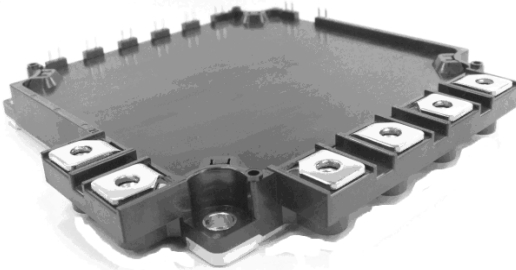


<IGBT Modules>

CM150RXL-34SA

**HIGH POWER SWITCHING USE
INSULATED TYPE**



sevenpack (3φ Inverter+Chopper Brake)

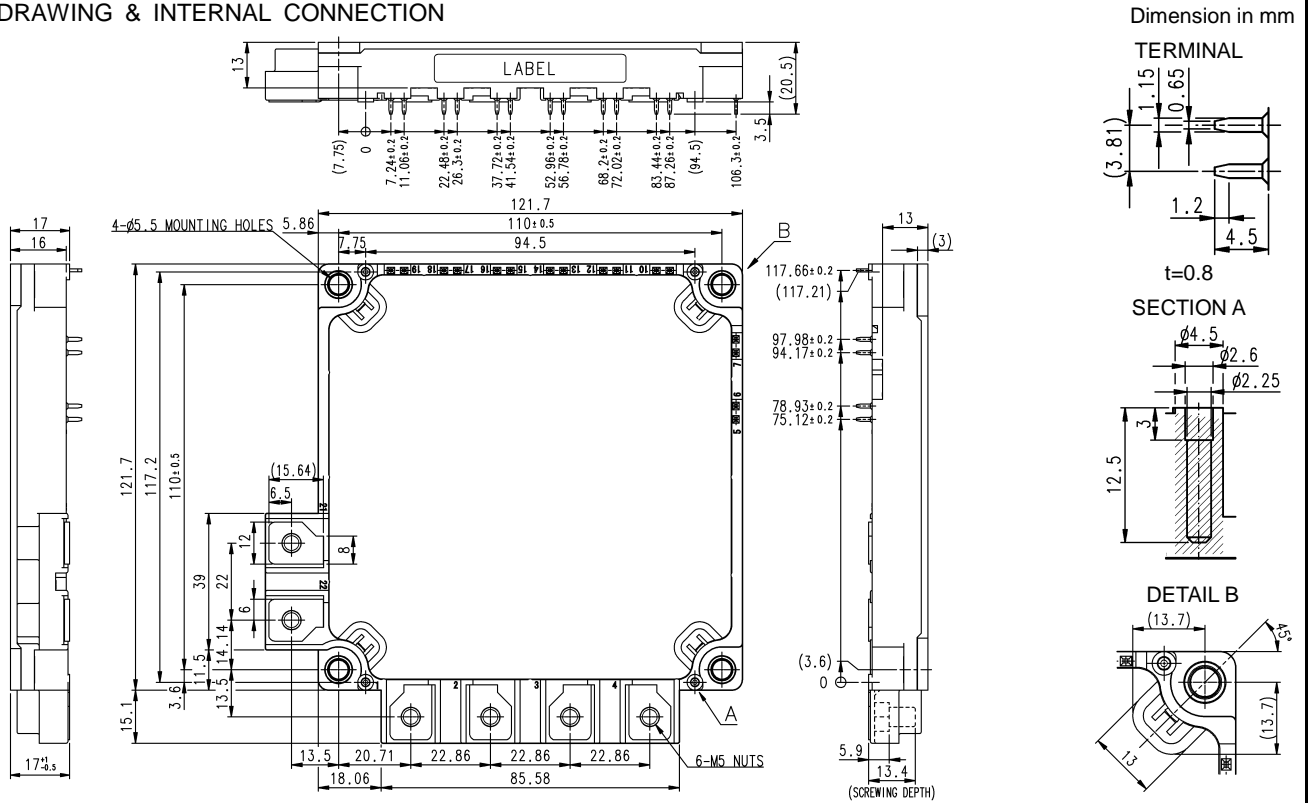
Collector current I_C 150 A
 Collector-emitter voltage V_{CES} 1700 V
 Maximum junction temperature T_{jmax} 175 °C

- 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



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

CM150RXL-34SAHIGH 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	1700	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I_C	Collector current	DC, $T_C=125\text{ }^\circ\text{C}$ (Note2, 4)	150	A
I_{CRM}		Pulse, Repetitive (Note3)	300	
P_{tot}	Total power dissipation	$T_C=25\text{ }^\circ\text{C}$ (Note2, 4)	1500	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	1700	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I_C	Collector current	DC, $T_C=125\text{ }^\circ\text{C}$ (Note2, 4)	75	A
I_{CRM}		Pulse, Repetitive (Note3)	150	
P_{tot}	Total power dissipation	$T_C=25\text{ }^\circ\text{C}$ (Note2, 4)	830	W
V_{RRM}	Repetitive peak reverse voltage	G-E short-circuited	1700	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	4000	V
T_{jmax}	Maximum junction temperature	Instantaneous event (overload)	175	$^\circ\text{C}$
T_{Cmax}	Maximum case temperature	(Note4)	125	
T_{jop}	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	$^\circ\text{C}$
T_{stg}	Storage temperature	-	-40 ~ +125	

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	$I_C=15\text{ mA}$, $V_{CE}=10\text{ V}$	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)	$T_j=25\text{ }^\circ\text{C}$	-	2.00	2.5	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.20	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.25	-	
V_{CESat} (Chip)	Collector-emitter saturation voltage	$I_C=150\text{ A}$, $V_{GE}=15\text{ V}$, (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	1.90	2.4	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.10	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.15	-	
C_{ies}	Input capacitance	$V_{CE}=10\text{ V}$, G-E short-circuited	-	-	40	nF	
C_{oes}	Output capacitance		-	-	3.3		
C_{res}	Reverse transfer capacitance		-	-	0.73		
Q_G	Gate charge	$V_{CC}=1000\text{ V}$, $I_C=150\text{ A}$, $V_{GE}=15\text{ V}$	-	828	-	nC	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=1000\text{ V}$, $I_C=150\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, Inductive load	-	-	400	ns	
t_r	Rise time		-	-	100		
$t_{d(off)}$	Turn-off delay time		-	-	700		
t_f	Fall time		-	-	600		

