

<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)
- Nickel-plating tab terminals
- RoHS Directive compliant
- UL Recognized under UL1557, File No. E323585

APPLICATION

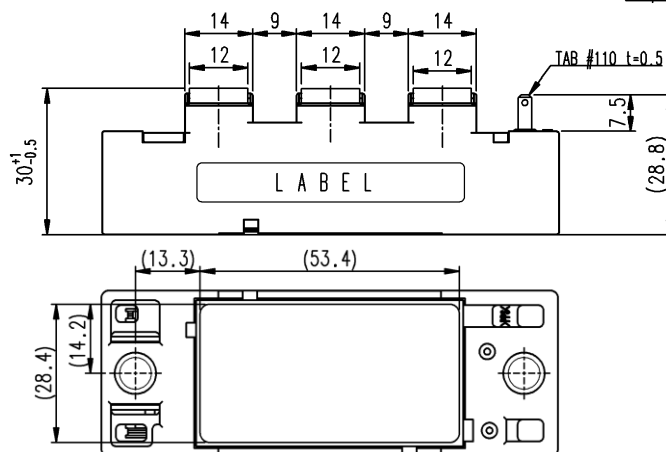
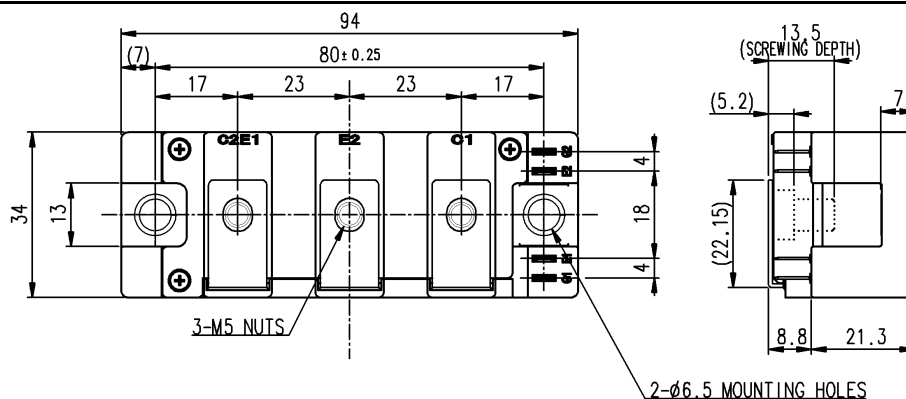
AC Motor Control, Motion/Servo Control, Power supply, etc.

OPTION (Below options are available.)

- PC-TIM (Phase Change Thermal Interface Material) pre-apply (Note8)

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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CM150DY-13THIGH POWER SWITCHING USE
INSULATED TYPE**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) (Note8) | 175 | °C |
| T _{Cmax} | Maximum case temperature | (Note4,8) | 150* | |
| T _{vjop} | Operating junction temperature | Continuous operation (under switching) (Note8) | -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 |
| | | | T _{vj} =125 °C | 1.50 | - | |
| | | | T _{vj} =150 °C | 1.55 | - | |
| V _{CESat} (Chip) | Collector-emitter saturation voltage | I _C =150 A, V _{GE} =15 V, (Note5) | T _{vj} =25 °C | 1.30 | 1.55 | V |
| | | | T _{vj} =125 °C | 1.35 | - | |
| | | | T _{vj} =150 °C | 1.35 | - | |
| C _{ies} | Input capacitance | V _{CE} =10 V, G-E short-circuited | - | - | 20.1 | nF |
| C _{oes} | Output capacitance | | - | - | 0.9 | |
| C _{res} | Reverse transfer capacitance | | - | - | 0.4 | |
| Q _G | Gate charge | V _{CC} =300 V, I _C =150 A, V _{GE} =15 V | - | 0.62 | - | μC |
| t _{d(on)} | Turn-on delay time | V _{CC} =300 V, I _C =150 A, V _{GE} =±15 V, R _G =1.0 Ω, Inductive load | - | - | 300 | ns |
| t _r | Rise time | | - | - | 150 | |
| t _{d(off)} | Turn-off delay time | | - | - | 400 | |
| t _f | Fall time | | - | - | 400 | |
| V _{EC} (Note.1) (Terminal) | Emitter-collector voltage | 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} (Note.1) (Chip) | Emitter-collector voltage | 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, R _G =1.0 Ω, Inductive load | - | - | 150 | ns |
| Q _{rr} (Note1) | Reverse recovery charge | | - | 5.0 | - | μC |
| E _{on} | Turn-on switching energy per pulse | V _{CC} =300 V, I _C =I _E =150 A, V _{GE} =±15 V, R _G =1.0 Ω, T _{vj} =150 °C, | - | 2.1 | - | mJ |
| E _{off} | Turn-off switching energy per pulse | Inductive load | - | 7.1 | - | |
| E _{rr} (Note1) | Reverse recovery energy per pulse | | - | 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.

