

<IGBT Modules>

CM1000DUC-34SA

HIGH POWER SWITCHING USE
INSULATED TYPE



dual switch (Half-Bridge)

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

- Flat base Type
- Copper base plate
- RoHS Directive compliant
- Recognized under UL1557, File E323585

APPLICATION

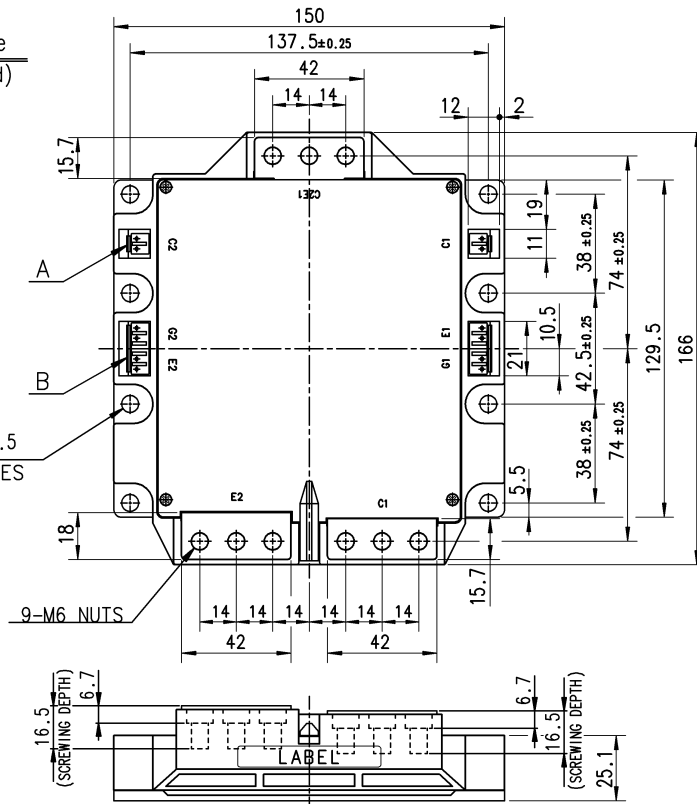
Wind power, Photovoltaic (Solar) power, AC Motor Control, Motion/Servo Control, Power supply, etc.

OUTLINE DRAWING & INTERNAL CONNECTION

A, B HOUSING Type
(J.S.T.Mfg.Co.,Ltd)

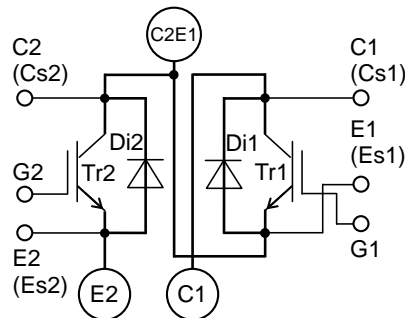
A : VHR-2N
B : VHR-5N

8- $\phi 6.5$
MOUNTING HOLES



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_j=25 °C, unless otherwise specified)

Symbol	Item	Conditions	Rating	Unit
V _{CES}	Collector-emitter voltage	G-E short-circuited	1700	V
V _{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I _C	Collector current	DC, T _C =125 °C (Note2, 4)	1000	A
I _{CRM}		Pulse, Repetitive (Note3)	2000	
P _{tot}	Total power dissipation	T _C =25 °C (Note2, 4)	10000	W
I _E (Note1)	Emitter current	DC (Note2)	1000	A
I _{ERM} (Note1)		Pulse, Repetitive (Note3)	2000	
V _{isol}	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	4000	V
T _{jmax}	Maximum junction temperature	Instantaneous event (overload)	175	°C
T _{cmax}	Maximum case temperature	(Note4)	125	
T _{jop}	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	°C
T _{stg}	Storage temperature	-	-40 ~ +125	

