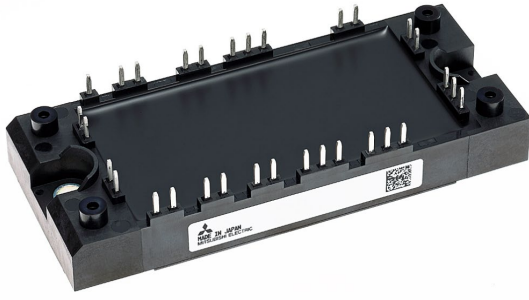



<IGBT Modules>

# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

 <p>MXUB</p>	<p>Collector current <math>I_c</math> ..... <b>50 A</b>          Collector-emitter voltage <math>V_{CES}</math> ..... <b>650 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>MXUBP</p>	<p>Collector current <math>I_c</math> ..... <b>50 A</b>          Collector-emitter voltage <math>V_{CES}</math> ..... <b>650 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><b>CIB (Converter+Inverter+Chopper Brake)</b>      •UL Recognized under UL1557, File No. E323585</p>	

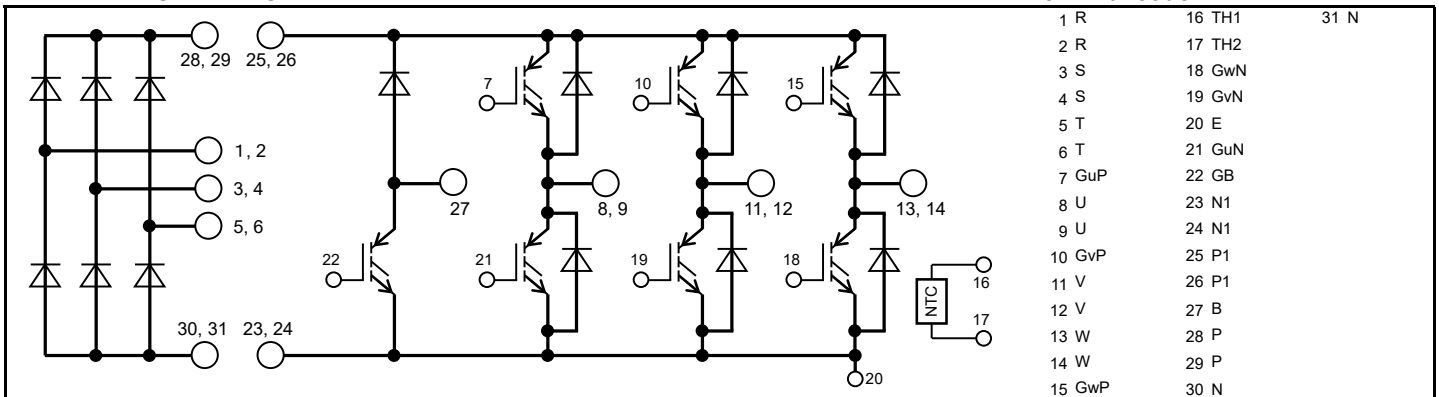
**APPLICATION**

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**

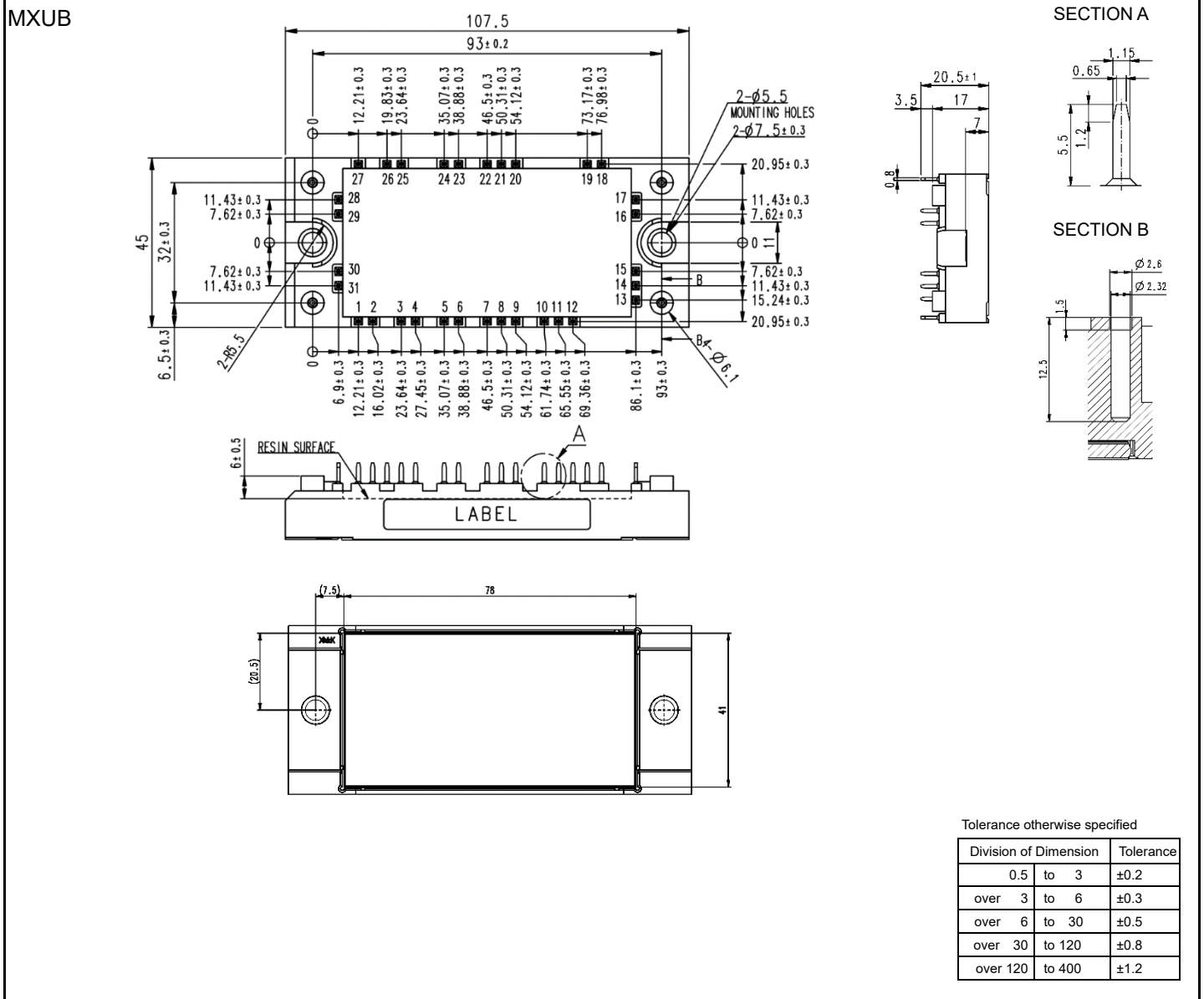


# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## OUTLINE DRAWING

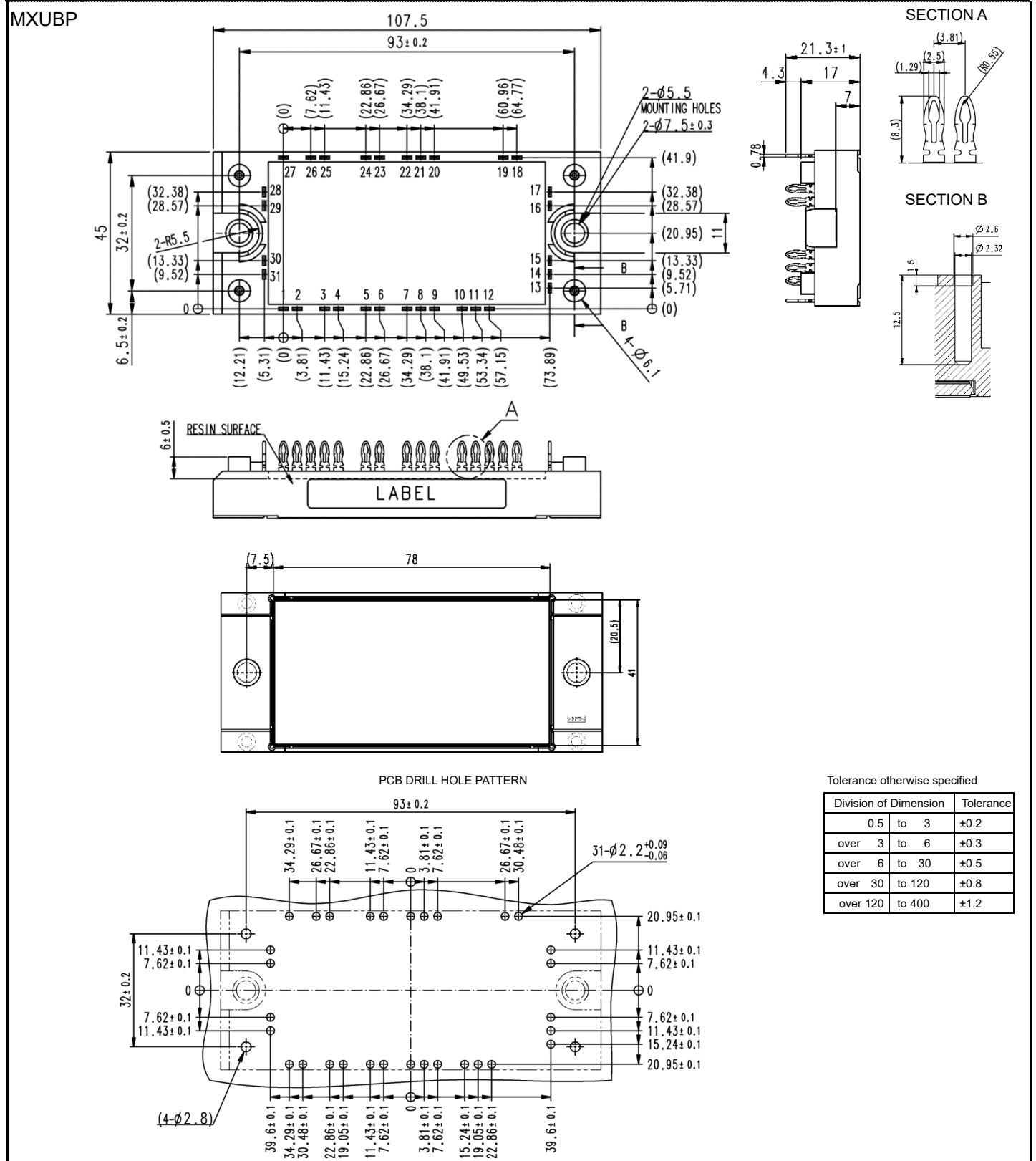
Dimension in mm



# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## OUTLINE DRAWING



**CM50MXUB-13T/CM50MXUBP-13T**HIGH POWER SWITCHING USE  
INSULATED TYPE**MAXIMUM RATINGS ( $T_{vj}=25\text{ }^{\circ}\text{C}$ , unless otherwise specified)****INVERTER PART IGBT/FWD**