CM150DY-13T

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 (Note4,6,8) | - | 36.6 | - | K/kW |

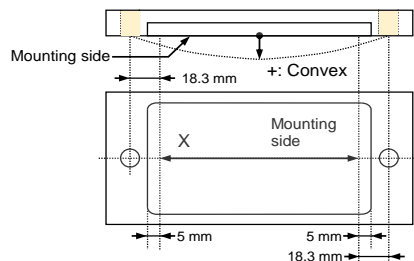
MECHANICAL CHARACTERISTICS

| 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 and (EU) 2015/863.

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

- Junction temperature (T_{vj}) should not increase beyond $T_{vj\max}$ rating.
- Pulse width and repetition rate should be such that the device junction temperature (T_{vj}) does not exceed $T_{vj\max}$ 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 $\lambda=3.0 \text{ W/(m}\cdot\text{K)}/D_{(c-s)}=50 \mu\text{m}$.
- The base plate (mounting side) flatness measurement point is as follows of the following figure.



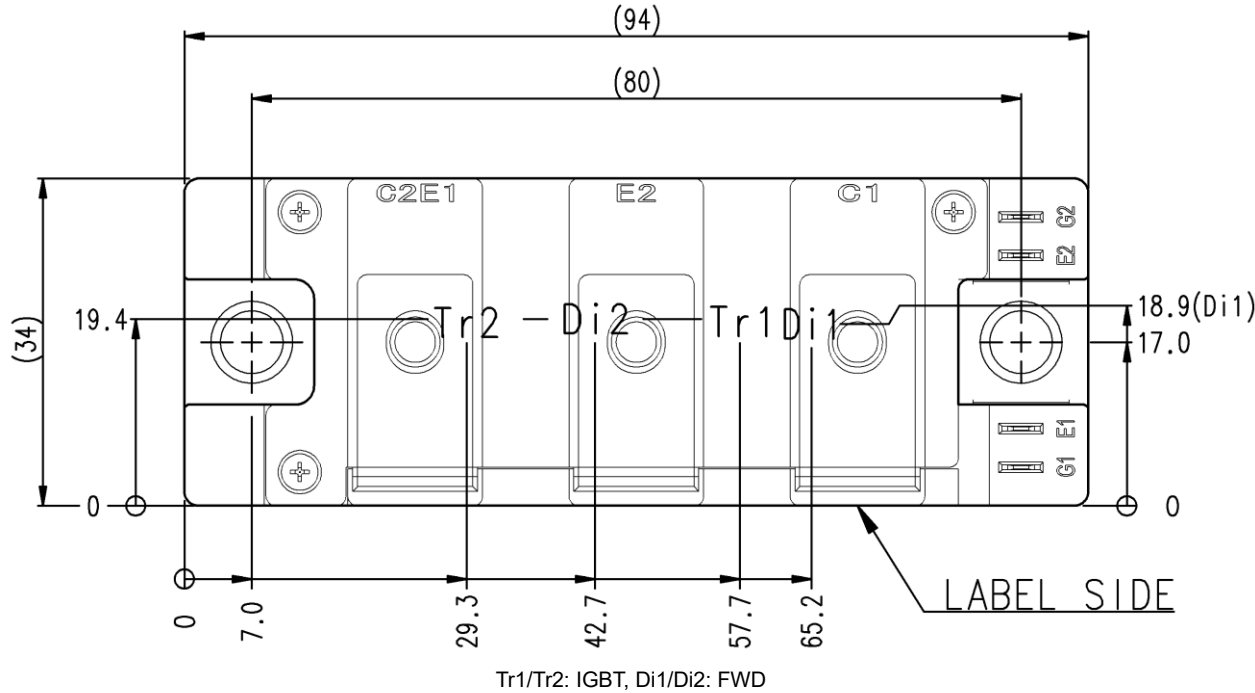
- Long term performance related to thermal conductive grease and PC-TIM (including but not limited to aspects such as the increase of thermal resistance due to pumping out, etc.) should be verified under your specific application conditions. Each temperature condition ($T_{vj\max}$, $T_{vj\text{op}}$, $T_{c\max}$) must be maintained below the maximum rated temperature throughout consideration of the temperature rise even for long term usage.