CM150RXL-34SAHIGH POWER SWITCHING USE
INSULATED TYPEELECTRICAL 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} (Note.1) (Terminal)	Emitter-collector voltage	$I_E=150\text{ A}$, G-E short-circuited, Refer to the figure of test circuit (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	4.1	5.3	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.9	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.7	-	
V_{EC} (Note.1) (Chip)	Emitter-collector voltage	$I_E=150\text{ A}$, G-E short-circuited, (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	4.0	5.2	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.8	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.6	-	
t_{rr} (Note1)	Reverse recovery time	$V_{CC}=1000\text{ V}$, $I_E=150\text{ A}$, $V_{GE}=\pm 15\text{ V}$,	-	-	300	ns	
Q_{rr} (Note1)	Reverse recovery charge	$R_G=0\text{ }\Omega$, Inductive load	-	5.0	-	μC	
E_{on}	Turn-on switching energy per pulse	$V_{CC}=1000\text{ V}$, $I_C=I_E=150\text{ A}$,	-	26	-	mJ	
E_{off}	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, $T_j=150\text{ }^\circ\text{C}$,	-	46	-		
E_{rr} (Note1)	Reverse recovery energy per pulse	Inductive load	-	32	-	mJ	
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, $T_C=25\text{ }^\circ\text{C}$ (Note4)	-	-	2.5	$\text{m}\Omega$	
r_g	Internal gate resistance	Per switch	-	3.4	-	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	$I_C=7.5\text{ mA}$, $V_{CE}=10\text{ V}$	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)	$T_j=25\text{ }^\circ\text{C}$	-	2.00	2.5	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.20	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.25	-	
V_{CESat} (Chip)	Collector-emitter saturation voltage	$I_C=75\text{ A}$, $V_{GE}=15\text{ V}$, (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	1.90	2.4	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.10	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.15	-	
C_{ies}	Input capacitance	$V_{CE}=10\text{ V}$, G-E short-circuited	-	-	20	nF	
C_{oes}	Output capacitance		-	-	1.6		
C_{res}	Reverse transfer capacitance		-	-	0.36		
Q_G	Gate charge	$V_{CC}=1000\text{ V}$, $I_C=75\text{ A}$, $V_{GE}=15\text{ V}$	-	414	-	nC	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=1000\text{ V}$, $I_C=75\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=10\text{ }\Omega$, Inductive load	-	-	200	ns	
t_r	Rise time		-	-	100		
$t_{d(off)}$	Turn-off delay time		-	-	700		
t_f	Fall time		-	-	600		
I_{RRM}	Repetitive peak reverse current	$V_R=V_{RRM}$, G-E short-circuited	-	-	1.0	mA	
V_F (Terminal)	Forward voltage	$I_F=75\text{ A}$, Refer to the figure of test circuit (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	4.1	5.3	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.9	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.7	-	
V_F (Chip)	Forward voltage	$I_F=75\text{ A}$, (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	4.0	5.2	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.8	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.6	-	
t_{rr}	Reverse recovery time	$V_{CC}=1000\text{ V}$, $I_E=75\text{ A}$, $V_{GE}=\pm 15\text{ V}$,	-	-	200	ns	
Q_{rr}	Reverse recovery charge	$R_G=10\text{ }\Omega$, Inductive load	-	2.0	-	μC	
E_{on}	Turn-on switching energy per pulse	$V_{CC}=1000\text{ V}$, $I_C=I_E=75\text{ A}$,	-	17.1	-	mJ	
E_{off}	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$, $R_G=10\text{ }\Omega$, $T_j=150\text{ }^\circ\text{C}$,	-	23	-		
E_{rr}	Reverse recovery energy per pulse	Inductive load	-	15.9	-	mJ	
r_g	Internal gate resistance	-	-	0	-	Ω	

CM150RXL-34SA

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)	-	-	0.16	
R _{th(j-c)Q}		Junction to case, per Brake IGBT (Note4)	-	-	0.18	K/W
R _{th(j-c)D}		Junction to case, per Brake DIODE (Note4)	-	-	0.27	
R _{th(c-s)}	Contact thermal resistance	Case to heat sink, per 1 module, Thermal grease applied (Note4, 7)	-	7	-	K/kW

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	16.3	-	-	mm
		Terminal to base plate	16.8	-	-	
d _a	Clearance	Terminal to terminal	10	-	-	mm
		Terminal to base plate	10	-	-	
m	mass	-	-	690	-	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.

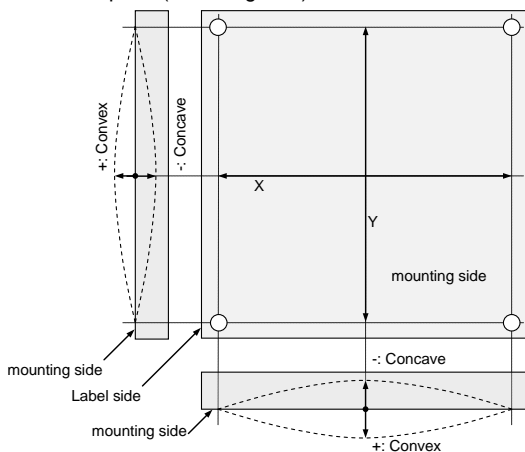
$$6. B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right),$$

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]

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.



CM150RXL-34SA

HIGH POWER SWITCHING USE
INSULATED TYPE

Note9. 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"

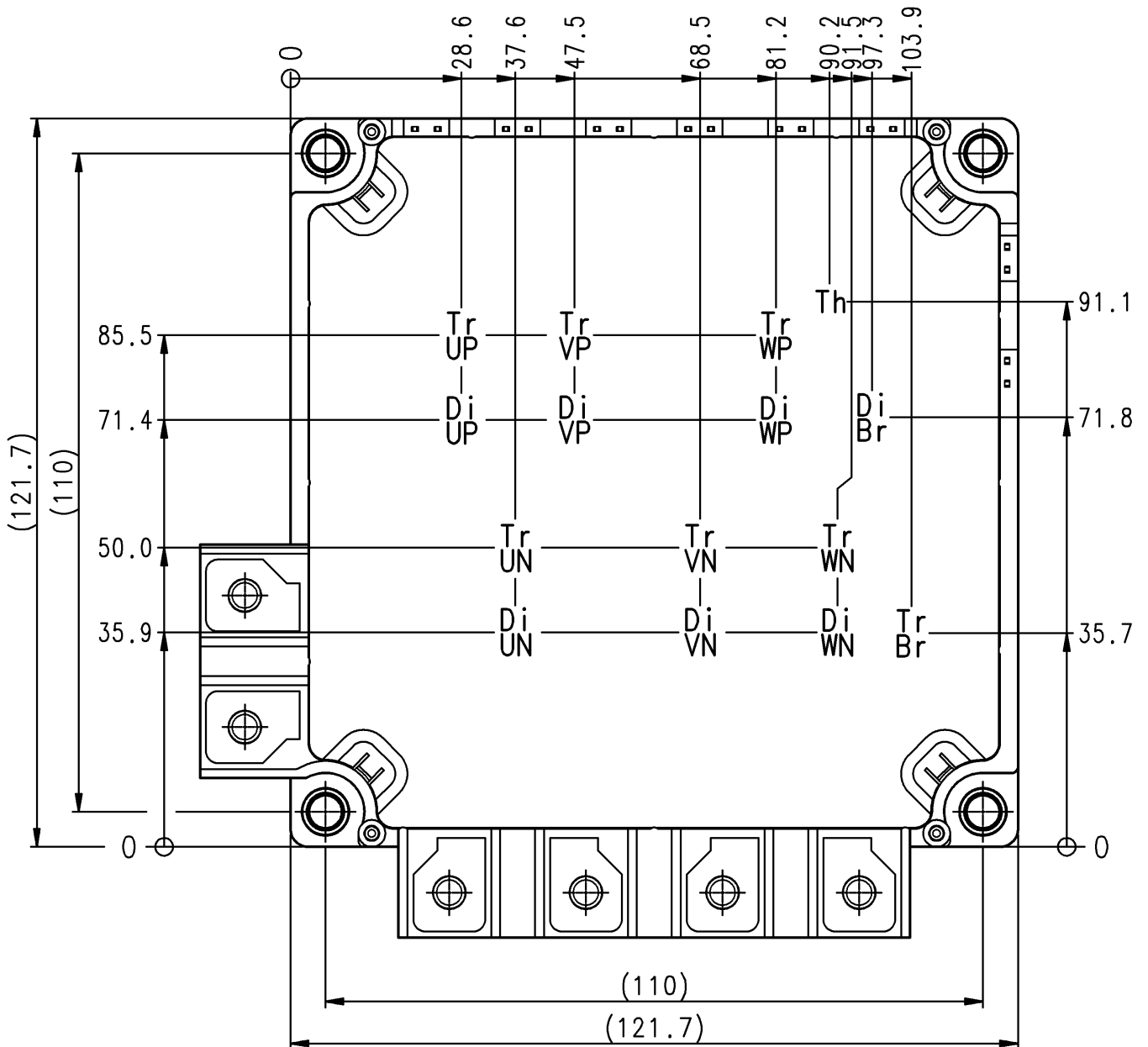
The length of the screw depends on the thickness (t1.6~t2.0) of the PCB.

