

MITSUBISHI IGBT MODULES
CM300DX-12A
 HIGH POWER SWITCHING USE
 INSULATED TYPE

CM300DX-12A

- 5th Generation NX series -



Dual (Half-Bridge)

I_C 300 A

V_{CES} 600 V

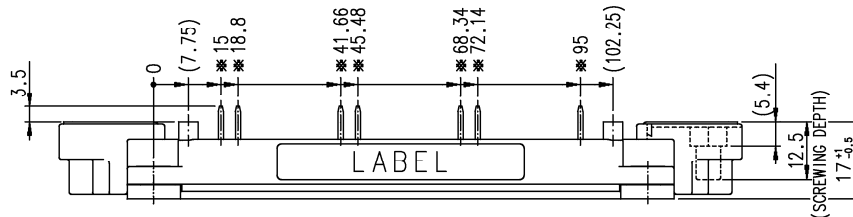
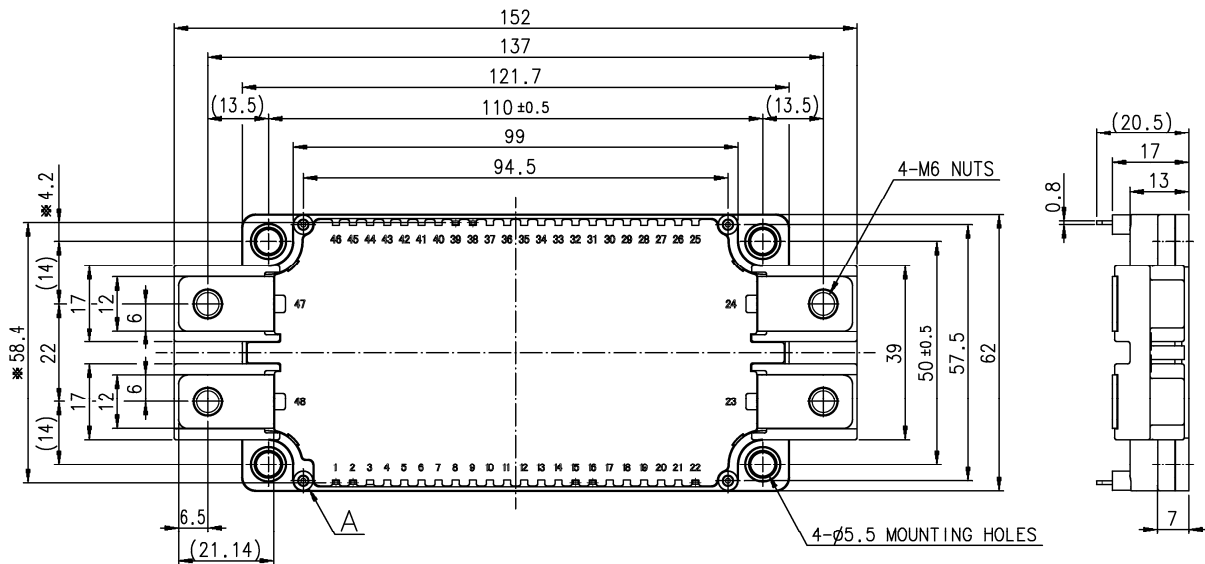
- Flat base Type
- Copper base plate (non-plating)
- RoHS Directive compliant
- UL Recognized under UL1557, File E323585

APPLICATION

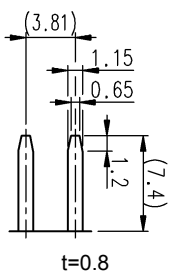
AC Motor Control, Motion/Servo Control, Power supply, etc.

OUTLINE DRAWING & INTERNAL CONNECTION

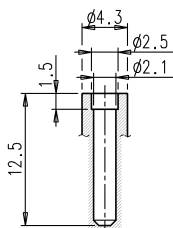
Dimension in mm



TERMINAL



SECTION A

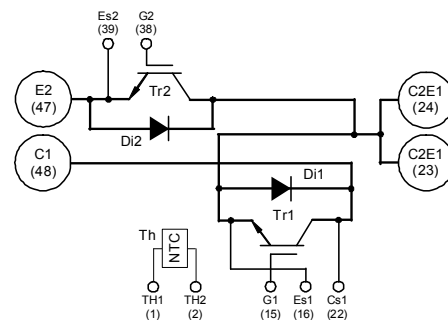


Tolerance otherwise specified

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

※: Dimensions with a
 Tolerance of $\phi \pm 0.5$

INTERNAL CONNECTION



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

INVERTER PART IGBT/FWDI

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 =56 °C (Note.2)	300	A
I _{CRM}		Pulse, Repetitive (Note.3)	600	
P _{tot}	Total power dissipation	T _C =25 °C (Note.2, 4)	960	W
I _E (Note.1)	Emitter current	T _C =25 °C (Note.2, 4)	300	A
I _{ERM} (Note.1)	(Free wheeling diode forward current)	Pulse, Repetitive (Note.3)	600	