<IGBT Modules>
CM150DY-13T
HIGH POWER SWITCHING USE
INSULATED TYPE

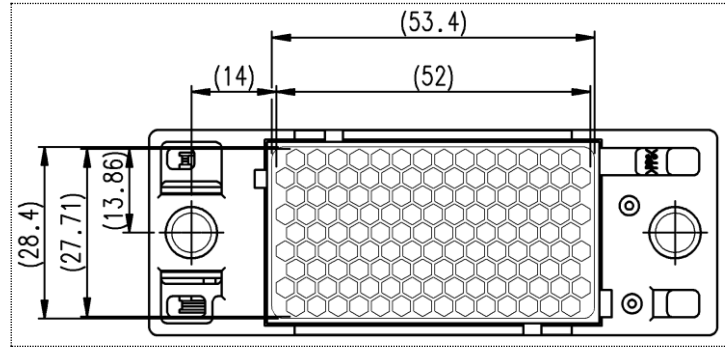
RECOMMENDED OPERATING CONDITIONS

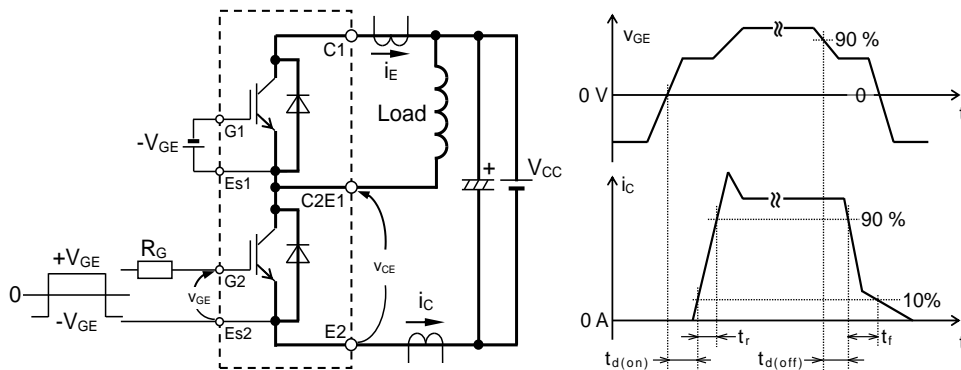
| Symbol | Item | Conditions | Limits | | | Unit |
|------------|-------------------------------|----------------------------------------|--------|------|------|----------|
| | | | Min. | Typ. | Max. | |
| V_{CC} | (DC) Supply voltage | Applied across C1-E2 terminals | - | 300 | 450 | V |
| V_{GEon} | 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

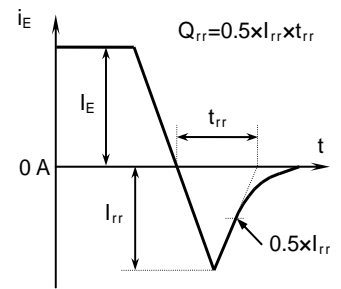
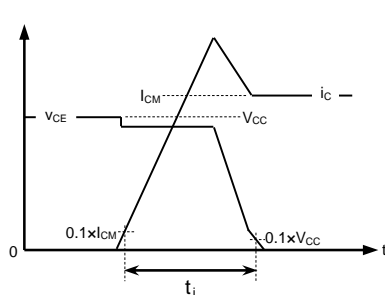


Option: PC-TIM applied baseplate outline

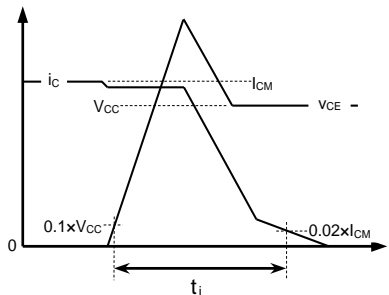


CM150DY-13THIGH POWER SWITCHING USE
INSULATED TYPE**TEST CIRCUIT AND WAVEFORMS**

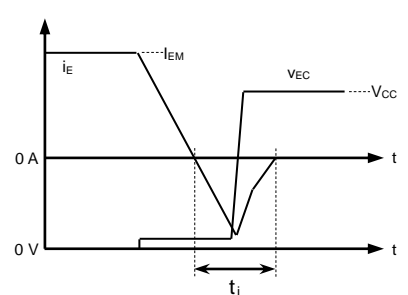
Switching characteristics test circuit and waveforms

