

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

APPLICATION

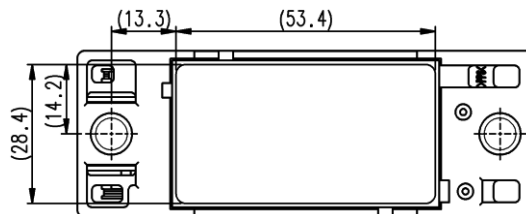
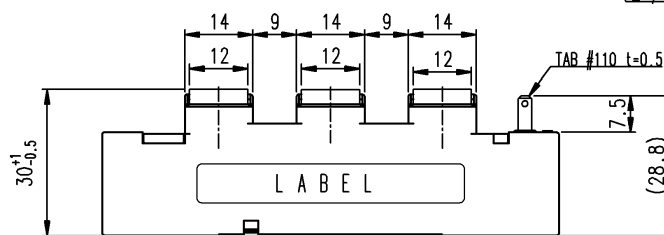
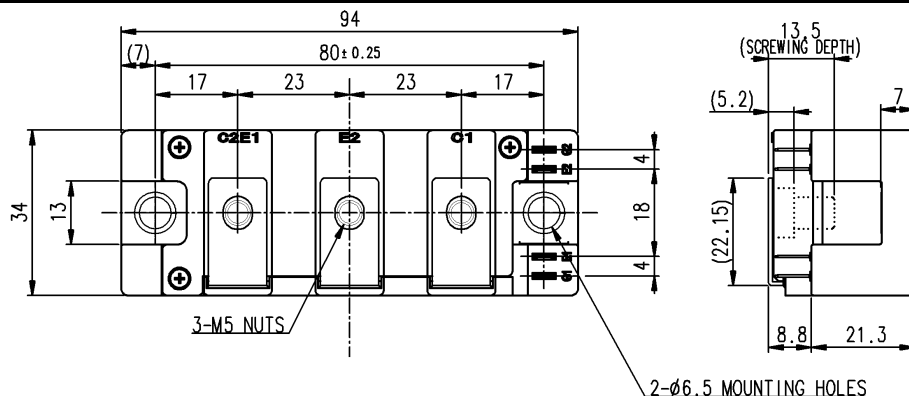
AC Motor Control, Motion/Servo Control, Power supply, etc.

OPTION (Below options are available.)

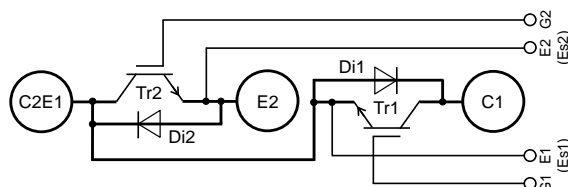
- PC-TIM (Phase Change Thermal Interface Material) pre-apply

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

JIS B 0405 c

CM150DY-13THIGH POWER SWITCHING USE
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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 =125 °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)	125	
T _{vjop}	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	°C
T _{stg}	Storage temperature	-	-40 ~ +125	

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,	-	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

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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, Thermal grease applied (Note4, 6)	-	36.6	-	K/kW
		per 1 module, PC-TIM applied (Note4, 7)	-	9.7	-	

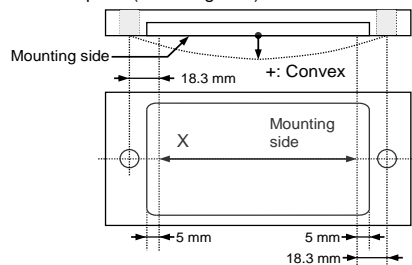
MECHANICAL CHARACTERISTICS

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 (Note8)	±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 $\lambda=0.9 \text{ W}/(\text{m}\cdot\text{K})/D_{(C-S)}=50 \text{ }\mu\text{m}$.
- Typical value is measured by using PC-TIM of $\lambda=3.4 \text{ W}/(\text{m}\cdot\text{K})/D_{(C-S)}=50 \text{ }\mu\text{m}$.
- The base plate (mounting side) flatness measurement point is as follows of the following figure.



