

<IGBT Modules>

CM1200DW-40T

HIGH POWER SWITCHING USE
INSULATED TYPE



Collector current I_C **1 2 0 0 A**
 Collector-emitter voltage V_{CES} **2 0 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

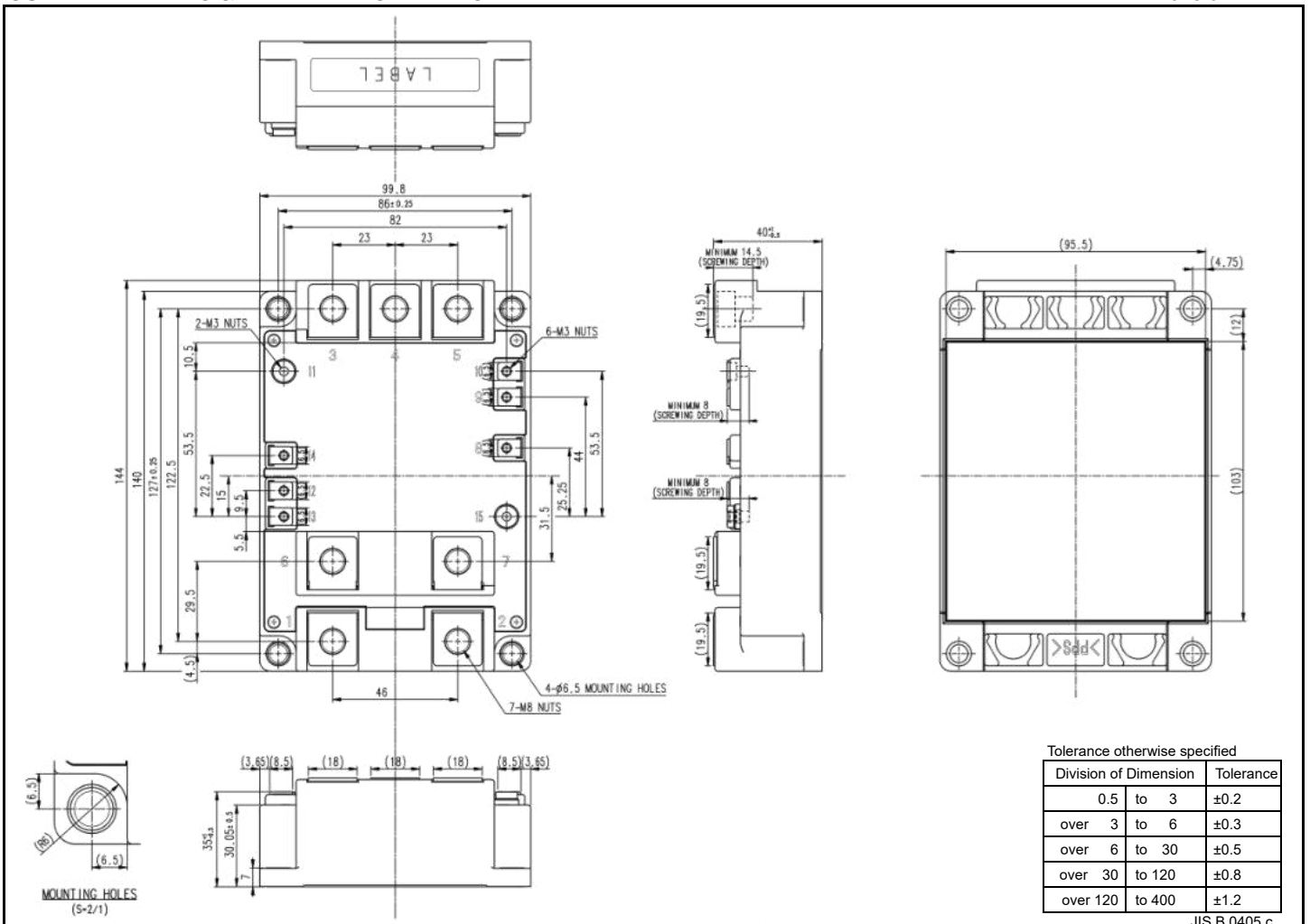
Photovoltaic power converter, Energy storage system, Wind power converter, etc.

OPTION

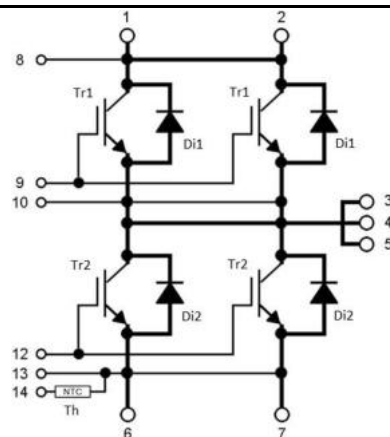
- V_{CESat} selection for parallel connection
- PC-TIM (Phase Change Thermal Interface Material) pre-apply

OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm

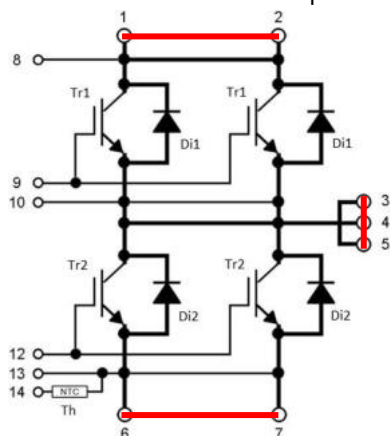


TERMINAL CODE



1. C1
2. C1
3. C2E1
4. C2E1
5. C2E1
6. E2
7. E2
8. Cs
9. G1
10. Es1
11. NC
12. G2
13. Es2, TH2
14. TH1
15. NC

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



CM1200DW-40THIGH POWER SWITCHING USE
INSULATED TYPE**MAXIMUM 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	2000	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I_C	Collector current	DC, $T_C=77\text{ }^{\circ}\text{C}$ (Note2, 4)	1200	A
I_{CRM}		Pulse, Repetitive (Note3)	2400	
P_{tot}	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	5555	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	$^{\circ}\text{C}$
$T_{vj\text{ op}}$	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	$I_C=120\text{ mA}$, $V_{CE}=10\text{ V}$	5.5	6.0	6.6	V
V_{CEsat}	Collector-emitter saturation voltage	$I_C=1200\text{ A}$ (Note5) $V_{GE}=15\text{ V}$, (Terminal)	$T_{vj}=25\text{ }^{\circ}\text{C}$	2.15	2.50	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	2.55	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	2.65	-	
		$I_C=1200\text{ A}$ (Note5) $V_{GE}=15\text{ V}$, (Chip)	$T_{vj}=25\text{ }^{\circ}\text{C}$	2.10	2.35	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	2.50	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	2.60	-	
C_{ies}	Input capacitance	$V_{CE}=10\text{ V}$, $V_{GE}=0\text{ V}$	-	-	330	nF
C_{oes}	Output capacitance		-	-	5.7	
C_{res}	Reverse transfer capacitance		-	-	2.4	
Q_G	Gate charge	$V_{CC}=1300\text{ V}$, $I_C=1200\text{ A}$, $V_{GE}=15\text{ V}$	-	9.5	-	μC
$t_{d(on)}$	Turn-on delay time	$V_{CC}=1300\text{ V}$, $I_E=1200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, Inductive load	-	-	900	ns
t_r	Rise time		-	-	160	
$t_{d(off)}$	Turn-off delay time		-	-	900	
t_f	Fall time		-	-	1250	
V_{EC} (Note1)	Emitter-collector voltage	$I_E=1200\text{ A}$ (Note5) G-E short-circuited (Terminal)	$T_{vj}=25\text{ }^{\circ}\text{C}$	2.25	3.20	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	2.60	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	2.60	-	
		$I_E=1200\text{ A}$ (Note5), G-E short-circuited, (Chip)	$T_{vj}=25\text{ }^{\circ}\text{C}$	2.20	2.95	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	2.55	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	2.55	-	
t_{rr} (Note1)	Reverse recovery time	$V_{CC}=1300\text{ V}$, $I_E=1200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, Inductive load	-	-	900	ns
Q_{rr} (Note1)	Reverse recovery charge		-	340	-	μC
E_{on}	Turn-on switching energy per pulse	$V_{CC}=1300\text{ V}$, $I_C=I_E=1200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, $T_{vj}=150\text{ }^{\circ}\text{C}$, Inductive load	-	270	-	mJ
E_{off}	Turn-off switching energy per pulse		-	580	-	
E_{rr} (Note1)	Reverse recovery energy per pulse		-	430	-	

CM1200DW-40THIGH POWER SWITCHING USE
INSULATED TYPE**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 Ω
$\Delta R/R$	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 IGBT switch (Note4)	-	-	27	K/kW
$R_{th(j-c)D}$		Junction to case, per FWD switch (Note4)	-	-	44	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module, Thermal grease applied (Note4, 7, 9)	-	10	-	K/kW

MODULE

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	N·m
M_l		Auxiliary terminals M 3 screw	0.4	0.5	0.6	N·m
e_c	Flatness of base plate	On the centerline X, Y (Note8)	0	-	+200	μm

Symbol	Item	Conditions	Value	Unit
m	mass	-	860	g
d_s	Creepage distance	Terminal to terminal	17.6	mm
		Terminal to base plate	39.3	
d_a	Clearance	Terminal to terminal	8.5	mm
		Terminal to base plate	36.6	
$R_{CC'+EE'}$	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	0.63	Ω

*: 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.

Note 1. Represent ratings and characteristics of the anti-parallel, emitter-collector free-wheeling diode (FWD).

2. Junction temperature (T_{vj}) should not increase beyond $T_{vj\max}$ rating.

3. Pulse width and repetition rate should be such that the device junction temperature (T_{vj}) dose not exceed $T_{vj\max}$ rating.

4. 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.

5. Pulse width and repetition rate should be such as to cause negligible temperature rise. Refer to the figure of test circuit.

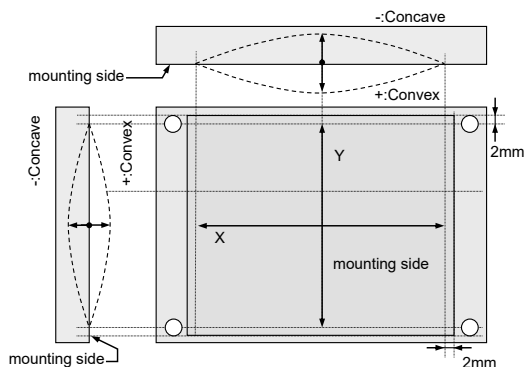
$$6. B(25/50) - \ln \left(\frac{R_{25}}{R_{50}} \right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}} \right)$$

R_{25} : resistance at absolute temperature T_{25} [K]; $T_{25}=25\text{ }^{\circ}\text{C}+273.15=298.15\text{ [K]}$

R_{50} : resistance at absolute temperature T_{50} [K]; $T_{50}=50\text{ }^{\circ}\text{C}+273.15=323.15\text{ [K]}$

7. Reference value. Thermally conductive grease of thermal conductivity $\lambda=0.9\text{ W/(m}\cdot\text{K)}$ and thickness $D_{(c-s)}=50\text{ }\mu\text{m}$.

