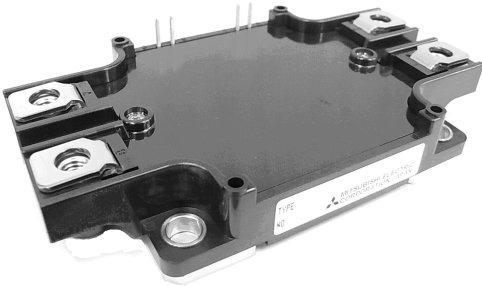


<IGBT Modules>

# CM200EXS-34SA

**HIGH POWER SWITCHING USE  
INSULATED TYPE**



**Brake-chopper**

Collector current  $I_C$  ..... 200 A  
 Collector-emitter voltage  $V_{CES}$  ..... 1700 V  
 Maximum junction temperature  $T_{jmax}$  ..... 175 °C

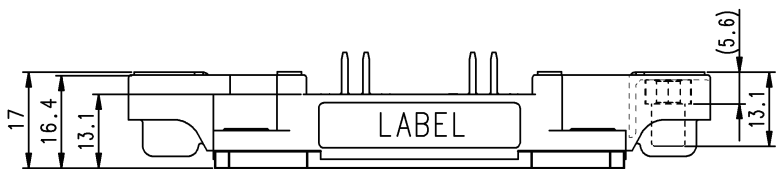
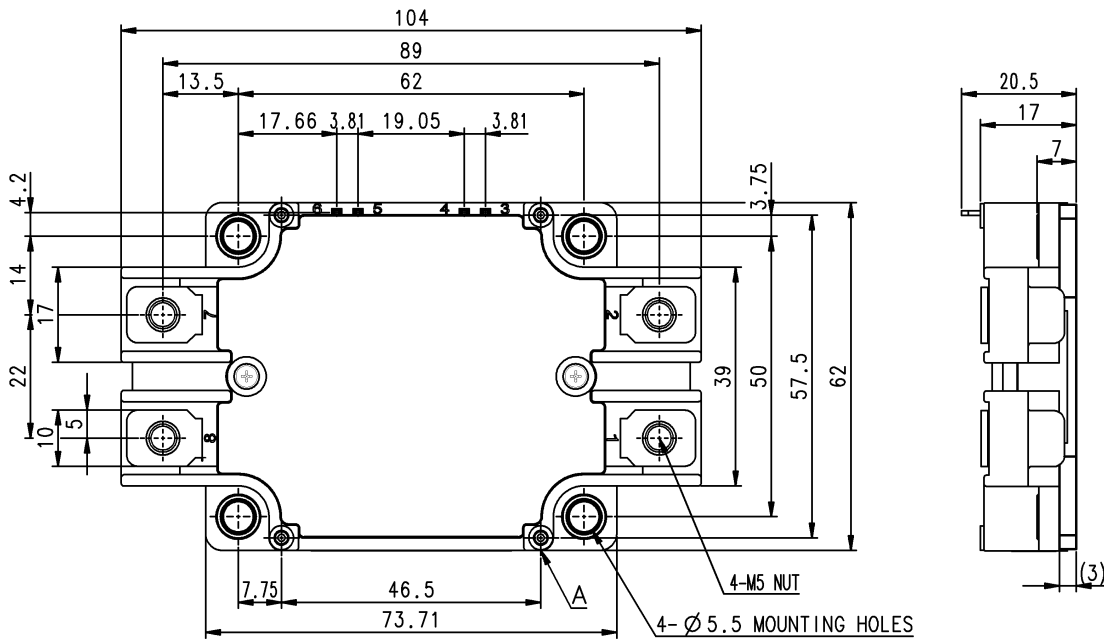
- Flat base Type
- Copper base plate (non-plating)
- Tin plating pin terminals
- RoHS Directive compliant
- Recognized under UL1557, File E323585

## APPLICATION

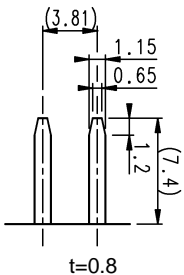
Brake

## OUTLINE DRAWING & INTERNAL CONNECTION

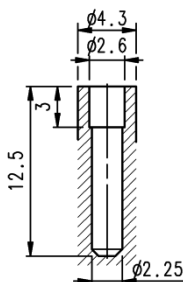
Dimension in mm



### TERMINAL



### SECTION A

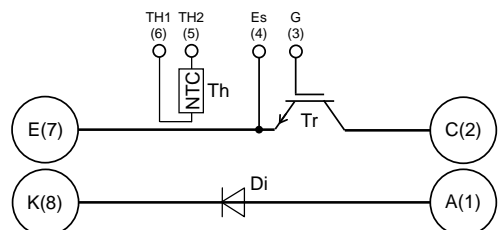


Tolerance otherwise specified

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.

