

<IGBT Modules>

# CM300DX-24T1/CM300DXP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE

DX



Collector current  $I_c$  ..... **3 0 0 A**  
 Collector-emitter voltage  $V_{CES}$  ..... **1 2 0 0 V**  
 Maximum junction temperature  $T_{vjmax}$  ..... **1 7 5 °C**

- Flat base type
- Copper base plate (Nickel-plating)
- RoHS Directive compliant
- Tin-plating pin terminals

DXP



Collector current  $I_c$  ..... **3 0 0 A**  
 Collector-emitter voltage  $V_{CES}$  ..... **1 2 0 0 V**  
 Maximum junction temperature  $T_{vjmax}$  ..... **1 7 5 °C**

- Flat base type
- Copper base plate (Nickel-plating)
- RoHS Directive compliant
- Tin-plating pressfit terminals

**dual switch (half-bridge)**

- UL Recognized under UL1557, File No. E323585

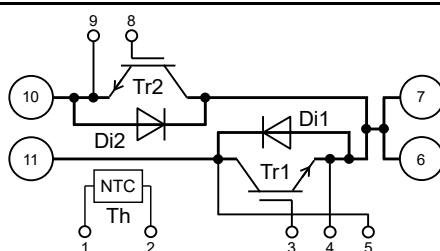
## APPLICATION

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

## OPTION (Below options are available.)

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

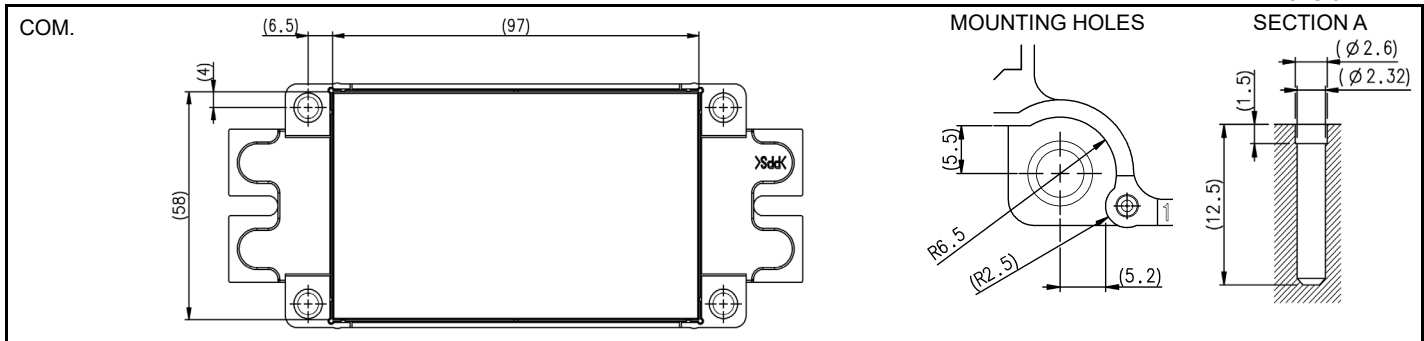
## INTERNAL CONNECTION



## TERMINAL CODE

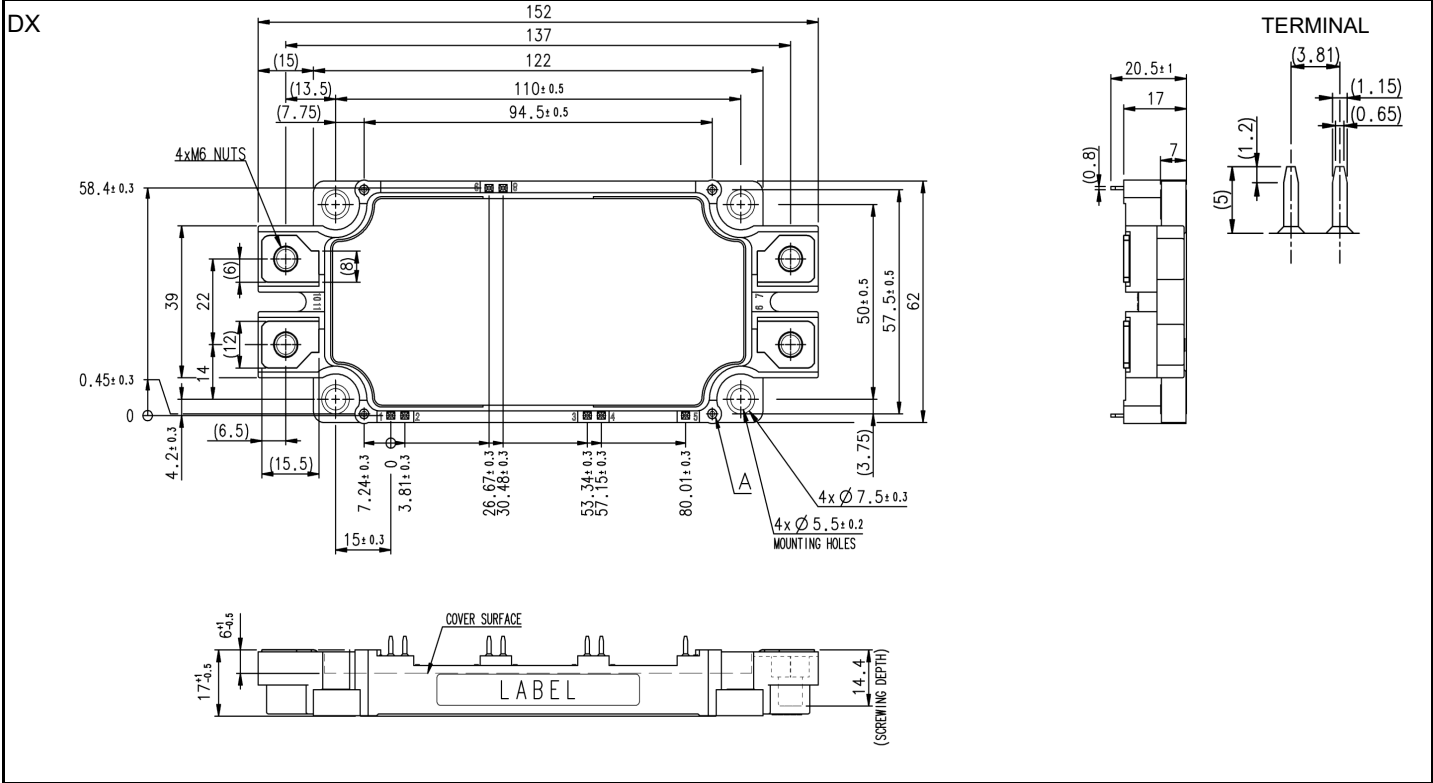
- |        |         |
|--------|---------|
| 1. TH1 | 6. C2E1 |
| 2. TH2 | 7. C2E1 |
| 3. G1  | 8. G2   |
| 4. Es1 | 9. Es2  |
| 5. Cs1 | 10. E2  |
|        | 11. C1  |

