



<IGBT Modules>

# CM150RX-13T/CM150RXP-13T

**HIGH POWER SWITCHING USE  
INSULATED TYPE**

 <p>RX</p>	<p>Collector current <math>I_c</math> ..... <b>1 5 0 A</b>            Collector-emitter voltage <math>V_{CES}</math> ..... <b>6 5 0 V</b>            Maximum junction temperature <math>T_{vjmax}</math> ..... <b>1 7 5 °C</b></p> <ul style="list-style-type: none"> <li>•Flat base type</li> <li>•Copper base plate (Nickel-plating)</li> <li>•RoHS Directive compliant</li> <li>•Tin-plating pin terminals</li> </ul>
 <p>RXP</p>	<p>Collector current <math>I_c</math> ..... <b>1 5 0 A</b>            Collector-emitter voltage <math>V_{CES}</math> ..... <b>6 5 0 V</b>            Maximum junction temperature <math>T_{vjmax}</math> ..... <b>1 7 5 °C</b></p> <ul style="list-style-type: none"> <li>•Flat base type</li> <li>•Copper base plate (Nickel-plating)</li> <li>•RoHS Directive compliant</li> <li>•Tin-plating pressfit terminals</li> </ul>
<p>sevenpack (three-phase bridge+Brake chopper)      •UL Recognized under UL1557, File No. E323585</p>	

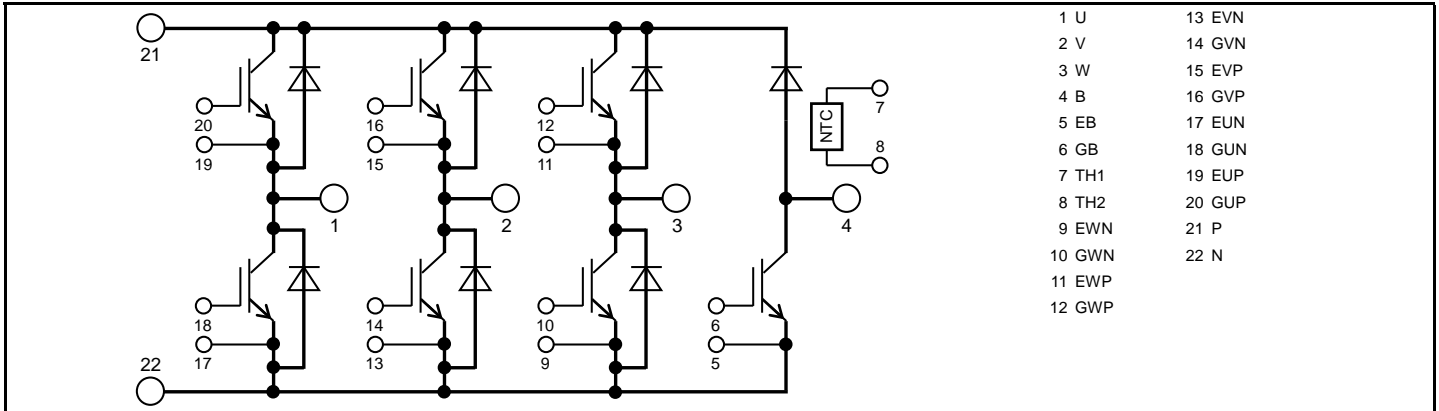
## APPLICATION

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

## OPTION (Below options are available.)

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

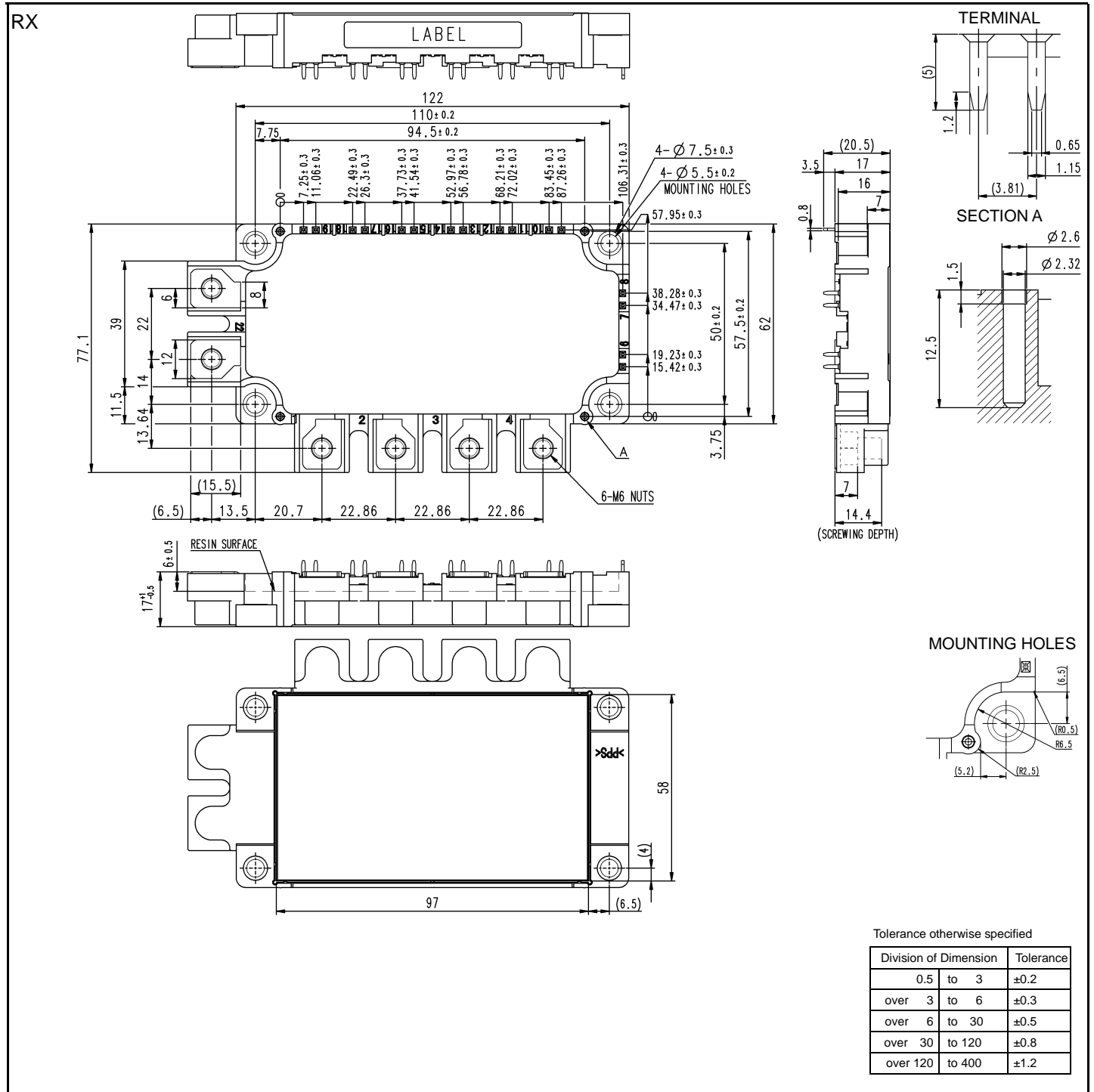
## INTERNAL CONNECTION



# CM150RX-13T/CM150RXP-13T

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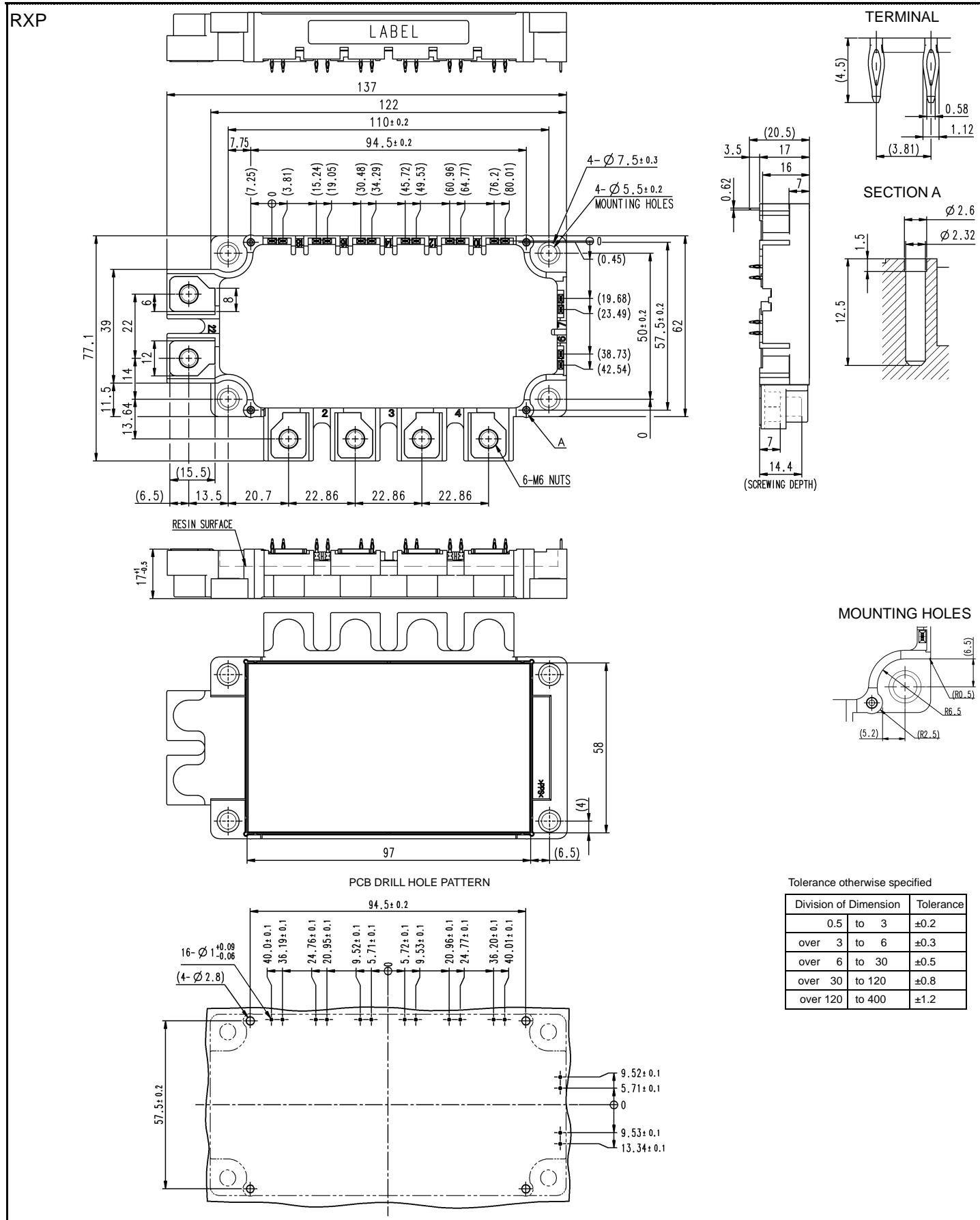
## OUTLINE DRAWING



