

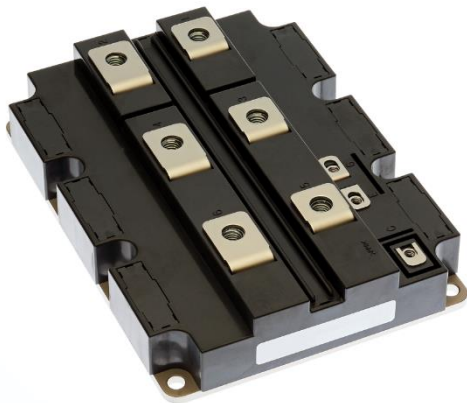
< High Voltage Insulated Gate Bipolar Transistor : HVIGBT >

CM1800HC-66X

HIGH POWER SWITCHING USE
INSULATED TYPE

5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

CM1800HC-66X



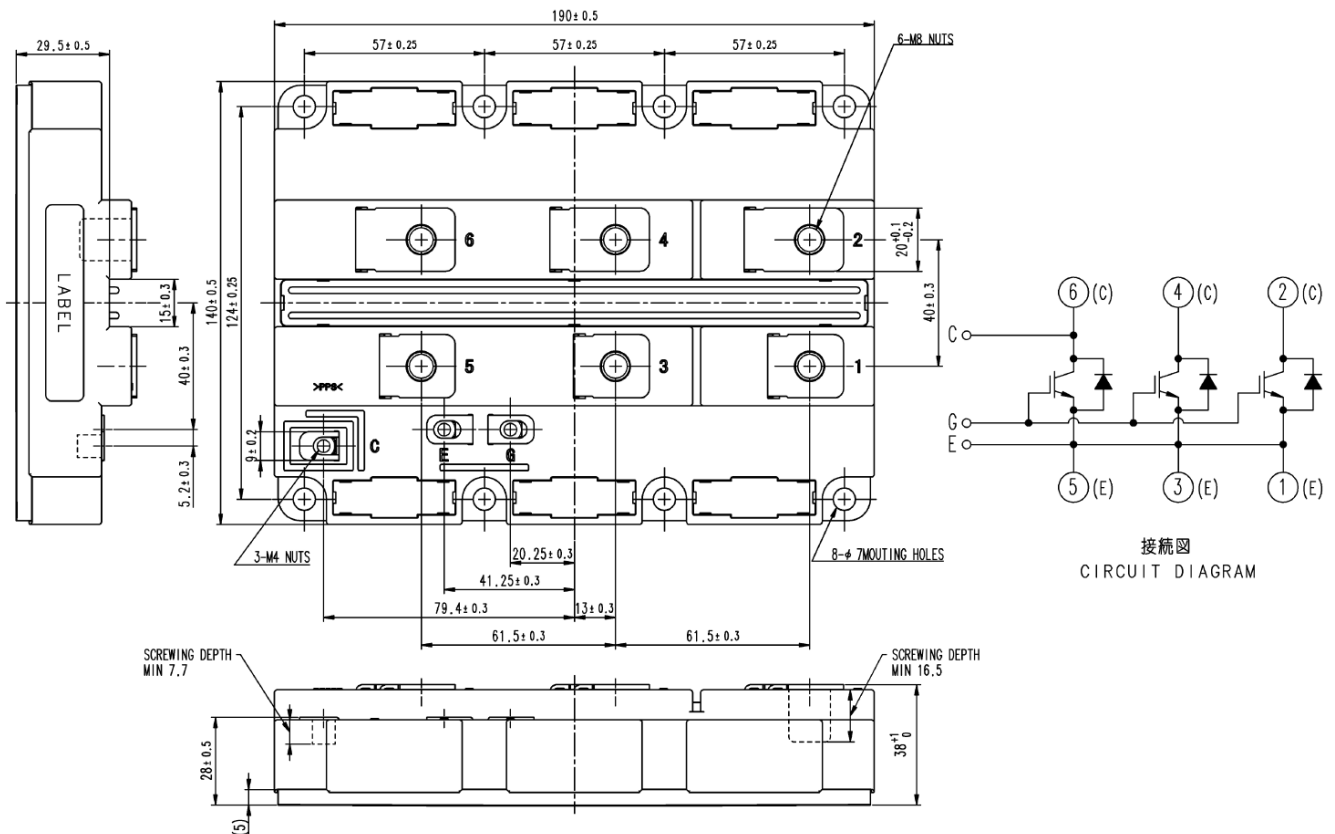
- I_C 1800A
- V_{CES} 3300V
- 1-element in a Pack
- Insulated Type
- CSTBT™(III)
- RFC Diode
- AISiC Baseplate
- UL recognized under UL1557

