<IGBT Modules>

CM1000DX-24T/CM1000DXP-24T

HIGH POWER SWITCHING USE
INSULATED TYPE

| DX | | Collector current I_C .... **1 0 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 .... **1 0 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 [Note9]

● V_{CEsat} selection for parallel connection

INTERNAL CONNECTION
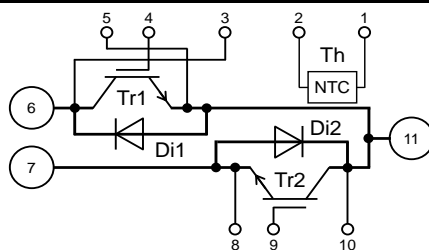
TERMINAL CODE

1. TH1	6. C1
2. TH2	7. E2
3. Cs1	8. Es2
4. G1	9. G2
5. Es1	10. Cs2
	11. C2E1

<IGBT Modules>
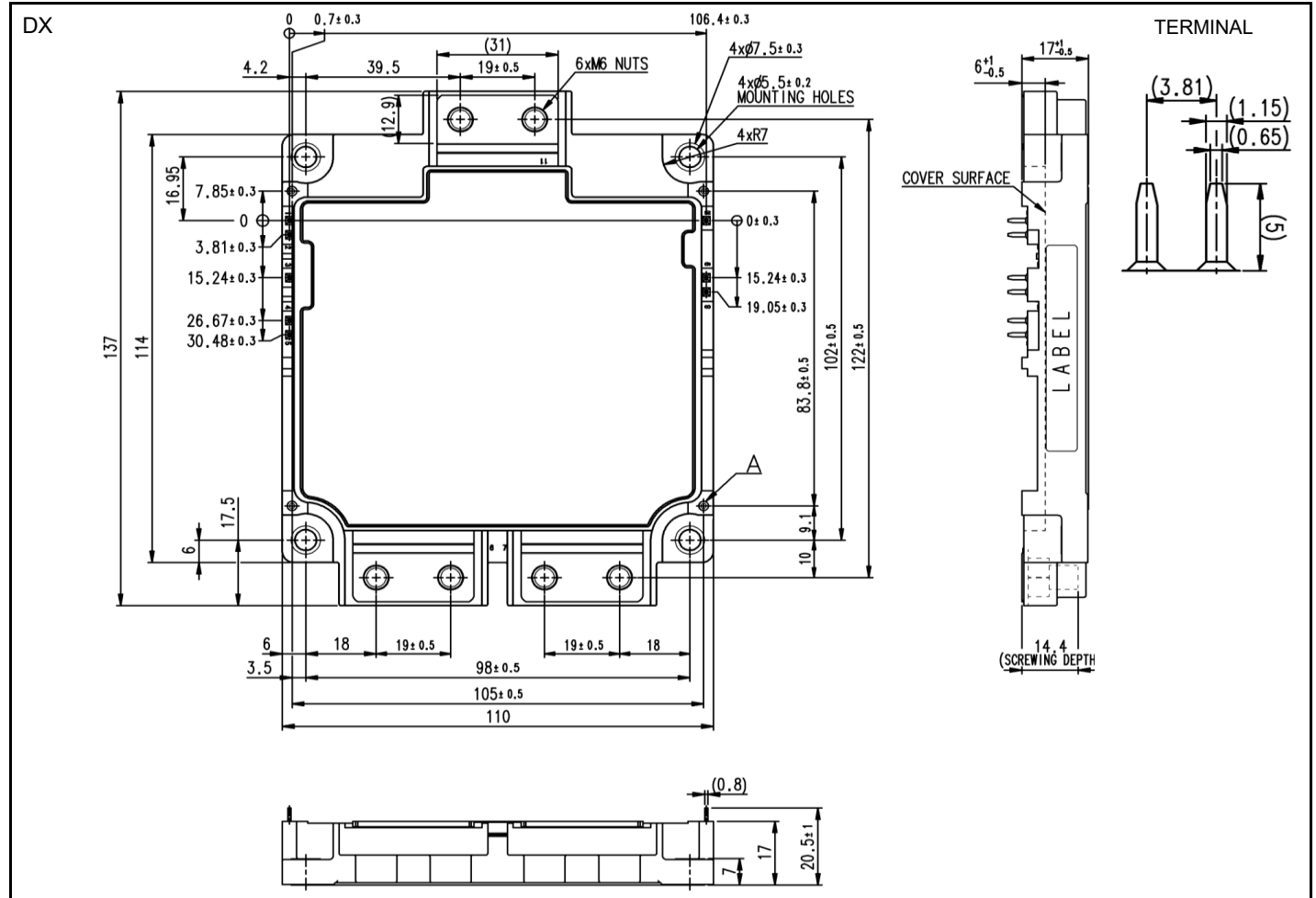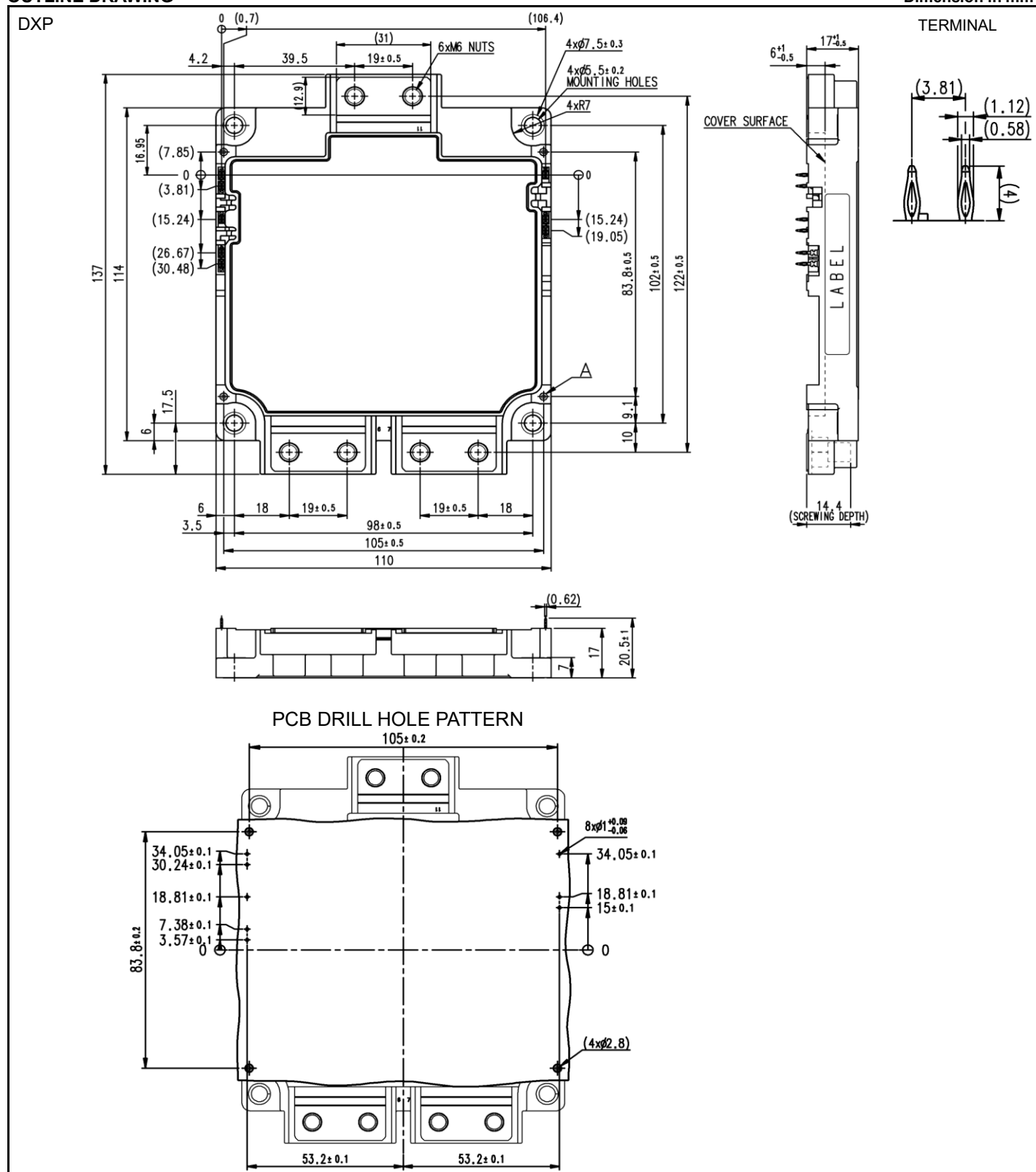# CM1000DX-24T/CM1000DXP-24T
HIGH POWER SWITCHING USE
INSULATED TYPE

