

<IGBT Modules>

CM450DY-24T

HIGH POWER SWITCHING USE
INSULATED TYPE



dual switch (half-bridge)

Collector current I_C **4 5 0 A**
 Collector-emitter voltage V_{CES} **1 2 0 0 V**
 Maximum junction temperature T_{vjmax} **1 7 5 °C**

- Flat base type
- Copper base plate (Nickel-plating)
- Tin-plating signal terminals
- RoHS Directive compliant
- UL Recognized under UL1557, File No.E323585

APPLICATION

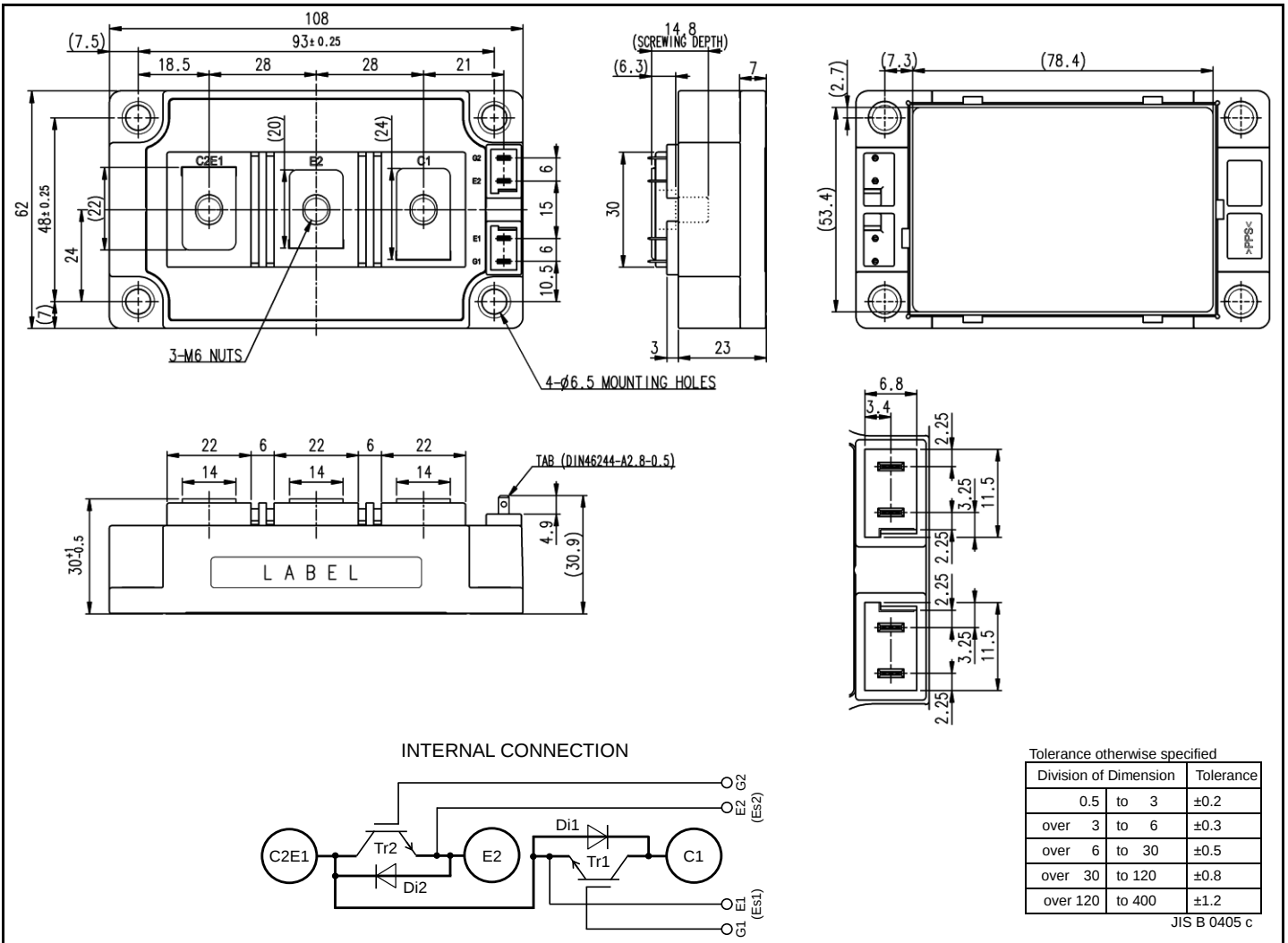
AC Motor Control, Motion/Servo Control, Power supply, etc.

OPTION (Below options are available.)

