

<IGBT Modules>

CM200RX-13T/CM200RXP-13T

HIGH POWER SWITCHING USE
INSULATED TYPE

 RX	Collector current I_c 2 0 0 A Collector-emitter voltage V_{CES} 6 5 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
 RXP	Collector current I_c 2 0 0 A Collector-emitter voltage V_{CES} 6 5 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
sevenpack (three-phase bridge+Brake chopper)	•UL Recognized under UL1557, File No. E323585

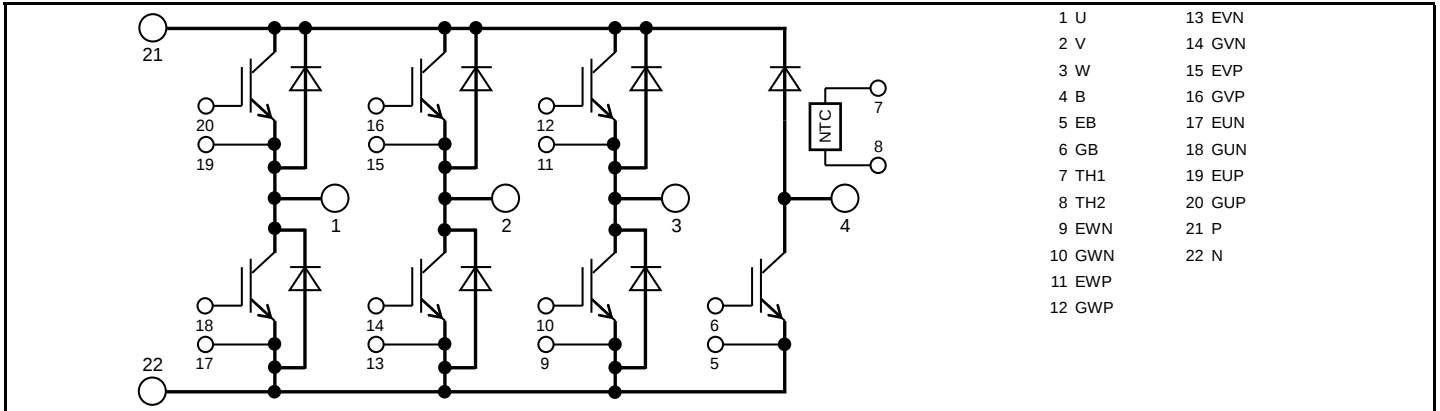
APPLICATION

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

OPTION (Below options are available.)

