MITSUBISHI ELECTRIC

TENTATIVE

Notice: This is not a final specification. Some parametric limits are subject to change.

< IGBT MODULES >

CM150DX-34SA

HIGH POWER SWITCHING USE
INSULATED TYPE

Prepared by	A	T.Matsuoka, T.Kuroda,
Approved by		Y.Nagashima
(Date)		17.Feb.2012

Dual (Half-Bridge)

Collector current I_C ..... **150** A
Collector-emitter voltage V_{CES} ..... **1700** V
Maximum junction temperature T_{jmax} ..... **175** °C

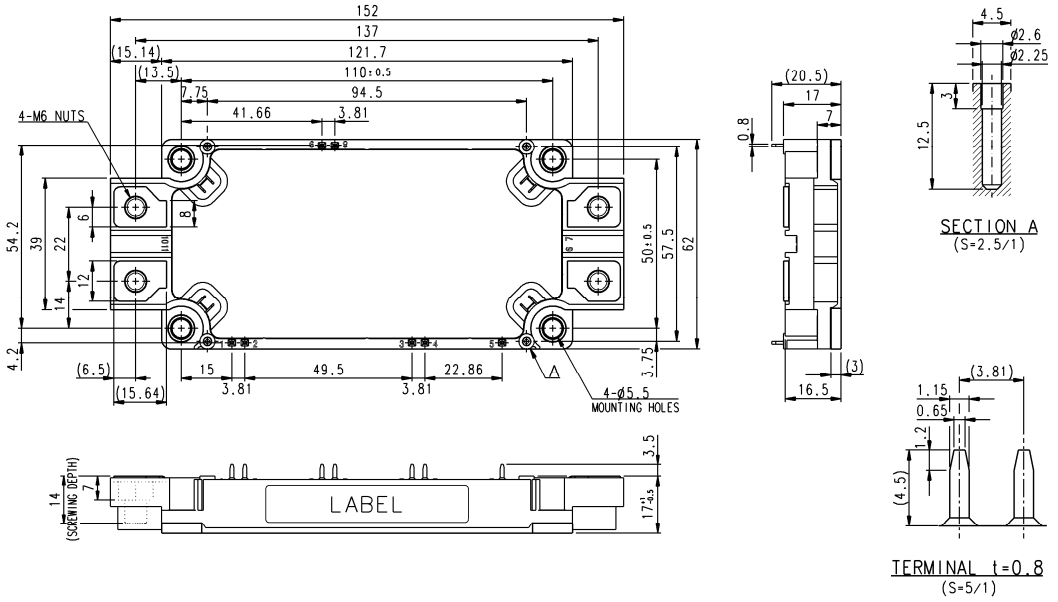
- ●Flat base Type
- ●Copper base plate (non-plating)
- ●Tin plating pin terminals
- ●RoHS Directive compliant
- ●UL under application

APPLICATION

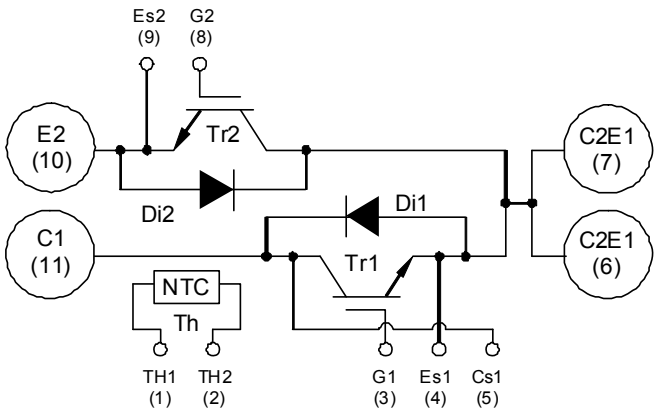
AC Motor Control, Motion/Servo Control, Power supply, etc.

OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm



INTERNAL CONNECTION



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

The tolerance of size between terminals is assumed to be ±0.4.

