

<IGBT Modules>

CM150DY-13T

HIGH POWER SWITCHING USE
INSULATED TYPE



dual switch (half-bridge)

Collector current I_C **1 5 0 A**
 Collector-emitter voltage V_{CES} **6 5 0 V**
 Maximum junction temperature T_{vjmax} **1 7 5 °C**

- dual switch (half-bridge)
- Copper base plate (Nickel-plating)
- Nickel-plating tab terminals
- RoHS Directive compliant
- UL Recognized under UL1557, File No. E323585

APPLICATION

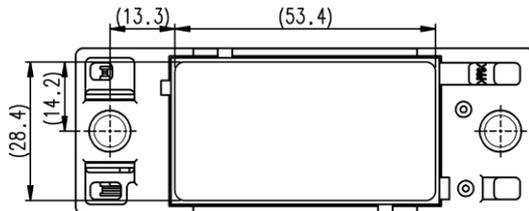
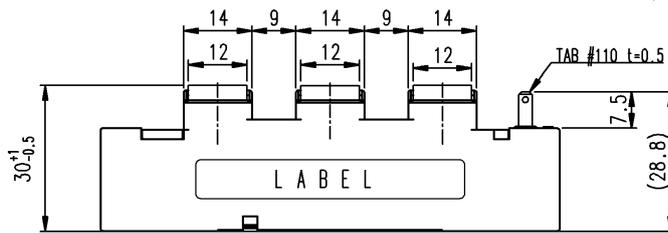
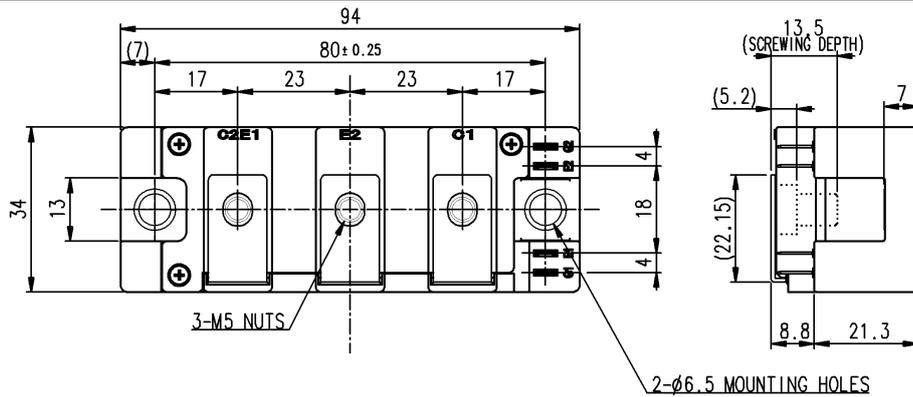
AC Motor Control, Motion/Servo Control, Power supply, etc.

OPTION (Below options are available.)

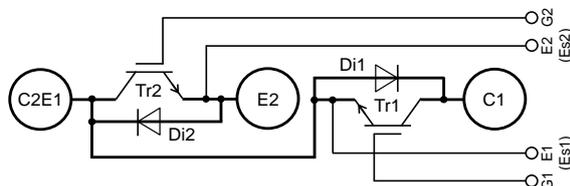
- PC-TIM (Phase Change Thermal Interface Material) pre-apply

OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm



INTERNAL CONNECTION



| 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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MAXIMUM RATINGS (T_{vj}=25 °C, unless otherwise specified)

| Symbol | Item | Conditions | Rating | Unit |
|--------------------------|--------------------------------|---|-------------|------|
| V _{CES} | Collector-emitter voltage | G-E short-circuited | 650 | V |
| V _{GES} | Gate-emitter voltage | C-E short-circuited | ± 20 | V |
| I _C | Collector current | DC, T _C =141 °C* (Note2, 4) | 150 | A |
| I _{CRM} | | Pulse, Repetitive (Note3) | 300 | |
| P _{tot} | Total power dissipation | T _C =25 °C (Note2, 4) | 1090 | W |
| I _E (Note1) | Emitter current | DC (Note2) | 150 | A |
| I _{ERM} (Note1) | | Pulse, Repetitive (Note3) | 300 | |
| V _{isol} | Isolation voltage | Terminals to base plate, RMS, f=60 Hz, AC 1 min | 4000 | V |
| T _{vjmax} | Maximum junction temperature | Instantaneous event (overload) | 175 | °C |
| T _{Cmax} | Maximum case temperature | (Note4) | 150* | |
| T _{vjop} | Operating junction temperature | Continuous operation (under switching) | -40 ~ +150 | °C |
| T _{stg} | Storage temperature | - | -40 ~ +150* | |

