

MITSUBISHI IGBT MODULES  
**CM1000DUC-34NF**  
 HIGH POWER SWITCHING USE  
 INSULATED TYPE

**CM1000DUC-34NF**

- MPD series using 5<sup>th</sup> Generation IGBT and FWDi -



**Dual switch (Half-Bridge)**

- I<sub>C</sub> ..... 1000 A
- V<sub>CES</sub> ..... 1700 V
- Flat base Type
- Copper (non-plating) base plate
- RoHS Directive compliant

● UL Recognized under UL1557, File E323585

**APPLICATION**

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

**OUTLINE DRAWING & INTERNAL CONNECTION**

Dimension in mm

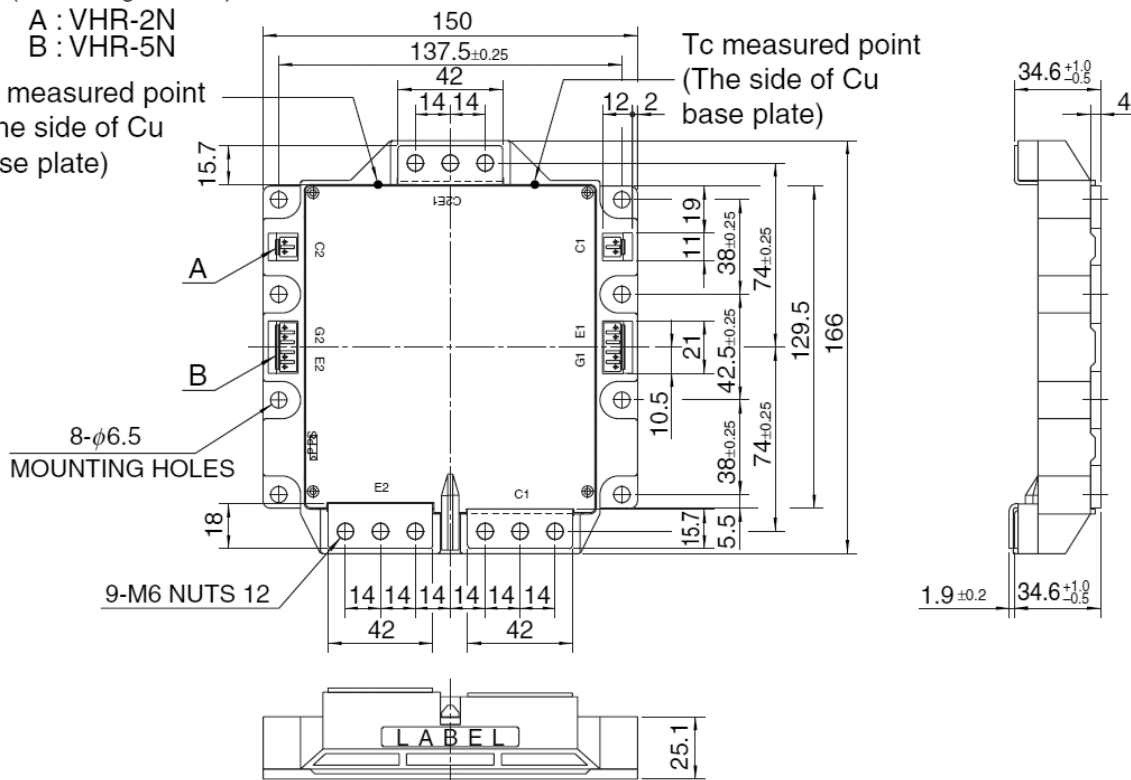
A,B HOUSING Type

(J. S. T. Mfg. Co. Ltd)

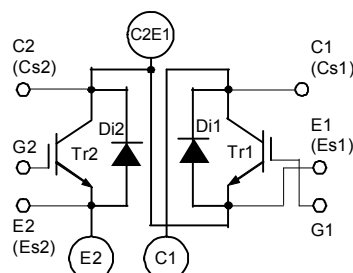
A : VHR-2N

B : VHR-5N

Tc measured point  
(The side of Cu  
base plate)



