

<IGBT Modules>

CM300DX-34SA

HIGH POWER SWITCHING USE
INSULATED TYPE



dual switch (half-bridge)

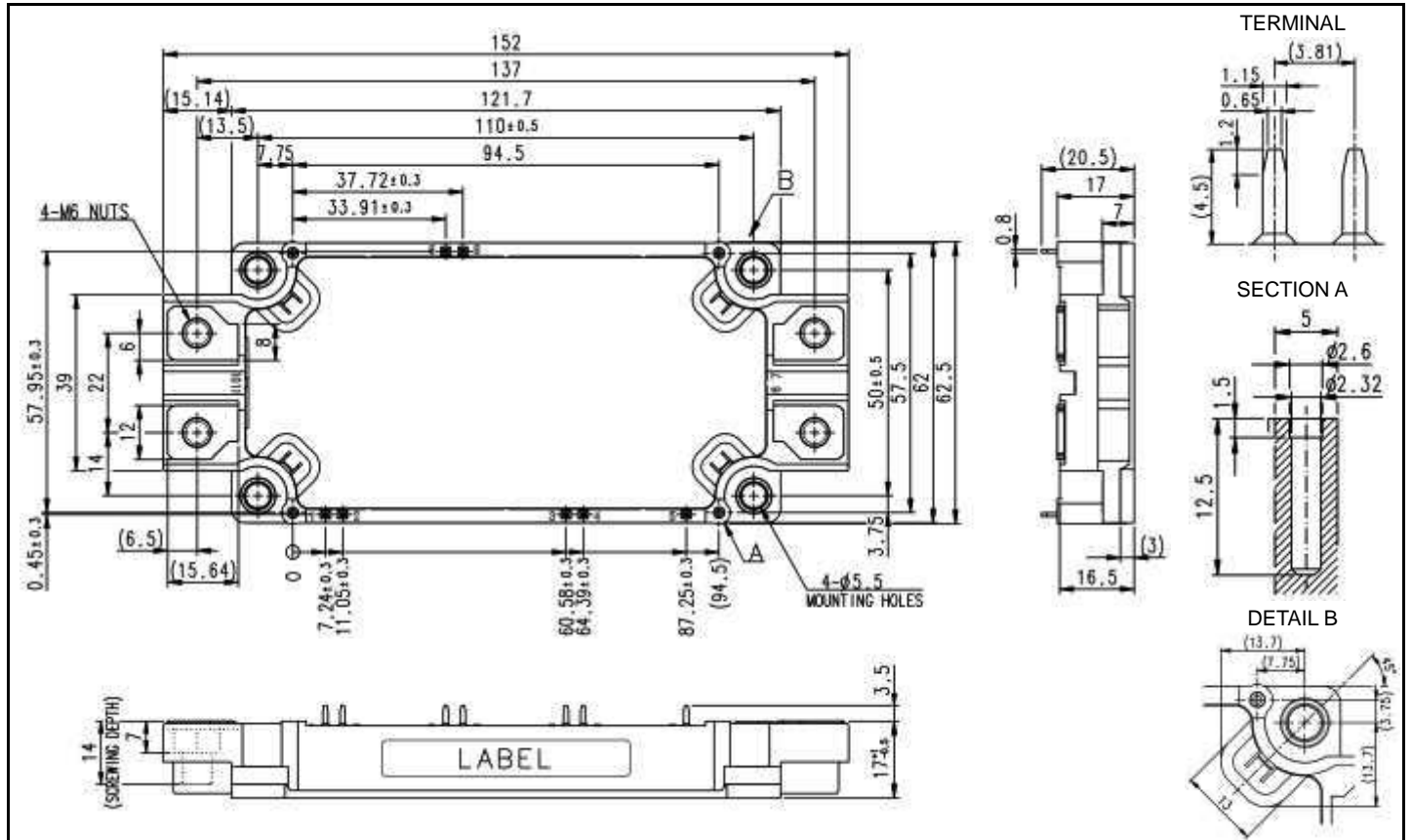
Collector current I_C **300 A**
 Collector-emitter voltage V_{CES} **1700 V**
 Maximum junction temperature T_{vjmax} **175 °C**

- Flat base type
- Copper base plate (non-plating)
- RoHS Directive compliant
- Tin-plating pin terminals
- UL Recognized under UL1557, File No. E323585

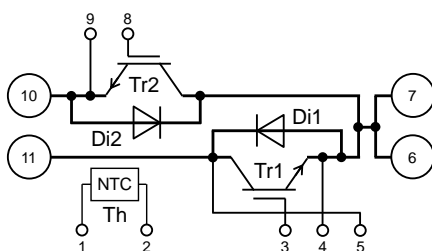
APPLICATION

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

OUTLINE DRAWING



INTERNAL CONNECTION



Terminal code

- | | |
|--------|---------|
| 1. TH1 | 6. C2E1 |
| 2. TH2 | 7. C2E1 |
| 3. G1 | 8. G2 |
| 4. Es1 | 9. Es2 |
| 5. Cs1 | 10. E2 |
| | 11. C1 |

