

MITSUBISHI IGBT MODULES
CM150DUS-12F
 HIGH POWER SWITCHING USE
 INSULATED TYPE

CM150DUS-12F



Dual (Half-Bridge)

- 4th generation Fast switching IGBT module -

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

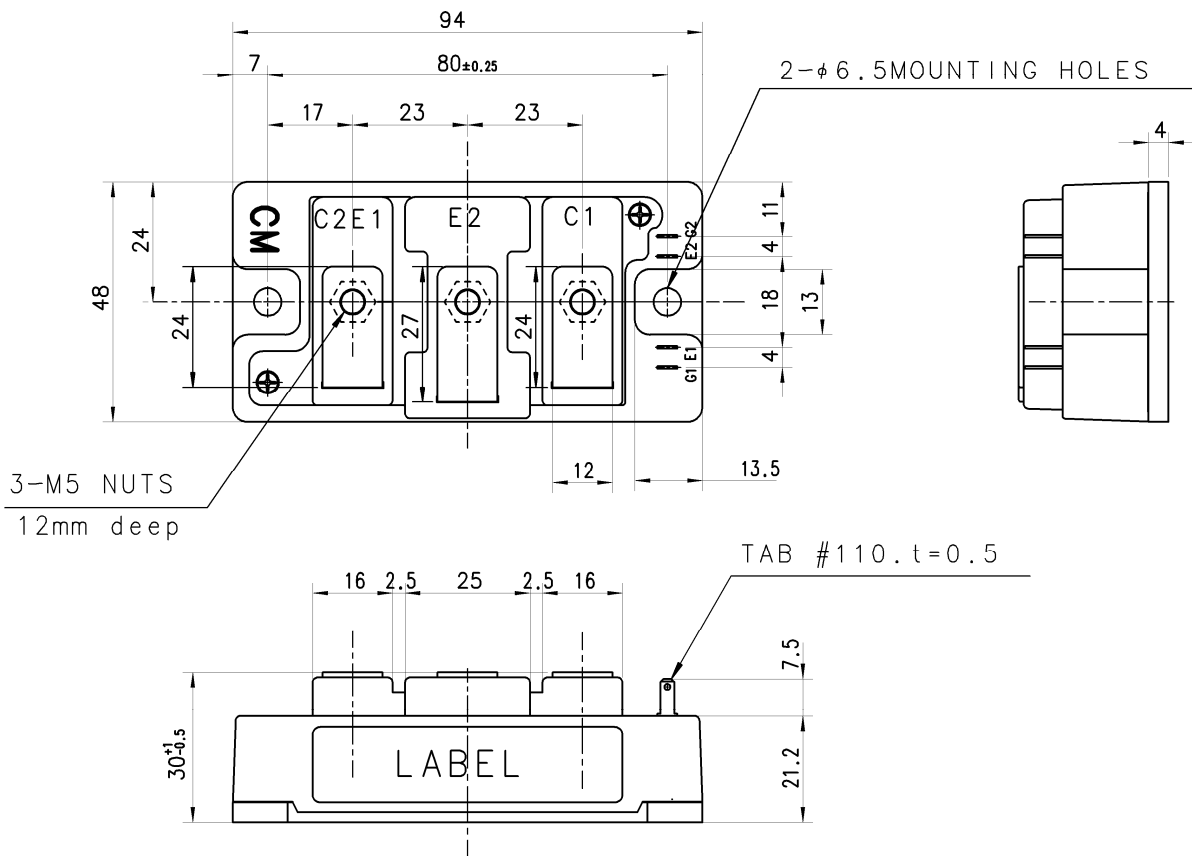
- Flat base Type
- Copper base plate
- RoHS Directive compliant
- UL Recognized under UL1557, File E323585

