

<IGBT Modules>

CM200RX-12A

HIGH POWER SWITCHING USE
INSULATED TYPE



sevenpack (3φ Inverter + Brake Chopper)

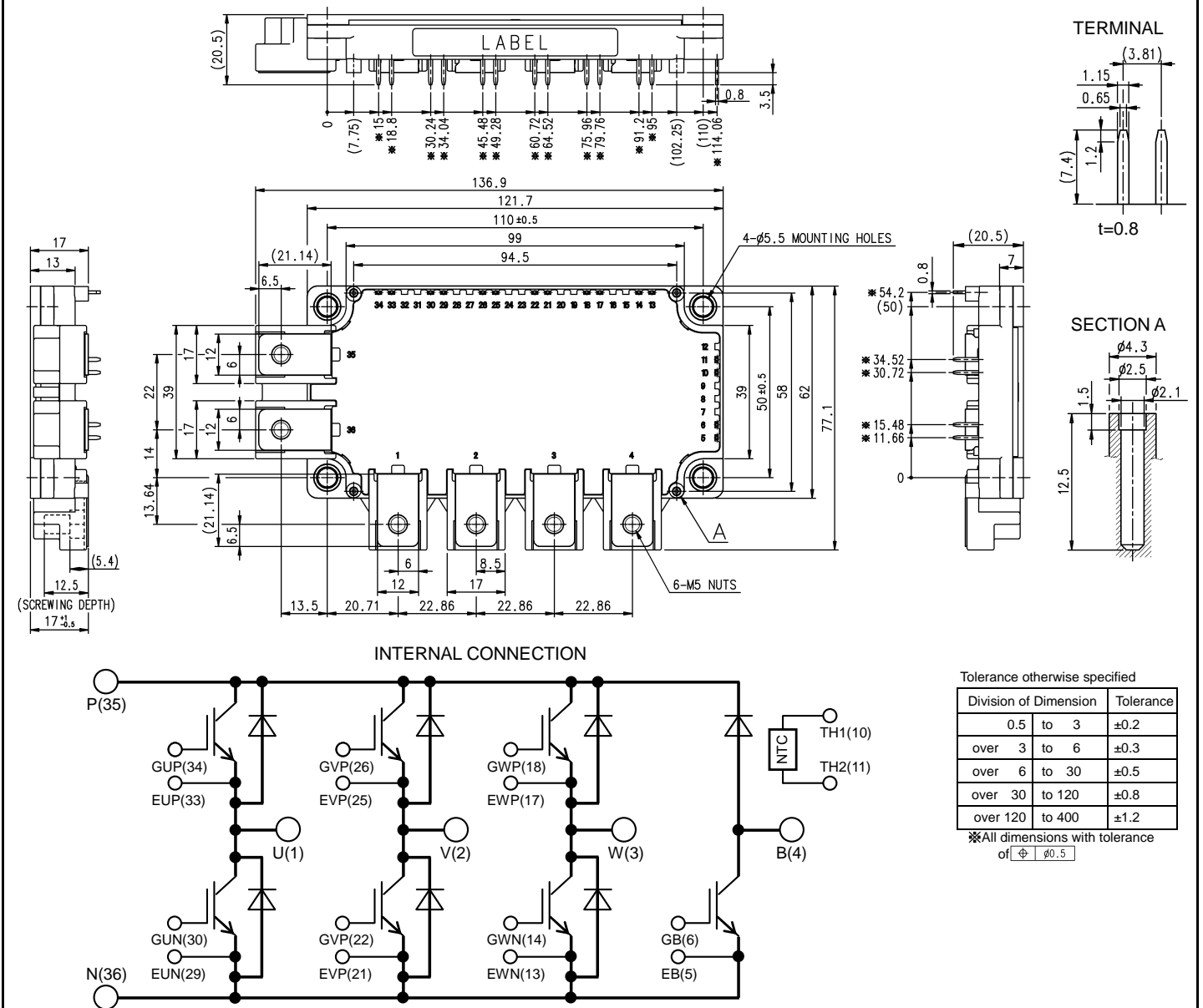
Collector current I_C 2 0 0 A
 Collector-emitter voltage V_{CES} 6 0 0 V
 Maximum junction temperature T_{jmax} 1 5 0 °C

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

APPLICATION

AC Motor Control, Motion/Servo Control, etc.