MODULE

Symbol	Item	Conditions	Rating	Unit
T _{jmax}	Maximum junction temperature	-	+150	°C
T _{jop}	Operating junction temperature	-	-40 ~ +150	
T _{stg}	Storage temperature	-	-40 ~ +125	
T _C (Note.2)	Case 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)

INVERTER PART IGBT/FWDI

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 =30 mA, V _{CE} =10 V	5	6	7	V
V _{CEsat}	Collector-emitter saturation voltage	I _C =300 A (Note.5), T _j =25 °C	-	1.7	2.1	V
		V _{GE} =15 V, (Terminal) T _j =125 °C	-	1.9	-	
		I _C =300 A, V _{GE} =15 V, (Chip)	-	1.6	-	
C _{ies}	Input capacitance	V _{CE} =10 V, G-E short-circuited	-	-	34	nF
C _{oes}	Output capacitance		-	-	4.0	
C _{res}	Reverse transfer capacitance		-	-	1.2	
Q _G	Gate charge	V _{CC} =300 V, I _C =300 A, V _{GE} =15 V	-	800	-	nC
t _{d(on)}	Turn-on delay time	V _{CC} =300 V, I _C =300 A, V _{GE} =±15 V, R _G =5.1 Ω, Inductive load	-	-	200	ns
t _r	Rise time		-	-	150	
t _{d(off)}	Turn-off delay time		-	-	350	
t _f	Fall time		-	-	600	
V _{EC} (Note.1)	Emitter-collector voltage	I _E =300 A (Note.5), T _j =25 °C, G-E short-circuited, (Terminal)	-	2.0	2.8	V
		T _j =125 °C	-	1.95	-	
		I _E =300 A, G-E short-circuited, (Chip)	-	1.9	-	
t _{rr} (Note.1)	Reverse recovery time	V _{CC} =300 V, I _E =300 A, V _{GE} =±15 V, R _G =5.1 Ω, Inductive load	-	-	200	ns
Q _{rr} (Note.1)	Reverse recovery charge	R _G =5.1 Ω, Inductive load	-	9.0	-	µC
E _{on}	Turn-on switching energy per pulse	V _{CC} =300 V, I _C =I _E =300 A, V _{GE} =±15 V, R _G =5.1 Ω, T _j =125 °C, Inductive load	-	12.7	-	mJ
E _{off}	Turn-off switching energy per pulse		-	16.5	-	
E _{rr} (Note.1)	Reverse recovery energy per pulse		-	2.6	-	
R _{CC'+EE'}	Internal lead resistance	Main terminals-chip, per switch, T _C =25 °C (Note.2)	-	1.1	-	mΩ
r _g	Internal gate resistance	Per switch, T _C =25 °C (Note.2)	-	0	-	Ω

NTC THERMISTOR PART

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R ₂₅	Zero-power resistance	T _C =25 °C (Note.2)	4.85	5.00	5.15	kΩ
ΔR/R	Deviation of resistance	T _C =100 °C, R ₁₀₀ =493 Ω	-7.3	-	+7.8	%
B _(25/50)	B-constant	Approximate by equation (Note.6)	-	3375	-	K
P ₂₅	Power dissipation	T _C =25 °C (Note.2)	-	-	10	mW

CM300DX-12A

HIGH POWER SWITCHING USE
INSULATED TYPE

THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance (Note.2)	Junction to case, per Inverter IGBT	-	-	0.13	K/W
$R_{th(j-c)D}$		Junction to case, per Inverter FWDi	-	-	0.22	K/W
$R_{th(c-s)}$	Contact thermal resistance (Note.2)	Case to heat sink, per 1 module, Thermal grease applied (Note.7)	-	15	-	K/kW

