CM1400DUC-24NF **- MPD series using 5th Generation IGBT and FWDi -**

Dual (Half-Bridge)

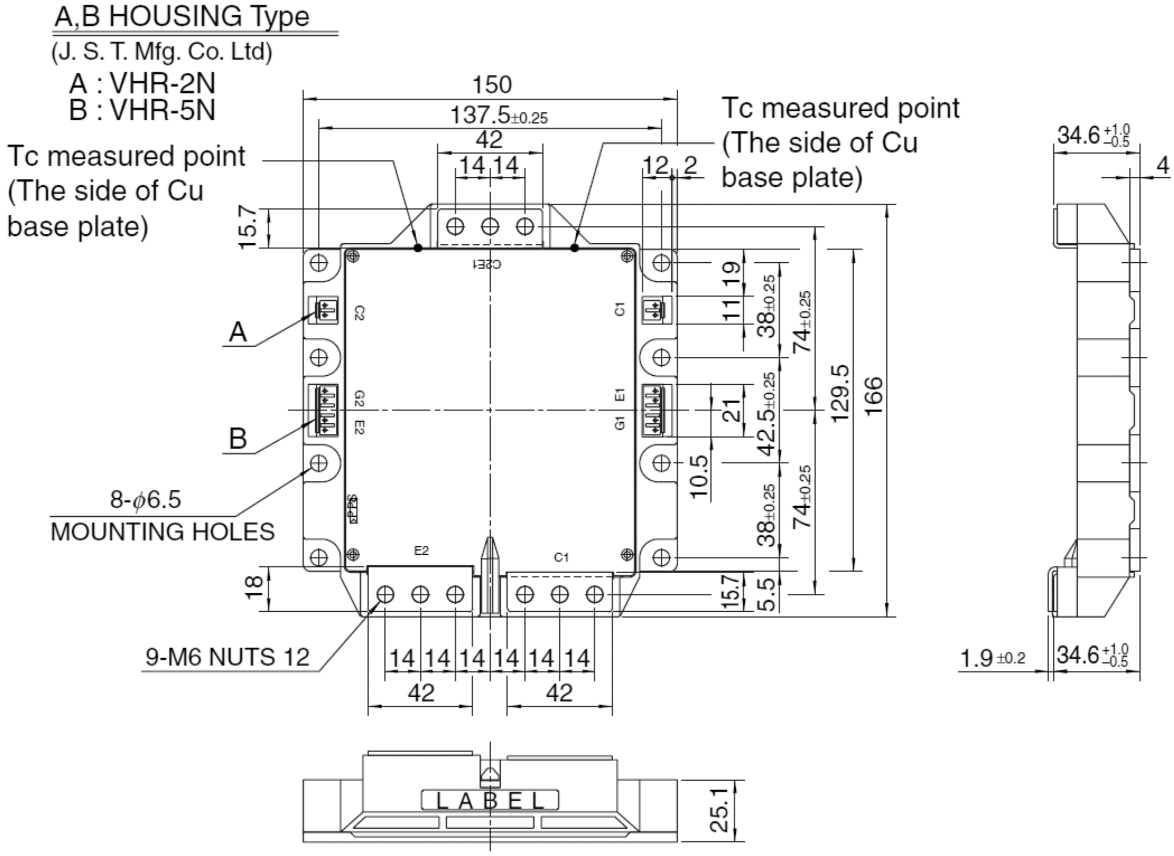
- I_C .... 1400 A
- V_{CES} .... 1200 V
- Flat base Type
  Copper (non-plating) base plate
- RoHS Directive compliant
- UL Recognized File No. E80276

APPLICATION

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

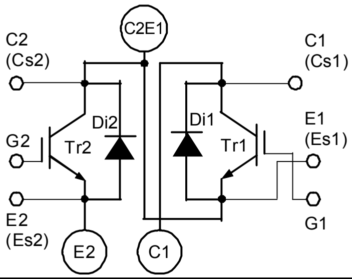
OUTLINE DRAWING & INTERNAL CONNECTION

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



ABSOLUTE MAXIMUM RATINGS (T_j=25 °C, unless otherwise specified)