OUTLINE DRAWING   **Dimension in mm**

<IGBT Modules>

CM1000DX-24T/CM1000DXP-24T

HIGH POWER SWITCHING USE
INSULATED TYPE

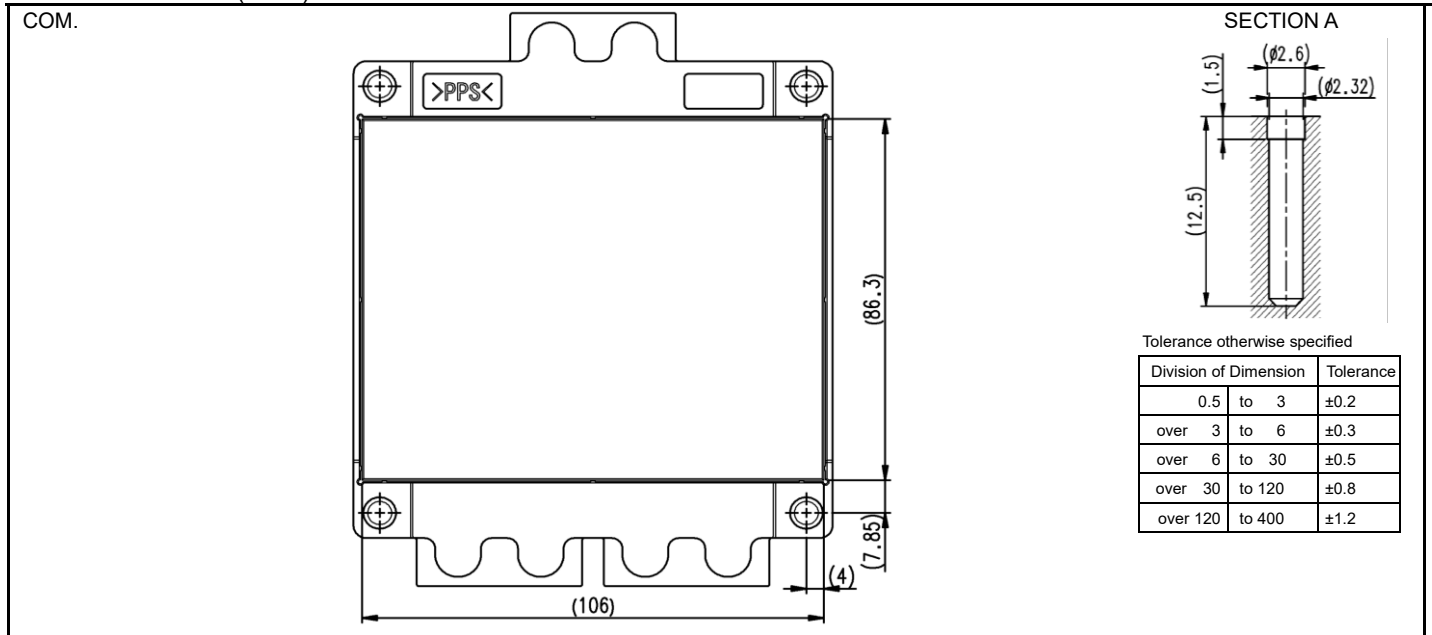**OUTLINE DRAWING**   **Dimension in mm**

PCB DRILL HOLE PATTERN

MITSUBISHI ELECTRIC CORPORATION

<IGBT Modules>
CM1000DX-24T/CM1000DXP-24T
HIGH POWER SWITCHING USE
INSULATED TYPE

OUTLINE DRAWING(Cont.)   Dimension in mm

| COM. | | SECTION A |

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

MAXIMUM RATINGS (T$_{vj}$=25 °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	± 20	V
I$_C$	Collector current	DC, T$_C$=116 °C (Note2, 4)	1000	A
I$_{CRM}$		Pulse, Repetitive (Note3)	2000	
P$_{tot}$	Total power dissipation	T$_C$=25 °C (Note2, 4)	5355	W
I$_E$ (Note1)	Emitter current	DC (Note2)	1000	A
I$_{ERM}$ (Note1)		Pulse, Repetitive (Note3)	2000	

MODULE

Symbol	Item	Conditions	Rating	Unit
V$_{isol}$	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	2500	V
T$_{vjmax}$	Maximum junction temperature	Instantaneous event (overload) (Note9)	175	°C
T$_{Cmax}$	Maximum case temperature	(Note4, 9)	125	
T$_{vjop}$	Operating junction temperature	Continuous operation (under switching) (Note9)	-40 ~ +150	°C
T$_{stg}$	Storage temperature	-	-40 ~ +125	