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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HIGH POWER SWITCHING USE
INSULATED TYPEMAXIMUM RATINGS ($T_{vj}=25\text{ }^{\circ}\text{C}$, unless otherwise specified)

INVERTER PART IGBT/FWD

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, $T_C=125\text{ }^{\circ}\text{C}$ (Note2, 4)	300	A
I_{CRM}		Pulse, Repetitive (Note3)	600	
P_{tot}	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	3000	W
I_E (Note1)	Emitter current	DC (Note2)	300	A
I_{ERM} (Note1)		Pulse, Repetitive (Note3)	600	

MODULE

Symbol	Item	Conditions	Rating	Unit
V_{isol}	Isolation voltage	Terminals to base plate, RMS, $f=60\text{ Hz}$, AC 1 min	4000	V
T_{vjmax}	Maximum junction temperature	Instantaneous event (overload)	175	$^{\circ}\text{C}$
T_{Cmax}	Maximum case temperature	(Note4)	125	
T_{vjop}	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	$^{\circ}\text{C}$
T_{stg}	Storage temperature	-	-40 ~ +125	

ELECTRICAL CHARACTERISTICS ($T_{vj}=25\text{ }^{\circ}\text{C}$, unless otherwise specified)

INVERTER PART IGBT/FWD

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
I_{CES}	Collector-emitter cut-off current	$V_{CE}=V_{CES}$, G-E short-circuited	-	-	1.0	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	$I_C=30\text{ mA}$, $V_{CE}=10\text{ V}$	5.4	6.0	6.6	V	
V_{CEsat} (Terminal)	Collector-emitter saturation voltage	$I_C=300\text{ A}$, $V_{GE}=15\text{ V}$, Refer to the figure of test circuit (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	2.00	2.50	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	2.20	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	2.25	-	
V_{CEsat} (Chip)		$I_C=300\text{ A}$, $V_{GE}=15\text{ V}$, (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.90	2.40	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	2.10	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	2.15	-	
C_{ies}	Input capacitance	$V_{CE}=10\text{ V}$, G-E short-circuited	-	-	79	nF	
C_{oes}	Output capacitance		-	-	6.5		
C_{res}	Reverse transfer capacitance		-	-	1.5		
Q_G	Gate charge	$V_{CC}=1000\text{ V}$, $I_C=300\text{ A}$, $V_{GE}=15\text{ V}$	-	1656	-	nC	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=1000\text{ V}$, $I_C=300\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=1.2\text{ }\Omega$, Inductive load	-	-	500	ns	
t_r	Rise time		-	-	100		
$t_{d(off)}$	Turn-off delay time		-	-	800		
t_f	Fall time		-	-	600		
V_{EC} (Note1) (Terminal)	Emitter-collector voltage	$I_E=300\text{ A}$, G-E short-circuited, Refer to the figure of test circuit (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	4.1	5.3	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	2.9	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	2.7	-	
V_{EC} (Note1) (Chip)		$I_E=300\text{ A}$, G-E short-circuited, (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	4.0	5.2	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	2.8	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	2.6	-	
t_{rr} (Note1)	Reverse recovery time	$V_{CC}=1000\text{ V}$, $I_E=300\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=1.2\text{ }\Omega$, Inductive load	-	-	300	ns	
Q_{rr} (Note1)	Reverse recovery charge		-	11	-	μC	
E_{on}	Turn-on switching energy per pulse	$V_{CC}=1000\text{ V}$, $I_C=I_E=300\text{ A}$,	-	48.4	-	mJ	
E_{off}	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$, $R_G=1.2\text{ }\Omega$, $T_{vj}=150\text{ }^{\circ}\text{C}$,	-	75.8	-		
E_{rr} (Note1)	Reverse recovery energy per pulse	Inductive load	-	63.2	-	mJ	
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, $T_C=25\text{ }^{\circ}\text{C}$ (Note4)	-	-	1.0	m Ω	
r_g	Internal gate resistance	Per switch	-	1.7	-	Ω	

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HIGH POWER SWITCHING USE
INSULATED TYPE

ELECTRICAL CHARACTERISTICS (cont.; T_{vj}=25 °C, unless otherwise specified) NTC THERMISTOR PART

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R ₂₅	Zero-power resistance	T _C =25 °C (Note4)	4.85	5.00	5.15	kΩ
ΔR/R	Deviation of resistance	R ₁₀₀ =493 Ω, T _C =100 °C (Note4)	-7.3	-	+7.8	%
B _(25/50)	B-constant	Approximate by equation (Note6)	-	3375	-	K
P ₂₅	Power dissipation	T _C =25 °C (Note4)	-	-	10	mW

THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R _{th(j-c)Q}	Thermal resistance	Junction to case, per Inverter IGBT (Note4)	-	-	50	K/kW
R _{th(j-c)D}		Junction to case, per Inverter FWD (Note4)	-	-	80	
R _{th(c-s)}	Contact thermal resistance	Case to heat sink, Thermal grease applied (Note4, 7) per 1 module,	-	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 torque	Mounting to heat sink M 5 screw	2.5	3.0	3.5	N·m
d _s	Creepage distance	Terminal to terminal	17	-	-	mm
		Terminal to base plate	18.5	-	-	
d _a	Clearance	Terminal to terminal	10	-	-	mm
		Terminal to base plate	16.3	-	-	
e _c	Flatness of base plate	On the centerline X, Y (Note8)	±0	-	+100	μm
m	mass	-	-	350	-	g

*: This product is compliant with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive 2011/65/EU.