MECHANICAL CHARACTERISTICS

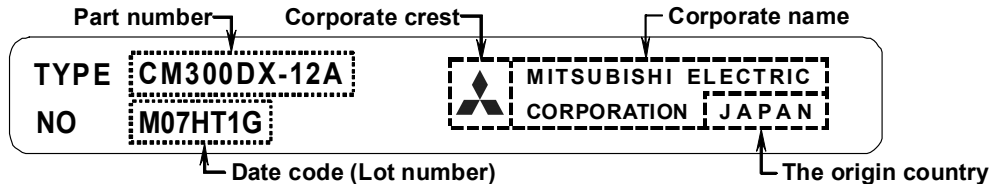
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M_t	Mounting torque	Main terminals M 6 screw	3.5	4.0	4.5	N·m
M_s		Mounting to heat sink M 5 screw	2.5	3.0	3.5	
d_s	Creepage distance	Terminal to terminal	11.55	-	-	mm
		Terminal to base plate	12.32	-	-	
d_a	Clearance	Terminal to terminal	10.00	-	-	mm
		Terminal to base plate	10.85	-	-	
m	Weight	-	-	330	-	g
e_c	Flatness of base plate	On the centerline X, Y (Note.8)	±0	-	+100	μm

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	2.0	-	21	Ω

LABEL MARKING

Label example



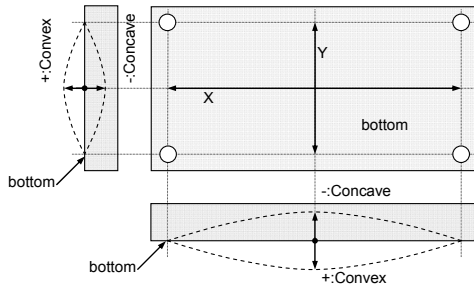
REPRESENTATIVE SOLDERING TEMPERATURE CONDITIONS FOR PIN TERMINALS

Dip soldering III-B (Note.9)		
Item	condition	Note
Soldering temperature	260 °C ± 5 °C	-
Immersion time	10 s ± 1 s	-
Solder type	Sn-Ag-Cu	RoHS Directive compliant

Soldering iron IV-A (Note.9)		
Item	Condition	Note
Soldering iron tip temperature	360 °C ± 10 °C	-
Heat time	5 s ± 1 s	-
Solder type	Sn-Ag-Cu	RoHS Directive compliant

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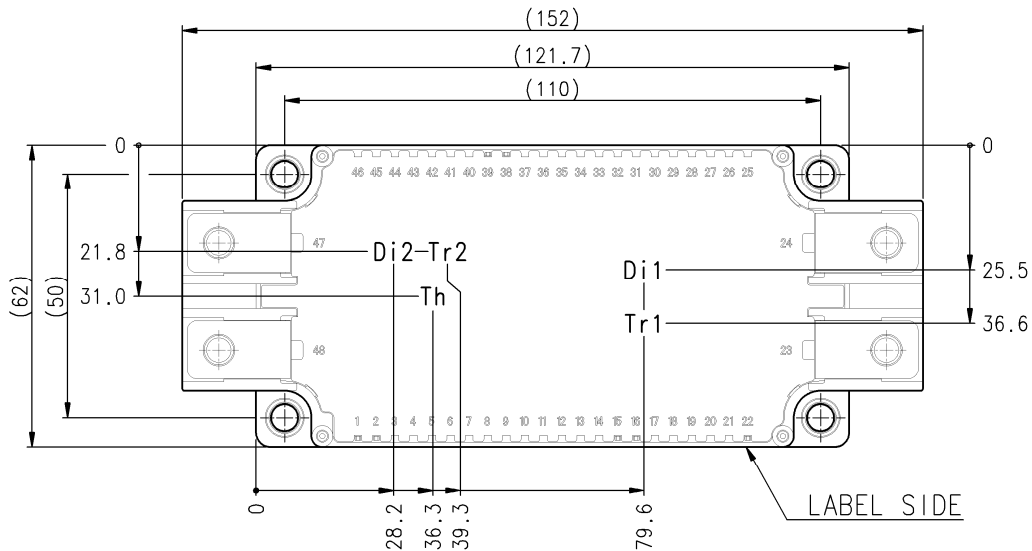
- Note.1: Represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (FWDi).
- Note.2: Case temperature (T_c) and heat sink temperature (T_s) are defined on the each surface of base plate and heat sink just under the chips. (Refer to the figure of chip location)
 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: $B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$
 R_{25} : resistance at absolute temperature T_{25} [K]; $T_{25}=25 [^{\circ}C]+273.15=298.15$ [K]
 R_{50} : resistance at absolute temperature T_{50} [K]; $T_{50}=50 [^{\circ}C]+273.15=323.15$ [K]
- Note.7: Typical value is measured by using thermally conductive grease of $\lambda=0.9$ W/(m·K).
- Note.8: Base plate flatness measurement point is as in the following figure.



