



<IGBT Modules>

# CM50MXUA-24T1/CM50MXUAP-24T1

**HIGH POWER SWITCHING USE  
INSULATED TYPE**

 <p>MXUA</p>	<p>Collector current <math>I_c</math> ..... <b>50 A</b>          Collector-emitter voltage <math>V_{CES}</math> ..... <b>1200 V</b>          Maximum junction temperature <math>T_{vjmax}</math> ..... <b>175 °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>MXUAP</p>	<p>Collector current <math>I_c</math> ..... <b>50 A</b>          Collector-emitter voltage <math>V_{CES}</math> ..... <b>1200 V</b>          Maximum junction temperature <math>T_{vjmax}</math> ..... <b>175 °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>CIB (Converter+Inverter+Chopper Brake)      •UL Recognized under UL1557, File No. E323585</p>	

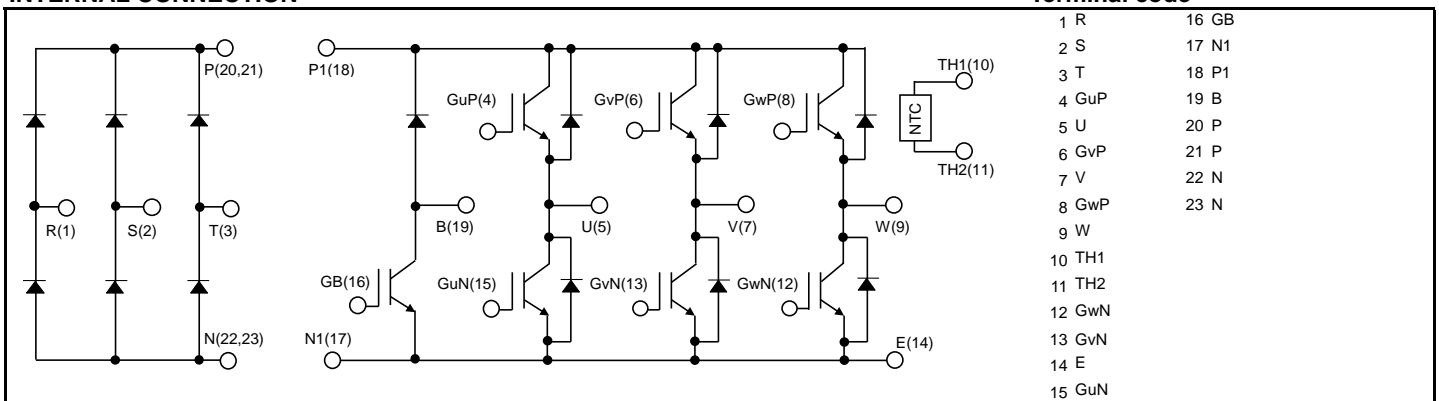
**APPLICATION**

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**

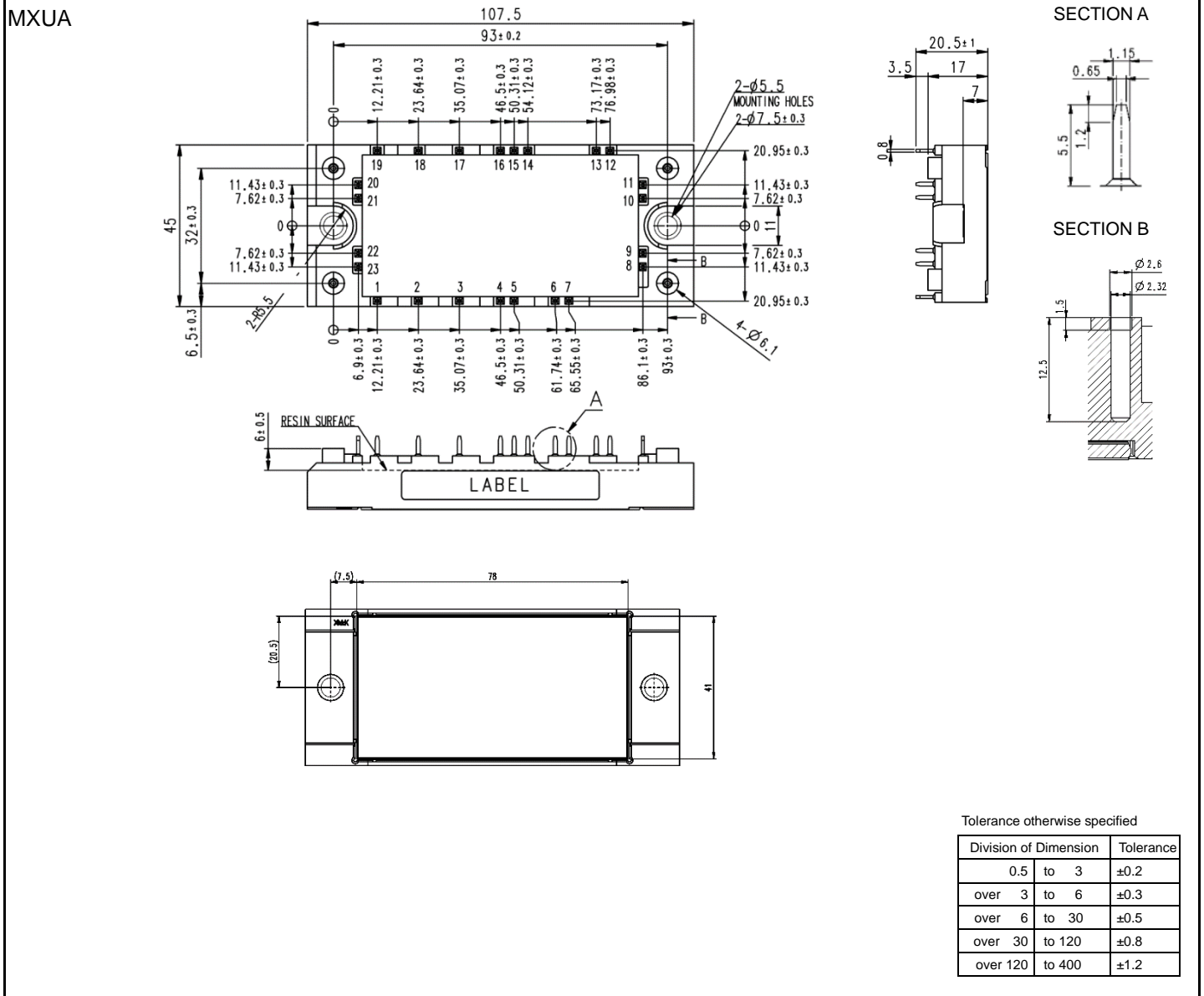


# CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE

## OUTLINE DRAWING

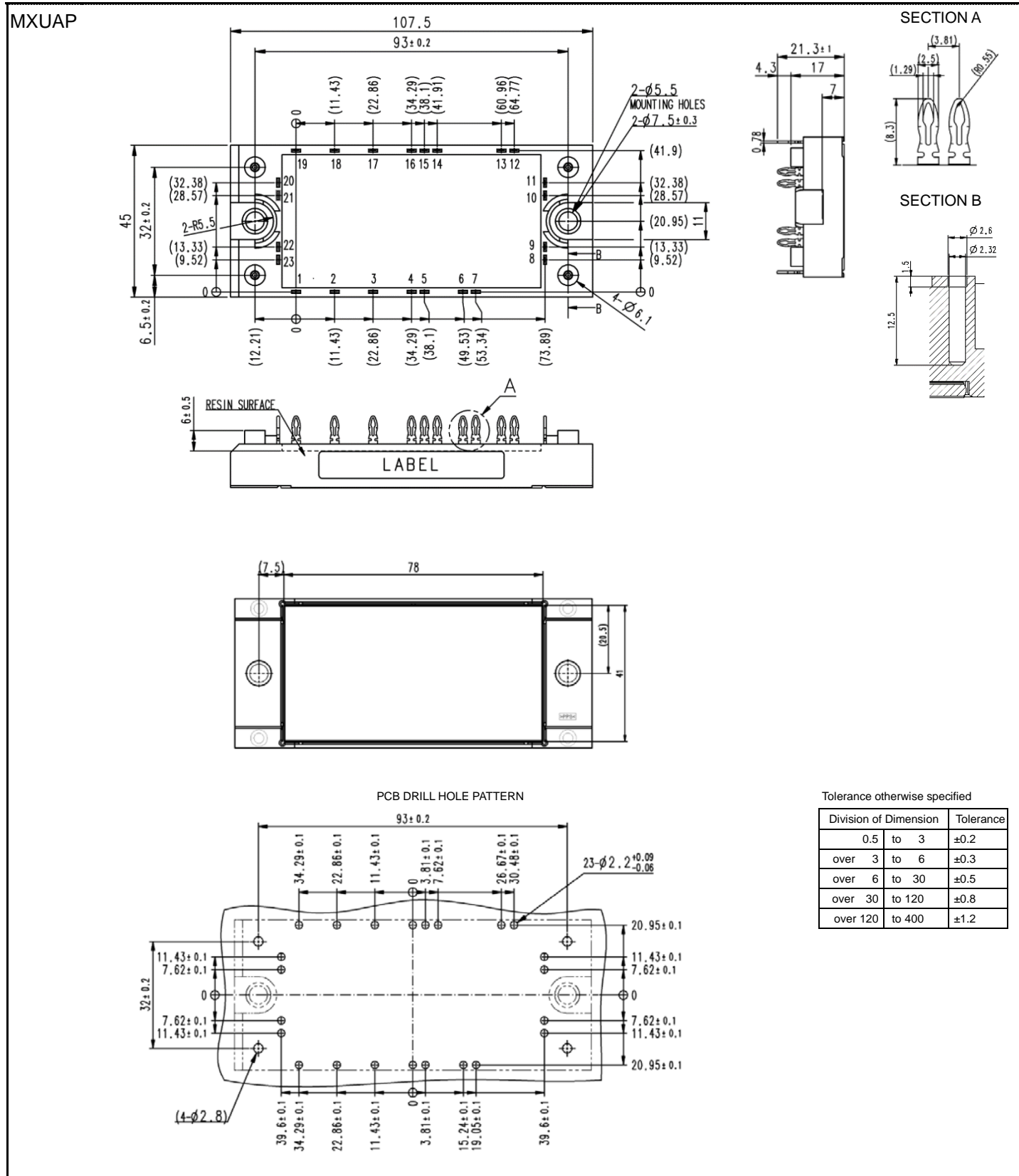
Dimension in mm



# CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE

## OUTLINE DRAWING



## CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE**MAXIMUM RATINGS (T<sub>vj</sub>=25 °C, unless otherwise specified)****INVERTER PART IGBT/FWD**

Symbol	Item	Conditions	Rating	Unit
V <sub>CES</sub>	Collector-emitter voltage	G-E short-circuited	1200	V
V <sub>GES</sub>	Gate-emitter voltage	C-E short-circuited	± 20	V
I <sub>C</sub>	Collector current	DC, T <sub>C</sub> =106 °C (Note2, 4)	50	A
I <sub>CRM</sub>		Pulse, Repetitive (Note3)	100	
P <sub>tot</sub>	Total power dissipation	T <sub>C</sub> =25 °C (Note2, 4)	279	W
I <sub>E</sub> (Note1)	Emitter current	DC (Note2)	50	A
I <sub>ERM</sub> (Note1)		Pulse, Repetitive (Note3)	100	
T <sub>vjmax</sub>	Maximum junction temperature	Instantaneous event (overload)	175	°C