APPLICATION

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

OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm

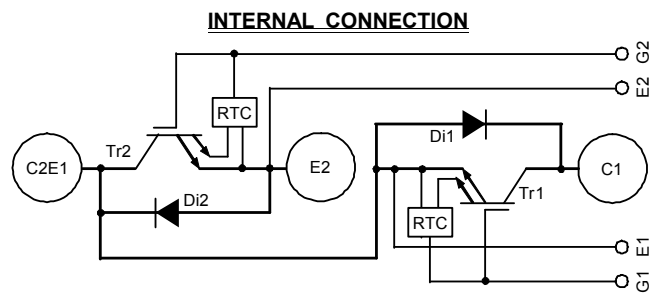


3-M5 NUTS
 12mm deep

TAB #110. t=0.5

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	DC, $T_C=25\text{ }^\circ\text{C}$ (Note.2)	150	A
I_{CRM}		Pulse, Repetitive (Note.4)	300	
P_{tot}	Total power dissipation	$T_C=25\text{ }^\circ\text{C}$ (Note.2, 5)	520	W
P_{tot}'		$T_C'=25\text{ }^\circ\text{C}$ (Note.3, 5)	655	
I_E (Note.1)	Emitter current (Free wheeling diode forward current)	$T_C=25\text{ }^\circ\text{C}$ (Note.2, 5)	150	A
I_{ERM} (Note.1)		Pulse, Repetitive (Note.4)	300	
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	$\pm V_{GE}=V_{GES}$, C-E short-circuited	-	-	20	μA
$V_{GE(th)}$	Gate-emitter threshold voltage	$I_C=15\text{ mA}$, $V_{CE}=10\text{ V}$	5	6	7	V
V_{CEsat}	Collector-emitter saturation voltage	$I_C=150\text{ A}$ (Note.6), $T_j=25\text{ }^\circ\text{C}$	1.7	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	-	-	41	nF
C_{oes}	Output capacitance		-	-	2.7	
C_{res}	Reverse transfer capacitance		-	-	1.5	
Q_G	Gate charge	$V_{CC}=300\text{ V}$, $I_C=150\text{ A}$, $V_{GE}=15\text{ V}$	-	930	-	nC
$t_{d(on)}$	Turn-on delay time	$V_{CC}=300\text{ V}$, $I_C=150\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=4.2\ \Omega$, Inductive load	-	-	120	ns
t_r	Rise time		-	-	100	
$t_{d(off)}$	Turn-off delay time		-	-	350	
t_f	Fall time		-	-	150	
V_{EC} (Note.1)	Emitter-collector voltage	$I_E=150\text{ A}$ (Note.6), G-E short-circuited	-	2.0	2.6	V
t_{rr} (Note.1)	Reverse recovery time	$V_{CC}=300\text{ V}$, $I_E=150\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=4.2\ \Omega$, Inductive load	-	-	150	ns
Q_{rr} (Note.1)	Reverse recovery charge	$R_G=4.2\ \Omega$, Inductive load	-	2.8	-	μC
E_{on}	Turn-on switching energy per pulse	$V_{CC}=300\text{ V}$, $I_C=I_E=150\text{ A}$,	-	2.5	-	mJ
E_{off}	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$, $R_G=4.2\ \Omega$, $T_j=125\text{ }^\circ\text{C}$,	-	3.35	-	
E_{rr} (Note.1)	Reverse recovery energy per pulse	Inductive load	-	2.2	-	
r_g	Internal gate resistance	Per switch	-	0	-	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	-	-	0.24	K/W
$R_{th(j-c)D}$		Junction to case, per FWDi	-	-	0.47	
$R_{th(c-s)}$	Contact thermal resistance (Note.2)	Case to heat sink, per 1/2 module, Thermal grease applied (Note.7)	-	0.07	-	K/W
$R_{th(j-c')Q}$	Thermal resistance (Note.3)	Junction to case, per IGBT	-	-	0.19	K/W
$R_{th(j-c')D}$		Junction to case, per FWDi	-	-	0.35	

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M_t	Mounting torque	Main terminals M 5 screw	2.5	3.0	3.5	N·m
M_s		Mounting to heat sink M 6 screw	3.5	4.0	4.5	
m	Weight	-	-	310	-	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	4.2	-	42	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.

