

<IGBT Modules>

CM150MXUD-13T1/CM150MXUDP-13T1

HIGH POWER SWITCHING USE
INSULATED TYPE

 MXUD	Collector current I_C 1 5 0 A Collector-emitter voltage V_{CES} 6 5 0 V Maximum junction temperature T_{vjmax} 1 7 5 °C •Flat base type •Copper base plate (Nickel-plating) •RoHS Directive compliant •Tin-plating pin terminals
 MXUDP	Collector current I_C 1 5 0 A Collector-emitter voltage V_{CES} 6 5 0 V Maximum junction temperature T_{vjmax} 1 7 5 °C •Flat base type •Copper base plate (Nickel-plating) •RoHS Directive compliant •Tin-plating pressfit terminals
CIB (Converter+Inverter+Chopper Brake)	•UL Recognized under UL1557, File No. E323585

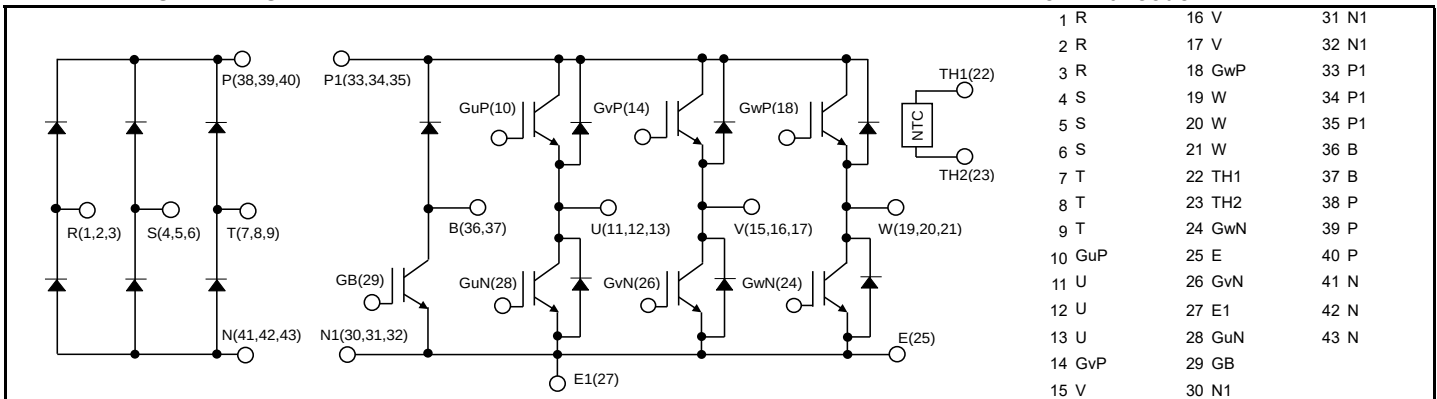
APPLICATION

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



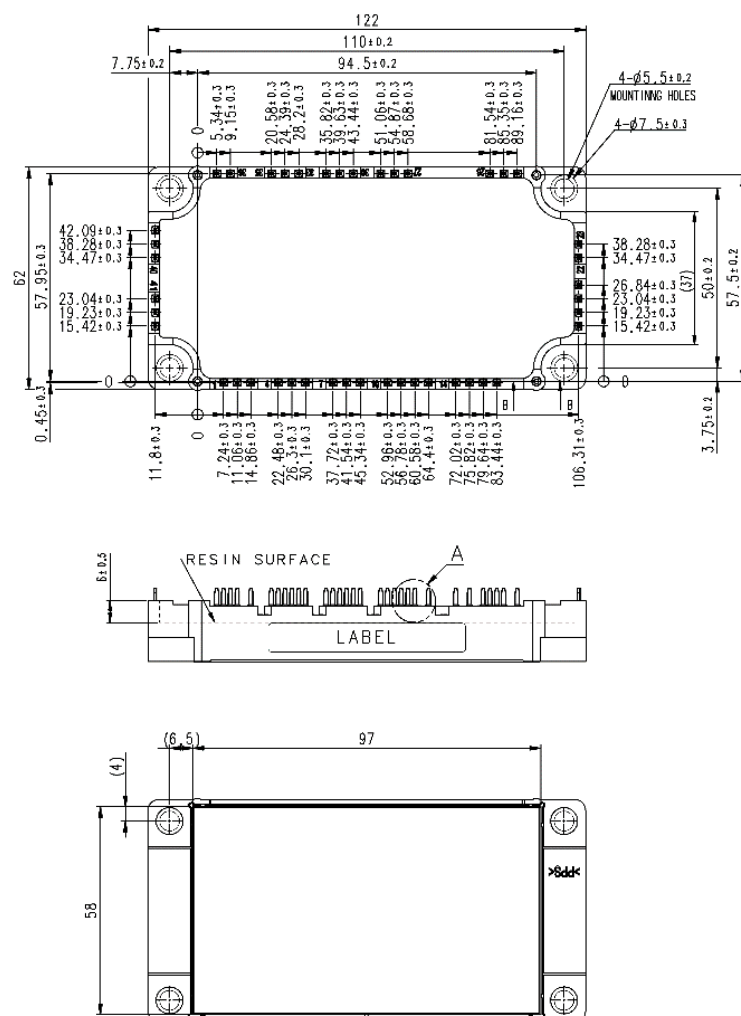
CM150MXUD-13T1/CM150MXUDP-13T1

HIGH POWER SWITCHING USE

INSULATED TYPE

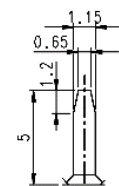
OUTLINE DRAWING

MXUD

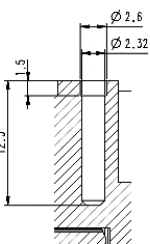


Dimension in mm

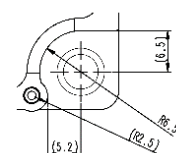
SECTION A



SECTION B



MOUNTING HOLES



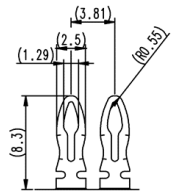
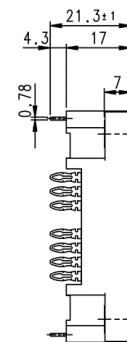
Tolerance otherwise specified

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

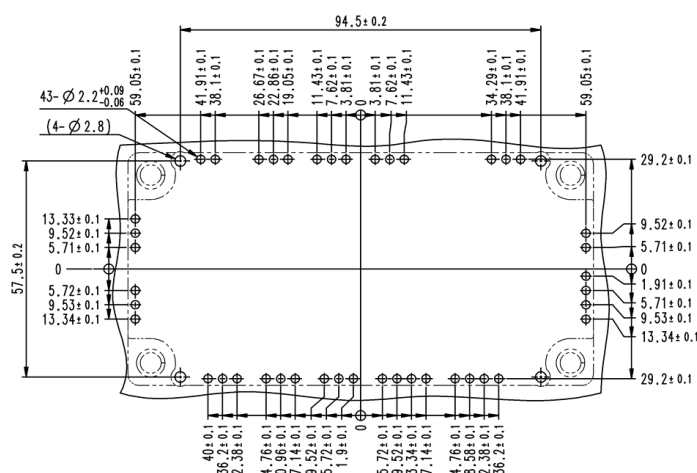
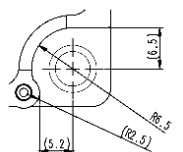
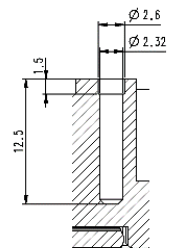
HIGH POWER SWITCHING USE INSULATED TYPE

Dimension in mm

SECTION A



SECTION B



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

CM150MXUD-13T1/CM150MXUDP-13T1

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	± 20	V
I_C	Collector current	DC, $T_C=75\text{ }^{\circ}\text{C}$ (Note2, 4)	150	A
I_{CRM}		Pulse, Repetitive (Note3)	300	
P_{tot}	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	425	W
I_E (Note1)	Emitter current	DC (Note2)	150	A
I_{ERM} (Note1)		Pulse, Repetitive (Note3)	300	
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	± 20	V
I_C	Collector current	DC, $T_C=90\text{ }^{\circ}\text{C}$ (Note2, 4)	100	A
I_{CRM}		Pulse, Repetitive (Note3)	200	
P_{tot}	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	325	W
V_{RRM}	Repetitive peak reverse voltage	G-E short-circuited	650	V
I_F	Forward current	DC (Note2)	75	A
I_{FRM}		Pulse, Repetitive (Note3)	150	
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, $T_C=109\text{ }^{\circ}\text{C}$ (Note4)	150	A
I_{FSM}	Surge forward current	The sine half wave 1 cycle peak value, f=60 Hz, non-repetitive	$T_{vj}=25\text{ }^{\circ}\text{C}$	A
			$T_{vj}=150\text{ }^{\circ}\text{C}$	
I^2t	Current square time	Value for one cycle of surge current	$T_{vj}=25\text{ }^{\circ}\text{C}$	A^2s
			$T_{vj}=150\text{ }^{\circ}\text{C}$	
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 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	

CM150MXUD-13T1/CM150MXUDP-13T1

HIGH POWER SWITCHING USE
INSULATED TYPEELECTRICAL CHARACTERISTICS ($T_{vj}=25\text{ }^{\circ}\text{C}$, unless otherwise specified)