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
V _{CC}	(DC) Supply voltage	Applied across P-N terminals	-	1000	1200	V	
V _{GEon}	Gate (-emitter drive) voltage	Applied across GB-EB/ G*P-E*P/G*N-E*N(*=U, V, W) terminals	13.5	15.0	16.5	V	
R _G	External gate resistance	Per switch	Inverter IGBT	0	-	50	Ω
			Brake IGBT	10	-	100	

CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm

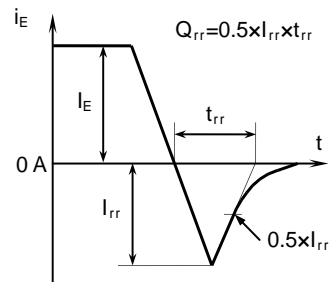
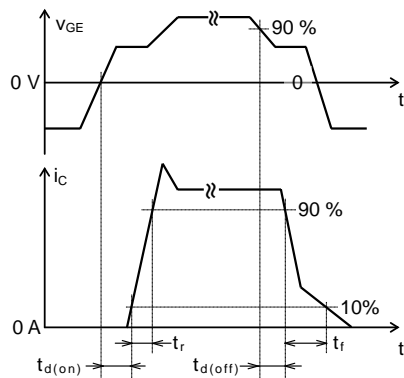
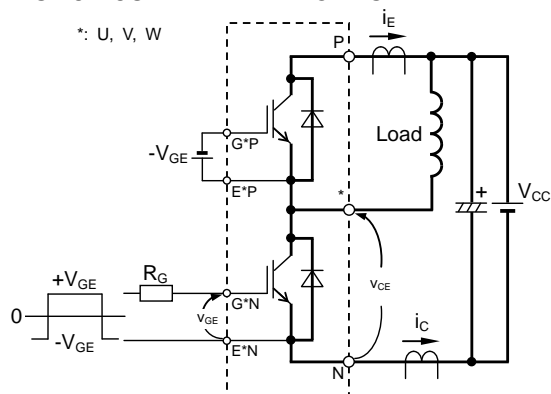


Tr*P/Tr*N/TrBr: IGBT, Di*P/Di*N: DIODE (*=U/V/W), DiBr: BRAKE DIODE, Th: NTC thermistor

CM150RXL-34SA

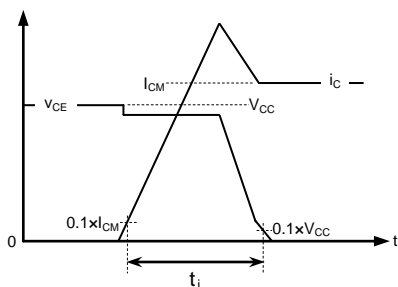
HIGH POWER SWITCHING USE
INSULATED TYPE

TEST CIRCUIT AND WAVEFORMS

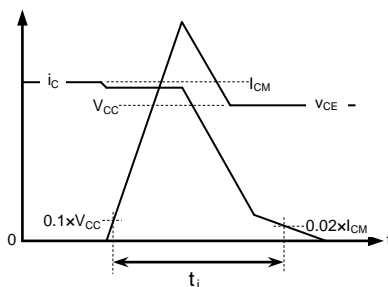


Switching characteristics test circuit and waveforms

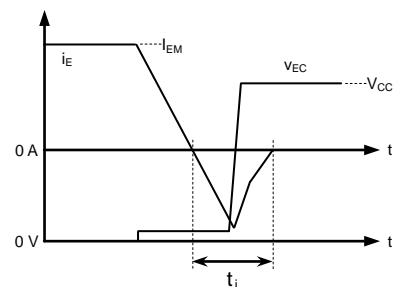
t_{rr} , Q_{rr} characteristics test waveform



IGBT Turn-on switching energy



IGBT Turn-off switching energy



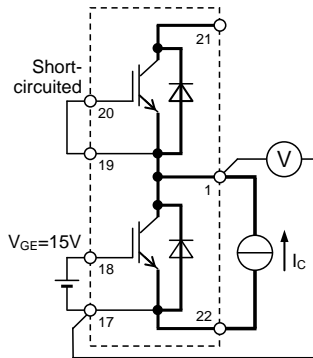
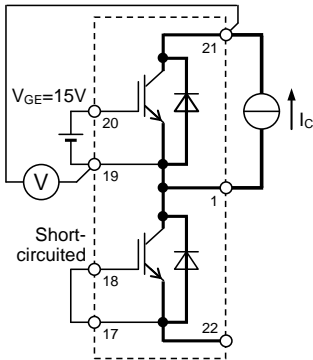
DIODE Reverse recovery energy

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

CM150RXL-34SA

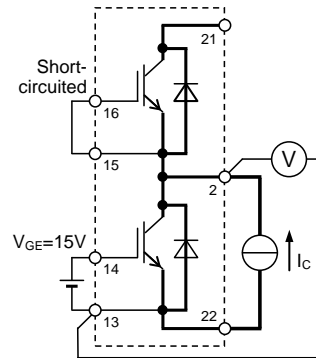
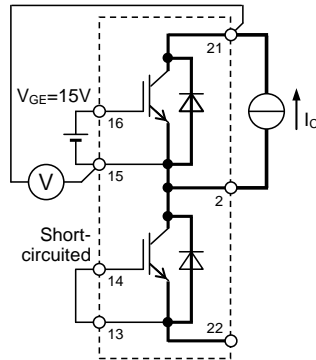
HIGH POWER SWITCHING USE
INSULATED TYPE

