CM600DU-12NFH

HIGH POWER SWITCHING USE
INSULATED TYPE

CM600DU-12NFH **- 5th generation Fast switching IGBT module -**

Dual (Half-Bridge)

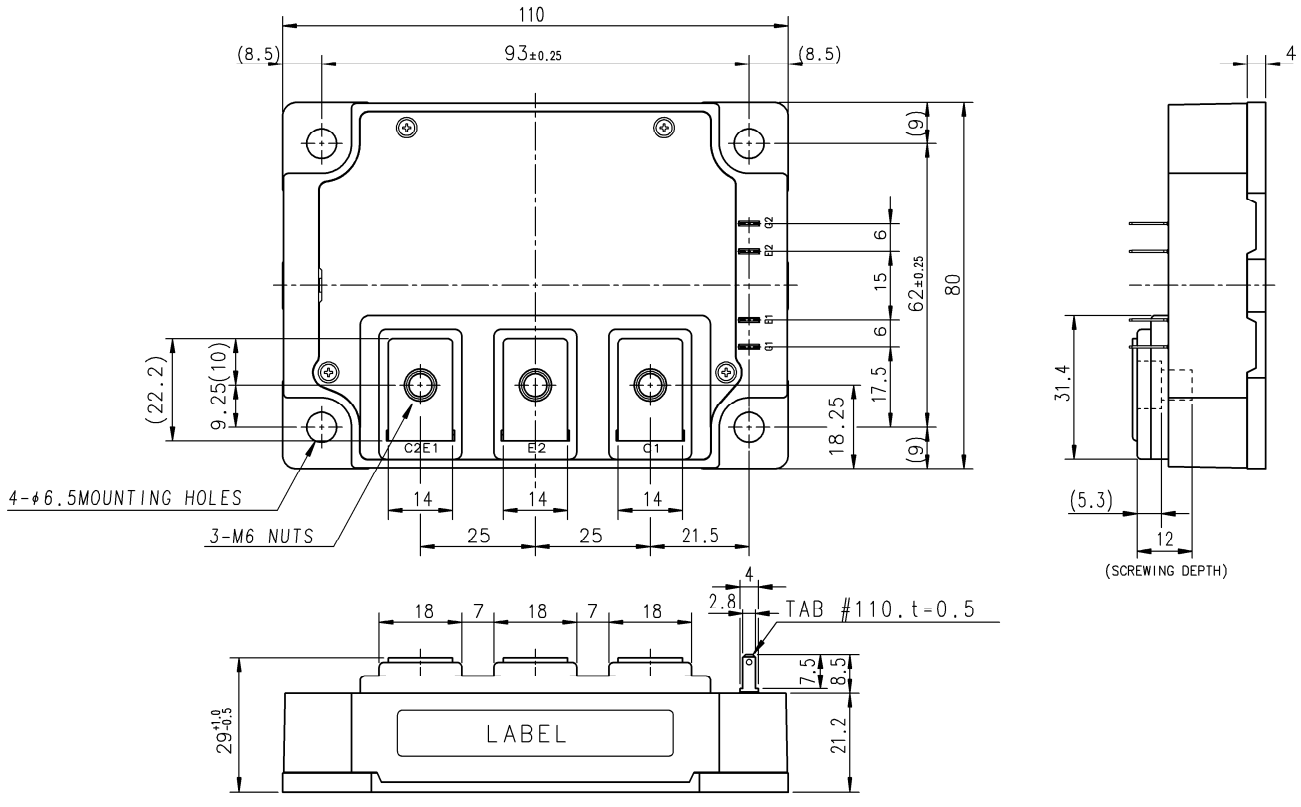
Collector current I_C ..... **600** A
Collector-emitter voltage V_{CES} ..... **600** V
Maximum junction temperature T_{jmax} ... **150** °C

