

< IGBT MODULES >

CM600DU-12NFH

HIGH POWER HIGH FREQUENTLY SWITCHING USE
INSULATED TYPE



Dual (Half-Bridge)

Collector current I_C **600 A**
Collector-emitter voltage V_{CES} **600 V**
Maximum junction temperature T_{jmax} ... **150 °C**

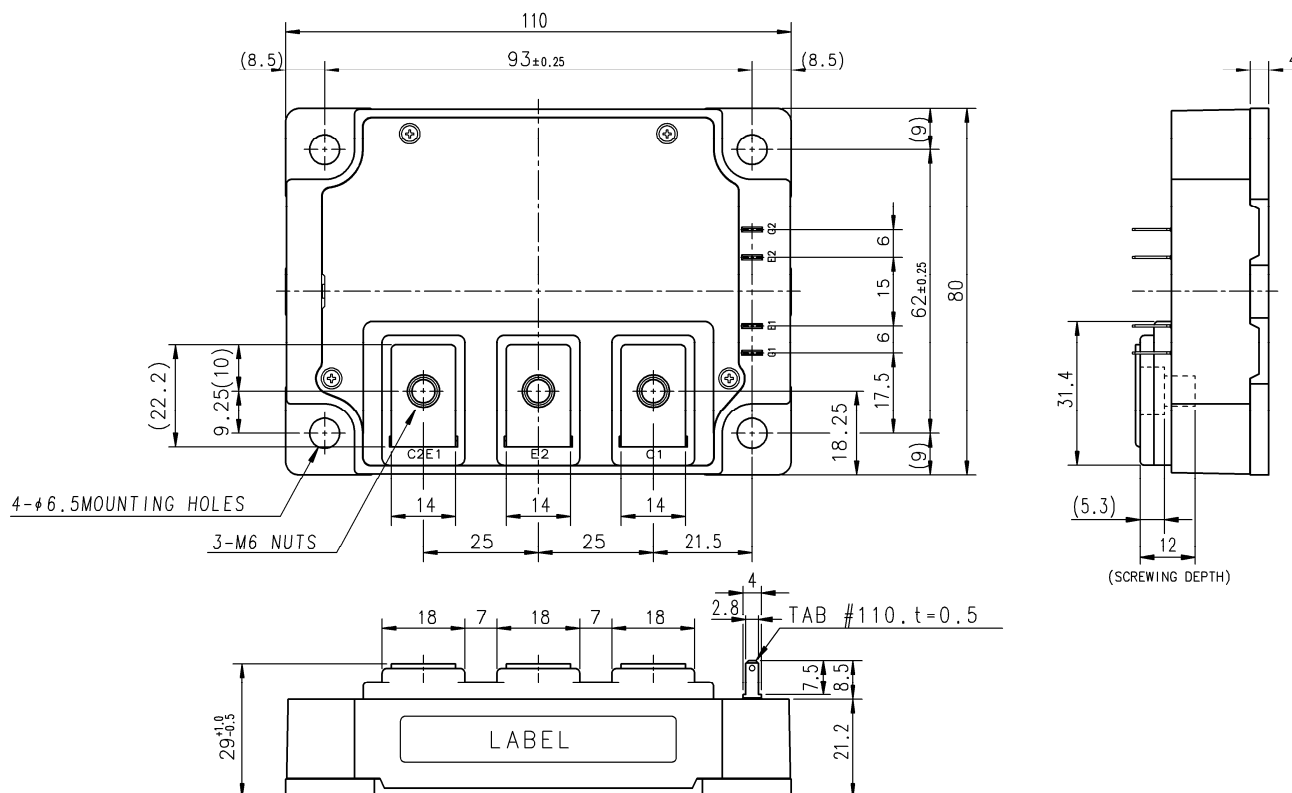
- Flat base Type
- Copper base plate
- RoHS Directive compliant
- UL Recognized under UL1557, File E323585

APPLICATION

High frequency (30 kHz ~ 60 kHz) switching use:
Gradient amplifier, Induction heating, Power supply, etc.