MITSUBISHI ELECTRIC CORPORATION

<IGBT Modules>
CM1000DX-24T/CM1000DXP-24T
HIGH POWER SWITCHING USE
INSULATED TYPE

ELECTRICAL CHARACTERISTICS (T_{vj}=25 °C, unless otherwise specified)

INVERTER PART IGBT/FWD

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
					Limits		
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=100 mA, V_{CE}=10 V		5.4	6.0	6.6	V
V_{CEsat} (Terminal)	Collector-emitter saturation voltage	I_C=1000 A, V_{GE}=15 V, Refer to the figure of test circuit (Note5)	T_{vj}=25 °C	-	1.55	1.95	V
			T_{vj}=125 °C	-	1.70	-	
			T_{vj}=150 °C	-	1.75	-	
V_{CEsat} (Chip)		I_C=1000 A, V_{GE}=15 V, (Note5)	T_{vj}=25 °C	-	1.50	1.75	V
			T_{vj}=125 °C	-	1.70	-	
			T_{vj}=150 °C	-	1.75	-	
C_{ies}	Input capacitance	V_{CE}=10 V, G-E short-circuited		-	-	242.5	nF
C_{oes}	Output capacitance			-	-	6.8	
C_{res}	Reverse transfer capacitance			-	-	3.0	
Q_G	Gate charge	V_{CC}=600 V, I_C=1000 A, V_{GE}=15 V		-	7.5	-	µC
$t_{d(on)}$	Turn-on delay time	V_{CC}=600 V, I_C=1000 A, V_{GE}=±15 V, R_G=2.0 Ω, Inductive load		-	-	800	ns
t_r	Rise time			-	-	400	
$t_{d(off)}$	Turn-off delay time			-	-	1300	
t_f	Fall time			-	-	400	
V_{EC} [Note1] (Terminal)	Emitter-collector voltage	I_E=1000 A, G-E short-circuited, Refer to the figure of test circuit (Note5)	T_{vj}=25 °C	-	1.65	2.15	V
			T_{vj}=125 °C	-	1.75	-	
			T_{vj}=150 °C	-	1.80	-	
V_{EC} [Note1] (Chip)		I_E=1000 A, G-E short-circuited, (Note5)	T_{vj}=25 °C	-	1.60	1.95	V
			T_{vj}=125 °C	-	1.60	-	
			T_{vj}=150 °C	-	1.60	-	
t_{rr} [Note1]	Reverse recovery time	V_{CC}=600 V, I_E=1000 A, V_{GE}=±15 V, R_G=2.0 Ω, Inductive load		-	-	500	ns
Q_{rr} [Note1]	Reverse recovery charge			-	78	-	µC
E_{on}	Turn-on switching energy per pulse	V_{CC}=600 V, I_C=I_E=1000 A, V_{GE}=±15 V, R_G=2.0 Ω, T_{vj}=150 °C, Inductive load		-	150.5	-	mJ
E_{off}	Turn-off switching energy per pulse			-	128.4	-	
E_{rr} [Note1]	Reverse recovery energy per pulse			-	69	-	mJ
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, T_C=25 °C (Note4)		-	0.5	-	mΩ
r_g	Internal gate resistance	Per switch		-	0.4	-	Ω

NTC THERMISTOR PART

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
				Limits		
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		Min.	Typ.	Max.	Unit
					Limits		
$R_{th(j-c)Q}$	Thermal resistance	Junction to case, per Inverter IGBT (Note4)		-	-	28	K/kW
$R_{th(j-c)D}$		Junction to case, per Inverter FWD (Note4)		-	-	49	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module,	Thermal grease applied (Note4, 7, 9)	-	7.1	-	K/kW

CM1000DX-24T/CM1000DXP-24T

HIGH POWER SWITCHING USE

INSULATED TYPE

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	Solder pin type (DX)	Terminal to terminal	17.3	-	-	mm
			Terminal to base plate	17.5	-	-	
		Pressfit pin type (DXP)	Terminal to terminal	16.5	-	-	mm
			Terminal to base plate	18.0	-	-	
d_a	Clearance	Solder pin type (DX)	Terminal to terminal	10.3	-	-	mm
			Terminal to base plate	11.7	-	-	
		Pressfit pin type (DXP)	Terminal to terminal	10.2	-	-	mm
			Terminal to base plate	11.8	-	-	
e_c	Flatness of base plate	On the centerline X, Y (Note8)		±0	-	+200	μm
m	mass	-		-	490	-	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).

2. Junction temperature (T_{vj}) should not increase beyond T_{vjmax} rating.

3. Pulse width and repetition rate should be such that the device junction temperature (T_{vj}) dose not exceed T_{vjmax} 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.
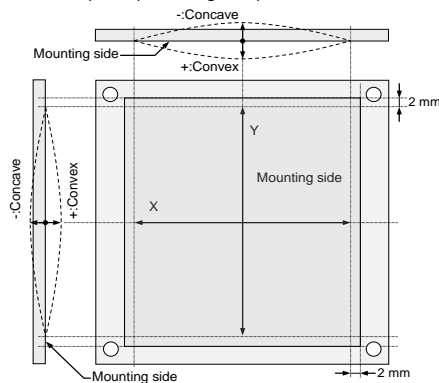
6. $B_{(25/50)} = \ln(\frac{R_{25}}{R_{50}})/(\frac{1}{T_{25}} - \frac{1}{T_{50}})$

   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]

7. Typical value is by 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.

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 your specific application conditions. Each temperature condition ($T_{vj\,max}$, $T_{vj\,op}$, $T_{C\,max}$) must be maintained below the maximum rated temperature throughout consideration of the temperature rise even for long term usage.

