Power Modules
Innovative Power Devices for a Sustainable Future

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 (HV/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

New Products

Surface mount package IPM MISOPTM 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, Vor, IL</td>
<td>Surface mount package</td>
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<tr>
<td>SP3SK**</td>
<td>3A</td>
<td></td>
<td></td>
<td></td>
<td></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
Featured Products

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

SLIMDIPTM

<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
• Additional terminals for floating supply and built-in bootstrap diodes simplify PCB wiring pattern
• Both VOT*2 and OT*3 functions integrated for temperature protection

*1 Reverse conducting IGBT
*2 Analog Temperature Output
*3 Over Temperature protection

SLIMDIPTM evaluation board EVA11-SDIP

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+

SLIMDIPTM evaluation board EVA01-SLIM
SLIMDIPTM evaluation board EVA15-SLIM

DIPIPM+™ evaluation board EVA03-DIP+

* For further information, please contact sales office.
### Series Matrix of 600V / 500V DIPIPM™

<table>
<thead>
<tr>
<th>Vccs (V)</th>
<th>600V</th>
<th>500V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ic (A)</td>
<td>SLIMDIP</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SLIMDIP-S</td>
<td>PSS05S92F6-AG</td>
</tr>
<tr>
<td>5</td>
<td>SLIMDIP-S</td>
<td>PSS05S92F6-AG</td>
</tr>
<tr>
<td>10</td>
<td>SLIMDIP-S</td>
<td>PSS05S92F6-AG</td>
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<tr>
<td>15</td>
<td>SLIMDIP-S</td>
<td>PSS05S92F6-AG</td>
</tr>
<tr>
<td>20</td>
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<td>PSS05S92F6-AG</td>
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<td>50</td>
<td>SLIMDIP-S</td>
<td>PSS05S92F6-AG</td>
</tr>
<tr>
<td>75</td>
<td>SLIMDIP-S</td>
<td>PSS05S92F6-AG</td>
</tr>
</tbody>
</table>

### Application circuit of super mini DIPIPM™

![Application circuit diagram]

[Notes]
1. PSxxS92F6 has OT function, PSxxS92E6 has VOT function
2. AC60Hz, 1 minute. Corresponds to isolation voltage 2500V rms in the case the convex-shaped heat sink
3. High melting point solder (Lead Over 85%) is used in the case the convex-shaped heat sink
4. Molding resin insulation for PSSxxS51F6/-C for chip soldering of PSSxxS51F6 only.
5. PSSxxSNC1F6 is not included brake.

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

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[Diagram description and notes]
### Series Matrix of 1200V DIPIPMTM

<table>
<thead>
<tr>
<th>Ic (A)</th>
<th>Series</th>
<th>Mini</th>
<th>Large</th>
<th>DIPIPMTM+</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>PSS05S72FT</td>
<td>PSS05SA2FT</td>
<td>PS22A72</td>
<td>PSS05MC1FT</td>
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<tr>
<td></td>
<td>PSS10S72FT</td>
<td>PSS10SA2FT</td>
<td>PS22A73</td>
<td>PSS10MC1FT</td>
</tr>
<tr>
<td>15</td>
<td>PSS15S72FT</td>
<td>PSS15SA2FT</td>
<td>PS22A74</td>
<td>PSS15MC1FT</td>
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<td>35</td>
<td>PSS35S72FT</td>
<td>PSS35SA2FT</td>
<td>PS22A78-E</td>
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<tr>
<td>50</td>
<td>PSS50S72FT</td>
<td>PSS50SA2FT</td>
<td>PS22A79</td>
<td>PSS50MC1FT</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td>PSS75S72FT</td>
<td></td>
<td>PSS75SA2FT</td>
</tr>
</tbody>
</table>

