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

**CM150DUS-12F**



**Dual (Half-Bridge)**

- 4<sup>th</sup> 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**

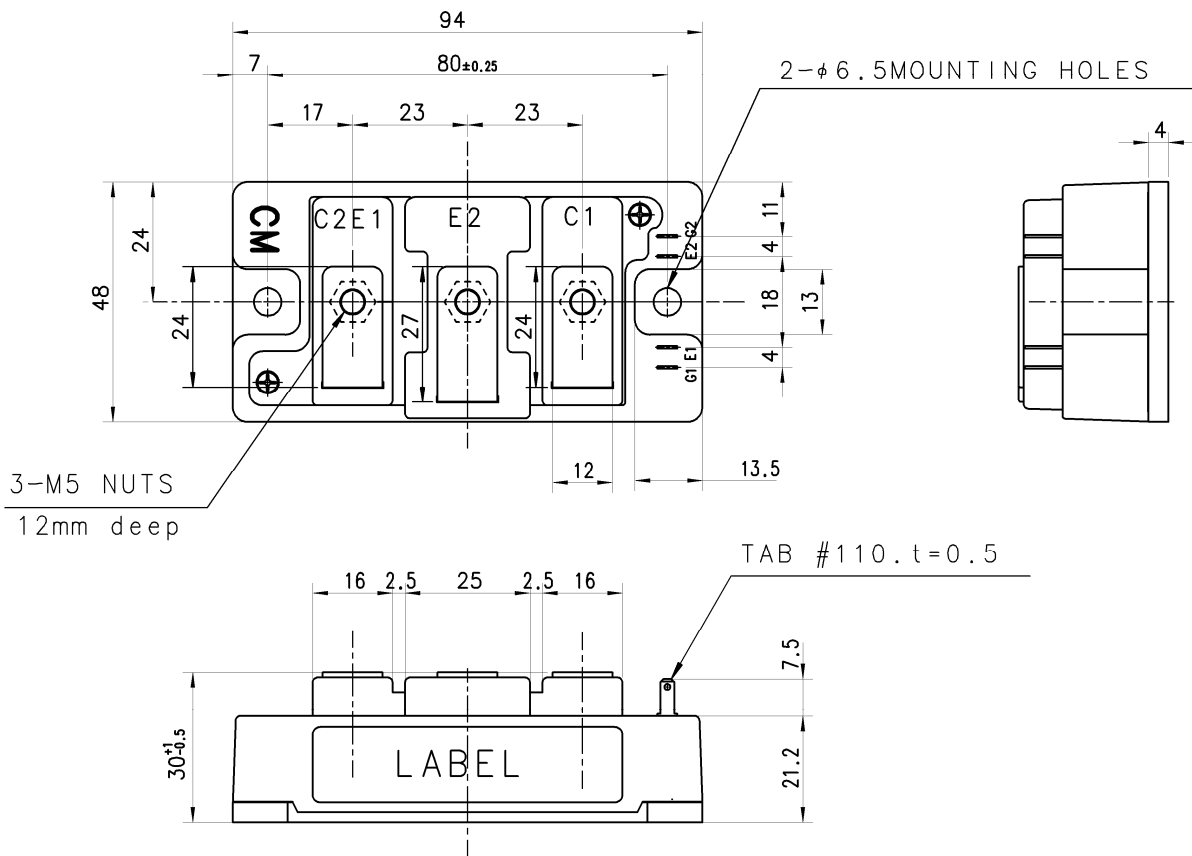
- Flat base Type
- Copper base plate
- RoHS Directive compliant
- UL Recognized under UL1557, File E323585

**APPLICATION**

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

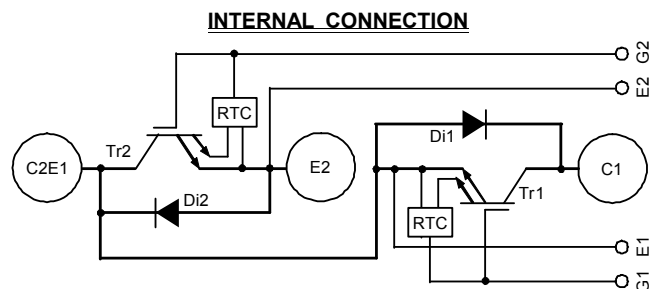
**OUTLINE DRAWING & INTERNAL CONNECTION**

Dimension in mm



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	$\pm 20$	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	$\mu\text{A}$	
$V_{GE(th)}$	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), $V_{GE}=15\text{ V}$	$T_j=25\text{ }^\circ\text{C}$	1.7	2.0	2.7	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	-	$\mu\text{C}$	
$E_{on}$	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	-	$\Omega$	

**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	$\mu\text{m}$

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INSULATED TYPE

**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	$\Omega$

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.