Symbol	Item	Conditions	Rating	Unit
$V_{CES}$	Collector-emitter voltage	G-E short-circuited	650	V
$V_{GES}$	Gate-emitter voltage	C-E short-circuited	$\pm 20$	V
$I_C$	Collector current	DC, $T_C=125\text{ }^{\circ}\text{C}$ (Note2, 4)	50	A
$I_{CRM}$		Pulse, Repetitive (Note3)	100	
$P_{tot}$	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	270	W
$I_E$ (Note1)	Emitter current	DC (Note2)	50	A
$I_{ERM}$ (Note1)		Pulse, Repetitive (Note3)	100	
$T_{vjmax}$	Maximum junction temperature	Instantaneous event (overload) (Note9)	175	$^{\circ}\text{C}$

**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, $T_C=125\text{ }^{\circ}\text{C}$ (Note2, 4)	35	A
$I_{CRM}$		Pulse, Repetitive (Note3)	70	
$P_{tot}$	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	240	W
$V_{RRM}$	Repetitive peak reverse voltage	G-E short-circuited	650	V
$I_F$	Forward current	DC (Note2)	35	A
$I_{FRM}$		Pulse, Repetitive (Note3)	70	
$T_{vjmax}$	Maximum junction temperature	Instantaneous event (overload) (Note9)	175	$^{\circ}\text{C}$

**CONVERTER PART DIODE**

Symbol	Item	Conditions	Rating	Unit	
$V_{RRM}$	Repetitive peak reverse voltage	-	800	V	
$E_a$	Recommended AC input voltage	RMS	220	V	
$I_o$	DC output current	3-phase full wave rectifying, $T_C=125\text{ }^{\circ}\text{C}$ (Note4)	50	A	
$I_{FSM}$	Surge forward current	The sine half wave 1 cycle peak value, $f=60\text{ Hz}$ , non-repetitive	$T_{vj}=25\text{ }^{\circ}\text{C}$	600	A
			$T_{vj}=150\text{ }^{\circ}\text{C}$	480	
$I^2 t$	Current square time	Value for one cycle of surge current	$T_{vj}=25\text{ }^{\circ}\text{C}$	1500	$\text{A}^2\text{ s}$
			$T_{vj}=150\text{ }^{\circ}\text{C}$	960	
$T_{vjmax}$	Maximum junction temperature	Instantaneous event (overload) (Note9)	150	$^{\circ}\text{C}$	

**MODULE**

Symbol	Item	Conditions	Rating	Unit
$V_{isol}$	Isolation voltage	Terminals to base plate, RMS, $f=60\text{ Hz}$ , AC 1 min	2500	V
$T_{Cmax}$	Maximum case temperature	(Note4, 9)	125	$^{\circ}\text{C}$
$T_{vjop}$	Operating junction temperature	Continuous operation (under switching) (Note9)	-40 ~ +150	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature	-	-40 ~ +125	

# CM50MXUB-13T/CM50MXUBP-13T

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	-	1.40	1.85	V
			T <sub>vj</sub> =125 °C	-	1.55	-	
			T <sub>vj</sub> =150 °C	-	1.60	-	
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	-	1.30	1.55	V
			T <sub>vj</sub> =125 °C	-	1.35	-	
			T <sub>vj</sub> =150 °C	-	1.35	-	
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> =10 V, G-E short-circuited	-	-	6.7	nF	
C <sub>oes</sub>	Output capacitance		-	-	0.3		
C <sub>res</sub>	Reverse transfer capacitance		-	-	0.1		
Q <sub>G</sub>	Gate charge	V <sub>CC</sub> =300 V, I <sub>C</sub> =50 A, V <sub>GE</sub> =15 V	-	0.21	-	μC	
t <sub>d(on)</sub>	Turn-on delay time	V <sub>CC</sub> =300 V, I <sub>C</sub> =50 A, V <sub>GE</sub> =±15 V, R <sub>G</sub> =12 Ω, Inductive load	-	-	400	ns	
t <sub>r</sub>	Rise time		-	-	200		
t <sub>d(off)</sub>	Turn-off delay time		-	-	400		
t <sub>f</sub>	Fall time		-	-	600		
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	-	1.50	2.00	V
			T <sub>vj</sub> =125 °C	-	1.60	-	
			T <sub>vj</sub> =150 °C	-	1.65	-	
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	-	1.35	1.75	V
			T <sub>vj</sub> =125 °C	-	1.35	-	
			T <sub>vj</sub> =150 °C	-	1.35	-	
t <sub>rr</sub> (Note1)	Reverse recovery time	V <sub>CC</sub> =300 V, I <sub>E</sub> =50 A, V <sub>GE</sub> =±15 V,	-	-	400	ns	
Q <sub>rr</sub> (Note1)	Reverse recovery charge	R <sub>G</sub> =12 Ω, Inductive load	-	4.0	-	μC	
E <sub>on</sub>	Turn-on switching energy per pulse	V <sub>CC</sub> =300 V, I <sub>C</sub> =I <sub>E</sub> =50 A,	-	1.6	-	mJ	
E <sub>off</sub>	Turn-off switching energy per pulse	V <sub>GE</sub> =±15 V, R <sub>G</sub> =12Ω, T <sub>vj</sub> =150 °C,	-	2.6	-		
E <sub>rr</sub> (Note1)	Reverse recovery energy per pulse	Inductive load	-	2.4	-	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	-	1.35	1.80	V
			T <sub>vj</sub> =125 °C	-	1.45	-	
			T <sub>vj</sub> =150 °C	-	1.50	-	
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	-	1.25	1.50	V
			T <sub>vj</sub> =125 °C	-	1.30	-	
			T <sub>vj</sub> =150 °C	-	1.30	-	
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> =10 V, G-E short-circuited	-	-	4.7	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> =300 V, I <sub>C</sub> =35 A, V <sub>GE</sub> =15 V	-	0.14	-	μC	
t <sub>d(on)</sub>	Turn-on delay time	V <sub>CC</sub> =300 V, I <sub>C</sub> =35 A, V <sub>GE</sub> =±15 V, R <sub>G</sub> =18 Ω, Inductive load	-	-	400	ns	
t <sub>r</sub>	Rise time		-	-	200		
t <sub>d(off)</sub>	Turn-off delay time		-	-	400		
t <sub>f</sub>	Fall time		-	-	600		

# CM50MXUB-13T/CM50MXUBP-13T

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	$V_{CC}=300\text{ V}$ , $V_{GE}=\pm 15\text{ V}$ , $T_{vj}=150\text{ }^{\circ}\text{C}$ , Inductive load	$I_C=35\text{ A}$ , $R_G=18\text{ }\Omega$	-	0.9	-	mJ	
$E_{off}$	Turn-off switching energy per pulse			-	1.9	-		
$E_{rr}$	Reverse recovery energy per pulse			$I_E=35\text{ A}$ , $R_G=18\text{ }\Omega$	-	1.8		-
$r_g$	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)		$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.55	2.10	V
				$T_{vj}=125\text{ }^{\circ}\text{C}$	-	1.65	-	
				$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.70	-	
$V_F$ (Chip)	Forward voltage	$I_F=35\text{ A}$ , 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	$V_{CC}=300\text{ V}$ , $I_F=35\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ ,	-	-	400	ns		
$Q_{rr}$	Reverse recovery charge	$R_G=15\text{ }\Omega$ , Inductive load	-	3.0	-	$\mu\text{C}$		

### 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	$I_F=50\text{ A}$		$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.20	1.65	V
				$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.15	-	
$V_F$ (chip)				$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.10	1.35	
				$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.05	-	

### 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)	-	-	554	K/kW
$R_{th(j-c)D}$		Junction to case, per Inverter FWD (Note4)	-	-	720	
$R_{th(j-c)Q}$		Junction to case, Brake IGBT (Note4)	-	-	625	
$R_{th(j-c)D}$		Junction to case, Brake DIODE (Note4)	-	-	1346	
$R_{th(j-c)D}$		Junction to case, per Converter DIODE (Note4)	-	-	834	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module, Thermal grease applied (Note4, 7, 9)	-	20.2	-	K/kW

# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
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	Solder pin type(MXUB)	Terminal to terminal	10.9	-	-	mm
			Terminal to base plate	18.3	-	-	
		Pressfit pin type(MXUBP)	Terminal to terminal	5.2	-	-	
			Terminal to base plate	16.1	-	-	
d <sub>a</sub>	Clearance	Solder pin type(MXUB)	Terminal to terminal	6.5	-	-	mm
			Terminal to base plate	13.1	-	-	
		Pressfit pin type(MXUBP)	Terminal to terminal	5.0	-	-	
			Terminal to base plate	16.1	-	-	
e <sub>c</sub>	Flatness of base plate	On the centerline X, Y (Note6)	±0	-	+200	µm	
m	mass	-	-	165	-	g	

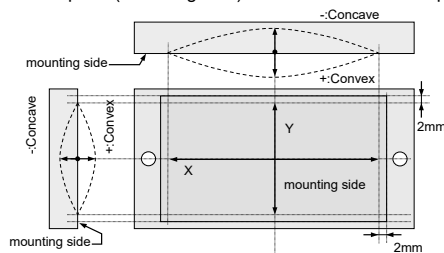
## RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V <sub>CC</sub>	(DC) Supply voltage	Applied across P-N(P1-N1) terminals	-	300	450	V
V <sub>GEon</sub>	Gate (-emitter drive) voltage	Applied across G*P-*/G*N-E/GB-E terminals (*=U,V,W)	13.5	15.0	16.5	V
R <sub>G</sub>	External gate resistance	Inverter IGBT, Per switch	12	-	120	Ω
		Brake IGBT	18	-	180	

\*: This product is compliant with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive 2011/65/EU and (EU) 2015/863.