Symbol	Item	Conditions	Rating	Unit
V_{CES}	Collector-emitter voltage	G-E short-circuited	1200	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	±20	V
I_C	Collector current	DC, T_C=94 °C (Note.2)	1400	A
I_{CRM}		Pulse, Repetitive (Note.3)	2800	
P_{tot}	Total power dissipation	T_C=25 °C (Note.2, 4)	8925	W
I_E (Note.1)	Emitter current (Free wheeling diode forward current)	T_C=25 °C (Note.2, 4)	1400	A
I_{ERM} (Note.1)		Pulse, Repetitive (Note.3)	2800	
T_j	Junction temperature	-	-40 ~ +150	°C
T_{stg}	Storage temperature	(Note.7)	-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 Min.	Typ.	Max.	Unit
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		-	-	1.5	μA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=140 mA, V_{CE}=10 V		6	7	8	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=1400 A (Note.5),	T_j=25 °C	-	1.8	2.5	V
		V_{GE}=15 V	T_j=125 °C	-	2.0	-	
C_{ies}	Input capacitance	V_{CE}=10 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}=600 V, I_C=1400 A, V_{GE}=15 V		-	7200	-	nC
$t_{d(on)}$	Turn-on delay time	V_{CC}=600 V, I_C=1400 A, V_{GE}=±15 V,		-	-	800	ns
t_r	Rise time			-	-	300	
$t_{d(off)}$	Turn-off delay time	R_G=0.22 Ω, Inductive load		-	-	1000	
t_f	Fall time			-	-	300	
V_{EC} (Note.1)	Emitter-collector voltage	I_E=1400 A (Note.5), G-E short-circuited		-	2.5	3.2	V
t_{rr} (Note.1)	Reverse recovery time	V_{CC}=600 V, I_E=1400 A, V_{GE}=±15 V,		-	-	700	ns
Q_{rr} (Note.1)	Reverse recovery charge	R_G=0.22 Ω, Inductive load		-	90	-	μC
E_{on}	Turn-on switching energy per pulse	V_{CC}=600 V, I_C=I_E=1400 A,		-	122.8	-	mJ
E_{off}	Turn-off switching energy per pulse	V_{GE}=±15 V, R_G=0.22 Ω, T_j=125 °C,		-	161.2	-	
E_{rr} (Note.1)	Reverse recovery energy per pulse	Inductive load		-	136.9	-	
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, T_C=25 °C (Note.2)		-	0.286	-	mΩ
r_g	Internal gate resistance	Per switch		-	1.0	-	Ω

THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits Min.	Typ.	Max.	Unit
$R_{th(j-c)Q}$	Thermal resistance (Note.2)	Junction to case, per IGBT	-	-	14	K/kW
$R_{th(j-c)D}$		Junction to case, per FWDi	-	-	23	K/kW
$R_{th(c-s)}$	Contact thermal resistance (Note.2)	Case to heat sink, per 1/2 module, Thermal grease applied (Note.6)	-	12	-	K/kW

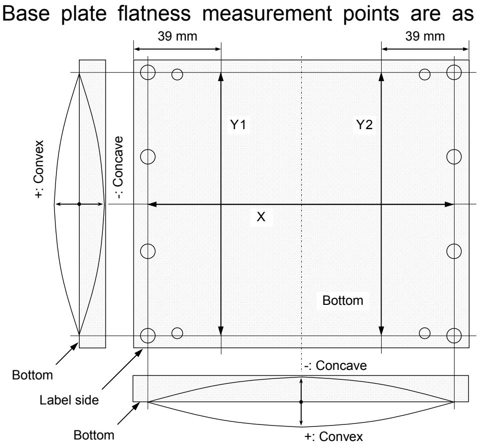
MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits Min.	Typ.	Max.	Unit
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 (Note.8)	-50	-	+100	μm

RECOMMENDED OPERATING CONDITIONS (T_a=25 °C)