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

IGBT Turn-on switching energy

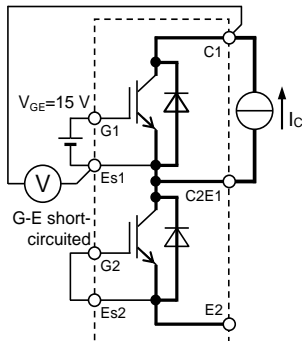


IGBT Turn-off switching energy

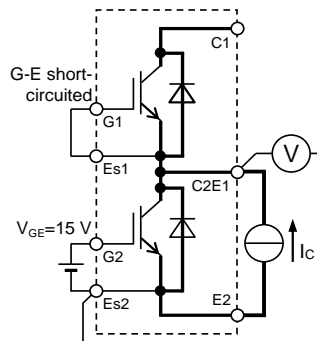


FWD Reverse recovery energy

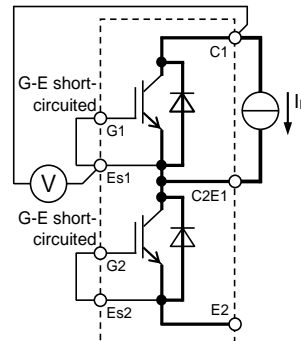
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

TEST CIRCUIT

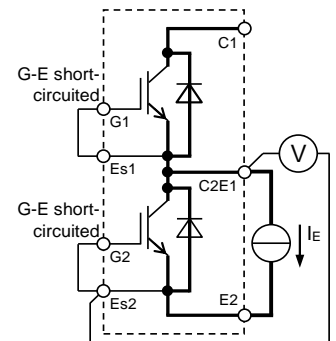
Tr1

 V_{CEsat} characteristics test circuit

Tr2



Di1

 V_{EC} characteristics test circuit

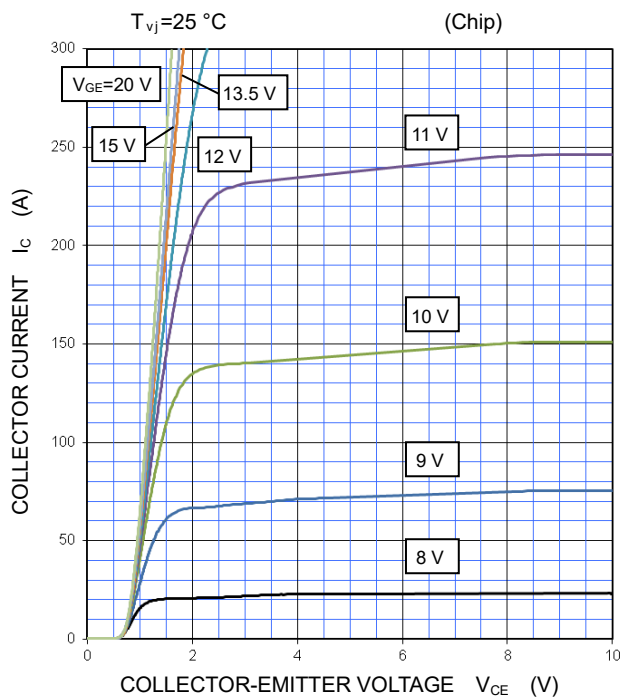
Di2

CM150DY-13T

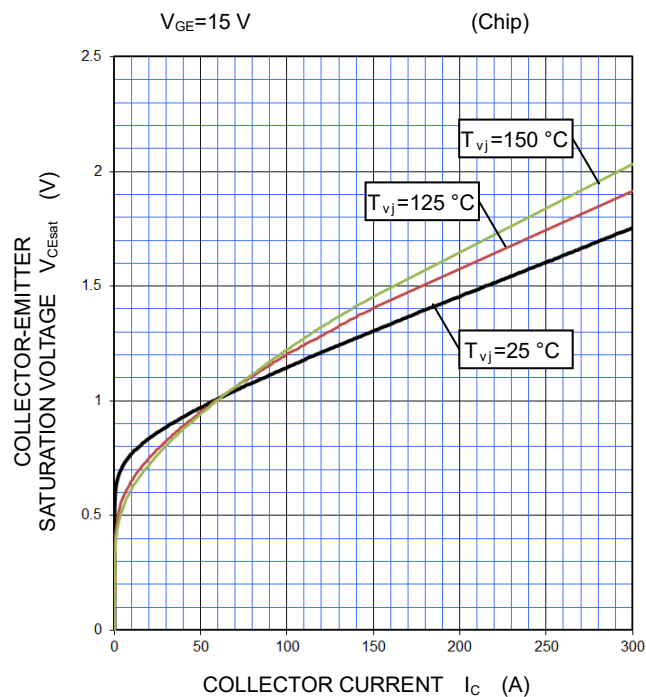
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