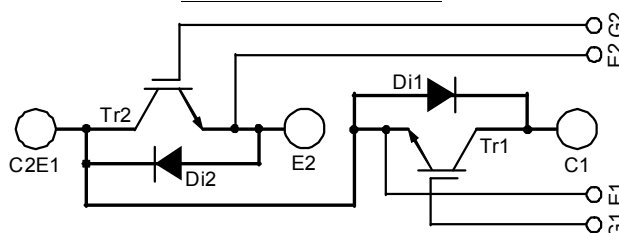
OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm



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	600	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I_C	Collector current	Operation (Note.5)	600	A
		Operation, RMS (Note.5)	400	
		Pulse, Repetitive (Note.4)	1200	
I_{CRM}				
P_{tot}	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note.2, 5)	1130	W
P_{tot}'		$T_C'=25\text{ }^{\circ}\text{C}$, RMS (Note.3, 5)	2350	
I_E (Note.1)	Emitter current (Free wheeling diode forward current)	Operation (Note.5)	600	A
		Operation, RMS (Note.5)	400	
I_{ERM} (Note.1)		Pulse, Repetitive (Note.4)	1200	
T_J	Junction temperature	-	$-40 \sim +150$	$^{\circ}\text{C}$
T_{stg}	Storage temperature	-	$-40 \sim +125$	
V_{isol}	Isolation voltage	Terminals to base plate, RMS, $f=60\text{ Hz}$, AC 1 min	2500	V

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	-	-	0.5	μA
$V_{GE(th)}$	Gate-emitter threshold voltage	$I_C=60\text{ mA}$, $V_{CE}=10\text{ V}$	5	6	7	V
V_{CEsat}	Collector-emitter saturation voltage	$I_C=600\text{ A}$ (Note.6), $T_J=25\text{ }^{\circ}\text{C}$	-	2.0	2.7	V
		$V_{GE}=15\text{ V}$, $T_J=125\text{ }^{\circ}\text{C}$	-	1.95	-	
C_{ies}	Input capacitance	$V_{CE}=10\text{ V}$, G-E short-circuited	-	-	166	nF
C_{oes}	Output capacitance		-	-	11	
C_{res}	Reverse transfer capacitance		-	-	6.0	
Q_G	Gate charge	$V_{CC}=300\text{ V}$, $I_C=600\text{ A}$, $V_{GE}=15\text{ V}$	-	3720	-	nC
$t_{d(on)}$	Turn-on delay time	$V_{CC}=300\text{ V}$, $I_C=600\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.0\text{ }\Omega$, Inductive load	-	-	650	ns
t_r	Rise time		-	-	250	
$t_{d(off)}$	Turn-off delay time		-	-	800	
t_f	Fall time		-	-	150	
V_{EC} (Note.1)	Emitter-collector voltage	$I_E=600\text{ A}$ (Note.6), G-E short-circuited	-	2.0	2.6	V
t_{rr} (Note.1)	Reverse recovery time	$V_{CC}=300\text{ V}$, $I_E=600\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.0\text{ }\Omega$, Inductive load	-	-	200	ns
Q_{rr} (Note.1)	Reverse recovery charge		-	11	-	μC
E_{on}	Turn-on switching energy per pulse	$V_{CC}=300\text{ V}$, $I_C=I_E=600\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.0\text{ }\Omega$, $T_J=125\text{ }^{\circ}\text{C}$, Inductive load	-	11	-	mJ
E_{off}	Turn-off switching energy per pulse		-	27	-	
E_{rr} (Note.1)	Reverse recovery energy per pulse		-	6.3	-	mJ
r_g	Internal gate resistance	Per switch, $T_C=25\text{ }^{\circ}\text{C}$	-	0.8	-	Ω

THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance (Note.2)	Junction to case, per IGBT	-	-	0.11	K/W
$R_{th(j-c)D}$		Junction to case, per FWDi	-	-	0.12	K/W
$R_{th(c-s)}$	Contact thermal resistance (Note.2)	Case to heat sink, per 1/2 module, Thermal grease applied (Note.7)	-	20	-	K/kW
$R_{th(j-c')Q}$	Thermal resistance (Note.3)	Junction to case, per IGBT	-	-	53	K/kW
$R_{th(j-c')D}$		Junction to case, per FWDi	-	-	78	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	-	-	580	-	g
e_c	Flatness of base plate	On the centerline X, Y (Note.8)	-100	-	+100	μm

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RECOMMENDED OPERATING CONDITIONS ($T_a=25\text{ }^{\circ}\text{C}$)

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across C1-E2	-	300	400	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	1.0	-	10	Ω

Note.1: Represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (FWDi).