ELECTRICAL CHARACTERISTICS (T_{vj}=25 °C, unless otherwise specified)

| Symbol | Item | Conditions | Limits | | | Unit | |
|-------------------------------|---|---|-------------------------|------|------|------|----|
| | | | Min. | Typ. | Max. | | |
| I _{CES} | Collector-emitter cut-off current | V _{CE} =V _{CES} , G-E short-circuited | - | - | 1.0 | mA | |
| I _{GES} | Gate-emitter leakage current | V _{GE} =V _{GES} , C-E short-circuited | - | - | 0.5 | µA | |
| V _{GE(th)} | Gate-emitter threshold voltage | I _C =15 mA, V _{CE} =10 V | 5.4 | 6.0 | 6.6 | V | |
| V _{CESat} (Terminal) | Collector-emitter saturation voltage | I _C =150 A, V _{GE} =15 V, Refer to the figure of test circuit (Note5) | T _{vj} =25 °C | - | 1.40 | 1.70 | V |
| V _{CESat} (Chip) | | | T _{vj} =125 °C | - | 1.50 | - | |
| | | | T _{vj} =150 °C | - | 1.55 | - | |
| | V _{EC} (Terminal) | I _E =150 A, G-E short-circuited, Refer to the figure of test circuit (Note5) | T _{vj} =25 °C | - | 2.10 | 2.90 | V |
| T _{vj} =125 °C | | | - | 2.05 | - | | |
| T _{vj} =150 °C | | | - | 2.05 | - | | |
| V _{EC} (Chip) | I _E =150 A, G-E short-circuited, (Note5) | T _{vj} =25 °C | - | 1.90 | 2.65 | V | |
| | | T _{vj} =125 °C | - | 1.80 | - | | |
| | | T _{vj} =150 °C | - | 1.80 | - | | |
| t _{rr} (Note1) | Reverse recovery time | V _{CC} =300 V, I _E =150 A, V _{GE} =±15 V, | - | - | 150 | ns | |
| Q _{rr} (Note1) | Reverse recovery charge | R _G =1.0 Ω, Inductive load | - | 5.0 | - | | µC |
| E _{on} | Turn-on switching energy per pulse | V _{CC} =300 V, I _C =I _E =150 A, | - | 2.1 | - | mJ | |
| E _{off} | Turn-off switching energy per pulse | V _{GE} =±15 V, R _G =1.0 Ω, T _{vj} =150 °C, | - | 7.1 | - | | |
| E _{rr} (Note1) | Reverse recovery energy per pulse | Inductive load | - | 2.7 | - | mJ | |
| R _{CC+EE} | Internal lead resistance | Main terminals-chip, per switch, T _C =25 °C (Note4) | - | 0.2 | - | mΩ | |
| r _g | Internal gate resistance | Per switch | - | 4.0 | - | Ω | |

*: The value of PC-TIM applied module is limited by the heat resistant temperature of PC-TIM.

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HIGH POWER SWITCHING USE
INSULATED TYPE

THERMAL RESISTANCE CHARACTERISTICS

| Symbol | Item | Conditions | | Limits | | | Unit |
|----------------|----------------------------|---|-----------------------------------|--------|------|------|------|
| | | | | Min. | Typ. | Max. | |
| $R_{th(j-c)Q}$ | Thermal resistance | Junction to case, per Inverter IGBT (Note4) | | - | - | 137 | K/kW |
| $R_{th(j-c)D}$ | | Junction to case, per Inverter FWD (Note4) | | - | - | 235 | |
| $R_{th(c-s)}$ | Contact thermal resistance | Case to heat sink, per 1 module | Thermal grease applied (Note4, 6) | - | 36.6 | - | K/kW |

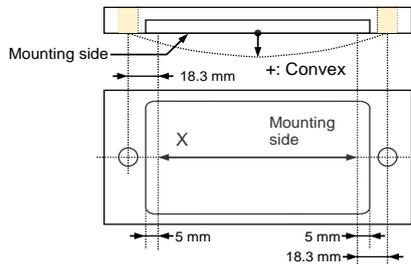
MECHANICAL CHARACTERISTICS

| Symbol | Item | Conditions | | Limits | | | Unit |
|--------|------------------------|---------------------------|-----------|--------|------|------|------|
| | | | | Min. | Typ. | Max. | |
| M_t | Mounting torque | Main terminals | M 5 screw | 2.5 | 3.0 | 3.5 | N·m |
| M_s | Mounting torque | Mounting to heat sink | M 6 screw | 3.5 | 4.0 | 4.5 | N·m |
| d_s | Creepage distance | Terminal to terminal | | 18.4 | - | - | mm |
| | | Terminal to base plate | | 21.1 | - | - | |
| d_a | Clearance | Terminal to terminal | | 9.6 | - | - | mm |
| | | Terminal to base plate | | 16.7 | - | - | |
| e_c | Flatness of base plate | On the centerline (Note7) | | ±0 | - | +200 | µm |
| m | mass | - | | - | 120 | - | g |

*: This product is compliant with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive 2011/65/EU.

Note1. Represent ratings and characteristics of the anti-parallel, emitter-collector free-wheeling diode (FWD).

- Junction temperature (T_{vj}) should not increase beyond T_{vjmax} rating.
- Pulse width and repetition rate should be such that the device junction temperature (T_{vj}) dose not exceed T_{vjmax} rating.
- Case temperature (T_C) and heat sink temperature (T_S) are defined on the each surface (mounting side) of base plate and heat sink just under the chips.
Refer to the figure of chip location.
- Pulse width and repetition rate should be such as to cause negligible temperature rise. Refer to the figure of test circuit.
- Typical value is measured by using thermally conductive grease of $\lambda=3.0 \text{ W/(m}\cdot\text{K)}/D_{(c-s)}=50 \text{ }\mu\text{m}$.
- The base plate (mounting side) flatness measurement point is as follows of the following figure.