- PC-TIM (Phase Change Thermal Interface Material) pre-apply
- V_{CESat} selection for parallel connection

OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm



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HIGH POWER SWITCHING USE
INSULATED TYPEMAXIMUM RATINGS (T_{vj}=25 °C, unless otherwise specified)

Symbol	Item	Conditions	Rating	Unit
V _{CES}	Collector-emitter voltage	G-E short-circuited	1200	V
V _{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I _C	Collector current	DC, T _C =125 °C (Note2, 4)	450	A
I _{CRM}		Pulse, Repetitive (Note3)	900	
P _{tot}	Total power dissipation	T _C =25 °C (Note2, 4)	4835	W
I _E (Note1)	Emitter current	DC (Note2)	450	A
I _{ERM} (Note1)		Pulse, Repetitive (Note3)	900	
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 =45 mA, V _{CE} =10 V	5.4	6.0	6.6	V
V _{CESat} (Terminal)	Collector-emitter saturation voltage	I _C =450 A, V _{GE} =15 V, Refer to the figure of test circuit (Note5)	T _{vj} =25 °C	1.70	2.00	V
			T _{vj} =125 °C	1.95	-	
			T _{vj} =150 °C	2.00	-	
V _{CESat} (Chip)	Collector-emitter saturation voltage	I _C =450 A, V _{GE} =15 V, (Note5)	T _{vj} =25 °C	1.55	1.80	V
			T _{vj} =125 °C	1.75	-	
			T _{vj} =150 °C	1.80	-	
C _{ies}	Input capacitance	V _{CE} =10 V, G-E short-circuited	-	-	92.3	nF
C _{oes}	Output capacitance		-	-	2.7	
C _{res}	Reverse transfer capacitance		-	-	1.1	
Q _G	Gate charge	V _{CC} =600 V, I _C =450 A, V _{GE} =15 V	-	3.0	-	μC
t _{d(on)}	Turn-on delay time	V _{CC} =600 V, I _C =450 A, V _{GE} =±15 V, R _G =1.0 Ω, Inductive load	-	-	500	ns
t _r	Rise time		-	-	200	
t _{d(off)}	Turn-off delay time		-	-	600	
t _f	Fall time		-	-	300	
V _{EC} (Note1) (Terminal)	Emitter-collector voltage	I _E =450 A, G-E short-circuited, Refer to the figure of test circuit (Note5)	T _{vj} =25 °C	1.80	2.20	V
			T _{vj} =125 °C	1.95	-	
			T _{vj} =150 °C	1.95	-	
V _{EC} (Note1) (Chip)	Emitter-collector voltage	I _E =450 A, G-E short-circuited, (Note5)	T _{vj} =25 °C	1.65	2.00	V
			T _{vj} =125 °C	1.65	-	
			T _{vj} =150 °C	1.65	-	
t _{rr} (Note1)	Reverse recovery time	V _{CC} =600 V, I _E =450 A, V _{GE} =±15 V, R _G =1.0 Ω, Inductive load	-	-	400	ns
Q _{rr} (Note1)	Reverse recovery charge	R _G =1.0 Ω, Inductive load	-	45	-	μC
E _{on}	Turn-on switching energy per pulse	V _{CC} =600 V, I _C =I _E =450 A, V _{GE} =±15 V, R _G =1.0 Ω, T _{vj} =150 °C, Inductive load	-	40.9	-	mJ
E _{off}	Turn-off switching energy per pulse		-	47	-	
E _{rr} (Note1)	Reverse recovery energy per pulse	Inductive load	-	31.6	-	mJ
R _{CC'+EE'}	Internal lead resistance	Main terminals-chip, per switch, T _C =25 °C (Note4)	-	0.3	-	mΩ
r _g	Internal gate resistance	Per switch	-	1.0	-	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)	-	-	31	K/kW
$R_{th(j-c)D}$		Junction to case, per Inverter FWD (Note4)	-	-	54	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, Thermal grease applied (Note4, 6)	-	13.3	-	K/kW
		per 1 module, PC-TIM applied (Note4, 7)	-	3.5	-	

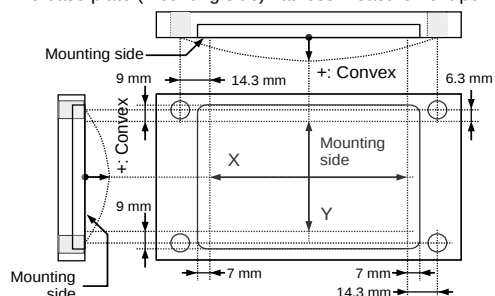
MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M_t	Mounting torque	Main terminals M 6 screw	3.5	4.0	4.5	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	17.3	-	-	mm
		Terminal to base plate	25.3	-	-	
d_a	Clearance	Terminal to terminal	12.6	-	-	mm
		Terminal to base plate	21.8	-	-	
e_c	Flatness of base plate	On the centerline X, Y (Note8)	±0	-	+200	μm
m	mass	-	-	260	-	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).

