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< IGBT MODULES >

CM200EXS-24S

HIGH POWER SWITCHING USE
INSULATED TYPE

Single switch

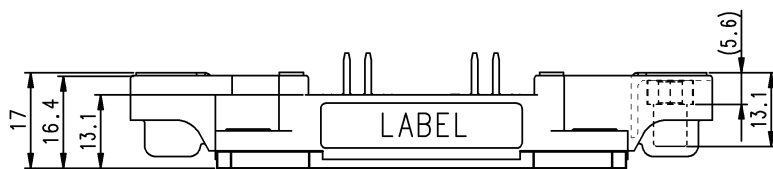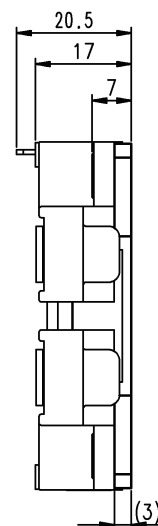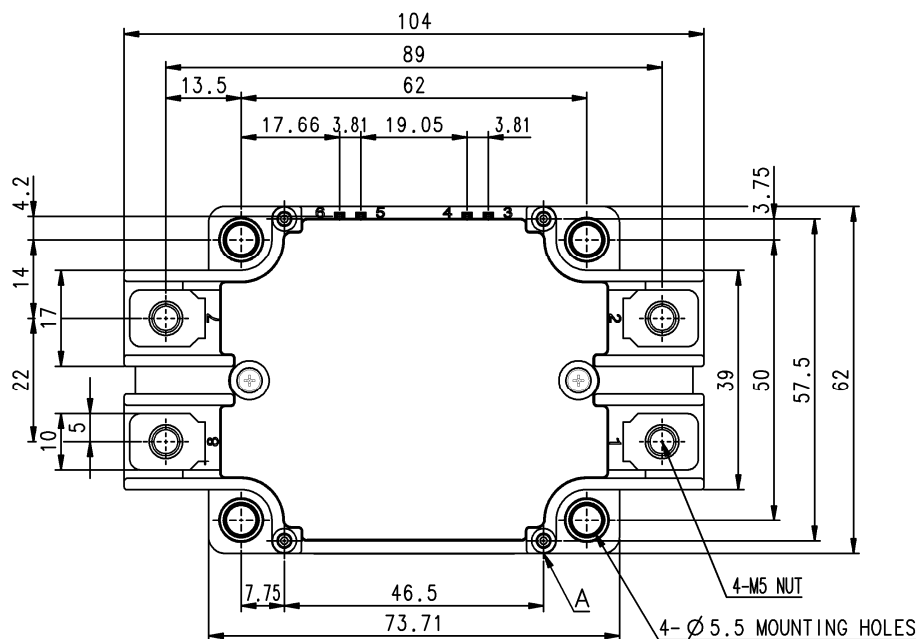|	
Collector current I_C	**200** A
Collector-emitter voltage V_{CES}	**1200** V
Maximum junction temperature T_{jmax}	**175** °C

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

APPLICATION
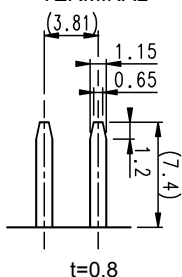
Brake

OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm

TERMINAL

SECTION A
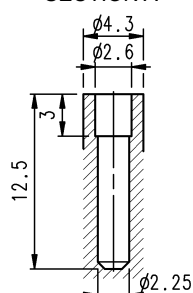
Tolerance otherwise specified

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
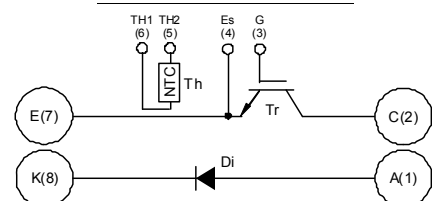
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CM200EXS-24S
HIGH POWER SWITCHING USE
INSULATED TYPE

ABSOLUTE MAXIMUM RATINGS (T$_j$=25 °C, unless otherwise specified)