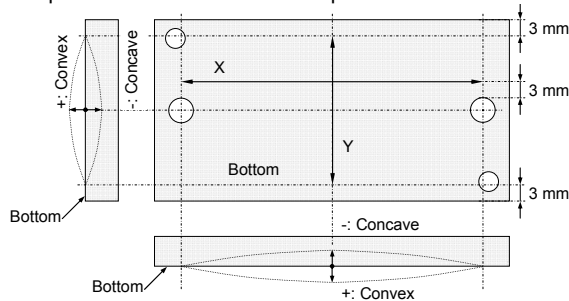
Note.5: Junction temperature ( $T_j$ ) should not increase beyond  $T_{jmax}$  rating.

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

(Refer to the figure of test circuit)

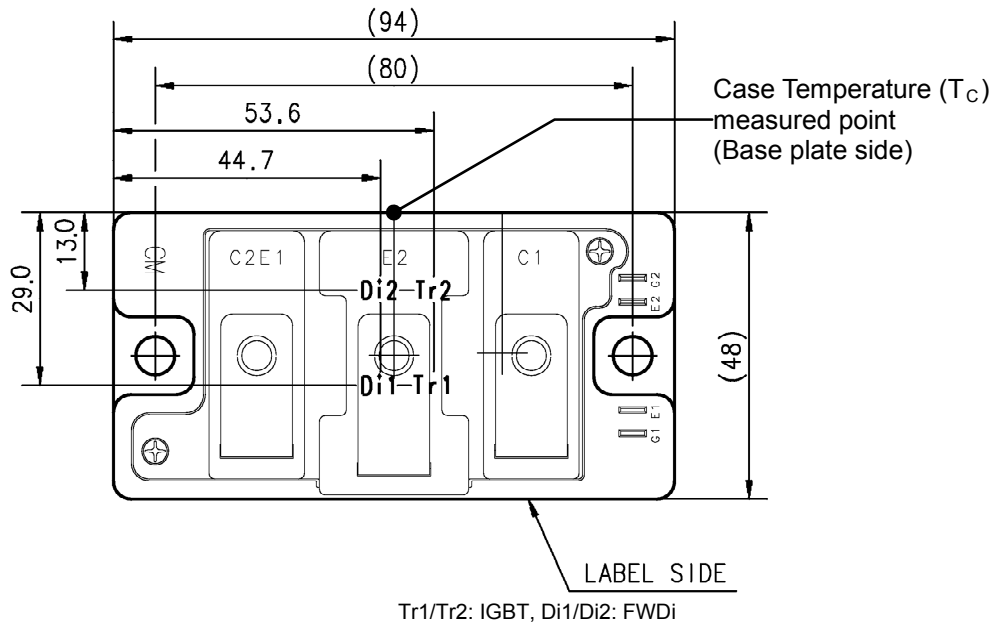
Note.7: Typical value is measured by using thermally conductive grease of  $\lambda=0.9\text{ W/(m}\cdot\text{K)}$ .

