MITSUBISHI ELECTRIC

< IGBT MODULES >

CM400DU-12NFH

HIGH POWER HIGH FREQUENTLY SWITCHING USE
INSULATED TYPE

Dual (Half-Bridge)

Collector current I_C ..... **400** A
Collector-emitter voltage V_{CES} ..... **600** V
Maximum junction temperature T_{jmax} ... **150** °C

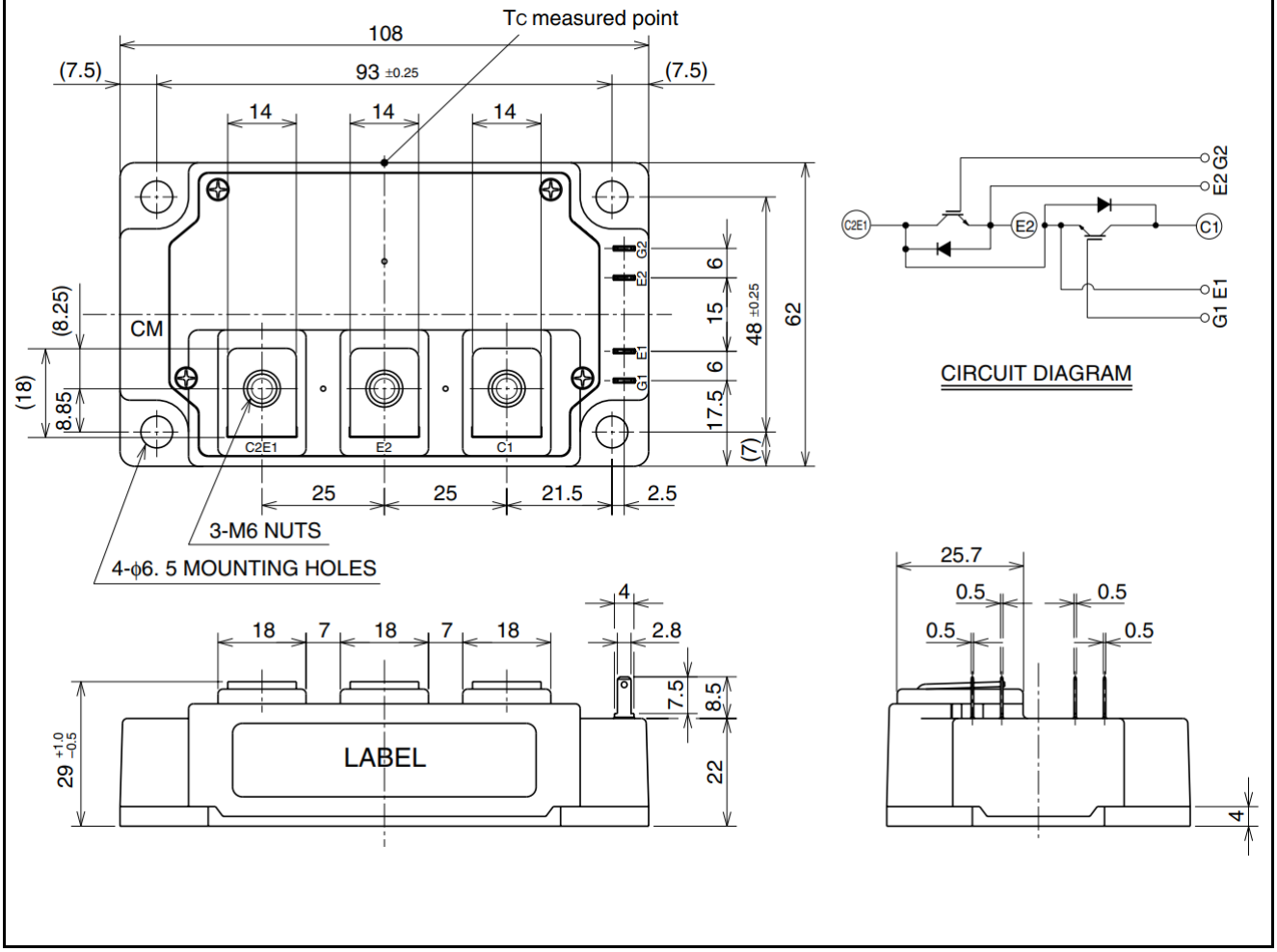
- ●Flat base Type
- ●Copper base plate
- ●RoHS Directive compliant
- ●UL Recognized under UL1557, File E323585