- PC-TIM (Phase Change Thermal Interface Material) pre-apply

INTERNAL CONNECTION

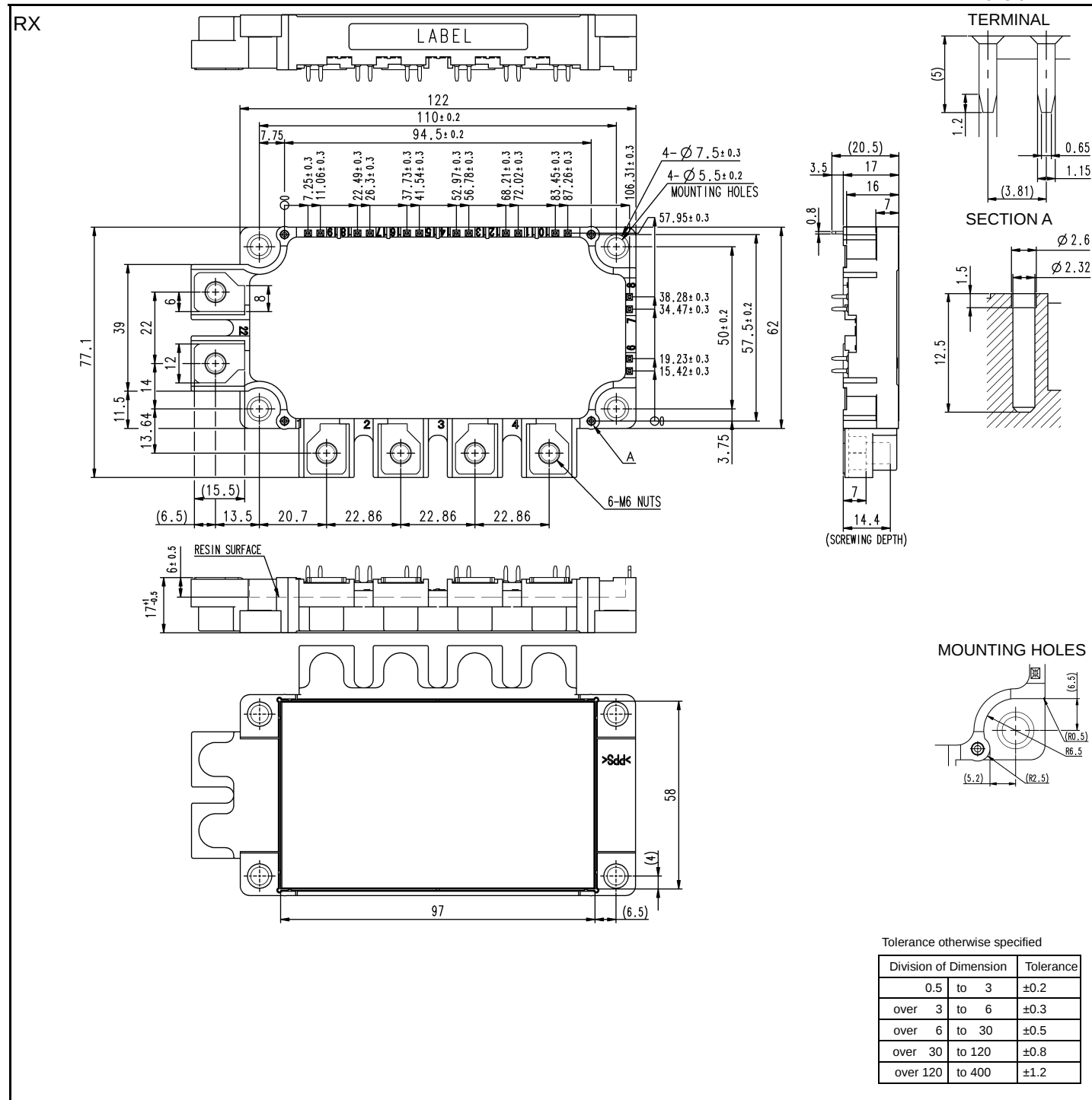


CM200RX-13T/CM200RXP-13T

HIGH POWER SWITCHING USE

INSULATED TYPE

OUTLINE DRAWING

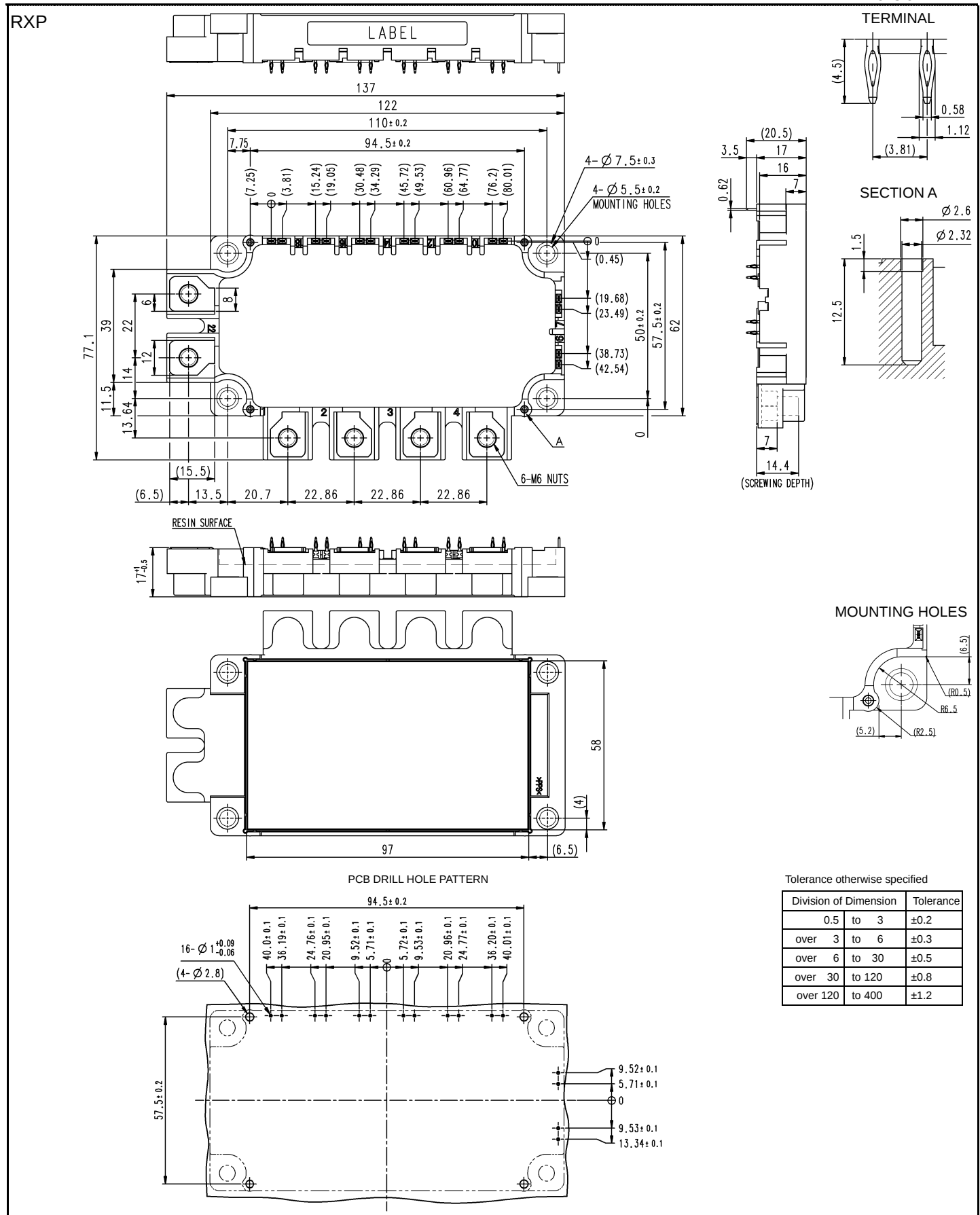


CM200RX-13T/CM200RXP-13T

HIGH POWER SWITCHING USE

INSULATED TYPE

OUTLINE DRAWING



CM200RX-13T/CM200RXP-13T

HIGH POWER SWITCHING USE

INSULATED TYPE

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	650	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I_C	Collector current	DC, $T_C=101\text{ }^{\circ}\text{C}$ (Note2, 4)	200	A
I_{CRM}		Pulse, Repetitive (Note3)	400	
P_{tot}	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	690	W
I_E (Note1)	Emitter current	DC (Note2)	200	A
I_{ERM} (Note1)		Pulse, Repetitive (Note3)	400	

BRAKE PART IGBT/DIODE

Symbol	Item	Conditions	Rating	Unit
V_{CES}	Collector-emitter voltage	G-E short-circuited	650	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I_C	Collector current	DC, $T_C=107\text{ }^{\circ}\text{C}$ (Note2, 4)	100	A
I_{CRM}		Pulse, Repetitive (Note3)	200	
P_{tot}	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	375	W
V_{RRM}	Repetitive peak reverse voltage	G-E short-circuited	650	V
I_F	Forward current	DC (Note2)	100	A
I_{FRM}		Pulse, Repetitive (Note3)	200	

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)	175	$^{\circ}\text{C}$
T_{cmmax}	Maximum case temperature	(Note4)	125	
T_{vjop}	Operating junction temperature	Continuous operation (under switching)	-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	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 _{vj} =25 °C	-	1.40	1.75	V
			T _{vj} =125 °C	-	1.50	-	
			T _{vj} =150 °C	-	1.55	-	
V _{CESat} (Chip)		I _C =200 A, V _{GE} =15 V, (Note5)	T _{vj} =25 °C	-	1.30	1.55	V
			T _{vj} =125 °C	-	1.35	-	
			T _{vj} =150 °C	-	1.35	-	
C _{ies}	Input capacitance	V _{CE} =10 V, G-E short-circuited		-	-	26.7	nF
C _{oes}	Output capacitance			-	-	1.1	
C _{res}	Reverse transfer capacitance			-	-	0.5	
Q _G	Gate charge	V _{CC} =300 V, I _C =200 A, V _{GE} =15 V		-	0.83	-	μC
t _{d(on)}	Turn-on delay time	V _{CC} =300 V, I _C =200 A, V _{GE} =±15 V, R _G =0.47 Ω, Inductive load		-	-	400	ns
t _r	Rise time			-	-	200	
t _{d(off)}	Turn-off delay time			-	-	400	
t _f	Fall time			-	-	600	

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

INVERTER PART IGBT/FWD

Symbol	Item	Conditions		Limits			Unit
				Min.	Typ.	Max.	
V_{EC} (Note1) (Terminal)	Emitter-collector voltage	$I_E=200\text{ A}$, G-E short-circuited, Refer to the figure of test circuit (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.50	2.05	V
V_{EC} (Note1) (Chip)		$I_E=200\text{ A}$, G-E short-circuited, (Note5)	$T_{vj}=125\text{ }^{\circ}\text{C}$	-	1.55	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.55	-	
	$T_{vj}=25\text{ }^{\circ}\text{C}$		-	1.45	1.85	V	
		$T_{vj}=125\text{ }^{\circ}\text{C}$	-	1.50	-		
		$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.50	-		
t_{rr} (Note1)	Reverse recovery time	$V_{CC}=300\text{ V}$, $I_E=200\text{ A}$, $V_{GE}=\pm 15\text{ V}$,		-	-	400	ns
Q_{rr} (Note1)	Reverse recovery charge	$R_G=0.47\text{ }\Omega$, Inductive load		-	12.5	-	μC
E_{on}	Turn-on switching energy per pulse	$V_{CC}=300\text{ V}$, $I_C=I_E=200\text{ A}$,		-	3.9	-	mJ
E_{off}	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$, $R_G=0.47\text{ }\Omega$, $T_{vj}=150\text{ }^{\circ}\text{C}$,		-	11.6	-	
E_{rr} (Note1)	Reverse recovery energy per pulse	Inductive load		-	10.1	-	mJ
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, $T_C=25\text{ }^{\circ}\text{C}$ (Note4)		-	1.4	-	m Ω
r_g	Internal gate resistance	Per switch		-	3.0	-	Ω

BRAKE 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 =10 mA, V _{CE} =10 V		5.4	6.0	6.6	V
V _{CEsat} (Terminal)	Collector-emitter saturation voltage	I _C =100 A, V _{GE} =15 V, Refer to the figure of test circuit (Note5)	T _{vj} =25 °C	-	1.40	1.75	V
			T _{vj} =125 °C	-	1.50	-	
			T _{vj} =150 °C	-	1.55	-	
V _{CEsat} (Chip)		I _C =100 A, V _{GE} =15 V, (Note5)	T _{vj} =25 °C	-	1.30	1.55	V
			T _{vj} =125 °C	-	1.35	-	
			T _{vj} =150 °C	-	1.35	-	
C _{ies}	Input capacitance	V _{CE} =10 V, G-E short-circuited		-	-	13.4	nF
C _{oes}	Output capacitance			-	-	0.6	
C _{res}	Reverse transfer capacitance			-	-	0.3	
Q _G	Gate charge	V _{CC} =300 V, I _C =100 A, V _{GE} =15 V		-	0.41	-	μC
t _{d(on)}	Turn-on delay time	V _{CC} =300 V, I _C =100 A, V _{GE} =±15 V, R _G =6.2 Ω, Inductive load		-	-	400	ns
t _r	Rise time			-	-	200	
t _{d(off)}	Turn-off delay time			-	-	400	
t _f	Fall time			-	-	600	
E _{on}	Turn-on switching energy per pulse	V _{CC} =300 V, I _C =100 A, V _{GE} =±15 V,		-	9.2	-	mJ
E _{off}	Turn-off switching energy per pulse	R _G =6.2 Ω, T _{vj} =150 °C, Inductive load		-	5.4	-	
r _g	Internal gate resistance	-		-	0	-	Ω
I _{RRM}	Reverse current	V _R =V _{RRM} , G-E short-circuited		-	-	1.0	mA
V _F (Terminal)	Forward voltage	I _F =100 A, G-E short-circuited, Refer to the figure of test circuit (Note5)	T _{vj} =25 °C	-	1.50	2.05	V
			T _{vj} =125 °C	-	1.55	-	
			T _{vj} =150 °C	-	1.55	-	
V _F (Chip)		I _F =100 A, G-E short-circuited, (Note5)	T _{vj} =25 °C	-	1.45	1.85	V
			T _{vj} =125 °C	-	1.50	-	
			T _{vj} =150 °C	-	1.50	-	
t _{rr}	Reverse recovery time	V _{CC} =300 V, I _F =100 A, V _{GE} =±15 V,		-	-	400	ns
Q _{rr}	Reverse recovery charge	R _G =6.2 Ω, Inductive load		-	4.0	-	μC
E _{rr}	Reverse recovery energy per pulse	V _{CC} =300 V, I _F =100 A, V _{GE} =±15 V, R _G =6.2 Ω, T _{vj} =150 °C, Inductive load		-	3.8	-	mJ

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INSULATED TYPE

ELECTRICAL CHARACTERISTICS (cont.; T_{vj}=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)	-	-	216	K/kW
R _{th(j-c)D}		Junction to case, per Inverter FWD (Note4)	-	-	333	
R _{th(j-c)Q}	Thermal resistance	Junction to case, Brake IGBT (Note4)	-	-	400	K/kW
R _{th(j-c)D}		Junction to case, Brake DIODE (Note4)	-	-	589	
R _{th(c-s)}	Contact thermal resistance	Case to heat sink, Thermal grease applied (Note4, 7)	-	11.5	-	K/kW
		per 1 module, PC-TIM applied (Note4, 8)	-	3.1	-	

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	Terminal to terminal	17	-	-	mm
		Terminal to base plate	18.4	-	-	
d _a	Clearance	Terminal to terminal	10	-	-	mm
		Terminal to base plate	16.2	-	-	
e _c	Flatness of base plate	On the centerline X, Y (Note9)	±0	-	+200	μm
m	mass	-	-	330	-	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.

