

<IGBT Modules>

CM1200DW-34T

HIGH POWER SWITCHING USE
INSULATED TYPE



Collector current I_C **1 2 0 0 A**
 Collector-emitter voltage V_{CES} **1 7 0 0 V**
 Maximum junction temperature T_{vjmax} **1 7 5 °C**

- Dual switch (Half-bridge)
- Copper base plate (Nickel-plating)
- Ni-plating signal terminals
- RoHS Directive compliant
- UL Recognized under UL1557, File No. E323585

APPLICATION

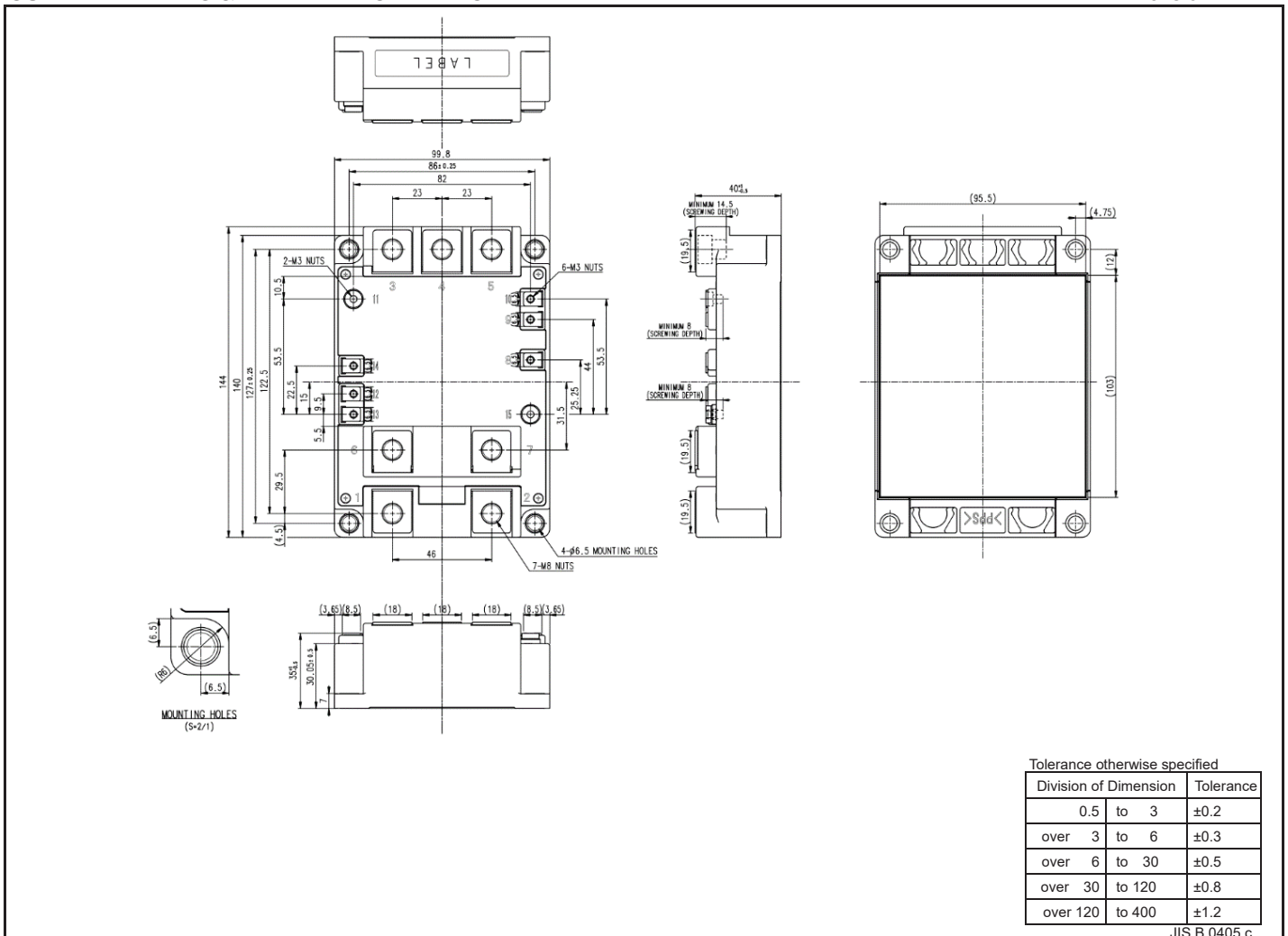
AC motor control, Wind power, etc.

OPTION (Below options are available.)

- PC-TIM (Phase Change Thermal Interface Material) pre-apply
- V_{CEsat} selection for parallel connection