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]
- Reference value. Thermally conductive grease of thermal conductivity λ=0.9 W/(m·K) and thickness D<sub>(C-S)</sub>=50 µm.
- The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



Long term performance related to thermal conductive grease (including but not limited to aspects such as the increase of thermal resistance

- due to pumping out, etc.) should be verified under user's specific application conditions. Each temperature condition (T<sub>vjmax</sub>, T<sub>vjop</sub>, T<sub>Cmax</sub>) must be maintained below the maximum rated temperature throughout consideration of the temperature rise even for long term usage.
- Use the following screws when mounting the printed circuit board (PCB) on the standoffs.

PCB thickness : t1.6

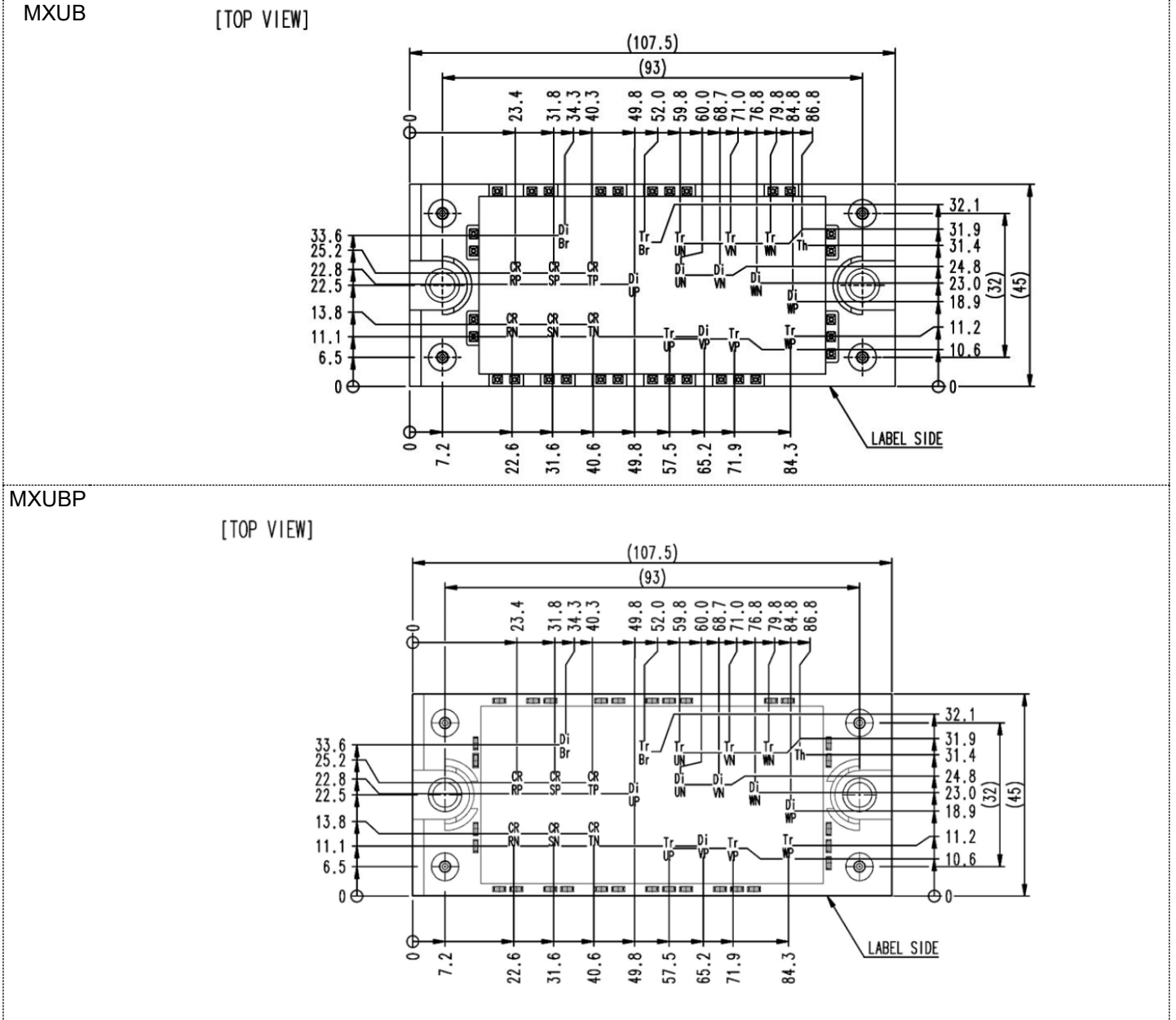
Type	Manufacturer	Size	Tightening torque (N·m)	Recommended tightening method
(1) PT®	EJOT	K25×8	0.55 ± 0.055	by handwork (equivalent to 30 rpm by mechanical screw driver) ~ 600 rpm (by mechanical screw driver)
(2) PT®		K25×10	0.75 ± 0.075 N·m	
(3) DELTA PT®		25×8	0.55 ± 0.055 N·m	
(4) DELTA PT®		25×10	0.75 ± 0.075 N·m	
(5) B1 tapping screw	-	φ2.6×10	0.75 ± 0.075 N·m	
		φ2.6×12		

# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## CHIP LOCATION (Top view)

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



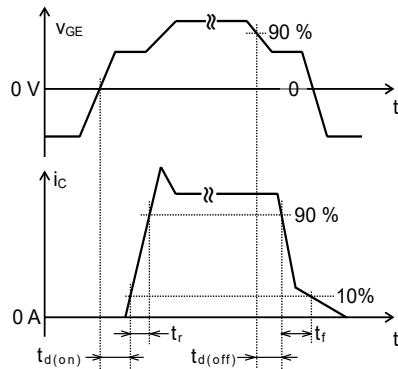
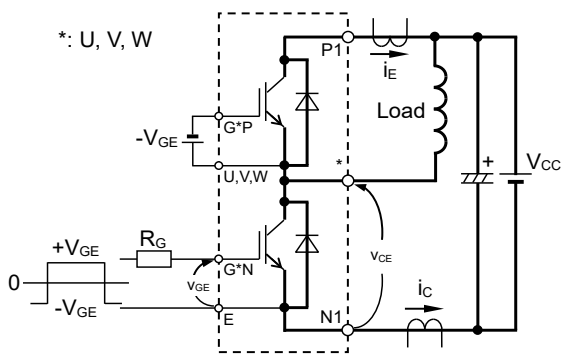
Tr\*P/Tr\*N/TrBr: IGBT, Di\*P/Di\*N: DIODE (\*=U/V/W), DiBr: BRAKE DIODE,  
CR\*P/CR\*N: CONVERTER DIODE (\*=R/S/T), Th: NTC thermistor



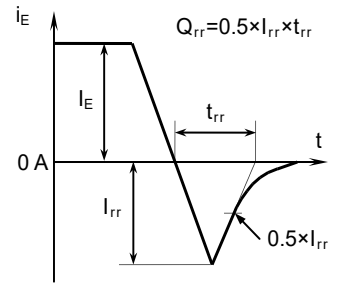
# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

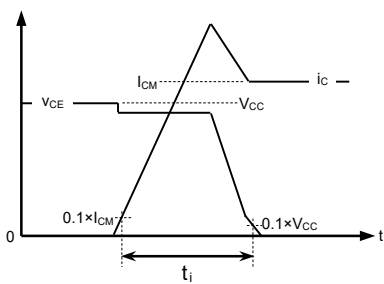
## TEST CIRCUIT AND WAVEFORMS



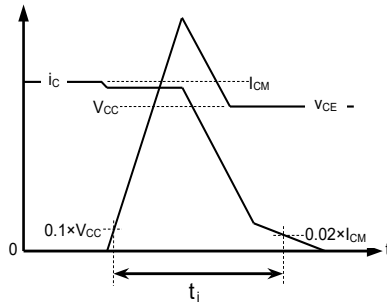
Switching characteristics test circuit and waveforms



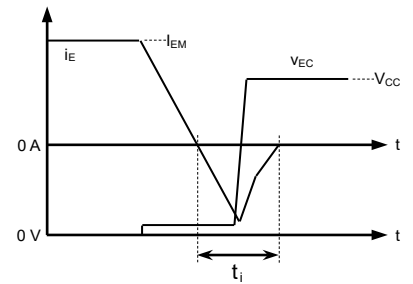
$t_{rr}$ ,  $Q_{rr}$  characteristics test waveform



IGBT Turn-on switching energy



IGBT Turn-off switching energy



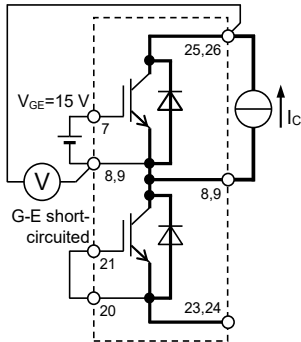
FWD Reverse recovery energy

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

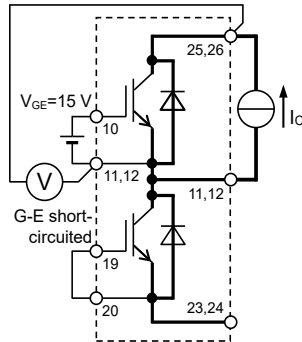
# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