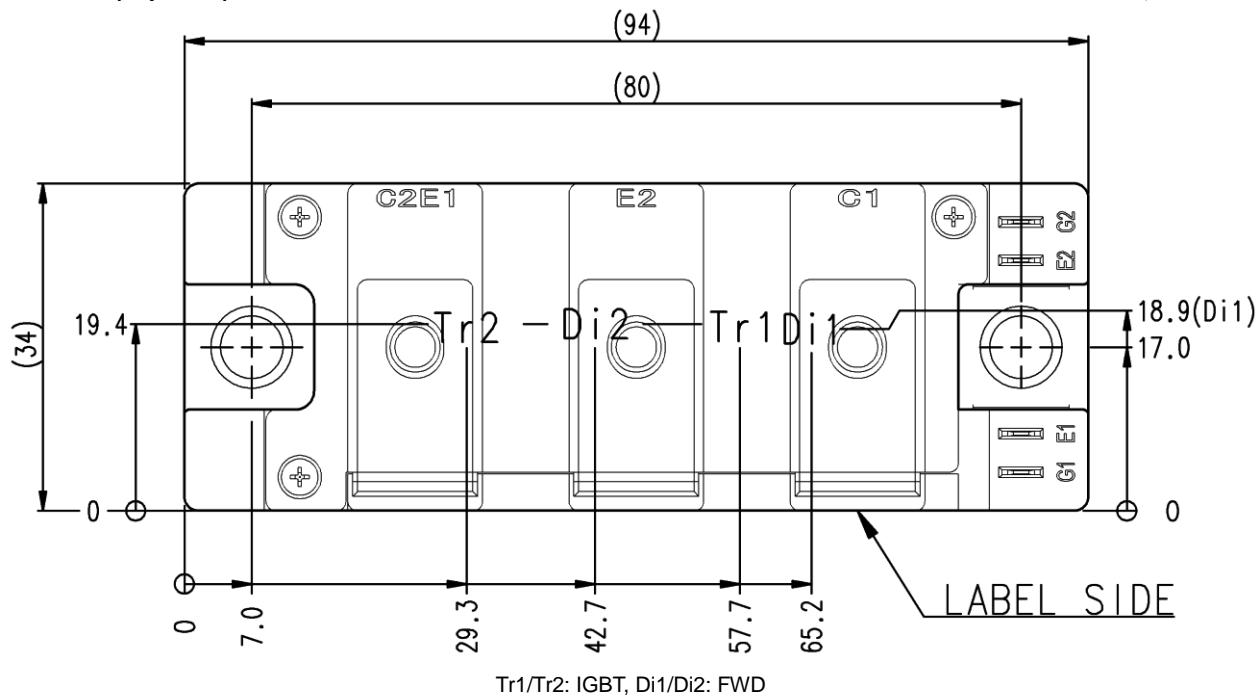
<IGBT Modules>
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INSULATED TYPE

RECOMMENDED OPERATING CONDITIONS

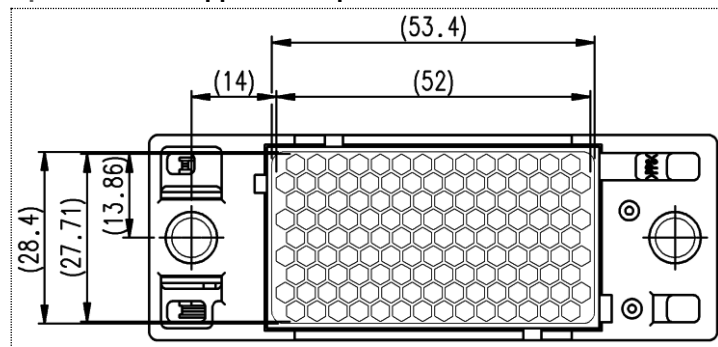
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across C1-E2 terminals	-	300	450	V
V_{GEon}	Gate (-emitter drive) voltage	Applied across G1-Es1/G2-Es2 terminals	13.5	15.0	16.5	V
R_G	External gate resistance	Per switch	1.0	-	47	Ω