Note1. Represent ratings and characteristics of the anti-parallel, emitter-collector free-wheeling diode (FWD).

- Junction temperature (T_{vj}) should not increase beyond T_{vjmax} rating.
- Pulse width and repetition rate should be such that the device junction temperature (T_{vj}) dose not exceed T_{vjmax} rating.
- 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.
- Pulse width and repetition rate should be such as to cause negligible temperature rise. Refer to the figure of test circuit.

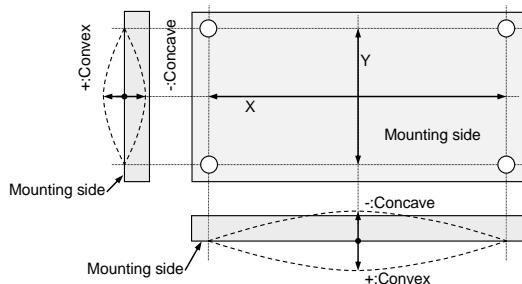
$$B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$$

R₂₅: resistance at absolute temperature T₂₅ [K]; T₂₅=25 [°C]+273.15=298.15 [K]

R₅₀: resistance at absolute temperature T₅₀ [K]; T₅₀=50 [°C]+273.15=323.15 [K]

7. Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K)/D_(C-S)=50 μm.

8. The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



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HIGH POWER SWITCHING USE
INSULATED TYPE

Note10. Use the following screws when mounting the printed circuit board (PCB) on the standoffs.

PCB thickness : t1.0~t1.6

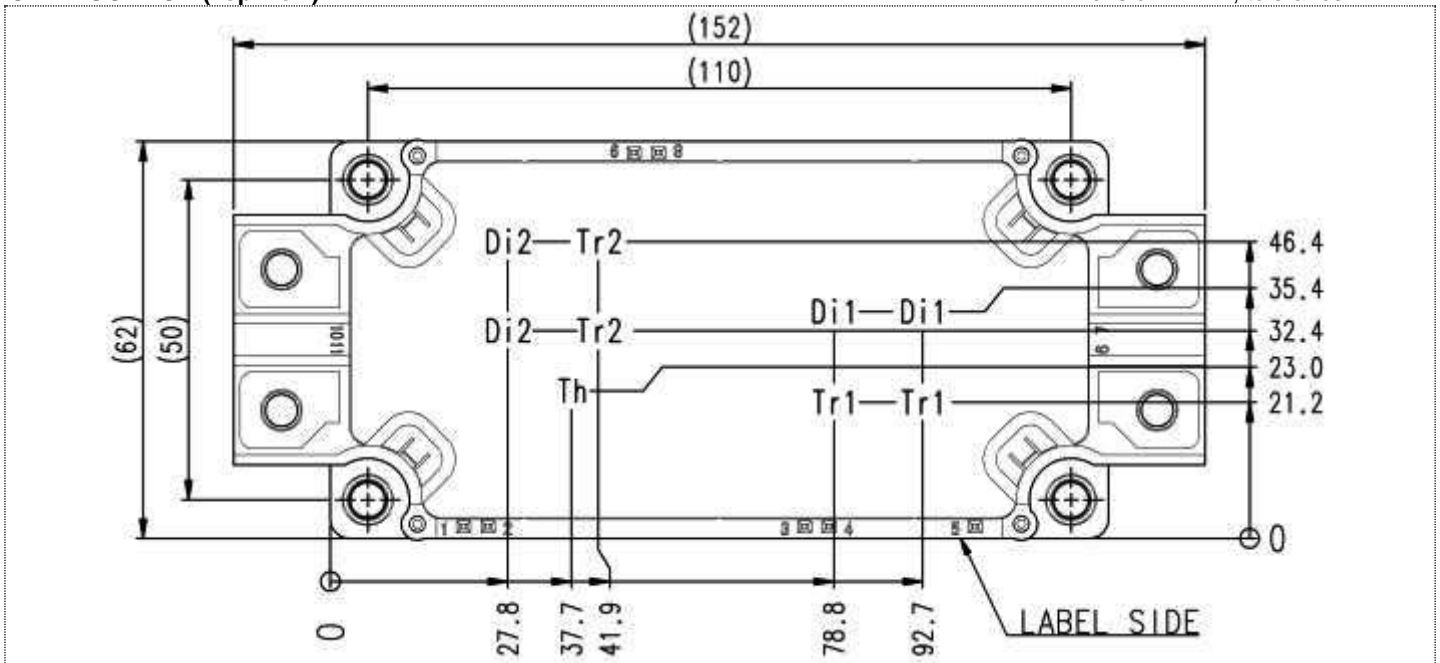
Type	Manufacturer	Size	Tightening torque (N·m)	Recommended tightening method
(1) PT®	EJOT	K25×8	0.55 ± 0.055	by handwork (equivalent to 30 r/min by mechanical screw driver) ~ 600 r/min (by mechanical screw driver)
(2) PT®		K25×10	0.75 ± 0.075 N·m	
(3) DELTA PT®		25×8	0.55 ± 0.055 N·m	
(4) DELTA PT®		25×10	0.75 ± 0.075 N·m	
(5) B1 tapping screw	-	φ2.6×10 φ2.6×12	0.75 ± 0.075 N·m	