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



9. 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.

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions		Limits			Unit
				Min.	Typ.	Max.	
V _{CC}	(DC) Supply voltage	Applied across C1-E2 terminals		-	1300	1500	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

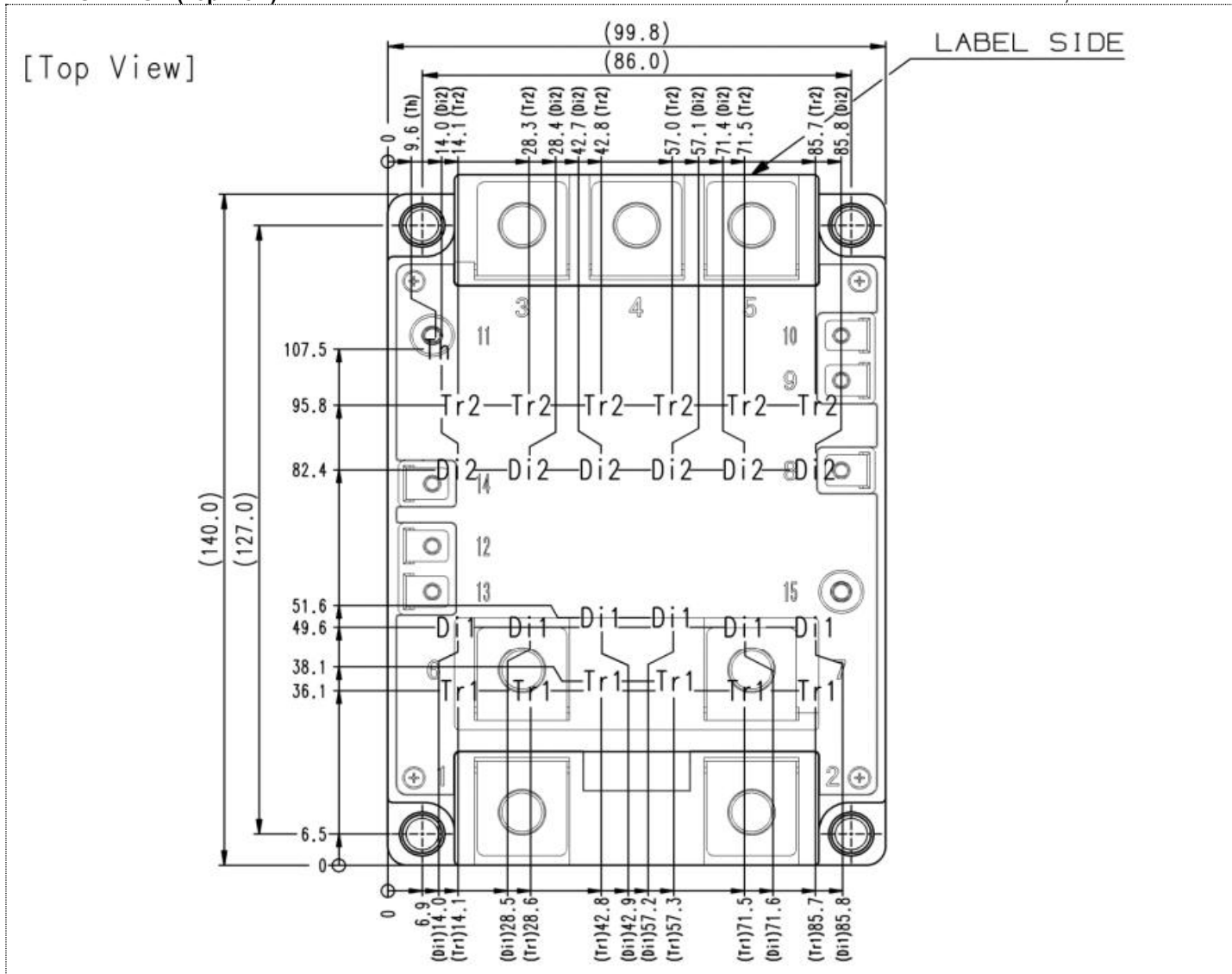
Optimum operating conditions should be selected with careful confirmation for no occurrence of any maximum rating violation (T_{vj} , V_{CES} , etc.) or any unexpected malfunction (arm-short-through, oscillation, etc.) at the actual application conditions.