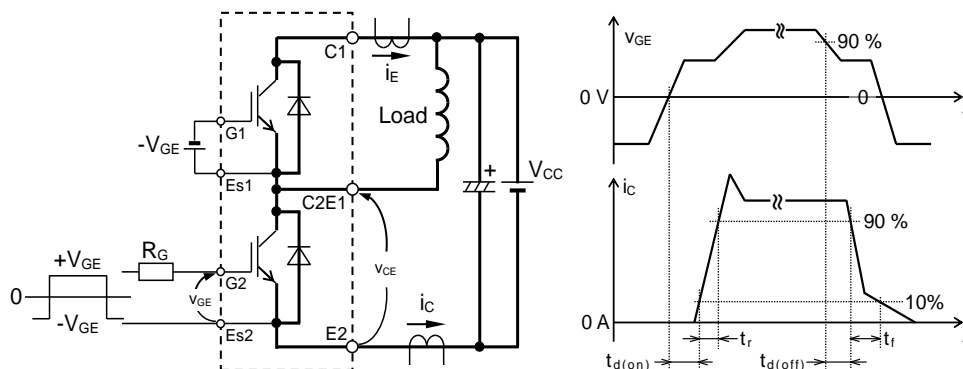
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ± 1 mm

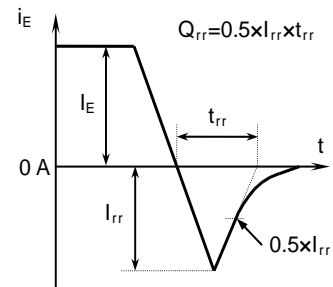
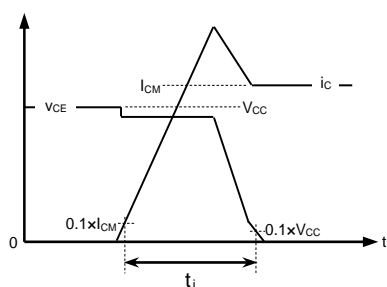


Option: PC-TIM applied baseplate outline

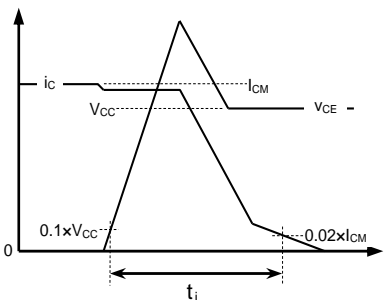


CM150DY-13THIGH POWER SWITCHING USE
INSULATED TYPE**TEST CIRCUIT AND WAVEFORMS**

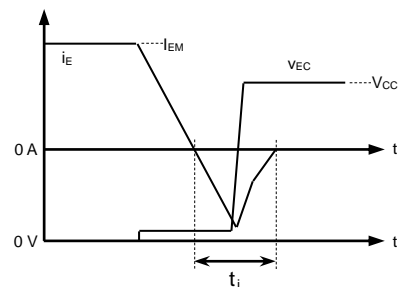
Switching characteristics test circuit and waveforms

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

IGBT Turn-on switching energy

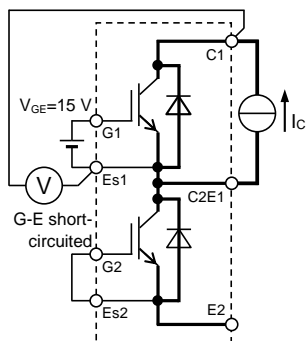


IGBT Turn-off switching energy

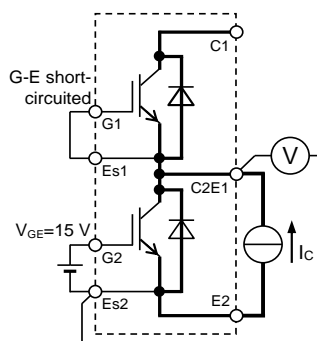


FWD Reverse recovery energy

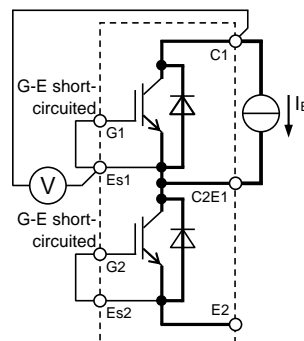
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