2: Case temperature (T_c) measured point is base plate side. (Refer to the figure of chip location)

3: 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)

4: Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} rating.

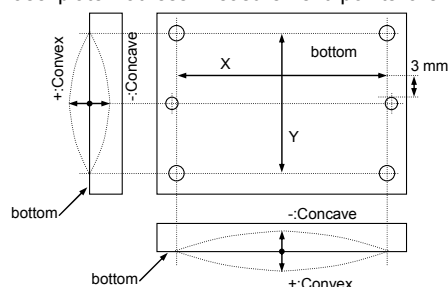
5: Junction temperature (T_j) should not increase beyond T_{jmax} rating.

6: Pulse width and repetition rate should be such as to cause negligible temperature rise.

(Refer to the figure of test circuit)

7: Typical value is measured by using thermally conductive grease of $\lambda=0.9\text{ W/(m}\cdot\text{K)}$.

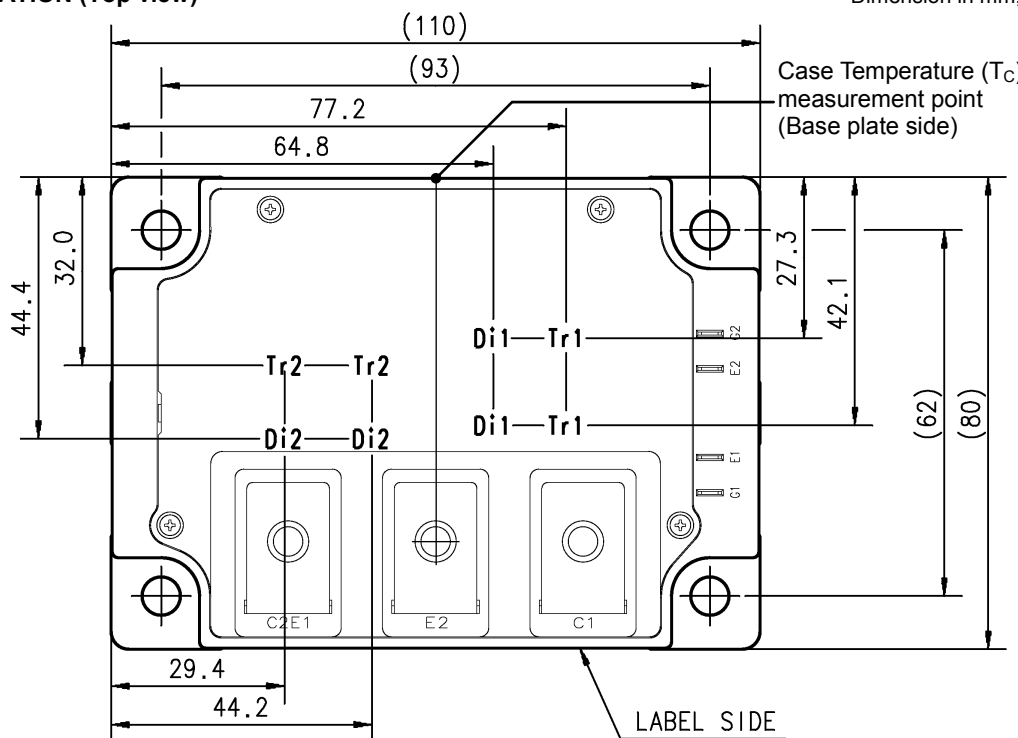
8: Base plate flatness measurement points are as in the following figure.



9: No short circuit capability is designed.

