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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

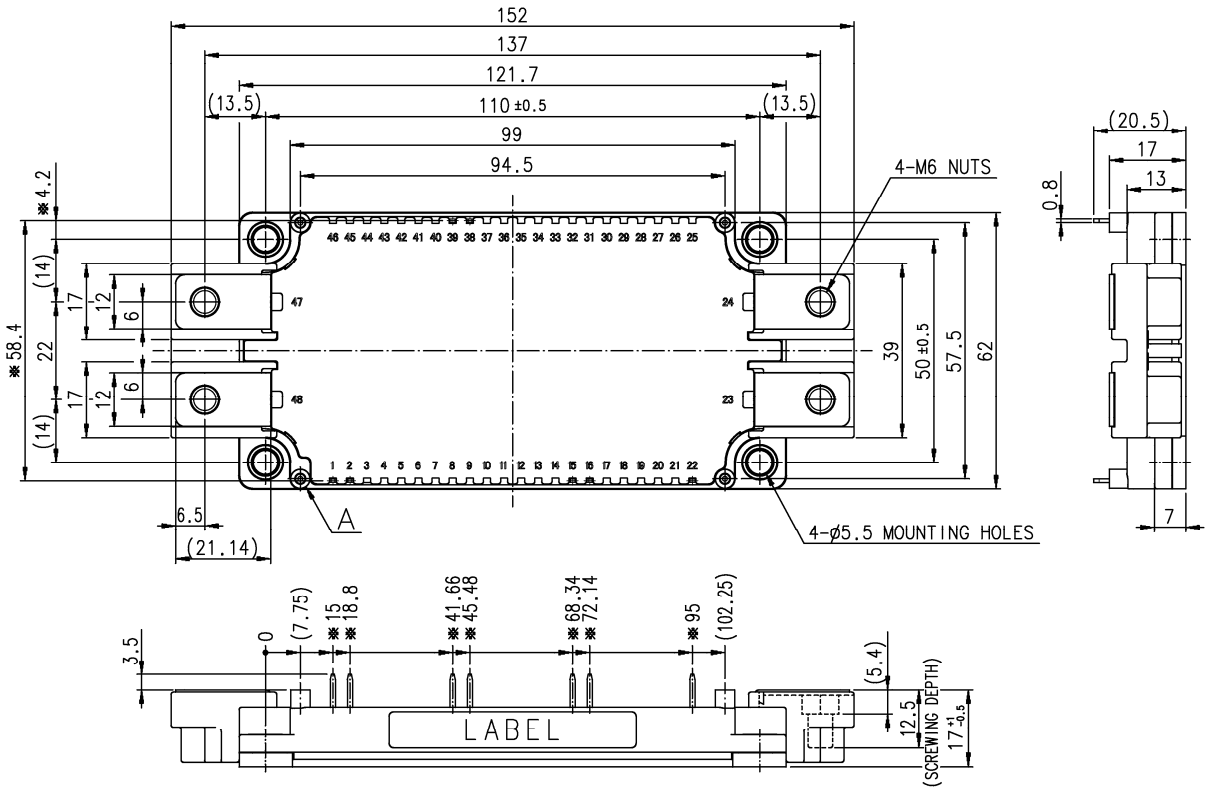
- Flat base Type
- Copper base plate (non-plating)
- RoHS Directive compliant
- UL Recognized under UL1557, File E323585

APPLICATION

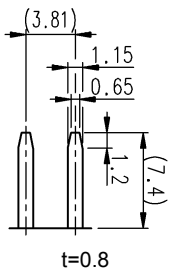
AC Motor Control, Motion/Servo Control, Power supply, etc.