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

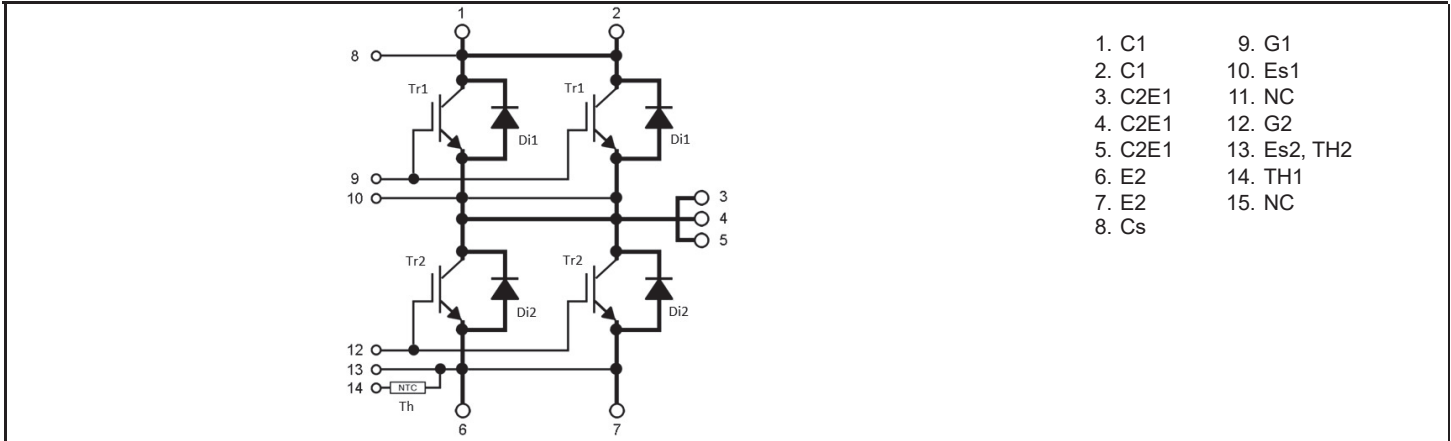
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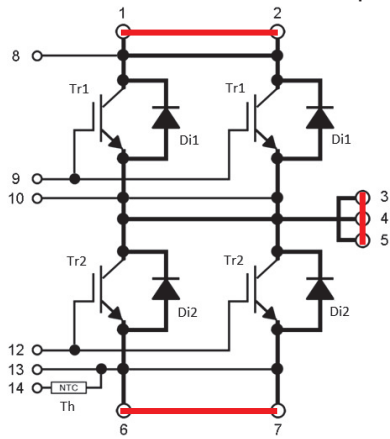
INTERNAL CONNECTION

TERMINAL CODE



NOTE

Terminal 1 and 2, Terminal 3,4 and 5, Terminal 6 and 7,
These terminals should be connected respectively when it is used.



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

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, $T_C=69\text{ }^{\circ}\text{C}$ (Note2, 4)	1200	A
I_{CRM}		Pulse, Repetitive (Note3)	2400	
P_{tot}	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	5355	W
I_E (Note1)	Emitter current	DC (Note2)	1200	A
I_{ERM} (Note1)		Pulse, Repetitive (Note3)	2400	
V_{isol}	Isolation voltage	Terminals to base plate, RMS, f=60Hz, AC 1min	4000	V
$T_{vj,max}$	Maximum junction temperature	Instantaneous event (overload) (Note9)	175	$^{\circ}\text{C}$
$T_{c,max}$	Maximum case temperature	(Note4, 9)	125	$^{\circ}\text{C}$
$T_{vj,op}$	Operating junction temperature	Continuous operation (Note9)	-40 ~ +150	$^{\circ}\text{C}$
T_{stg}	Storage temperature	-	-40 ~ +125	

ELECTRICAL CHARACTERISTICS ($T_{vj}=25\text{ }^{\circ}\text{C}$, 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	-	-	1.0	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	$I_C=120\text{ mA}$, $V_{CE}=10\text{ V}$	5.4	6	6.6	V	
V_{CESat}	Collector-emitter saturation voltage	$I_C=1200\text{ A}$ (Note5) $V_{GE}=15\text{ V}$, (Terminal)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	2.00	2.40	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	2.40	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	2.50	-	
		$I_C=1200\text{ A}$ (Note5) $V_{GE}=15\text{ V}$, (Chip)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.95	2.35	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	2.35	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	2.45	-	
C_{ies}	Input capacitance	$V_{CE}=10\text{ V}$, $V_{GE}=0\text{ V}$	-	-	330	nF	
C_{oes}	Output capacitance		-	-	8.7		
C_{res}	Reverse transfer capacitance		-	-	2.8		
Q_G	Gate charge	$V_{CC}=1000\text{ V}$, $I_C=1200\text{ A}$, $V_{GE}=15\text{ V}$	-	9.4	-	μC	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=1000\text{ V}$, $I_E=1200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, Inductive load	-	-	800	ns	
t_r	Rise time		-	-	200		
$t_{d(off)}$	Turn-off delay time		-	-	800		
t_f	Fall time		-	-	600		
V_{EC} (Note1)	Emitter-collector voltage	$I_E=1200\text{ A}$ (Note5) G-E short-circuited (Terminal)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	2.70	3.30	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	2.80	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	2.80	-	
		$I_E=1200\text{ A}$ (Note5), G-E short-circuited, (Chip)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	2.65	3.25	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	2.75	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	2.75	-	
t_{rr} (Note1)	Reverse recovery time	$V_{CC}=1000\text{ V}$, $I_E=1200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, Inductive load	-	-	300	ns	
Q_{rr} (Note1)	Reverse recovery charge		-	72	-		μC
E_{on}	Turn-on switching energy per pulse	$V_{CC}=1000\text{ V}$, $I_C=I_E=1200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, $T_{vj}=150\text{ }^{\circ}\text{C}$, Inductive load	-	138	-	mJ	
E_{off}	Turn-off switching energy per pulse		-	309	-		
E_{rr} (Note1)	Reverse recovery energy per pulse		-	220	-		
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip $T_C=25\text{ }^{\circ}\text{C}$ (Note4)	-	0.25	-	m Ω	
r_g	Internal gate resistance	Per switch	-	0.67	-	Ω	

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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 IGBT switch ^(Note4)	-	-	28	K/kW
R _{th(j-c)D}		Junction to case, per FWD seitch ^(Note4)	-	-	43	
R _{th(c-s)}	Contact thermal resistance	Case to heat sink, per 1 module, Thermal grease applied (Note4,7,9)	-	10	-	K/kW