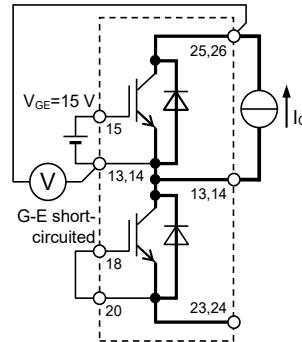
## TEST CIRCUIT



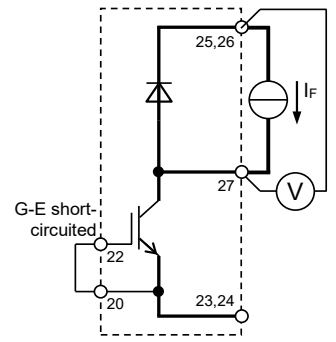
TrUP



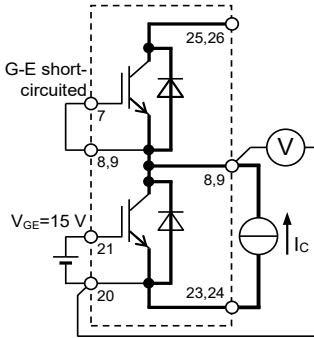
TrVP



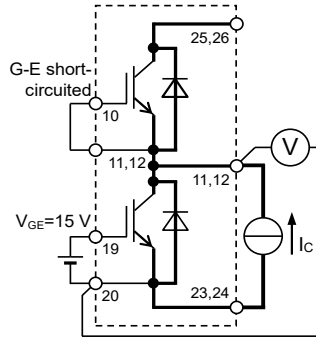
TrWP



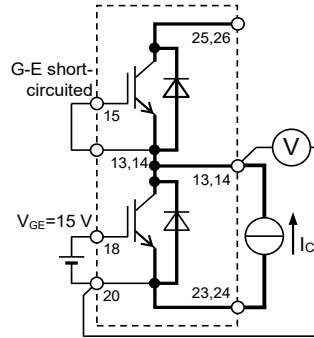
Brake DIODE



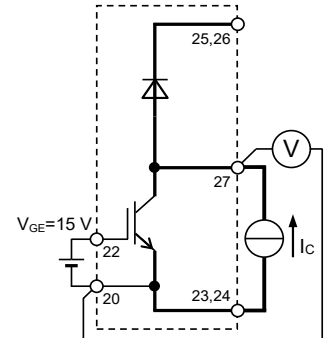
TrUN



TrVN



TrWN



Brake IGBT

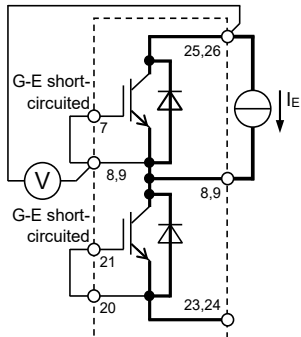
Gate-emitter GVP-V, GVN-E,  
short-circuited GWP-W, GWN-E  
GB-E

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

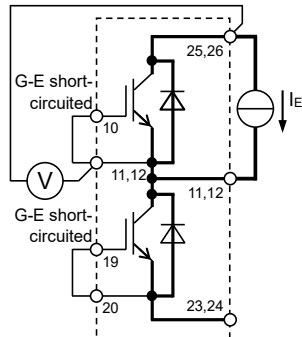
Gate-emitter GUP-U, GUN-E,  
short-circuited GVP-V, GVN-E  
GB-E

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

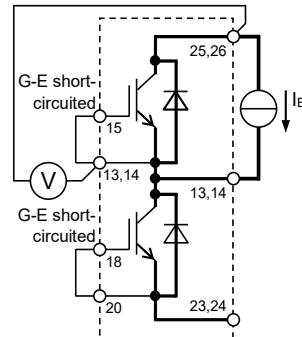
### $V_{CEsat}$ /BRAKE DIODE $V_F$ characteristics test circuit



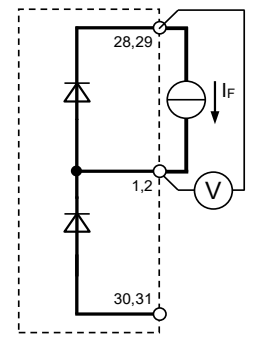
DiUP



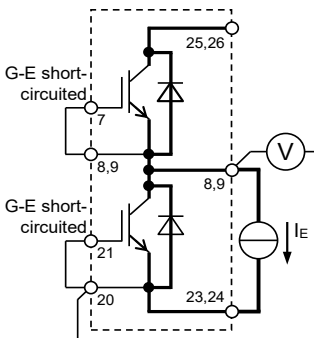
DiVP



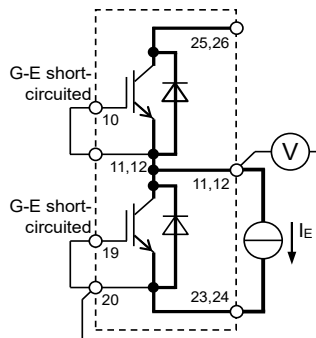
DiWP



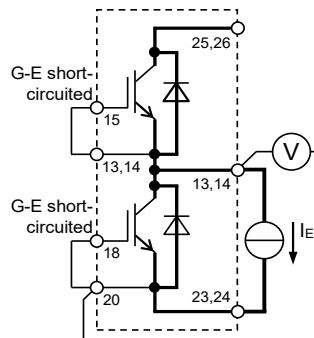
CONVERTER DIODE (ex.phase-R)



DiUN



DiVN



DiWN

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

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

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

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

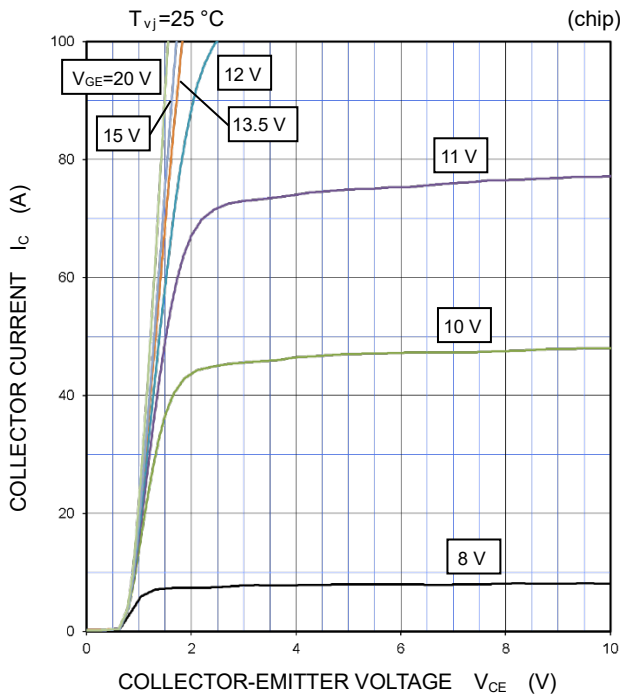
# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

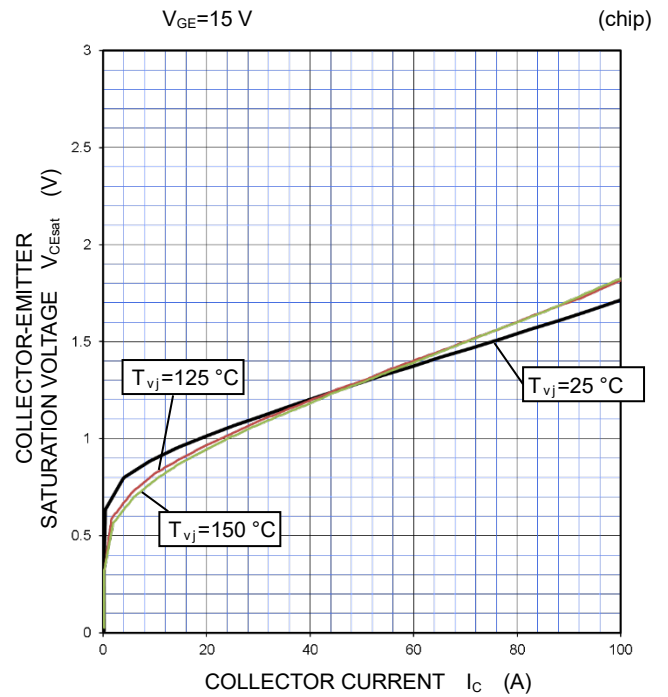
## PERFORMANCE CURVES

### INVERTER PART

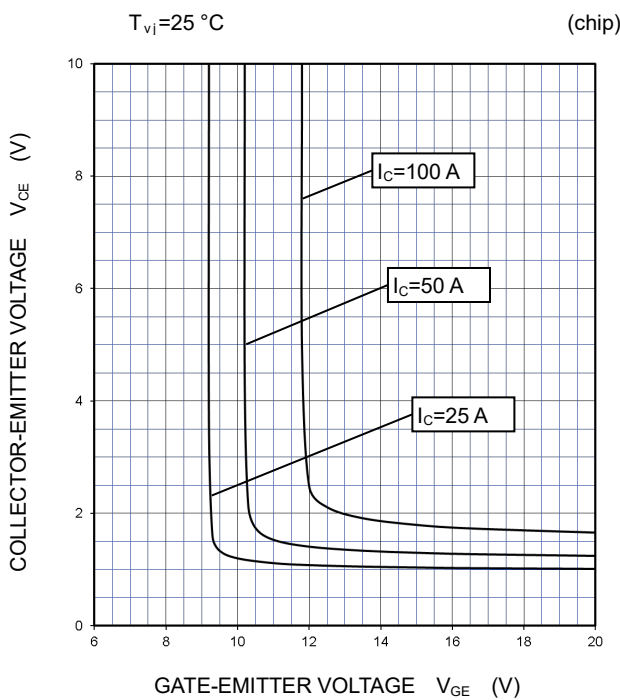
OUTPUT CHARACTERISTICS  
(TYPICAL)



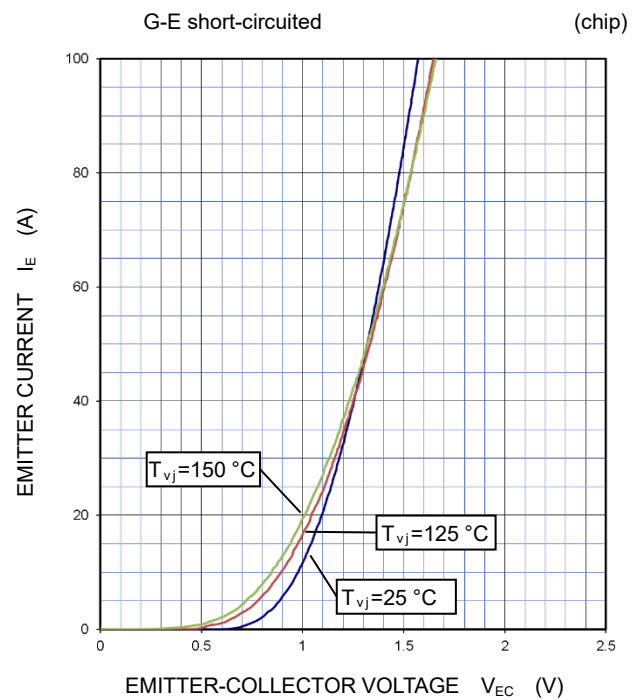
COLLECTOR-EMITTER SATURATION VOLTAGE  
CHARACTERISTICS  
(TYPICAL)



COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS  
(TYPICAL)



FREE WHEELING DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)



# CM50MXUB-13T/CM50MXUBP-13T

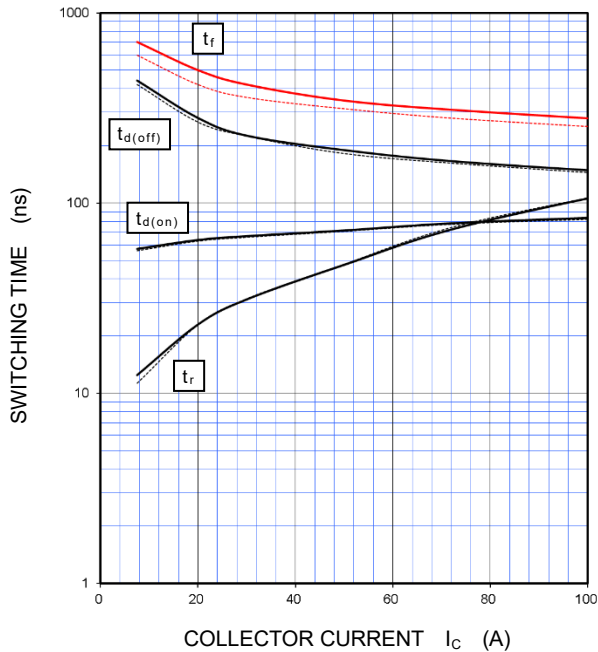
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### INVERTER PART

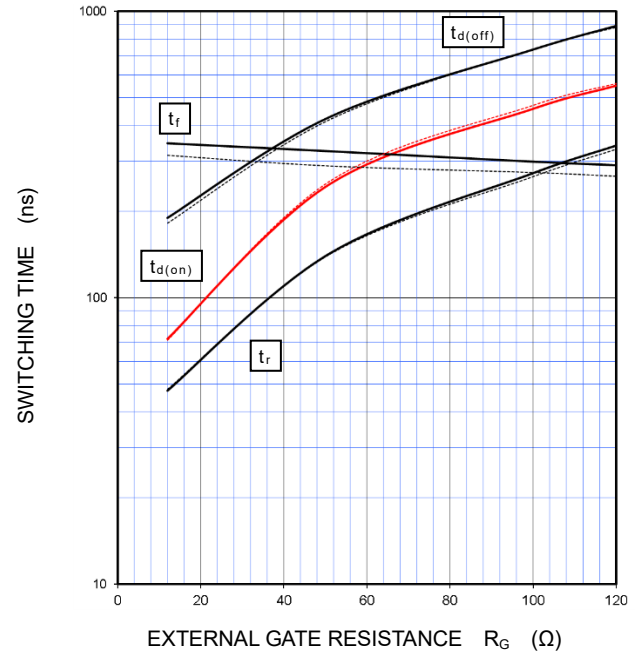
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $R_G=12\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



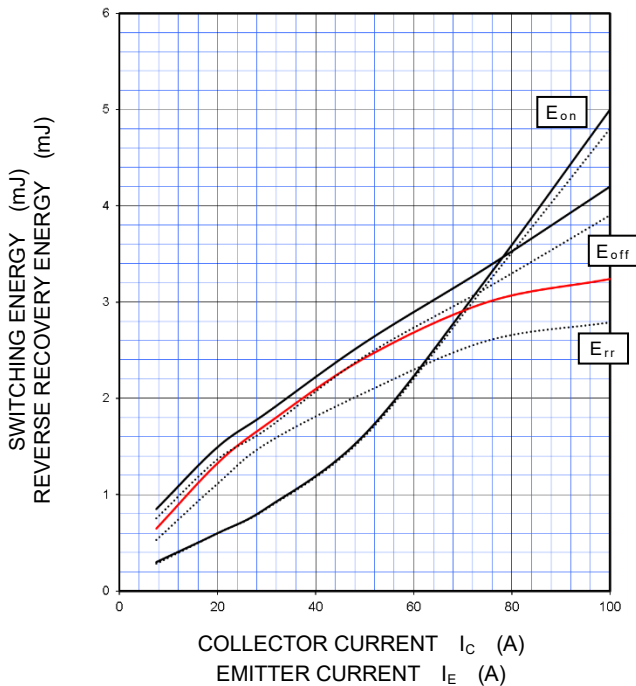
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $I_C=50\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



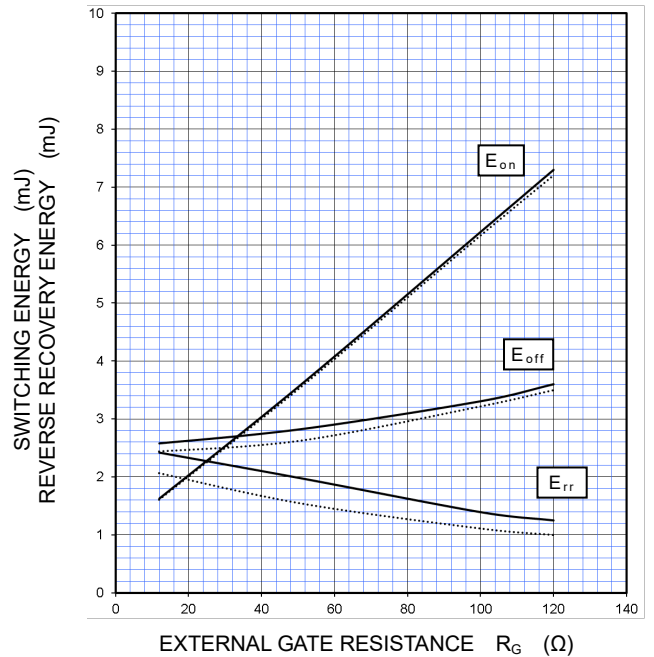
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $R_G=12\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD,  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$ , PER PULSE



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

$V_{CC}=300\text{ V}$ ,  $I_C/I_E=50\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD,  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$ , PER PULSE



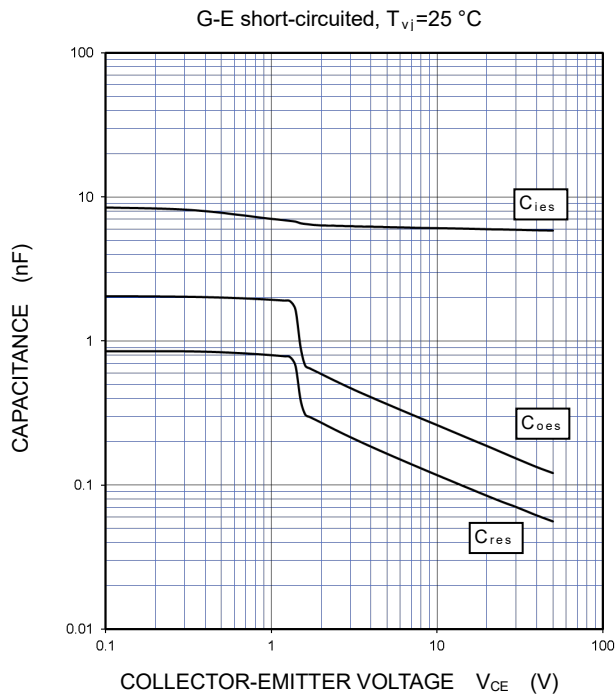
# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

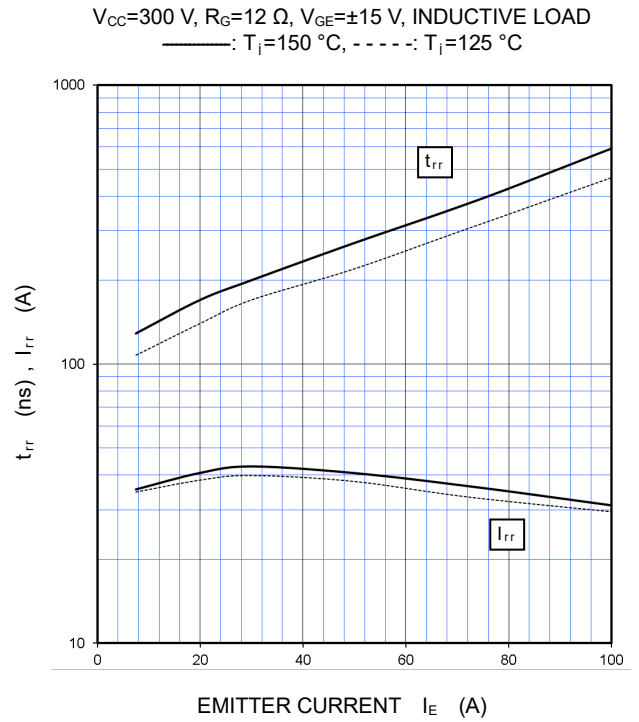
## PERFORMANCE CURVES

### INVERTER PART

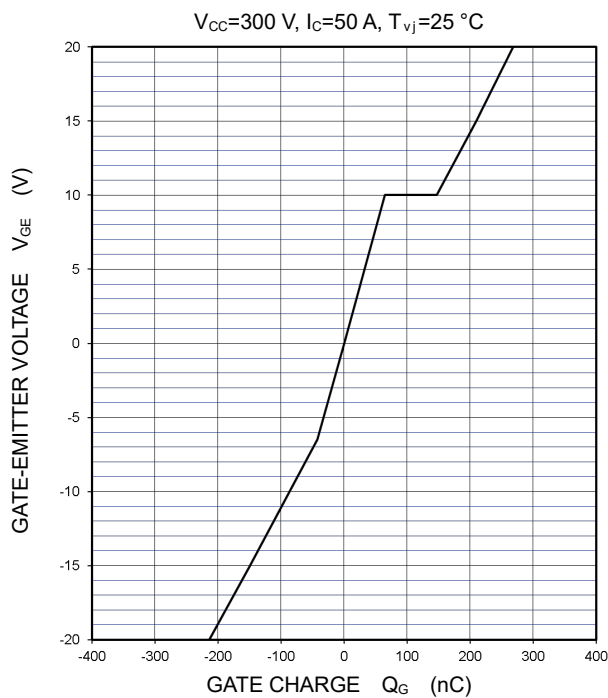
**CAPACITANCE CHARACTERISTICS (TYPICAL)**



