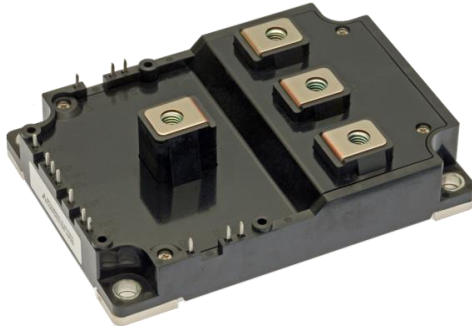


<IGBT Modules>

CM400ST-24T

HIGH POWER SWITCHING USE
INSULATED TYPE



fourpack (BRIDGE & AC SWITCH)

Collector current I_c 4 0 0 A
Collector-emitter voltage V_{CES}

BRIDGE 1 2 0 0 V
AC SWITCH 6 5 0 V

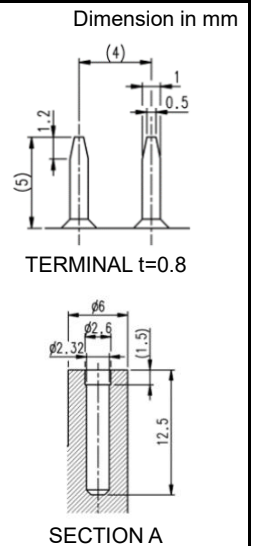
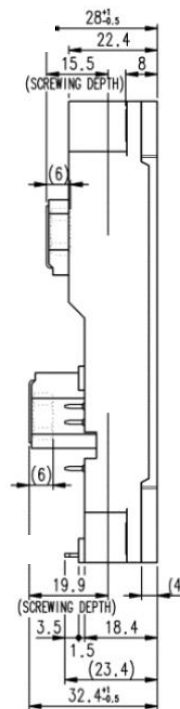
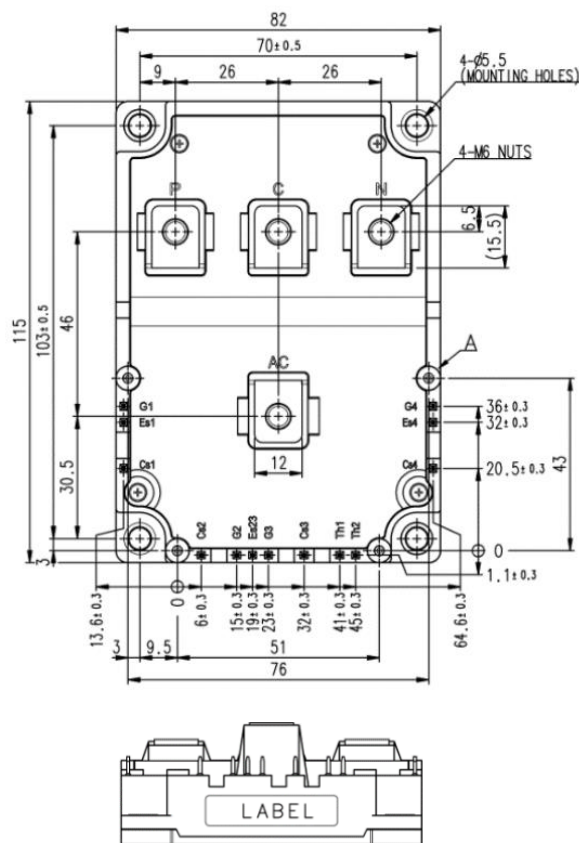
Maximum junction temperature T_{vjmax} 1 7 5 °C

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

APPLICATION

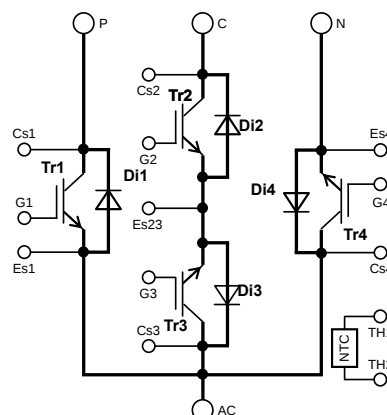
3level inverter, UPS, PV

OUTLINE DRAWING & INTERNAL CONNECTION



Tolerance otherwise specified

Division of Dimension	Tolerance
0.5 to 3	±0.2
over 3 to 6	±0.3
over 6 to 30	±0.5
over 30 to 120	±0.8
over 120 to 400	±1.2



BRIDGE

- IGBT : Tr1, Tr4
- DIODE : Di1, Di4

AC SWITCH

- IGBT : Tr2, Tr3
- DIODE : Di2, Di3

CM400ST-24T

HIGH POWER SWITCHING USE
INSULATED TYPE

MAXIMUM RATINGS ($T_{vj}=25\text{ }^{\circ}\text{C}$, unless otherwise specified)

BRIDGE PART IGBT/DIODE (Tr1, Tr4, Di1, Di4)

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, $T_C=106\text{ }^{\circ}\text{C}$ (Note2, 4)	400	A
I_{CRM}		Pulse, Repetitive, $V_{GE}=15\text{ V}$ (Note3)	800	
P_{tot}	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	1970	W
I_E (Note1)	Emitter current	DC (Note2)	400	A
I_{ERM} (Note1)		Pulse, Repetitive (Note3)	800	

AC SWITCH PART IGBT/DIODE (Tr2, Tr3, Di2, Di3)

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, $T_C=94\text{ }^{\circ}\text{C}$ (Note2, 4)	400	A
I_{CRM}		Pulse, Repetitive, $V_{GE}=15\text{ V}$ (Note3)	800	
P_{tot}	Total power dissipation	$T_C=25\text{ }^{\circ}\text{C}$ (Note2, 4)	1375	W
I_E (Note1)	Emitter current	DC (Note2)	400	A
I_{ERM} (Note1)		Pulse, Repetitive (Note3)	800	

MODULE

Symbol	Item	Conditions	Rating	Unit
V_{isol}	Isolation voltage	Terminals to base plate, RMS, $f=60\text{ Hz}$, AC 1 min	4000	V
T_{vjmax}	Maximum junction temperature	Instantaneous event (overload) (Note9)	175	$^{\circ}\text{C}$
T_{Cmax}	Maximum case temperature	(Note4, 9)	125	
T_{vjop}	Operating junction temperature	Continuous operation (under switching) (Note9)	-40 ~ 150	$^{\circ}\text{C}$
T_{stg}	Storage temperature	-	-40 ~ 125	

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

BRIDGE PART IGBT/DIODE (Tr1, Tr4, Di1, Di4)

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
I_{CES}	Collector-emitter cut-off current	$V_{CE}=V_{CES}$, G-E short-circuited	-	-	1	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	$I_C=40\text{ mA}$, $V_{CE}=10\text{ V}$	5.4	6.0	6.6	V
V_{CEsat} (Terminal)	Collector-emitter saturation voltage	$I_C=400\text{ A}$, $V_{GE}=15\text{ V}$, Auxiliary Terminal (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.60	1.95	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.85	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	1.90	-	
V_{CEsat} (Chip)		$I_C=400\text{ A}$, $V_{GE}=15\text{ V}$, Chip (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.50	1.75	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.70	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	1.75	-	
C_{ies}	Input capacitance	$V_{CE}=10\text{ V}$, G-E short-circuited	-	-	97	nF
C_{oes}	Output capacitance		-	-	2.7	
C_{res}	Reverse transfer capacitance		-	-	1.2	
Q_G	Gate charge	$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $I_C=400\text{ A}$, $V_{GE}=15\text{ V}$	-	3.0	-	μC
$t_{d(on)}$	Turn-on delay time	$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $I_C=400\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=1.6\text{ }\Omega$, Inductive load	-	-	750	ns
t_r	Rise time		-	-	200	
$t_{d(off)}$	Turn-off delay time		-	-	850	
t_f	Fall time		-	-	200	
V_{EC} (Note1) (Terminal)	Emitter-collector voltage	$I_E=400\text{ A}$, G-E short-circuited, Auxiliary Terminal (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.70	2.15	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.75	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	1.75	-	
V_{EC} (Note1) (Chip)		$I_E=400\text{ A}$, G-E short-circuited, Chip (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.60	1.95	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.60	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	1.60	-	

ELECTRICAL CHARACTERISTICS (Cont; $T_{vj}=25\text{ }^{\circ}\text{C}$, unless otherwise specified)**BRIDGE PART IGBT/DIODE (Tr1, Tr4, Di1, Di4)**

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
t_{rr} (Note1)	Reverse recovery time	$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $I_E=400\text{ A}$, $V_{GE}=\pm 15\text{ V}$,	-	-	350	ns
Q_{rr} (Note1)	Reverse recovery charge	$R_G=0\text{ }\Omega$ (Tr2/Tr3), Inductive load	-	38.0	-	μC
E_{on}	Turn-on switching energy per pulse	$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $I_C=I_E=400\text{ A}$,	-	12.8	-	mJ
E_{off}	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$, $T_{vj}=150\text{ }^{\circ}\text{C}$,	-	24.3	-	
E_{rr} (Note1)	Reverse recovery energy per pulse	Inductive load	-	15.8	-	mJ
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, $T_C=25\text{ }^{\circ}\text{C}$ (Note4)	-	0.25	-	m Ω
r_g	Internal gate resistance	Per switch	-	1.0	-	Ω

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$V_{CC(P-C)}$	(DC) Supply voltage	Applied across each of P to C and C to N	-	300	425	V
$V_{CC(C-N)}$						
V_{GEon}	Gate (-emitter drive) voltage	Applied across emitter to gate of each IGBT	13.5	15.0	16.5	V
R_G	External gate resistance	Per switch	1.6	-	16	Ω

