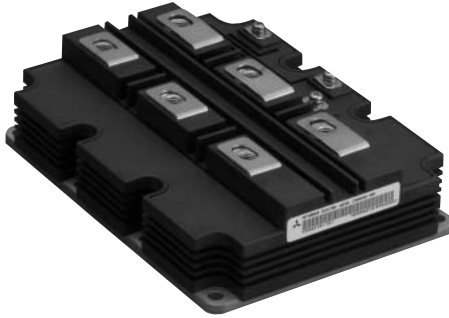


MITSUBISHI HVIGBT MODULES
CM600HG-130H

3rd-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

HIGH POWER SWITCHING USE
INSULATED TYPE

CM600HG-130H



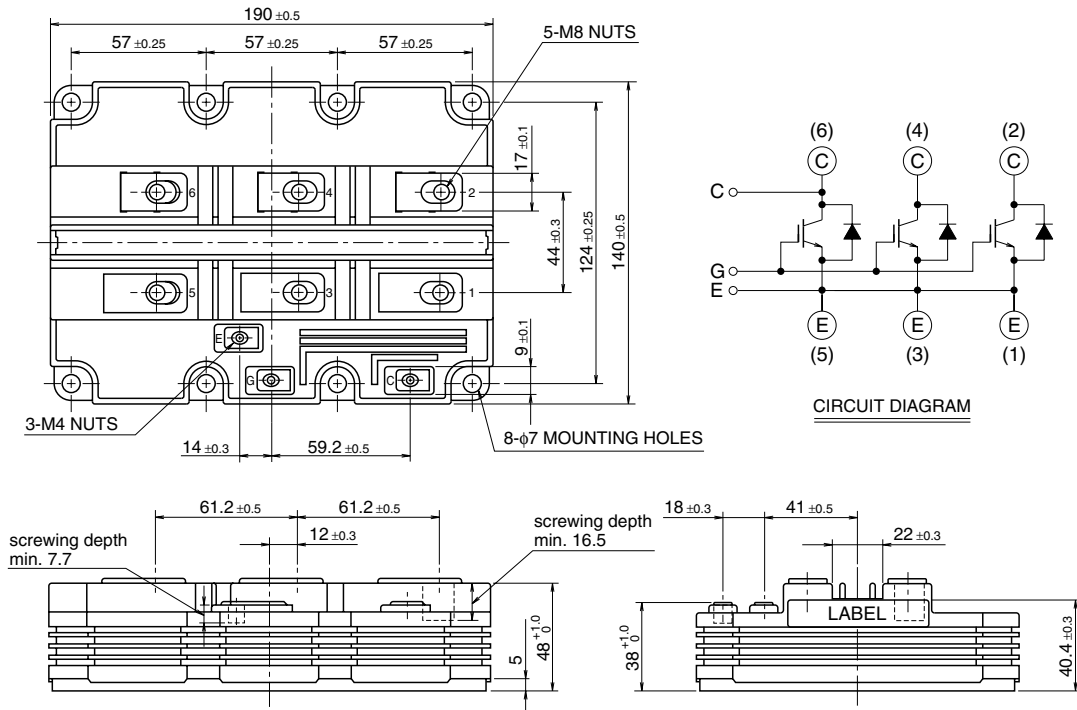
- IC 600 A
- VCES 6500 V
- High Insulated Type
- 1-element in a Pack
- AISiC Baseplate