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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	1700	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	±20	V
I_C	Collector current	DC, T_C=125 °C (Note.2, 4)	150	A
I_{CRM}		Pulse, Repetitive (Note.3)	300	
P_{tot}	Total power dissipation	T_C=25 °C (Note.2, 4)	1500	W
I_E (Note.1)	Emitter current	T_C=25 °C (Note.2, 4)	150	A
I_{ERM} (Note.1)		Pulse, Repetitive (Note.3)	300	
T_{jmax}	Maximum junction temperature	-	175	°C

MODULE

Symbol	Item	Conditions	Rating	Unit
T_{Cmax}	Maximum case temperature	(Note.2)	125	°C
T_{jop}	Operating junction temperature	-	-40 ~ +150	°C
T_{stg}	Storage temperature	-	-40 ~ +125	
V_{isol}	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	4000	V

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M_t	Mounting torque	Mounting to heat sink M 5 screw	2.5	3.0	3.5	N·m
M_s		Mounting to heat sink M 5 screw	2.5	3.0	3.5	
d_s	Creepage distance	Terminal to terminal	11.5	-	-	mm
		Terminal to base plate	8.0	-	-	
d_a	Clearance	Terminal to terminal	9.5	-	-	mm
		Terminal to base plate	6.3	-	-	
m	Weight	-	-	(350)	-	g
e_c	Flatness of base plate	On the centerline X, Y (Note.5)	±0	-	+100	μm

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=15 mA, V_{CE}=10 V		5.4	6.0	6.6	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=150 A (Note.6), V_{GE}=15 V, (Terminal)	T_j=25 °C	-	2.2	2.7	V
			T_j=125 °C	-	2.4	-	
			T_j=150 °C	-	2.45	-	
		I_C=150 A (Note.6), V_{GE}=15 V, (Chip)	T_j=25 °C	-	2.1	2.6	V
			T_j=125 °C	-	2.3	-	
			T_j=150 °C	-	2.35	-	
C_{ies}	Input capacitance	V_{CE}=10 V, G-E short-circuited		-	-	26	nF
C_{oes}	Output capacitance			-	-	1.1	
C_{res}	Reverse transfer capacitance			-	-	0.26	
Q_G	Gate charge	V_{CC}=1000 V, I_C=150 A, V_{GE}=15 V		-	828	-	nC
$t_{d(on)}$	Turn-on delay time	V_{CC}=1000 V, I_C=150 A, V_{GE}=±15 V, R_G=(1.6) Ω, Inductive load		-	-	(400)	ns
t_r	Rise time			-	-	(100)	
$t_{d(off)}$	Turn-off delay time			-	-	(700)	
t_f	Fall time			-	-	(600)	

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ELECTRICAL CHARACTERISTICS (T_j=25 °C, unless otherwise specified)

INVERTER PART IGBT/FWDi

Symbol	Item	Conditions		Limits			Unit
				Min.	Typ.	Max.	
V_{EC} (Note.1)	Emitter-collector voltage	I_E=150 A (Note.6), G-E short-circuited, (Terminal)	T_j=25 °C	-	4.1	5.3	V
			T_j=125 °C	-	2.7	-	
			T_j=150 °C	-	2.6	-	
		I_E=150 A (Note.6), G-E short-circuited, (Chip)	T_j=25 °C	-	4.0	5.2	V
			T_j=125 °C	-	2.6	-	
			T_j=150 °C	-	2.5	-	
t_{rr} (Note.1)	Reverse recovery time	V_{CC}=1000 V, I_E=150 A, V_{GE}=±15 V, R_G=(1.6) Ω, Inductive load		-	-	(300)	ns
Q_{rr} (Note.1)	Reverse recovery charge			-	(16.0)	-	μC
E_{on}	Turn-on switching energy per pulse	V_{CC}=1000 V, I_C=I_E=150 A, V_{GE}=±15 V, R_G=(1.6) Ω, T_j=150 °C, Inductive load		-	34	-	mJ
E_{off}	Turn-off switching energy per pulse			-	46	-	
E_{rr} (Note.1)	Reverse recovery energy per pulse			-	32	-	
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, T_C=25 °C (Note.2)		-	-	2.0	mΩ
r_g	Internal gate resistance	Per switch		-	3.4	-	Ω

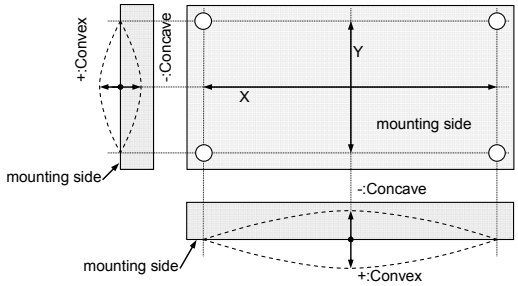
NTC THERMISTOR PART

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.7)	-	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	-	-	0.10	K/W
$R_{th(j-c)D}$		Junction to case, per Inverter FWDi	-	-	0.16	
$R_{th(c-s)}$	Contact thermal resistance (Note.2)	Case to heat sink, per 1 module, Thermal grease applied (Note.8)	-	15	-	K/kW

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 (mounting side) of base plate and heat sink just under the chips. Refer to the figure of chip location.
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: The base plate (mounting side) flatness measurement points (X, Y) are as follows of the following figure.