IGBT

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 $^{(Note1, 3)}$	200	A
I$_{CRM}$		Pulse, Repetitive $^{(Note2)}$	400	
P$_{tot}$	Total power dissipation	T$_C$=25 °C $^{(Note1, 3)}$	1500	W

DIODE

Symbol	Item	Conditions	Rating	Unit
V$_{RRM}$	Repetitive peak reverse voltage	-	1200	V
I$_F$	Forward current	$^{(Note1)}$	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 Hz, AC 1 min	4000	V
T$_{jmax}$	Maximum junction temperature	Instantaneous event (overload)	175	°C
T$_{Cmax}$	Maximum case temperature	$^{(Note3)}$	125	
T$_{jop}$	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	°C
T$_{stg}$	Storage temperature	-	-40 ~ +125	

ELECTRICAL CHARACTERISTICS (T$_j$=25 °C, unless otherwise specified)

IGBT

Symbol	Item	Conditions		Limits Min.	Limits Typ.	Limits Max.	Unit
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$_C$=20 mA, V$_{CE}$=10 V		5.4	6.0	6.6	V
V$_{CEsat}$	Collector-emitter saturation voltage	I$_C$=200 A $^{(Note4)}$, 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$_C$=200 A $^{(Note4)}$, 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		-	-	20	nF
C$_{oes}$	Output capacitance			-	-	4.0	
C$_{res}$	Reverse transfer capacitance			-	-	0.33	
Q$_G$	Gate charge	V$_{CC}$=600 V, I$_C$=200 A, V$_{GE}$=15 V		-	466	-	nC
t$_{d(on)}$	Turn-on delay time	V$_{CC}$=600 V, I$_C$=200 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			-	-	600	
t$_f$	Fall time			-	-	300	
E$_{on}$	Turn-on switching energy per pulse	V$_{CC}$=600 V, I$_F$=200 A, V$_{GE}$=±15 V, R$_G$=0 Ω, T$_j$=150 °C, Inductive load		-	30.7	-	mJ
E$_{off}$	Turn-off switching energy per pulse			-	21.5	-	
R$_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per element, T$_C$=25 °C $^{(Note3)}$		-	-	2.0	mΩ
r$_g$	Internal gate resistance	-		-	9.8	-	Ω

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CM200EXS-24S
HIGH POWER SWITCHING USE
INSULATED TYPE

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

DIODE

Symbol	Item	Conditions		Limits Min.	Limits Typ.	Limits Max.	Unit
I_{RRM}	Reverse current	$V_R = V_{RRM}$		-	-	1.0	mA
V_F	Forward voltage	I_F=200 A (Note4),	T_j=25 °C	-	1.8	2.25	V
			T_j=125 °C	-	1.8	-	
		(Terminal)	T_j=150 °C	-	1.8	-	
		I_F=200 A (Note4),	T_j=25 °C	-	1.7	2.15	V
			T_j=125 °C	-	1.7	-	
		(Chip)	T_j=150 °C	-	1.7	-	
t_{rr}	Reverse recovery time	V_{CC}=600 V, I_F=200 A, V_{GE}=±15 V,		-	-	300	ns
Q_{rr}	Reverse recovery charge	R_G=0 Ω, Inductive load		-	10.7	-	µC
E_{rr}	Reverse recovery energy per pulse	V_{CC}=600 V, I_F=200 A, V_{GE}=±15 V, R_G=0 Ω, T_j=150 °C, Inductive load		-	14.2	-	mJ

NTC THERMISTOR

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

THERMAL RESISTANCE CHARACTERISTICS

| Symbol	Item	Conditions	Limits Min.	Limits Typ.	Limits Max.	Unit
$R_{th(j-c)Q}$	Thermal resistance	Junction to case, IGBT (ote3)	-	-	0.10	K/W
$R_{th(j-c)D}$		Junction to case, DIODE (Note3)	-	-	0.19	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module, Thermal grease applied (Note3, 6)	-	25	-	K/kW

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions		Limits Min.	Limits Typ.	Limits Max.	Unit
M_t	Mounting torque	Main terminals	M 5 screw	2.5	3.0	3.5	N·m
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		20.6	-	-	mm
		Terminal to base plate		17	-	-	
d_a	Clearance	Terminal to terminal		12	-	-	mm
		Terminal to base plate		10.6	-	-	
m	Weight	-		-	210	-	g
e_c	Flatness of base plate	On the centerline X, Y (Note7)		-100	-	+100	µm

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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. Refer to the figure of test circuit.

