

< IGBT MODULES >

CM200DX-24S

HIGH POWER SWITCHING USE
INSULATED TYPE



Dual switch (Half-Bridge)

Collector current I_C **200 A**
 Collector-emitter voltage V_{CES} **1200 V**
 Maximum junction temperature T_{jmax} **175 °C**

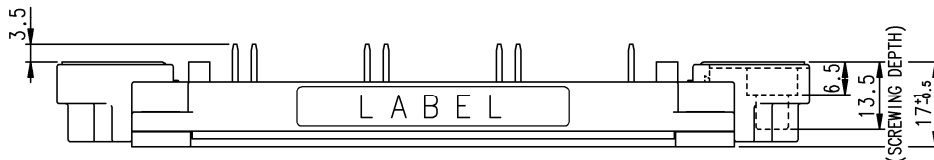
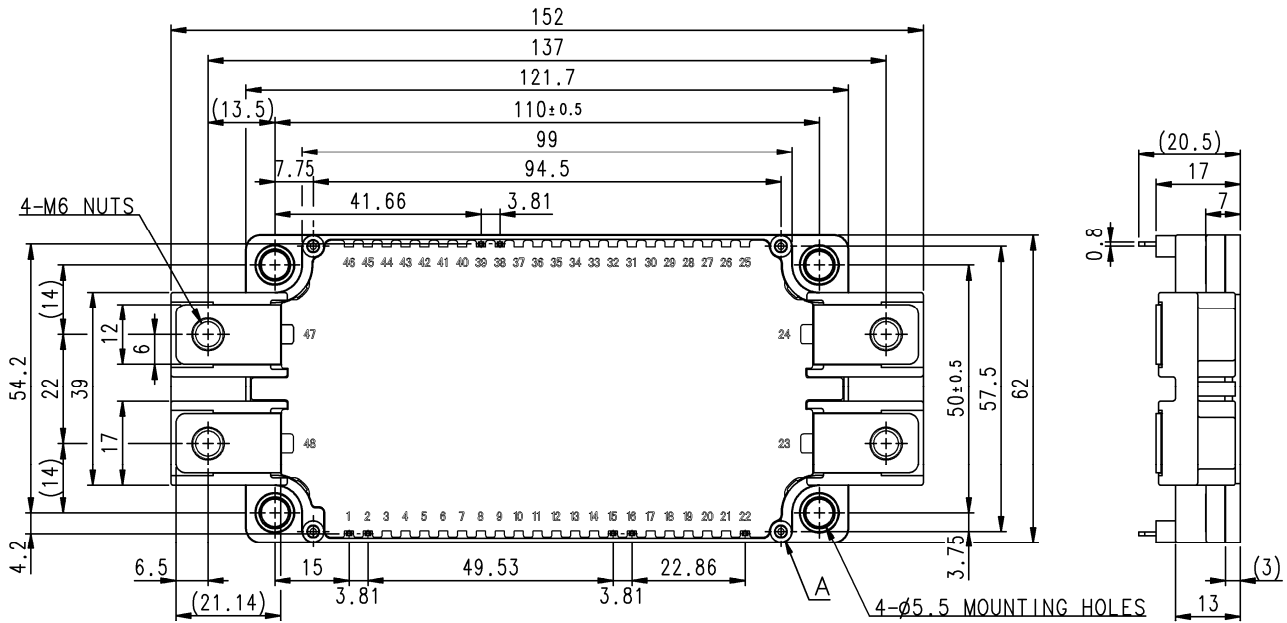
- Flat base Type
- Copper base plate (non-plating)
- Tin plating pin terminals
- RoHS Directive compliant
- Recognized under UL1557, File E323585

APPLICATION

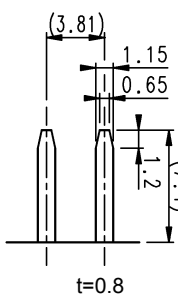
AC Motor Control, Motion/Servo Control, Power supply, etc.

OUTLINE DRAWING & INTERNAL CONNECTION

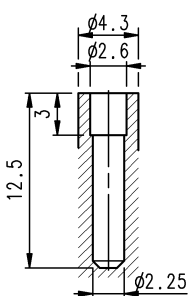
Dimension in mm



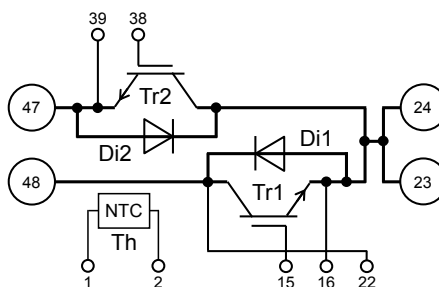
TERMINAL



SECTION A



INTERNAL CONNECTION



Terminal code

- 1 TH1
- 2 TH2
- 15 G1
- 16 Es1
- 22 Cs1
- 23 C2E1
- 24 C2E1
- 38 G2
- 39 Es2
- 47 E2
- 48 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

The tolerance of size between terminals is assumed to be ±0.4.