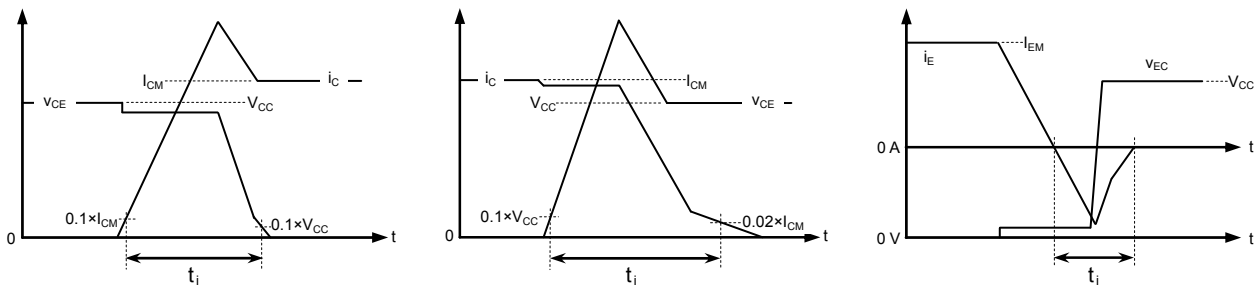
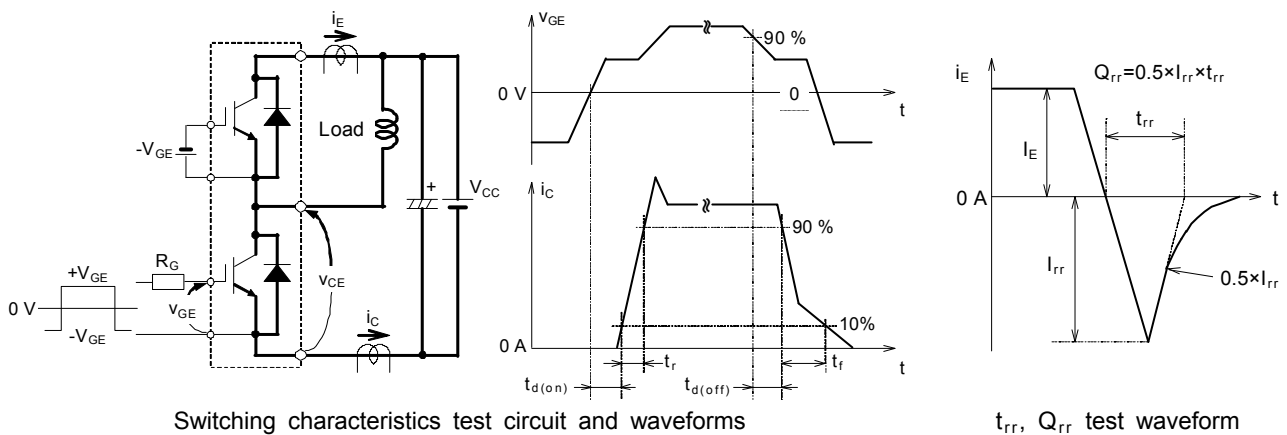
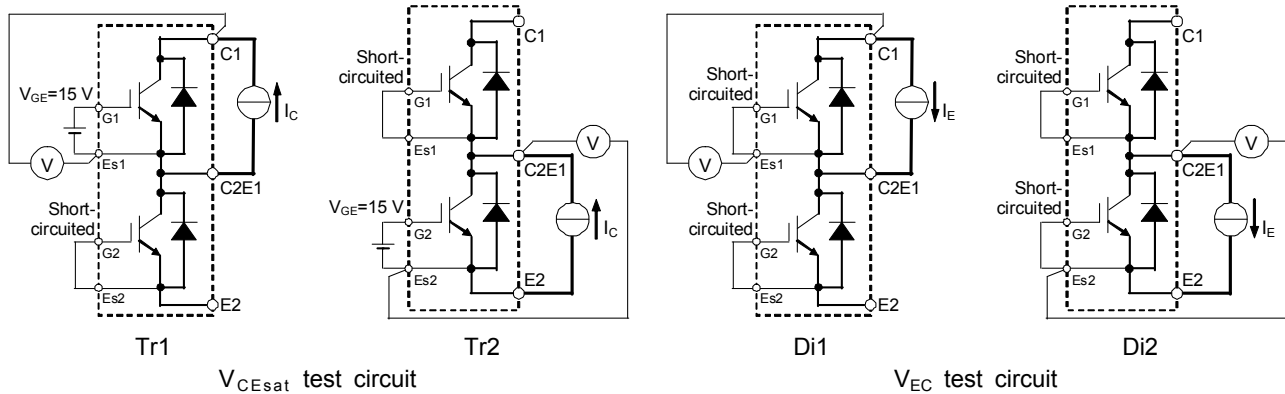
CHIP LOCATION (Top view)

