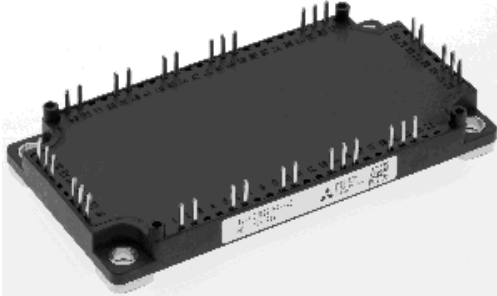


< IGBT MODULES >

CM100MXA-24S

HIGH POWER SWITCHING USE
INSULATED TYPE



CIB (Converter+Inverter+Chopper Brake)

Collector current I_C **100 A**
 Collector-emitter voltage V_{CES} **1200 V**
 Maximum junction temperature T_{jmax} **175 °C**

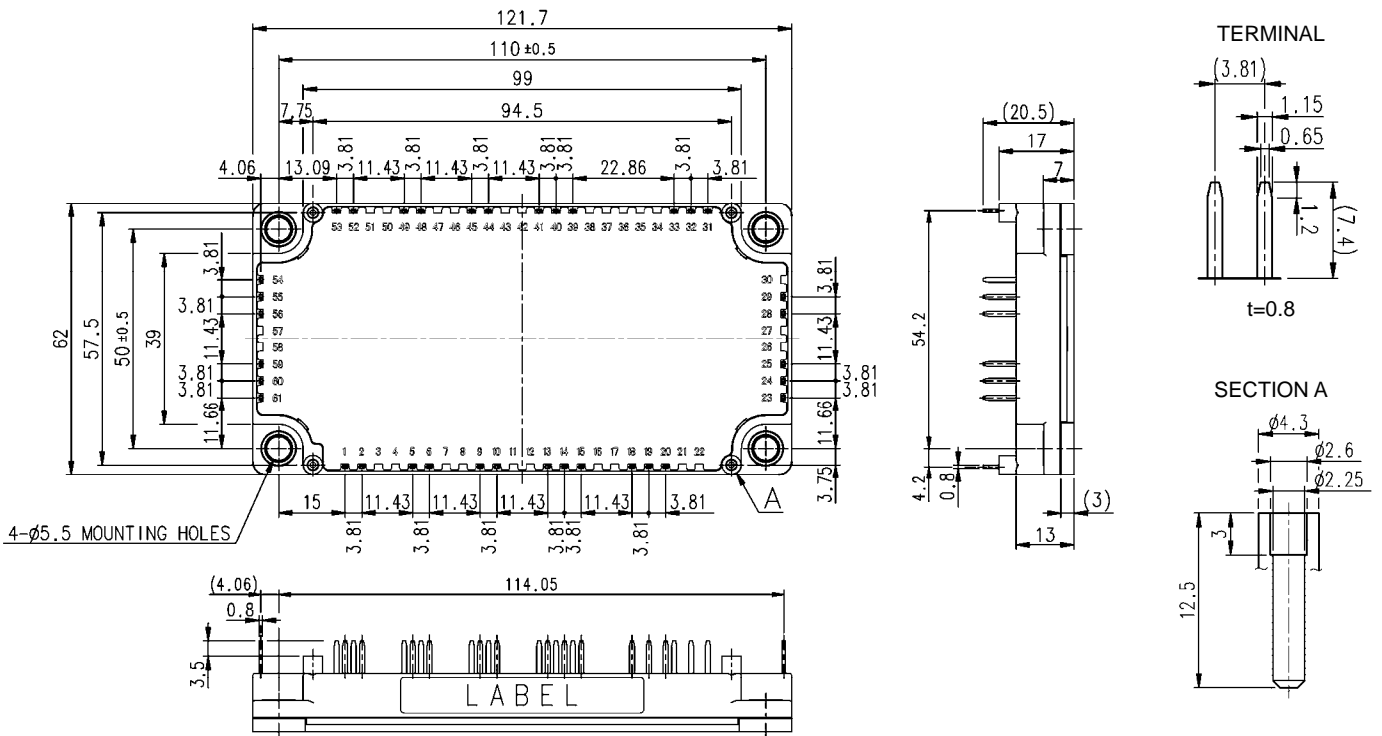
- Flat base Type
- Copper base plate
- Tin plating pin terminals
- RoHS Directive compliant
- Recognized under UL1557, File E323585

APPLICATION

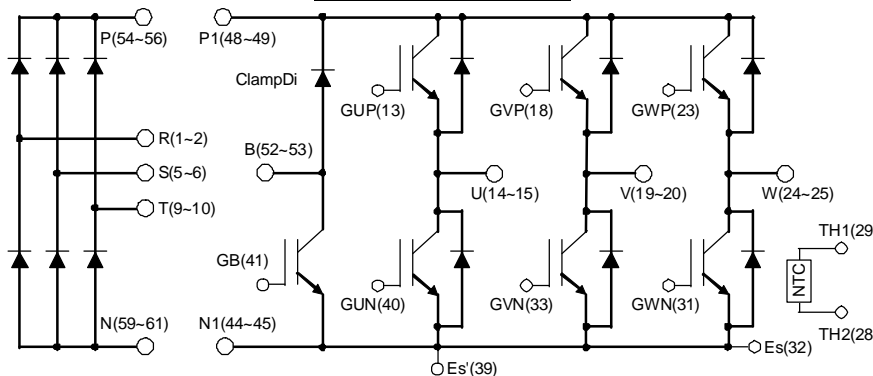
AC Motor Control, Motion/Servo Control, Power supply, etc.

OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm



INTERNAL CONNECTION



Caution: Each (two or three) pin terminal of P/N/P1/N1/U/V/W/B/R/S/T is connected in the module, but should use all each three pins for the external wiring.

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

The tolerance of size between terminals is assumed to be ±0.4.

< IGBT MODULES >

CM100MXA-24S

HIGH POWER SWITCHING USE
INSULATED TYPE

ABSOLUTE MAXIMUM RATINGS (T_j=25 °C, unless otherwise specified)

INVERTER PART IGBT/DIODE

Symbol	Item	Conditions	Rating	Unit
V _{CES}	Collector-emitter voltage	G-E short-circuited	1200	V
V _{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I _C	Collector current	DC, T _C =119 °C (Note2, 4)	100	A
I _{CRM}		Pulse, Repetitive (Note3)	200	
P _{tot}	Total power dissipation	T _C =25 °C (Note2, 4)	750	W
I _E (Note1)	Emitter current	(Note2)	100	A
I _{ERM} (Note1)		Pulse, Repetitive (Note3)	200	
T _{jm ax}	Maximum junction temperature	Instantaneous event (overload)	175	°C

BRAKE PART IGBT/DIODE

Symbol	Item	Conditions	Rating	Unit
V _{CES}	Collector-emitter voltage	G-E short-circuited	1200	V
V _{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I _C	Collector current	DC, T _C =125 °C (Note2, 4)	50	A
I _{CRM}		Pulse, Repetitive (Note3)	100	
P _{tot}	Total power dissipation	T _C =25 °C (Note2, 4)	425	W
V _{R RM}	Repetitive peak reverse voltage	G-E short-circuited	1200	V
I _F	Forward current	(Note2)	50	A
I _{FRM}		Pulse, Repetitive (Note3)	100	
T _{jm ax}	Maximum junction temperature	Instantaneous event (overload)	175	°C

CONVERTER PART DIODE

Symbol	Item	Conditions	Rating	Unit
V _{R RM}	Repetitive peak reverse voltage	-	1600	V
E _a	Recommended AC input voltage	RMS	440	V
I _O	DC output current	3-phase full wave rectifying, T _C =125 °C (Note4)	100	A
I _{FSM}	Surge forward current	The sine half wave 1 cycle peak value, f=60 Hz, non-repetitive	1000	A
I ² t	Current square time	Value for one cycle of surge current	4160	A ² s
T _{jm ax}	Maximum junction temperature	Instantaneous event (overload)	150	°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 _{C max}	Maximum case temperature	(Note4)	125	°C
T _{j op}	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	°C
T _{stg}	Storage temperature	-	-40 ~ +125	