# CM150RX-13T/CM150RXP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## OUTLINE DRAWING



# CM150RX-13T/CM150RXP-13T

HIGH POWER SWITCHING USE  
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## 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	$\pm 20$	V
$I_C$	Collector current	DC, $T_C=106\text{ }^{\circ}\text{C}$ (Note2, 4)	150	A
$I_{CRM}$		Pulse, Repetitive (Note3)	300	
$P_{tot}$	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	560	W
$I_E$ (Note1)	Emitter current	DC (Note2)	150	A
$I_{ERM}$ (Note1)		Pulse, Repetitive (Note3)	300	

### 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	$\pm 20$	V
$I_C$	Collector current	DC, $T_C=113\text{ }^{\circ}\text{C}$ (Note2, 4)	75	A
$I_{CRM}$		Pulse, Repetitive (Note3)	150	
$P_{tot}$	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	310	W
$V_{RRM}$	Repetitive peak reverse voltage	G-E short-circuited	650	V
$I_F$	Forward current	DC (Note2)	75	A
$I_{FRM}$		Pulse, Repetitive (Note3)	150	

### 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	$^{\circ}\text{C}$
$T_{Cmax}$	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	$\mu\text{A}$	
$V_{GE(th)}$	Gate-emitter threshold voltage	$I_C=15\text{ mA}$ , $V_{CE}=10\text{ V}$	5.4	6.0	6.6	V	
$V_{CEsat}$ (Terminal)	Collector-emitter saturation voltage	$I_C=150\text{ A}$ , $V_{GE}=15\text{ V}$ , Refer to the figure of test circuit (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.40	1.75	V
$V_{CEsat}$ (Chip)			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	1.50	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.55	-	
$V_{CEsat}$ (Chip)	Collector-emitter saturation voltage	$I_C=150\text{ A}$ , $V_{GE}=15\text{ V}$ , (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.30	1.55	V
$V_{CEsat}$ (Chip)			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	1.35	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.35	-	
$C_{ies}$	Input capacitance	$V_{CE}=10\text{ V}$ , G-E short-circuited	-	-	20.1	nF	
$C_{oes}$	Output capacitance		-	-	0.9		
$C_{res}$	Reverse transfer capacitance		-	-	0.4		
$Q_G$	Gate charge	$V_{CC}=300\text{ V}$ , $I_C=150\text{ A}$ , $V_{GE}=15\text{ V}$	-	0.62	-	$\mu\text{C}$	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=300\text{ V}$ , $I_C=150\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ , $R_G=1.0\text{ }\Omega$ , Inductive load	-	-	400	ns	
$t_r$	Rise time		-	-	200		
$t_{d(off)}$	Turn-off delay time		-	-	400		
$t_f$	Fall time		-	-	600		

## CM150RX-13T/CM150RXP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPEELECTRICAL 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	$I_E=150\text{ A}$ , G-E short-circuited, Refer to the figure of test circuit (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.50	2.05	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	1.55	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.55	-	
$V_{EC}$ (Note1) (Chip)		$I_E=150\text{ A}$ , G-E short-circuited, (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	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	$V_{CC}=300\text{ V}$ , $I_E=150\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ ,	-	-	400	ns	
$Q_{rr}$ (Note1)	Reverse recovery charge	$R_G=1.0\text{ }\Omega$ , Inductive load	-	12	-	$\mu\text{C}$	
$E_{on}$	Turn-on switching energy per pulse	$V_{CC}=300\text{ V}$ , $I_C=I_E=150\text{ A}$ ,	-	4.3	-	mJ	
$E_{off}$	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$ , $R_G=1.0\text{ }\Omega$ , $T_{vj}=150\text{ }^{\circ}\text{C}$ ,	-	7.2	-		
$E_{rr}$ (Note1)	Reverse recovery energy per pulse	Inductive load	-	5.8	-	mJ	
$R_{CC+EE}$	Internal lead resistance	Main terminals-chip, per switch, $T_C=25\text{ }^{\circ}\text{C}$ (Note4)	-	1.6	-	m $\Omega$	
$r_g$	Internal gate resistance	Per switch	-	4.0	-	$\Omega$	

## 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	$\mu\text{A}$	
$V_{GE(th)}$	Gate-emitter threshold voltage	$I_C=7.5\text{ mA}$ , $V_{CE}=10\text{ V}$	5.4	6.0	6.6	V	
$V_{CEsat}$ (Terminal)	Collector-emitter saturation voltage	$I_C=75\text{ A}$ , $V_{GE}=15\text{ V}$ , Refer to the figure of test circuit (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.35	1.70	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	1.45	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.50	-	
$V_{CEsat}$ (Chip)		$I_C=75\text{ A}$ , $V_{GE}=15\text{ V}$ , (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.30	1.55	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	1.35	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.35	-	
$C_{ies}$	Input capacitance	$V_{CE}=10\text{ V}$ , G-E short-circuited	-	-	10.1	nF	
$C_{oes}$	Output capacitance		-	-	0.5		
$C_{res}$	Reverse transfer capacitance		-	-	0.2		
$Q_G$	Gate charge	$V_{CC}=300\text{ V}$ , $I_C=75\text{ A}$ , $V_{GE}=15\text{ V}$	-	0.31	-	$\mu\text{C}$	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=300\text{ V}$ , $I_C=75\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ , $R_G=8.2\text{ }\Omega$ , 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	$V_{CC}=300\text{ V}$ , $I_C=75\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ ,	-	1.37	-	mJ	
$E_{off}$	Turn-off switching energy per pulse	$R_G=8.2\text{ }\Omega$ , $T_{vj}=150\text{ }^{\circ}\text{C}$ , Inductive load	-	3.63	-		
$r_g$	Internal gate resistance	-	-	0	-	$\Omega$	
$I_{RRM}$	Reverse current	$V_R=V_{RRM}$ , G-E short-circuited	-	-	1.0	mA	
$V_F$ (Terminal)	Forward voltage	$I_F=75\text{ A}$ , G-E short-circuited, Refer to the figure of test circuit (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.60	2.15	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	1.65	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.65	-	
$V_F$ (Chip)		$I_F=75\text{ A}$ , G-E short-circuited, (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.45	1.85	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	-	1.50	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.50	-	
$t_{rr}$	Reverse recovery time	$V_{CC}=300\text{ V}$ , $I_F=75\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ ,	-	-	400	ns	
$Q_{rr}$	Reverse recovery charge	$R_G=8.2\text{ }\Omega$ , Inductive load	-	3.4	-	$\mu\text{C}$	
$E_{rr}$	Reverse recovery energy per pulse	$V_{CC}=300\text{ V}$ , $I_F=75\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ , $R_G=8.2\text{ }\Omega$ , $T_{vj}=150\text{ }^{\circ}\text{C}$ , Inductive load	-	2.76	-	mJ	

# CM150RX-13T/CM150RXP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## ELECTRICAL CHARACTERISTICS (cont.; T<sub>vj</sub>=25 °C, unless otherwise specified)

### NTC THERMISTOR PART

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R <sub>25</sub>	Zero-power resistance	T <sub>C</sub> =25 °C (Note4)	4.85	5.00	5.15	kΩ
ΔR/R	Deviation of resistance	R <sub>100</sub> =493 Ω, T <sub>C</sub> =100 °C (Note4)	-7.3	-	+7.8	%
B <sub>(25/50)</sub>	B-constant	Approximate by equation (Note6)	-	3375	-	K
P <sub>25</sub>	Power dissipation	T <sub>C</sub> =25 °C (Note4)	-	-	10	mW

### THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
R <sub>th(j-c)Q</sub>	Thermal resistance	Junction to case, per Inverter IGBT (Note4)	-	-	267	K/kW	
R <sub>th(j-c)D</sub>		Junction to case, per Inverter FWD (Note4)	-	-	393		
R <sub>th(j-c)Q</sub>	Thermal resistance	Junction to case, Brake IGBT (Note4)	-	-	479	K/kW	
R <sub>th(j-c)D</sub>		Junction to case, Brake DIODE (Note4)	-	-	708		
R <sub>th(c-s)</sub>	Contact thermal resistance	Case to heat sink, per 1 module,	Thermal grease applied (Note4, 7)	-	11.5	-	K/kW
			PC-TIM applied (Note4, 8)	-	3.1	-	

### MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M <sub>t</sub>	Mounting torque	Main terminals M 6 screw	3.5	4.0	4.5	N·m
M <sub>s</sub>	Mounting torque	Mounting to heat sink M 5 screw	2.5	3.0	3.5	N·m
d <sub>s</sub>	Creepage distance	Terminal to terminal	17	-	-	mm
		Terminal to base plate	18.4	-	-	
d <sub>a</sub>	Clearance	Terminal to terminal	10	-	-	mm
		Terminal to base plate	16.2	-	-	
e <sub>c</sub>	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).