2. Junction temperature (T_{vj}) should not increase beyond T_{vjmax} rating.
3. Pulse width and repetition rate should be such that the device junction temperature (T_{vj}) dose not exceed T_{vjmax} rating.
4. 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.
5. Pulse width and repetition rate should be such as to cause negligible temperature rise. Refer to the figure of test circuit.
6. Typical value is measured by using thermally conductive grease of $\lambda=0.9 \text{ W}/(\text{m}\cdot\text{K})/D_{(c-s)}=50 \text{ }\mu\text{m}$.
7. Typical value is measured by using PC-TIM of $\lambda=3.4 \text{ W}/(\text{m}\cdot\text{K})/D_{(c-s)}=50 \text{ }\mu\text{m}$.
8. The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



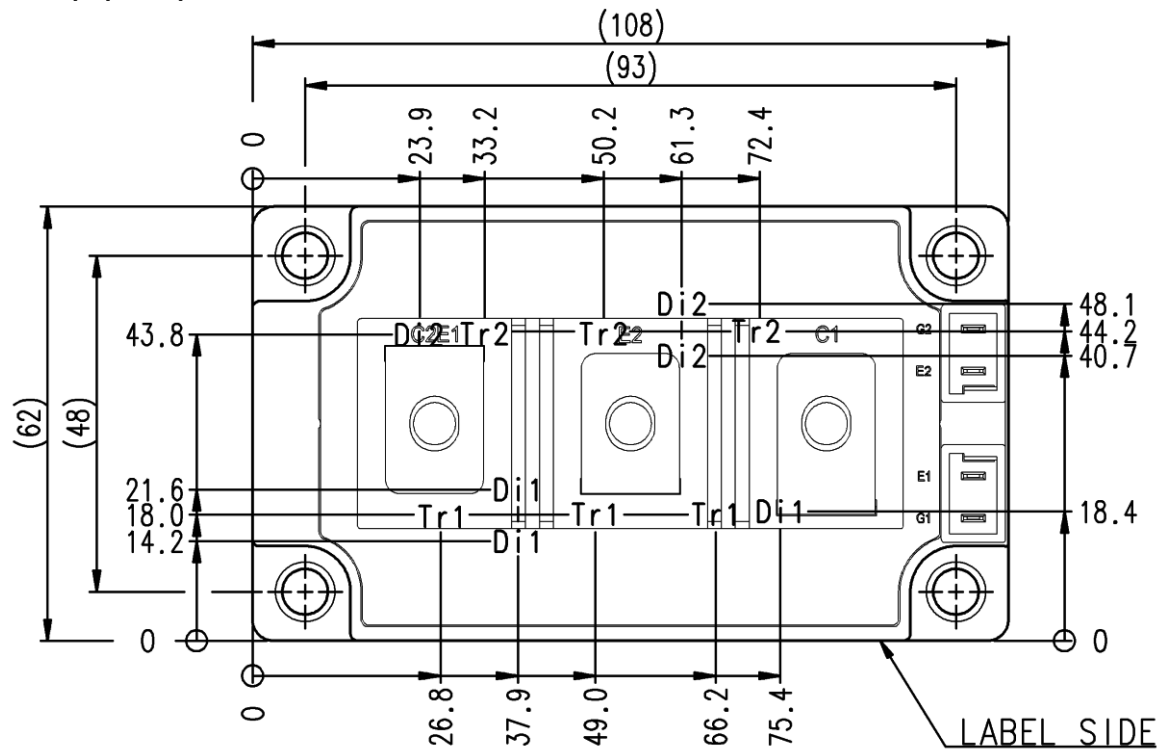
<IGBT Modules>
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RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across C1-E2 terminals	-	600	850	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	-	10	Ω

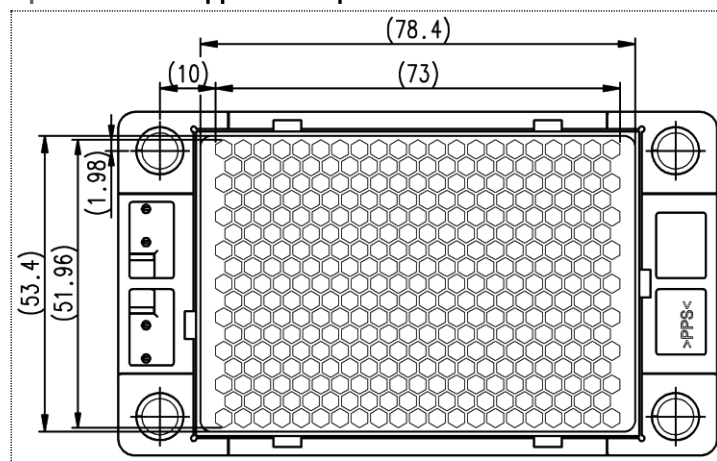
CHIP LOCATION (Top view)