INVERTER PART IGBT/FWD

Symbol	Item	Conditions		Limits			Unit
				Min.	Typ.	Max.	
I _{CES}	Collector-emitter cut-off current	V _{CE} =V _{CES} , G-E short-circuited		-	-	1.0	mA
I _{GES}	Gate-emitter leakage current	V _{GE} =V _{GES} , C-E short-circuited		-	-	0.5	μA
V _{GE(th)}	Gate-emitter threshold voltage	I _C =15 mA, V _{CE} =10 V		5.4	6.0	6.6	V
V _{CEsat} (Terminal)	Collector-emitter saturation voltage	I _C =150 A, V _{GE} =15 V, Refer to the figure of test circuit (Note5)	T _{vj} =25 °C	-	1.75	2.20	V
			T _{vj} =125 °C	-	2.00	-	
			T _{vj} =150 °C	-	2.10	-	
V _{CEsat} (Chip)		I _C =150 A, V _{GE} =15 V, (Note5)	T _{vj} =25 °C	-	1.50	1.75	V
			T _{vj} =125 °C	-	1.55	-	
			T _{vj} =150 °C	-	1.55	-	
C _{ies}	Input capacitance	V _{CE} =10 V, G-E short-circuited		-	-	13.4	nF
C _{oes}	Output capacitance			-	-	0.6	
C _{res}	Reverse transfer capacitance			-	-	0.3	
Q _G	Gate charge	V _{CC} =300 V, I _C =150 A, V _{GE} =15 V		-	0.41	-	μC
t _{d(on)}	Turn-on delay time	V _{CC} =300 V, I _C =150 A, V _{GE} =±15 V, R _G =4.3 Ω, Inductive load		-	-	400	ns
t _r	Rise time			-	-	200	
t _{d(off)}	Turn-off delay time			-	-	400	
t _f	Fall time			-	-	600	
V _{EC} (Note1) (Terminal)	Emitter-collector voltage	I _E =150 A, G-E short-circuited, Refer to the figure of test circuit (Note5)	T _{vj} =25 °C	-	1.85	2.30	V
			T _{vj} =125 °C	-	2.05	-	
			T _{vj} =150 °C	-	2.15	-	
V _{EC} (Note1) (Chip)		I _E =150 A, G-E short-circuited, (Note5)	T _{vj} =25 °C	-	1.45	1.85	V
			T _{vj} =125 °C	-	1.50	-	
			T _{vj} =150 °C	-	1.50	-	
t _{rr} (Note1)	Reverse recovery time	V _{CC} =300 V, I _E =150 A, V _{GE} =±15 V,		-	-	400	ns
Q _{rr} (Note1)	Reverse recovery charge	R _G =4.3 Ω, Inductive load		-	10.0	-	μC
E _{on}	Turn-on switching energy per pulse	V _{CC} =300 V, I _C =I _E =150 A,		-	2.7	-	mJ
E _{off}	Turn-off switching energy per pulse	V _{GE} =±15 V, R _G =4.3 Ω, T _{vj} =150 °C,		-	6.2	-	
E _{rr} (Note1)	Reverse recovery energy per pulse	Inductive load		-	8.3	-	mJ
r _g	Internal gate resistance	Per switch		-	0	-	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 =10 mA, V _{CE} =10 V		5.4	6.0	6.6	V
V _{CEsat} (Terminal)	Collector-emitter saturation voltage	I _C =100 A, V _{GE} =15 V, Refer to the figure of test circuit (Note5)	T _{vj} =25 °C	-	1.65	2.05	V
			T _{vj} =125 °C	-	1.95	-	
			T _{vj} =150 °C	-	2.05	-	
V _{CEsat} (Chip)		I _C =100 A, V _{GE} =15 V, (Note5)	T _{vj} =25 °C	-	1.45	1.70	V
			T _{vj} =125 °C	-	1.50	-	
			T _{vj} =150 °C	-	1.50	-	
C _{ies}	Input capacitance	V _{CE} =10 V, G-E short-circuited		-	-	10.1	nF
C _{oes}	Output capacitance			-	-	0.5	
C _{res}	Reverse transfer capacitance			-	-	0.2	
Q _G	Gate charge	V _{CC} =300 V, I _C =100 A, V _{GE} =15 V		-	0.31	-	μC
t _{d(on)}	Turn-on delay time	V _{CC} =300 V, I _C =100 A, V _{GE} =±15 V, R _G =6.8 Ω, Inductive load		-	-	400	ns
t _r	Rise time			-	-	200	
t _{d(off)}	Turn-off delay time			-	-	400	
t _f	Fall time			-	-	600	

CM150MXUD-13T1/CM150MXUDP-13T1

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	-	0.8	-	mJ
E_{off}	Turn-off switching energy per pulse			4.8	-	
E_{rr}	Reverse recovery energy per pulse			3.7	-	
r_g	Internal gate resistance	-	-	0	-	Ω
I_{RRM}	Reverse current	$V_R=V_{RRM}$, G-E short-circuited	-	-	1.0	mA
V_F (Terminal)	Forward voltage	$I_F=75\text{ A}$, G-E short-circuited, Refer to the figure of test circuit (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.95	2.30	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	2.10	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	2.15	-	
V_F (Chip)	Forward voltage	$I_F=75\text{ A}$, G-E short-circuited, (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.45	1.85	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.50	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	1.50	-	
t_{rr}	Reverse recovery time	$V_{CC}=300\text{ V}$, $I_F=75\text{ A}$, $V_{GE}=\pm 15\text{ V}$,	-	-	400	ns
Q_{rr}	Reverse recovery charge	$R_G=10\text{ }\Omega$, Inductive load	-	6.5	-	μC

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	$I_F=150\text{ A}$	$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.45	1.90	V
V_F (chip)			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.45	-	
			$T_{vj}=25\text{ }^{\circ}\text{C}$	-	1.25	1.50	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	-	1.25	-	

NTC THERMISTOR PART

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R_{25}	Zero-power resistance	$T_C=25\text{ }^{\circ}\text{C}$ (Note4)	4.85	5.00	5.15	k Ω
$\Delta R/R$	Deviation of resistance	$R_{100}=493\text{ }\Omega$, $T_C=100\text{ }^{\circ}\text{C}$ (Note4)	-7.3	-	+7.8	%
$B_{(25/50)}$	B-constant	Approximate by equation (Note6)	-	3375	-	K
P_{25}	Power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note4)	-	-	10	mW

THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance	Junction to case, per Inverter IGBT (Note4)	-	-	350	K/kW
$R_{th(j-c)D}$		Junction to case, per Inverter FWD (Note4)	-	-	440	
$R_{th(j-c)Q}$		Junction to case, Brake IGBT (Note4)	-	-	458	
$R_{th(j-c)D}$		Junction to case, Brake DIODE (Note4)	-	-	1032	
$R_{th(j-c)D}$		Junction to case, per Converter DIODE (Note4)	-	-	538	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module Thermal grease applied (Note4, 7, 9)	-	11.5	-	K/kW

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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(MXUD)	Terminal to terminal	11.7	-	-
			Terminal to base plate	18.3	-	-
		Pressfit pin type(MXUDP)	Terminal to terminal	5.1	-	-
			Terminal to base plate	15.8	-	-
d _a	Clearance	Solder pin type(MXUD)	Terminal to terminal	6.5	-	-
			Terminal to base plate	18.1	-	-
		Pressfit pin type(MXUDP)	Terminal to terminal	5.0	-	-
			Terminal to base plate	15.8	-	-
e _c	Flatness of base plate	On the centerline X, Y (Note8)	±0	-	+200	μm
m	mass	-	-	270	-	g

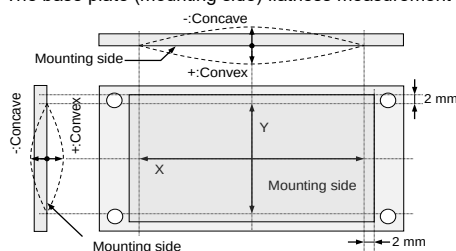
RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V _{CC}	(DC) Supply voltage	Applied across P-N(P1-N1) terminals	-	300	450	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	4.3	-	43	Ω
		Brake IGBT	6.8	-	68	

*: 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_{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.
- $B_{(25/50)} = \ln \left(\frac{R_{25}}{R_{50}} \right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}} \right)$
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]
- Reference value. Thermally conductive grease of thermal conductivity λ=0.9 W/(m·K) and thickness D_(C-S)=50 μm.
- The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



- Long term performance related to PC-TIM (including but not limited to aspects such as the increase of thermal resistance due to pumping out, etc.) should be verified user's your specific application conditions. Each temperature condition (T_{vjmax}, T_{vjop}, T_{Cmax}) 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

