

# MITSUBISHI IGBT MODULES

## CM150DX-24A

HIGH POWER SWITCHING USE

### CM150DX-24A



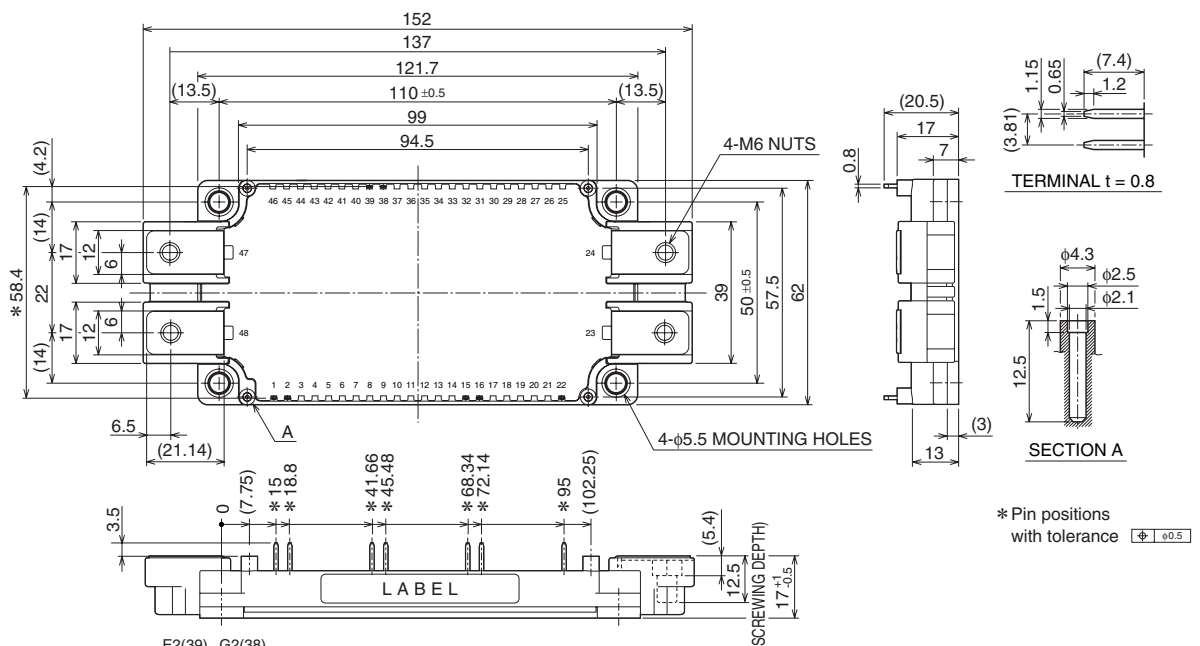
- Ic ..... 150A
- VCES ..... 1200V
- Dual
- Flatbase Type / Insulated Package /  
Copper (non-plating) base plate
- RoHS Directive compliant

### APPLICATION

General purpose Inverters, Servo Amplifiers, Power supply, etc.

### OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



\* Pin positions  
with tolerance  $\pm 0.5$

Tolerance otherwise specified

| Division of Dimension | Tolerance |
|-----------------------|-----------|
| 0.5 to 3              | ±0.2      |
| over 3 to 6           | ±0.3      |
| over 6 to 30          | ±0.5      |
| over 30 to 120        | ±0.8      |
| over 120 to 400       | ±1.2      |

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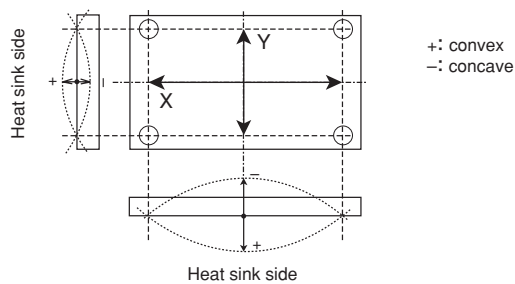
## HIGH POWER SWITCHING USE