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	Terminal to terminal	6.47	-	-	mm
		Terminal to base plate	14.27	-	-	
d _a	Clearance	Terminal to terminal	6.47	-	-	mm
		Terminal to base plate	12.33	-	-	
m	mass	-	-	300	-	g
e _c	Flatness of base plate	On the centerline X, Y (Note5)	±0	-	+100	µm

< IGBT MODULES >

CM100MXA-24S

HIGH POWER SWITCHING USE
INSULATED TYPE

ELECTRICAL CHARACTERISTICS (T_j=25 °C, unless otherwise specified)

INVERTER PART IGBT/DIODE

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
I _{CES}	Collector-emitter cut-off current	V _{CE} =V _{CES} , G-E short-circuited	-	-	1.0	mA	
I _{GES}	Gate-emitter leakage current	V _{GE} =V _{GES} , C-E short-circuited	-	-	0.5	μA	
V _{GE(th)}	Gate-emitter threshold voltage	I _C =10 mA, V _{CE} =10 V	5.4	6.0	6.6	V	
V _{CEsat}	Collector-emitter saturation voltage	I _C =100 A ^(Note6) , V _{GE} =15 V, (Terminal)	T _j =25 °C	-	1.80	2.25	V
			T _j =125 °C	-	2.00	-	
			T _j =150 °C	-	2.05	-	
		I _C =100 A ^(Note6) , V _{GE} =15 V, (Chip)	T _j =25 °C	-	1.70	2.15	V
			T _j =125 °C	-	1.90	-	
			T _j =150 °C	-	1.95	-	
C _{ies}	Input capacitance	V _{CE} =10 V, G-E short-circuited	-	-	10	nF	
C _{oes}	Output capacitance		-	-	2.0		
C _{res}	Reverse transfer capacitance		-	-	0.17		
Q _G	Gate charge	V _{CC} =600 V, I _C =100 A, V _{GE} =15 V	-	233	-	nC	
t _{d(on)}	Turn-on delay time	V _{CC} =600 V, I _C =100 A, V _{GE} =±15 V, R _G =6.2 Ω, Inductive load	-	-	300	ns	
t _r	Rise time		-	-	200		
t _{d(off)}	Turn-off delay time		-	-	600		
t _f	Fall time		-	-	300		
V _{EC} ^(Note1)	Emitter-collector voltage	I _E =100 A ^(Note6) , G-E short-circuited, (Terminal)	T _j =25 °C	-	1.80	2.25	V
			T _j =125 °C	-	1.80	-	
			T _j =150 °C	-	1.80	-	
		I _E =100 A ^(Note6) , G-E short-circuited, (Chip)	T _j =25 °C	-	1.70	2.15	V
			T _j =125 °C	-	1.70	-	
			T _j =150 °C	-	1.70	-	
t _{rr} ^(Note1)	Reverse recovery time	V _{CC} =600 V, I _E =100 A, V _{GE} =±15 V, R _G =6.2 Ω, Inductive load	-	-	300	ns	
Q _{rr} ^(Note1)	Reverse recovery charge	R _G =6.2 Ω, Inductive load	-	5.3	-	μC	
E _{on}	Turn-on switching energy per pulse	V _{CC} =600 V, I _C =I _E =100 A, V _{GE} =±15 V, R _G =6.2 Ω, T _j =150 °C, Inductive load	-	8.6	-	mJ	
E _{off}	Turn-off switching energy per pulse		-	10.7	-		
E _{rr} ^(Note1)	Reverse recovery energy per pulse		-	10.2	-		
R _{CC+EE'}	Internal lead resistance	Main terminals-chip, per switch, T _C =25 °C ^(Note4)	-	-	3.5	mΩ	
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 =5 mA, V _{CE} =10 V	5.4	6.0	6.6	V	
V _{CEsat}	Collector-emitter saturation voltage	I _C =50 A ^(Note6) , V _{GE} =15 V, (Terminal)	T _j =25 °C	-	1.80	2.25	V
			T _j =125 °C	-	2.00	-	
			T _j =150 °C	-	2.05	-	
		I _C =50 A ^(Note6) , V _{GE} =15 V, (Chip)	T _j =25 °C	-	1.70	2.15	V
			T _j =125 °C	-	1.90	-	
			T _j =150 °C	-	1.95	-	
C _{ies}	Input capacitance	V _{CE} =10 V, G-E short-circuited	-	-	5.0	nF	
C _{oes}	Output capacitance		-	-	1.0		
C _{res}	Reverse transfer capacitance		-	-	0.08		
Q _G	Gate charge	V _{CC} =600 V, I _C =50 A, V _{GE} =15 V	-	117	-	nC	

< IGBT MODULES >

CM100MXA-24S

HIGH POWER SWITCHING USE
INSULATED TYPE

ELECTRICAL CHARACTERISTICS (cont.; T_j=25 °C, unless otherwise specified)

BRAKE PART IGBT/DIODE

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
t _{d(on)}	Turn-on delay time	V _{CC} =600 V, I _C =50 A, V _{GE} =±15 V, R _G =13 Ω, Inductive load	-	-	300	ns	
t _r	Rise time		-	-	200		
t _{d(off)}	Turn-off delay time		-	-	600		
t _f	Fall time		-	-	300		
I _{RRM}	Reverse current	V _R =V _{RRM} , G-E short-circuited	-	-	1.0	mA	
V _F	Forward voltage	I _F =50 A ^(Note6) , G-E short-circuited, (Terminal)	T _j =25 °C	-	1.80	2.25	V
			T _j =125 °C	-	1.80	-	
			T _j =150 °C	-	1.80	-	
		I _F =50 A ^(Note6) , G-E short-circuited, (Chip)	T _j =25 °C	-	1.70	2.15	V
			T _j =125 °C	-	1.70	-	
			T _j =150 °C	-	1.70	-	
t _{rr}	Reverse recovery time	V _{CC} =600 V, I _F =50 A, V _{GE} =±15 V, R _G =13 Ω, Inductive load	-	-	300	ns	
Q _{rr}	Reverse recovery charge	R _G =13 Ω, Inductive load	-	2.7	-	μC	
E _{on}	Turn-on switching energy per pulse	V _{CC} =600 V, I _C =I _F =50 A,	-	5.5	-	mJ	
E _{off}	Turn-off switching energy per pulse	V _{GE} =±15 V, R _G =13 Ω, T _j =150 °C,	-	5.3	-		
E _{rr}	Reverse recovery energy per pulse	Inductive load	-	4.5	-	mJ	
r _g	Internal gate resistance	-	-	0	-	Ω	

CONVERTER PART DIODE

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
I _{RRM}	Repetitive peak reverse current	V _R =V _{RRM} , T _j =150 °C	-	-	20	mA
V _F (Terminal)	Forward voltage	I _F =100 A ^(Note6)	-	1.28	1.8	V

NTC THERMISTOR PART

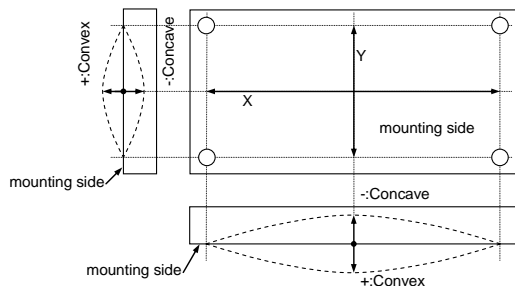
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R ₂₅	Zero-power resistance	T _C =25 °C ^(Note4)	4.85	5.00	5.15	kΩ
ΔR/R	Deviation of resistance	R ₁₀₀ =493 Ω, T _C =100 °C ^(Note4)	-7.3	-	+7.8	%
B _(25/50)	B-constant	Approximate by equation ^(Note7)	-	3375	-	K
P ₂₅	Power dissipation	T _C =25 °C ^(Note4)	-	-	10	mW

THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R _{th(j-c)Q}	Thermal resistance ^(Note4)	Junction to case, per Inverter IGBT	-	-	0.20	K/W
R _{th(j-c)D}		Junction to case, per Inverter DIODE	-	-	0.29	
R _{th(j-c)Q}		Junction to case, per Brake IGBT	-	-	0.35	K/W
R _{th(j-c)D}		Junction to case, per Brake DIODE	-	-	0.63	
R _{th(j-c)D}		Junction to case, per Converter DIODE	-	-	0.24	K/W
R _{th(c-s)}	Contact thermal resistance ^(Note4)	Case to heat sink, per 1 module, Thermal grease applied ^(Note8)	-	15	-	K/kW

< IGBT MODULES >
CM100MXA-24S
HIGH POWER SWITCHING USE
INSULATED TYPE

- Note1. Represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (FWDi).
- Junction temperature (T_j) should not increase beyond T_{jmax} rating.
 - Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} rating.
 - Case temperature (T_c) and heat sink temperature (T_s) are defined on the each surface (mounting side) of base plate and heat sink just under the chips. Refer to the figure of chip location.
 - The base plate (mounting side) flatness measurement points (X, Y) are as follows of the following figure.



- Pulse width and repetition rate should be such as to cause negligible temperature rise. Refer to the figure of test circuit.

$$7. B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right),$$

R_{25} : resistance at absolute temperature T_{25} [K]; $T_{25}=25 [^{\circ}\text{C}]+273.15=298.15$ [K]

R_{50} : resistance at absolute temperature T_{50} [K]; $T_{50}=50 [^{\circ}\text{C}]+273.15=323.15$ [K]

- Typical value is measured by using thermally conductive grease of $\lambda=0.9$ W/(m·K).
- Use the following screws when mounting the printed circuit board (PCB) on the stand offs.
 "φ2.6×10 or φ2.6×12 self tapping screw"
 The length of the screw depends on the thickness (t1.6~t2.0) of the PCB.

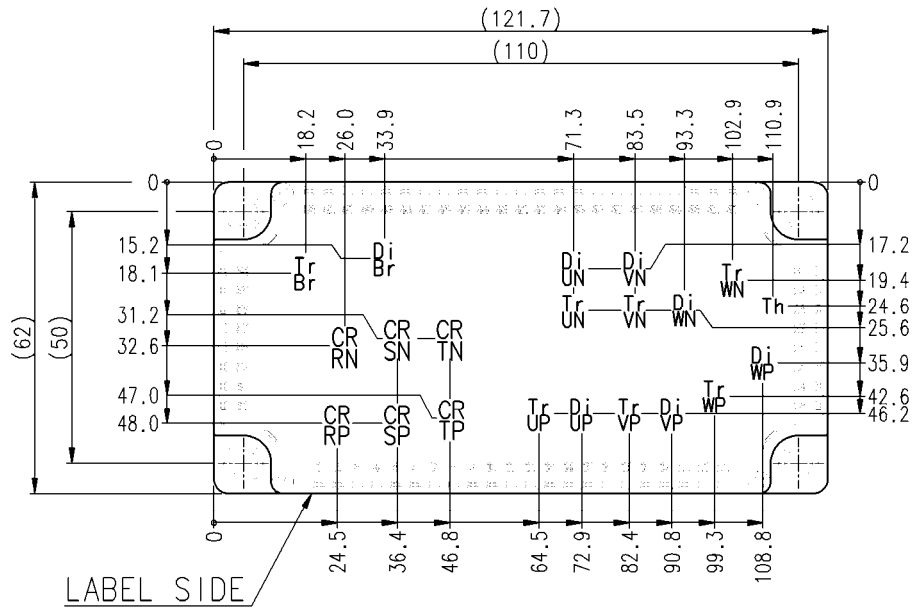
RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across P-N/P1-N1 terminals	-	600	850	V
V_{GEon}	Gate (-emitter drive) voltage	Applied across GB-Es/ G*P-*/G*N-Es(*=U, V, W) terminals	13.5	15.0	16.5	V
R_G	External gate resistance	Per switch				Ω
		Inverter IGBT	6.2	-	62	
		Brake IGBT	13	-	130	

< IGBT MODULES >
CM100MXA-24S
 HIGH POWER SWITCHING USE
 INSULATED TYPE

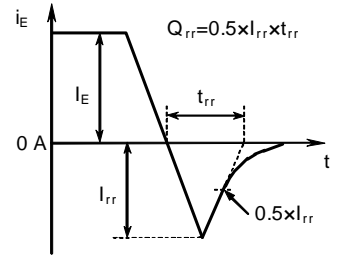
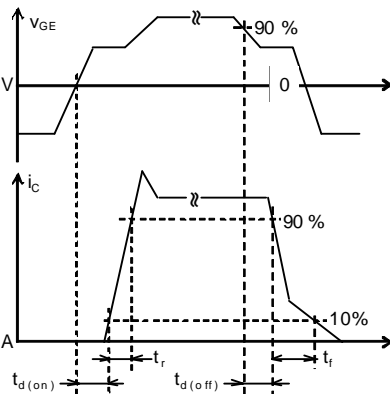
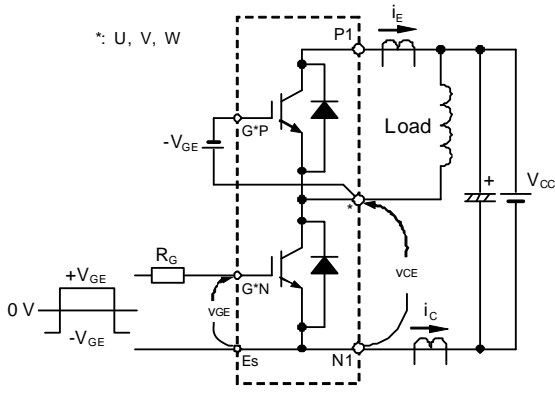
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm



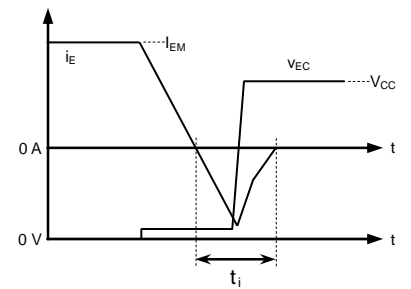
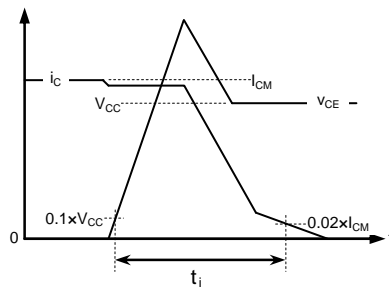
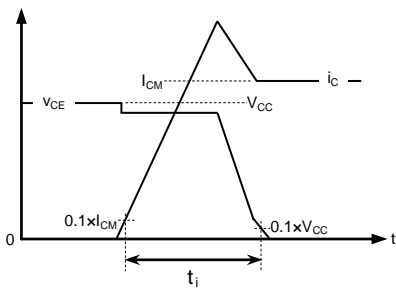
Tr*P/Tr*N/Tr*Br: IGBT, Di*P/Di*N: DIODE (*=U/V/W), Di*Br: BRAKE DIODE, CR*P/CR*N: CONVERTER DIODE (*=R/S/T), Th: NTC thermistor