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V _{CC}	(DC) Supply voltage	Applied across C1-E2 terminals	-	1000	1200	V
V _{GEon}	Gate (-emitter drive) voltage	Applied across G1-E1s/G2-E2s terminals	13.5	15.0	16.5	V
R _G	External gate resistance	Per switch	1.2	-	27	Ω

CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm

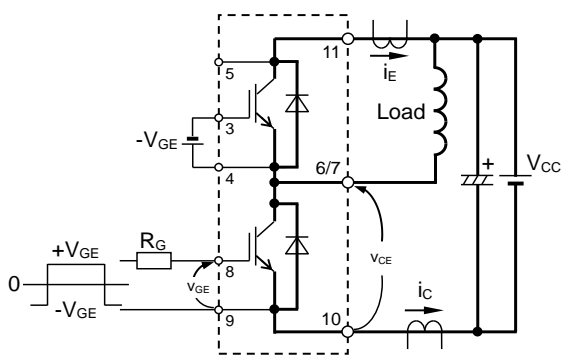


Tr1/Tr2: IGBT, Di1/Di2: FWD, Th: NTC thermistor

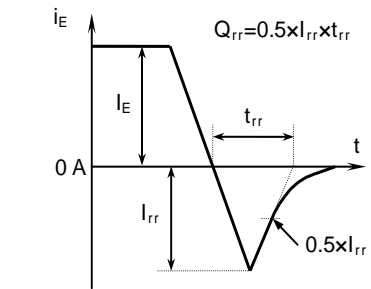
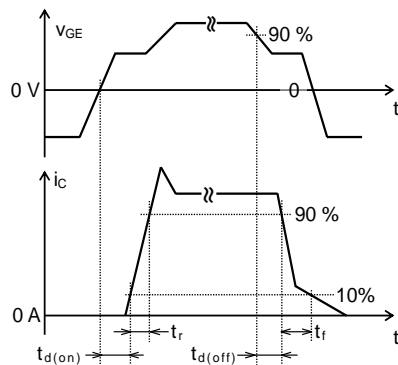
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HIGH POWER SWITCHING USE
INSULATED TYPE

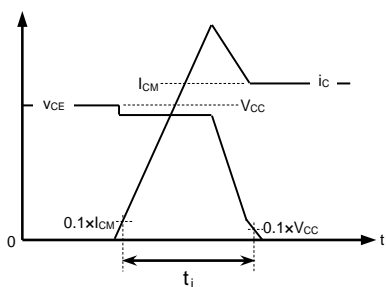
TEST CIRCUIT AND WAVEFORMS



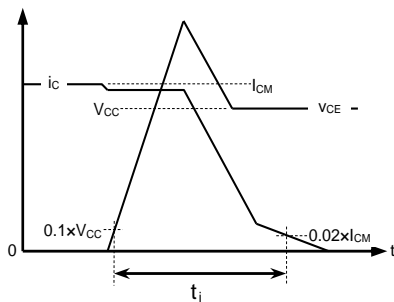
Switching characteristics test circuit and waveforms



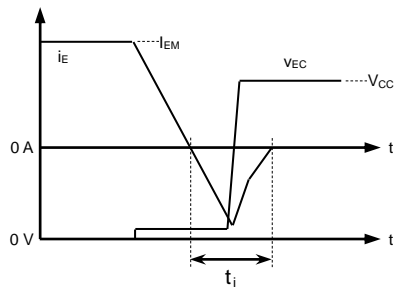
t_{rr} , Q_{rr} characteristics test waveform



IGBT Turn-on switching energy



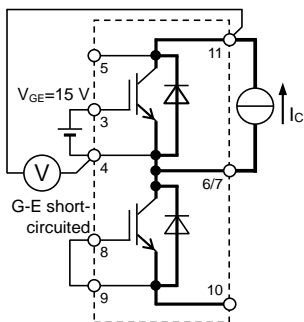
IGBT Turn-off switching energy



FWD Reverse recovery energy

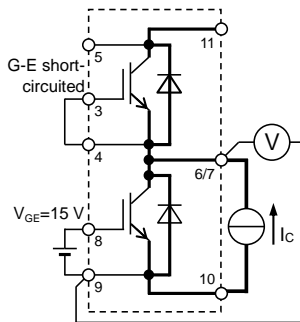
Switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