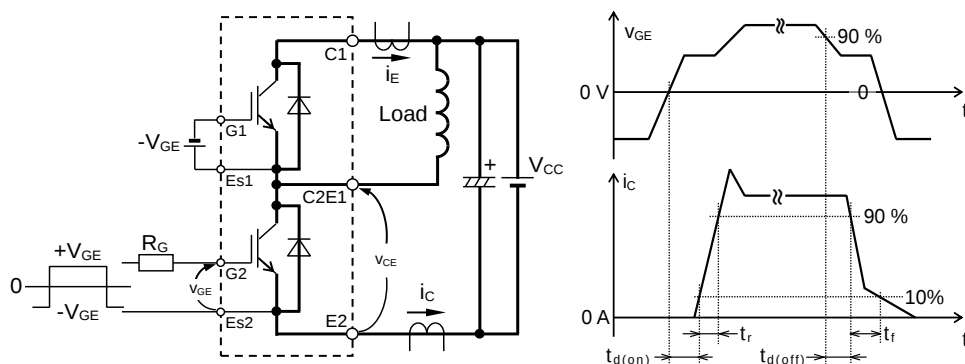
Dimension in mm, tolerance: ± 1 mm



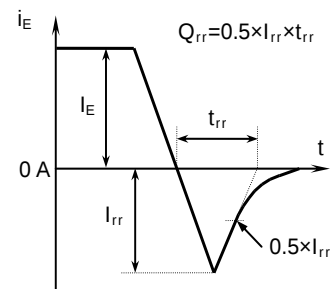
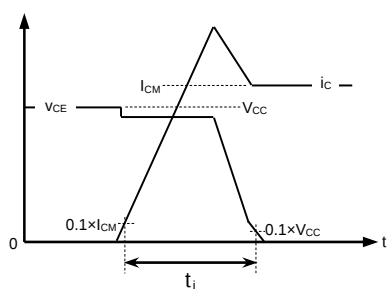
Tr1/Tr2: IGBT, Di1/Di2: FWD

Option: PC-TIM applied baseplate outline

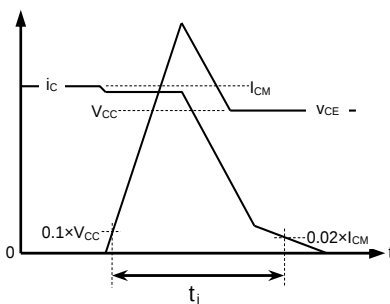


CM450DY-24THIGH POWER SWITCHING USE
INSULATED TYPE**TEST CIRCUIT AND WAVEFORMS**

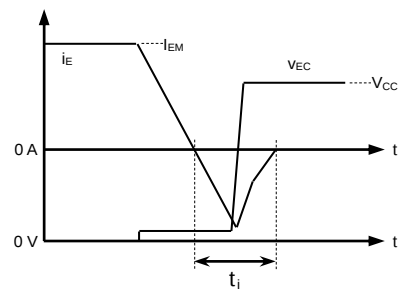
Switching characteristics test circuit and waveforms

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

IGBT Turn-on switching energy

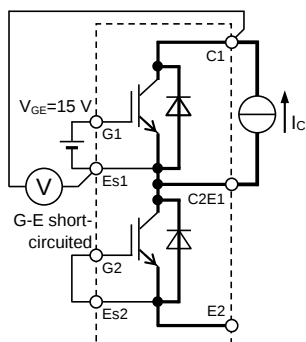


IGBT Turn-off switching energy

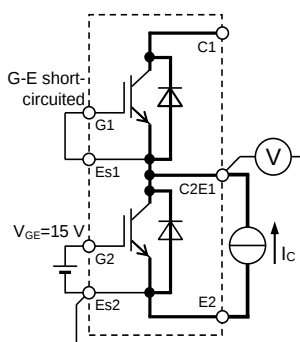


FWD Reverse recovery energy

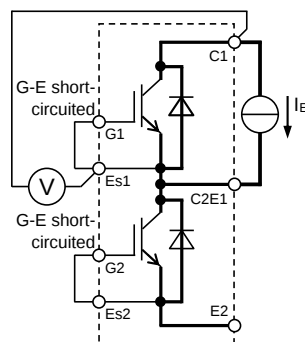
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