TEST CIRCUIT



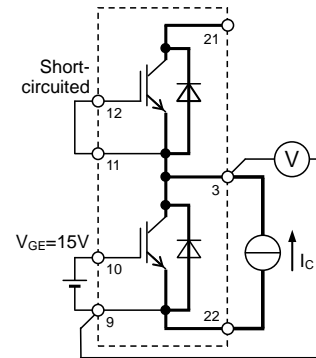
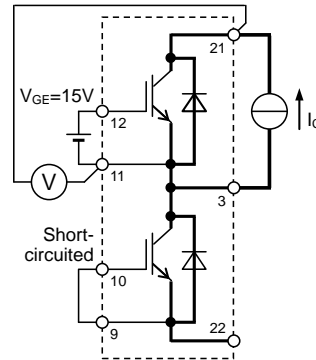
Gate-emitter GVP-EVP GVN-EVN,
short-circuited GWP-EWP, GWN-EWN,
GB-EB

UP / UN IGBT



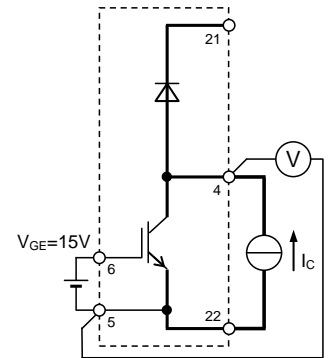
Gate-emitter GUP-EUP, GUN-EUN,
short-circuited GWP-EWP, GWN-EWN,
GB-EB

VP / VN IGBT



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

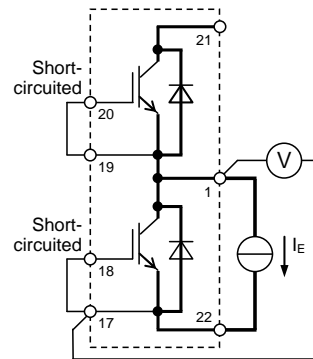
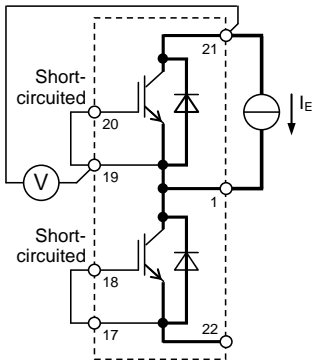
WP / WN IGBT



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

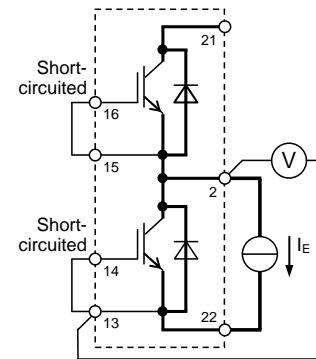
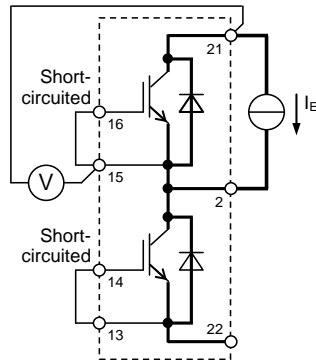
Brake IGBT

V_{CEsat} characteristics test circuit



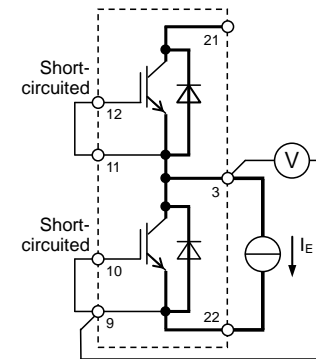
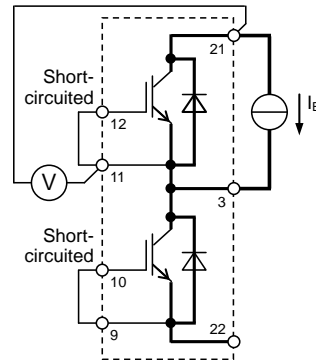
Gate-emitter GVP-EVP GVN-EVN,
short-circuited GWP-EWP, GWN-EWN,
GB-EB

UP / UN DIODE



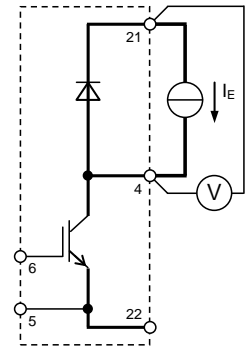
Gate-emitter GUP-EUP, GUN-EUN,
short-circuited GWP-EWP, GWN-EWN,
GB-EB