OUTLINE DRAWING & INTERNAL CONNECTION

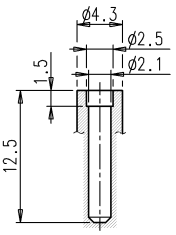
Dimension in mm



TERMINAL



SECTION A

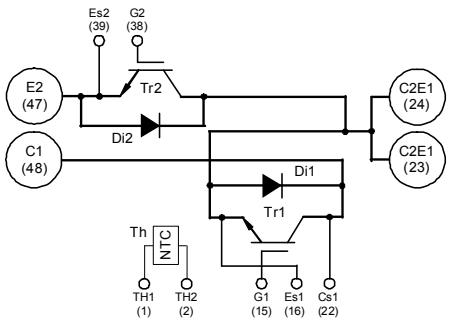


Tolerance otherwise specified

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 ⊕ ø0.5

INTERNAL CONNECTION



MITSUBISHI ELECTRIC

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 (Free wheeling diode forward current)	T_C=25 °C (Note.2, 4)	300	A
I_{ERM} (Note.1)		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 Min.	Limits Typ.	Limits 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		-	-	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), V_{GE}=15 V, (Terminal)	T_j=25 °C	-	1.7	2.1	V
			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), G-E short-circuited, (Terminal)	T_j=25 °C	-	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			-	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 Min.	Limits Typ.	Limits Max.	Unit
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

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

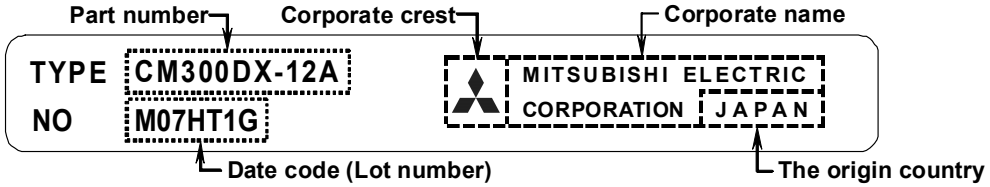
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M_t	Mounting torque	Main terminals M 6 screw	3.5	4.0	4.5	N·m
M_s		Mounting to heat sink M 5 screw	2.5	3.0	3.5	
d_s	Creepage distance	Terminal to terminal	11.55	-	-	mm
		Terminal to base plate	12.32	-	-	
d_a	Clearance	Terminal to terminal	10.00	-	-	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 °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