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

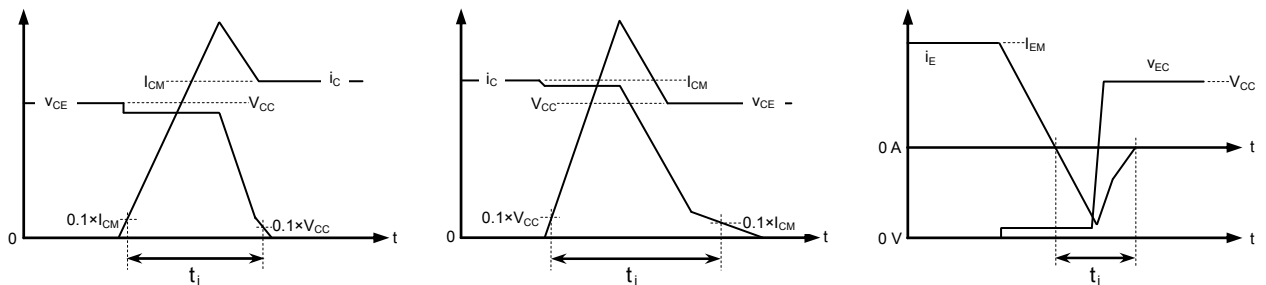
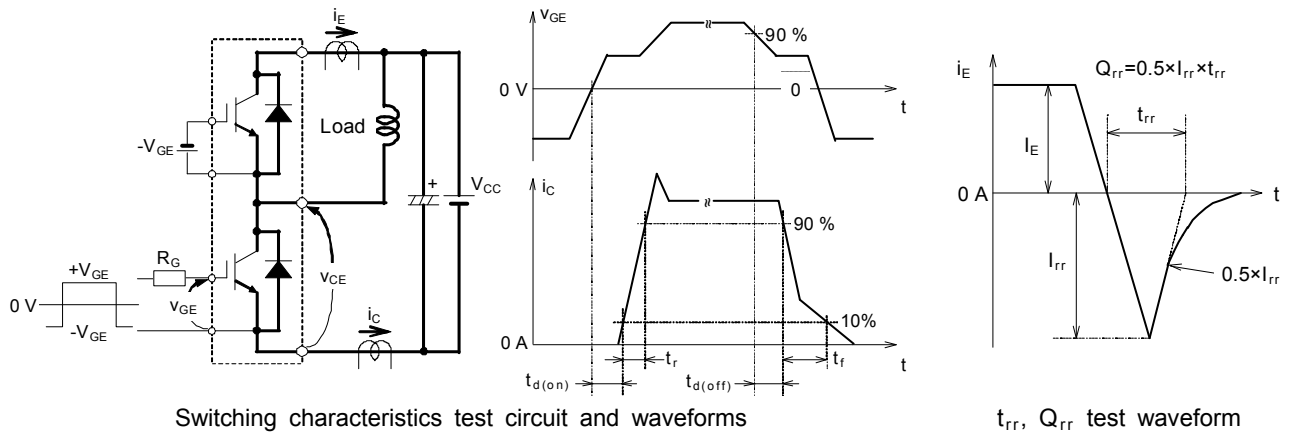
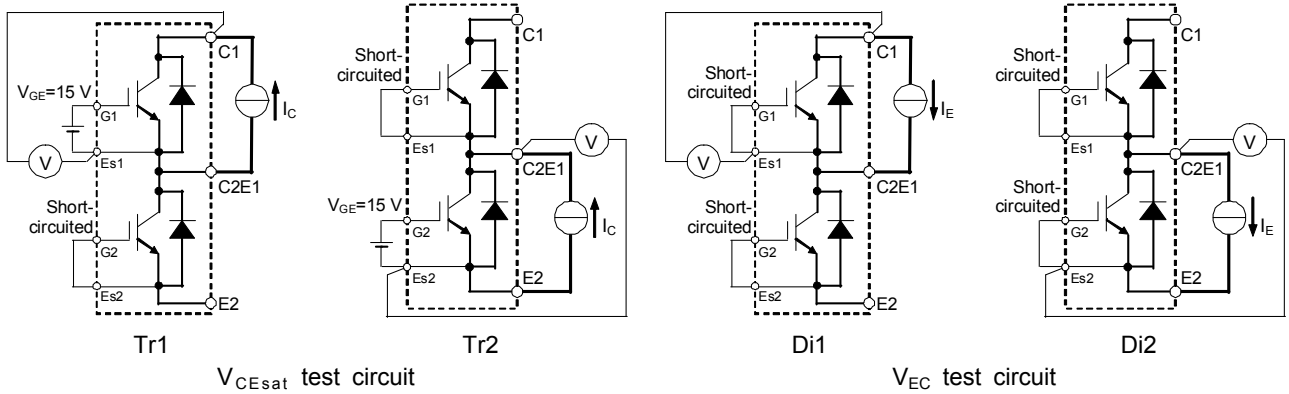