**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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**ABSOLUTE MAXIMUM RATINGS ( $T_j=25\text{ }^\circ\text{C}$ , 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	$\pm 20$	V
$I_C$	Collector current	DC, $T_C=104\text{ }^\circ\text{C}$ (Note2)	1000	A
$I_{CRM}$		Pulse, Repetitive (Note3)	2000	
$P_{tot}$	Total power dissipation	$T_C=25\text{ }^\circ\text{C}$ (Note2, 4)	8925	W
$I_E$ (Note1)	Emitter current	$T_C=25\text{ }^\circ\text{C}$ (Note2, 4)	1000	A
$I_{ERM}$ (Note1)	(Free wheeling diode forward current)	Pulse, Repetitive (Note3)	2000	
$V_{isol}$	Isolation voltage	Terminals to base plate, RMS, $f=60\text{ Hz}$ , AC 1 min	3500	V
$T_j$	Junction temperature	-	$-40 \sim +150$	$^\circ\text{C}$
$T_{stg}$	Storage temperature	(Note7)	$-40 \sim +125$	

**ELECTRICAL CHARACTERISTICS ( $T_j=25\text{ }^\circ\text{C}$ , 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	mA	
$I_{GES}$	Gate-emitter leakage current	$V_{GE}=V_{GES}$ , C-E short-circuited	-	-	5	$\mu\text{A}$	
$V_{GE(th)}$	Gate-emitter threshold voltage	$I_C=100\text{ mA}$ , $V_{CE}=10\text{ V}$	6	7	8	V	
$V_{CEsat}$	Collector-emitter saturation voltage	$I_C=1000\text{ A}$ (Note5), $V_{GE}=15\text{ V}$	$T_j=25\text{ }^\circ\text{C}$	-	2.2	2.85	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.45	-	
$C_{ies}$	Input capacitance	$V_{CE}=10\text{ V}$ , G-E short-circuited	-	-	220	nF	
$C_{oes}$	Output capacitance		-	-	25		
$C_{res}$	Reverse transfer capacitance		-	-	4.7		
$Q_G$	Gate charge	$V_{CC}=1000\text{ V}$ , $I_C=1000\text{ A}$ , $V_{GE}=15\text{ V}$	-	6000	-	nC	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=1000\text{ V}$ , $I_C=1000\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ , $R_G=0.47\text{ }\Omega$ , Inductive load	-	-	600	ns	
$t_r$	Rise time		-	-	200		
$t_{d(off)}$	Turn-off delay time		-	-	1000		
$t_f$	Fall time		-	-	300		
$V_{EC}$ (Note1)	Emitter-collector voltage	$I_E=1000\text{ A}$ , G-E short-circuited (Note5)	-	2.3	3.0	V	
$t_{rr}$ (Note1)	Reverse recovery time	$V_{CC}=1000\text{ V}$ , $I_E=1000\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ , $R_G=0.47\text{ }\Omega$ , Inductive load	-	-	500	ns	
$Q_{rr}$ (Note1)	Reverse recovery charge	$R_G=0.47\text{ }\Omega$ , Inductive load	-	90	-	$\mu\text{C}$	
$E_{on}$	Turn-on switching energy per pulse	$V_{CC}=1000\text{ V}$ , $I_C=I_E=1000\text{ A}$ ,	-	272.4	-	mJ	
$E_{off}$	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$ , $R_G=0.47\text{ }\Omega$ , $T_j=125\text{ }^\circ\text{C}$ ,	-	250.2	-		
$E_{rr}$ (Note1)	Reverse recovery energy per pulse	Inductive load	-	172.4	-		
$R_{CC+EE}$	Internal lead resistance	Main terminals-chip, per switch, $T_C=25\text{ }^\circ\text{C}$ (Note2)	-	0.286	-	m $\Omega$	
$r_g$	Internal gate resistance	Per switch	-	0.67	-	$\Omega$	

**THERMAL RESISTANCE CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance (Note2)	Junction to case, per IGBT	-	-	14	K/kW
$R_{th(j-c)D}$		Junction to case, per FWDi	-	-	23	
$R_{th(c-s)}$	Contact thermal resistance (Note2)	Case to heat sink, per 1/2 module, Thermal grease applied (Note6)	-	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	
$m$	Weight	-	-	1450	-	g
$e_c$	Flatness of base plate	On the centerline X, Y1, Y2 (Note8)	-50	-	+100	$\mu\text{m}$

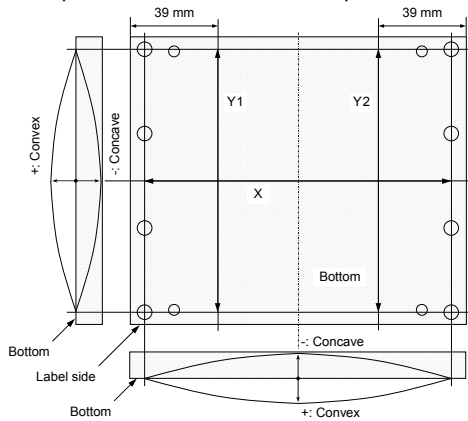
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**RECOMMENDED OPERATING CONDITIONS**