< IGBT MODULES >

CM200DX-24S

HIGH POWER SWITCHING USE
INSULATED TYPE

MAXIMUM RATINGS (T_j=25 °C, unless otherwise specified)

INVERTER PART IGBT/DIODE

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 =119 °C (Note2, 4)	200	A
I _{CRM}		Pulse, Repetitive (Note3)	400	
P _{tot}	Total power dissipation	T _C =25 °C (Note2, 4)	1500	W
I _E (Note1)	Emitter current	DC (Note2)	200	A
I _{ERM} (Note1)		Pulse, Repetitive (Note3)	400	

MODULE

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

ELECTRICAL CHARACTERISTICS (T_j=25 °C, unless otherwise specified)

INVERTER PART IGBT/DIODE

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 =20 mA, V _{CE} =10 V	5.4	6.0	6.6	V	
V _{CEsat} (Terminal)	Collector-emitter saturation voltage	I _C =200 A, V _{GE} =15 V, Refer to the figure of test circuit (Note5)	T _j =25 °C	-	1.80	2.25	V
			T _j =125 °C	-	2.00	-	
			T _j =150 °C	-	2.05	-	
V _{CEsat} (Chip)		I _C =200 A, V _{GE} =15 V, (Note5)	T _j =25 °C	-	1.70	2.15	V
			T _j =125 °C	-	1.90	-	
			T _j =150 °C	-	1.95	-	
C _{ies}	Input capacitance	V _{CE} =10 V, G-E short-circuited	-	-	20	nF	
C _{oes}	Output capacitance		-	-	4.0		
C _{res}	Reverse transfer capacitance		-	-	0.33		
Q _G	Gate charge	V _{CC} =600 V, I _C =200 A, V _{GE} =15 V	-	466	-	nC	
t _{d(on)}	Turn-on delay time	V _{CC} =600 V, I _C =200 A, V _{GE} =±15 V, R _G =0 Ω, Inductive load	-	-	800	ns	
t _r	Rise time		-	-	200		
t _{d(off)}	Turn-off delay time		-	-	600		
t _f	Fall time		-	-	300		
V _{EC} (Note1) (Terminal)	Emitter-collector voltage	I _E =200 A, G-E short-circuited, Refer to the figure of test circuit (Note5)	T _j =25 °C	-	1.80	2.25	V
			T _j =125 °C	-	1.80	-	
			T _j =150 °C	-	1.80	-	
V _{EC} (Note1) (Chip)		I _E =200 A, G-E short-circuited, (Note5)	T _j =25 °C	-	1.70	2.15	V
			T _j =125 °C	-	1.70	-	
			T _j =150 °C	-	1.70	-	
t _{rr} (Note1)	Reverse recovery time	V _{CC} =600 V, I _E =200 A, V _{GE} =±15 V,	-	-	300	ns	
Q _{rr} (Note1)	Reverse recovery charge	R _G =0 Ω, Inductive load	-	10.7	-	µC	
E _{on}	Turn-on switching energy per pulse	V _{CC} =600 V, I _C =I _E =200 A,	-	30.7	-	mJ	
E _{off}	Turn-off switching energy per pulse	V _{GE} =±15 V, R _G =0 Ω, T _j =150 °C,	-	21.5	-		
E _{rr} (Note1)	Reverse recovery energy per pulse	Inductive load	-	14.2	-	mJ	
R _{CC'+EE'}	Internal lead resistance	Main terminals-chip, per switch, T _C =25 °C (Note4)	-	-	1.1	mΩ	
r _g	Internal gate resistance	Per switch	-	9.8	-	Ω	

< IGBT MODULES >
CM200DX-24S

**HIGH POWER SWITCHING USE
 INSULATED TYPE**

ELECTRICAL CHARACTERISTICS (cont.; T_j=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)	-	-	0.10	K/W
R _{th(j-c)D}		Junction to case, per Inverter DIODE (Note4)	-	-	0.19	
R _{th(c-s)}	Contact thermal resistance	Case to heat sink, per 1 module, Thermal grease applied (Note4, 7)	-	15	-	K/W

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
m	mass	-	-	350	-	g
d _s	Creepage distance	Terminal to terminal	11.26	-	-	mm
		Terminal to base plate	12.46	-	-	
d _a	Clearance	Terminal to terminal	10	-	-	mm
		Terminal to base plate	10.12	-	-	
e _c	Flatness of base plate	On the centerline X, Y (Note8)	±0	-	+100	μm

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

- Junction temperature (T_j) should not increase beyond T_{jmax} rating.
- Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} 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.