5. $B_{(25/50)} = \ln(\dfrac{R_{25}}{R_{50}})/(\dfrac{1}{T_{25}} - \dfrac{1}{T_{50}})$,

   R_{25}: resistance at absolute temperature T_{25} [K]; T_{25}=25 [°C]+273.15=298.15 [K]
   R_{50}: resistance at absolute temperature T_{50} [K]; T_{50}=50 [°C]+273.15=323.15 [K]

6. Typical value is measured by using thermally conductive grease of λ=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 stand offs.
   "φ2.6×10 or φ2.6×12 self tapping screw"
   The length of the screw depends on 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 terminals	-	600	850	V
V_{GEon}	Gate (-emitter drive) voltage	Applied across G-Es terminals	13.5	15.0	16.5	V
R_G	External gate resistance	-	0	-	22	Ω

CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm

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

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TEST CIRCUIT AND WAVEFORMS

Switching characteristics test circuit and waveforms

$Q_{rr} = 0.5 \times I_{rr} \times t_{rr}$

$0.5 \times I_{rr}$
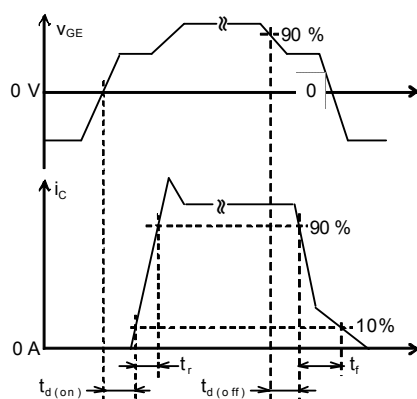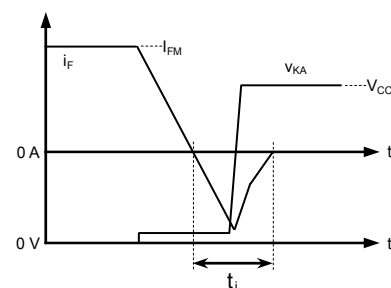
t_{rr}, Q_{rr} test waveform
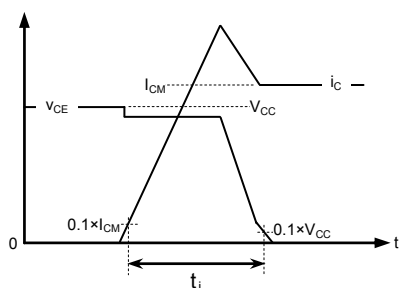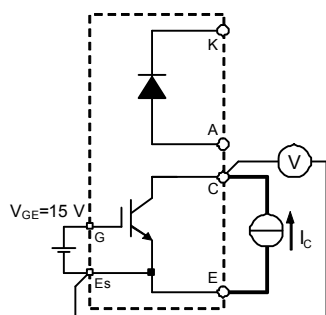
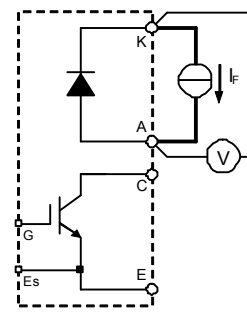**IGBT Turn-on switching energy**
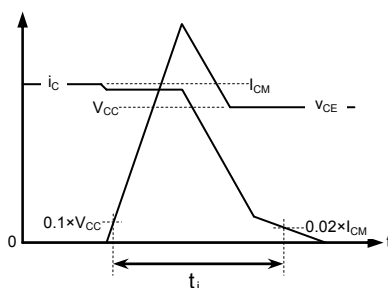
IGBT Turn-off switching energy