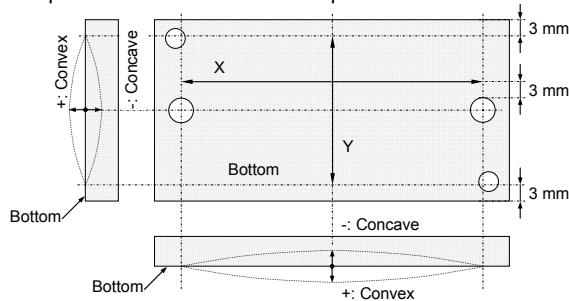
Note.5: Junction temperature (T_j) should not increase beyond T_{jmax} rating.

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

(Refer to the figure of test circuit)

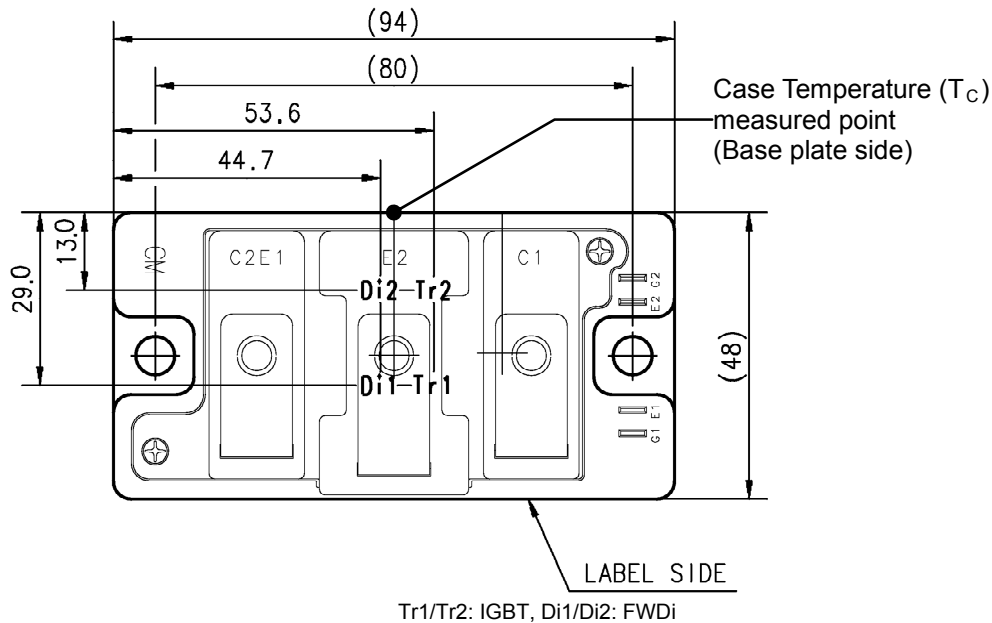
Note.7: Typical value is measured by using thermally conductive grease of $\lambda=0.9\text{ W/(m}\cdot\text{K)}$.