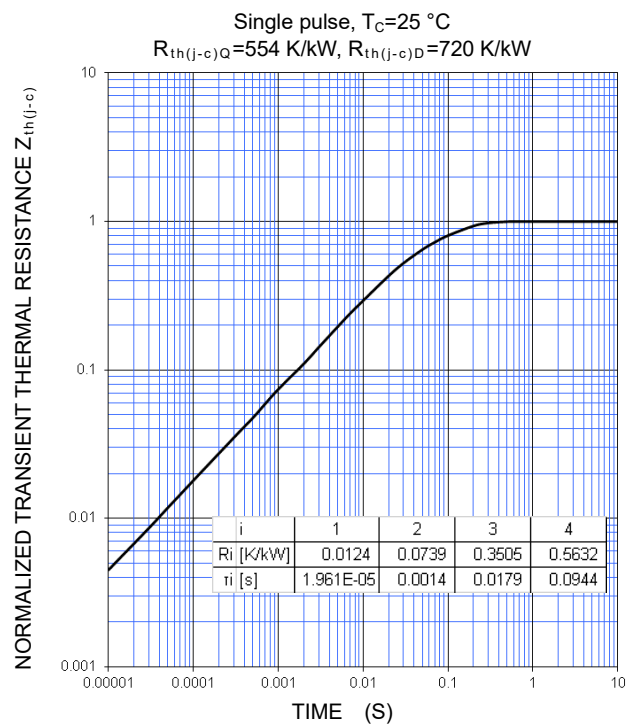
**FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



**GATE CHARGE CHARACTERISTICS (TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)**



# CM50MXUB-13T/CM50MXUBP-13T

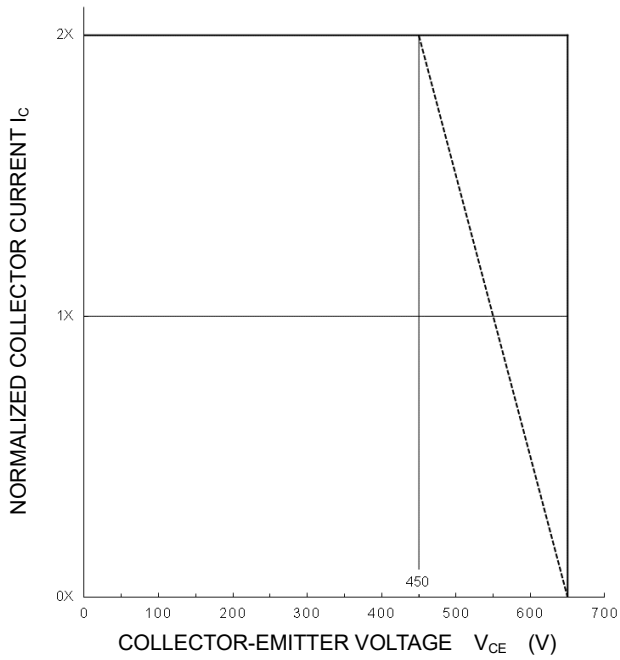
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### INVERTER PART

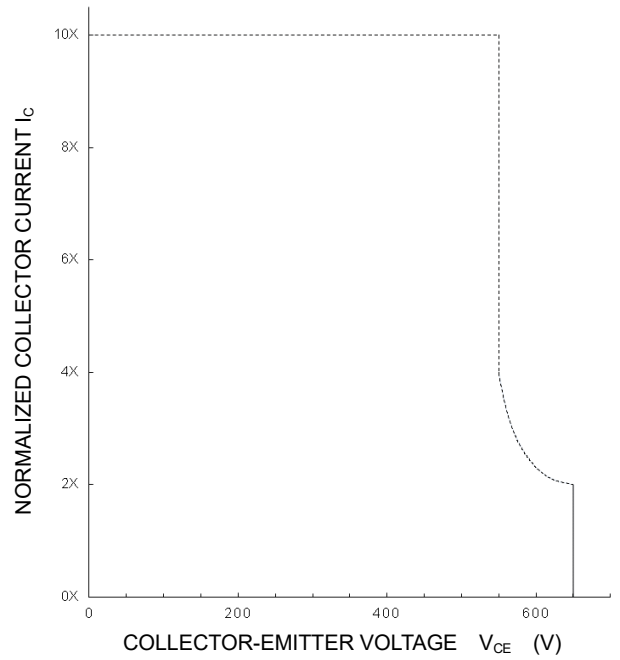
**TURN-OFF SWITCHING SAFE OPERATING AREA  
(REVERSE BIAS SAFE OPERATING AREA)  
(MAXIMUM)**

$V_{CC} \leq 450 \text{ V}$ ,  $R_G = 12 \sim 120 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
——:  $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$  (Normal load operations (Continuous))  
-----:  $T_{vj} = 175 \text{ }^\circ\text{C}$  (Unusual load operations (Limited period))



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

$V_{CC} \leq 400 \text{ V}$ ,  $R_G = 12 \sim 120 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
 $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$ ,  $t_W \leq 8 \ \mu\text{s}$ , Non-Repetitive



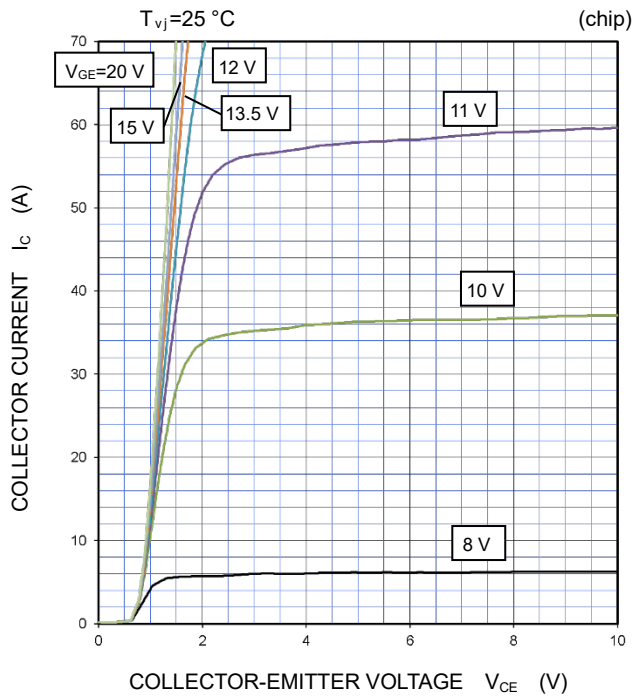
# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