**BRAKE PART IGBT/DIODE**

Symbol	Item	Conditions	Rating	Unit
V <sub>CES</sub>	Collector-emitter voltage	G-E short-circuited	1200	V
V <sub>GES</sub>	Gate-emitter voltage	C-E short-circuited	± 20	V
I <sub>C</sub>	Collector current	DC, T <sub>C</sub> =119 °C (Note2, 4)	35	A
I <sub>CRM</sub>		Pulse, Repetitive (Note3)	70	
P <sub>tot</sub>	Total power dissipation	T <sub>C</sub> =25 °C (Note2, 4)	235	W
V <sub>RRM</sub>	Repetitive peak reverse voltage	G-E short-circuited	1200	V
I <sub>F</sub>	Forward current	DC (Note2)	35	A
I <sub>FRM</sub>		Pulse, Repetitive (Note3)	70	
T <sub>vjmax</sub>	Maximum junction temperature	Instantaneous event (overload)	175	°C

**CONVERTER PART DIODE**

Symbol	Item	Conditions	Rating	Unit	
V <sub>RRM</sub>	Repetitive peak reverse voltage	-	1600	V	
E <sub>a</sub>	Recommended AC input voltage	RMS	440	V	
I <sub>o</sub>	DC output current	3-phase full wave rectifying, T <sub>C</sub> =125 °C (Note4)	50	A	
I <sub>FSM</sub>	Surge forward current	The sine half wave 1 cycle peak value, f=60 Hz, non-repetitive	T <sub>vj</sub> =25 °C	532	A
			T <sub>vj</sub> =150 °C	426	
I <sup>2</sup> <sub>t</sub>	Current square time	Value for one cycle of surge current	T <sub>vj</sub> =25 °C	1179	A <sup>2</sup> s
			T <sub>vj</sub> =150 °C	756	
T <sub>vjmax</sub>	Maximum junction temperature	Instantaneous event (overload)	150	°C	

**MODULE**

Symbol	Item	Conditions	Rating	Unit
V <sub>isol</sub>	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	2500	V
T <sub>Cmax</sub>	Maximum case temperature	(Note4)	125	°C
T <sub>vjop</sub>	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	°C
T <sub>stg</sub>	Storage temperature	-	-40 ~ +125	

## CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE**ELECTRICAL CHARACTERISTICS (T<sub>vj</sub>=25 °C, unless otherwise specified)**  
**INVERTER PART IGBT/FWD**

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
I <sub>CES</sub>	Collector-emitter cut-off current	V <sub>CE</sub> =V <sub>CES</sub> , G-E short-circuited	-	-	1.0	mA	
I <sub>GES</sub>	Gate-emitter leakage current	V <sub>GE</sub> =V <sub>GES</sub> , C-E short-circuited	-	-	0.5	μA	
V <sub>GE(th)</sub>	Gate-emitter threshold voltage	I <sub>C</sub> =5.0 mA, V <sub>CE</sub> =10 V	5.4	6.0	6.6	V	
V <sub>CEsat</sub> (Terminal)	Collector-emitter saturation voltage	I <sub>C</sub> =50 A, V <sub>GE</sub> =15 V, Refer to the figure of test circuit (Note5)	T <sub>vj</sub> =25 °C	-	1.95	2.45	V
			T <sub>vj</sub> =125 °C	-	2.30	-	
			T <sub>vj</sub> =150 °C	-	2.40	-	
V <sub>CEsat</sub> (Chip)	Collector-emitter saturation voltage	I <sub>C</sub> =50 A, V <sub>GE</sub> =15 V, (Note5)	T <sub>vj</sub> =25 °C	-	1.85	2.15	V
			T <sub>vj</sub> =125 °C	-	2.10	-	
			T <sub>vj</sub> =150 °C	-	2.15	-	
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> =10 V, G-E short-circuited	-	-	8.5	nF	
C <sub>oes</sub>	Output capacitance		-	-	0.2		
C <sub>res</sub>	Reverse transfer capacitance		-	-	0.1		
Q <sub>G</sub>	Gate charge	V <sub>CC</sub> =600 V, I <sub>C</sub> =50 A, V <sub>GE</sub> =15 V	-	0.26	-	μC	
t <sub>d(on)</sub>	Turn-on delay time	V <sub>CC</sub> =600 V, I <sub>C</sub> =50 A, V <sub>GE</sub> =±15 V, R <sub>G</sub> =18 Ω, Inductive load	-	-	300	ns	
t <sub>r</sub>	Rise time		-	-	150		
t <sub>d(off)</sub>	Turn-off delay time		-	-	500		
t <sub>f</sub>	Fall time		-	-	400		
V <sub>EC</sub> (Note1) (Terminal)	Emitter-collector voltage	I <sub>E</sub> =50 A, G-E short-circuited, Refer to the figure of test circuit (Note5)	T <sub>vj</sub> =25 °C	-	2.00	2.60	V
			T <sub>vj</sub> =125 °C	-	2.25	-	
			T <sub>vj</sub> =150 °C	-	2.30	-	
V <sub>EC</sub> (Note1) (Chip)	Emitter-collector voltage	I <sub>E</sub> =50 A, G-E short-circuited, (Note5)	T <sub>vj</sub> =25 °C	-	1.90	2.35	V
			T <sub>vj</sub> =125 °C	-	1.90	-	
			T <sub>vj</sub> =150 °C	-	1.90	-	
t <sub>rr</sub> (Note1)	Reverse recovery time	V <sub>CC</sub> =600 V, I <sub>E</sub> =50 A, V <sub>GE</sub> =±15 V,	-	-	500	ns	
Q <sub>rr</sub> (Note1)	Reverse recovery charge	R <sub>G</sub> =18 Ω, Inductive load	-	3.6	-	μC	
E <sub>on</sub>	Turn-on switching energy per pulse	V <sub>CC</sub> =600 V, I <sub>C</sub> =I <sub>E</sub> =50 A,	-	7.1	-	mJ	
E <sub>off</sub>	Turn-off switching energy per pulse	V <sub>GE</sub> =±15 V, R <sub>G</sub> =18Ω, T <sub>vj</sub> =150 °C,	-	5.0	-		
E <sub>rr</sub> (Note1)	Reverse recovery energy per pulse	Inductive load	-	2.2	-	mJ	
r <sub>g</sub>	Internal gate resistance	Per switch	-	0	-	Ω	

**BRAKE PART IGBT/DIODE**

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
I <sub>CES</sub>	Collector-emitter cut-off current	V <sub>CE</sub> =V <sub>CES</sub> , G-E short-circuited	-	-	1.0	mA	
I <sub>GES</sub>	Gate-emitter leakage current	V <sub>GE</sub> =V <sub>GES</sub> , C-E short-circuited	-	-	0.5	μA	
V <sub>GE(th)</sub>	Gate-emitter threshold voltage	I <sub>C</sub> =3.5 mA, V <sub>CE</sub> =10 V	5.4	6.0	6.6	V	
V <sub>CEsat</sub> (Terminal)	Collector-emitter saturation voltage	I <sub>C</sub> =35 A, V <sub>GE</sub> =15 V, Refer to the figure of test circuit (Note5)	T <sub>vj</sub> =25 °C	-	1.90	2.40	V
			T <sub>vj</sub> =125 °C	-	2.25	-	
			T <sub>vj</sub> =150 °C	-	2.35	-	
V <sub>CEsat</sub> (Chip)	Collector-emitter saturation voltage	I <sub>C</sub> =35 A, V <sub>GE</sub> =15 V, (Note5)	T <sub>vj</sub> =25 °C	-	1.85	2.15	V
			T <sub>vj</sub> =125 °C	-	2.10	-	
			T <sub>vj</sub> =150 °C	-	2.15	-	
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> =10 V, G-E short-circuited	-	-	6.1	nF	
C <sub>oes</sub>	Output capacitance		-	-	0.2		
C <sub>res</sub>	Reverse transfer capacitance		-	-	0.1		
Q <sub>G</sub>	Gate charge	V <sub>CC</sub> =600 V, I <sub>C</sub> =35 A, V <sub>GE</sub> =15 V	-	0.19	-	μC	
t <sub>d(on)</sub>	Turn-on delay time	V <sub>CC</sub> =600 V, I <sub>C</sub> =35 A, V <sub>GE</sub> =±15 V, R <sub>G</sub> =27 Ω, Inductive load	-	-	300	ns	
t <sub>r</sub>	Rise time		-	-	150		
t <sub>d(off)</sub>	Turn-off delay time		-	-	500		
t <sub>f</sub>	Fall time		-	-	400		

# CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE

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

### BRAKE PART IGBT/DIODE

Symbol	Item	Conditions	Limits			Unit		
			Min.	Typ.	Max.			
$E_{on}$	Turn-on switching energy per pulse	$V_{CC}=600\text{ V}$ , $V_{GE}=\pm 15\text{ V}$ , $T_{vj}=150\text{ }^{\circ}\text{C}$ , Inductive load	$I_C=35\text{ A}$ , $R_G=27\text{ }\Omega$	-	4.4	-	mJ	
$E_{off}$	Turn-off switching energy per pulse			-	3.3	-		
$E_{rr}$	Reverse recovery energy per pulse			$I_E=35\text{ A}$ , $R_G=27\text{ }\Omega$	-	1.2		-
$r_g$	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	$I_F=35\text{ A}$ , G-E short-circuited, Refer to the figure of test circuit (Note5)		$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.95	2.55	V
				$T_{vj}=125\text{ }^{\circ}\text{C}$	-	2.20	-	
				$T_{vj}=150\text{ }^{\circ}\text{C}$	-	2.25	-	
$V_F$ (Chip)	Forward voltage	$I_F=35\text{ A}$ , G-E short-circuited, (Note5)		$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.90	2.35	V
				$T_{vj}=125\text{ }^{\circ}\text{C}$	-	1.90	-	
				$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.90	-	
$t_{rr}$	Reverse recovery time	$V_{CC}=600\text{ V}$ , $I_F=35\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ ,	-	-	500	ns		
$Q_{rr}$	Reverse recovery charge	$R_G=27\text{ }\Omega$ , Inductive load	-	2.2	-	$\mu\text{C}$		

### CONVERTER PART DIODE

Symbol	Item	Conditions	Limits			Unit		
			Min.	Typ.	Max.			
$I_{RRM}$	Repetitive peak reverse current	$V_R=V_{RRM}$ , $T_{vj}=150\text{ }^{\circ}\text{C}$	-	-	20	mA		
$V_F$ (Terminal)	Forward voltage	$I_F=50\text{ A}$		$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.30	1.75	V
				$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.20	-	
$V_F$ (chip)				$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.20	1.45	
				$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.15	-	

### 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 $\Omega$
$\Delta R/R$	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)	-	-	536	K/kW	
$R_{th(j-c)D}$		Junction to case, per Inverter FWD (Note4)	-	-	1070		
$R_{th(j-c)Q}$		Junction to case, Brake IGBT (Note4)	-	-	627		
$R_{th(j-c)D}$		Junction to case, Brake DIODE (Note4)	-	-	1393		
$R_{th(j-c)D}$		Junction to case, per Converter DIODE (Note4)	-	-	995		
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module,	Thermal grease applied (Note4, 7)	-	20.2	-	K/kW
			PC-TIM applied (Note4, 8)	-	5.5	-	

# CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE

## MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
$M_s$	Mounting torque	Mounting to heat sink M 5 screw	2.5	3.0	3.5	N·m	
$d_s$	Creepage distance	Solder pin type(MXUA)	Terminal to terminal	14.7	-	-	mm
			Terminal to base plate	18.3	-	-	
		Pressfit pin type(MXUAP)	Terminal to terminal	9.0	-	-	
			Terminal to base plate	16.1	-	-	
$d_a$	Clearance	Solder pin type(MXUA)	Terminal to terminal	10.3	-	-	mm
			Terminal to base plate	13.1	-	-	
		Pressfit pin type(MXUAP)	Terminal to terminal	8.8	-	-	
			Terminal to base plate	16.1	-	-	
$e_c$	Flatness of base plate	On the centerline X, Y (Note9)	±0	-	+200	µm	
$m$	mass	-	-	165	-	g	

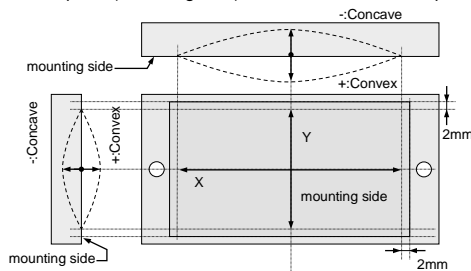
## RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$V_{CC}$	(DC) Supply voltage	Applied across P-N(P1-N1) terminals	-	600	850	V
$V_{GEon}$	Gate (-emitter drive) voltage	Applied across G*P-/G*N-E/GB-E terminals (*=U,V,W) (Note11)	13.5	15.0	16.5	V
$R_G$	External gate resistance	Inverter IGBT, Per switch	18	-	180	Ω
		Brake IGBT	27	-	270	

\*: 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 ( $T_{vj}$ ) should not increase beyond  $T_{vjmax}$  rating.
- Pulse width and repetition rate should be such that the device junction temperature ( $T_{vj}$ ) dose not exceed  $T_{vjmax}$  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. Refer to the figure of test circuit.
- $B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$   
 $R_{25}$ : resistance at absolute temperature  $T_{25}$  [K];  $T_{25}=25\text{ [°C]}+273.15=298.15$  [K]  
 $R_{50}$ : resistance at absolute temperature  $T_{50}$  [K];  $T_{50}=50\text{ [°C]}+273.15=323.15$  [K]
- Typical value is measured by using thermally conductive grease of  $\lambda=0.9\text{ W/(m·K)}/D_{(C-S)}=50\text{ }\mu\text{m}$ .
- Typical value is measured by using PC-TIM of  $\lambda=3.4\text{ W/(m·K)}/D_{(C-S)}=50\text{ }\mu\text{m}$ .
- The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



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

PCB thickness : t1.6

Type	Manufacturer	Size	Tightening torque (N·m)	Recommended tightening method
(1) PT®	EJOT	K25x8	0.55 ± 0.055	by handwork (equivalent to 30 rpm by mechanical screw driver) ~ 600 rpm (by mechanical screw driver)
(2) PT®		K25x10	0.75 ± 0.075 N·m	
(3) DELTA PT®		25x8	0.55 ± 0.055 N·m	
(4) DELTA PT®		25x10	0.75 ± 0.075 N·m	
(5) B1 tapping screw	-	φ2.6x10 φ2.6x12	0.75 ± 0.075 N·m	

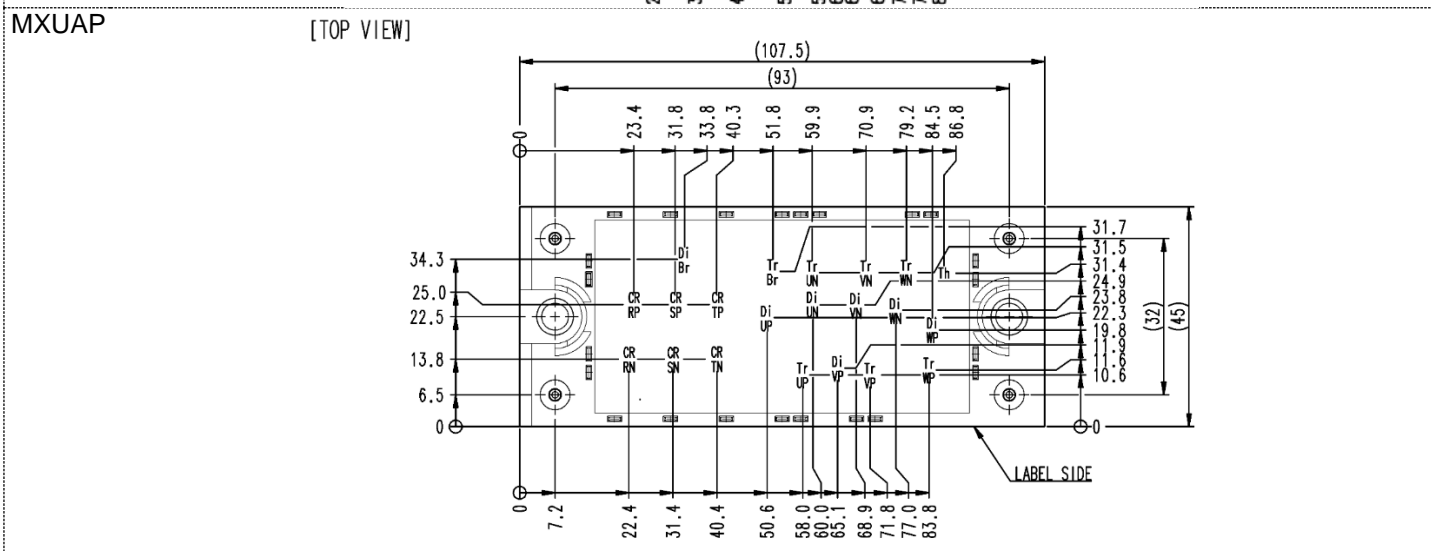
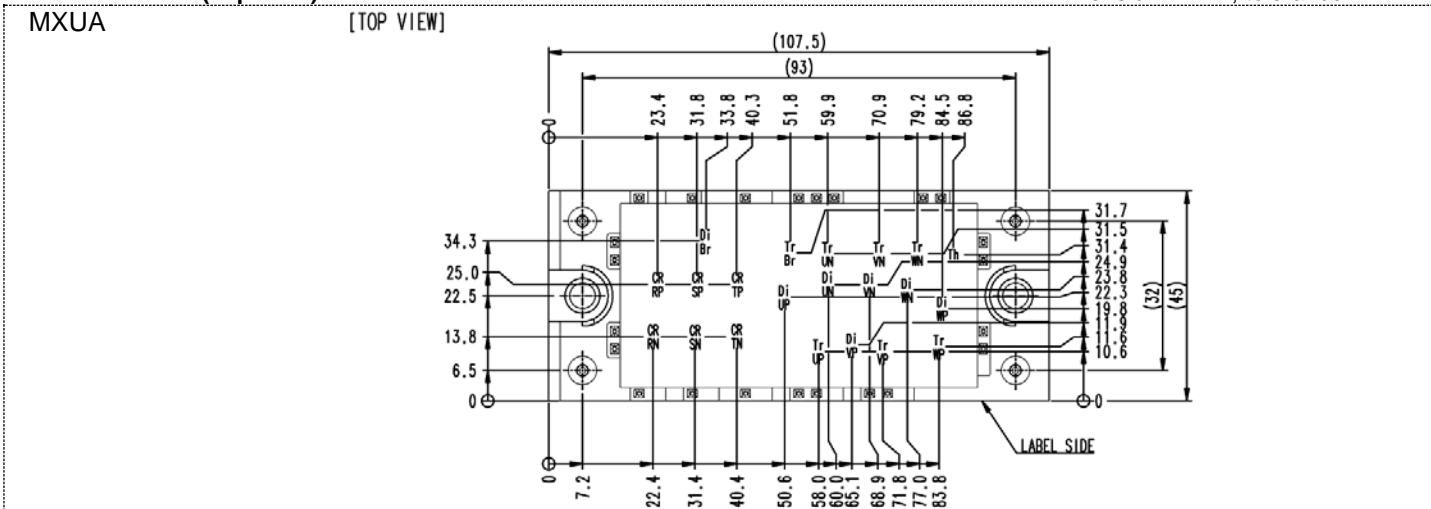
- $V_{GEon}=15V$  is necessary for IGBT to operate at  $I_{CRM}$ .

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HIGH POWER SWITCHING USE  
INSULATED TYPE

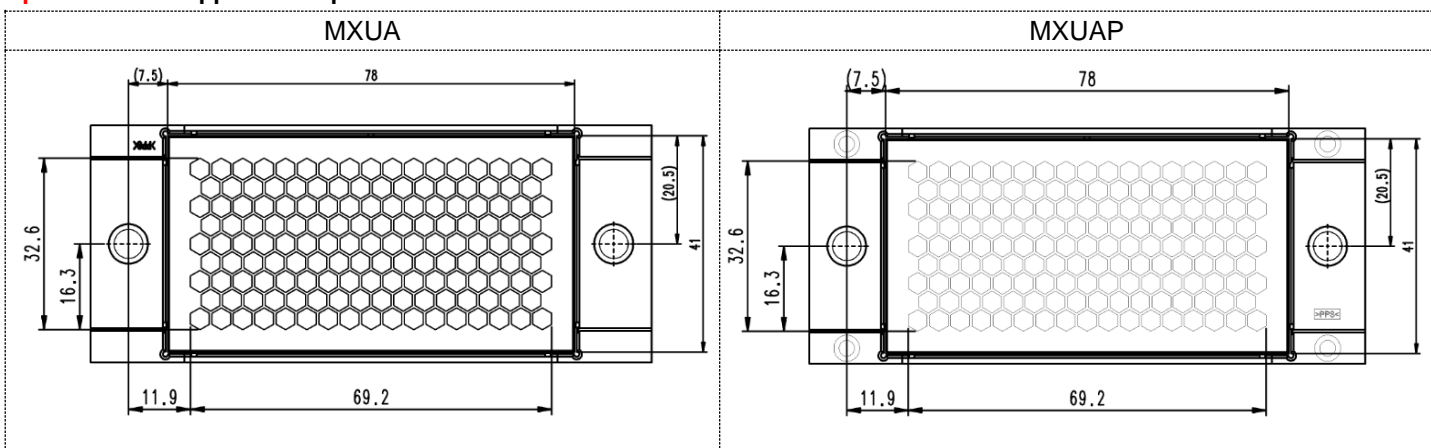
## CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm



Tr\*P/Tr\*N/TrBr: IGBT, Di\*P/Di\*N: DIODE (\*=U/V/W), DiBr: BRAKE DIODE,  
CR\*P/CR\*N: CONVERTER DIODE (\*=R/S/T), Th: NTC thermistor

