/800/1200DG-90F**
- **RM250DG-130F**
- **RM600/900/1200DG-66X**
- **RM450/900/1500DG-90X**
- **RM300/450/600DG-130X**
- **RM1000DG-130XA**

### 25
- **RM400,600DY-66S**

### 26
- **RM1000,1500DC-66F**
- **RM600DC-66X**
- **RM1200DC-66X**
- **RM1500DC-90X**

### 27
- **RM1200DB-66S**
- **RM900DB/HC-90S**
### Series Matrix of MOSFET Modules

<table>
<thead>
<tr>
<th>Vo(D) (V)</th>
<th>75V</th>
<th>100V</th>
<th>150V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Io(A)</td>
<td>Connection</td>
<td>Connection</td>
<td>Connection</td>
</tr>
<tr>
<td>100</td>
<td>FM200TU-07A</td>
<td>T</td>
<td>FM200TU-2A</td>
</tr>
<tr>
<td>200</td>
<td>FM400TU-07A</td>
<td>T</td>
<td>FM400TU-2A</td>
</tr>
<tr>
<td>300</td>
<td>FM600TU-07A</td>
<td>T</td>
<td>FM600TU-2A</td>
</tr>
</tbody>
</table>

RoHS directive (2011/65/EU, (EU)2015/863) compliant

### Outline Drawing of MOSFET Modules

Unit: mm

[Outline Drawing Image]
New Products

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

High Power J1 Series Power Modules for EVs/HEVs

CT1000CJ1B060, CT600CJ1B120

Features

Common

- Long power/temperature cycle life
- High-precision on-chip temperature sensor
- High traceability in managing materials/components for each product throughout the entire production process
- Package structure compliant with the End-of-Life-Vehicles Directive, regulations relating to substances of environmental concern

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

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

J1 Series (6-in-1)

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

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

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Power Module with pin fin</th>
<th>Connection</th>
<th>No.</th>
<th>T-PM</th>
<th>Connection</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>CT600CJ1A060</td>
<td>C</td>
<td>01</td>
<td>D</td>
<td>-</td>
<td>D</td>
</tr>
<tr>
<td>600</td>
<td>CT700CJ1A060</td>
<td>C</td>
<td>01</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1000</td>
<td>CT1000CJ1B060</td>
<td>C</td>
<td>03</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1200V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Matrix of 1200V Power Modules (No. : Number of Outline Drawing, please refer to page 30)

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Power Module with pin fin</th>
<th>Connection</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>CT300CJ1A120**</td>
<td>C</td>
<td>01</td>
</tr>
<tr>
<td>600</td>
<td>CT600CJ1B120</td>
<td>C</td>
<td>03</td>
</tr>
</tbody>
</table>

Type Name Definition of Power Modules for Electric and Hybrid Vehicles

CT 600 C J1B 120

NOTE: In case of CT1000CJ1B060 and CT600CJ1B120, each pair of arms is not connected internally.
Outline Drawing of Power Modules for Electric and Hybrid Vehicles

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**Series J1**

- CT1000CJ1B060
- CT600CJ1B120

Each pair of arms is not connected internally.

**Series J**

- CT300CJ1A120

Installation of the 7th generation IGBT adapting the CSTBT DLB structure realizes high reliability and configuration, contributing to minimize the automobile inverter structure, realizing a further reduction in loss.

- Mitsubishi Electric’s unique IGBT that utilizes the carrier cumulative effect.

- Loss further reduced by incorporating 7th-generation IGBT built with a connection, contributing to more compact inverters for EVs/HEVs.

- Completely lead-free, conforms to RoHS directives (2011/65/EU).

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