Dimension in mm, tolerance: $\pm 1\text{ mm}$



Tr1/Tr2: IGBT, Di1/Di2: FWDi

TEST CIRCUIT AND WAVEFORMS



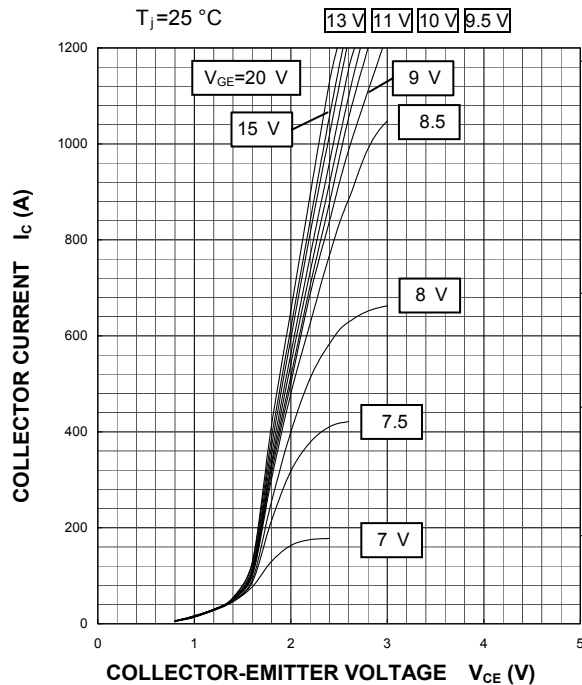
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

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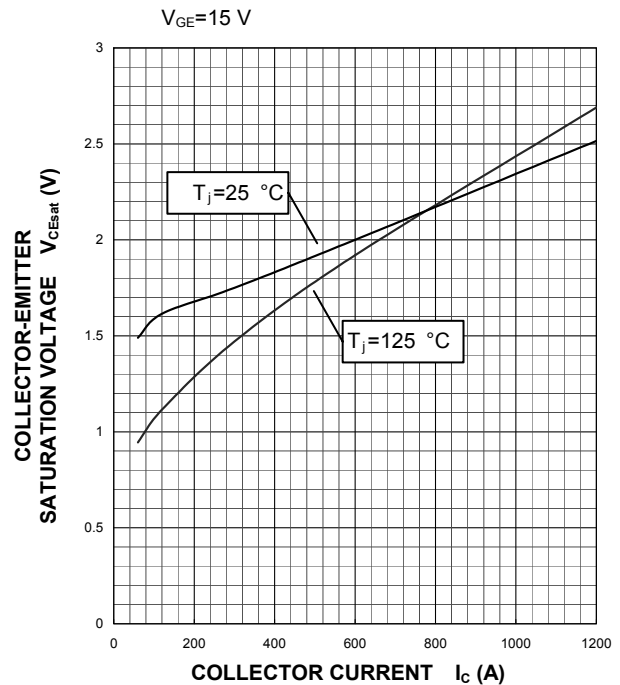
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PERFORMANCE CURVES

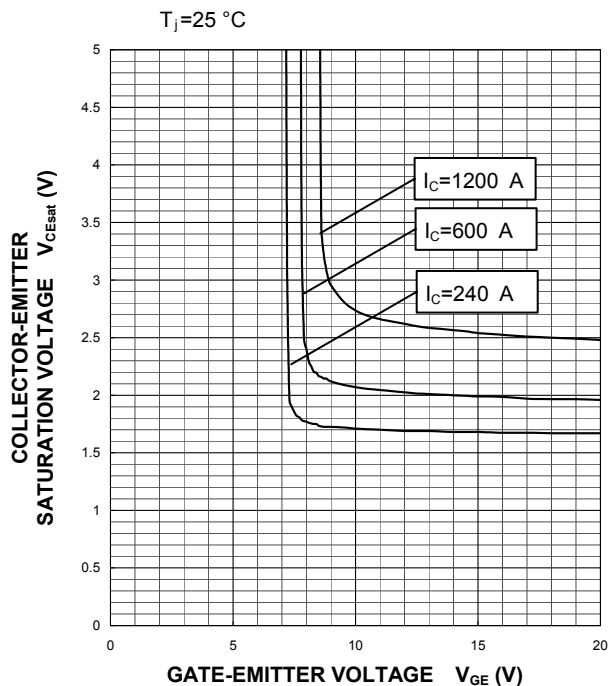
OUTPUT CHARACTERISTICS
(TYPICAL)