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

APPLICATION

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

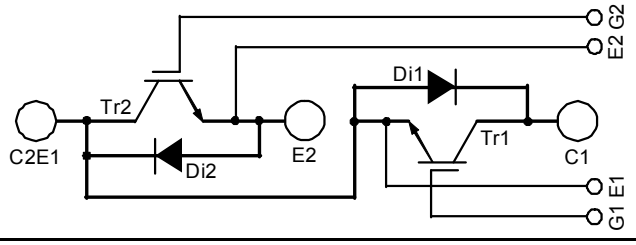
OUTLINE DRAWING & INTERNAL CONNECTION **Dimension in mm**



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

INTERNAL CONNECTION



MITSUBISHI ELECTRIC

ABSOLUTE MAXIMUM RATINGS (T_j=25 °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
$I_{C(rms)}$			400	
I_{CRM}		Pulse, Repetitive (Note.4)	1200	
P_{tot}	Total power dissipation	T_C=25 °C (Note.2, 5)	1130	W
P_{tot}'		T_C'=25 °C (Note.3, 5)	2350	
I_E (Note.1)	Emitter current (Free wheeling diode forward current)	Operation (Note.5)	600	A
$I_{E(rms)}$ (Note.1)			400	
I_{ERM} (Note.1)		Pulse, Repetitive (Note.4)	1200	
T_j	Junction temperature	-	-40 ~ +150	°C
T_{stg}	Storage temperature	-	-40 ~ +125	
V_{isol}	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	2500	V

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	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 mA, V_{CE}=10 V		5	6	7	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=600 A (Note.6), V_{GE}=15 V	T_j=25 °C	-	2.0	2.7	V
			T_j=125 °C	-	1.95	-	
C_{ies}	Input capacitance	V_{CE}=10 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 V, I_C=600 A, V_{GE}=15 V		-	3720	-	nC
$t_{d(on)}$	Turn-on delay time	V_{CC}=300 V, I_C=600 A, V_{GE}=±15 V, R_G=2.0 Ω, 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 A (Note.6), G-E short-circuited		-	2.0	2.6	V
t_{rr} (Note.1)	Reverse recovery time	V_{CC}=300 V, I_E=600 A, V_{GE}=±15 V, R_G=2.0 Ω, Inductive load		-	-	200	ns
Q_{rr} (Note.1)	Reverse recovery charge			-	11	-	µC
E_{on}	Turn-on switching energy per pulse	V_{CC}=300 V, I_C=I_E=600 A, V_{GE}=±15 V, R_G=2.0 Ω, T_j=125 °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	-	
r_g	Internal gate resistance	Per switch, T_C=25 °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)	-	0.02	-	K/W
$R_{th(j-c')Q}$	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

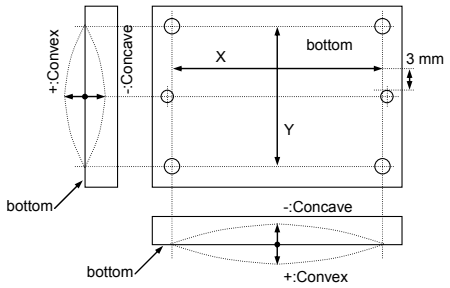
MECHANICAL CHARACTERISTICS

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

RECOMMENDED OPERATING CONDITIONS (T_a=25 °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