AC SWITCH PART IGBT/DIODE (Tr2, Tr3, Di2, Di3)

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
I_{CES}	Collector-emitter cut-off current	$V_{CE}=V_{CES}$, G-E short-circuited	-	-	1	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	$I_C=40\text{ mA}$, $V_{CE}=10\text{ V}$	5.4	6.0	6.6	V
V_{CESat} (Terminal)	Collector-emitter saturation voltage	$I_C=400\text{ A}$, $V_{GE}=15\text{ V}$, Auxiliary Terminal (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.40	1.75	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.50	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	1.50	-	
V_{CESat} (Chip)		$I_C=400\text{ A}$, $V_{GE}=15\text{ V}$, Chip (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.30	1.55	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.35	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	1.35	-	
C_{ies}	Input capacitance	$V_{CE}=10\text{ V}$, G-E short-circuited	-	-	53.5	nF
C_{oes}	Output capacitance		-	-	2.3	
C_{res}	Reverse transfer capacitance		-	-	1.0	
Q_G	Gate charge	$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $I_C=400\text{ A}$, $V_{GE}=15\text{ V}$	-	1.65	-	μC
$t_{d(on)}$	Turn-on delay time	$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $I_C=400\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, Inductive load	-	-	400	ns
t_r	Rise time		-	-	150	
$t_{d(off)}$	Turn-off delay time		-	-	500	
t_f	Fall time		-	-	400	
V_{EC} (Note1) (Terminal)	Emitter-collector voltage	$I_E=400\text{ A}$, G-E short-circuited, Auxiliary Terminal (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.50	1.95	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.60	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	1.60	-	
V_{EC} (Note1) (Chip)		$I_E=400\text{ A}$, G-E short-circuited, Chip (Note5)	$T_{vj}=25\text{ }^{\circ}\text{C}$	1.40	1.74	V
			$T_{vj}=125\text{ }^{\circ}\text{C}$	1.45	-	
			$T_{vj}=150\text{ }^{\circ}\text{C}$	1.45	-	
t_{rr} (Note1)	Reverse recovery time	$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $I_E=400\text{ A}$, $V_{GE}=\pm 15\text{ V}$,	-	-	450	ns
Q_{rr} (Note1)	Reverse recovery charge	$R_G=1.6\text{ }\Omega$ (Tr1/Tr4), Inductive load	-	38.0	-	μC
E_{on}	Turn-on switching energy per pulse	$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $I_C=I_E=400\text{ A}$,	-	0.28	-	mJ
E_{off}	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$, $T_{vj}=150\text{ }^{\circ}\text{C}$,	-	22.7	-	
E_{rr} (Note1)	Reverse recovery energy per pulse	Inductive load	-	10.0	-	mJ
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, $T_C=25\text{ }^{\circ}\text{C}$ (Note4)	-	0.25	-	m Ω
r_g	Internal gate resistance	Per switch	-	1.5	-	Ω

CM400ST-24THIGH POWER SWITCHING USE
INSULATED TYPEELECTRICAL CHARACTERISTICS (Cont; T_{vj}=25 °C, unless otherwise specified)

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V _{CC(P-C)}	(DC) Supply voltage	Applied across each of P to C and C to N	-	300	425	V
V _{CC(C-N)}						
V _{GEon}	Gate (-emitter drive) voltage	Applied across emitter to gate of each IGBT	13.5	15.0	16.5	V
R _G	External gate resistance	Per switch	0	-	16	Ω

NTC THERMISTOR PART

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R ₂₅	Zero-power resistance	T _C =25 °C (Note4)	4.85	5.00	5.15	kΩ
ΔR/R	Deviation of resistance	R ₁₀₀ =493 Ω, T _C =100 °C (Note4)	-7.3	-	+7.8	%
B _(25/50)	B-constant	Approximate by equation (Note6)	-	3375	-	K
P ₂₅	Power dissipation	T _C =25 °C (Note4)	-	-	10	mW

THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R _{th(j-c)Q}	Thermal resistance	Junction to case, per BRIDGE PART IGBT (Note4)	-	-	76	K/kW
R _{th(j-c)D}		Junction to case, per BRIDGE PART FWD (Note4)	-	-	118	
R _{th(j-c)Q}		Junction to case, per AC SWITCH PART IGBT (Note4)	-	-	109	
R _{th(j-c)D}		Junction to case, per AC SWITCH PART FWD (Note4)	-	-	167	
R _{th(c-s)}	Contact thermal resistance	Case to heat sink, per 1 module, Thermal grease applied (Note4, 7, 9)	-	11	-	K/kW

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M _t	Mounting torque	Main terminals M 6 screw	3.5	4.0	4.5	N·m
M _s	Mounting torque	Mounting to heat sink M 5 screw	2.5	3.0	3.5	N·m
m	mass	-	-	560	-	g
d _s	Creepage distance	Terminal to terminal	14.4	-	-	mm
		Terminal to base plate	16.7	-	-	
d _a	Clearance	Terminal to terminal	8.0	-	-	mm
		Terminal to base plate	16.7	-	-	
e _c	Flatness of base plate	On the centerline X, Y (Note8)	-50	-	100	μm

*: 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.

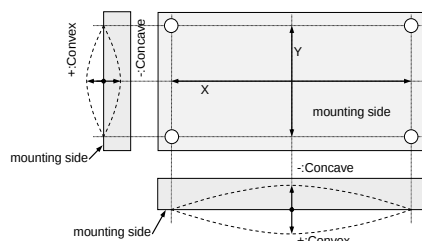
$$6. B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$$

R₂₅: resistance at absolute temperature T₂₅ [K]; T₂₅=25 [°C]+273.15=298.15 [K]

R₅₀: resistance at absolute temperature T₅₀ [K]; T₅₀=50 [°C]+273.15=323.15 [K]

- Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K).

- The base plate (mounting side) flatness measurement points (X, Y) are as follows of the next figure.



CM400ST-24T

HIGH POWER SWITCHING USE
INSULATED TYPE

Note9. 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 your specific application conditions. Each temperature condition ($T_{vj\ max}$, $T_{vj\ op}$, $T_{C\ max}$) must be maintained below the maximum rated temperature throughout consideration of the temperature rise even for long term usage.

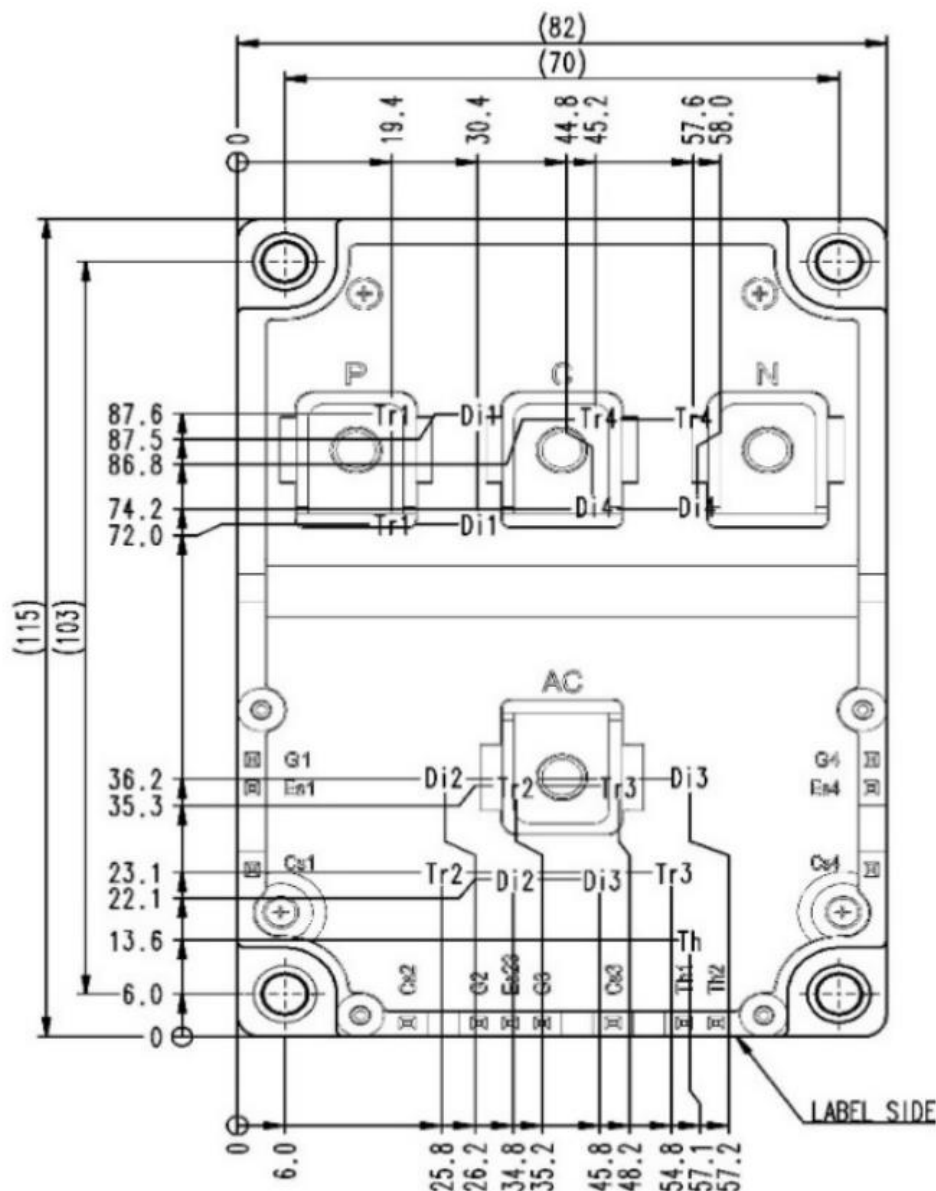
10. Use the following screws when mounting the printed circuit board (PCB) on the standoffs.