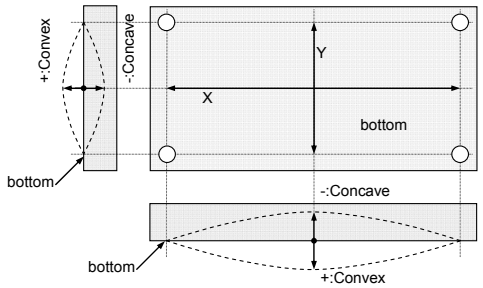


REPRESENTATIVE SOLDERING TEMPERATURE CONDITIONS FOR PIN TERMINALS

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

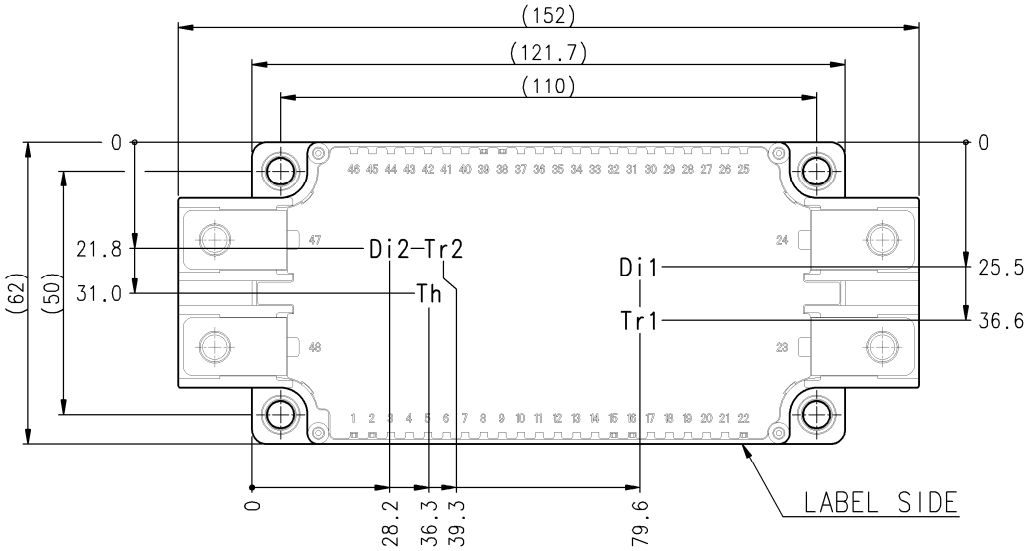
Note.1: Represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (FWDi).
Note.2: Case temperature (T_C) and heat sink temperature (T_s) are defined on the each surface of base plate and heat sink just under the chips. (Refer to the figure of chip location)
The 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: $B_{(25/50)} = \ln(\frac{R_{25}}{R_{50}}) / (\frac{1}{T_{25}} - \frac{1}{T_{50}})$
R_{25}: resistance at absolute temperature T_{25} [K]; T_{25}=25 [°C]+273.15=298.15 [K]
R_{50}: resistance at absolute temperature T_{50} [K]; T_{50}=50 [°C]+273.15=323.15 [K]
Note.7: Typical value is measured by using thermally conductive grease of λ=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.

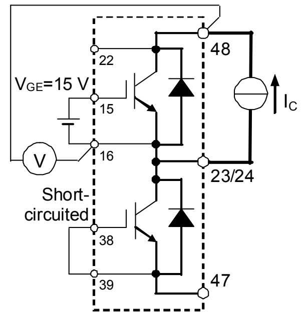
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm

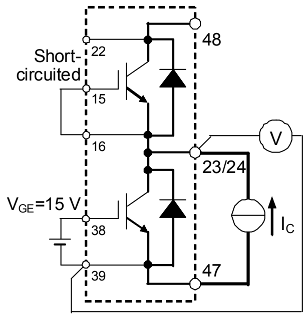


Tr1/Tr2: IGBT, Di1/Di2: FWDi, Th: NTC thermistor. Each mark points the center position of each chip.