TEST CIRCUIT

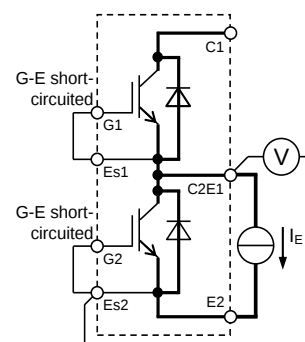
Tr1

 V_{CEsat} characteristics test circuit

Tr2



Di1

 V_{EC} characteristics test circuit

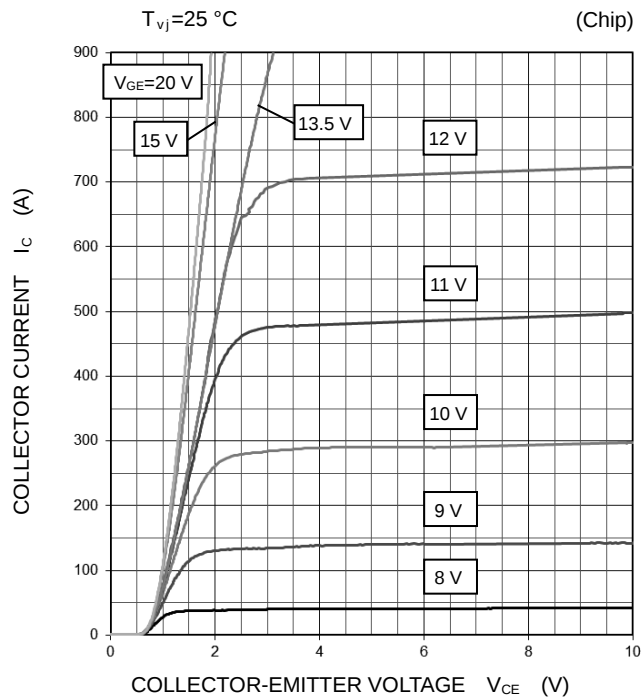
Di2

CM450DY-24T

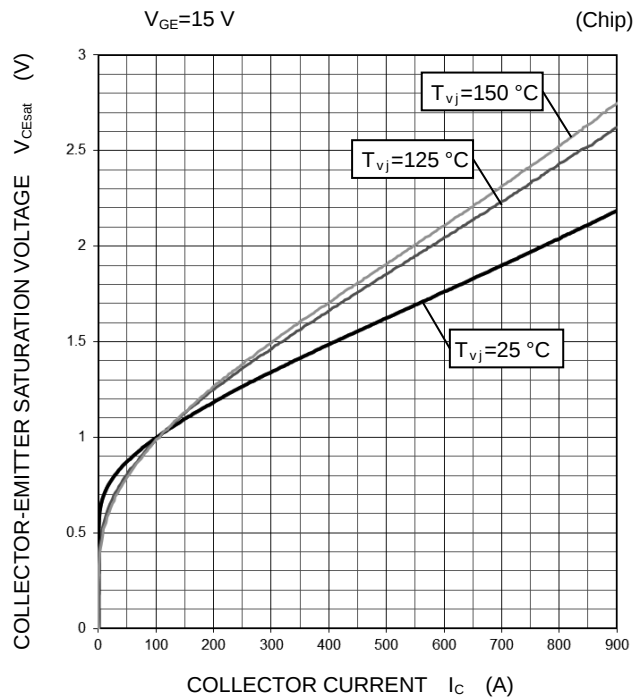
HIGH POWER SWITCHING USE
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PERFORMANCE CURVES

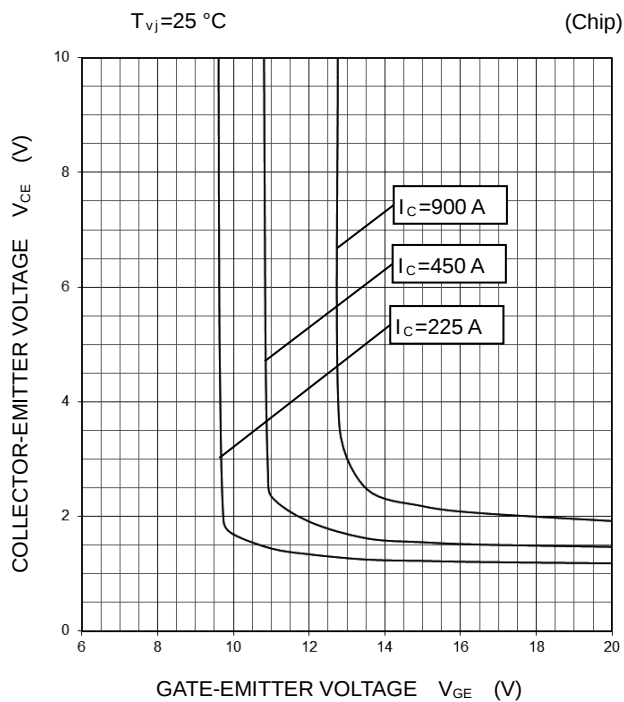
**OUTPUT CHARACTERISTICS
(TYPICAL)**



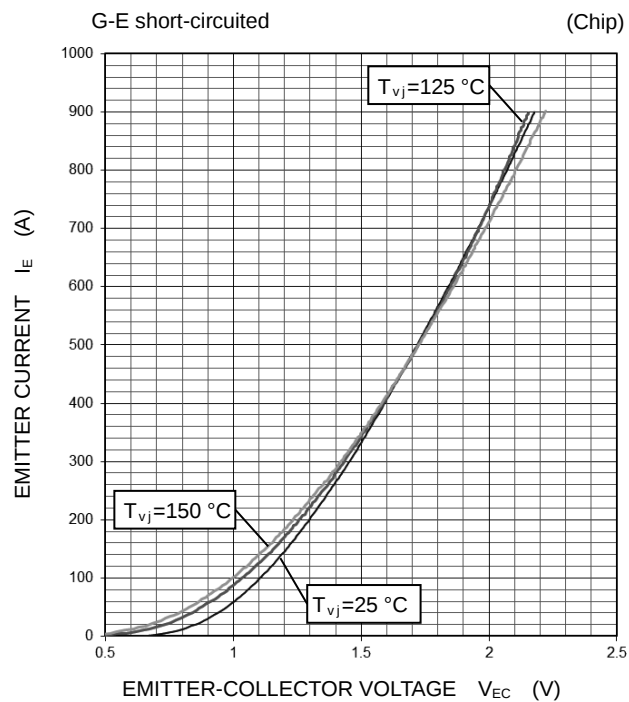
**COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)**