**IGBT/MOSFET**
- UV: P-side/N-side, P-side/N-side, P-side/N-side, P-side/N-side/Brake
- SC: N-side, N-side, N-side, N-side
- OT: N-side, N-side, N-side, N-side
- Active input: High(5V), High(5V), High(5V), High(5V)
- Fault output: N-side, N-side, N-side, N-side, N-side, N-side, N-side, N-side
- Insulation voltage: 2500Vrms, 2500Vrms, 2500Vrms
- Insulation structure: Insulation sheet, Insulation sheet, Insulation sheet, Insulation sheet
- RoHs directive: Compliant, Compliant, Compliant, Compliant
- Pin type: —, —, —, —, —

**Specifications**
- Not recommended: Please contact the sales offices.

[Notes] *1: PSS**NC1FT is not included brake

### Type Name Definition of DIPIPMTM

- **PS**
  - Options: Voltage class, Function, Series, Package, Circuit construction, Rated current, Chip type, DIPIPMTM

**Term**
- BSD: Bootstrap Diode
- CSTBT: Mitsubishi Electric’s unique IGBT that makes use of the carrier cumulative effect
- LVIC: Low Voltage IC
- HVIC: High 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
### Mini DIPIPM (PSSxxS71F6) 1200V Mini DIPIPM

- Type name: PSSxxS71F6
- Normal SLIMDIP: MOSFET
- Mini DIPIPM: MOSFET Super mini DIPIPM

### Mini DIPIPM (PSSxxS51F6)

#### Zigzag

- Type name, Lot No.
- Power Pin: Solder pin
- Power Pin: Screw

#### Large DIPIPM

- Type name, Lot No.
- Power Pin: Solder pin
- Power Pin: Screw

#### DIPIPM+

- Type name, Lot No.
- Power Pin: Solder pin
- Power Pin: Screw

### SLIMDIP

#### Normal

- Type name, Lot No.
- Power Pin: Solder pin
- Power Pin: Screw

#### Short

- Type name, Lot No.
- Power Pin: Solder pin
- Power Pin: Screw

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**Unit:mm**

**Short-circuit protection (SC), Over-temperature protection (OT)**

**Main Features**

- Inverters with enhanced energy savings
- Loaded with built-in functions, contributing to inverter loss and shortening design time
- Thermal cycle lifetime and improving inverter reliability
- That contributes to reducing the power consumed in inverters

**For the “A” package 6-in-1 (CG1A) main pin shape, select either solder pin or screw type**
<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
3 Conventional product: IPM L1-Series

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.

■ Lineup

<table>
<thead>
<tr>
<th>Vce (V)</th>
<th>Package</th>
<th>Main pin shape</th>
<th>Main pin layout</th>
<th>ic (A)</th>
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<tbody>
<tr>
<td>650V</td>
<td>A</td>
<td>Screw</td>
<td>Straight</td>
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<td></td>
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<td></td>
<td></td>
<td>L-shaped</td>
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<tr>
<td>1200V</td>
<td>A</td>
<td>Screw</td>
<td>Straight</td>
<td>75</td>
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<td></td>
<td>L-shaped</td>
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<td>L-shaped</td>
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<td></td>
<td>300</td>
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<tr>
<td></td>
<td>C</td>
<td>Screw</td>
<td>L-shaped</td>
<td>450</td>
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</tbody>
</table>

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

(No.: Number of outline drawing, see page 11 to 12)

