

&lt;IGBT Modules&gt;

# CM200DY-40TA

 HIGH POWER SWITCHING USE  
INSULATED TYPE


dual switch (half-bridge)

**APPLICATION**

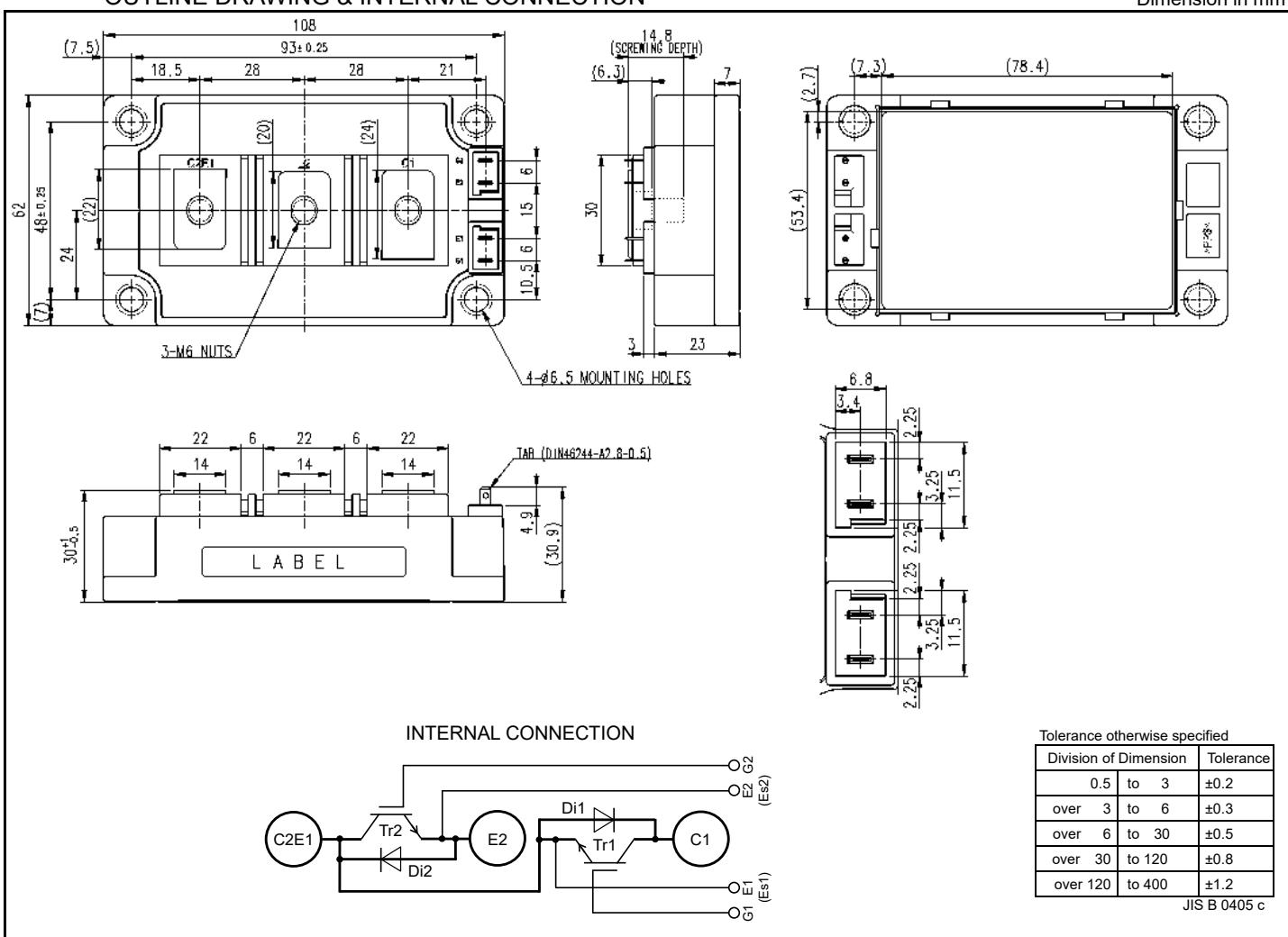
- Medium voltage drive, etc.

**OPTION**

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

**OUTLINE DRAWING & INTERNAL CONNECTION**

Dimension in mm



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**MAXIMUM RATINGS (T<sub>vj</sub>=25 °C, unless otherwise specified)**

Symbol	Item	Conditions	Rating	Unit
V <sub>CES</sub>	Collector-emitter voltage	G-E short-circuited	2000	V
V <sub>GES</sub>	Gate-emitter voltage	C-E short-circuited	± 20	V
I <sub>C</sub>	Collector current	DC, T <sub>C</sub> =140 °C (Note2, 4)	200	A
I <sub>CRM</sub>		Pulse, Repetitive (Note3)	400	
P <sub>tot</sub>	Total power dissipation	T <sub>C</sub> =25 °C (Note2, 4)	2170	W
I <sub>E</sub> (Note1)	Emitter current	DC (Note2)	200	A
I <sub>ERM</sub> (Note1)		Pulse, Repetitive (Note3)	400	
V <sub>isol</sub>	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	4000	V
T <sub>vjmax</sub>	Maximum junction temperature	Instantaneous event (overload) (Note8)	175	°C
T <sub>Cmax</sub>	Maximum case temperature	(Note4, 8)	150	
T <sub>vjop</sub>	Operating junction temperature	Continuous operation (Note8)	-40 ~ +150	°C
T <sub>stg</sub>	Storage temperature	-	-40 ~ +150	