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



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



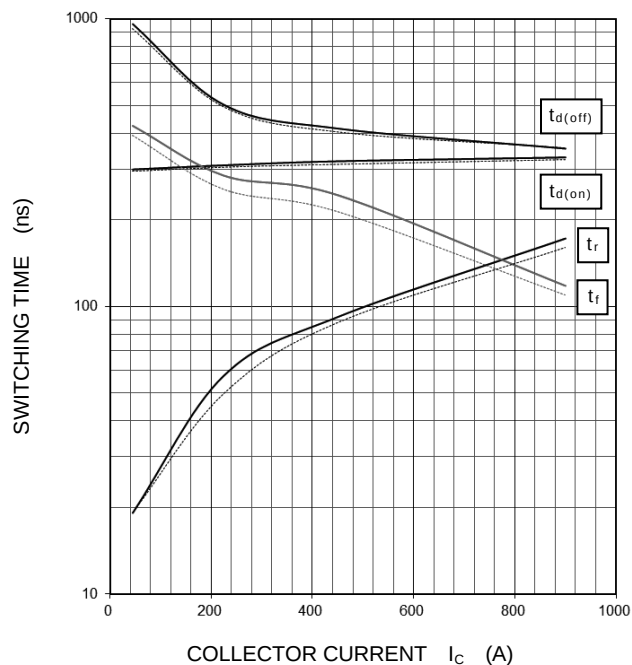
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PERFORMANCE CURVES

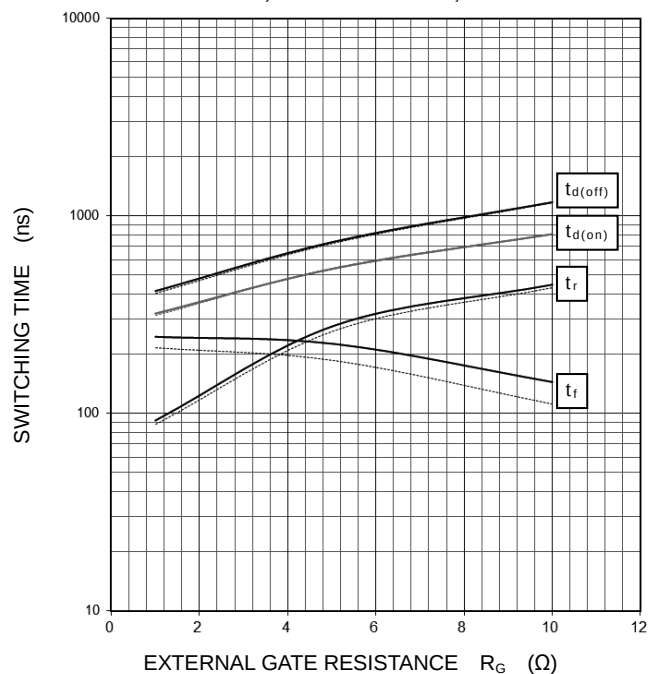
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=1.0\ \Omega$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



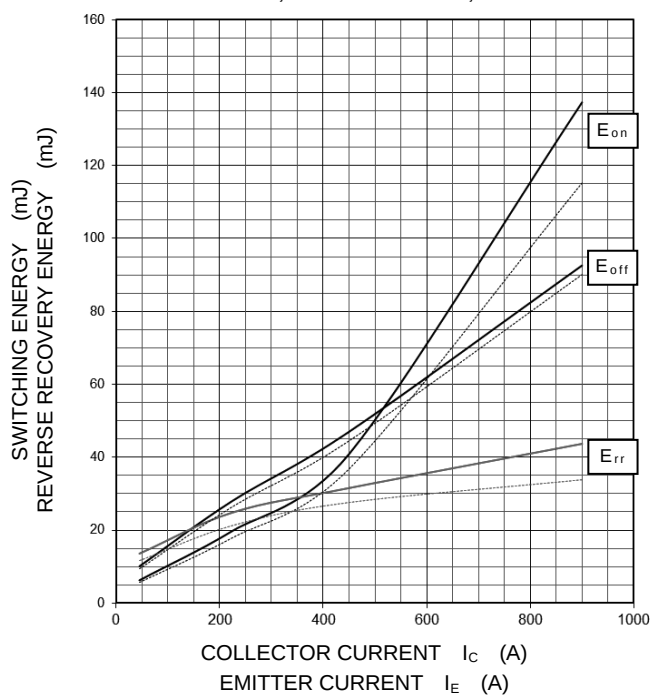
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=450\text{ A}$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