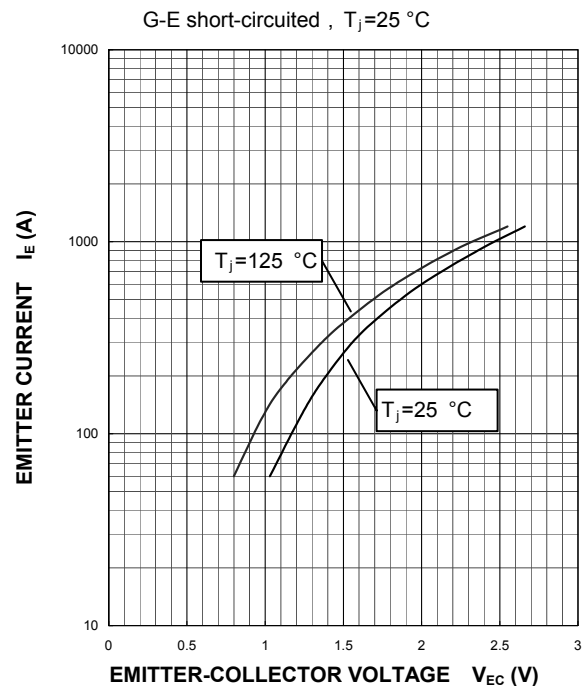
COLLECTOR-EMITTER SATURATION
VOLTAGE CHARACTERISTICS
(TYPICAL)



COLLECTOR-EMITTER SATURATION
VOLTAGE CHARACTERISTICS
(TYPICAL)



FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)

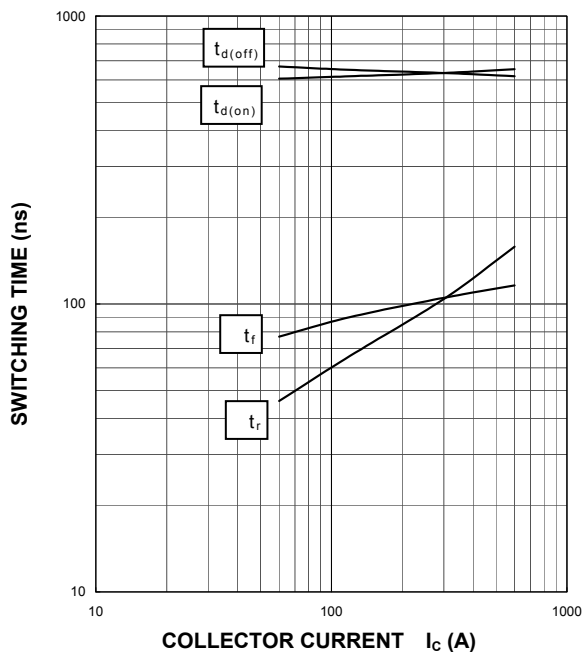


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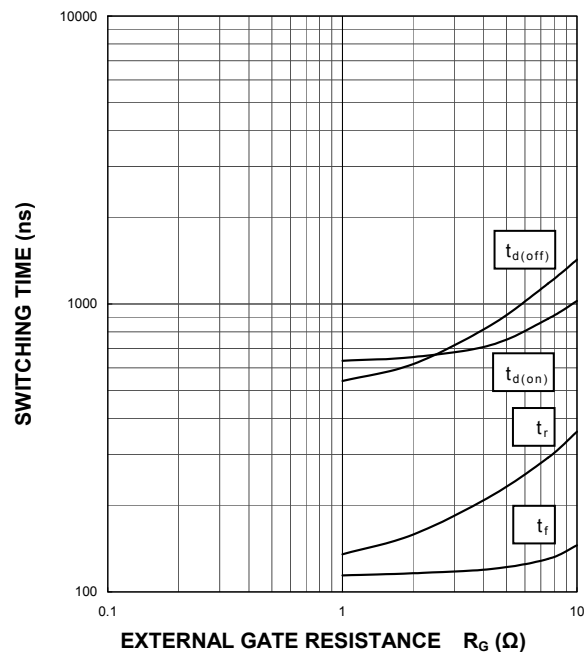
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.0\ \Omega$,
 $T_j=125\text{ }^\circ\text{C}$, INDUCTIVE LOAD