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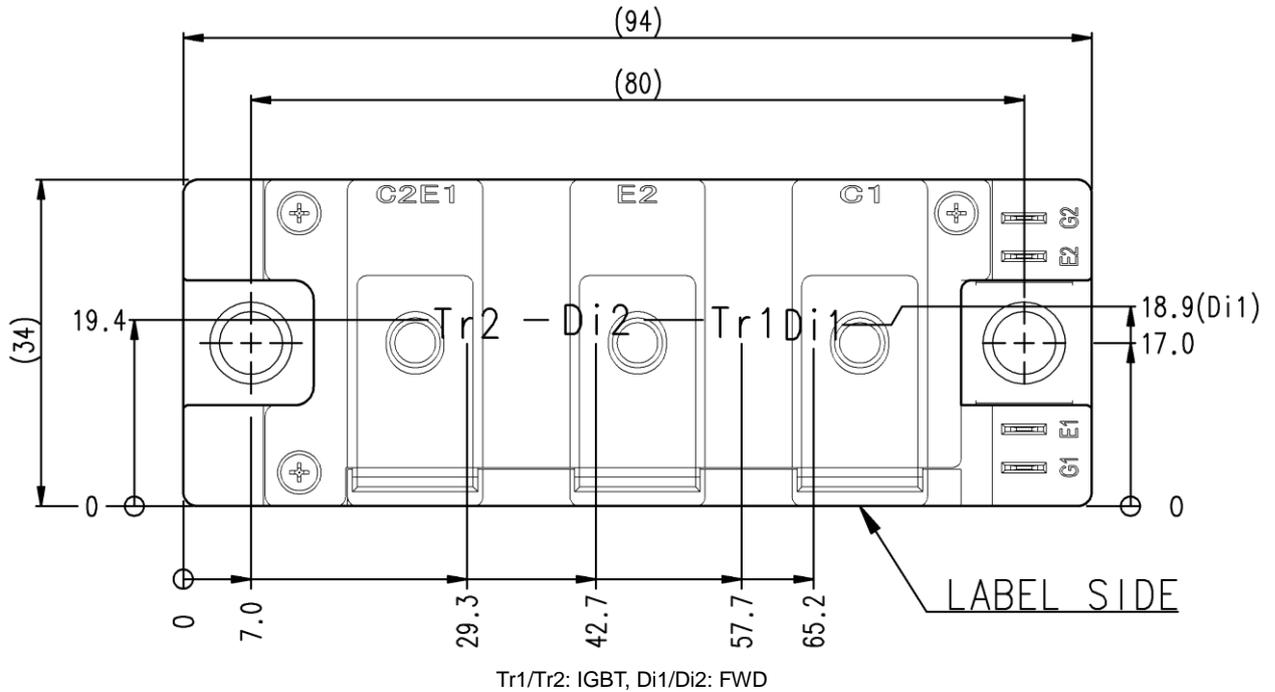
HIGH POWER SWITCHING USE
INSULATED TYPE

RECOMMENDED OPERATING CONDITIONS

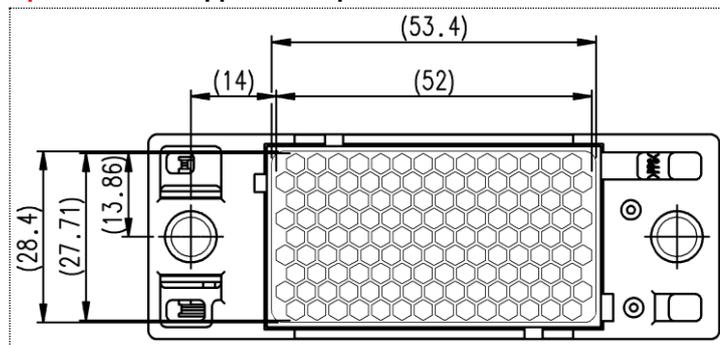
| Symbol | Item | Conditions | Limits | | | Unit |
|------------|-------------------------------|--|--------|------|------|----------|
| | | | Min. | Typ. | Max. | |
| V_{CC} | (DC) Supply voltage | Applied across C1-E2 terminals | - | 300 | 450 | V |
| V_{GEon} | Gate (-emitter drive) voltage | Applied across G1-Es1/G2-Es2 terminals | 13.5 | 15.0 | 16.5 | V |
| R_G | External gate resistance | Per switch | 1.0 | - | 47 | Ω |

CHIP LOCATION (Top view)