**CHIP LOCATION (Top view)**

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



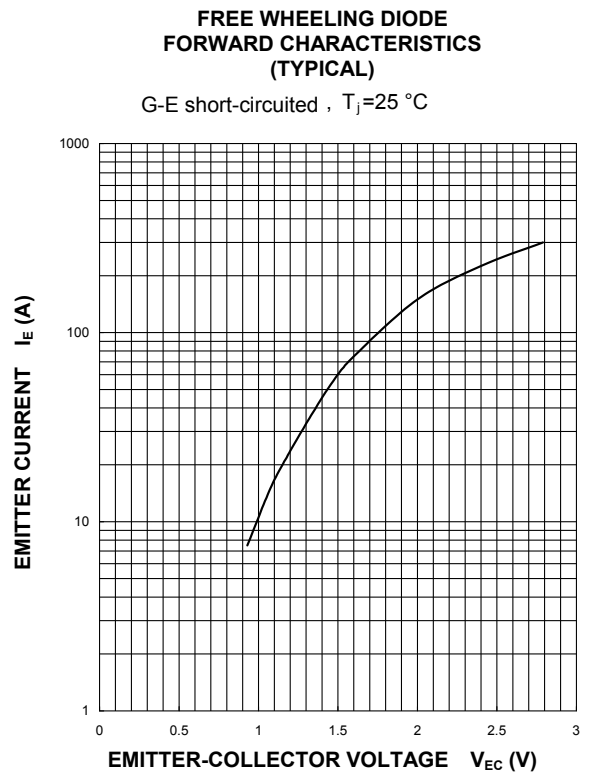