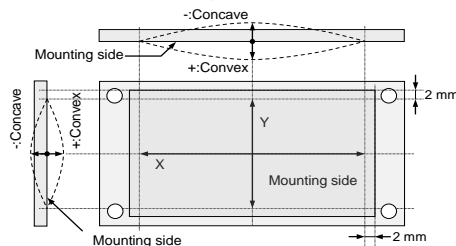
- Junction temperature (T<sub>vj</sub>) should not increase beyond T<sub>vjmax</sub> rating.
- Pulse width and repetition rate should be such that the device junction temperature (T<sub>vj</sub>) dose not exceed T<sub>vjmax</sub> rating.
- Case temperature (T<sub>C</sub>) and heat sink temperature (T<sub>S</sub>) 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. Refer to the figure of test circuit.

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

R<sub>25</sub>: resistance at absolute temperature T<sub>25</sub> [K]; T<sub>25</sub>=25 [°C]+273.15=298.15 [K]

R<sub>50</sub>: resistance at absolute temperature T<sub>50</sub> [K]; T<sub>50</sub>=50 [°C]+273.15=323.15 [K]

- Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K)/D<sub>(C-S)</sub>=50 μm.
- Typical value is measured by using PC-TIM of λ=3.4 W/(m·K)/D<sub>(C-S)</sub>=50 μm.
- The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



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HIGH POWER SWITCHING USE

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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 ± 0.055 N·m	by handwork (equivalent to 30 rpm by mechanical screw driver) ~ 600 rpm (by mechanical screw driver)
(2) PT®	K25×10	0.75 ± 0.075 N·m	
(3) DELTA PT®	25×8	0.55 ± 0.055 N·m	
(4) DELTA PT®	25×10	0.75 ± 0.075 N·m	
(5) B1 tapping screw	φ2.6×10 or φ2.6×12	0.75 ± 0.075 N·m	

**RECOMMENDED OPERATING CONDITIONS**

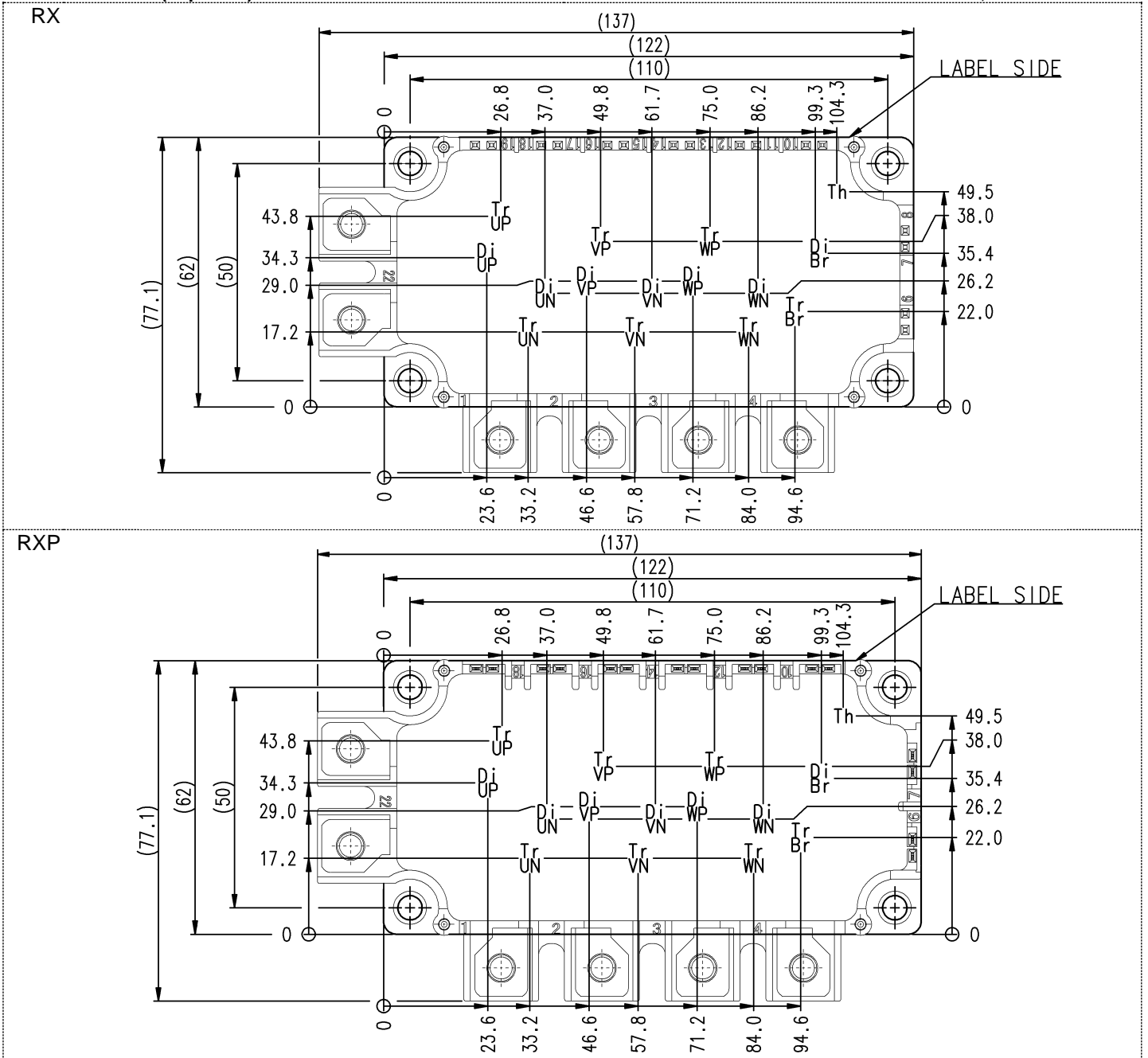
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$V_{CC}$	(DC) Supply voltage	Applied across P-N terminals	-	300	450	V
$V_{GEon}$	Gate (-emitter drive) voltage	Applied across G*P-E*P/G*N-E*N/GB-EB terminals (*=U,V,W)	13.5	15.0	16.5	V
$R_G$	External gate resistance	Inverter IGBT, Per switch	1.0	-	39	$\Omega$
		Brake IGBT	8.2	-	82	

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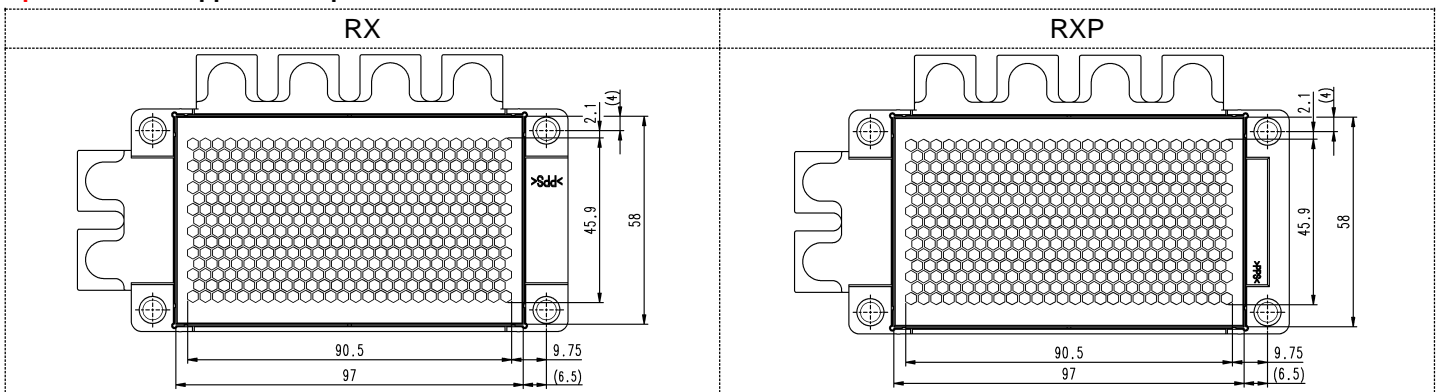
## CHIP LOCATION (Top view)

Dimension in mm, tolerance:  $\pm 1$  mm



Tr\*P/Tr\*N/Tr\*Br: IGBT, Di\*P/Di\*N: FWD, Di\*Br: DIODE, Th: NTC thermistor

## Option: PC-TIM applied baseplate outline

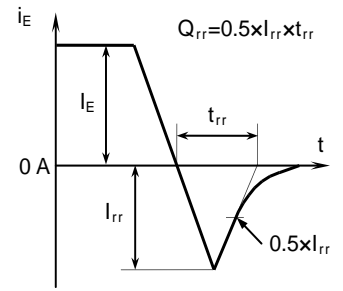
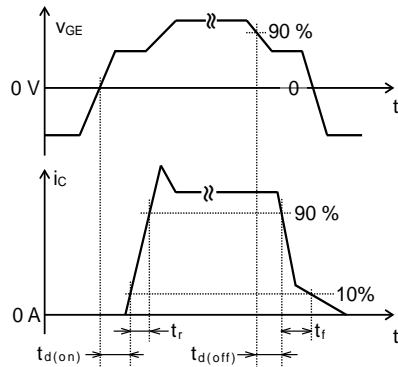
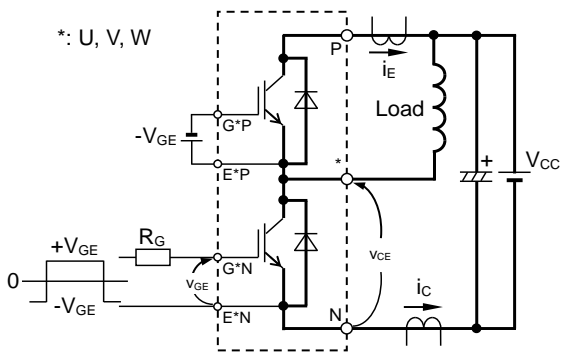




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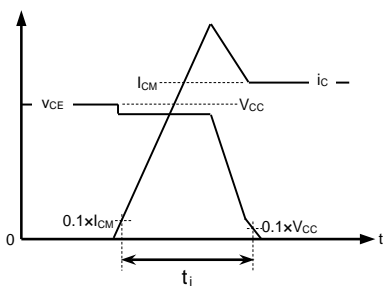
HIGH POWER SWITCHING USE  
INSULATED TYPE