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

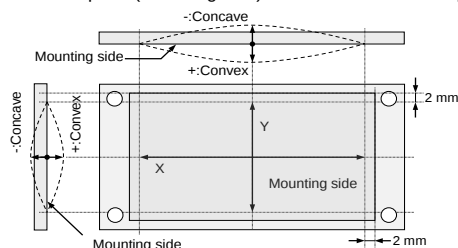
2. Junction temperature (T_{vj}) should not increase beyond T_{vjmax} rating.
3. Pulse width and repetition rate should be such that the device junction temperature (T_{vj}) dose not exceed T_{vjmax} rating.
4. Case temperature (T_C) and heat sink temperature (T_S) are defined on the each surface (mounting 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.

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

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)/D_(C-S)=50 μm.
8. Typical value is measured by using PC-TIM of λ=3.4 W/(m·K)/D_(C-S)=50 μm.
9. The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



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

PCB thickness : $t=1.6$.

Type	Size	Tightening torque	Recommended tightening method
(1) PT®	K25×8	$0.55 \pm 0.055 \text{ N} \cdot \text{m}$	by handwork (equivalent to 30 rpm by mechanical screw driver) ~ 600 rpm (by mechanical screw driver)
(2) PT®	K25×10	$0.75 \pm 0.075 \text{ N} \cdot \text{m}$	
(3) DELTA PT®	25×8	$0.55 \pm 0.055 \text{ N} \cdot \text{m}$	
(4) DELTA PT®	25×10	$0.75 \pm 0.075 \text{ N} \cdot \text{m}$	
(5) B1 tapping screw	$\phi 2.6 \times 10$ or $\phi 2.6 \times 12$	$0.75 \pm 0.075 \text{ N} \cdot \text{m}$	

RECOMMENDED OPERATING CONDITIONS

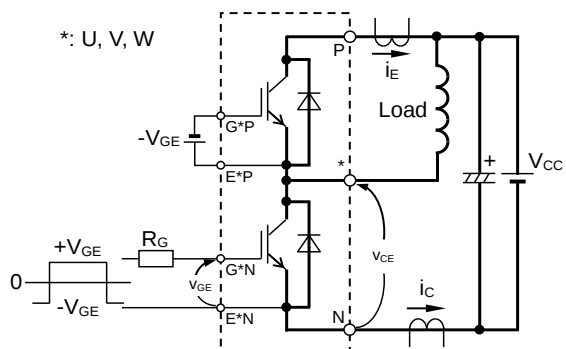
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across P-N terminals	-	300	450	V
V_{GEon}	Gate (-emitter drive) voltage	Applied across G*P-E*P/G*N-E*N/GB-EB terminals (*=U,V,W)	13.5	15.0	16.5	V
R_G	External gate resistance	Inverter IGBT, Per switch	0.47	-	30	Ω
		Brake IGBT	6.2	-	62	



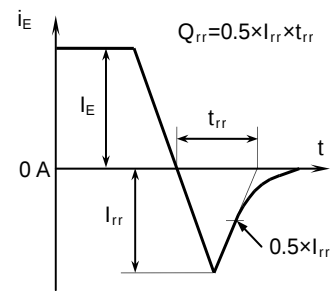
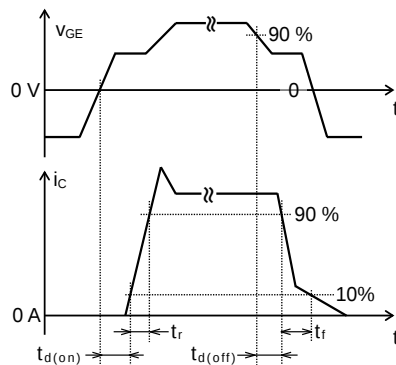
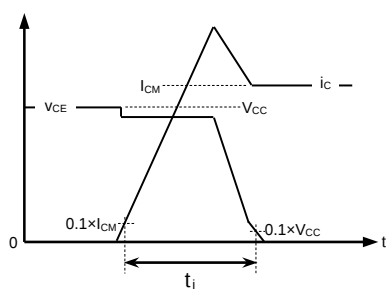
CM200RX-13T/CM200RXP-13T

HIGH POWER SWITCHING USE

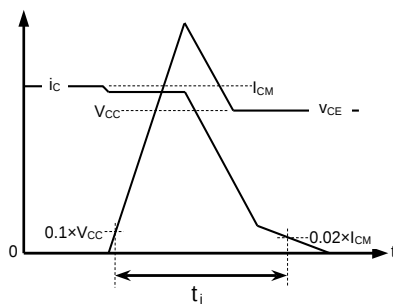
INSULATED TYPE

TEST CIRCUIT AND WAVEFORMS

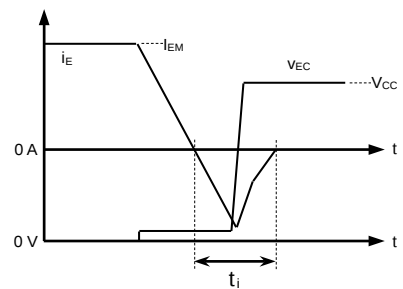
Switching characteristics test circuit and waveforms

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

IGBT Turn-on switching energy



IGBT Turn-off switching energy



FWD Reverse recovery energy

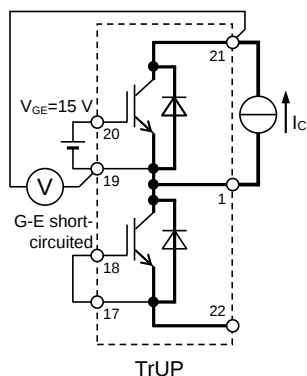
Switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

CM200RX-13T/CM200RXP-13T

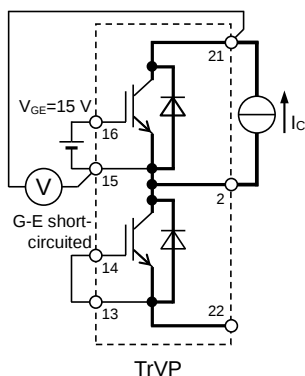
HIGH POWER SWITCHING USE

INSULATED TYPE

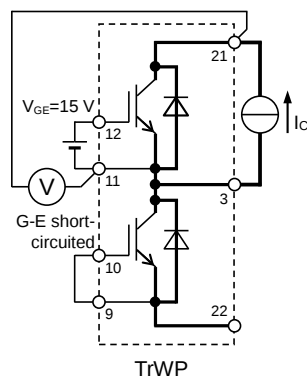
TEST CIRCUIT



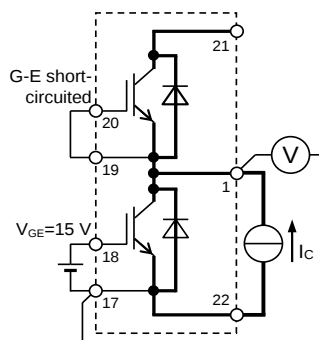
TrUP



TrVP

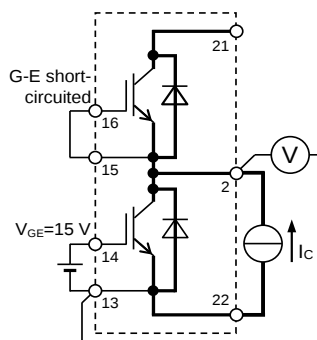


TrWP



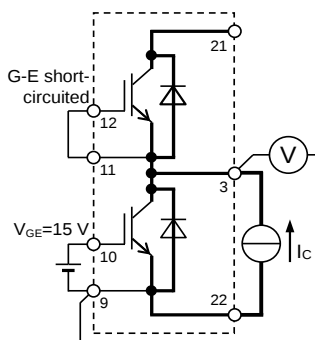
TrUN

Gate-emitter GVP-EVP, GVN-EVN,
short-circuited GWP-EWP, GWN-EWN
GB-EB



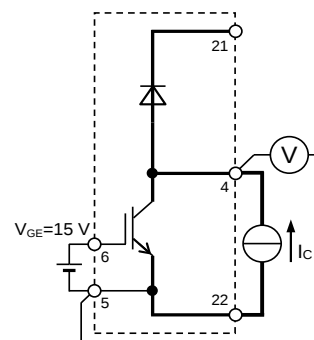
TrVN

Gate-emitter GUP-EUP, GUN-EUN,
short-circuited GWP-EWP, GWN-EWN
GB-EB

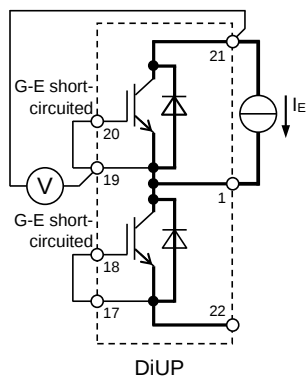


TrWN

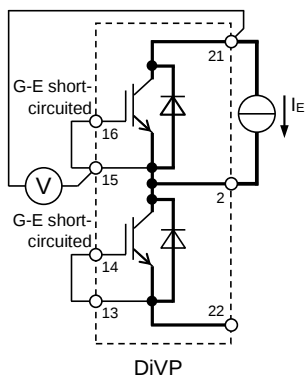
Gate-emitter GUP-EUP, GUN-EUN,
short-circuited GVP-EVP, GVN-EVN
GB-EB



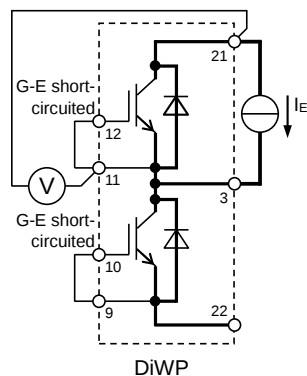
Gate-emitter GUP-EUP, GUN-EUN,
short-circuited GVP-EVP, GVN-EVN,
GWP-EWP, GWN-EWN