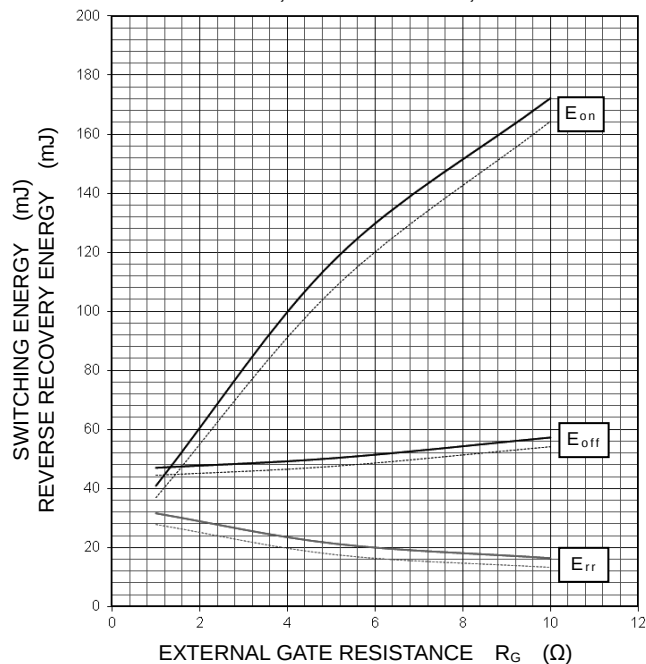
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=1.0\ \Omega$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



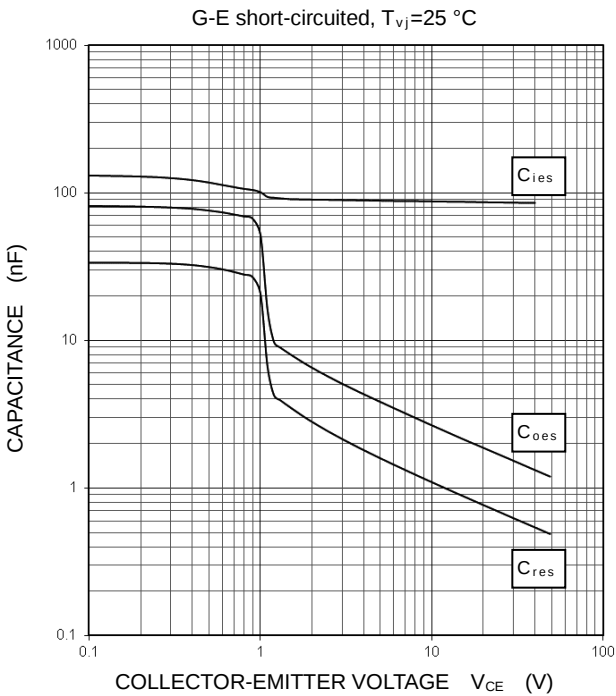
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=450\text{ A}$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$

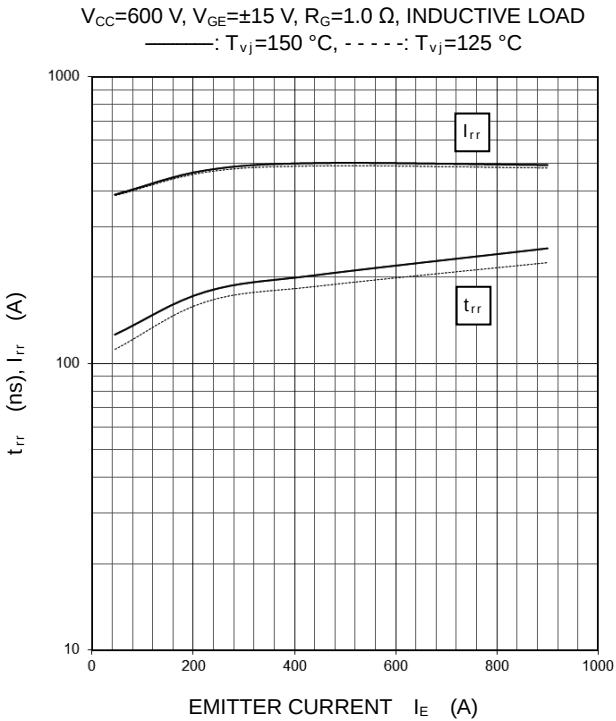


PERFORMANCE CURVES

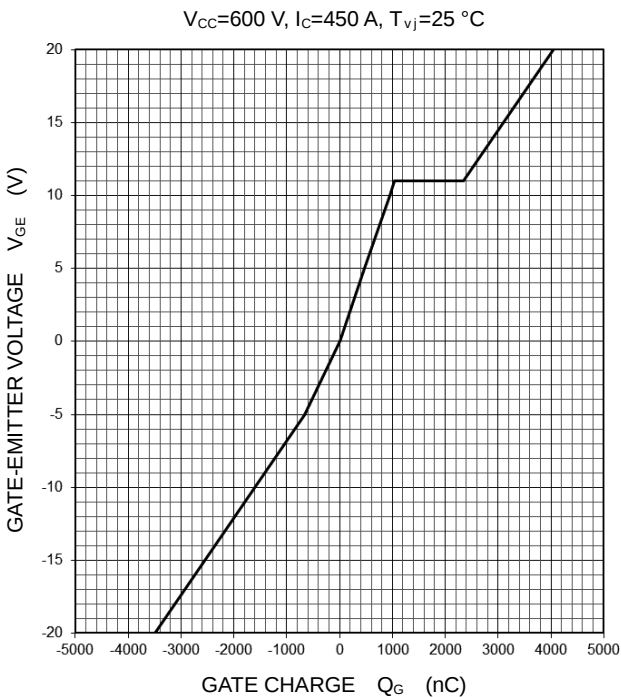
CAPACITANCE CHARACTERISTICS
(TYPICAL)



