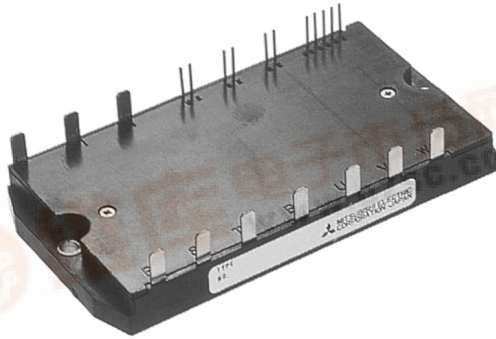


# CM50MD1-12H

MEDIUM POWER SWITCHING USE  
FLAT-BASE TYPE, INSULATED TYPE

## CM50MD1-12H



- IC ..... 50A
- VCES ..... 600V
- Insulated Type
- CIB Module  
3φ Inverter+3φ Converter
- UL Recognized

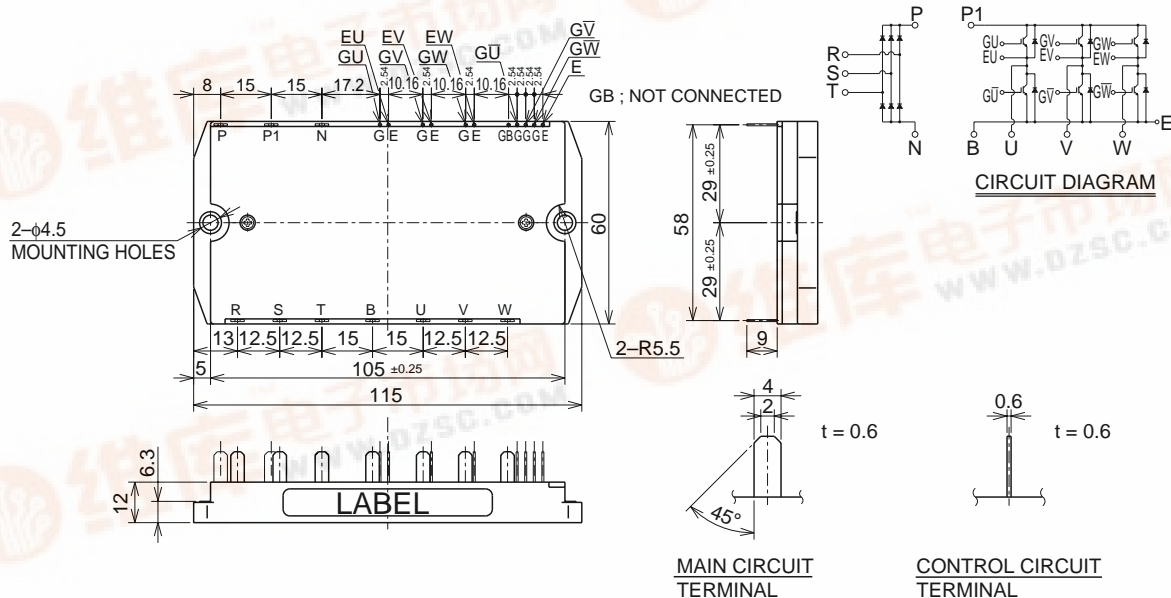
Yellow Card No. E80276 (N)  
File No. E80271

## APPLICATION

AC & DC motor controls, General purpose inverters, Servo controls, NC, Robotics, UPS

## OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



**CM50MD1-12H**MEDIUM POWER SWITCHING USE  
FLAT-BASE TYPE, INSULATED TYPE**MAXIMUM RATINGS** ( $T_j = 25^\circ\text{C}$ )**INVERTER PART**

| Symbol                    | Parameter                     | Condition             | Rating | Unit |
|---------------------------|-------------------------------|-----------------------|--------|------|
| V <sub>CES</sub>          | Collector-emitter voltage     | G – E Short           | 600    | V    |
| V <sub>GES</sub>          | Gate-emitter voltage          | C – E Short           | ±20    | V    |
| I <sub>C</sub>            | Collector Current             | T <sub>c</sub> = 25°C | 50     | A    |
| I <sub>CM</sub>           |                               | PULSE (Note. 2)       | 100    | A    |
| I <sub>E</sub> (Note. 1)  | Emitter Current               | T <sub>c</sub> = 25°C | 50     | A    |
| I <sub>EM</sub> (Note. 1) |                               | PULSE (Note. 2)       | 100    | A    |
| P <sub>C</sub> (Note. 3)  | Maximum collector dissipation | T <sub>f</sub> = 25°C | 104    | W    |