**ELECTRICAL CHARACTERISTICS (T<sub>vj</sub>=25 °C, unless otherwise specified)**

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
I <sub>CES</sub>	Collector-emitter cut-off current	V <sub>CE</sub> =V <sub>CES</sub> , G-E short-circuited	-	-	1	mA
I <sub>GES</sub>	Gate-emitter leakage current	V <sub>GE</sub> =V <sub>GES</sub> , C-E short-circuited	-	-	0.5	µA
V <sub>GE(th)</sub>	Gate-emitter threshold voltage	I <sub>C</sub> =20 mA, V <sub>CE</sub> =10 V	5.5	6.0	6.6	V
V <sub>CEsat</sub> (Terminal)	Collector-emitter saturation voltage	I <sub>C</sub> =200 A, V <sub>GE</sub> =15 V, Refer to the figure of test circuit (Note5)	T <sub>vj</sub> =25 °C	-	1.80	2.10
			T <sub>vj</sub> =125 °C	-	2.15	-
			T <sub>vj</sub> =150 °C	-	2.20	-
V <sub>CEsat</sub> (Chip)	Collector-emitter saturation voltage	I <sub>C</sub> =200 A, V <sub>GE</sub> =15 V, (Note5)	T <sub>vj</sub> =25 °C	-	1.75	2.00
			T <sub>vj</sub> =125 °C	-	2.10	-
			T <sub>vj</sub> =150 °C	-	2.15	-
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> =10 V, G-E short-circuited	-	-	55	nF
C <sub>oes</sub>	Output capacitance		-	-	1.0	
C <sub>res</sub>	Reverse transfer capacitance		-	-	0.4	
Q <sub>G</sub>	Gate charge	V <sub>CC</sub> =1300 V, I <sub>C</sub> =200 A, V <sub>GE</sub> =15 V	-	1.6	-	µC
t <sub>d(on)</sub>	Turn-on delay time	V <sub>CC</sub> =1300 V, I <sub>C</sub> =200 A, V <sub>GE</sub> =±15 V, R <sub>G</sub> =0 Ω, Inductive load	-	-	800	ns
t <sub>r</sub>	Rise time		-	-	150	
t <sub>d(off)</sub>	Turn-off delay time		-	-	900	
t <sub>f</sub>	Fall time		-	-	2300	
V <sub>EC</sub> (Note1) (Terminal)	Emitter-collector voltage	I <sub>E</sub> =200 A, G-E short-circuited, Refer to the figure of test circuit (Note5)	T <sub>vj</sub> =25 °C	-	2.05	2.90
			T <sub>vj</sub> =125 °C	-	2.35	-
			T <sub>vj</sub> =150 °C	-	2.35	-
V <sub>EC</sub> (Note1) (Chip)	Emitter-collector voltage	I <sub>E</sub> =200 A, G-E short-circuited, (Note5)	T <sub>vj</sub> =25 °C	-	2.00	2.75
			T <sub>vj</sub> =125 °C	-	2.30	-
			T <sub>vj</sub> =150 °C	-	2.30	-
t <sub>rr</sub> (Note1)	Reverse recovery time	V <sub>CC</sub> =1300 V, I <sub>E</sub> =200 A, V <sub>GE</sub> =±15 V, R <sub>G</sub> =0 Ω, Inductive load	-	-	1000	ns
	Reverse recovery charge		-	52.5	-	
E <sub>on</sub>	Turn-on switching energy per pulse	V <sub>CC</sub> =1300 V, I <sub>C</sub> =I <sub>E</sub> =200 A, V <sub>GE</sub> =±15 V, R <sub>G</sub> =0 Ω, T <sub>vj</sub> =150 °C, Inductive load	-	97.1	-	mJ
E <sub>off</sub>	Turn-off switching energy per pulse		-	163.2	-	
E <sub>rr</sub> (Note1)	Reverse recovery energy per pulse		-	64.4	-	
R <sub>CC'+EE'</sub>	Internal lead resistance	Main terminals-chip, per switch, T <sub>C</sub> =25 °C (Note4)	-	0.40	-	mΩ
r <sub>g</sub>	Internal gate resistance	Per switch	-	3.8	-	Ω

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HIGH POWER SWITCHING USE

INSULATED TYPE

**THERMAL RESISTANCE CHARACTERISTICS**

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
$R_{th(j-c)Q}$	Thermal resistance	Junction to case, per Inverter IGBT <sup>(Note4)</sup>	-	-	69	K/kW	
$R_{th(j-c)D}$		Junction to case, per Inverter FWD <sup>(Note4)</sup>	-	-	123		
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module.	Thermal grease applied <sup>(Note4, 6, 8)</sup>	-	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 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 <sup>(Note7)</sup>		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.

Note 1. Represent ratings and characteristics of the anti-parallel, emitter-collector free-wheeling diode (FWD).

2. Junction temperature ( $T_{vj}$ ) should not increase beyond  $T_{vj\max}$  rating.

3. Pulse width and repetition rate should be such that the device junction temperature ( $T_{vj}$ ) dose not exceed  $T_{vj\max}$  rating.