 V_{CEsat} characteristics test circuit

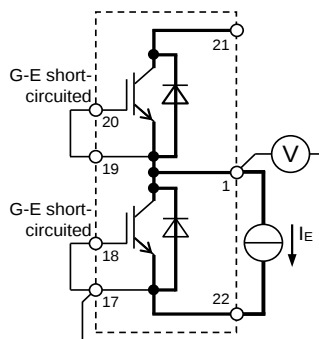
DiUP



DiVP

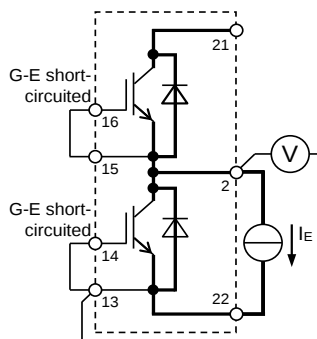


DiWP



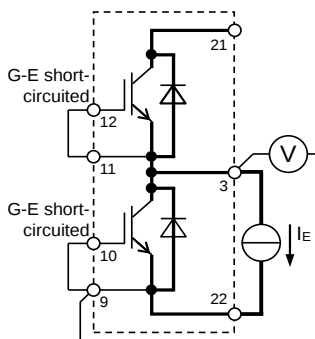
DiUN

Gate-emitter GVP-EVP, GVN-EVN,
short-circuited GWP-EWP, GWN-EWN
GB-EB



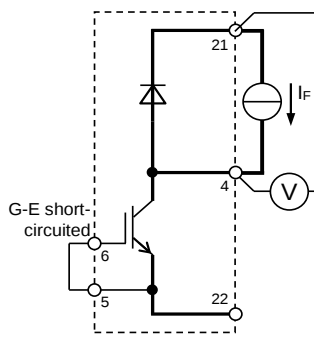
DiVN

Gate-emitter GUP-EUP, GUN-EUN,
short-circuited GWP-EWP, GWN-EWN
GB-EB



DiWN

Gate-emitter GUP-EUP, GUN-EUN,
short-circuited GVP-EVP, GVN-EVN
GB-EB



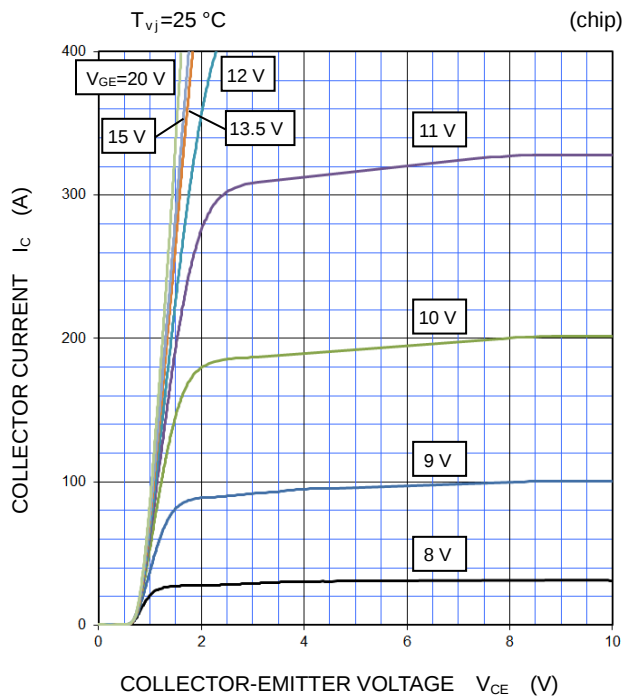
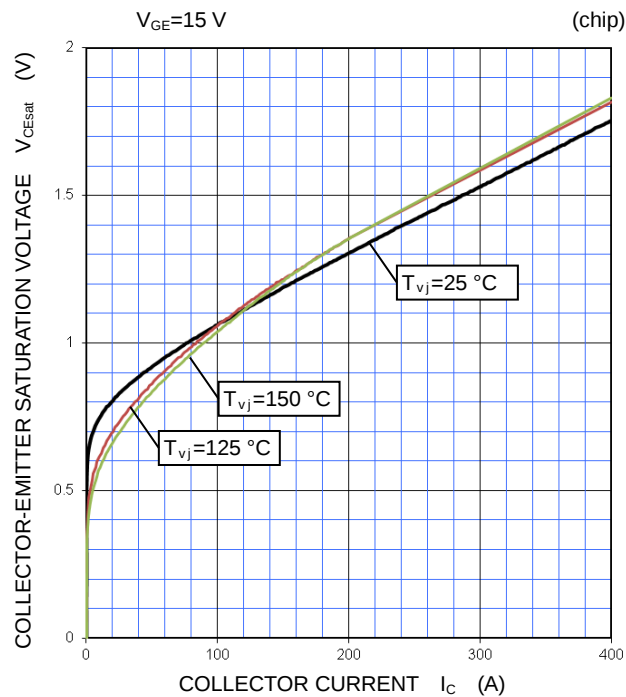
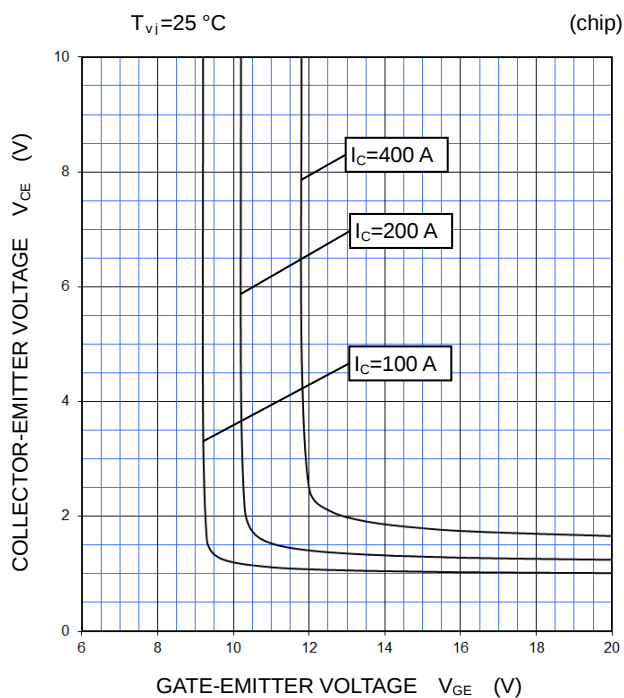
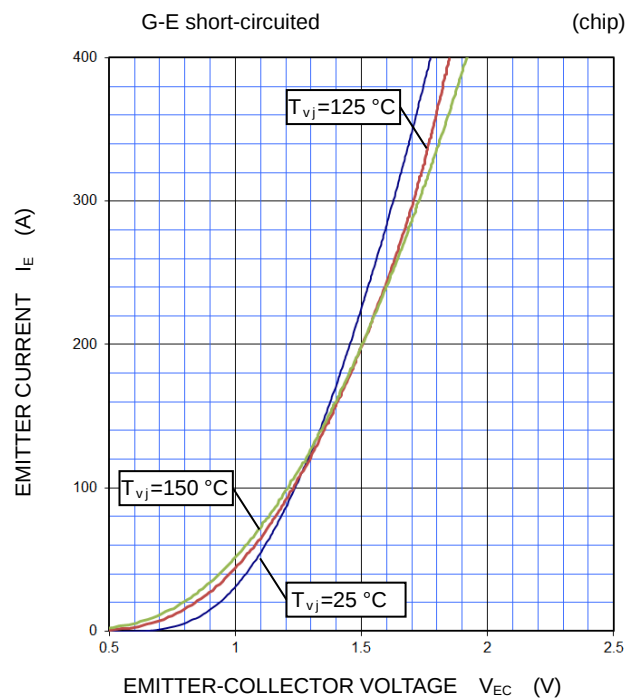
Gate-emitter GUP-EUP, GUN-EUN,
short-circuited GVP-EVP, GVN-EVN,
GWP-EWP, GWN-EWN