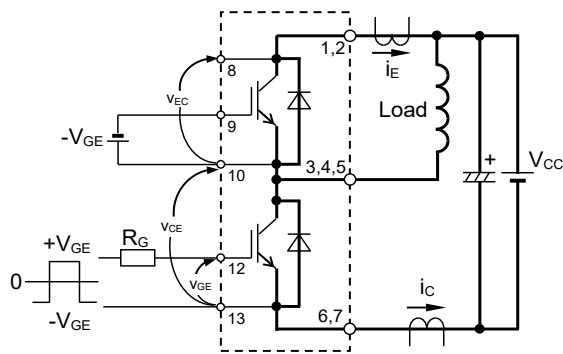
CM1200DW-40T

HIGH POWER SWITCHING USE
INSULATED TYPE

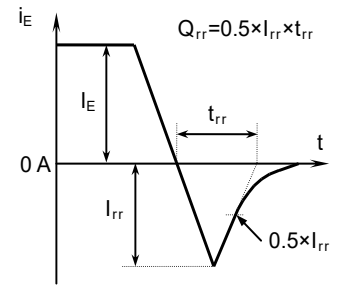
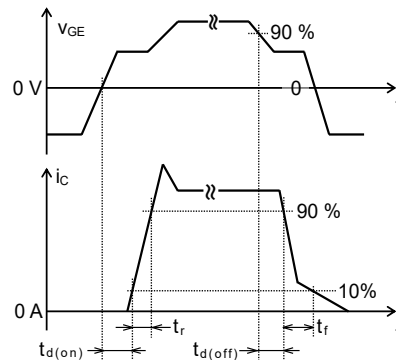
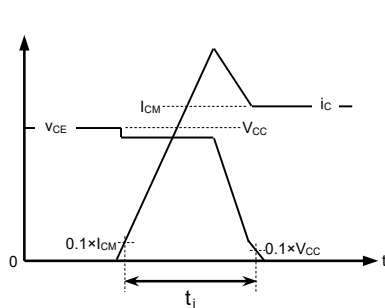
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ± 1 mm

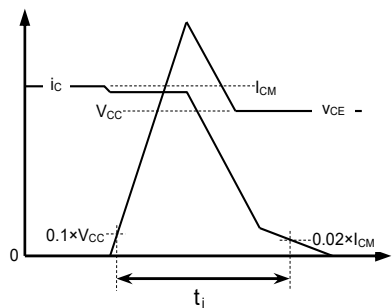


TEST CIRCUIT AND WAVEFORMS

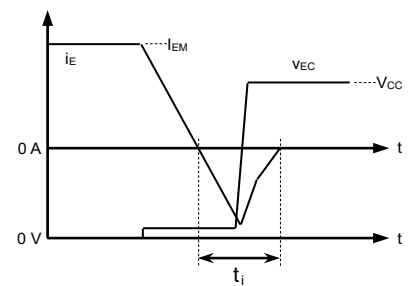
Switching characteristics test circuit and waveforms

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

IGBT Turn-on switching energy

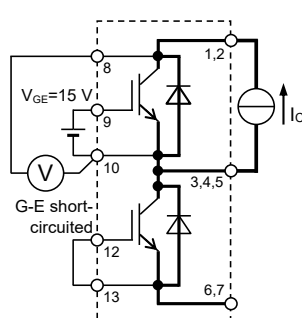


IGBT Turn-off switching energy

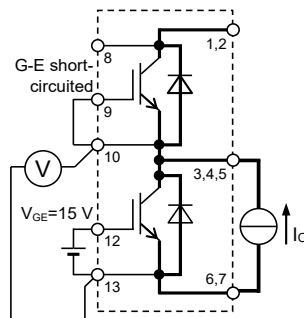


FWD Reverse recovery energy

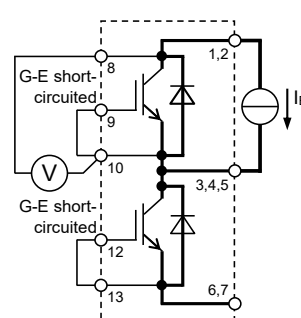
Switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