**CONVERTER PART**

| Symbol           | Parameter                              | Condition                                    | Rating              | Unit             |
|------------------|--|--|---------------------|------------------|
| V <sub>RRM</sub> | Repetitive peak reverse voltage        |  | 800                 | V                |
| E <sub>a</sub>   | Recommended AC input voltage           |  | 220                 | V                |
| I <sub>O</sub>   | DC output current                      | 3φ rectifying circuit T <sub>f</sub> = 106°C | 50                  | A                |
| I <sub>FSM</sub> | Surge (non-repetitive) forward current | 1 cycle at 60Hz, peak value Non-repetitive   | 550                 | A                |
| I <sup>2</sup> t | I <sup>2</sup> t for fusing            | Value for one cycle of surge current         | 1.2X10 <sup>3</sup> | A <sup>2</sup> s |

**COMMON RATING**

| Symbol           | Parameter            | Condition         | Rating     | Unit |
|------------------|----------------------|-------------------|------------|------|
| T <sub>j</sub>   | Junction temperature |                   | -40 ~ +150 | °C   |
| T <sub>stg</sub> | Storage temperature  |                   | -40 ~ +125 | °C   |
| V <sub>iso</sub> | Isolation voltage    | AC 1 min.         | 2500       | V    |
| —                | Mounting torque      | Mounting M4 screw | 0.98 ~1.47 | N·m  |
| —                | Weight               | Typical value     | 100        | g    |

## CM50MD1-12H

MEDIUM POWER SWITCHING USE  
FLAT-BASE TYPE, INSULATED TYPEELECTRICAL CHARACTERISTICS ( $T_j = 25^\circ\text{C}$ )

## INVERTER PART

| Symbol                   | Parameter                            | Test conditions                          | Limits |      |      | Unit               |
|--------------------------|--------------------------------------|--|--------|------|------|--------------------|
|                          |                                      |  | Min.   | Typ. | Max. |                    |
| ICES                     | Collector cutoff current             | $V_{CE} = V_{CES}, V_{GE} = 0V$          | —      | —    | 1    | mA                 |
| $V_{GE(th)}$             | Gate-emitter threshold voltage       | $I_C = 5mA, V_{CE} = 10V$                | 4.5    | 6    | 7.5  | V                  |
| IGES                     | Gate-emitter cutoff current          | $V_{GE} = V_{GES}, V_{CE} = 0V$          | —      | —    | 0.5  | $\mu A$            |
| $V_{CE(sat)}$            | Collector-emitter saturation voltage | $T_j = 25^\circ\text{C}$                 | —      | 2.2  | 2.8  | V                  |
|                          |                                      | $T_j = 150^\circ\text{C}$                | —      | —    | —    |                    |
| $C_{ies}$                | Input capacitance                    | $V_{CE} = 10V$<br>$V_{GE} = 0V$          | —      | —    | 5.0  | nF                 |
| $C_{oes}$                | Output capacitance                   |  | —      | —    | 3.8  | nF                 |
| $C_{res}$                | Reverse transfer capacitance         |  | —      | —    | 1.0  | nF                 |
| QG                       | Total gate charge                    | $V_{CC} = 300V, I_C = 50A, V_{GE} = 15V$ | —      | 150  | —    | nC                 |
| $t_{d(on)}$              | Turn-on delay time                   | $V_{CC} = 300V, I_C = 50A$               | —      | —    | 120  | ns                 |
| $t_r$                    | Turn-on rise time                    | $V_{GE1} = V_{GE2} = 15V$                | —      | —    | 300  | ns                 |
| $t_{d(off)}$             | Turn-off delay time                  | $R_G = 13\Omega$                         | —      | —    | 200  | ns                 |
| $t_f$                    | Turn-off fall time                   | Resistive load                           | —      | —    | 300  | ns                 |
| $V_{EC}$ (Note. 1)       | Emitter-collector voltage            | $I_E = 50A, V_{GE} = 0V$                 | —      | —    | 2.8  | V                  |
| $t_{rr}$ (Note. 1)       | Reverse recovery time                | $I_E = 50A, V_{GE} = 0V$                 | —      | —    | 110  | ns                 |
| $Q_{rr}$ (Note. 1)       | Reverse recovery charge              | $di_e / dt = -100A / \mu s$              | —      | 0.14 | —    | $\mu C$            |
| $R_{th(j-f)Q}$ (Note. 5) | Thermal resistance                   | IGBT part, Per 1/6 module                | —      | —    | 1.2  | $^\circ\text{C/W}$ |
| $R_{th(j-f)R}$ (Note. 5) |                                      | FWDi part, Per 1/6 module                | —      | —    | 1.9  | $^\circ\text{C/W}$ |

## CONVERTER PART

| Symbol                  | Parameter                  | Condition                                | Limits |      |      | Unit               |
|-------------------------|----------------------------|--|--------|------|------|--------------------|
|                         |                            |  | Min.   | Typ. | Max. |                    |
| IRRM                    | Repetitive reverse current | $V_R = V_{RRM}, T_j = 150^\circ\text{C}$ | —      | —    | 8    | mA                 |
| V <sub>FM</sub>         | Forward voltage drop       | $I_F = 50A$                              | —      | —    | 1.5  | V                  |
| $R_{th(j-f)}$ (Note. 5) | Thermal resistance         | Per 1/6 module                           | —      | —    | 1.7  | $^\circ\text{C/W}$ |

Note 1.  $I_E$ ,  $V_{EC}$ ,  $t_{rr}$ ,  $Q_{rr}$  &  $di_e/dt$  represent characteristics of the anti-parallel, emitter to collector free-wheel diode.