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

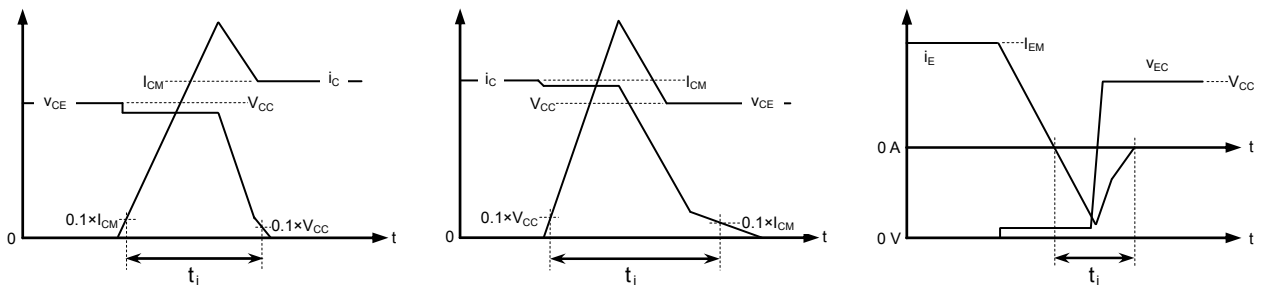
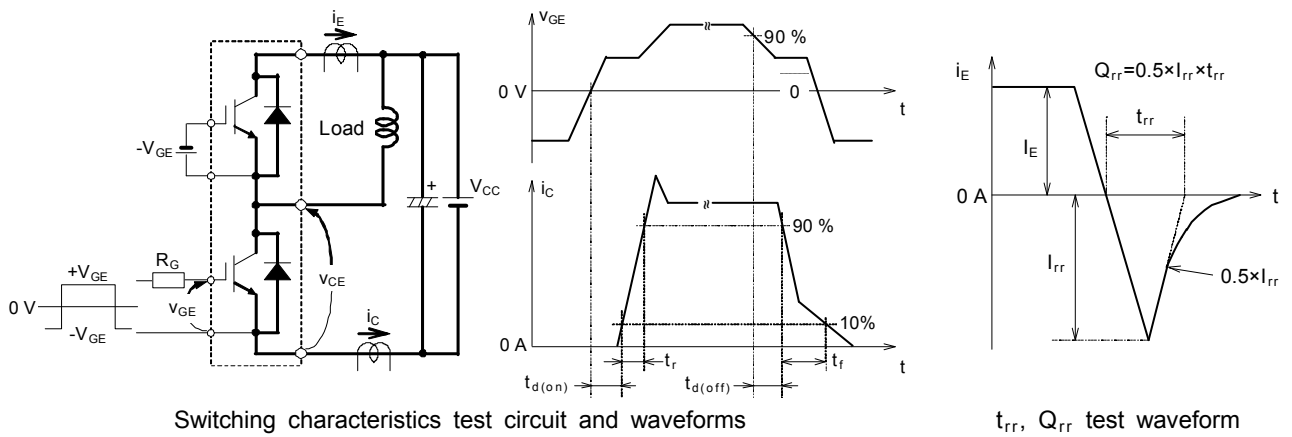
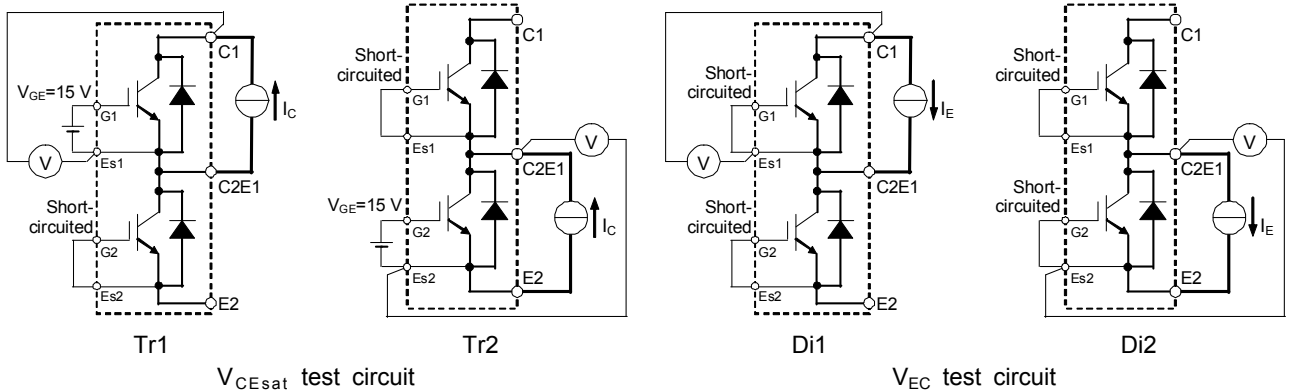


CHIP LOCATION (Top view)