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<thead>
<tr>
<th>Voltage (V)</th>
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<th>600V</th>
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<tr>
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<td>PM50RG1A065</td>
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<td>PM50RG1B065</td>
<td>PM50CL1B060</td>
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<td>75</td>
<td>PM75CG1A065</td>
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<td>PM75RG1A065</td>
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<td>PM300RG1C065</td>
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<table>
<thead>
<tr>
<th>IGBT chip</th>
<th>CSTBT*1 Emitter sensor installed Temperature sensor installed</th>
<th>CSTBT*1 Built-in emitter sensor Built-in temperature sensor</th>
<th>CSTBT*1 Built-in emitter sensor Built-in temperature sensor</th>
<th>CSTBT*1 Built-in emitter sensor Built-in temperature sensor</th>
<th>CSTBT*1 Built-in emitter sensor Built-in temperature sensor</th>
<th>CSTBT*2 Built-in emitter sensor Built-in temperature sensor</th>
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<tbody>
<tr>
<td>UV</td>
<td>P-side/N-side</td>
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<td>P-side/N-side</td>
<td>P-side/N-side</td>
<td>P-side/N-side</td>
<td>P-side/N-side</td>
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<td>OT</td>
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<td>P-side/N-side</td>
<td>P-side/N-side</td>
<td>P-side/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>P-side/N-side</td>
<td>P-side/N-side</td>
<td>P-side/N-side</td>
<td>P-side/N-side</td>
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<td>Testicular</td>
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<td>P-side/N-side</td>
<td>P-side/N-side</td>
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<td>Compliant</td>
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<td>L Series</td>
<td>S-DASH SERVO</td>
<td>V Series</td>
<td>L Series</td>
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<table>
<thead>
<tr>
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<th>D</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
<th>C</th>
<th>R</th>
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<tbody>
<tr>
<td>Not recommended</td>
<td>Please contact to the sales offices.</td>
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<td></td>
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</tr>
</tbody>
</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: Restriction of hazardous substances in electrical and electronic equipment
|| Voltage (V) | G1 Series | LI Series | SI Series | V1 Series | L Series |
|---|---|---|---|---|---|
| 25 | PM25CG1A120 | PM25CL1A120 | PM25CL1B120 | PM25CS1D120 | PM25CLA120 |
| | PM25CG1B120 | PM25CL1B120 | PM25RL1B120 | | |
| | PM25RG1A120 | PM25RL1A120 | PM25RL1B120 | | |
| | PM25RG1B120 | PM25RL1B120 | PM25RL1C120 | PM25CS1D120 | PM25CLA120 |
| | PM25CG1AP120 | | | | |
| | PM25CG1AL120 | | | | |
| | PM25RG1AP120 | | | | |
| | PM25RG1AP120 | | | | |
| 35 | PM35CG1A120 | PM35CL1A120 | PM35CL1B120 | PM35CS1D120 | PM35CLA120 |
| | PM35CG1B120 | PM35CL1B120 | PM35RL1B120 | | |
| | PM35RG1A120 | PM35RL1A120 | PM35RL1B120 | | |
| | PM35RG1B120 | PM35RL1B120 | PM35RL1B120 | PM35CS1D120 | PM35CLA120 |
| | PM35CG1AP120 | | | | |
| | PM35CG1AL120 | | | | |
| | PM35RG1AP120 | | | | |
| | PM35RG1AP120 | | | | |
| 50 | PM50CG1A120 | PM50CL1A120 | PM50CL1B120 | PM50CS1D120 | PM50CLA120 |
| | PM50CG1B120 | PM50CL1B120 | PM50RL1B120 | | |
| | PM50RG1A120 | PM50RL1A120 | PM50RL1B120 | | |
| | PM50RG1B120 | PM50RL1B120 | PM50RL1B120 | PM50CS1D120 | PM50CLA120 |
| | PM50CG1AP120 | | | | |
| | PM50CG1AL120 | | | | |
| | PM50RG1AP120 | | | | |
| | PM50RG1AP120 | | | | |
| 75 | PM75CG1B120 | PM75CL1A120 | PM75CL1B120 | PM75CS1D120 | PM75CLA120 |
| | PM75RG1B120 | PM75CL1B120 | PM75RL1B120 | | |
| | PM100CG1B120 | PM100CL1A120 | PM100CL1B120 | PM100CS1D120 | PM100CLA120 |
| | PM100CG1C120 | PM100CL1B120 | PM100RL1A120 | | |
| | PM100RG1B120 | PM100CL1A120 | PM100RL1A120 | | |
| | PM100RG1C120 | PM100CL1B120 | PM100RL1A120 | PM100CS1D120 | PM100CLA120 |
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| | PM150RG1C120 | PM150CL1B120 | PM150RL1A120 | | |
| | PM200CG1C120 | PM200CL1A120 | PM200CL1B120 | PM200CS1D120 | PM200CLA120 |
| | PM200RG1C120 | PM200CL1B120 | PM200RL1A120 | | |
| | PM200RG1C120 | PM200CL1B120 | PM200RL1A120 | PM200CS1D120 | PM200CLA120 |
| 200 | PM300DV1A120 | PM300DV1A120 | PM300DV1A120 | PM300CS1D120 | PM300CLA120 |
| | PM450DV1A120 | PM450DV1A120 | PM450DV1A120 | PM450CS1D120 | PM450CLA120 |