Note11. 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	
(2)	PT®		K25×10	0.75 ± 0.075 N·m	by handwork (equivalent to 30 rpm
(3)	DELTA PT®		25×8	0.55 ± 0.055 N·m	by mechanical screw driver)
(4)	DELTA PT®		25×10	0.75 ± 0.075 N·m	~ 600 rpm (by mechanical screw driver)
(5)	B1	-	φ2.6×10	0.75 ± 0.075 N·m	
	tapping screw		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	2.0	-	20	Ω

CM1000DX-24T/CM1000DXP-24T
HIGH POWER SWITCHING USE
INSULATED TYPE

CHIP LOCATION (Top view)   Dimension in mm, tolerance: ±1 mm

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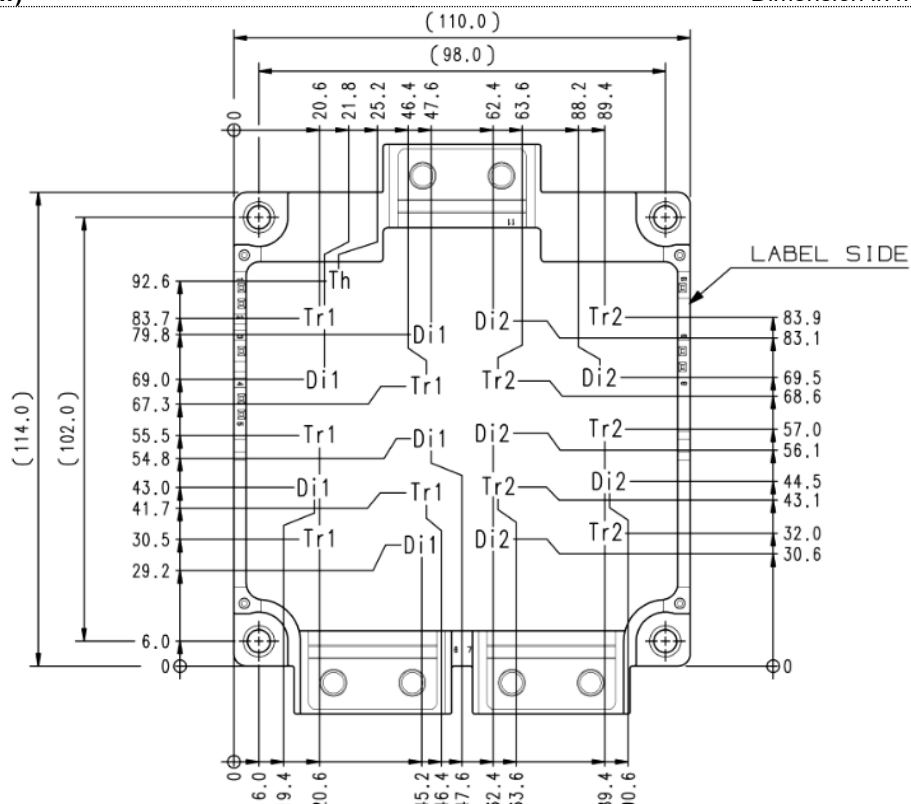
DXP
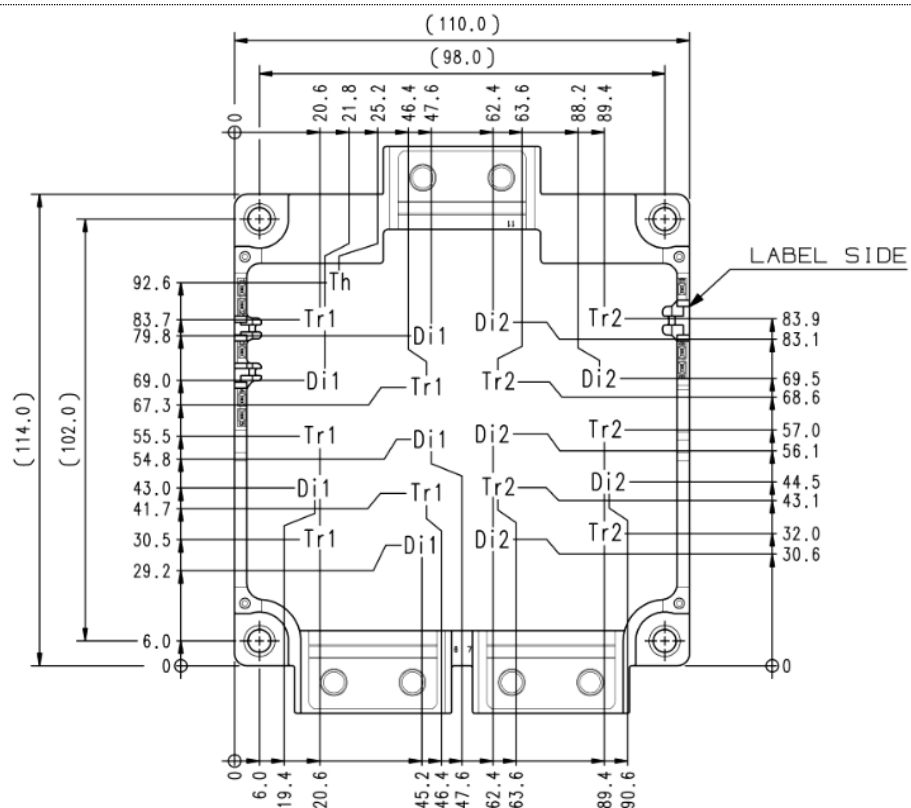
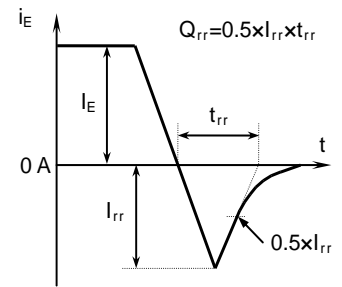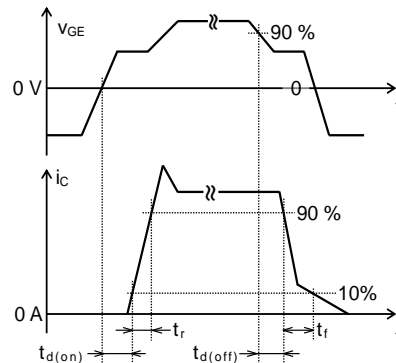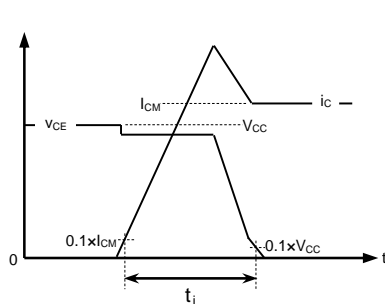
Tr1/Tr2: IGBT, Di1/Di2: FWD, Th: NTC thermistor

<IGBT Modules>
CM1000DX-24T/CM1000DXP-24T
HIGH POWER SWITCHING USE
INSULATED TYPE

TEST CIRCUIT AND WAVEFORMS
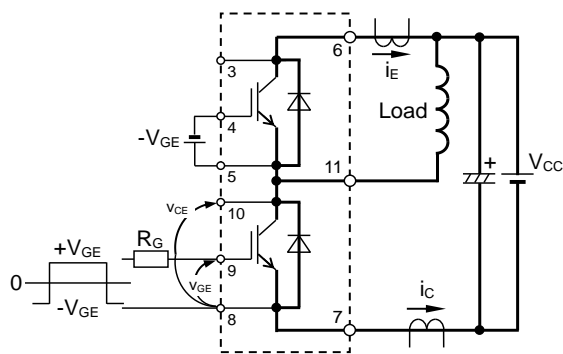
Switching characteristics test circuit and waveforms