## OUTLINE DRAWING



<IGBT Modules>  
CM300DX-24T1/CM300DXP-24T1  
HIGH POWER SWITCHING USE  
INSULATED TYPE

OUTLINE DRAWING



Tolerance otherwise specified

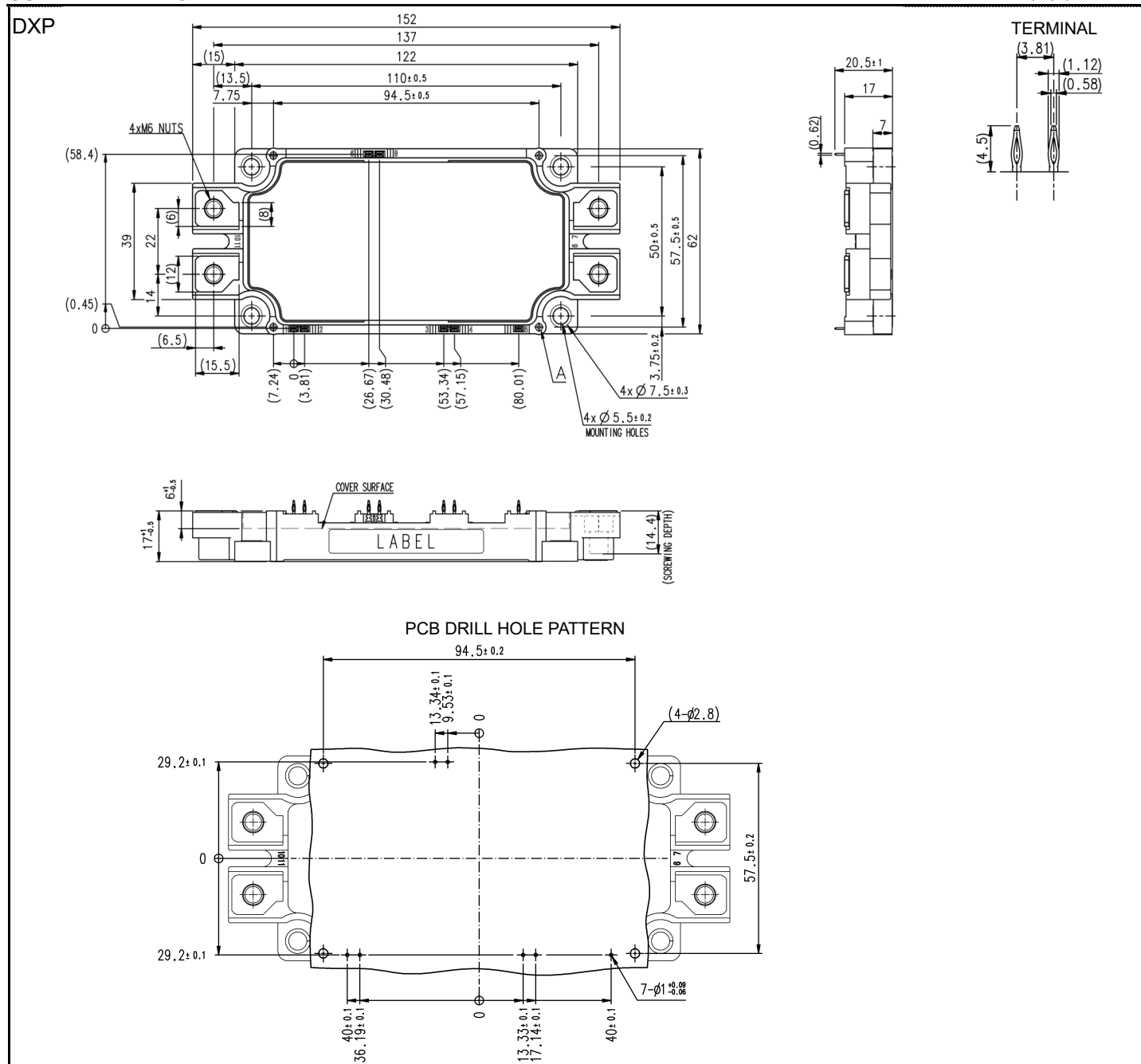
Division of Dimension	Tolerance
0.5 to 3	±0.2
over 3 to 6	±0.3
over 6 to 30	±0.5
over 30 to 120	±0.8
over 120 to 400	±1.2

## CM300DX-24T1/CM300DXP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE

## OUTLINE DRAWING

**Dimension in mm**



Tolerance otherwise specified

Division of Dimension		Tolerance
0.5	to 3	$\pm 0.2$
over 3	to 6	$\pm 0.3$
over 6	to 30	$\pm 0.5$
over 30	to 120	$\pm 0.8$
over 120	to 400	$\pm 1.2$