## TEST CIRCUIT AND WAVEFORMS

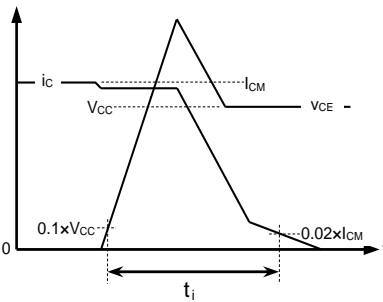


Switching characteristics test circuit and waveforms

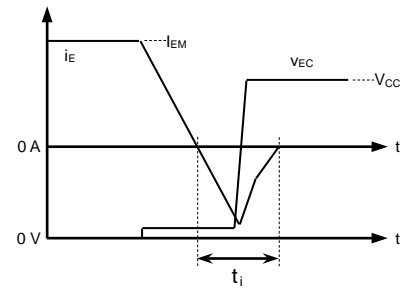
$t_{rr}$ ,  $Q_{rr}$  characteristics test waveform



IGBT Turn-on switching energy



IGBT Turn-off switching energy



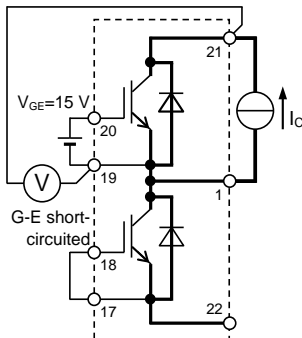
FWD Reverse recovery energy

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

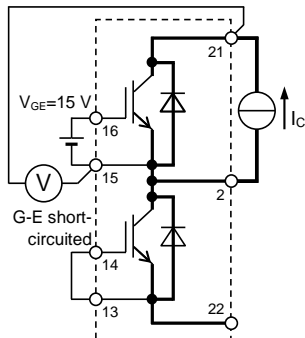
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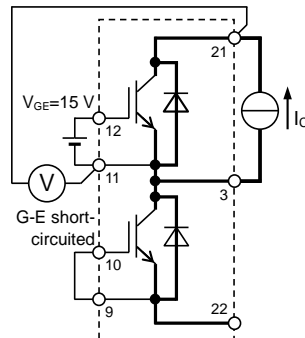
## TEST CIRCUIT



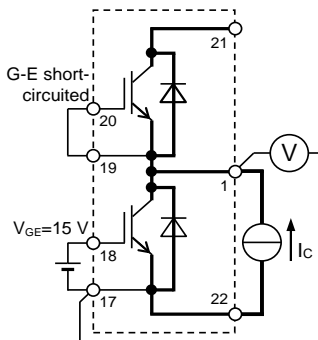
TrUP



TrVP

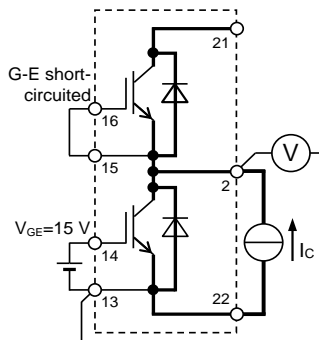


TrWP



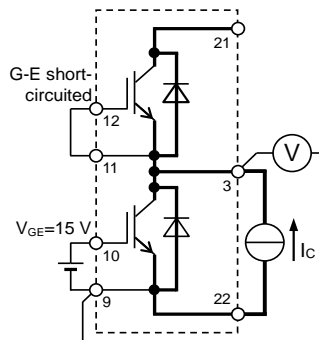
TrUN

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



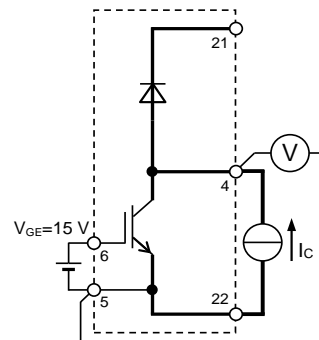
TrVN

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



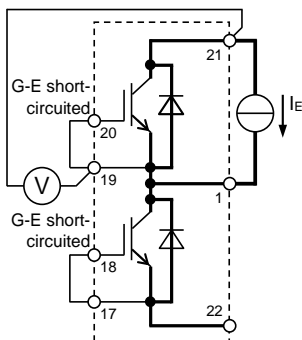
TrWN

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

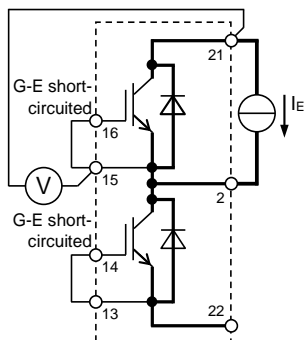


Gate-emitter GUP-EUP, GUN-EUN,  
short-circuited GVP-EVP, GVN-EVN,  
GWP-EWP, GWN-EWN

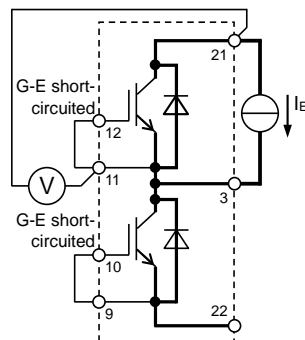
### $V_{CEsat}$ characteristics test circuit



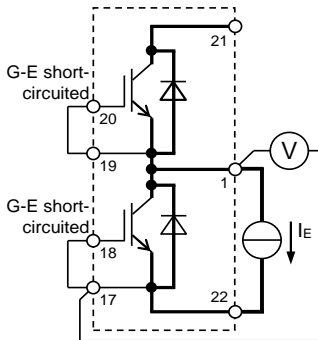
DiUP



DiVP

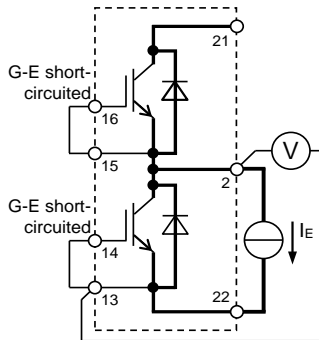


DiWP



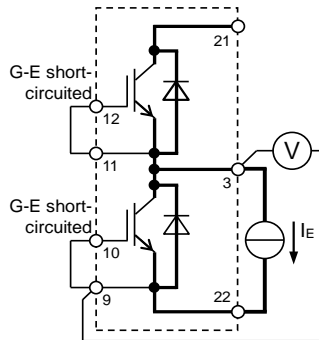
DiUN

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



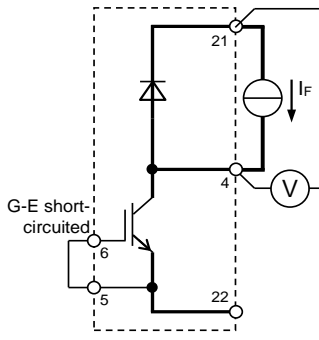
DiVN

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

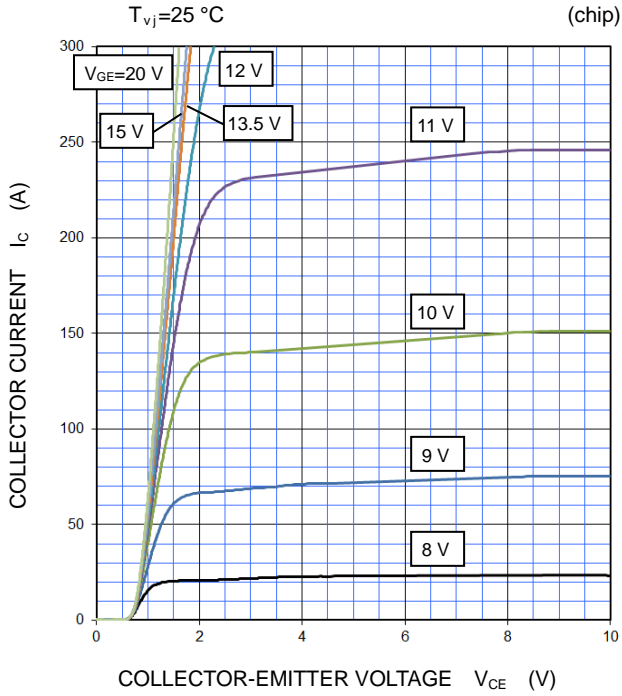
# CM150RX-13T/CM150RXP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