**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

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*Please contact your sales office for any questions not covered in the table.*
Line-up of IPM

Outline Drawing of IPM

01 PM50,75,100,150C1A/RL1A060
PM25,50,75C1A/RL1A120
PM50,75B4/B5/B6L060

02 PM50,75,100,150C1B/RL1B060
PM25,50,75C1B/RL1B120
PM50,75B4/B5/B6LB060

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

04 PM200,300C1A/RL1A060
PM100,150C1A/RL1A120

05 PM50,75,100,150,200C1D060
PM25,50,75,100C1D120

06 PM400,600DV1A060
PM200,300,450DV1A120

07 PM800DV1B060

08 PM450,600CLA060
PM200,300,450CLA120

09 PM50,75,100C1AP/C1APL065
PM50,75RG1A055
PM25,35,50C1AP/C1APL120
PM25,35RG1AP120

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

**IGBT Module T/T1-Series**

*Main Features*

- 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™ 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

---

**New structure realizes improved reliability**

(Improved thermal cycle lifetime)

- **NX package structure comparison**
  - 8th-generation IGBT
  - 7th-generation IGBT

- **Compared to standard (std) package structure**
  - 8th-generation IGBT

- **Features**
  - Possible to select the control pin shape
  - Solder attachment process eliminated

- **Press-fit pin**
  - Main pin
  - Signal pin

---

**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 module T-series (LV100 for industrial)**

- **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
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 130×67mm, 4-in-1 type external dimensions of 115×82mm, new package developed with innovative terminal positioning.
*3 IGBT specifications optimized for 3-level inverters, adopting CSTBTTM (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>Model</th>
<th>Function</th>
<th>Model type</th>
<th>Rated voltage</th>
<th>Rated current</th>
<th>Circuit structure</th>
<th>External dimensions WxD(mm)</th>
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■ Features of IGBT Module Series

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

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

CSTBTTM: 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
- Other specifications
- Connection type
- Rated current capacity
- IGBT module

Data sheet here

Internal circuit diagram

Typical circuit of 3-level inverter

T type

AC Switch

BRIDGE

Clamp Diode

I type

Clamp Diode

Brige

Clamp Diode
Matrix of IGBT Modules 650V/600V (No.: Number of outline drawing, see page 18 to 23)

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

Matrix of IGBT Modules

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<th>T/S1-Series NX Type</th>
<th>Connection No.</th>
<th>T-Series std Type</th>
<th>Connection No.</th>
<th>A-Series NX Type</th>
<th>Connection No.</th>
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<th>NF-Series NFH Type</th>
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Connection

Matrix of Power Modules for 3-level Inverter (No.: Number of outline drawing, see page 19 to 21)

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

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Connection

* Connection of diode module and IGBT module are different.