TEST CIRCUIT AND WAVEFORMS TEST CIRCUIT AND WAVEFORMS

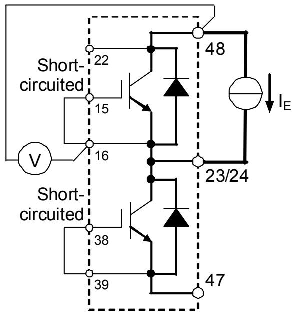


Tr1

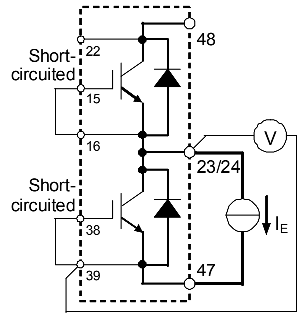


Tr2

V_{CEsat} test circuit

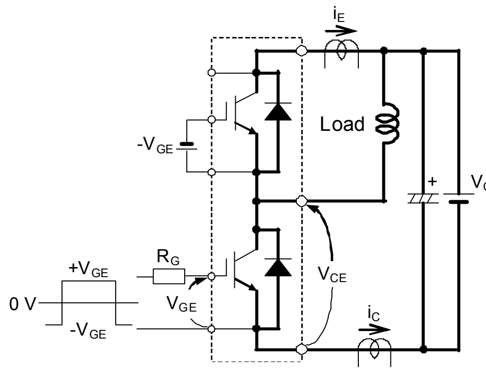


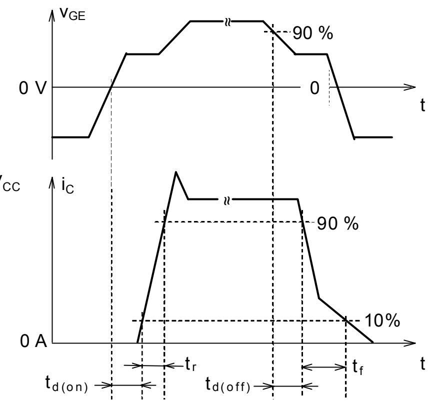
Di1



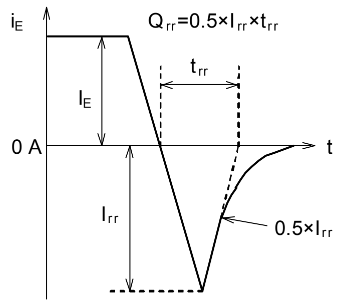
Di2

V_{EC} test circuit

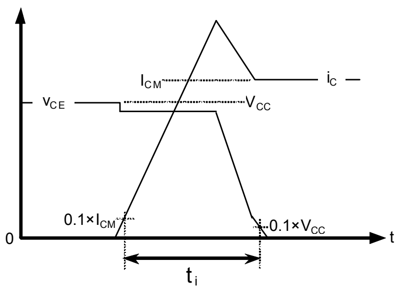




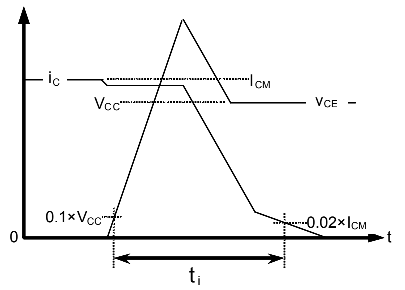
Switching characteristics test circuit and waveforms



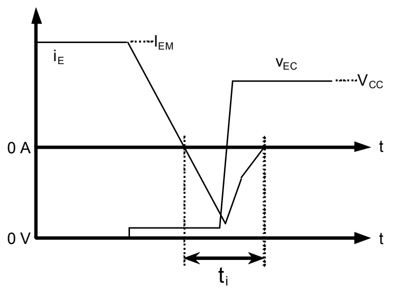
t_{rr}, Q_{rr} test waveform



IGBT Turn-on switching energy



IGBT Turn-off switching energy



FWDi Reverse recovery energy

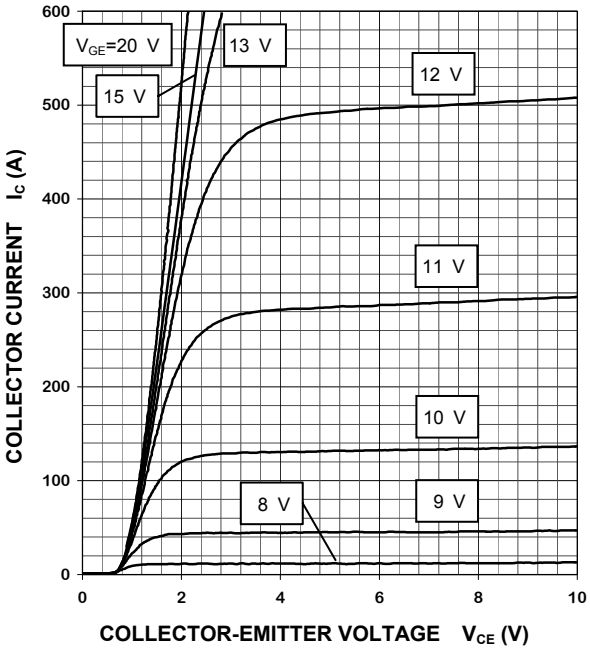
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