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



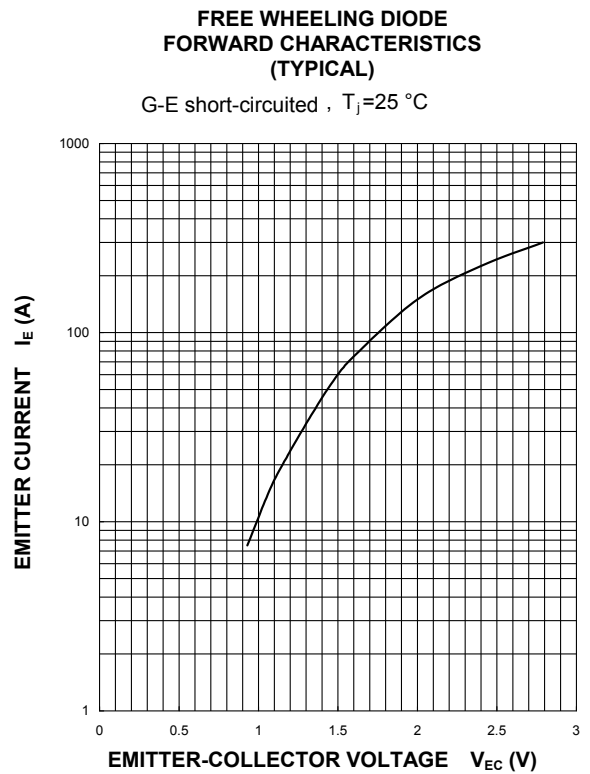
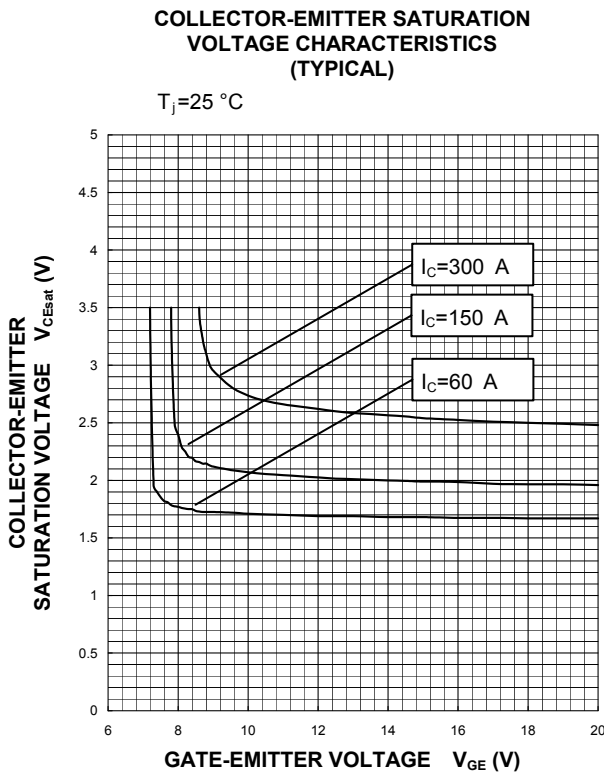
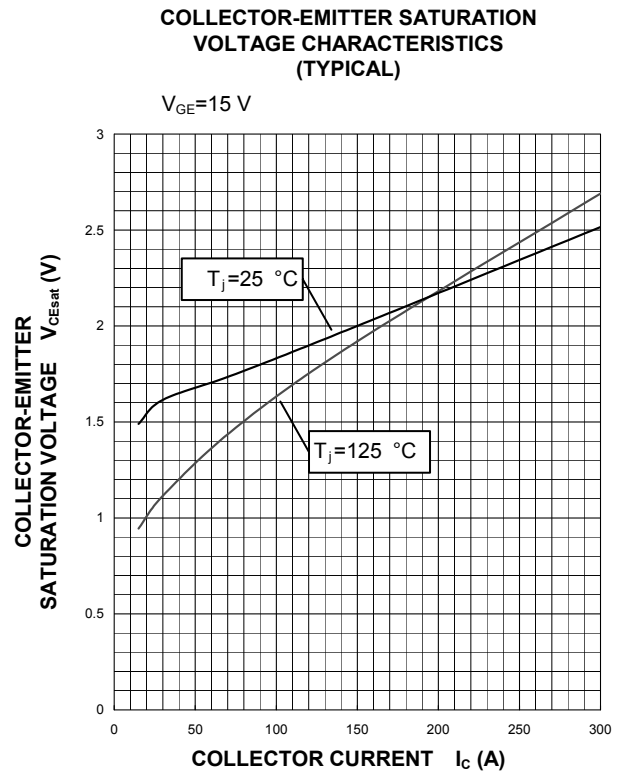
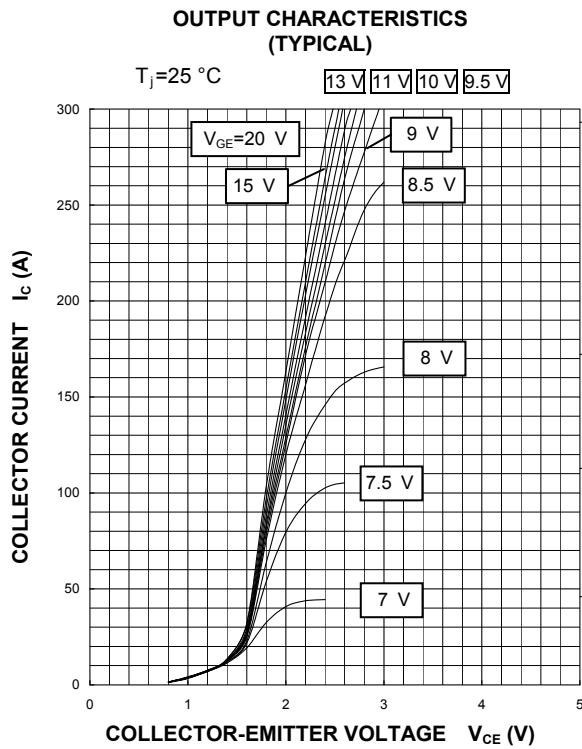
TEST CIRCUIT AND WAVEFORMS