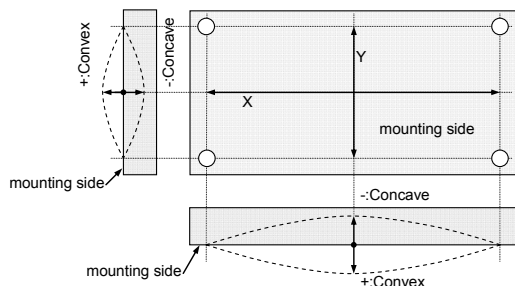
$$6. B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right),$$

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).

8. The base plate (mounting side) flatness measurement points (X, Y) are as follows of the following figure.



- Use the following screws when mounting the printed circuit board (PCB) on the stand offs.
 "φ2.6×10 or φ2.6×12 B1 tapping screw"
 The length of the screw depends on thickness (t1.6~t2.0) of the PCB.

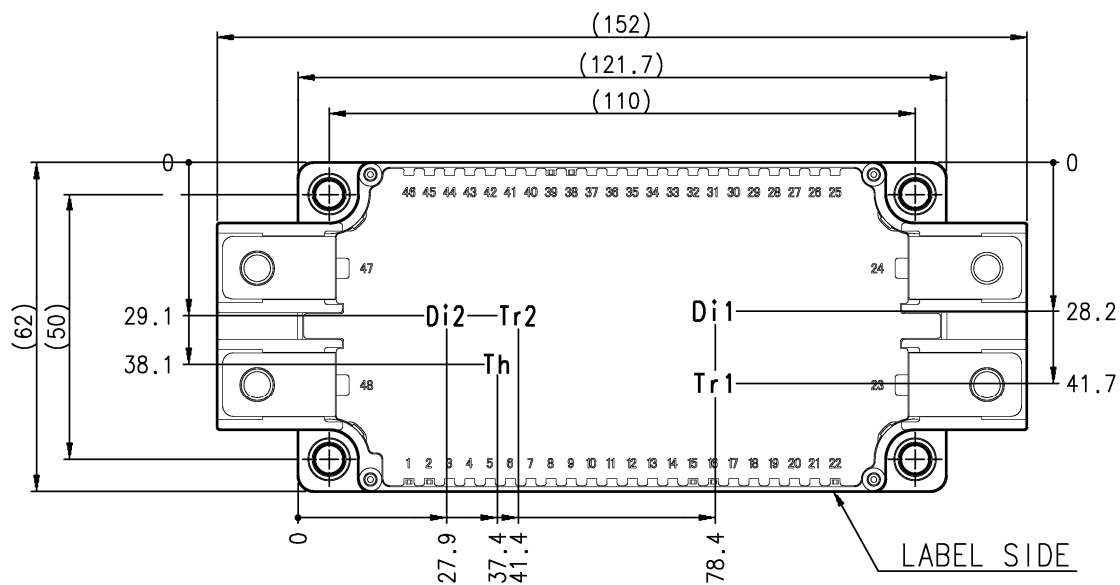
< IGBT MODULES >
CM200DX-24S
HIGH POWER SWITCHING USE
INSULATED TYPE

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across C1-E2 terminals	-	600	850	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	0	-	22	Ω

CHIP LOCATION (Top view)

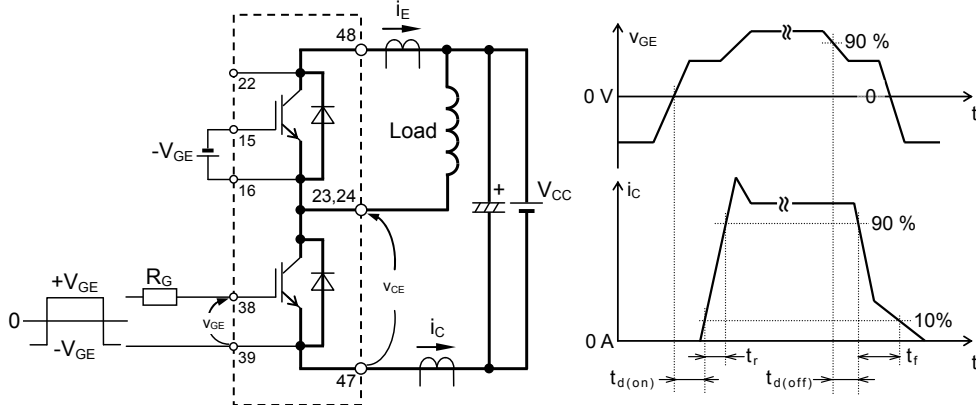
Dimension in mm, tolerance: ± 1 mm



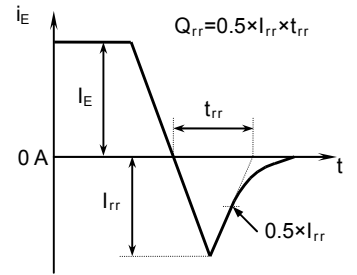
Tr1/Tr2: IGBT, Di1/Di2: DIODE, Th: NTC thermistor