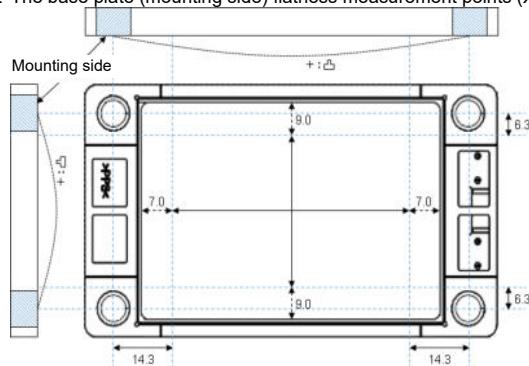
4. Case temperature ( $T_c$ ) and heat sink temperature ( $T_s$ ) are defined on the each surface (mounting side) of base plate and heat sink just under the chips.

Refer to the figure of chip location.

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

6. Typical value by using thermally conductive grease of  $\lambda=3.0$  W/(m·K)/ $D_{(c-s)}=50$  μm.

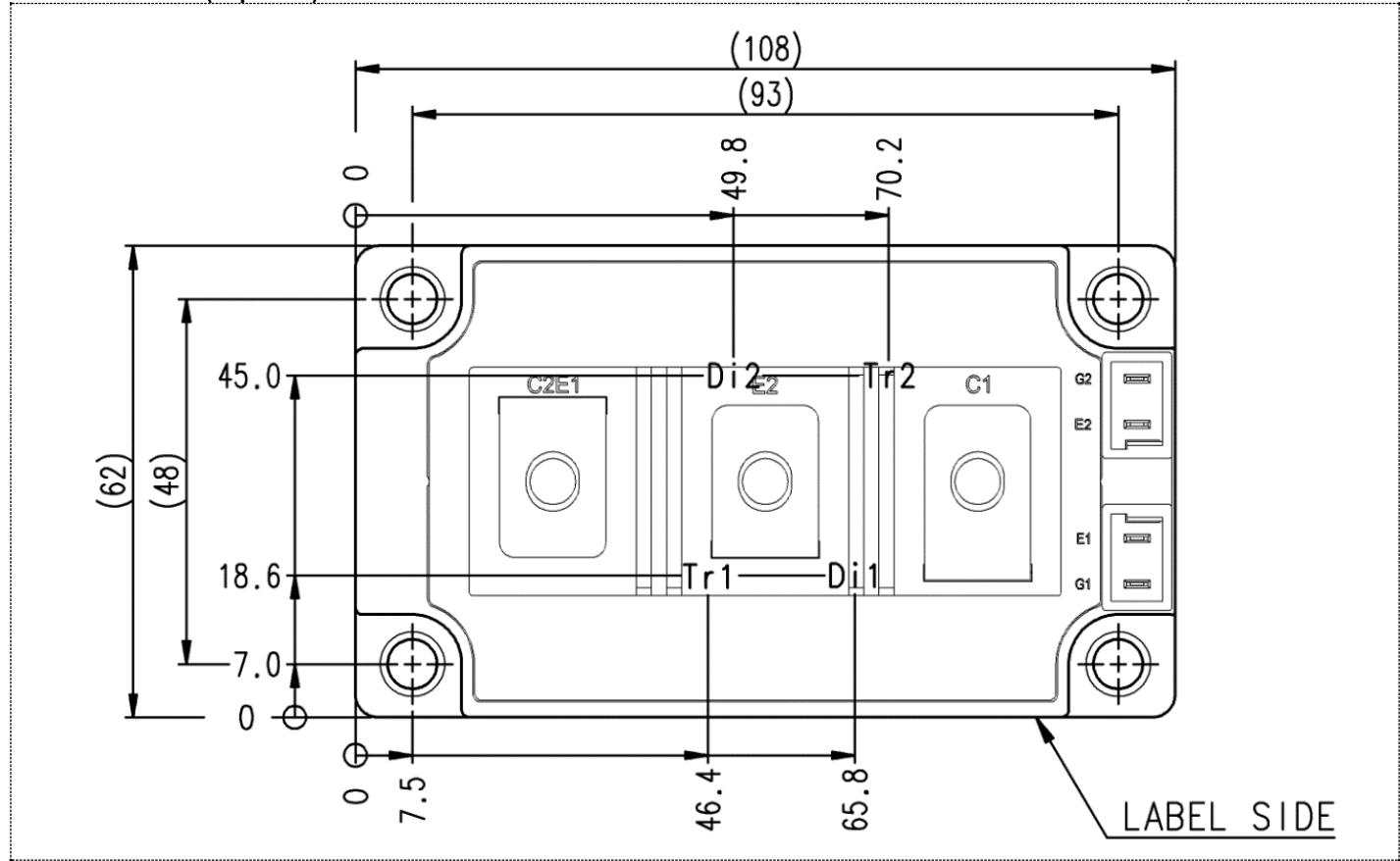
7. The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



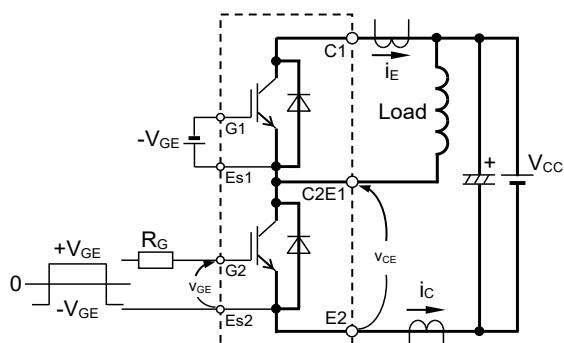
8. Long term performance related to thermal conductive grease (including but not limited to aspects such as the increase of thermal resistance due to pumping out, etc.) should be verified under your specific application conditions. Each temperature condition ( $T_{vj\max}$ ,  $T_{vj\text{op}}$ ,  $T_{c\max}$ ) must be maintained below the maximum rated temperature throughout consideration of the temperature rise even for long term usage.