TEST CIRCUIT

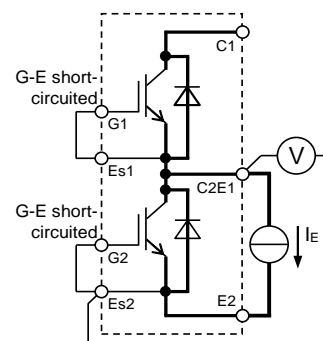
Tr1

 V_{CEsat} characteristics test circuit

Tr2



Di1

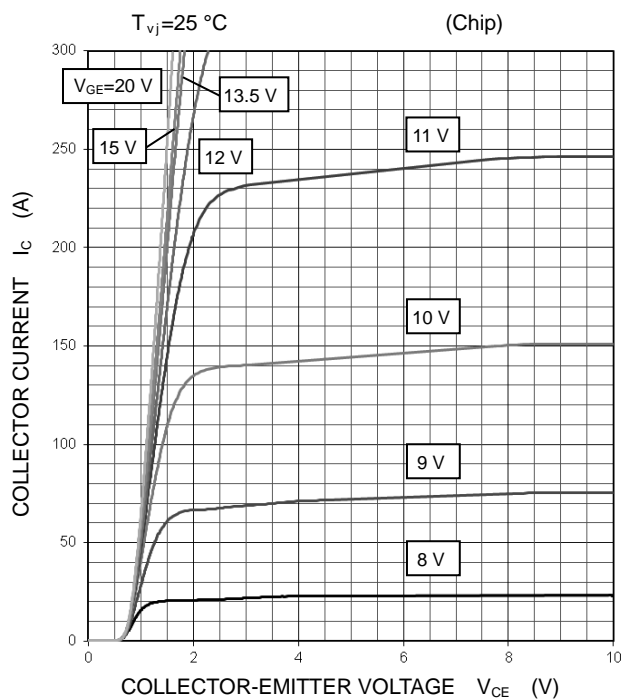
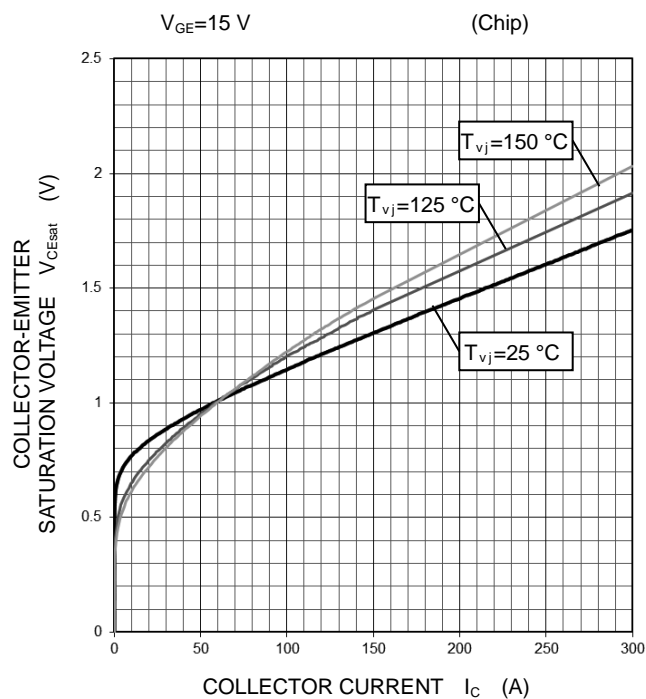
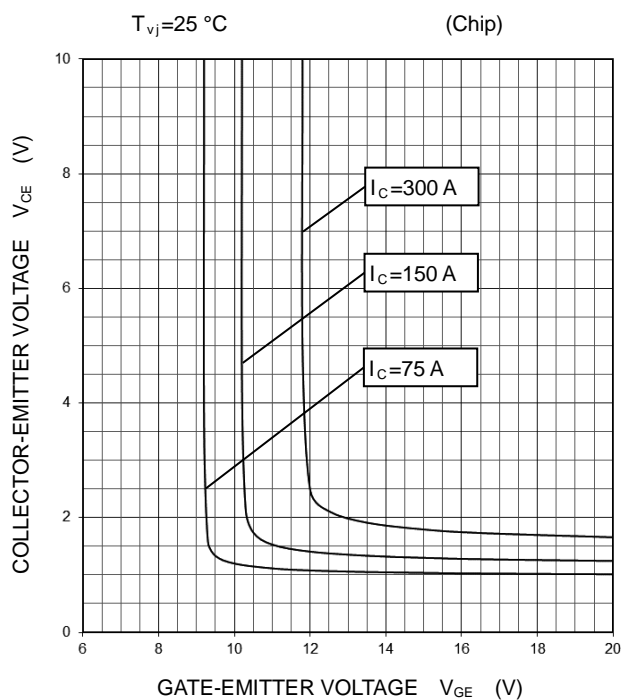
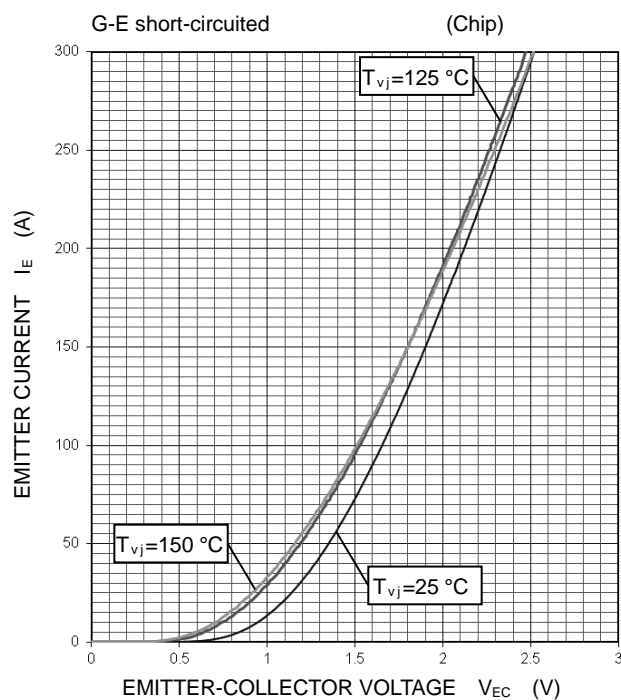
 V_{EC} characteristics test circuit