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

May 2009

CM600HG-130H

**HIGH POWER SWITCHING USE
INSULATED TYPE**

3rd-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

MAXIMUM RATINGS

| Symbol | Item | Conditions | Ratings | Unit | |
|------------------|--------------------------------------|---|-------------------------|------|---|
| V _{CES} | Collector-emitter voltage | V _{GE} = 0V | T _J = -40°C | 5800 | V |
| | | | T _J = +25°C | 6300 | |
| | | | T _J = +125°C | 6500 | |
| V _{GES} | Gate-emitter voltage | V _{CE} = 0V, T _J = 25°C | ± 20 | V | |
| I _C | Collector current | DC, T _c = 80°C | 600 | A | |
| I _{CM} | | Pulse (Note 1) | 1200 | A | |
| I _E | Emitter current (Note 2) | DC | 600 | A | |
| I _{EM} | | Pulse (Note 1) | 1200 | A | |
| P _C | Maximum power dissipation (Note 3) | T _c = 25°C, IGBT part | 8900 | W | |
| V _{iso} | Isolation voltage | RMS, sinusoidal, f = 60Hz, t = 1 min. | 10200 | V | |
| V _e | Partial discharge extinction voltage | RMS, sinusoidal, f = 60Hz, Q _{PD} ≤ 10 pC | 5100 | V | |
| T _J | Junction temperature | | -40 ~ +150 | °C | |
| T _{op} | Operating temperature | | -40 ~ +125 | °C | |
| T _{stg} | Storage temperature | | -40 ~ +125 | °C | |
| t _{psc} | Maximum short circuit pulse width | V _{CC} = 4500V, V _{CE} ≤ V _{CES} , V _{GE} = 15V, T _J = 125°C | 10 | μs | |

ELECTRICAL CHARACTERISTICS

| Symbol | Item | Conditions | Limits | | | Unit | |
|-----------------------|--|---|--|------|------|------|----|
| | | | Min | Typ | Max | | |
| I _{CES} | Collector cutoff current | V _{CE} = V _{CES} , V _{GE} = 0V | T _J = 25°C | — | — | 10 | mA |
| | | | T _J = 125°C | — | 30 | 90 | |
| V _{GE(th)} | Gate-emitter threshold voltage | V _{CE} = 10 V, I _C = 60 mA, T _J = 25°C | 5.0 | 6.0 | 7.0 | V | |
| I _{GES} | Gate leakage current | V _{GE} = V _{GES} , V _{CE} = 0V, T _J = 25°C | -0.5 | — | 0.5 | μA | |
| C _{ies} | Input capacitance | V _{CE} = 10 V, V _{GE} = 0 V, f = 100 kHz, T _J = 25°C | — | 124 | — | nF | |
| C _{oes} | Output capacitance | | — | 7.6 | — | nF | |
| C _{res} | Reverse transfer capacitance | | — | 2.2 | — | nF | |
| Q _g | Total gate charge | | V _{CC} = 3600 V, I _C = 600 A, V _{GE} = ±15 V, T _J = 25°C | — | 9.9 | — | μC |
| V _{CE(sat)} | Collector-emitter saturation voltage | I _C = 600 A (Note 4) V _{GE} = 15 V | T _J = 25°C | — | 4.50 | — | V |
| | | | T _J = 125°C | — | 4.60 | — | |
| t _{d(on)} | Turn-on delay time | V _{CC} = 3600 V, I _C = 600 A, V _{GE} = ±15 V R _{G(on)} = 10 Ω, T _J = 125°C, L _s = 150 nH | — | 1.20 | — | μs | |
| t _r | Turn-on rise time | | — | 0.35 | — | μs | |
| E _{on(10%)} | Turn-on switching energy (Note 5) | t _(IGBT_off) = 60 μs ^(Note 6) , Inductive load | — | 4.50 | — | J/P | |
| t _{d(off)} | Turn-off delay time | V _{CC} = 3600 V, I _C = 600 A, V _{GE} = ±15 V R _{G(off)} = 33 Ω, T _J = 125°C, L _s = 150 nH Inductive load | — | 8.20 | — | μs | |
| t _f | Turn-off fall time | | — | 0.50 | — | μs | |
| t _{f2} | Turn-off fall time | | — | 3.10 | — | μs | |
| E _{off(10%)} | Turn-off switching energy (Note 5) | | — | 4.30 | — | J/P | |
| V _{EC} | Emitter-collector voltage (Note 2) | I _E = 600 A (Note 4) V _{GE} = 0 V | T _J = 25°C | — | 4.00 | — | V |
| | | | T _J = 125°C | — | 3.60 | — | |
| t _{rr} | Reverse recovery time (Note 2) | V _{CC} = 3600 V, I _E = 600 A, V _{GE} = ±15 V R _{G(on)} = 10 Ω, T _J = 125°C, L _s = 150 nH t _(IGBT_off) = 60 μs ^(Note 6) , Inductive load | — | 1.00 | — | μs | |
| t _{rr2} | Reverse recovery time (Note 2) | | — | 2.40 | — | μs | |
| Q _{rr} | Reverse recovery charge (Note 2) | | — | 1100 | — | μC | |
| E _{rec(10%)} | Reverse recovery energy (Note 2), (Note 5) | | — | 2.00 | — | J/P | |