Note.9: Based on the "JAPAN Electronics and Information Technology Industries Association (JEITA)" standard.

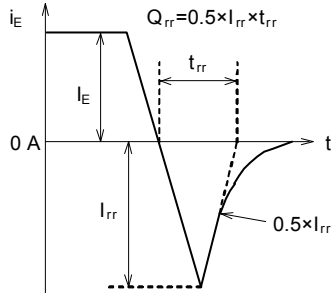
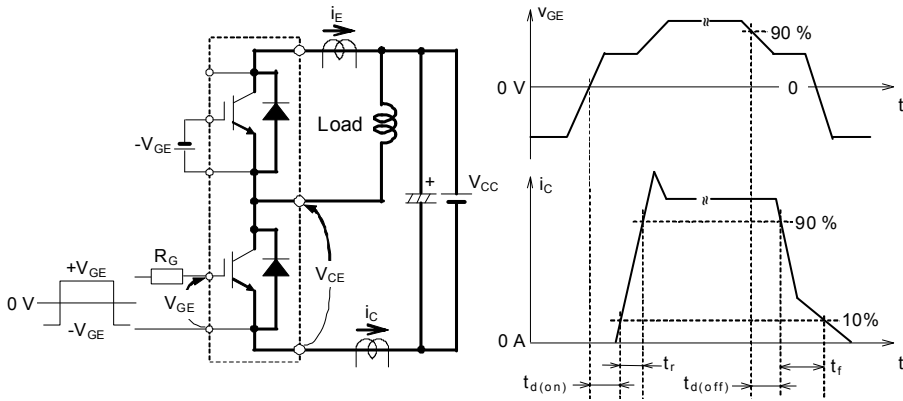
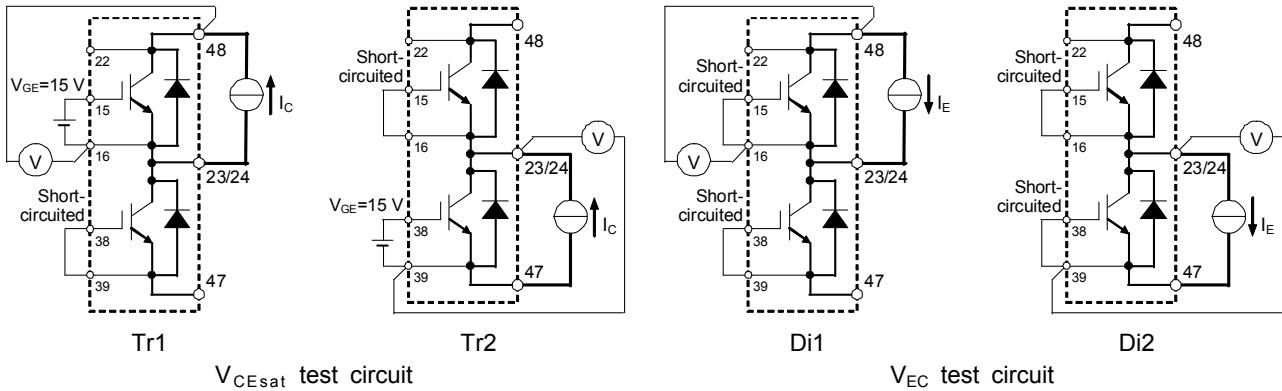
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ± 1 mm



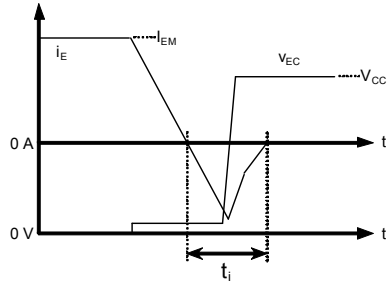
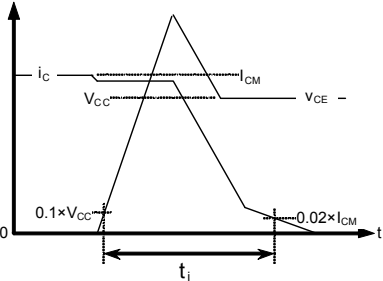
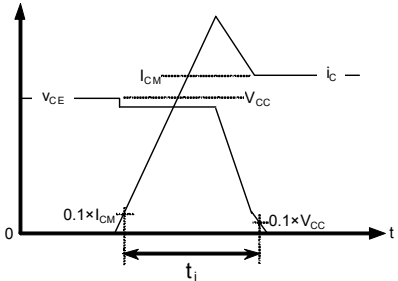
Tr1/Tr2: IGBT, Di1/Di2: FWDi, Th: NTC thermistor. Each mark points the center position of each chip.