OUTLINE DRAWING & INTERNAL CONNECTION



CM200RX-12A

HIGH POWER SWITCHING USE
INSULATED TYPEMAXIMUM RATINGS ($T_j=25\text{ }^\circ\text{C}$, unless otherwise specified)

INVERTER PART IGBT/DIODE

Symbol	Item	Conditions	Rating	Unit
V_{CES}	Collector-emitter voltage	G-E short-circuited	600	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I_C	Collector current	DC, $T_C=68\text{ }^\circ\text{C}$ (Note2, 4)	200	A
I_{CRM}		Pulse, Repetitive (Note3)	400	
P_{tot}	Total power dissipation	$T_C=25\text{ }^\circ\text{C}$ (Note2, 4)	735	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	600	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I_C	Collector current	DC, $T_C=75\text{ }^\circ\text{C}$ (Note2, 4)	100	A
I_{CRM}		Pulse, Repetitive (Note3)	200	
P_{tot}	Total power dissipation	$T_C=25\text{ }^\circ\text{C}$ (Note2, 4)	400	W
V_{RRM}	Repetitive peak reverse voltage	G-E short-circuited	600	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_j	Junction temperature	-	-40 ~ +150	$^\circ\text{C}$
T_{stg}	Storage temperature	-	-40 ~ +125	
T_{Cmax}	Maximum case temperature	(Note4)	125	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_j=25\text{ }^\circ\text{C}$, 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	$I_C=20\text{ mA}$, $V_{CE}=10\text{ V}$	5	6	7	V
V_{CESat}	Collector-emitter saturation voltage	$I_C=200\text{ A}$, $V_{GE}=15\text{ V}$ (Note5)	-	1.7	2.1	V
		Refer to the figure of test circuit				
		$I_C=200\text{ A}$, $V_{GE}=15\text{ V}$, chip (Note5)	-	1.6	-	
C_{ies}	Input capacitance	$V_{CE}=10\text{ V}$, G-E short-circuited	-	-	27	nF
C_{oes}	Output capacitance		-	-	2.7	
C_{res}	Reverse transfer capacitance		-	-	0.8	
Q_G	Gate charge	$V_{CC}=300\text{ V}$, $I_C=200\text{ A}$, $V_{GE}=15\text{ V}$	-	530	-	nC
$t_{d(on)}$	Turn-on delay time	$V_{CC}=300\text{ V}$, $I_C=200\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=5.1\text{ }\Omega$, Inductive load	-	-	120	ns
t_r	Rise time		-	-	150	
$t_{d(off)}$	Turn-off delay time		-	-	350	
t_f	Fall time		-	-	600	
r_g	Internal gate resistance	Per switch, $T_C=25\text{ }^\circ\text{C}$ (Note4)	-	0	-	Ω

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HIGH POWER SWITCHING USE
INSULATED TYPE

ELECTRICAL CHARACTERISTICS (cont.; $T_j=25\text{ }^\circ\text{C}$, unless otherwise specified)
INVERTER PART IGBT/DIODE

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
V_{EC} (Note1)	Emitter-collector voltage	$I_E=200\text{ A}$, G-E short-circuited (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	2.0	2.8	V
		Refer to the figure of test circuit		$T_j=125\text{ }^\circ\text{C}$	-	1.95	
		$I_E=200\text{ A}$, G-E short-circuited, chip (Note5)	-	1.9	-		
t_{rr} (Note1)	Reverse recovery time	$V_{CC}=300\text{ V}$, $I_E=200\text{ A}$, $V_{GE}=\pm 15\text{ V}$,	-	-	200	ns	
Q_{rr} (Note1)	Reverse recovery charge	$R_G=5.1\text{ }\Omega$, Inductive load	-	5.0	-	μC	
E_{on}	Turn-on switching energy per pulse	$V_{CC}=300\text{ V}$, $I_C=I_E=200\text{ A}$,	-	4.8	-	mJ	
E_{off}	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$, $R_G=5.1\text{ }\Omega$, $T_j=125\text{ }^\circ\text{C}$,	-	11	-		
E_{rr} (Note1)	Reverse recovery energy per pulse	Inductive load	-	2.1	-	mJ	

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	$I_C=10\text{ mA}$, $V_{CE}=10\text{ V}$	5	6	7	V	
V_{CESat}	Collector-emitter saturation voltage	$I_C=100\text{ A}$, $V_{GE}=15\text{ V}$ (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	1.7	2.1	V
		Refer to the figure of test circuit		$T_j=125\text{ }^\circ\text{C}$	-	1.9	
		$I_C=100\text{ A}$, $V_{GE}=15\text{ V}$, chip (Note5)	-	1.6	-		
C_{ies}	Input capacitance	$V_{CE}=10\text{ V}$, G-E short-circuited	-	-	13.3	nF	
C_{oes}	Output capacitance		-	-	1.4		
C_{res}	Reverse transfer capacitance		-	-	0.45		
Q_G	Gate charge	$V_{CC}=300\text{ V}$, $I_C=100\text{ A}$, $V_{GE}=15\text{ V}$	-	270	-	nC	
I_{RRM}	Reverse current	$V_R=V_{RRM}$, G-E short-circuited	-	-	1.0	mA	
V_F	Forward voltage	$I_F=100\text{ A}$, G-E short-circuited (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	2.0	2.8	V
		Refer to the figure of test circuit		$T_j=125\text{ }^\circ\text{C}$	-	1.95	
		$I_F=100\text{ A}$, G-E short-circuited, chip (Note5)	-	1.9	-		
r_g	Internal gate resistance	Per switch, $T_C=25\text{ }^\circ\text{C}$ (Note4)	-	0	-	Ω	