2. Pulse width and repetition rate should be such that the device junction temp. ( $T_j$ ) does not exceed  $T_{jmax}$  rating.

3. Junction temperature ( $T_j$ ) should not increase beyond  $150^\circ\text{C}$ .

4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

5. Thermal resistance is specified under following conditions.

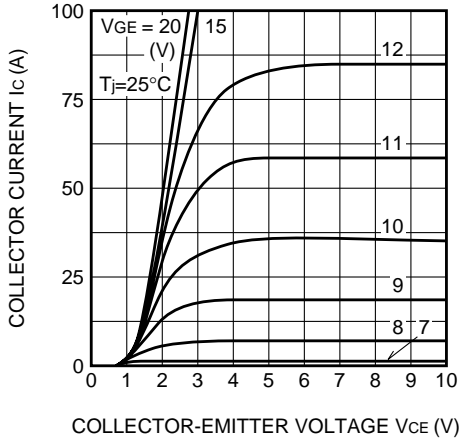
- The conductive grease applied, between module and fin.
- Al plate is used as fin.

# CM50MD1-12H

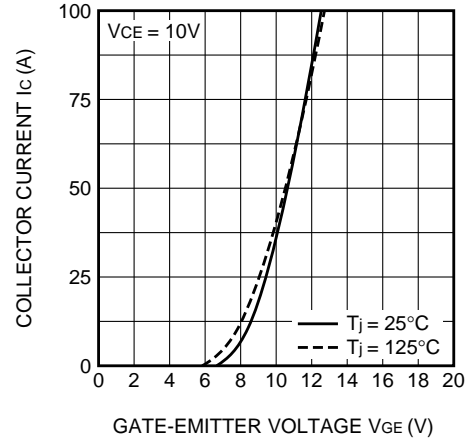
MEDIUM POWER SWITCHING USE  
FLAT-BASE TYPE, INSULATED TYPE

## PERFORMANCE CURVES

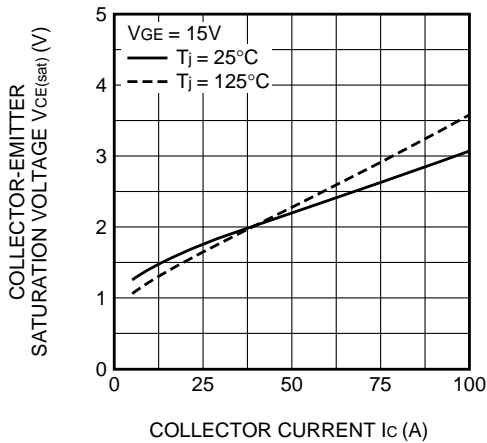
OUTPUT CHARACTERISTICS  
(TYPICAL)



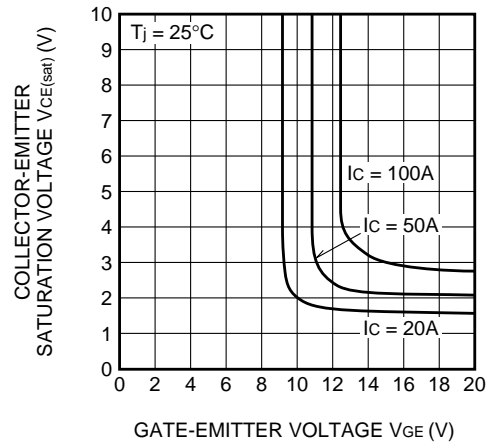
TRANSFER CHARACTERISTICS  
(TYPICAL)



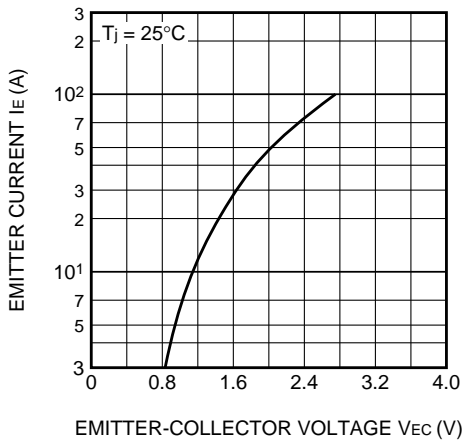
COLLECTOR-EMITTER SATURATION  
VOLTAGE CHARACTERISTICS  
(TYPICAL)