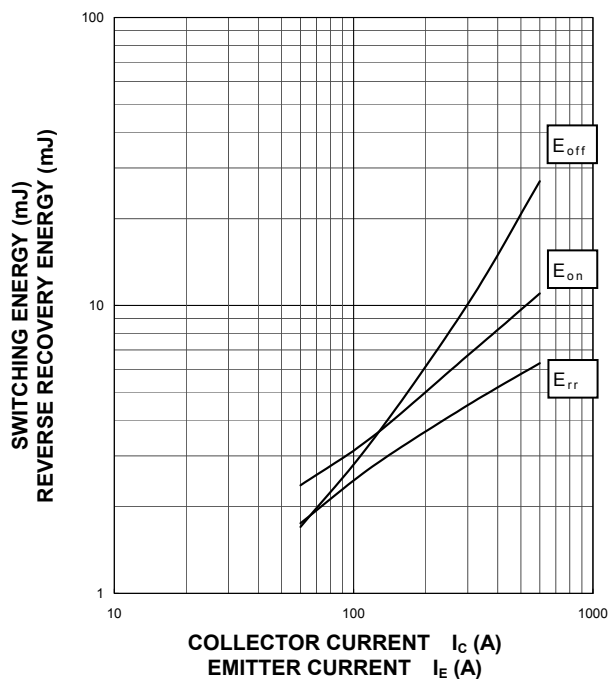
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=300\text{ V}$, $I_C=600\text{ A}$, $V_{GE}=\pm 15\text{ V}$,
 $T_j=125\text{ }^\circ\text{C}$, INDUCTIVE LOAD



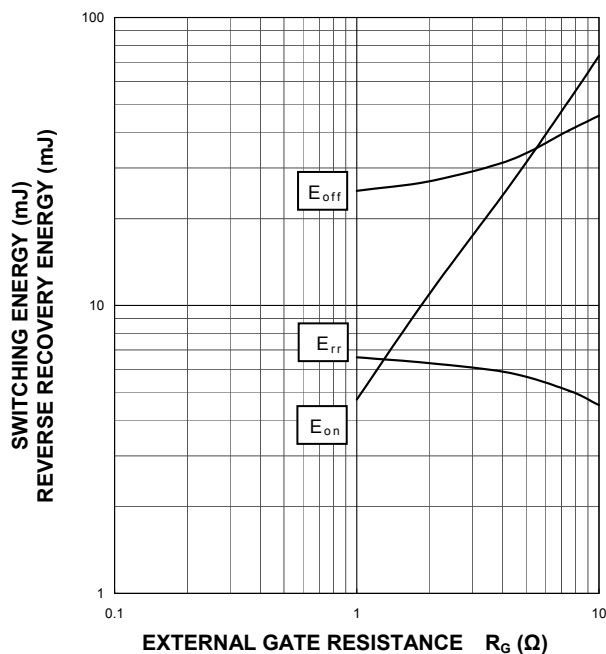
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.0\ \Omega$, $T_j=125\text{ }^\circ\text{C}$,
INDUCTIVE LOAD, PER PULSE



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=300\text{ V}$, $I_C/I_E=600\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $T_j=125\text{ }^\circ\text{C}$,
INDUCTIVE LOAD, PER PULSE