DIODE Reverse recovery energy

Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)
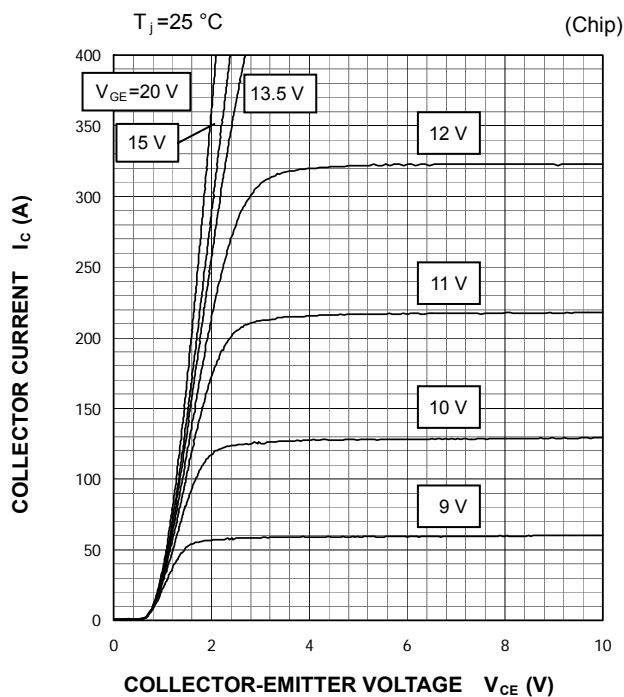
$V_{GE} = 15\ V$

V_{CEsat} test circuit

V_F test circuit

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PERFORMANCE CURVES

IGBT/DIODE

OUTPUT CHARACTERISTICS
(TYPICAL)

COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)
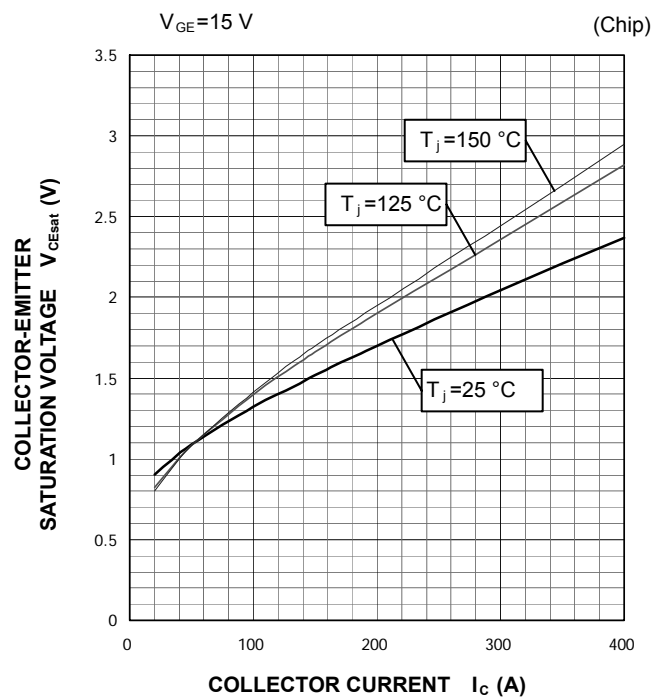
COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)
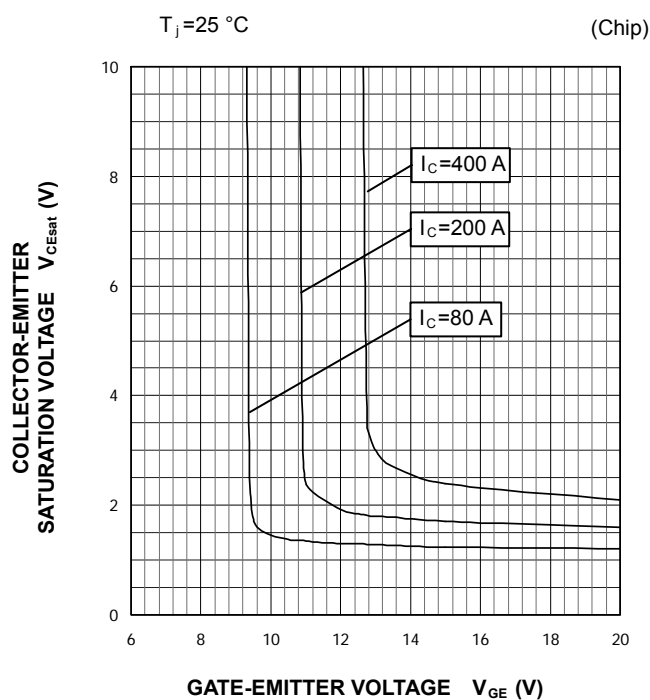
DIODE
FORWARD CHARACTERISTICS
(TYPICAL)