CM600HG-130H

HIGH POWER SWITCHING USE
INSULATED TYPE

3rd-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

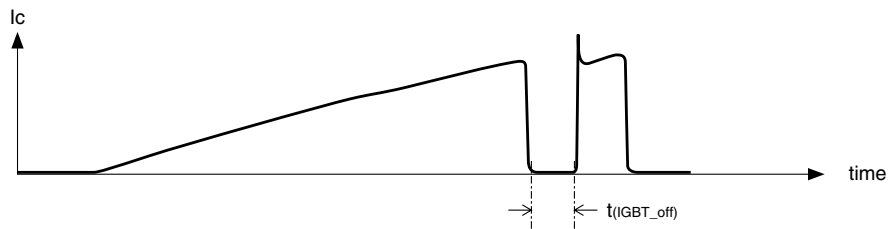
THERMAL CHARACTERISTICS

| Symbol | Item | Conditions | Limits | | | Unit |
|----------------|----------------------------|---|--------|-----|------|------|
| | | | Min | Typ | Max | |
| $R_{th(j-c)Q}$ | Thermal resistance | Junction to Case, IGBT part | — | — | 14.0 | K/kW |
| $R_{th(j-c)R}$ | Thermal resistance | Junction to Case, FWDi part | — | — | 22.0 | K/kW |
| $R_{th(c-f)}$ | Contact thermal resistance | Case to Fin, $\lambda_{grease} = 1W/m-K$, $D(c-f) = 100 \mu m$ | — | 6.0 | — | K/kW |

MECHANICAL CHARACTERISTICS

| Symbol | Item | Conditions | Limits | | | Unit |
|-------------|----------------------------|-------------------------------|--------|------|------|------|
| | | | Min | Typ | Max | |
| M_t | Mounting torque | M8: Main terminals screw | 7.0 | — | 15.0 | N·m |
| M_s | | M6: Mounting screw | 3.0 | — | 6.0 | N·m |
| M_t | | M4: Auxiliary terminals screw | 1.0 | — | 3.0 | N·m |
| m | Mass | | — | 1.35 | — | kg |
| CTI | Comparative tracking index | | 600 | — | — | — |
| d_a | Clearance | | 26 | — | — | mm |
| d_s | Creepage distance | | 56 | — | — | mm |
| LP CE | Internal inductance | | — | 17 | — | nH |
| R_{CC+EE} | Internal lead resistance | $T_c = 25^\circ C$ | — | 0.14 | — | mΩ |

- Note 1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{opmax} rating (125°C).
 2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWDi).
 3. Junction temperature (T_j) should not exceed T_{jmax} rating (150°C).
 4. Pulse width and repetition rate should be such as to cause negligible temperature rise.
 5. $E_{on(10\%)} / E_{off(10\%)} / E_{rec(10\%)}$ are the integral of $0.1V_{CE} \times 0.1I_c \times dt$.
 6. $t_{(IGBT_off)}$ definition is shown as follows.



