

<IGBT Modules>

CM1800DY-34S

HIGH POWER SWITCHING USE
INSULATED TYPE



dual switch (Half-Bridge)

Collector current I_C **1 8 0 0 A**
 Collector-emitter voltage V_{CES} **1 7 0 0 V**
 Maximum junction temperature T_{jmax} **1 7 5 °C**

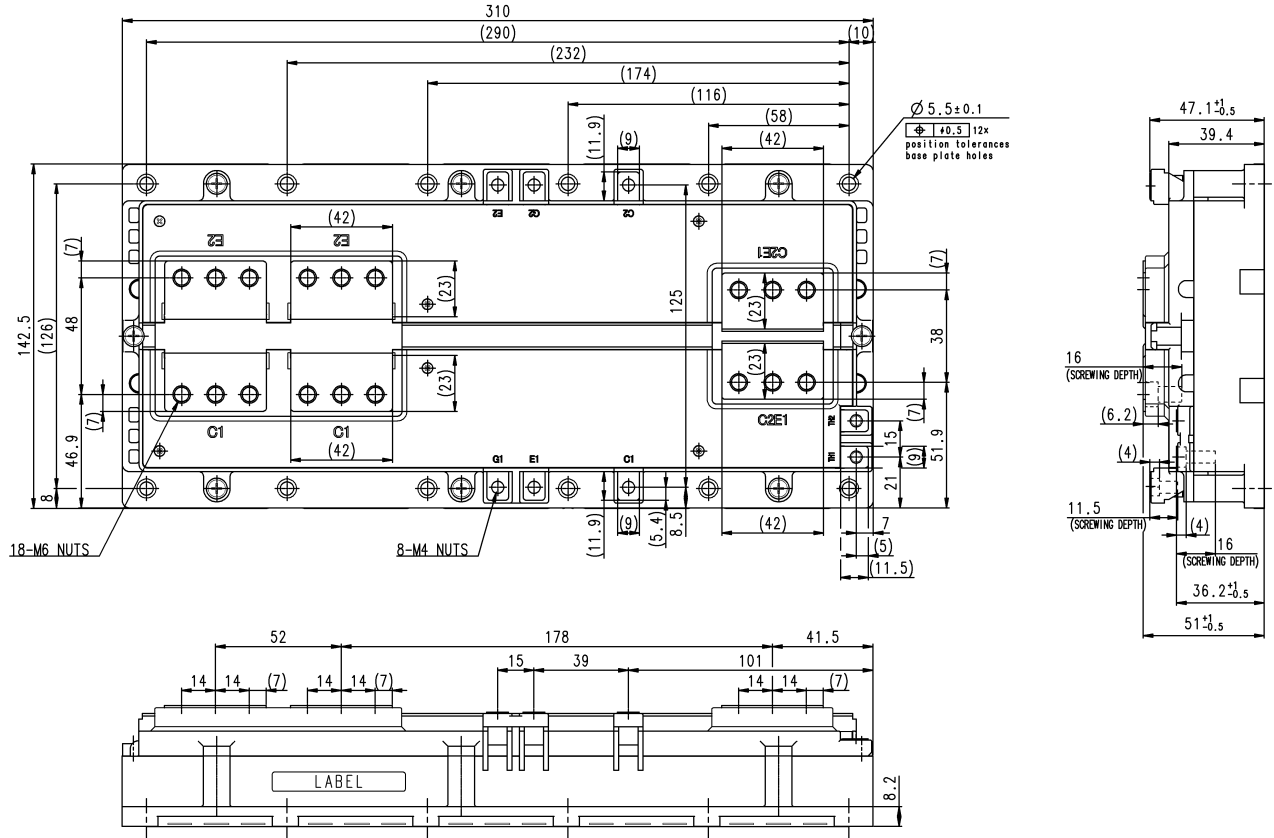
- Flat base Type
- Aluminum base plate
- RoHS Directive compliance
- Recognized under UL1557, File E323585

APPLICATION

Wind power, Photovoltaic (Solar) power, AC Motor Control, Motion/Servo Control, Power supply, etc.

OUTLINE DRAWING & INTERNAL CONNECTION

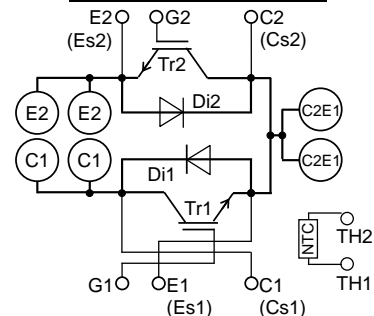
Dimension in mm



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

INTERNAL CONNECTION



CM1800DY-34SHIGH POWER SWITCHING USE
INSULATED TYPEMAXIMUM RATINGS ($T_j=25\text{ }^\circ\text{C}$, unless otherwise specified)

INVERTER PART IGBT/DIODE

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, $T_C=105\text{ }^\circ\text{C}$ (Note2, 4)	1800	A
I_{CRM}		Pulse, Repetitive (Note3)	3600	
P_{tot}	Total power dissipation	$T_C=25\text{ }^\circ\text{C}$ (Note2, 4)	11535	W
I_E (Note.1)	Emitter current	DC (Note2)	1800	A
I_{ERM} (Note.1)		Pulse, Repetitive (Note3)	3600	

