

<IGBT Modules>

CM400DY-34T

HIGH POWER SWITCHING USE
INSULATED TYPE



dual switch (half-bridge)

Collector current I_C **4 0 0 A**
 Collector-emitter voltage V_{CES} **1 7 0 0 V**
 Maximum junction temperature T_{vjmax} **1 7 5 °C**

- Flat base type
- Nickel-plating tab terminals
- RoHS Directive compliant
- UL Recognized under UL1557, File No.E323585

APPLICATION

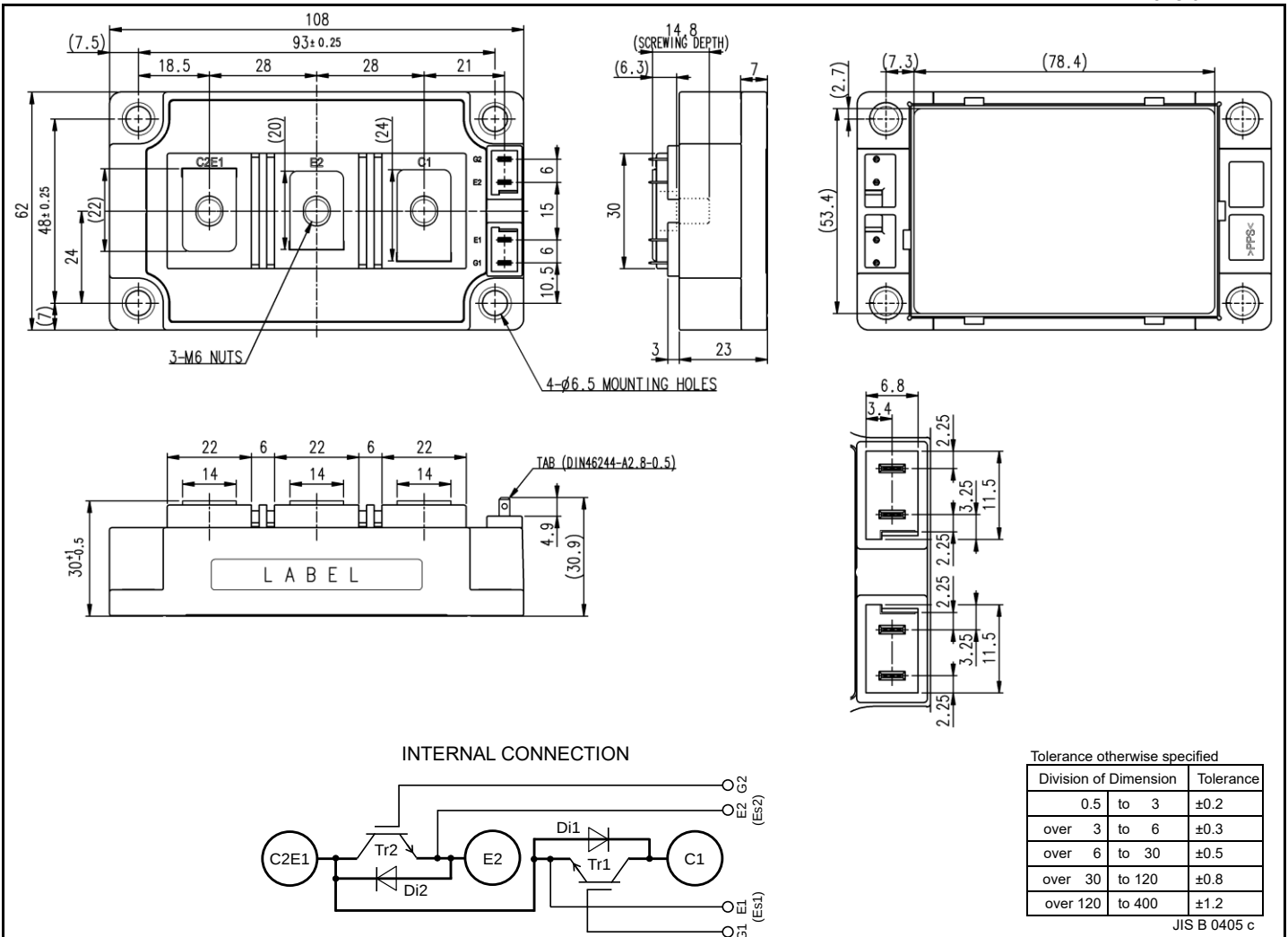
AC Motor Control, Motion/Servo Control, Power supply, etc.

OPTION (Below options are available.)