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 Inverter IGBT (Note4)	-	-	0.17	K/W
$R_{th(j-c)D}$		Junction to case, per Inverter DIODE (Note4)	-	-	0.33	
$R_{th(j-c)Q}$	Thermal resistance	Junction to case, Brake IGBT (Note4)	-	-	0.31	K/W
$R_{th(j-c)D}$		Junction to case, Brake DIODE (Note4)	-	-	0.59	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module, Thermal grease applied (Note4, 7)	-	15	-	K/kW

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MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M _t	Mounting torque	Main terminals M 5 screw	2.5	3.0	3.5	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	10.28	-	-	mm
		Terminal to base plate	12.46	-	-	
d _a	Clearance	Terminal to terminal	9.88	-	-	mm
		Terminal to base plate	10.12	-	-	
m	mass	-	-	350	-	g
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).

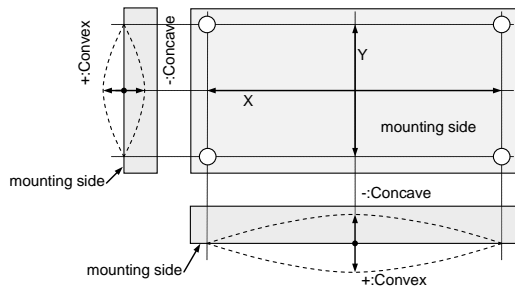
- Junction temperature (T_j) should not increase beyond T_{jmax} rating.
- Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} rating.
- Case temperature (T_c) and heat sink temperature (T_s) are defined on the each surface (mounting side) 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]

- Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K).
- 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 standoffs.
"φ2.3×10 or φ2.3×12, B1 tapping screw"
The length of the screw depends on the thickness (t1.6~t2.0) of the PCB.

RECOMMENDED OPERATING CONDITIONS

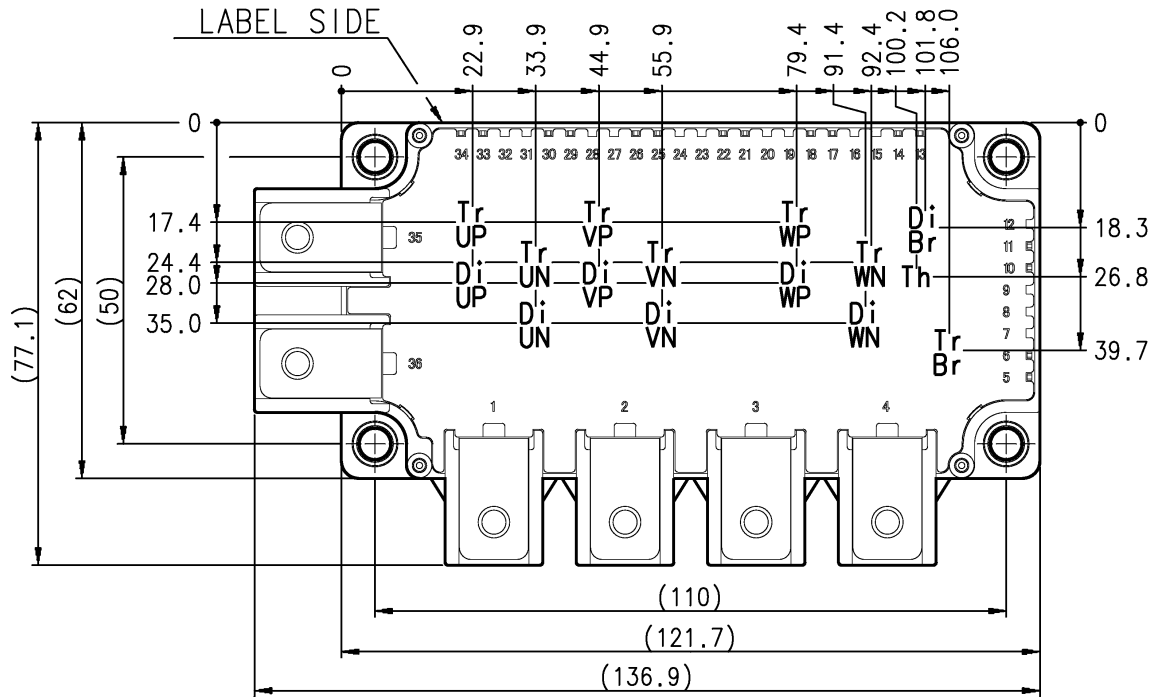
Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
V _{CC}	(DC) Supply voltage	Applied across P-N	-	300	400	V	
V _{GEon}	Gate (-emitter drive) voltage	Applied across G*P-E*P/G*N-E*N/GB-EB	13.5	15.0	16.5	V	
R _G	External gate resistance	Per switch	Inverter part	3.0	-	31	Ω
			Brake part	6.0	-	62	