VP / VN DIODE



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

WP / WN DIODE



Brake DIODE

V_{EC} / V_F characteristics test circuit

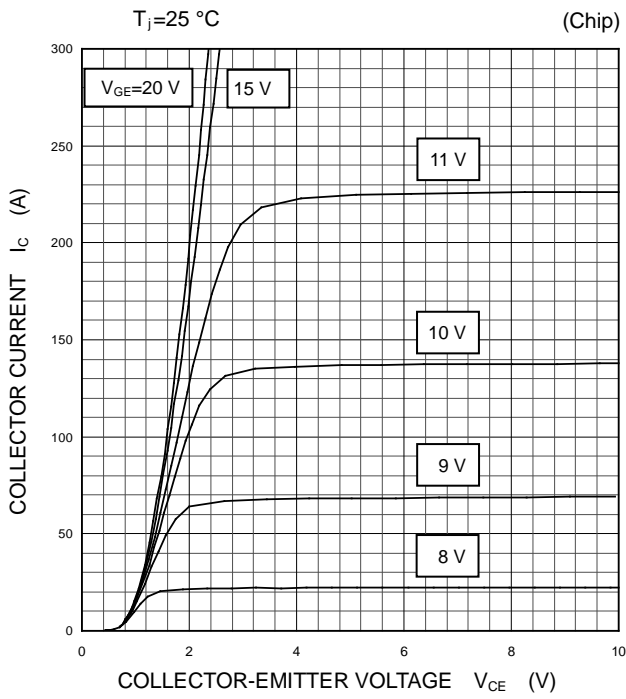
CM150RXL-34SA

HIGH POWER SWITCHING USE
INSULATED TYPE

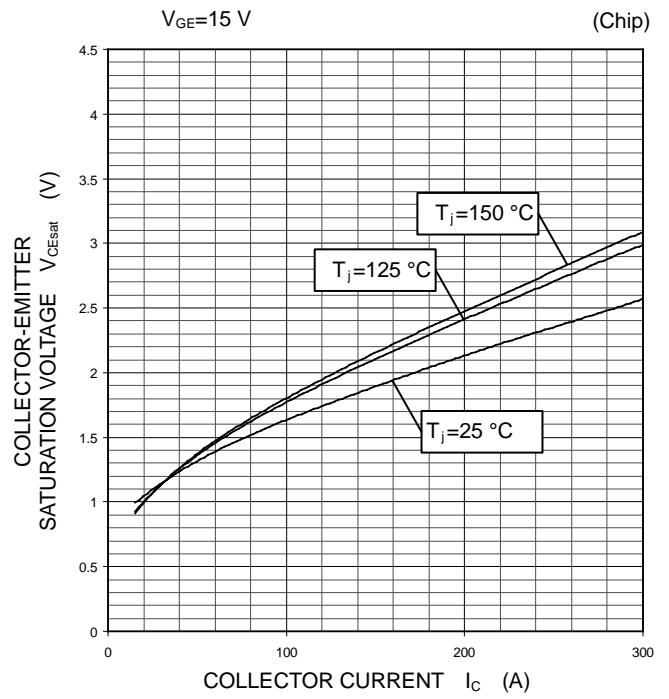
PERFORMANCE CURVES

INVERTER PART

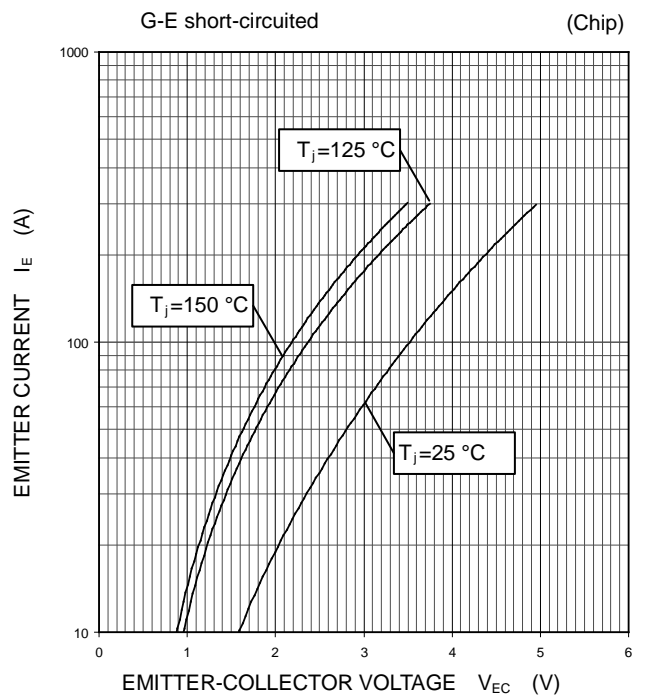
OUTPUT CHARACTERISTICS
(TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)



FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)



CM150RXL-34SA

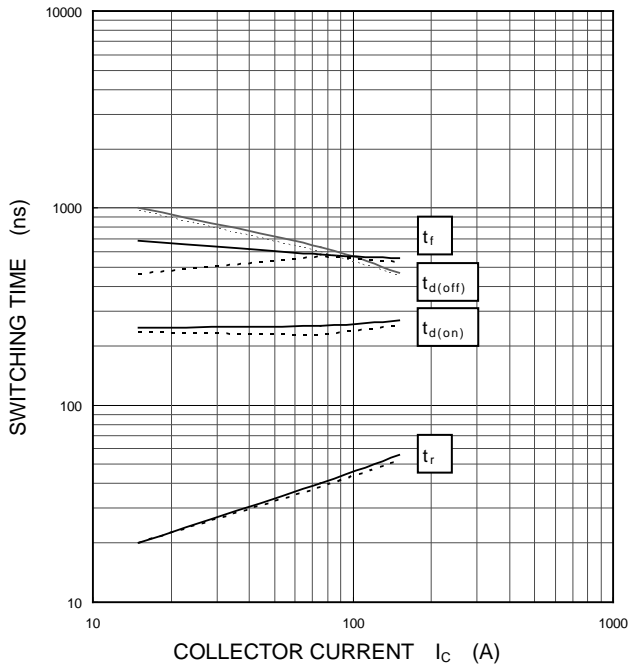
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

INVERTER PART

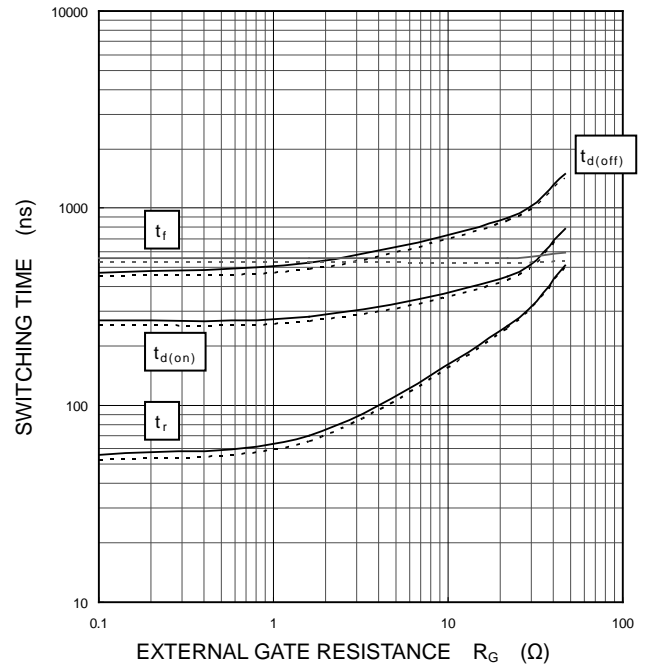
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$, INDUCTIVE LOAD
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



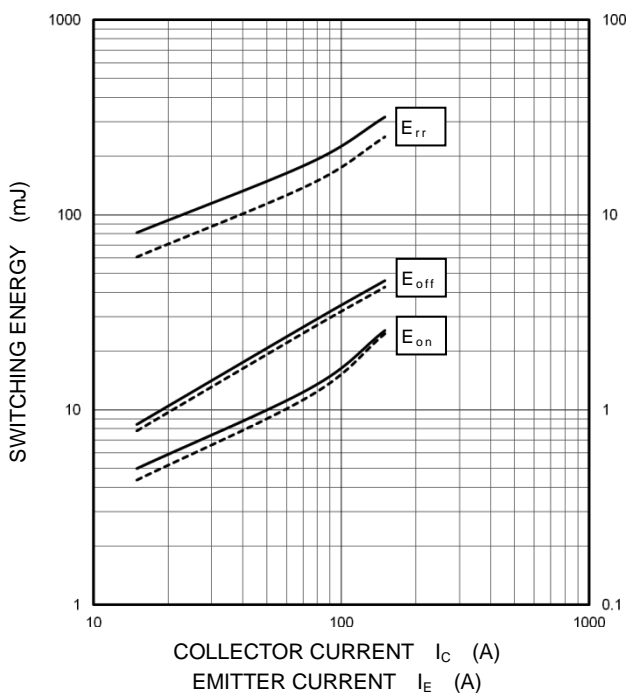
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=150\text{ A}$, INDUCTIVE LOAD
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



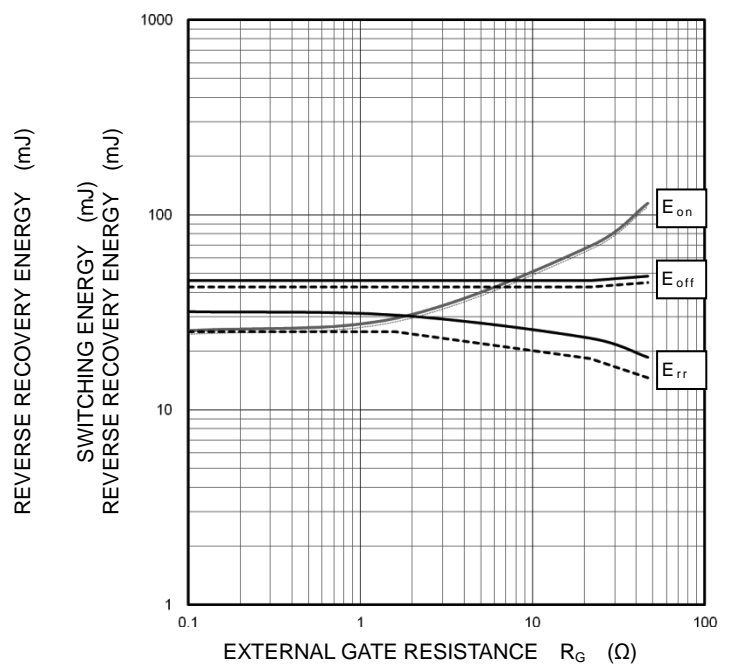
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$,
INDUCTIVE LOAD, PER PULSE
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C/I_E=150\text{ A}$,
INDUCTIVE LOAD, PER PULSE
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