APPLICATION

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

OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm



CM400DU-12NFH

HIGH POWER HIGH FREQUENTLY SWITCHING USE
INSULATED TYPE

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	(Note.2)	400	A
I_{CRM}		Pulse, Repetitive (Note.3)	800	
P_{tot}	Total power dissipation	T_C=25 °C (Note.2, 4)	960	W
P_{tot}'		T_C'=25 °C (Note.2, 5)	1640	
I_E (Note.1)	Emitter current	(Note.2)	400	A
I_{ERM} (Note.1)		Pulse, Repetitive (Note.3)	800	
V_{isol}	Isolation voltage	Charged part to base plate, RMS, f=60 Hz, AC 1 min	2500	V
T_j	Junction temperature	-	-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	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=40 mA, V_{CE}=10 V		5	6	7	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=400 A, V_{GE}=15 V (Note.6)	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		-	-	110	nF
C_{oes}	Output capacitance			-	-	7.2	
C_{res}	Reverse transfer capacitance			-	-	4.0	
Q_G	Gate charge	V_{CC}=300 V, I_C=400 A, V_{GE}=15 V		-	2480	-	nC
$t_{d(on)}$	Turn-on delay time	V_{CC}=300 V, I_C=400 A, V_{GE}=±15 V, R_G=3.1 Ω, Inductive load		-	-	400	ns
t_r	Rise time			-	-	200	
$t_{d(off)}$	Turn-off delay time			-	-	700	
t_f	Fall time			-	-	150	
V_{EC}	Emitter-collector voltage (Note.1)	I_E=400 A, G-E short-circuited (Note.6)		-	1.95	2.4	V
t_{rr}	Reverse recovery time (Note.1)	V_{CC}=300 V, I_E=400 A, V_{GE}=±15 V, R_G=3.1 Ω, Inductive load		-	-	200	ns
Q_{rr}	Reverse recovery charge (Note.1)			-	7.7	-	μC
r_g	Internal gate resistance	T_c = 25 °C, per switch		-	0.8	-	Ω
R_G	External gate resistance	Per switch		1.6	-	16	Ω

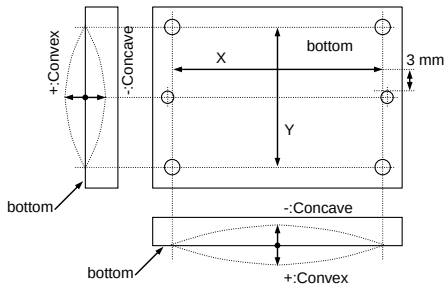
THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance (Note.4)	Junction to case, per IGBT	-	-	0.13	K/W
$R_{th(j-c)D}$		Junction to case, per FWDi	-	-	0.18	K/W
$R_{th(c-s)}$	Contact thermal resistance (Note.4)	Case to heat sink, per 1/2 module, Thermal grease applied (Note.7)	-	0.04	-	K/W
$R_{th(j-c')Q}$	Thermal resistance (Note.5)	Junction to case, per IGBT	-	-	0.076	K/W
$R_{th(j-c')D}$		Junction to case, per FWDi	-	-	0.1	K/W

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M_t	Mounting torque	Main terminals M 5 screw	3.5	-	4.5	N·m
M_s		Mounting to heat sink M 6 screw	3.5	-	4.5	
m	Weight	-	-	400	-	g
e_c	Flatness of base plate	On the centerline X, Y (Note.8)	-100	-	+100	μm