CM200RX-12A

HIGH POWER SWITCHING USE
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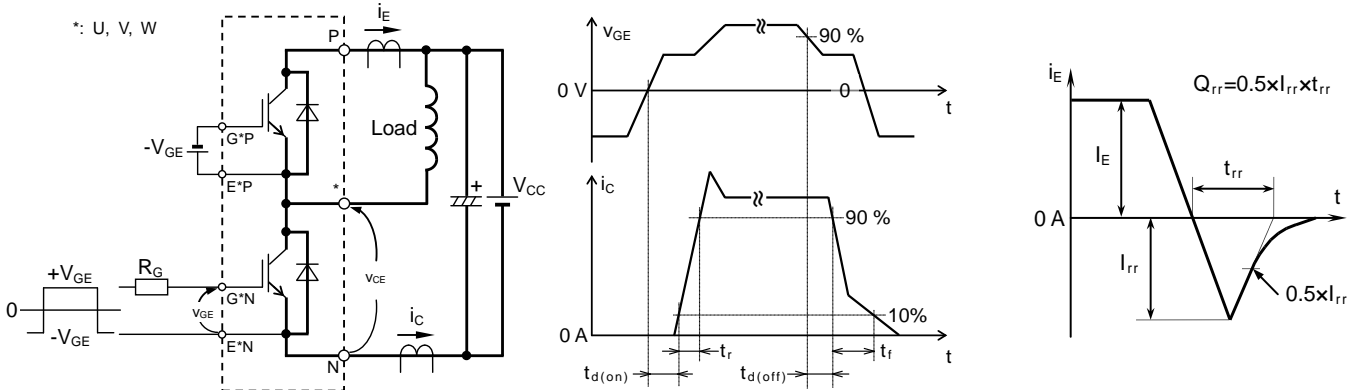
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm



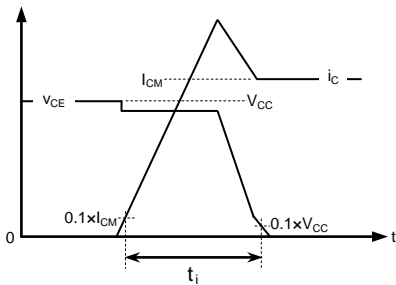
Tr*P/Tr*N/TrBr: IGBT, Di*P/Di*N: DIODE (*=U/V/W), DiBr: BRAKE DIODE, Th: NTC thermistor