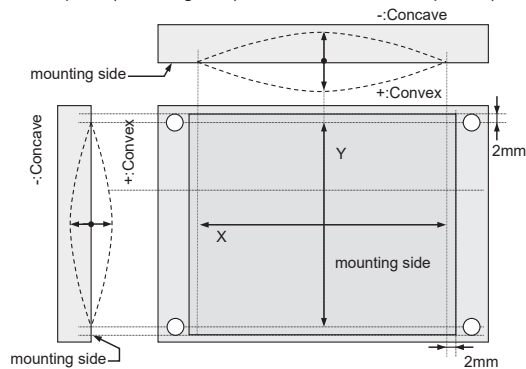
MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M _t	Mounting torque	Main terminals M 8 screw	7.0	10.5	14.0	N·m
M _s		Mounting to heat sink M 6 screw	3.5	4.0	4.5	
M _t		Auxiliary terminals M 3 screw	0.4	0.5	0.6	
d _s	Creepage distance	Terminal to terminal	17	-	-	mm
		Terminal to base plate	30	-	-	
d _a	Clearance	Terminal to terminal	8.5	-	-	mm
		Terminal to vase plate	28	-	-	
e _c	Flatness of base plate	On the centerline X, Y (Note8)	0	-	+200	μm
m	mass	-	-	860	-	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 and (EU)2015/863.

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]
- Reference value. Thermally conductive grease of thermal conductivity λ=0.9 W/(m·K) and thickness D(C-S)=50 μm.
- The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



- Long term performance related to thermal conductive grease (including but not limited to aspects such as the increase of thermal resistance due to pumping out, etc.) should be verified under user's specific application conditions. Each temperature condition (T_{vjmax}, T_{vjop}, T_{Cmax}) must be maintained below the maximum rated temperature throughout consideration of the temperature rise even for long term usage.

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HIGH POWER SWITCHING USE
INSULATED TYPE

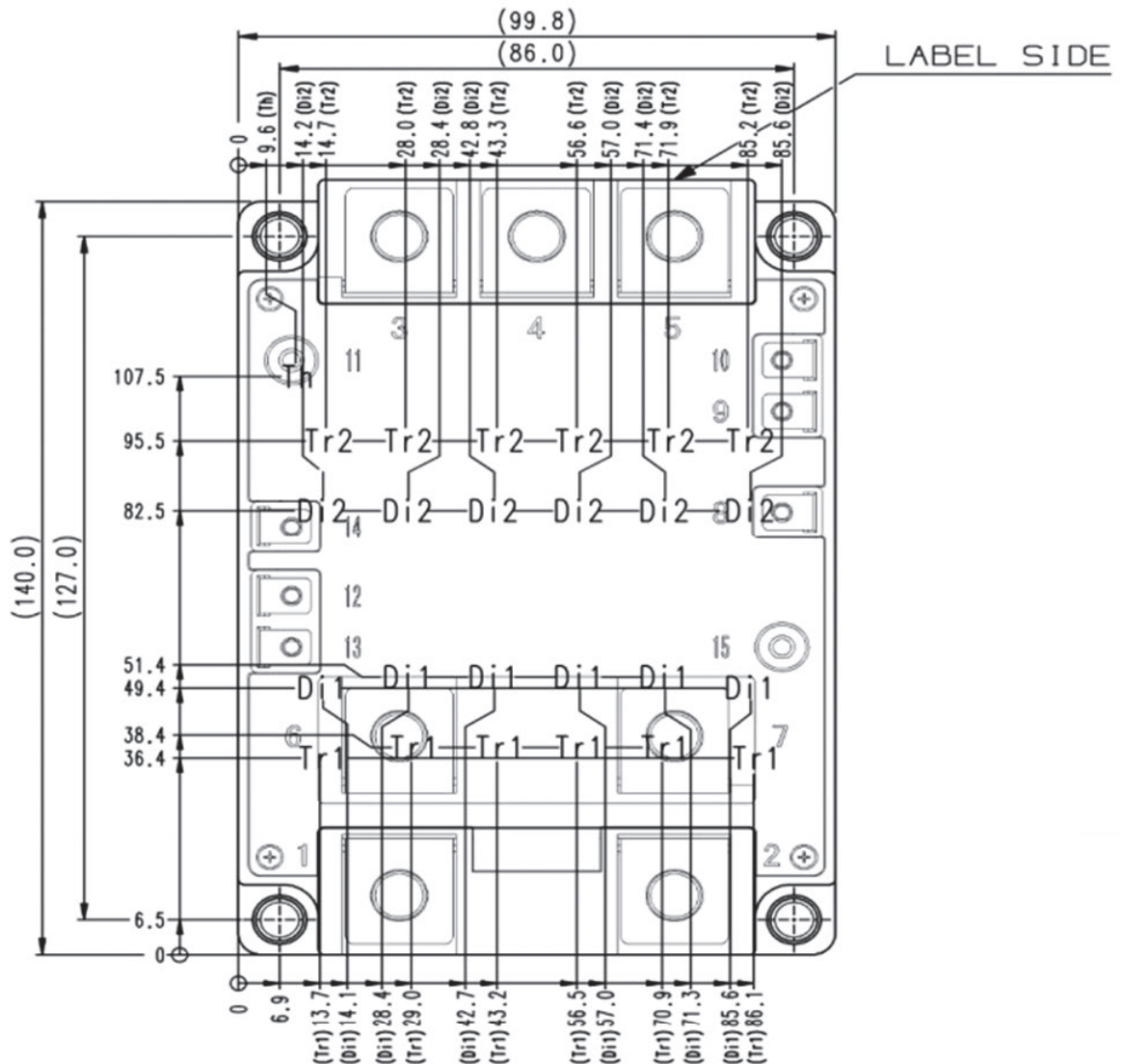
RECOMMENDED OPERATING CONDITIONS

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-Es1/G2-Es2 terminals	13.5	15.0	16.5	V	
R_G	External gate resistance	Per switch	on	0	-	6.8	Ω
			off	0	-	15	Ω

Optimum operating conditions should be selected with careful confirmation for no occurrence of any maximum rating violation (T_{vj} , V_{CES} , etc.) or any unexpected malfunction (arm-short-through, oscillation, etc.) at the actual application conditions.