ELECTRICAL CHARACTERISTICS (T_j=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	-	-	10	µA	
V _{GE(th)}	Gate-emitter threshold voltage	I _C =100 mA, V _{CE} =10 V	5.4	6.0	6.6	V	
V _{CESat}	Collector-emitter saturation voltage	I _C =1000 A (Note5), V _{GE} =15 V, Terminal=chip	T _j =25 °C	-	1.9	2.4	V
			T _j =125 °C	-	2.1	-	
			T _j =150 °C	-	2.15	-	
C _{ies}	Input capacitance	V _{CE} =10 V, G-E short-circuited	-	-	260	nF	
C _{oes}	Output capacitance		-	-	27		
C _{res}	Reverse transfer capacitance		-	-	5		
Q _G	Gate charge	V _{CC} =1000 V, I _C =1000 A, V _{GE} =15 V	-	4700	-	nC	
t _{d(on)}	Turn-on delay time	V _{CC} =1000 V, I _C =1000 A, V _{GE} =±15 V, R _G =2.0 Ω, Inductive load	-	-	900	ns	
t _r	Rise time		-	-	350		
t _{d(off)}	Turn-off delay time		-	-	1250		
t _f	Fall time		-	-	400		
V _{EC} (Note1)	Emitter-collector voltage	I _E =1000 A (Note5), G-E short-circuited, Terminal=chip	T _j =25 °C	-	4.0	5.2	V
			T _j =125 °C	-	2.8	-	
			T _j =150 °C	-	2.6	-	
t _{rr} (Note1)	Reverse recovery time	V _{CC} =1000 V, I _E =1000 A, V _{GE} =±15 V, R _G =2.0 Ω, Inductive load	-	-	400	ns	
Q _{rr} (Note1)	Reverse recovery charge	R _G =2.0 Ω, Inductive load	-	270	-	µC	
E _{on}	Turn-on switching energy per pulse	V _{CC} =1000 V, I _C =I _E =1000 A, V _{GE} =±15 V, R _G =2.0 Ω,	-	239	-	mJ	
E _{off}	Turn-off switching energy per pulse	T _j =150 °C, Inductive load	-	269	-		
E _{rr} (Note1)	Reverse recovery energy per pulse	T _j =150 °C, Inductive load	-	130	-	mJ	
R _{CC'+EE'}	Internal lead resistance	Main terminals-chip, per switch, T _C =25 °C (Note4)	-	0.286	-	mΩ	
r _g	Internal gate resistance	Per switch	-	0.56	-	Ω	

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HIGH POWER SWITCHING USE
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THERMAL RESISTANCE CHARACTERISTICS

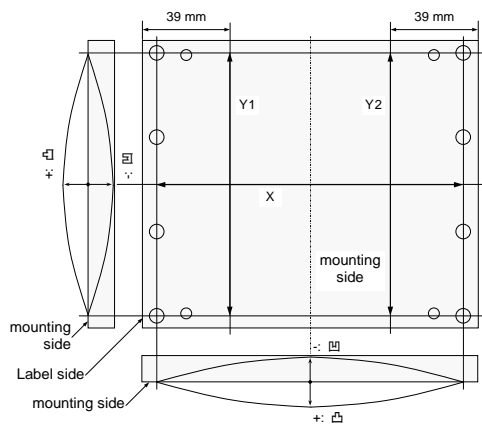
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance	Junction to case, per IGBT (Note4)	-	-	15	K/kW
$R_{th(j-c)D}$		Junction to case, per DIODE (Note4)	-	-	24	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1/2 module, Thermal grease applied (Note4, 6)	-	12	-	K/kW

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 to heat sink M 6 screw	3.5	4.0	4.5	N·m
d_s	Creepage distance	Terminal to terminal	24	-	-	mm
		Terminal to base plate	33	-	-	
d_a	Clearance	Terminal to terminal	14	-	-	mm
		Terminal to base plate	33	-	-	
m	mass	-	-	1450	-	g
e_c	Flatness of base plate	On the centerline X, Y1, Y2 (Note7)	-50	-	+100	μm

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

- Junction temperature (T_j) should not increase beyond T_{jmax} rating.
- Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} 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.
The heat sink thermal resistance should measure just under the chips.
- 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 $\lambda=0.9 \text{ W/(m}\cdot\text{K)}$.
- Base plate (mounting side) flatness measurement points (X, Y1 and Y2) are as follows of the following figure.