## CM300DX-24T1/CM300DXP-24T1

HIGH POWER SWITCHING USE

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MAXIMUM 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	1200	V
$V_{GES}$	Gate-emitter voltage	C-E short-circuited	$\pm 20$	V
$I_C$	Collector current	DC, $T_C=99\text{ }^{\circ}\text{C}$ (Note2, 4)	300	A
$I_{CRM}$		Pulse, Repetitive (Note3)	600	
$P_{tot}$	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	1470	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	2500	V
$T_{vjmax}$	Maximum junction temperature	Instantaneous event (overload) (Note9)	175	$^{\circ}\text{C}$
$T_{Cmax}$	Maximum case temperature	(Note4, 9)	125	
$T_{vjop}$	Operating junction temperature	Continuous operation (under switching) (Note9)	-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	$\mu\text{A}$
$V_{GE(th)}$	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)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.80	2.15	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	2.05	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	2.15	-	
$V_{CEsat}$ (Chip)		$I_C=300\text{ A}$ , $V_{GE}=15\text{ V}$ , (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.70	2.00	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.95	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	2.05	-	
$C_{ies}$	Input capacitance	$V_{CE}=10\text{ V}$ , G-E short-circuited	-	-	55	nF
$C_{oes}$	Output capacitance		-	-	1.65	
$C_{res}$	Reverse transfer capacitance		-	-	0.66	
$Q_G$	Gate charge	$V_{CC}=600\text{ V}$ , $I_C=300\text{ A}$ , $V_{GE}=15\text{ V}$	-	1.7	-	$\mu\text{C}$
$t_{d(on)}$	Turn-on delay time	$V_{CC}=600\text{ V}$ , $I_C=300\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ , $R_G=1.6\text{ }\Omega$ , Inductive load	-	-	600	ns
$t_r$	Rise time		-	-	300	
$t_{d(off)}$	Turn-off delay time		-	-	800	
$t_f$	Fall time		-	-	400	
$V_{EC}$ (Note1) (Terminal)	Emitter-collector voltage	$I_E=300\text{ A}$ , G-E short-circuited, Refer to the figure of test circuit (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.75	2.15	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.80	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	1.85	-	
$V_{EC}$ (Note1) (Chip)		$I_E=300\text{ A}$ , G-E short-circuited, (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.65	2.00	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.70	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	1.70	-	
$t_{rr}$ (Note1)	Reverse recovery time	$V_{CC}=600\text{ V}$ , $I_E=300\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ , $R_G=1.6\text{ }\Omega$ , Inductive load	-	-	400	ns
$Q_{rr}$ (Note1)	Reverse recovery charge		-	25.7	-	$\mu\text{C}$
$E_{on}$	Turn-on switching energy per pulse	$V_{CC}=600\text{ V}$ , $I_C=I_E=300\text{ A}$ ,	-	36.0	-	mJ
$E_{off}$	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$ , $R_G=1.6\text{ }\Omega$ , $T_{vj}=150\text{ }^{\circ}\text{C}$ ,	-	28.0	-	
$E_{rr}$ (Note1)	Reverse recovery energy per pulse	Inductive load	-	18.0	-	mJ
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, $T_C=25\text{ }^{\circ}\text{C}$ (Note4)	-	0.94	-	m $\Omega$
$r_g$	Internal gate resistance	Per switch	-	1.3	-	$\Omega$

## CM300DX-24T1/CM300DXP-24T1

HIGH POWER SWITCHING USE

INSULATED TYPE

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

## NTC THERMISTOR PART

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{25}$	Zero-power resistance	$T_C=25\text{ }^{\circ}\text{C}$ (Note4)	4.85	5.00	5.15	k $\Omega$
$\Delta R/R$	Deviation of resistance	$R_{100}=493\text{ }\Omega$ , $T_C=100\text{ }^{\circ}\text{C}$ (Note4)	-7.3	-	+7.8	%
$B_{(25/50)}$	B-constant	Approximate by equation (Note6)	-	3375	-	K
$P_{25}$	Power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (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)	-	-	102	K/kW
$R_{th(j-c)D}$		Junction to case, per Inverter FWD (Note4)	-	-	150	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module Thermal grease applied (Note4, 7,9)	-	11.5	-	K/kW

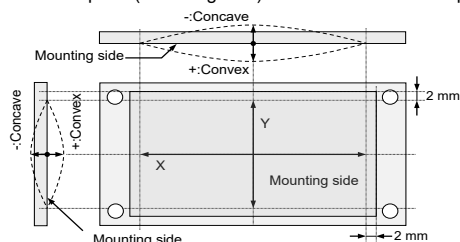
## MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions		Limits			Unit
				Min.	Typ.	Max.	
M <sub>t</sub>	Mounting torque	Main terminals M 6 screw		3.5	4.0	4.5	N·m
M <sub>s</sub>	Mounting torque	Mounting to heat sink M 5 screw		2.5	3.0	3.5	N·m
d <sub>s</sub>	Creepage distance	Solder pin type (DX)	Terminal to terminal	17	-	-	mm
			Terminal to base plate	16.4	-	-	
		Pressfit pin type (DXP)	Terminal to terminal	17	-	-	mm
			Terminal to base plate	16.8	-	-	
d <sub>a</sub>	Clearance	Solder pin type (DX)	Terminal to terminal	10	-	-	mm
			Terminal to base plate	16.2	-	-	
		Pressfit pin type (DXP)	Terminal to terminal	10	-	-	mm
			Terminal to base plate	16.2	-	-	
e <sub>c</sub>	Flatness of base plate	On the centerline X, Y (Note8)		±0	-	+200	μm
m	mass	-		-	300	-	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  $T_{vj\max}$  rating.
- Pulse width and repetition rate should be such that the device junction temperature ( $T_{vj}$ ) dose not exceed  $T_{vj\max}$  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.
- $B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$   
 $R_{25}$ : resistance at absolute temperature  $T_{25}$  [K];  $T_{25}=25\text{ }^{\circ}\text{C}+273.15=298.15$  [K]  
 $R_{50}$ : resistance at absolute temperature  $T_{50}$  [K];  $T_{50}=50\text{ }^{\circ}\text{C}+273.15=323.15$  [K]
- Reference value. Thermally conductive grease of thermal conductivity  $\lambda=0.9\text{ W/(m}\cdot\text{K)}$  and thickness  $D_{(c-s)}=50\text{ }\mu\text{m}$ .
- 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 ( $T_{vj\max}$ ,  $T_{vj\text{op}}$ ,  $T_{C\max}$ ) must be maintained below the maximum rated temperature throughout consideration of the temperature rise even for long term usage.