CHIP LOCATION (Top view)

Dimension in mm, tolerance: ± 1 mm

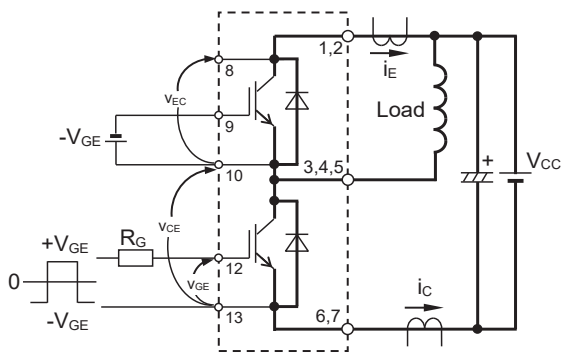


Tr1/Tr2: IGBT, Di1/Di2: FWD, Th: NTC thermistor

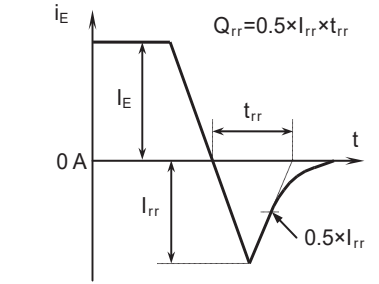
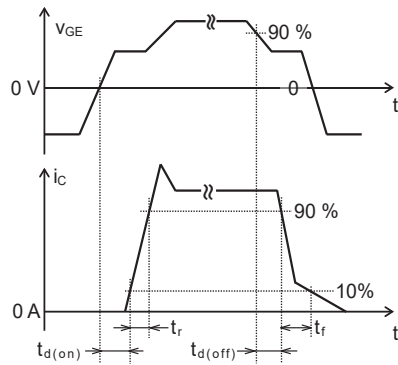
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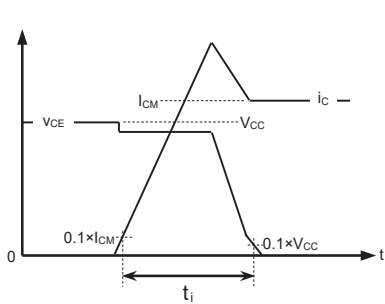
TEST CIRCUIT AND WAVEFORMS



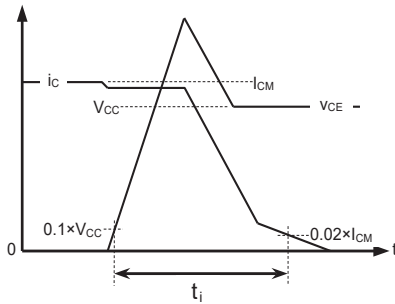
Switching characteristics test circuit and waveforms



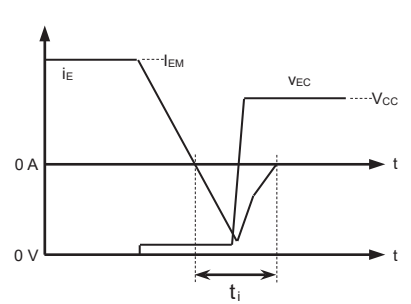
t_{rr} , Q_{rr} characteristics test waveform



IGBT Turn-on switching energy



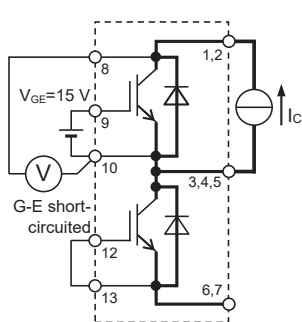
IGBT Turn-off switching energy



FWD Reverse recovery energy

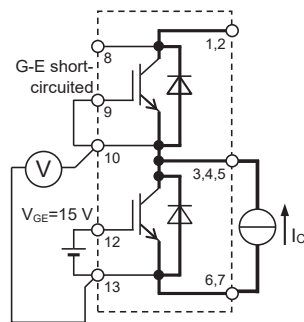
Switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

TEST CIRCUIT

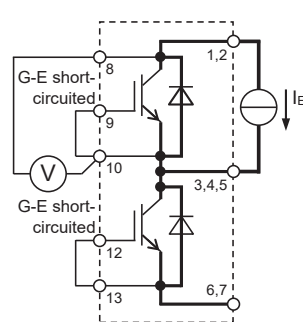


Tr1

V_{CEsat} characteristics test circuit

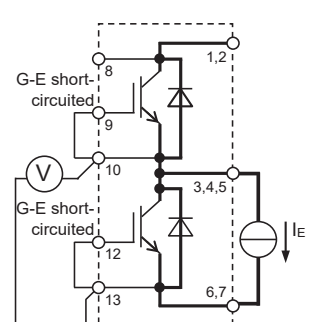


Tr2



Di1

V_{CE} characteristics test circuit



Di2

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HIGH POWER SWITCHING USE
INSULATED TYPE