 V_{EC} characteristics test circuit V_F characteristics test circuit

CM200RX-13T/CM200RXP-13T

HIGH POWER SWITCHING USE

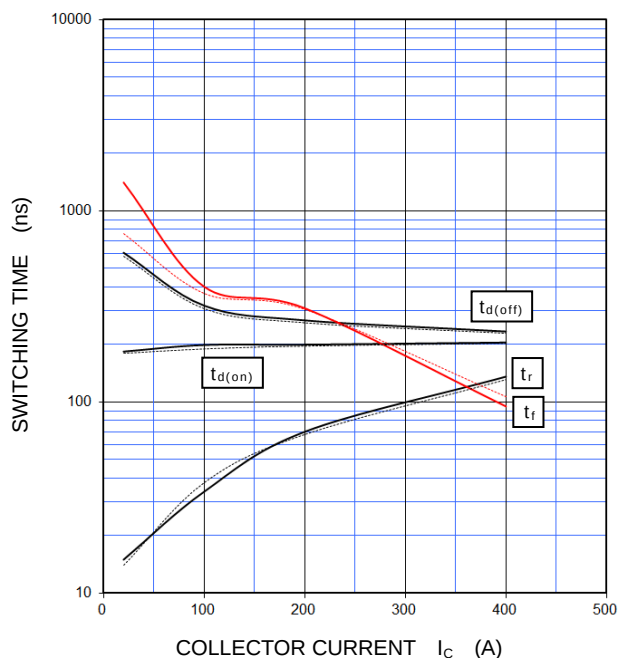
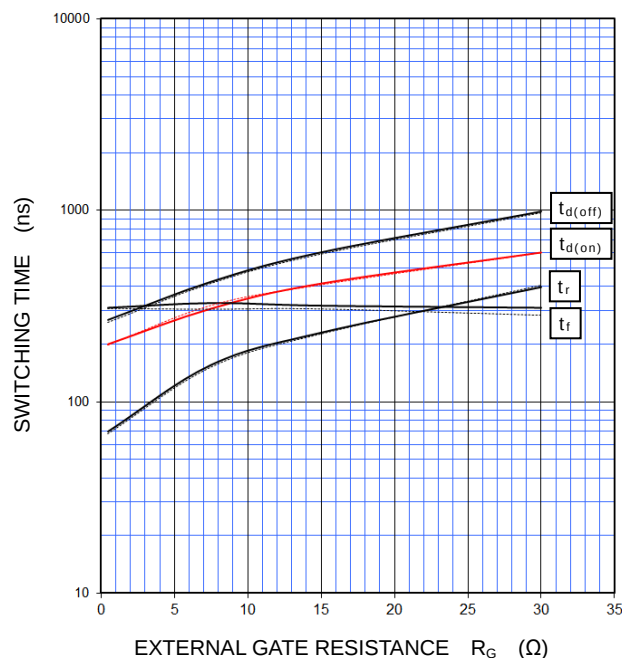
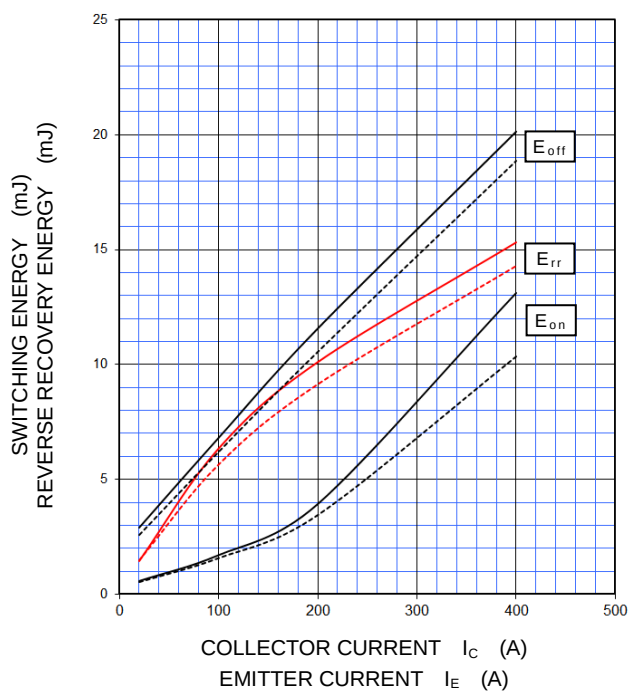
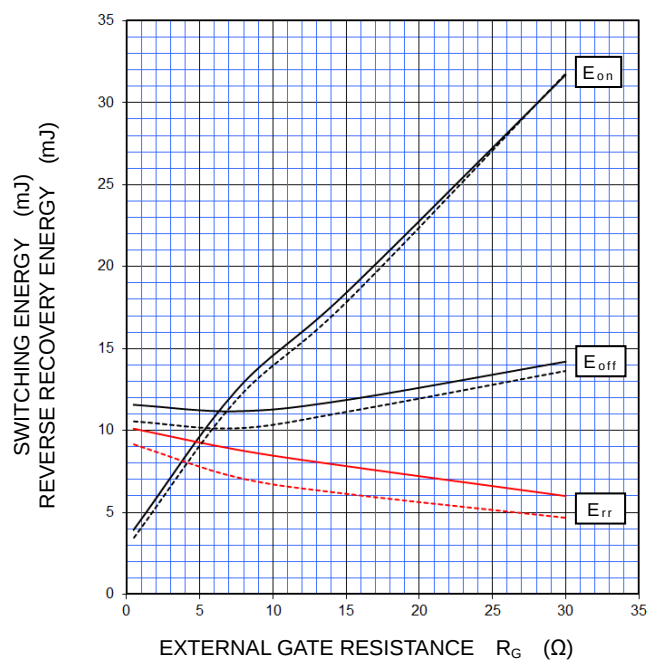
INSULATED TYPE

PERFORMANCE CURVES**INVERTER PART****OUTPUT CHARACTERISTICS
(TYPICAL)****COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)****COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS
(TYPICAL)****FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)**

CM200RX-13T/CM200RXP-13T

HIGH POWER SWITCHING USE

INSULATED TYPE

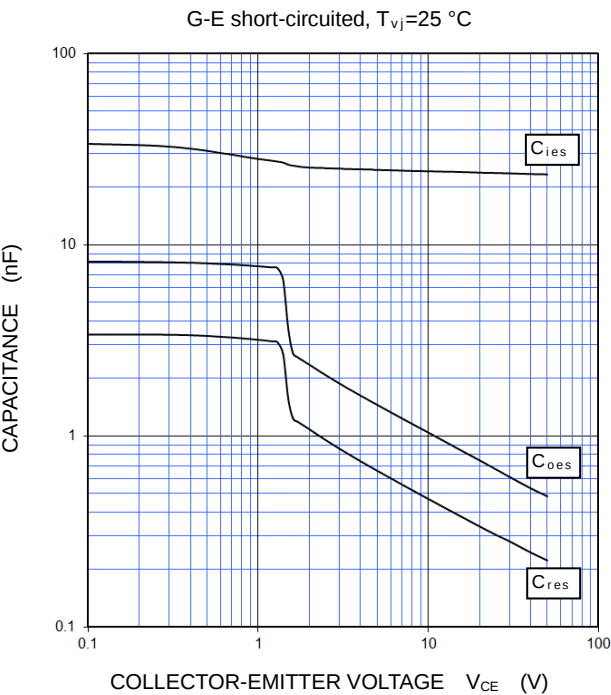
PERFORMANCE CURVES**INVERTER PART****HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**
 $V_{CC}=300\text{ V}$, $R_G=0.47\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - - -: $T_{vj}=125\text{ }^\circ\text{C}$
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**
 $V_{CC}=300\text{ V}$, $I_C=200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - - -: $T_{vj}=125\text{ }^\circ\text{C}$
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**
 $V_{CC}=300\text{ V}$, $R_G=0.47\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD,
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - - -: $T_{vj}=125\text{ }^\circ\text{C}$, PER PULSE
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**
 $V_{CC}=300\text{ V}$, $I_C/I_E=200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD,
 —: $T_{vj}=150\text{ }^\circ\text{C}$, - - - - -: $T_{vj}=125\text{ }^\circ\text{C}$, PER PULSE


<IGBT Modules>
CM200RX-13T/CM200RXP-13T
HIGH POWER SWITCHING USE
INSULATED TYPE

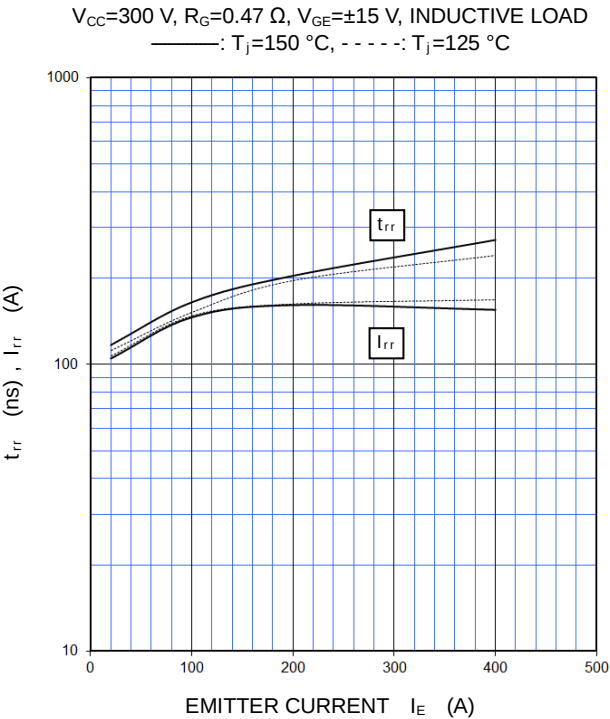
PERFORMANCE CURVES

INVERTER PART

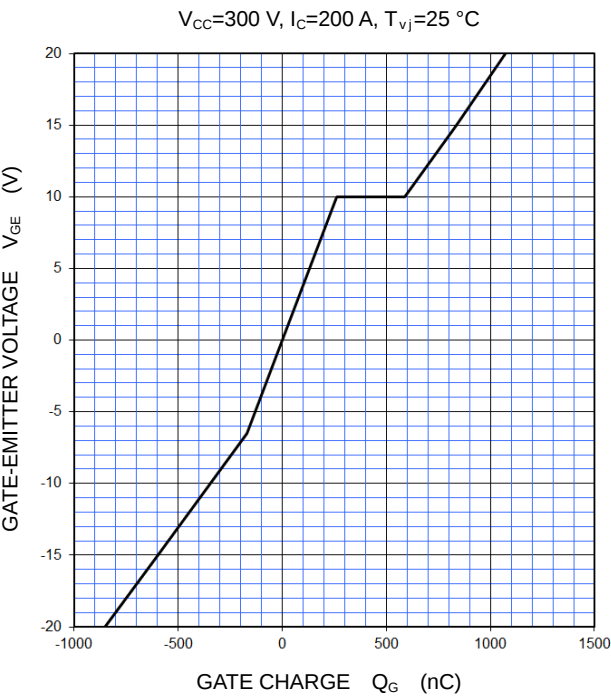
CAPACITANCE CHARACTERISTICS
(TYPICAL)