### INTERNAL CONNECTION



**CM200EXS-34SA**HIGH POWER SWITCHING USE  
INSULATED TYPEMAXIMUM RATINGS ( $T_j=25\text{ }^\circ\text{C}$ , unless otherwise specified)

## IGBT PART

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	$\pm 20$	V
$I_C$	Collector current	DC, $T_C=125\text{ }^\circ\text{C}$ (Note1, 3)	200	A
$I_{CRM}$		Pulse, Repetitive (Note2)	400	
$P_{tot}$	Total power dissipation	$T_C=25\text{ }^\circ\text{C}$ (Note1, 3)	2000	W

## DIODE PART

Symbol	Item	Conditions	Rating	Unit
$V_{RRM}$	Repetitive peak reverse voltage	-	1700	V
$I_F$	Forward current	DC (Note1)	200	A
$I_{FRM}$		Pulse, Repetitive (Note2)	400	

## MODULE

Symbol	Item	Conditions	Rating	Unit
$V_{isol}$	Isolation voltage	Terminals to base plate, RMS, $f=60\text{ Hz}$ , AC 1 min	4000	V
$T_{jmax}$	Maximum junction temperature	Instantaneous event (overload)	175	$^\circ\text{C}$
$T_{Cmax}$	Maximum case temperature	(Note3)	125	
$T_{jop}$	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	$^\circ\text{C}$
$T_{stg}$	Storage temperature	-	-40 ~ +125	

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

## IGBT PART

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	$\mu\text{A}$	
$V_{GE(th)}$	Gate-emitter threshold voltage	$I_C=20\text{ mA}$ , $V_{CE}=10\text{ V}$	5.4	6.0	6.6	V	
$V_{Cesat}$ (Terminal)	Collector-emitter saturation voltage	$I_C=200\text{ A}$ , $V_{GE}=15\text{ V}$ , Refer to the figure of test circuit. (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	2.00	2.50	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.20	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.25	-	
$V_{Cesat}$ (Chip)		$I_C=200\text{ A}$ , $V_{GE}=15\text{ V}$ , (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	1.90	2.40	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.10	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.15	-	
$C_{ies}$	Input capacitance	$V_{CE}=10\text{ V}$ , G-E short-circuited	-	-	53	nF	
$C_{oes}$	Output capacitance		-	-	4.3		
$C_{res}$	Reverse transfer capacitance		-	-	0.97		
$Q_G$	Gate charge	$V_{CC}=1000\text{ V}$ , $I_C=200\text{ A}$ , $V_{GE}=15\text{ V}$	-	1100	-	nC	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=1000\text{ V}$ , $I_C=200\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ , $R_G=0\text{ }\Omega$ , Inductive load	-	-	400	ns	
$t_r$	Rise time		-	-	100		
$t_{d(off)}$	Turn-off delay time		-	-	700		
$t_f$	Fall time		-	-	600		
$E_{on}$	Turn-on switching energy per pulse	$V_{CC}=1000\text{ V}$ , $I_C=I_E=200\text{ A}$ ,	-	28	-	mJ	
$E_{off}$	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$ , $R_G=0\text{ }\Omega$ , $T_j=150\text{ }^\circ\text{C}$ ,	-	52	-		
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, $T_C=25\text{ }^\circ\text{C}$ (Note3)	-	-	2.0	m $\Omega$	
$r_g$	Internal gate resistance	-	-	2.5	-	$\Omega$	

**CM200EXS-34SA**HIGH POWER SWITCHING USE  
INSULATED TYPEELECTRICAL CHARACTERISTICS (cont.;  $T_j=25\text{ }^\circ\text{C}$ , unless otherwise specified)

## DIODE PART

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
$I_{RRM}$	Reverse current	$V_R=V_{RRM}$	-	-	1.0	mA	
$V_F$ (Terminal)	Emitter-collector voltage	$I_F=200\text{ A}$ , Refer to the figure of test circuit. (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	4.1	5.3	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.9	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.7	-	
$V_F$ (Chip)	Emitter-collector voltage	$I_F=200\text{ A}$ , (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	4.0	5.2	V
			$T_j=125\text{ }^\circ\text{C}$	-	2.8	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.6	-	
$t_{rr}$	Reverse recovery time	$V_{CC}=1000\text{ V}$ , $I_F=200\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ ,	-	-	300	ns	
$Q_{rr}$	Reverse recovery charge	$R_G=0\text{ }\Omega$ , Inductive load	-	8.0	-	$\mu\text{C}$	
$E_{rr}$	Reverse recovery energy per pulse	$V_{CC}=1000\text{ V}$ , $I_F=200\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ , $R_G=0\text{ }\Omega$ , $T_j=150\text{ }^\circ\text{C}$ , Inductive load	-	42	-	mJ	