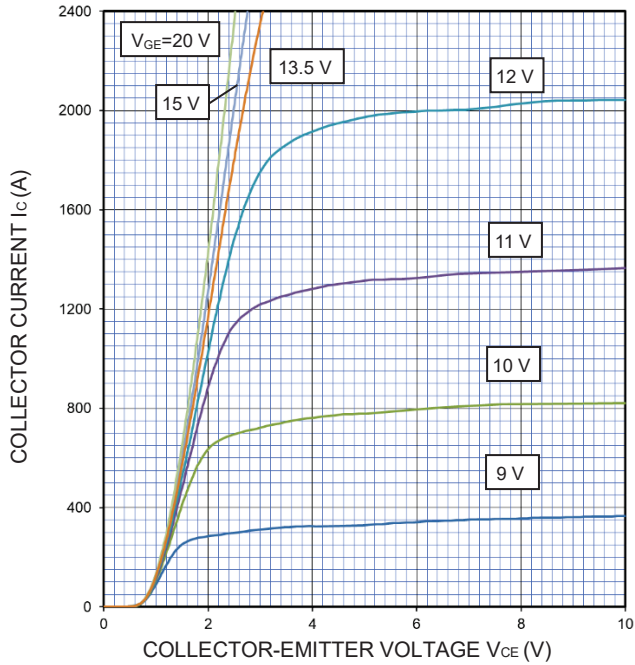
PERFORMANCE CURVES

INVERTER PART

OUTPUT CHARACTERISTICS

(TYPICAL)

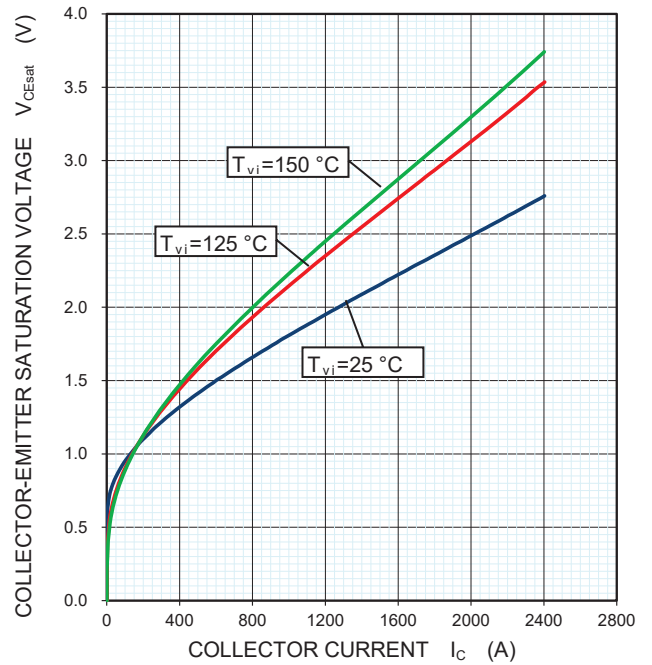
$T_{vj}=25^{\circ}\text{C}$ (chip)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS

(TYPICAL)

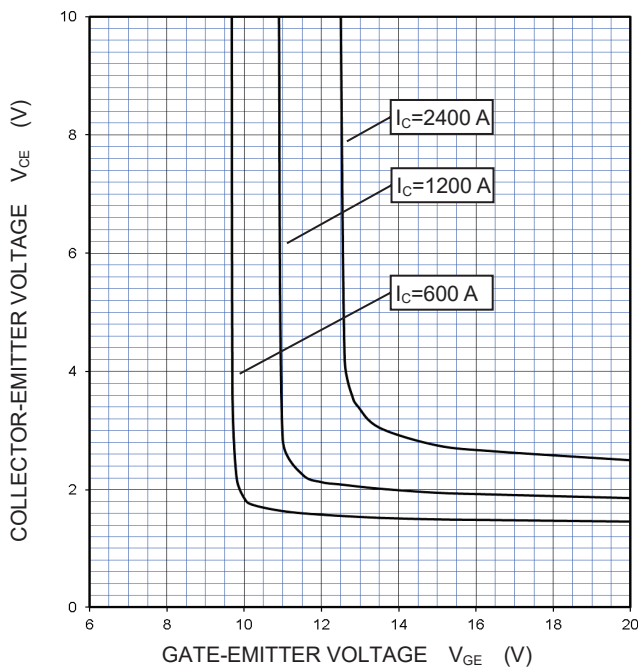
$V_{ge}=15\text{V}$ (chip)



COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS

(TYPICAL)

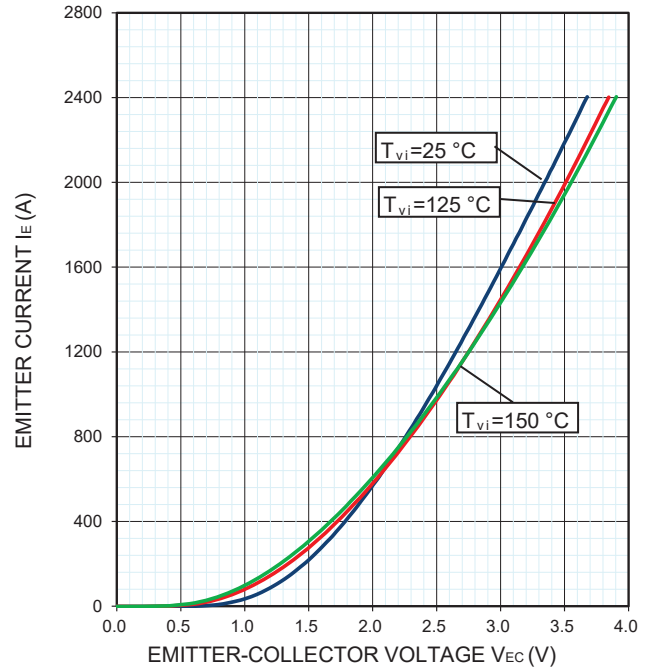
$T_{vj}=25^{\circ}\text{C}$ (chip)



FREE WHEELING DIODE FORWARD CHARACTERISTICS

(TYPICAL)

G-E short-circuited (chip)