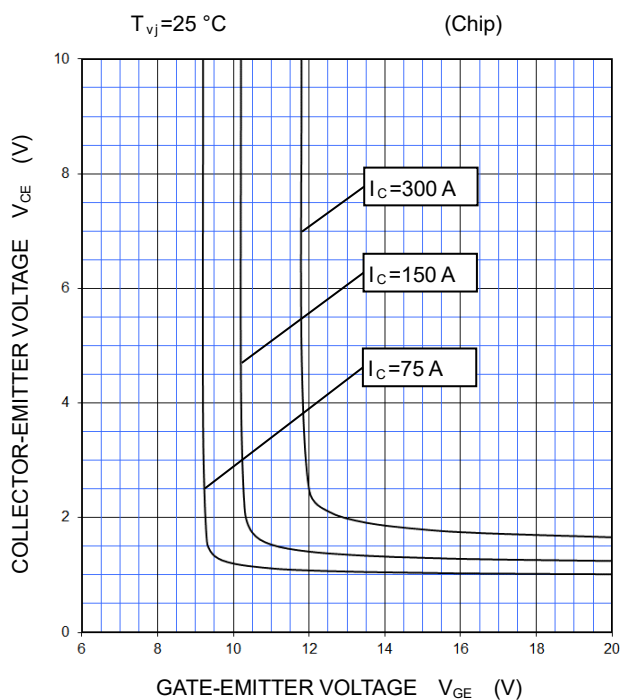
**OUTPUT CHARACTERISTICS
(TYPICAL)**



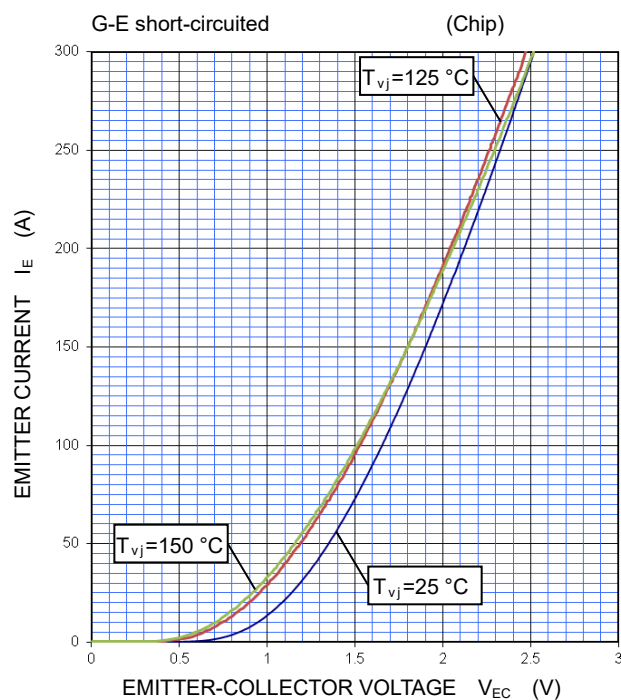
**COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)**



**COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS
(TYPICAL)**



**FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)**



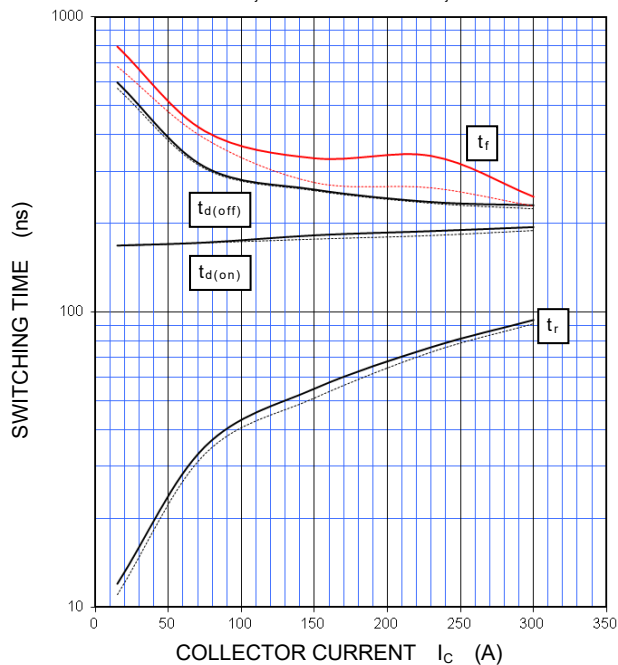
CM150DY-13T

HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

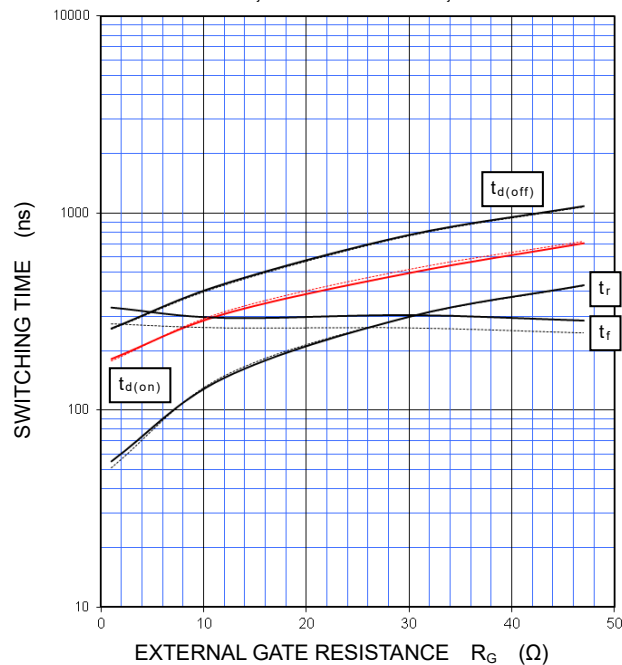
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

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



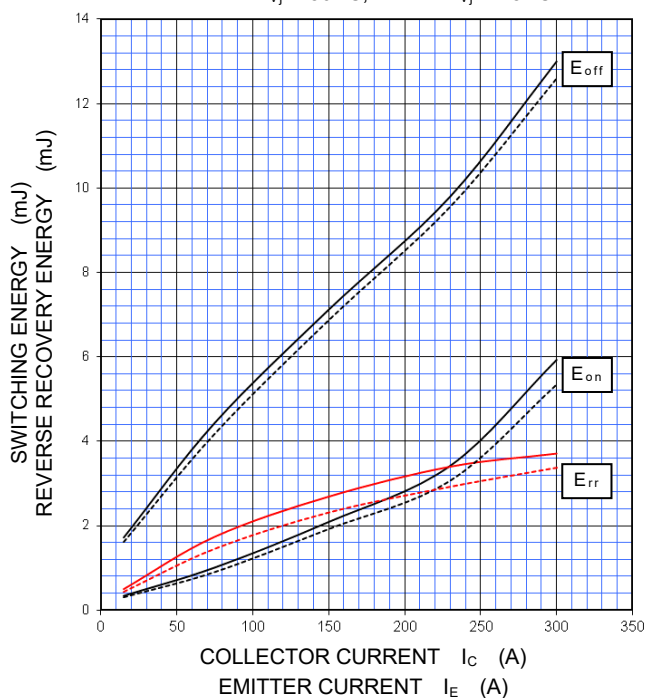
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

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



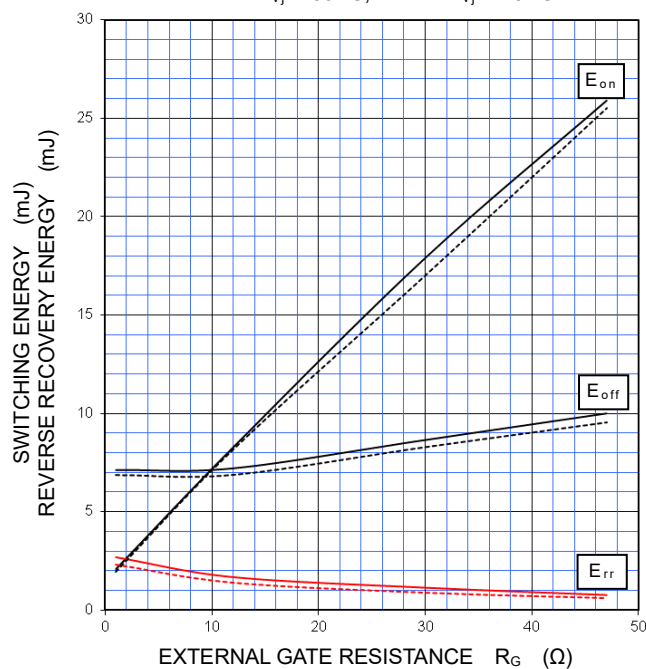
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