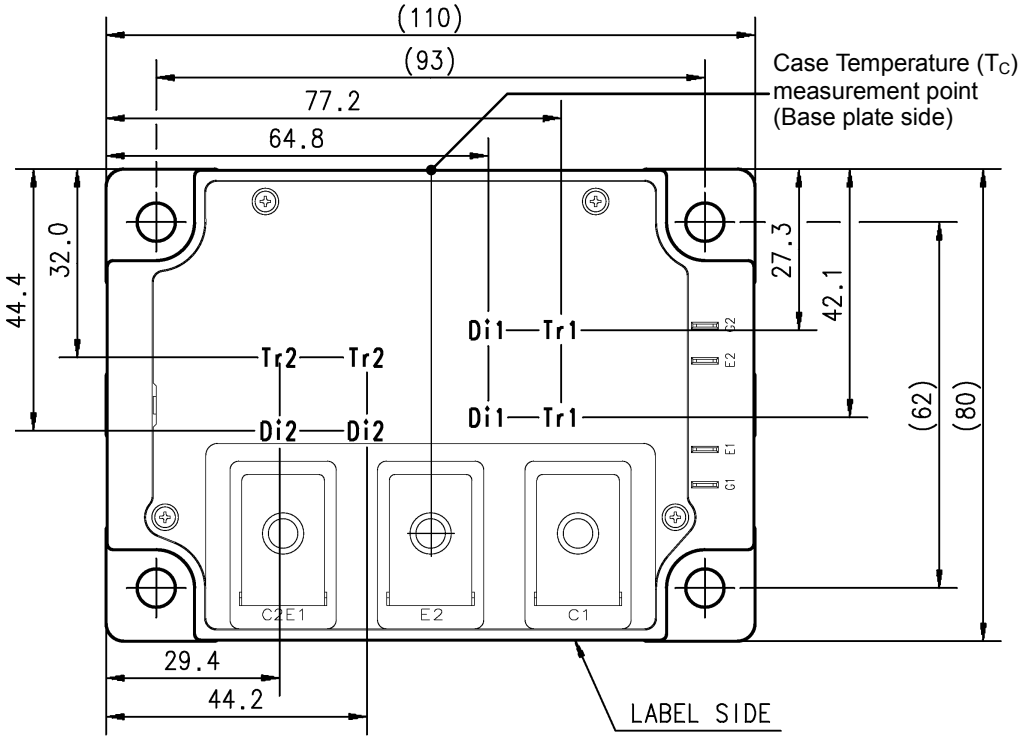
Note.1: Represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (FWDi).
Note.2: Case temperature (T_C) measured point is base plate side. (Refer to the figure of chip location)
Note.3: Case temperature (T_C') and heat sink temperature (T_s') are defined on the each surface of base plate and heat sink just under the chips. (Refer to the figure of chip location)
The heat sink thermal resistance {$R_{th(s-a)}$} should measure just under the chips.
Note.4: Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} rating.
Note.5: Junction temperature (T_j) should not increase beyond T_{jmax} rating.
Note.6: Pulse width and repetition rate should be such as to cause negligible temperature rise.
(Refer to the figure of test circuit)
Note.7: Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K).
Note.8: Base plate flatness measurement points are as in the following figure.



Note.9: No short circuit capability is designed.

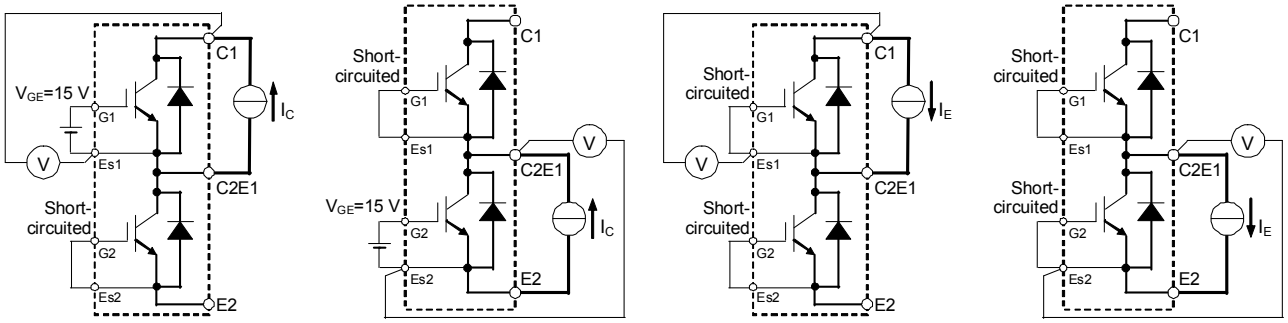
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm



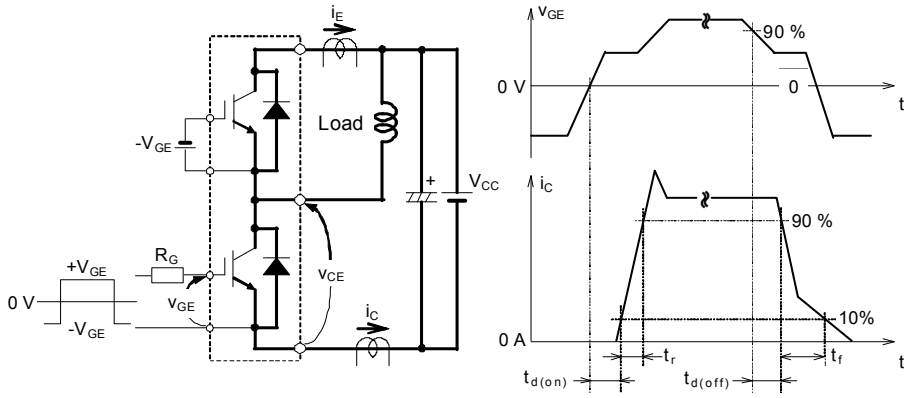
Tr1/Tr2: IGBT, Di1/Di2: FWDi

TEST CIRCUIT AND WAVEFORMS

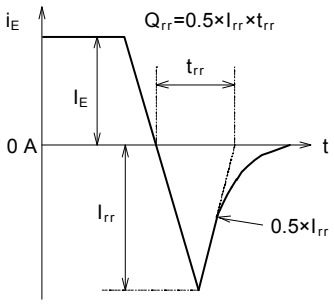


Tr1 Tr2 Di1 Di2

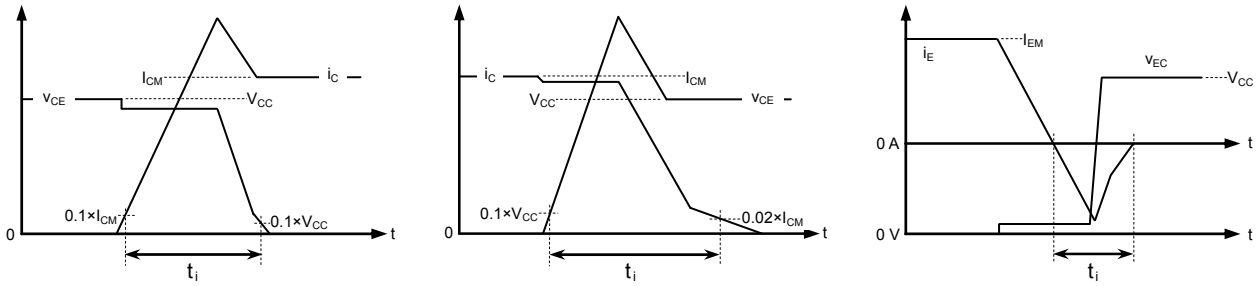
V_{CEsat} test circuit V_{EC} test circuit



Switching characteristics test circuit and waveforms



t_{rr}, Q_{rr} test waveform



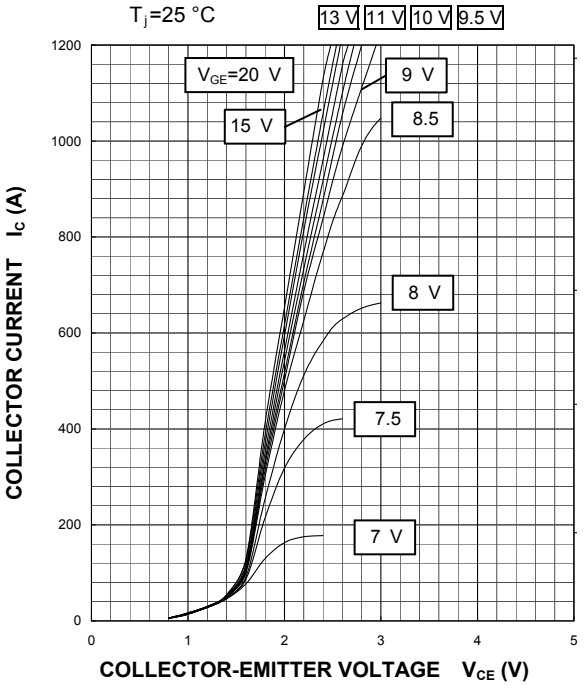
IGBT Turn-on switching energy IGBT Turn-off switching energy FWDi Reverse recovery energy