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: $B_{(25/50)} = \ln(\frac{R_{25}}{R_{50}}) / (\frac{1}{T_{25}} - \frac{1}{T_{50}})$,

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]

TENTATIVE

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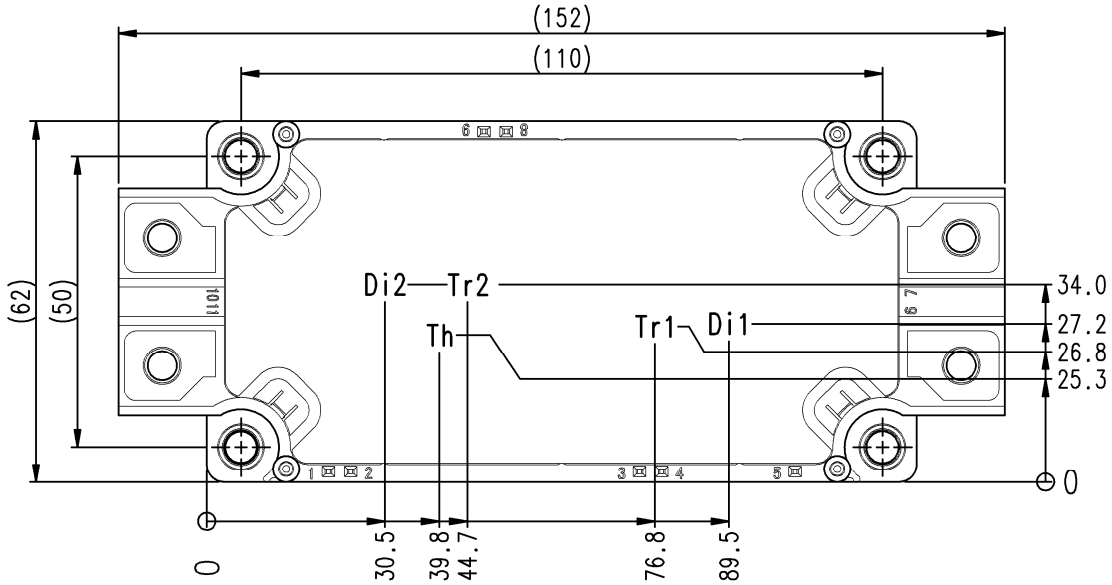
Note.8: Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K).
Note.9: Use the following screws when mounting the printed circuit board (PCB) on the stand offs.
"M2.6×10 or M2.6×12 self tapping screw"
The length of the screw depends on the thickness of the PCB.

RECOMMENDED OPERATING CONDITIONS (T_a=25 °C)

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across C1-E2	-	1000	1200	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	(1.6)	-	(47)	Ω

CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm



Tr1,Tr2: IGBT, Di1,Di2: FWDi, Th: NTC thermistor

TENTATIVE

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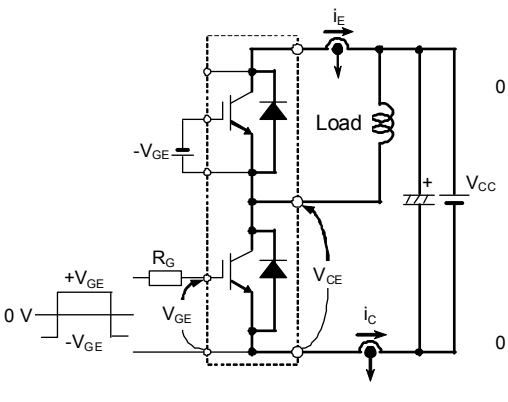
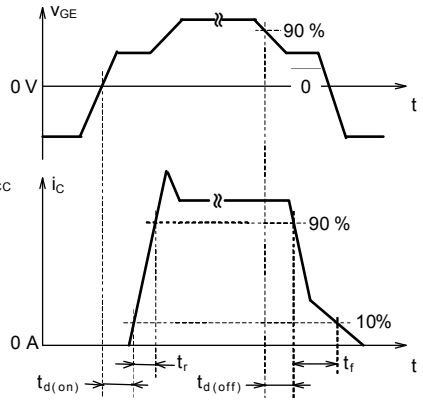
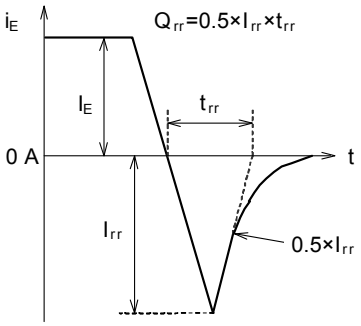
TEST CIRCUIT AND WAVEFORMS