### ABSOLUTE MAXIMUM RATINGS (Tj = 25°C, unless otherwise specified)

#### INVERTER PART

| Symbol                    | Parameter                             | Conditions                                     | Rating     | Unit |
|---------------------------|---------------------------------------|------------------------------------------------|------------|------|
| V <sub>CES</sub>          | Collector-emitter voltage             | G-E Short                                      | 1200       | V    |
| V <sub>GES</sub>          | Gate-emitter voltage                  | C-E Short                                      | ±20        |      |
| I <sub>C</sub>            | Collector current                     | DC, Tc = 91°C (Note. 1)                        | 150        | A    |
| I <sub>CRM</sub>          |                                       | Pulse (Note. 4)                                | 300        |      |
| P <sub>C</sub>            | Maximum collector dissipation         | Tc = 25°C (Note. 1, 5)                         | 960        | W    |
| I <sub>E</sub> (Note.3)   | Emitter current                       | Tc = 25°C (Note. 1)                            | 150        | A    |
| I <sub>ERM</sub> (Note.3) | (Free wheeling diode forward current) | Pulse (Note. 4)                                | 300        |      |
| T <sub>j</sub>            | Junction temperature                  |                                                | -40 ~ +150 | °C   |
| T <sub>stg</sub>          | Storage temperature                   |                                                | -40 ~ +125 |      |
| V <sub>iso</sub>          | Isolation voltage                     | Terminals to base plate, f = 60Hz, AC 1 minute | 2500       | Vrms |
| —                         | Base plate flatness                   | On the centerline X, Y (Note. 8)               | ±0 ~ +100  | μm   |
| —                         | Torque strength                       | Main terminals M6 screw                        | 3.5 ~ 4.5  | N·m  |
| —                         | Torque strength                       | Mounting M5 screw                              | 2.5 ~ 3.5  |      |
| —                         | Weight                                | (Typical)                                      | 330        | g    |

Note. 8: The base plate flatness measurement points are in the following figure.



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## HIGH POWER SWITCHING USE

### ELECTRICAL CHARACTERISTICS (T<sub>j</sub> = 25°C, unless otherwise specified)

#### INVERTER PART

| Symbol       | Parameter                                                | Conditions                                           | Limits |       |      | Unit |
|--------------|----------------------------------------------------------|------------------------------------------------------|--------|-------|------|------|
|              |                                                          |                                                      | Min.   | Typ.  | Max. |      |
| ICES         | Collector cutoff current                                 | VCE = VCES, VGE = 0V                                 | —      | —     | 1    | mA   |
| VGE(th)      | Gate-emitter threshold voltage                           | IC = 15mA, VCE = 10V                                 | 6      | 7     | 8    | V    |
| IGES         | Gate leakage current                                     | ±VGE = VGES, VCE = 0V                                | —      | —     | 0.5  | μA   |
| VCE(sat)     | Collector-emitter saturation voltage                     | IC = 150A, VGE = 15V (Note. 6) T <sub>j</sub> = 25°C | —      | 2.0   | 2.6  | V    |
|              |                                                          | T <sub>j</sub> = 125°C                               | —      | 2.2   | —    |      |
|              |                                                          | Chip                                                 | —      | 1.9   | —    |      |
| Cies         | Input capacitance                                        | VCE = 10V<br>VGE = 0V (Note. 6)                      | —      | —     | 23   | nF   |
| Coes         | Output capacitance                                       |                                                      | —      | —     | 2.0  |      |
| Cres         | Reverse transfer capacitance                             |                                                      | —      | —     | 0.45 |      |
| QG           | Total gate charge                                        | VCC = 600V, IC = 150A, VGE = 15V                     | —      | 675   | —    | nC   |
| td(on)       | Turn-on delay time                                       | VCC = 600V, IC = 150A                                | —      | —     | 130  | ns   |
| tr           | Turn-on rise time                                        | VGE = ±15V, RG = 2.2Ω                                | —      | —     | 100  |      |
| td(off)      | Turn-off delay time                                      | Inductive load                                       | —      | —     | 450  |      |
| tf           | Turn-off fall time                                       |                                                      | —      | —     | 600  |      |
| trr (Note.3) | Reverse recovery time                                    |                                                      | —      | —     | 150  |      |
| Qrr (Note.3) | Reverse recovery charge                                  | (IE = 150A)                                          | —      | 6.0   | —    | μC   |
| VEC(Note.3)  | Emitter-collector voltage                                | IE = 150A, VGE = 0V (Note. 6) T <sub>j</sub> = 25°C  | —      | 2.6   | 3.4  | V    |
|              |                                                          | T <sub>j</sub> = 125°C                               | —      | 2.16  | —    |      |
|              |                                                          | Chip                                                 | —      | 2.5   | —    |      |
| Rlead        | Module lead resistance                                   | Main terminals-chip, per switch                      | —      | 1.6   | —    | mΩ   |
| Rth(j-c)Q    | Thermal resistance                                       | per IGBT                                             | —      | —     | 0.13 | K/W  |
| Rth(j-c)R    | (Junction to case) (Note. 1)                             | per free wheeling diode                              | —      | —     | 0.23 |      |
| Rth(c-f)     | Contact thermal resistance (Case to heat sink) (Note. 1) | Thermal grease applied per 1 module (Note. 2)        | —      | 0.015 | —    |      |
| RGint        | Internal gate resistance                                 | Tc = 25°C, per switch                                | —      | 0     | —    | Ω    |
| RG           | External gate resistance                                 |                                                      | 2.0    | —     | 21   |      |