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$V_{CC}$	(DC) Supply voltage	Applied across C1-E2	-	1000	1100	V
$V_{GEon}$	Gate (-emitter drive) voltage	Applied across G1-Es1/G2-Es2	13.5	15.0	16.5	
$R_G$	External gate resistance	Per switch	0.47	-	4.7	$\Omega$

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

2. Case temperature ( $T_C$ ) and heat sink temperature ( $T_s$ ) are defined on the each surface of base plate and heat sink just under the chips. (Refer to the figure of chip location)  
The heat sink thermal resistance  $\{R_{th(s-a)}\}$  should measure just under the chips.
3. Pulse width and repetition rate should be such that the device junction temperature ( $T_j$ ) dose not exceed  $T_{jmax}$  rating.
4. Junction temperature ( $T_j$ ) should not increase beyond  $T_{jmax}$  rating.
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  $\lambda=0.9$  W/(m·K).
7. The operation temperature is restrained by the permission temperature of female connector housing.
8. Base plate flatness measurement points are as in the following figure.

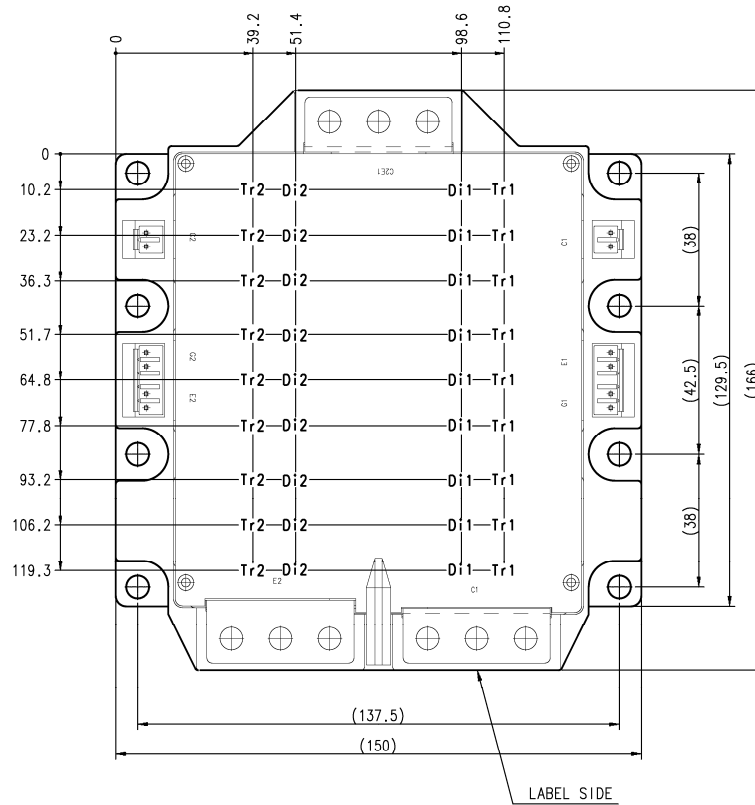


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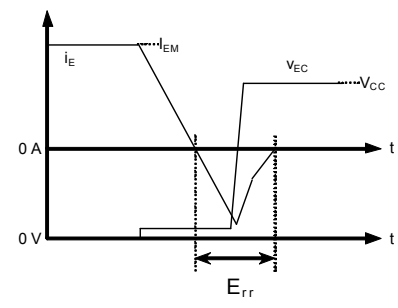
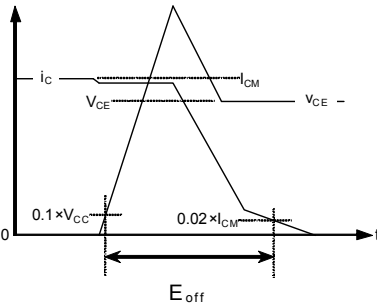
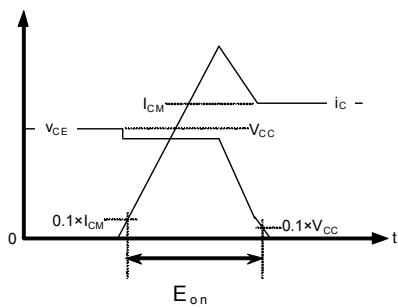
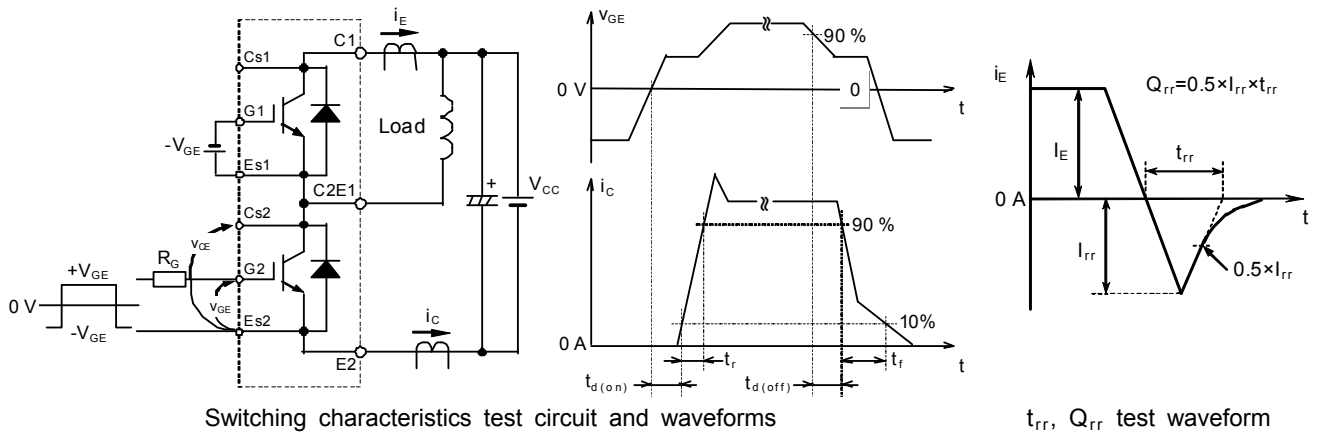
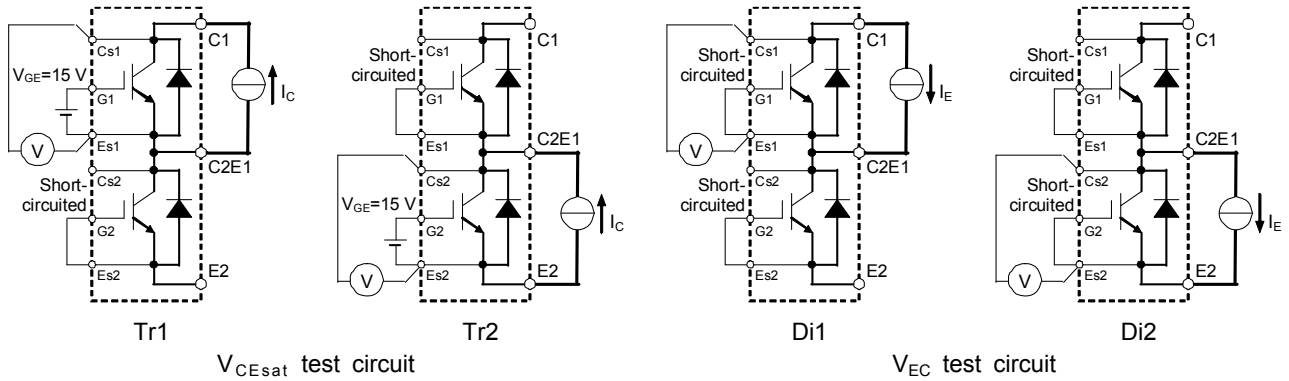
**CHIP LOCATION (Top view)**

Dimension in mm, tolerance:  $\pm 1$  mm



Tr1/Tr2: IGBT, Di1/Di2: FWDi. Each mark points the center position of each chip.