- PC-TIM (Phase Change Thermal Interface Material) pre-apply (Note8)
- V_{CESat} selection for parallel connection

OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm



CM400DY-34T

HIGH POWER SWITCHING USE
INSULATED TYPEMAXIMUM RATINGS (T_{vj}=25 °C, unless otherwise specified)

Symbol	Item	Conditions	Rating	Unit
V _{CES}	Collector-emitter voltage	G-E short-circuited	1700	V
V _{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I _C	Collector current	DC, T _C =132 °C* (Note2, 4)	400	A
I _{CRM}		Pulse, Repetitive (Note3)	800	
P _{tot}	Total power dissipation	T _C =25 °C (Note2, 4)	4345	W
I _E (Note1)	Emitter current	DC (Note2)	400	A
I _{ERM} (Note1)		Pulse, Repetitive (Note3)	800	
V _{isol}	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	4000	V
T _{vjmax}	Maximum junction temperature	Instantaneous event (overload) (Note8)	175	°C
T _{Cmax}	Maximum case temperature	(Note4,8)	150*	
T _{vjop}	Operating junction temperature	Continuous operation (under switching) (Note8)	-40 ~ +150	°C
T _{stg}	Storage temperature	-	-40 ~ +150*	

ELECTRICAL CHARACTERISTICS (T_{vj}=25 °C, unless otherwise specified)

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 =40 mA, V _{CE} =10 V		5.4	6.0	6.6	V
V _{CESat} (Terminal)	Collector-emitter saturation voltage	I _C =400 A, V _{GE} =15 V, Refer to the figure of test circuit (Note5)	T _{vj} =25 °C	-	2.10	2.50	V
			T _{vj} =125 °C	-	2.55	-	
			T _{vj} =150 °C	-	2.65	-	
V _{CESat} (Chip)		I _C =400 A, V _{GE} =15 V, (Note5)	T _{vj} =25 °C	-	1.95	2.35	V
			T _{vj} =125 °C	-	2.35	-	
			T _{vj} =150 °C	-	2.45	-	
C _{ies}	Input capacitance	V _{CE} =10 V, G-E short-circuited		-	-	110	nF
C _{oes}	Output capacitance			-	-	2.9	
C _{res}	Reverse transfer capacitance			-	-	0.9	
Q _G	Gate charge	V _{CC} =1000 V, I _C =400 A, V _{GE} =15 V		-	3.1	-	μC
t _{d(on)}	Turn-on delay time	V _{CC} =1000 V, I _C =400 A, V _{GE} =±15 V, R _G =0 Ω, Inductive load		-	-	800	ns
t _r	Rise time			-	-	200	
t _{d(off)}	Turn-off delay time			-	-	800	
t _f	Fall time			-	-	600	
V _{EC} (Note.1) (Terminal)	Emitter-collector voltage	I _E =400 A, G-E short-circuited, Refer to the figure of test circuit (Note5)	T _{vj} =25 °C	-	2.80	3.55	V
			T _{vj} =125 °C	-	3.05	-	
			T _{vj} =150 °C	-	3.05	-	
V _{EC} (Note.1) (Chip)		I _E =400 A, G-E short-circuited, (Note5)	T _{vj} =25 °C	-	2.65	3.35	V
			T _{vj} =125 °C	-	2.75	-	
			T _{vj} =150 °C	-	2.75	-	
t _{rr} (Note1)	Reverse recovery time	V _{CC} =1000 V, I _E =400 A, V _{GE} =±15 V, R _G =0 Ω, Inductive load		-	-	300	ns
Q _{rr} (Note1)	Reverse recovery charge	R _G =0 Ω, Inductive load		-	20	-	μC
E _{on}	Turn-on switching energy per pulse	V _{CC} =1000 V, I _C =I _E =400 A, V _{GE} =±15 V, R _G =0 Ω, T _{vj} =150 °C, Inductive load		-	80.6	-	mJ
E _{off}	Turn-off switching energy per pulse			-	97.5	-	
E _{rr} (Note1)	Reverse recovery energy per pulse	Inductive load		-	50.6	-	mJ
R _{CC'+EE'}	Internal lead resistance	Main terminals-chip, per switch, T _C =25 °C (Note4)		-	0.3	-	mΩ
r _g	Internal gate resistance	Per switch		-	2.0	-	Ω

*The value of PC-TIM applied module is limited by the heat resistant temperature of PC-TIM.