**CM300DX-24T1/CM300DXP-24T1**

HIGH POWER SWITCHING USE

INSULATED TYPE

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

PCB thickness : 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	0.75 ± 0.075 N·m	
		φ2.6×12		

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$V_{CC}$	(DC) Supply voltage	Applied across C1-E2 terminals	-	600	850	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	1.6	-	16	Ω

Dimension in mm, tolerance:  $\pm 1$  mm

Technical drawing of the front view of a 12U rack. The drawing shows a symmetrical structure with two main vertical sections. Dimensions are provided in millimeters. Key dimensions include: overall width (122 mm), overall height (62 mm), and various internal offsets and hole positions. Labels include 'Tr1', 'Di1', 'Th', 'Tr2', 'Di2', and 'LABEL SIDE'.

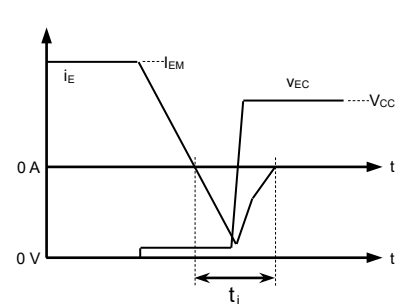
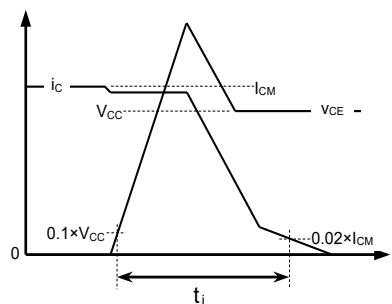
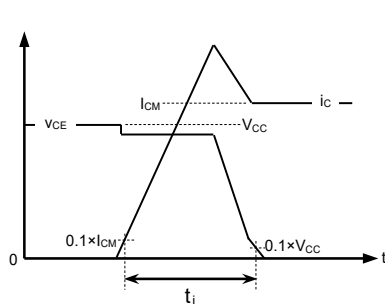
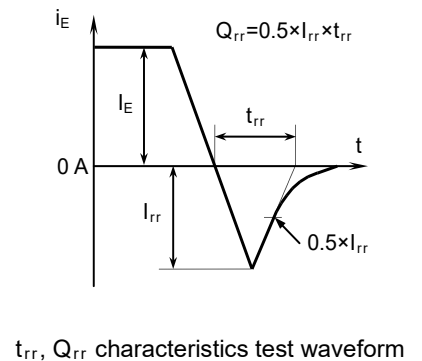
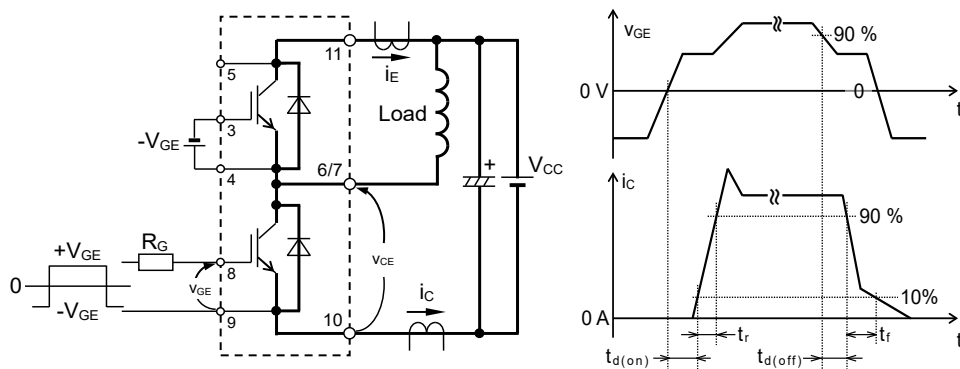
[illegible]

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

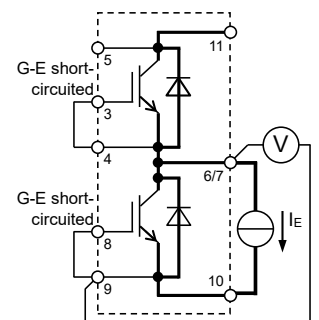
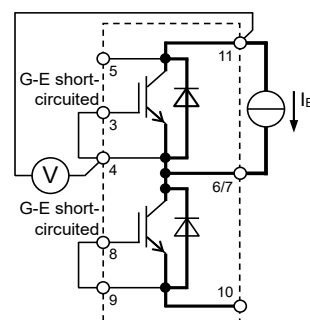
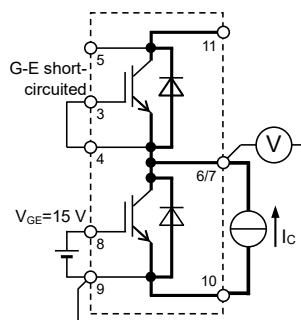
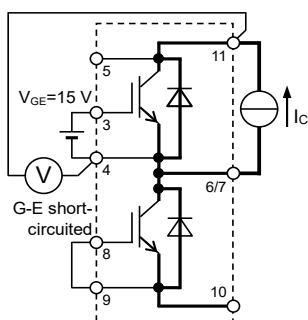
**CM300DX-24T1/CM300DXP-24T1**