$Q_{rr} = 0.5 \times I_{rr} \times t_{rr}$

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

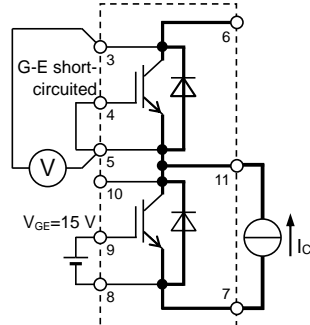IGBT Turn-on switching energy
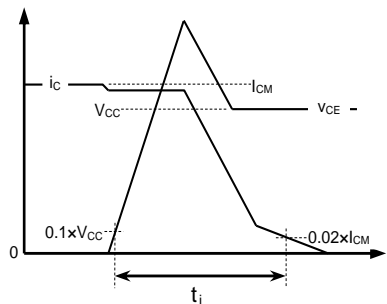
IGBT Turn-off switching energy
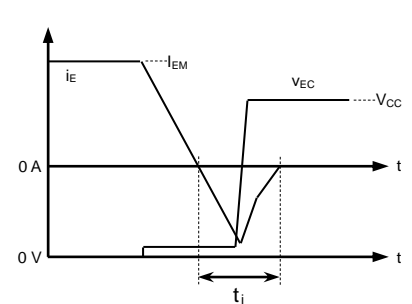
FWD Reverse recovery energy

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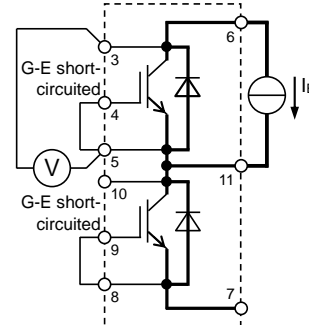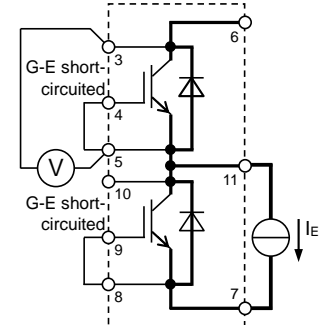
TEST CIRCUIT

$V_{GE} = 15\text{ V}$

G-E short-circuited

Tr1

Tr2

V_{CEsat} characteristics test circuit

Di1

Di2

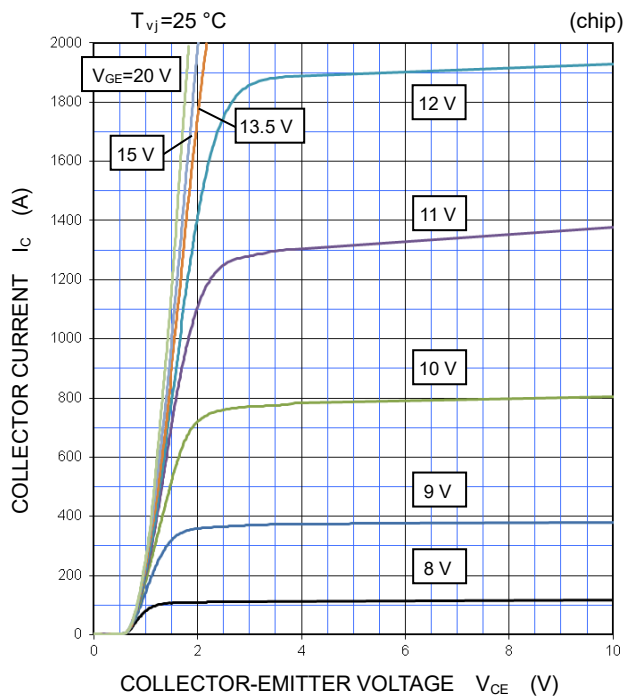V_{EC} characteristics test circuit

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MITSUBISHI ELECTRIC CORPORATION

CM1000DX-24T/CM1000DXP-24T

HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

INVERTER PART

OUTPUT CHARACTERISTICS (TYPICAL)

$T_{vj}=25\ °C$ (chip)

COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

$V_{GE}=15\ V$ (chip)
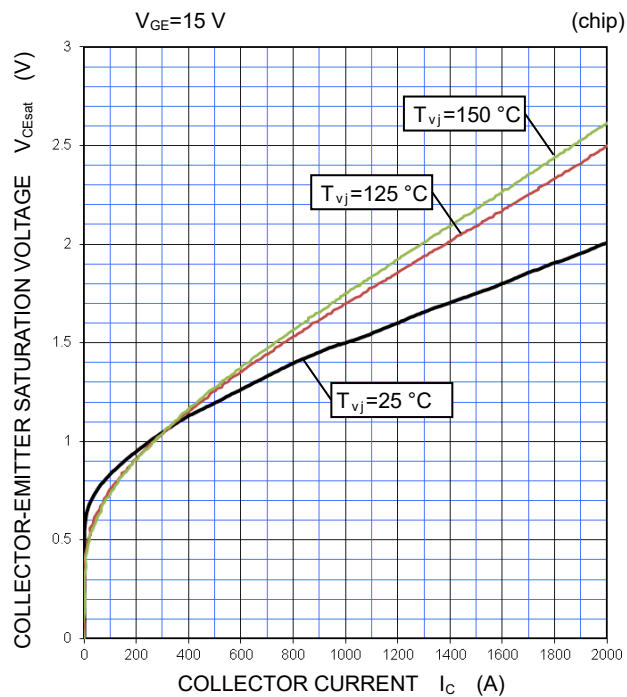
COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS (TYPICAL)