**RECOMMENDED OPERATING CONDITIONS**

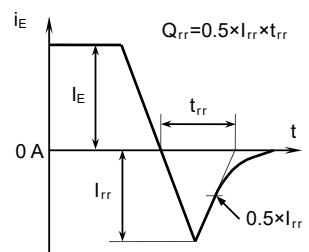
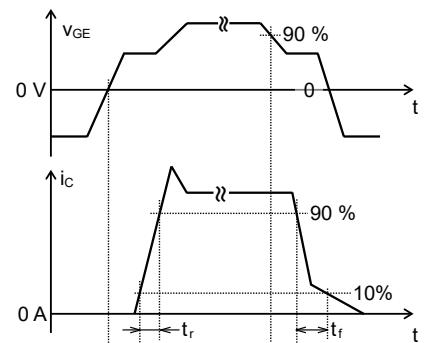
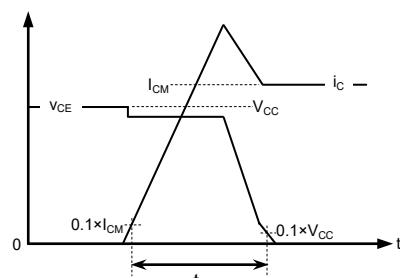
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$V_{CC}$	(DC) Supply voltage	Applied across C1-E2 terminals	-	1300	1500	V
$V_{GEon}$	Gate-emitter drive voltage	Applied across G1-Es1/G2-Es2 terminals	13.5	15.0	16.5	V
$R_G$	External gate resistance	Per switch	0	-	10	$\Omega$

**CHIP LOCATION (Top view)**Dimension in mm, tolerance:  $\pm 1$  mm

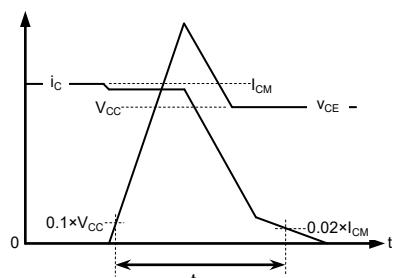
Tr1/Tr2: IGBT, Di1/Di2: FWD

**TEST CIRCUIT AND WAVEFORMS**

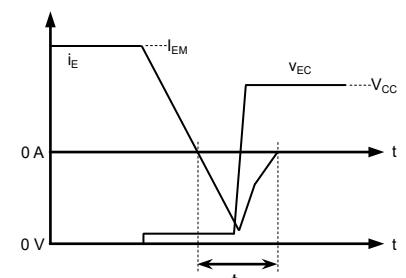
Switching characteristics test circuit and waveforms

t<sub>rr</sub>, Q<sub>rr</sub> characteristics test waveform

IGBT Turn-on switching energy

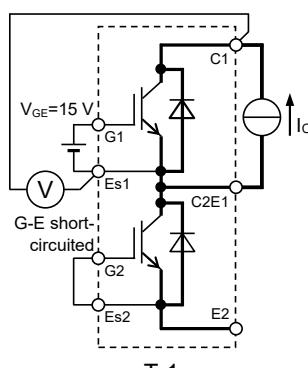
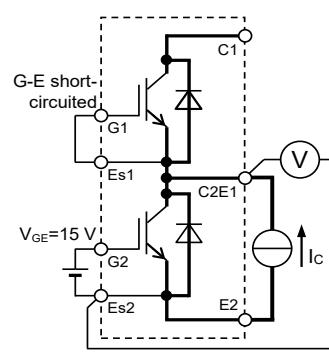


IGBT Turn-off switching energy

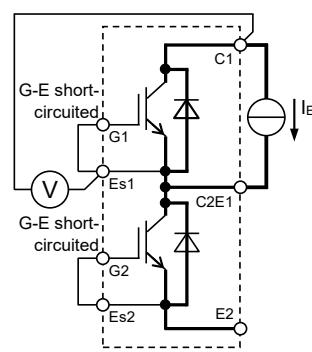


FWD Reverse recovery energy

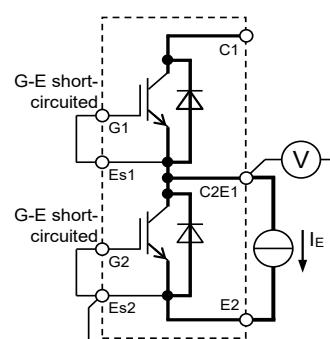
Switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