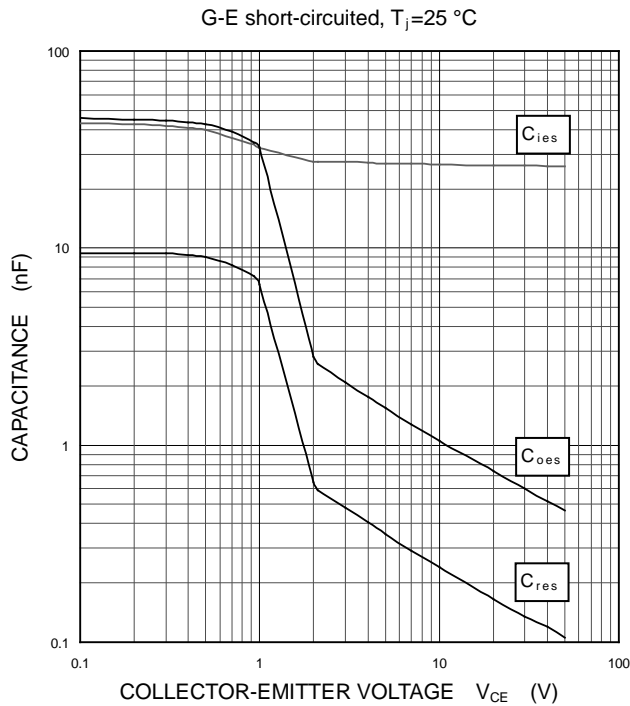
CM150RXL-34SA

HIGH POWER SWITCHING USE
INSULATED TYPE

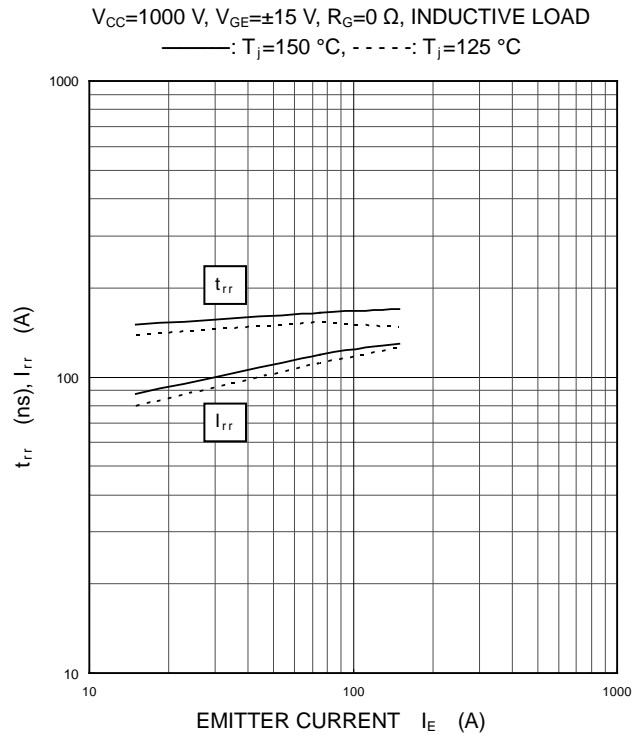
PERFORMANCE CURVES

INVERTER PART

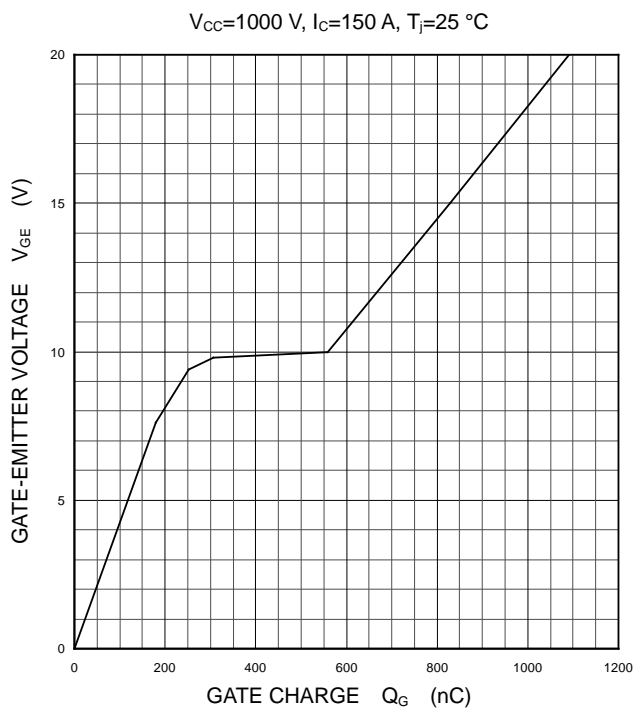
CAPACITANCE CHARACTERISTICS
(TYPICAL)



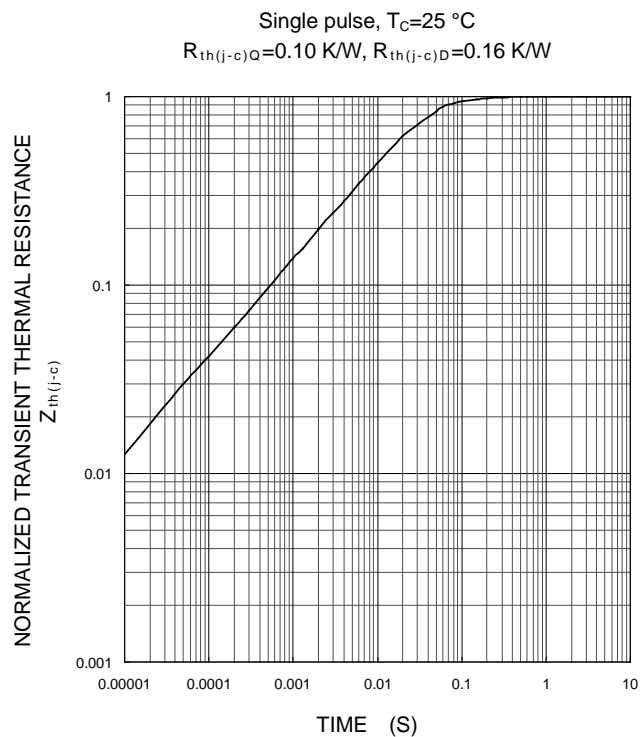
FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)