HIGH POWER SWITCHING USE

INSULATED TYPE

**TEST CIRCUIT AND WAVEFORMS**

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

**TEST CIRCUIT** $V_{CE}$  characteristics test circuit



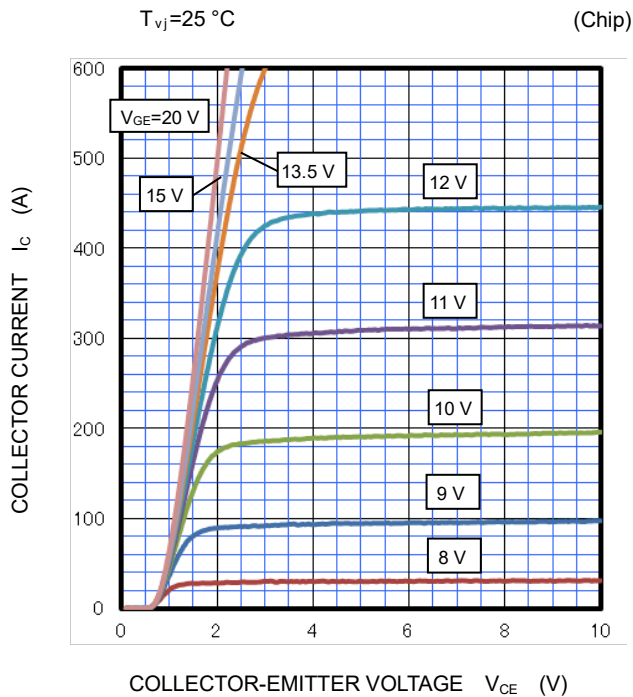
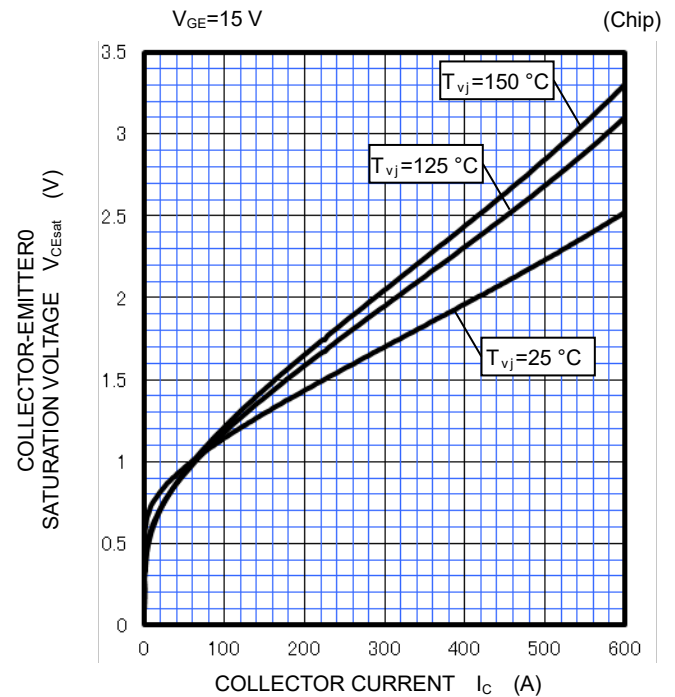
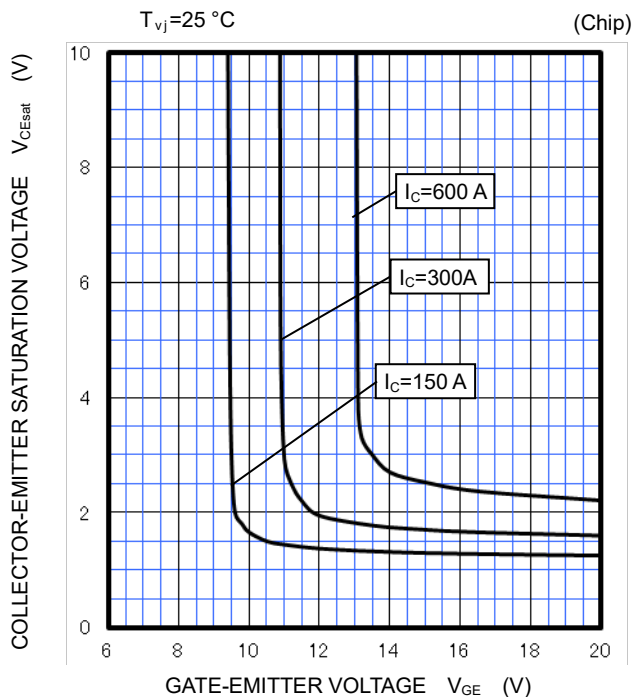
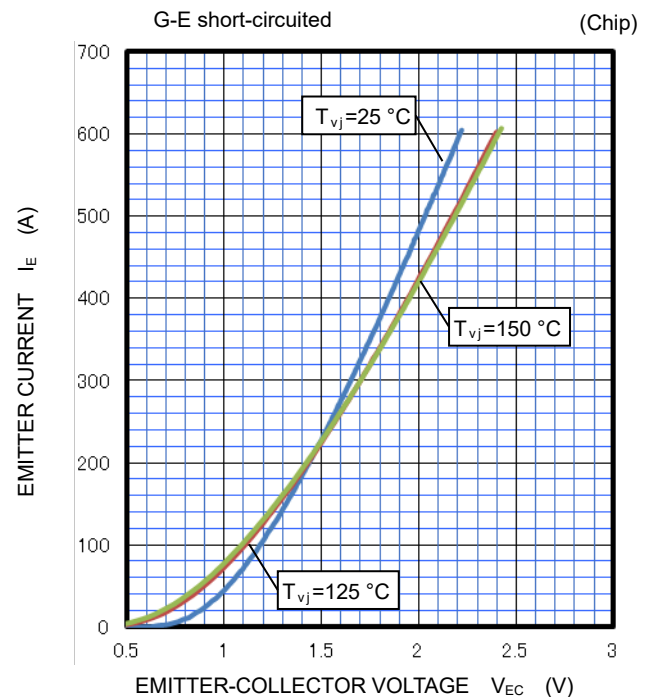
**CM300DX-24T1/CM300DXP-24T1**