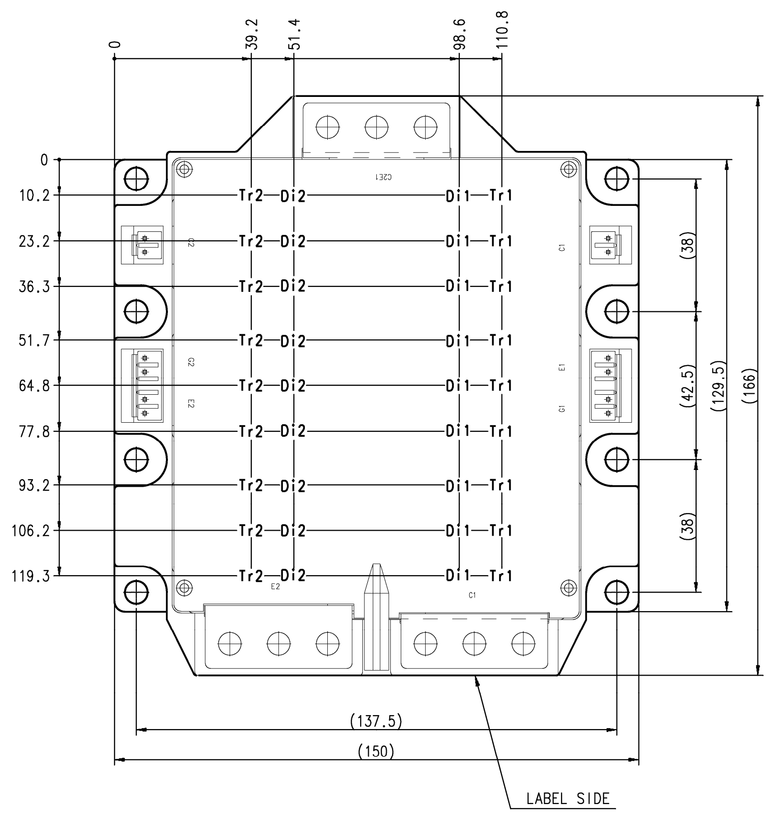
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across C1-E2	-	600	800	V
V_{GEon}	Gate (-emitter drive) voltage	Applied across G1-Es1/G2-Es2	13.5	15.0	16.5	V
R_G	External gate resistance	Per switch	0.22	-	2.2	Ω

Note.1: Represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (FWDi).
Note.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.
Note.3: Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} rating.
Note.4: Junction temperature (T_j) should not increase beyond T_{jmax} rating.
Note.5: Pulse width and repetition rate should be such as to cause negligible temperature rise.
(Refer to the figure of test circuit)
Note.6: Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K).
Note.7: The operation temperature is restrained by the permission temperature of female connector housing.
Note.8: Base plate flatness measurement points are as in the following figure.



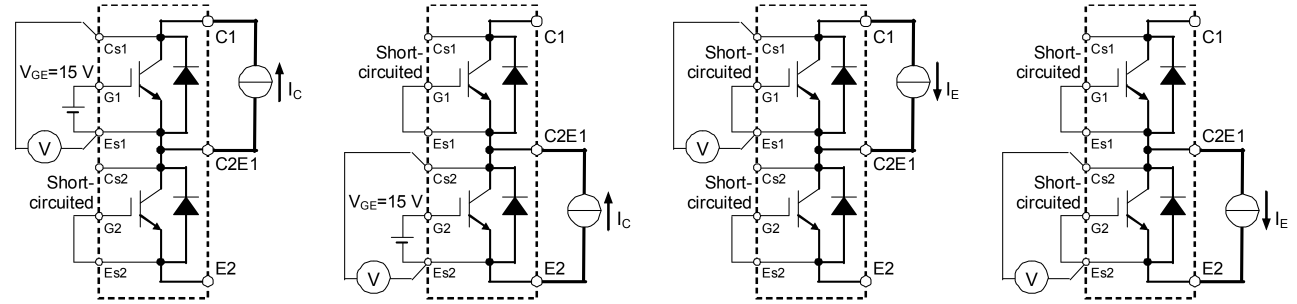
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm