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	(Note4)	125	
T_{jopr}	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)

INVERTER PART IGBT/DIODE

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	-	-	5.0	μA	
$V_{GE(th)}$	Gate-emitter threshold voltage	$I_C=180\text{ mA}$, $V_{CE}=10\text{ V}$	5.4	6.0	6.6	V	
V_{CEsat} (Terminal)	Collector-emitter saturation voltage	$I_C=1800\text{ A}$, $V_{GE}=15\text{ V}$, Refer to the figure of test circuit (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	2.20	2.70	V
V_{CEsat} (Chip)			$T_j=125\text{ }^\circ\text{C}$	-	2.40	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.45	-	
		$T_j=25\text{ }^\circ\text{C}$	-	2.10	2.60	V	
$T_j=125\text{ }^\circ\text{C}$		-	2.30	-			
$T_j=150\text{ }^\circ\text{C}$		-	2.35	-			
C_{ies}	Input capacitance	$V_{CE}=10\text{ V}$, G-E short-circuited	-	-	460	nF	
C_{oes}	Output capacitance		-	-	48		
C_{res}	Reverse transfer capacitance		-	-	8.0		
Q_G	Gate charge	$V_{CC}=1000\text{ V}$, $I_C=1800\text{ A}$, $V_{GE}=15\text{ V}$	-	8400	-	nC	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=1000\text{ V}$, $I_C=1800\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, Inductive load	-	-	1100	ns	
t_r	Rise time		-	-	200		
$t_{d(off)}$	Turn-off delay time		-	-	950		
t_f	Fall time		-	-	500		
V_{EC} (Note1) (Terminal)	Emitter-collector voltage	$I_E=1800\text{ A}$, G-E short-circuited, Refer to the figure of test circuit (Note5)	$T_j=25\text{ }^\circ\text{C}$	-	2.00	2.50	V
V_{EC} (Note1) (Chip)			$T_j=125\text{ }^\circ\text{C}$	-	2.10	-	
			$T_j=150\text{ }^\circ\text{C}$	-	2.05	-	
		$T_j=25\text{ }^\circ\text{C}$	-	1.90	2.40	V	
$T_j=125\text{ }^\circ\text{C}$		-	2.00	-			
$T_j=150\text{ }^\circ\text{C}$		-	1.95	-			
t_{rr} (Note1)	Reverse recovery time	$V_{CC}=1000\text{ V}$, $I_E=1800\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, Inductive load	-	-	350	ns	
Q_{rr} (Note1)	Reverse recovery charge		-	80	-	μC	
E_{on}	Turn-on switching energy per pulse	$V_{CC}=1000\text{ V}$, $I_C=I_E=1800\text{ A}$,	-	722.8	-	mJ	
E_{off}	Turn-off switching energy per pulse	$V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$,	-	509.5	-		
E_{rr} (Note1)	Reverse recovery energy per pulse	$T_j=150\text{ }^\circ\text{C}$, Inductive load	-	509.2	-	mJ	
$R_{CC'+EE'}$	Internal lead resistance	Main terminals -chip, per switch, $T_C=25\text{ }^\circ\text{C}$ (Note4)	-	0.11	-	m Ω	
r_g	Internal gate resistance	Per switch	-	1.1	-	Ω	

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HIGH POWER SWITCHING USE
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ELECTRICAL CHARACTERISTICS (cont.; $T_j=25\text{ }^\circ\text{C}$, unless otherwise specified)
NTC THERMISTOR PART

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R_{25}	Zero-power resistance	$T_C=25\text{ }^\circ\text{C}$ (Note4)	4.85	5.00	5.15	k Ω
$\Delta R/R$	Deviation of resistance	$R_{100}=493\ \Omega$, $T_C=100\text{ }^\circ\text{C}$ (Note4)	-7.3	-	+7.8	%
$B_{(25/50)}$	B-constant	Approximate by equation (Note6)	-	3375	-	K
P_{25}	Power dissipation	$T_C=25\text{ }^\circ\text{C}$ (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 IGBT (Note4)	-	-	13	K/kW
$R_{th(j-c)D}$		Junction to case, per DIODE (Note4)	-	-	22	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module, Thermal grease applied (Note4, 7)	-	3.1	-	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_t		Auxiliary terminals M 4 screw	1.3	1.5	1.7	
M_s		Mounting to heat sink M 5 screw	2.5	3.0	3.5	
d_s	Creepage distance	Terminal to terminal	16	-	-	mm
		Terminal to base plate	25	-	-	
d_a	Clearance	Terminal to terminal	16	-	-	mm
		Terminal to base plate	24	-	-	
m	mass	-	2	-	kg	
e_c	Flatness of base plate	On the centerline X, Y (Note8)	-50	-	+100	μm

Note1. Represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (DIODE).