HIGH POWER SWITCHING USE

INSULATED TYPE

**PERFORMANCE CURVES****INVERTER PART****OUTPUT CHARACTERISTICS**

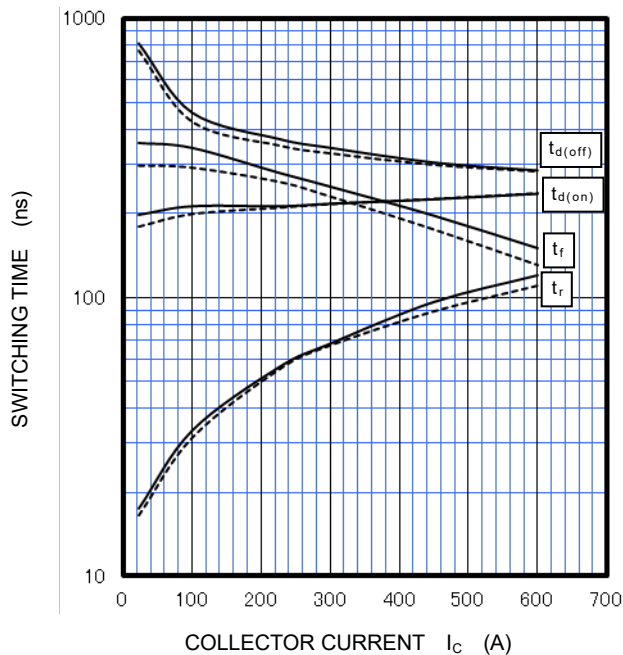
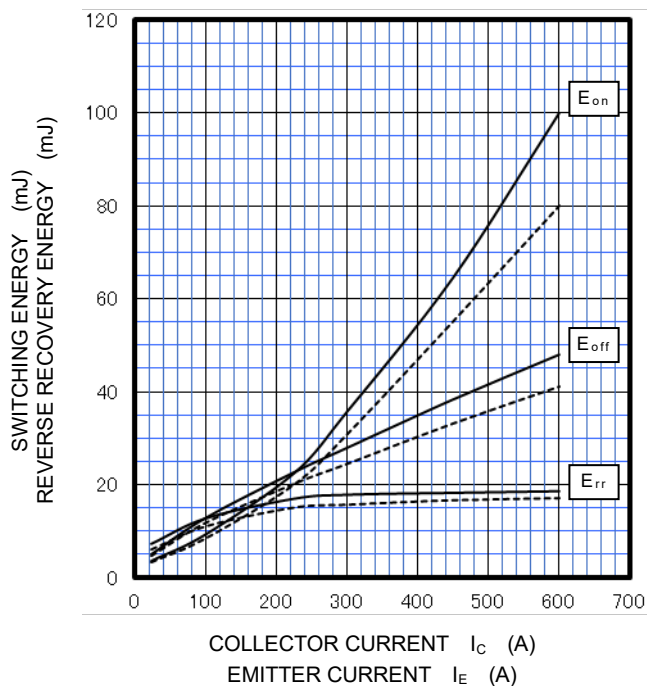
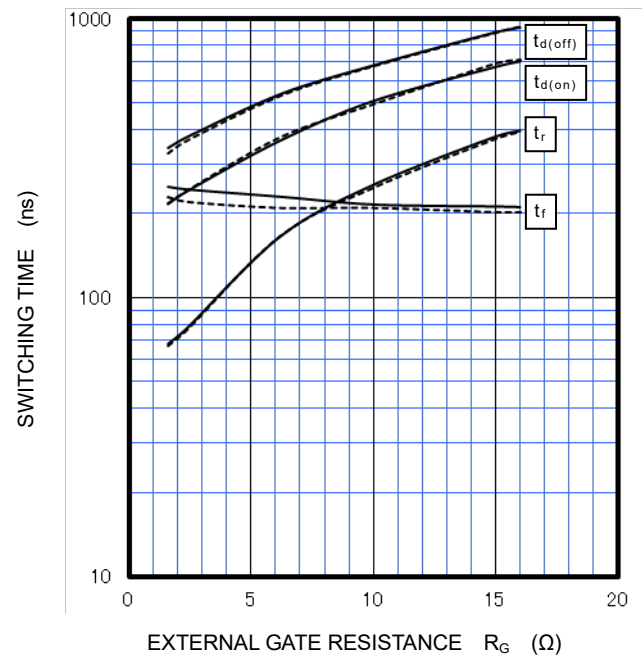
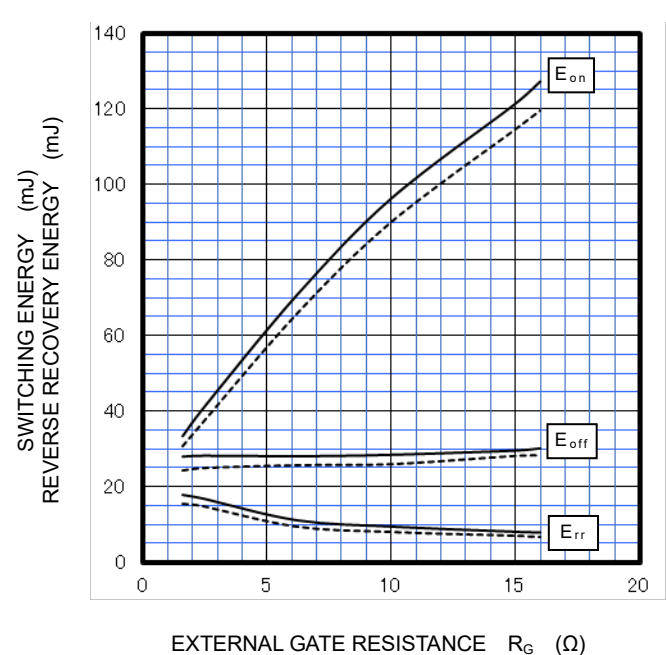
(TYPICAL)