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



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MAXIMUM RATINGS

| Symbol | Item | Conditions | Ratings | Unit |
|------------------|--------------------------------------|---|------------|------|
| V _{CES} | Collector-emitter voltage | V _{GE} = 0V, T _j = -40...+150°C | 3300 | V |
| | | V _{GE} = 0V, T _j = -50°C | 3200 | |
| V _{GES} | Gate-emitter voltage | V _{CE} = 0V, T _j = 25°C | ±20 | V |
| I _C | Collector current | DC, T _c = 105°C | 1800 | A |
| I _{CRM} | | Pulse (Note 1) | 3600 | A |
| I _E | Emitter current (Note 2) | DC, T _c = 90°C | 1800 | A |
| I _{ERM} | | Pulse (Note 1) | 3600 | A |
| P _{tot} | Maximum power dissipation (Note 3) | T _c = 25°C, IGBT part | 17800 | W |
| V _{iso} | Isolation voltage | RMS, sinusoidal, f = 60Hz, t = 1min. | 6000 | V |
| V _e | Partial discharge extinction voltage | RMS, sinusoidal, f = 60Hz, Q _{PD} ≤ 10pC | 2600 | V |
| T _j | Junction temperature | | -50 ~ +150 | °C |
| T _{top} | Operating junction temperature | | -50 ~ +150 | °C |
| T _{stg} | Storage temperature | | -55 ~ +150 | °C |
| t _{psc} | Short circuit pulse width | V _{CC} = 2500V, V _{CE} ≤ V _{CES} , V _{GE} = 15V, T _j = 150°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 | — | — | 6.0 | mA |
| | | | T _j = 125°C | — | 6.0 | — | |
| | | | T _j = 150°C | — | 36.0 | — | |
| V _{GE(th)} | Gate-emitter threshold voltage | V _{CE} = 10V, I _C = 180mA, T _j = 25°C | 6.5 | 7.0 | 7.5 | 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} = 10V, V _{GE} = 0V, f = 100kHz T _j = 25°C | — | 208 | — | nF | |
| C _{oes} | Output capacitance | | — | 14.0 | — | | |
| C _{res} | Reverse transfer capacitance | | — | 1.9 | — | | |
| Q _G | Total gate charge | V _{CC} = 1800V, I _C = 1800A, V _{GE} = ±15V | — | 13.5 | — | μC | |
| V _{CEsat} | Collector-emitter saturation voltage | I _C = 1800A (Note 4) V _{GE} = 15V | T _j = 25°C | — | 2.00 | — | V |
| | | | T _j = 125°C | — | 2.50 | — | |
| | | | T _j = 150°C | — | 2.60 | 3.10 | |
| t _{d(on)} | Turn-on delay time | V _{CC} = 1800V I _C = 1800A V _{GE} = ±15V R _{G(on)} = 1.5Ω L _S = 100nH | T _j = 150°C | — | — | 0.90 | μs |
| t _r | Turn-on rise time | | T _j = 150°C | — | — | 0.50 | |
| E _{on(10%)} | Turn-on switching energy (Note 7) | | Inductive load | T _j = 25°C | — | 2.95 | — |
| | | T _j = 125°C | | — | 3.25 | — | |
| | | T _j = 150°C | | — | 3.40 | — | |
| E _{on} | Turn-on switching energy (Note 5) | Inductive load | T _j = 25°C | — | 3.00 | — | J |
| | | | T _j = 125°C | — | 3.40 | — | |
| | | | T _j = 150°C | — | 3.55 | — | |
| t _{d(off)} | Turn-off delay time | V _{CC} = 1800V I _C = 1800A V _{GE} = ±15V R _{G(off)} = 12Ω L _S = 100nH Inductive load | T _j = 25°C | — | 2.90 | — | μs |
| | | | T _j = 125°C | — | 3.20 | — | |
| | | | T _j = 150°C | — | 3.20 | 4.25 | |
| t _f | Turn-off fall time | Inductive load | T _j = 25°C | — | 0.40 | — | μs |
| | | | T _j = 125°C | — | 0.45 | — | |
| | | | T _j = 150°C | — | 0.50 | 1.00 | |
| E _{off(10%)} | Turn-off switching energy (Note 7) | Inductive load | T _j = 25°C | — | 2.30 | — | J |
| | | | T _j = 125°C | — | 3.05 | — | |
| | | | T _j = 150°C | — | 3.10 | — | |
| E _{off} | Turn-off switching energy (Note 5) | Inductive load | T _j = 25°C | — | 2.45 | — | J |
| | | | T _j = 125°C | — | 3.10 | — | |
| | | | T _j = 150°C | — | 3.35 | — | |