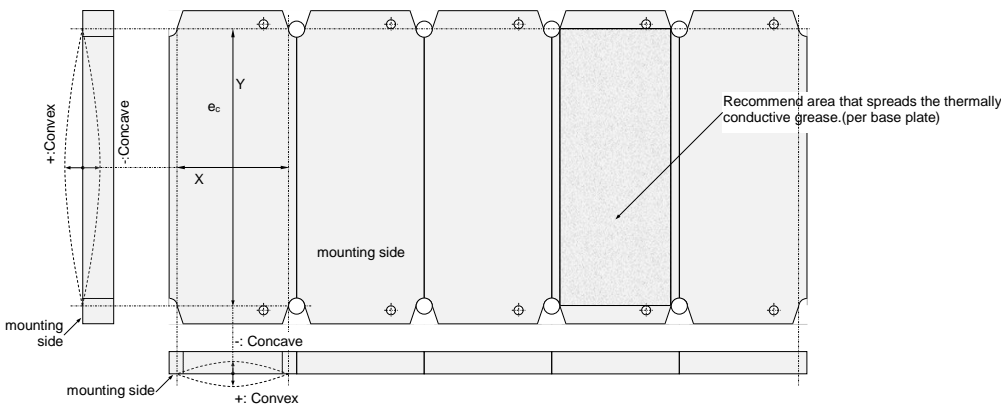
- Junction temperature (T_j) should not increase beyond T_{jmax} rating.
- Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} rating.
- Case temperature (T_C) and heat sink temperature (T_s) are defined on the each surface (mounting side) of base plate and heat sink just under the chips. Refer to the figure of chip location.
The heat sink thermal resistance should measure just under the chips.
- Pulse width and repetition rate should be such as to cause negligible temperature rise.

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

R_{25} : resistance at absolute temperature T_{25} [K]; $T_{25}=25\text{ }^\circ\text{C}+273.15=298.15$ [K]

R_{50} : resistance at absolute temperature T_{50} [K]; $T_{50}=50\text{ }^\circ\text{C}+273.15=323.15$ [K]

- Typical value is measured by using thermally conductive grease of $\lambda=0.9\text{ W/(m}\cdot\text{K)}$.
- Base plate (mounting side) flatness measurement points (X, Y) are as follows of the following figure.



- Main terminal pair should be connected together in case of the current through it.

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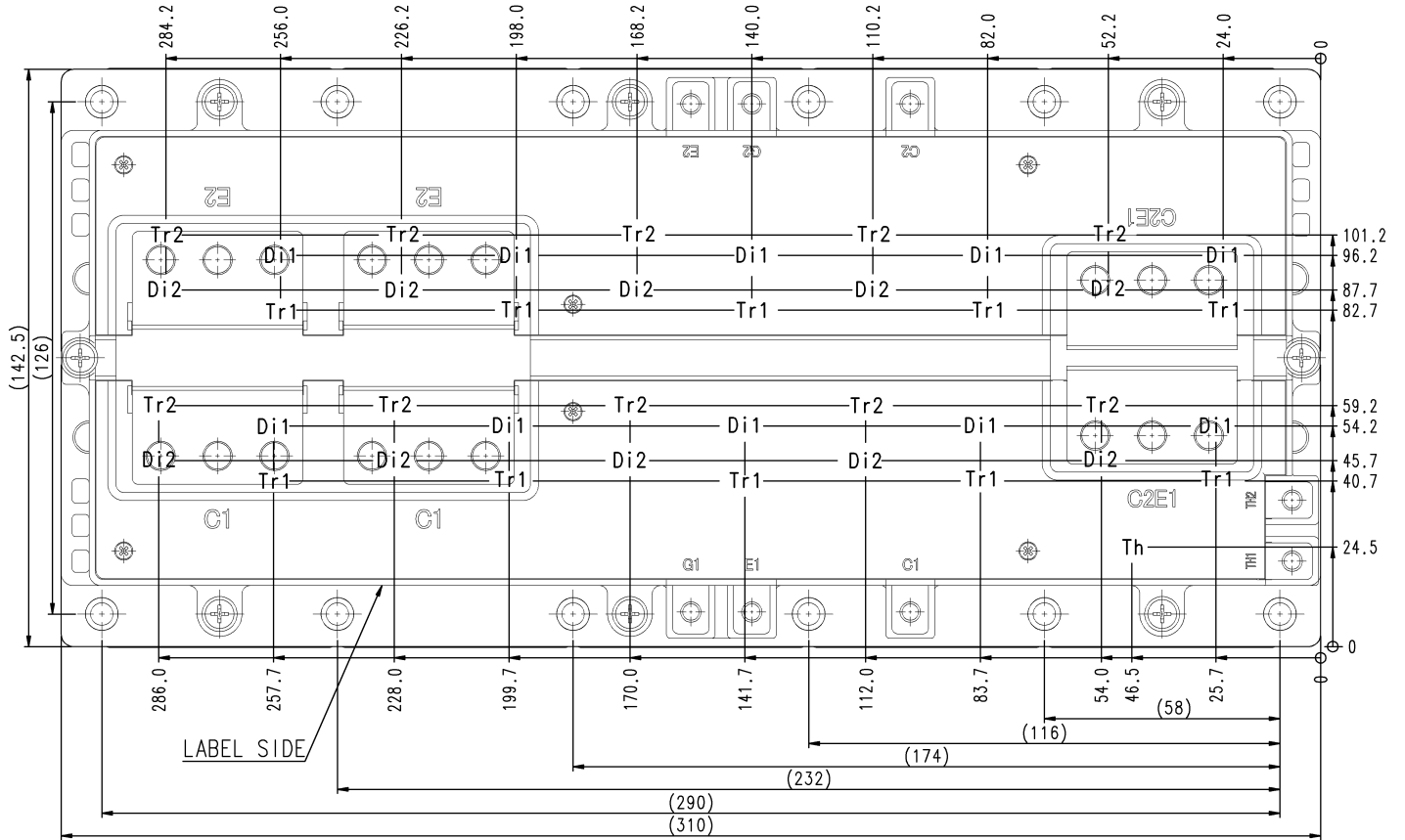
HIGH POWER SWITCHING USE
INSULATED TYPE