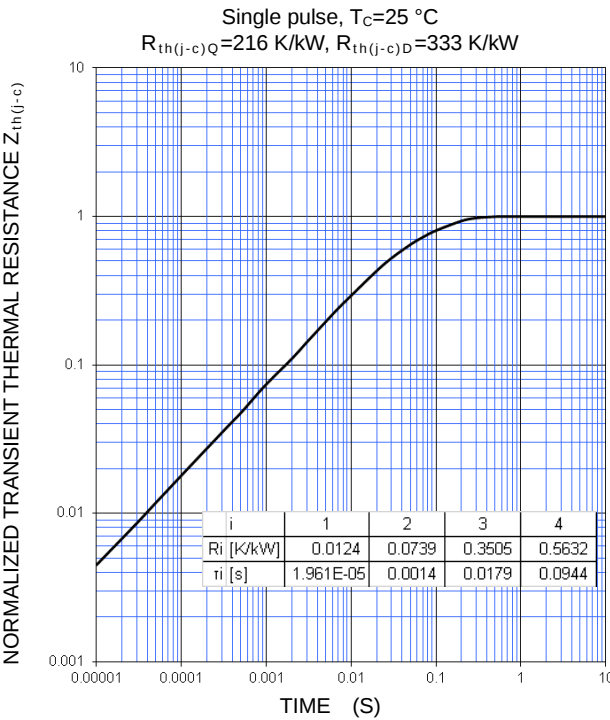
FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)



GATE CHARGE CHARACTERISTICS
(TYPICAL)



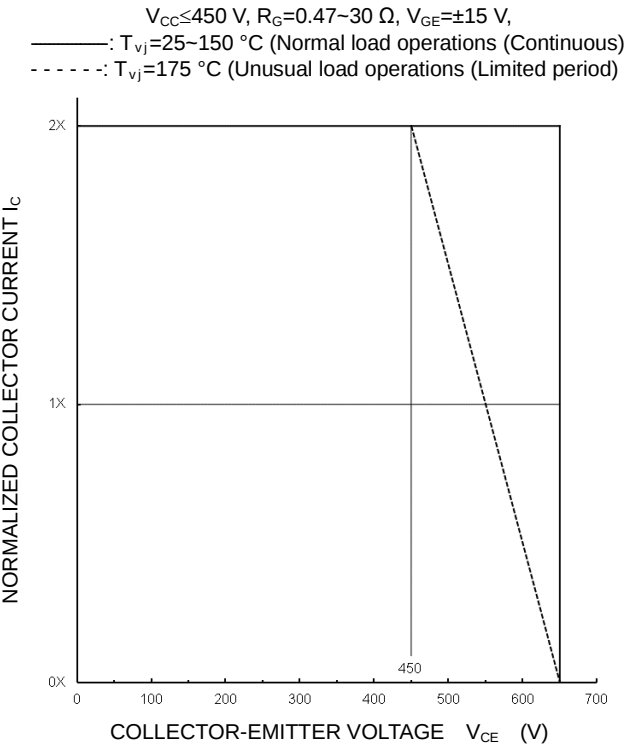
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)



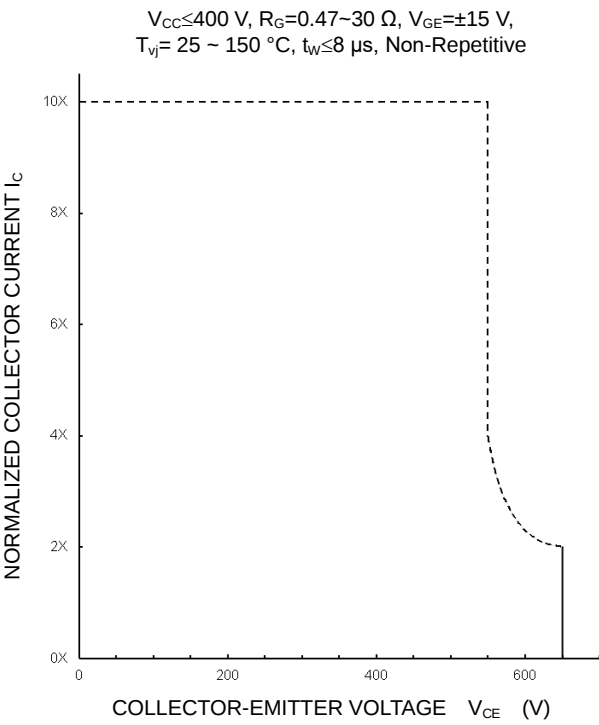
PERFORMANCE CURVES

INVERTER PART

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



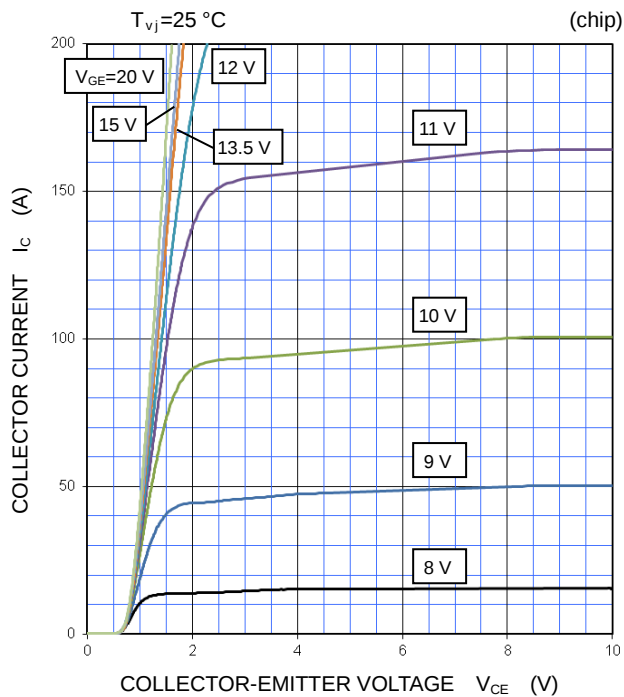
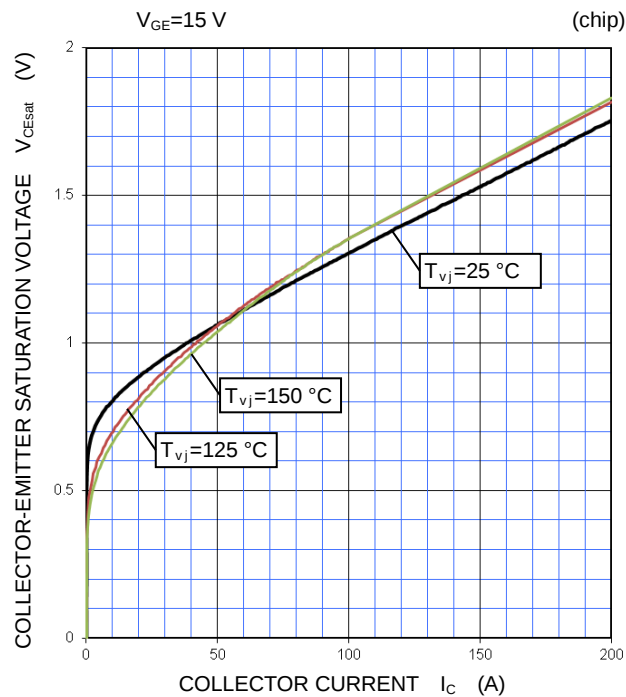
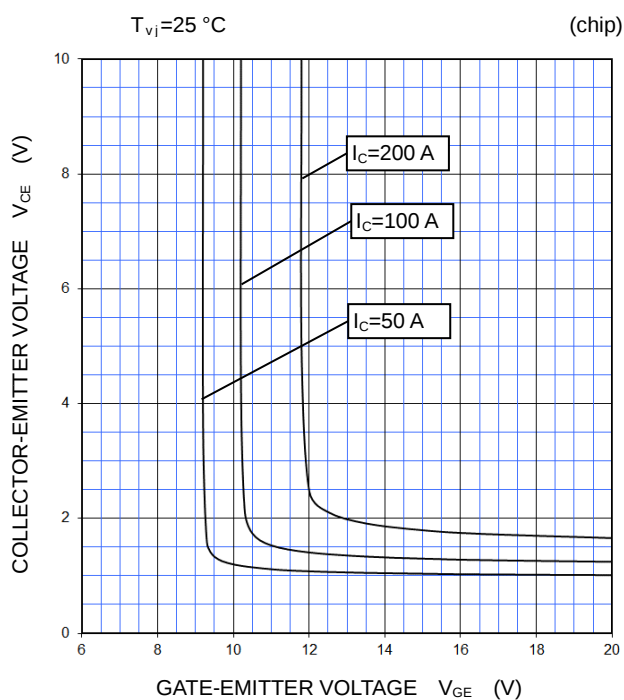
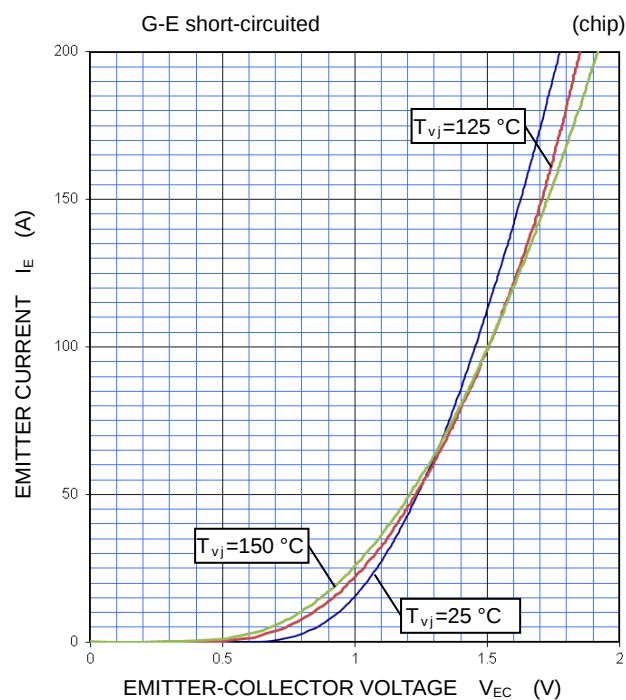
SHORT-CIRCUIT SAFE OPERATING AREA
(MAXIMUM)