Di2

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INSULATED TYPE

PERFORMANCE CURVES**OUTPUT CHARACTERISTICS
(TYPICAL)****COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)****COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS
(TYPICAL)****FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)**

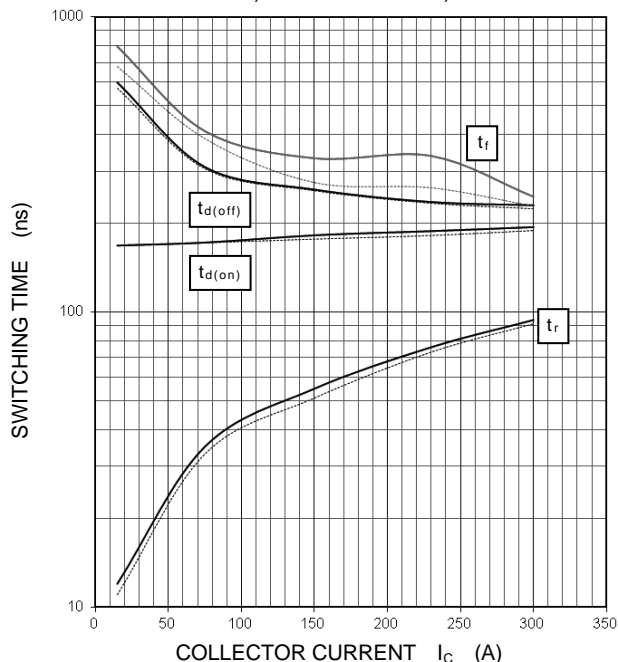
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HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

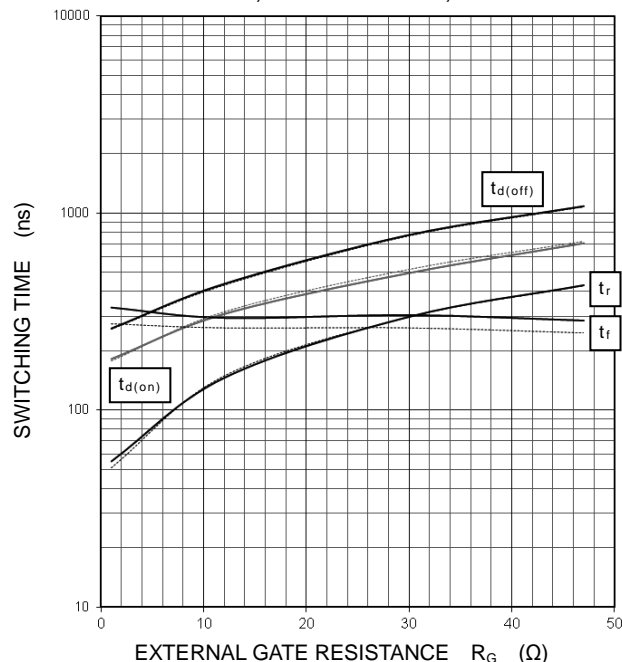
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