PERFORMANCE CURVES

INVERTER PART

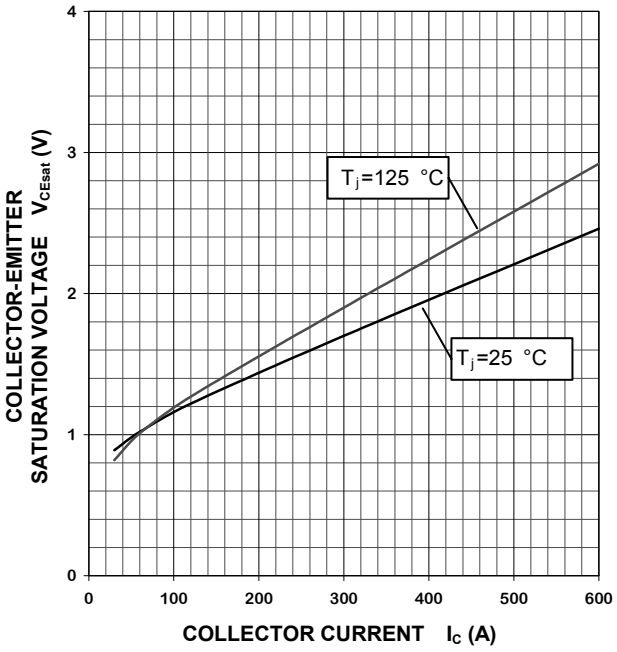
OUTPUT CHARACTERISTICS (TYPICAL)

T_j=25 °C



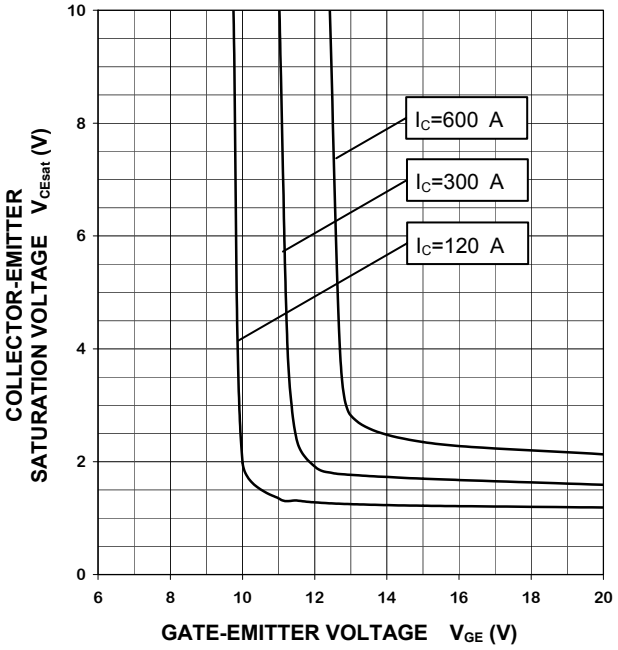
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

V_{GE}=15 V



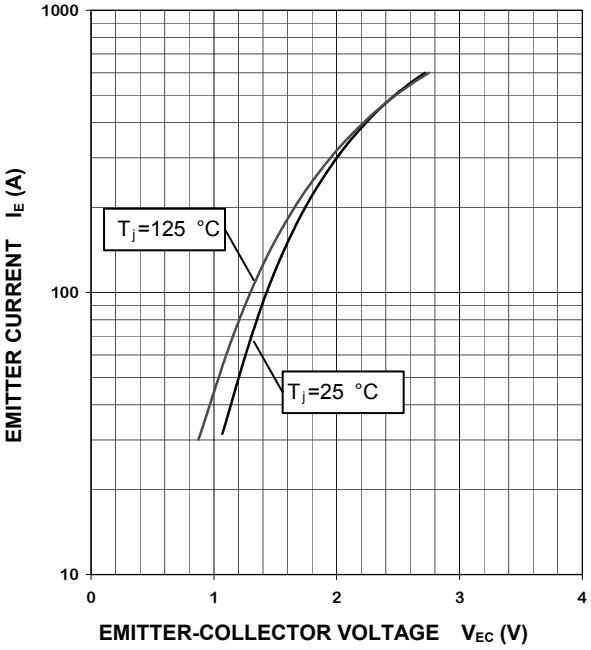
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