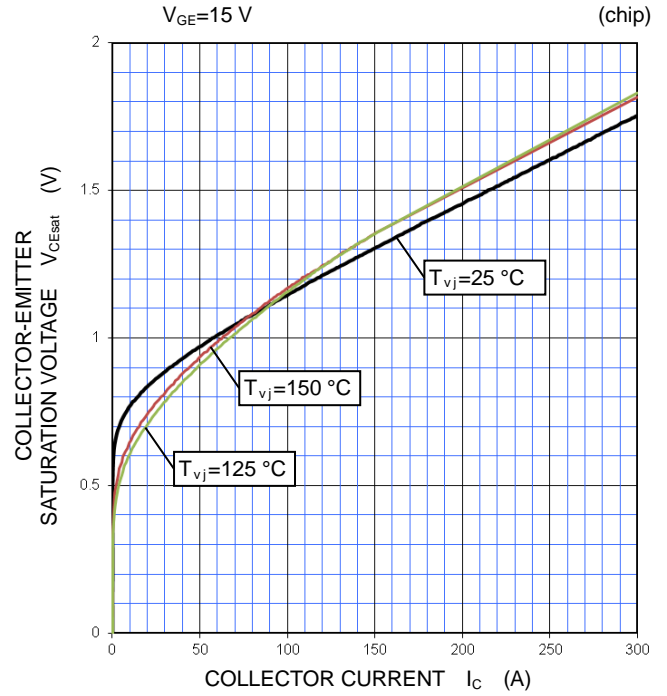
## PERFORMANCE CURVES

### INVERTER PART

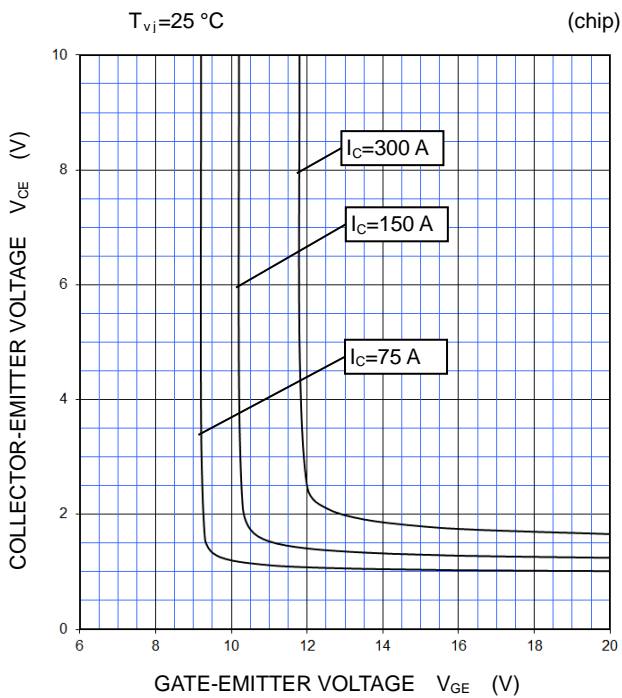
**OUTPUT CHARACTERISTICS (TYPICAL)**



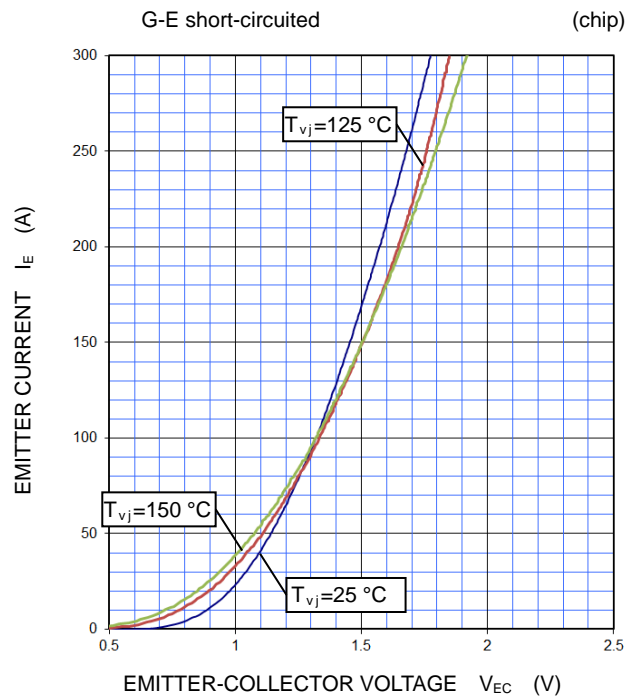
**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



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



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



# CM150RX-13T/CM150RXP-13T

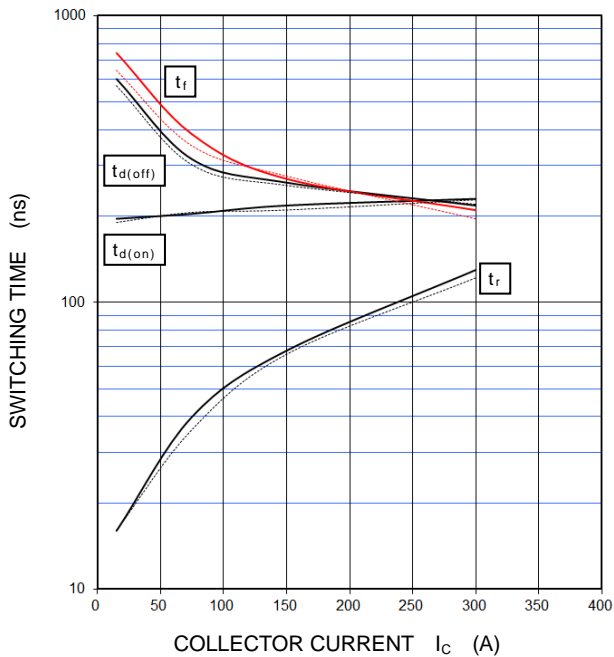
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### INVERTER PART

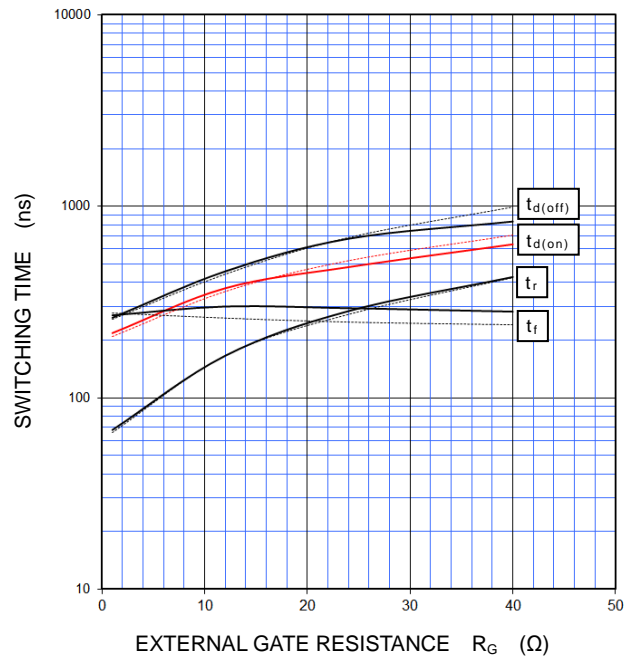
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $R_G=1.0\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



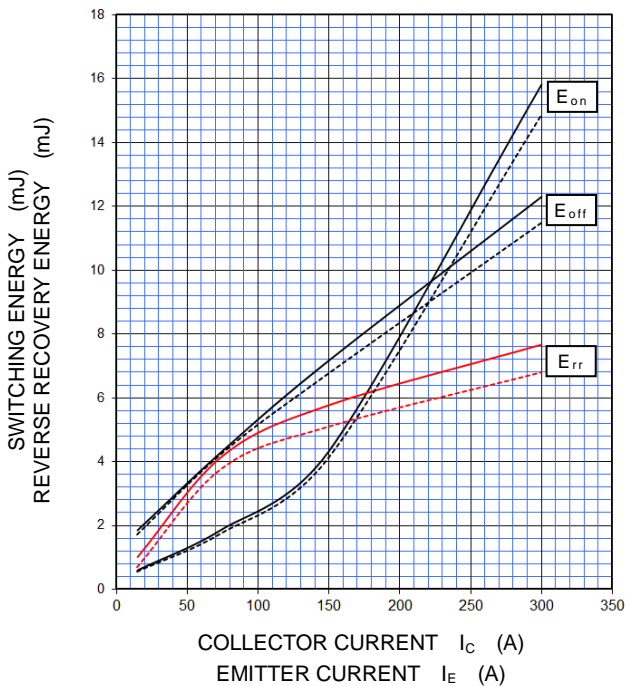
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $I_C=150\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



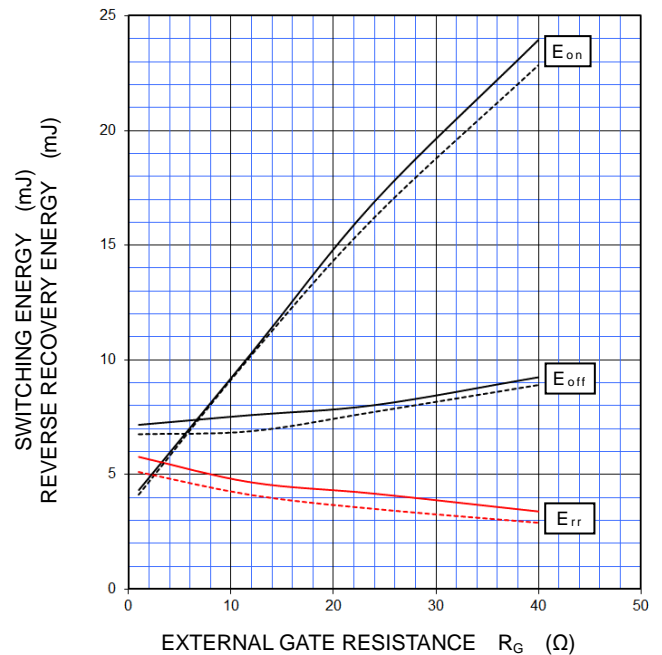
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $R_G=1.0\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD,  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$ , PER PULSE



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

$V_{CC}=300\text{ V}$ ,  $I_C/I_E=150\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD,  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$ , PER PULSE



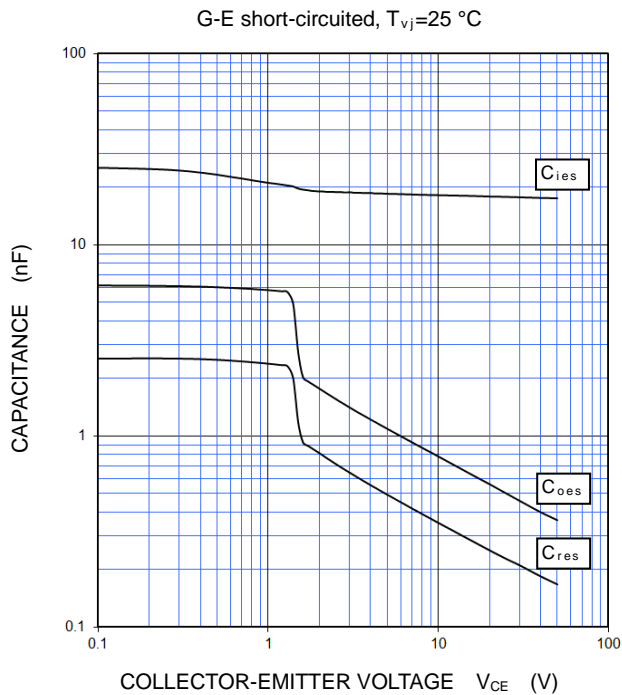
# CM150RX-13T/CM150RXP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