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| Symbol | Item | Conditions | Limits | | | Unit | |
|-----------------------|------------------------------------|---|------------------------|-----|------|------|----|
| | | | Min | Typ | Max | | |
| V _{EC} | Emitter-collector voltage (Note 2) | I _E = 1800A (Note 4) V _{GE} = 0V | T _j = 25°C | — | 2.20 | — | V |
| | | | T _j = 125°C | — | 2.40 | — | |
| | | | T _j = 150°C | — | 2.50 | 3.00 | |
| t _{rr} | Reverse recovery time (Note 2) | | T _j = 25°C | — | 0.95 | — | μs |
| | | | T _j = 125°C | — | 1.10 | — | |
| | | | T _j = 150°C | — | 1.15 | — | |
| I _{rr} | Reverse recovery current (Note 2) | | T _j = 25°C | — | — | — | A |
| | | | T _j = 125°C | — | 2350 | — | |
| | | | T _j = 150°C | — | 2500 | — | |
| Q _{rr(10%)} | Reverse recovery charge (Note 2,6) | V _{CC} = 1800V I _E = 1800A V _{GE} = ±15V | T _j = 25°C | — | 1600 | — | μC |
| | | | T _j = 125°C | — | 2400 | — | |
| | | | T _j = 150°C | — | 2500 | — | |
| Q _{rr} | Reverse recovery charge (Note 2,5) | R _{G(on)} = 1.5Ω L _S = 100nH Inductive load | T _j = 25°C | — | 1800 | — | μC |
| | | | T _j = 125°C | — | 2600 | — | |
| | | | T _j = 150°C | — | 2700 | — | |
| E _{rec(10%)} | Reverse recovery energy (Note 2,7) | | T _j = 25°C | — | 1.70 | — | J |
| | | | T _j = 125°C | — | 2.45 | — | |
| | | | T _j = 150°C | — | 2.80 | — | |
| E _{rec} | Reverse recovery energy (Note 2,5) | | T _j = 25°C | — | 1.85 | — | J |
| | | | T _j = 125°C | — | 2.60 | — | |
| | | | T _j = 150°C | — | 2.95 | — | |

THERMAL CHARACTERISTICS

| Symbol | Item | Conditions | Limits | | | Unit |
|-----------------------|----------------------------|--|--------|-----|------|------|
| | | | Min | Typ | Max | |
| R _{th(j-c)Q} | Thermal resistance | Junction to Case, IGBT part | — | — | 7.0 | K/kW |
| R _{th(j-c)D} | | Junction to Case, FWDi part | — | — | 11.0 | |
| R _{th(c-s)} | Contact thermal resistance | Case to heat sink λ _{grease} = 1W/m·k, D _(c-s) = 80μm | — | 5.0 | — | K/kW |

MECHANICAL CHARACTERISTICS

| Symbol | Item | Conditions | Limits | | | Unit |
|---------------------|----------------------------|---|--------|------|------|------|
| | | | Min | Typ | Max | |
| M _t | Mounting torque | M8 : Main terminals screw | 7.0 | — | 19.0 | N·m |
| M _s | | M6 : Mounting screw | 3.0 | — | 6.0 | N·m |
| M _t | | M4 : Auxiliary terminals screw (Note 8) | 1.0 | — | 3.0 | N·m |
| M | Mass | | — | 1.2 | — | kg |
| CTI | Comparative tracking index | | 600 | — | — | — |
| d _a | Clearance | | 19.5 | — | — | mm |
| d _s | Creepage distance | | 32.0 | — | — | mm |
| L _{P-CE} | Parasitic stray inductance | | — | 8.0 | — | nH |
| R _{CC+EE'} | Internal lead resistance | T _C = 25°C | — | 0.09 | — | mΩ |

Note1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{jopmax} rating.

Note2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWDi).

Note3. Junction temperature (T_j) should not exceed T_{jmax} rating (150°C).

Note4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

Note5. Definition of all items is according to IEC 60747, unless otherwise specified.

Note6. The integration range of reverse recovery charge is from I_E = 0A to 10%I_E.

Note7. The integration range of switching energies is from 10%V_{CE} to 10%I_C(10%I_E).

Note8. The maximum specified value is under the condition of using PCB mounted on the power module. In case no PCB is used this maximum torque for M4 screw is 2.0 Nm.