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

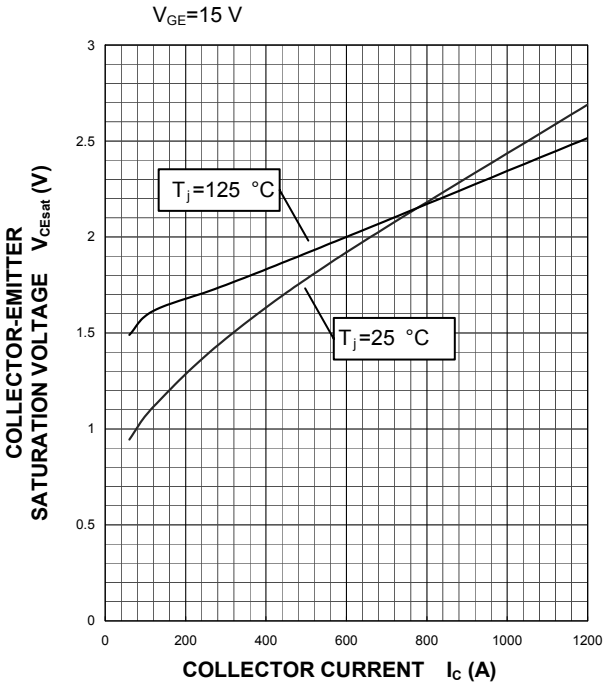
PERFORMANCE CURVES

INVERTER PART

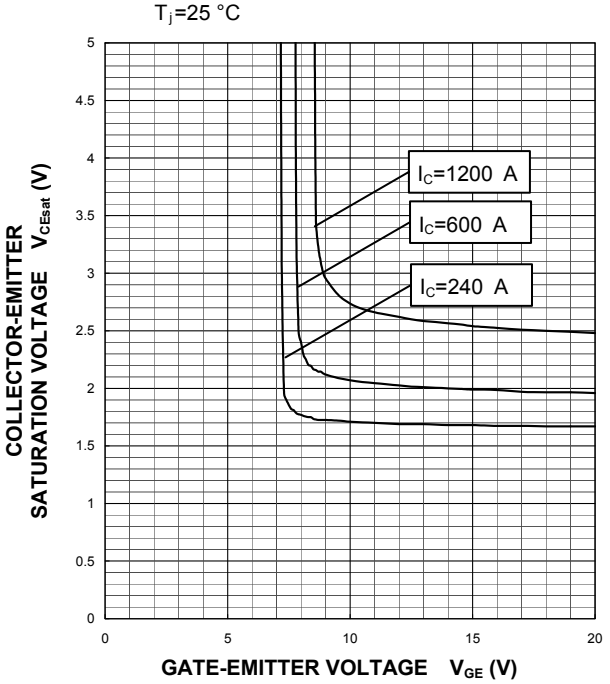
OUTPUT CHARACTERISTICS (TYPICAL)



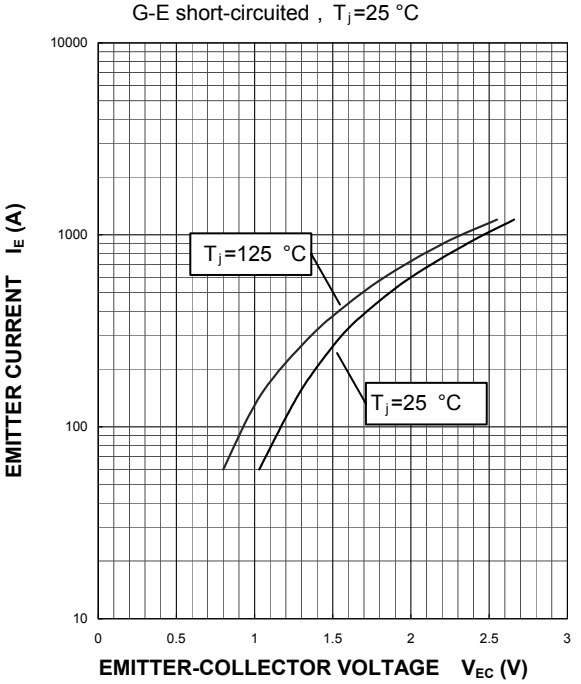
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