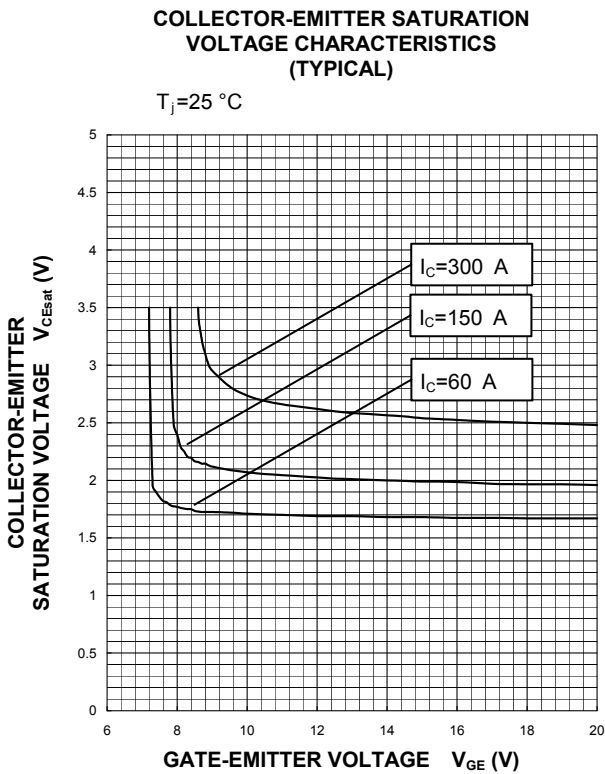
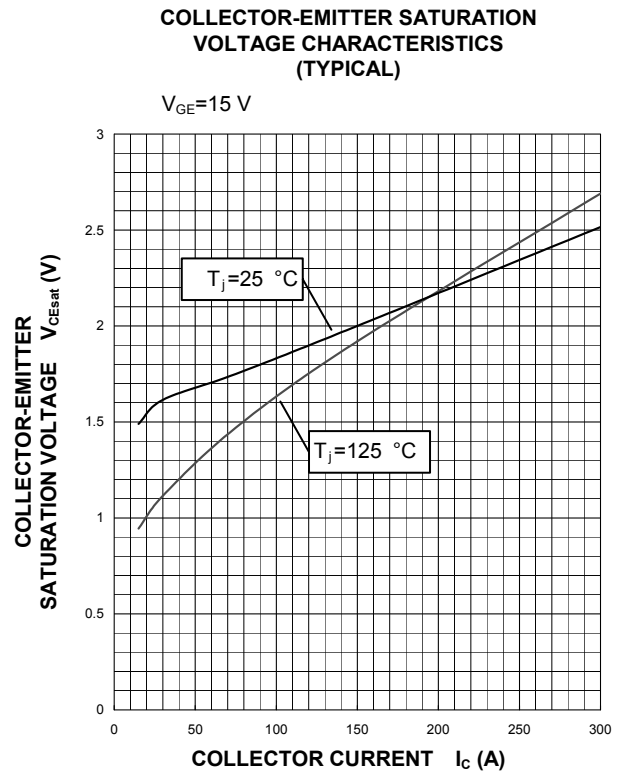
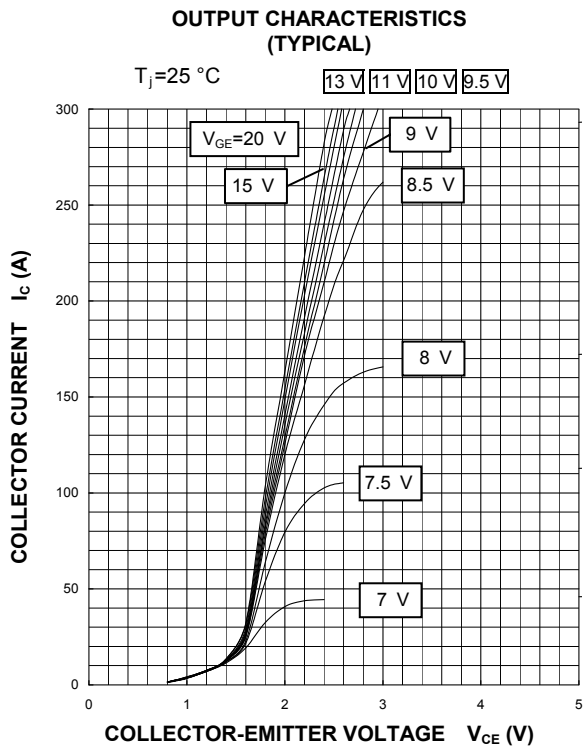
**TEST CIRCUIT AND WAVEFORMS**