The length of the screw depends on thickness ($t1.0\sim t1.6$) of the PCB.

Type	Size	Tightening torque	Recommended tightening method
(1) PT®	K25×8	$0.55 \pm 0.055\ N\cdot m$	by handwork (equivalent to 30 r/min by mechanical screw driver) ~ 600 r/min (by mechanical screw driver)
(2) PT®	K25×10	$0.75 \pm 0.075\ N\cdot m$	
(3) DELTA PT®	25×8	$0.55 \pm 0.055\ N\cdot m$	
(4) DELTA PT®	25×10	$0.75 \pm 0.075\ N\cdot m$	
(5) B1 tapping screw	$\phi 2.6 \times 10$ or $\phi 2.6 \times 12$	$0.75 \pm 0.075\ N\cdot m$	

CHIP LOCATION (Top view)

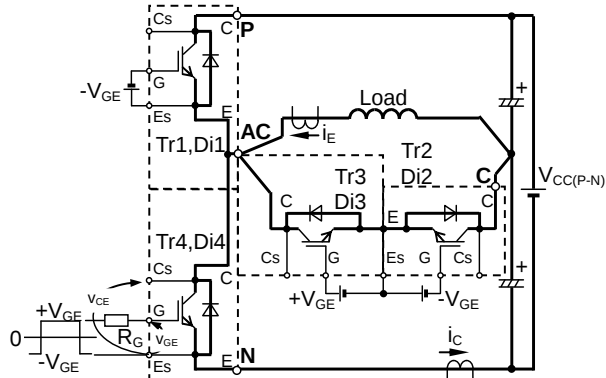
Dimension in mm, tolerance: $\pm 1\ mm$



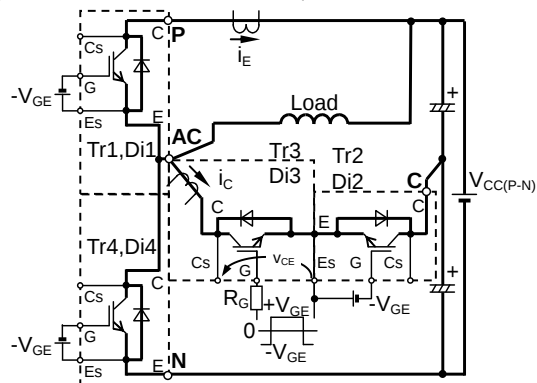
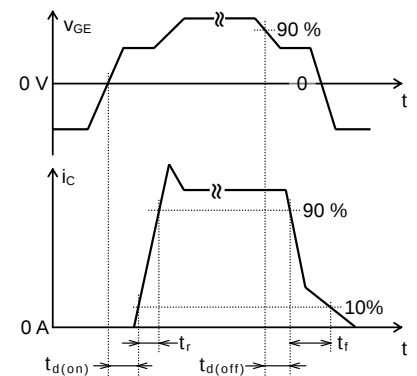
Tr1/Tr4: BRIDGE IGBT, Tr2/Tr3: AC SWITCH IGBT,
Di1/Di4: BRIDGE FWD, Di2/Di3: AC SWITCH FWD,
Th: NTC thermistor.

CM400ST-24THIGH POWER SWITCHING USE
INSULATED TYPE

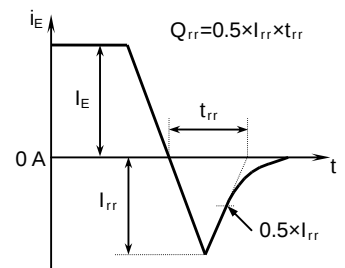
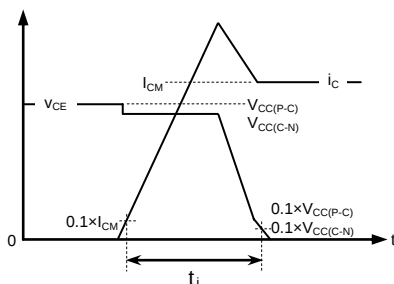
TEST CIRCUIT AND WAVEFORMS



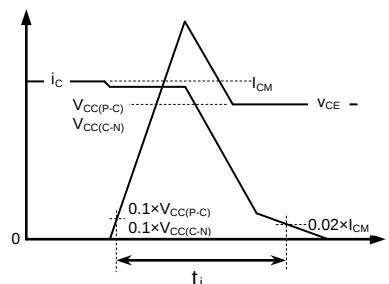
Switching test circuit and waveforms (BRIDGE PART switching)



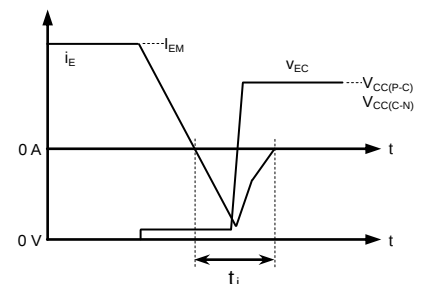
Switching test circuit and waveforms (AC SWITCH PART switching)

 t_{rr} , Q_{rr} test waveform

IGBT Turn-on switching energy



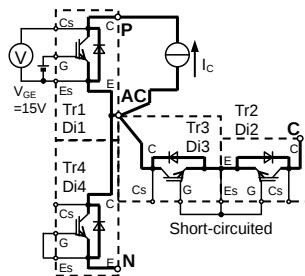
IGBT Turn-off switching energy



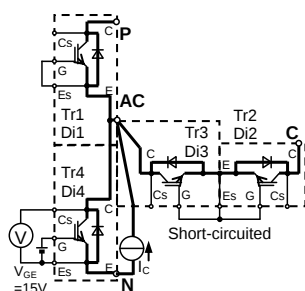
FWD Reverse recovery energy

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

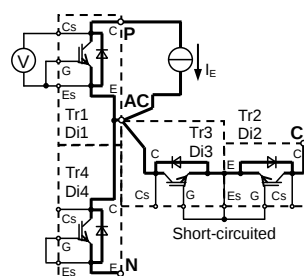
TEST CIRCUIT



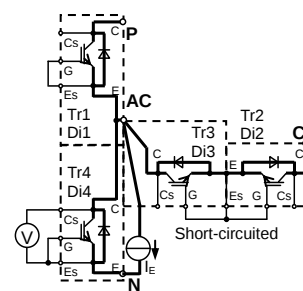
Tr1

 V_{CEsat} characteristics test circuit (BRIDGE PART)

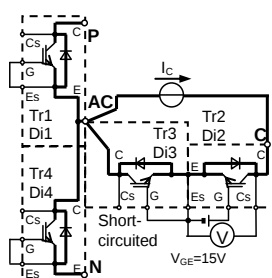
Tr4



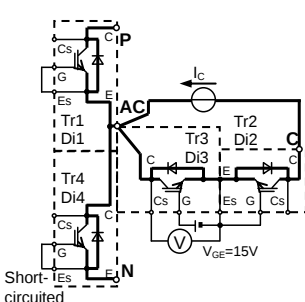
Di1

 V_{EC} characteristics test circuit (BRIDGE PART)

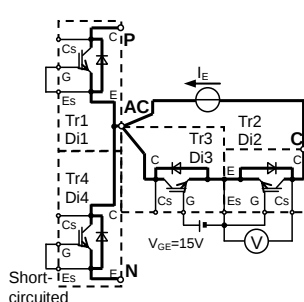
Di4



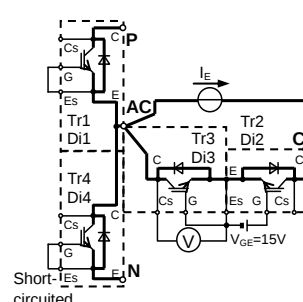
Tr2

 V_{CEsat} characteristics test circuit (AC SWITCH PART)