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

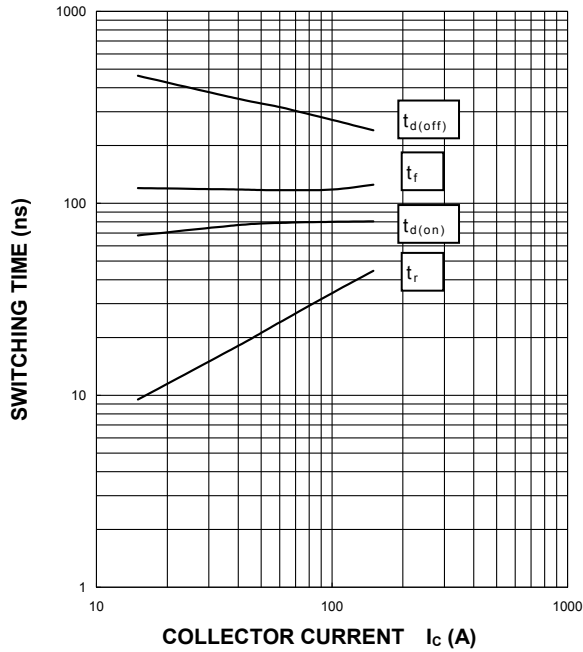
PERFORMANCE CURVES

INVERTER PART



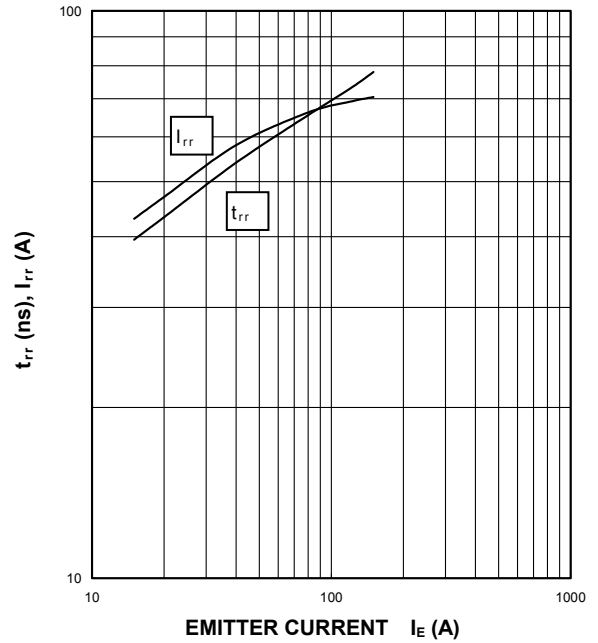
**HALF-BRIDGE
 SWITCHING CHARACTERISTICS
 (TYPICAL)**