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**HIGH POWER SWITCHING USE
INSULATED TYPE**
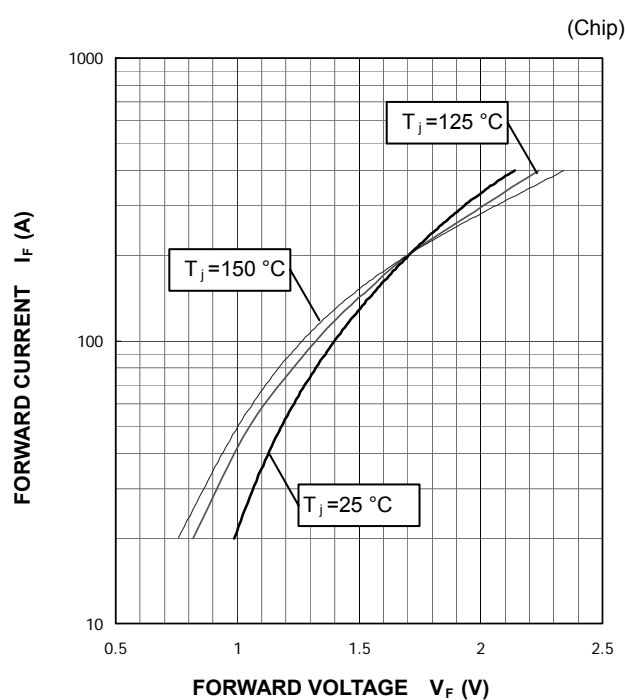
PERFORMANCE CURVES

IGBT/DIODE

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

V_{CC}=600 V, V_{GE}=±15 V, R_G=0 Ω, INDUCTIVE LOAD
————: T_j=150 °C, - - - - -: T_j=125 °C
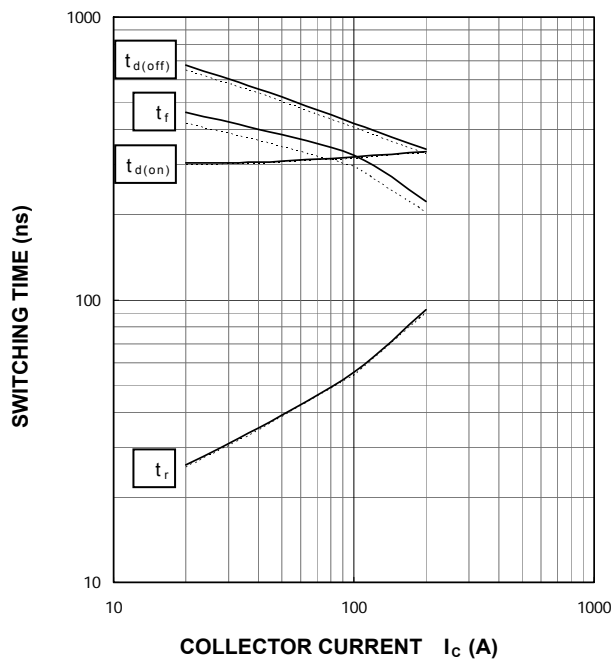
**HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)**