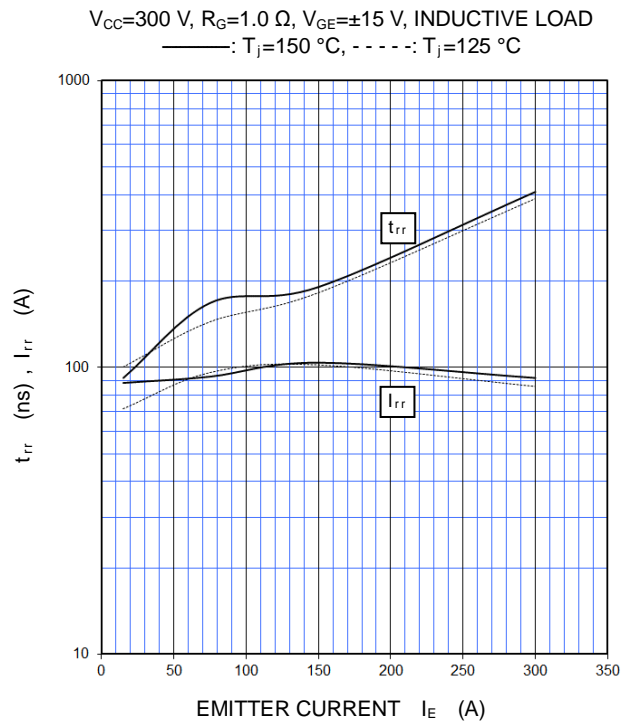
## PERFORMANCE CURVES

### INVERTER PART

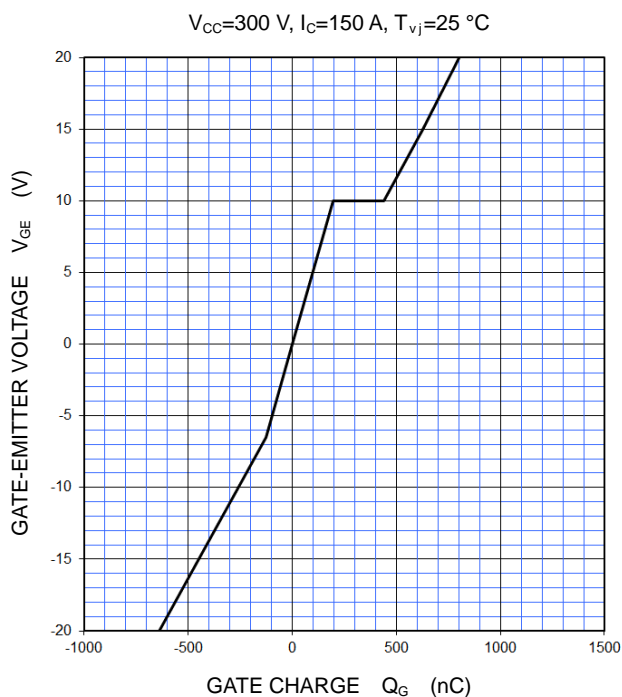
**CAPACITANCE CHARACTERISTICS (TYPICAL)**



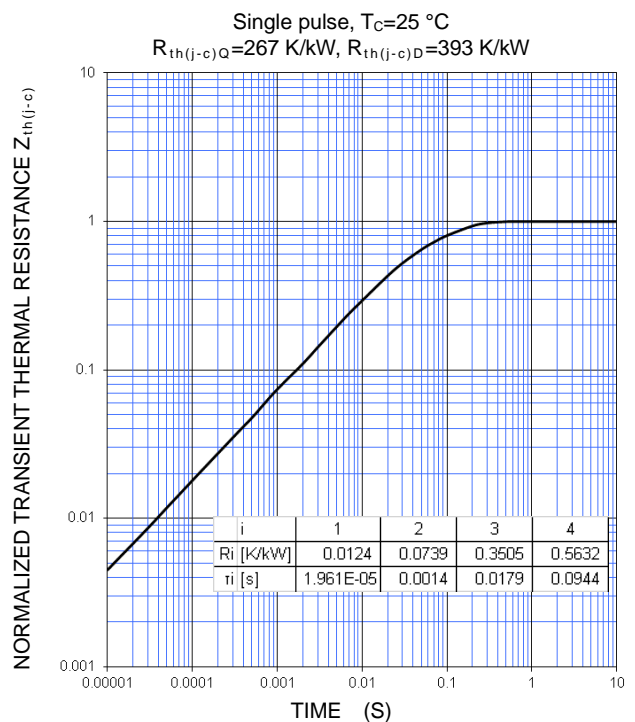
**FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



**GATE CHARGE CHARACTERISTICS (TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)**



# CM150RX-13T/CM150RXP-13T

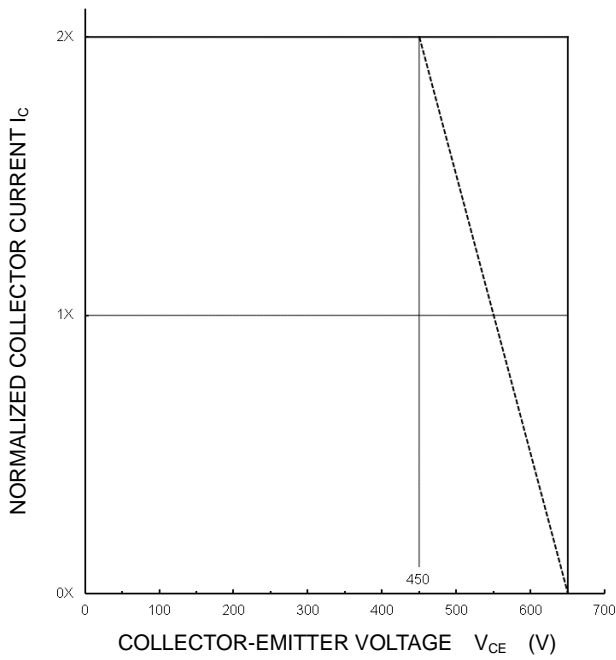
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### INVERTER PART

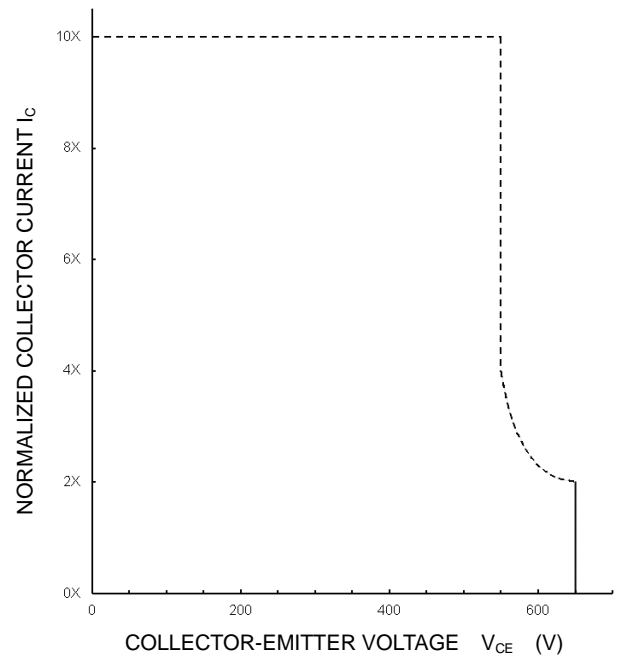
**TURN-OFF SWITCHING SAFE OPERATING AREA  
(REVERSE BIAS SAFE OPERATING AREA)  
(MAXIMUM)**

$V_{CC} \leq 450 \text{ V}$ ,  $R_G = 1.0 \sim 39 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
——:  $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$  (Normal load operations (Continuous))  
- - - - -:  $T_{vj} = 175 \text{ }^\circ\text{C}$  (Unusual load operations (Limited period))



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

$V_{CC} \leq 400 \text{ V}$ ,  $R_G = 1.0 \sim 39 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
 $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$ ,  $t_W \leq 8 \ \mu\text{s}$ , Non-Repetitive



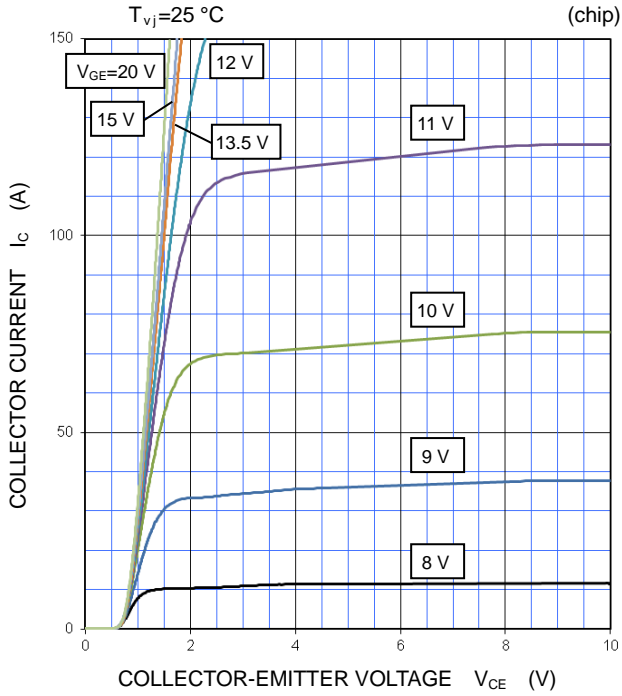
# CM150RX-13T/CM150RXP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