**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)****COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)****FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)**

**CM300DX-24T1/CM300DXP-24T1**

HIGH POWER SWITCHING USE

INSULATED TYPE

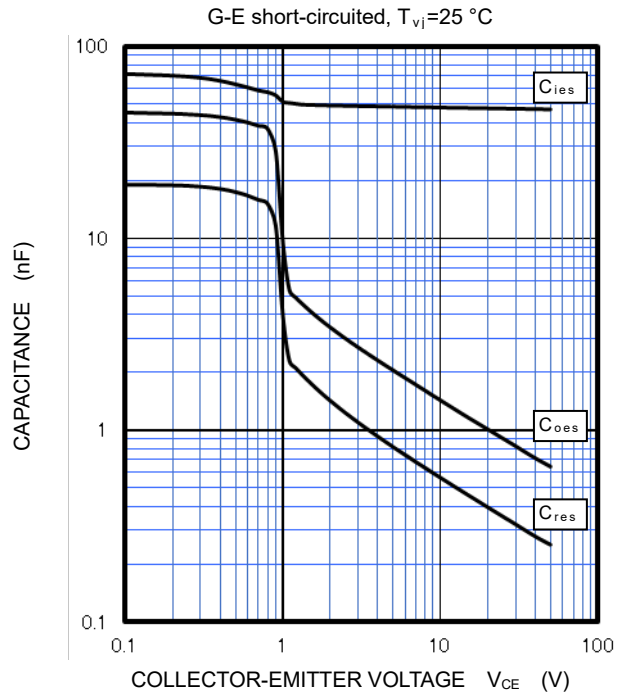
**PERFORMANCE CURVES****INVERTER PART****HALF-BRIDGE SWITCHING CHARACTERISTICS  
(TYPICAL)** $V_{CC}=600\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $R_G=1.6\ \Omega$ , INDUCTIVE LOAD  
—:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - - :  $T_{vj}=125\text{ }^\circ\text{C}$ **HALF-BRIDGE SWITCHING CHARACTERISTICS  
(TYPICAL)** $V_{CC}=600\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $R_G=1.6\ \Omega$ ,  
INDUCTIVE LOAD, PER PULSE  
—:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - - :  $T_{vj}=125\text{ }^\circ\text{C}$ **HALF-BRIDGE SWITCHING CHARACTERISTICS  
(TYPICAL)** $V_{CC}=600\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $I_c=300\text{ A}$ , INDUCTIVE LOAD  
—:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - - :  $T_{vj}=125\text{ }^\circ\text{C}$ **HALF-BRIDGE SWITCHING CHARACTERISTICS  
(TYPICAL)** $V_{CC}=600\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $I_c/I_E=300\text{ A}$ ,  
INDUCTIVE LOAD, PER PULSE  
—:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - - :  $T_{vj}=125\text{ }^\circ\text{C}$ 

PERFORMANCE CURVES

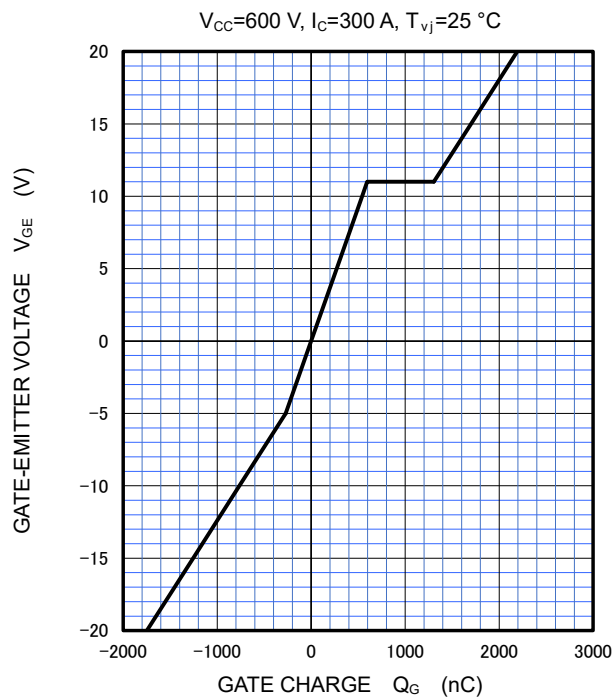
INVERTER PART

CAPACITANCE CHARACTERISTICS

(TYPICAL)

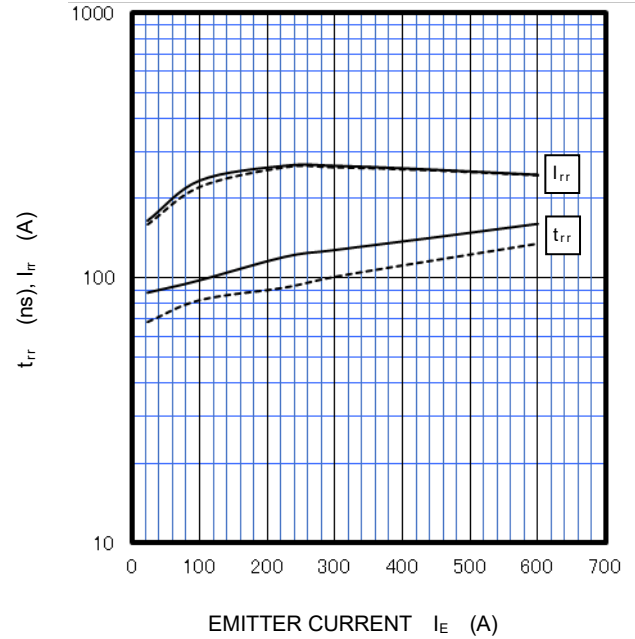


GATE CHARGE CHARACTERISTICS  
(TYPICAL)