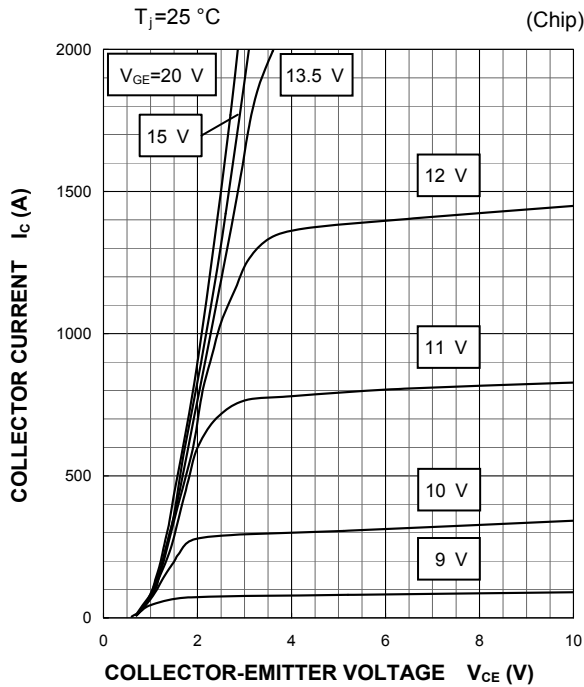
**TEST CIRCUIT AND WAVEFORMS**



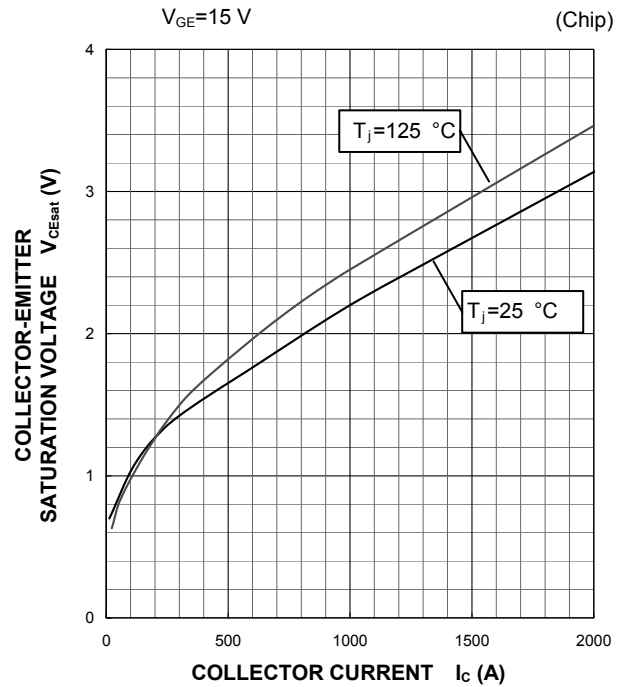
Turn-on / Turn-off switching energy and Reverse recovery energy integral range

PERFORMANCE CURVES

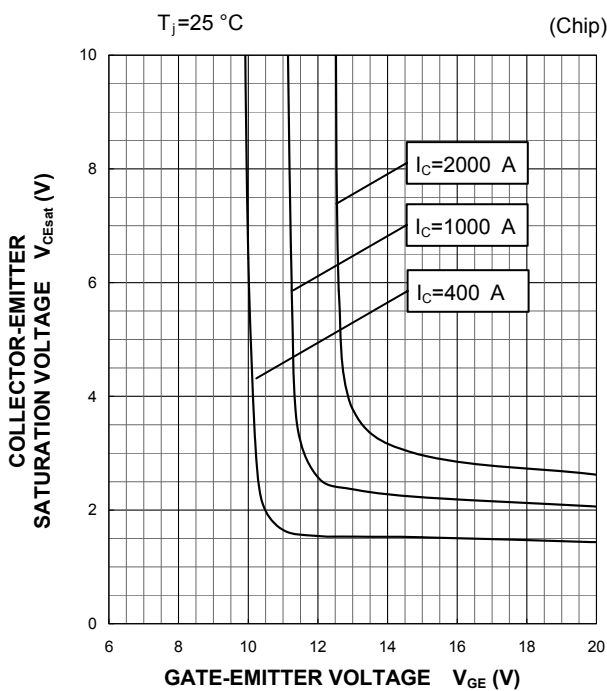
OUTPUT CHARACTERISTICS  
 (TYPICAL)