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

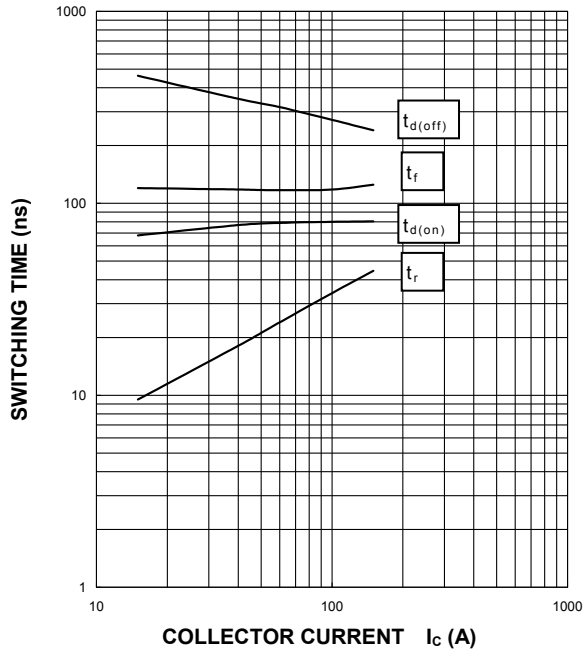
PERFORMANCE CURVES

INVERTER PART



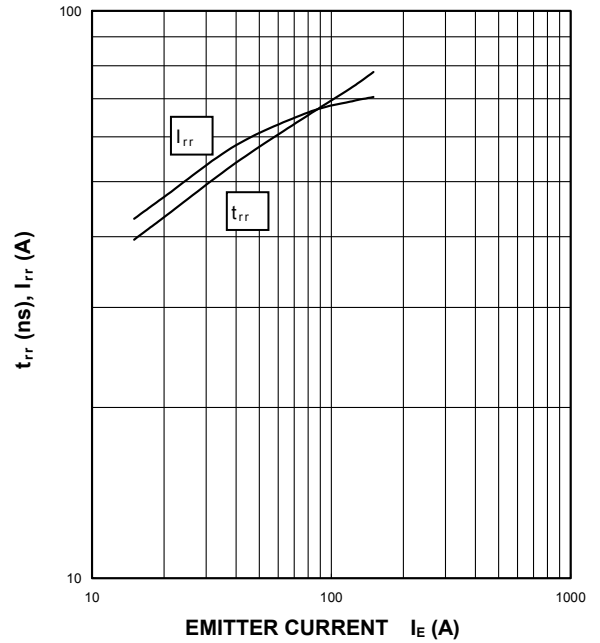
**HALF-BRIDGE  
 SWITCHING CHARACTERISTICS  
 (TYPICAL)**

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



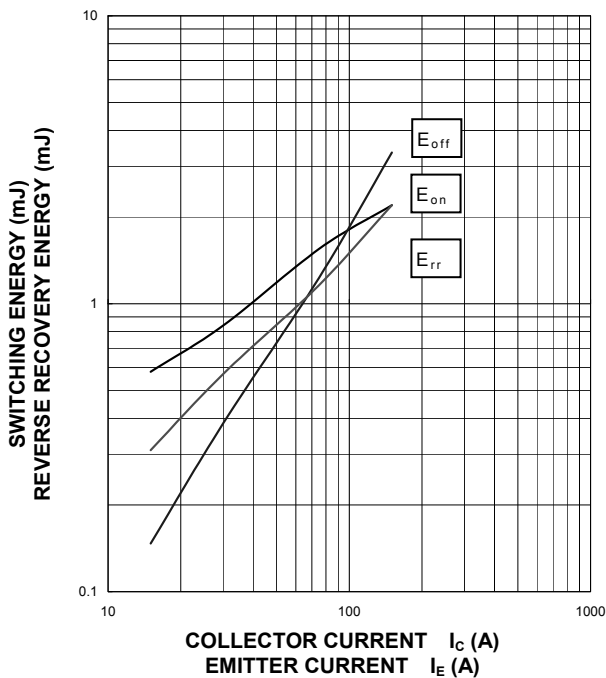
**FREE WHEELING DIODE  
 REVERSE RECOVERY CHARACTERISTICS  
 (TYPICAL)**

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



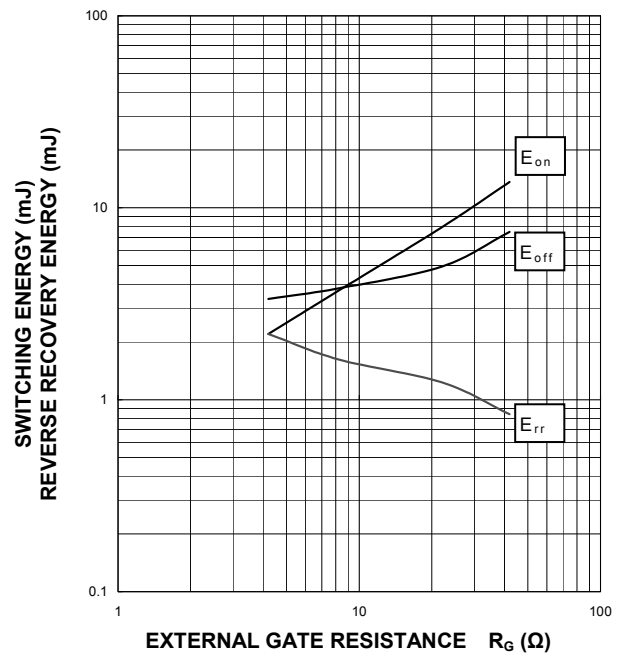
**HALF-BRIDGE  
 SWITCHING CHARACTERISTICS  
 (TYPICAL)**