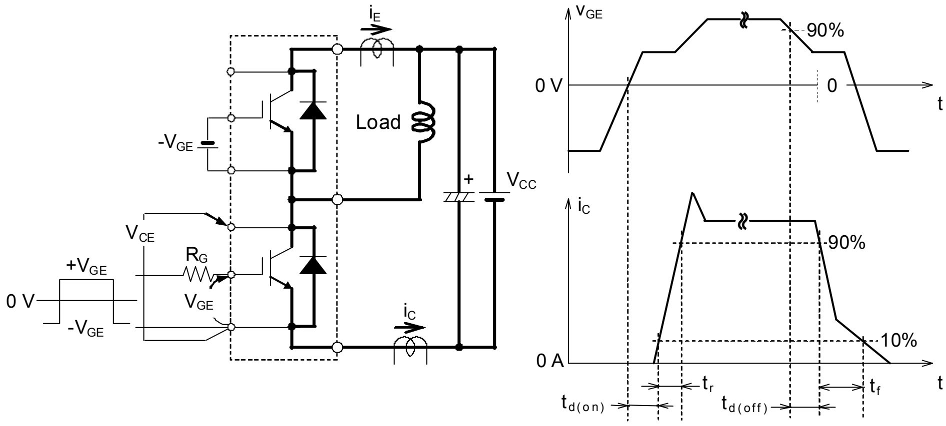
Tr1/Tr2: IGBT, Di1/Di2: FWDi. Each mark points the center position of each chip.

TEST CIRCUIT AND WAVEFORMS

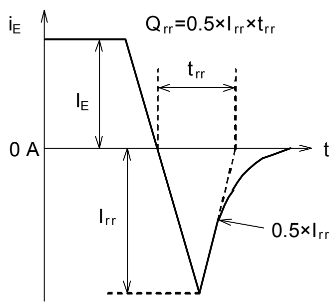


Tr1 Tr2 Di1 Di2

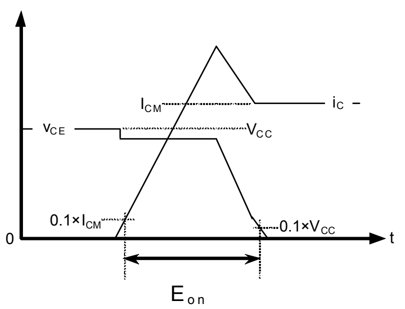
V_{CEsat} test circuit V_{EC} test circuit



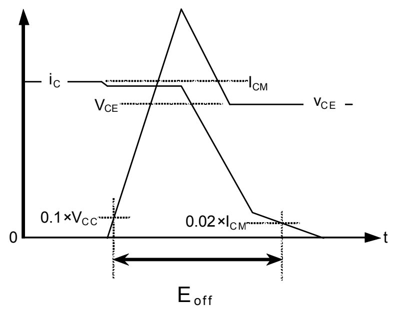
Switching characteristics test circuit and waveforms