TEST CIRCUIT AND WAVEFORMS TEST CIRCUIT AND WAVEFORMS



Switching characteristics test circuit and waveforms

t_{rr} , Q_{rr} test waveform



IGBT Turn-on switching energy

IGBT Turn-off switching energy

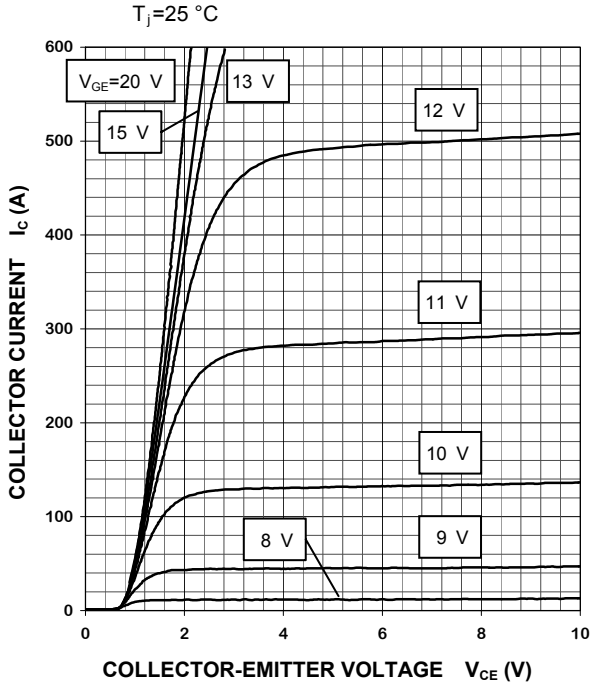
FWDi Reverse recovery energy

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

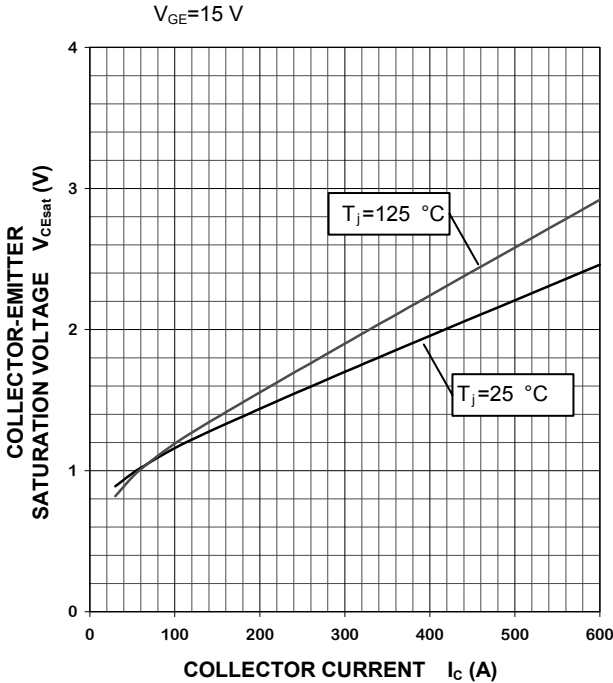
PERFORMANCE CURVES

INVERTER PART

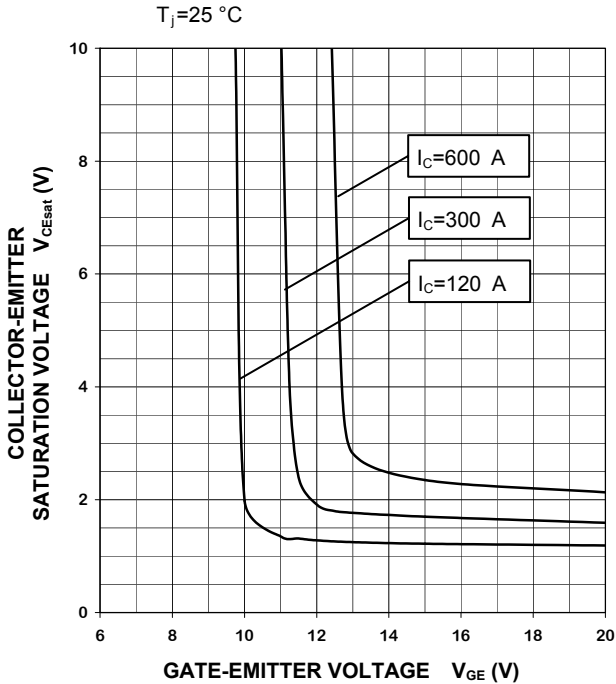
OUTPUT CHARACTERISTICS (TYPICAL)