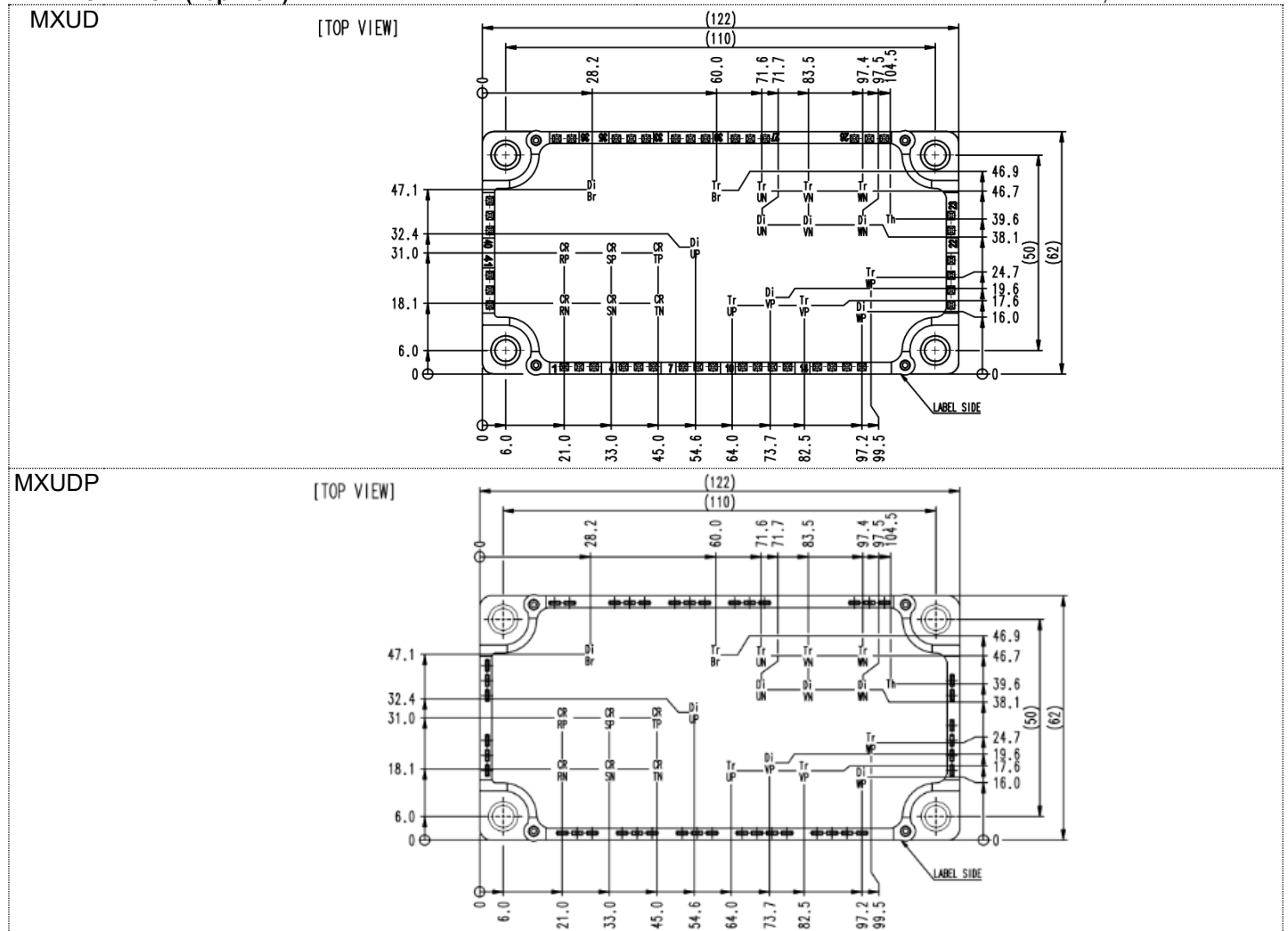
Type	Manufacturer	Size	Tightening torque (N·m)	Recommended tightening method
(1) PT®	EJOT	K25×8	0.55 ± 0.055	by handwork (equivalent to 30 rpm by mechanical screw driver) ~ 600 rpm (by mechanical screw driver)
(2) PT®		K25×10	0.75 ± 0.075 N·m	
(3) DELTA PT®		25×8	0.55 ± 0.055 N·m	
(4) DELTA PT®		25×10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

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

CM150MXUD-13T1/CM150MXUDP-13T1

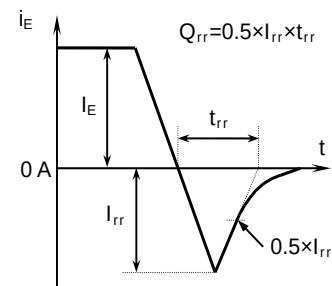
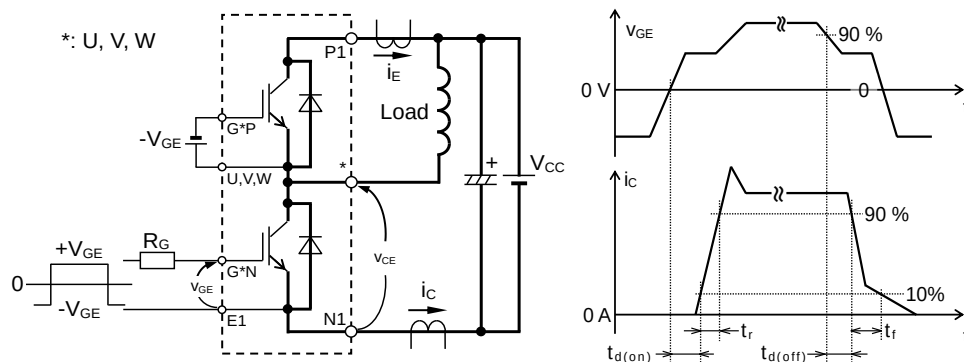
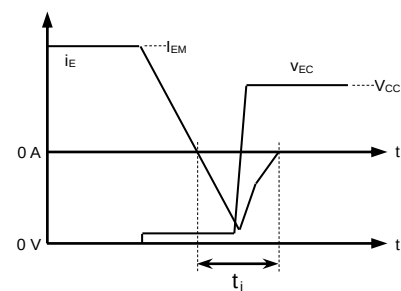
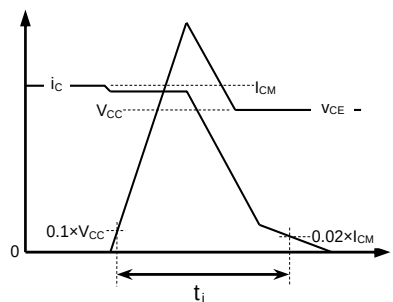
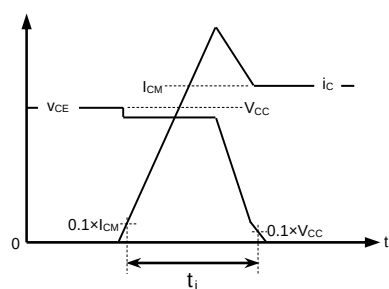
HIGH POWER SWITCHING USE

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

TEST CIRCUIT AND WAVEFORMS

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

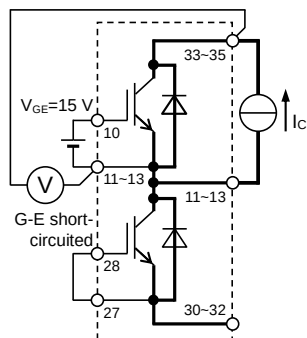
Switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

CM150MXUD-13T1/CM150MXUDP-13T1

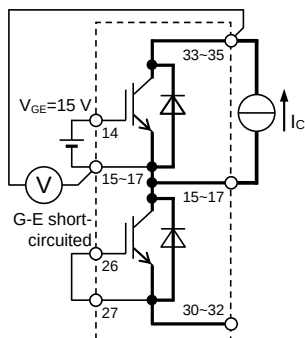
HIGH POWER SWITCHING USE

INSULATED TYPE

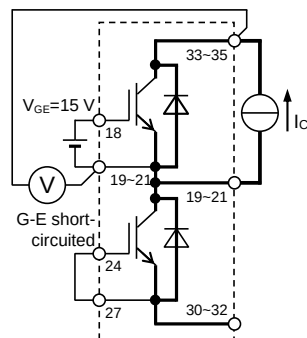
TEST CIRCUIT



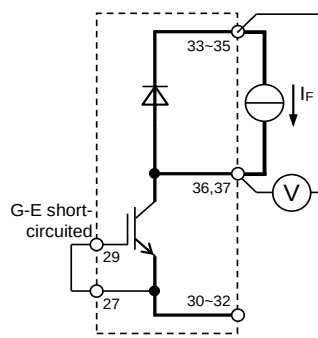
TrUP



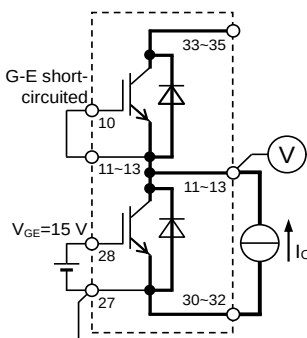
TrVP



TrWP

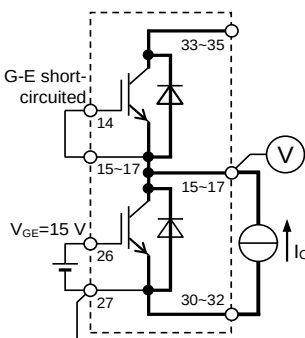


Brake DIODE



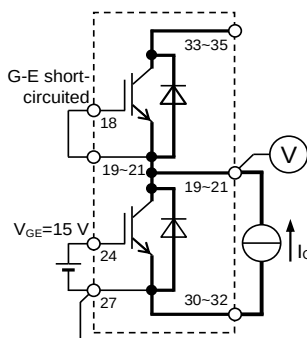
TrUN

Gate-emitter GVP-V, GVN-E1,
short-circuited GWP-W, GWN-E1
GB-E1



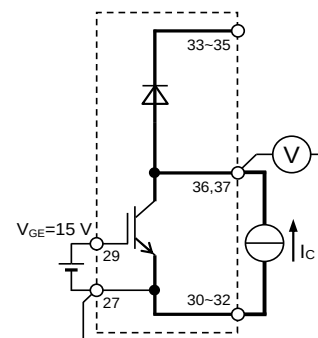
TrVN

Gate-emitter GUP-U, GUN-E1,
short-circuited GWP-W, GWN-E1
GB-E1



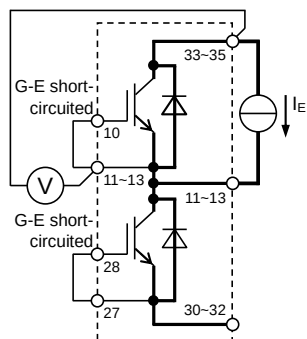
TrWN

Gate-emitter GUP-U, GUN-E1,
short-circuited GVP-V, GVN-E1
GB-E1

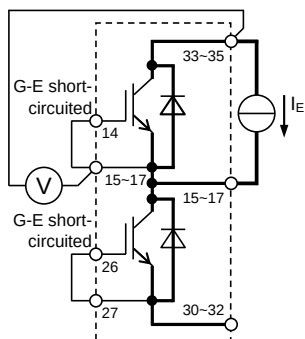


Brake IGBT

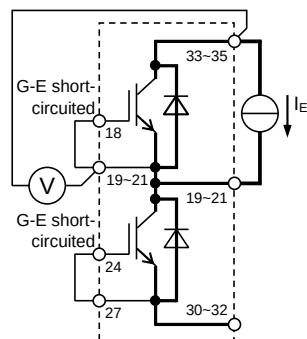
Gate-emitter GUP-U, GUN-E1,
short-circuited GVP-V, GVN-E1,
GWP-W, GWN-E1