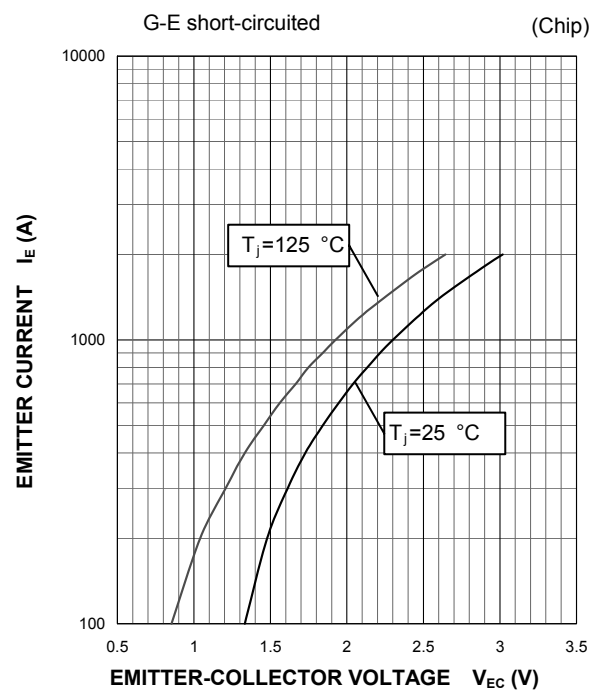
COLLECTOR-EMITTER SATURATION  
 VOLTAGE CHARACTERISTICS  
 (TYPICAL)



COLLECTOR-EMITTER SATURATION  
 VOLTAGE CHARACTERISTICS  
 (TYPICAL)



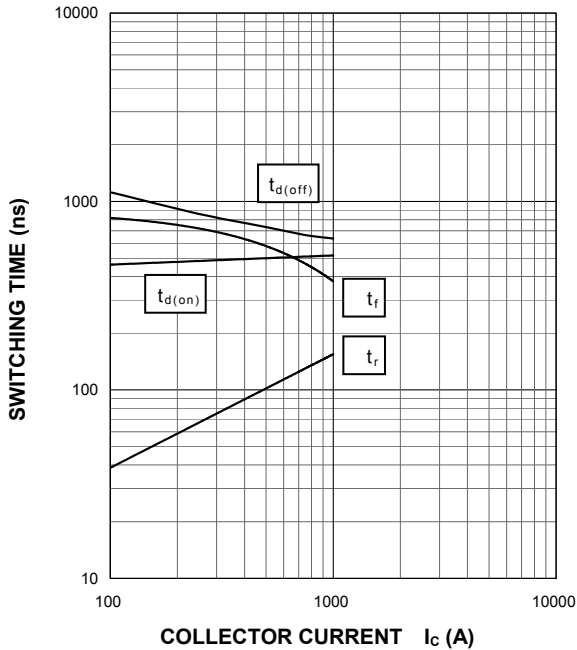
FREE WHEELING DIODE  
 FORWARD CHARACTERISTICS  
 (TYPICAL)



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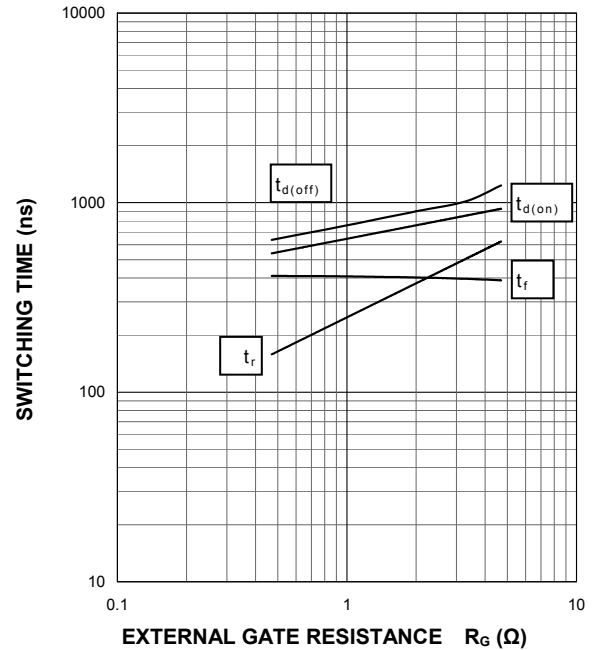
HALF-BRIDGE  
 SWITCHING CHARACTERISTICS  
 (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $R_G=0.47\ \Omega$ ,  $T_j=125\text{ }^\circ\text{C}$ ,  
 INDUCTIVE LOAD