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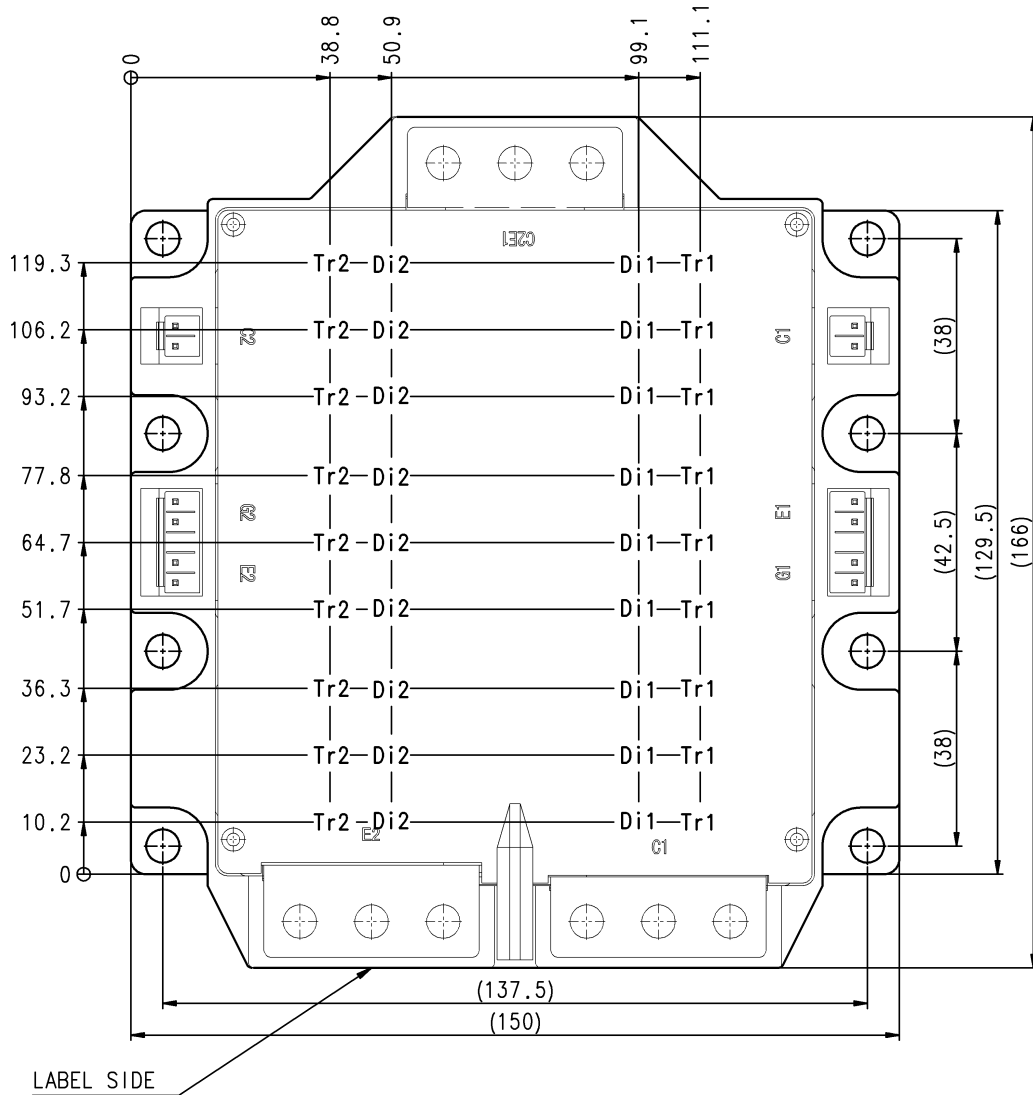
HIGH POWER SWITCHING USE
INSULATED TYPE

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across C1-E2	-	1000	1200	V
V_{GEon}	Gate (-emitter drive) voltage	Applied across G1-Es1/G2-Es2	13.5	15.0	16.5	V
R_G	External gate resistance	Per switch	2.0	-	6.0	Ω

CHIP LOCATION (Top view)

Dimension in mm, tolerance: ± 1 mm

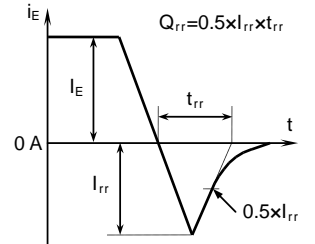
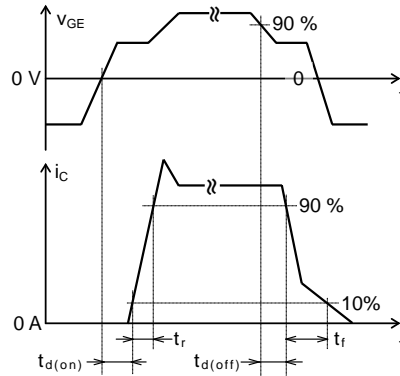
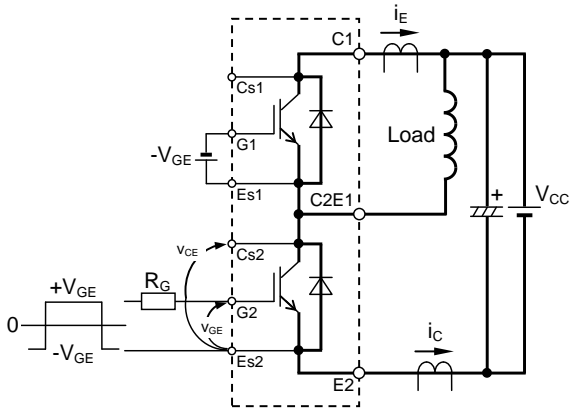