TEST CIRCUIT AND WAVEFORMS

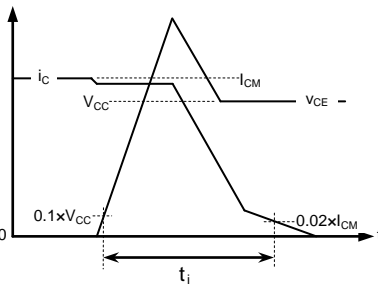


Switching test circuit and waveforms

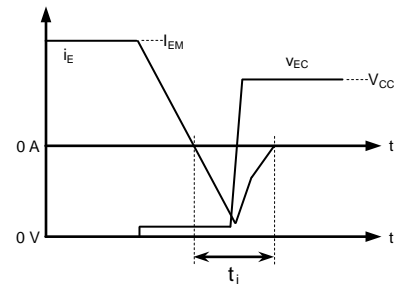
t_{rr} , Q_{rr} test waveform



IGBT Turn-on switching energy



IGBT Turn-off switching energy



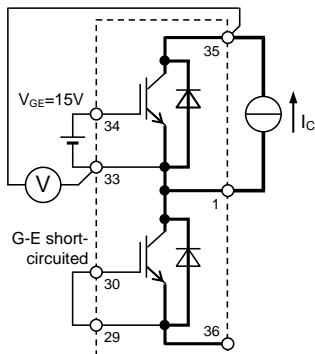
DIODE Reverse recovery energy

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

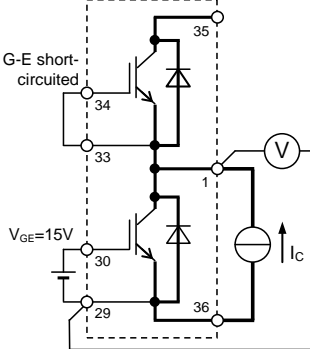
CM200RX-12A

HIGH POWER SWITCHING USE
INSULATED TYPE

TEST CIRCUIT

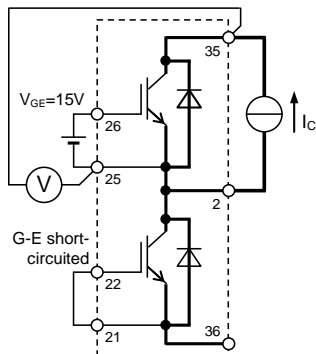


G-E short-circuited

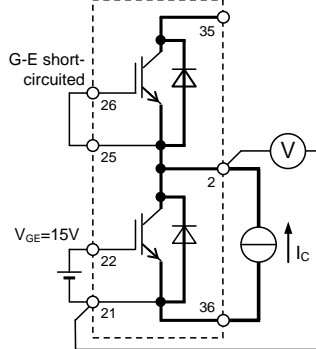


Gate-emitter GVP-EVP, GVN-EVN,
short-circuited GWP-EWP, GWN-EWN,
GB-EB

UP / UN IGBT

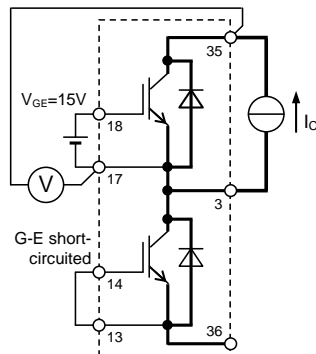


G-E short-circuited

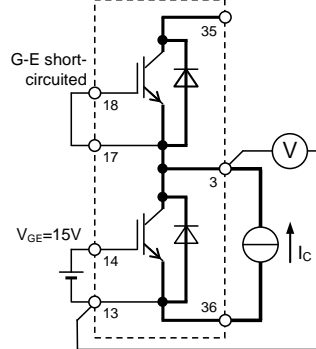


Gate-emitter GUP-EUP, GUN-EUN,
short-circuited GWP-EWP, GWN-EWN,
GB-EB

VP / VN IGBT

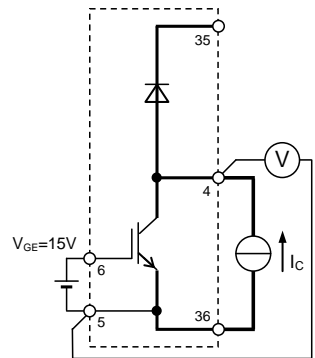


G-E short-circuited



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

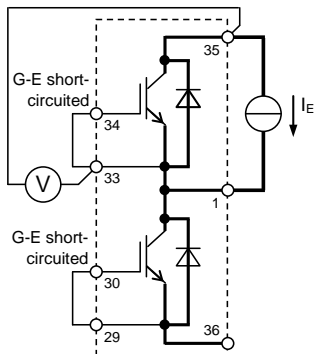
WP / WN IGBT



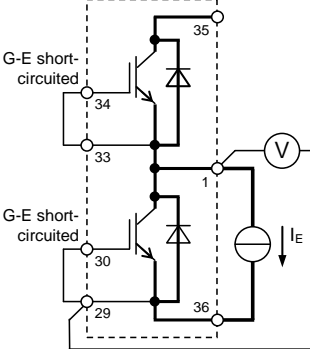
Gate-emitter GUP-EUP, GUN-EUN,
short-circuited GVP-EVP, GVN-EVN,
GWP-EWP, GWN-EWN