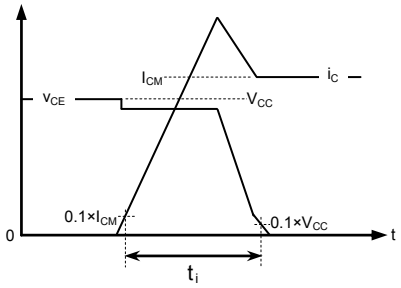




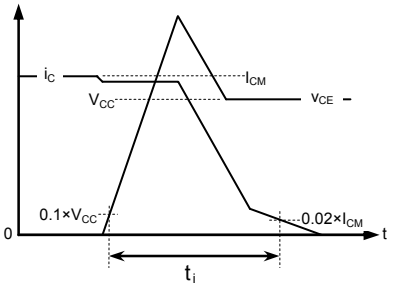
Switching characteristics test circuit and waveforms



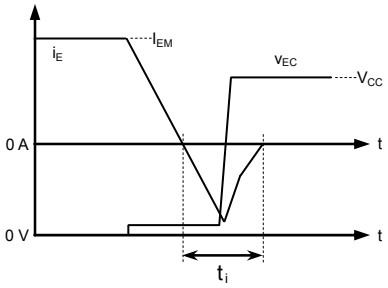
trr, Qrr test waveform



IGBT Turn-on switching energy



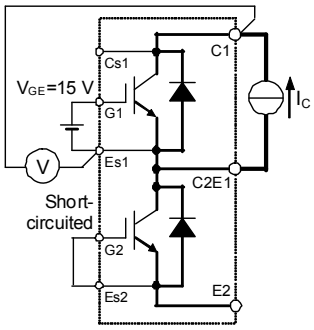
IGBT Turn-off switching energy



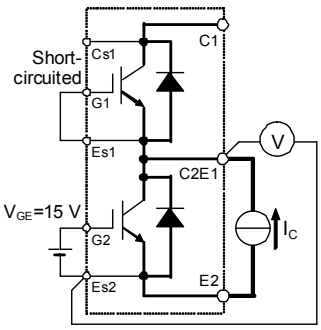
FWDi Reverse recovery energy