Tr1/Tr2: IGBT, Di1/Di2: DIODE

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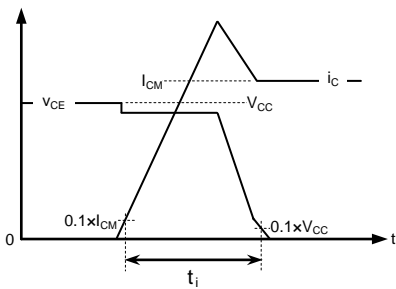
HIGH POWER SWITCHING USE
INSULATED TYPE

TEST CIRCUIT AND WAVEFORMS

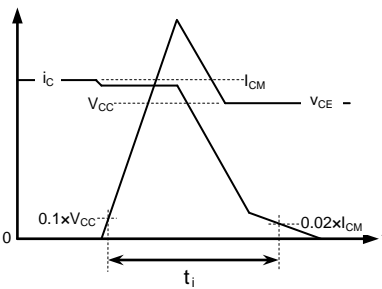


Switching characteristics test circuit and waveforms

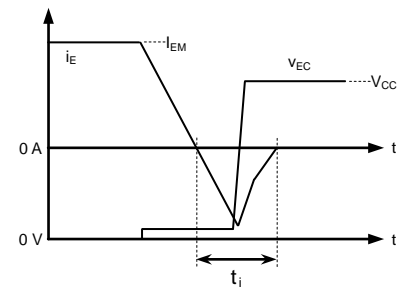
t_{rr} , Q_{rr} test waveform



IGBT Turn-on switching energy



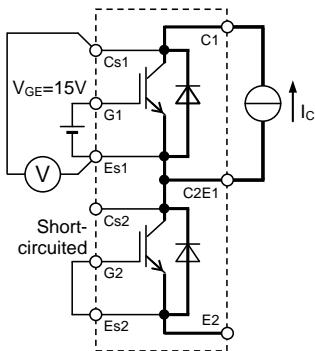
IGBT Turn-off switching energy



DIODE Reverse recovery energy

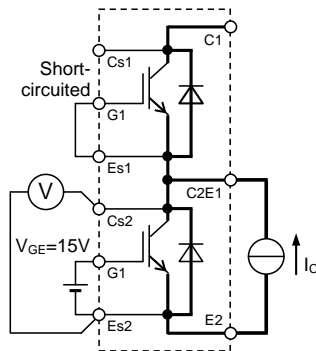
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