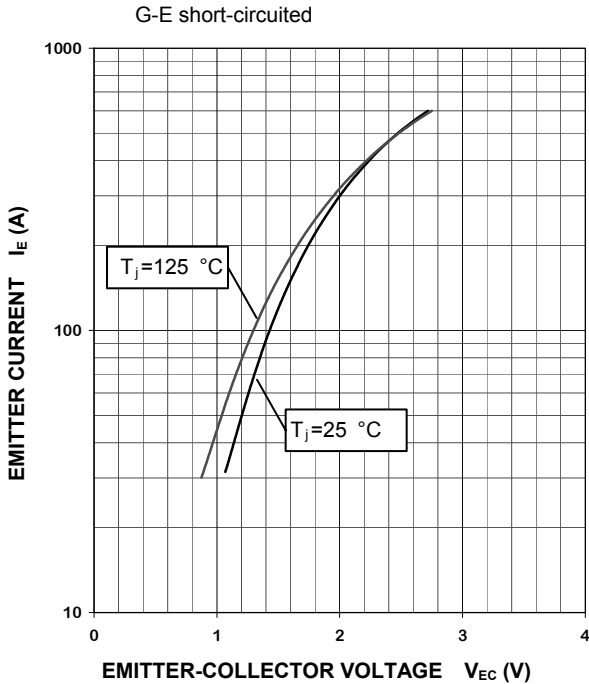
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

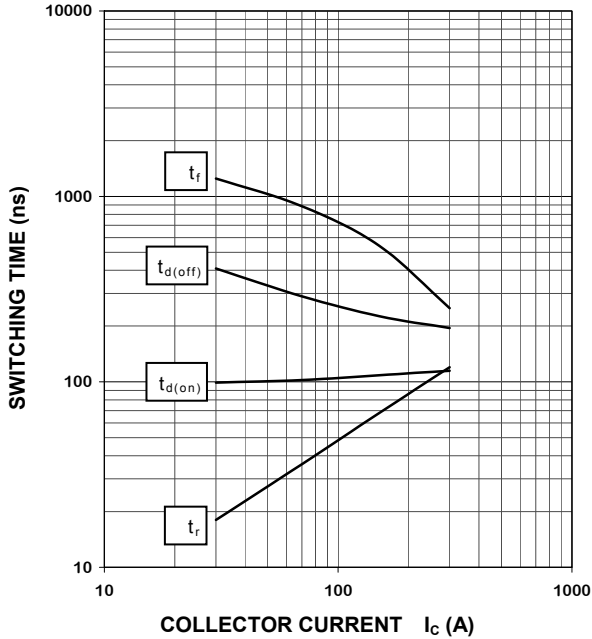


FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)



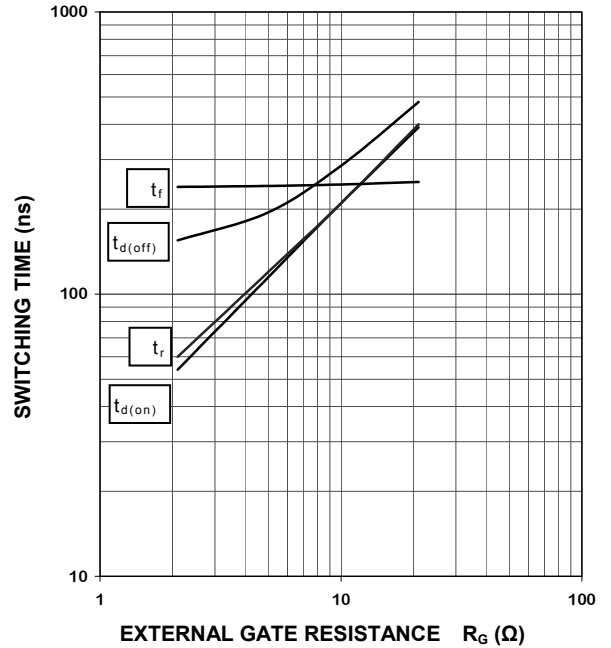
HALF-BRIDGE
 SWITCHING CHARACTERISTICS
 (TYPICAL)

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=5.1\ \Omega$,
 INDUCTIVE LOAD, $T_j=125\text{ }^\circ\text{C}$