**Option: PC-TIM applied baseplate outline**

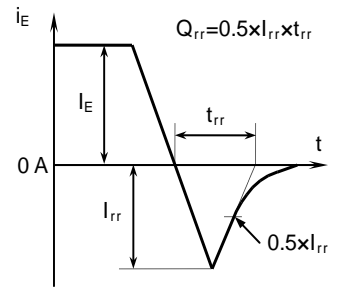
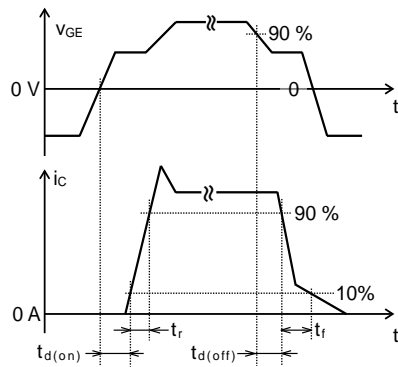
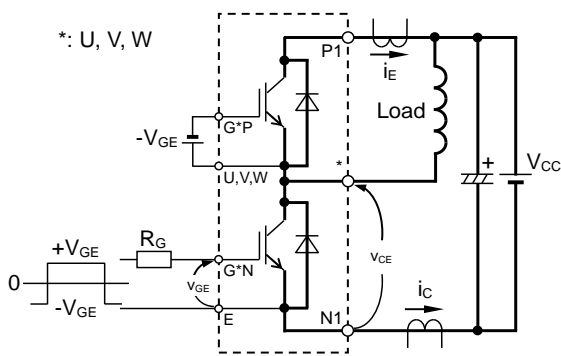




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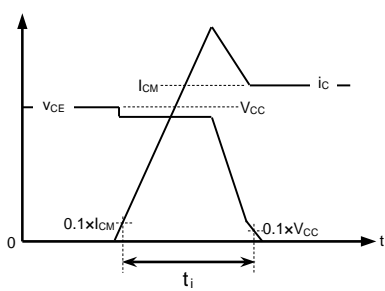
HIGH POWER SWITCHING USE  
INSULATED TYPE

## TEST CIRCUIT AND WAVEFORMS

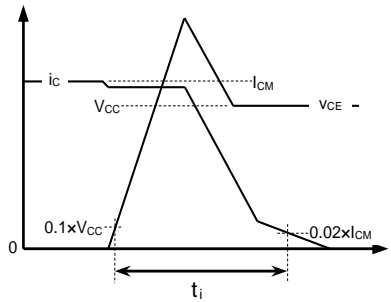


Switching characteristics test circuit and waveforms

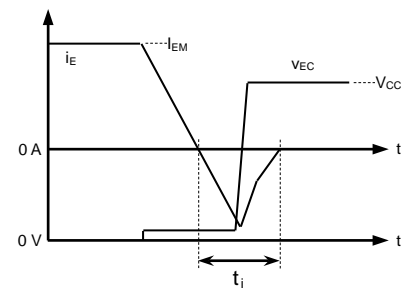
$t_{rr}$ ,  $Q_{rr}$  characteristics test waveform



IGBT Turn-on switching energy



IGBT Turn-off switching energy



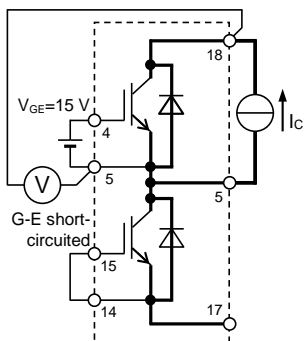
FWD Reverse recovery energy

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

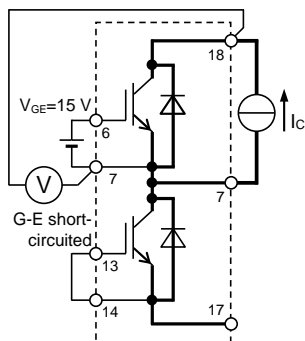
# CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE

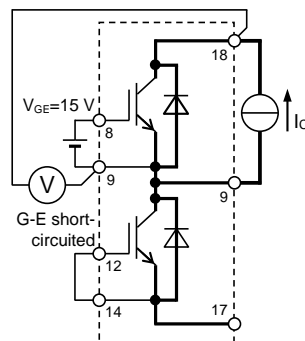
## TEST CIRCUIT



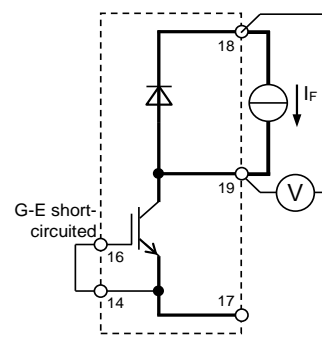
TrUP



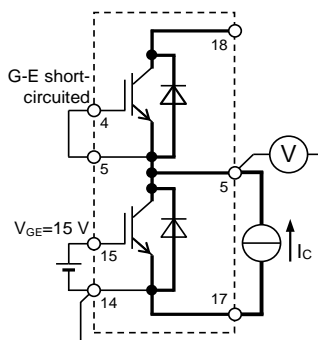
TrVP



TrWP

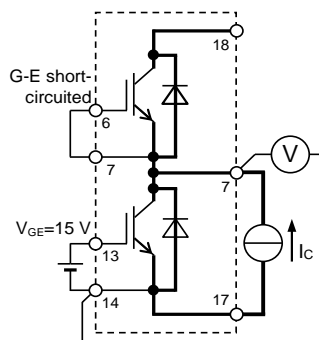


Brake DIODE



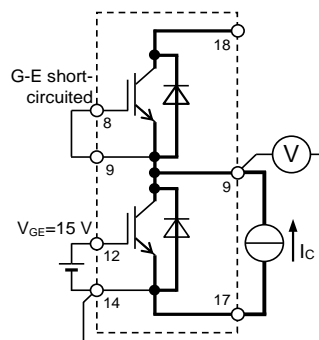
TrUN

Gate-emitter GVP-V, GVN-E,  
short-circuited GWP-W, GWN-E  
GB-E



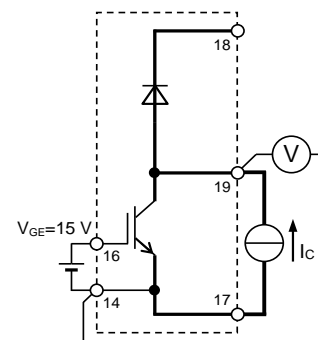
TrVN

Gate-emitter GUP-U, GUN-E,  
short-circuited GWP-W, GWN-E  
GB-E



TrWN

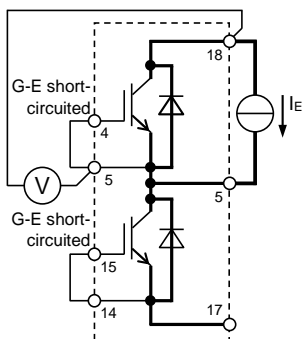
Gate-emitter GUP-U, GUN-E,  
short-circuited GVP-V, GVN-E  
GB-E



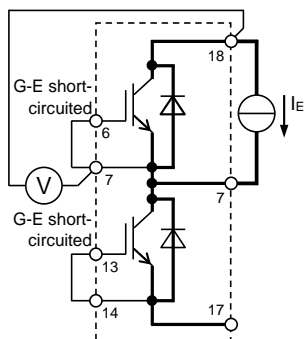
Brake IGBT

Gate-emitter GUP-U, GUN-E,  
short-circuited GVP-V, GVN-E,  
GWP-W, GWN-E

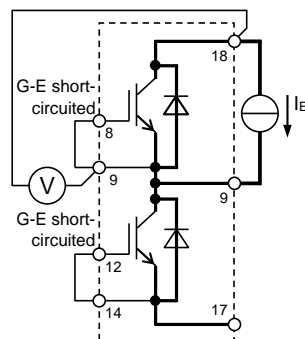
### $V_{CEsat}$ /BRAKE DIODE $V_F$ characteristics test circuit



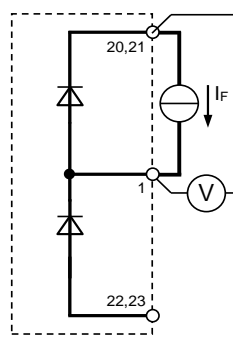
DiUP



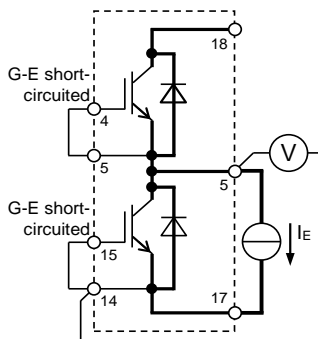
DiVP



DiWP

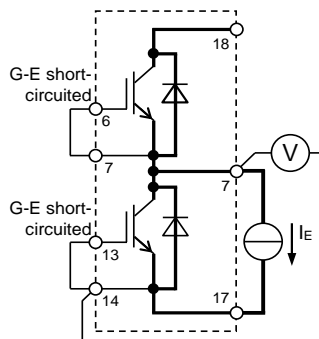


CONVERTER DIODE (ex.phase-R)



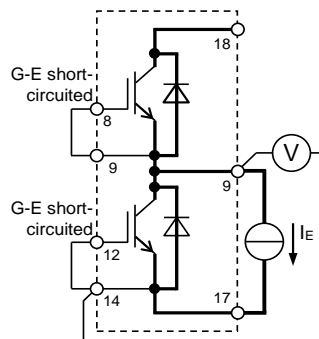
DiUN

Gate-emitter GVP-V, GVN-E,  
short-circuited GWP-W, GWN-E  
GB-E



DiVN

Gate-emitter GUP-U, GUN-E,  
short-circuited GWP-W, GWN-E  
GB-E



DiWN

Gate-emitter GUP-U, GUN-E,  
short-circuited GVP-V, GVN-E  
GB-E

### $V_{EC}$ / CONVERTER DIODE $V_F$ characteristics test circuit

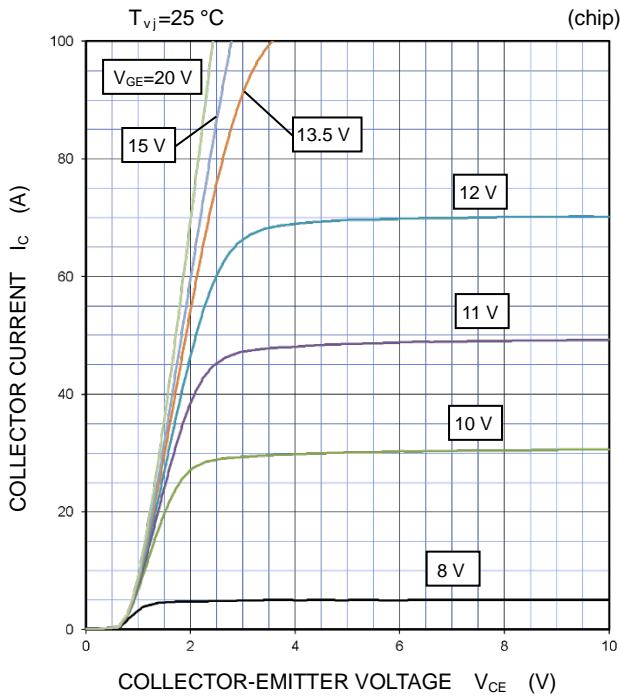
# CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE

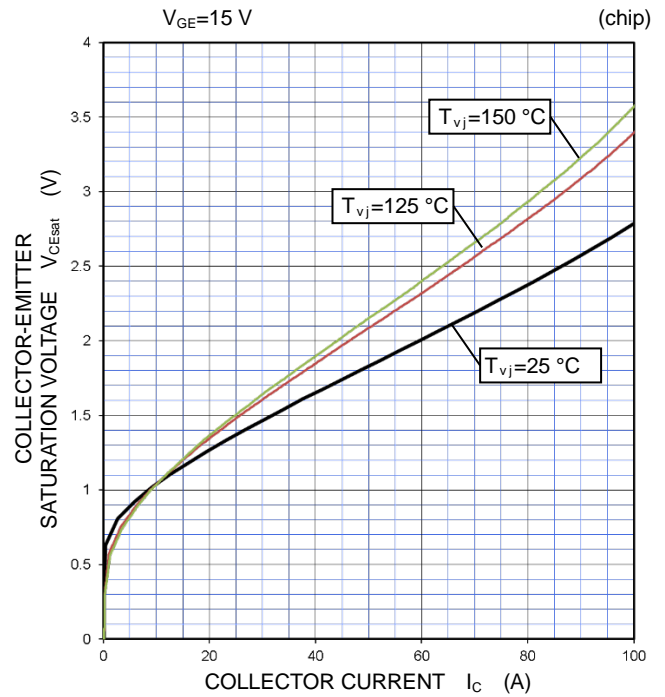
## PERFORMANCE CURVES

### INVERTER PART

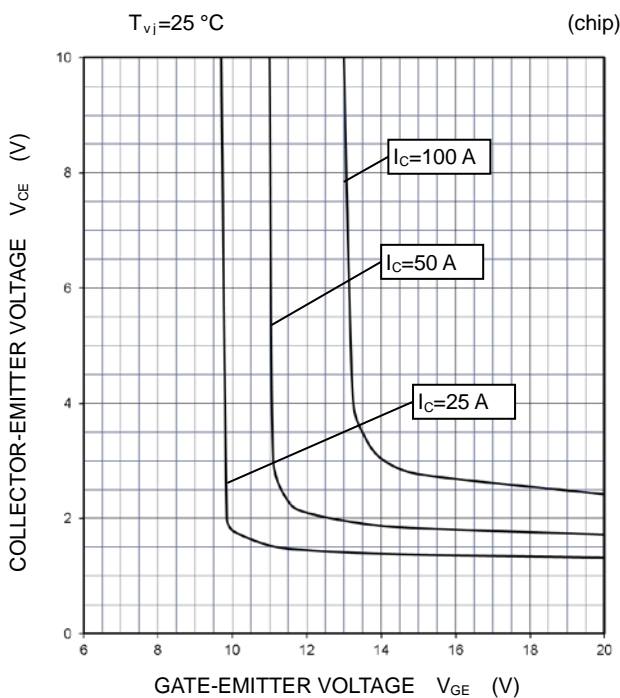
OUTPUT CHARACTERISTICS  
(TYPICAL)



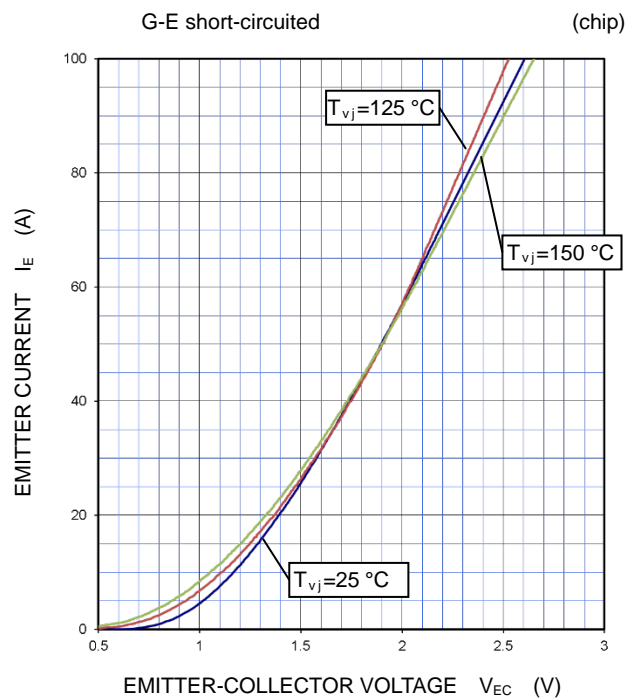
COLLECTOR-EMITTER SATURATION VOLTAGE  
CHARACTERISTICS  
(TYPICAL)



COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS  
(TYPICAL)



FREE WHEELING DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)



# CM50MXUA-24T1/CM50MXUAP-24T1

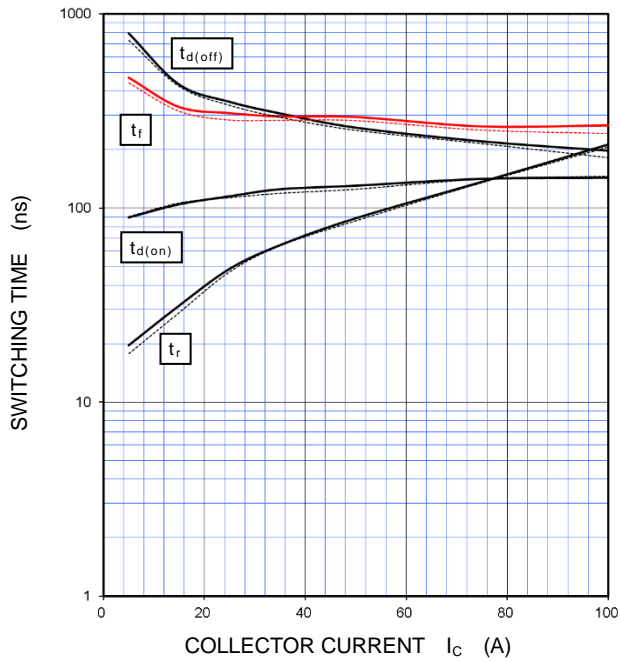
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### INVERTER PART

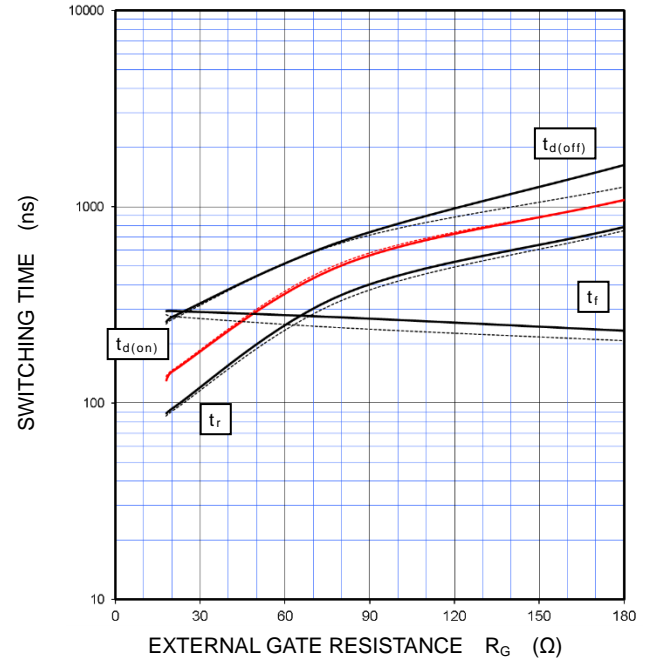
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=600\text{ V}$ ,  $R_G=18\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



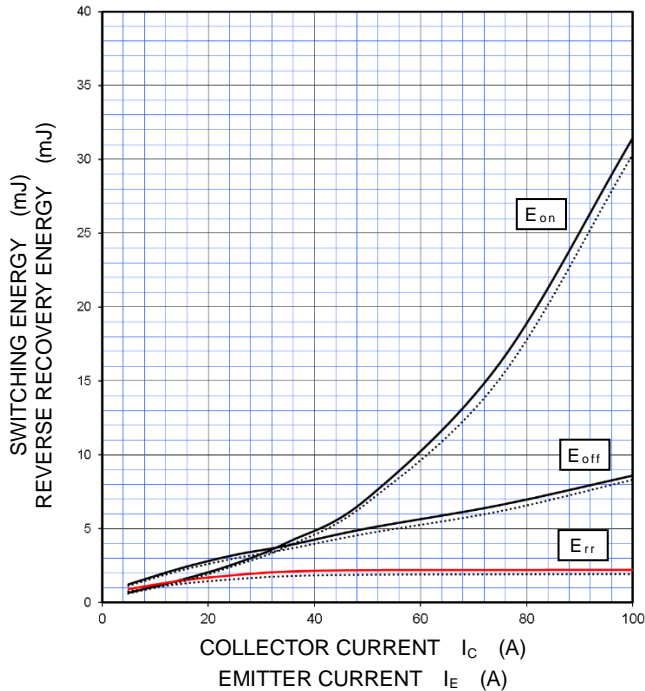
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=600\text{ V}$ ,  $I_c=50\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



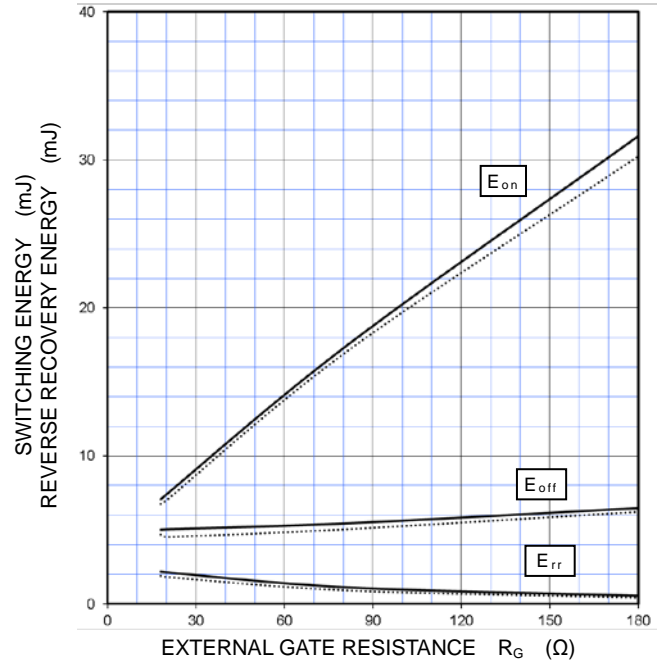
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=600\text{ V}$ ,  $R_G=18\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD, PER PULSE  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



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

$V_{CC}=600\text{ V}$ ,  $I_c/I_E=50\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD, PER PULSE  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