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

TEST CIRCUIT

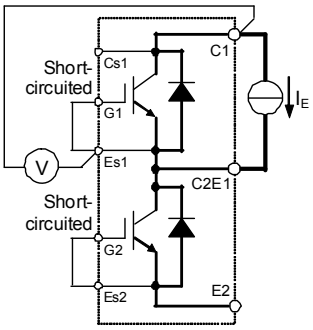


Tr1

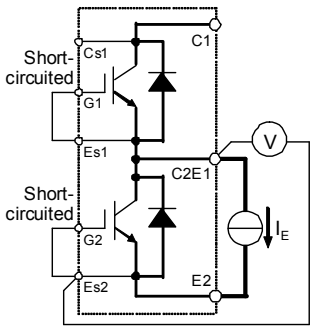


Tr2

VCEsat test circuit



Di1



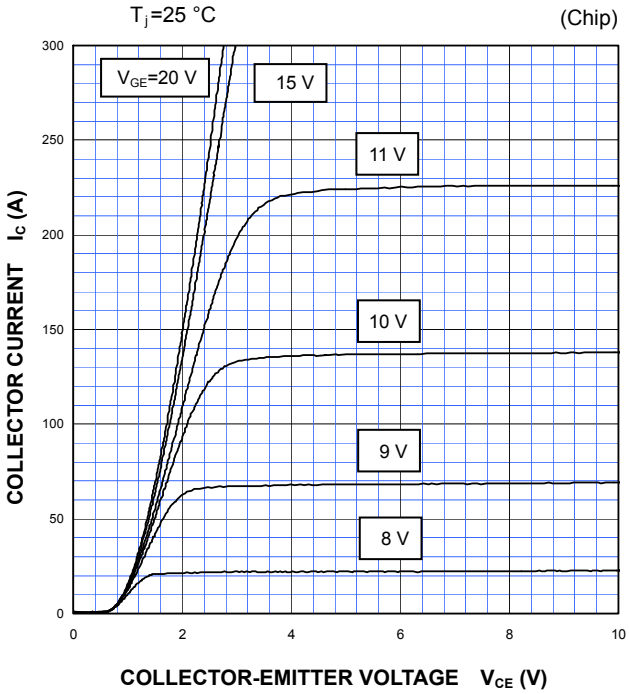
Di2

VEC test circuit

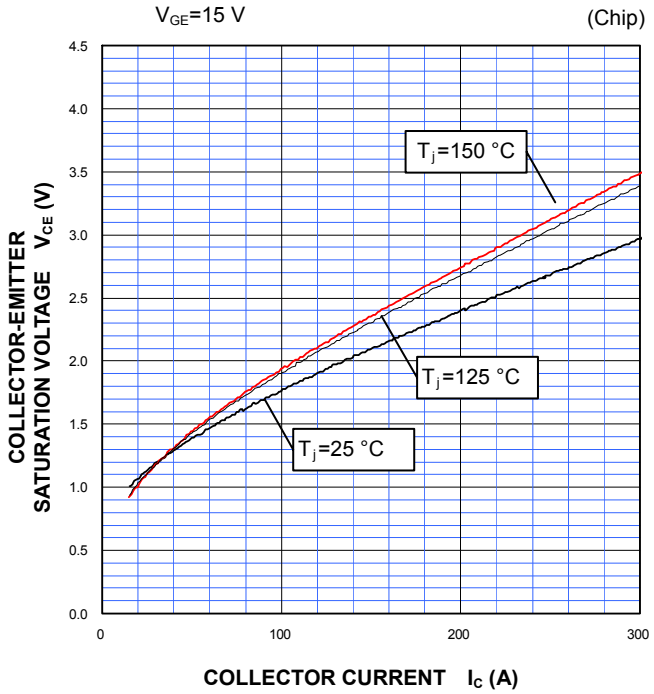
PERFORMANCE CURVES

INVERTER PART

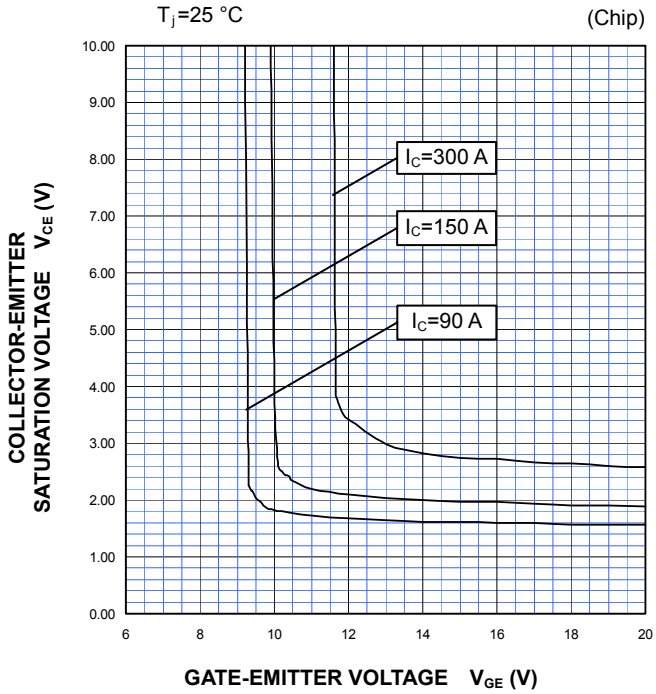
OUTPUT CHARACTERISTICS (TYPICAL)