 V_{CEsat} /BRAKE DIODE V_F characteristics test circuit

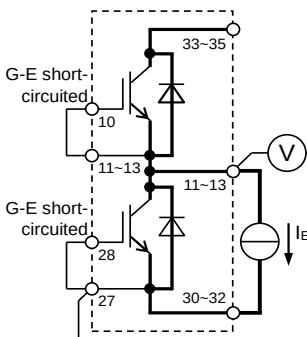
DiUP



DiVP

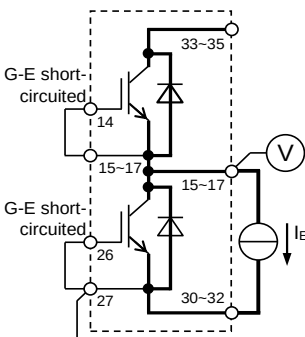


DiWP



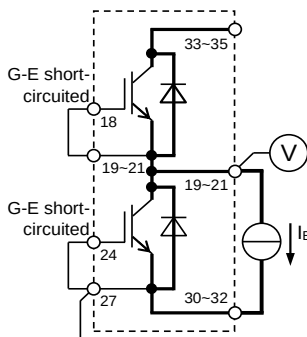
DiUN

Gate-emitter GVP-V, GVN-E1,
short-circuited GWP-W, GWN-E1
GB-E1



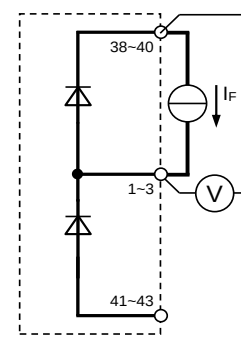
DiVN

Gate-emitter GUP-U, GUN-E1,
short-circuited GWP-W, GWN-E1
GB-E1



DiWN

Gate-emitter GUP-U, GUN-E1,
short-circuited GVP-V, GVN-E1
GB-E1

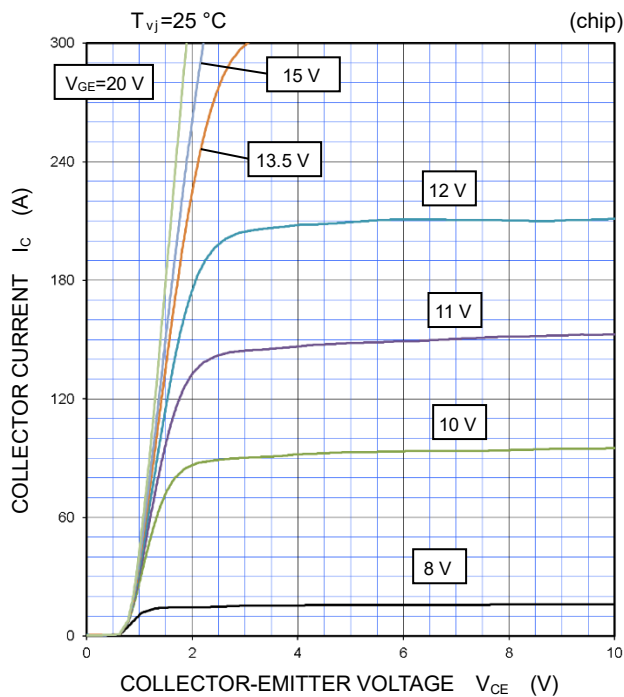
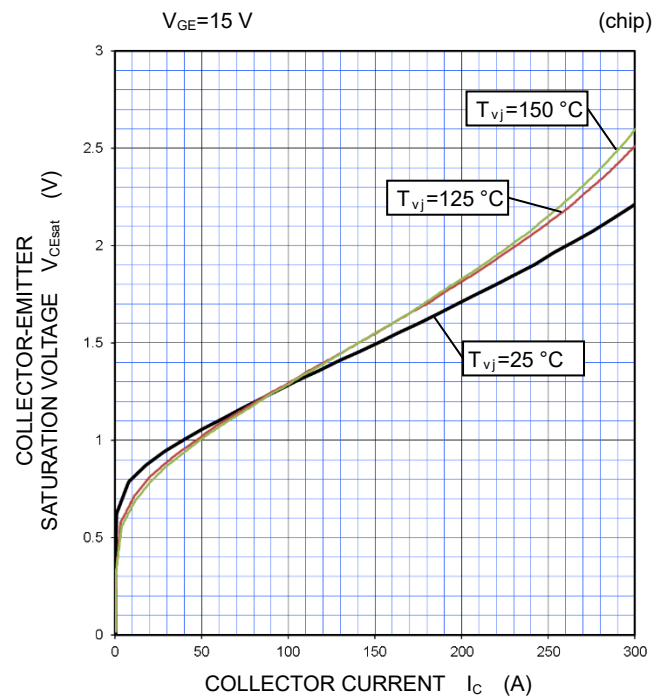
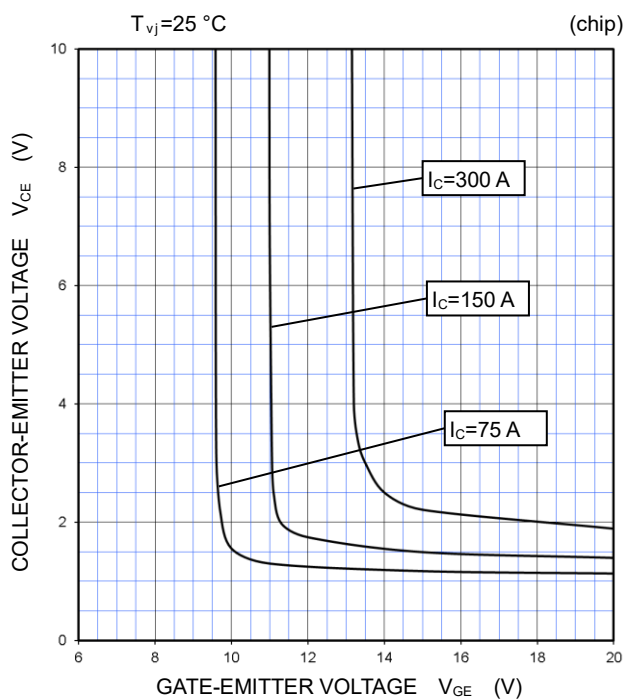
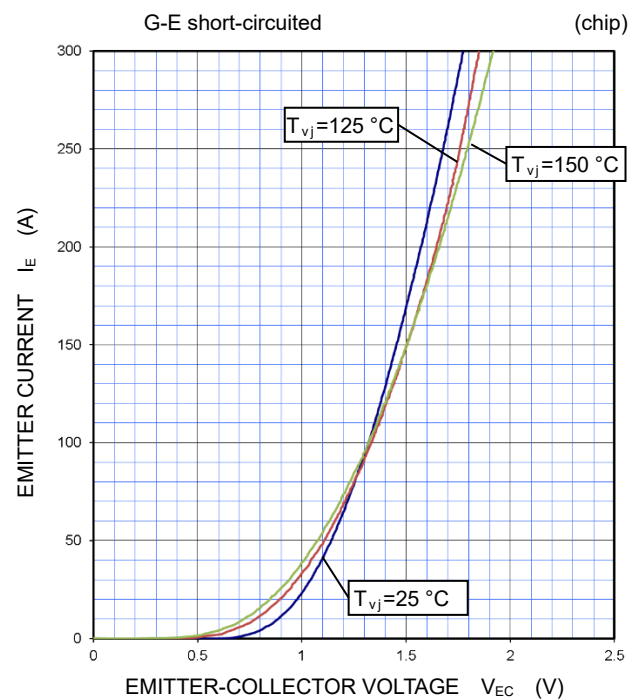


CONVERTER DIODE (ex.phase-R)

 V_{EC} / CONVERTER DIODE V_F characteristics test circuit

PERFORMANCE CURVES

INVERTER PART

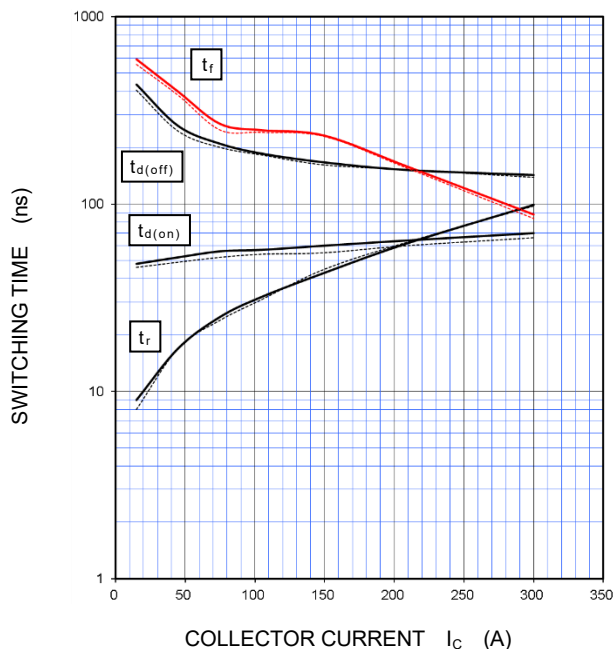
OUTPUT CHARACTERISTICS
(TYPICAL)COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS
(TYPICAL)FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)