TEST CIRCUIT

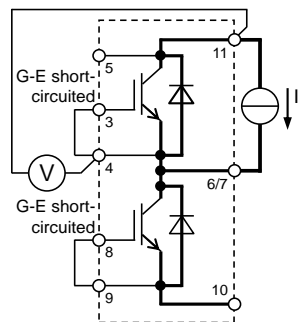


Tr1

V_{CEsat} characteristics test circuit

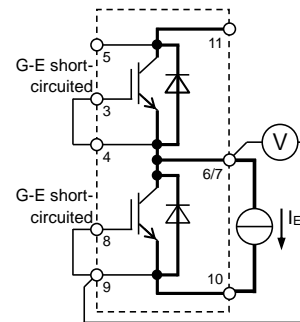


Tr2



Di1

V_{EC} characteristics test circuit



Di2

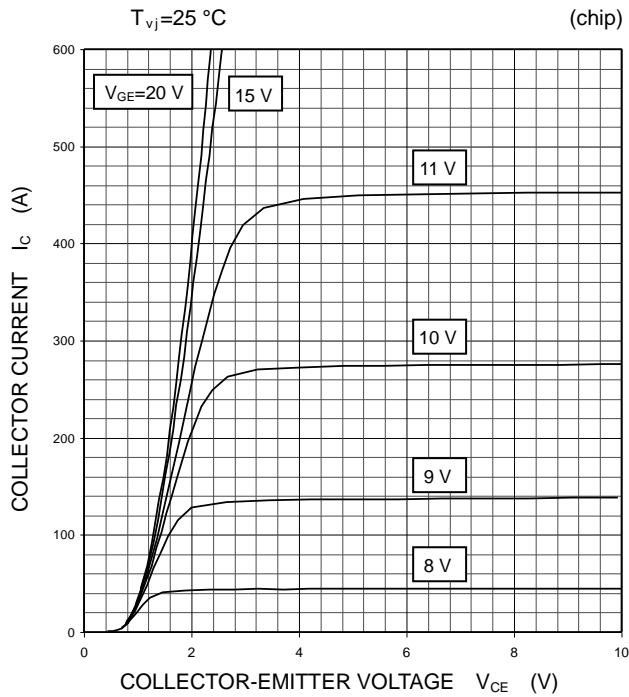
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HIGH POWER SWITCHING USE
INSULATED TYPE