V_{CC}=600 V, V_{GE}=±15 V, I_C=200 A, INDUCTIVE LOAD
————: T_j=150 °C, - - - - -: T_j=125 °C
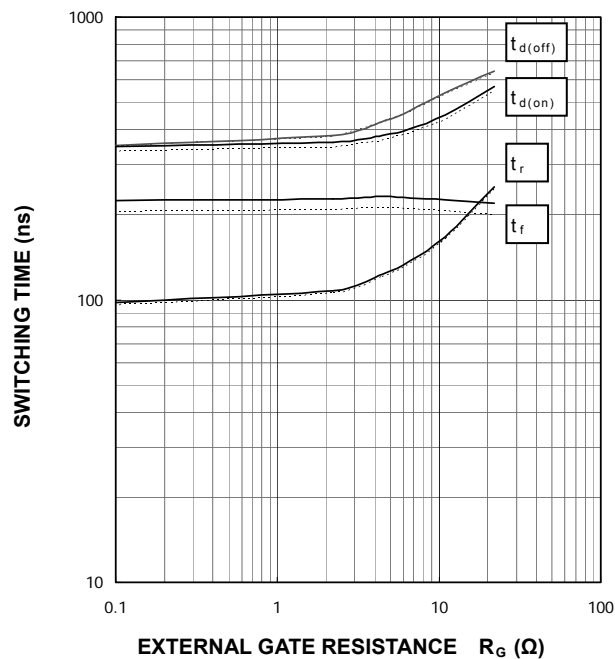
**HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)**
V_{CC}=600 V, V_{GE}=±15 V, R_G=0 Ω,
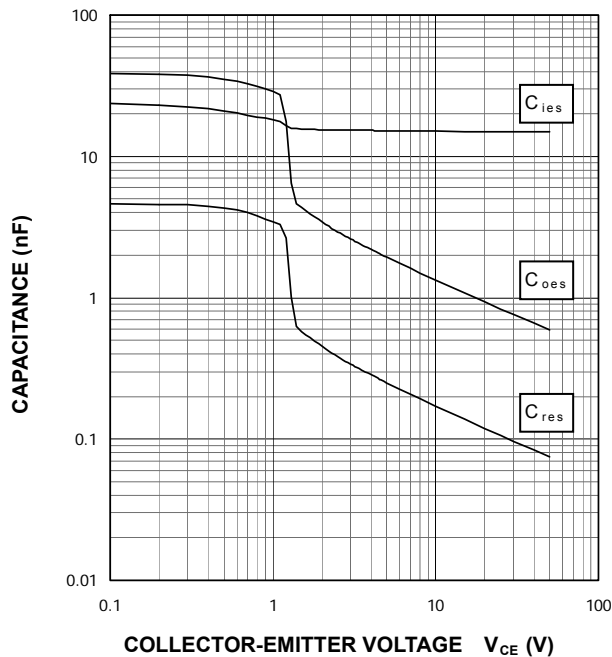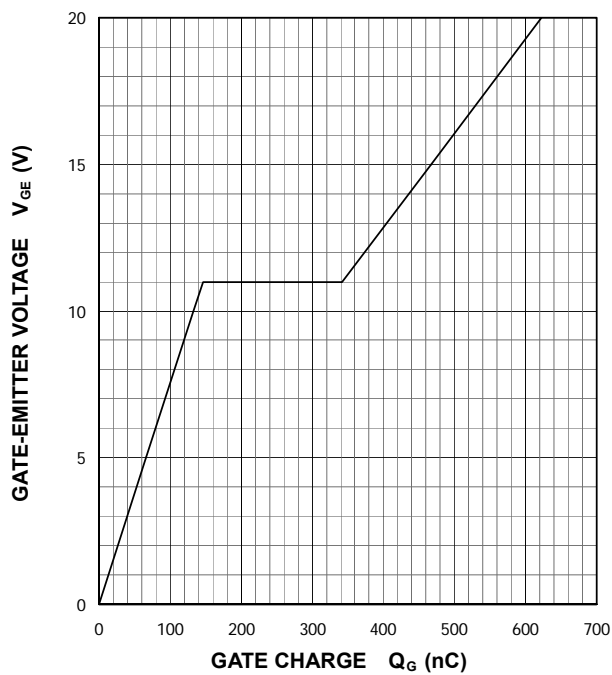INDUCTIVE LOAD, PER PULSE
————: T_j=150 °C, - - - - -: T_j=125 °C
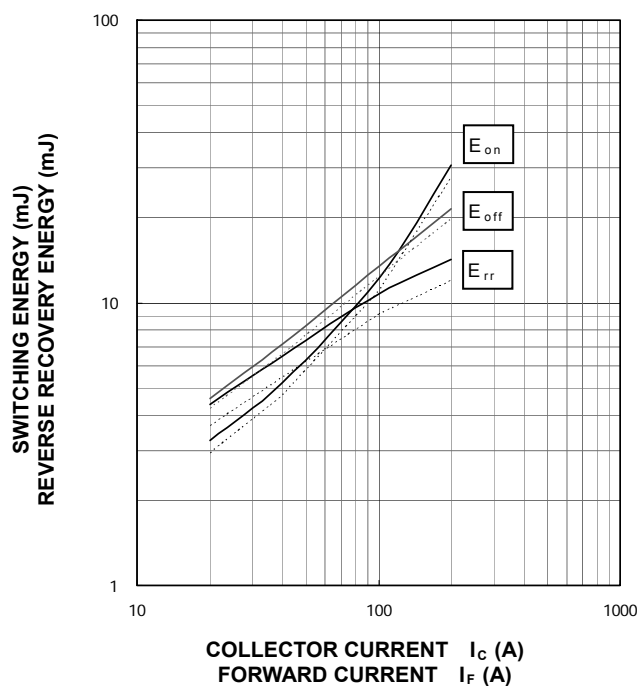
**HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)**
V_{CC}=600 V, V_{GE}=±15 V, I_C/I_F=200 A,
INDUCTIVE LOAD, PER PULSE
————: T_j=150 °C, - - - - -: T_j=125 °C