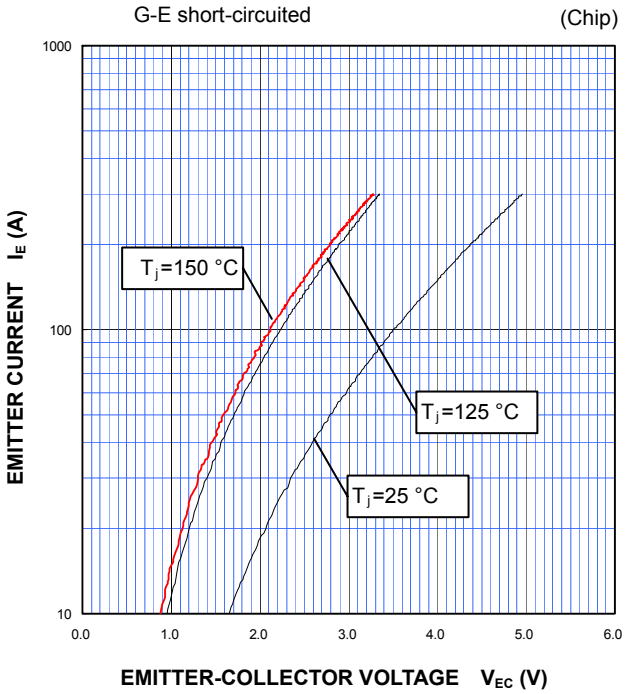
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)



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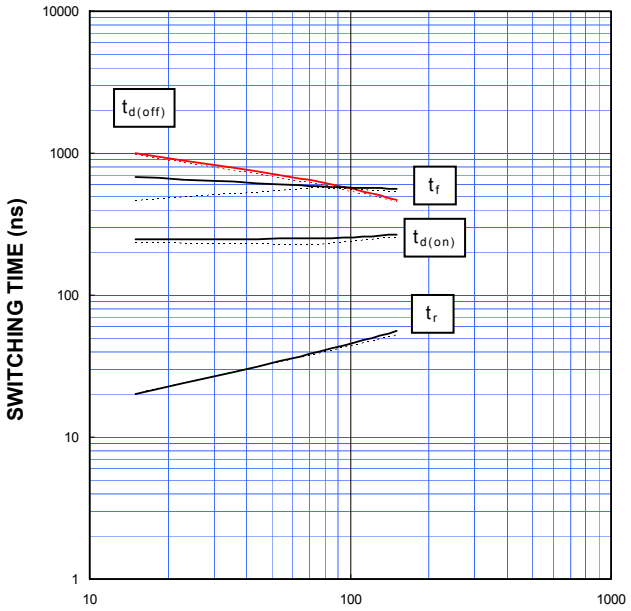
PERFORMANCE CURVES

INVERTER PART

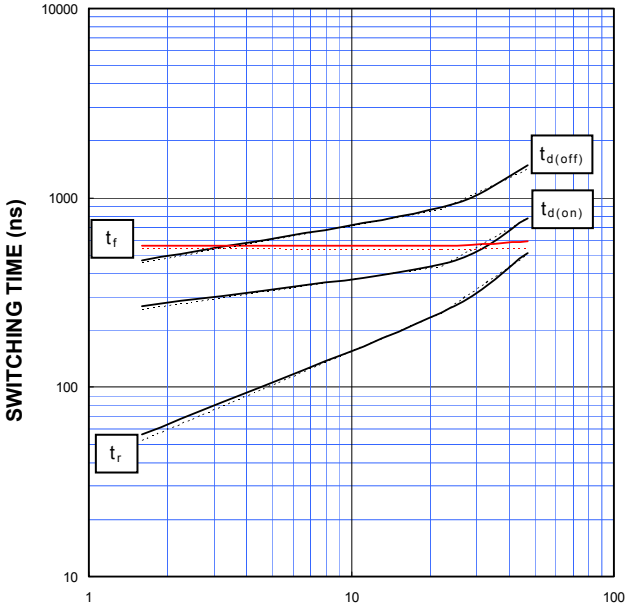
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=1000 V, V_{GE}=±15 V, R_G=(1.6) Ω, INDUCTIVE LOAD
————: T_j=150 °C, - - - - -: T_j=125 °C