New Product

New Product

15
Matrix of IGBT Modules 1200V

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

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*1: A-Series have model name ending with A, NF-Series have model name ending with NF/NFH

**Connection**

- **H**: New Product

---

**Connection Diagram**

- **D**: New Product

---

**Legend**:

- **H**: New Product
- **D**: New Product
# Matrix of IGBT Modules 1700V

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

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

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**Connection Diagram**

- **H**: Under Development
- **M**: New Product
Outline Drawing of IGBT Modules

01 CM75,100MX-12A

02 CM100,150,200RX-12A
CM75RX-24S

03 CM300,400DX-12A
CM150,200DX-24S

04 CM35,50,75,100MXA-24S

05 CM75TX-24S

06 CM600,1000DXL-24S

07 CM75,100,150TL/RL-12NF
CM50,75,100TL/RL-24NF

08 CM150,200,300DY-12NF
CM100,150DY-24NF
CM100,150,200DY-24A
CM75,100DY-34A
CM100,150E3Y-24NF

09 CM200TL/RL-12NF
CM150,200TL/RL-24NF

Unit: mm
Line-up of IGBT Modules

10 CM400DY-12NF
   CM200DY-24NF
   CM300DY-24A
   CM300DY-24S
   CM150,2000DY-34A

11 CM600DY-12NF
   CM400DY-24NF
   CM500DY-24S
   CM40,600DY-24A
   CM600DY-24S
   CM300DY-34A
   CM300DY-24NF

12 CM600DU-24NF
   CM800DY-24S

13 CM200DU-12NFH
   CM100,150DU-24NFH

14 CM300,400DU-12NFH
   CM200,300DU-24NFH

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

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 CM100,150,200DY-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
CM100,150,200TXP-13T
CM100,150,200TXP-13T1

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

35 CM400ST-24S1

36 CM500C2Y-24S
CM1400HA-24S
CM1000HA-34S
RM1400HA-24S
Line-up of IGBT Modules

Outline Drawing of IGBT Modules

Unit:mm

CM50/75/100MXUBP-13T/T1 CM75MXUBP-24T/T1

CM75/100MXUCP-24T/T1 CM100/150MXUDP-13T/T1

CM150MXUDP-24T/T1

<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

Positioning from conventional series
H Series (CM1200HC-66H)

X Series (CM1200HC-66X)

X Series B Type (CM1200HCB-66X)

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

Various current ratings for optimal system design

Inverter capacities

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

450A/3.3kV product parallel connection
600A/3.3kV product parallel connection
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

New Products
1.7kV 3.3kV 4.5kV 6.6kV std Type
X Series HVIGBT Modules std type

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

■ Product lineup

1200A 1600A 2400A
1200A 900A 1000A 600A
2400A 3600A 1200A 1800A 900A 1350A 1500A 600A 900A 1000A

■ Internal circuit diagram

C type/G type (130mm×140mm)

C type/G type (190mm×140mm)

E4 type (190mm×140mm)
**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

### Positioning from conventional series

**H Series (CM1200HC-66H)**
- 2/3 size
- For smaller inverter

**X Series (CM1800HC-66X)**
- 1.3 times rated current
- For larger output power
- For quicker design

**X Series B Type (CM1200HCB-66X)**
- Compatible external shape

### Various current ratings for optimal system design

**Inverter capacities**

- 1 parallel: 500A, 450A, 400A
- 2 parallel: 900A, 800A, 600A
- 3 parallel: 1350A, 1200A, 1000A

**LV100 1.7kV**
- 1000A
- 1200A

**LV100 3.3kV**
- 450A
- 600A

**LV100 4.5kV**
- 350A
- 450A

**LV100 6.6kV**
- 225A
- 300A

**HV100 3.3kV**
- 450A
- 600A

**HV100 4.5kV**
- 450A

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

### Internal circuit diagram

#### C type/G type (130mm x 140mm)

#### C type/G type (190mm x 140mm)

#### E4 type (150mm x 140mm)
### 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>1700V</th>
<th>2500V</th>
<th>3300V</th>
</tr>
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<tbody>
<tr>
<td>1000A</td>
<td></td>
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<td></td>
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<td>1500A</td>
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<td>1600A</td>
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<td>1800A</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2400A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3600A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Connection**

- **H**: Base plate
- **E2/E6**: 6kV Isolation
- **E4**: 6kV Isolation
- **D1**: 10kV Isolation
- **D2**: Under Development