GATE CHARGE CHARACTERISTICS
(TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)



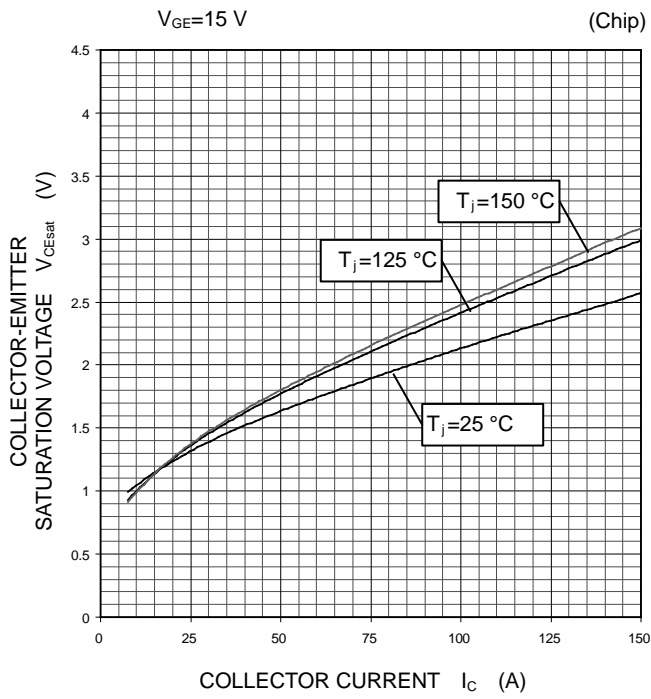
CM150RXL-34SA

HIGH POWER SWITCHING USE
INSULATED TYPE

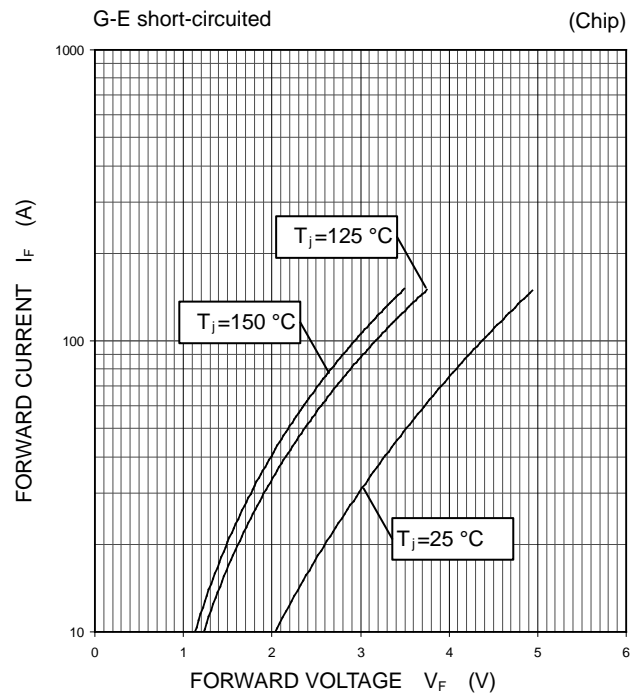
PERFORMANCE CURVES

BRAKE PART

COLLECTOR-EMITTER SATURATION
VOLTAGE CHARACTERISTICS
(TYPICAL)

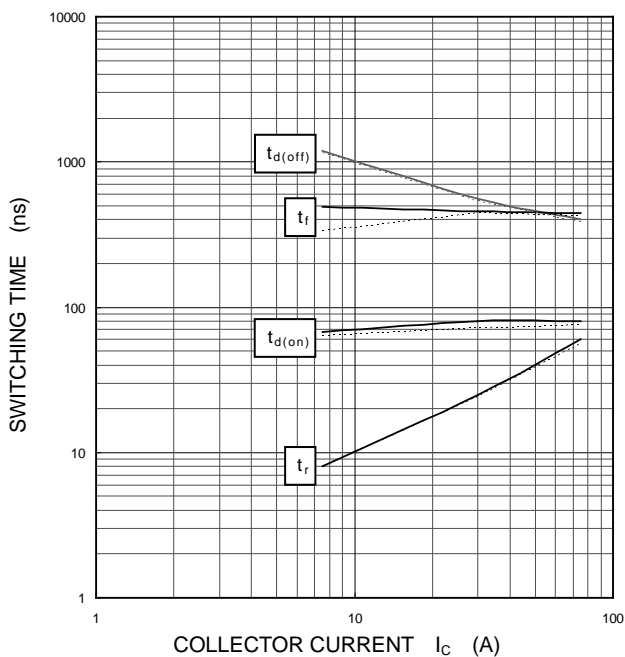


CLAMP DIODE
FORWARD CHARACTERISTICS
(TYPICAL)



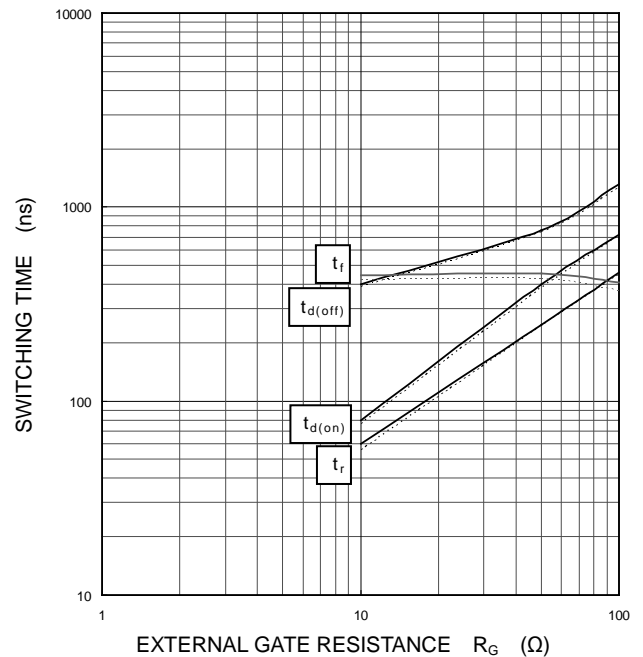
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=10\text{ }\Omega$, INDUCTIVE LOAD
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=1000\text{ V}$, $I_C=75\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