CM150MXUD-13T1/CM150MXUDP-13T1

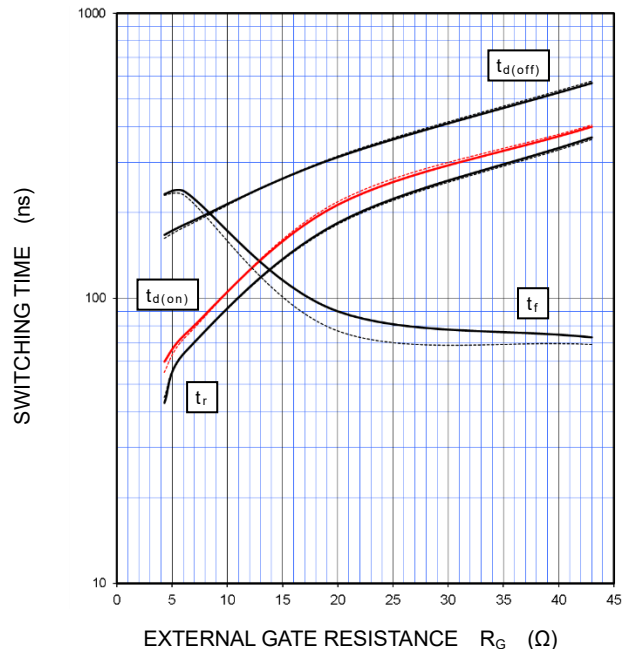
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES**INVERTER PART****HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

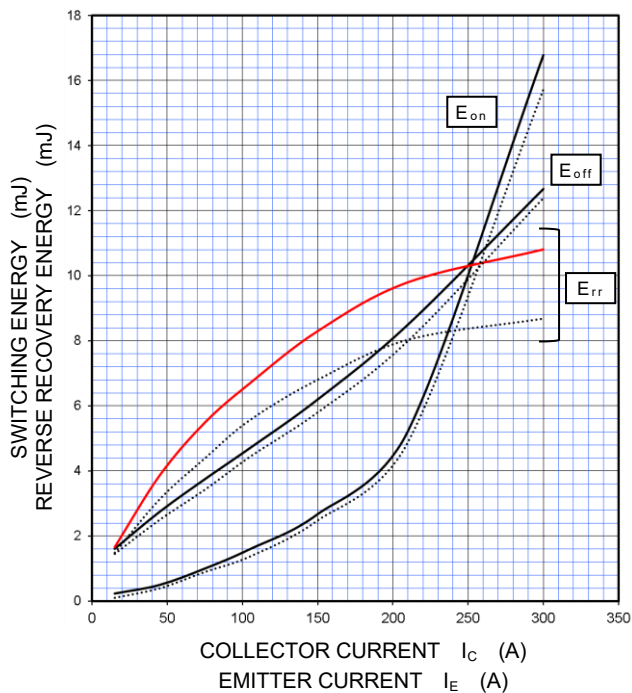
$V_{CC}=300\text{ V}$, $R_G=4.3\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - - -: $T_{vj}=125\text{ }^\circ\text{C}$

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

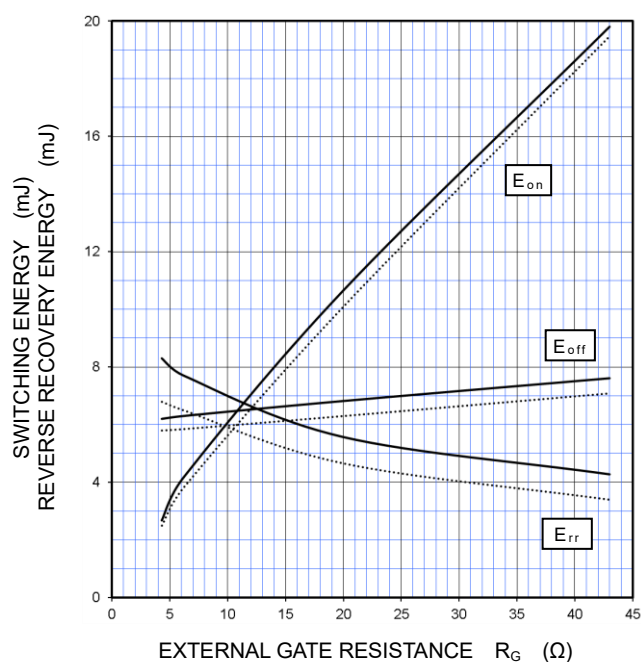
$V_{CC}=300\text{ V}$, $I_C=150\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - - -: $T_{vj}=125\text{ }^\circ\text{C}$

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

$V_{CC}=300\text{ V}$, $R_G=4.3\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD,
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - - -: $T_{vj}=125\text{ }^\circ\text{C}$, PER PULSE

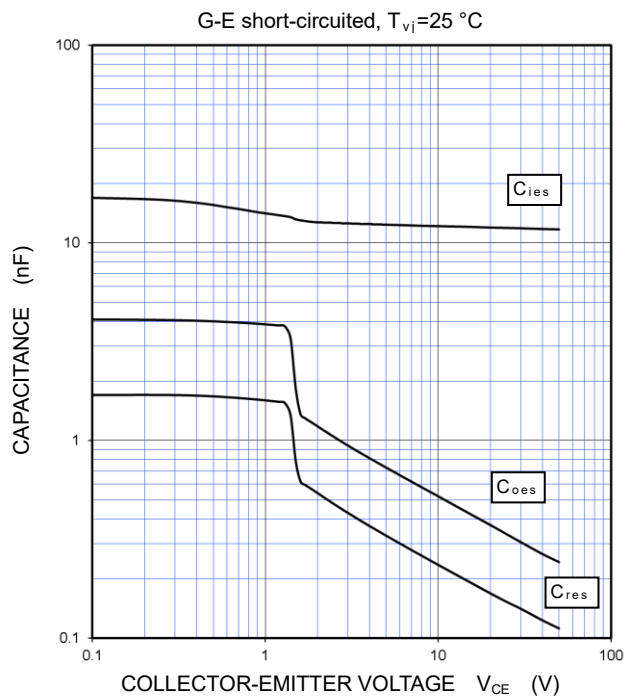
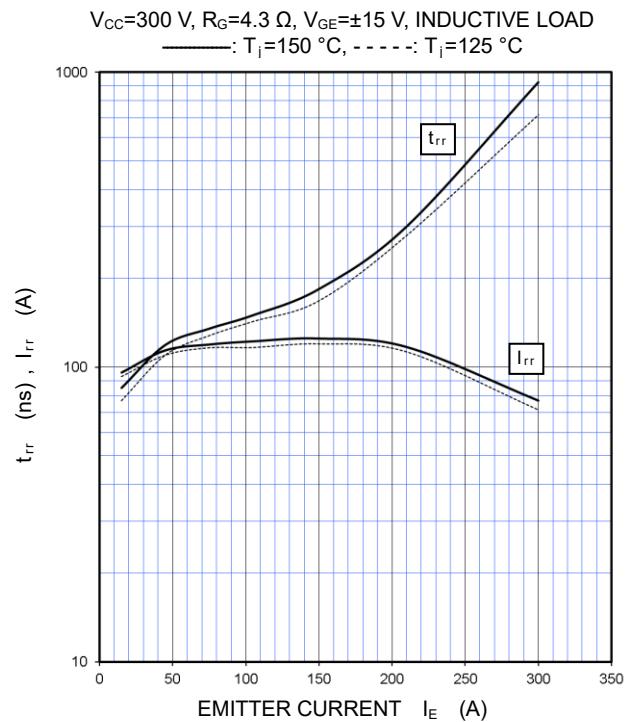
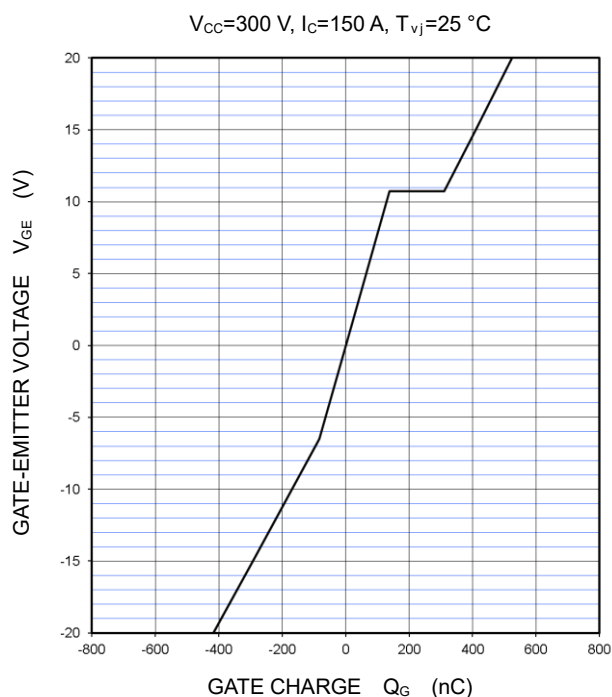
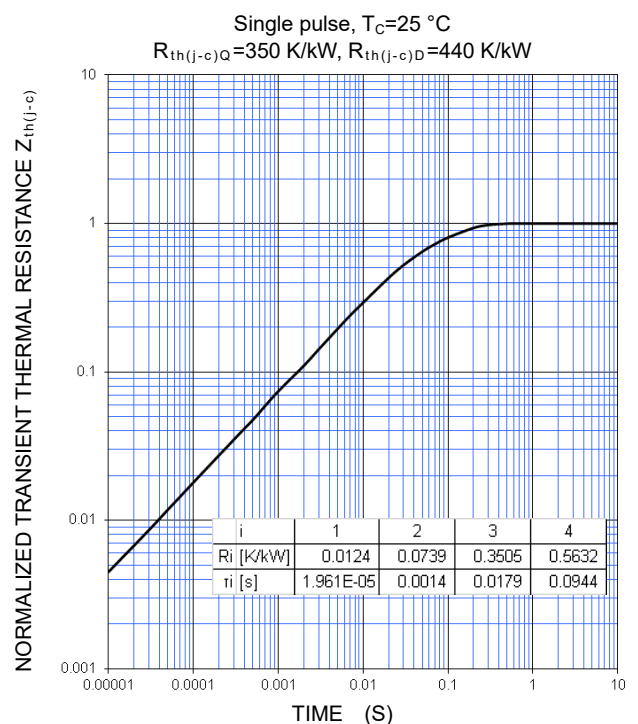
**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)**