TEST CIRCUIT

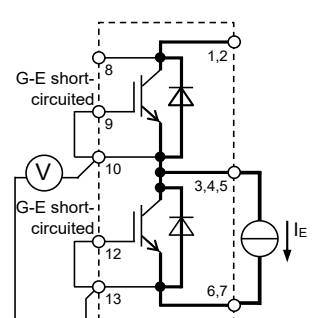
Tr1

 V_{CEsat} characteristics test circuit

Tr2



Di1

 V_{EC} characteristics test circuit

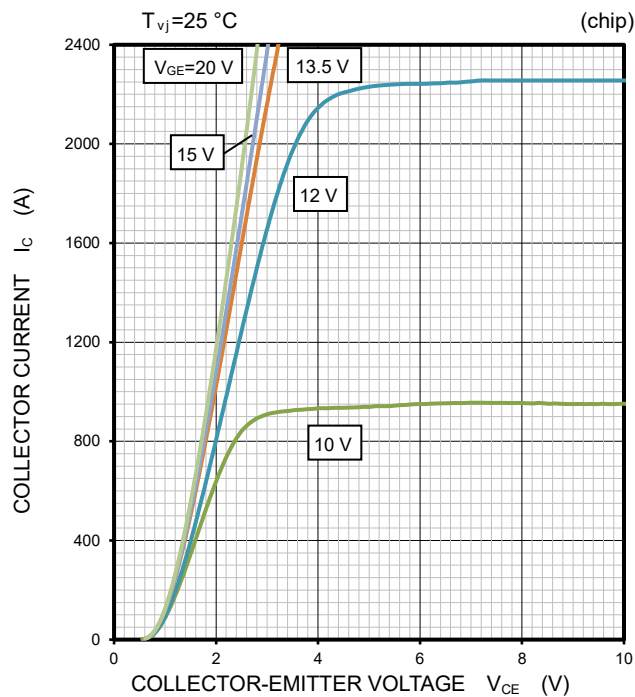
Di2

CM1200DW-40T

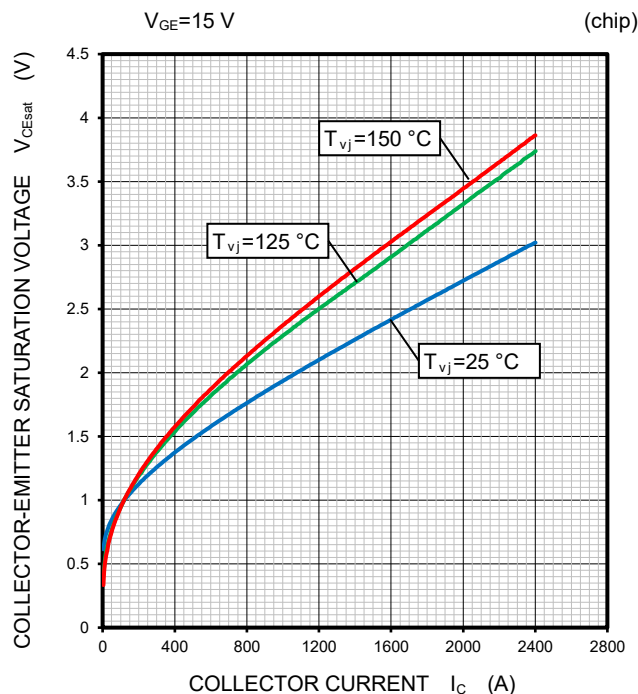
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES**INVERTER PART**

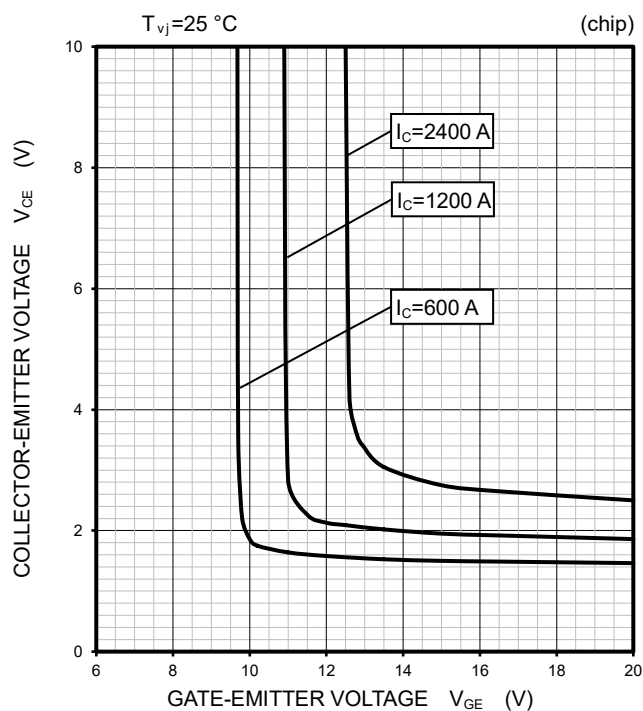
**OUTPUT CHARACTERISTICS
(TYPICAL)**



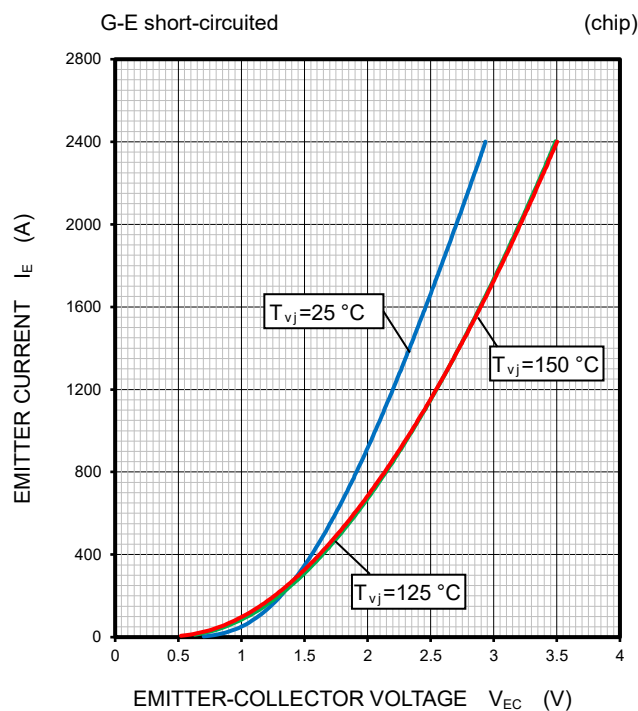
**COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)**