Tr3



Di2

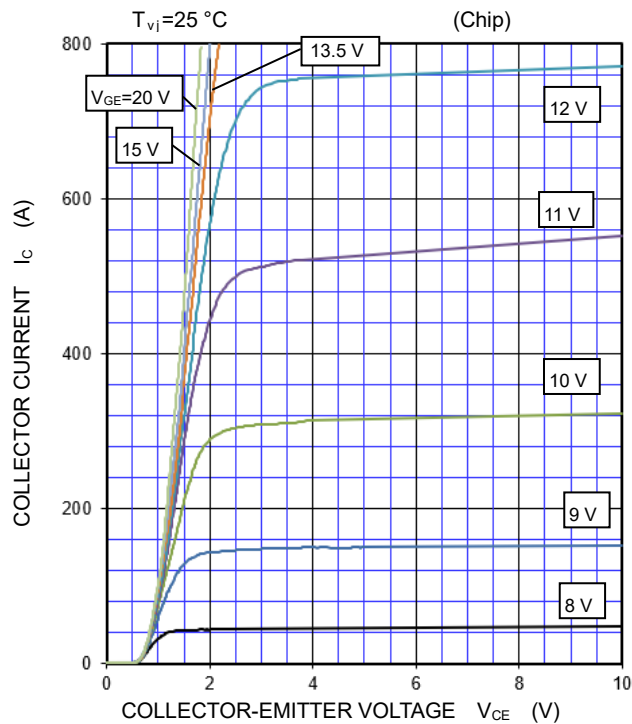
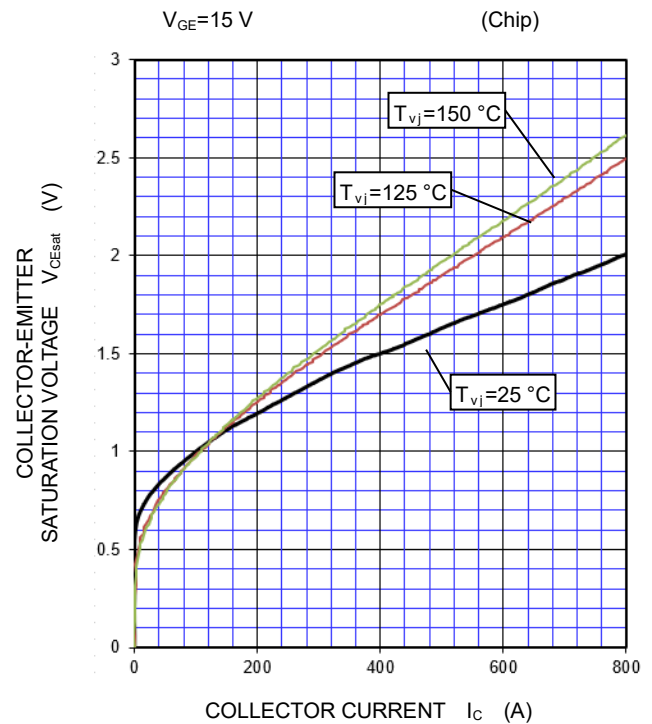
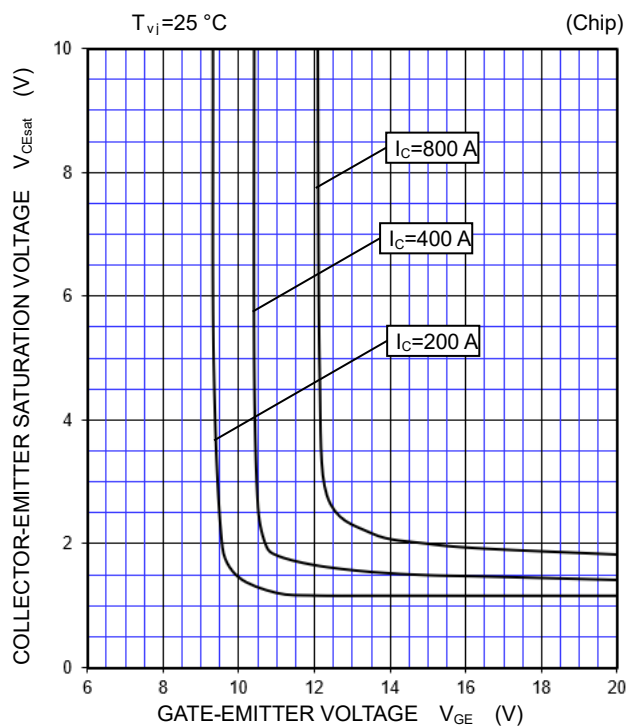
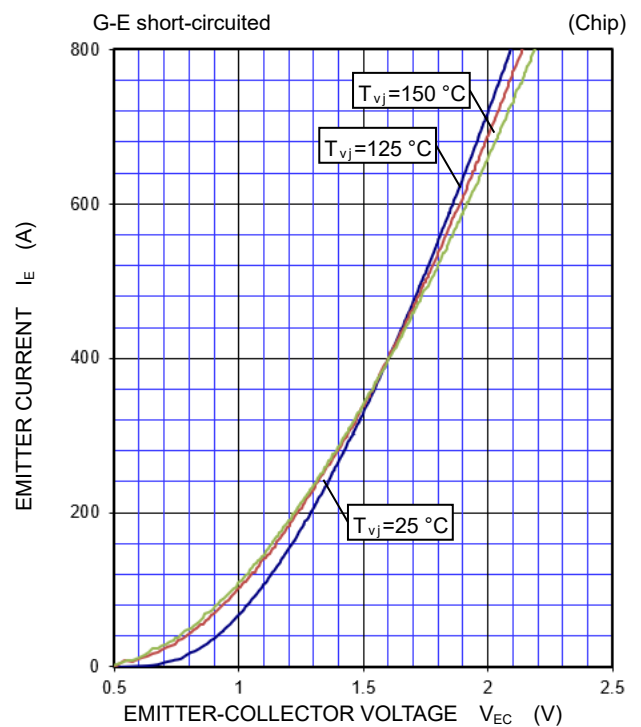
 V_{EC} characteristics test circuit (AC SWITCH PART)

Di3

CM400ST-24THIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

BRIDGE PART

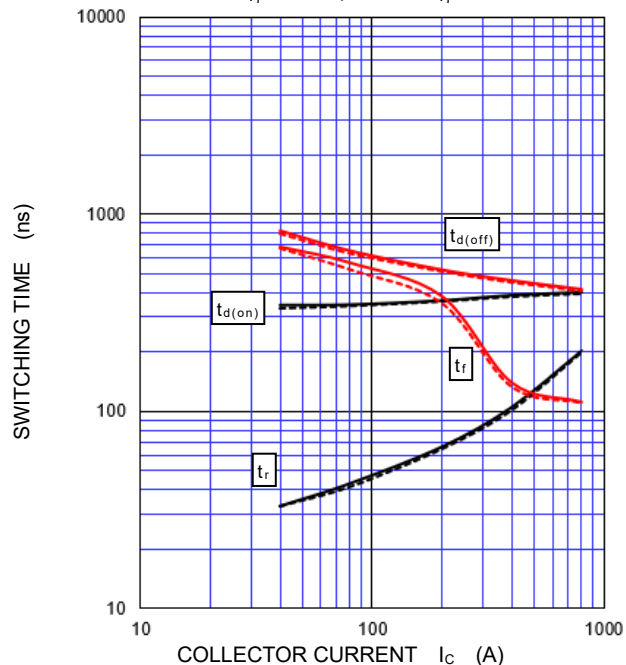
OUTPUT
CHARACTERISTICS
(TYPICAL)COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)

PERFORMANCE CURVES

BRIDGE PART

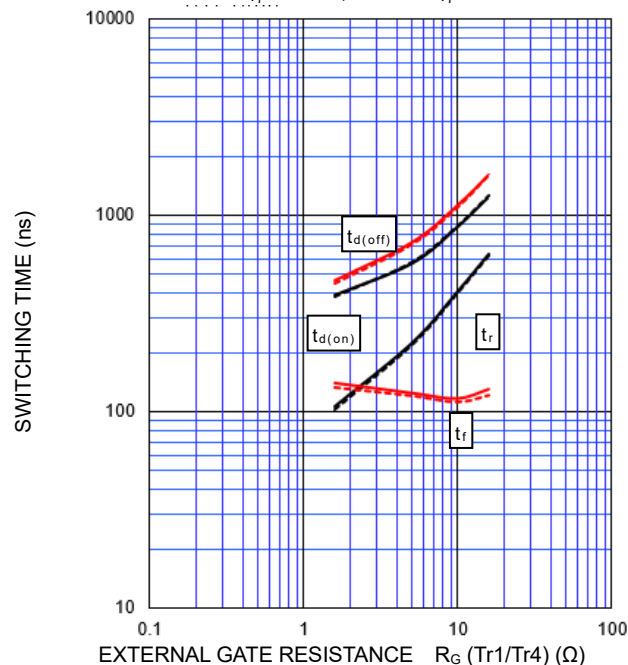
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
 $V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=1.6\ \Omega$ (Tr1/Tr4),
INDUCTIVE LOAD

—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



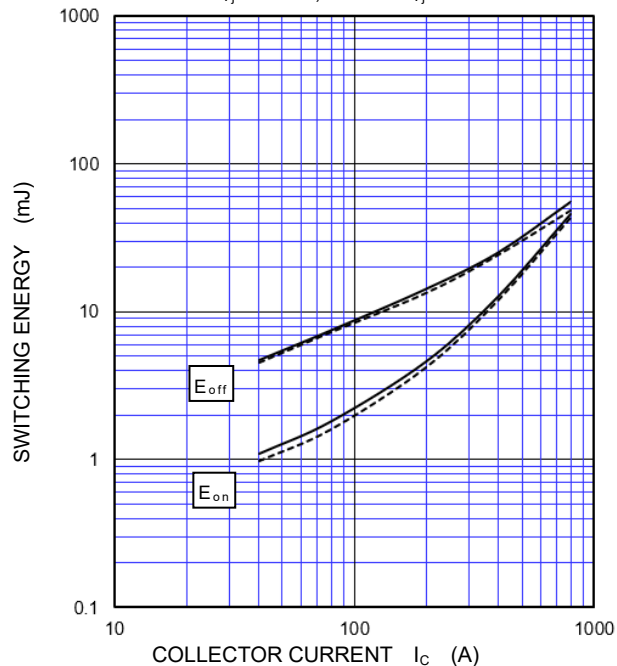
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
 $V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=400\text{ A}$,
INDUCTIVE LOAD

—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



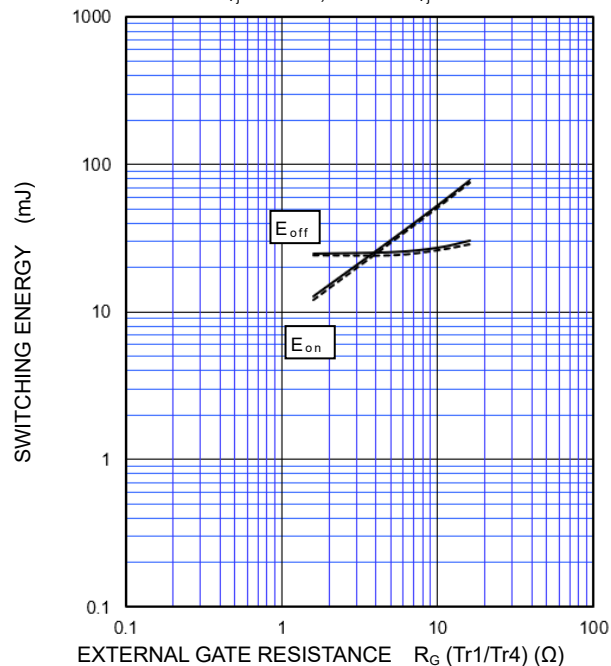
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
 $V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=1.6\ \Omega$ (Tr1/Tr4),
INDUCTIVE LOAD, PER PULSE