Brake IGBT

V_{CEsat} characteristics test circuit

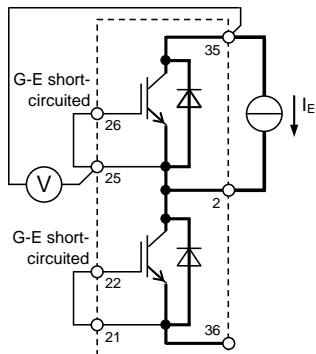


G-E short-circuited

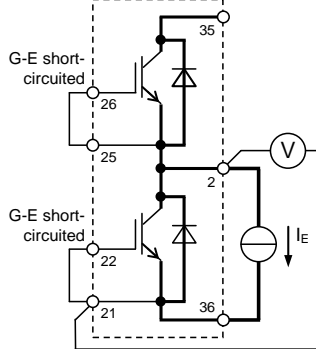


Gate-emitter GVP-EVP, GVN-EVN,
short-circuited GWP-EWP, GWN-EWN,
GB-EB

UP / UN DIODE

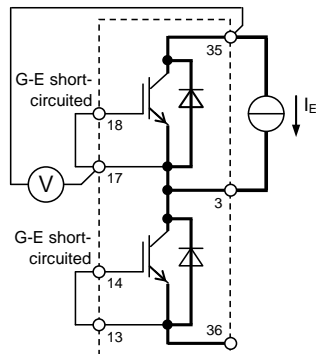


G-E short-circuited

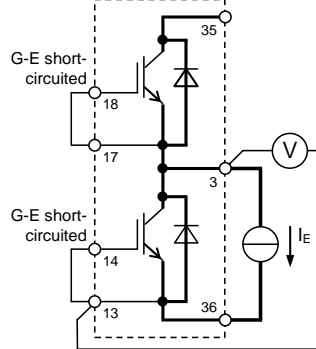


Gate-emitter GUP-EUP, GUN-EUN,
short-circuited GWP-EWP, GWN-EWN,
GB-EB

VP / VN DIODE

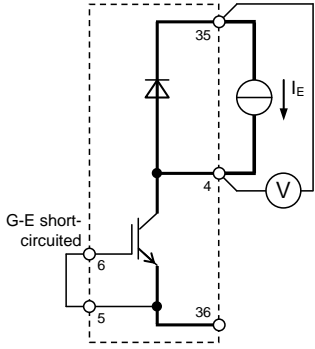


G-E short-circuited



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

WP / WN DIODE



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

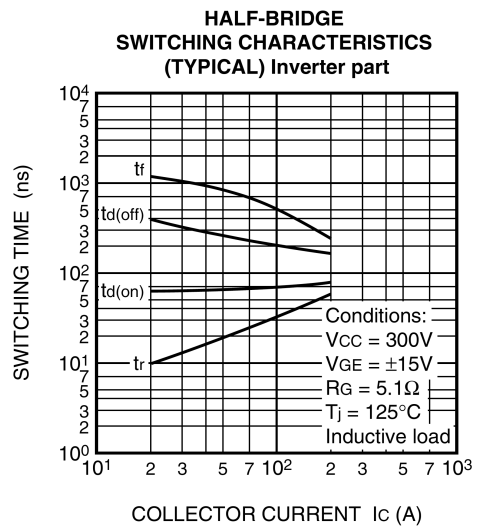
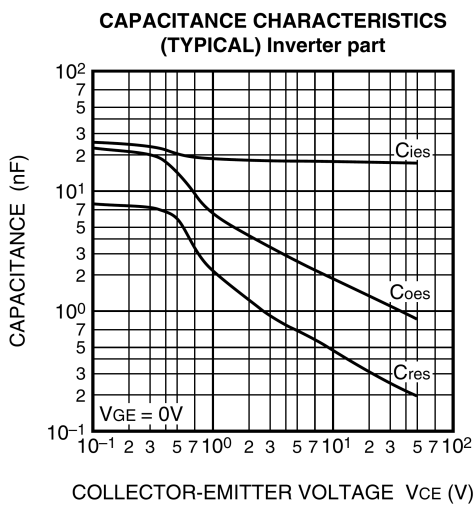
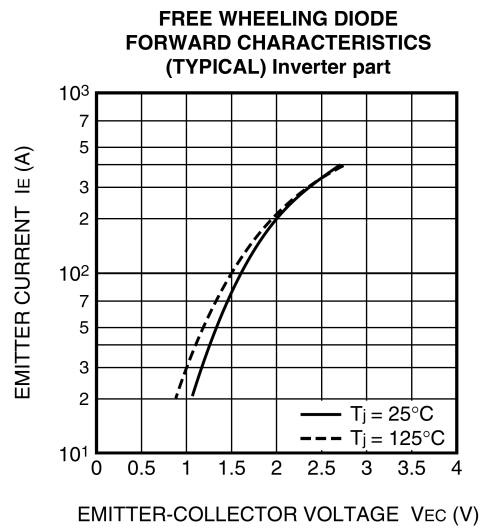
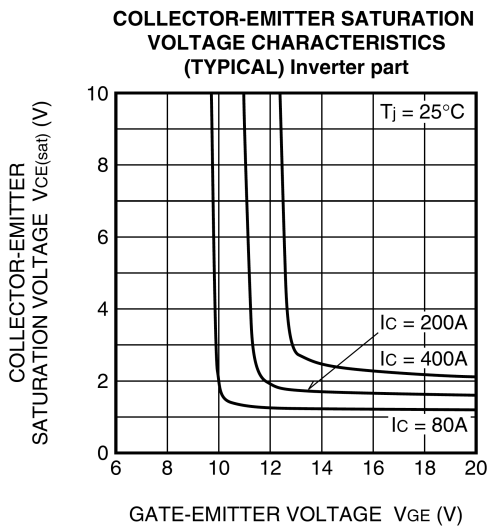
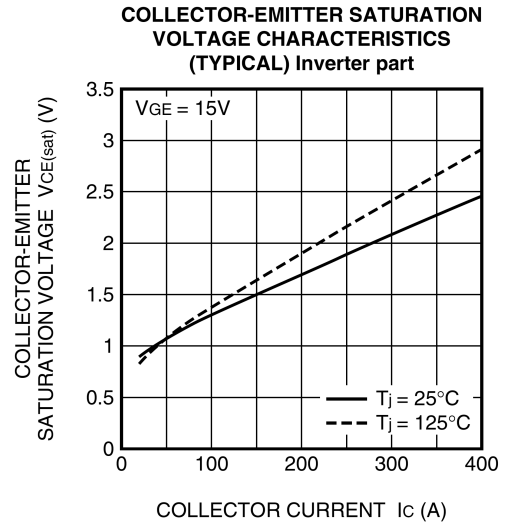
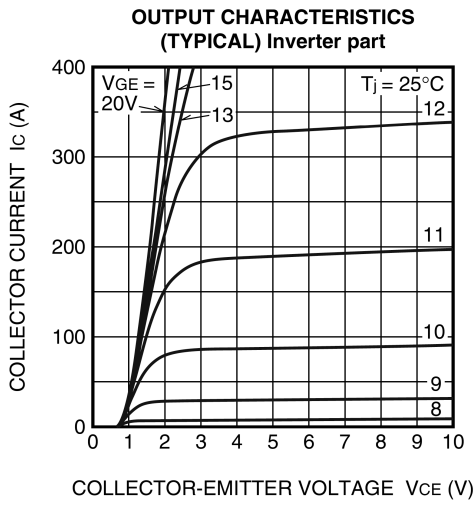
Brake DIODE