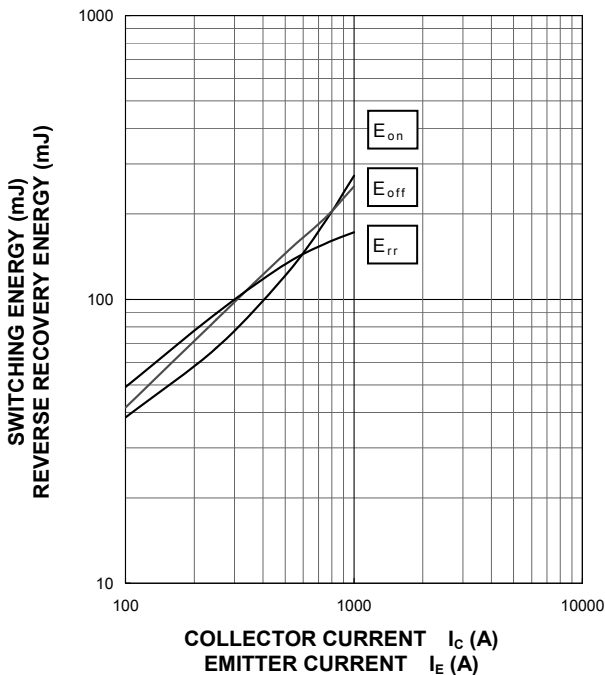
HALF-BRIDGE  
 SWITCHING CHARACTERISTICS  
 (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $I_c=1000\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $T_j=125\text{ }^\circ\text{C}$ ,  
 INDUCTIVE LOAD



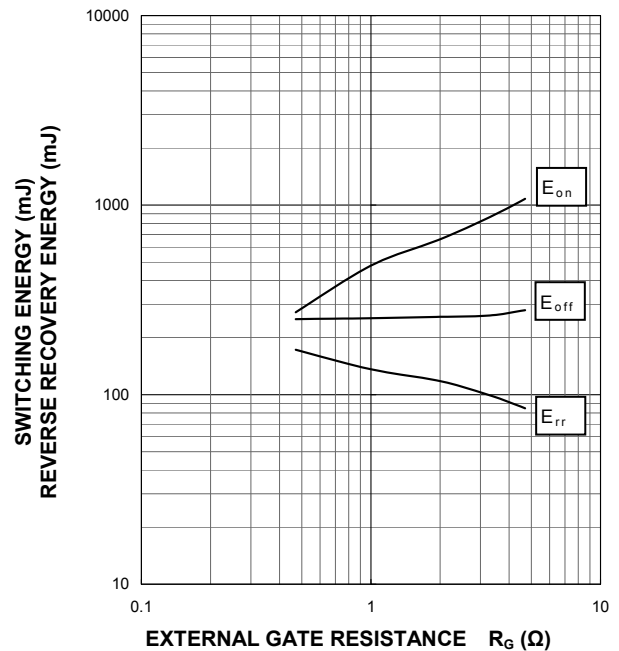
HALF-BRIDGE  
 SWITCHING CHARACTERISTICS  
 (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $R_G=0.47\ \Omega$ ,  $T_j=125\text{ }^\circ\text{C}$ ,  
 INDUCTIVE LOAD, PER PULSE



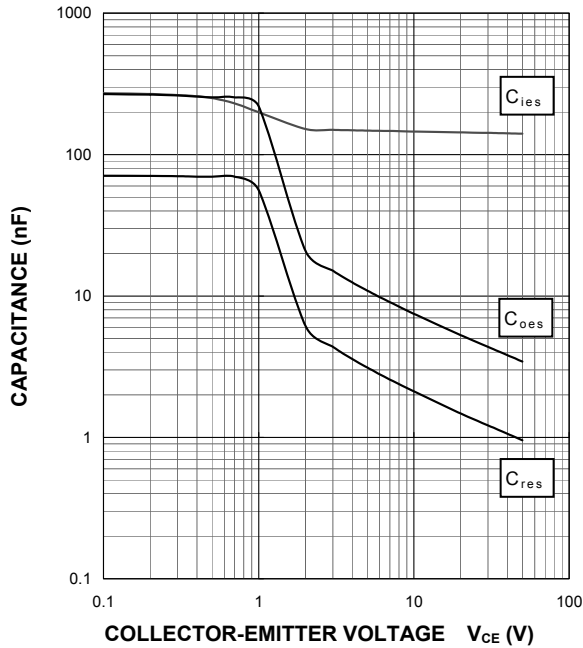
HALF-BRIDGE  
 SWITCHING CHARACTERISTICS  
 (TYPICAL)