CM200RX-13T/CM200RXP-13T

HIGH POWER SWITCHING USE

INSULATED TYPE

PERFORMANCE CURVES**BRAKE PART****OUTPUT CHARACTERISTICS
(TYPICAL)****COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)****COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS
(TYPICAL)****DIODE
FORWARD CHARACTERISTICS
(TYPICAL)**

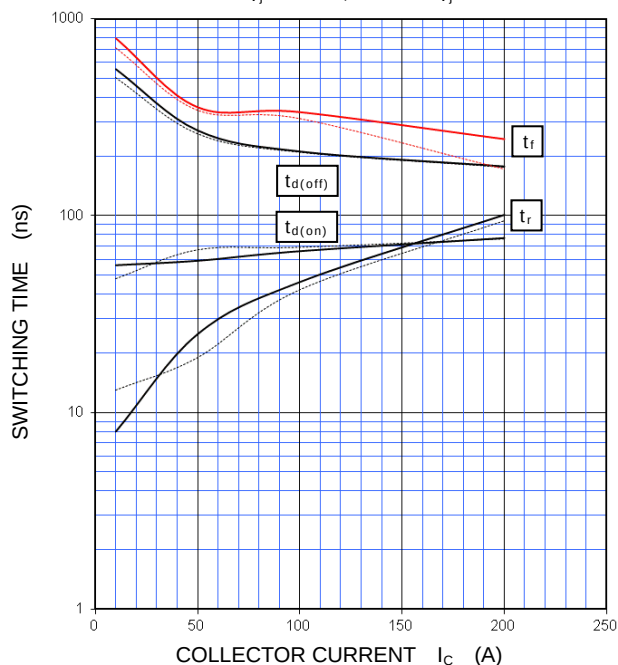
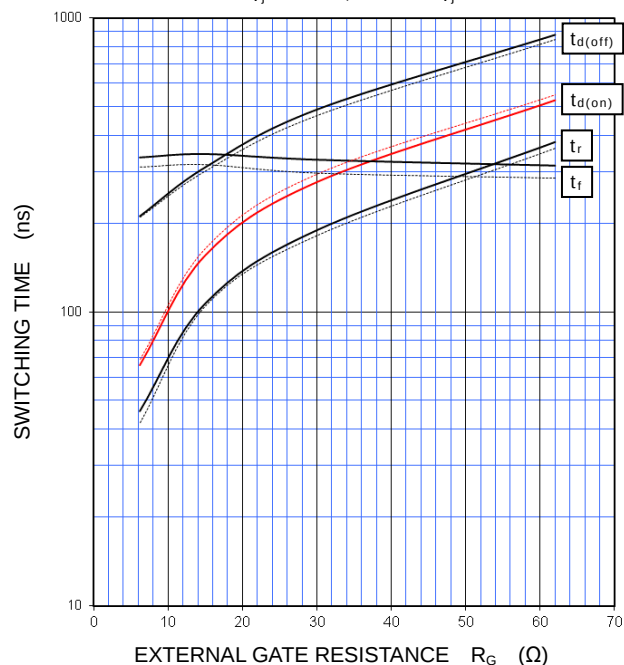
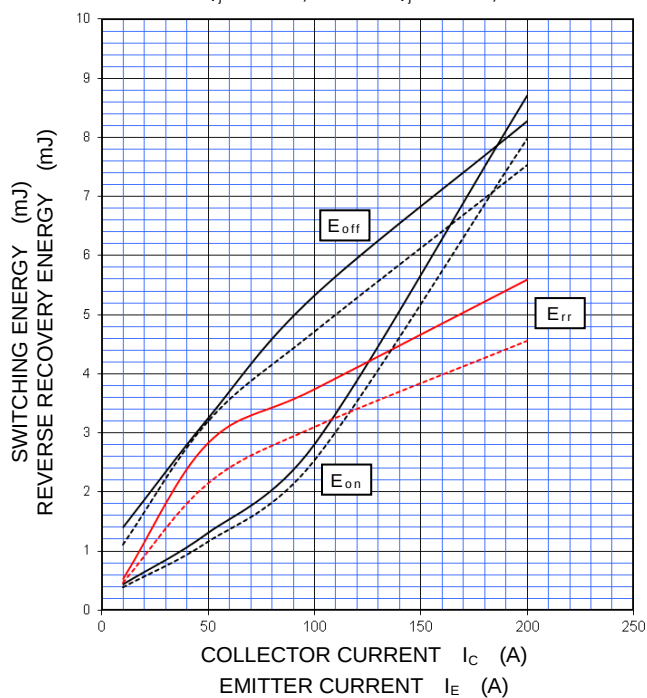
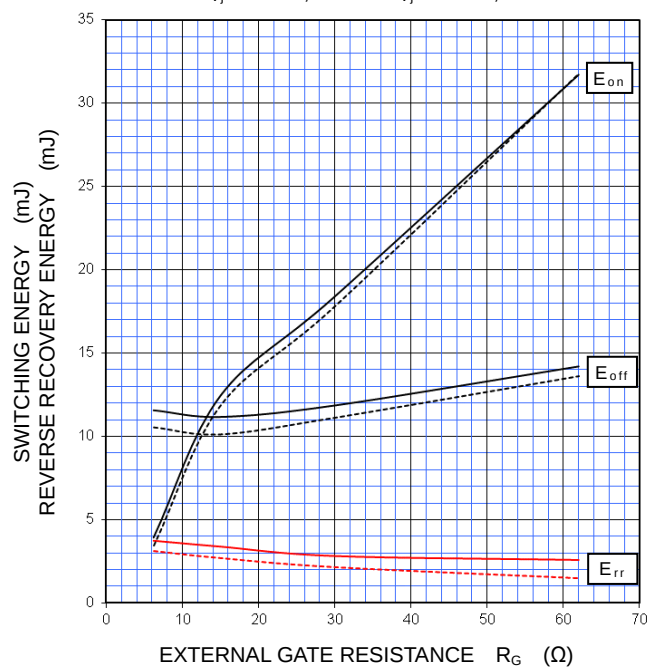
CM200RX-13T/CM200RXP-13T

HIGH POWER SWITCHING USE

INSULATED TYPE

PERFORMANCE CURVES

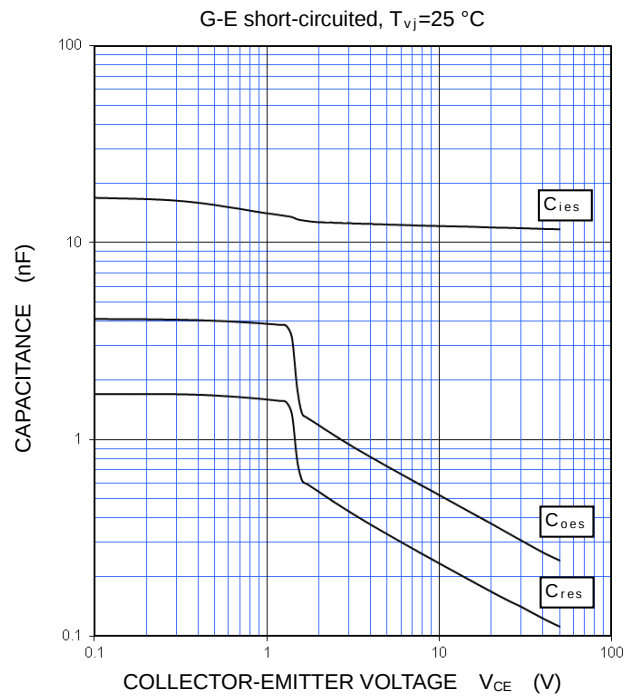
BRAKE PART

HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL) $V_{CC}=300\text{ V}$, $R_G=6.2\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$ HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL) $V_{CC}=300\text{ V}$, $I_C=75\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$ HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL) $V_{CC}=300\text{ V}$, $R_G=6.2\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD,
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$, PER PULSEHALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL) $V_{CC}=300\text{ V}$, $I_C/I_E=75\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD,
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$, PER PULSE