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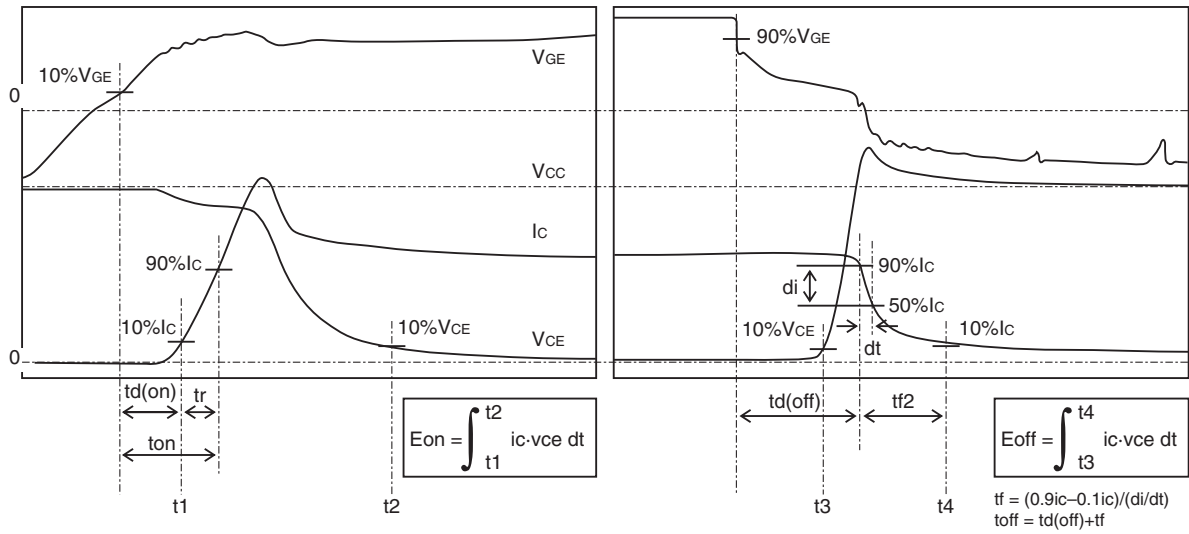