V_{EC} / V_F characteristics test circuit

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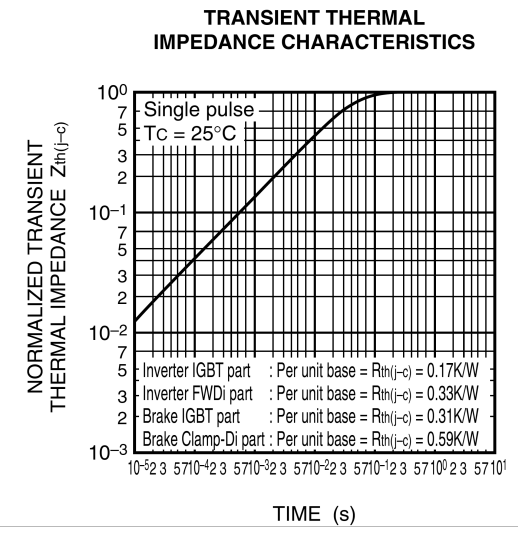
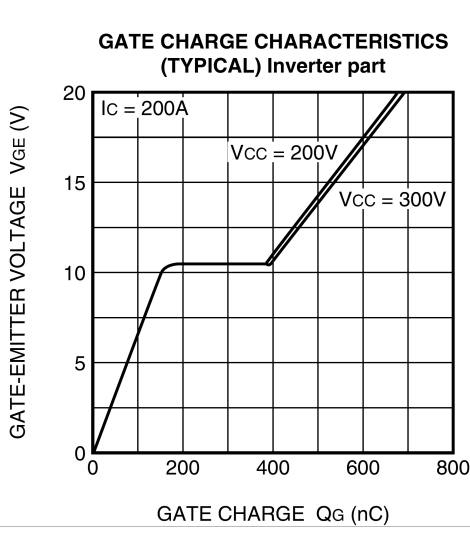
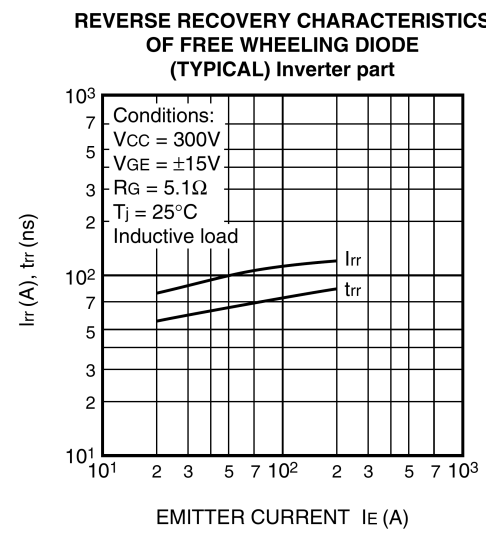
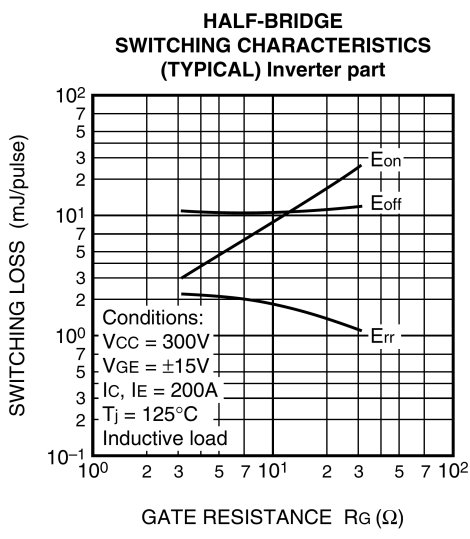
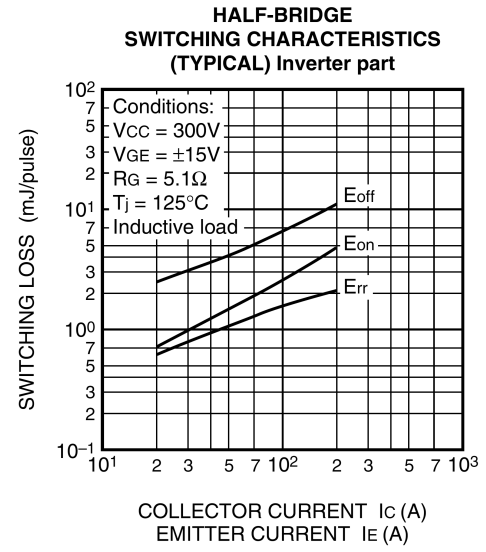
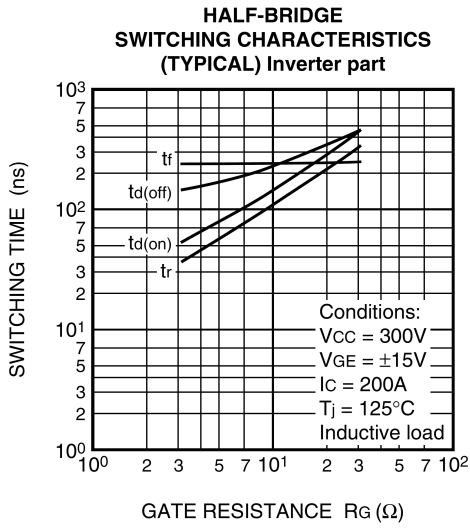
PERFORMANCE CURVES INVERTER PART