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)	-	-	34.5	K/kW
$R_{th(j-c)D}$		Junction to case, per Inverter FWD (Note4)	-	-	58.3	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module Thermal grease applied (Note4,6,8)	-	13.3	-	K/kW

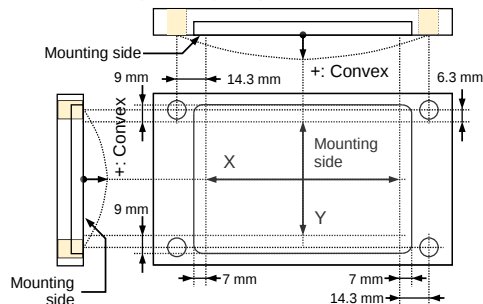
MECHANICAL CHARACTERISTICS

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 6 screw	3.5	4.0	4.5	N·m
d_s	Creepage distance	Terminal to terminal	17.3	-	-	mm
		Terminal to base plate	25.3	-	-	
d_a	Clearance	Terminal to terminal	12.6	-	-	mm
		Terminal to base plate	21.8	-	-	
e_c	Flatness of base plate	On the centerline X, Y (Note7)	±0	-	+200	μm
m	mass	-	-	260	-	g

*, 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}) does 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.
- Typical value is measured by using thermally conductive grease of $\lambda=3.0 \text{ W/(m}\cdot\text{K)}/D_{(C-S)}=50 \text{ }\mu\text{m}$.
- The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



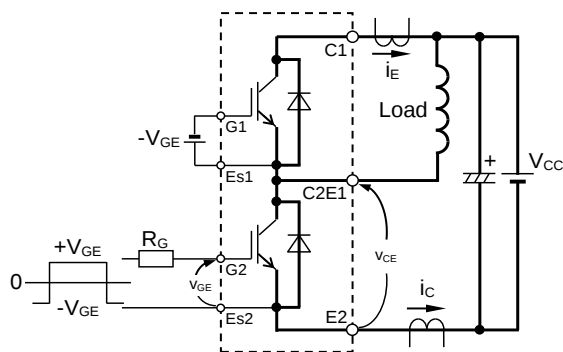
- Long term performance related to thermal conductive grease and PC-TIM (including but not limited to aspects such as the increase of thermal resistance due to pumping out, etc.) should be verified under your specific application conditions. Each temperature condition (T_{vjmax} , T_{vjop} , T_{cmax}) must be maintained below the maximum rated temperature throughout consideration of the temperature rise even for long term usage.

CHIP LOCATION (Top view)

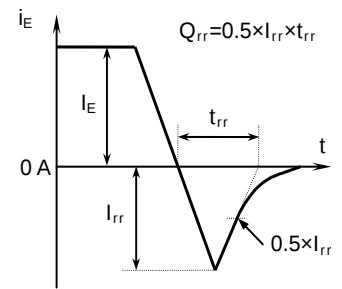
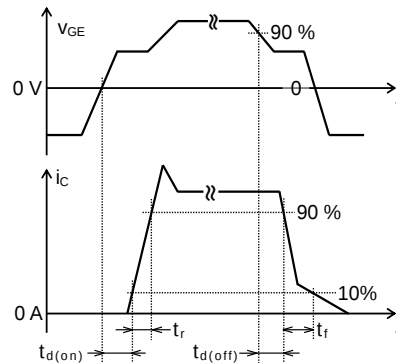
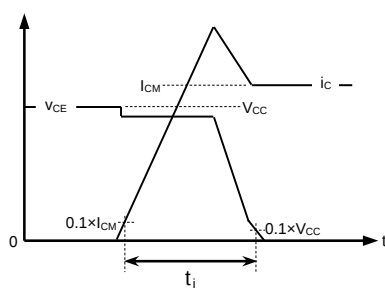
Technical drawing of the front view of the PCB assembly. The drawing shows a rectangular board with four mounting holes at the corners. Dimensions are provided in millimeters. The overall width is 108 mm and the overall height is 62 mm. The distance between the centers of the mounting holes is 93 mm horizontally and 48 mm vertically. The drawing also shows the locations of various components, including two D-sub connectors (E1, E2) and two RJ45 connectors (G1, G2). The components are labeled with their part numbers: Tr1-Di1, Tr1-Tr1, Tr2-Di2, Tr2-Tr2, and G1. The drawing is labeled "LABEL SIDE" at the bottom right.

MITSUBISHI ELECTRIC CORPORATION

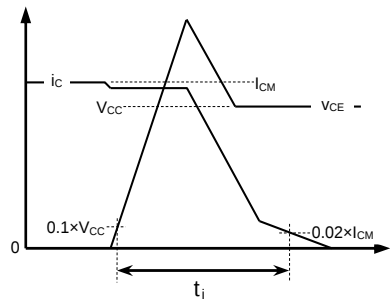
TEST CIRCUIT AND WAVEFORMS



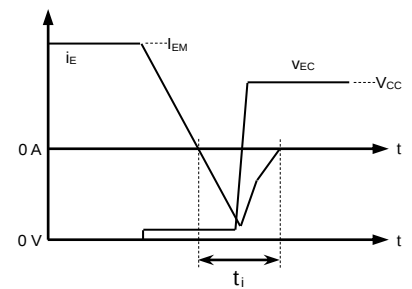
Switching characteristics test circuit and waveforms