Dimension in mm, tolerance: ± 1 mm



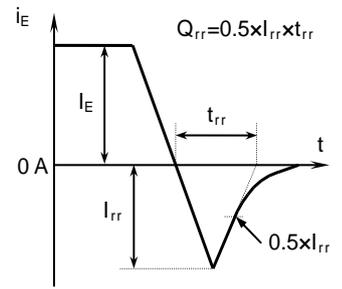
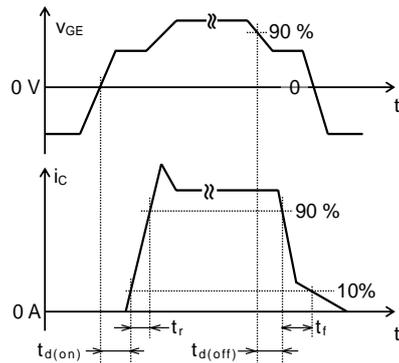
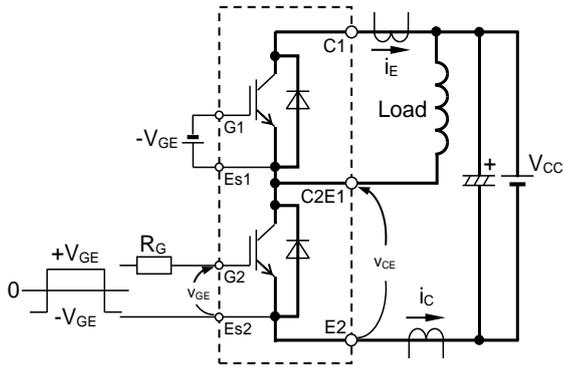
Option: PC-TIM applied baseplate outline



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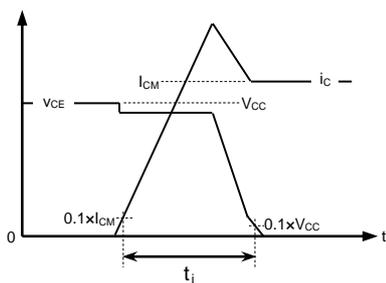
HIGH POWER SWITCHING USE
INSULATED TYPE

TEST CIRCUIT AND WAVEFORMS

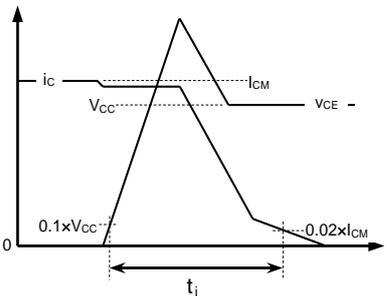


Switching characteristics test circuit and waveforms

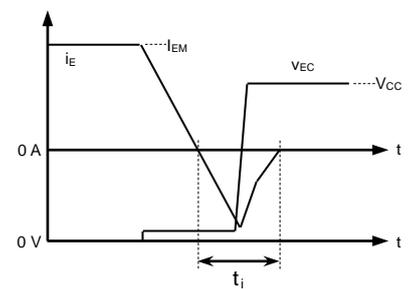
t_{rr} , Q_{rr} characteristics test waveform



IGBT Turn-on switching energy



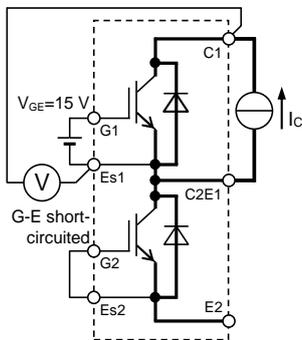
IGBT Turn-off switching energy



FWD Reverse recovery energy

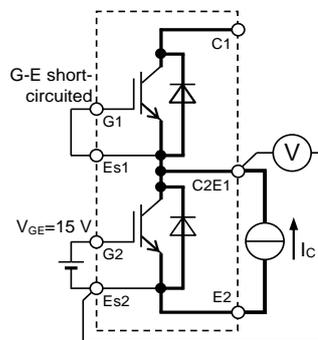
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