< IGBT MODULES >
CM200DX-24S
 HIGH POWER SWITCHING USE
 INSULATED TYPE

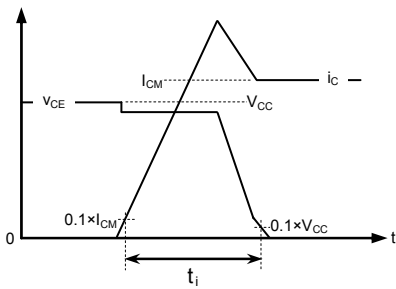
TEST CIRCUIT AND WAVEFORMS



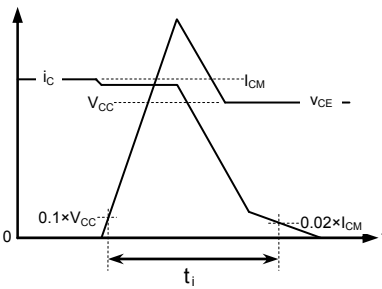
Switching characteristics test circuit and waveforms



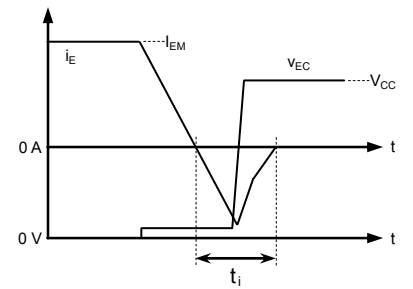
t_{rr}, Q_{rr} characteristics test waveform



IGBT Turn-on switching energy



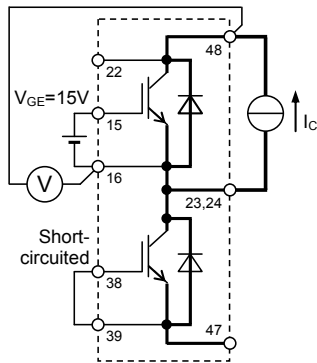
IGBT Turn-off switching energy



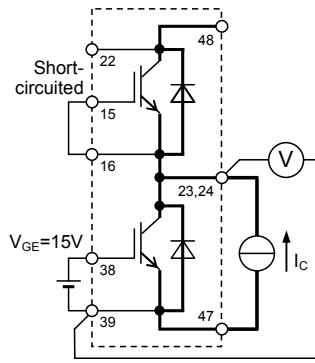
DIODE Reverse recovery energy

Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

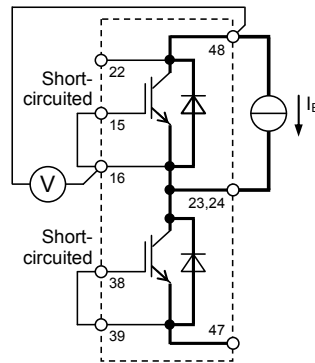
TEST CIRCUIT



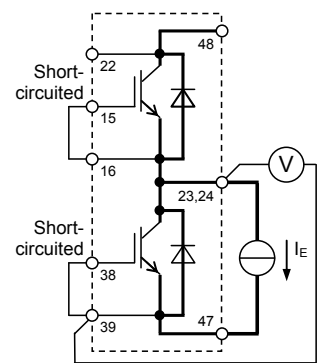
Tr1
V_{CEsat} characteristics test circuit



