

<IGBT Modules>

CM600DY-24S

HIGH POWER SWITCHING USE
INSULATED TYPE



dual switch (Half-Bridge)

Collector current I_C 600 A
 Collector-emitter voltage V_{CES} 1200 V
 Maximum junction temperature T_{jmax} 175 °C

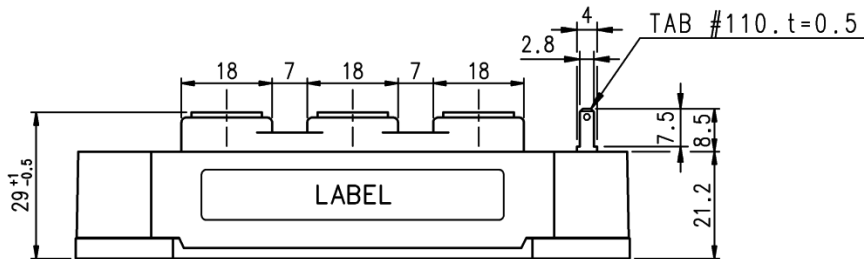
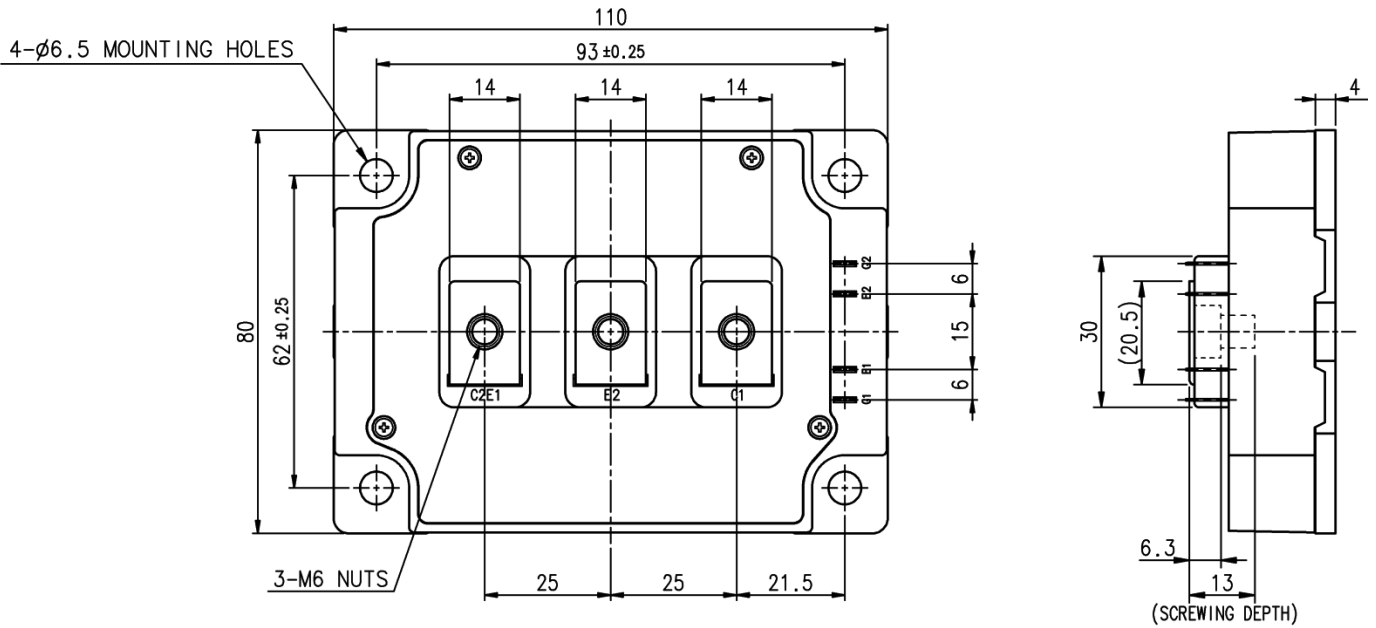
- Flat base Type
- Copper base plate
- RoHS Directive compliance
- UL Recognized under UL1557, File E323585