TEST CIRCUIT

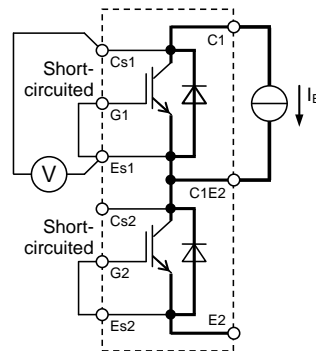


Tr1

V_{CEsat} test circuit

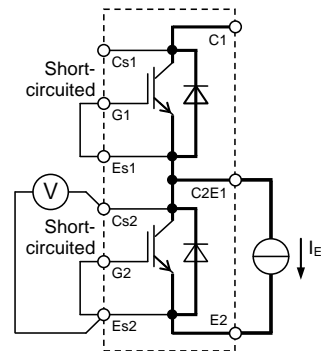


Tr2



Di1

V_{CE} test circuit



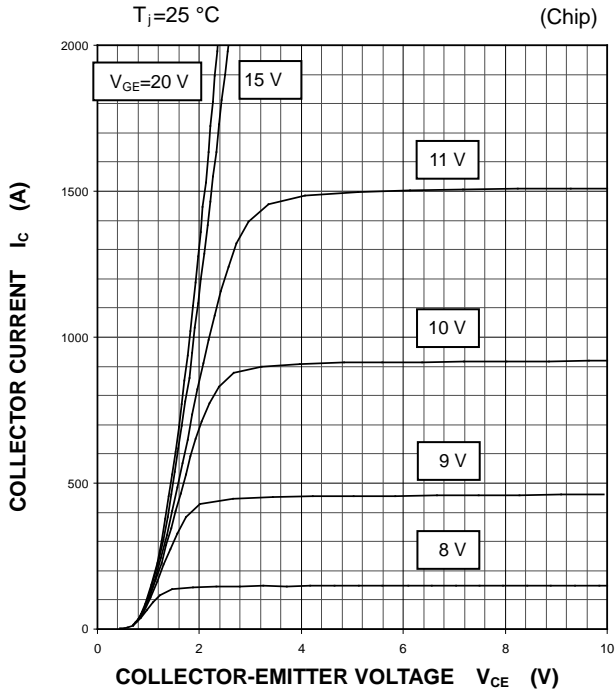
Di2

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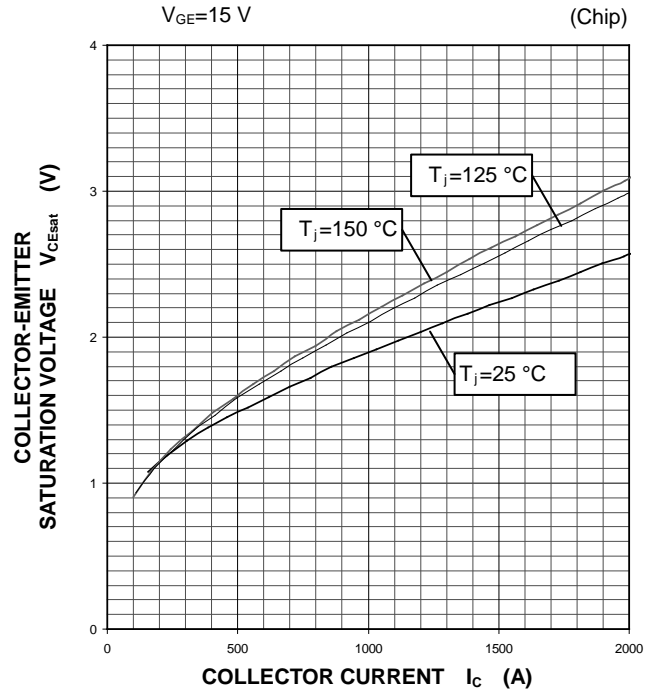
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

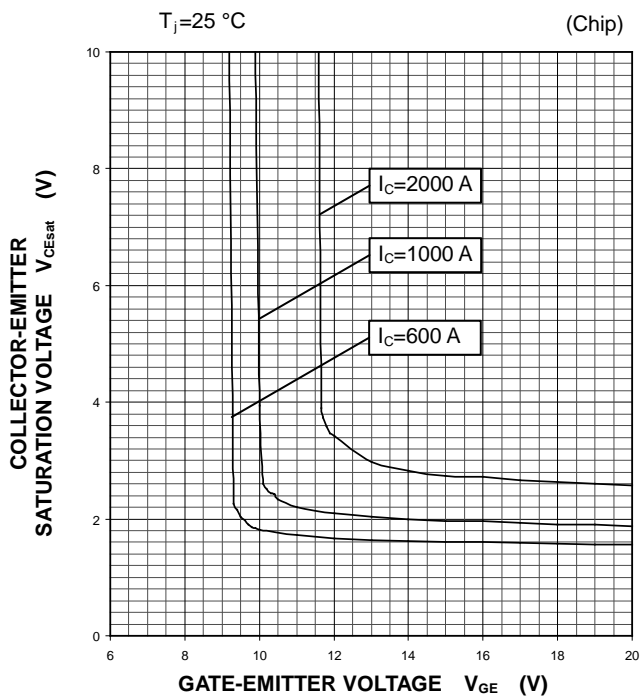
OUTPUT CHARACTERISTICS
(TYPICAL)



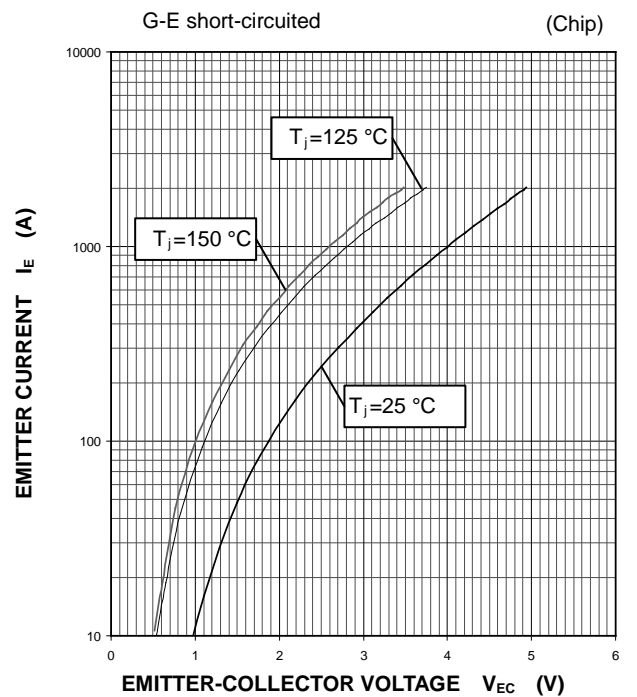
COLLECTOR-EMITTER SATURATION
VOLTAGE CHARACTERISTICS
(TYPICAL)