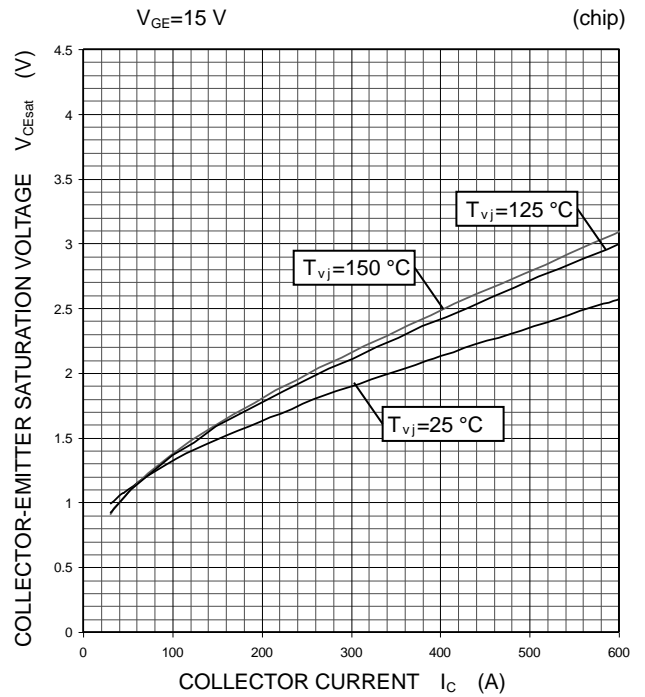
PERFORMANCE CURVES

INVERTER PART

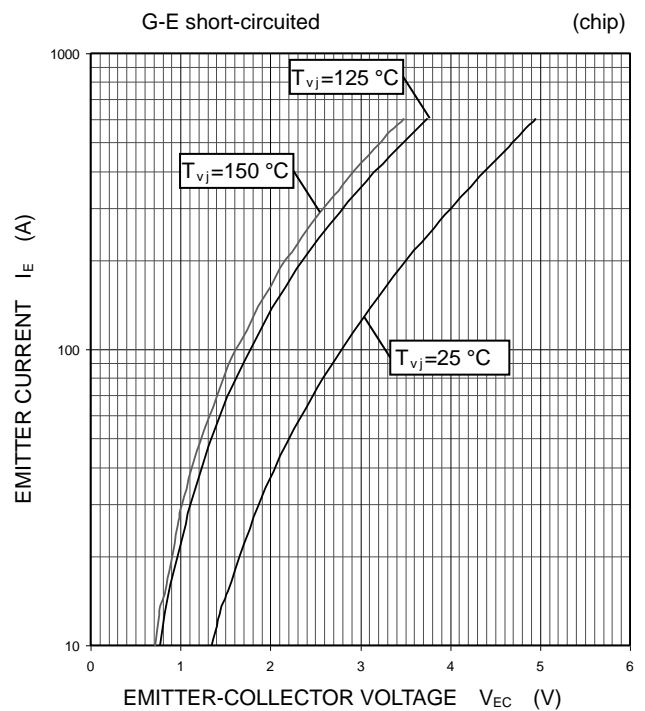
**OUTPUT CHARACTERISTICS
(TYPICAL)**



**COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)**



**FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)**



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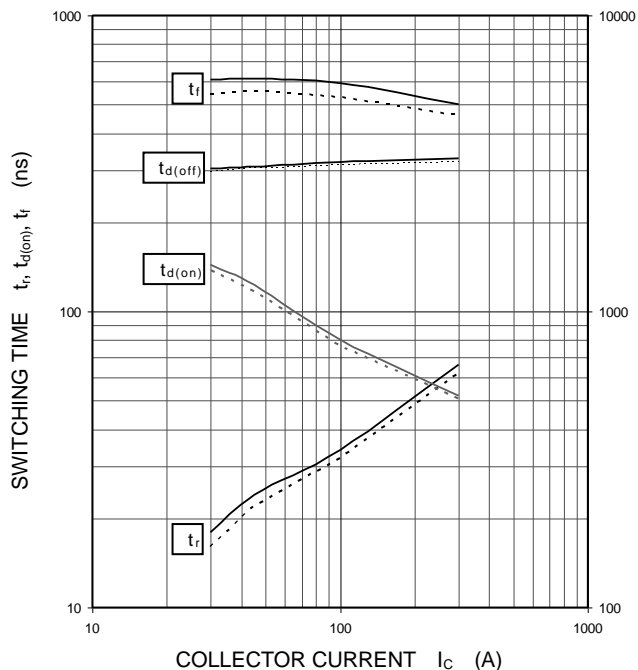
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

INVERTER PART

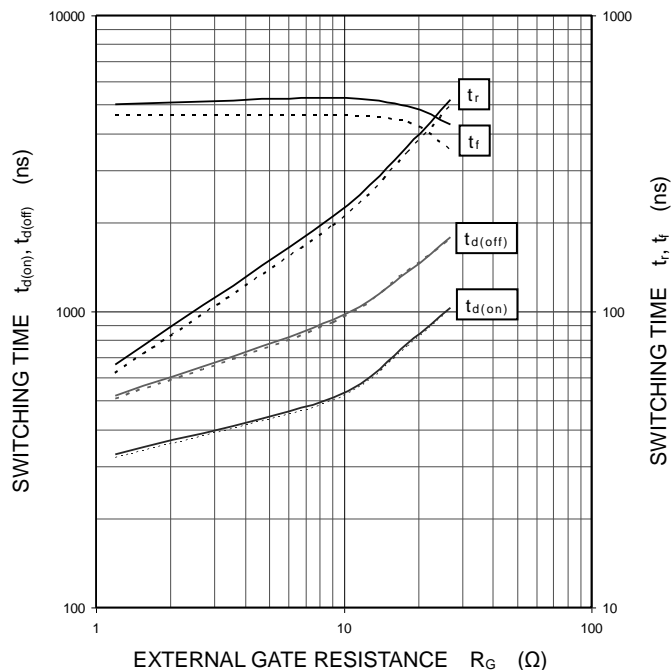
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$, $R_G=0\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - -: $T_{vj}=125\text{ }^\circ\text{C}$



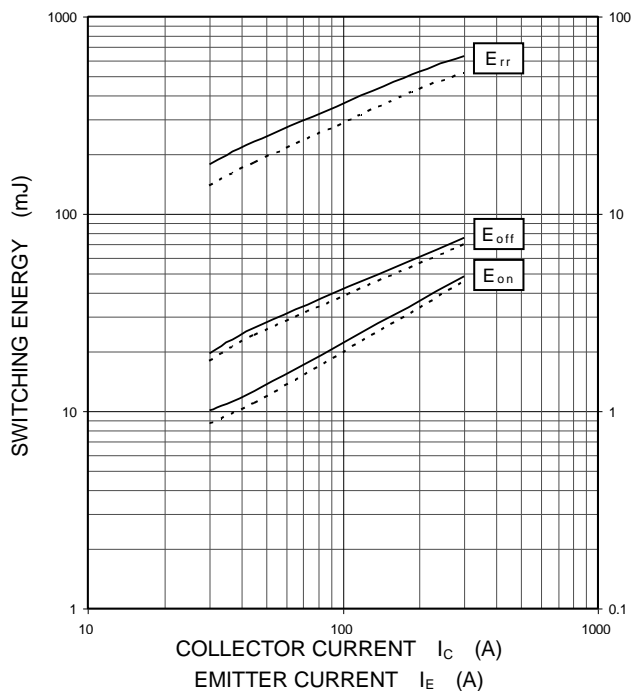
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$, $I_C=300\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - -: $T_{vj}=125\text{ }^\circ\text{C}$