#### NTC THERMISTOR PART

| Symbol   | Parameter               | Conditions                          | Limits |      |      | Unit |
|----------|-------------------------|-------------------------------------|--------|------|------|------|
|          |                         |                                     | Min.   | Typ. | Max. |      |
| R        | Zero power resistance   | Tc = 25°C                           | 4.85   | 5.00 | 5.15 | kΩ   |
| ΔR/R     | Deviation of resistance | Tc = 100°C, R <sub>100</sub> = 493Ω | -7.3   | —    | +7.8 | %    |
| B(25/50) | B constant              | Approximate by equation (Note. 7)   | —      | 3375 | —    | K    |
| P25      | Power dissipation       | Tc = 25°C                           | —      | —    | 10   | mW   |

Note. 1: Case temperature (Tc), heat sink temperature (Tr) measured point is just under the chips. (Refer to the figure of the chip location.)

2: Typical value is measured by using thermally conductive grease of λ = 0.9W/(m·K).

3: IE, IERM, VEC, trr and Qrr represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (FWDi).

4: Pulse width and repetition rate should be such that the device junction temperature (Tj) dose not exceed Tjmax rating.

5: Junction temperature (Tj) should not increase beyond 150°C.

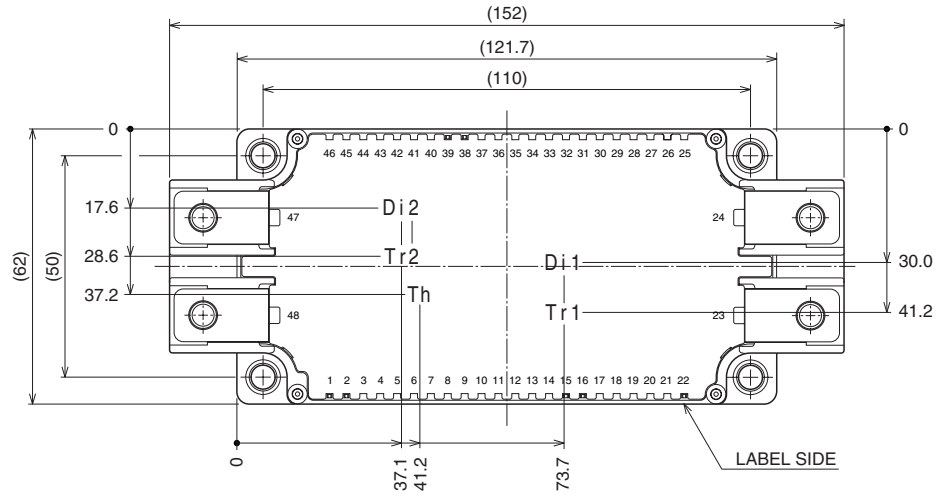
6: Pulse width and repetition rate should be such as to cause negligible temperature rise.

(Refer to the figure of the test circuit for VCE(sat) and VEC)

$$7: B(25/50) = \ln \left( \frac{R_{25}}{R_{50}} \right) / \left( \frac{1}{T_{25}} - \frac{1}{T_{50}} \right)$$

R<sub>25</sub>: resistance at absolute temperature T<sub>25</sub> [K]; T<sub>25</sub> = 25 [°C]+273.15 = 298.15 [K]