Tr2



Di1
V_{EC} characteristics test circuit



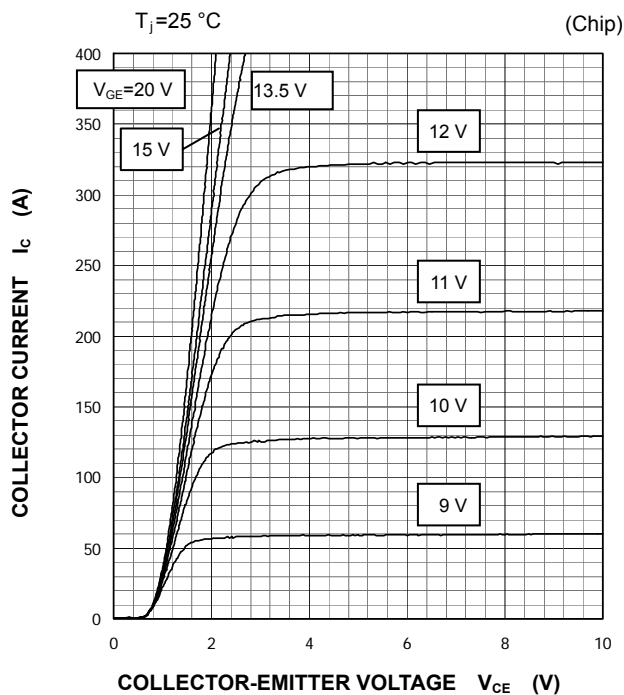
Di2

< IGBT MODULES >
CM200DX-24S
 HIGH POWER SWITCHING USE
 INSULATED TYPE

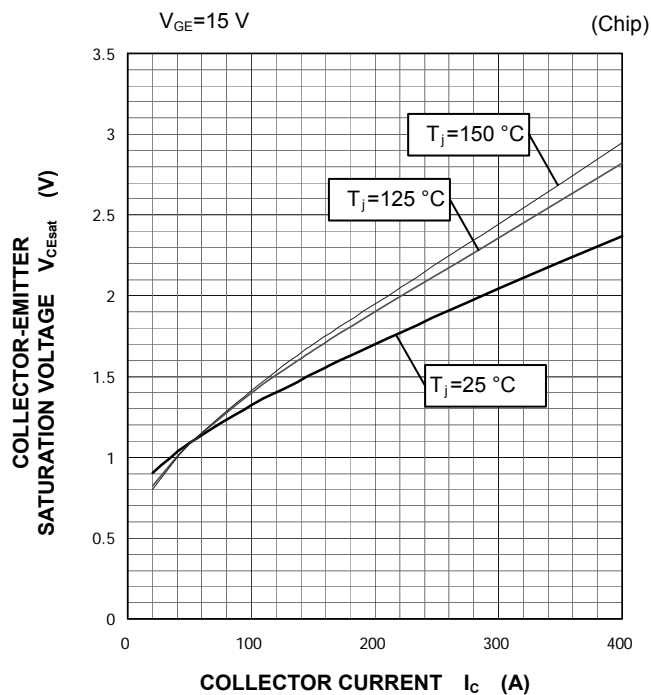
PERFORMANCE CURVES

INVERTER PART

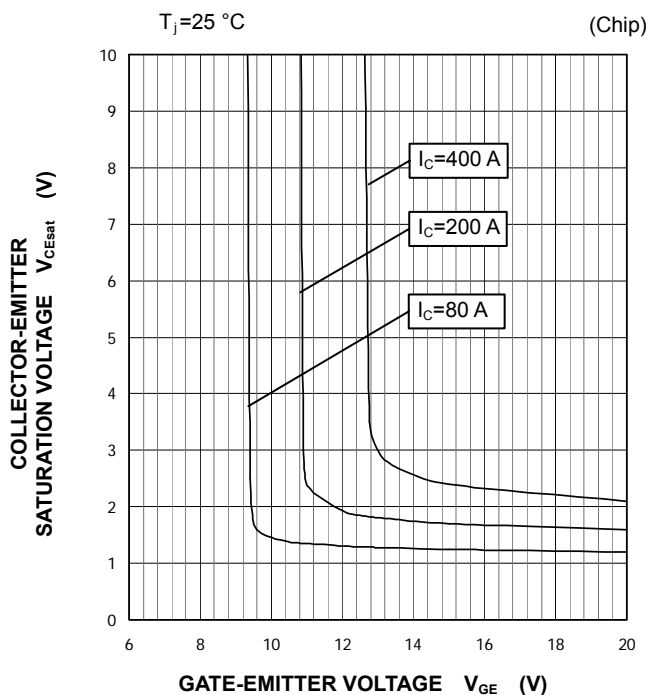
OUTPUT CHARACTERISTICS
 (TYPICAL)



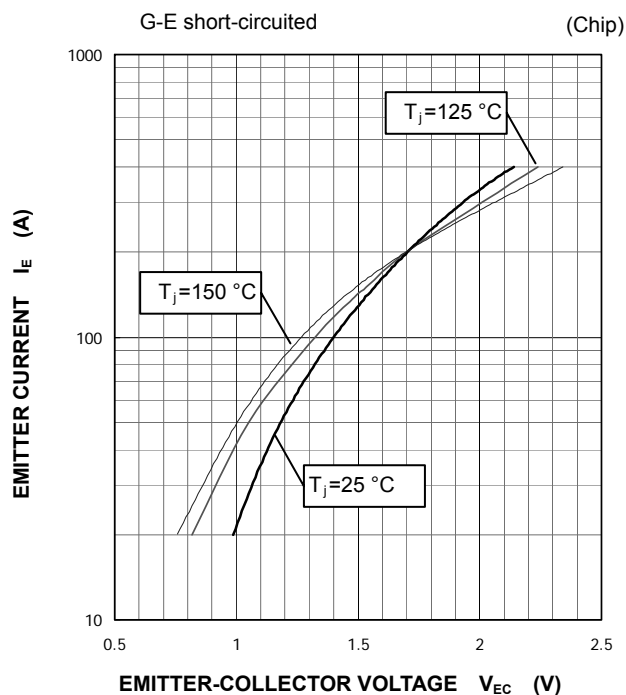
COLLECTOR-EMITTER SATURATION VOLTAGE
 CHARACTERISTICS
 (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE
 CHARACTERISTICS
 (TYPICAL)