T_j=25 °C

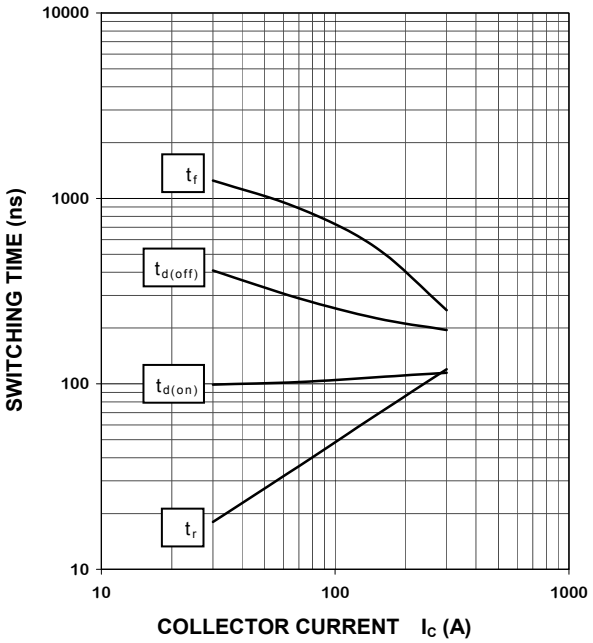


FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)

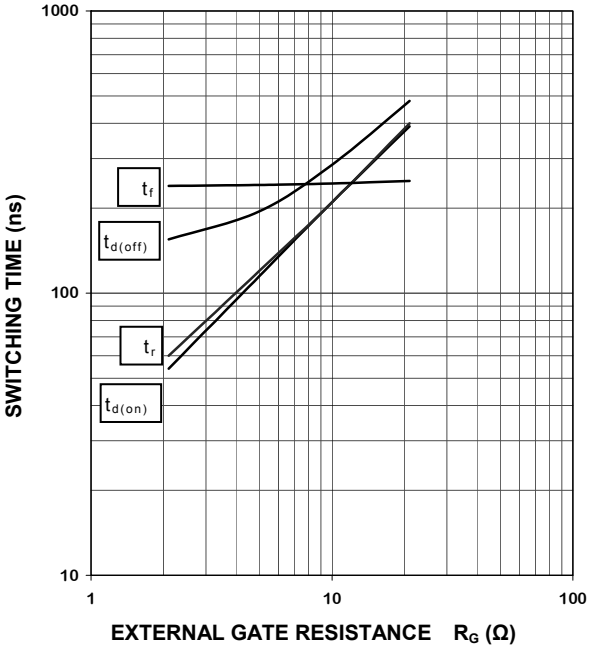
G-E short-circuited



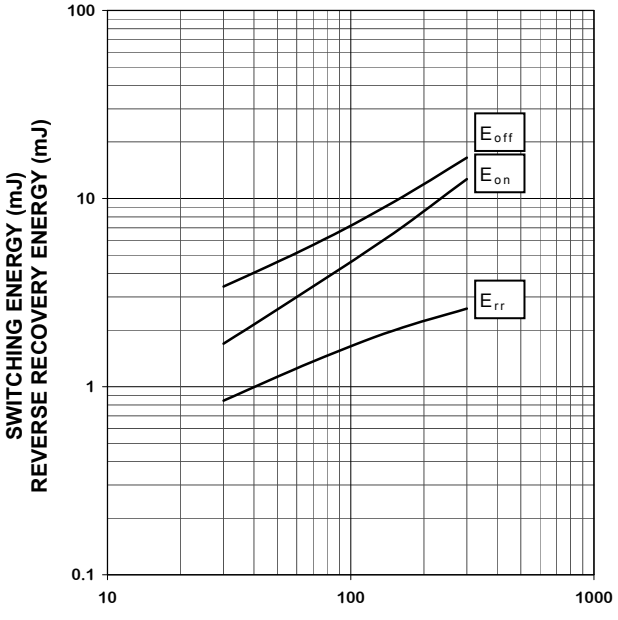
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)
V_{CC}=300 V, V_{GE}=±15 V, R_G=5.1 Ω,
INDUCTIVE LOAD, T_j=125 °C