V<sub>CEsat</sub> characteristics test circuit

Tr2



Di1

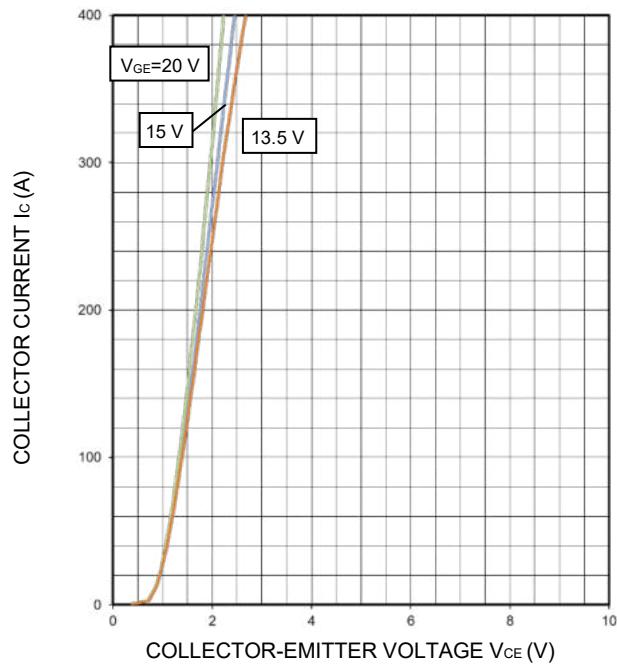


Di2

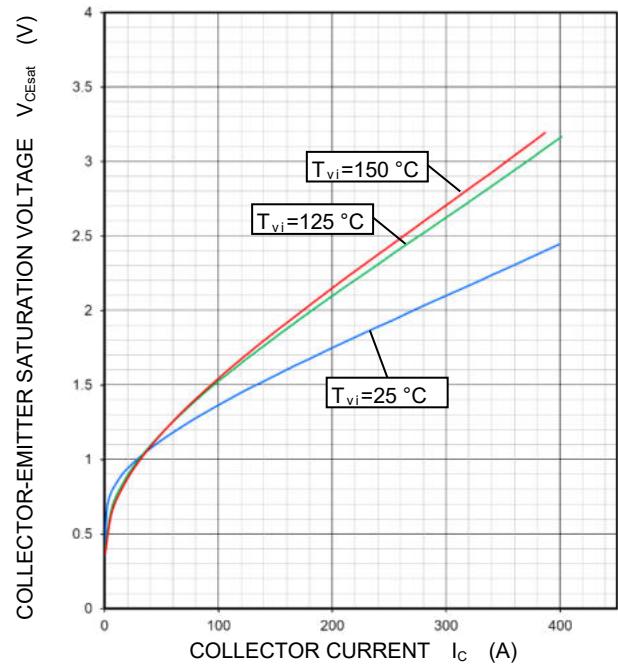
V<sub>CE</sub> characteristics test circuit

**PERFORMANCE CURVES****INVERTER PART****OUTPUT CHARACTERISTICS**

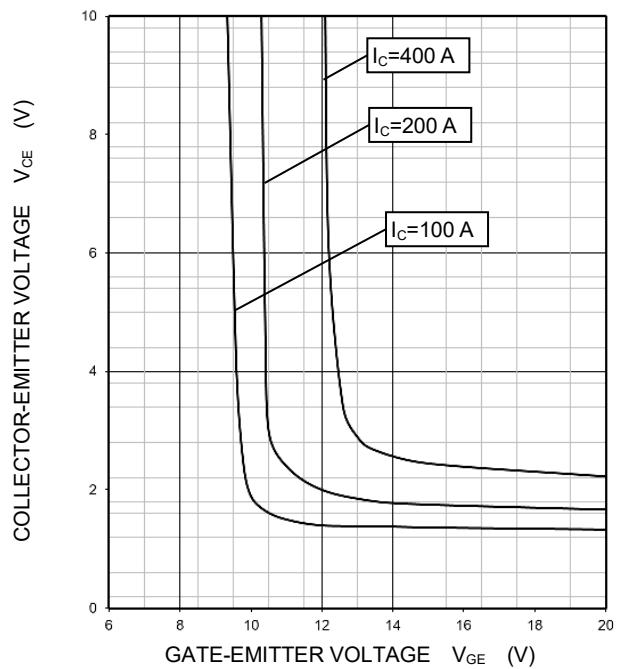
**(TYPICAL)**  
 $T_{vj}=25^{\circ}\text{C}$  (chip)

**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS**

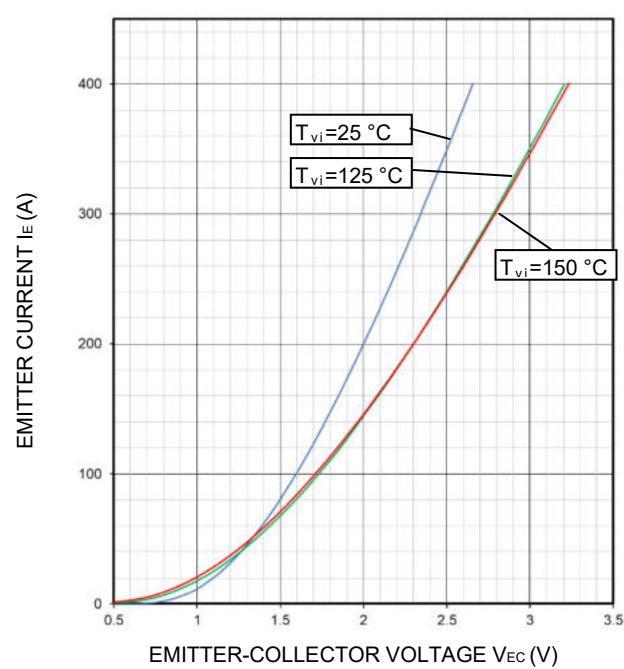
**(TYPICAL)**  
 $V_{GE}=15\text{V}$  (chip)

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

$T_{vj}=25^{\circ}\text{C}$  (chip)