## NTC THERMISTOR PART

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{25}$	Zero-power resistance	$T_C=25\text{ }^\circ\text{C}$ (Note3)	4.85	5.00	5.15	k $\Omega$
$\Delta R/R$	Deviation of resistance	$R_{100}=493\text{ }\Omega$ , $T_C=100\text{ }^\circ\text{C}$ (Note3)	-7.3	-	+7.8	%
$B_{(25/50)}$	B-constant	Approximate by equation (Note5)	-	3375	-	K
$P_{25}$	Power dissipation	$T_C=25\text{ }^\circ\text{C}$ (Note3)	-	-	10	mW

## THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance	Junction to case, per IGBT (Note3)	-	-	0.075	K/W
$R_{th(j-c)D}$		Junction to case, per DIODE (Note3)	-	-	0.12	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module, Thermal grease applied (Note3, 6)	-	25	-	K/kW

## MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$M_t$	Mounting torque	Main terminals M 5 screw	2.5	3.0	3.5	N·m
$M_s$		Mounting to heat sink M 5 screw	2.5	3.0	3.5	
$d_s$	Creepage distance	Terminal to terminal	20.6	-	-	mm
		Terminal to base plate	17	-	-	
$d_a$	Clearance distance	Terminal to terminal	12	-	-	mm
		Terminal to base plate	10.6	-	-	
$m$	mass	-	210	-	g	
$e_c$	Flatness of base plate	On the centerline X, Y (Note7)	-100	-	+100	$\mu\text{m}$

# CM200EXS-34SA

HIGH POWER SWITCHING USE  
INSULATED TYPE

This product is compliant with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive 2011/65/EU.

Note1. Junction temperature ( $T_j$ ) should not increase beyond  $T_{jmax}$  rating.

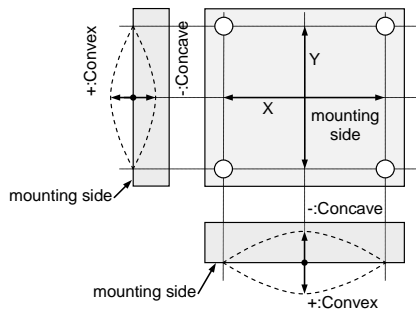
2. Pulse width and repetition rate should be such that the device junction temperature ( $T_j$ ) dose not exceed  $T_{jmax}$  rating.
3. Case temperature ( $T_c$ ) and heat sink temperature ( $T_s$ ) are defined on the each surface (mounting side) of base plate and heat sink just under the chips. Refer to the figure of chip location.
4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

$$5. B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$$

$R_{25}$ : 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]

6. Typical value is measured by using thermally conductive grease of  $\lambda=0.9$  W/(m·K).
7. The base plate (mounting side) flatness measurement points (X, Y) are as follows of the following figure.



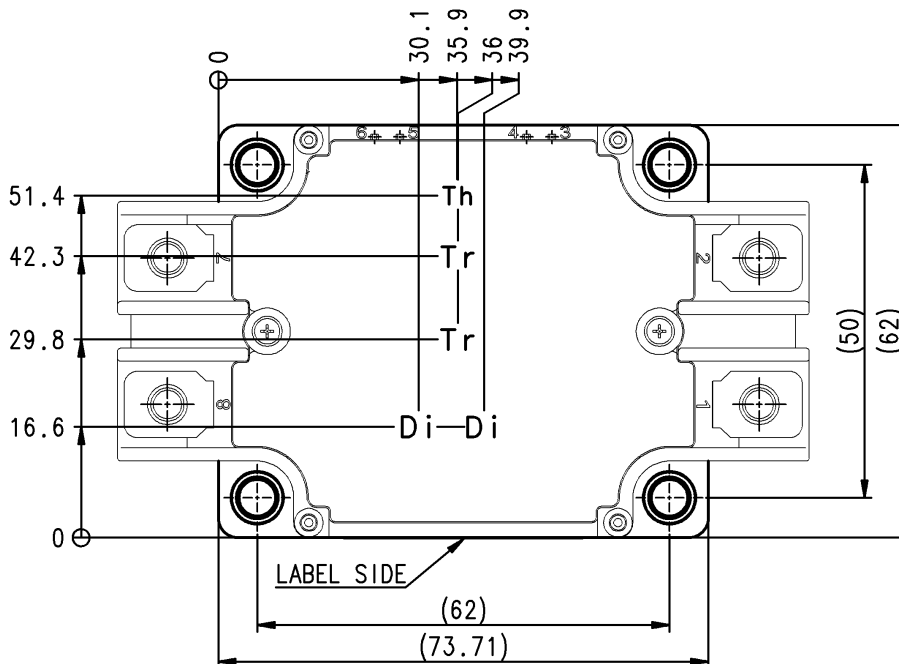
8. Use the following screws when mounting the printed circuit board (PCB) on the standoffs.  
"φ2.6×10 or φ2.6×12, B1 tapping screw"  
The length of the screw depends on the thickness (t1.6~t2.0) of the PCB.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$V_{CC}$	(DC) Supply voltage	Applied across C-E/A-K	-	1000	1200	V
$V_{GEon}$	Gate (-emitter drive) voltage	Applied across G-Es	13.5	15.0	16.5	V
$R_G$	External gate resistance	-	0	-	38	Ω

## CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm

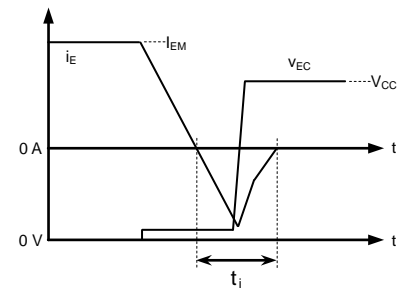
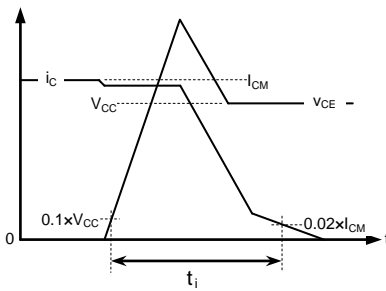
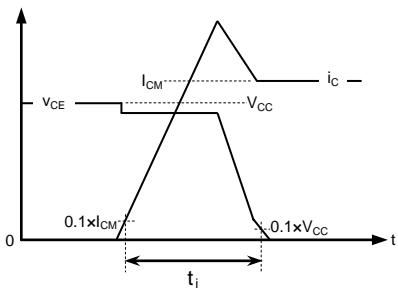
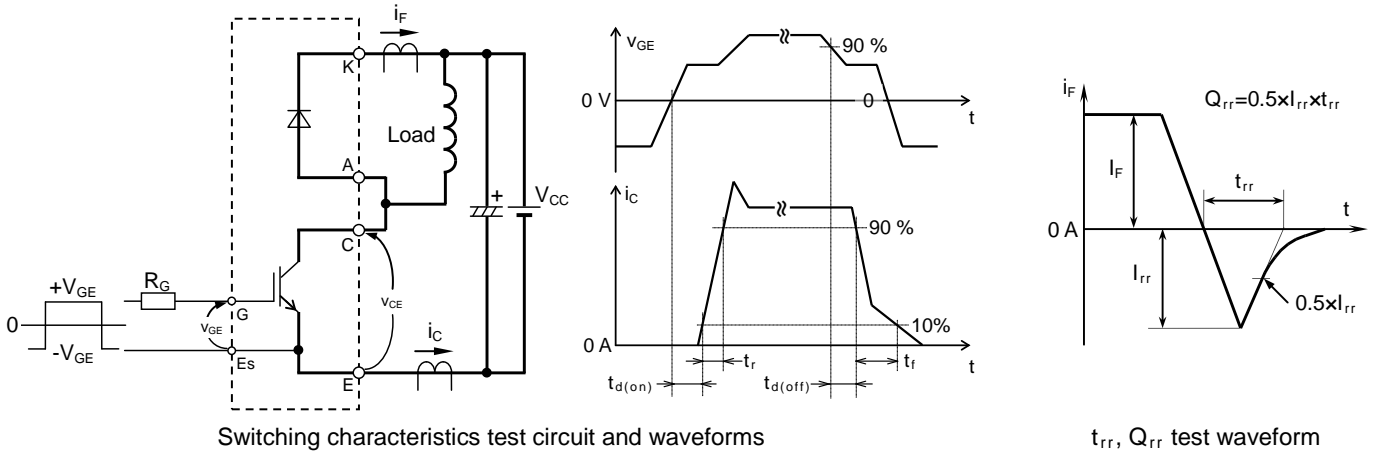


Tr: IGBT, Di: DIODE, Th: NTC thermistor

# CM200EXS-34SA

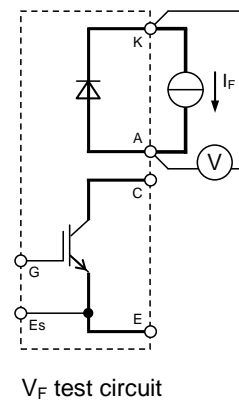
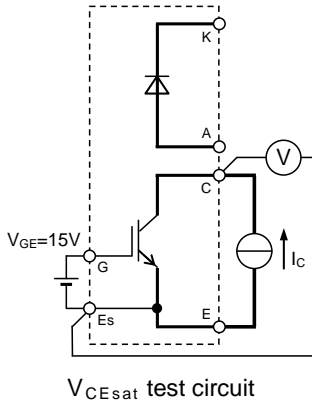
HIGH POWER SWITCHING USE  
INSULATED TYPE