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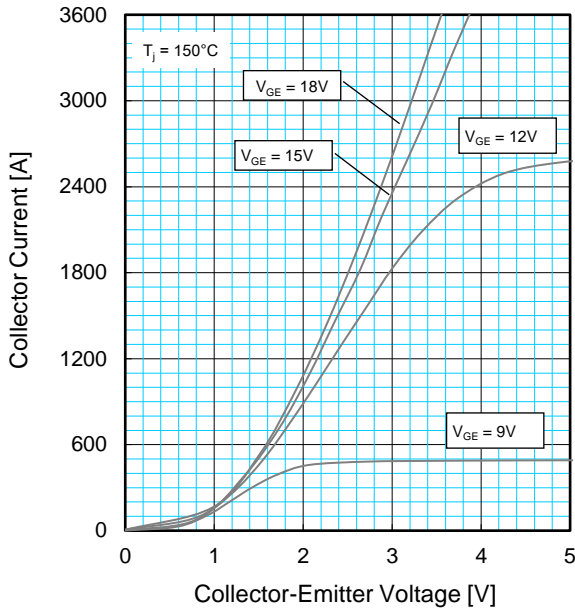
HIGH POWER SWITCHING USE

INSULATED TYPE

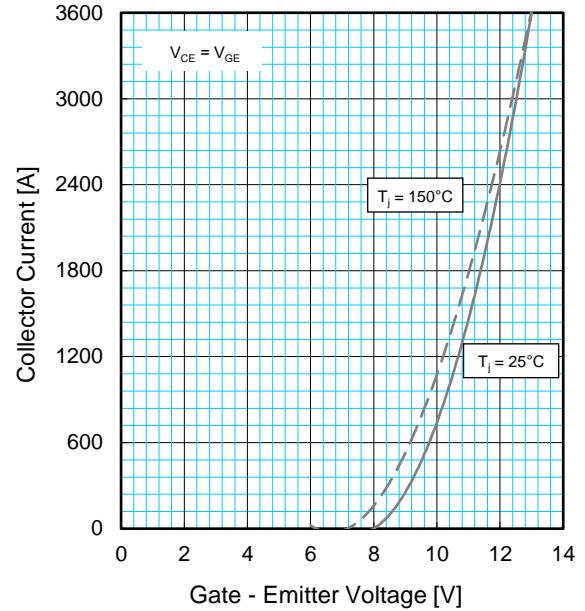
5th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

PERFORMANCE CURVES

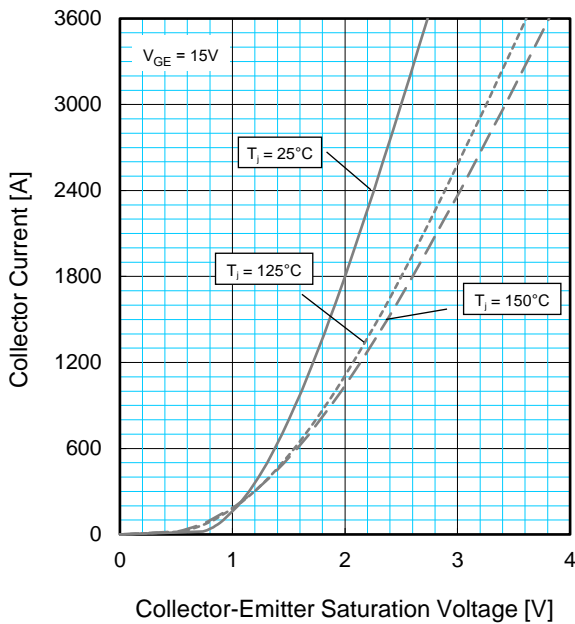
OUTPUT CHARACTERISTICS (TYPICAL)



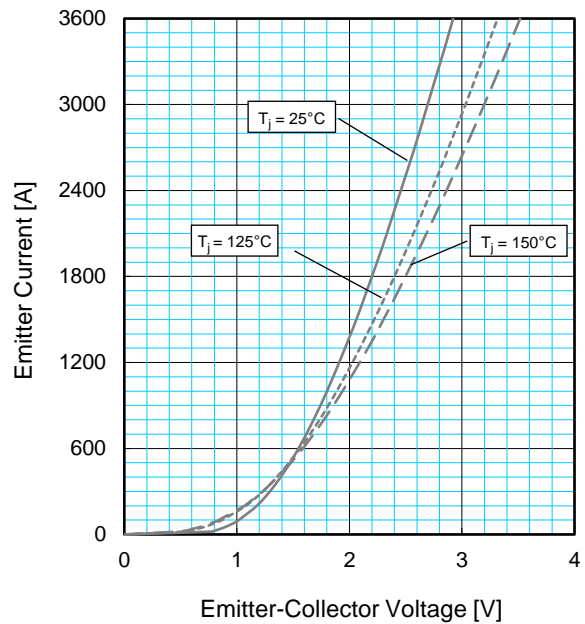
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