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



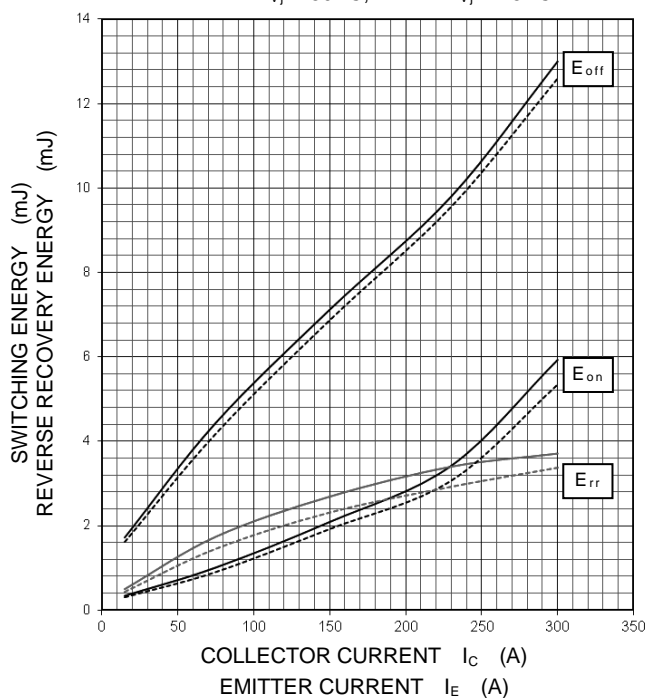
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

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



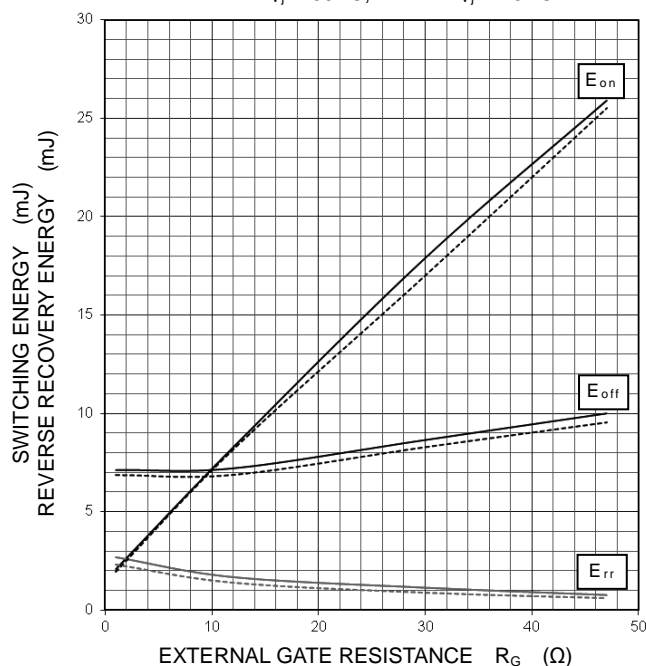
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

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



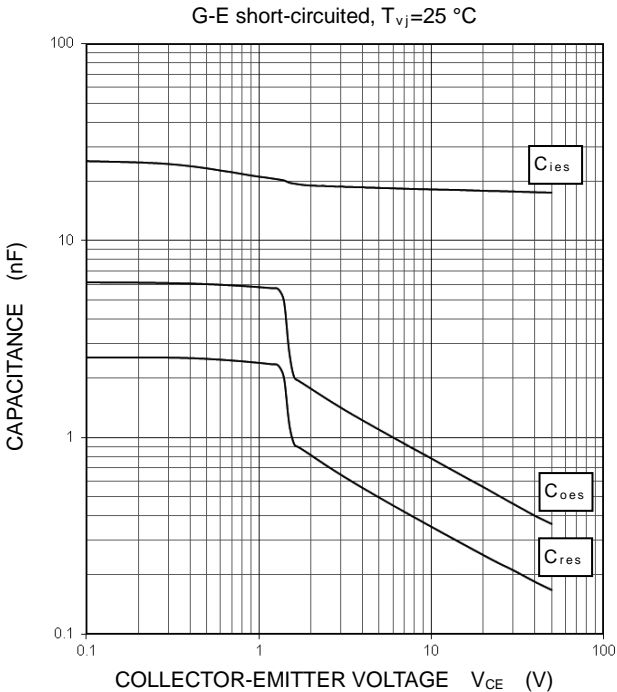
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