TEST CIRCUIT AND WAVEFORMS



Switching characteristics test circuit and waveforms

t_{rr}, Q_{rr} test waveform



IGBT Turn-on switching energy

IGBT Turn-off switching energy

DIODE Reverse recovery energy

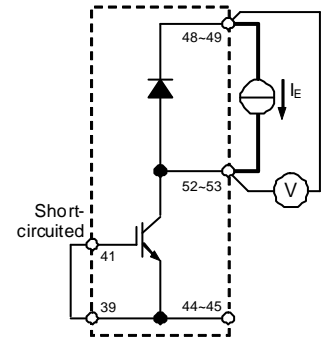
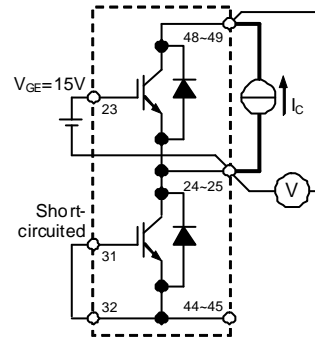
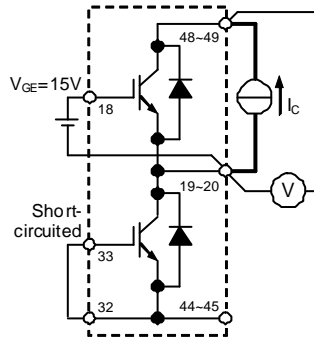
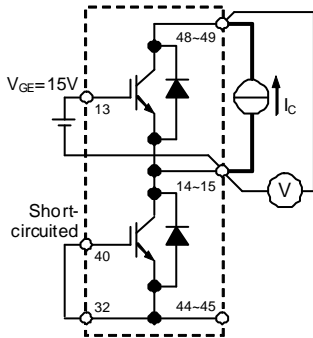
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

< IGBT MODULES >

CM100MXA-24S

HIGH POWER SWITCHING USE
INSULATED TYPE

TEST CIRCUIT



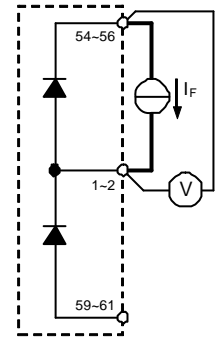
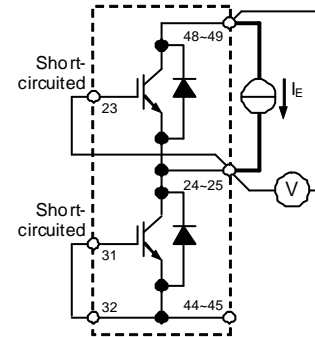
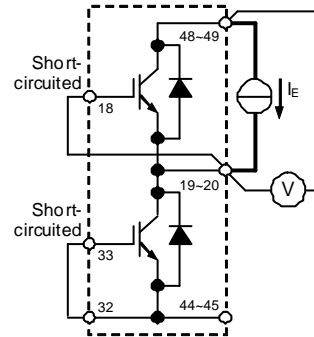
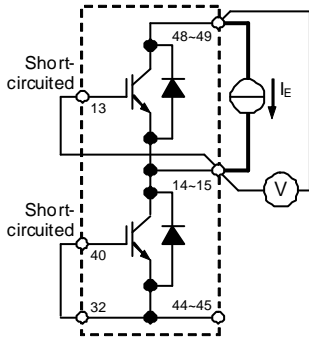
G-E short-circuited
UP / UN IGBT

G-E short-circuited
VP / VN IGBT

G-E short-circuited
WP / WN IGBT

G-E short-circuited
Brake IGBT / DIODE

V_{CEsat} / BRAKE DIODE V_F test circuit



G-E short-circuited
UP / UN DIODE

G-E short-circuited
VP / VN DIODE

G-E short-circuited
WP / WN DIODE

CONVERTER DIODE (ex. phase-R)

V_{EC} / CONVERTER DIODE V_F test circuit

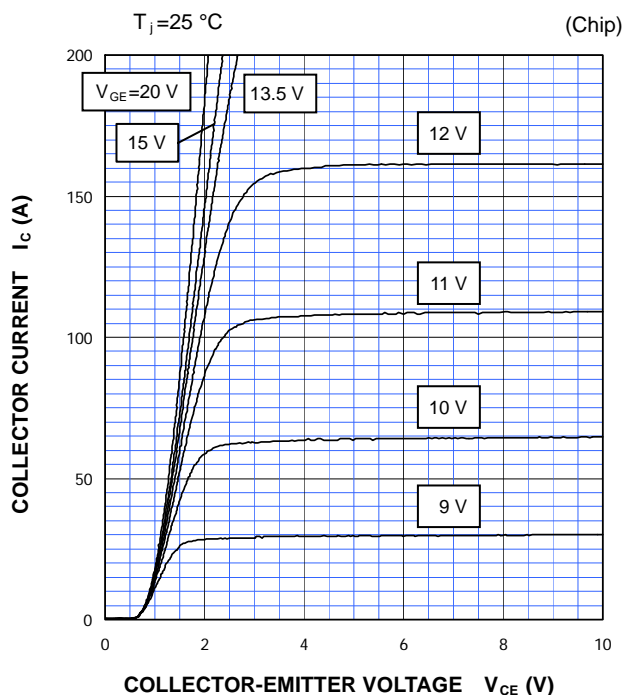
* In the above test circuit, should use all three main pin terminals (P1/N1/P/N/U/V/W) for connection with the terminals and the current source.

< IGBT MODULES >
CM100MXA-24S
 HIGH POWER SWITCHING USE
 INSULATED TYPE

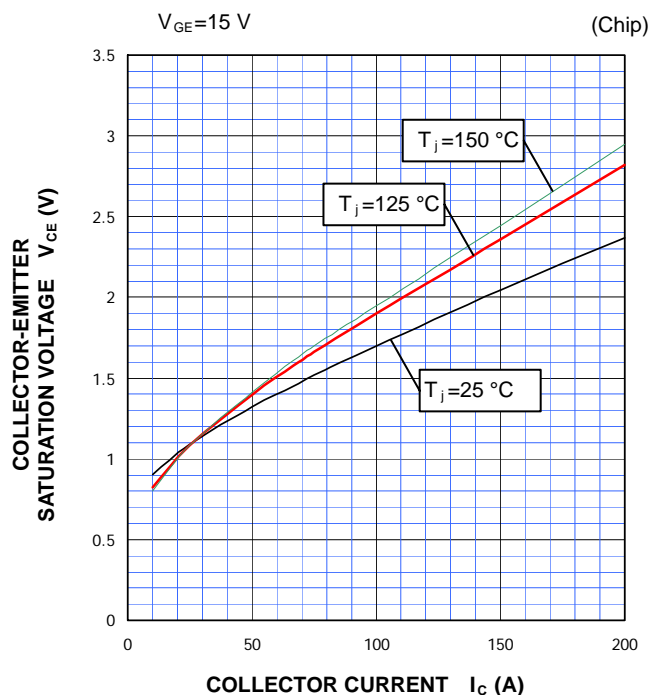
PERFORMANCE CURVES

INVERTER PART

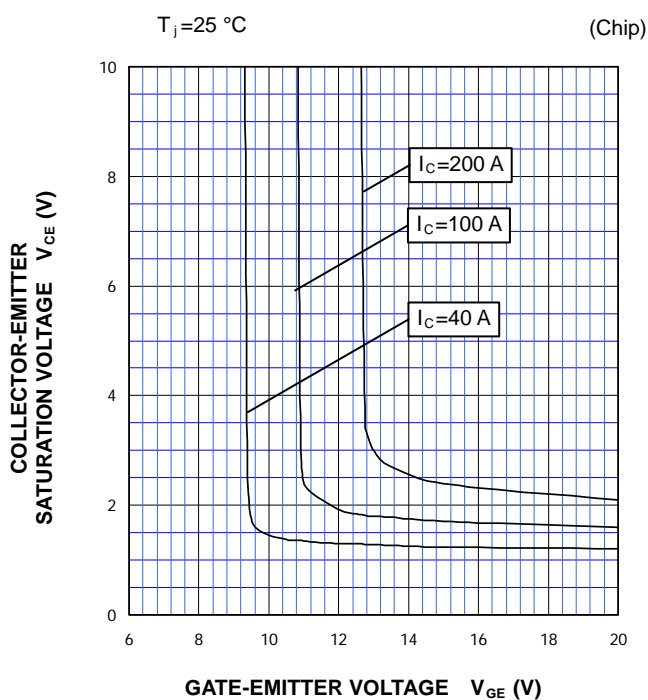
OUTPUT CHARACTERISTICS (TYPICAL)