Fig. 1 – Definitions of switching times & energies of IGBT part

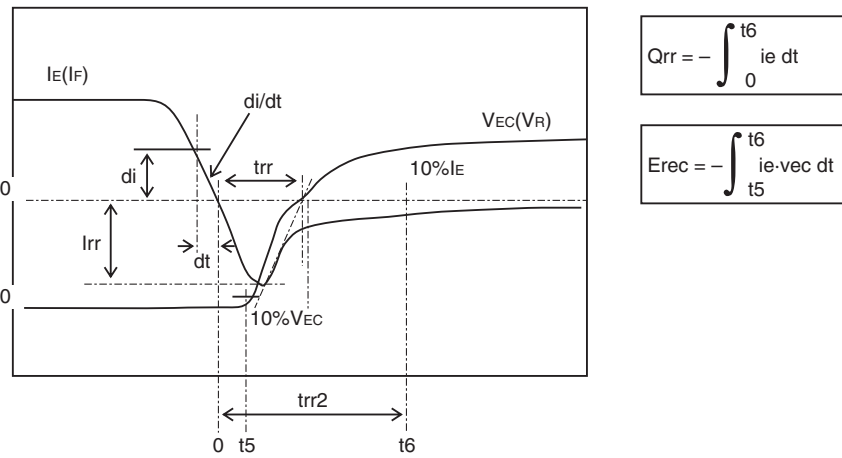


Fig. 2 – Definitions of reverse recovery charge & energy of FWDi part

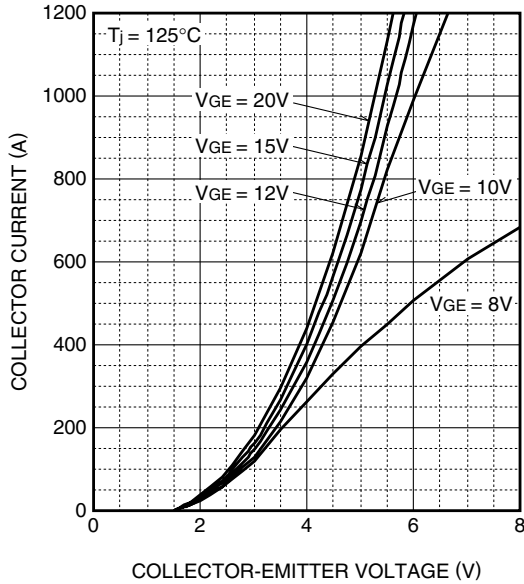
CM600HG-130H

HIGH POWER SWITCHING USE
INSULATED TYPE

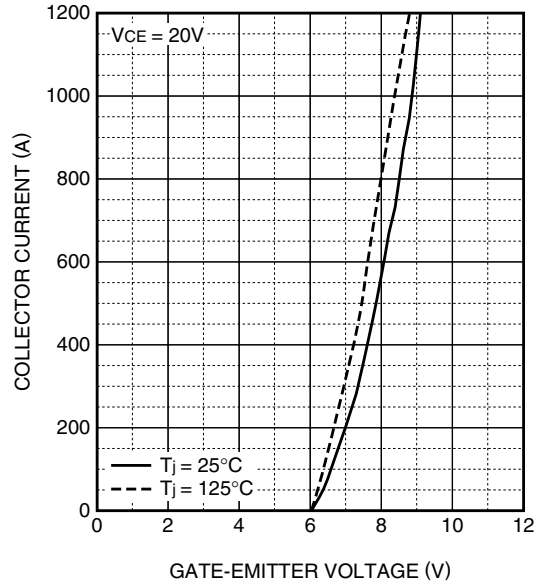
3rd-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

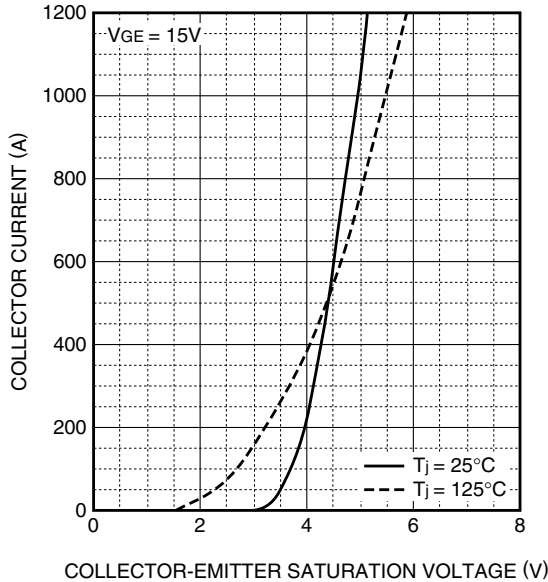
OUTPUT CHARACTERISTICS (TYPICAL)



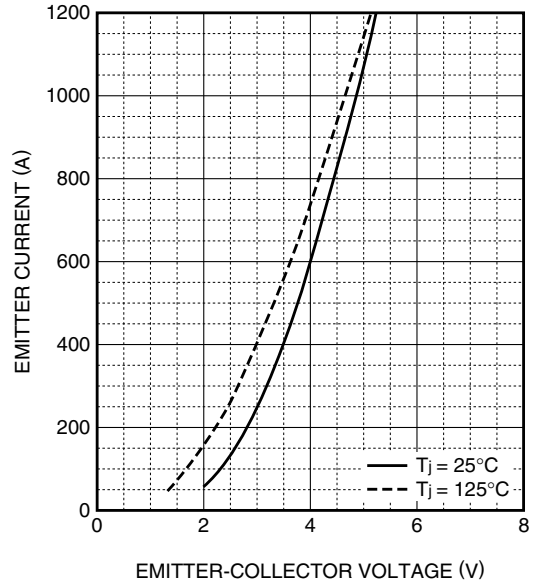
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