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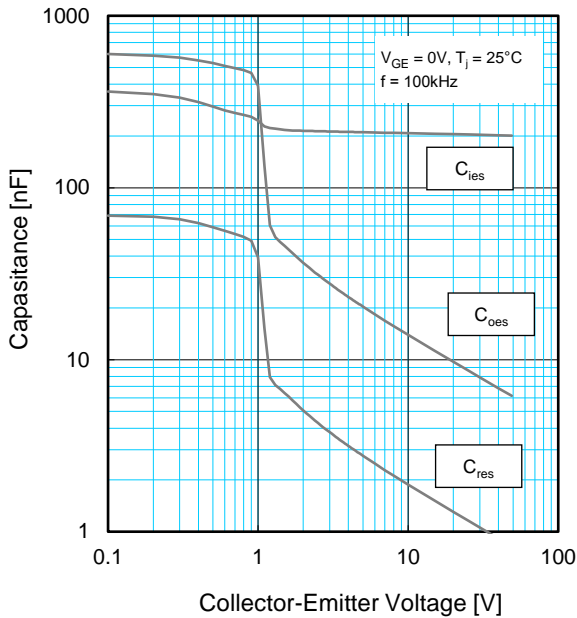
HIGH POWER SWITCHING USE

INSULATED TYPE

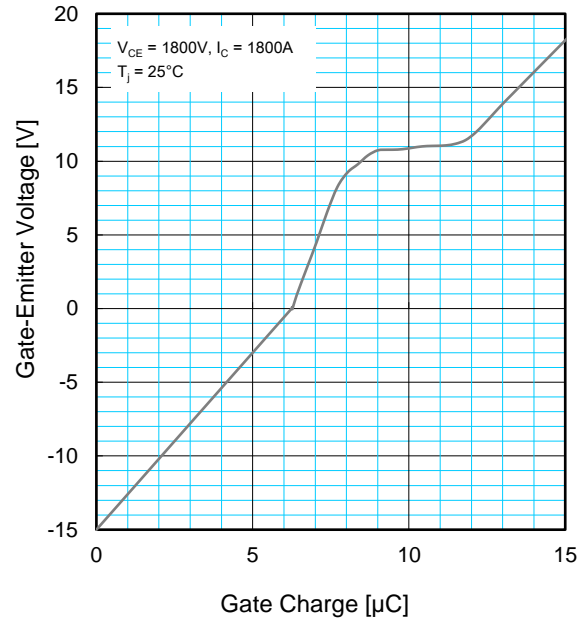
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PERFORMANCE CURVES

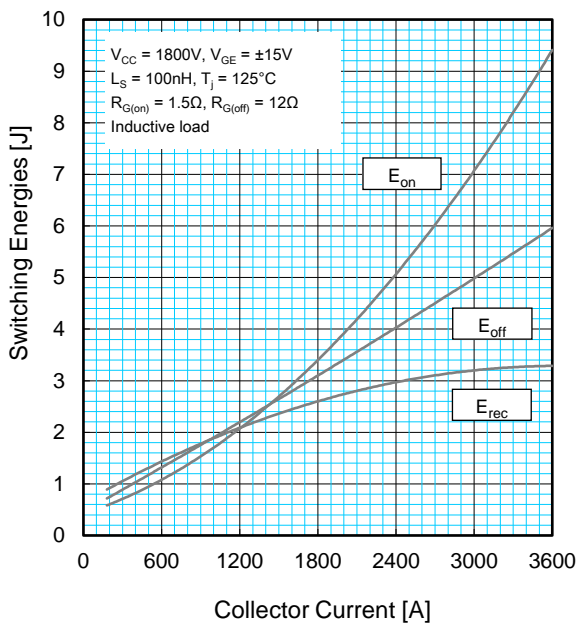
CAPACITANCE CHARACTERISTICS (TYPICAL)



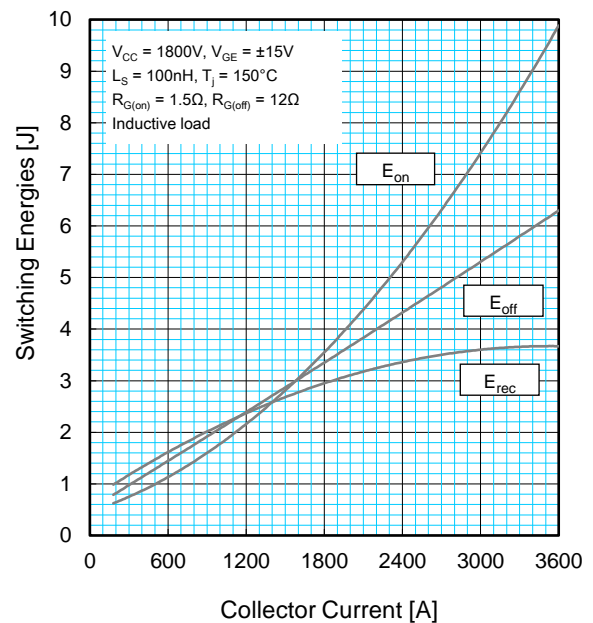
GATE CHARGE CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