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



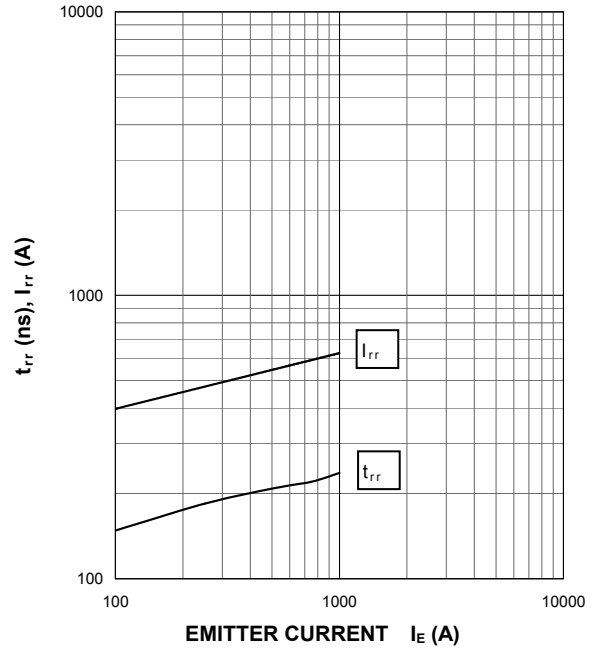
**CAPACITANCE CHARACTERISTICS  
 (TYPICAL)**

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



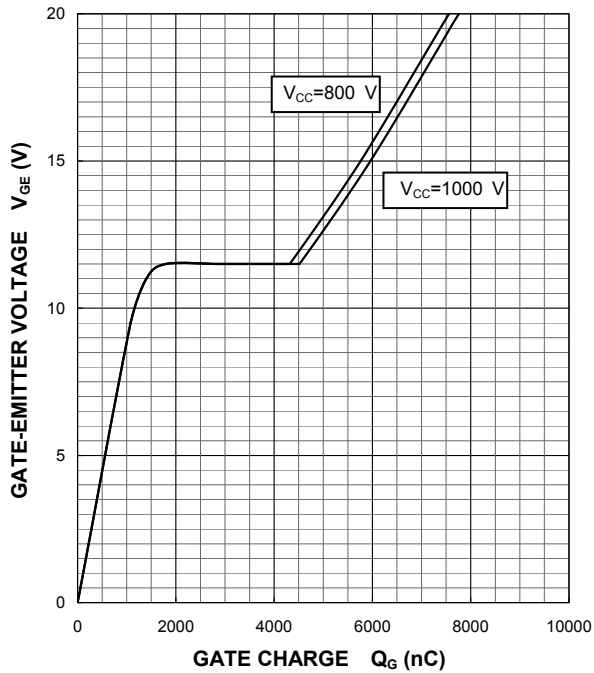
**FREE WHEELING DIODE  
 REVERSE RECOVERY CHARACTERISTICS  
 (TYPICAL)**

$V_{CC}=1000\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $R_G=0.47\text{ }\Omega$ ,  $T_j=25\text{ }^\circ\text{C}$ ,  
 INDUCTIVE LOAD



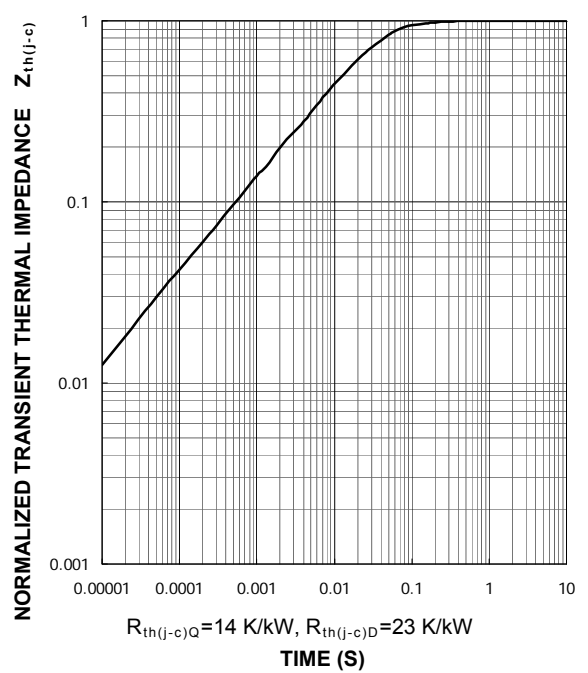
**GATE CHARGE CHARACTERISTICS  
 (TYPICAL)**

$I_c=1000\text{ A}$ ,  $T_j=25\text{ }^\circ\text{C}$



**TRANSIENT THERMAL IMPEDANCE  
 CHARACTERISTICS  
 (MAXIMUM)**

Single pulse,  $T_c=25\text{ }^\circ\text{C}$





**Keep safety first in your circuit designs!**

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