FREE WHEELING DIODE
 FORWARD CHARACTERISTICS
 (TYPICAL)



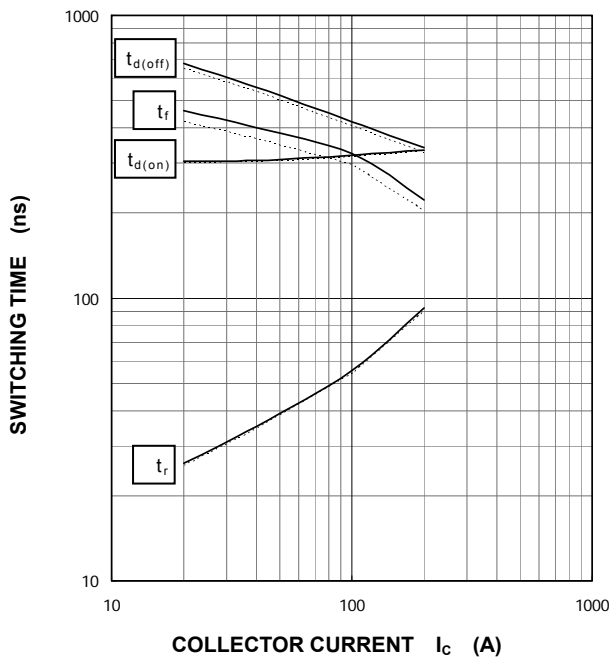
< IGBT MODULES >
CM200DX-24S
 HIGH POWER SWITCHING USE
 INSULATED TYPE

PERFORMANCE CURVES

INVERTER PART

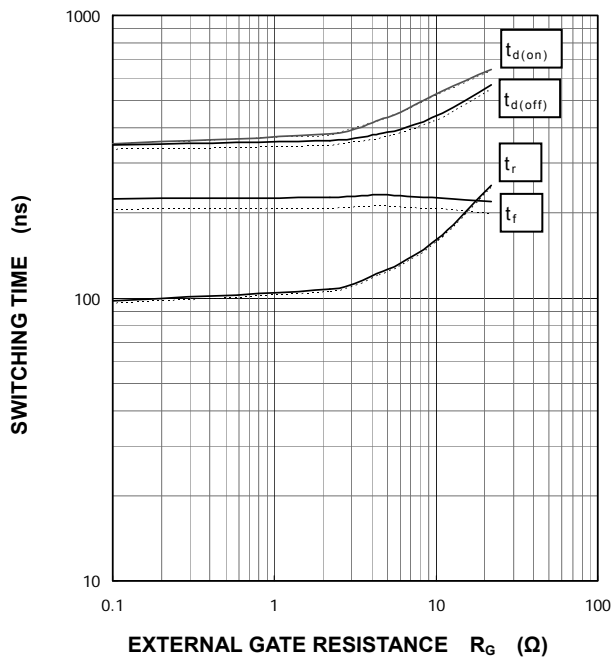
HALF-BRIDGE
 SWITCHING CHARACTERISTICS
 (TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$, INDUCTIVE LOAD
 —: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



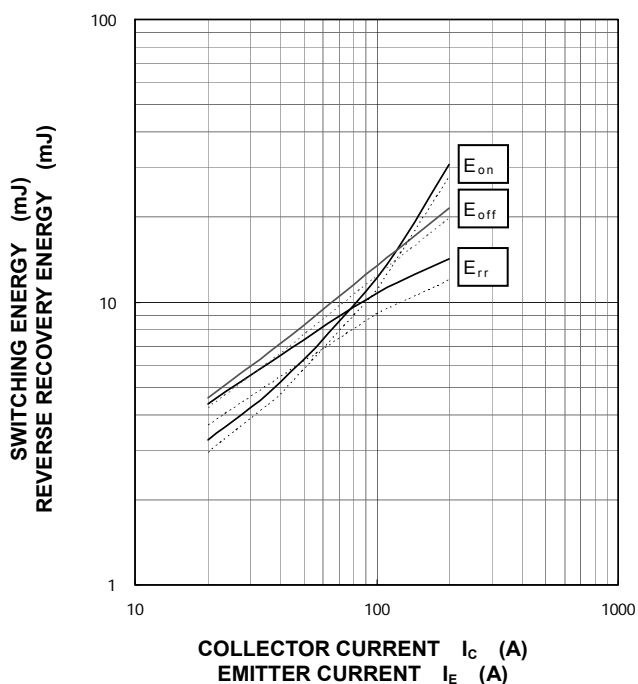
HALF-BRIDGE
 SWITCHING CHARACTERISTICS
 (TYPICAL)