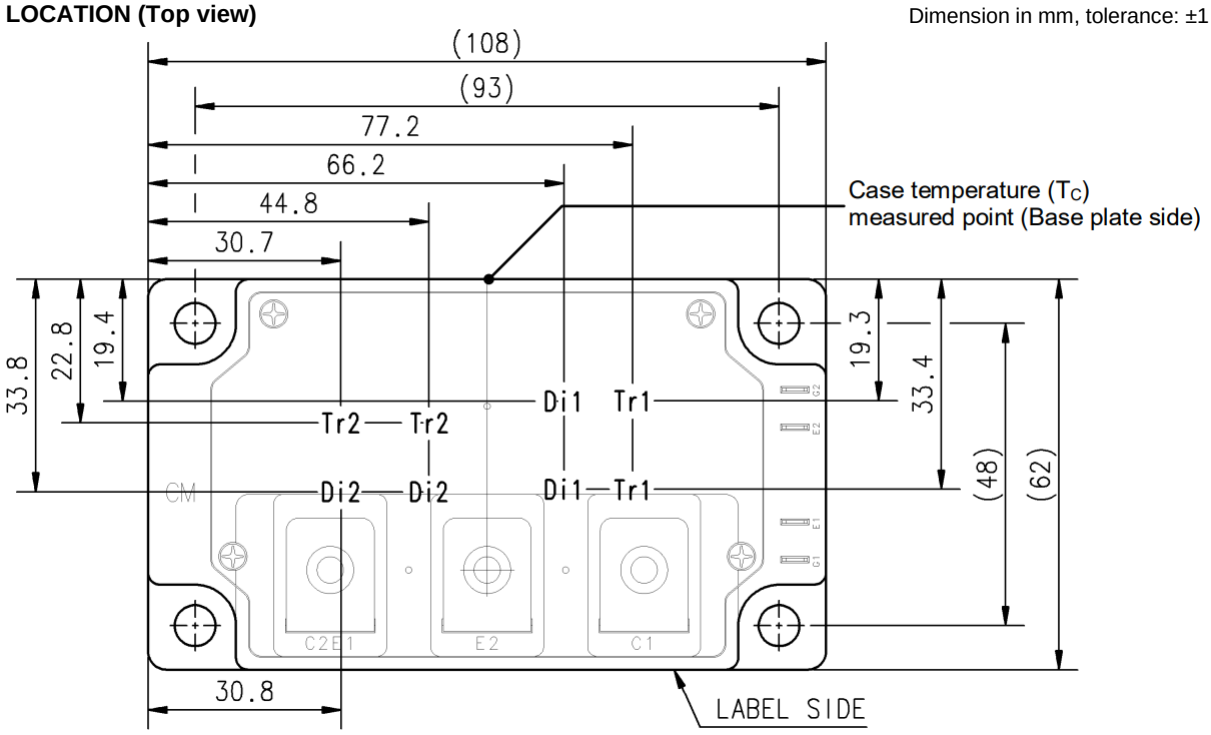
Note1. Represent the ratings of the anti-parallel, emitter-collector free wheeling diode (FWDi).
2. The device junction temperature is T_{jmax} rating (150°C) or less.
3. Pulse width and repetition rate should be such that the device junction temperature (T_j) does not exceed T_{jmax} rating.
4. Case temperature (T_C) is defined on the base plate side. (Refer to the figure of chip location)
5. Case temperature (T_C') and heat sink temperature (T_s') are defined on the each surface just under the chip. (Refer to the figure of chip location)
6. Pulse width and repetition rate should be such as to cause negligible temperature rise.
7. Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K).
8: Base plate flatness measurement points are as in the following figure.



9: No short circuit capability is designed.