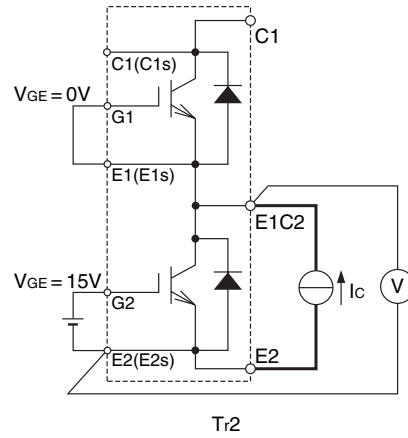
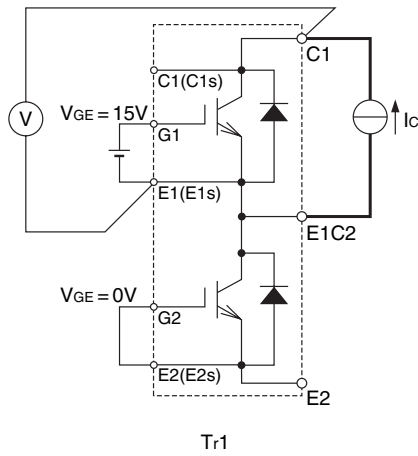
R<sub>50</sub>: resistance at absolute temperature T<sub>50</sub> [K]; T<sub>50</sub> = 50 [°C]+273.15 = 323.15 [K]

**CM150DX-24A****HIGH POWER SWITCHING USE****Chip Location (Top view)**Dimensions in mm (tolerance:  $\pm 1$ mm)

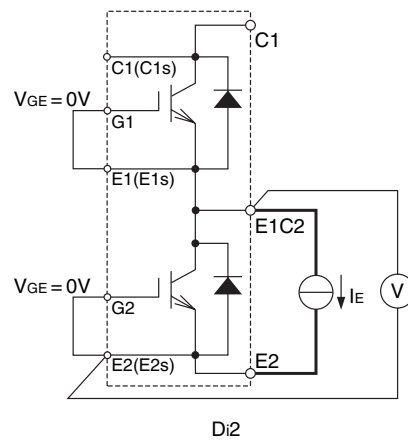
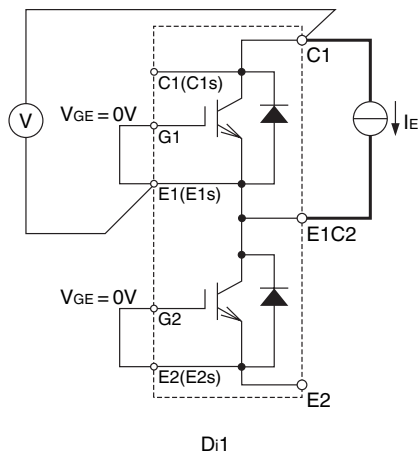
Each mark points the center position of each chip. Tr\*: IGBT, Di\*: FWDi, Th: NTC thermistor

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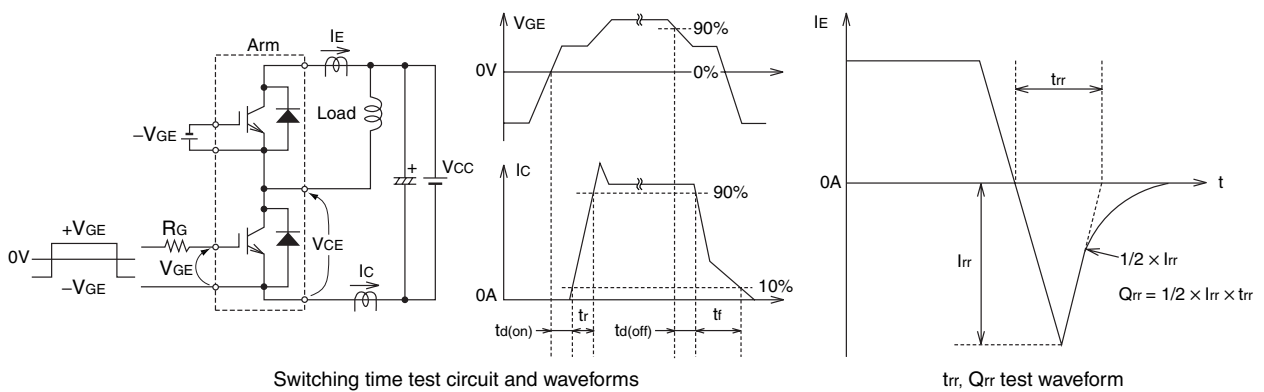
HIGH POWER SWITCHING USE