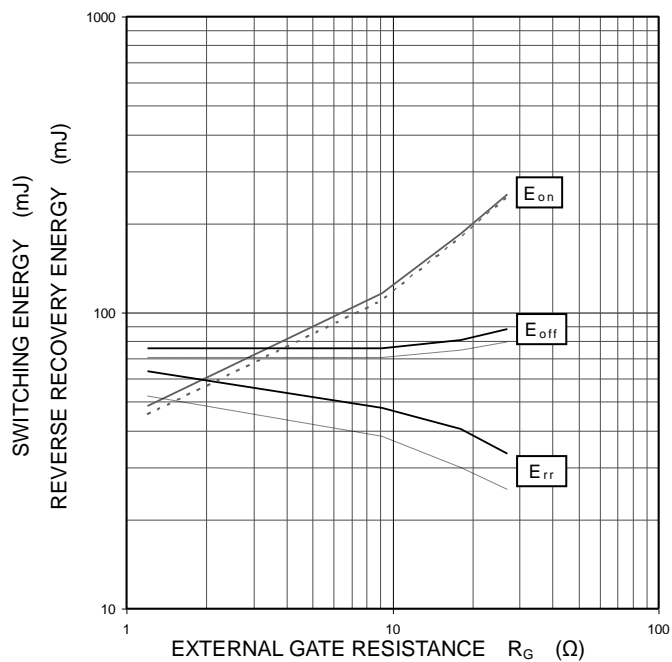
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$, $R_G=0\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD, PER PULSE
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - -: $T_{vj}=125\text{ }^\circ\text{C}$



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$, $I_C/I_E=300\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD, PER PULSE
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - -: $T_{vj}=125\text{ }^\circ\text{C}$



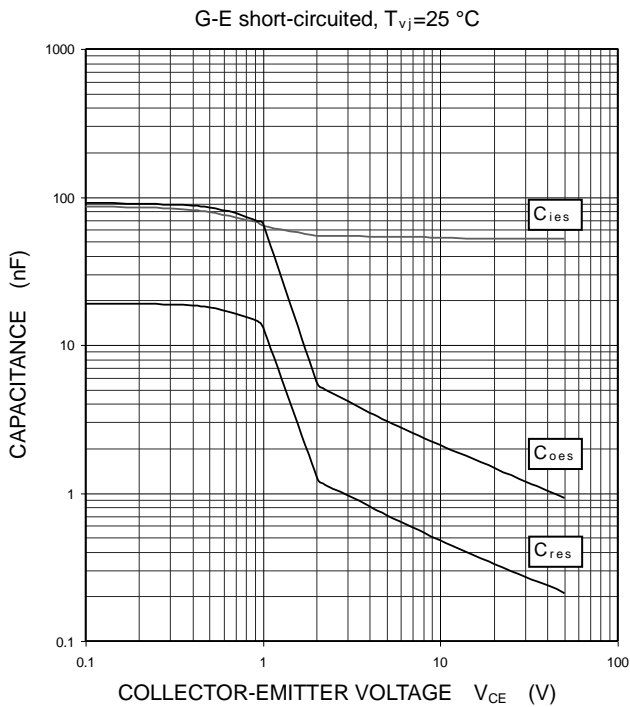
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HIGH POWER SWITCHING USE
INSULATED TYPE