—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
 $V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=400\text{ A}$,
INDUCTIVE LOAD, PER PULSE

—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



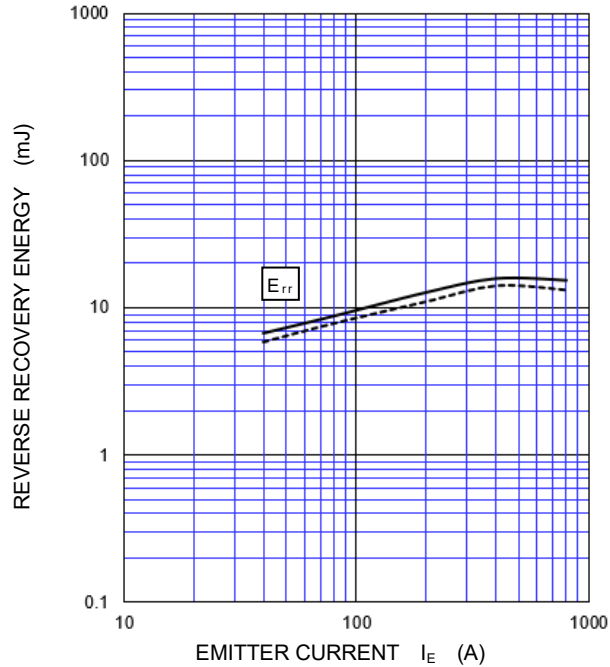
CM400ST-24T

HIGH POWER SWITCHING USE
INSULATED TYPE

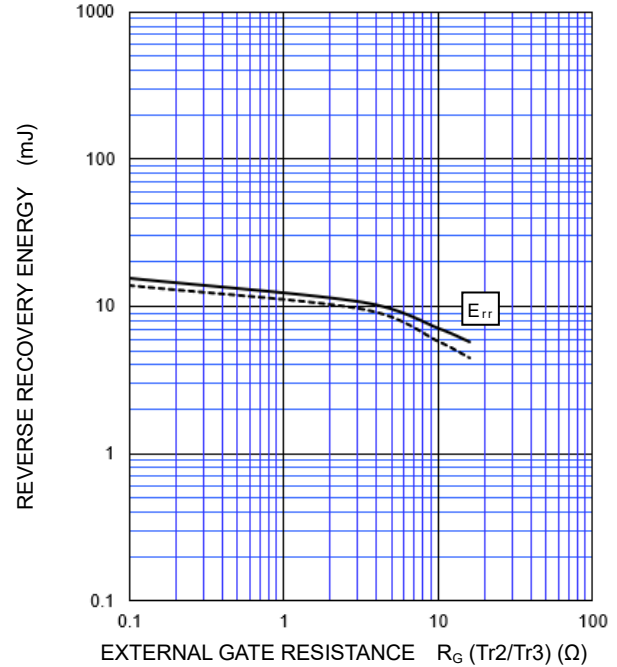
PERFORMANCE CURVES

BRIDGE PART

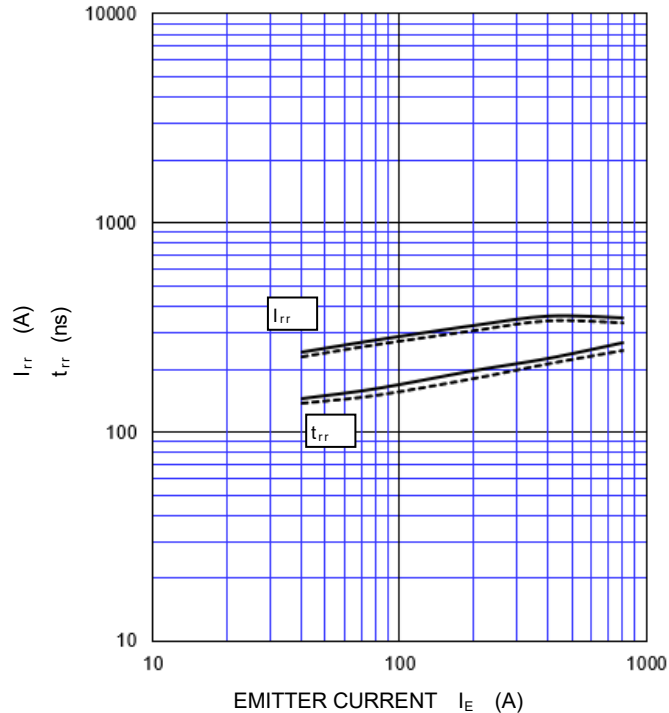
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
 $V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$ (Tr2/Tr3),
INDUCTIVE LOAD, PER PULSE
——: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
 $V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_E=400\text{ A}$,
INDUCTIVE LOAD, PER PULSE
——: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$

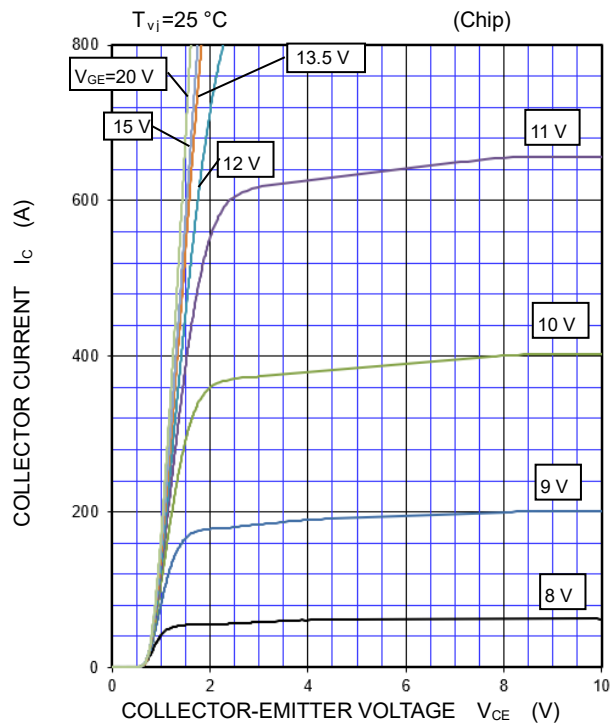
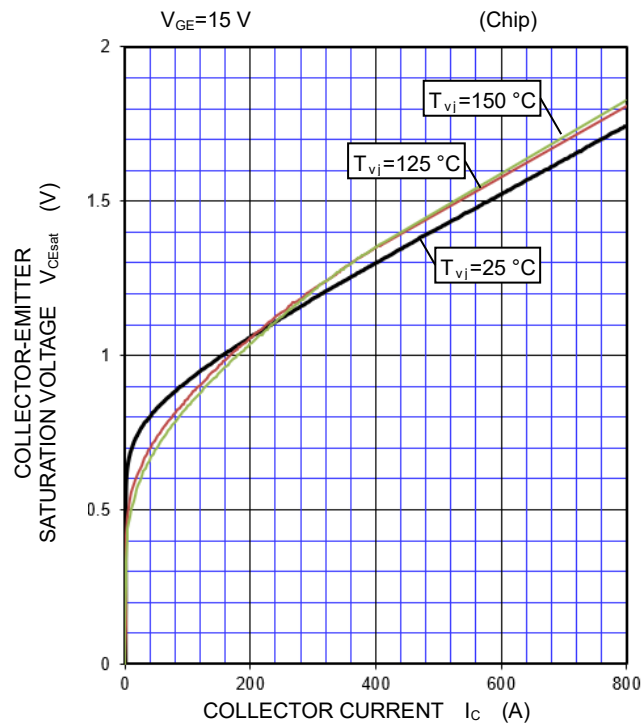
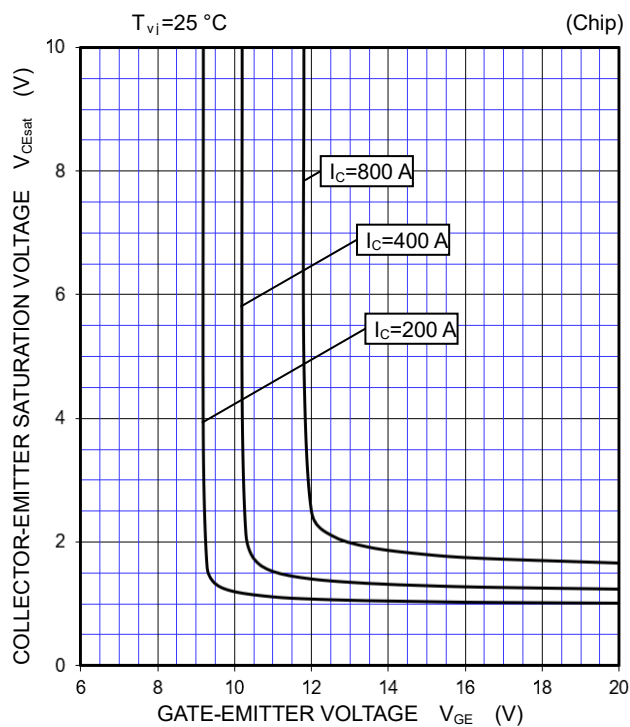
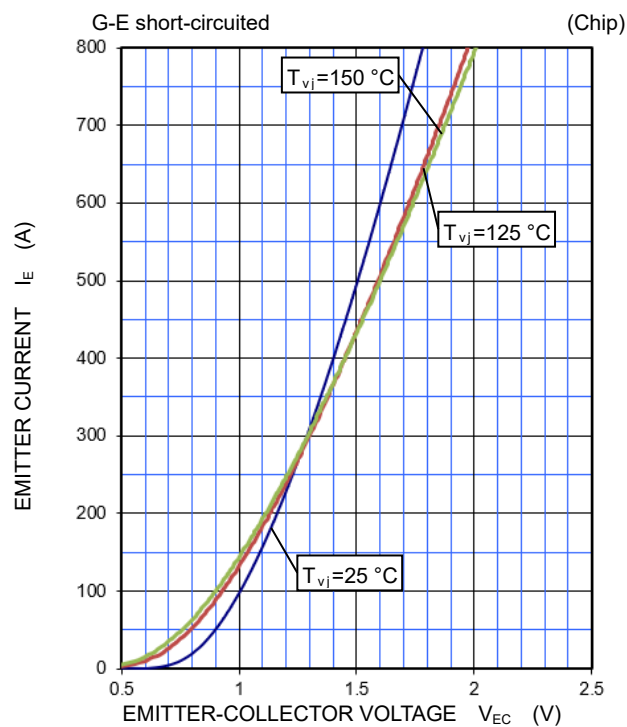


FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)
 $V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$ (Tr2/Tr3),
INDUCTIVE LOAD
——: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



PERFORMANCE CURVES

AC SWITCH PART

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

CM400ST-24T

HIGH POWER SWITCHING USE
INSULATED TYPE

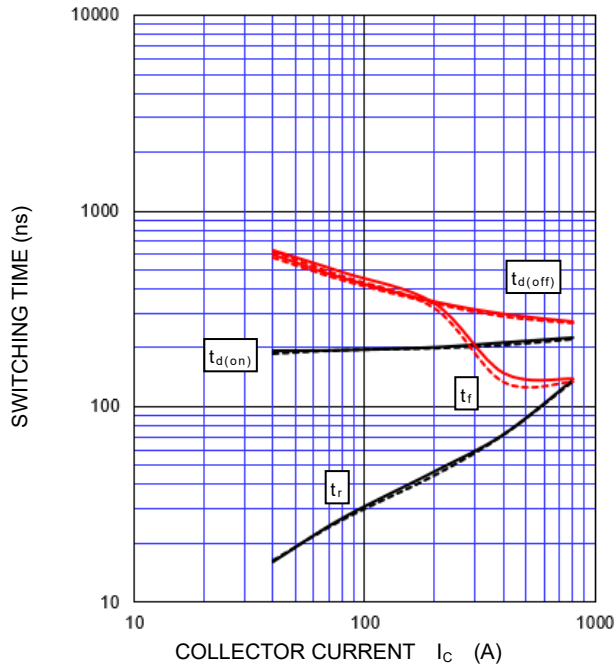
PERFORMANCE CURVES

AC SWITCH PART

HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$ (Tr2/Tr3),
INDUCTIVE LOAD

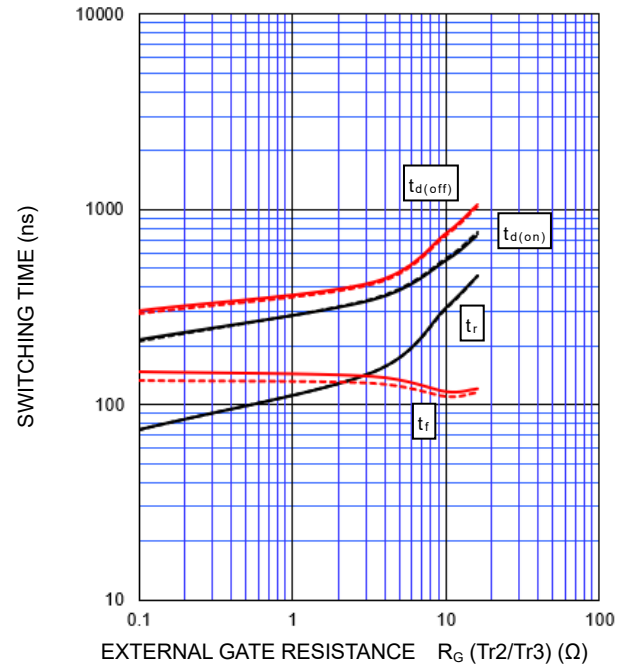
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=400\text{ A}$,
INDUCTIVE LOAD

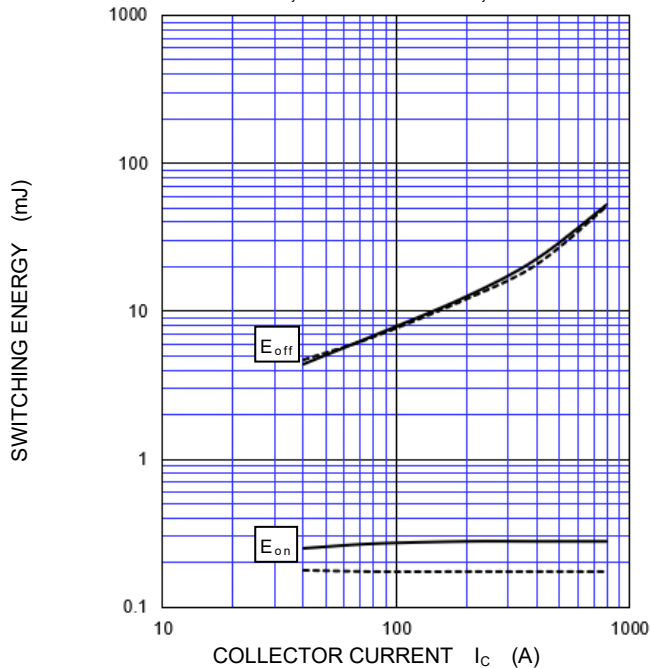
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$ (Tr2/Tr3),
INDUCTIVE LOAD, PER PULSE

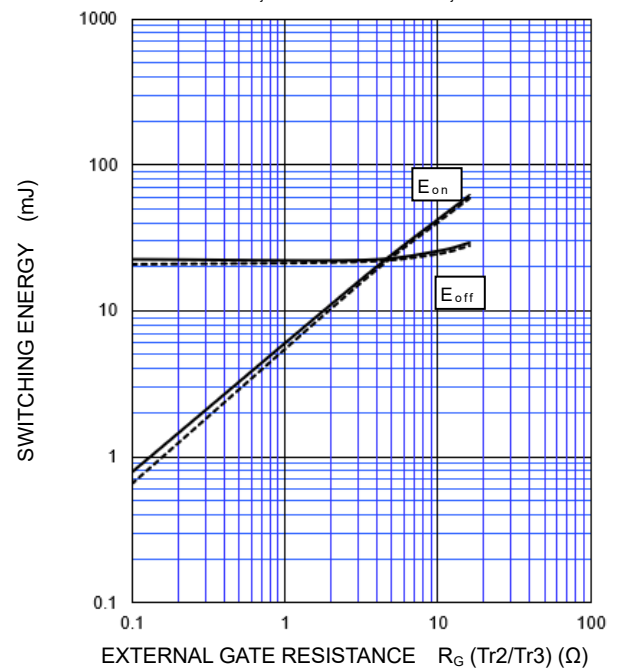
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=400\text{ A}$,
INDUCTIVE LOAD, PER PULSE

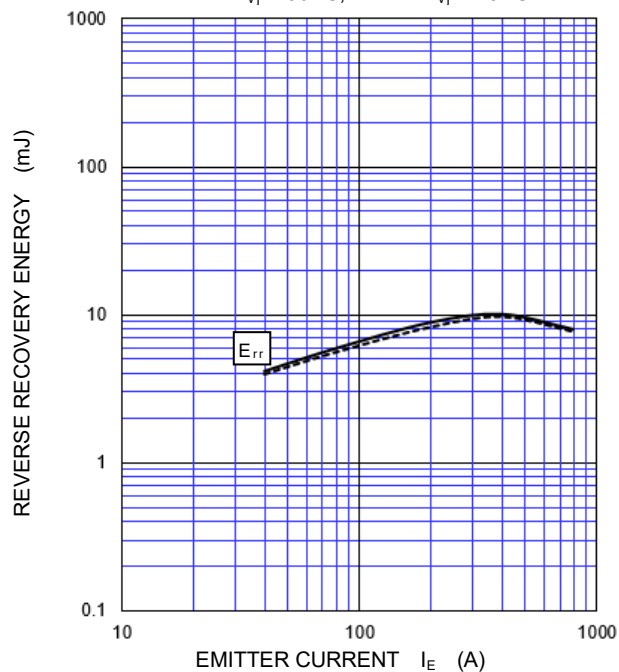
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



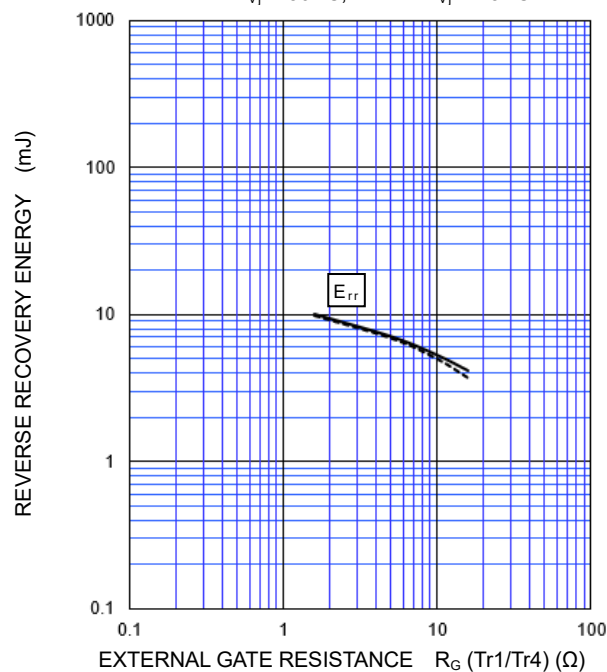
PERFORMANCE CURVES

AC SWITCH PART

HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
 $V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=1.6\ \Omega$ (Tr1/Tr4),
INDUCTIVE LOAD, PER PULSE
——: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$