TEST CIRCUIT

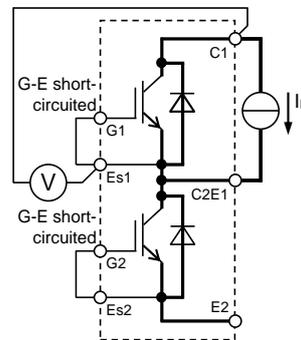


Tr1

V_{CEsat} characteristics test circuit

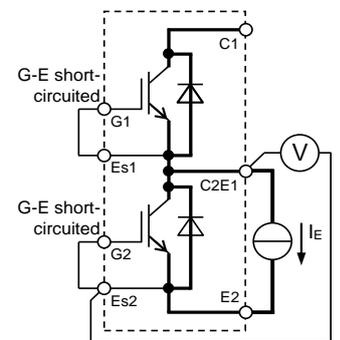


Tr2



Di1

V_{EC} characteristics test circuit



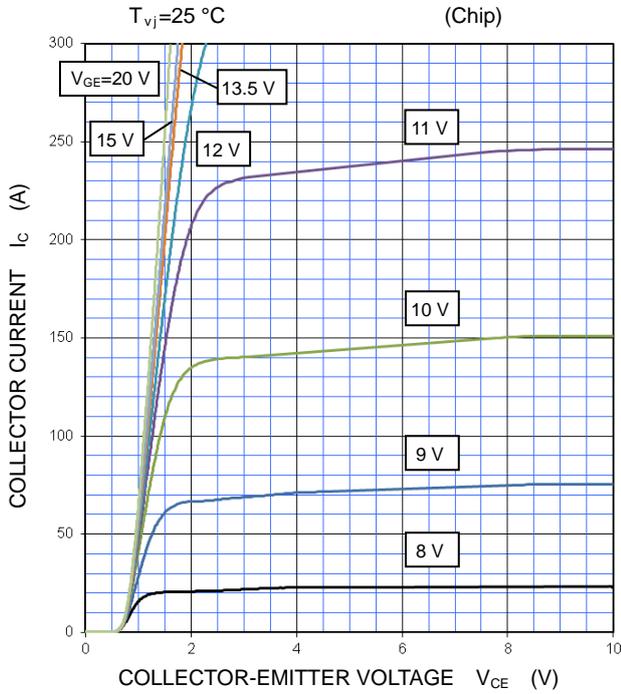
Di2

CM150DY-13T

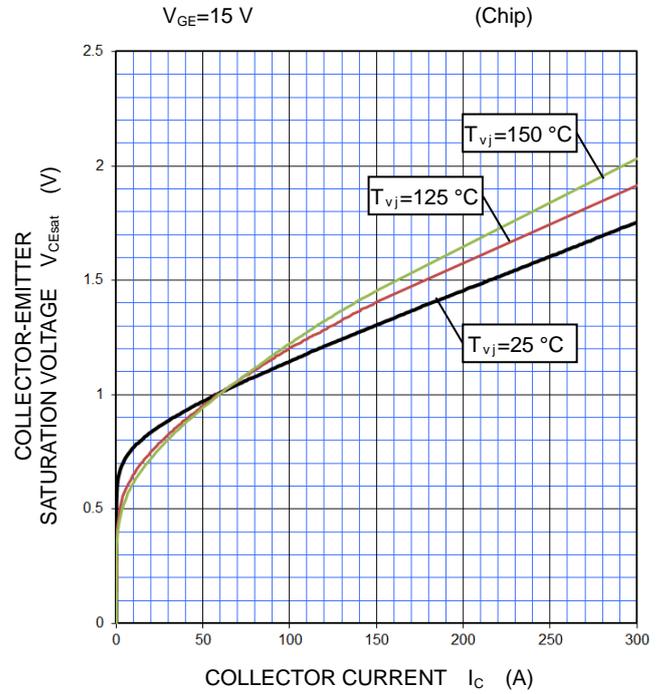
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

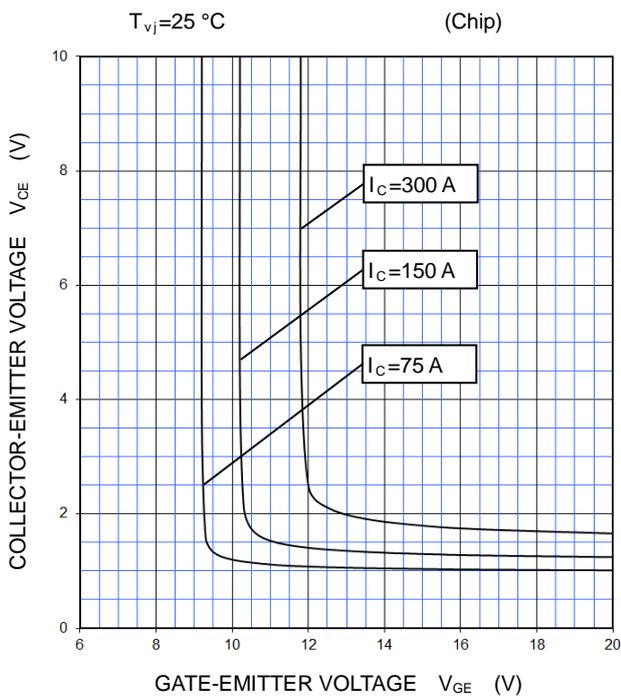
OUTPUT CHARACTERISTICS (TYPICAL)



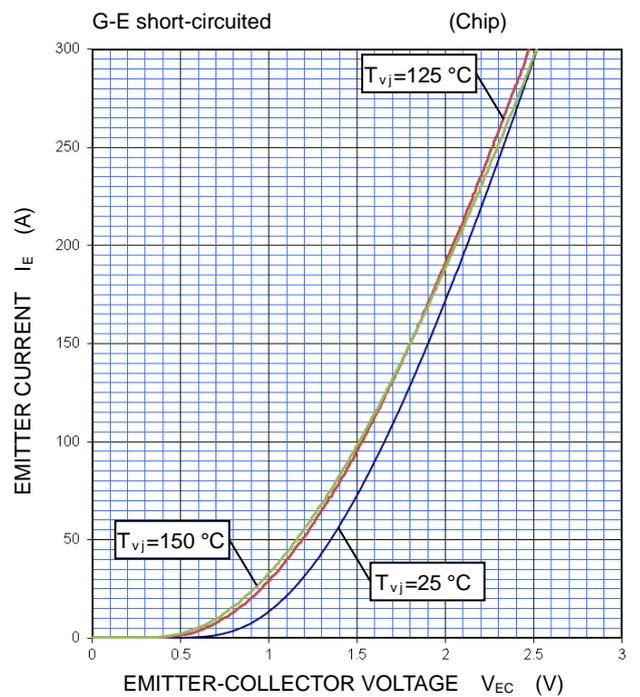
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS (TYPICAL)



FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)