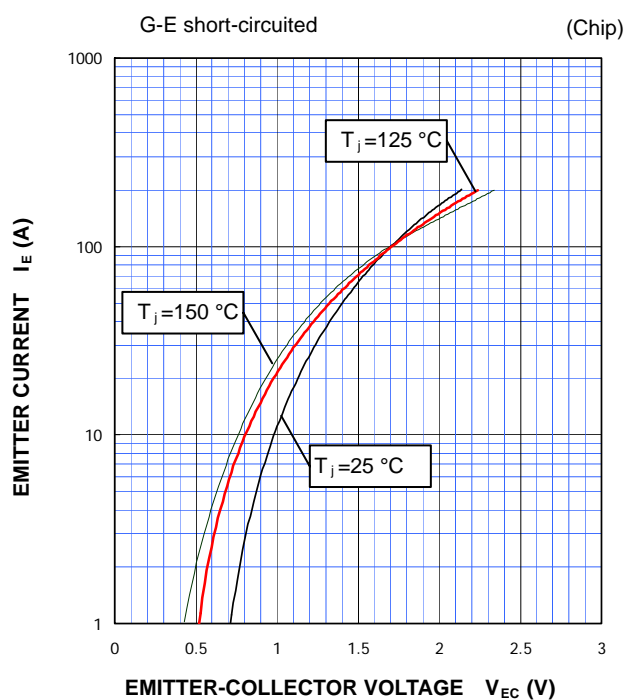
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)

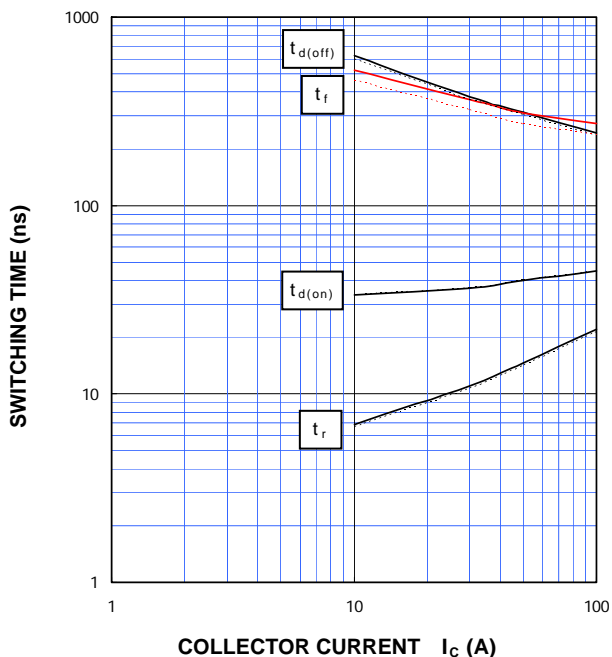


PERFORMANCE CURVES

INVERTER PART

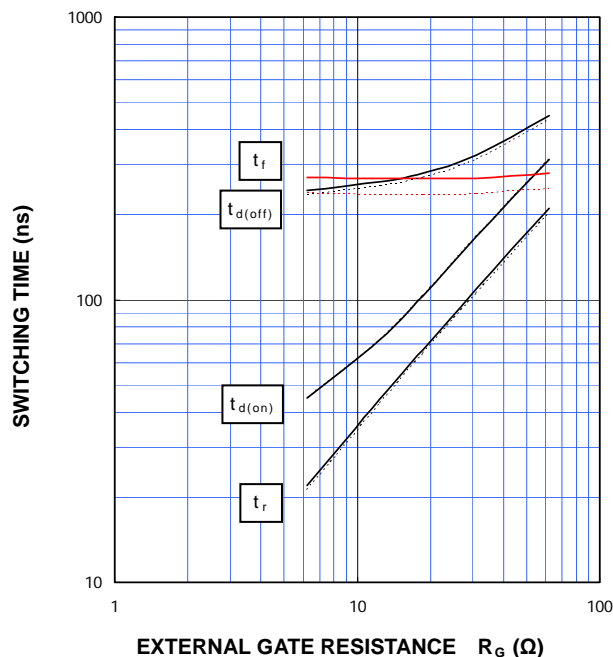
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=6.2\ \Omega$, INDUCTIVE LOAD
—: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



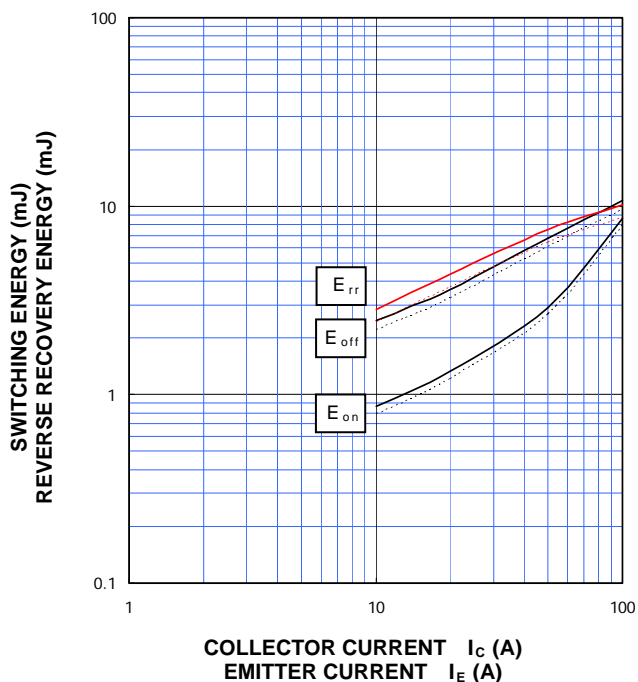
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=100\text{ A}$, INDUCTIVE LOAD
—: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



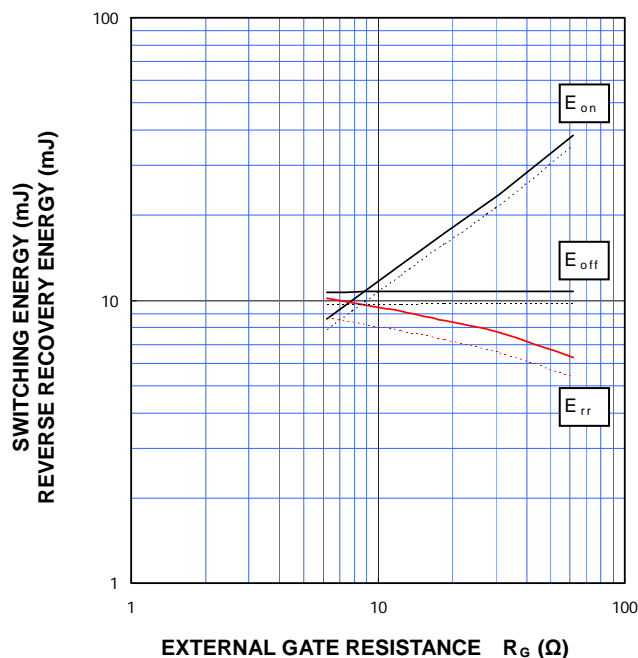
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=6.2\ \Omega$,
INDUCTIVE LOAD, PER PULSE
—: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=100\text{ A}$,
INDUCTIVE LOAD, PER PULSE
—: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$