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



PERFORMANCE CURVES

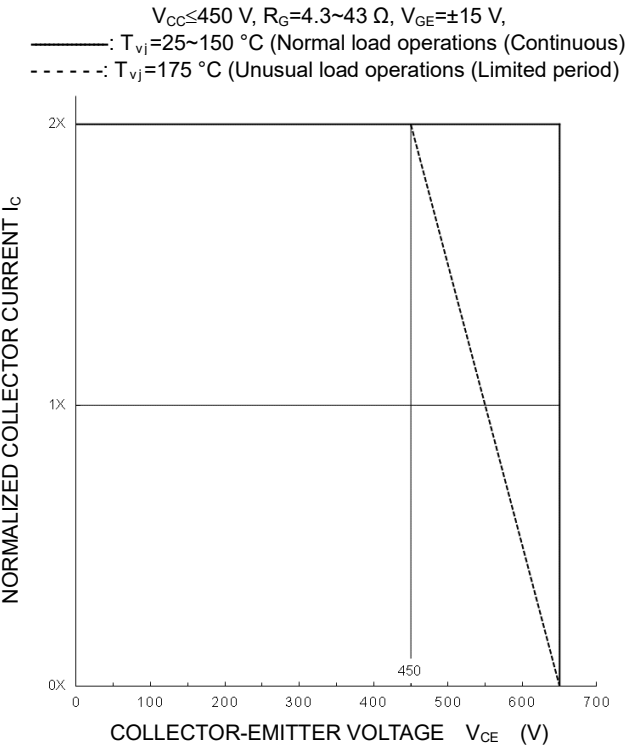
INVERTER PART

CAPACITANCE CHARACTERISTICS
(TYPICAL)FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)GATE CHARGE CHARACTERISTICS
(TYPICAL)TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)

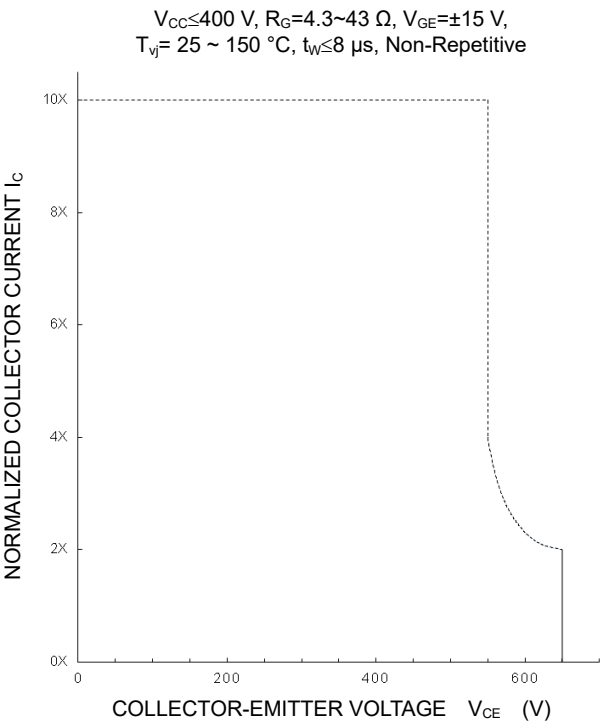
PERFORMANCE CURVES

INVERTER PART

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

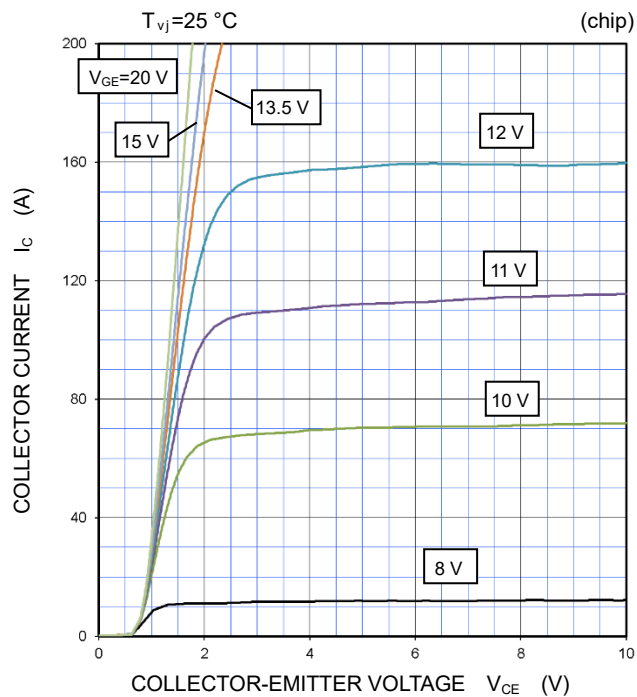
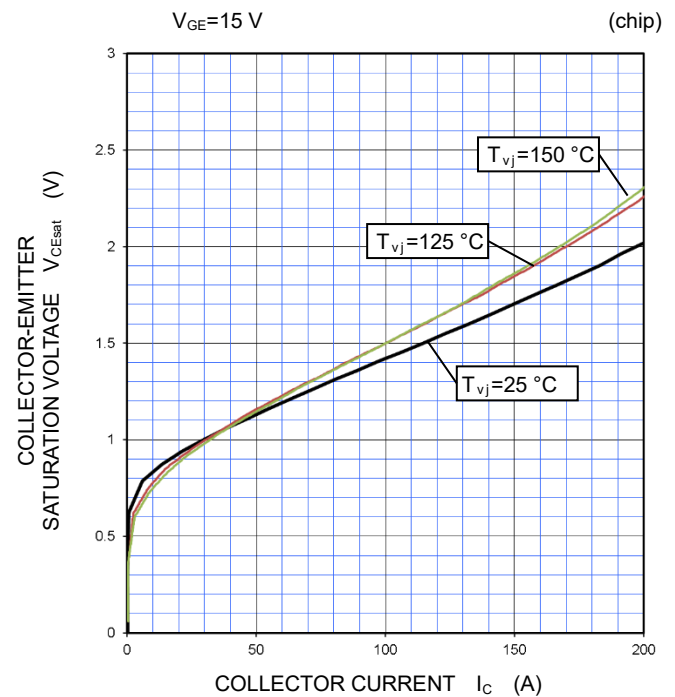
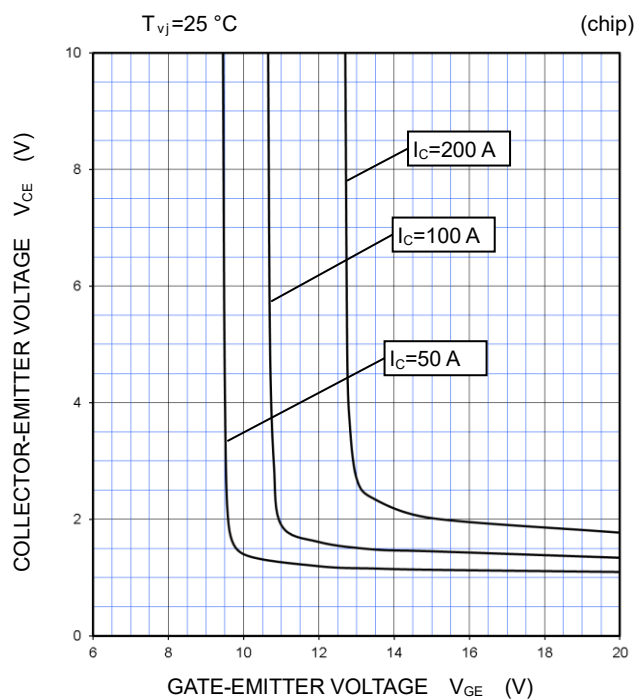
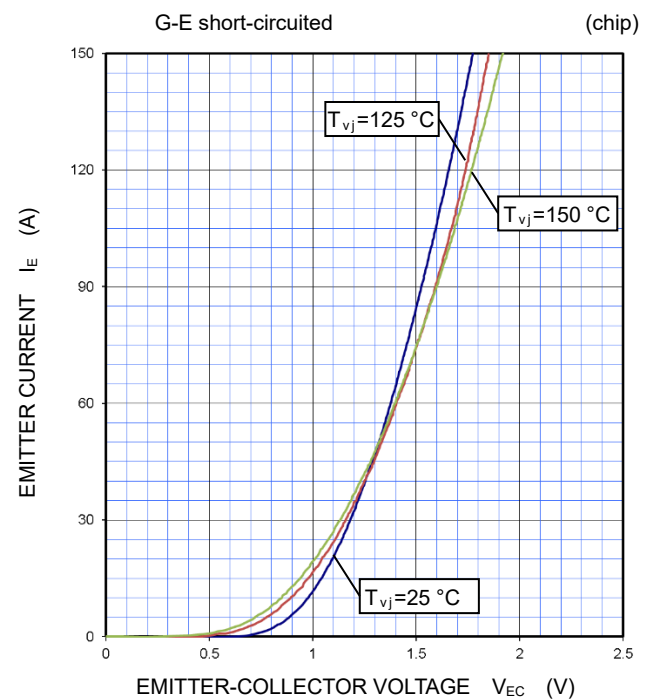