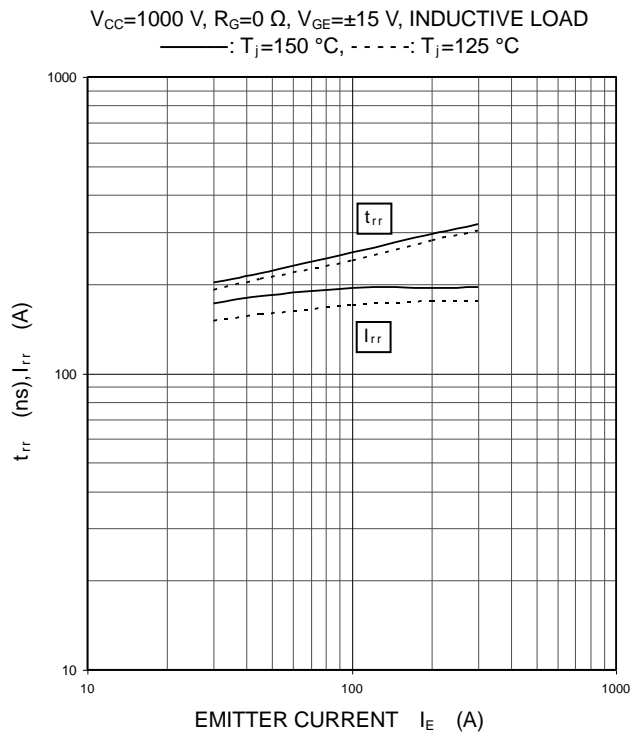
PERFORMANCE CURVES

INVERTER PART

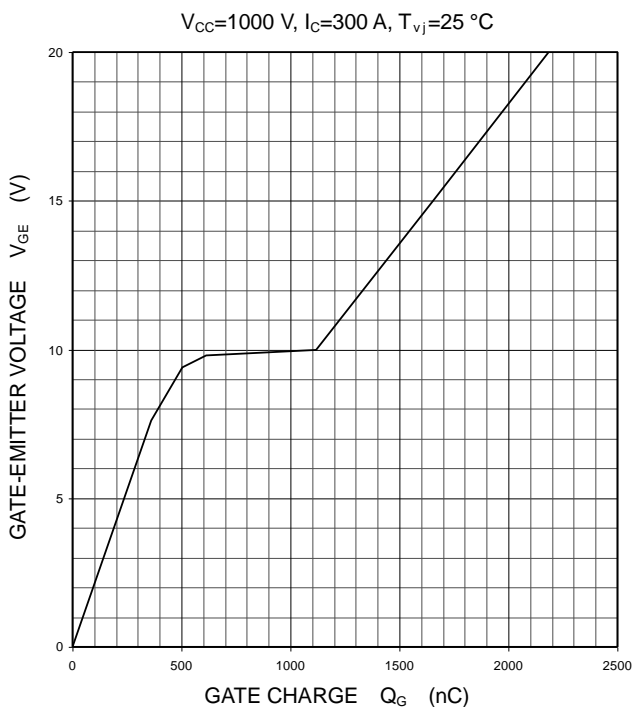
CAPACITANCE CHARACTERISTICS (TYPICAL)



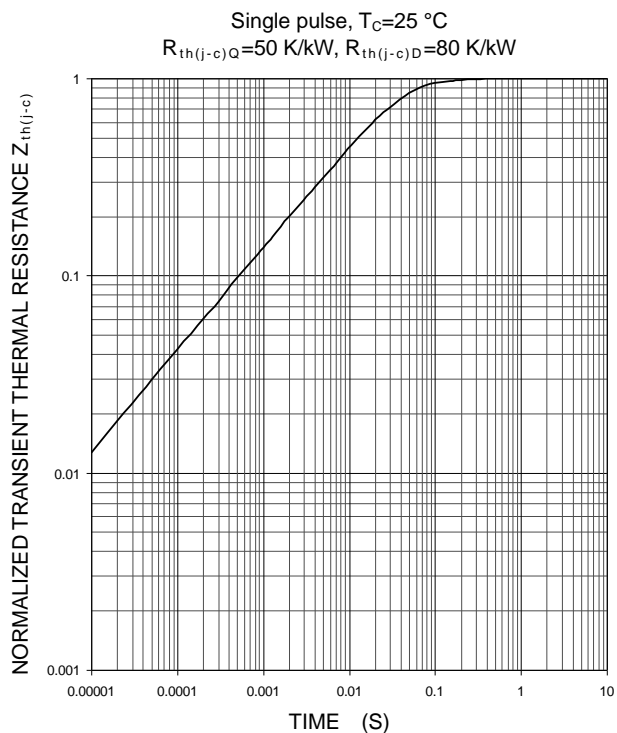
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



GATE CHARGE CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)



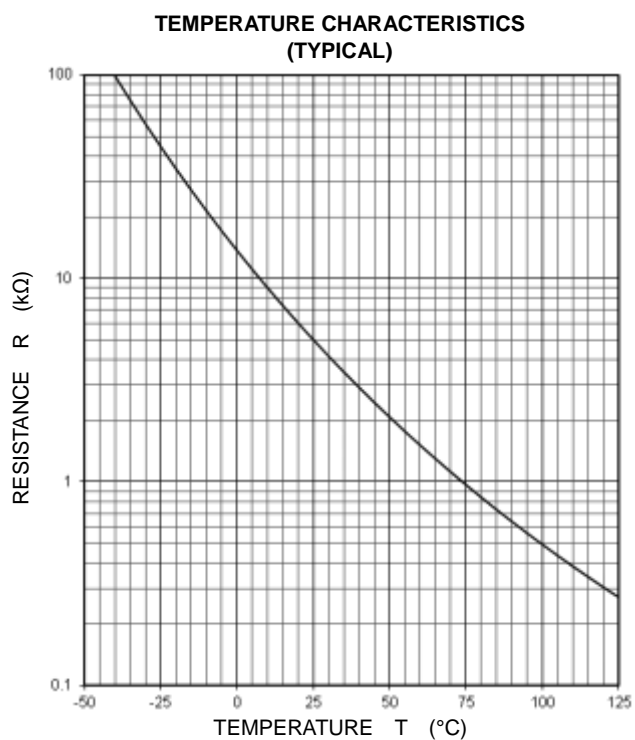
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HIGH POWER SWITCHING USE

INSULATED TYPE

PERFORMANCE CURVES

NTC thermistor part



Note: The characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

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