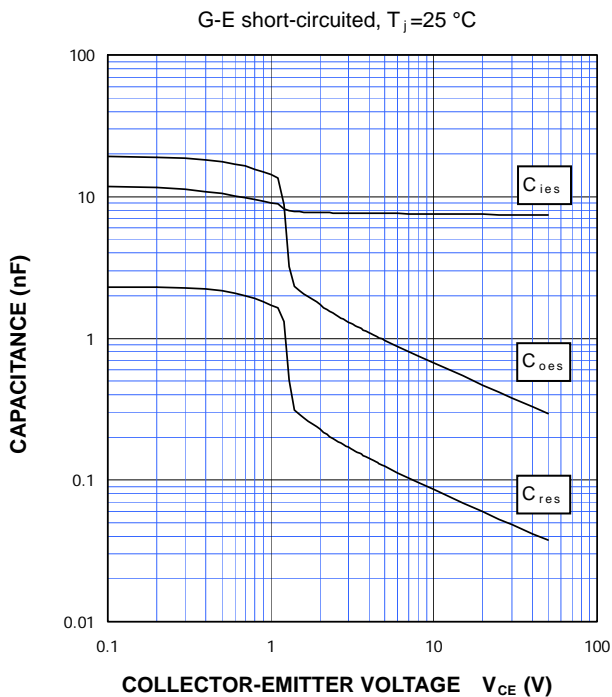


< IGBT MODULES >
CM100MXA-24S
 HIGH POWER SWITCHING USE
 INSULATED TYPE

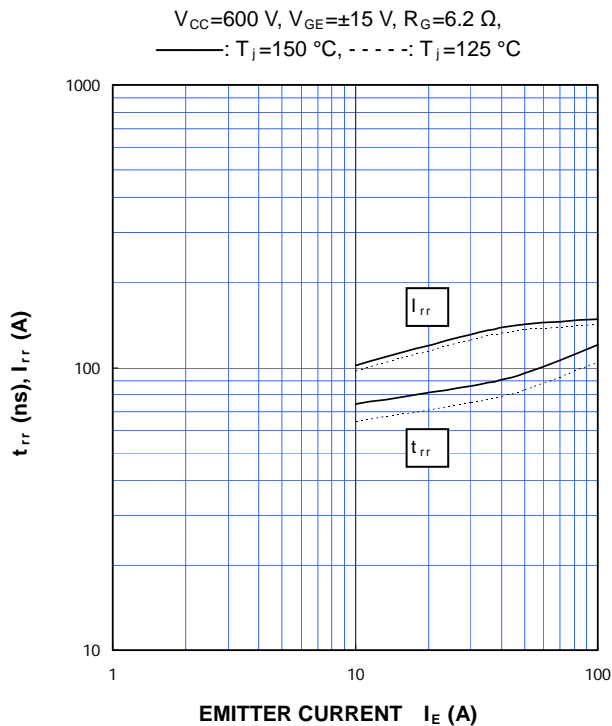
PERFORMANCE CURVES

INVERTER PART

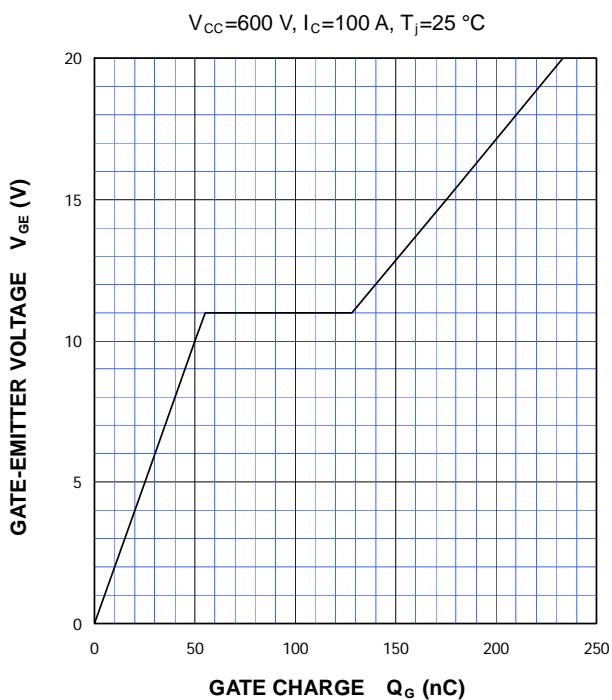
**CAPACITANCE CHARACTERISTICS
 (TYPICAL)**



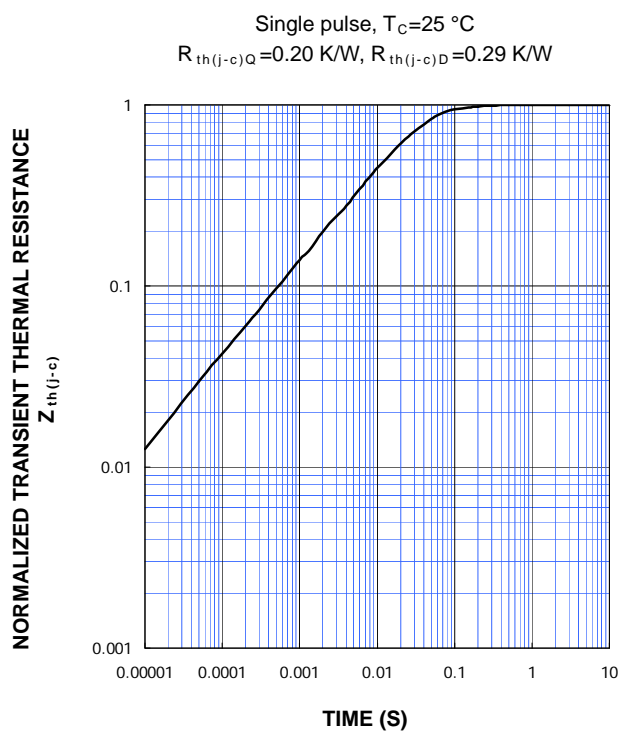
**FREE WHEELING DIODE
 REVERSE RECOVERY CHARACTERISTICS
 (TYPICAL)**