**[Type]**

- **B**: Cu base plate
- **C**: AlSiC base plate
- **G**: AlSiC base plate

---

**Note:** Please refer to page 29 to 31 for more details.
## Series Matrix of HVIGBT/HVPM

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

<table>
<thead>
<tr>
<th>Vce(V)</th>
<th>4500V</th>
<th>6500V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X-Series</td>
<td>R-Series</td>
</tr>
<tr>
<td>200A</td>
<td>CM600HG-90X**</td>
<td>CM600HG-90H</td>
</tr>
<tr>
<td>225A</td>
<td>CM500HG-90X**</td>
<td>CM500HG-90H</td>
</tr>
<tr>
<td>350A</td>
<td>CM300DG-90X**</td>
<td>CM300DG-90H</td>
</tr>
<tr>
<td>400A</td>
<td>CM250DG-90X**</td>
<td>CM250DG-90H</td>
</tr>
<tr>
<td>600A</td>
<td>CM150HG-90X**</td>
<td>CM150HG-90H</td>
</tr>
<tr>
<td>750A</td>
<td>CM100HG-90X**</td>
<td>CM100HG-90H</td>
</tr>
<tr>
<td>800A</td>
<td>CM500HC-90R</td>
<td>CM500HG-90R</td>
</tr>
<tr>
<td>900A</td>
<td>CM500HG-90X**</td>
<td>CM500HG-90H</td>
</tr>
<tr>
<td>1000A</td>
<td>CM100HG-90X**</td>
<td>CM100HG-90H</td>
</tr>
<tr>
<td>1350A</td>
<td>CM1350HG-90X**</td>
<td>CM1350HG-90H</td>
</tr>
<tr>
<td>1500A</td>
<td>CM1500HG-90X**</td>
<td>CM1500HG-90H</td>
</tr>
<tr>
<td>3000A</td>
<td>CM600HG-90X**</td>
<td>CM600HG-90H</td>
</tr>
</tbody>
</table>

[Type]
- ★★: Under Development
- ★: New Product
- B: Cu base plate 6kV Isolation
- C: AlSiC base plate 6kV Isolation
- G: AlSiC base plate 10kV Isolation

![Connection Diagram]

Connection:
- H
- E2/E6
- E4
- D2

Series: X-Series, R-Series, H-Series, X-Series, R-Series, H-Series

### Line-up of HVDIODE Modules

#### Series Matrix of HVDIODE Modules

<table>
<thead>
<tr>
<th>Type</th>
<th>Connection</th>
<th>1700V</th>
<th>3300V</th>
<th>4500V</th>
<th>6500V</th>
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</thead>
<tbody>
<tr>
<td>IF(A)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
<td>RM200DG-130S</td>
<td>D G 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td></td>
<td>RM250DG-130F</td>
<td>D G 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td></td>
<td>RM300DG-90S</td>
<td>D G 24</td>
<td>RM300DG-1300**</td>
<td>D G 24</td>
</tr>
<tr>
<td>400</td>
<td>RM400DG-66S</td>
<td>RM400DG-90F</td>
<td>D G 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>450</td>
<td></td>
<td>RM450DG-90X**</td>
<td>D G 24</td>
<td>RM450DG-1300**</td>
<td>D G 24</td>
</tr>
<tr>
<td>600</td>
<td>RM600DG-66S</td>
<td>RM600HE-90S</td>
<td>H C 23</td>
<td>RM600DG-1300**</td>
<td>D G 24</td>
</tr>
<tr>
<td>800</td>
<td>RM800DC-34X**</td>
<td>RM800DG-90F</td>
<td>D G 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>900</td>
<td>RM900DG-66X**</td>
<td>RM900HC-90S</td>
<td>H C 27</td>
<td>RM900DG-90X**</td>
<td>D G 24</td>
</tr>
<tr>
<td>1000</td>
<td>RM1000DC-66F</td>
<td>RM1000DG-130X**</td>
<td>D G 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td>RM1200DG-66S</td>
<td>RM1200DG-90F</td>
<td>D D 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1500</td>
<td>RM1500HC-90S</td>
<td>RM1500DC-90X**</td>
<td>D C 26</td>
<td>RM1500DG-90X**</td>
<td>D G 24</td>
</tr>
<tr>
<td>1800</td>
<td>RM1800HE-34S</td>
<td>RM1800HE-34S</td>
<td>D C 21</td>
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<td></td>
</tr>
</tbody>
</table>