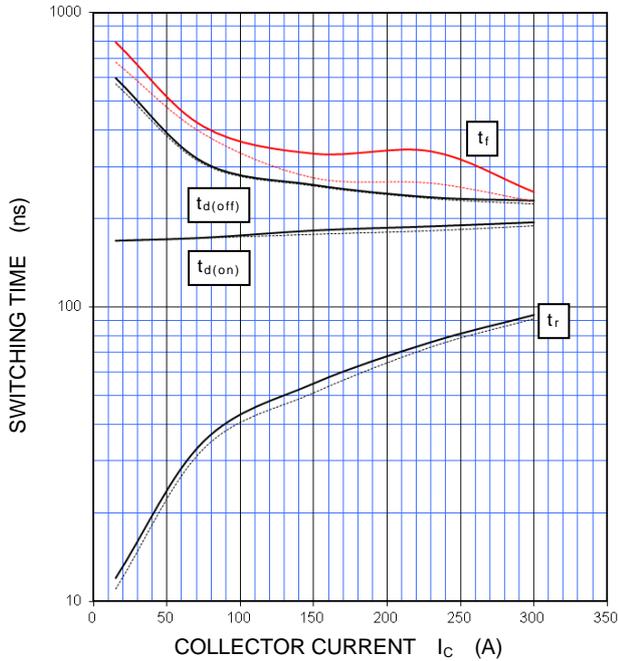
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HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

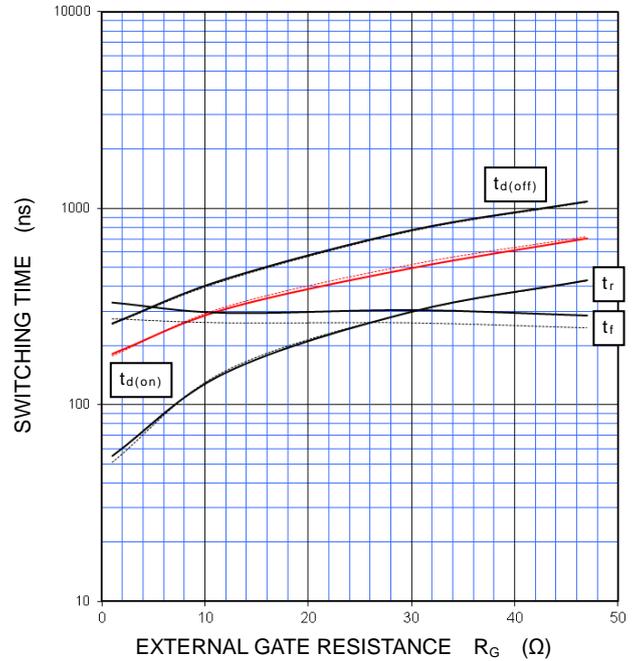
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=1.0\ \Omega$, INDUCTIVE LOAD
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



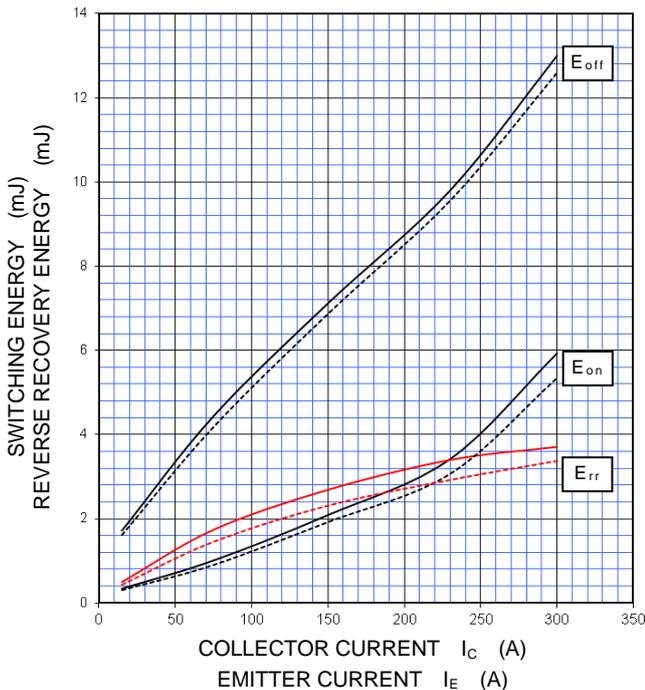
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=150\text{ A}$, INDUCTIVE LOAD
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



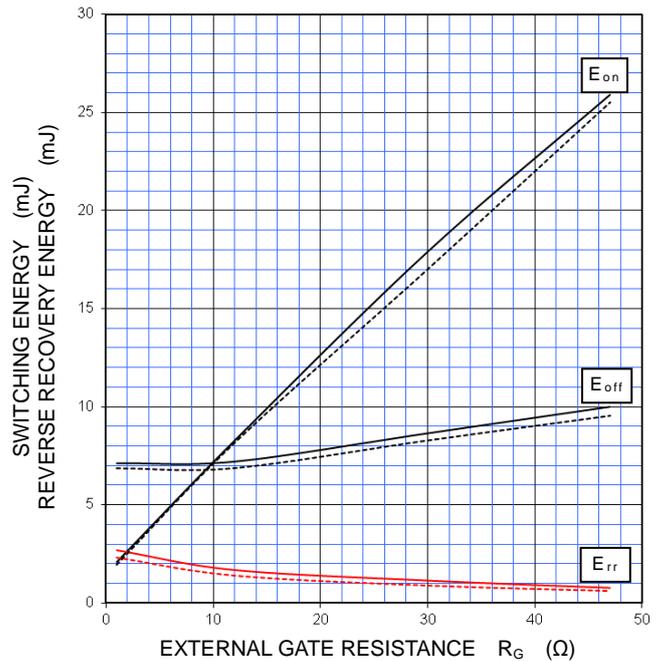
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=1.0\ \Omega$,
INDUCTIVE LOAD, PER PULSE
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C/I_E=150\text{ A}$,
INDUCTIVE LOAD, PER PULSE
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$