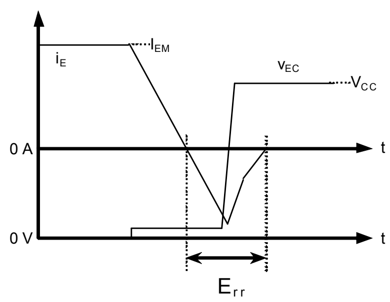
t_{rr}, Q_{rr} test waveform



IGBT Turn-on switching energy



IGBT Turn-off switching energy

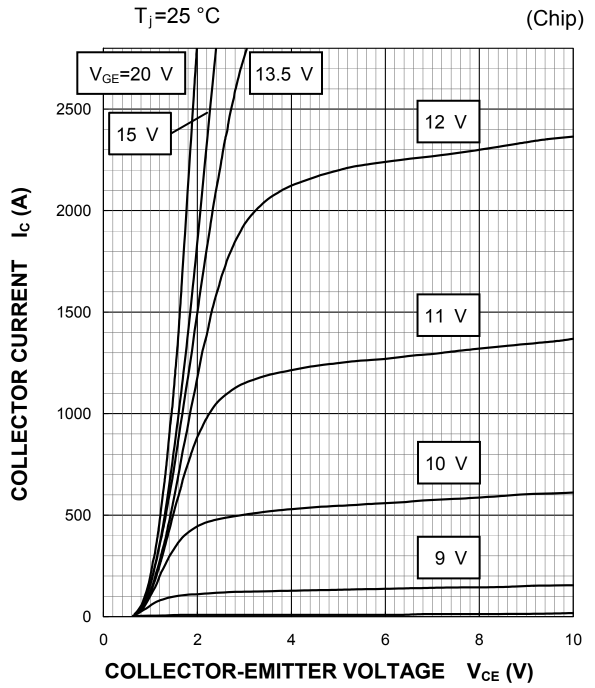


FWDi Reverse recovery energy

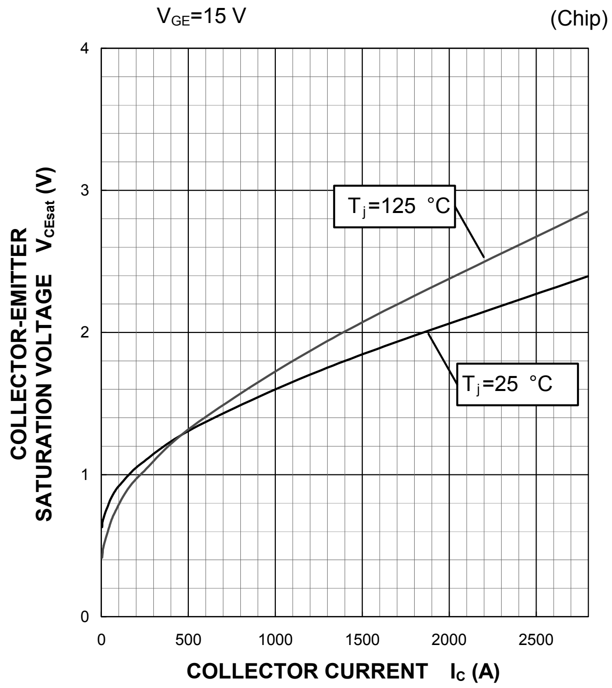
Turn-on / Turn-off switching energy and Reverse recovery energy integral range

PERFORMANCE CURVES

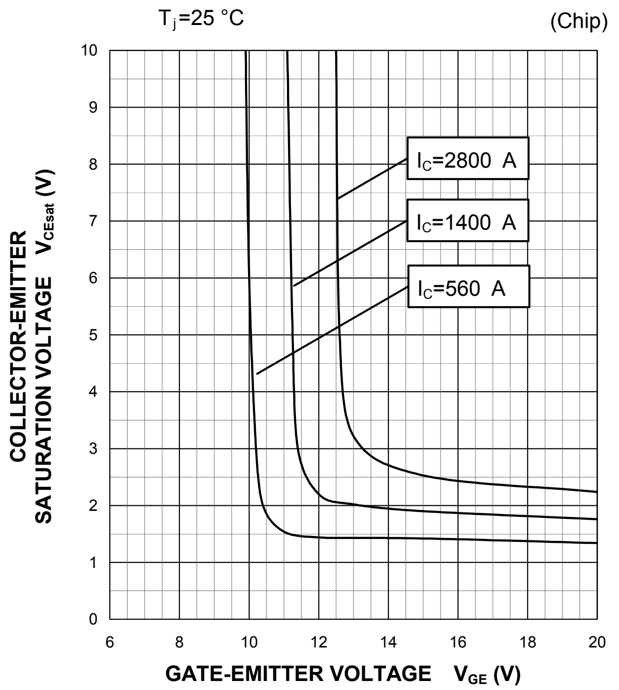
OUTPUT CHARACTERISTICS (TYPICAL)