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

IGBT Turn-on switching energy



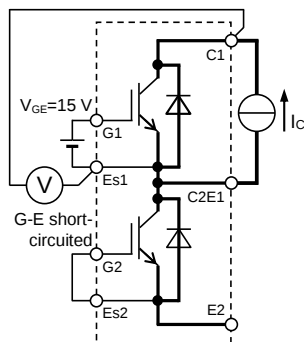
IGBT Turn-off switching energy



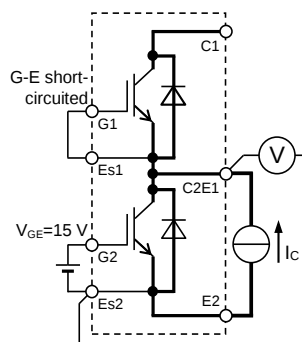
FWD Reverse recovery energy

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

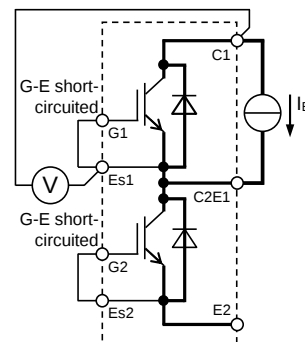
TEST CIRCUIT



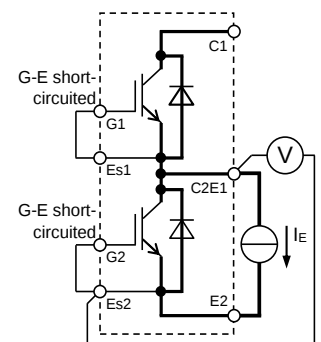
Tr1

 V_{CEsat} characteristics test circuit

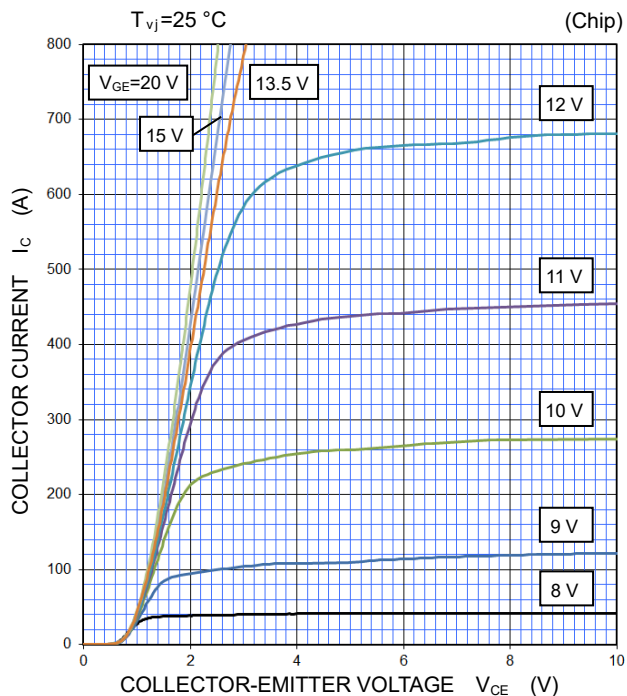
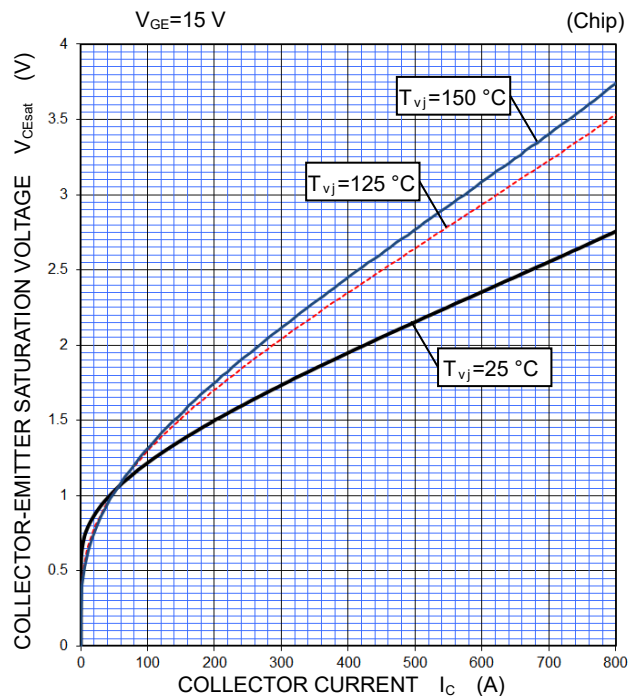
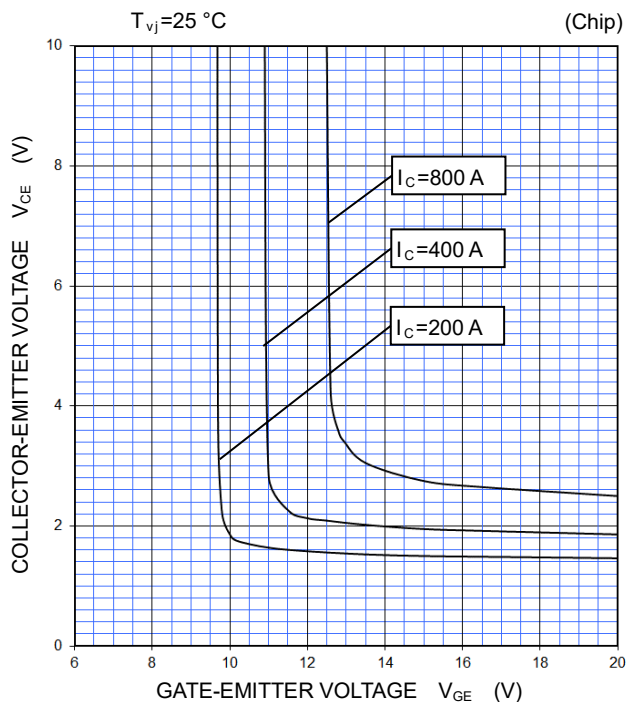
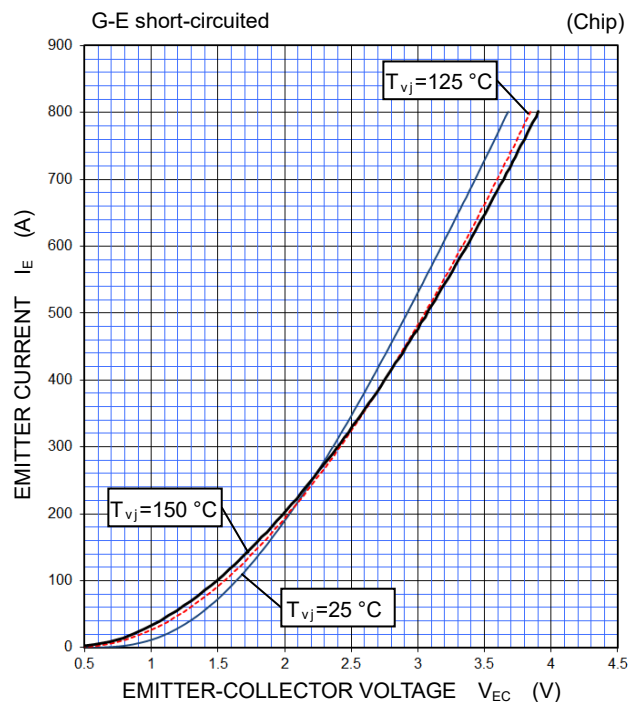
Tr2