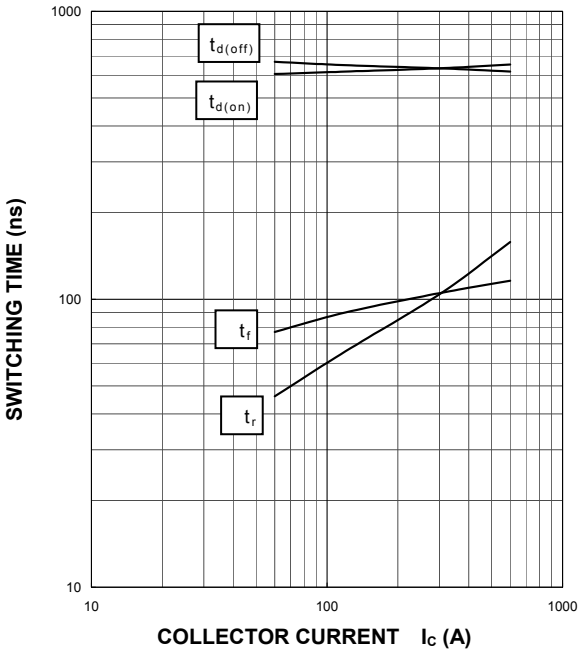


FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)



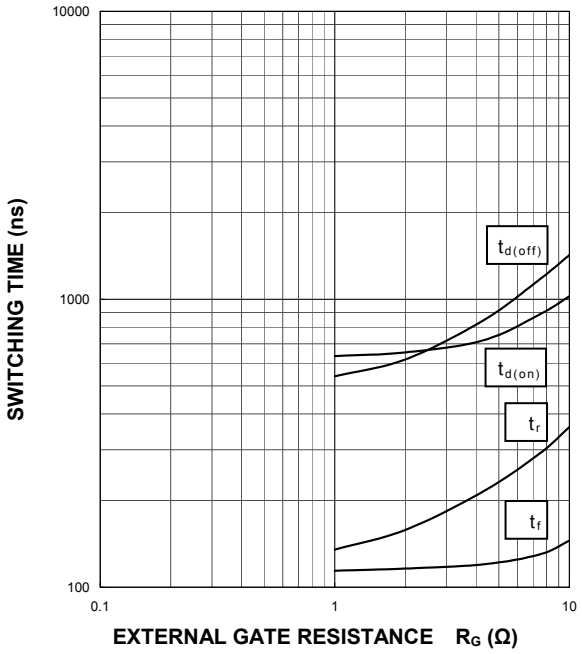
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=300 V, V_{GE}=±15 V, R_G=2.0 Ω, T_j=125 °C, INDUCTIVE LOAD