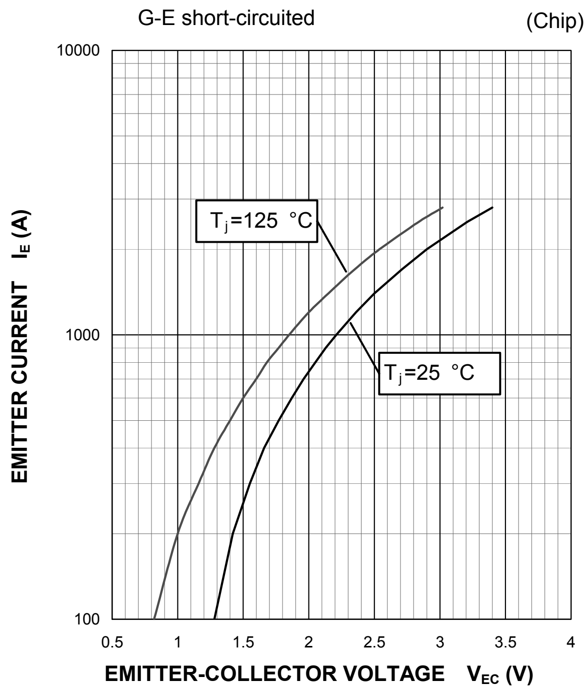
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



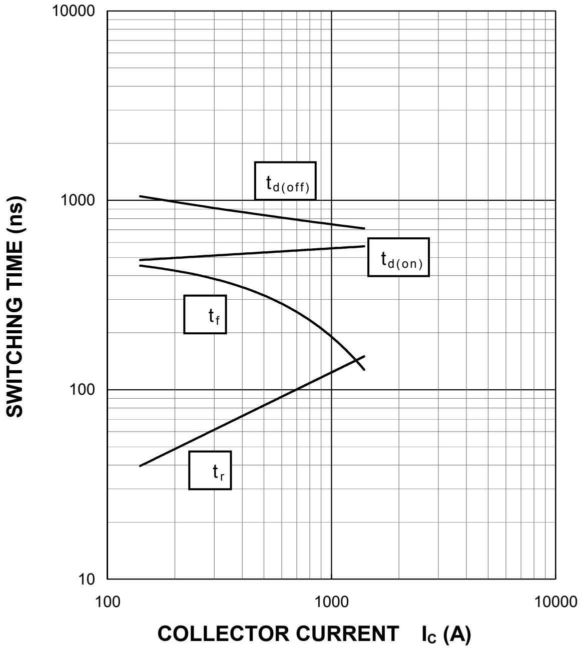
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



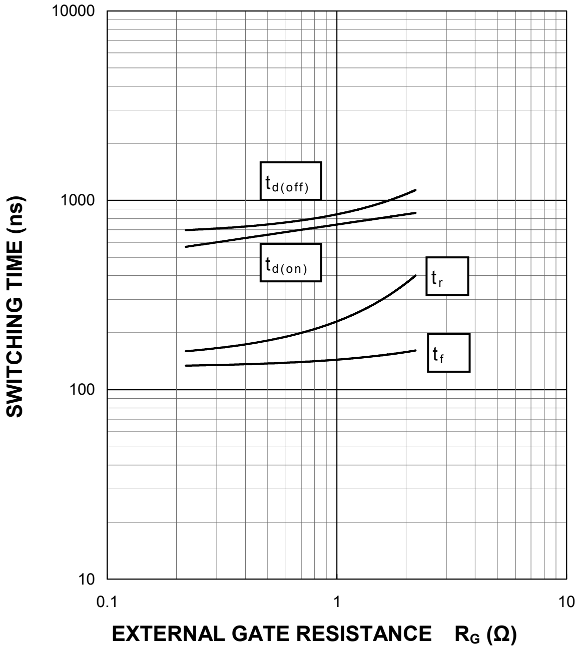
FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)



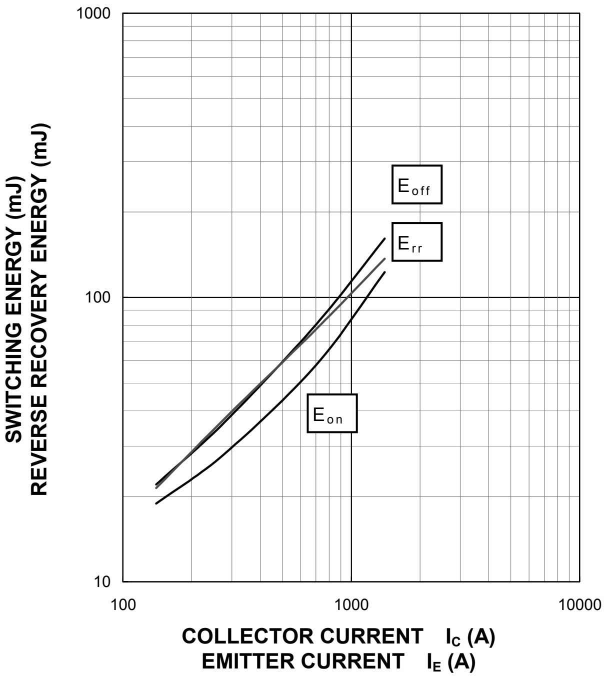
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
V_{CC}=600 V, V_{GE}=±15 V, R_G=0.22 Ω, T_j=125 °C,
INDUCTIVE LOAD