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across C1-E2	-	1000	1200	V
V_{GEon}	Gate (-emitter drive) voltage	Applied across G1-Es1/G2-Es2	13.5	15.0	16.5	V
R_G	External gate resistance	Per switch	0	-	2	Ω

CHIP LOCATION (Top view)

Dimension in mm, tolerance: ± 1 mm

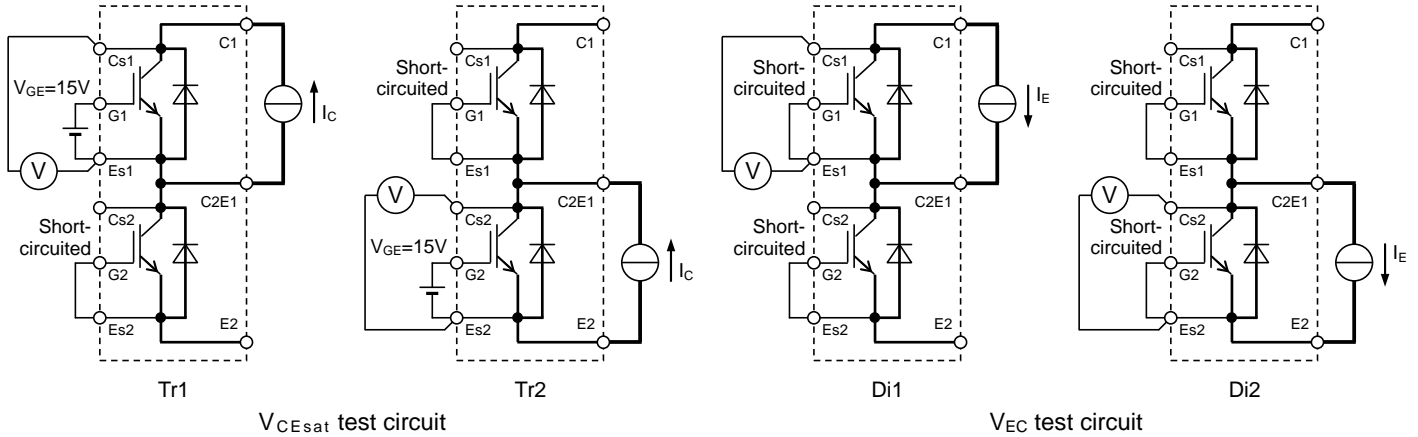


Tr1/Tr2: IGBT, Di1/Di2: DIODE, Th: NTC thermistor

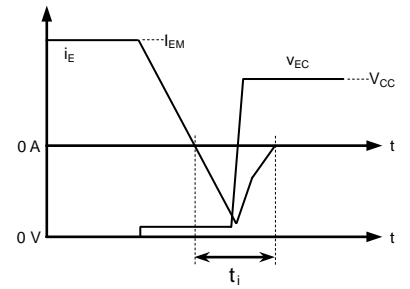
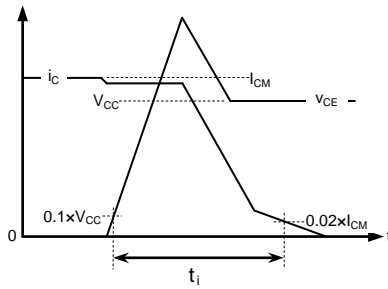
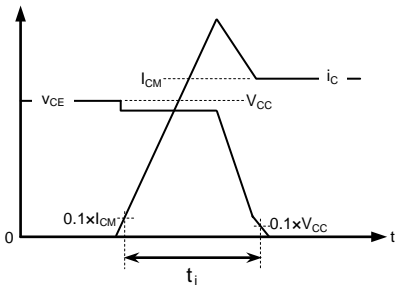
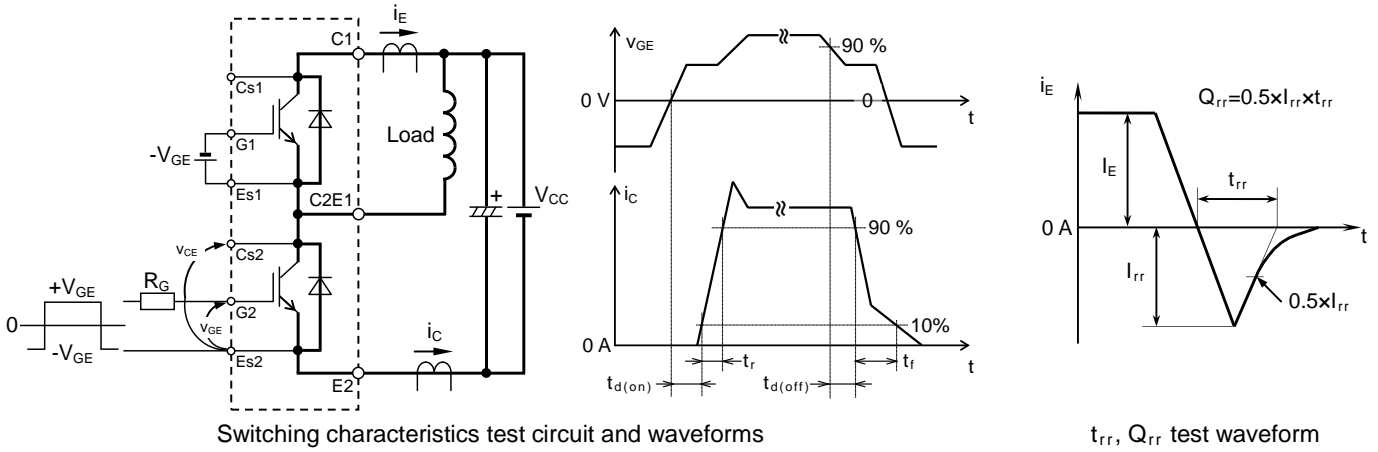
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HIGH POWER SWITCHING USE
INSULATED TYPE