## TEST CIRCUIT AND WAVEFORMS



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

## TEST CIRCUIT



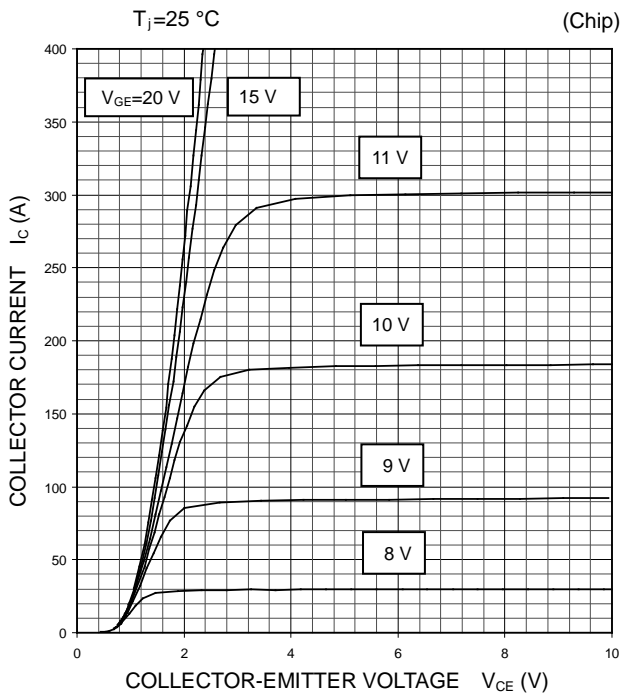
# CM200EXS-34SA

HIGH POWER SWITCHING USE  
INSULATED TYPE

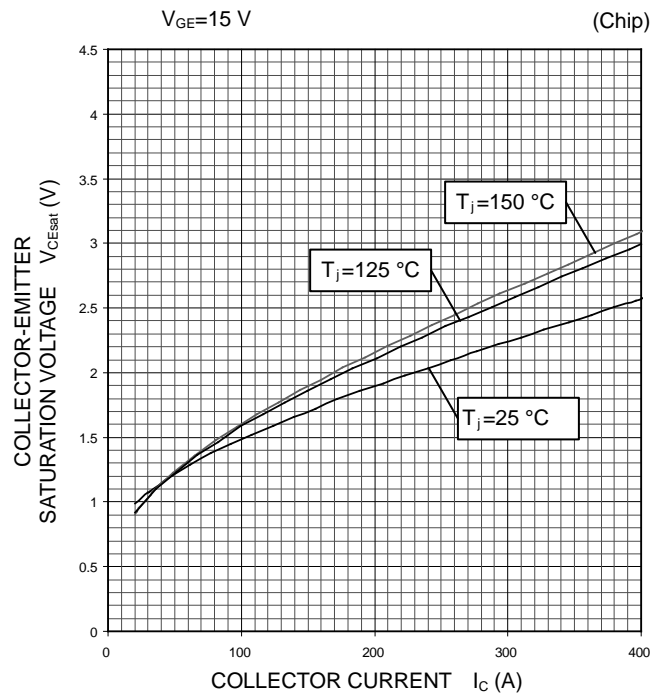
## PERFORMANCE CURVES

IGBT / DIODE PART

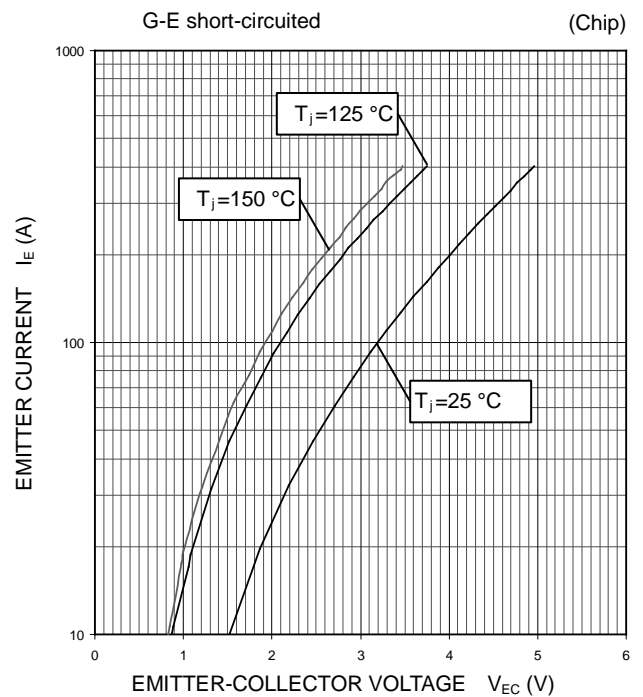
OUTPUT CHARACTERISTICS  
(TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE  
CHARACTERISTICS  
(TYPICAL)



DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)