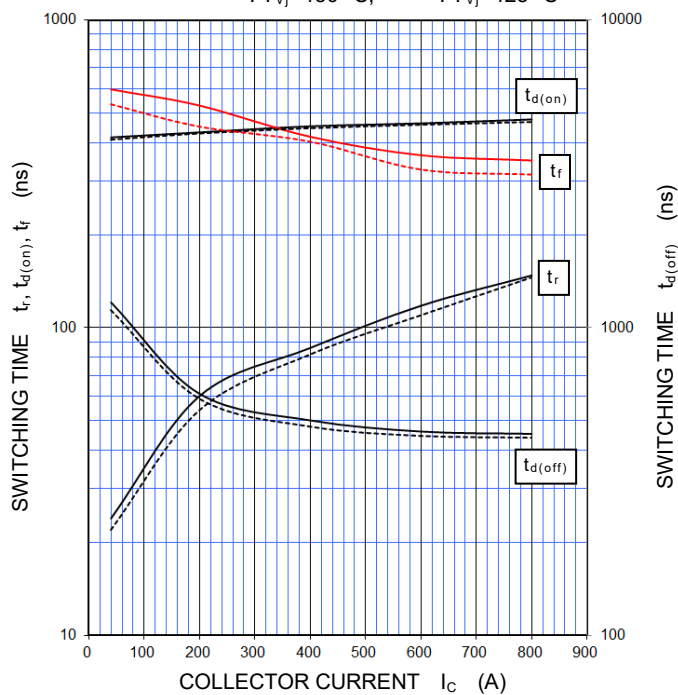
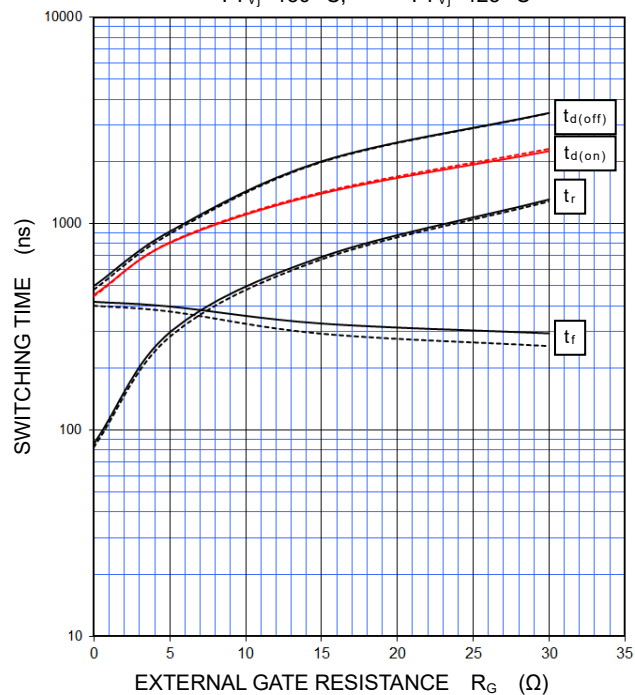
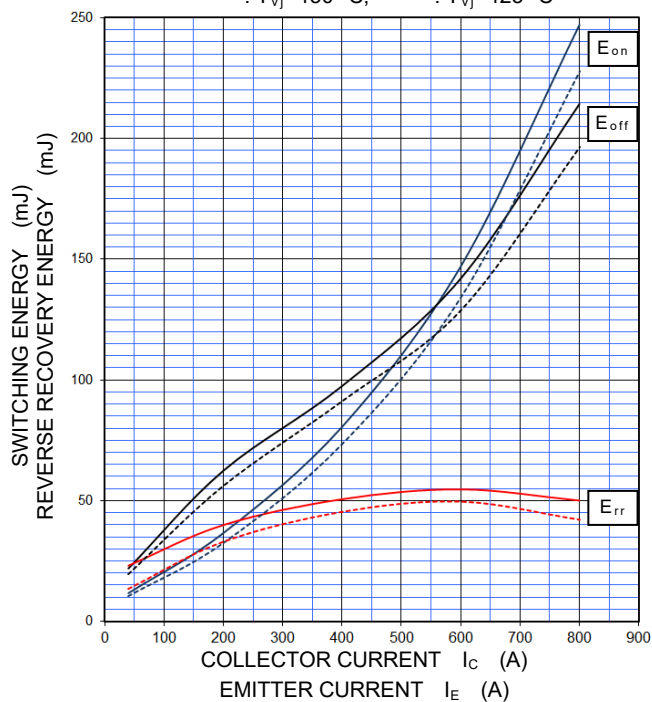
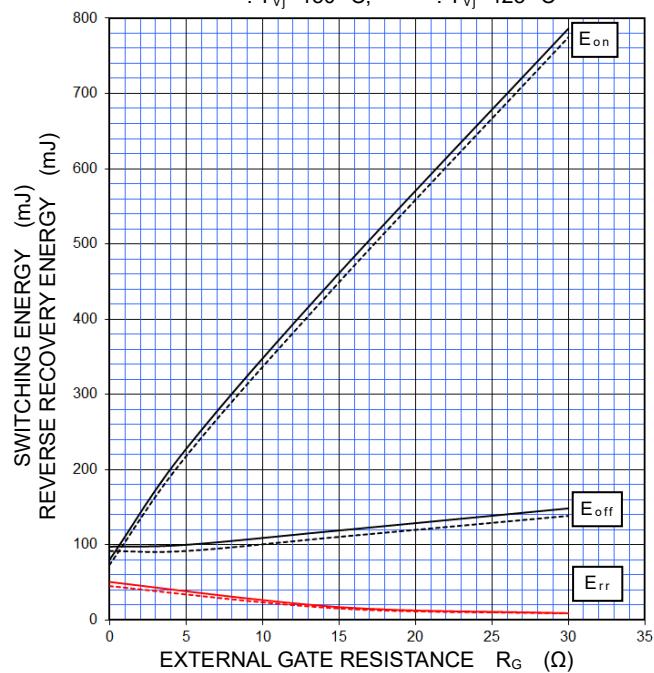
Di1