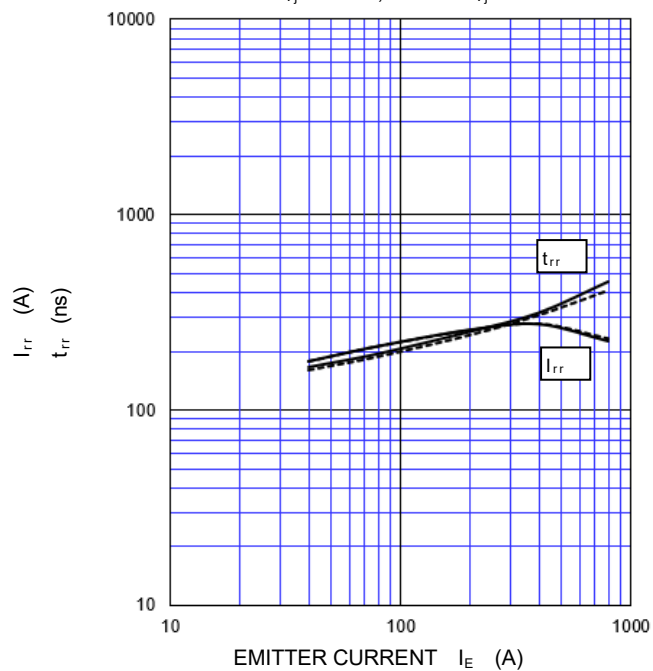


HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
 $V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_E=400\text{ A}$,
INDUCTIVE LOAD, PER PULSE
——: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)

$V_{CC(P-C)}=V_{CC(C-N)}=300\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=1.6\ \Omega$ (Tr1/Tr4),
INDUCTIVE LOAD
——: $T_{vj}=150\text{ }^\circ\text{C}$, - - - -: $T_{vj}=125\text{ }^\circ\text{C}$



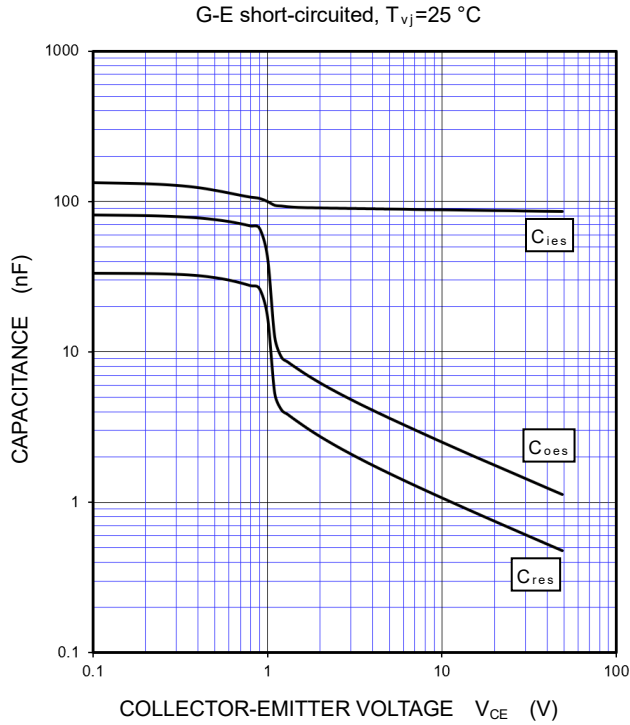
CM400ST-24T

HIGH POWER SWITCHING USE
INSULATED TYPE

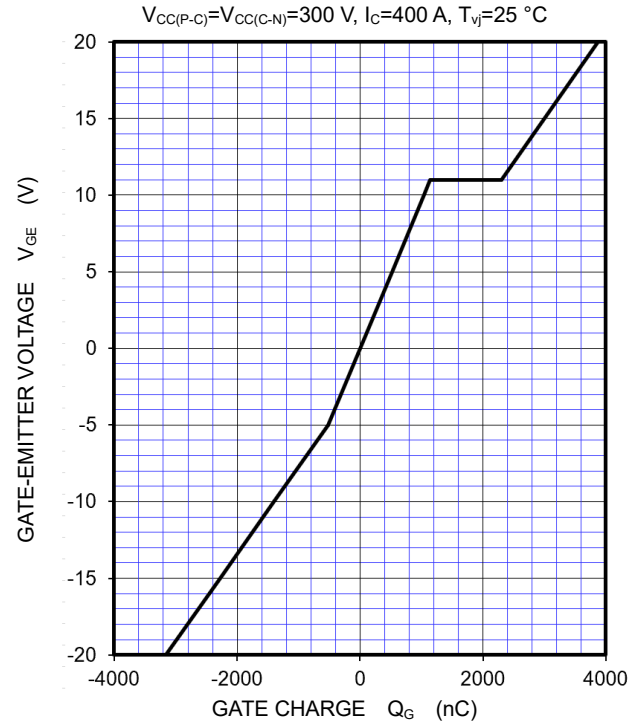
PERFORMANCE CURVES

BRIDGE PART

CAPACITANCE
CHARACTERISTICS
(TYPICAL)

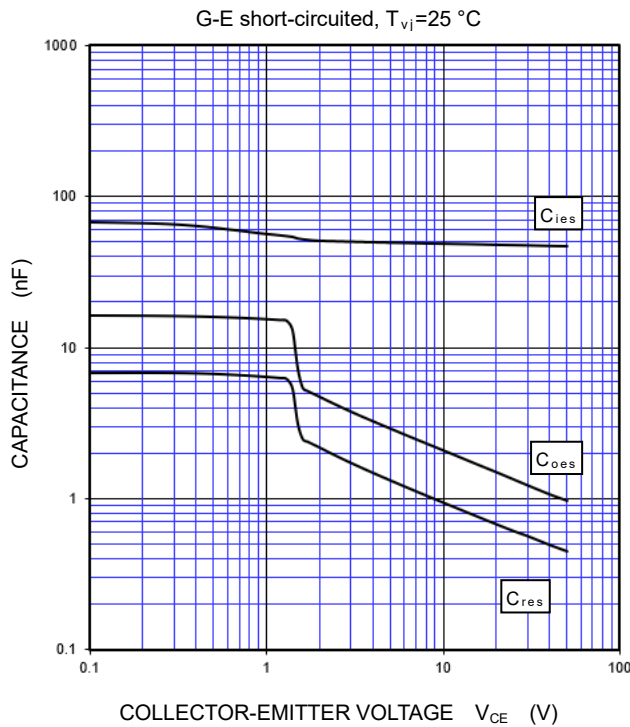


GATE CHARGE
CHARACTERISTICS
(TYPICAL)

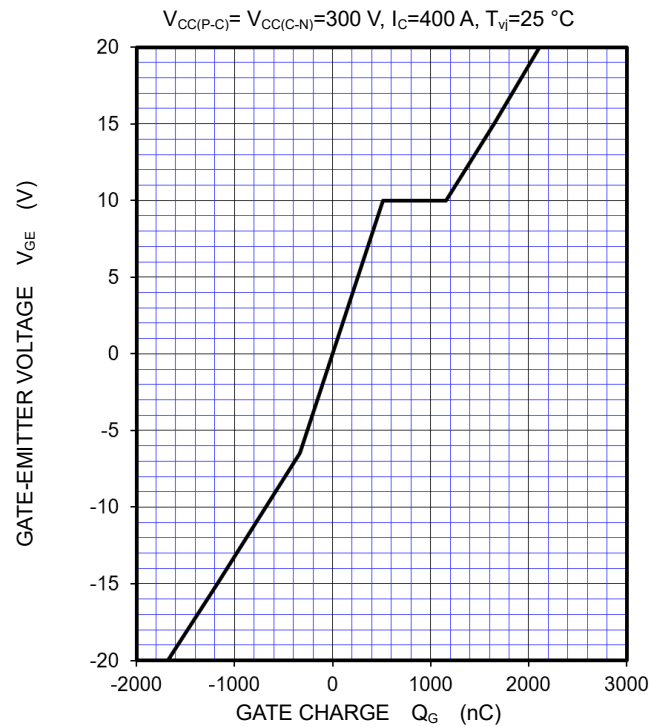


AC SWITCH PART

CAPACITANCE
CHARACTERISTICS
(TYPICAL)



GATE CHARGE
CHARACTERISTICS
(TYPICAL)



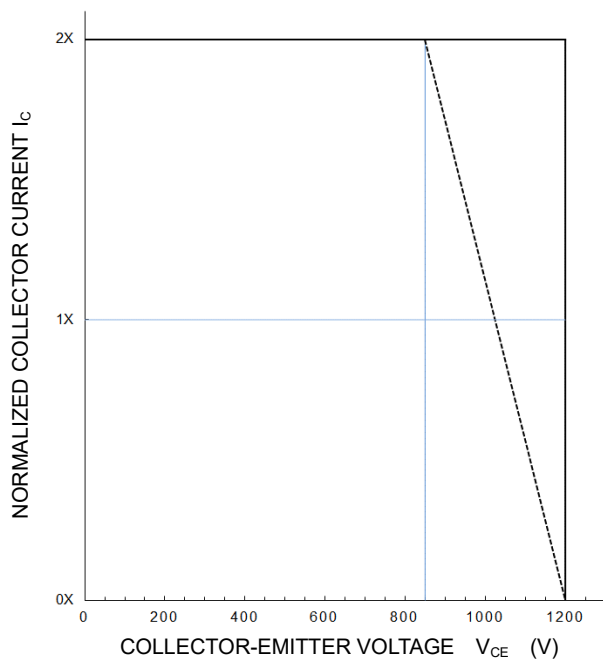
CM400ST-24THIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