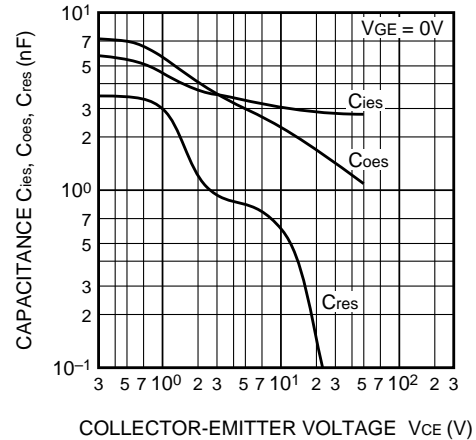
COLLECTOR-EMITTER SATURATION  
VOLTAGE CHARACTERISTICS  
(TYPICAL)



FREE-WHEEL DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)



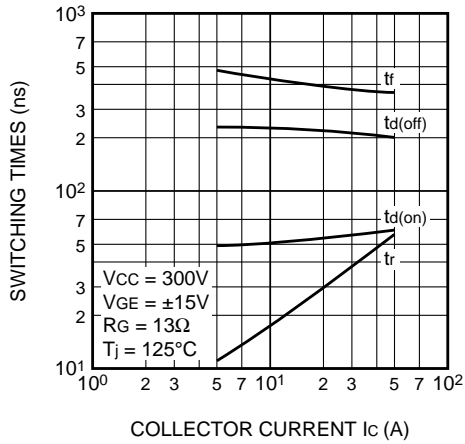
CAPACITANCE VS.  $V_{ce}$   
(TYPICAL)



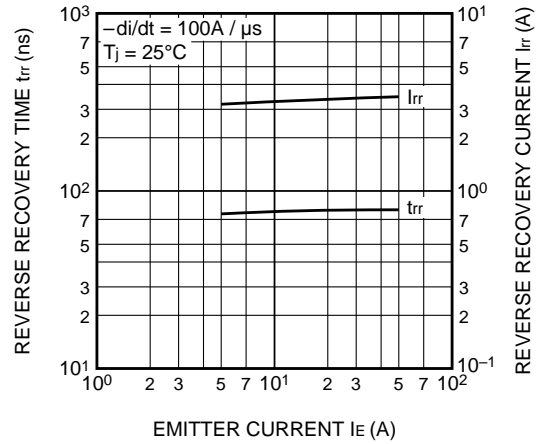
# CM50MD1-12H

MEDIUM POWER SWITCHING USE  
FLAT-BASE TYPE, INSULATED TYPE

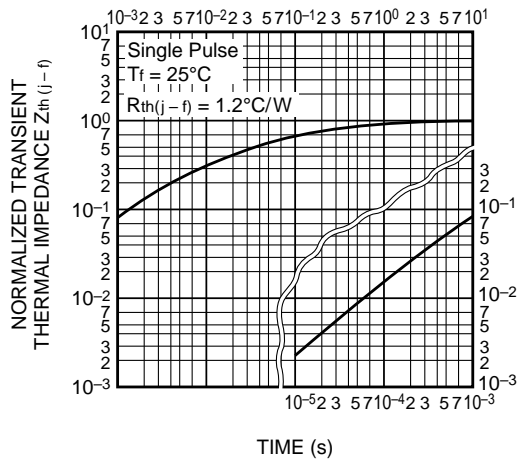
**HALF-BRIDGE  
SWITCHING CHARACTERISTICS  
(TYPICAL)**



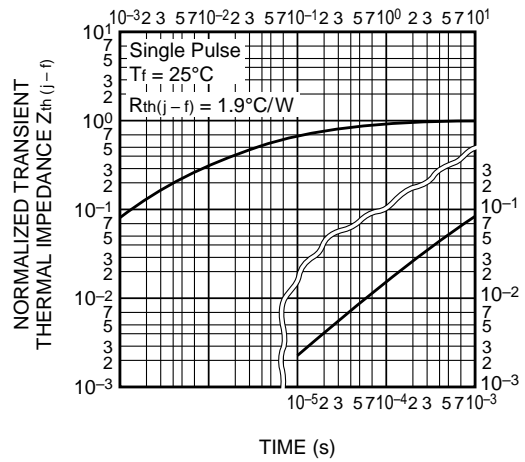
**REVERSE RECOVERY CHARACTERISTICS  
OF FREE-WHEEL DIODE  
(TYPICAL)**



**TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(IGBT part)**



**TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(FWDi part)**



**V<sub>GE</sub> - GATE CHARGE  
(TYPICAL)**