 V_{EC} characteristics test circuit

Di2

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

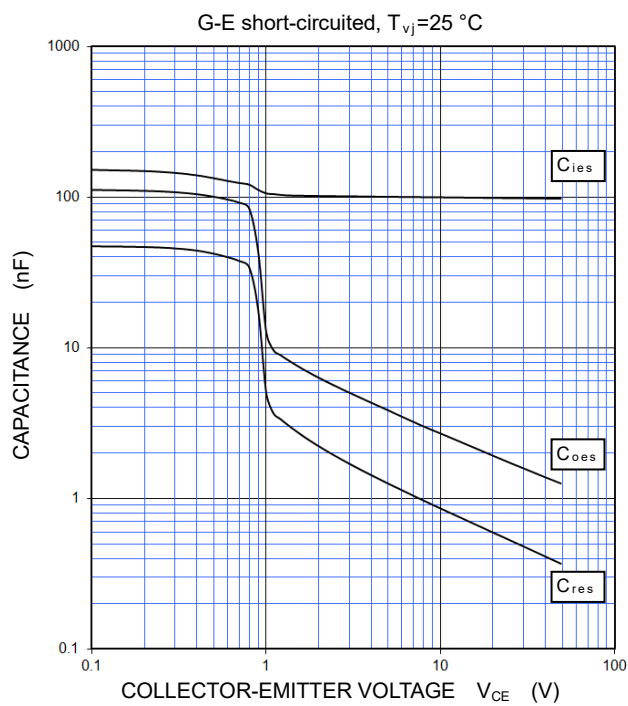
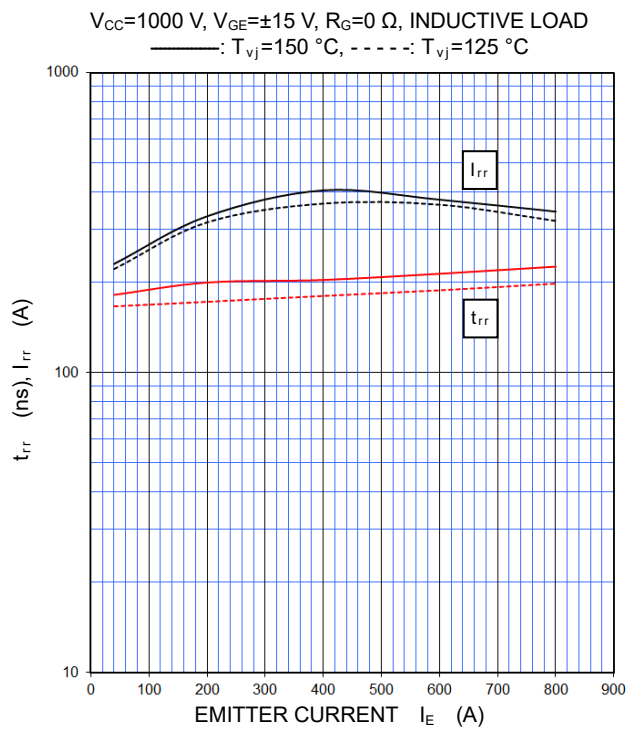
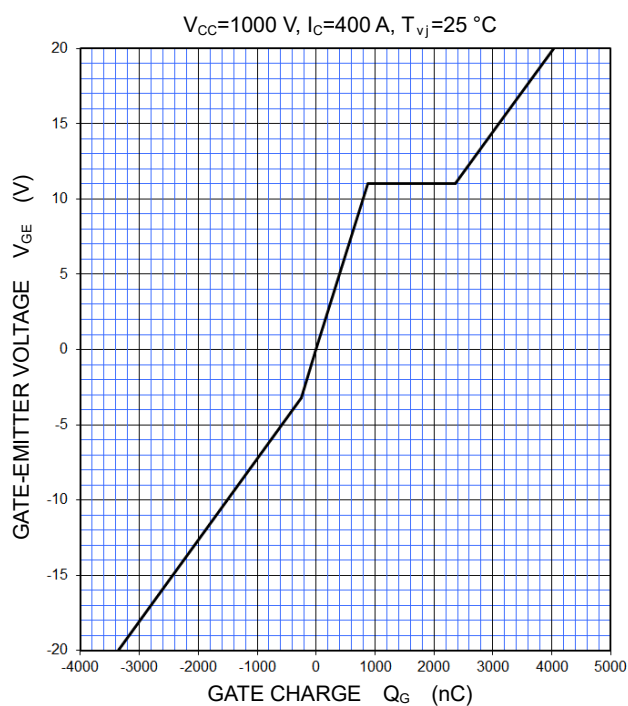
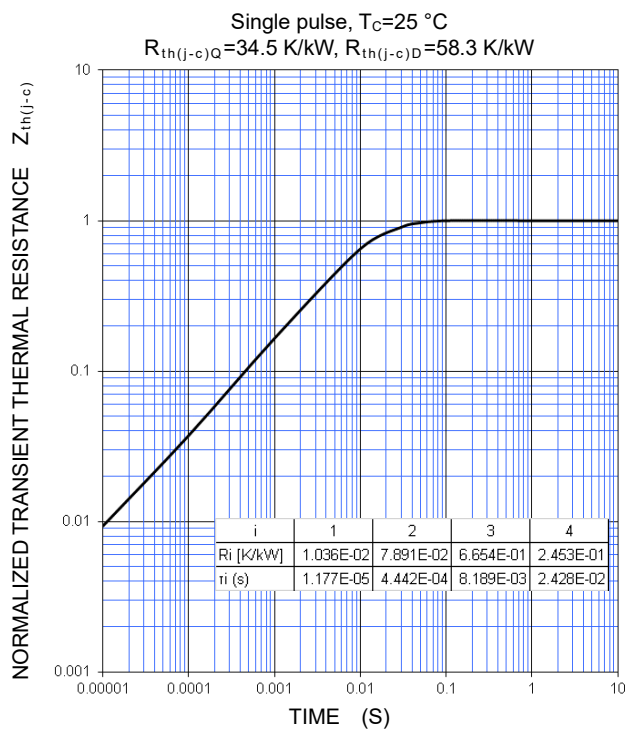
PERFORMANCE CURVES