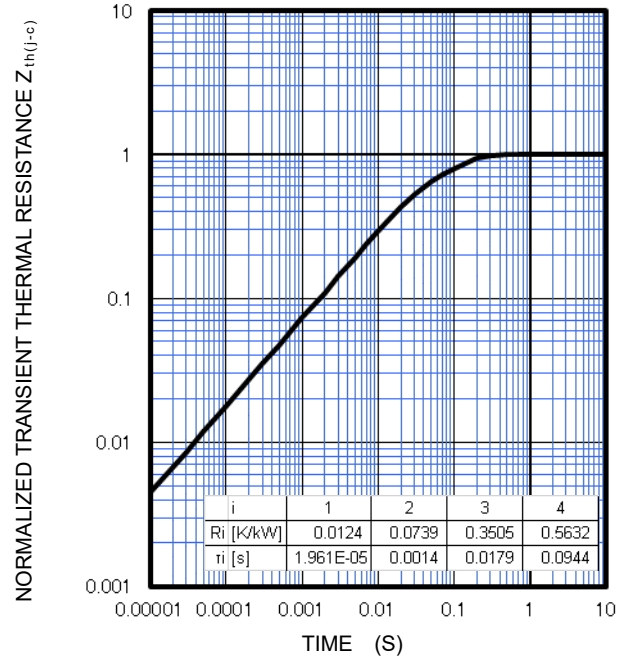
FREE WHEELING DIODE  
REVERSE RECOVERY CHARACTERISTICS  
(TYPICAL)

$V_{CC}=600\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $R_G=1.6\text{ }\Omega$ , INDUCTIVE LOAD  
—:  $T_{vj}=150\text{ }^{\circ}\text{C}$ , - - - -:  $T_{vj}=125\text{ }^{\circ}\text{C}$



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS  
(MAXIMUM)

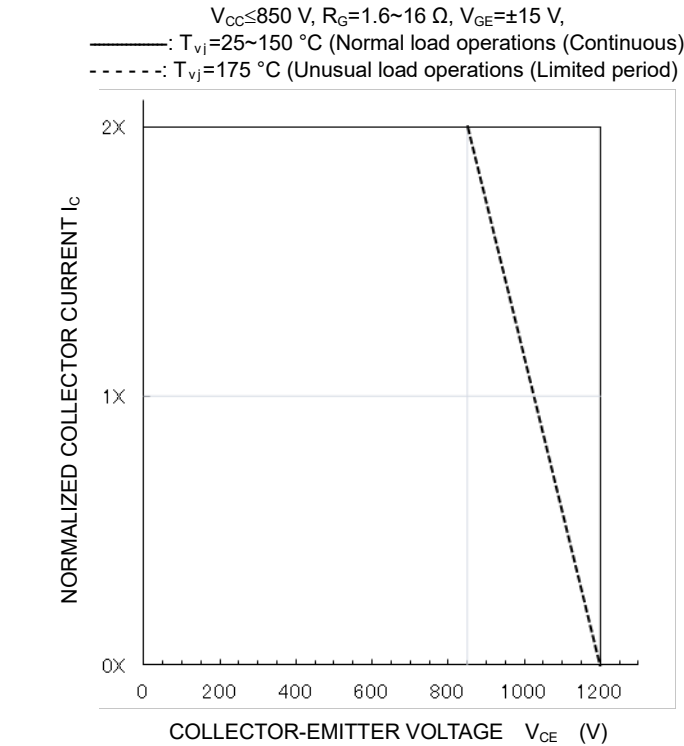
Single pulse,  $T_C=25\text{ }^{\circ}\text{C}$   
 $R_{th(j-c)Q}=102\text{ K/kW}$ ,  $R_{th(j-c)D}=150\text{ K/kW}$



PERFORMANCE CURVES

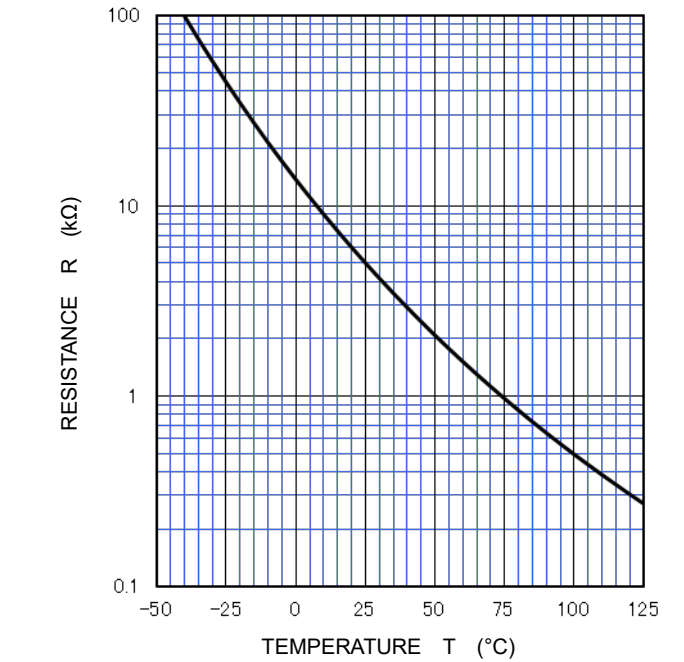
INVERTER PART

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



NTC thermistor part

TEMPERATURE CHARACTERISTICS  
(TYPICAL)



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

### **Important Notice**

The information contained in this datasheet shall in no event be regarded as a guarantee of conditions or characteristics. This product has to be used within its specified maximum ratings, and is subject to customer's compliance with any applicable legal requirement, norms and standards.

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