VCE(sat) test circuit



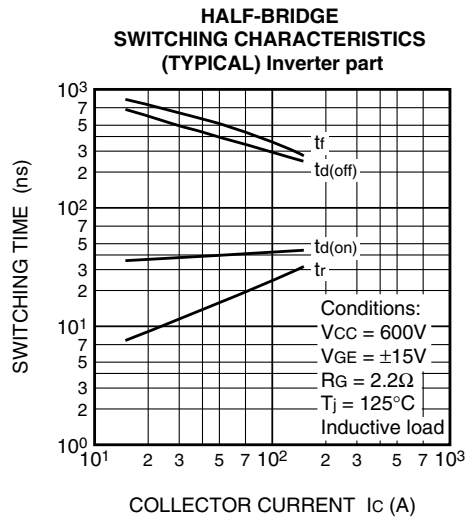
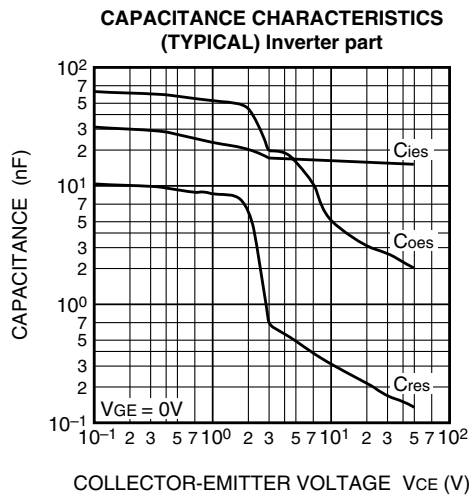
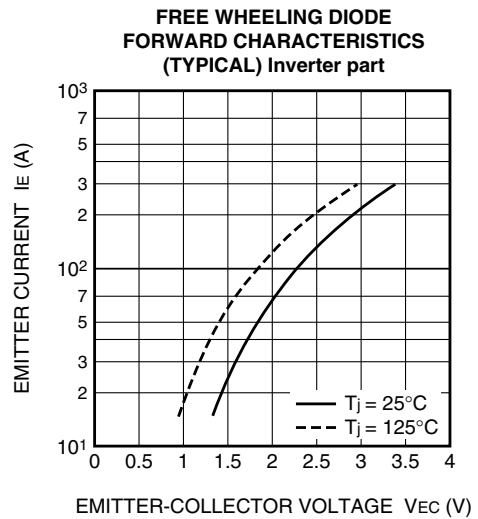
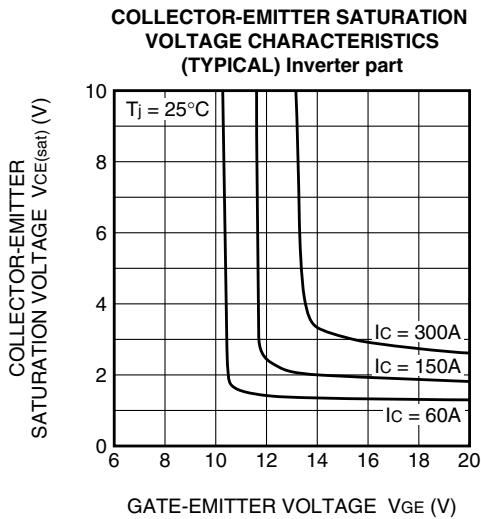
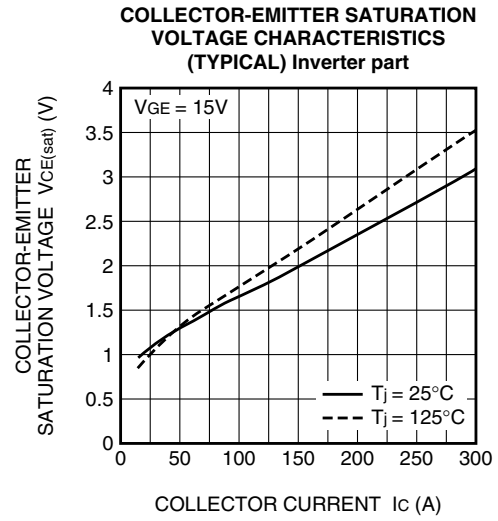
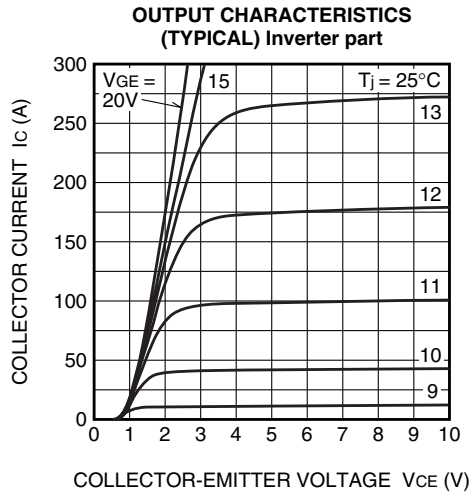
VEC test circuit