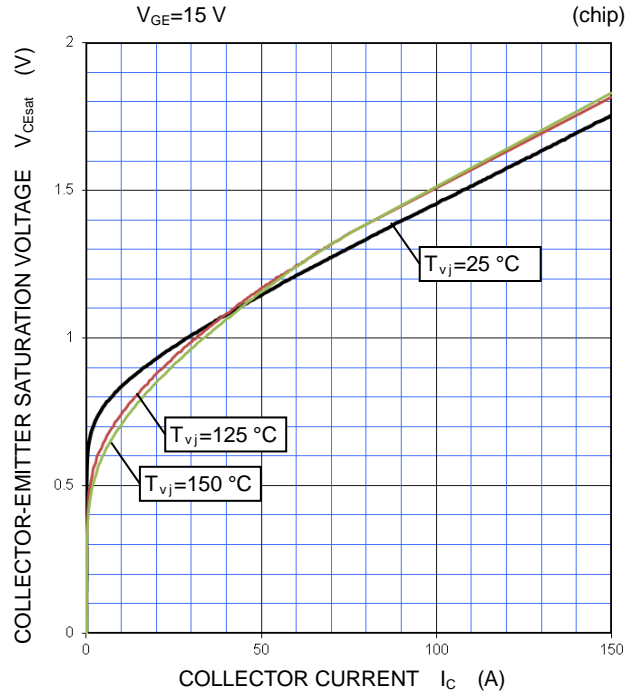
## PERFORMANCE CURVES

### BRAKE PART

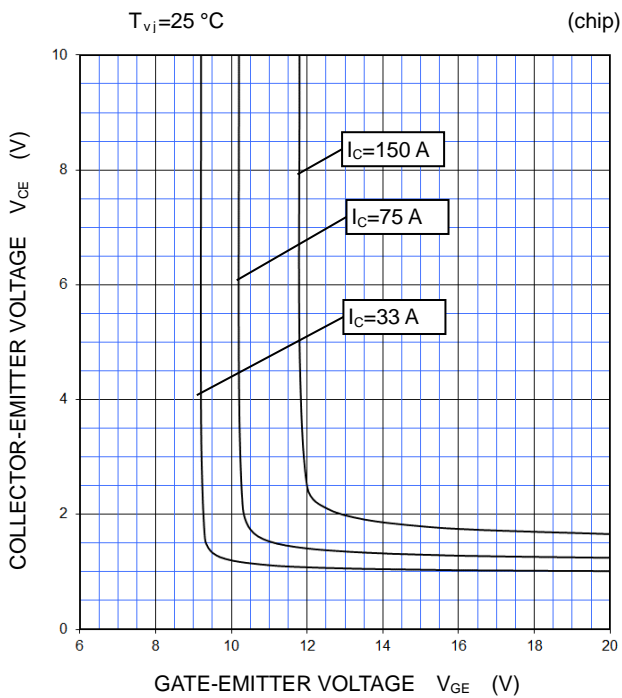
**OUTPUT CHARACTERISTICS (TYPICAL)**



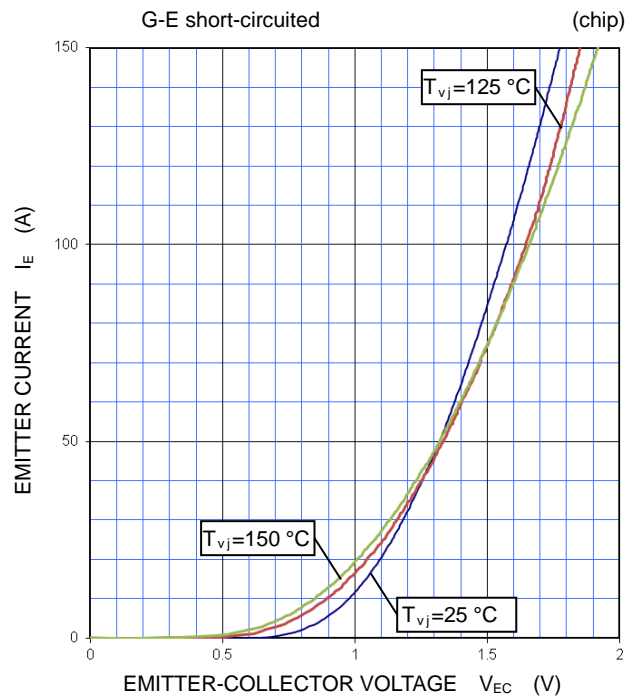
**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



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



**DIODE FORWARD CHARACTERISTICS (TYPICAL)**



# CM150RX-13T/CM150RXP-13T

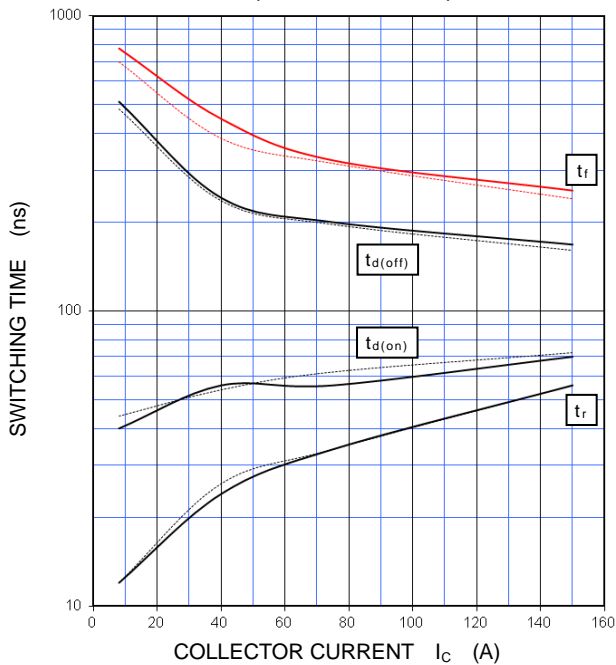
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### BRAKE PART

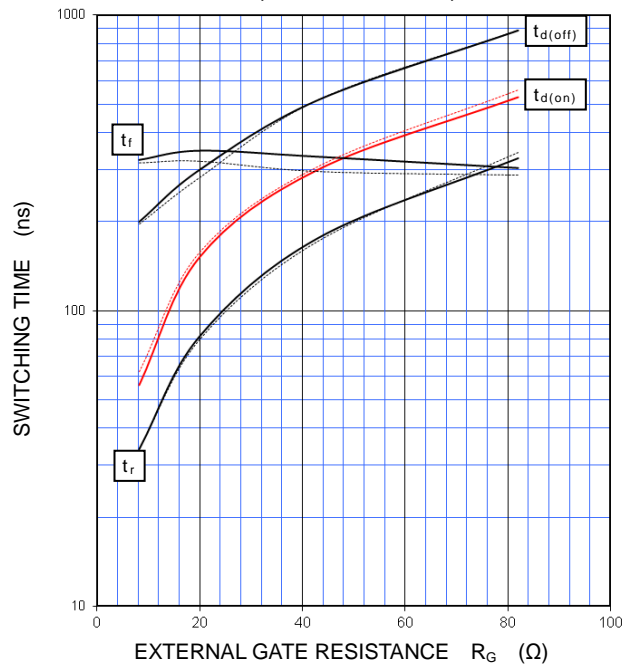
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $R_G=8.2\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



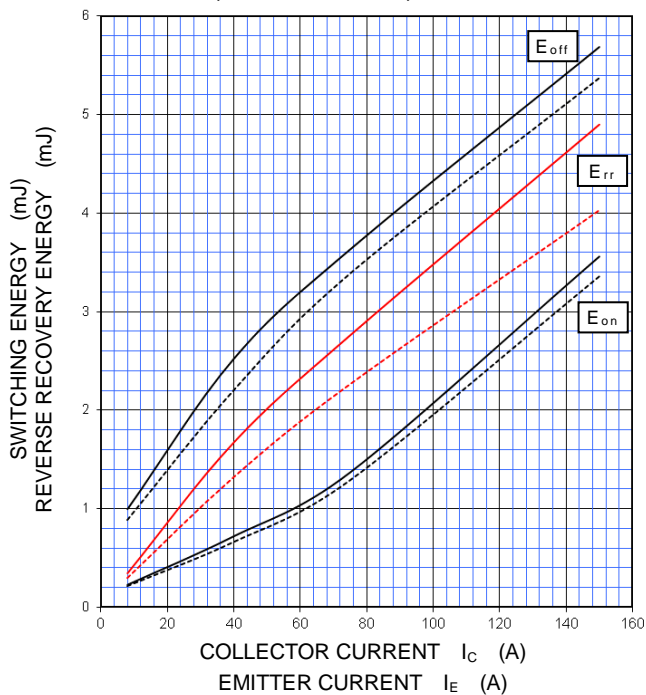
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $I_c=75\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



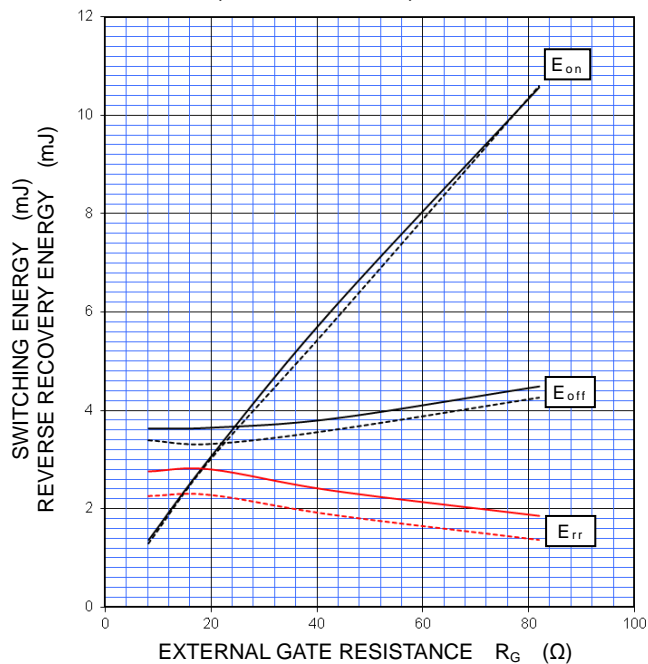
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $R_G=8.2\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD,  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$ , PER PULSE



**HALF-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





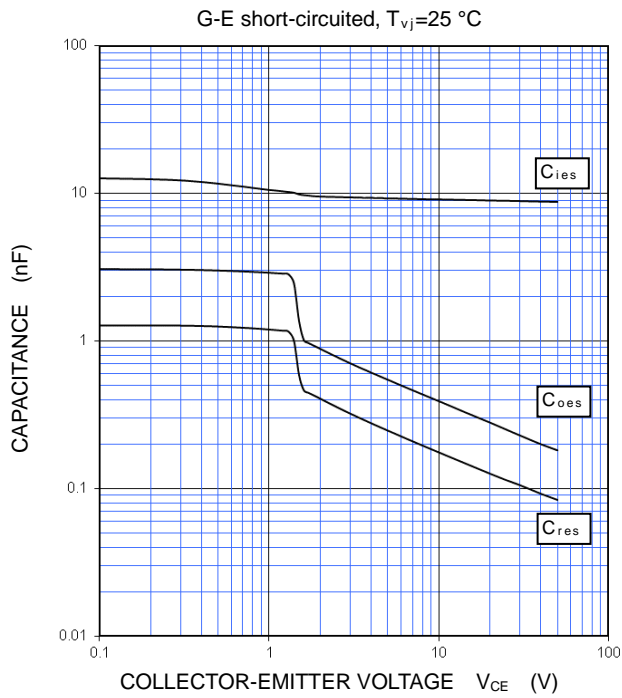
# CM150RX-13T/CM150RXP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