TEST CIRCUIT



TEST CIRCUIT AND WAVEFORMS



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

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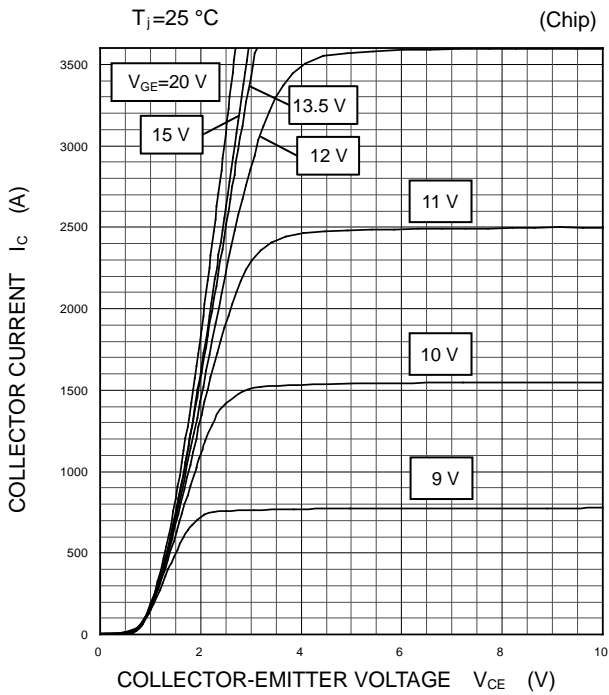
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

Inverter part

OUTPUT CHARACTERISTICS

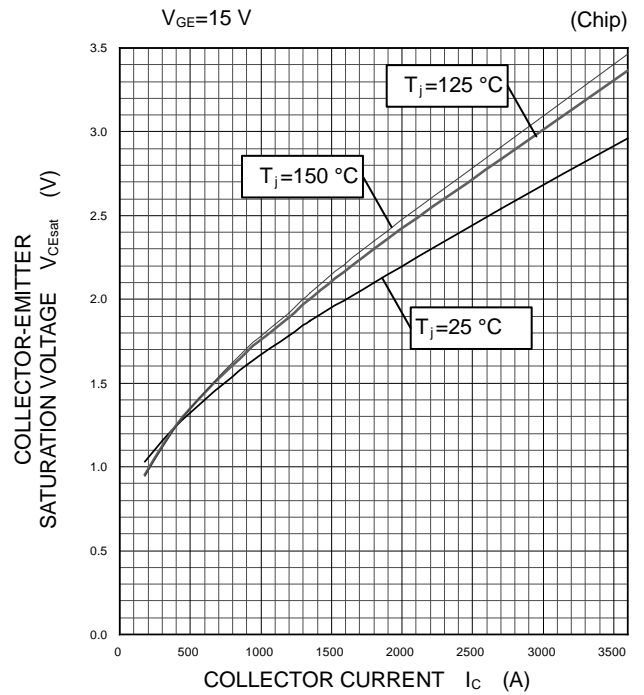
(TYPICAL)



COLLECTOR-EMITTER SATURATION

VOLTAGE CHARACTERISTICS

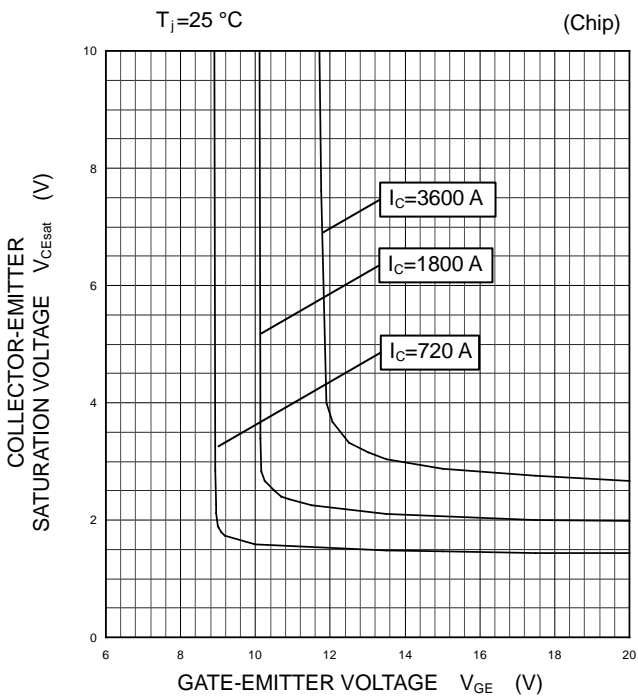
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COLLECTOR-EMITTER SATURATION