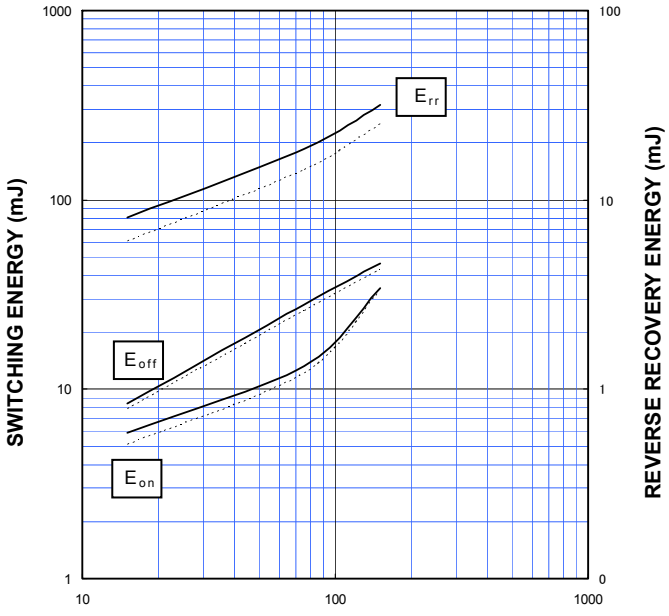
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=1000 V, V_{GE}=±15 V, I_C=150 A, INDUCTIVE LOAD
————: T_j=150 °C, - - - - -: T_j=125 °C



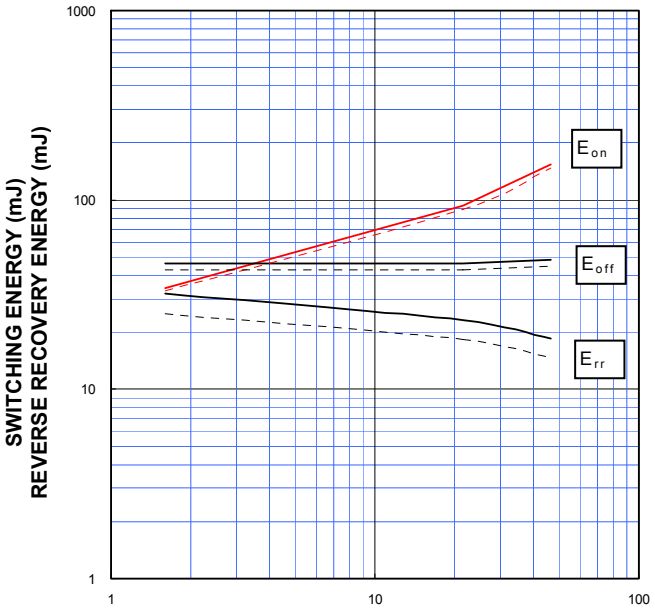
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=1000 V, V_{GE}=±15 V, R_G=(1.6) Ω,
INDUCTIVE LOAD, PER PULSE
————: T_j=150 °C, - - - - -: T_j=125 °C



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=1000 V, V_{GE}=±15 V, I_C=150 A,
INDUCTIVE LOAD, PER PULSE
————: T_j=150 °C, - - - - -: T_j=125 °C