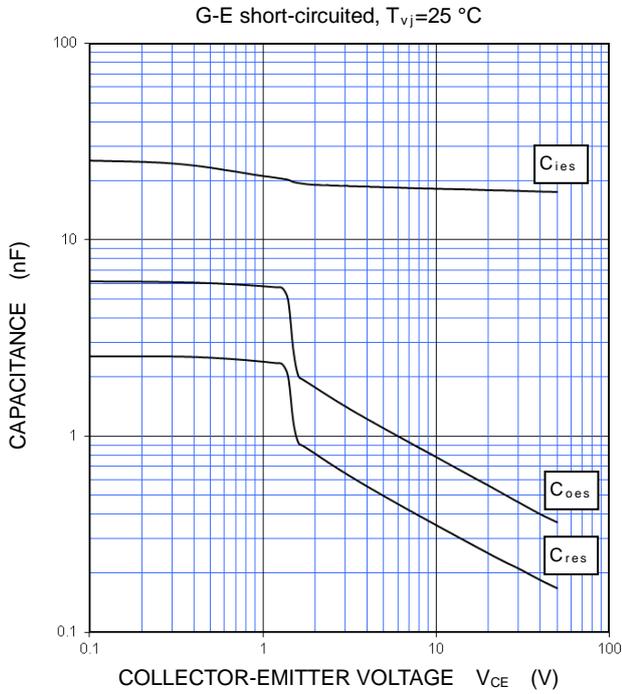


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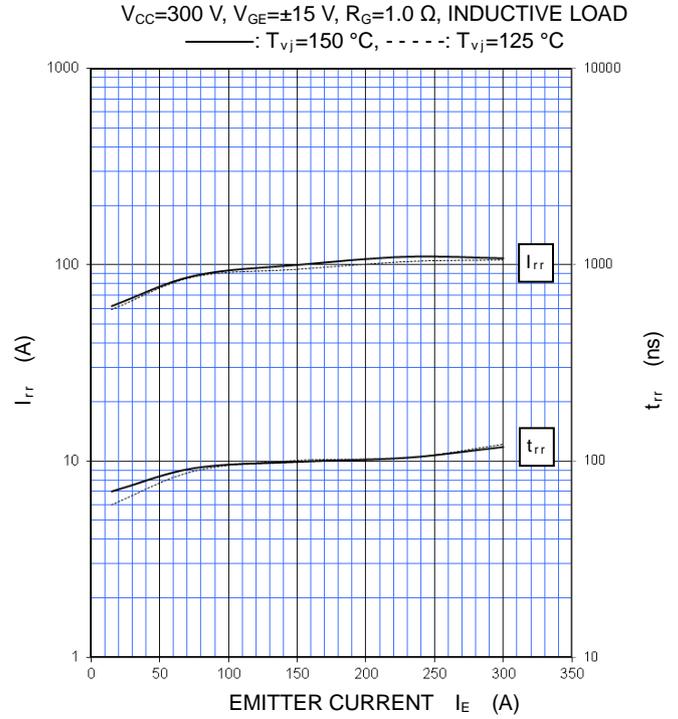
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

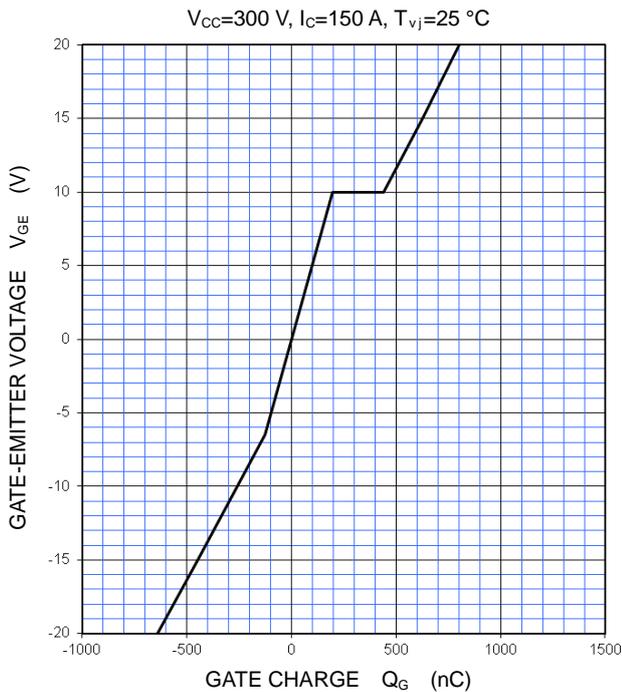
CAPACITANCE CHARACTERISTICS (TYPICAL)