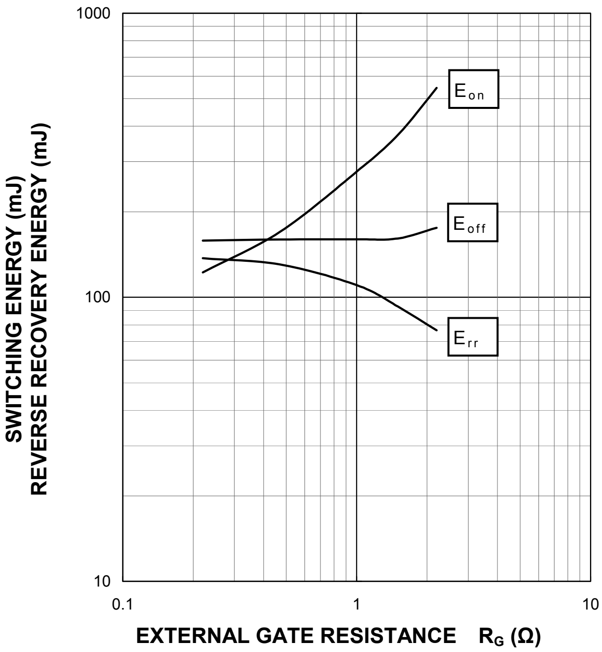
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
V_{CC}=600 V, I_C=1400 A, V_{GE}=±15 V, T_j=125 °C,
INDUCTIVE LOAD



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
V_{CC}=600 V, V_{GE}=±15 V, R_G=0.22 Ω, T_j=125 °C,
INDUCTIVE LOAD, PER PULSE

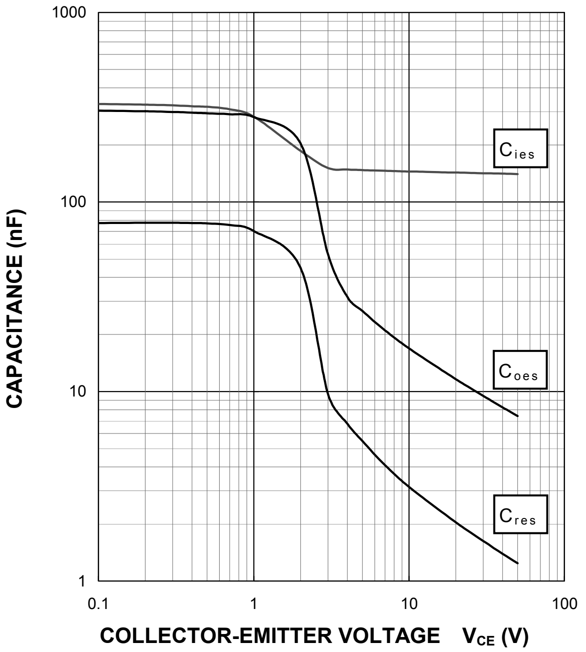


HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
V_{CC}=600 V, I_C/I_E=1400 A, V_{GE}=±15 V, T_j=125 °C,
INDUCTIVE LOAD, PER PULSE