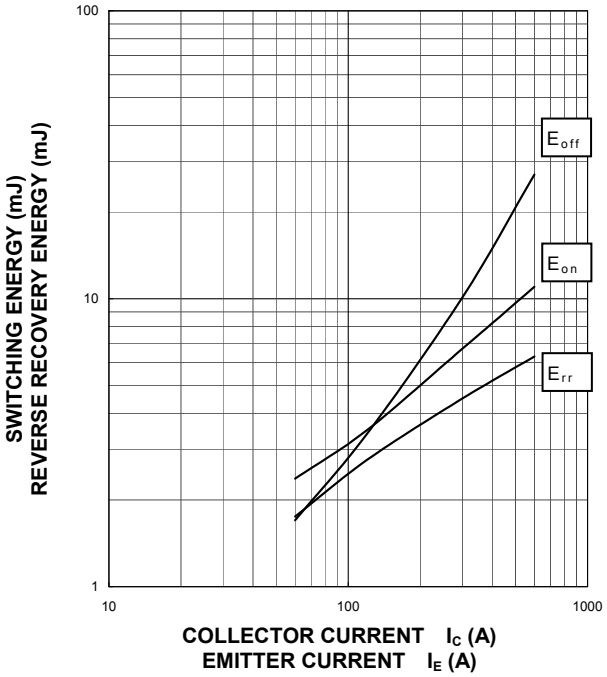
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=300 V, I_C=600 A, V_{GE}=±15 V, T_j=125 °C, INDUCTIVE LOAD



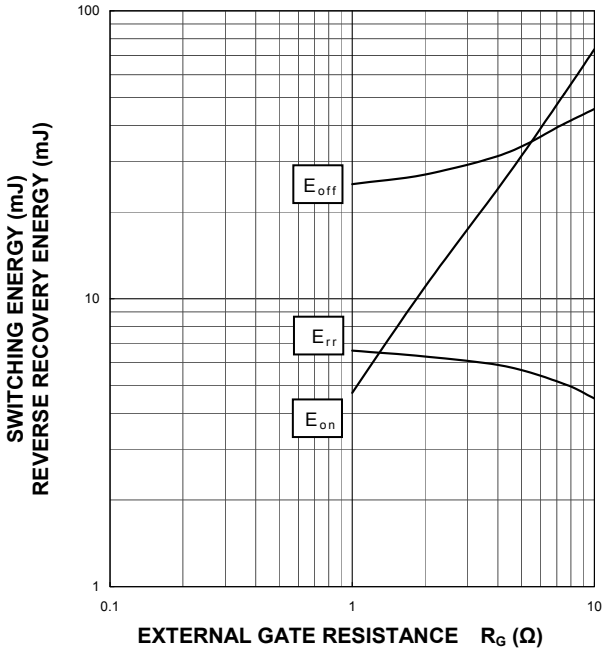
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=300 V, V_{GE}=±15 V, R_G=2.0 Ω, T_j=125 °C, INDUCTIVE LOAD, PER PULSE



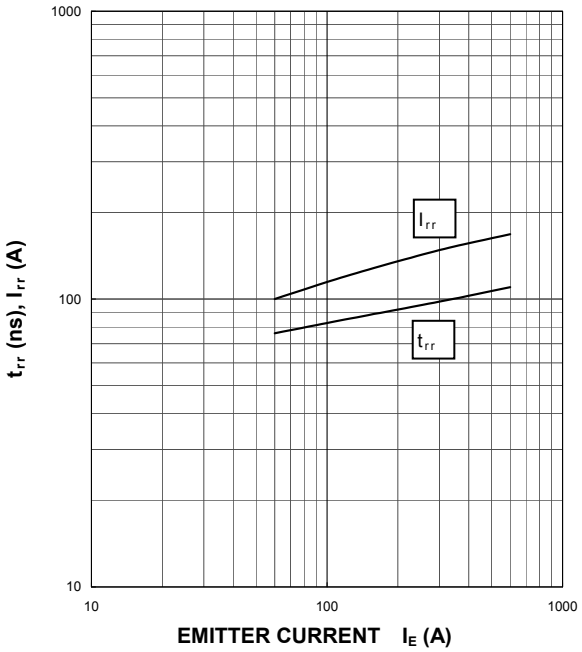
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=300 V, I_C/I_E=600 A, V_{GE}=±15 V, T_j=125 °C, INDUCTIVE LOAD, PER PULSE