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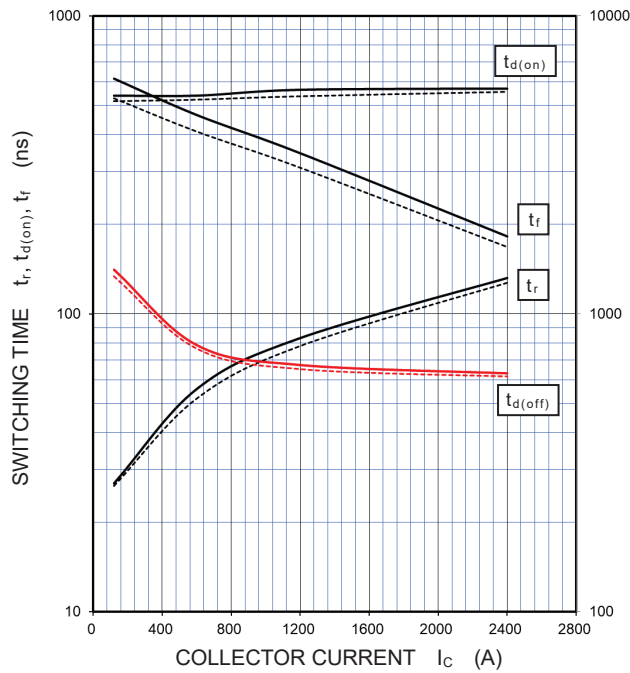
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

INVERTER PART

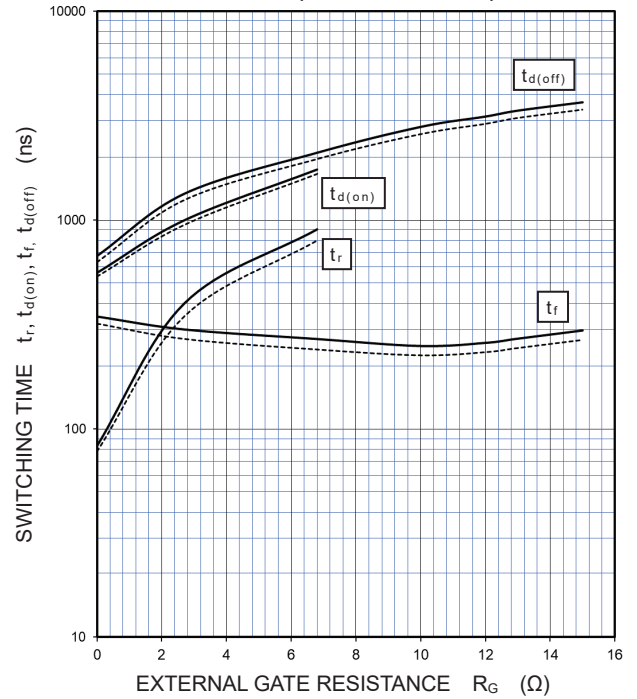
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

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



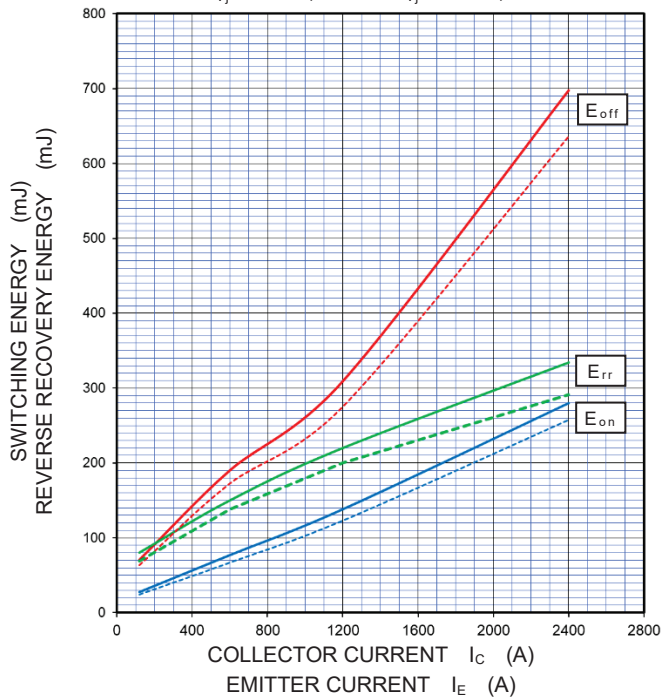
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$, $I_C=1200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



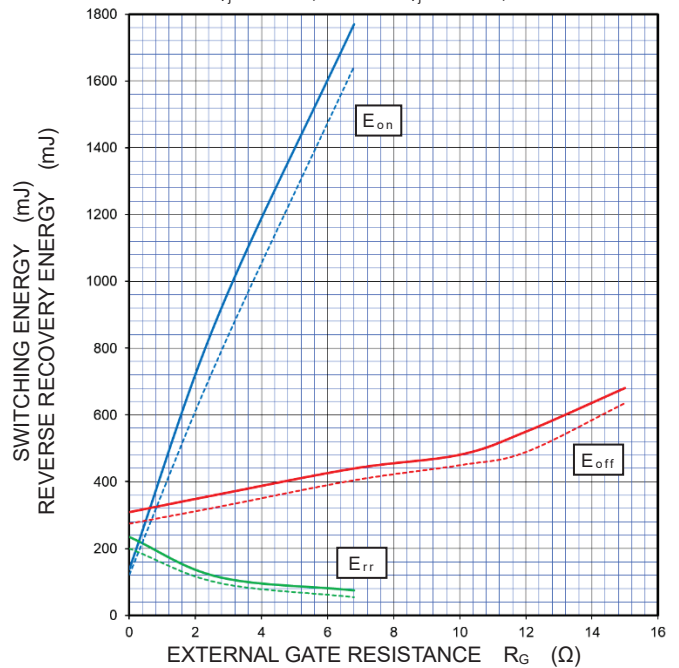
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