COLLECTOR-EMITTER SATURATION
VOLTAGE CHARACTERISTICS
(TYPICAL)



FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)



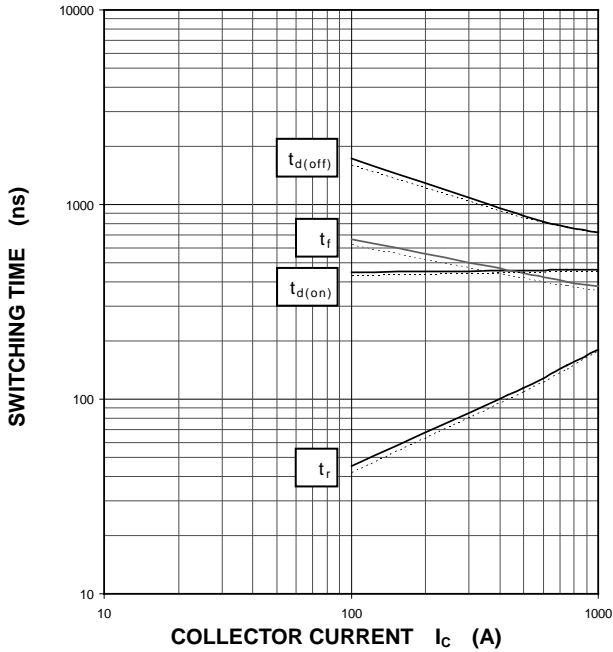
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HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

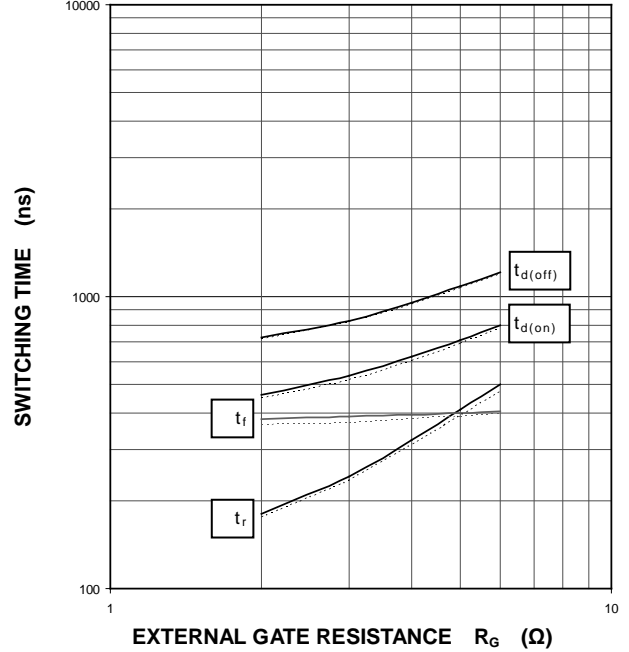
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.0\ \Omega$, INDUCTIVE LOAD
—: $T_j=150\text{ }^\circ\text{C}$, - - - - -: $T_j=125\text{ }^\circ\text{C}$



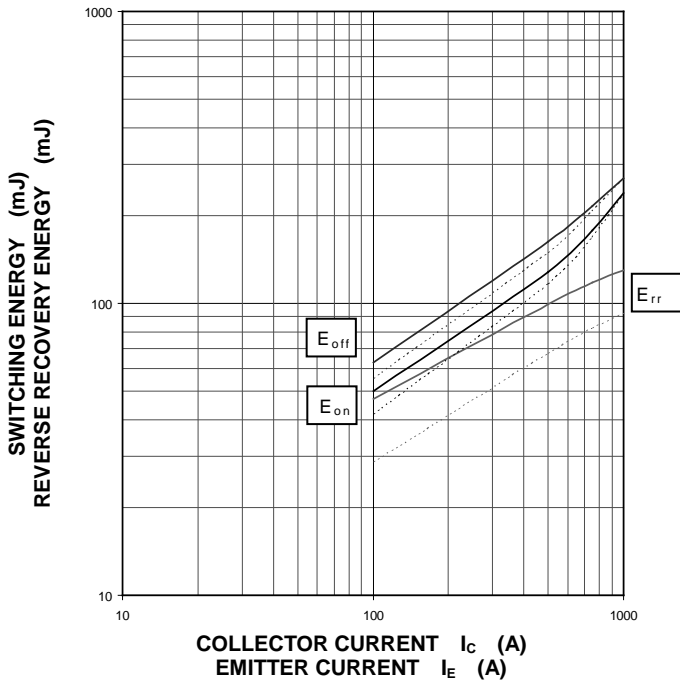
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$, $I_C=1000\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
—: $T_j=150\text{ }^\circ\text{C}$, - - - - -: $T_j=125\text{ }^\circ\text{C}$