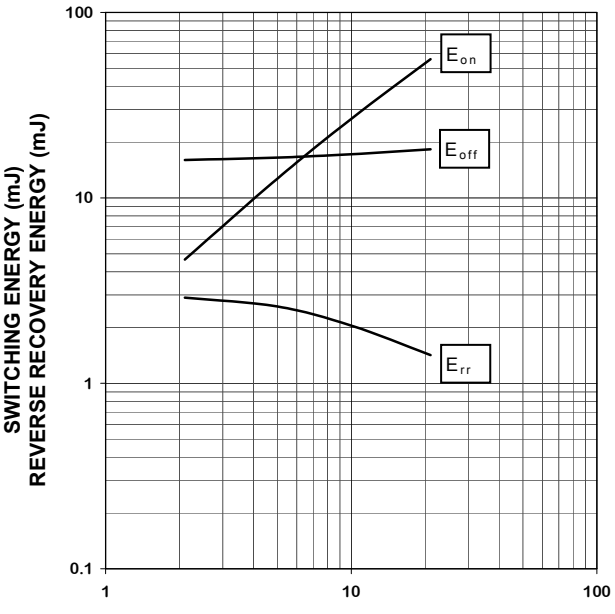
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)
V_{CC}=300 V, I_C=300 A, V_{GE}=±15 V,
INDUCTIVE LOAD, T_j=125 °C



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)
V_{CC}=300 V, V_{GE}=±15 V, R_G=5.1 Ω,
INDUCTIVE LOAD, PER PULSE, T_j=125 °C

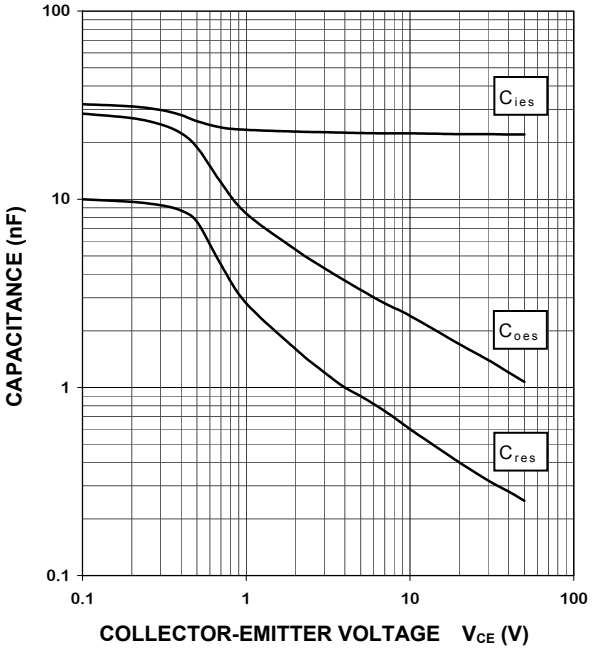


HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)
V_{CC}=300 V, I_C/I_E=300 A, V_{GE}=±15 V,
INDUCTIVE LOAD, PER PULSE, T_j=125 °C