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



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

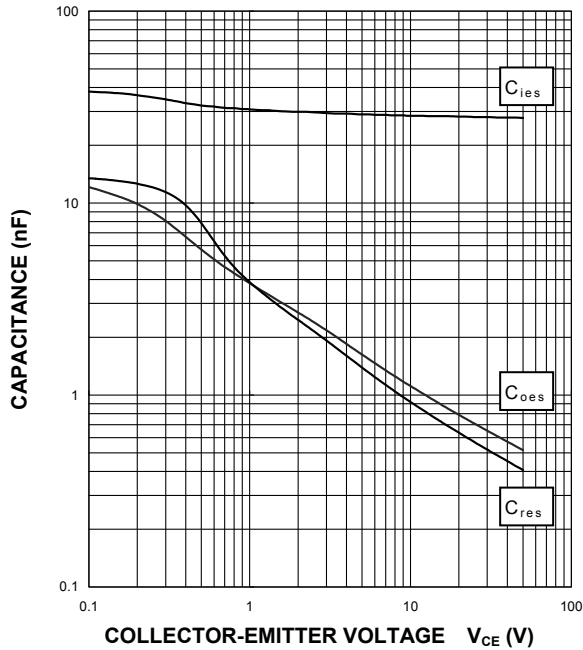
$V_{CC}=300\text{ V}$ ,  $I_c/I_E=150\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $T_j=125\text{ }^\circ\text{C}$ ,  
 INDUCTIVE LOAD, PER PULSE



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 HIGH POWER SWITCHING USE  
 INSULATED TYPE

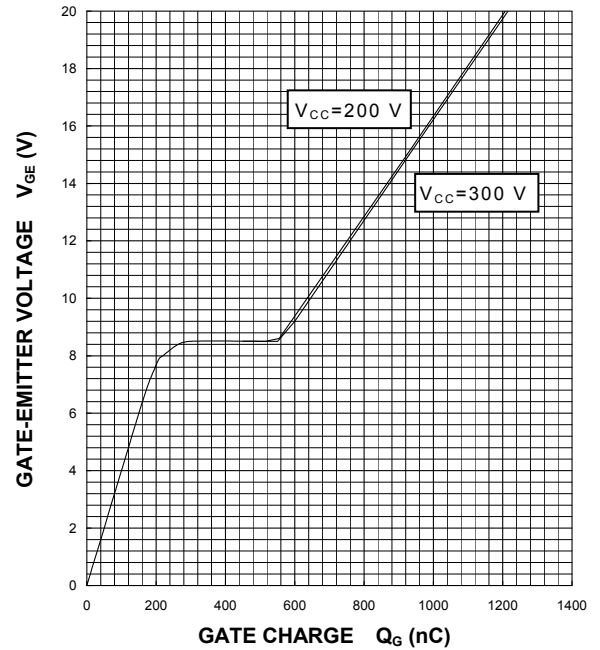
**CAPACITANCE CHARACTERISTICS  
 (TYPICAL)**

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



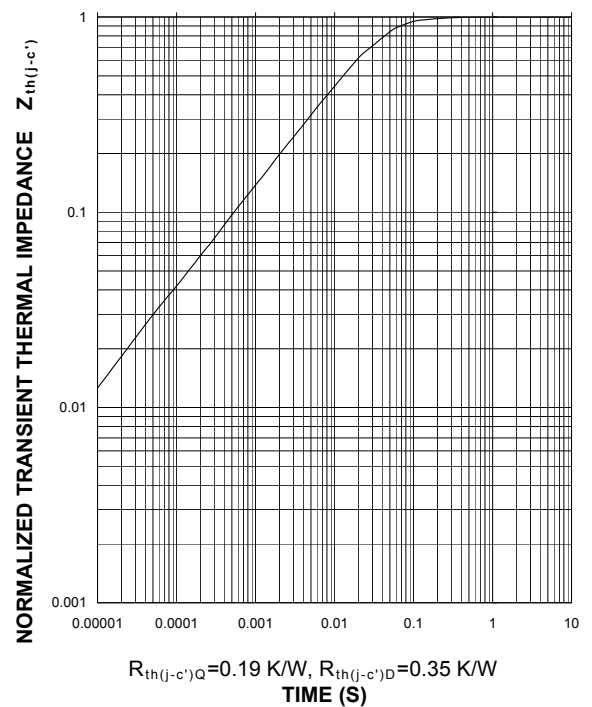
**GATE CHARGE CHARACTERISTICS  
 (TYPICAL)**

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



**TRANSIENT THERMAL IMPEDANCE  
 CHARACTERISTICS  
 (MAXIMUM)**

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





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