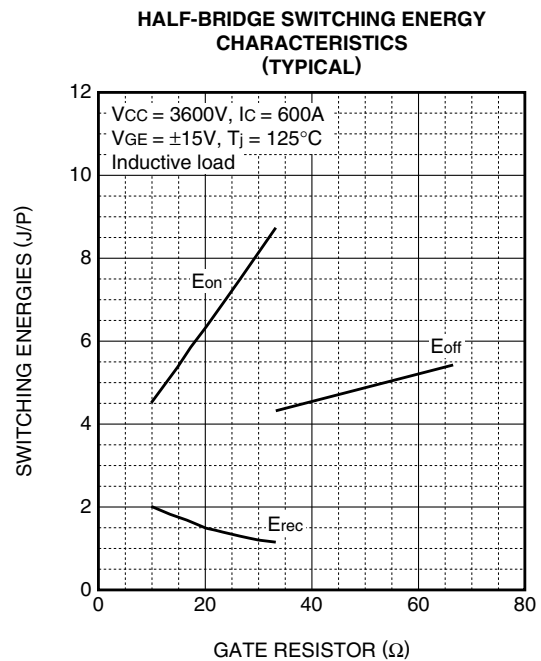
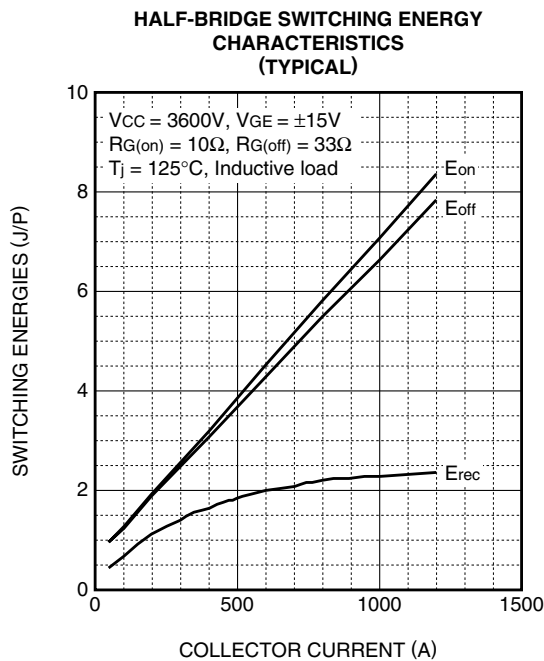
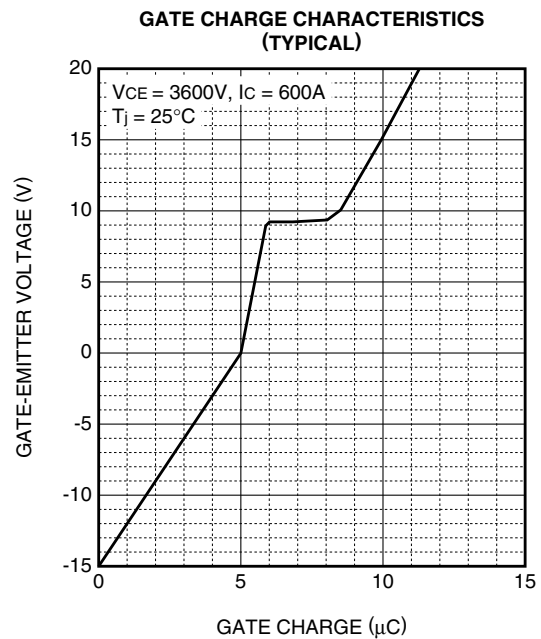
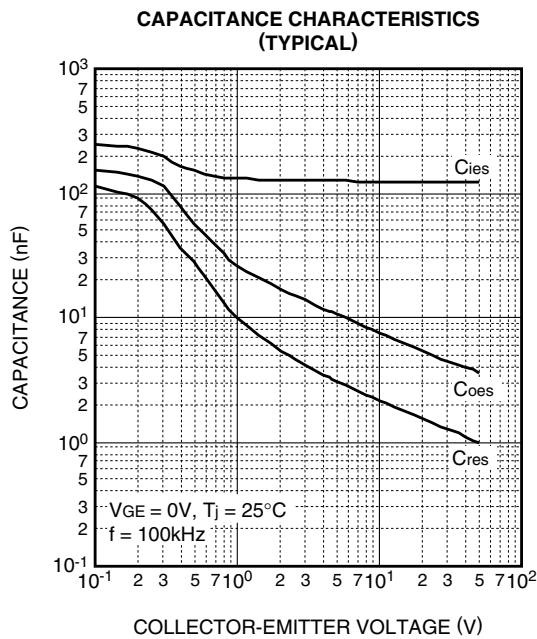
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