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

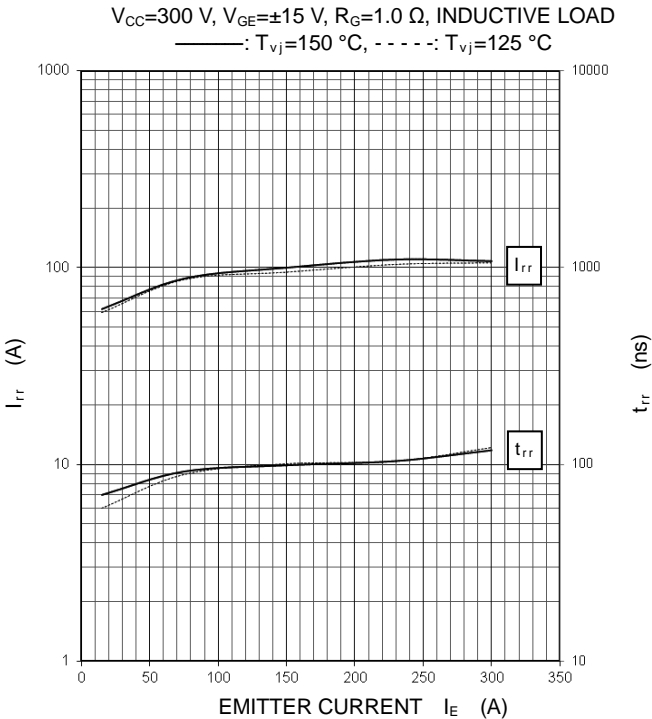


PERFORMANCE CURVES

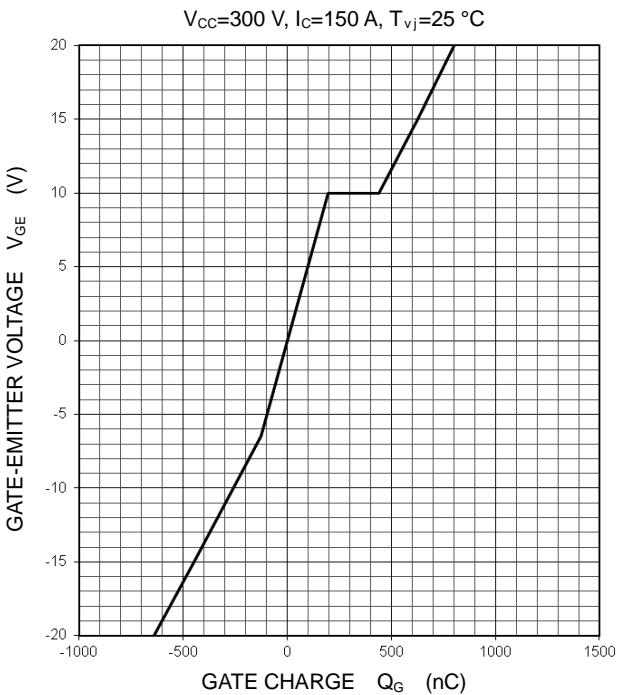
CAPACITANCE CHARACTERISTICS
(TYPICAL)