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

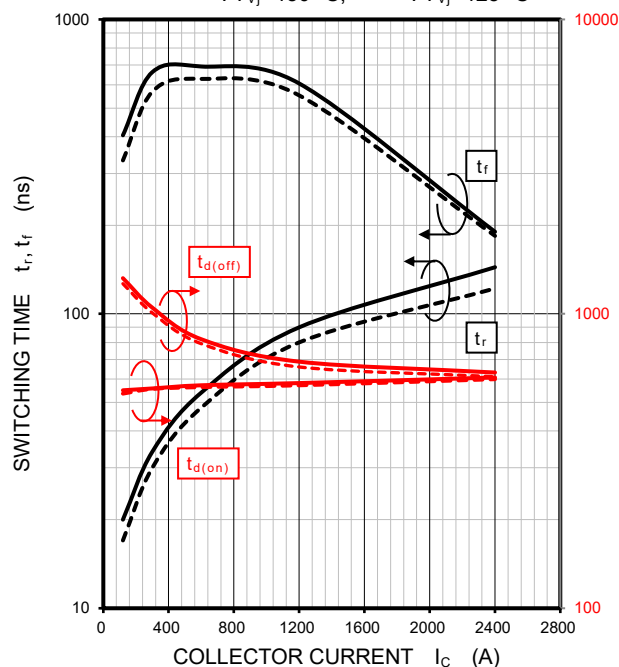


**FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)**

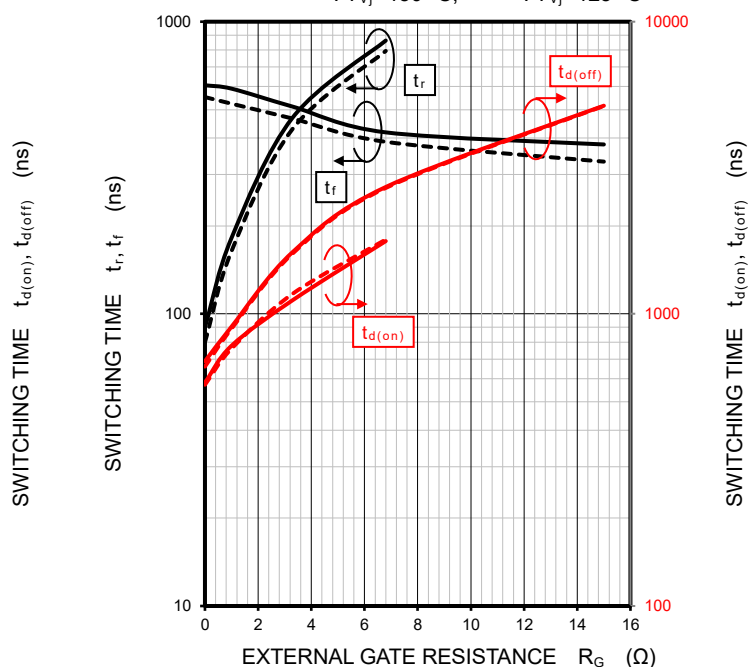


PERFORMANCE CURVES**INVERTER PART****HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

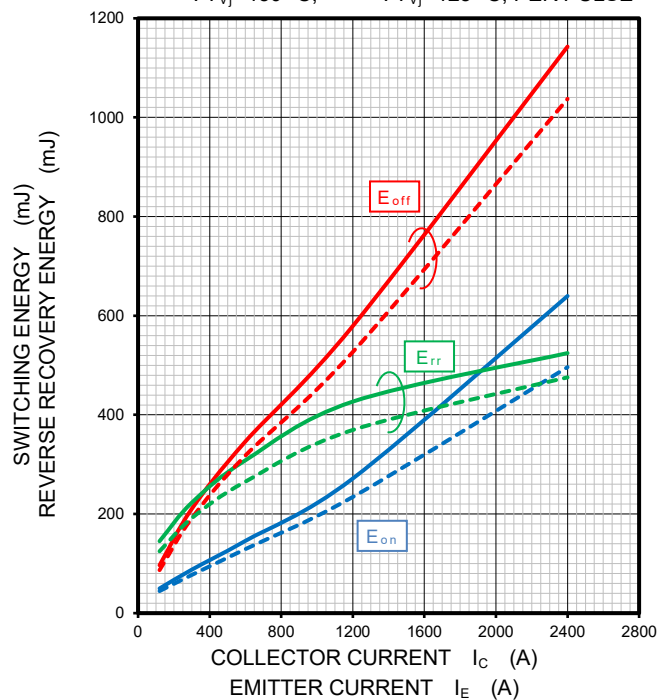
$V_{CC}=1300\text{ V}$, $R_G=0\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$

**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

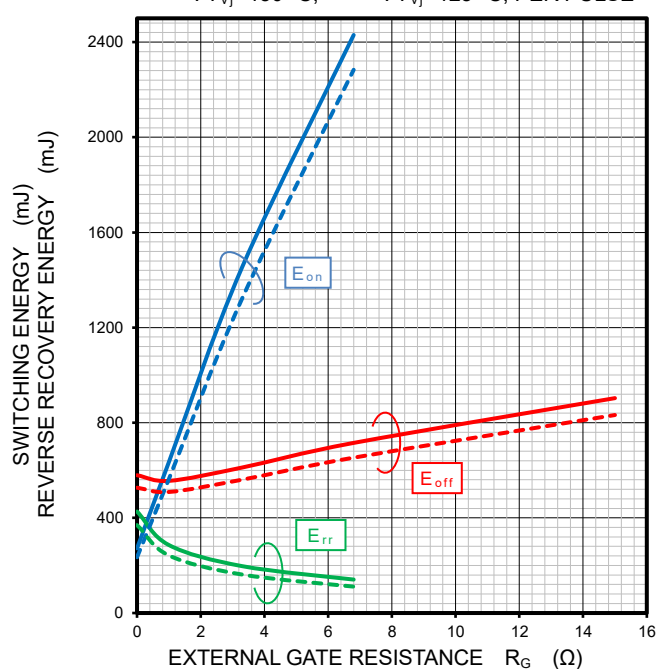
$V_{CC}=1300\text{ V}$, $I_C=1200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$

**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

$V_{CC}=1300\text{ V}$, $R_G=0\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD,
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$, PER PULSE