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HIGH POWER SWITCHING USE
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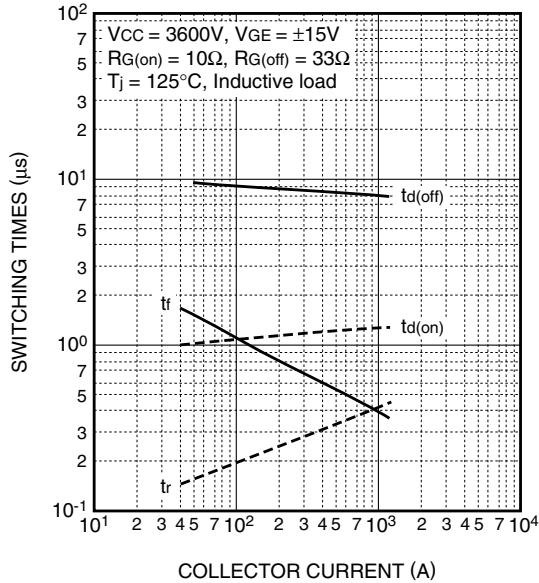


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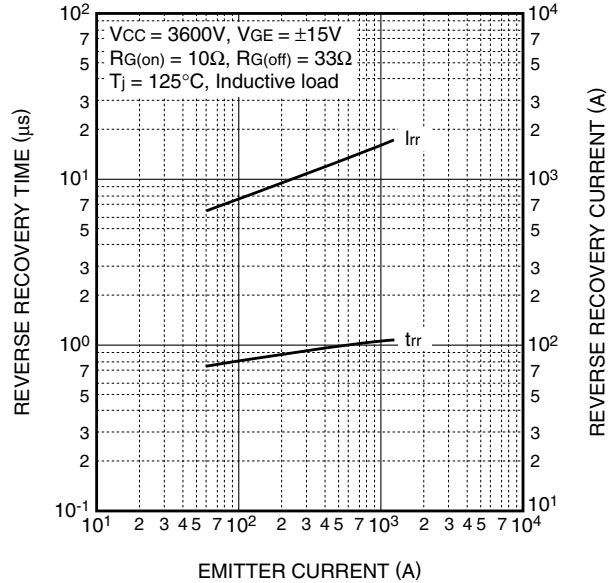
HIGH POWER SWITCHING USE
INSULATED TYPE

3rd-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

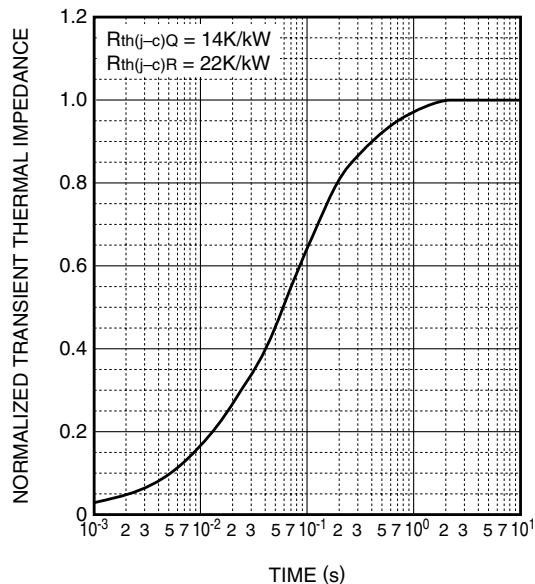
HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS



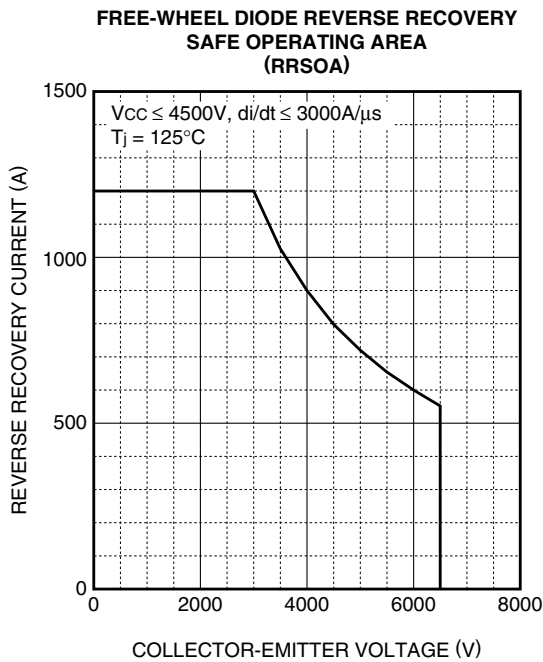
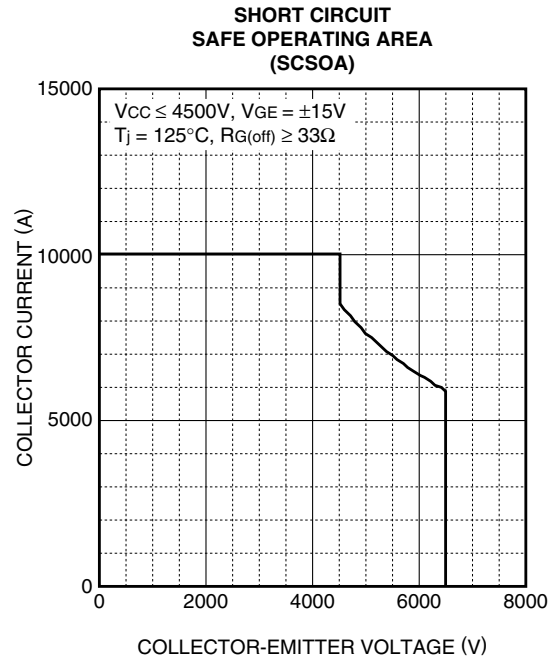
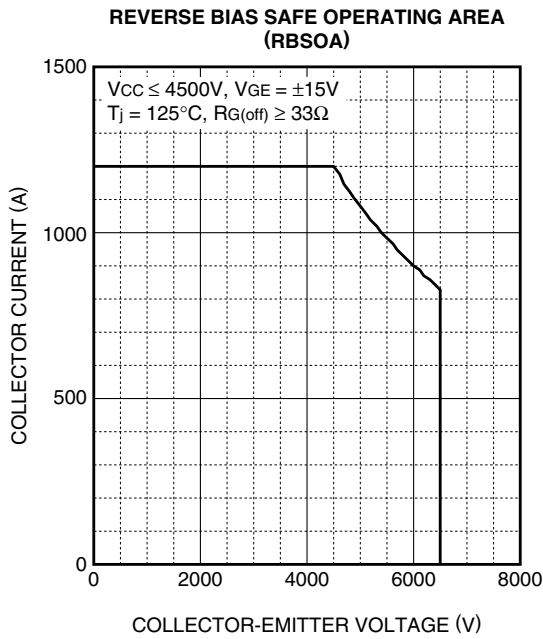
$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_i \left\{ 1 - \exp\left(-\frac{t}{\tau_i}\right) \right\}$$

| | 1 | 2 | 3 | 4 |
|----------------|--------|--------|--------|--------|
| R_i [K/kW] | 0.0059 | 0.0978 | 0.6571 | 0.2392 |
| τ_i [sec] | 0.0002 | 0.0074 | 0.0732 | 0.4488 |

CM600HG-130H

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