$V_{CC}=600\text{ V}$, $I_C=200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
 —: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



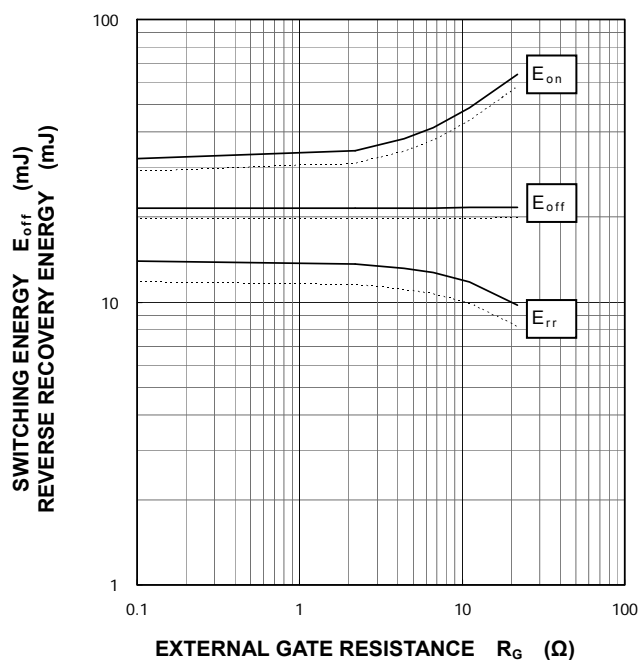
HALF-BRIDGE
 SWITCHING CHARACTERISTICS
 (TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$,
 INDUCTIVE LOAD, PER PULSE
 —: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



HALF-BRIDGE
 SWITCHING CHARACTERISTICS
 (TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C/I_E=200\text{ A}$,
 INDUCTIVE LOAD, PER PULSE
 —: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



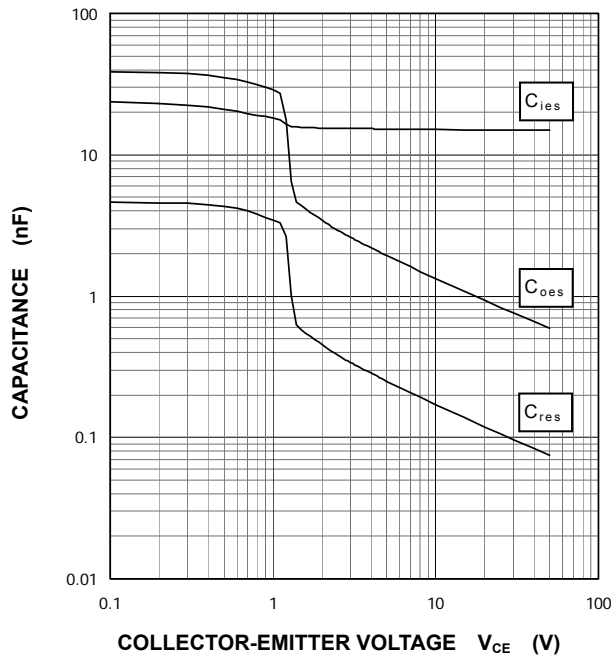
< IGBT MODULES >
CM200DX-24S
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 INSULATED TYPE

PERFORMANCE CURVES

INVERTER PART

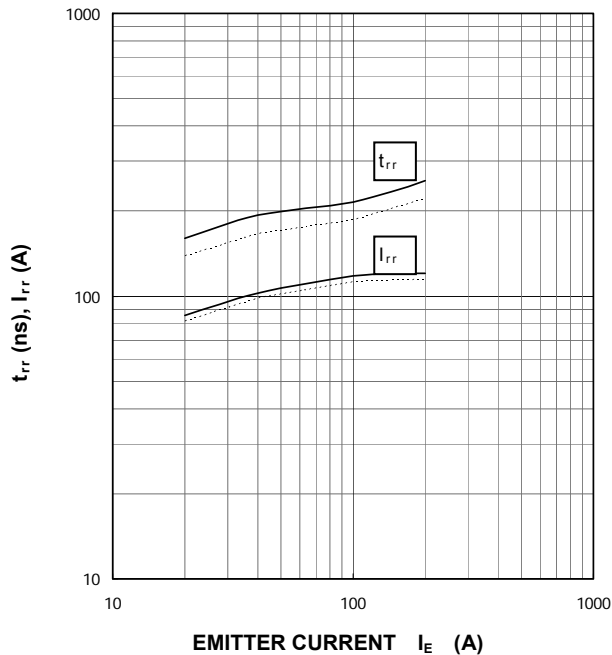
CAPACITANCE CHARACTERISTICS (TYPICAL)