**GATE CHARGE CHARACTERISTICS
 (TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
 (MAXIMUM)**

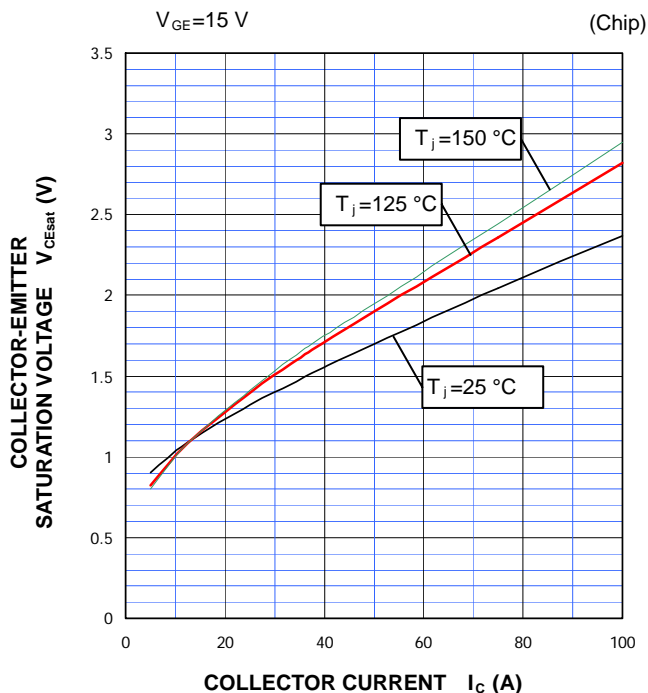


< IGBT MODULES >
CM100MXA-24S
 HIGH POWER SWITCHING USE
 INSULATED TYPE

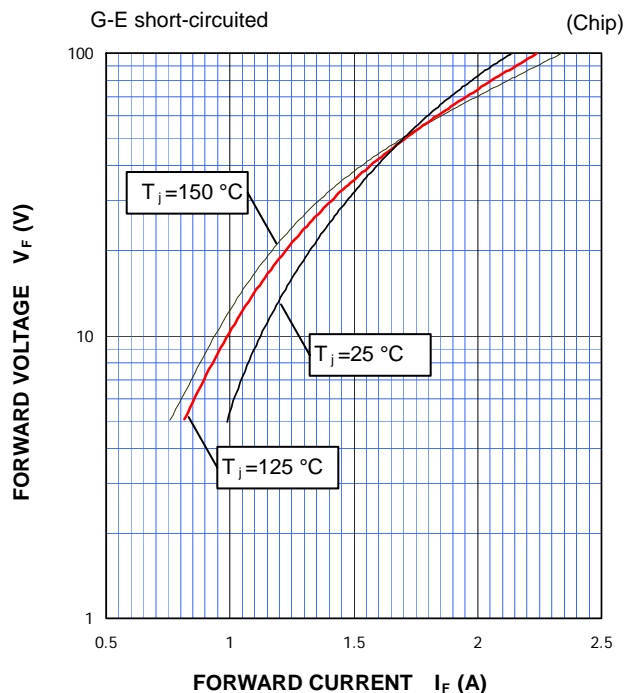
PERFORMANCE CURVES

BRAKE PART

COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

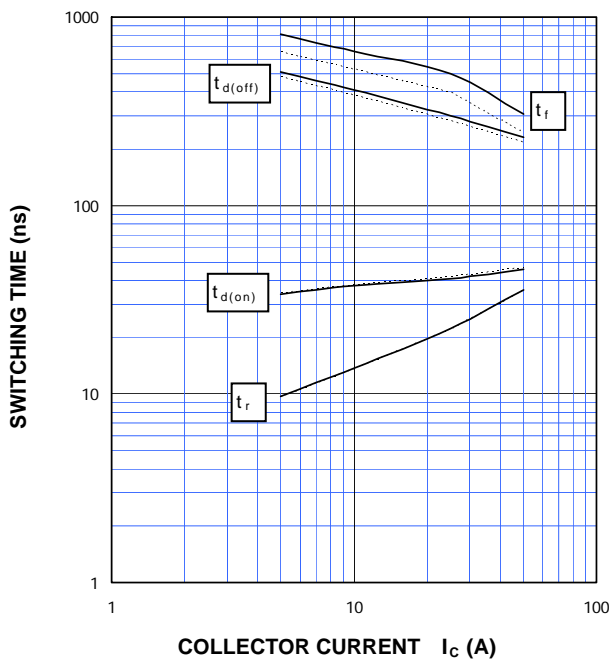


CLAMP DIODE FORWARD CHARACTERISTICS (TYPICAL)



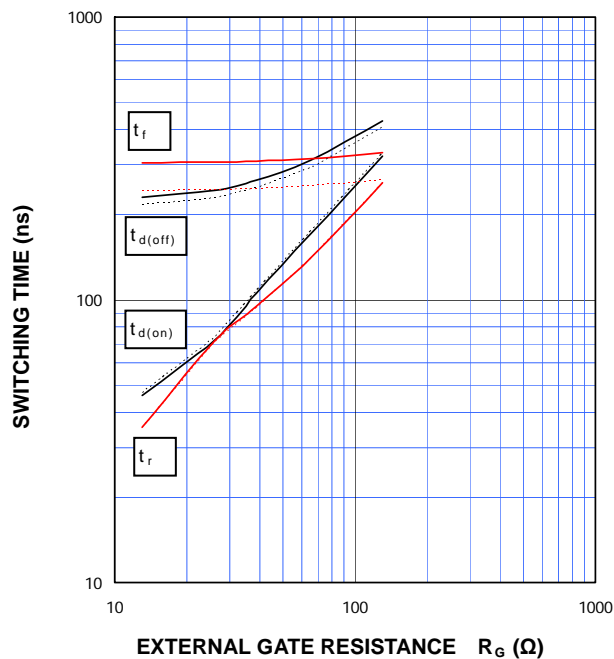
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=13\ \Omega$, INDUCTIVE LOAD
 —: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

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

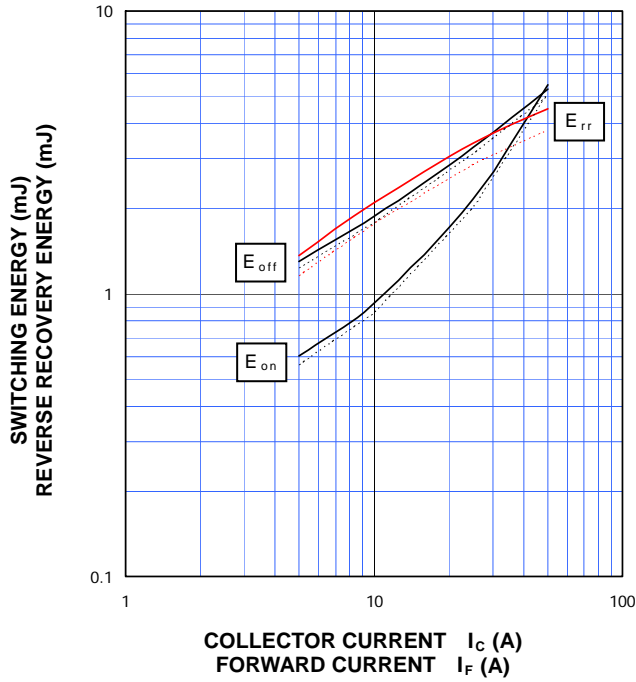


PERFORMANCE CURVES

BRAKE PART

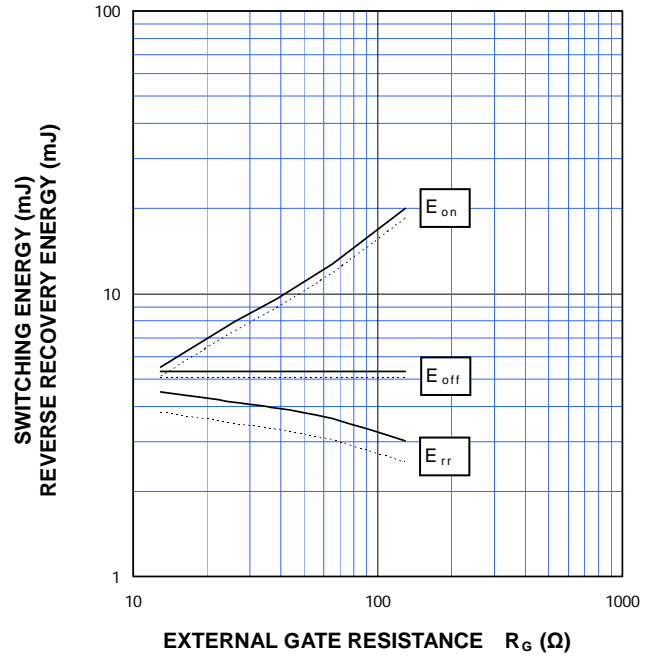
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=13\ \Omega$,
INDUCTIVE LOAD, PER PULSE
——: $T_j=150\text{ }^\circ\text{C}$, - - - - -: $T_j=125\text{ }^\circ\text{C}$