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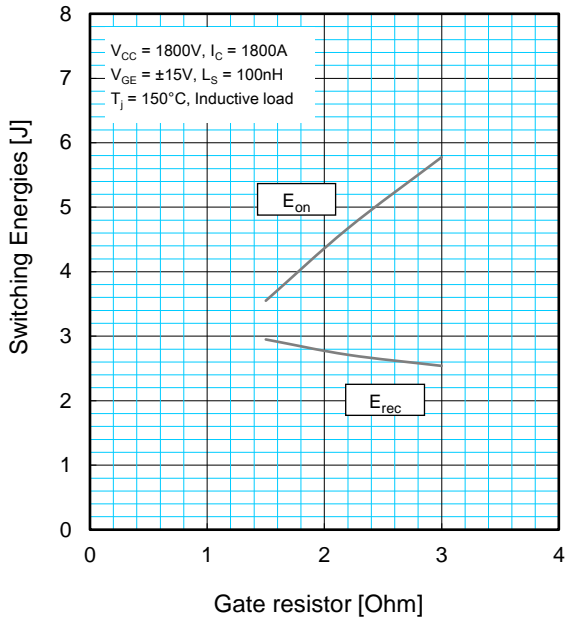
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INSULATED TYPE

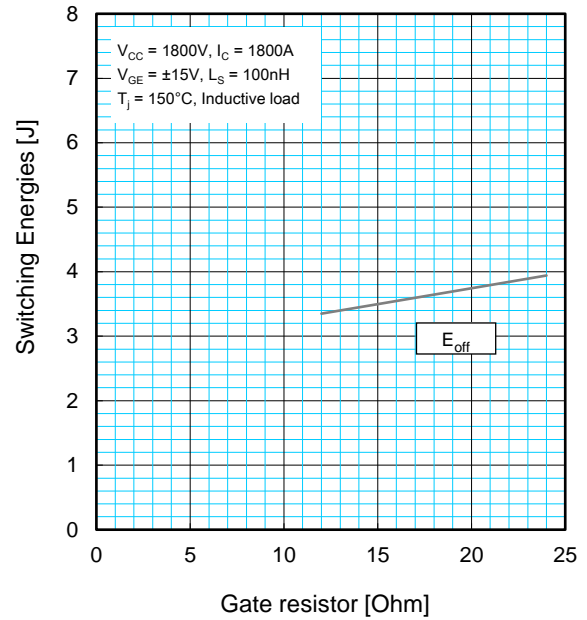
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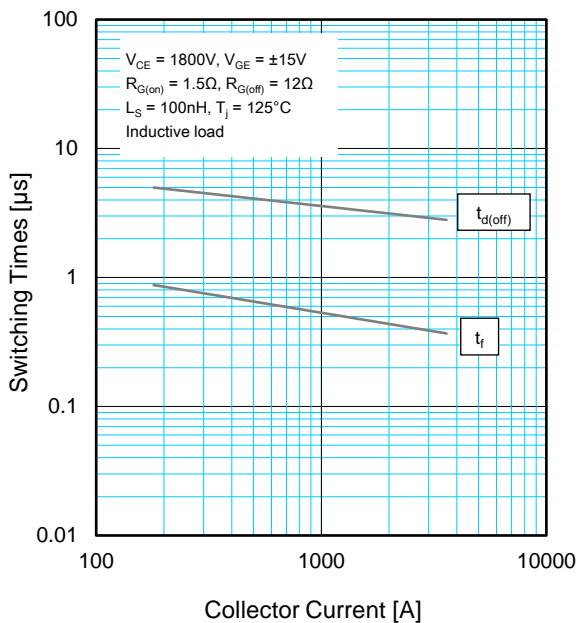
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