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



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$, $I_C/I_E=1200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD, PER PULSE
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



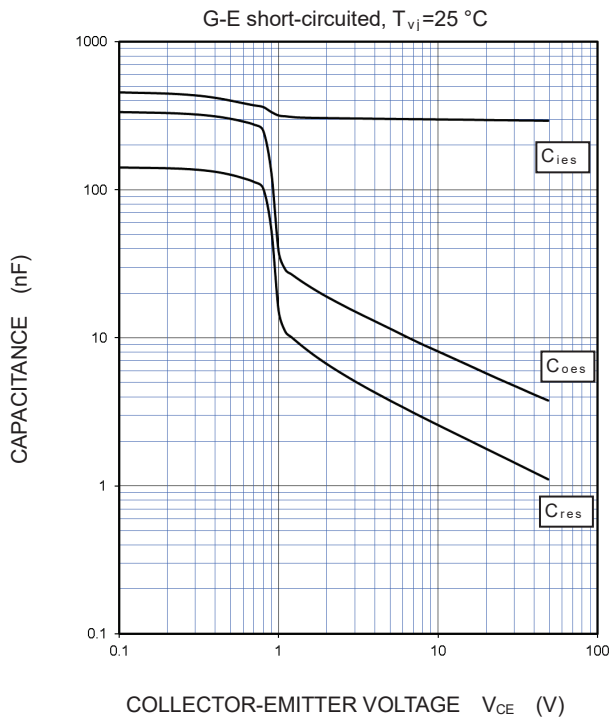
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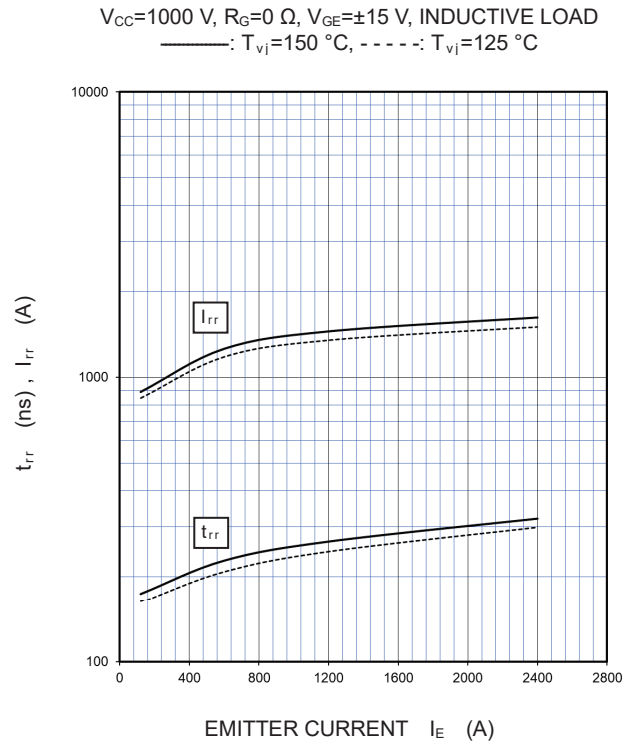
PERFORMANCE CURVES

INVERTER PART

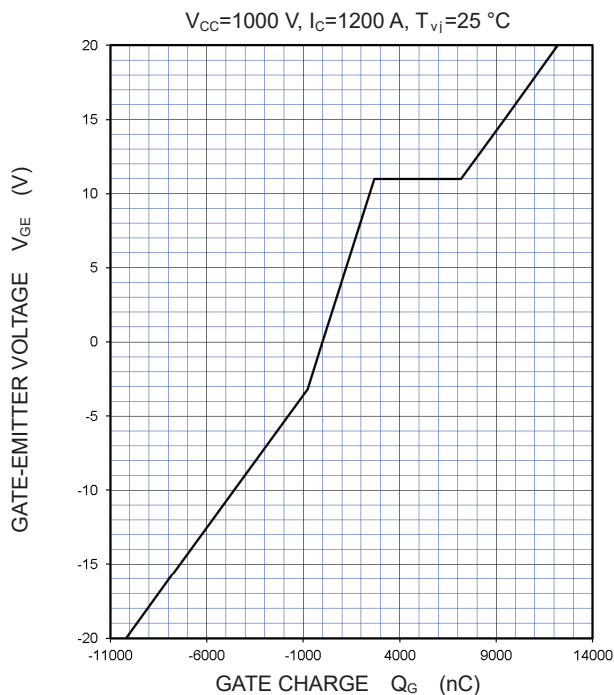
CAPACITANCE CHARACTERISTICS (TYPICAL)



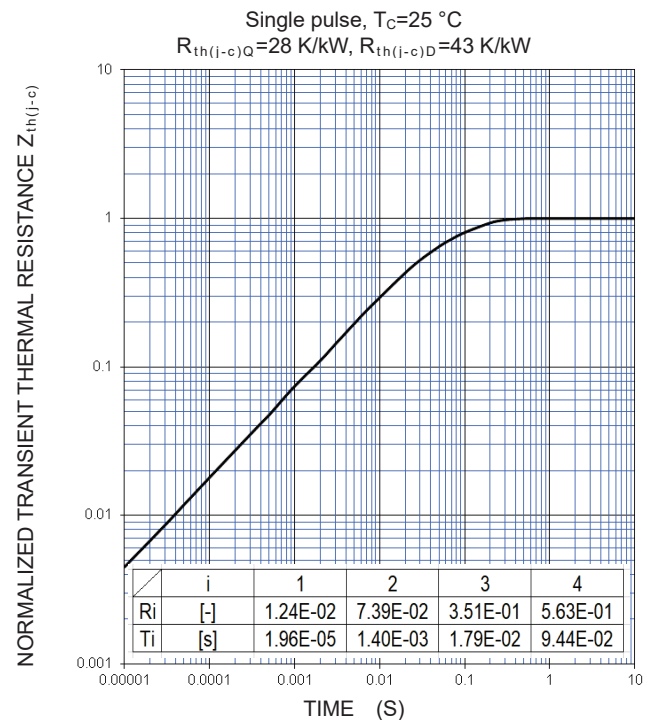
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