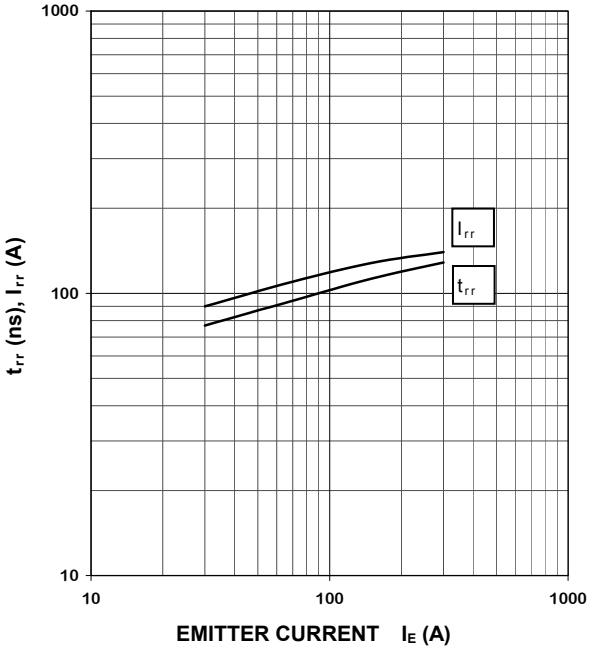
CAPACITANCE CHARACTERISTICS (TYPICAL)

G-E short-circuited, T_j=25 °C



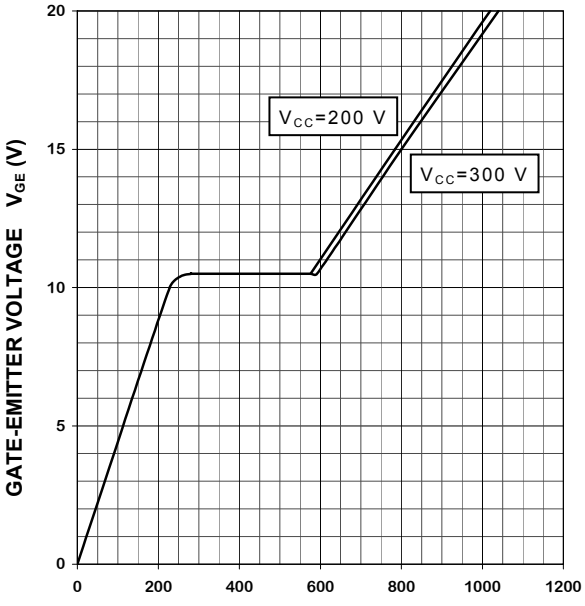
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

V_{CC}=300 V, V_{GE}=±15 V, R_G=5.1 Ω, INDUCTIVE LOAD, T_j=25 °C



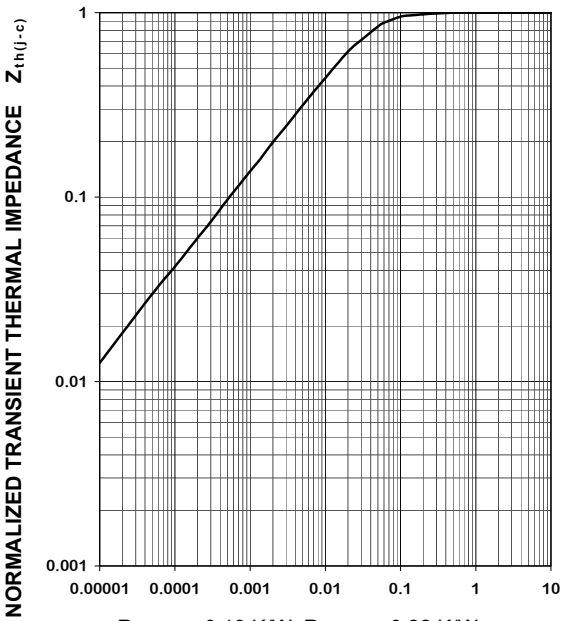
GATE CHARGE CHARACTERISTICS (TYPICAL)

I_C=300 A, T_j=25 °C



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)

Single pulse, T_C=25°C



$R_{th(j-c)Q}$=0.13 K/W, $R_{th(j-c)D}$=0.22 K/W

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