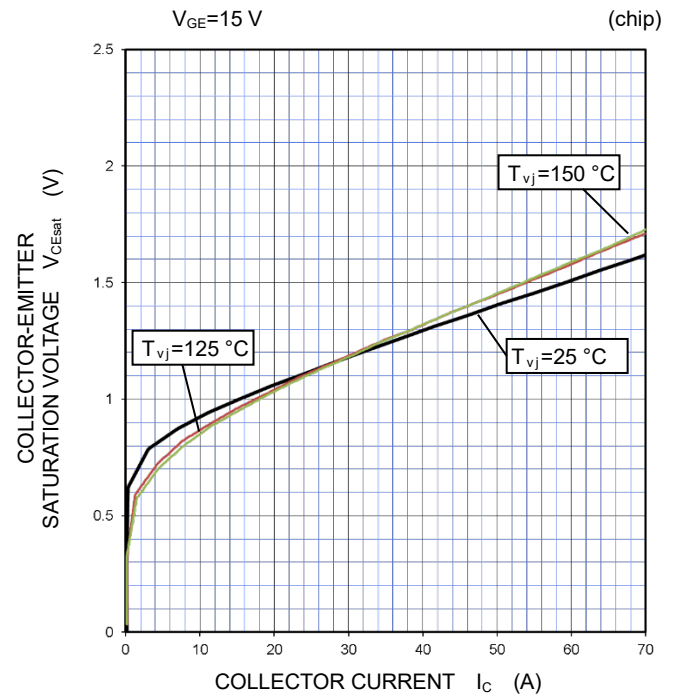
## PERFORMANCE CURVES

### BRAKE PART

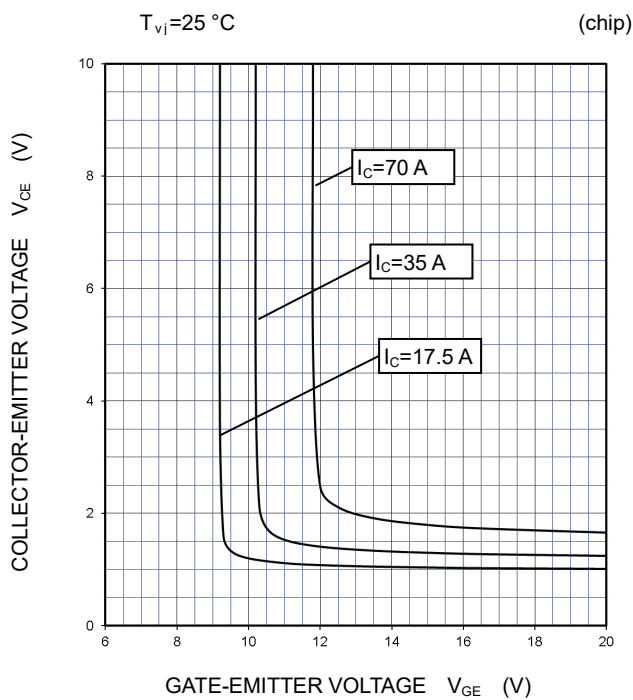
**OUTPUT CHARACTERISTICS  
(TYPICAL)**



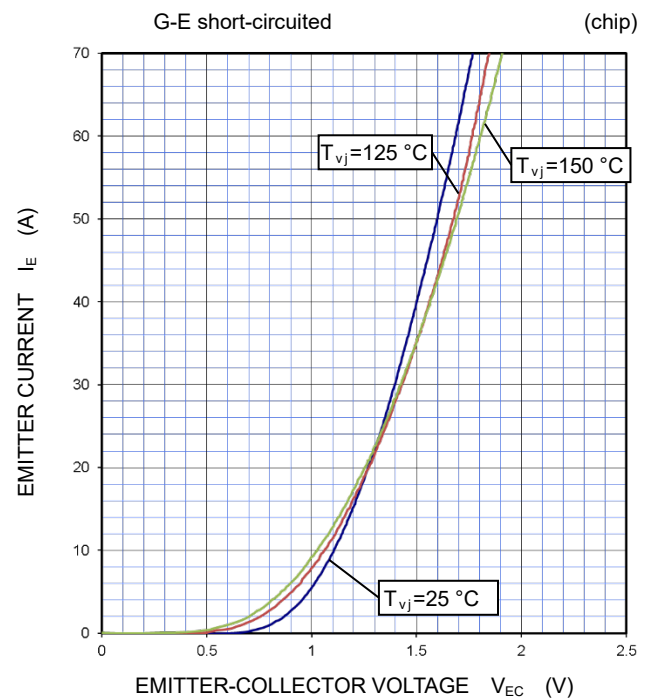
**COLLECTOR-EMITTER SATURATION VOLTAGE  
CHARACTERISTICS  
(TYPICAL)**



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



**DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)**



# CM50MXUB-13T/CM50MXUBP-13T

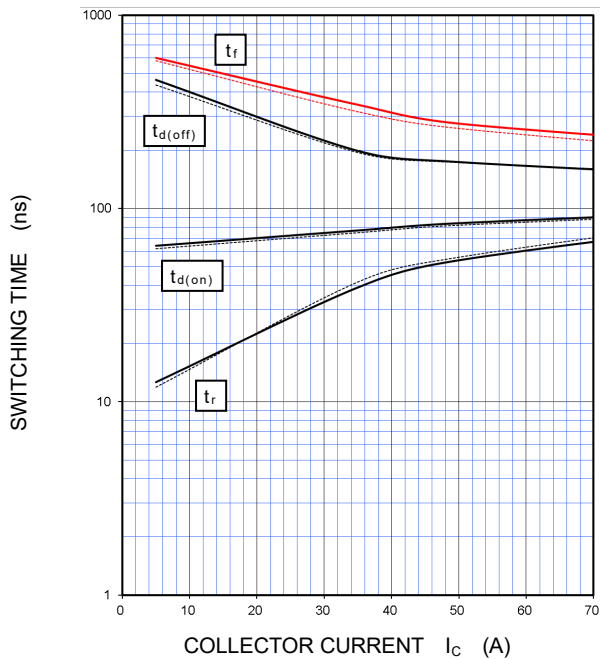
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### BRAKE PART

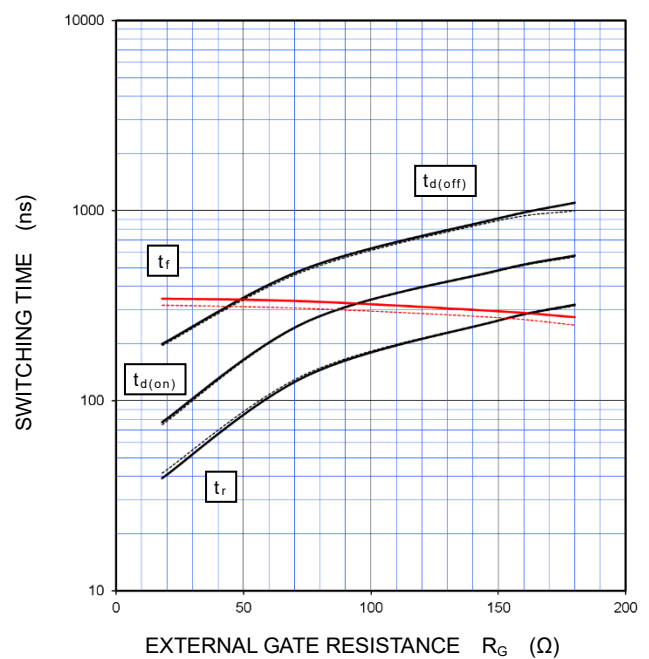
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $R_G=18\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



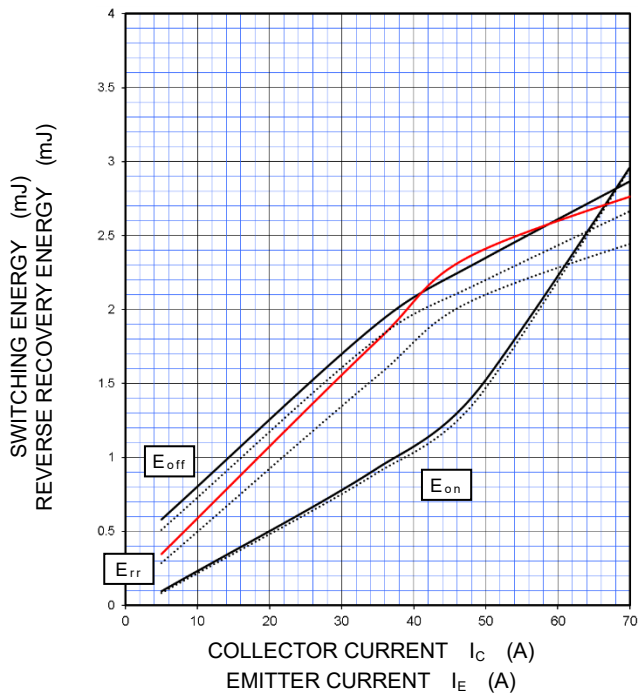
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $I_C=35\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



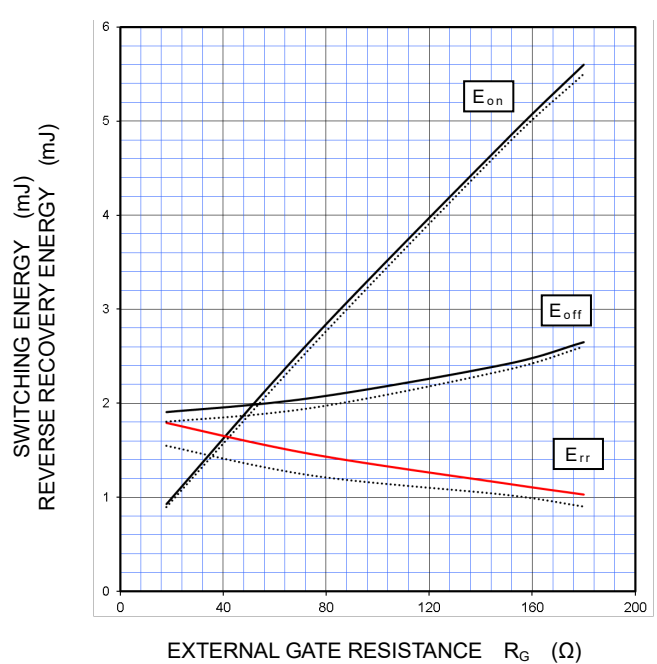
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

$V_{CC}=300\text{ V}$ ,  $R_G=18\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD, PER PULSE  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



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

$V_{CC}=300\text{ V}$ ,  $I_C/I_E=35\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD, PER PULSE  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$





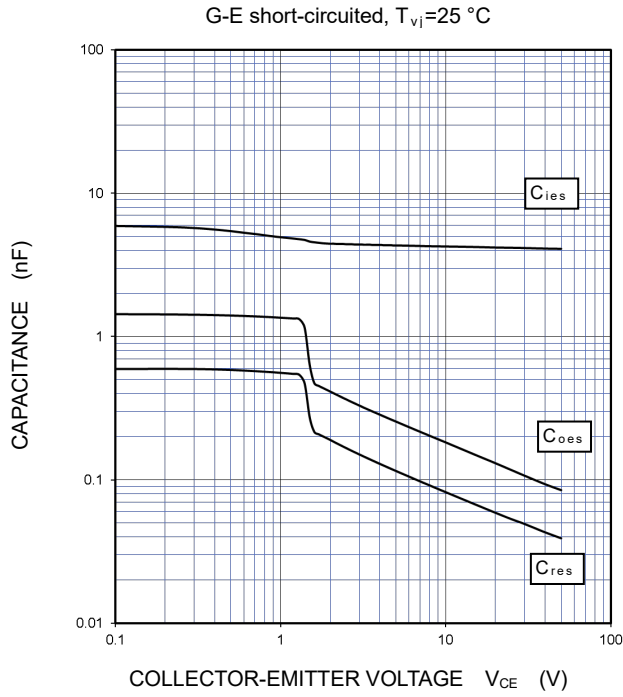
# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