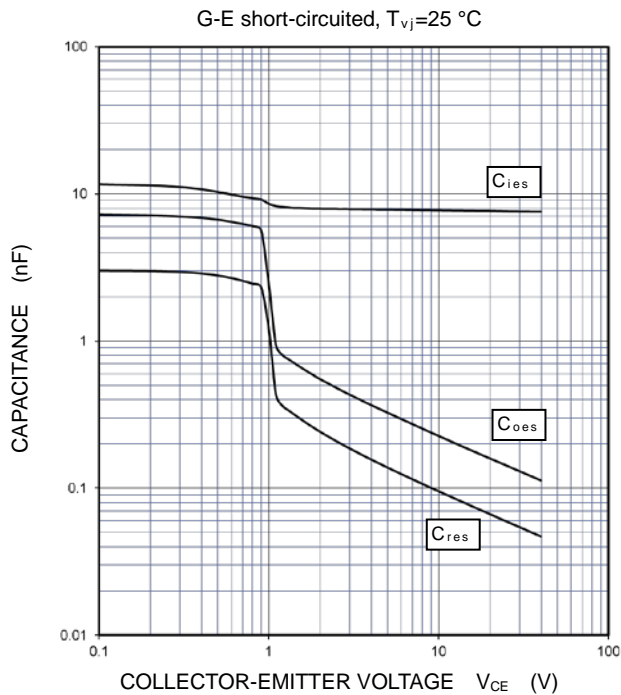
# CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE

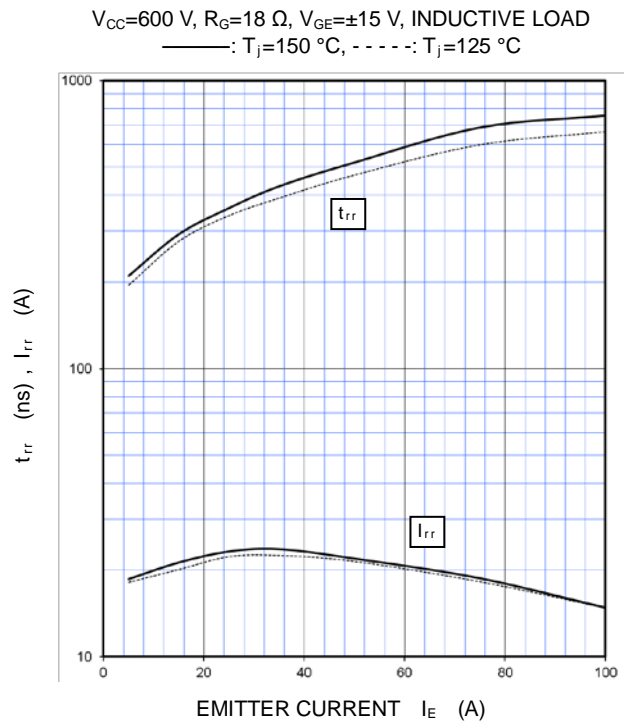
## PERFORMANCE CURVES

### INVERTER PART

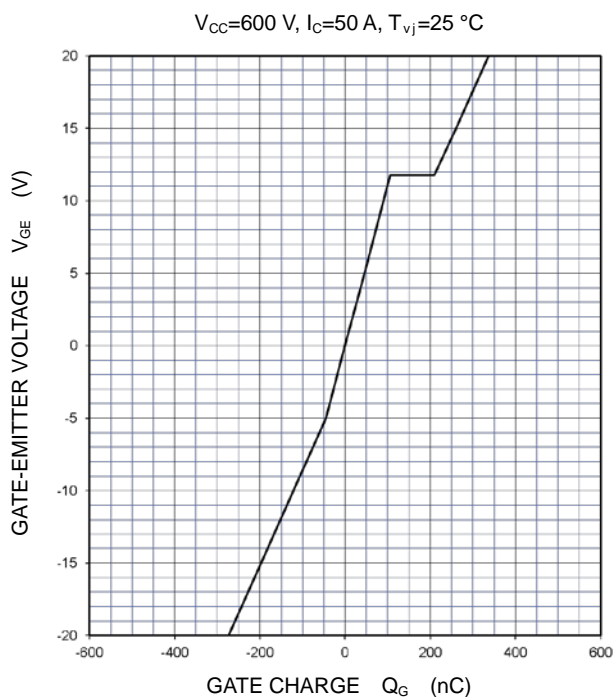
**CAPACITANCE CHARACTERISTICS (TYPICAL)**



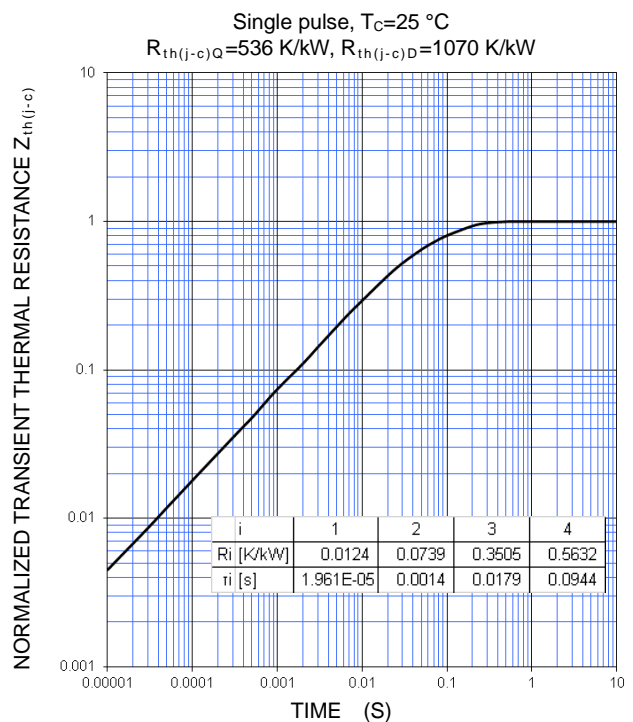
**FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



**GATE CHARGE CHARACTERISTICS (TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)**



# CM50MXUA-24T1/CM50MXUAP-24T1

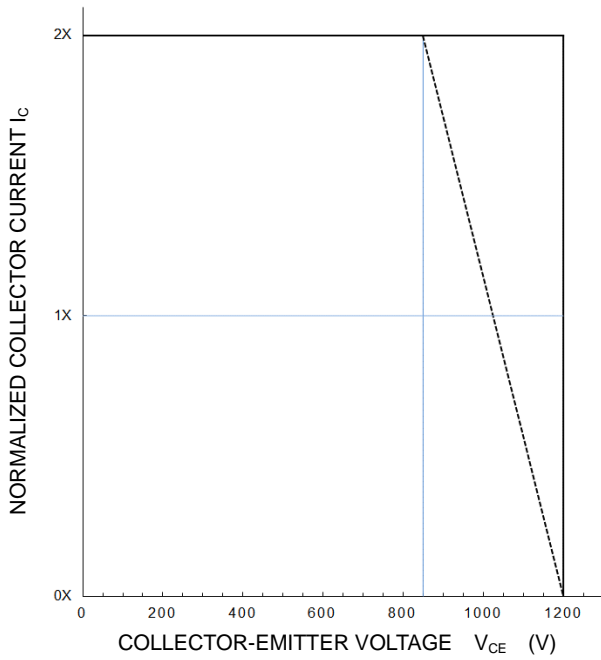
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### INVERTER PART

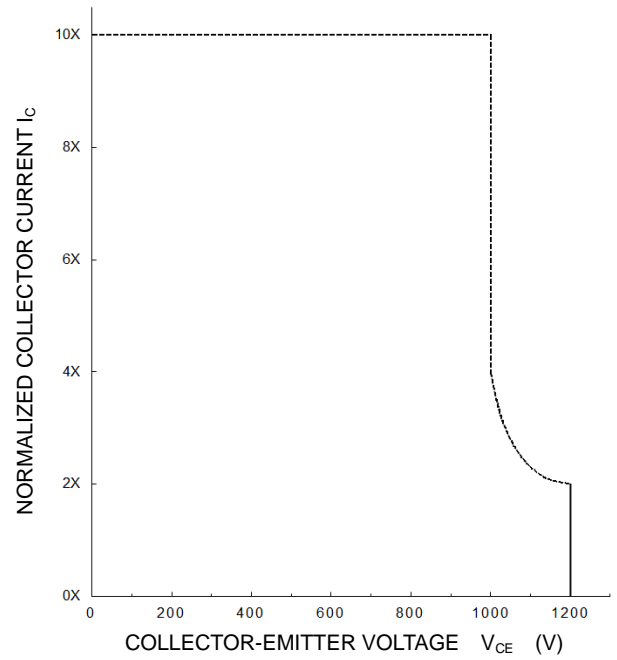
**TURN-OFF SWITCHING SAFE OPERATING AREA  
(REVERSE BIAS SAFE OPERATING AREA)  
(MAXIMUM)**

$V_{CC} \leq 850 \text{ V}$ ,  $R_G = 18 \sim 180 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
——:  $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$  (Normal load operations (Continuous))  
- - - - -:  $T_{vj} = 175 \text{ }^\circ\text{C}$  (Unusual load operations (Limited period))



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

$V_{CC} \leq 800 \text{ V}$ ,  $R_G = 18 \sim 180 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
 $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$ ,  $t_W \leq 8 \ \mu\text{s}$ , Non-Repetitive



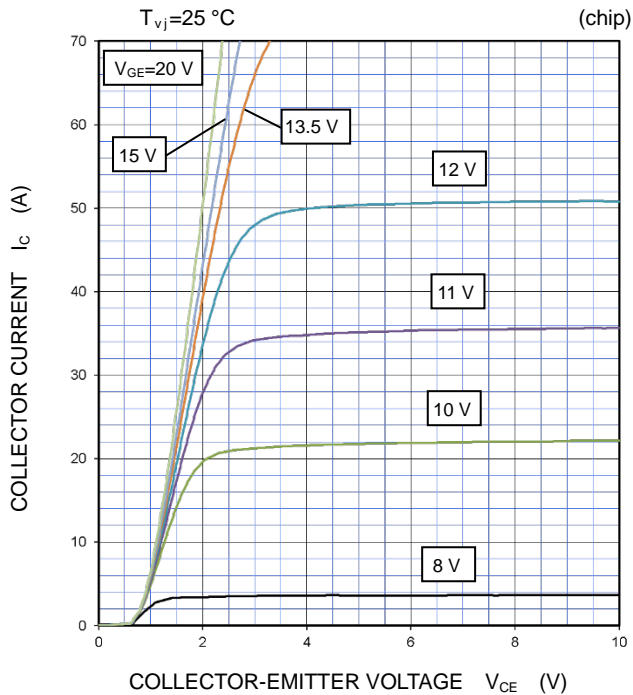
# CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE

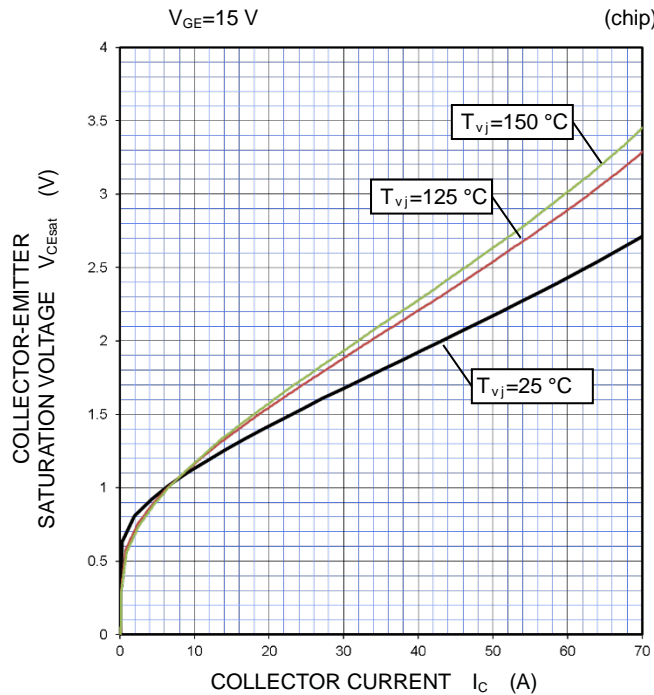
## PERFORMANCE CURVES

### BRAKE PART

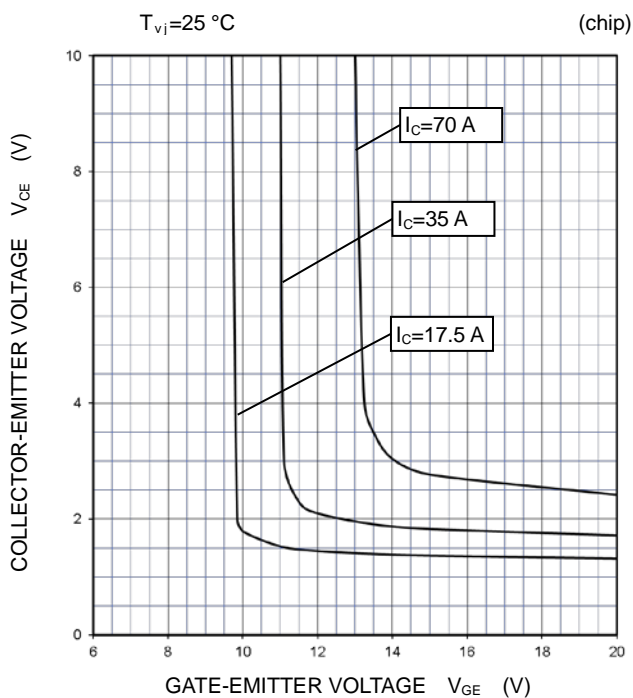
**OUTPUT CHARACTERISTICS (TYPICAL)**



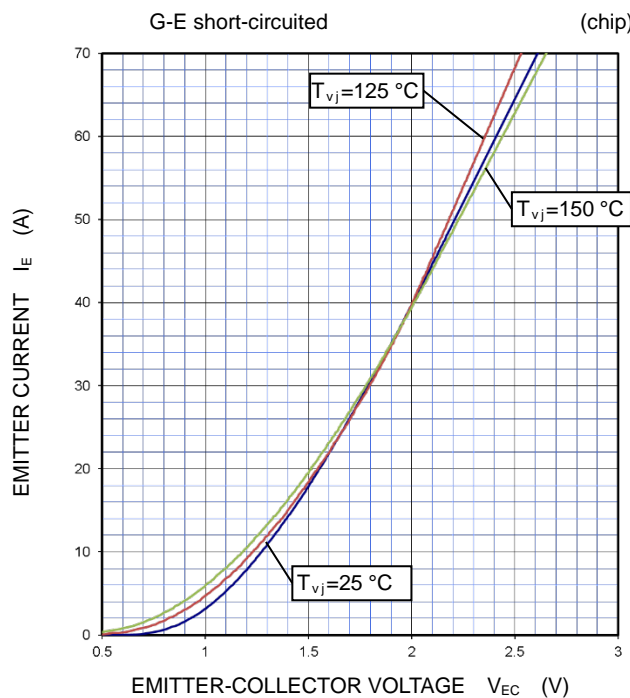
**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



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



**DIODE FORWARD CHARACTERISTICS (TYPICAL)**



# CM50MXUA-24T1/CM50MXUAP-24T1

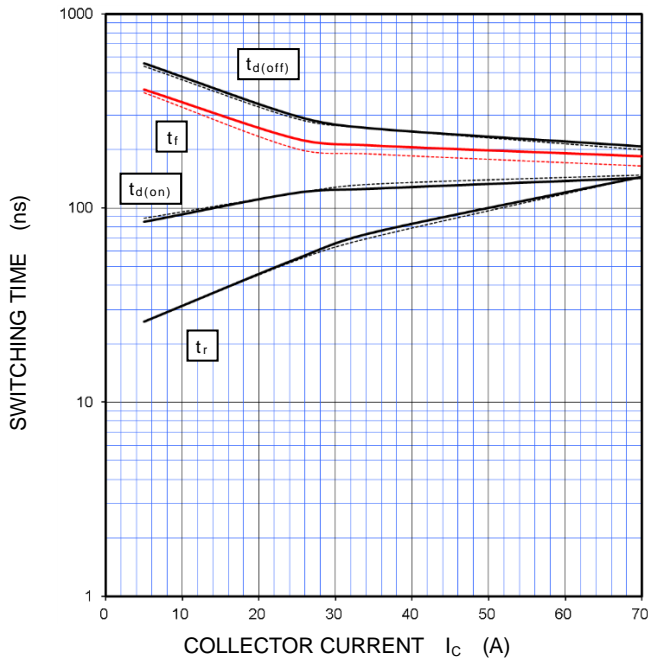
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### BRAKE PART

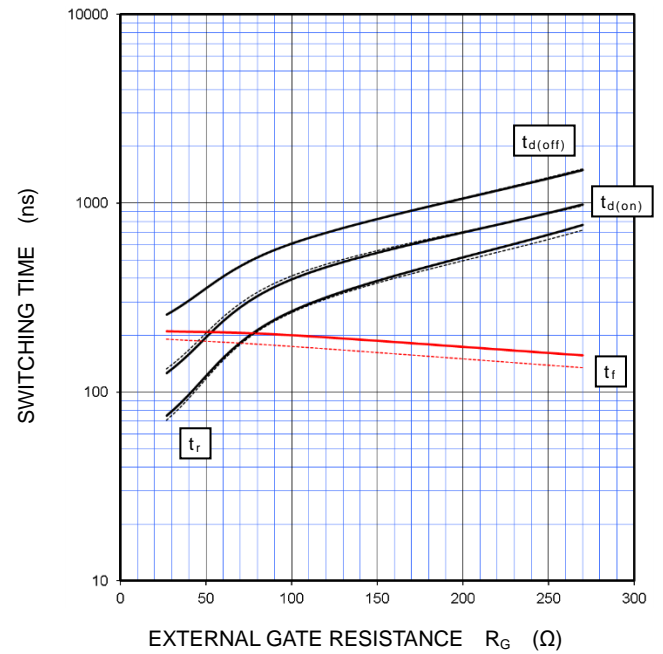
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=600\text{ V}$ ,  $R_G=27\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



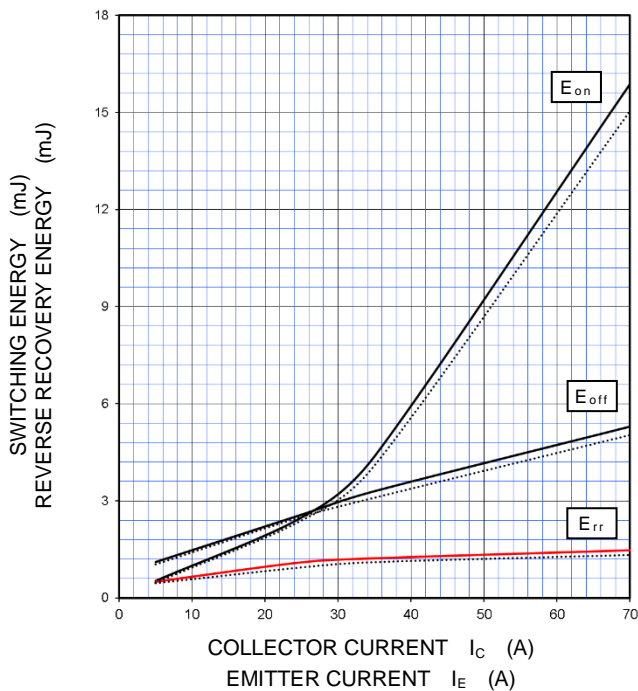
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=600\text{ V}$ ,  $I_C=35\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



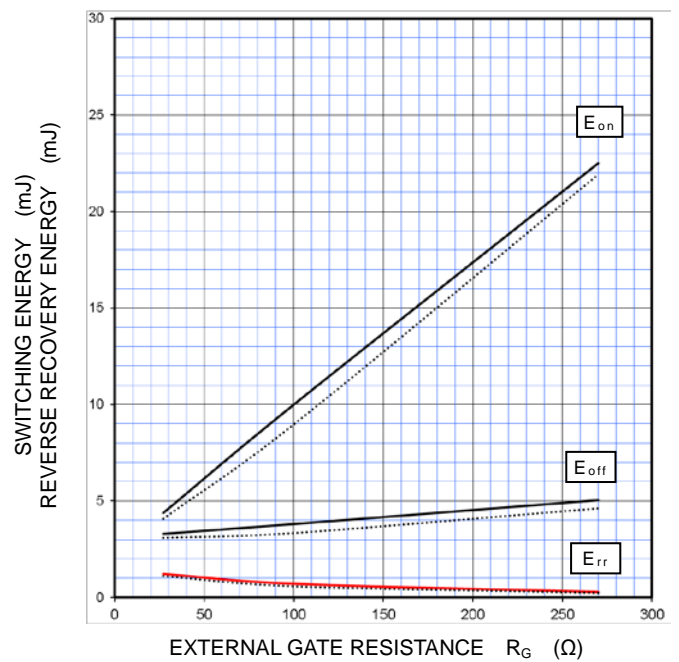
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=600\text{ V}$ ,  $R_G=27\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD,  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$ , PER PULSE



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

$V_{CC}=600\text{ V}$ ,  $I_C/I_E=35\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD,  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$ , PER PULSE





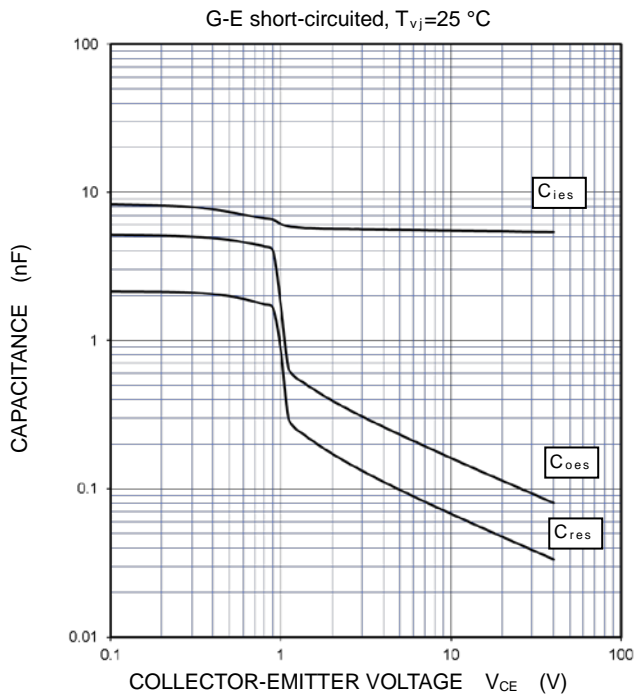
# CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE  
INSULATED TYPE