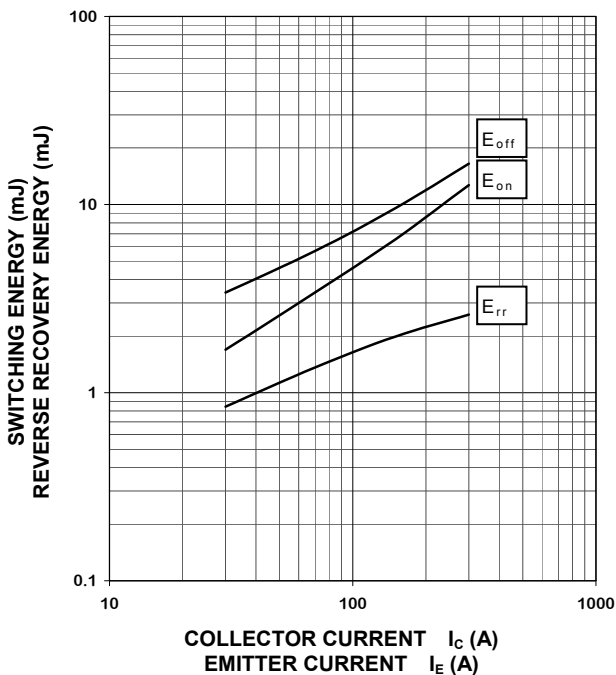
HALF-BRIDGE
 SWITCHING CHARACTERISTICS
 (TYPICAL)

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



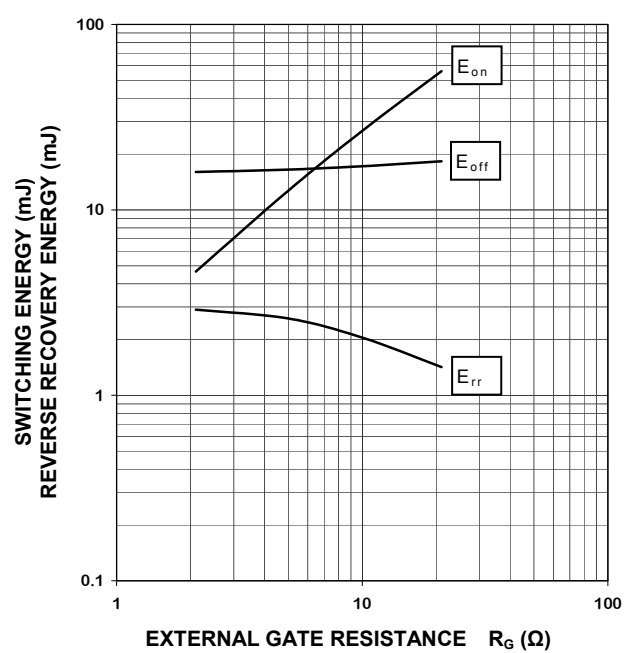
HALF-BRIDGE
 SWITCHING CHARACTERISTICS
 (TYPICAL)

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=5.1\ \Omega$,
 INDUCTIVE LOAD, PER PULSE, $T_j=125\text{ }^\circ\text{C}$



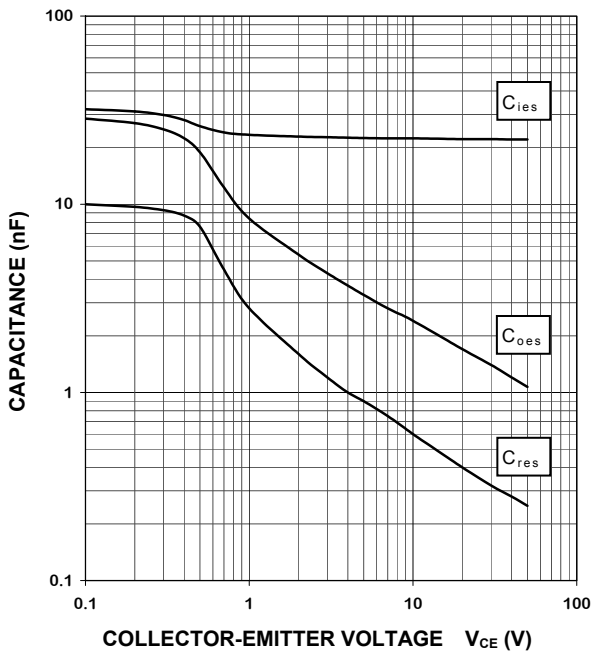
HALF-BRIDGE
 SWITCHING CHARACTERISTICS
 (TYPICAL)