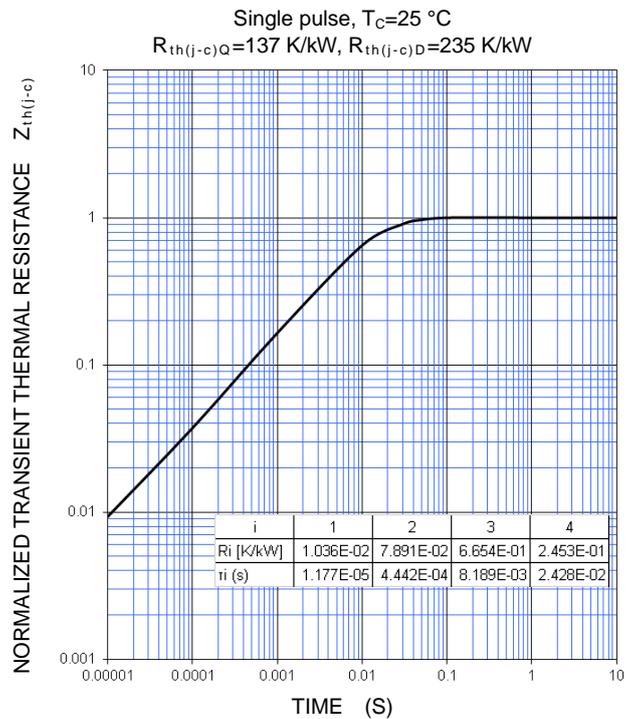
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



GATE CHARGE CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)



Note: The characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

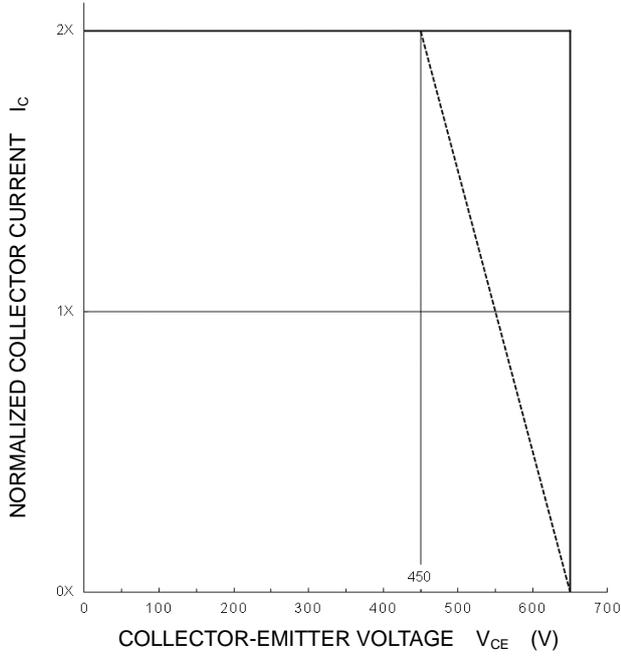
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HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

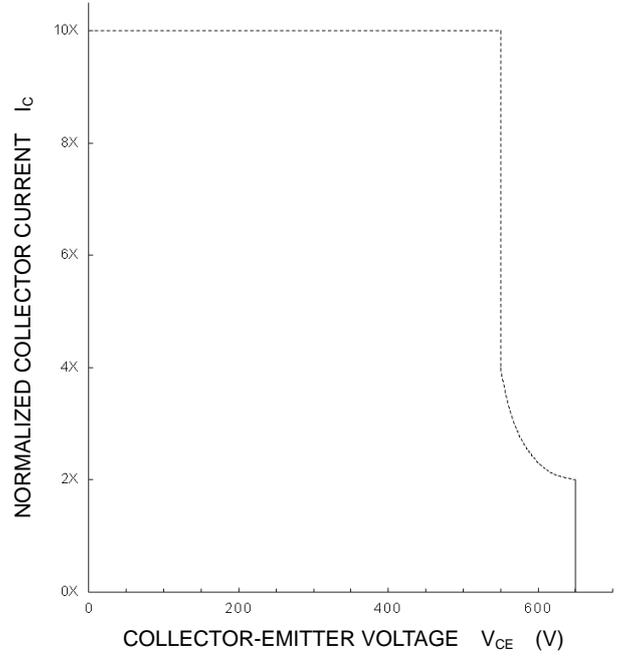
**TURN-OFF SWITCHING SAFE OPERATING AREA
(REVERSE BIAS SAFE OPERATING AREA)
(MAXIMUM)**

$V_{CC} \leq 450 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_G = 1.0 \sim 47 \Omega$,
——: $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$ (Normal load operations (Continuous))
- - - -: $T_{vj} = 175 \text{ }^\circ\text{C}$ (Unusual load operations (Limited period))



**SHORT-CIRCUIT SAFE OPERATING AREA
(MAXIMUM)**

$V_{CC} \leq 400 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_G = 1.0 \sim 47 \Omega$,
 $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$, $t_W \leq 8 \mu\text{s}$, Non-Repetitive



CM150DY-13T

HIGH POWER SWITCHING USE

INSULATED TYPE

Keep safety first in your circuit designs!

This product is designed for industrial application purpose. The performance, the quality and support level of the product is guaranteed by "Customer's Std. Spec."

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