G-E short-circuited, $T_j=25\text{ }^\circ\text{C}$



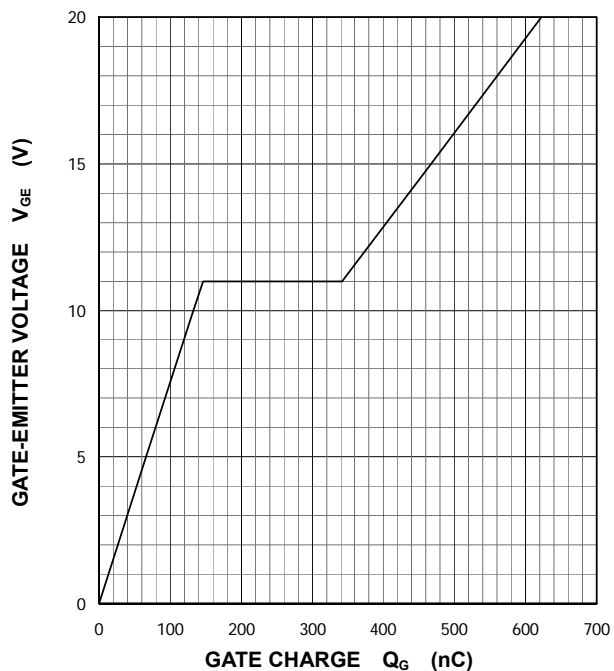
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$, INDUCTIVE LOAD
 —: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



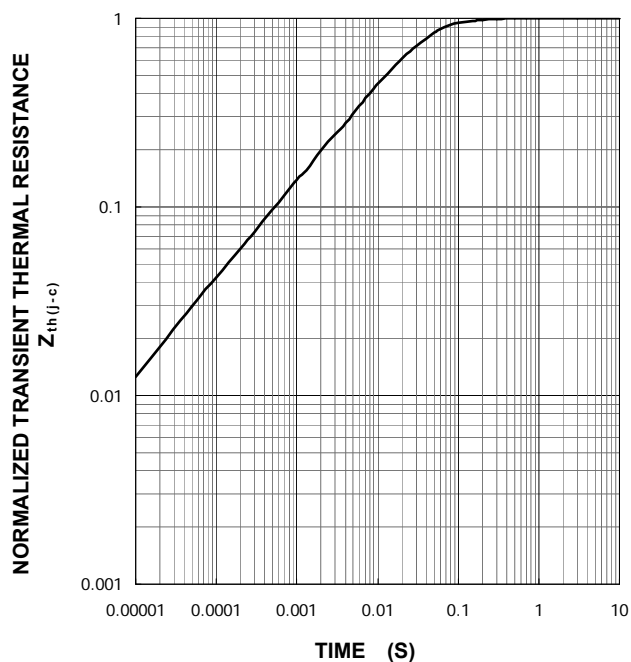
GATE CHARGE CHARACTERISTICS (TYPICAL)

$V_{CC}=600\text{ V}$, $I_C=200\text{ A}$, $T_j=25\text{ }^\circ\text{C}$



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)

Single pulse, $T_C=25\text{ }^\circ\text{C}$
 $R_{th(j-c)Q}=0.10\text{ K/W}$, $R_{th(j-c)D}=0.19\text{ K/kW}$

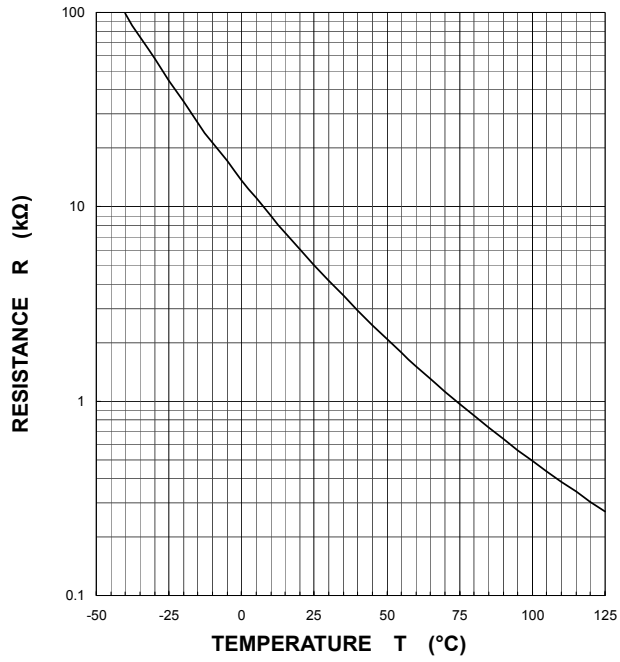


< IGBT MODULES >
CM200DX-24S
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

NTC thermistor part

TEMPERATURE CHARACTERISTICS
(TYPICAL)



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