**CM: IGBT, RM: DIODE, PM: IPM**

#### Evolution of HVIGBT Module Series

<table>
<thead>
<tr>
<th>Voltage (kV)</th>
<th>H Series</th>
<th>N Series</th>
<th>S Series</th>
<th>X Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.7</td>
<td>std type</td>
<td>std type</td>
<td>std type</td>
<td>std type</td>
</tr>
<tr>
<td>2.5</td>
<td>std type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td>std type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>std type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5</td>
<td>std type</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Evolution of HVDIODE Module Series

<table>
<thead>
<tr>
<th>Voltage (kV)</th>
<th>S Series</th>
<th>X Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Type Name Definition of IGBT Modules

- **CM**: IGBT Modules
- **RM**: DIODE Modules
- **PM**: IPM Modules
Line-up of HVDIODE Modules

C: AlSiC
B: Cu

Evolution of HVDIODE Module Series

Connection

IF(A)
1500
1200
1000
4.5kV
3.3kV
1.7kV
6.5kV
4.5kV

Series Matrix of HVDIODE Modules (No.: Number of outline drawing, see page 31)

base plate

H Series
S Series
X Series
std type

Isolation

1.7kV

CM, IGBT, RM: DIODE, PM: IPM

Type Name Definition

Rating current

Connection type

CM1200, 1600HC-34H
CM800HB-50, -66H
CM800HC-66H

CM1200DC-34H
CM800E2Y-34H
CM600E2Y-34H

CM1200DG-90F
RM800DG-90F
GD 24
CM 1800 H C -66 X

CM1800, 2400HC-34N
CM1800, 2400HC-34H
CM1200HB/HC-50H, -66H
CM800E4C/E6C-66H
CM900HC-90H

CM400HG-66H
CM200HG-130H

CM1000HC-66R
CM800HC-90R

CM1200HG-66H
CM900HC-90H
CM400E2G/E4G-130H
CM600HG-130H

Unit: mm
Line-up of HVIGBT Modules

Outline Drawing of HVIGBT Modules

10
CM1000E4C-66R
CM1500HC-66R
CM1200HC-90R
CM1200HC-90RA

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

12
CM600HG-90H
CM400HG-130H

13
CM800HG-90R

14
PM1200HCE330-1

15
CM400DY-50H/66H

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

17
CM2400HCB-34X, CM3600HC-34X
CM1200E4C-66X, CM1200HCB-66X
CM1800HC-66X
CM1350HC-90X
CM1500HC-90X

18
CM900HG-90X
CM1000HG-90X
CM600HG-130X

Unit: mm
Line-up of HVIGBT Modules

CM1200E4C-34X
CM1000E4C-66R

Outline Drawing of HVIGBT Modules
Unit:mm

CM1200HC-66X
CM2400HC-34X
CM1500HC-66R
CM1200HC-90R
CM1200HC-90RA

CM1800HG-66X
CM900HGB-90X, CM900E4G-90X
CM1350HG-90X, CM1500HG-90X
CM600HGB-130X, CM600E4G-130X
CM900HG-130X, CM1000HG-130X

CM900HGB-90X, CM900E4G-90X
CM900HG-130X, CM1000HG-130XA

CM600HGB-130X, CM600E4G-130X
CM400DY-50H/66H

CM450DG-66X, CM600DG-66X
CM225DG-130X, CM300DG-130X
CM450DC-66X
CM600DC-66X
CM1000DC-34X
CM350DG-90X, CM450DG-90X
CM225DG-130X, CM300DG-130X
Line-up of MOSFET Modules