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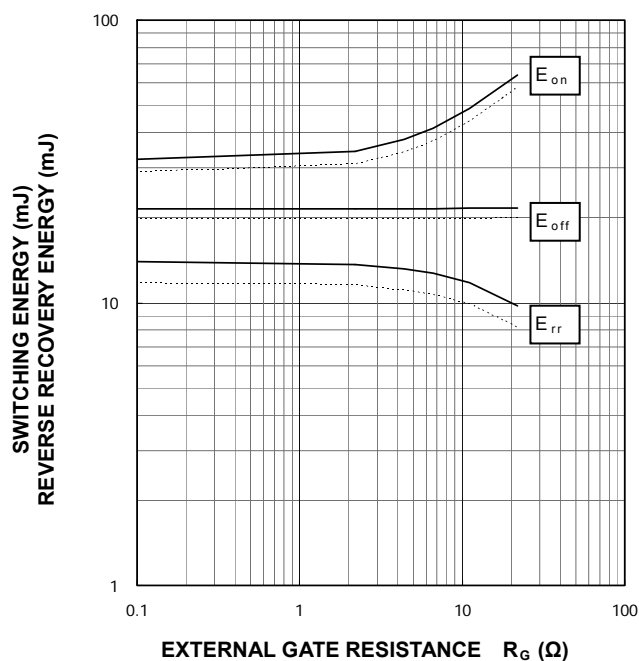
PERFORMANCE CURVES

IGBT/DIODE

CAPACITANCE CHARACTERISTICS
(TYPICAL)

G-E short-circuited, T_j =25 °C

CAPACITANCE (nF)

C_{ies}

C_{oes}

C_{res}

COLLECTOR-EMITTER VOLTAGE V_{CE} (V)

DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)

V_{CC} =600 V, V_{GE} =±15 V, R_G =0 Ω, INDUCTIVE LOAD
————: T_j =150 °C, - - - - -: T_j =125 °C

t_{rr} (ns), I_{rr} (A)

t_{rr}

I_{rr}

FORWARD CURRENT I_F (A)
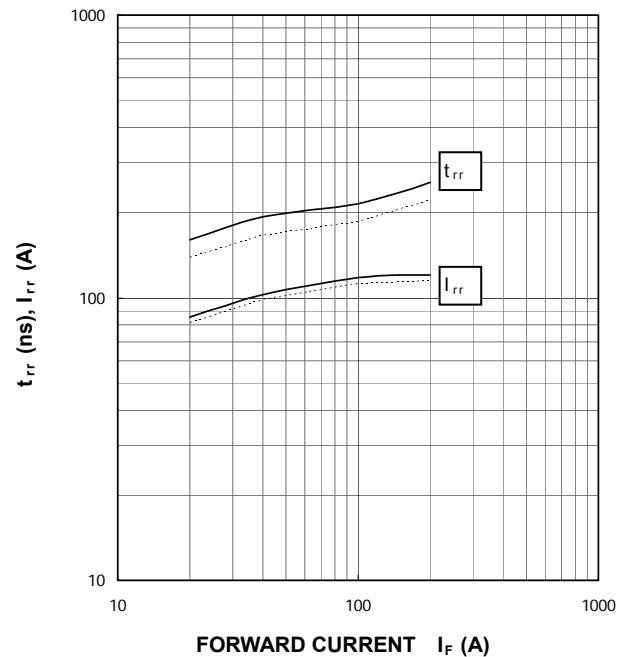
GATE CHARGE CHARACTERISTICS
(TYPICAL)