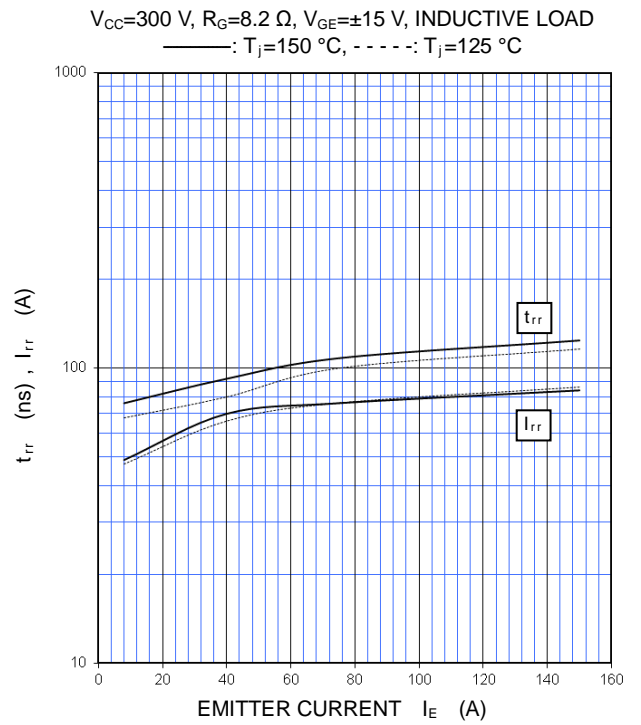
## PERFORMANCE CURVES

### BRAKE PART

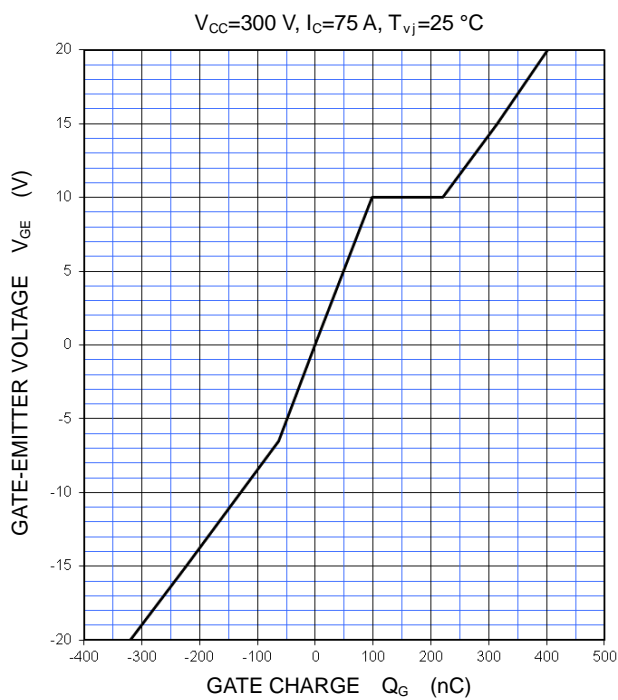
**CAPACITANCE CHARACTERISTICS (TYPICAL)**



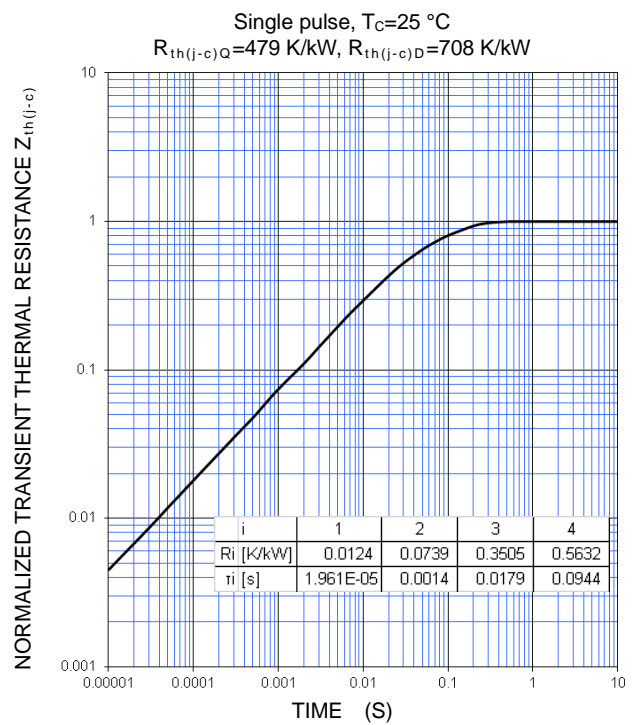
**DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



**GATE CHARGE CHARACTERISTICS (TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)**



# CM150RX-13T/CM150RXP-13T

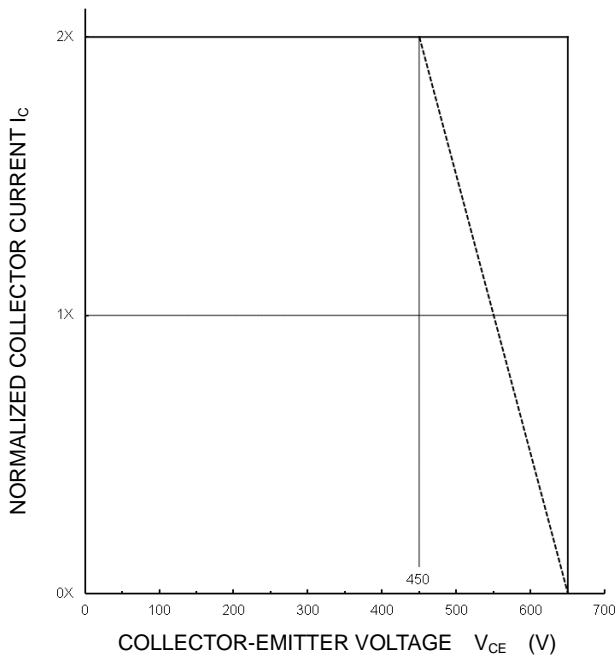
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### BRAKE PART

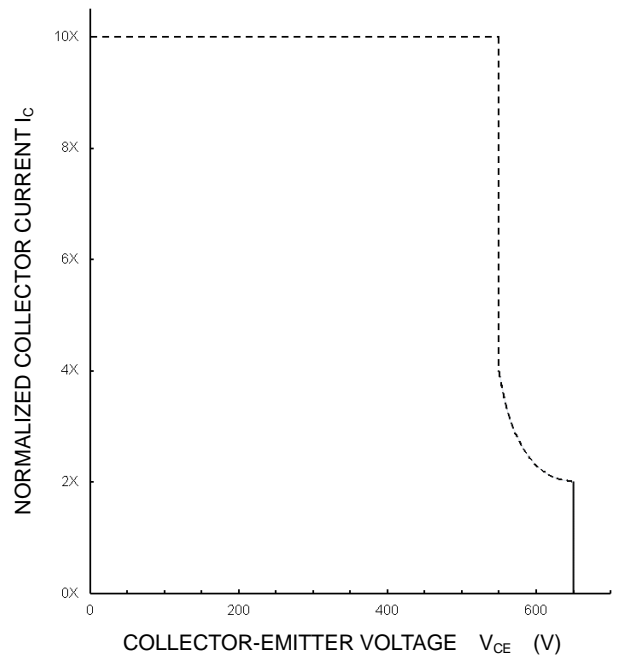
**TURN-OFF SWITCHING SAFE OPERATING AREA  
(REVERSE BIAS SAFE OPERATING AREA)  
(MAXIMUM)**

$V_{CC} \leq 450 \text{ V}$ ,  $R_G = 8.2 \sim 82 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
——:  $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$  (Normal load operations (Continuous))  
- - - - -:  $T_{vj} = 175 \text{ }^\circ\text{C}$  (Unusual load operations (Limited period))



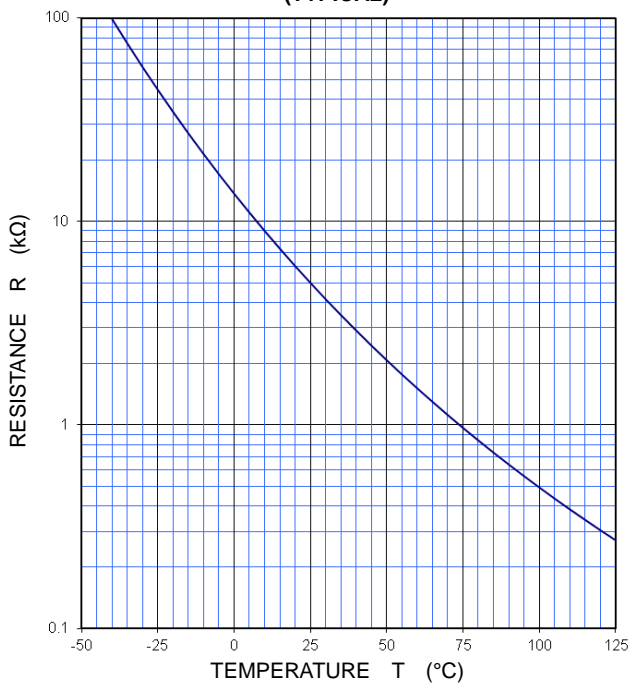
**SHORT-CIRCUIT SAFE OPERATING AREA  
(MAXIMUM)**

$V_{CC} \leq 400 \text{ V}$ ,  $R_G = 8.2 \sim 82 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
 $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$ ,  $t_W \leq 8 \ \mu\text{s}$ , 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.

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