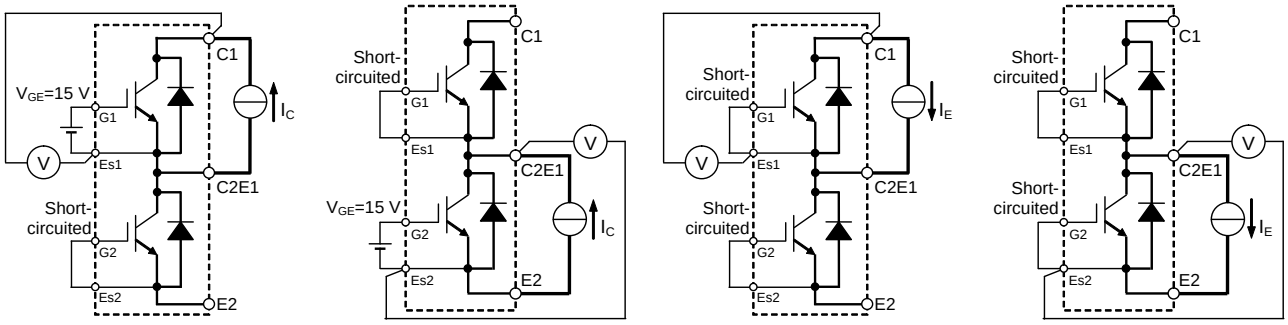
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm



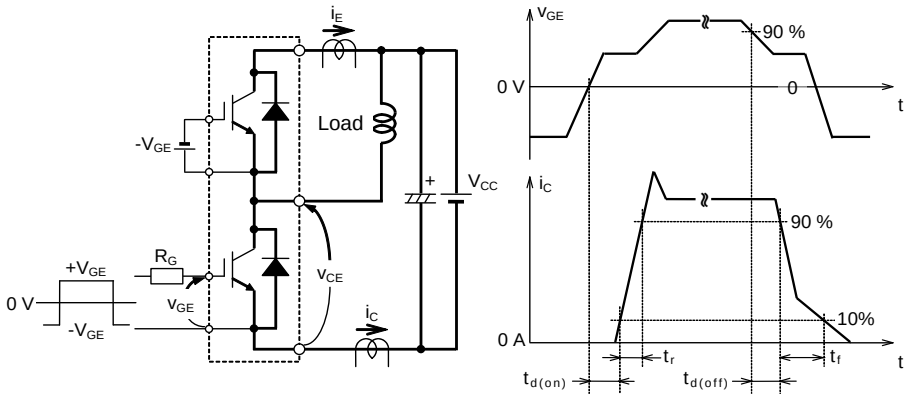
Tr1/Tr2: IGBT, Di1/Di2: FWDi

TEST CIRCUIT AND WAVEFORMS

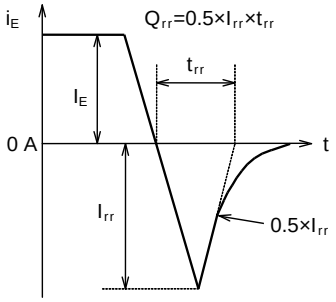


Tr1 Tr2 Di1 Di2

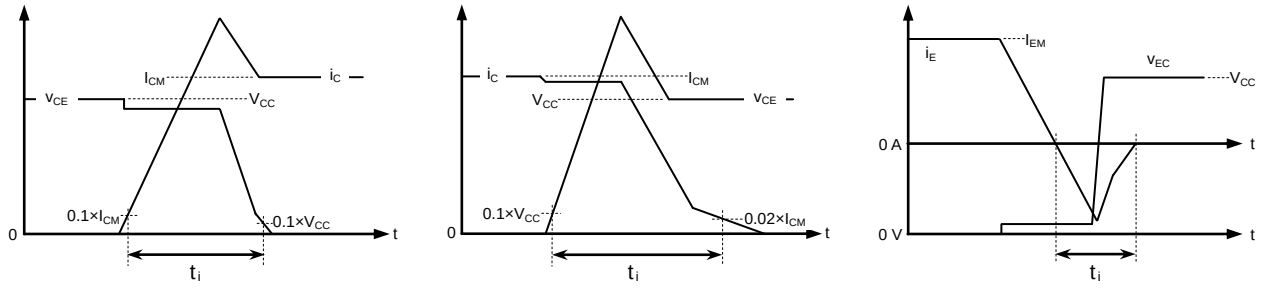
V_{CEsat} test circuit V_{EC} test circuit