GATE CHARGE CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)



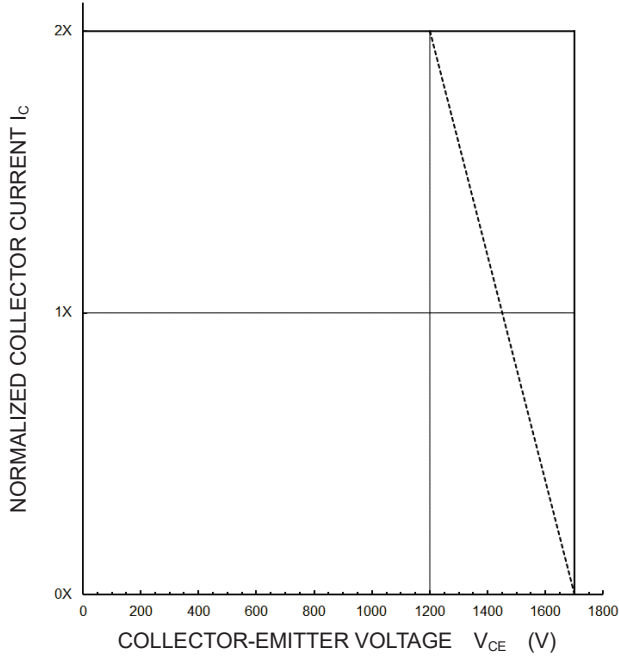
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PERFORMANCE CURVES

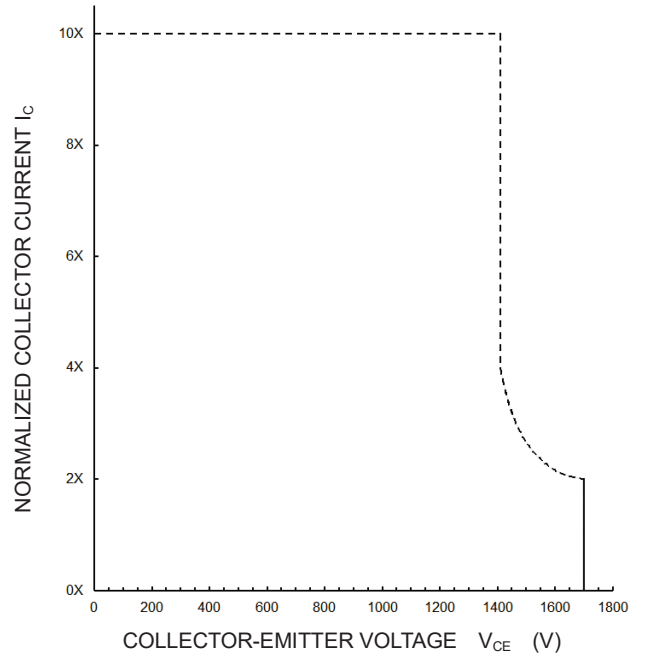
**TURN-OFF SWITCHING SAFE OPERATING AREA
(REVERSE BIAS SAFE OPERATING AREA)
(MAXIMUM)**

$V_{CC} \leq 1200 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{G(off)} = 0 \sim 15 \Omega$,
 —: $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$ (Normal load operations (Continuous))
 - - - -: $T_{vj} = 175 \text{ }^\circ\text{C}$ (Unusual load operations (Limited period))



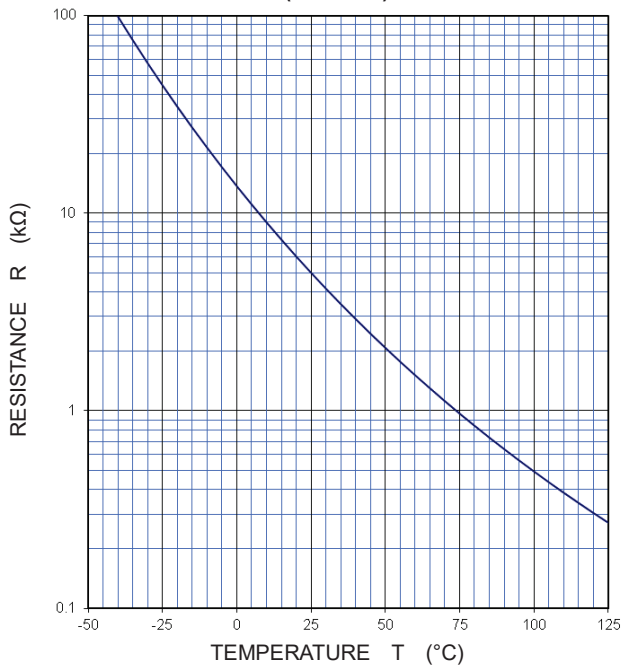
**SHORT-CIRCUIT SAFE OPERATING AREA
(MAXIMUM)**

$V_{CC} \leq 1200 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$,
 $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$, $t_w \leq 8 \mu\text{s}$, Non-Repetitive



NTC thermistor part

**TEMPERATURE CHARACTERISTICS
(TYPICAL)**



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

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HIGH POWER SWITCHING USE
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Important Notice

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