V_{CC} =600 V, I_C =200 A, T_j =25 °C

GATE-EMITTER VOLTAGE V_{GE} (V)

GATE CHARGE Q_G (nC)

TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)

Single pulse, T_C =25 °C
$R_{th(j-c)Q}$ =0.10 K/W, $R_{th(j-c)D}$ =0.19 K/W

NORMALIZED TRANSIENT THERMAL RESISTANCE
$Z_{th(j-c)}$

TIME (S)

8
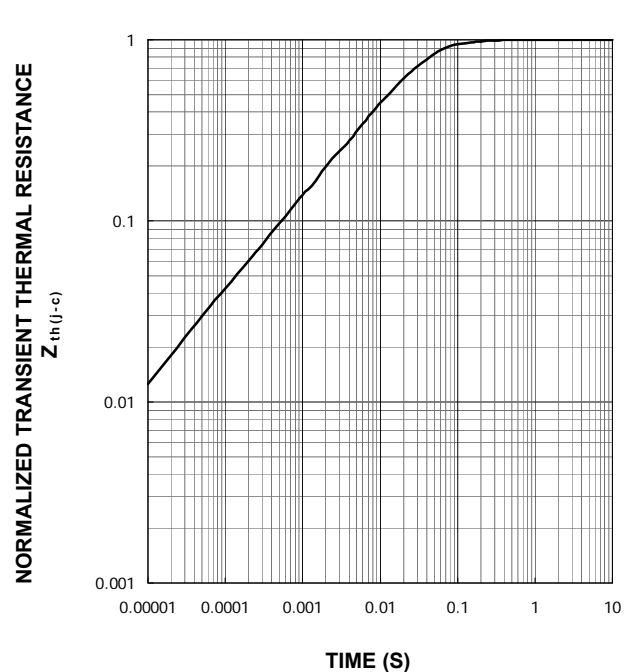
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PERFORMANCE CURVES

NTC THERMISTOR

TEMPERATURE CHARACTERISTICS
(TYPICAL)

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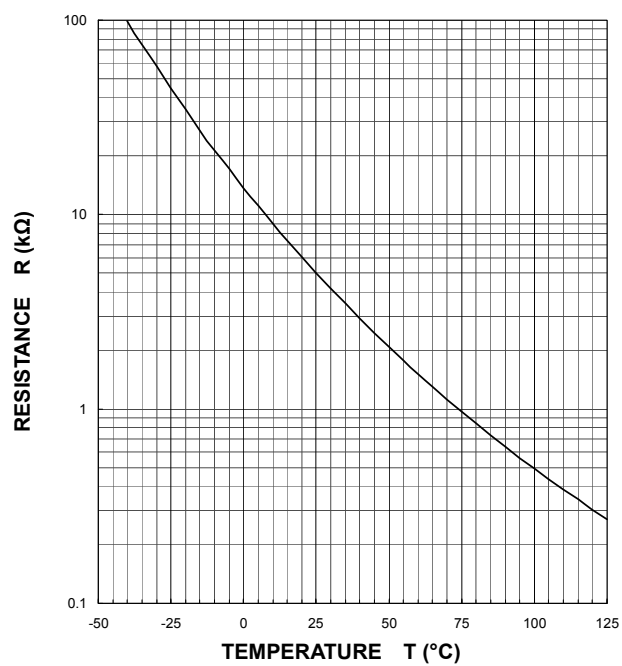
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