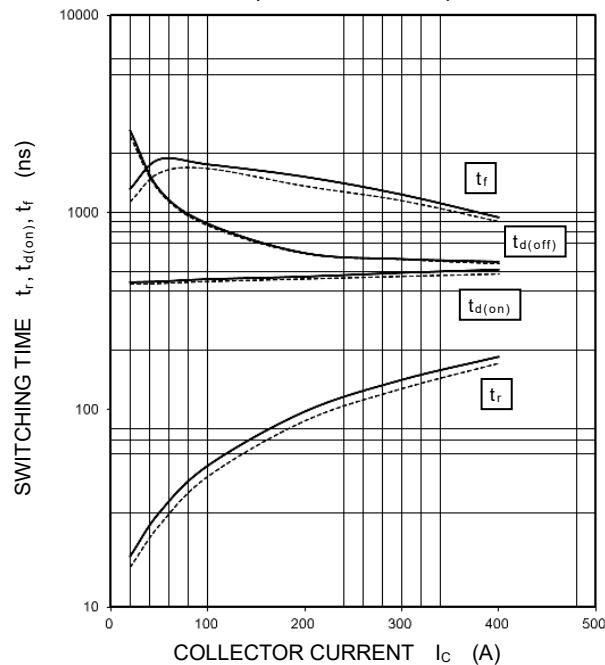
**FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)**

G-E short-circuited (chip)

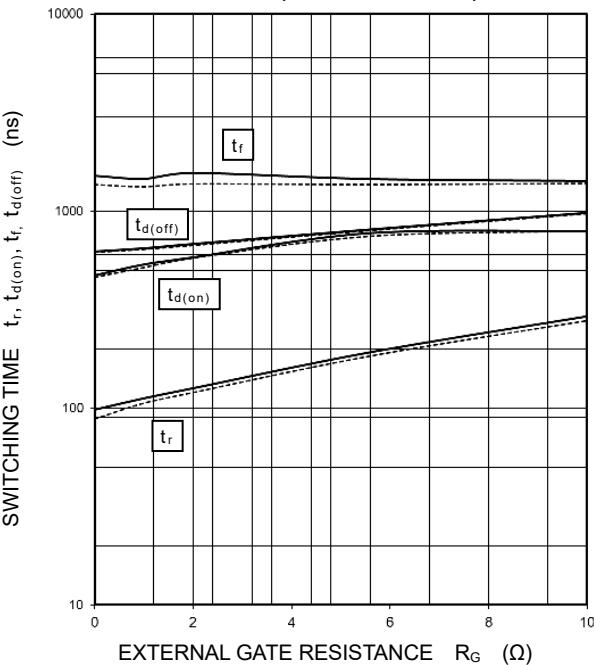


**PERFORMANCE CURVES****INVERTER PART****HALF-BRIDGE SWITCHING CHARACTERISTICS  
(TYPICAL)**

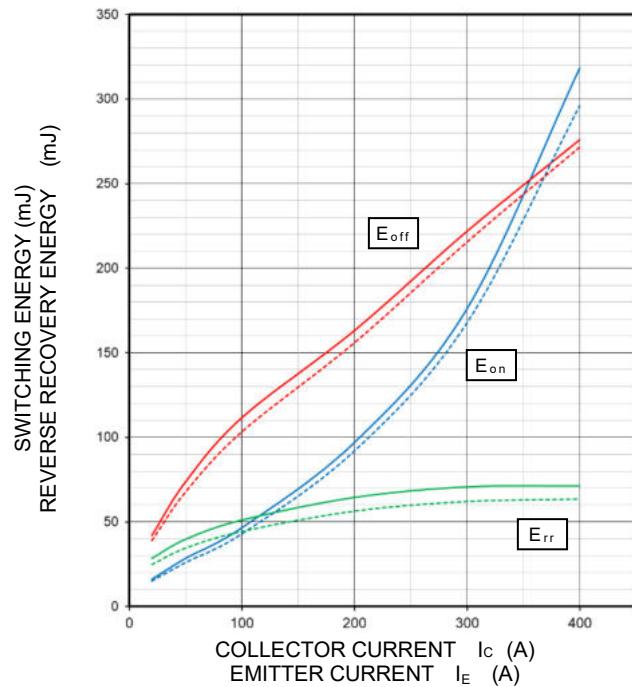
$V_{CC}=1300$  V,  $R_G=0$   $\Omega$ ,  $V_{GE}=\pm 15$  V, INDUCTIVE LOAD  
— :  $T_{vj}=150$   $^{\circ}$ C, - - - :  $T_{vj}=125$   $^{\circ}$ C

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

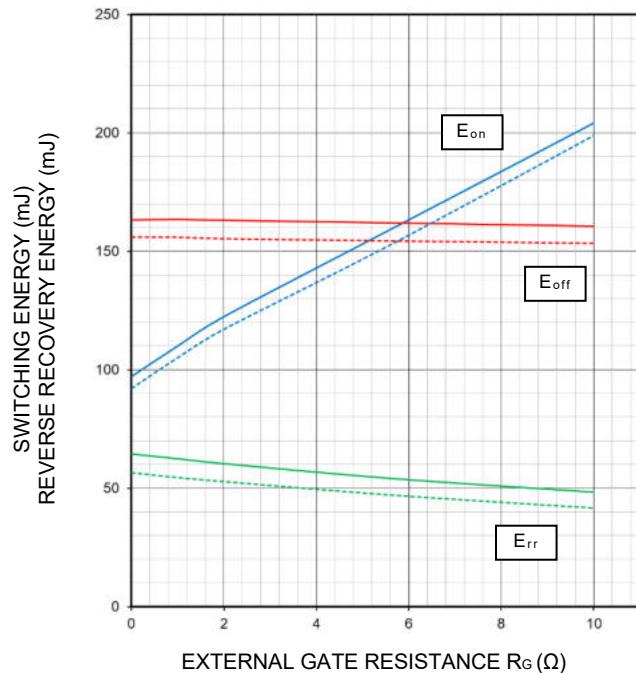
$V_{CC}=1300$  V,  $I_C=200$  A,  $V_{GE}=\pm 15$  V, INDUCTIVE LOAD  
— :  $T_{vj}=150$   $^{\circ}$ C, - - - :  $T_{vj}=125$   $^{\circ}$ C