# CM200EXS-34SA

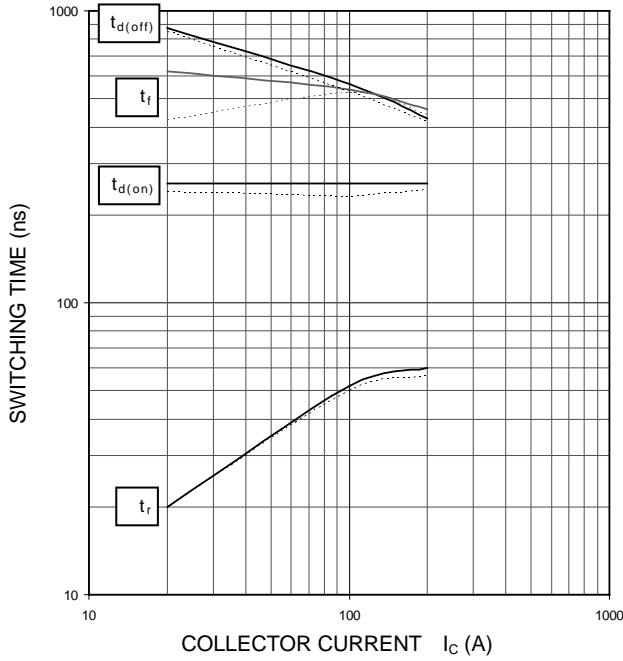
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

IGBT / DIODE PART

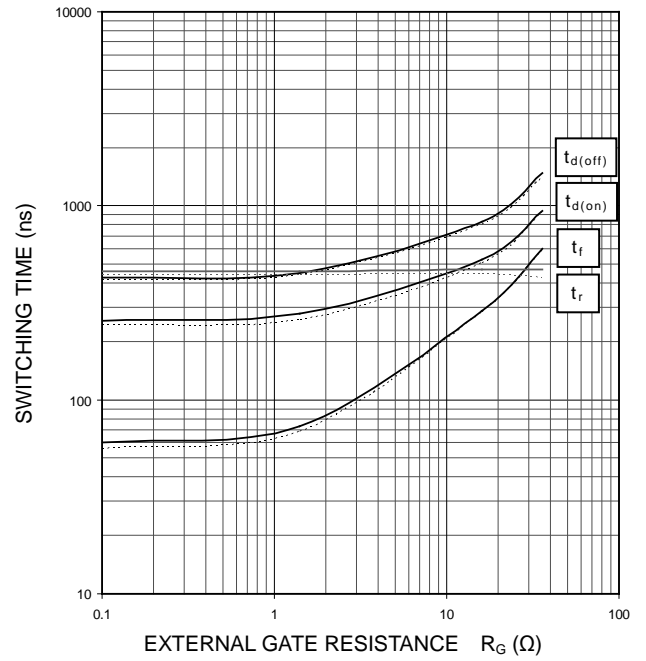
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $R_G=0\ \Omega$ , INDUCTIVE LOAD  
 —:  $T_j=150\text{ }^\circ\text{C}$ , - - - -:  $T_j=125\text{ }^\circ\text{C}$



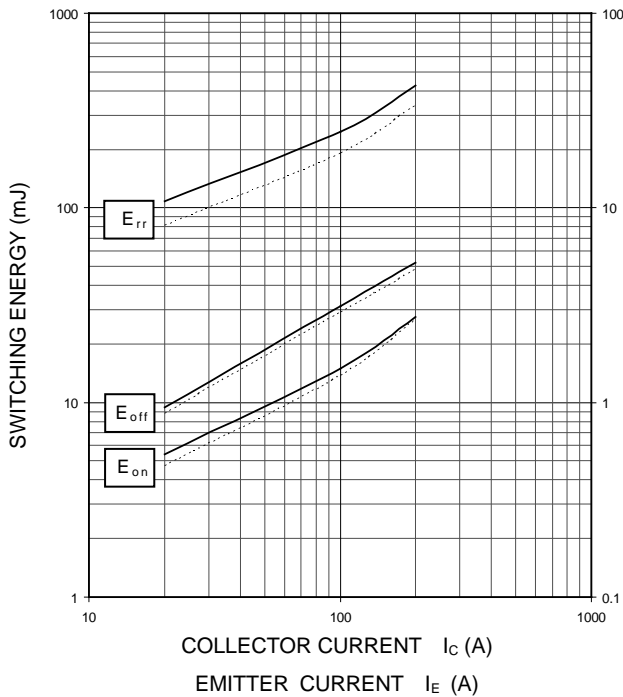
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $I_C=200\text{ A}$ , INDUCTIVE LOAD  
 —:  $T_j=150\text{ }^\circ\text{C}$ , - - - -:  $T_j=125\text{ }^\circ\text{C}$