SHORT-CIRCUIT SAFE OPERATING AREA
(MAXIMUM)



PERFORMANCE CURVES

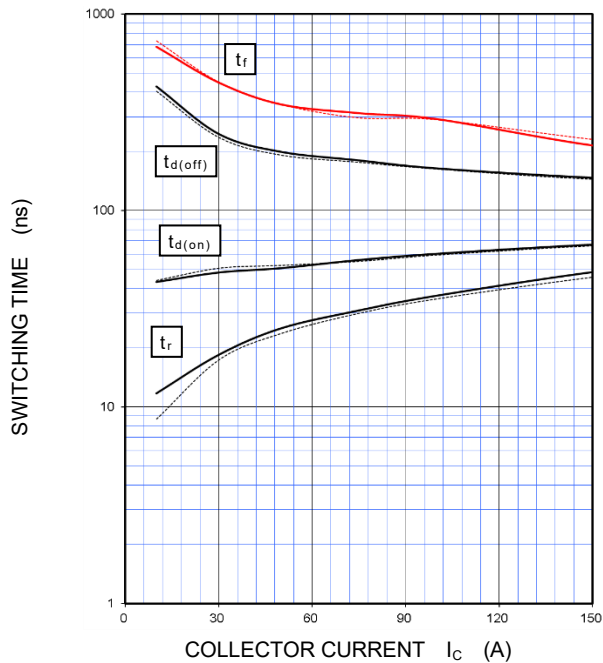
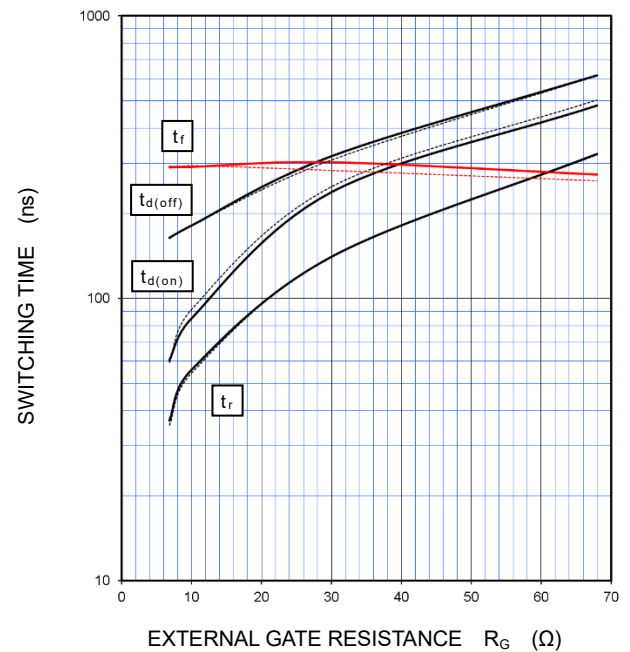
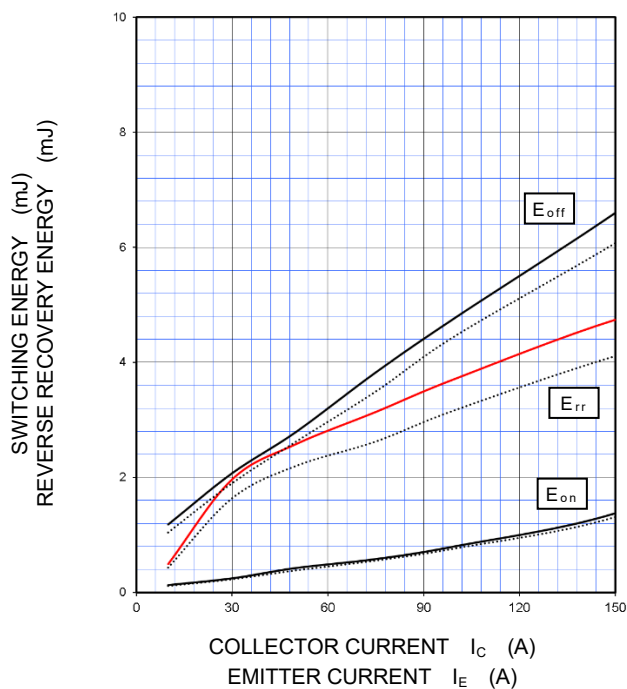
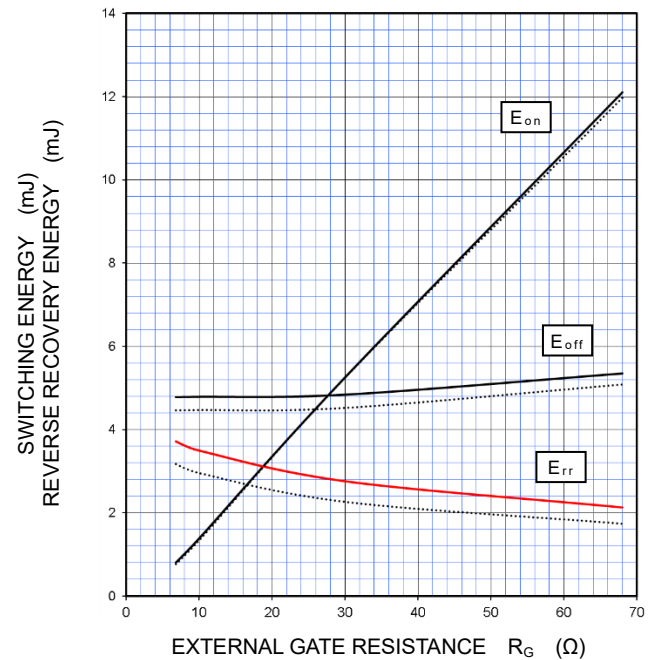
BRAKE PART

OUTPUT CHARACTERISTICS
(TYPICAL)COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS
(TYPICAL)DIODE
FORWARD CHARACTERISTICS
(TYPICAL)

CM150MXUD-13T1/CM150MXUDP-13T1

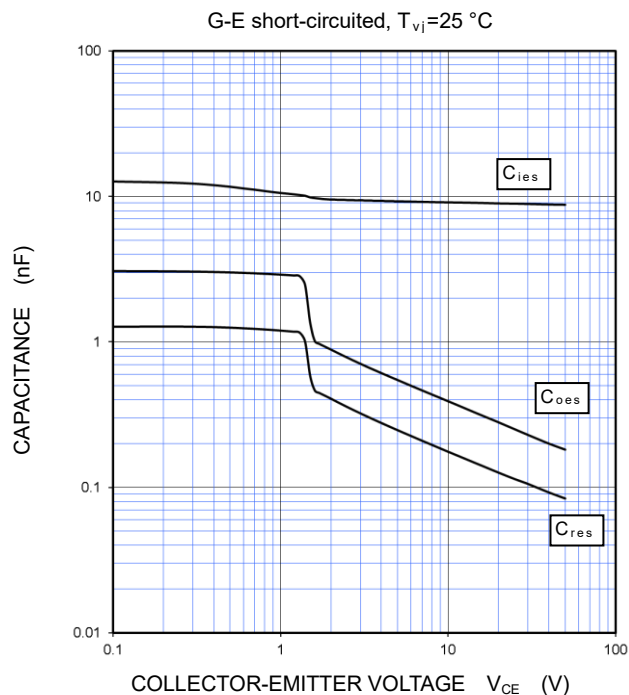
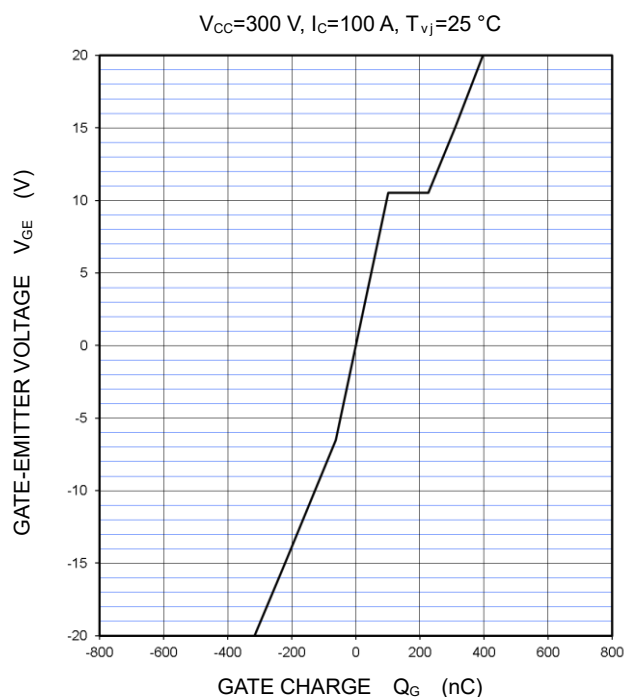
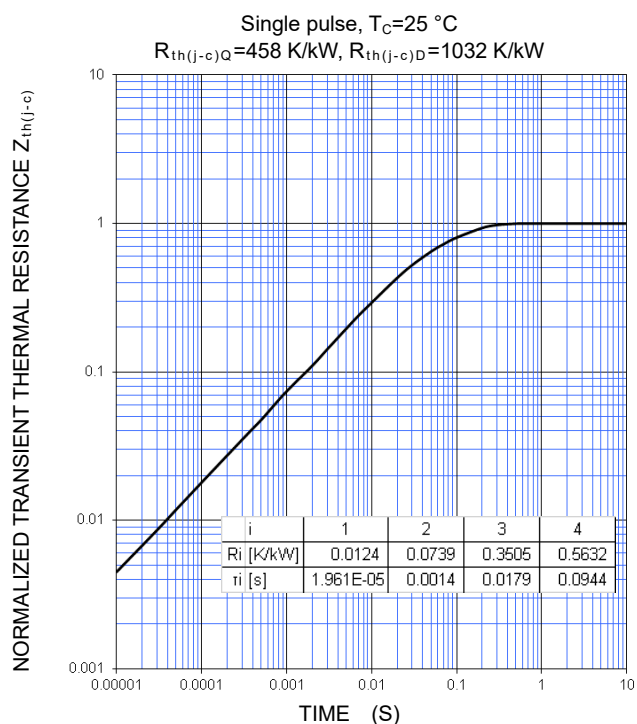
HIGH POWER SWITCHING USE