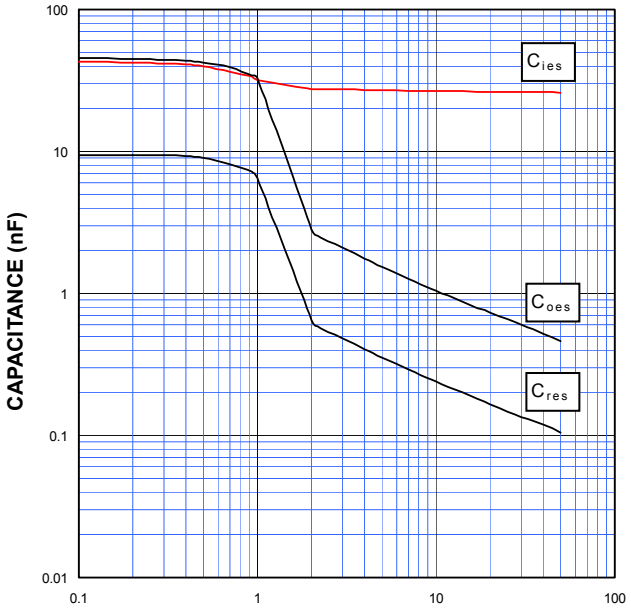


PERFORMANCE CURVES

INVERTER PART

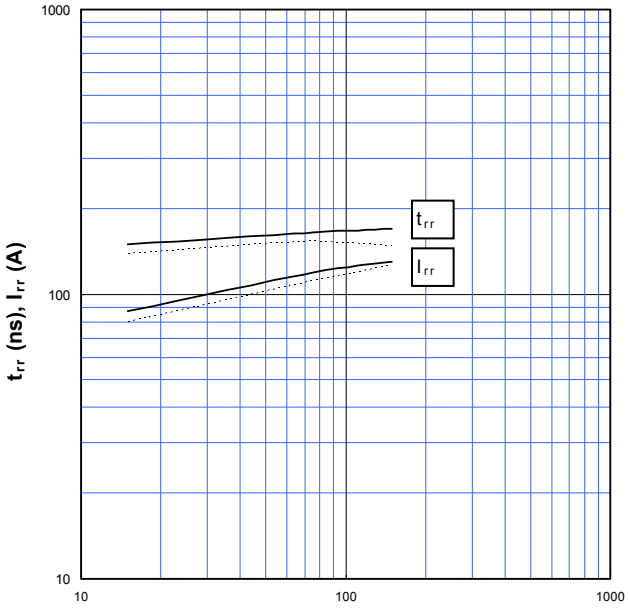
CAPACITANCE CHARACTERISTICS (TYPICAL)

G-E short-circuited, T_j=25 °C



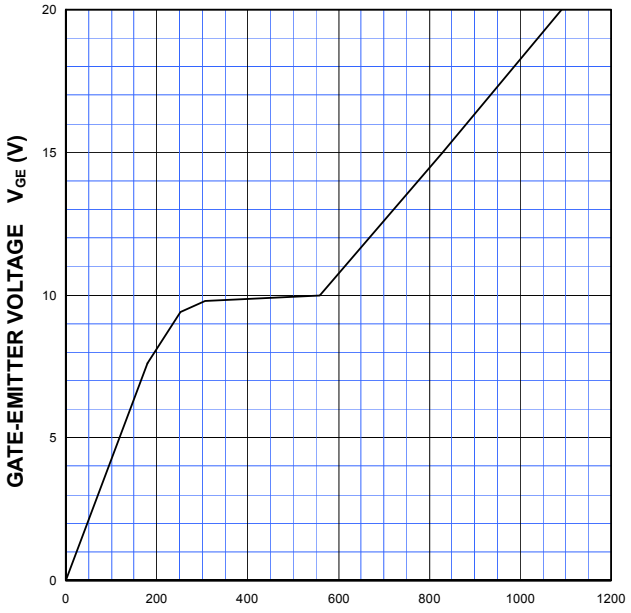
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

V_{CC}=1000 V, V_{GE}=±15 V, R_G=(1.6) Ω, INDUCTIVE LOAD
————: T_j=150 °C, - - - - -: T_j=125 °C



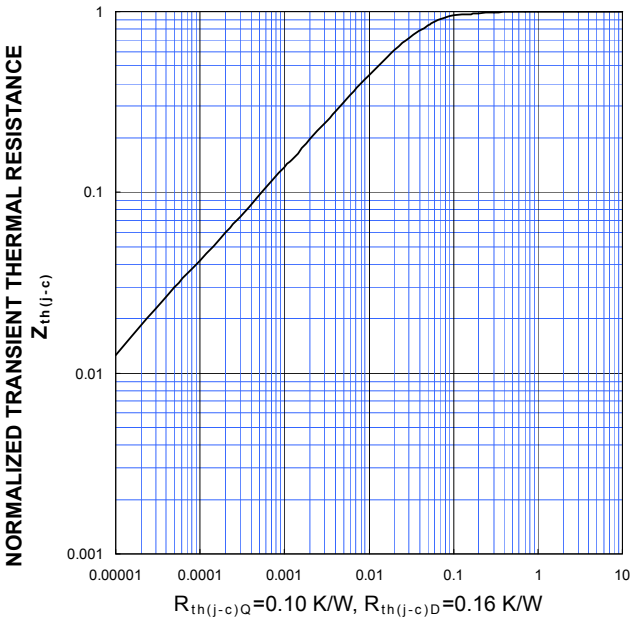
GATE CHARGE CHARGE CHARACTERISTICS (TYPICAL)

V_{CC}=1000 V, I_C=150 A, T_j=25 °C



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)

Single pulse, T_C=25 °C



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