$T_{vj}=25\ °C$ (chip)
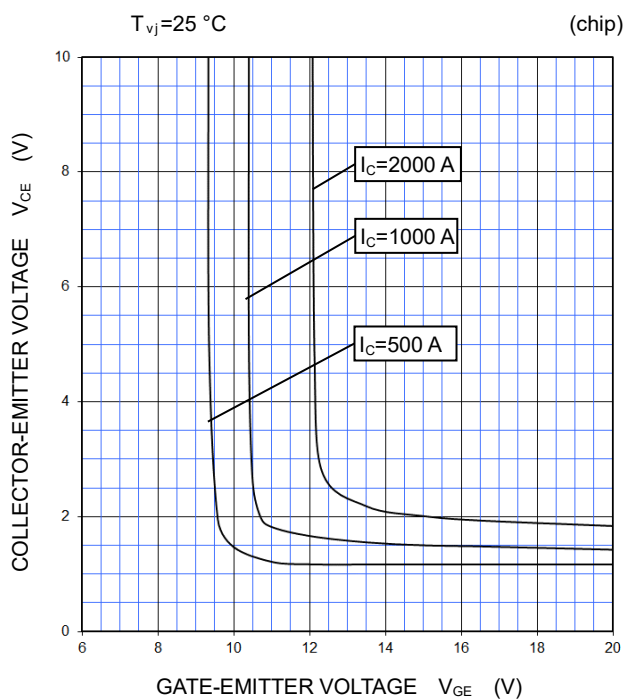
FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)

G-E short-circuited (chip)

MITSUBISHI ELECTRIC CORPORATION

<IGBT Modules>

CM1000DX-24T/CM1000DXP-24T

HIGH POWER SWITCHING USE
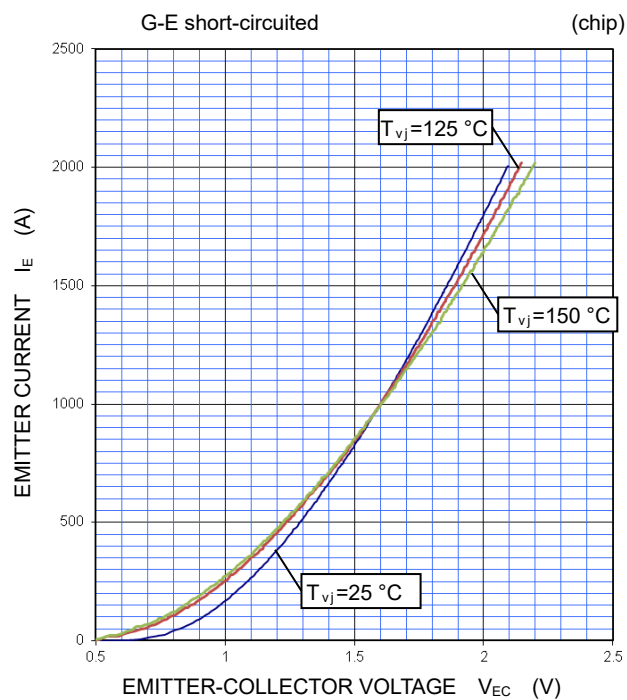## INSULATED TYPE

PERFORMANCE CURVES

INVERTER PART

HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, R_G=2.0 Ω, V_{GE}=±15 V, INDUCTIVE LOAD
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C
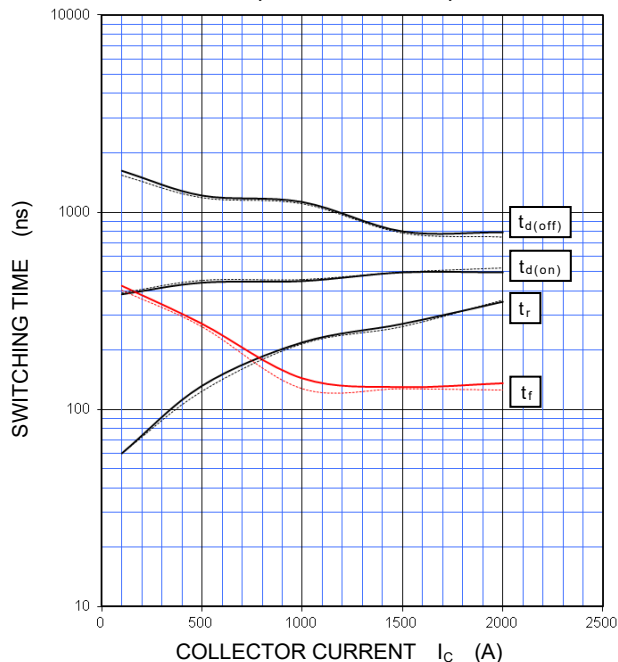
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, I_C=1000 A, V_{GE}=±15 V, INDUCTIVE LOAD
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C
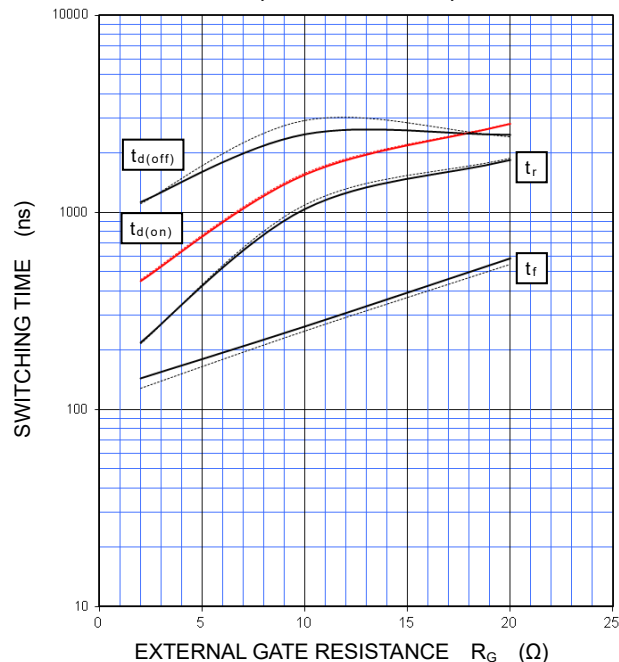
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, R_G=2.0 Ω, V_{GE}=±15 V, INDUCTIVE LOAD,
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C, PER PULSE

HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, I_C/I_E=1000 A, V_{GE}=±15 V, INDUCTIVE LOAD,
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C, PER PULSE
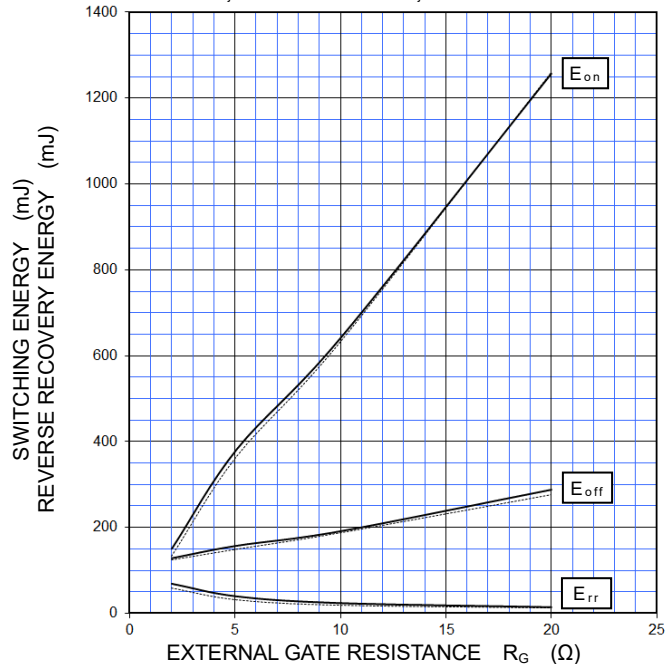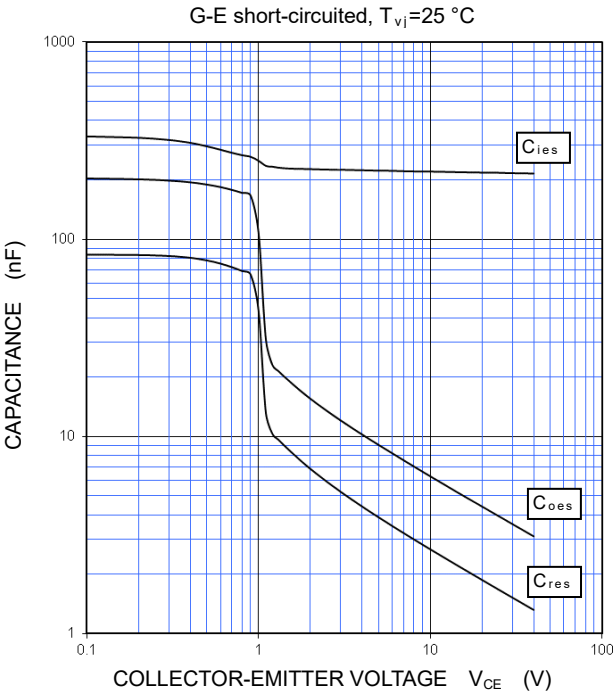
MITSUBISHI ELECTRIC CORPORATION

CM1000DX-24T/CM1000DXP-24T
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

INVERTER PART

CAPACITANCE CHARACTERISTICS (TYPICAL)

G-E short-circuited, T_{vj}=25 °C

CAPACITANCE (nF) vs COLLECTOR-EMITTER VOLTAGE V_{CE} (V)

C_{ies}, C_{oes}, C_{res}

FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, R_G=2.0 Ω, V_{GE}=±15 V, INDUCTIVE LOAD
————: T_j=150 °C, - - - - -: T_j=125 °C

t_{rr} (ns), I_{rr} (A) vs EMITTER CURRENT I_E (A)

t_{rr}, I_{rr}
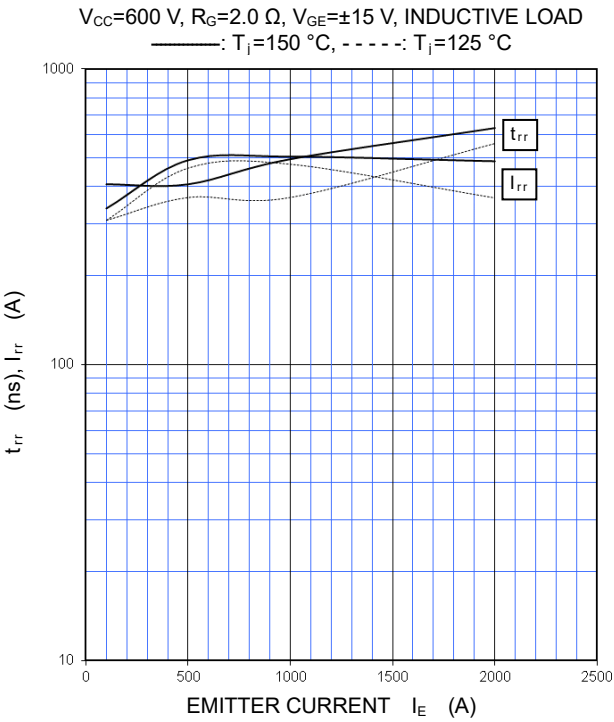
GATE CHARGE CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, I_C=1000 A, T_{vj}=25 °C

GATE-EMITTER VOLTAGE V_{GE} (V) vs GATE CHARGE Q_G (nC)
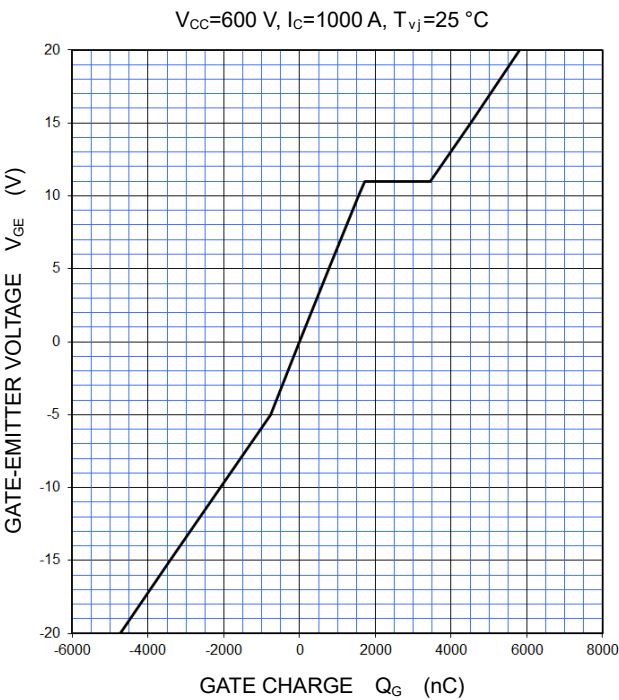
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)
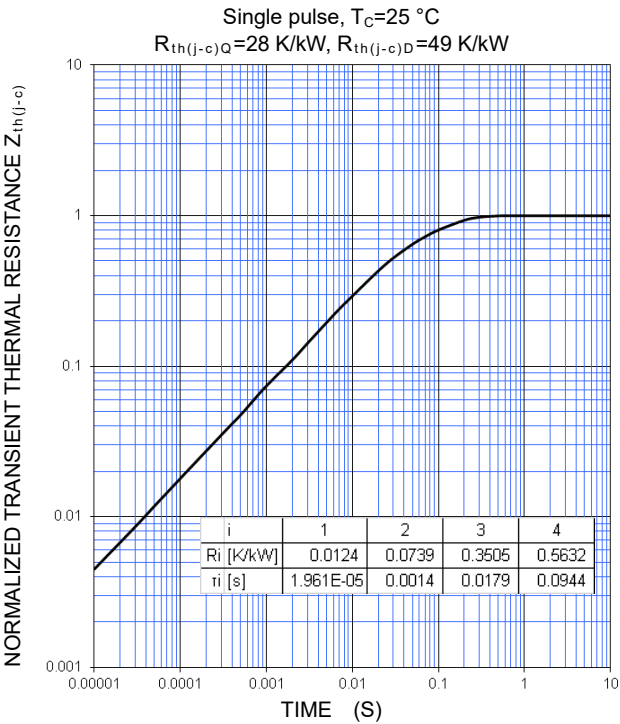
Single pulse, T_C=25 °C
$R_{th(j-c)Q}$=28 K/kW, $R_{th(j-c)D}$=49 K/kW