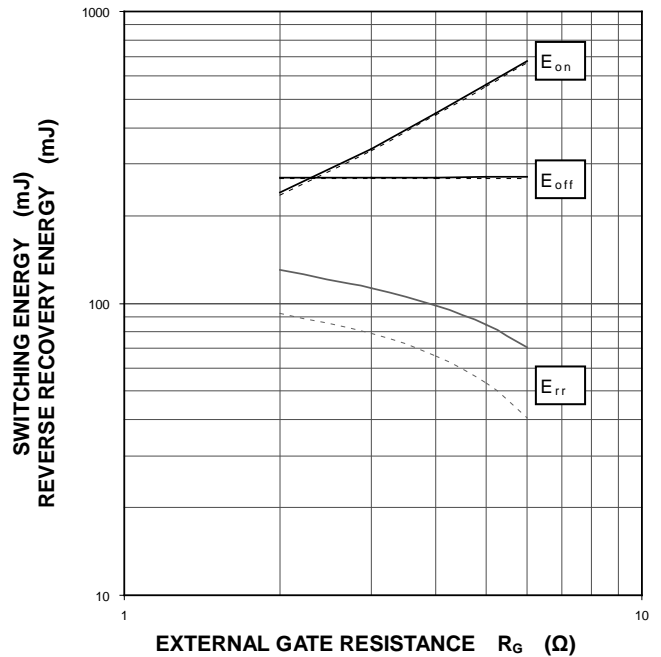
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.0\ \Omega$,
INDUCTIVE LOAD, PER PULSE
—: $T_j=150\text{ }^\circ\text{C}$, - - - - -: $T_j=125\text{ }^\circ\text{C}$



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$, $I_C/I_E=1000\text{ A}$, $V_{GE}=\pm 15\text{ V}$,
INDUCTIVE LOAD, PER PULSE
—: $T_j=150\text{ }^\circ\text{C}$, - - - - -: $T_j=125\text{ }^\circ\text{C}$



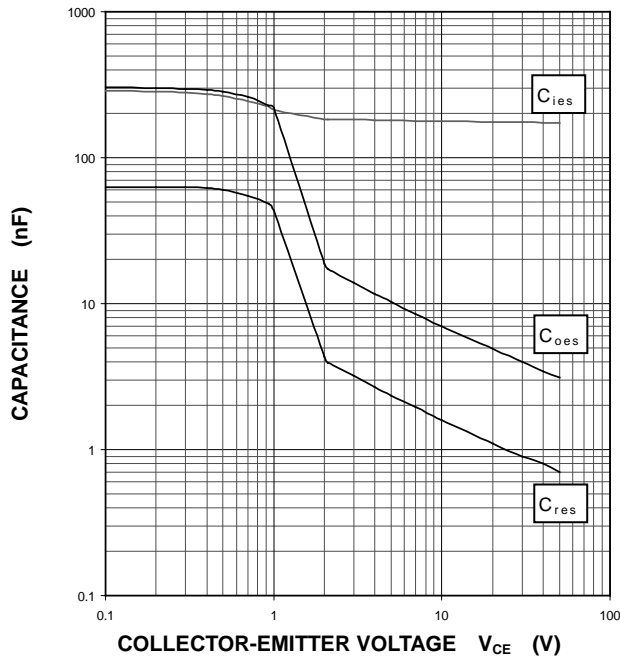
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PERFORMANCE CURVES