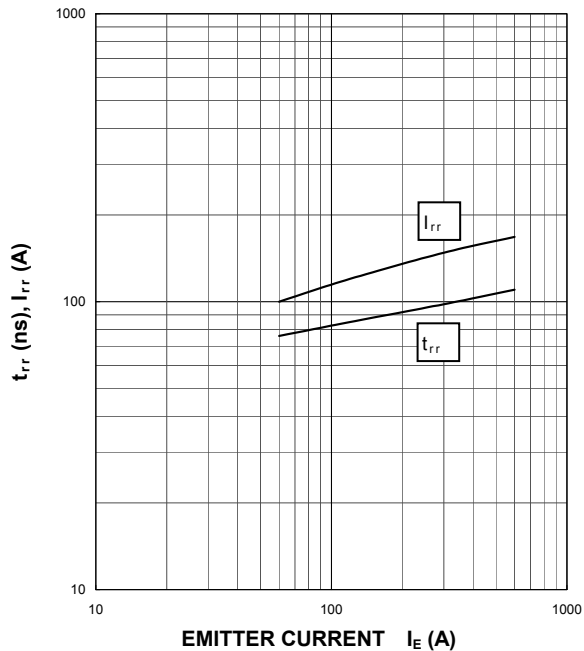


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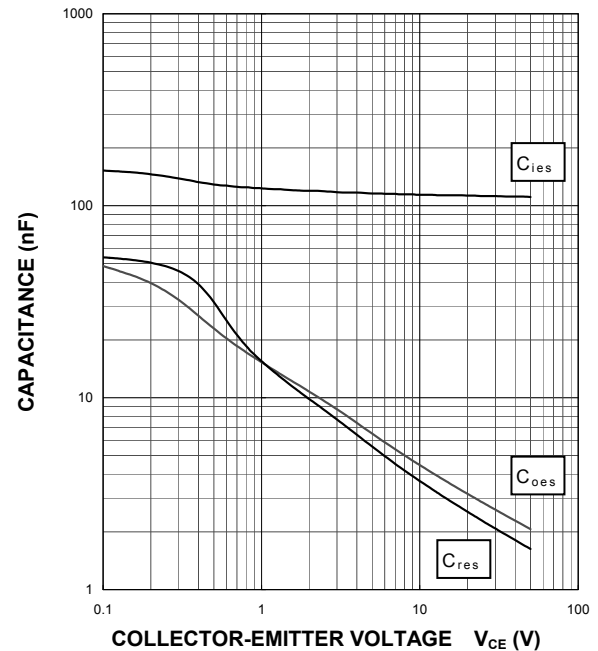
FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.0\ \Omega$,
 $T_J=25\text{ }^\circ\text{C}$, INDUCTIVE LOAD



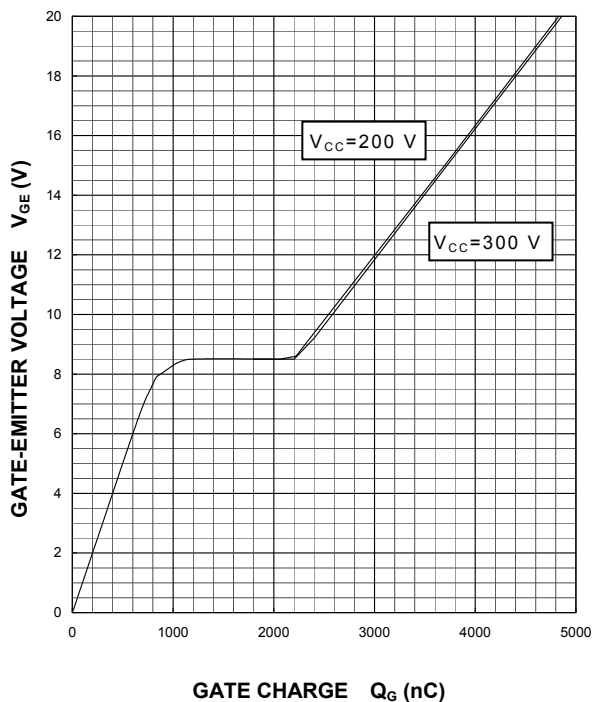
CAPACITANCE CHARACTERISTICS
(TYPICAL)

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



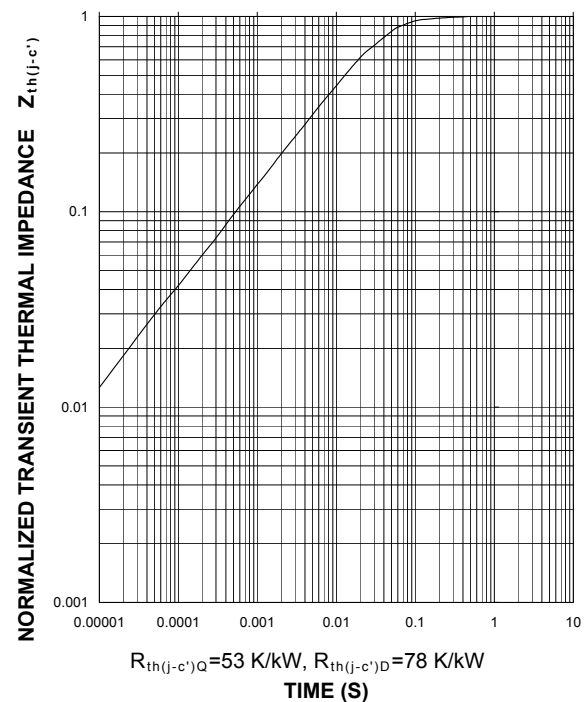
GATE CHARGE CHARACTERISTICS
(TYPICAL)

$I_C=600\text{ A}$, $T_J=25\text{ }^\circ\text{C}$



TRANSIENT THERMAL IMPEDANCE
CHARACTERISTICS
(MAXIMUM)

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



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