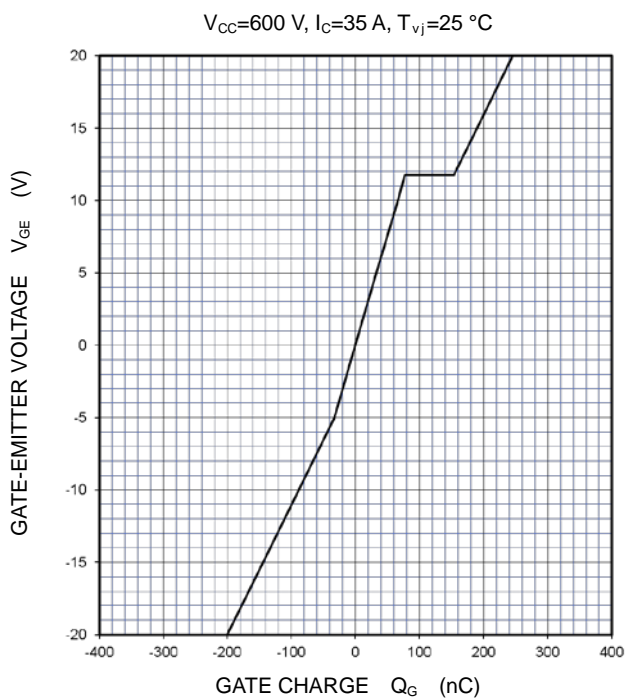
## PERFORMANCE CURVES

### BRAKE PART

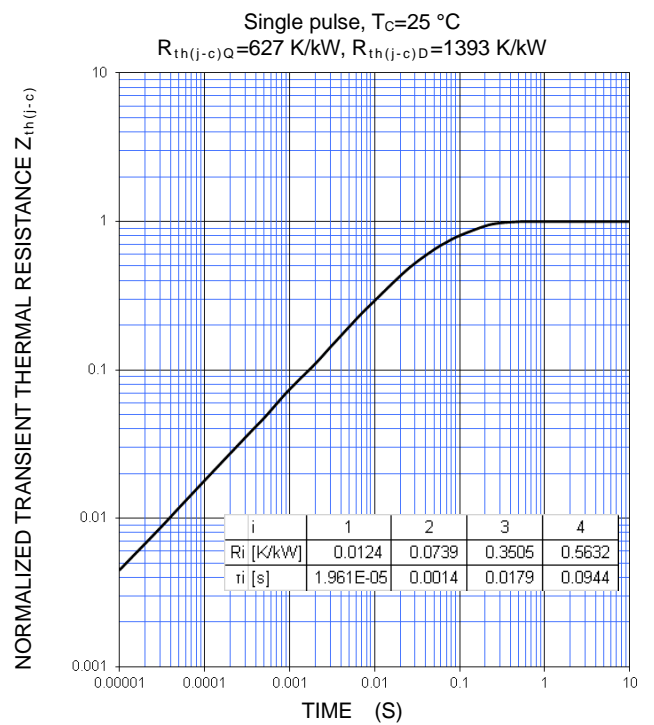
#### CAPACITANCE CHARACTERISTICS (TYPICAL)



#### GATE CHARGE CHARACTERISTICS (TYPICAL)



#### TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)



# CM50MXUA-24T1/CM50MXUAP-24T1

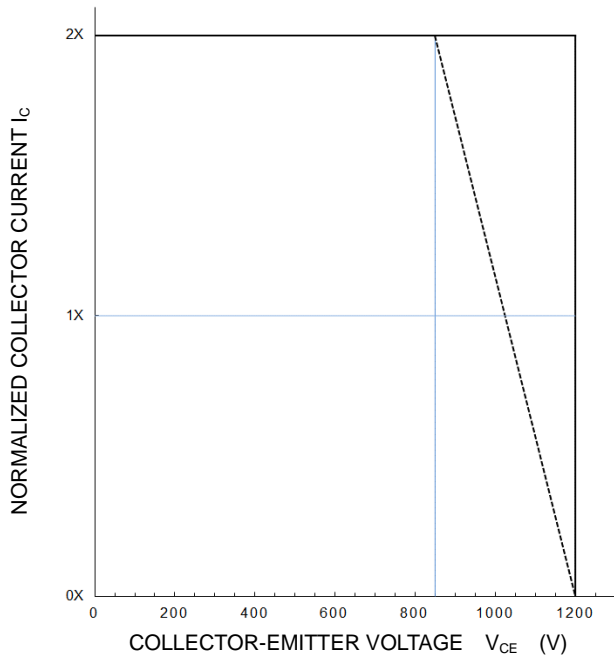
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### BRAKE PART

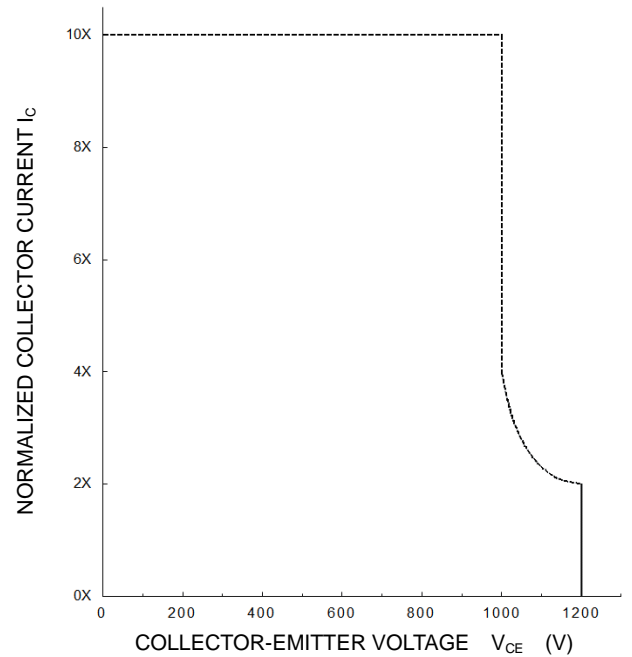
**TURN-OFF SWITCHING SAFE OPERATING AREA  
(REVERSE BIAS SAFE OPERATING AREA)  
(MAXIMUM)**

$V_{CC} \leq 850 \text{ V}$ ,  $R_G = 27 \sim 270 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
 ———:  $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$  (Normal load operations (Continuous))  
 - - - - -:  $T_{vj} = 175 \text{ }^\circ\text{C}$  (Unusual load operations (Limited period))



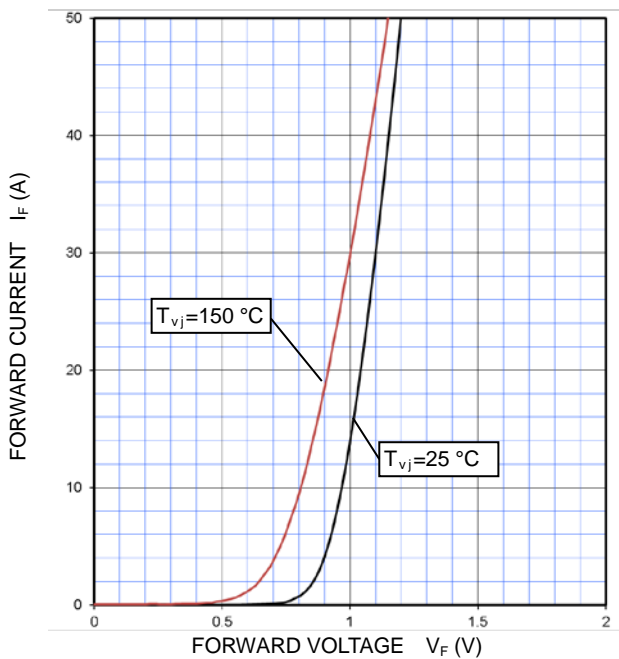
**SHORT-CIRCUIT SAFE OPERATING AREA  
(MAXIMUM)**

$V_{CC} \leq 800 \text{ V}$ ,  $R_G = 27 \sim 270 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
 $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$ ,  $t_W \leq 8 \ \mu\text{s}$ , Non-Repetitive



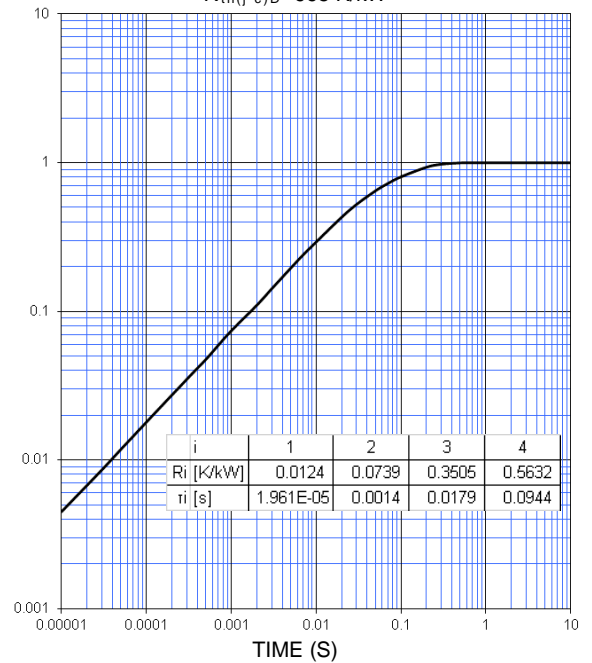
### CONVERTER PART

**CONVERTER DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS  
(MAXIMUM)**

Single pulse,  $T_C = 25 \text{ }^\circ\text{C}$   
 $R_{th(j-c)D} = 995 \text{ K/kW}$



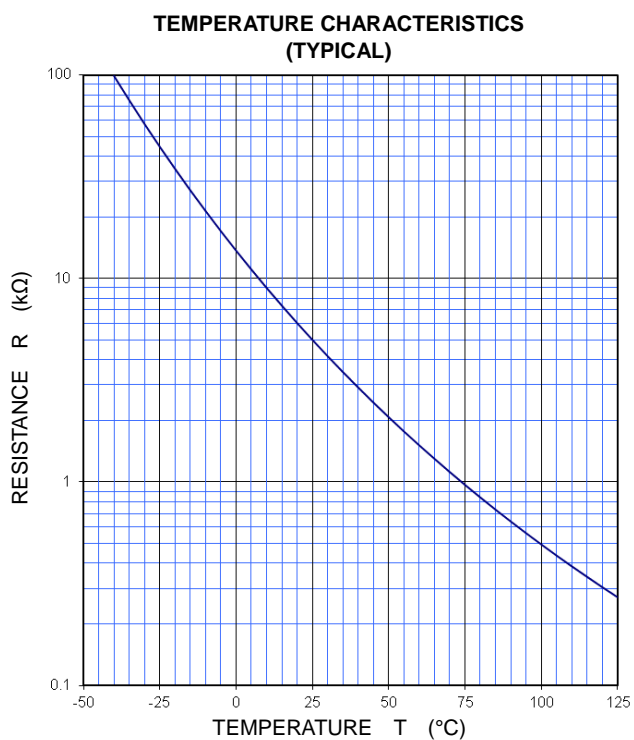
# CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE

INSULATED TYPE

## PERFORMANCE CURVES

### NTC thermistor part



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

# CM50MXUA-24T1/CM50MXUAP-24T1

HIGH POWER SWITCHING USE

INSULATED TYPE

## **Keep safety first in your circuit designs!**

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