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



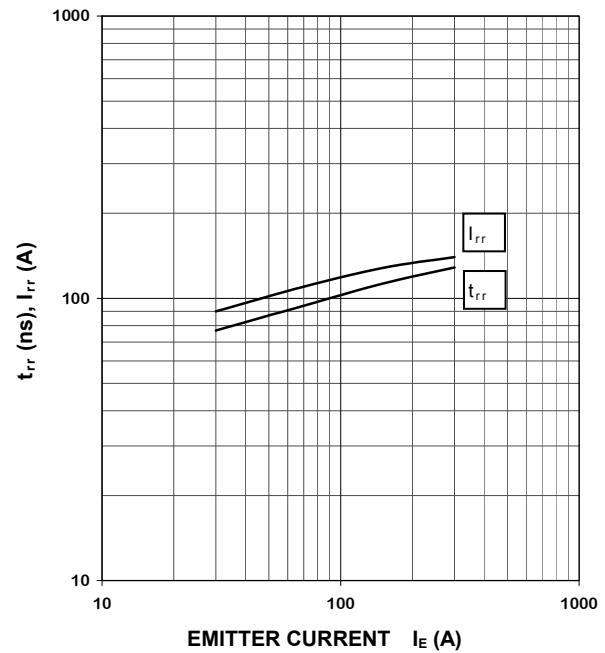
**CAPACITANCE CHARACTERISTICS
 (TYPICAL)**

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



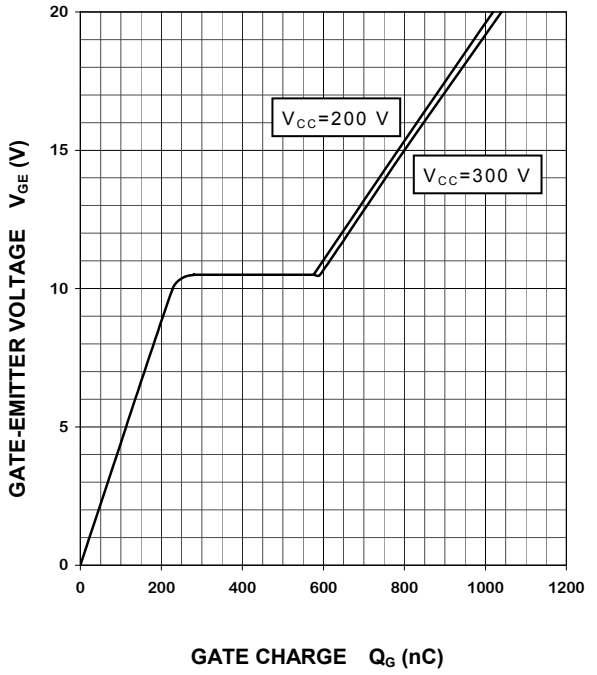
**FREE WHEELING DIODE
 REVERSE RECOVERY CHARACTERISTICS
 (TYPICAL)**

$V_{CC}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=5.1\ \Omega$,
 INDUCTIVE LOAD, $T_J=25\text{ }^\circ\text{C}$



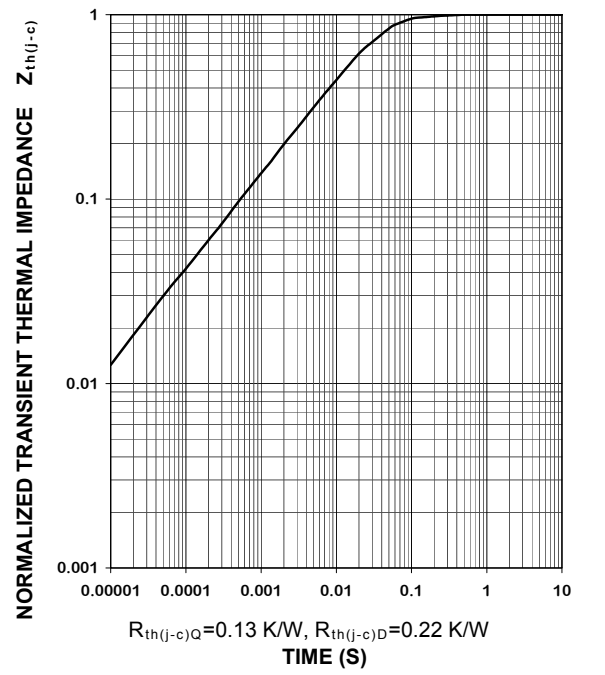
**GATE CHARGE CHARACTERISTICS
 (TYPICAL)**

$I_C=300\text{ A}$, $T_J=25\text{ }^\circ\text{C}$



**TRANSIENT THERMAL IMPEDANCE
 CHARACTERISTICS
 (MAXIMUM)**

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



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