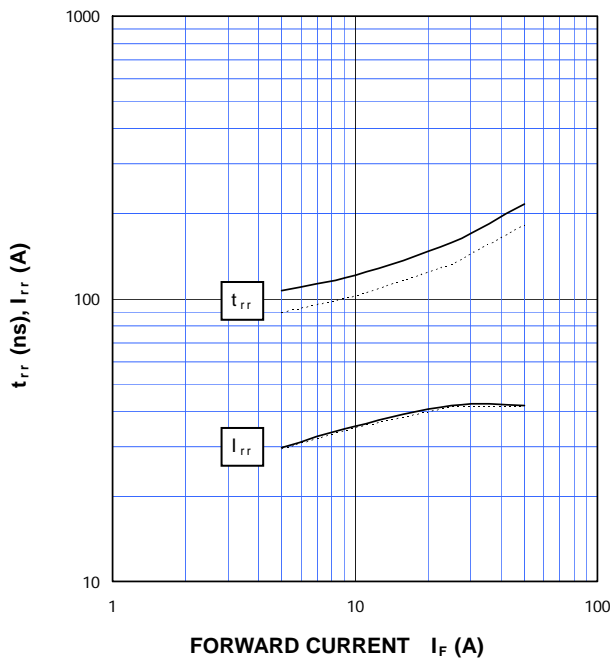
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

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



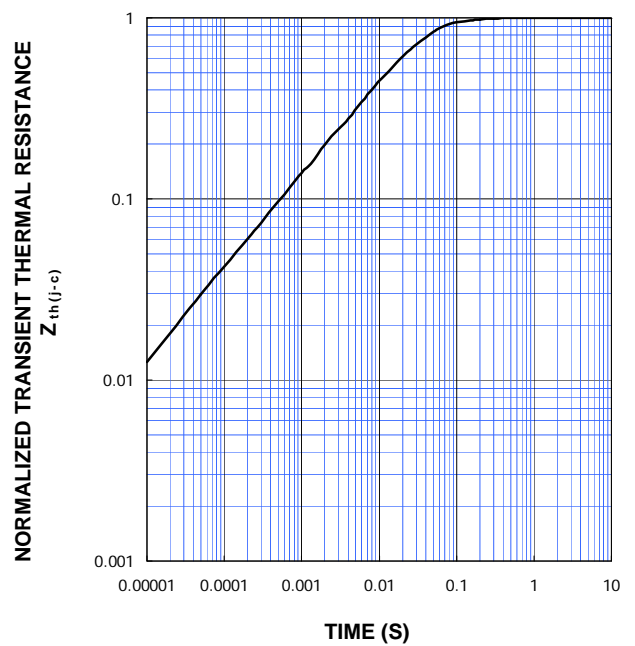
CLAMP DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=13\ \Omega$, INDUCTIVE LOAD
——: $T_j=150\text{ }^\circ\text{C}$, - - - - -: $T_j=125\text{ }^\circ\text{C}$



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)

Single pulse, $T_C=25\text{ }^\circ\text{C}$
 $R_{th(j-c)Q}=0.35\text{ K/W}$, $R_{th(j-c)D}=0.63\text{ K/W}$

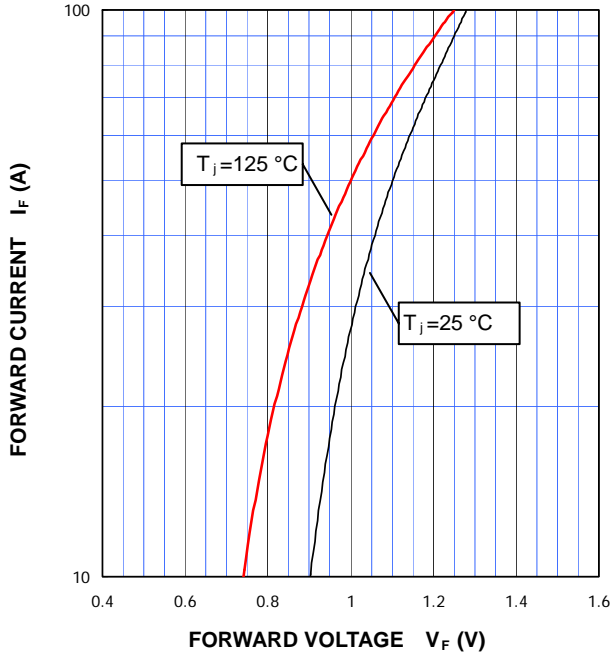


< IGBT MODULES >
CM100MXA-24S
 HIGH POWER SWITCHING USE
 INSULATED TYPE

PERFORMANCE CURVES

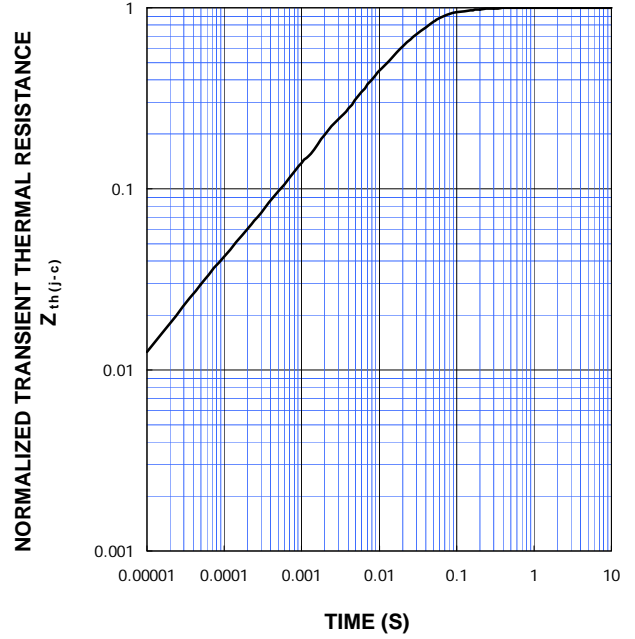
CONVERTER PART

**CONVERTER DIODE
 FORWARD CHARACTERISTICS
 (TYPICAL)**



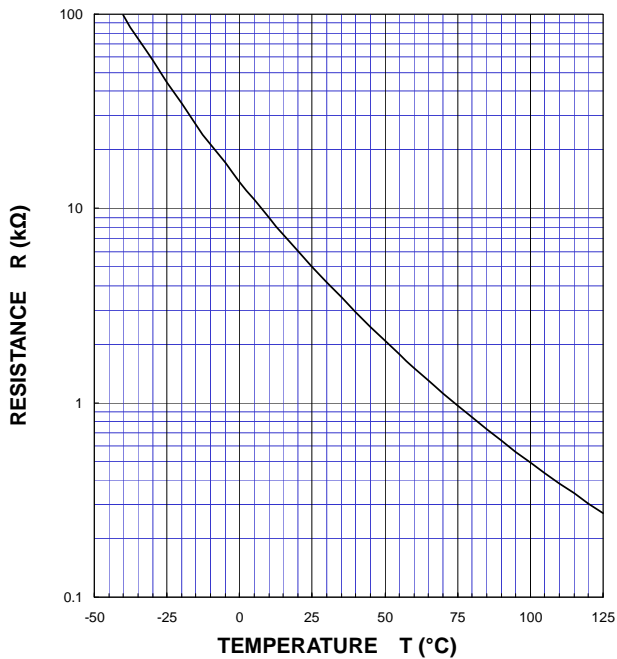
**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
 (MAXIMUM)**

Single pulse, $T_C = 25\text{ °C}$
 $R_{th(j-c)D} = 0.24\text{ K/W}$



NTC thermistor part

**TEMPERATURE CHARACTERISTICS
 (TYPICAL)**



Keep safety first in your circuit designs!

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