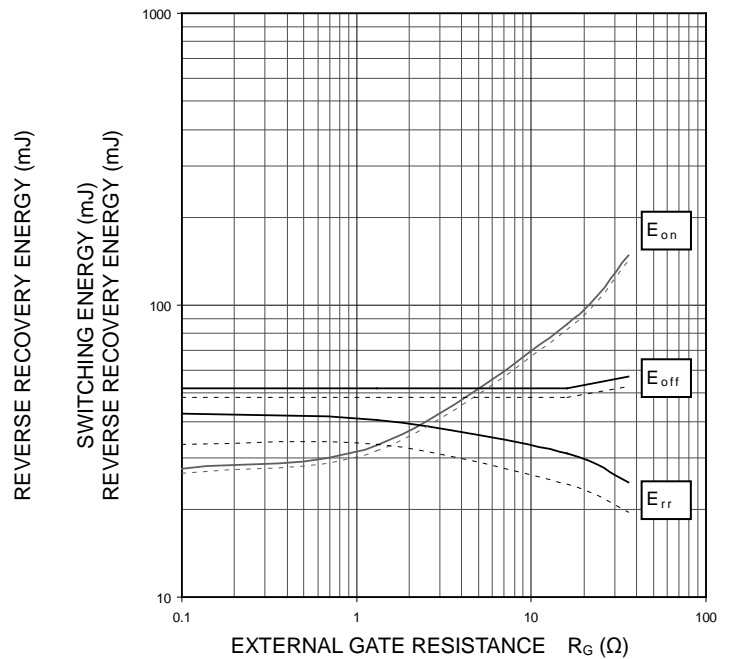
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $R_G=0\ \Omega$ , INDUCTIVE LOAD, PER PULSE  
 —:  $T_j=150\text{ }^\circ\text{C}$ , - - - -:  $T_j=125\text{ }^\circ\text{C}$



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $I_C=200\text{ A}$ , INDUCTIVE LOAD, PER PULSE  
 —:  $T_j=150\text{ }^\circ\text{C}$ , - - - -:  $T_j=125\text{ }^\circ\text{C}$



# CM200EXS-34SA

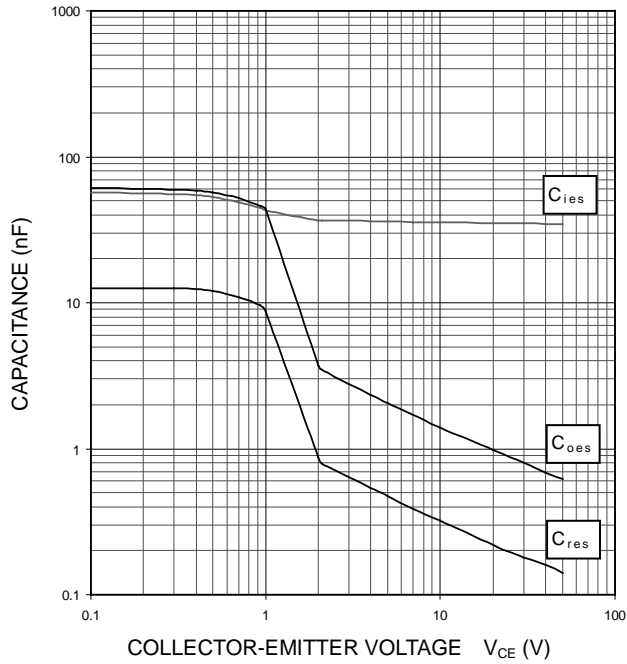
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### IGBT / DIODE PART

CAPACITANCE CHARACTERISTICS  
(TYPICAL)

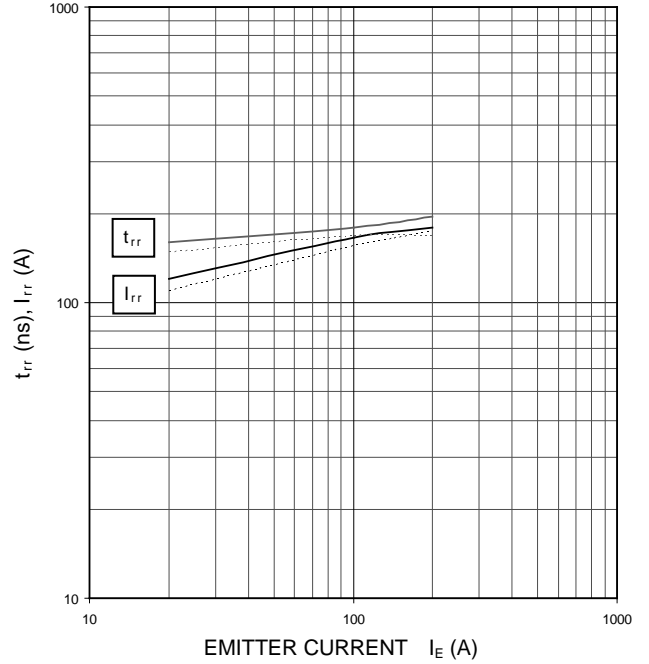
G-E short-circuited,  $T_j=25\text{ }^\circ\text{C}$



DIODE  
REVERSE RECOVERY CHARACTERISTICS  
(TYPICAL)