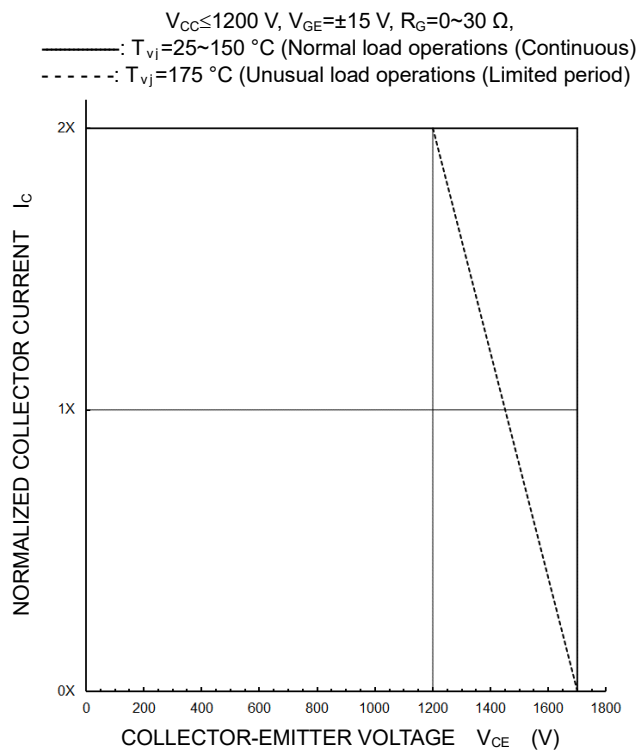
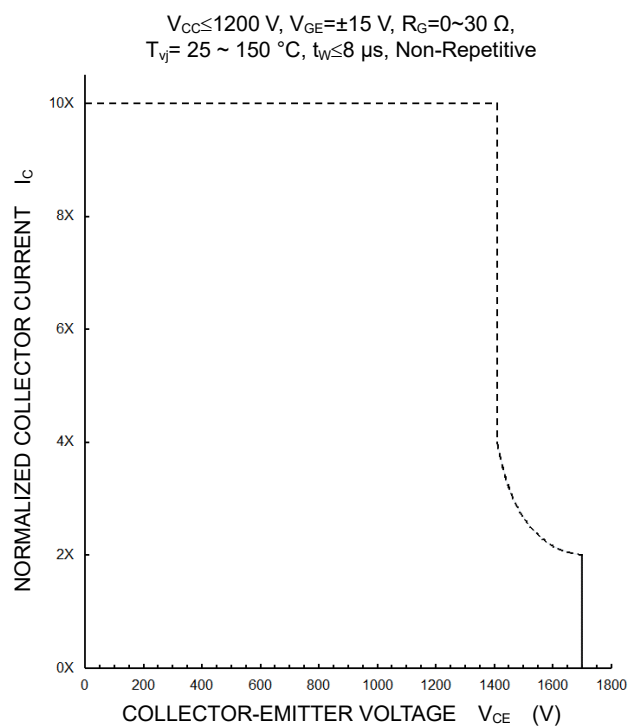
HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL) $V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - - : $T_{vj}=125\text{ }^\circ\text{C}$ HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL) $V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=400\text{ A}$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - - : $T_{vj}=125\text{ }^\circ\text{C}$ HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL) $V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - - : $T_{vj}=125\text{ }^\circ\text{C}$ HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL) $V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $I_C=400\text{ A}$, INDUCTIVE LOAD
—: $T_{vj}=150\text{ }^\circ\text{C}$, - - - - : $T_{vj}=125\text{ }^\circ\text{C}$ 

CM400DY-34T

HIGH POWER SWITCHING USE

INSULATED TYPE

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

PERFORMANCE CURVES**TURN-OFF SWITCHING SAFE OPERATING AREA
(REVERSE BIAS SAFE OPERATING AREA)
(MAXIMUM)****SHORT-CIRCUIT SAFE OPERATING AREA
(MAXIMUM)**

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

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