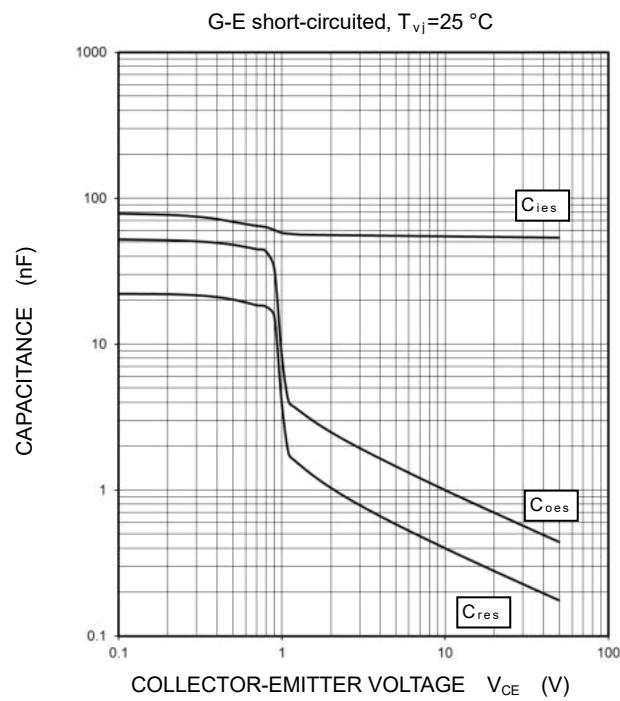
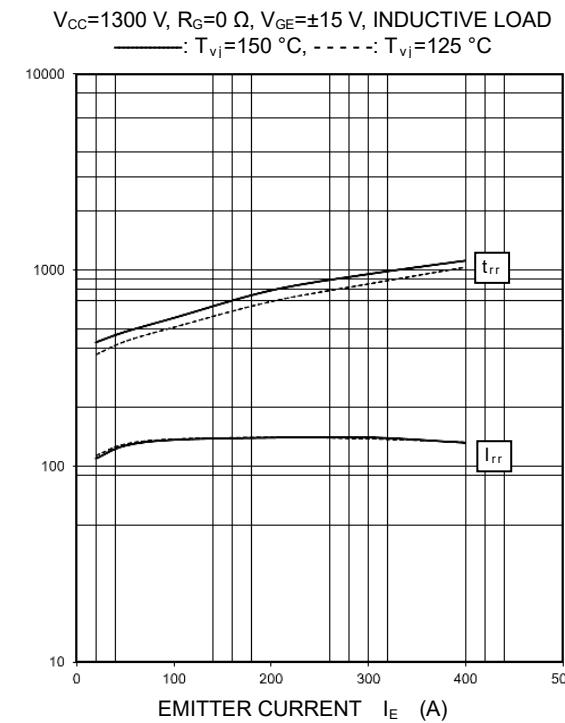
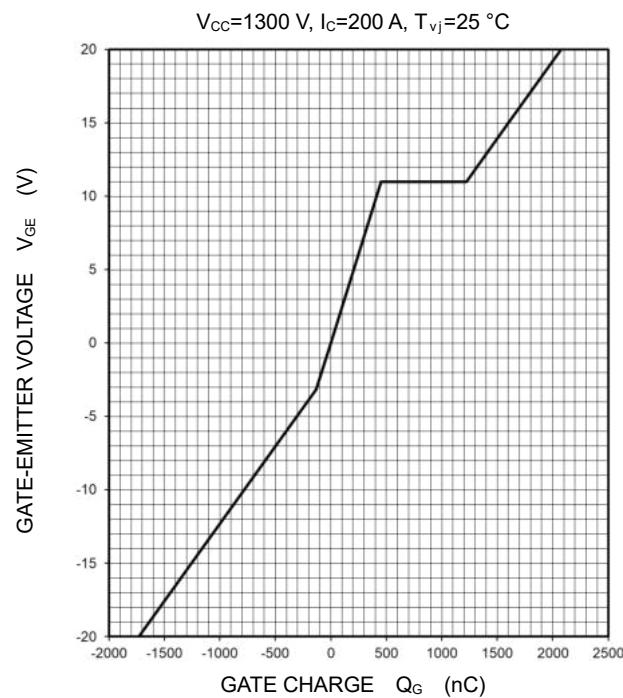
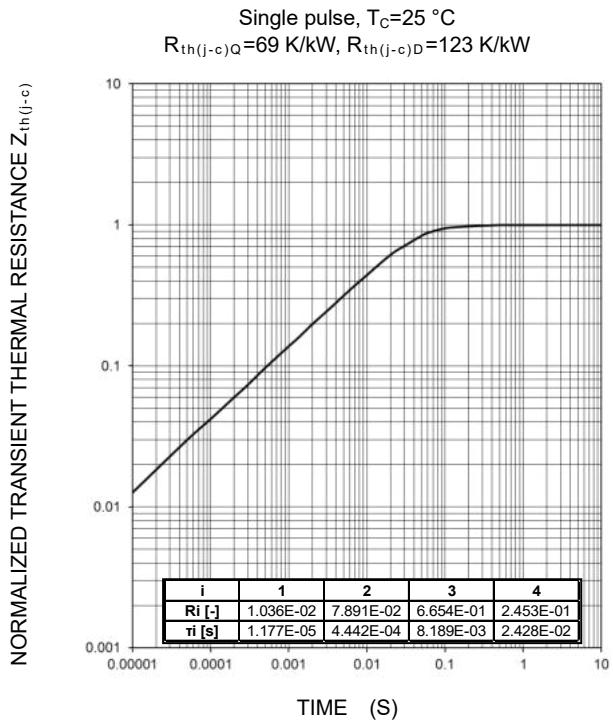
**HALF-BRIDGE SWITCHING CHARACTERISTICS  
(TYPICAL)**