VOLTAGE CHARACTERISTICS

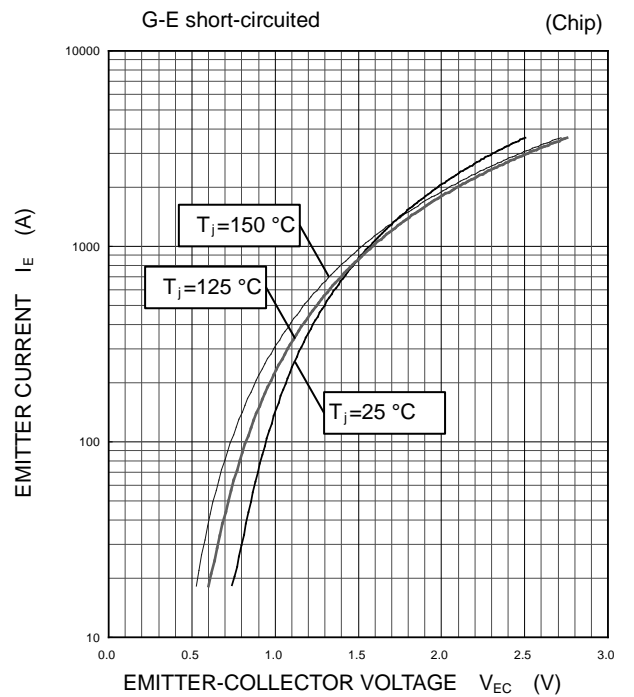
(TYPICAL)



FREE WHEELING DIODE

FORWARD CHARACTERISTICS

(TYPICAL)



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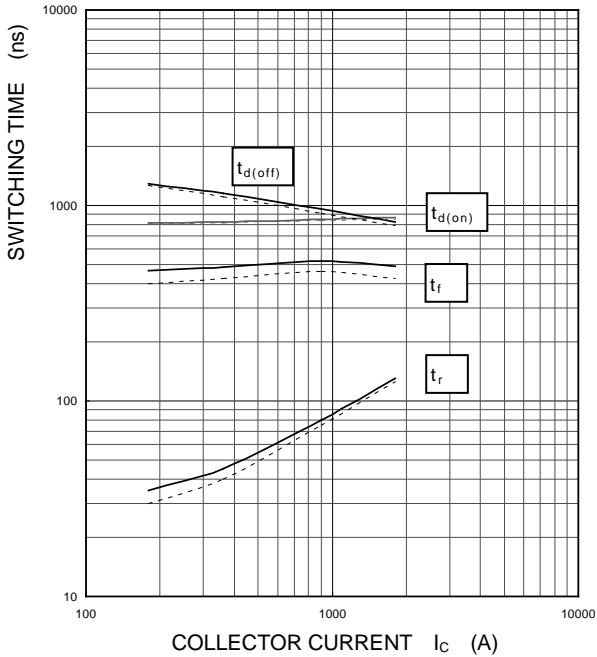
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

Inverter part

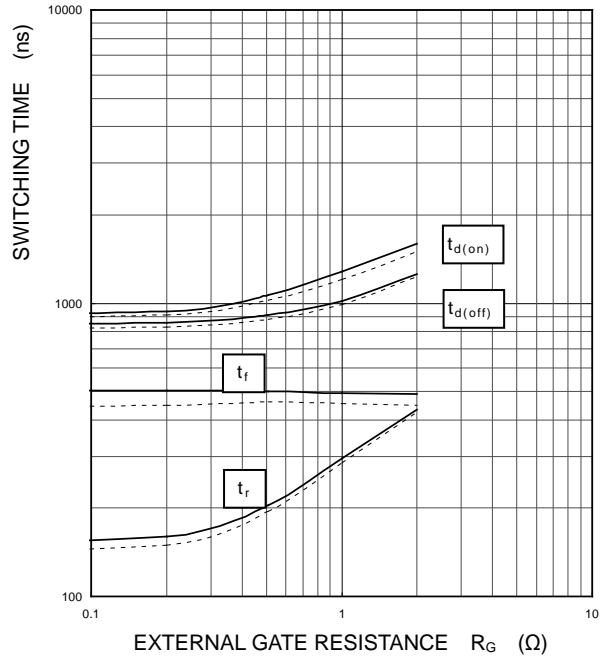
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