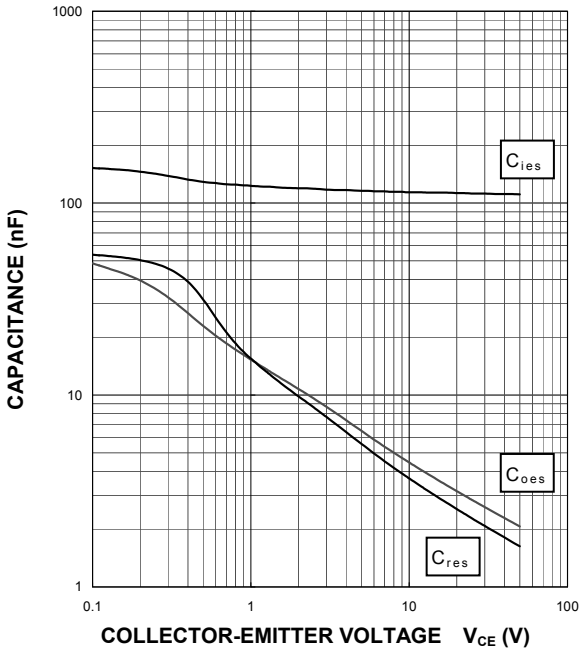
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

V_{CC}=300 V, V_{GE}=±15 V, R_G=2.0 Ω,
T_j=25 °C, INDUCTIVE LOAD



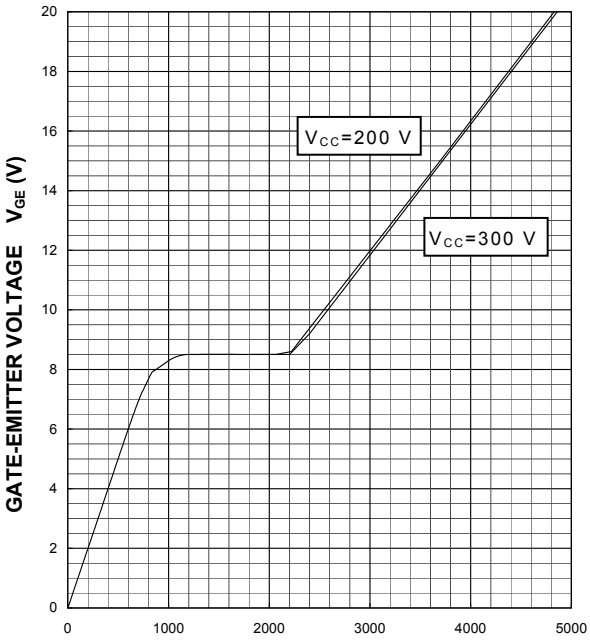
CAPACITANCE CHARACTERISTICS (TYPICAL)

G-E short-circuited, T_j=25 °C



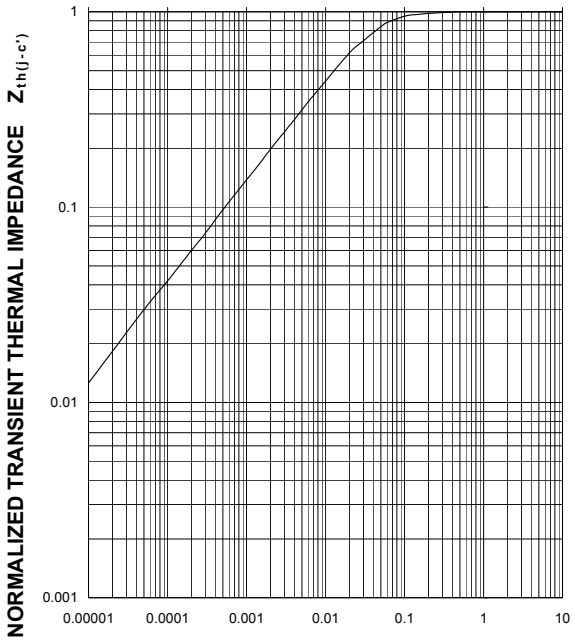
GATE CHARGE CHARACTERISTICS (TYPICAL)

I_C=600 A, T_j=25 °C



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)

Single pulse, T_C'=25°C



$R_{th(j-c')Q}$=53 K/kW, $R_{th(j-c')D}$=78 K/kW

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