Switching characteristics test circuit and waveforms



t_{rr}, Q_{rr} test waveform

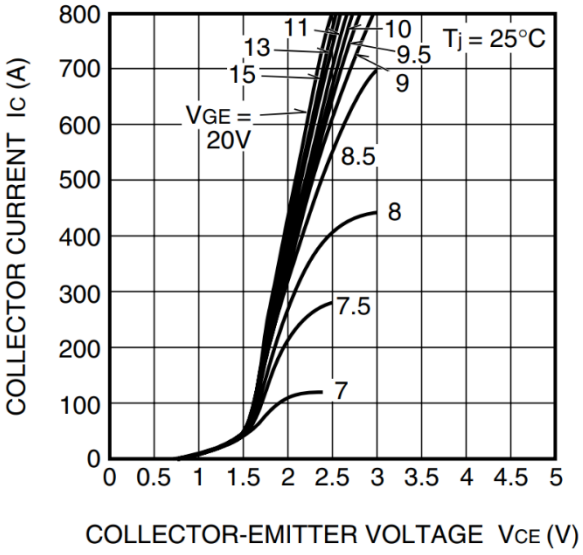


IGBT Turn-on switching energy IGBT Turn-off switching energy FWDi Reverse recovery energy

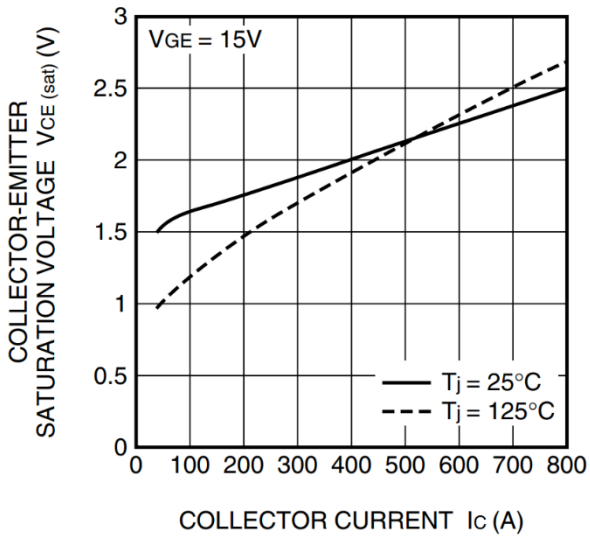
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

PERFORMANCE CURVES

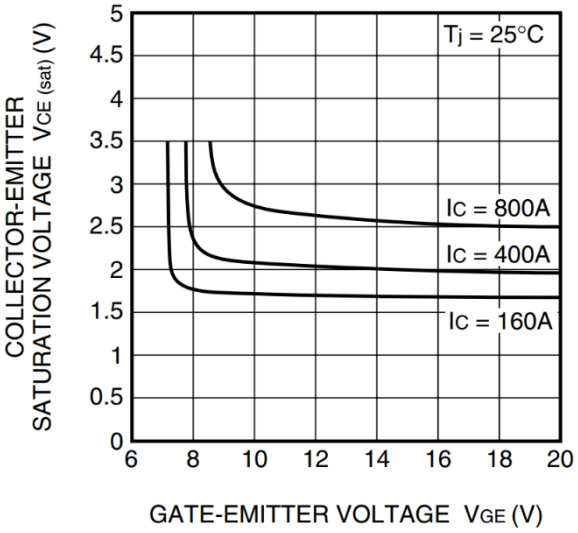
OUTPUT CHARACTERISTICS (TYPICAL)