APPLICATION

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

OUTLINE DRAWING & INTERNAL CONNECTION

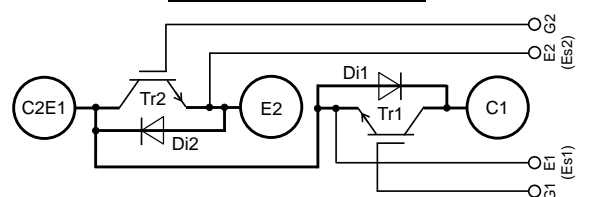
Dimension in mm



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



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MAXIMUM RATINGS (T_j=25 °C, unless otherwise specified)

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 =112 °C (Note2, 4)	600	A
I _{CRM}		Pulse, Repetitive (Note3)	1200	
P _{tot}	Total power dissipation	T _C =25 °C (Note2, 4)	4050	W
I _E (Note1)	Emitter current	DC (Note2)	600	A
I _{ERM} (Note1)		Pulse, Repetitive (Note3)	1200	
V _{isol}	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	2500	V
T _{jmax}	Maximum junction temperature	Instantaneous event (overload)	175	°C
T _{cmax}	Maximum case temperature	(Note4)	125	
T _{jopr}	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)

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 =60 mA, V _{CE} =10 V	5.4	6.0	6.6	V	
V _{CEsat} (Terminal)	Collector-emitter saturation voltage	I _C =600 A, V _{GE} =15 V, Refer to figure of test circuit (Note5)	T _j =25 °C	-	1.85	2.25	V
V _{CEsat} (Chip)			T _j =125 °C	-	2.05	-	
			T _j =150 °C	-	2.10	-	
V _{CEsat} (Chip)	Collector-emitter saturation voltage	I _C =600 A, V _{GE} =15 V, (Note5)	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	-	-	60	nF	
C _{oes}	Output capacitance		-	-	12		
C _{res}	Reverse transfer capacitance		-	-	1.0		
Q _G	Gate charge	V _{CC} =600 V, I _C =600 A, V _{GE} =15 V	-	1400	-	nC	
t _{d(on)}	Turn-on delay time	V _{CC} =600 V, I _C =600 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		
V _{EC} (Note1) (Terminal)	Emitter-collector voltage	I _E =600 A, G-E short-circuited, Refer to figure of test circuit (Note5)	T _j =25 °C	-	1.85	2.30	V
V _{EC} (Note1) (Chip)			T _j =125 °C	-	1.85	-	
			T _j =150 °C	-	1.85	-	
V _{EC} (Note1) (Chip)	Emitter-collector voltage	I _E =600 A, G-E short-circuited, (Note5)	T _j =25 °C	-	1.70	2.15	V
			T _j =125 °C	-	1.70	-	
			T _j =150 °C	-	1.70	-	
t _{rr} (Note.1)	Reverse recovery time	V _{CC} =600 V, I _E =600 A, V _{GE} =±15 V, R _G =0 Ω, Inductive load	-	-	300	ns	
Q _{rr} (Note.1)	Reverse recovery charge	R _G =0 Ω, Inductive load	-	32	-	μC	
E _{on}	Turn-on switching energy per pulse	V _{CC} =600 V, I _C =I _E =600 A,	-	65.9	-	mJ	
E _{off}	Turn-off switching energy per pulse	V _{GE} =±15 V, R _G =0 Ω,	-	79.1	-		
E _{rr} (Note.1)	Reverse recovery energy per pulse	T _j =150 °C, Inductive load	-	55.2	-	mJ	
r _g	Internal gate resistance	Per switch	-	3.3	-	Ω	

CM600DY-24SHIGH POWER SWITCHING USE
INSULATED TYPE**THERMAL RESISTANCE CHARACTERISTICS**

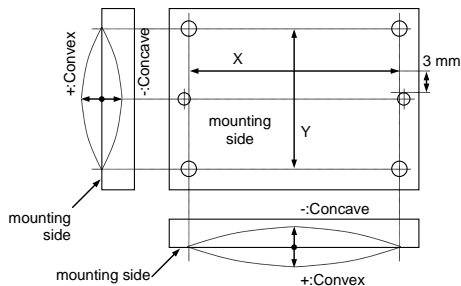
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance	Junction to case, per IGBT (Note4)	-	-	37	K/kW
$R_{th(j-c)D}$		Junction to case, per FWD (Note4)	-	-	60	K/kW
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1/2 module, Thermal grease applied (Note4, 6)	-	18	-	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
m	mass	-	-	580	-	g
e_c	Flatness of base plate	On the centerline X, Y (Note7)	-100	-	+100	μm

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

- 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.
- 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.