NORMALIZED TRANSIENT THERMAL RESISTANCE $Z_{th(j-c)}$ vs TIME (S)

i	1	2	3	4
Ri [K/kW]	0.0124	0.0739	0.3505	0.5632
τi [s]	1.961E-05	0.0014	0.0179	0.0944

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MITSUBISHI ELECTRIC CORPORATION

<IGBT Modules>

CM1000DX-24T/CM1000DXP-24T

HIGH POWER SWITCHING USE
INSULATED TYPE

AbN
automation

PERFORMANCE CURVES

INVERTER PART

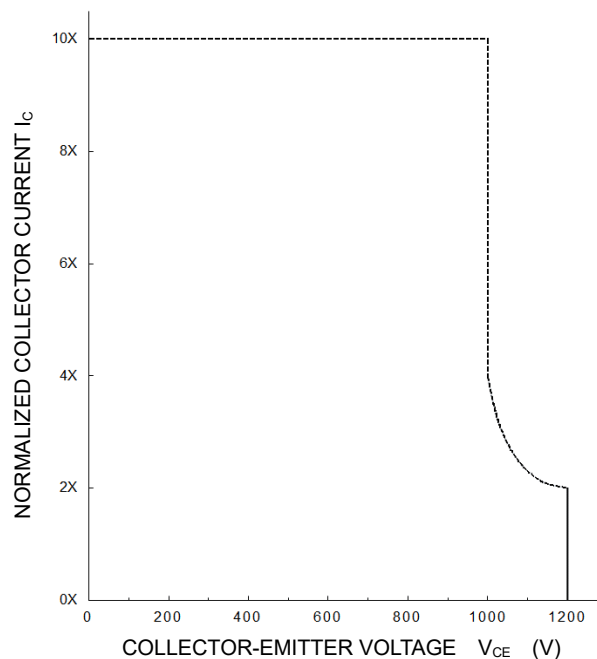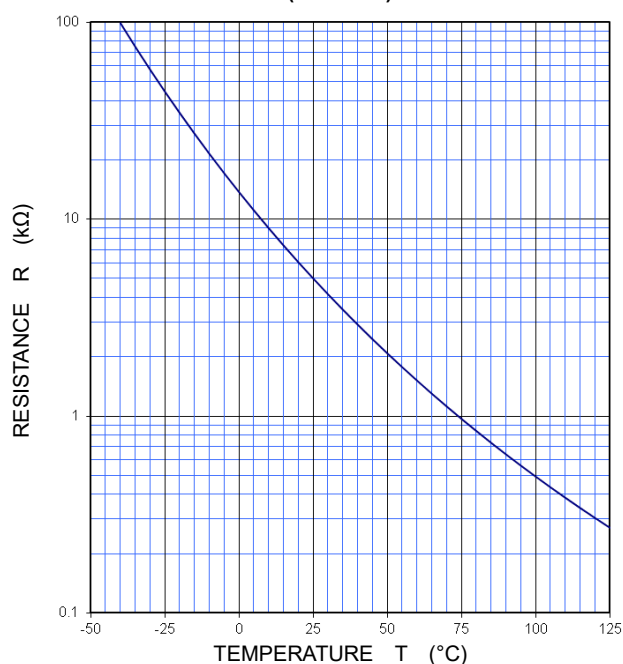**TURN-OFF SWITCHING SAFE OPERATING AREA**
(REVERSE BIAS SAFE OPERATING AREA)
(MAXIMUM)

$V_{CC} \leq 850$ V, R_G=2.0~20 Ω, V_{GE}=±15 V,
———— : T_{vj}=25~150 °C (Normal load operations (Continuous)
- - - - - : T_{vj}=175 °C (Unusual load operations (Limited period)

NORMALIZED COLLECTOR CURRENT I_C vs COLLECTOR-EMITTER VOLTAGE V_{CE} (V)
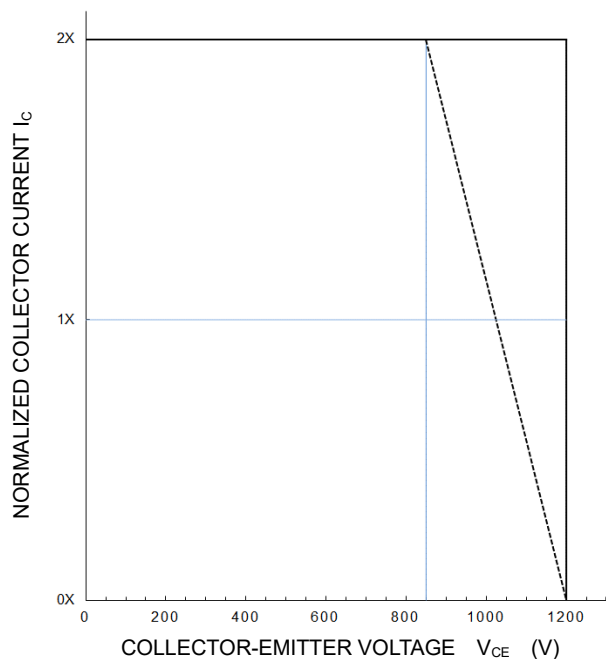
SHORT-CIRCUIT SAFE OPERATING AREA
(MAXIMUM)

$V_{CC} \leq 800$ V, R_G=2.0~20 Ω, V_{GE}=±15 V,
T_{vj}= 25 ~ 150 °C, $t_W \leq 8$ µs, Non-Repetitive

NORMALIZED COLLECTOR CURRENT I_C vs COLLECTOR-EMITTER VOLTAGE V_{CE} (V)

NTC thermistor part

TEMPERATURE CHARACTERISTICS
(TYPICAL)

RESISTANCE R (kΩ) vs TEMPERATURE T (°C)

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

MITSUBISHI ELECTRIC CORPORATION

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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