$V_{CC}=1300$  V,  $R_G=0$   $\Omega$ ,  $V_{GE}=\pm 15$  V, INDUCTIVE LOAD  
— :  $T_{vj}=150$   $^{\circ}$ C, - - - :  $T_{vj}=125$   $^{\circ}$ C,  
PER PULSE

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

$V_{CC}=1300$  V,  $I_C/I_E=200$  A,  $V_{GE}=\pm 15$  V, INDUCTIVE LOAD,  
— :  $T_{vj}=150$   $^{\circ}$ C, - - - :  $T_{vj}=125$   $^{\circ}$ C,  
PER PULSE

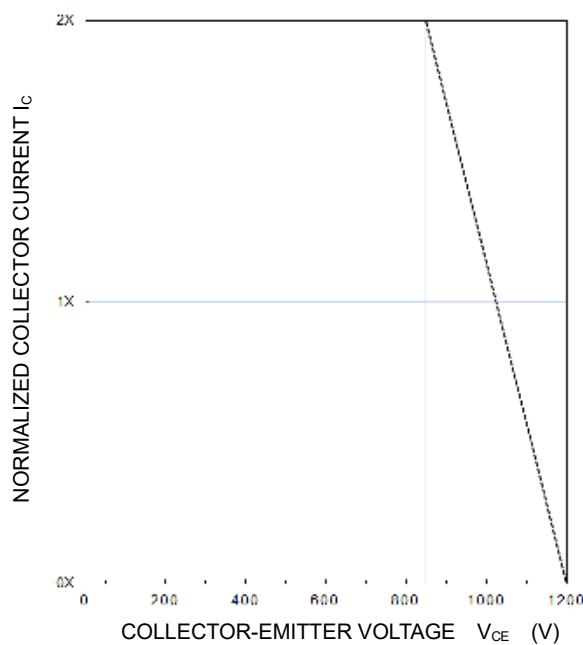


**PERFORMANCE CURVES****INVERTER PART****CAPACITANCE CHARACTERISTICS  
(TYPICAL)****FREE WHEELING DIODE  
REVERSE RECOVERY CHARACTERISTICS  
(TYPICAL)****GATE CHARGE CHARACTERISTICS  
(TYPICAL)****TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS  
(MAXIMUM)**

**PERFORMANCE CURVES**

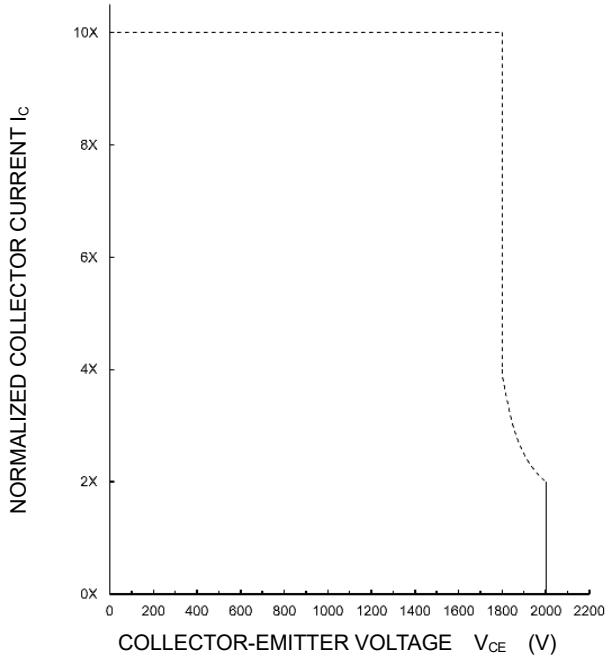
**TURN-OFF SWITCHING SAFE OPERATION AREA  
(REVERSE BIAS SAFE OPERATING AREA)  
(MAXIMUM)**

$V_{CC} \leq 1500 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $R_{G(off)} = 0 \sim 10 \Omega$ ,  
—:  $T_{vj} = 25 \sim 150 \text{ }^{\circ}\text{C}$  (Normal load operations (Continuous))  
- - -:  $T_{vj} = 175 \text{ }^{\circ}\text{C}$  (Unusual load operations (Limited period))



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

$V_{CC} \leq 1500 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
 $T_{vj} = 25 \sim 150 \text{ }^{\circ}\text{C}$ ,  $t_W \leq 6 \mu\text{s}$ , Non-Repetitive



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

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&lt;IGBT Modules&gt;

**CM200DY-40TA**

HIGH POWER SWITCHING USE

INSULATED TYPE

**Keep safety first in your circuit designs!**

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