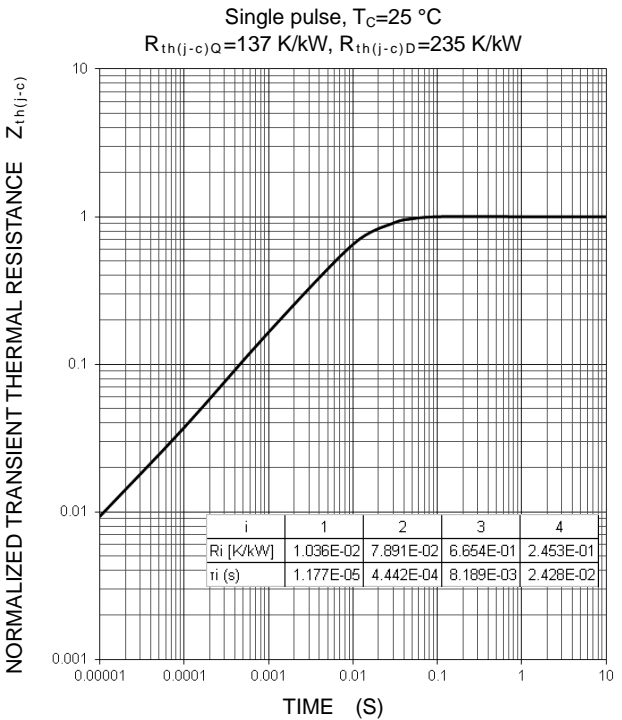
FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)



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.

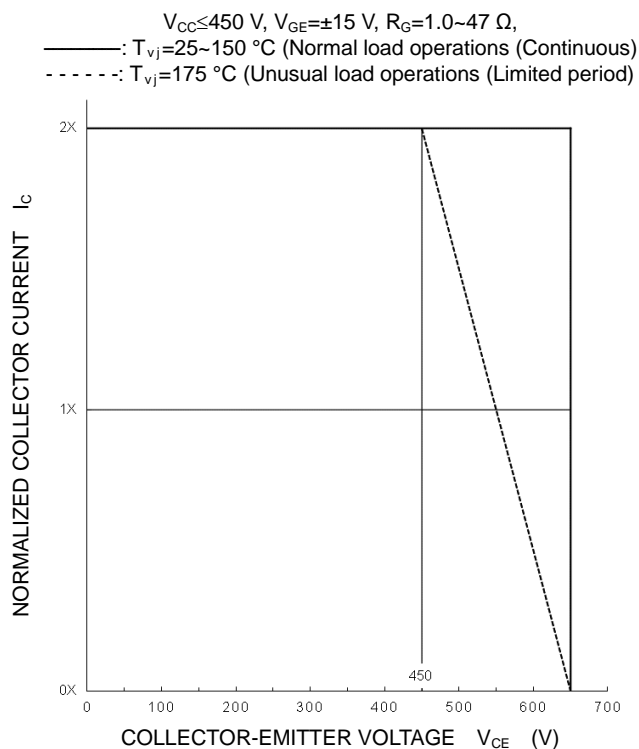
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HIGH POWER SWITCHING USE

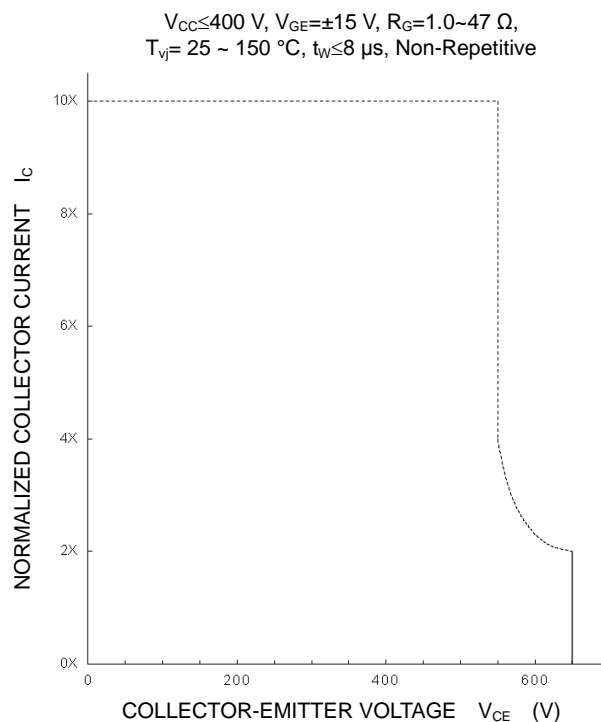
INSULATED TYPE

PERFORMANCE CURVES

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



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



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