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

### Series Matrix of MOSFET Modules

<table>
<thead>
<tr>
<th>Io (A)</th>
<th>75V</th>
<th>100V</th>
<th>150V</th>
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</thead>
<tbody>
<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>

### Outline Drawing of MOSFET Modules

Unit: mm

![Outline Drawing of MOSFET Modules](image-url)
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

<Main Features>
- Integrated direct water-cooling structure with cooling fins and 6-in-1 connection to more compact inverters for EVs/HEVs
- Direct lead bonding (DLB) structure ensures high reliability
- Loss further reduced by incorporating 7th-generation IGBT built with a CSTBT™ structure
- Completely lead-free, conforms to RoHS directives (2011/65/EU)
- Suitable for a variety of electric and hybrid vehicle inverters

* CSTBT™: Mitsubishi Electric’s unique IGBT that utilizes the carrier cumulative effect.

![Block Diagram]

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

J Series T-PM (Transfer-molded Power Module)
- Structure incorporates transfer molding and original direct lead bonding (DLB) 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>Series (A)</th>
<th>J Series</th>
<th>650V</th>
<th>J Series</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>500</td>
<td></td>
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<tr>
<td>300</td>
<td></td>
<td>Power Module with pin fin</td>
<td>Connection No.</td>
<td>T-PM</td>
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<tr>
<td>600</td>
<td>CT600CJ1A060</td>
<td>C 01</td>
<td>-</td>
<td>CT300DJK060 **</td>
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<tr>
<td>700</td>
<td>CT700CJ1A060</td>
<td>C 01</td>
<td>-</td>
<td></td>
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<tr>
<td>1000</td>
<td>CT1000CJ1B060</td>
<td>C 03</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Connection:

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

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Series (A)</th>
<th>1200V</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td>300</td>
<td>CT300CJ1A120 **</td>
<td>C 01</td>
</tr>
<tr>
<td>600</td>
<td>CT600CJ1B120</td>
<td>C 03</td>
</tr>
</tbody>
</table>

Connection:

Type Name Definition of Power Modules for Electric and Hybrid Vehicles

CT 600 C J1B 120

Voltage class
Series name and structure
Connection type
Rating current class
CT: IGBT

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

---

**Features**
- Completely Pb-free (including the pins)
- High-precision on-chip temperature sensor
- Common inductance
- DLB structure reduces internal wiring resistance and lead bonding (DLB) technique
- Structure incorporates transfer molding and original direct block (J1 Series) realizes a further reduction in loss

**New Products**
- (Transfer-molded Power Module)

**Connection**
- On-chip current sensor that enables high-speed current-cutoff protection is installed
- Installation of the 7th generation IGBT adapting the CSTB™ technology
- Cooling fin integrated direct water-cooled structure and 6-in-1 cooling fin structure realizes high reliability

**Ordering Information**

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Voltage class</th>
<th>Rating current class</th>
</tr>
</thead>
<tbody>
<tr>
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<td>600V</td>
<td>2.54 A</td>
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<td>02</td>
<td>CT700CJ1A060</td>
<td>700V</td>
<td>3.54 A</td>
</tr>
<tr>
<td>03</td>
<td>CT300CJ1A120</td>
<td>300V</td>
<td>6.75 A</td>
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<tr>
<td>04</td>
<td>CT600CJ1A060</td>
<td>600V</td>
<td>12.4 A</td>
</tr>
<tr>
<td>05</td>
<td>CT700CJ1A060</td>
<td>700V</td>
<td>23.8 A</td>
</tr>
<tr>
<td>06</td>
<td>CT1000CJ1B060</td>
<td>1000V</td>
<td>43.2 A</td>
</tr>
</tbody>
</table>

**Dimensions**

Unit: mm

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**Outline Drawing of Power Modules for Electric and Hybrid Vehicles**