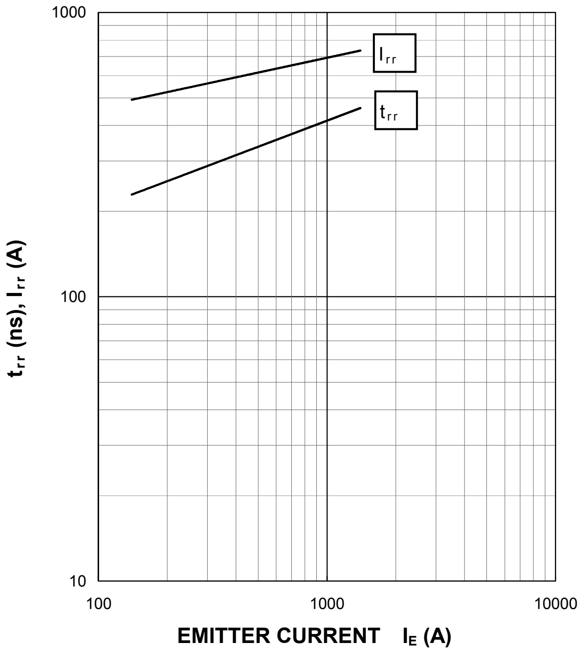
CAPACITANCE CHARACTERISTICS (TYPICAL)

G-E short-circuited, T_j=25 °C



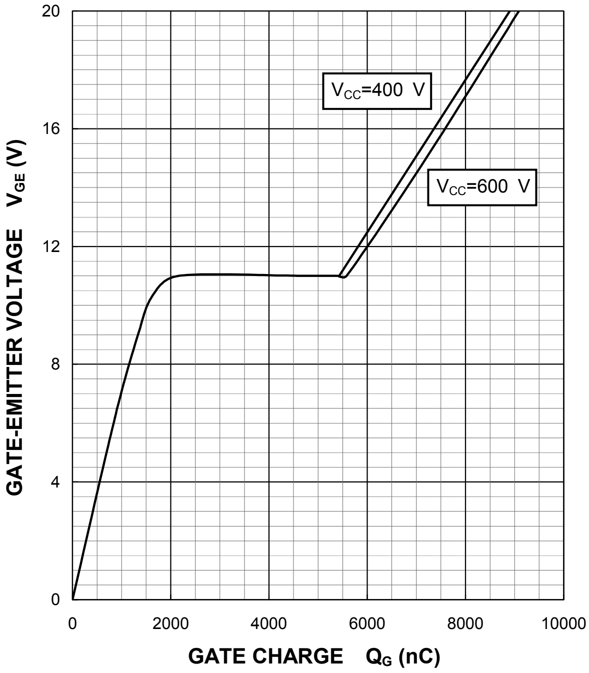
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, V_{GE}=±15 V, R_G=0.22 Ω, T_j=25 °C,
INDUCTIVE LOAD



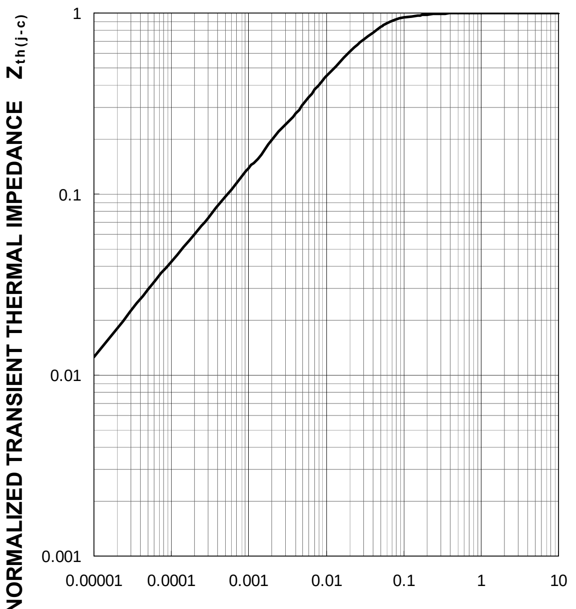
GATE CHARGE CHARACTERISTICS (TYPICAL)

I_C=1400 A, T_j=25 °C



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)

Single pulse, T_C=25°C



$R_{th(j-c)Q}$=14 K/kW, $R_{th(j-c)D}$=23 K/kW

TIME (S)

Keep safety first in your circuit designs!

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