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PERFORMANCE CURVES INVERTER PART

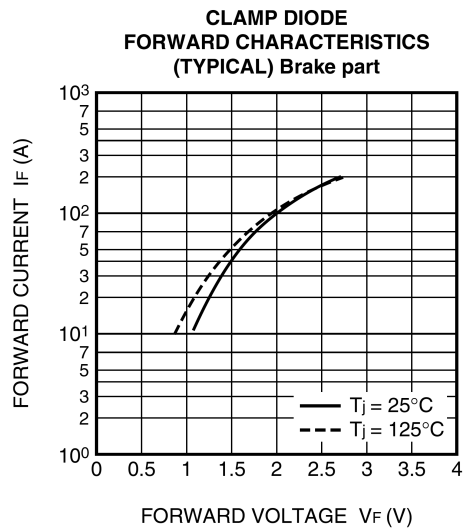
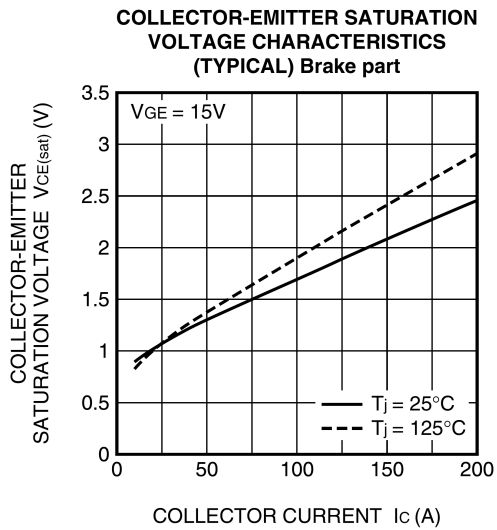


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PERFORMANCE CURVES

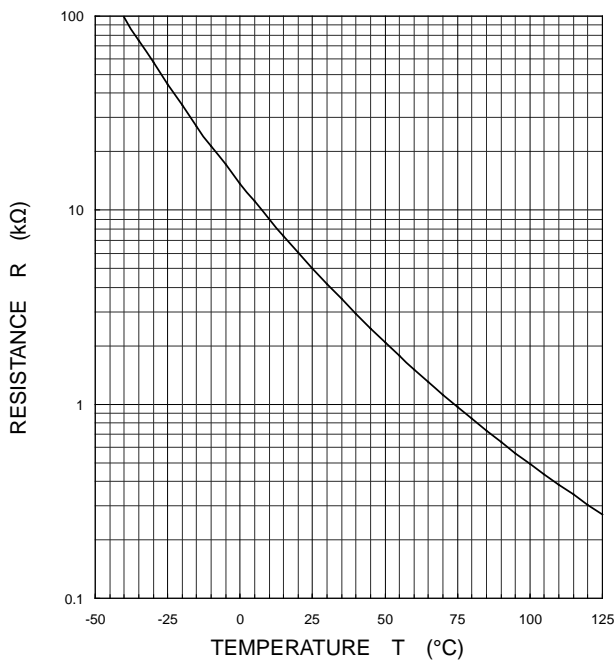
BRAKE PART



NTC thermistor part

TEMPERATURE CHARACTERISTICS

(TYPICAL)



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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Keep safety first in your circuit designs!

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