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



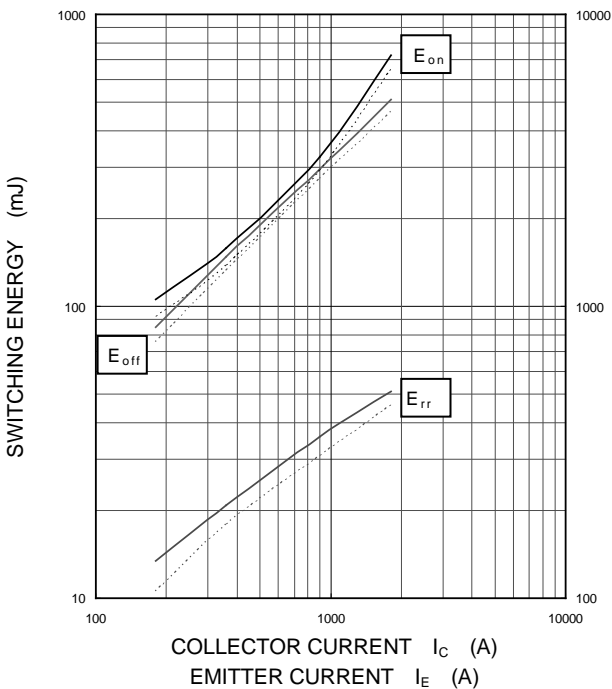
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=1000\text{ V}$, $I_C=1800\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



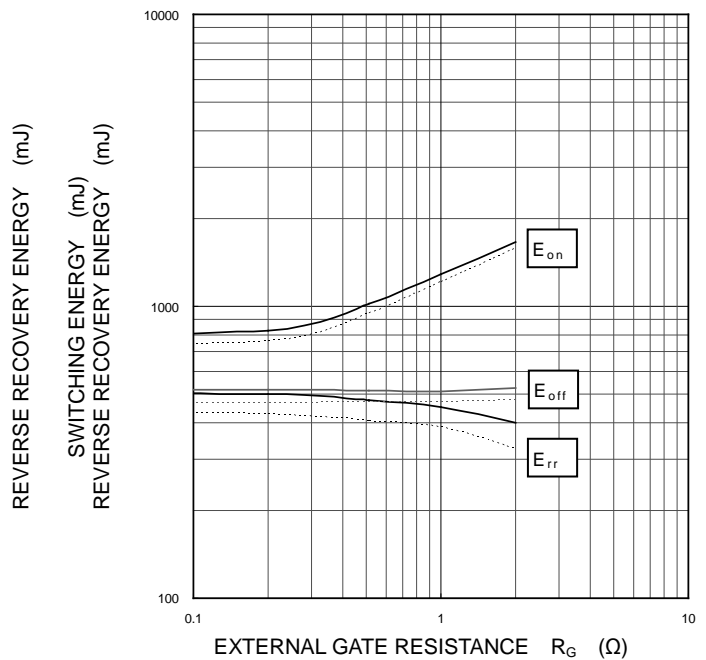
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

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



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=1000\text{ V}$, $I_C/I_E=1800\text{ A}$, $V_{GE}=\pm 15\text{ V}$,
INDUCTIVE LOAD, PER PULSE
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



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HIGH POWER SWITCHING USE
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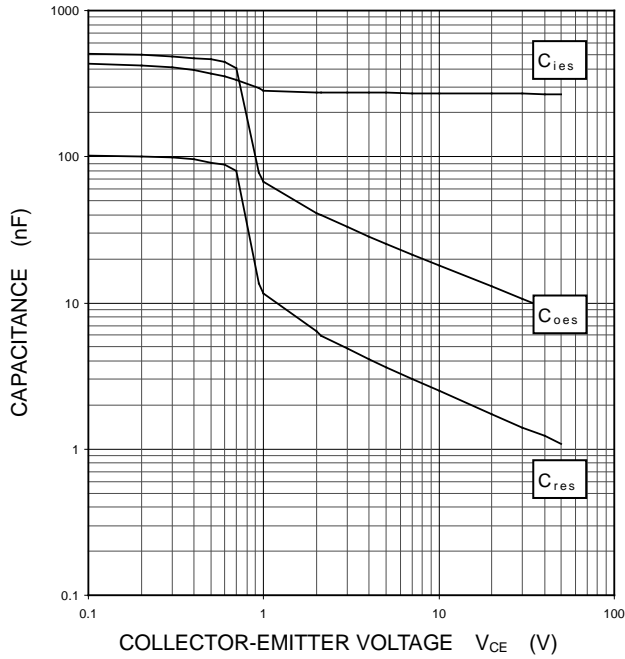
PERFORMANCE CURVES

Inverter part

CAPACITANCE CHARACTERISTICS

(TYPICAL)

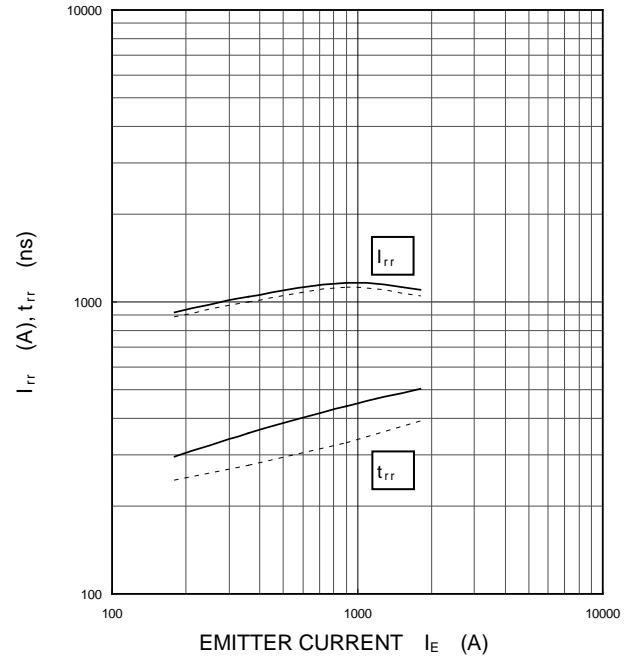
G-E short-circuited, $T_j=25\text{ }^\circ\text{C}$



FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS

(TYPICAL)

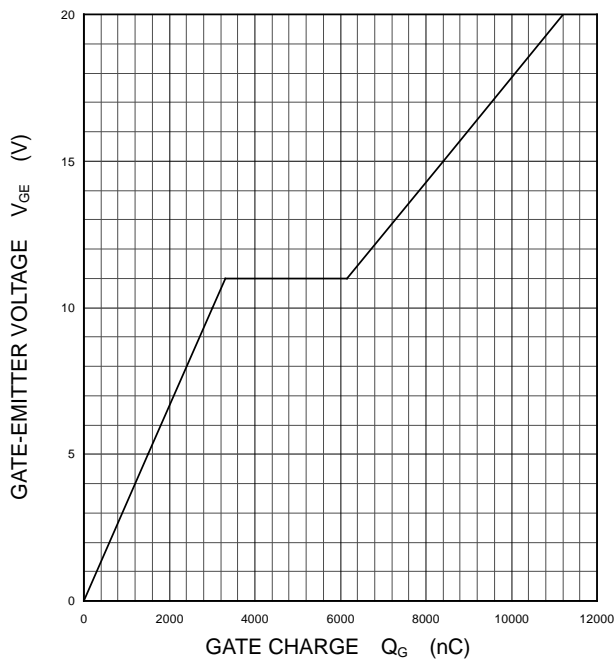
$V_{CC}=1000\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\text{ }\Omega$, INDUCTIVE LOAD
—: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



GATE CHARGE CHARACTERISTICS

(TYPICAL)

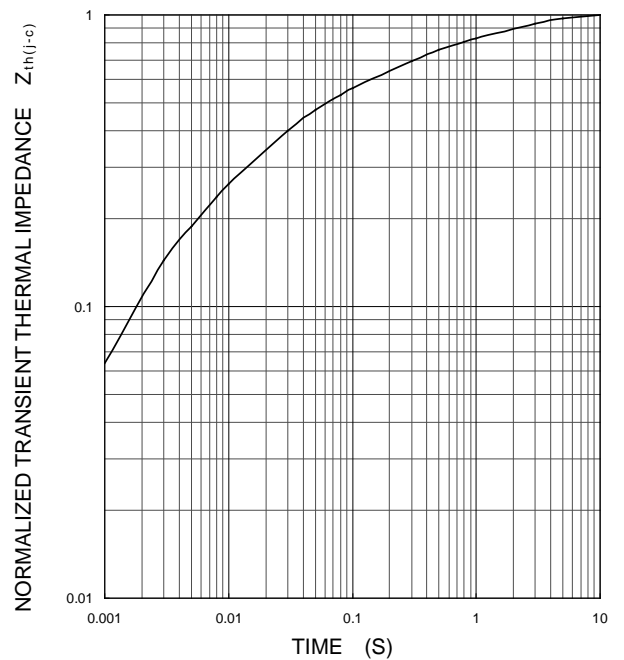
$V_{CC}=1000\text{ V}$, $I_C=1800\text{ A}$, $T_j=25\text{ }^\circ\text{C}$



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS

(MAXIMUM)

Single pulse, $T_C=25\text{ }^\circ\text{C}$
 $R_{th(j-c)Q}=13\text{ K/kW}$, $R_{th(j-c)D}=22\text{ K/kW}$



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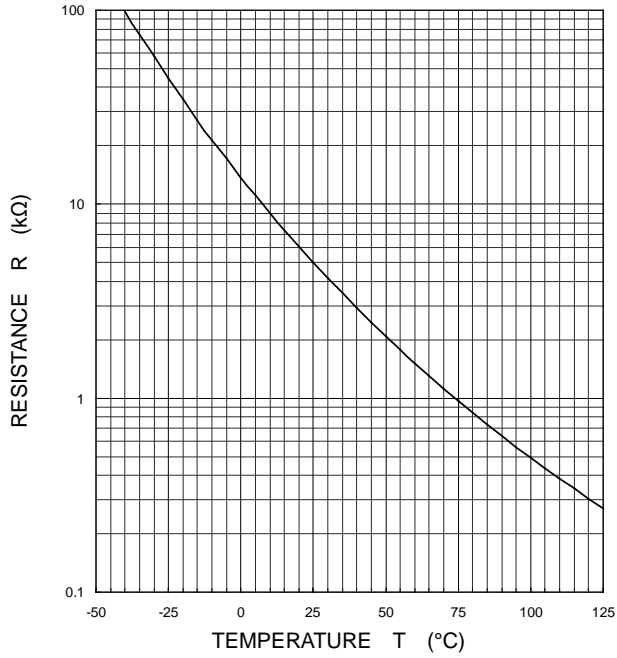
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

NTC thermistor part

TEMPERATURE CHARACTERISTICS

(TYPICAL)



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