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=4.2\ \Omega$,
 $T_j=125\text{ }^\circ\text{C}$, INDUCTIVE LOAD



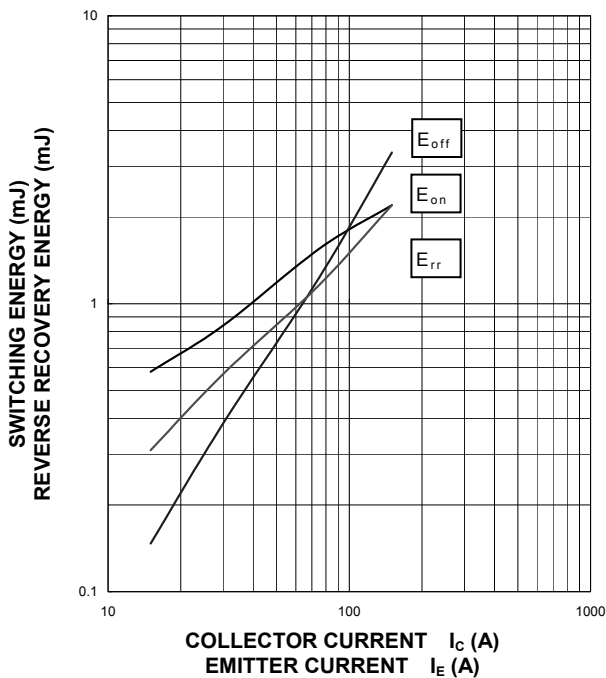
**FREE WHEELING DIODE
 REVERSE RECOVERY CHARACTERISTICS
 (TYPICAL)**

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=4.2\ \Omega$,
 $T_j=125\text{ }^\circ\text{C}$, INDUCTIVE LOAD



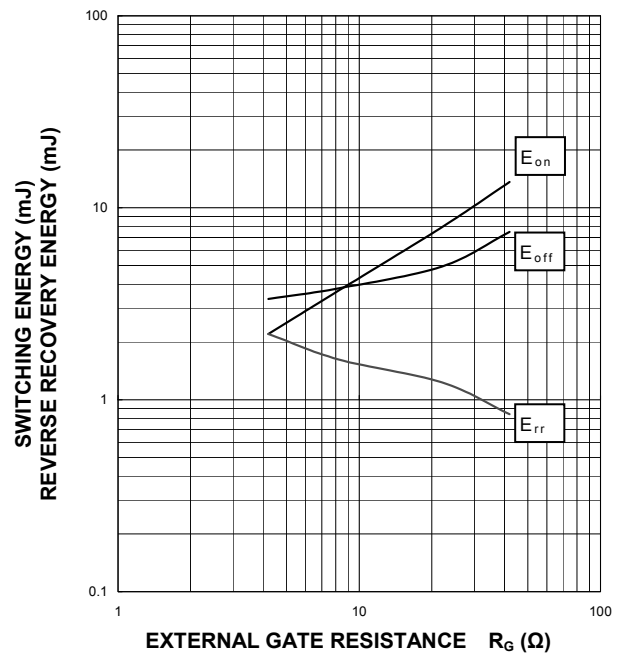
**HALF-BRIDGE
 SWITCHING CHARACTERISTICS
 (TYPICAL)**

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=4.2\ \Omega$, $T_j=125\text{ }^\circ\text{C}$,
 INDUCTIVE LOAD, PER PULSE