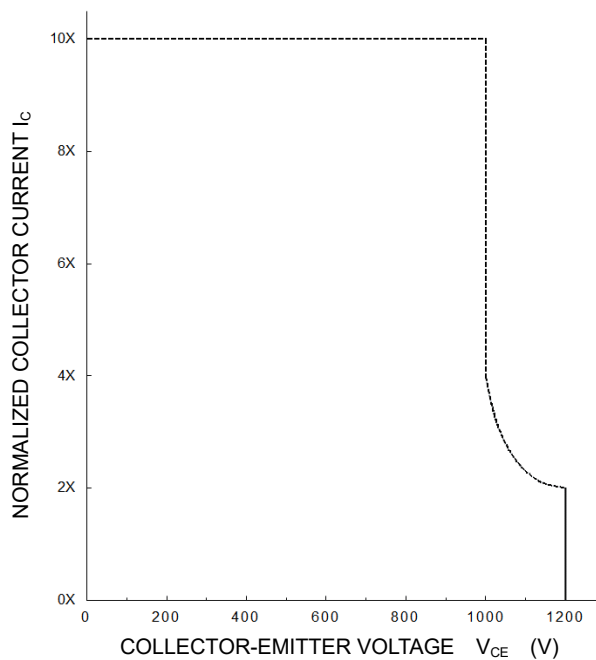
BRIDGE PART

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

$V_{CC} \leq 850 \text{ V}$, $R_G = 1.6 \sim 16 \ \Omega$, $V_{GE} = \pm 15 \text{ V}$,
 —: $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$ (Normal load operations (Continuous))
 - - - - -: $T_{vj} = 175 \text{ }^\circ\text{C}$ (Unusual load operations (Limited period))

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

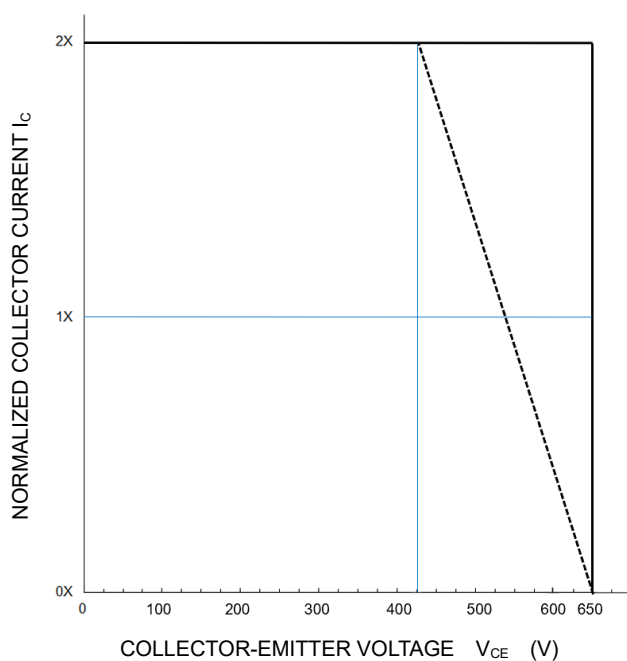
$V_{CC} \leq 800 \text{ V}$, $R_G = 1.6 \sim 16 \ \Omega$, $V_{GE} = \pm 15 \text{ V}$,
 $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$, $t_W \leq 6 \ \mu\text{s}$, Non-Repetitive



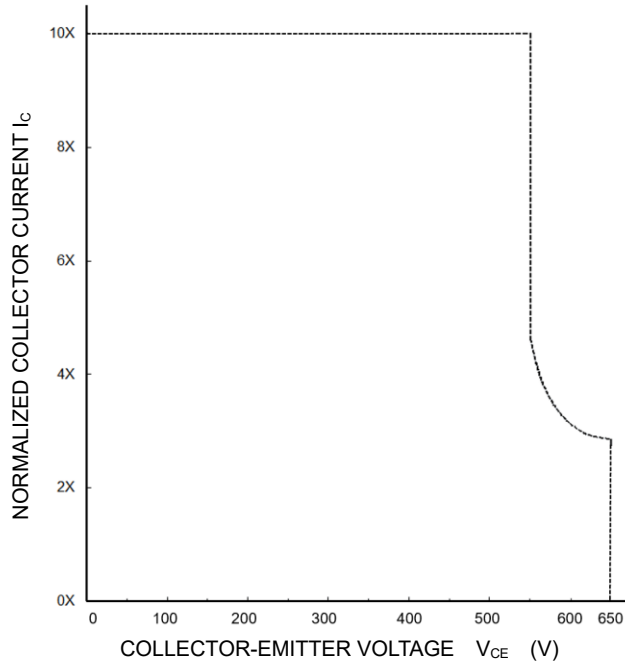
AC SWITCH PART

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

$V_{CC} \leq 425 \text{ V}$, $R_G = 0 \sim 16 \ \Omega$, $V_{GE} = \pm 15 \text{ V}$,
 —: $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$ (Normal load operations (Continuous))
 - - - - -: $T_{vj} = 175 \text{ }^\circ\text{C}$ (Unusual load operations (Limited period))

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

$V_{CC} \leq 400 \text{ V}$, $R_G = 0 \sim 16 \ \Omega$, $V_{GE} = \pm 15 \text{ V}$,
 $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$, $t_W \leq 6 \ \mu\text{s}$, Non-Repetitive



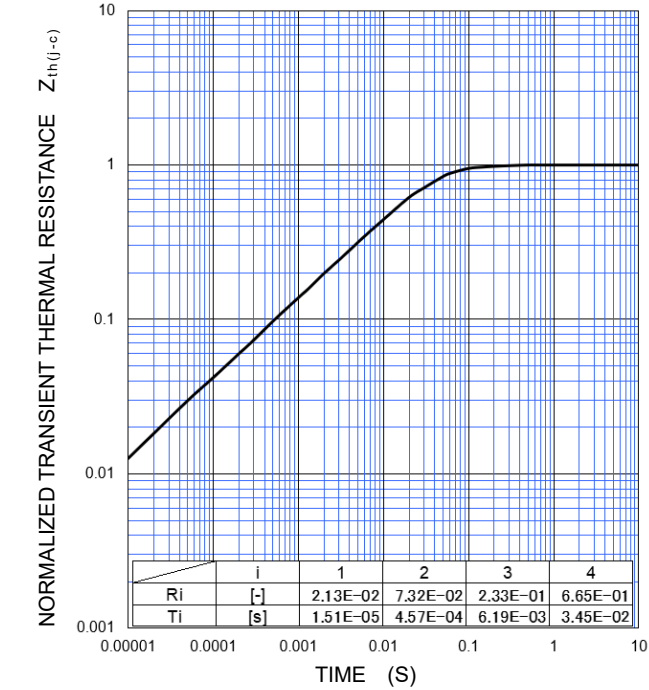
PERFORMANCE CURVES

COMMON PART

TRANSIENT THERMAL IMPEDANCE
CHARACTERISTICS
(MAXIMUM)

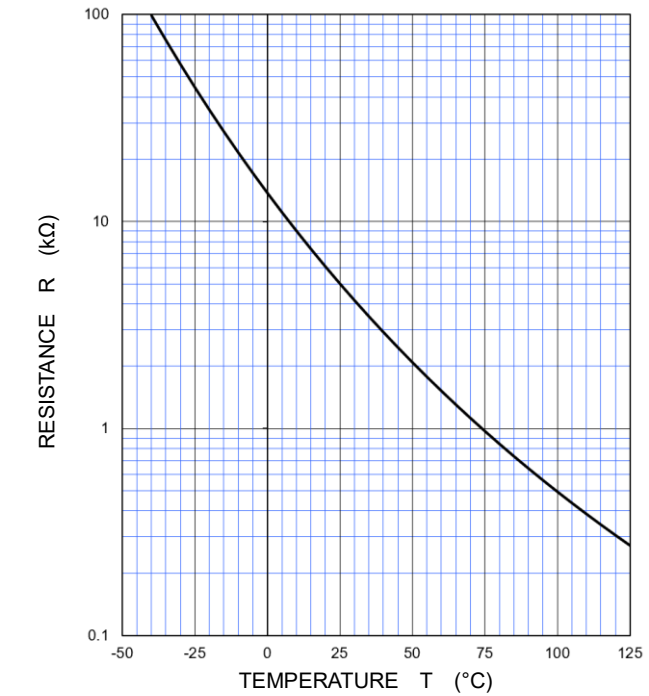
Single pulse, $T_c=25\text{ }^{\circ}\text{C}$

BRIDGE PART: $R_{th(j-c)Q}=76\text{ K/kW}$, $R_{th(j-c)D}=118\text{ K/kW}$
AC SWITCH PART: $R_{th(j-c)Q}=109\text{ K/kW}$, $R_{th(j-c)D}=167\text{ K/kW}$



NTC THERMISTOR PART

TEMPERATURE
CHARACTERISTICS
(TYPICAL)



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

CM400ST-24THIGH POWER SWITCHING USE
INSULATED TYPE**Important Notice**

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CM400ST-24T

HIGH POWER SWITCHING USE
INSULATED TYPE

Keep safety first in your circuit designs!

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