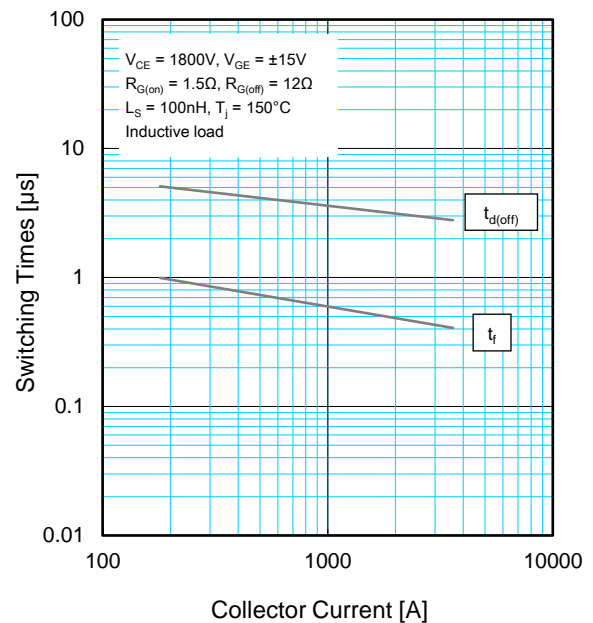
HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING TIME CHARACTERISTICS (TYPICAL)



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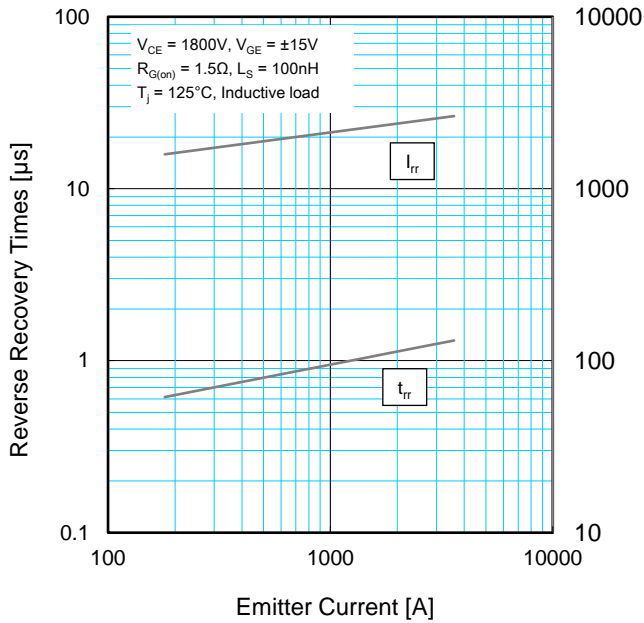
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INSULATED TYPE

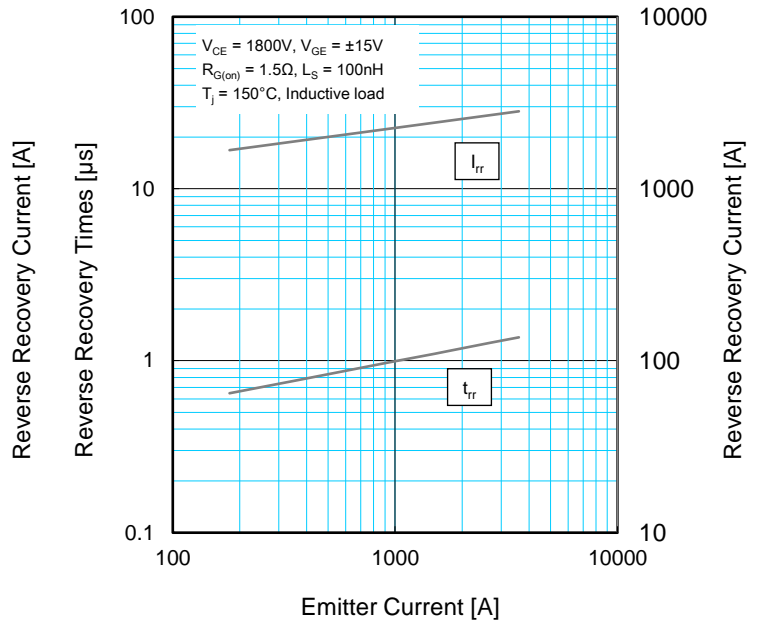
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PERFORMANCE CURVES

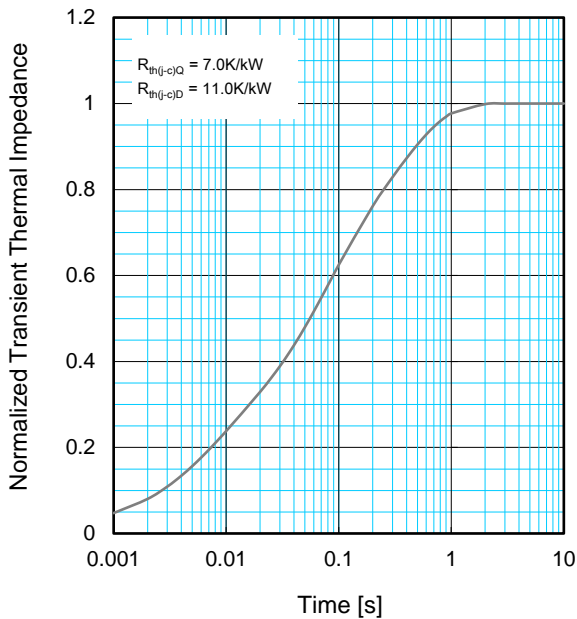
FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