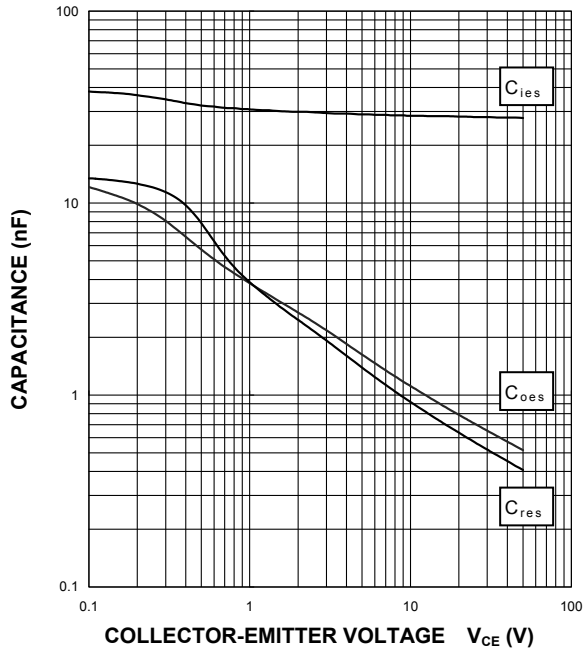
**HALF-BRIDGE
 SWITCHING CHARACTERISTICS
 (TYPICAL)**

$V_{CC}=300\text{ V}$, $I_c/I_E=150\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $T_j=125\text{ }^\circ\text{C}$,
 INDUCTIVE LOAD, PER PULSE



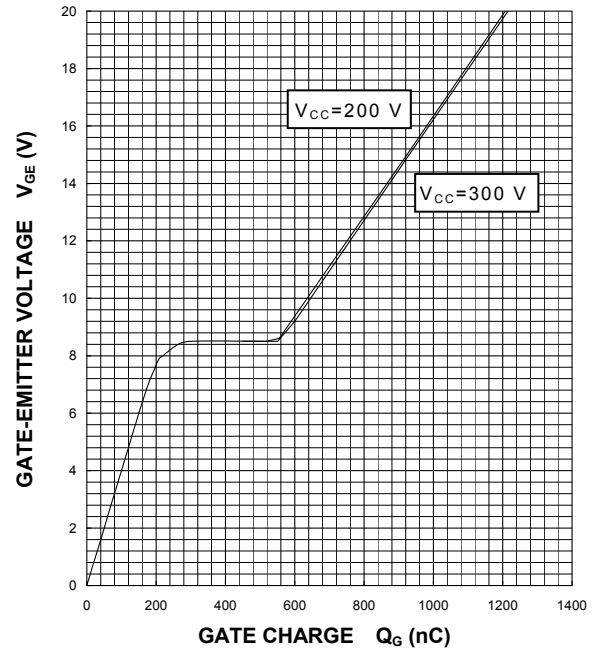
**CAPACITANCE CHARACTERISTICS
 (TYPICAL)**

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



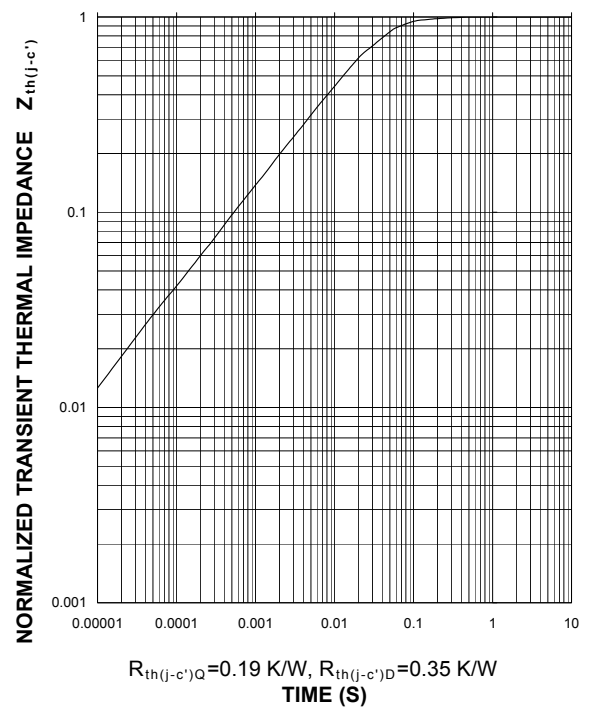
**GATE CHARGE CHARACTERISTICS
 (TYPICAL)**

$I_C=150\text{ A}$, $T_j=25^\circ\text{C}$



**TRANSIENT THERMAL IMPEDANCE
 CHARACTERISTICS
 (MAXIMUM)**

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



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