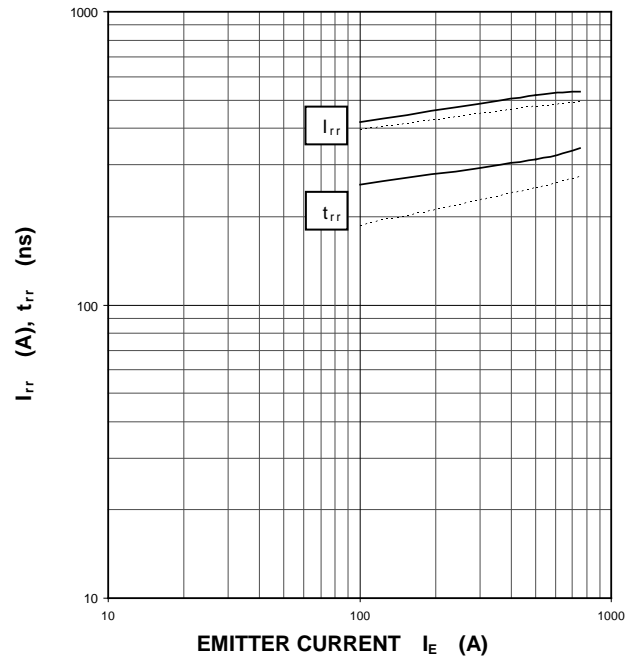
**CAPACITANCE CHARACTERISTICS
(TYPICAL)**

G-E short-circuited, $T_j=25^\circ\text{C}$



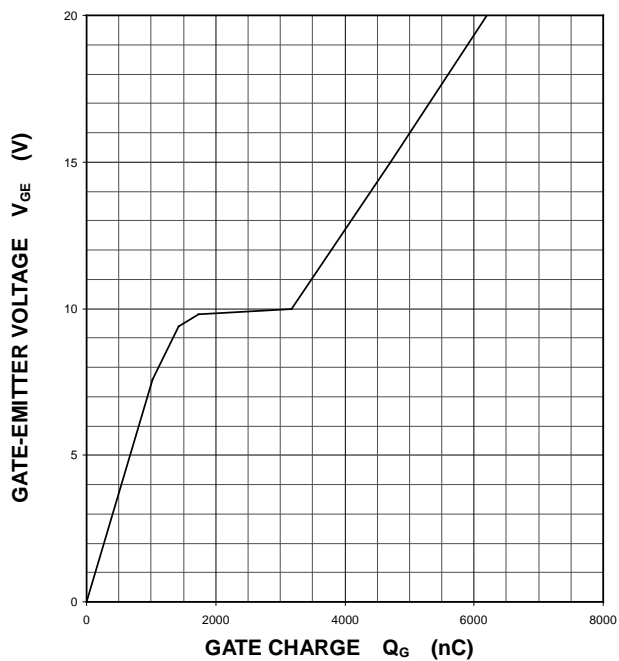
**FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)**

$V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.0\ \Omega$, INDUCTIVE LOAD
—: $T_j=150^\circ\text{C}$, - - - -: $T_j=125^\circ\text{C}$



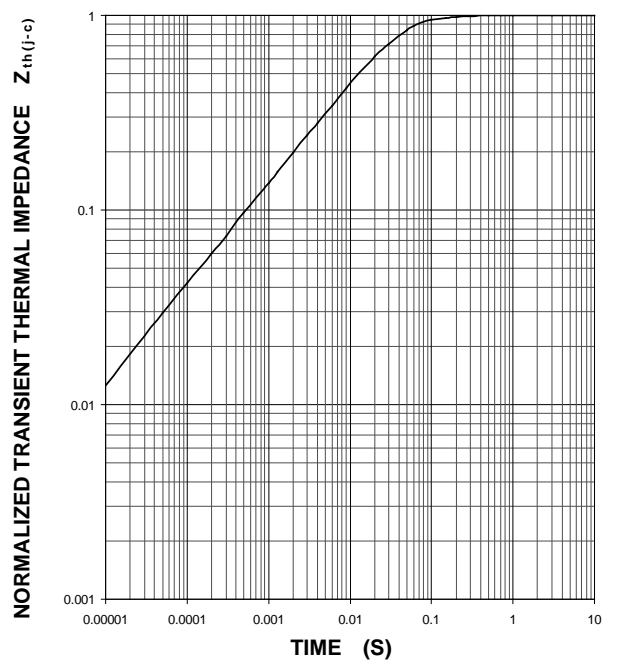
**GATE CHARGE CHARACTERISTICS
(TYPICAL)**

$V_{CC}=1000\text{ V}$, $I_C=1000\text{ A}$, $T_j=25^\circ\text{C}$



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)**

Single pulse, $T_C=25^\circ\text{C}$
 $R_{th(j-c)Q}=15\text{ K/kW}$, $R_{th(j-c)D}=24\text{ K/kW}$



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