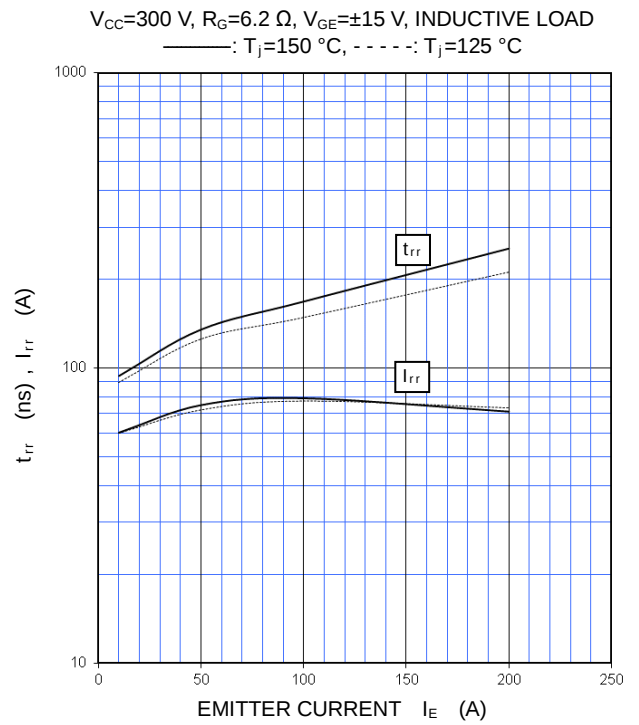
PERFORMANCE CURVES

BRAKE PART

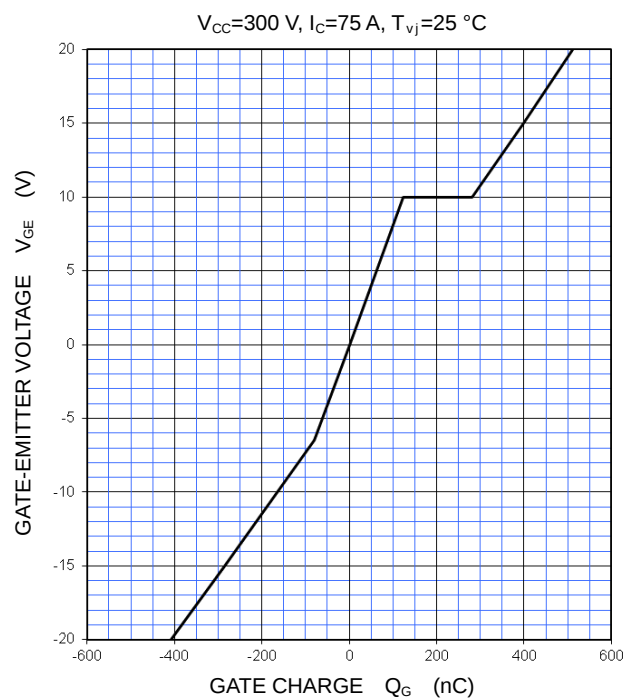
CAPACITANCE CHARACTERISTICS
(TYPICAL)



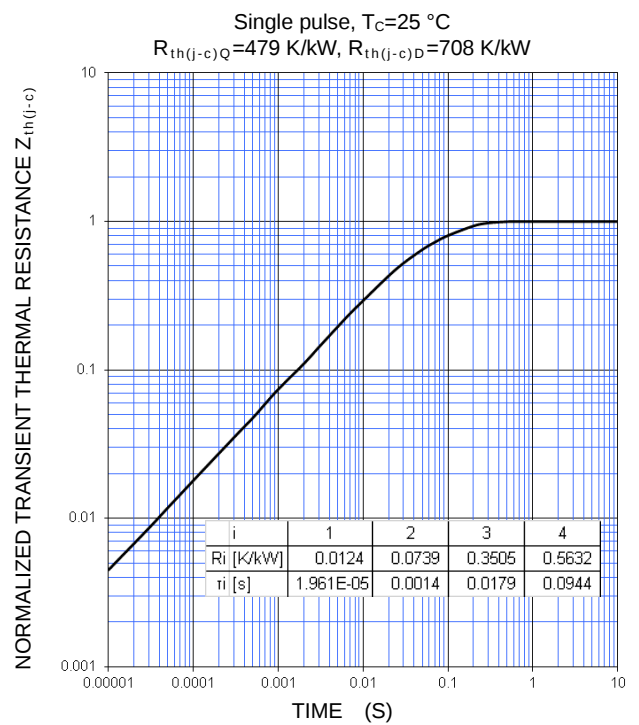
DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)



GATE CHARGE CHARACTERISTICS
(TYPICAL)



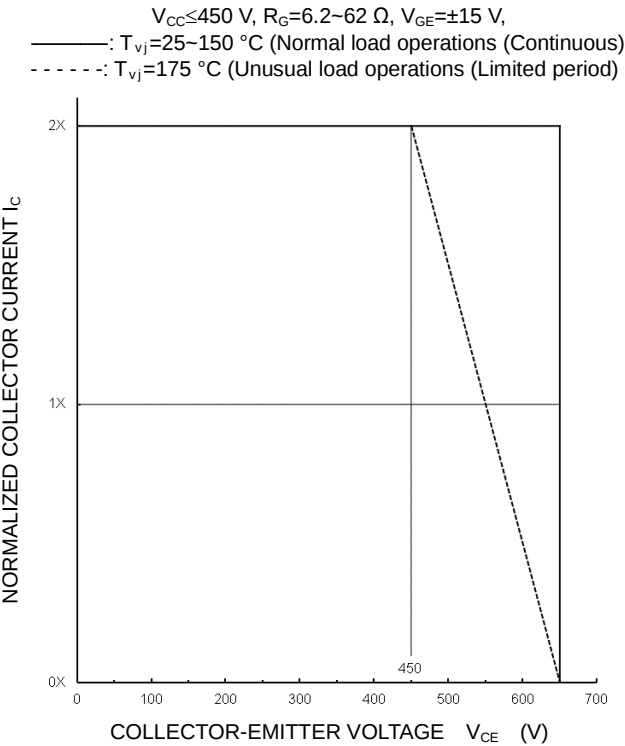
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)



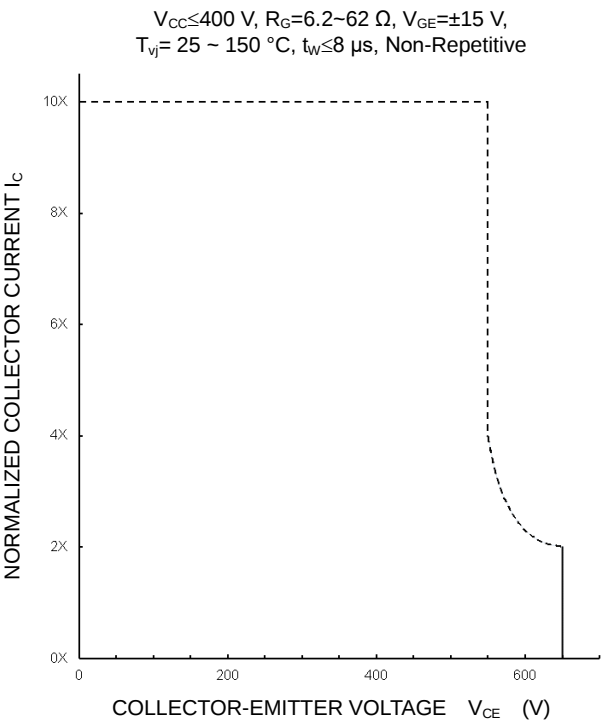
PERFORMANCE CURVES

BRAKE PART

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

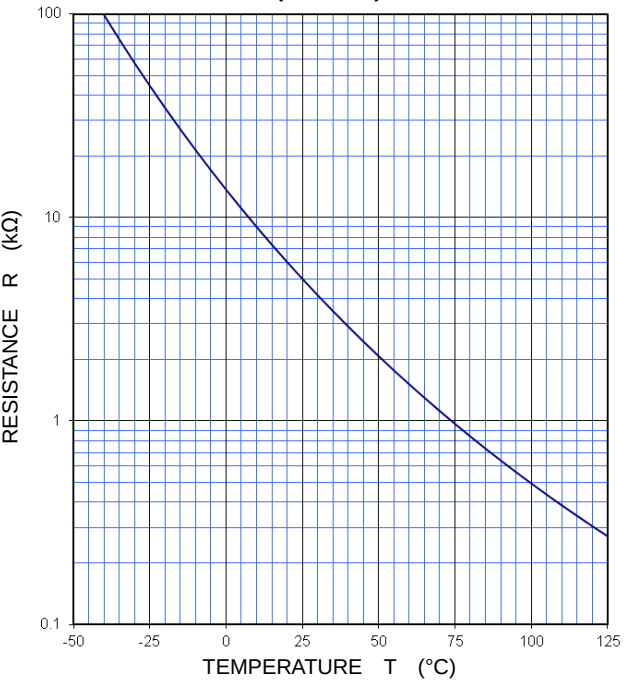


SHORT-CIRCUIT SAFE OPERATING AREA
(MAXIMUM)



NTC thermistor part

TEMPERATURE CHARACTERISTICS
(TYPICAL)



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

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