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 |
|-----------------------|--------|--------|--------|--------|
| $R_i / R_{th(j-c)}$: | 0.0096 | 0.1893 | 0.4044 | 0.3967 |
| τ_i [sec]: | 0.0001 | 0.0058 | 0.0602 | 0.3512 |

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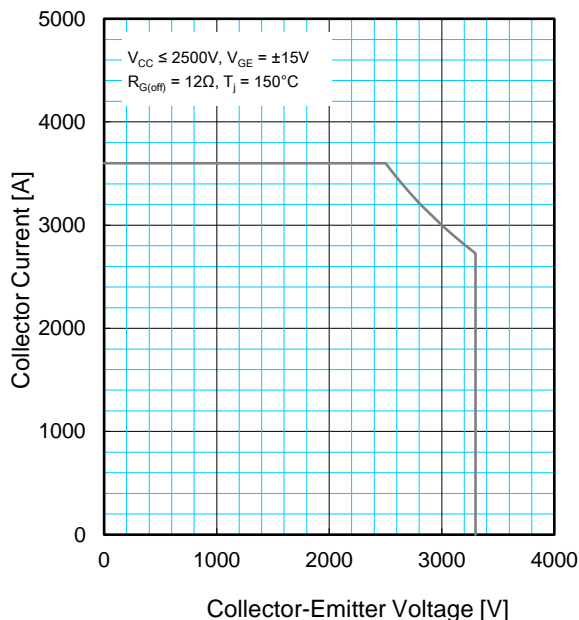
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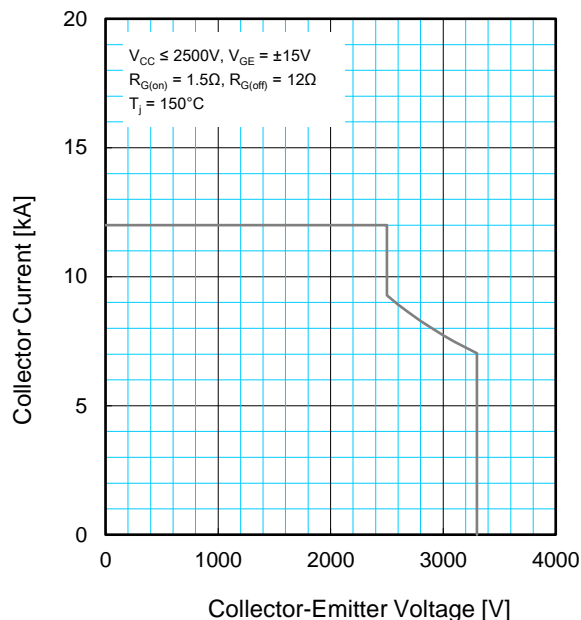
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PERFORMANCE CURVES

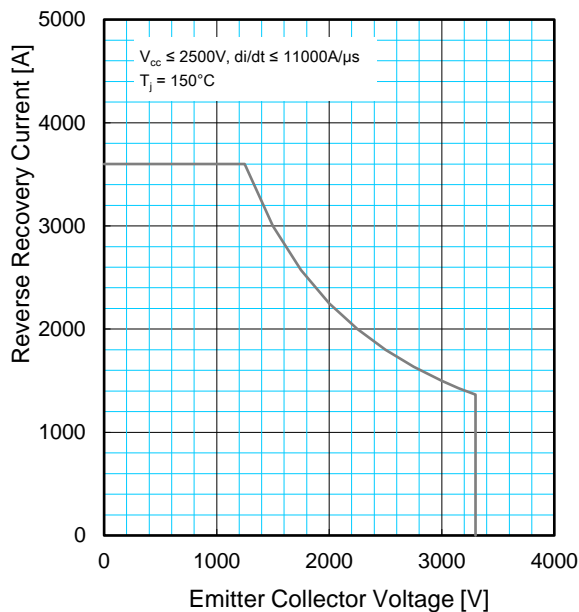
REVERSE BIAS SAFE OPERATING AREA (RBSOA)



SHORT CIRCUIT SAFE OPERATING AREA (SCSOA)



FREE-WHEEL DIODE REVERSE RECOVERY SAFE OPERATING AREA (RRSOA)



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