**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

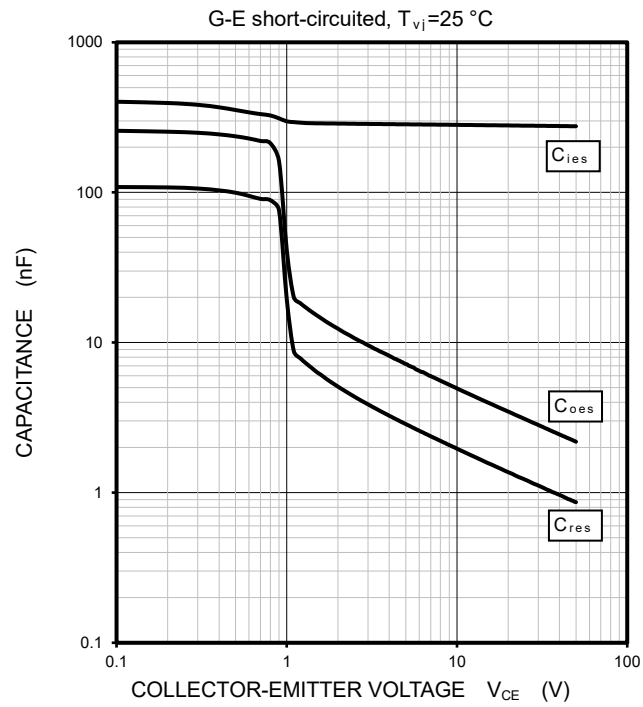
$V_{CC}=1300\text{ V}$, $I_C/I_E=1200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD,
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$, PER PULSE



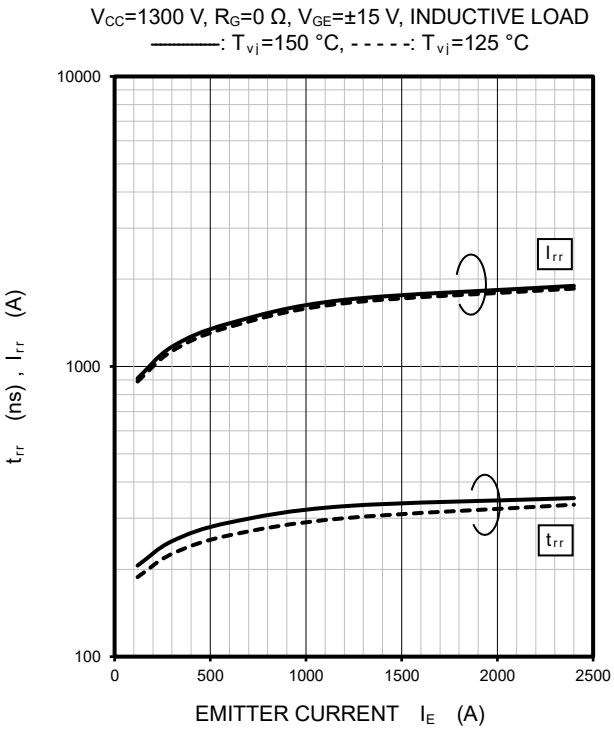
PERFORMANCE CURVES

INVERTER PART

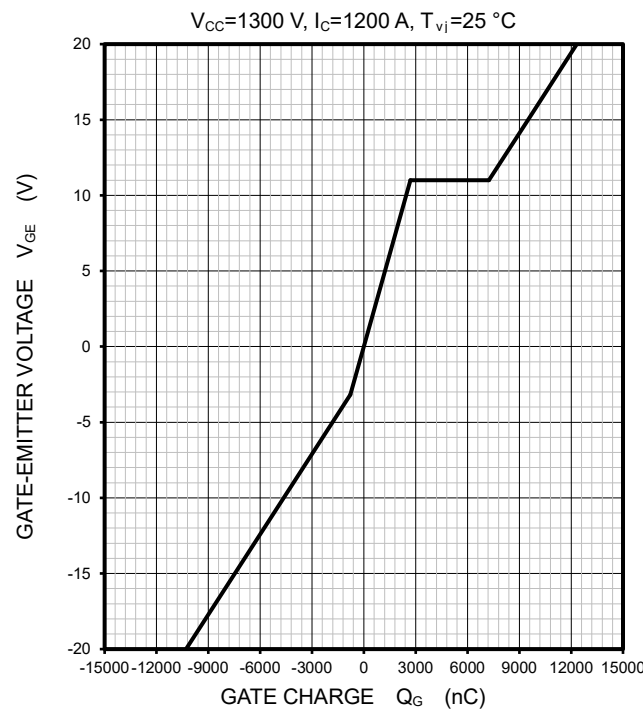
CAPACITANCE CHARACTERISTICS
(TYPICAL)



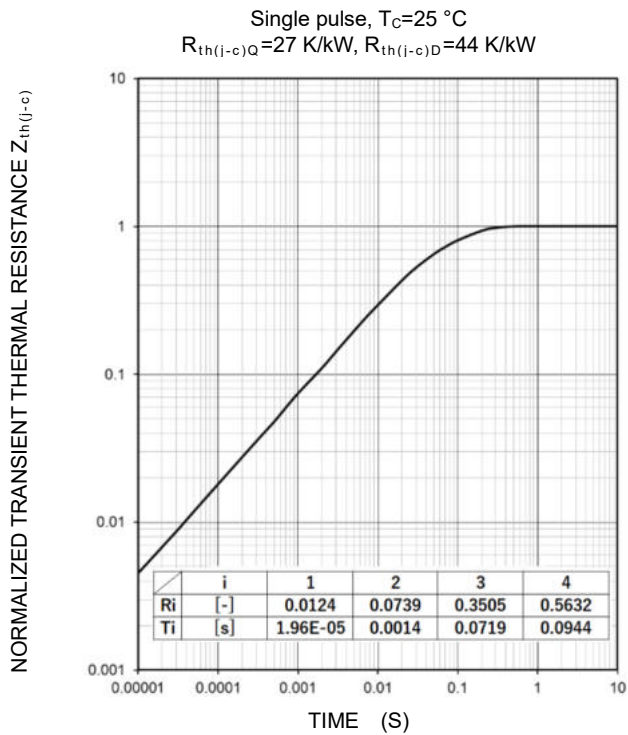
FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)