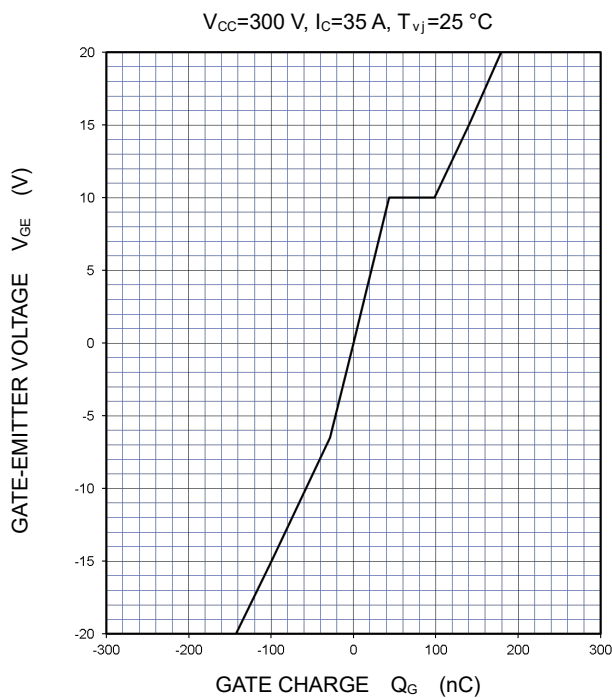
## PERFORMANCE CURVES

### BRAKE PART

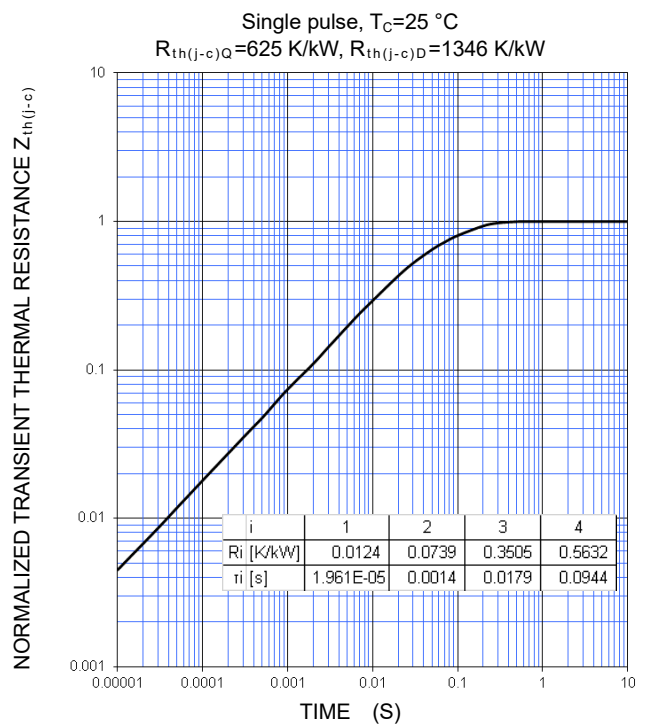
#### CAPACITANCE CHARACTERISTICS (TYPICAL)



#### GATE CHARGE CHARACTERISTICS (TYPICAL)



#### TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)



# CM50MXUB-13T/CM50MXUBP-13T

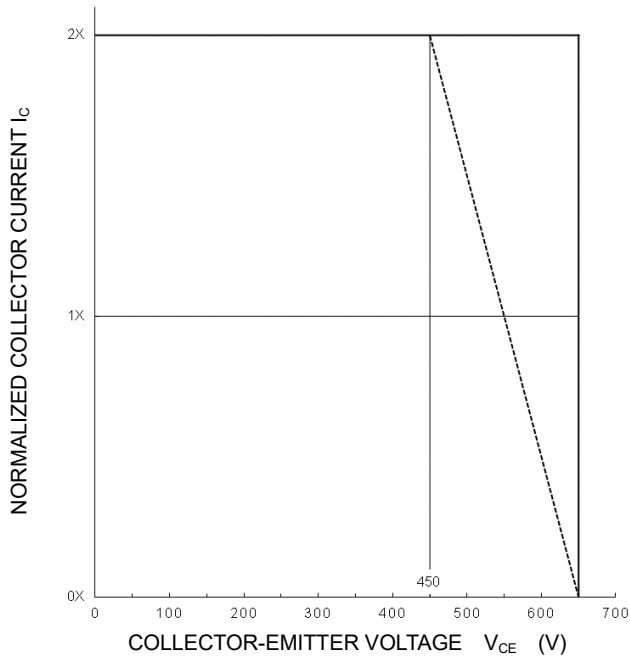
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### BRAKE PART

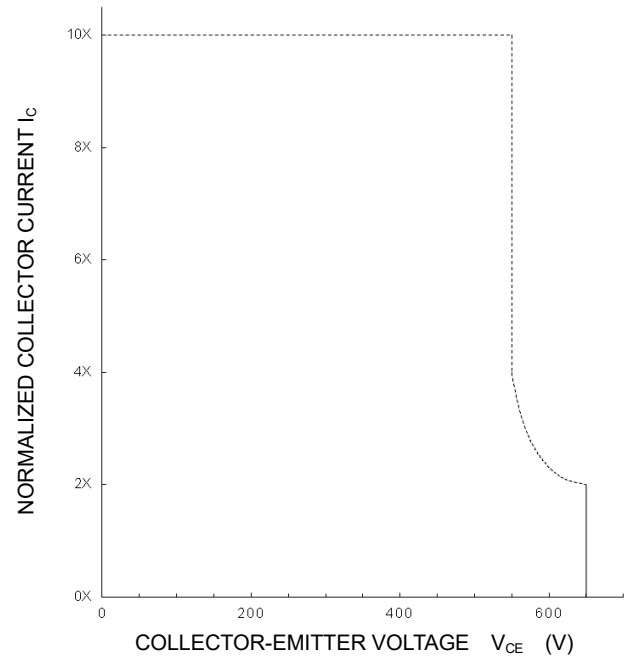
**TURN-OFF SWITCHING SAFE OPERATING AREA  
(REVERSE BIAS SAFE OPERATING AREA)  
(MAXIMUM)**

$V_{CC} \leq 450 \text{ V}$ ,  $R_G = 18 \sim 180 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
 ———:  $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$  (Normal load operations (Continuous))  
 - - - - -:  $T_{vj} = 175 \text{ }^\circ\text{C}$  (Unusual load operations (Limited period))



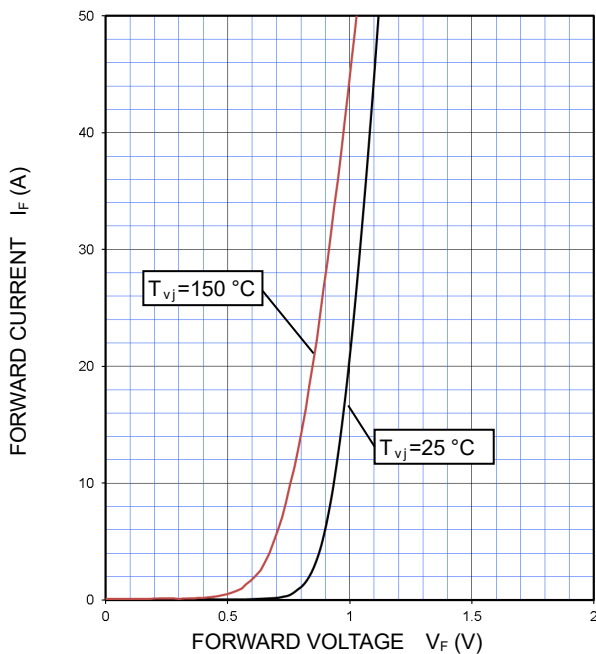
**SHORT-CIRCUIT SAFE OPERATING AREA  
(MAXIMUM)**

$V_{CC} \leq 400 \text{ V}$ ,  $R_G = 18 \sim 180 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
 $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$ ,  $t_W \leq 8 \ \mu\text{s}$ , Non-Repetitive



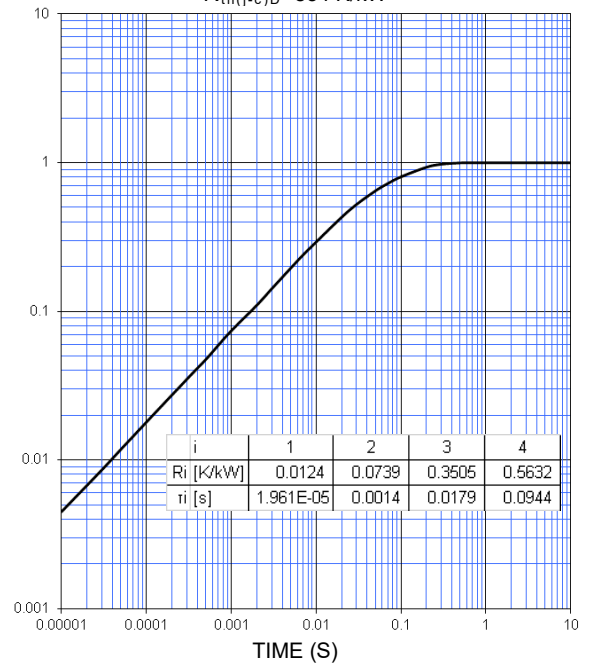
### CONVERTER PART

**CONVERTER DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS  
(MAXIMUM)**

Single pulse,  $T_C = 25 \text{ }^\circ\text{C}$   
 $R_{th(j-c)D} = 834 \text{ K/kW}$



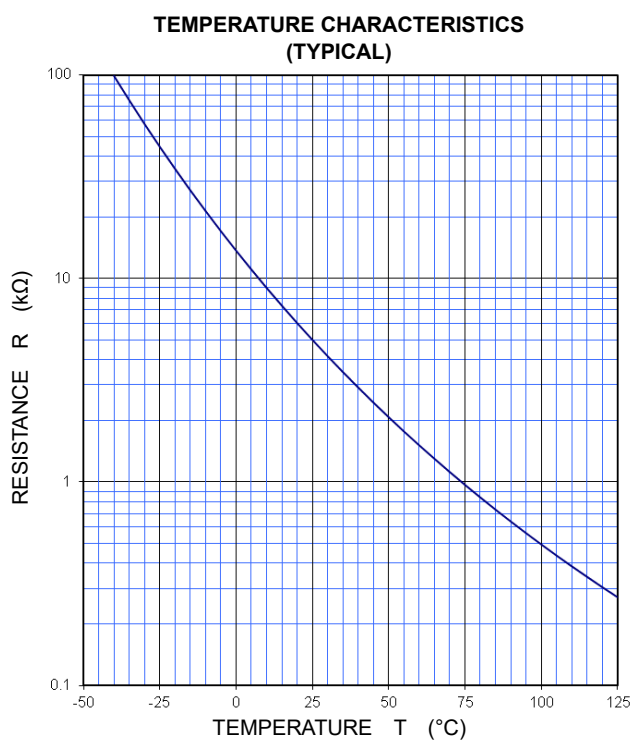
# CM50MXUB-13T/CM50MXUBP-13T

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.

# CM50MXUB-13T/CM50MXUBP-13T

HIGH POWER SWITCHING USE  
INSULATED TYPE

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