INSULATED TYPE

PERFORMANCE CURVES**BRAKE PART****HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)** $V_{CC}=300\text{ V}$, $R_G=6.8\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$ **HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)** $V_{CC}=300\text{ V}$, $I_C=100\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$ **HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)** $V_{CC}=300\text{ V}$, $R_G=6.8\ \Omega$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD,
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$, PER PULSE**HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)** $V_{CC}=300\text{ V}$, $I_C/I_E=100\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD,
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$, PER PULSE

PERFORMANCE CURVES

BRAKE PART

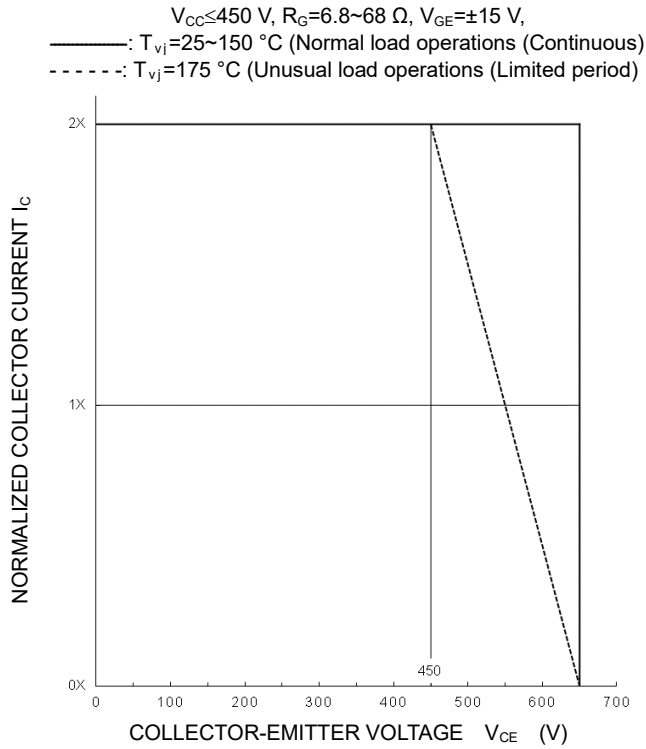
CAPACITANCE CHARACTERISTICS
(TYPICAL)GATE CHARGE CHARACTERISTICS
(TYPICAL)TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)

<IGBT Modules>
CM150MXUD-13T1/CM150MXUDP-13T1
HIGH POWER SWITCHING USE
INSULATED TYPE

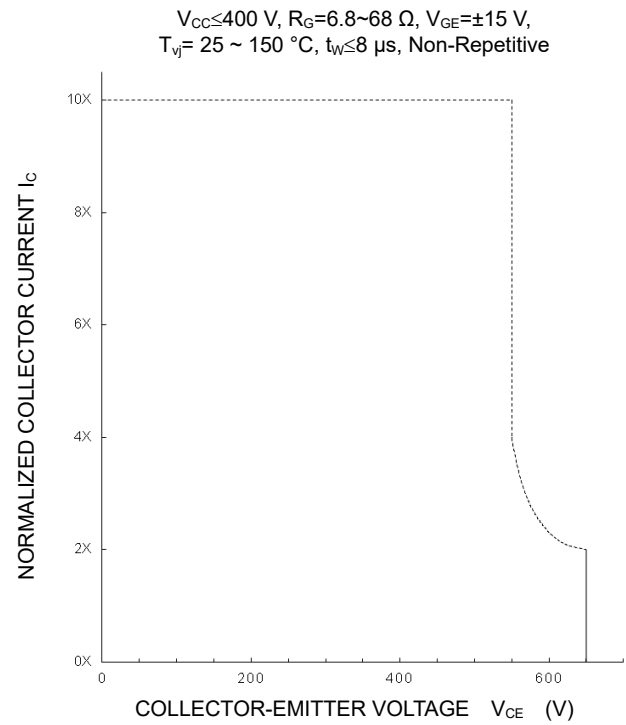
PERFORMANCE CURVES

BRAKE PART

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

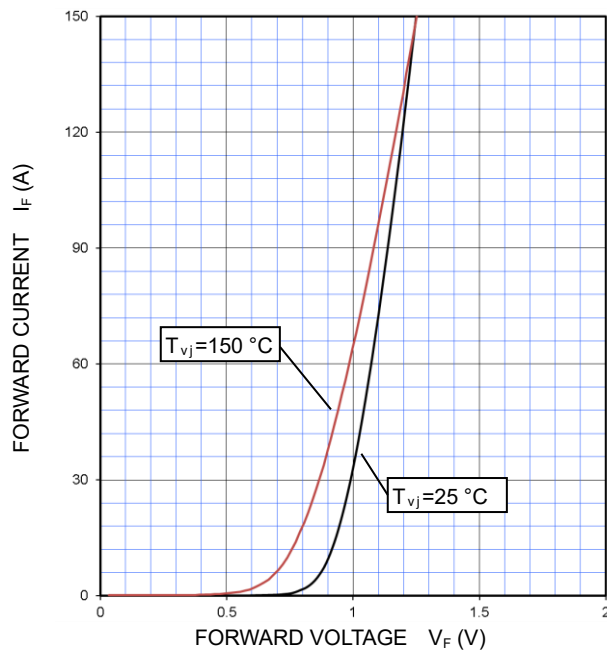


**SHORT-CIRCUIT SAFE OPERATING AREA
(MAXIMUM)**

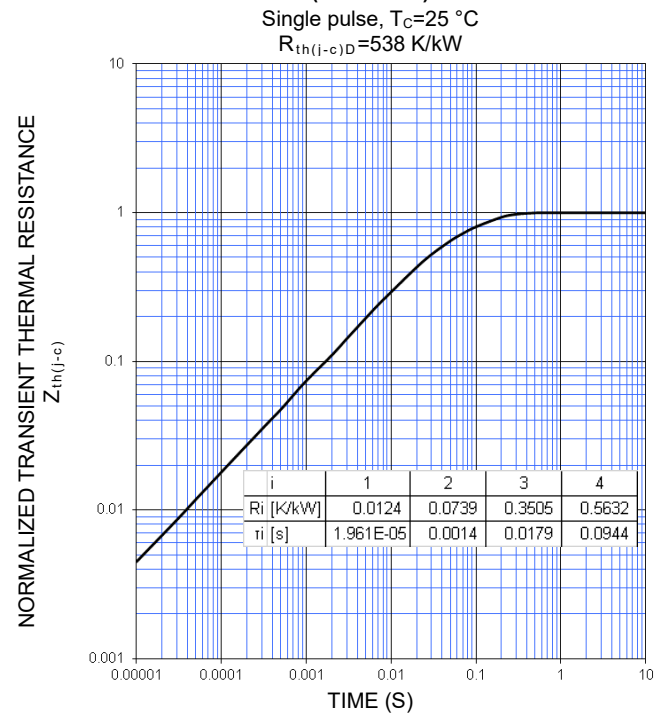


CONVERTER PART

**CONVERTER DIODE
FORWARD CHARACTERISTICS
(TYPICAL)**

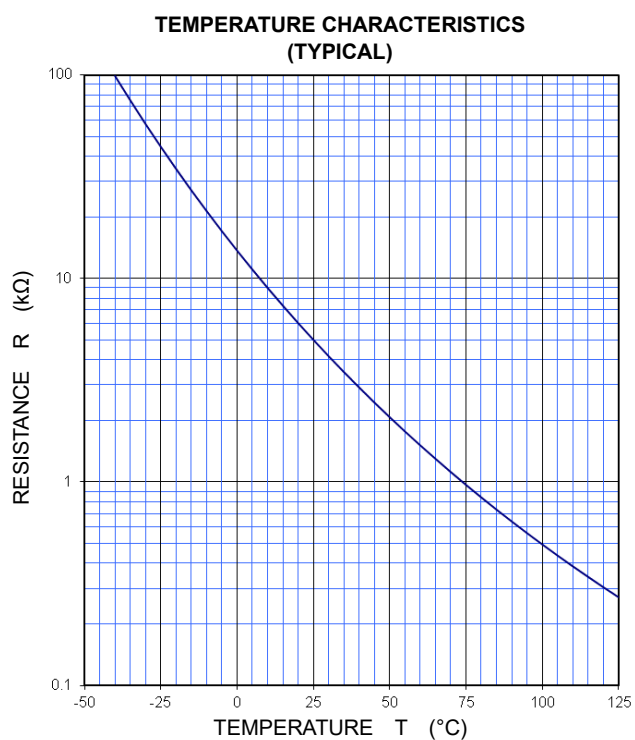


**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)**



PERFORMANCE CURVES

NTC thermistor part



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

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CM150MXUD-13T1/CM150MXUDP-13T1

HIGH POWER SWITCHING USE

INSULATED TYPE

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