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



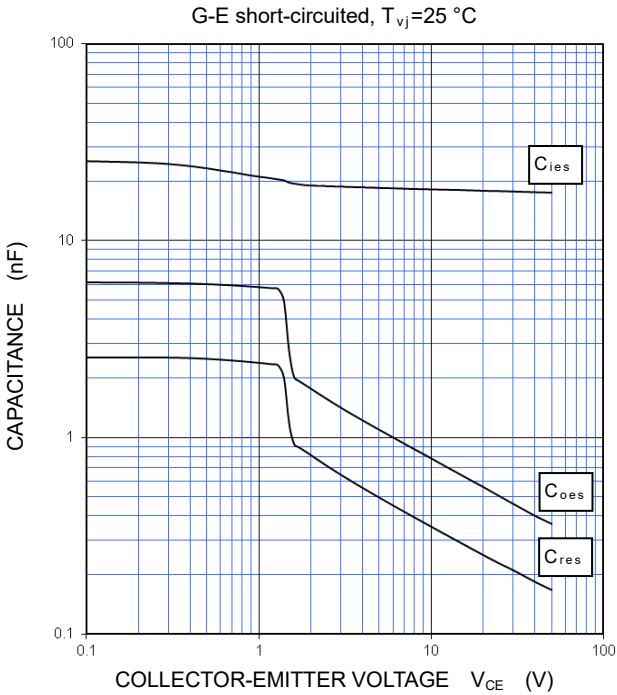
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

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

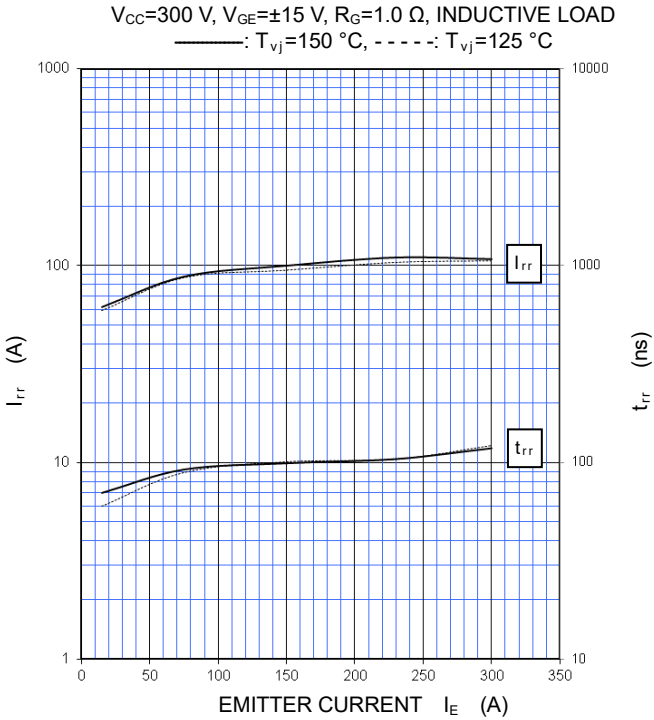


PERFORMANCE CURVES

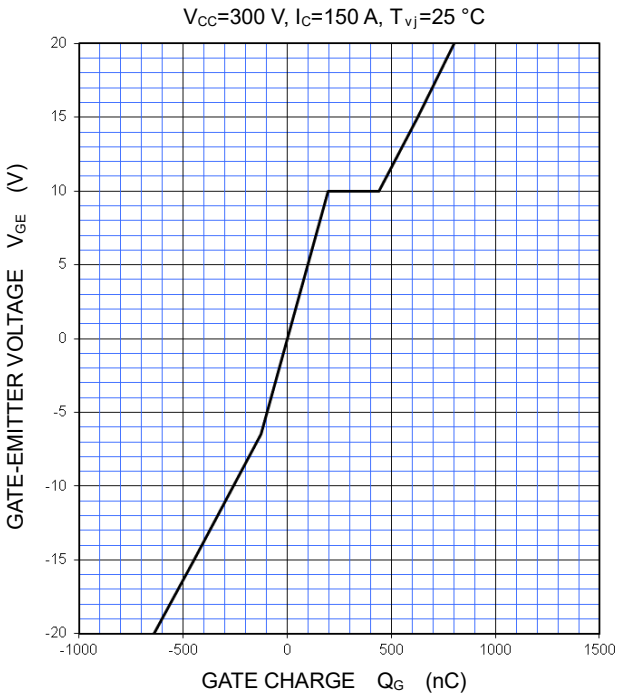
CAPACITANCE CHARACTERISTICS
(TYPICAL)