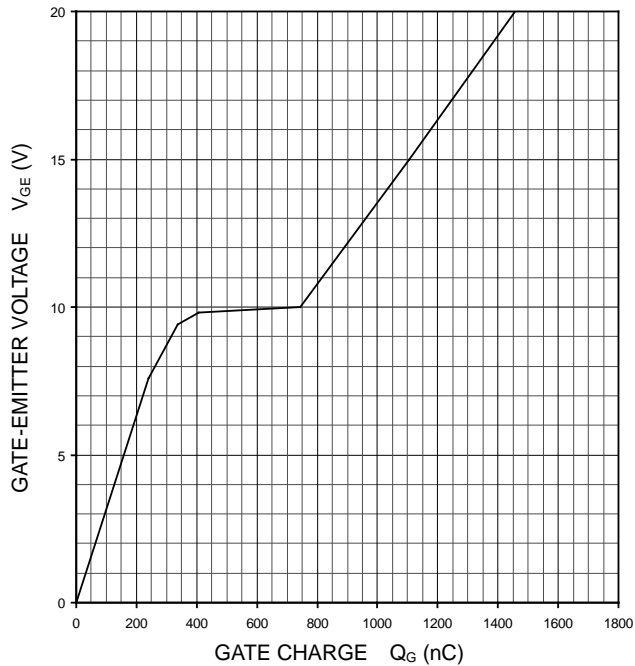
$V_{CC}=1000\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $R_G=0\ \Omega$ , INDUCTIVE LOAD

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



GATE CHARGE CHARACTERISTICS  
(TYPICAL)

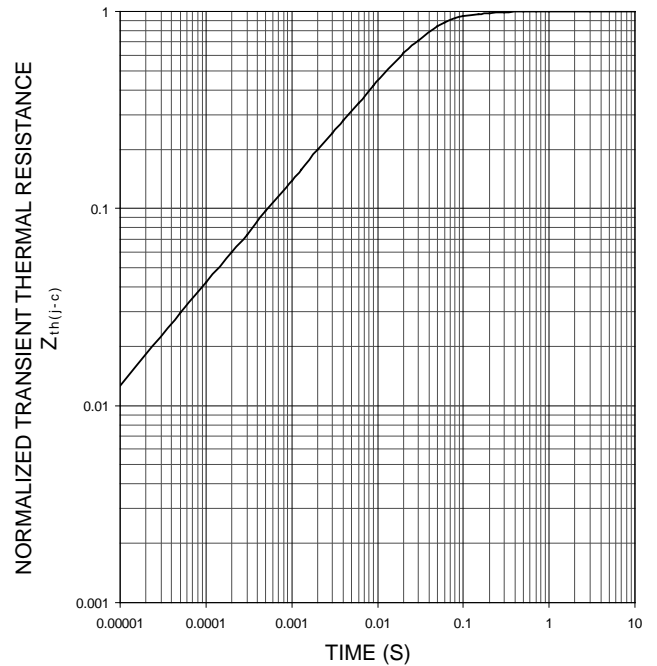
$V_{CC}=1000\text{ V}$ ,  $I_C=200\text{ A}$ ,  $T_j=25\text{ }^\circ\text{C}$



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS  
(MAXIMUM)

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

$R_{th(j-c)Q}=0.075\text{ K/W}$ ,  $R_{th(j-c)D}=0.12\text{ K/W}$





# CM200EXS-34SA

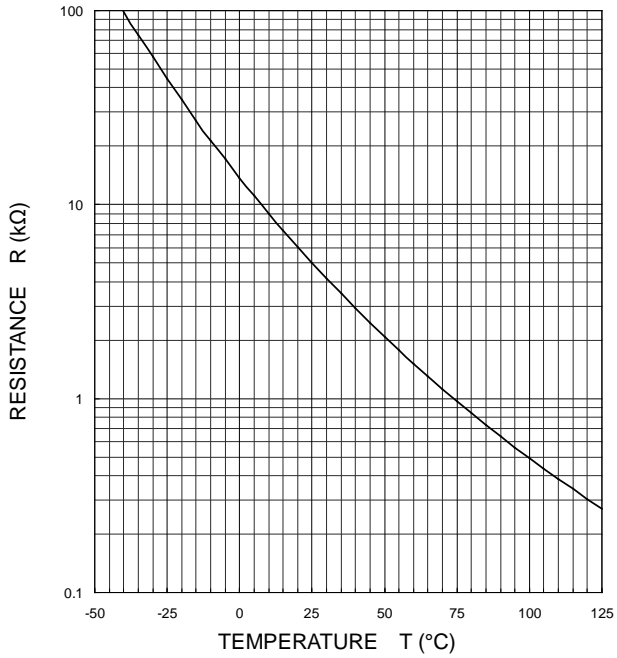
HIGH POWER SWITCHING USE  
INSULATED TYPE

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## PERFORMANCE CURVES

NTC thermistor part

TEMPERATURE CHARACTERISTICS  
(TYPICAL)



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