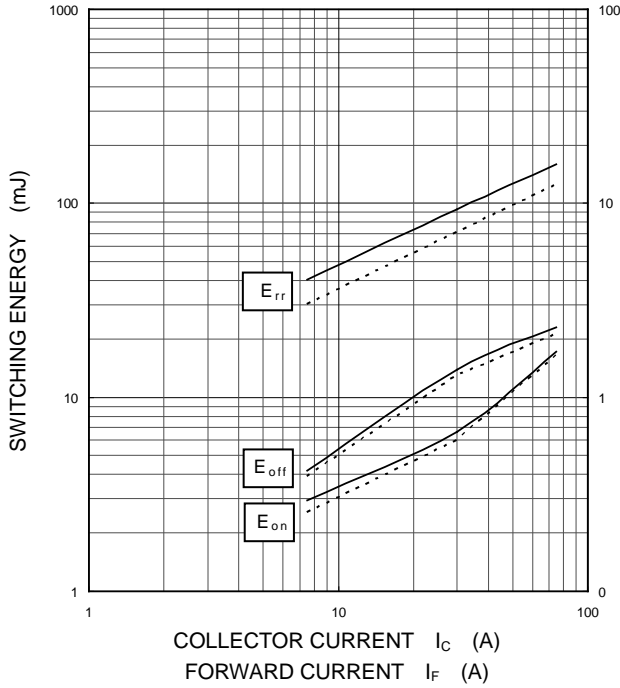
CM150RXL-34SA

HIGH POWER SWITCHING USE
INSULATED TYPE

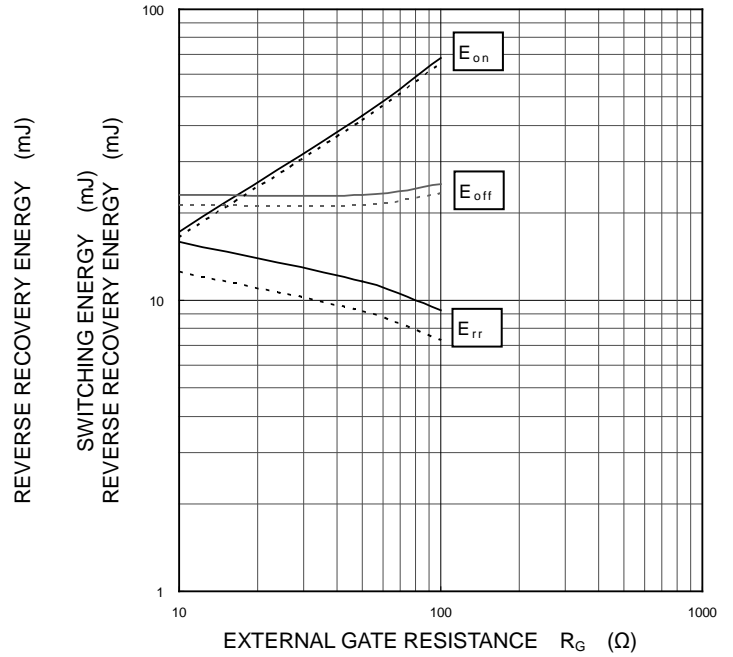
PERFORMANCE CURVES

BRAKE PART

HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
 $V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=10\ \Omega$,
INDUCTIVE LOAD, PER PULSE
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$

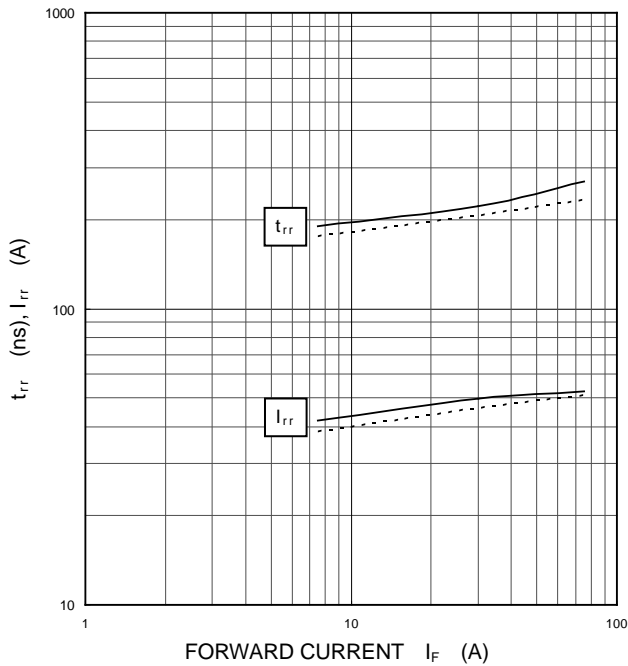


HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
 $V_{CC}=1000\text{ V}$, $I_C/I_F=75\text{ A}$, $V_{GE}=\pm 15\text{ V}$,
INDUCTIVE LOAD, PER PULSE
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



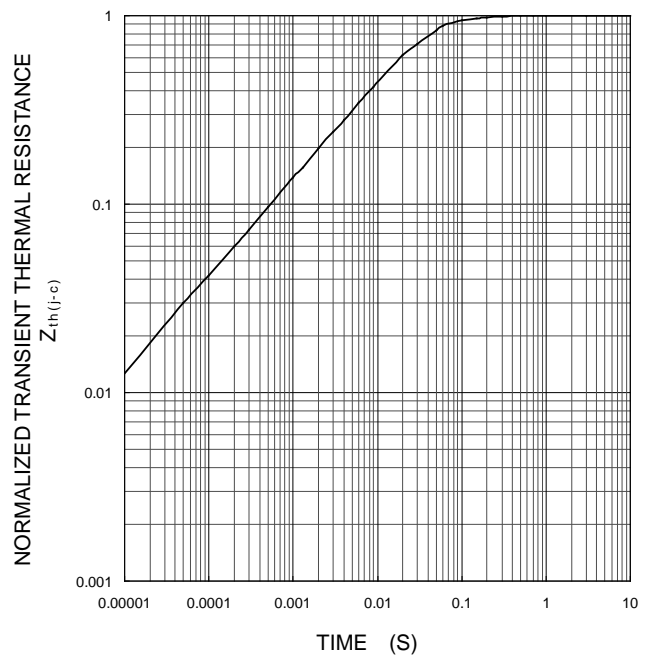
CLAMP DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)

$V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=10\ \Omega$, INDUCTIVE LOAD
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)

Single pulse, $T_C=25\text{ }^\circ\text{C}$
 $R_{th(j-c)Q}=0.18\text{ K/W}$, $R_{th(j-c)D}=0.27\text{ K/W}$



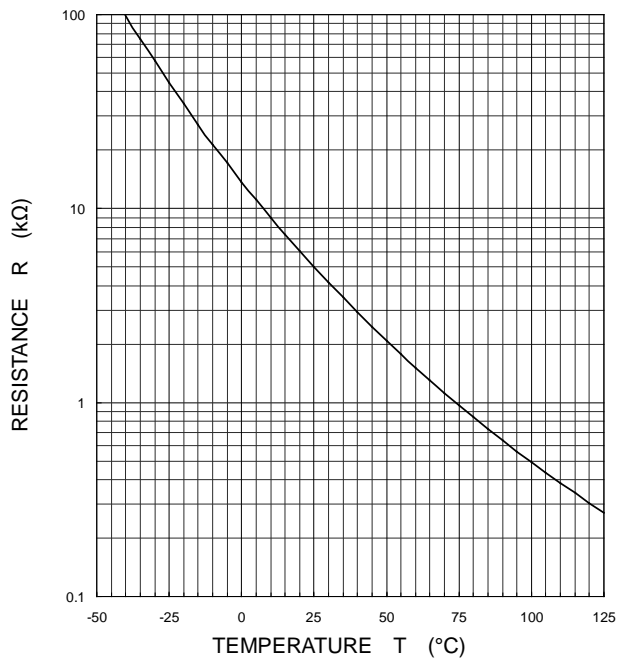
CM150RXL-34SA

HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

NTC thermistor part

TEMPERATURE CHARACTERISTICS
(TYPICAL)



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