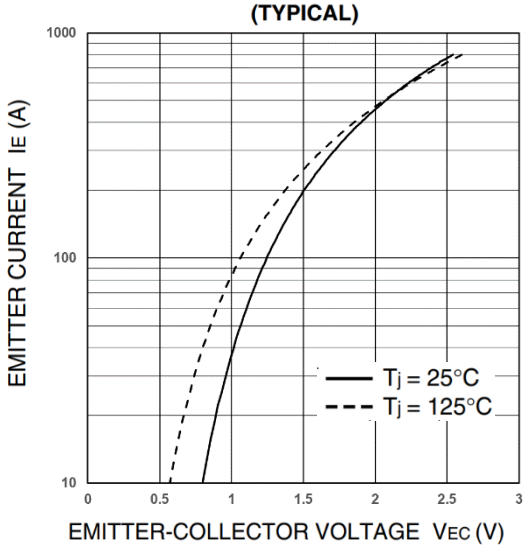
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

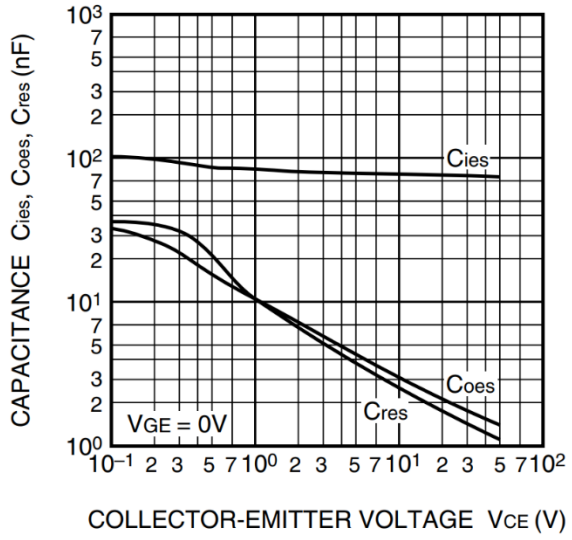


FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)

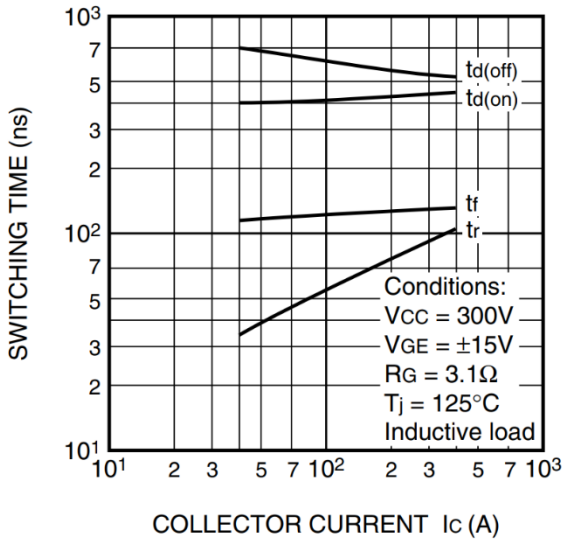


PERFORMANCE CURVES

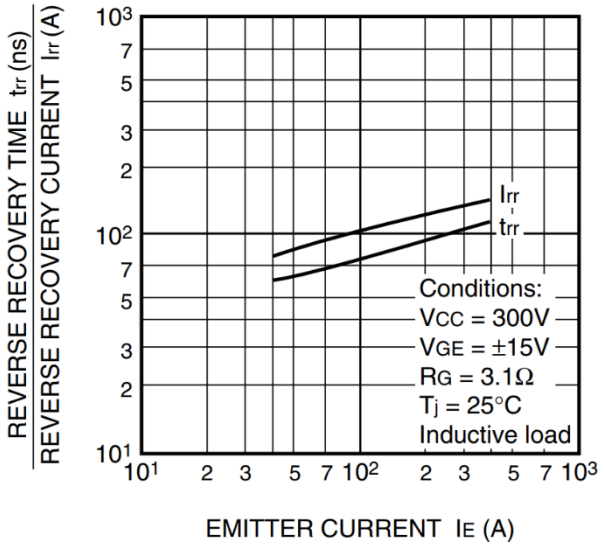
CAPACITANCE–VCE CHARACTERISTICS (TYPICAL)