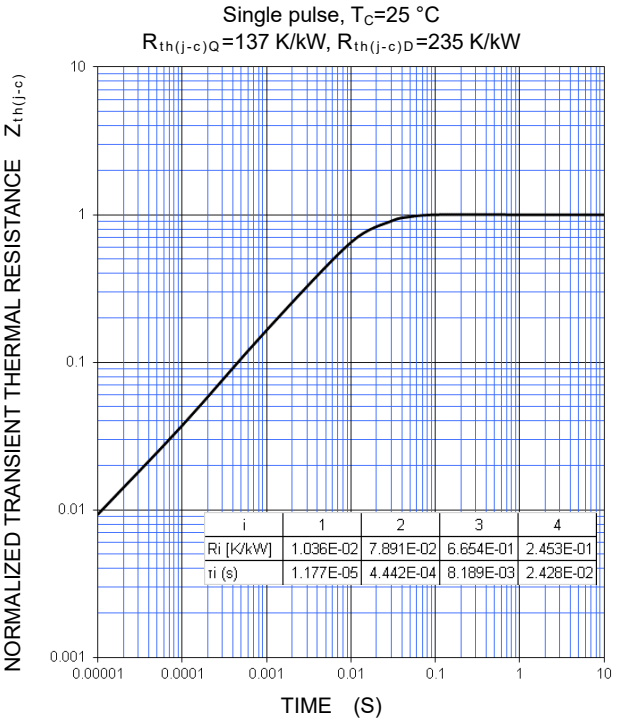
FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)



GATE CHARGE CHARACTERISTICS
(TYPICAL)

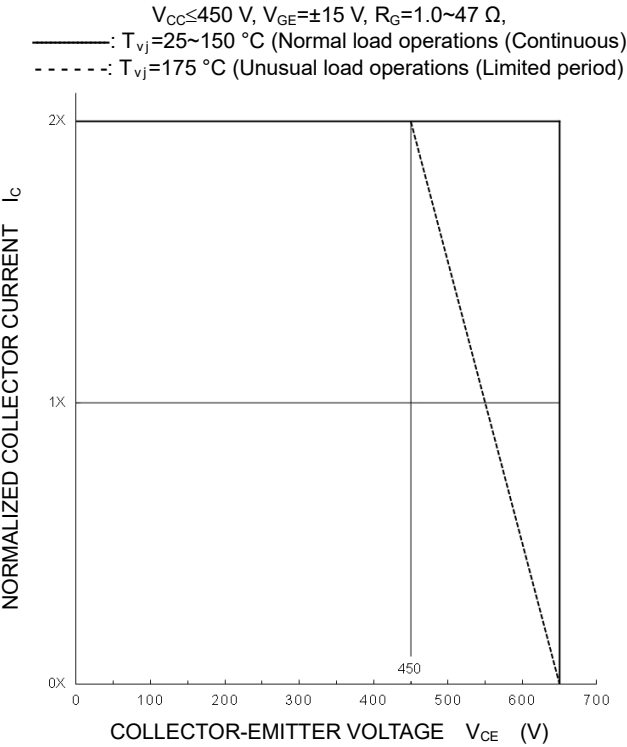


TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)

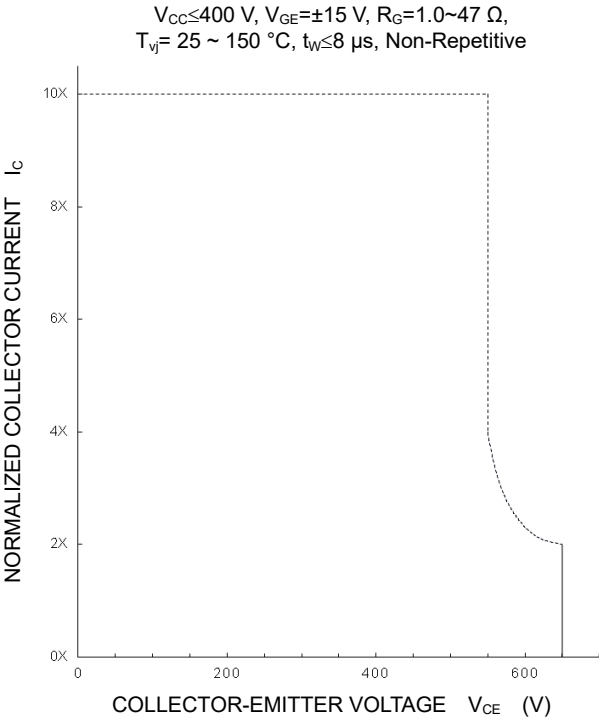


PERFORMANCE CURVES

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



SHORT-CIRCUIT SAFE OPERATING AREA
(MAXIMUM)



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

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