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HIGH POWER SWITCHING USE

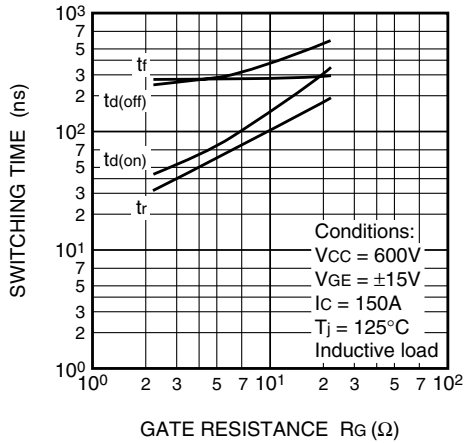
## PERFORMANCE CURVES



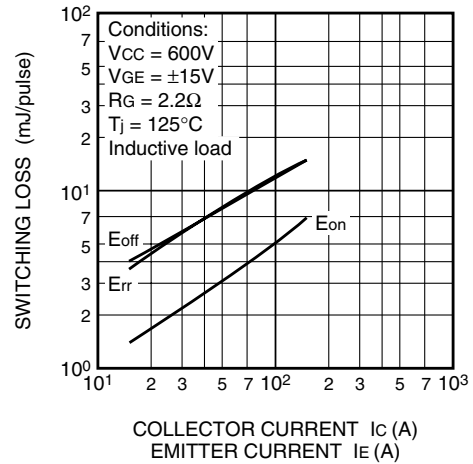
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## HIGH POWER SWITCHING USE

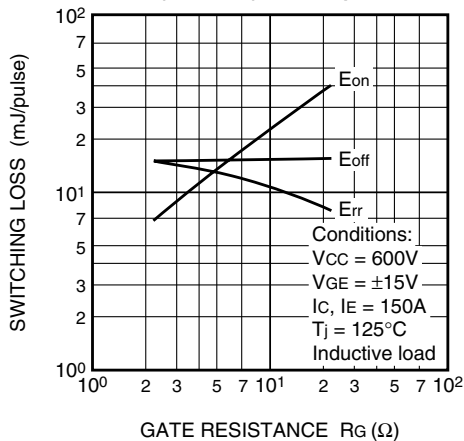
**HALF-BRIDGE  
SWITCHING CHARACTERISTICS  
(TYPICAL) Inverter part**



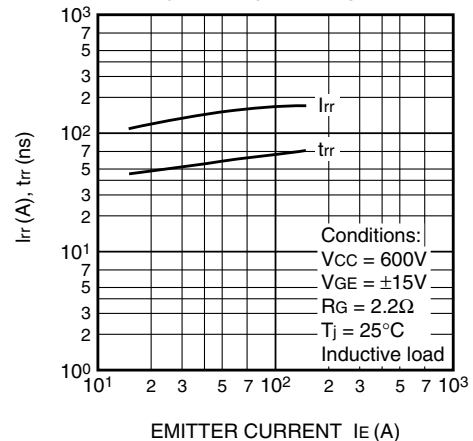
**HALF-BRIDGE  
SWITCHING CHARACTERISTICS  
(TYPICAL) Inverter part**



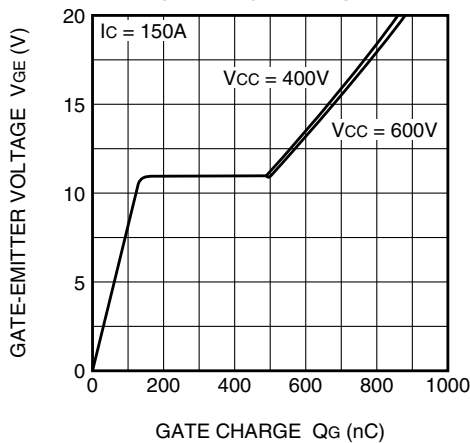
**HALF-BRIDGE  
SWITCHING CHARACTERISTICS  
(TYPICAL) Inverter part**



**REVERSE RECOVERY CHARACTERISTICS  
OF FREE WHEELING DIODE  
(TYPICAL) Inverter part**



**GATE CHARGE CHARACTERISTICS  
(TYPICAL) Inverter part**



**TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS**