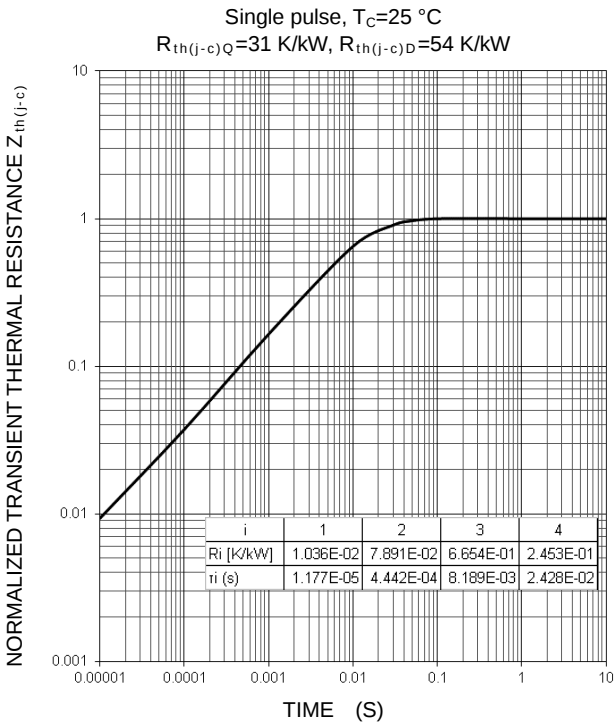
FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)



GATE CHARGE CHARACTERISTICS
(TYPICAL)



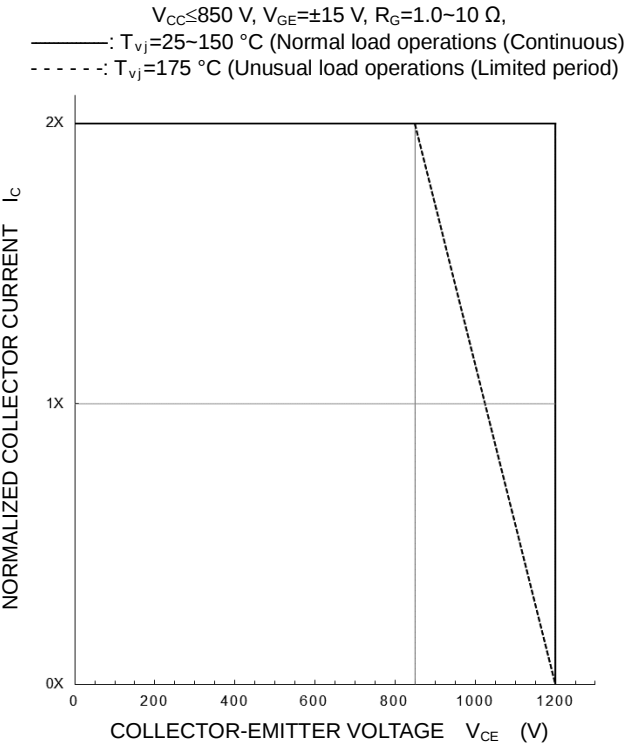
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)



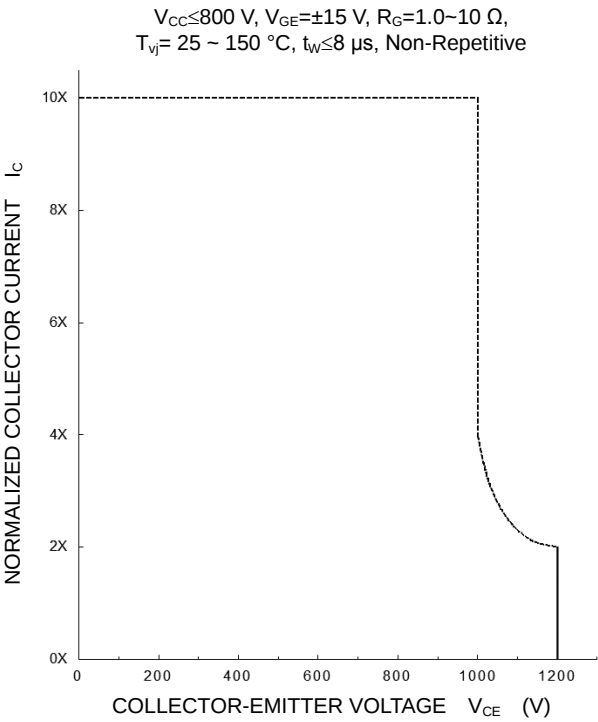
Note: The characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

PERFORMANCE CURVES

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



SHORT-CIRCUIT SAFE OPERATING AREA
(MAXIMUM)



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