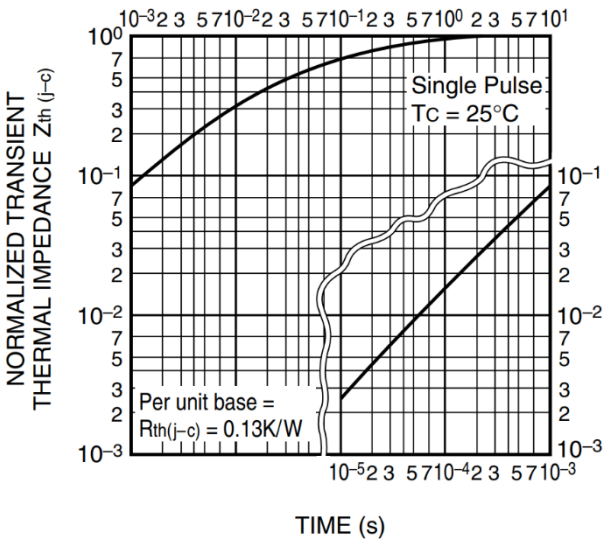
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)



REVERSE RECOVERY CHARACTERISTICS OF FREE-WHEEL DIODE (TYPICAL)

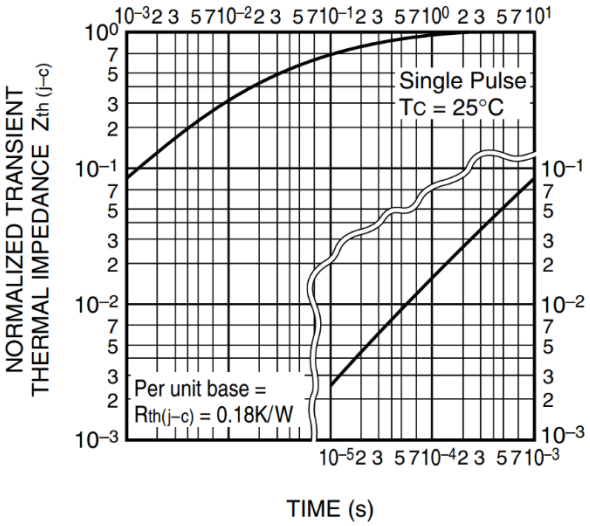


TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT part)

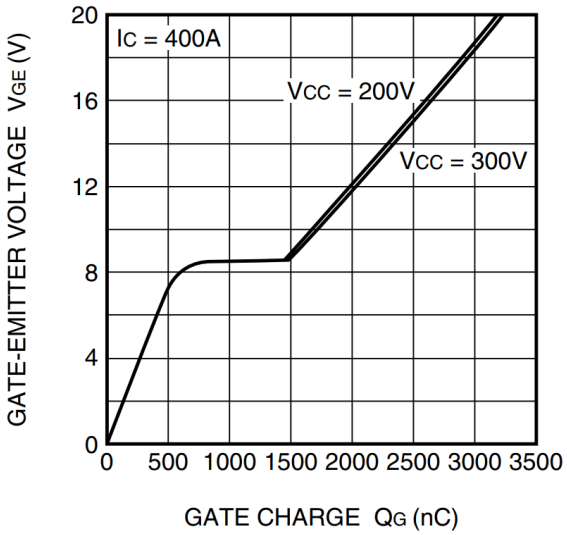


PERFORMANCE CURVES

TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWDi part)



GATE CHARGE CHARACTERISTICS (TYPICAL)



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