GATE CHARGE CHARACTERISTICS
(TYPICAL)

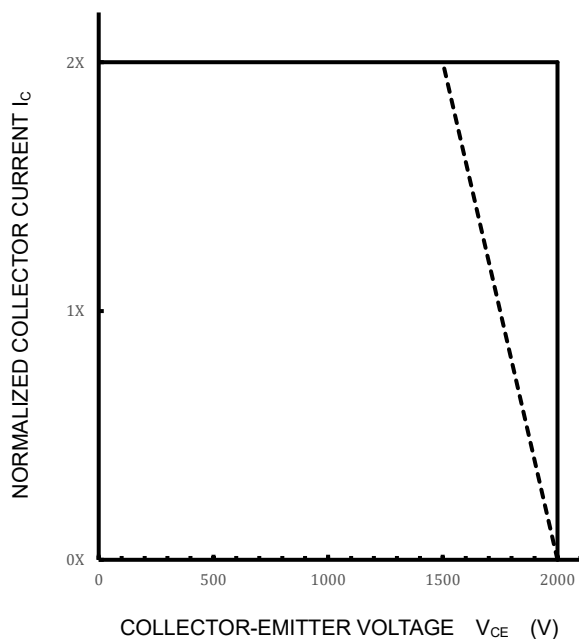


TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)

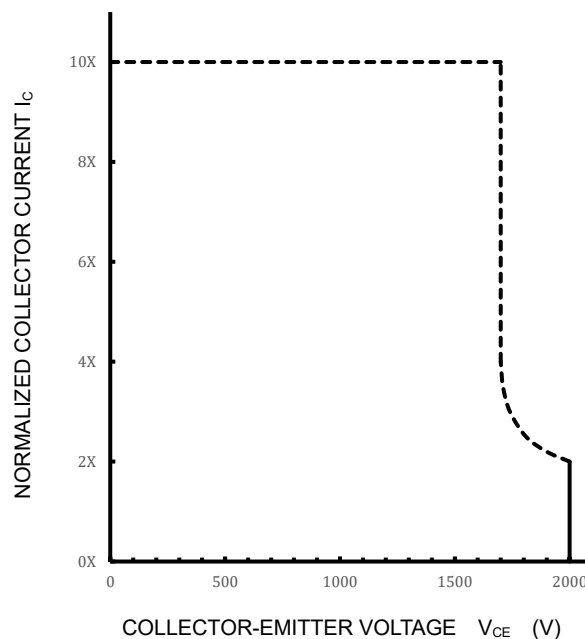
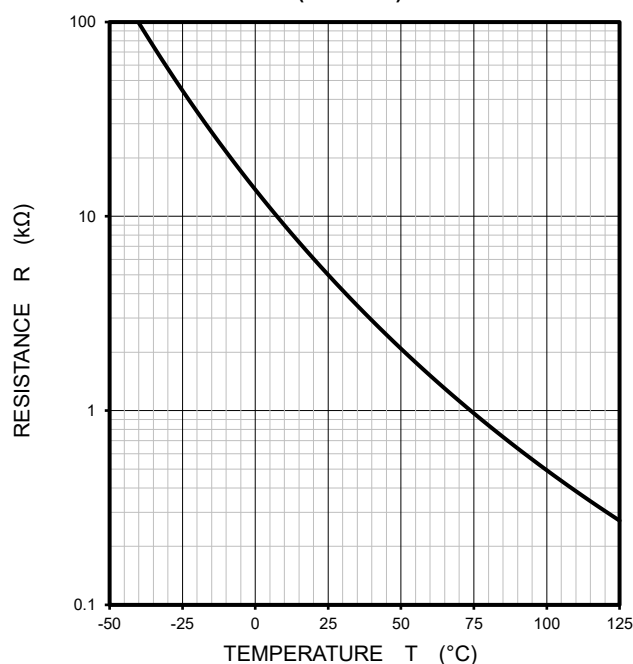


CM1200DW-40THIGH POWER SWITCHING USE
INSULATED TYPE**PERFORMANCE CURVES****INVERTER PART****TURN-OFF SWITCHING SAFE OPERATIONG AREA
(REVERSE BIAS SAFE OPERATING AREA)
(MAXIMUM)**

$V_{CC} \leq 1500 \text{ V}$, $R_{G(OFF)} = 0 \sim 15 \text{ } \Omega$, $V_{GE} = \pm 15 \text{ V}$,
 ———: $T_{vj} = 25 \sim 150 \text{ } ^\circ\text{C}$ (Normal load operations (Continuous))
 - - - - -: $T_{vj} = 175 \text{ } ^\circ\text{C}$ (Unusual load operations (Limited period))

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

$V_{CC} \leq 1500 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$,
 $T_{vj} = 25 \sim 150 \text{ } ^\circ\text{C}$, $t_w \leq 6 \text{ } \mu\text{s}$, 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.

CM1200DW-40T

HIGH POWER SWITCHING USE
INSULATED TYPE

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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