**RECOMMENDED OPERATING CONDITIONS**

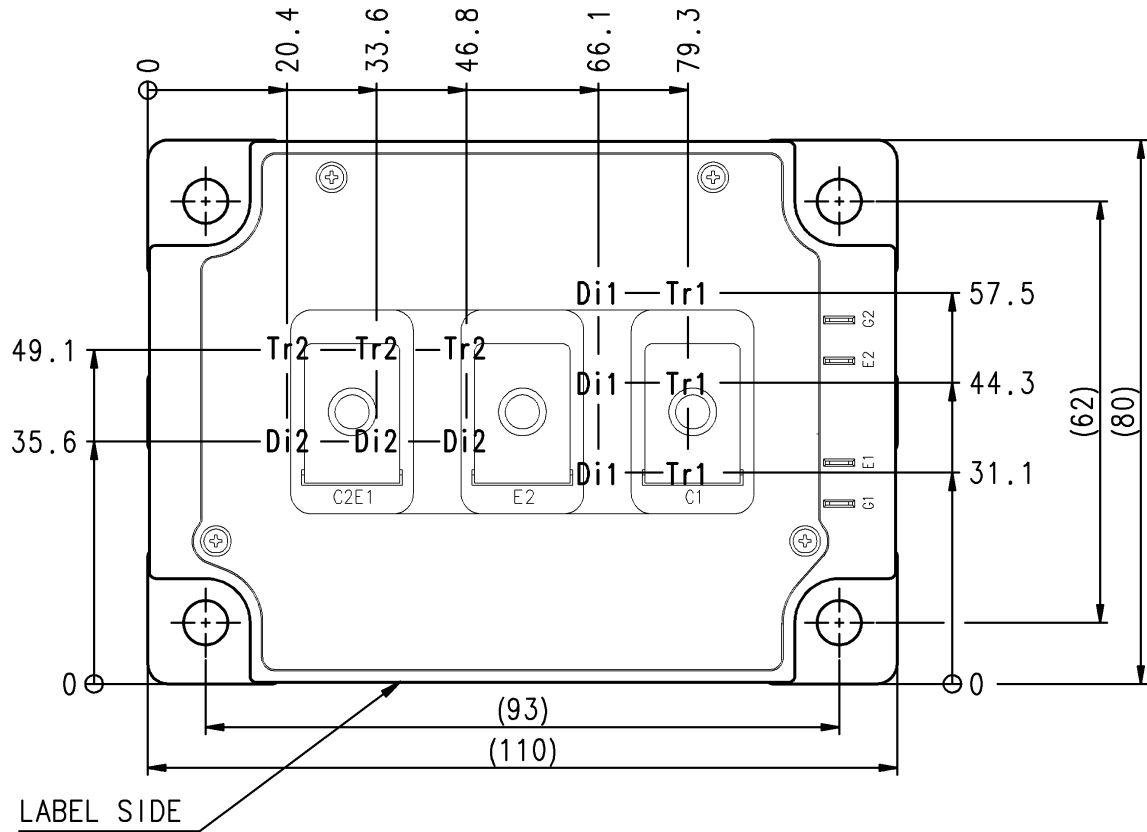
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across C1-E2	-	600	850	V
V_{GEon}	Gate (-emitter drive) voltage	Applied across G1-Es1/G2-Es2	13.5	15.0	16.5	V
R_G	External gate resistance	Per switch	0	-	7.5	Ω

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HIGH POWER SWITCHING USE
INSULATED TYPE

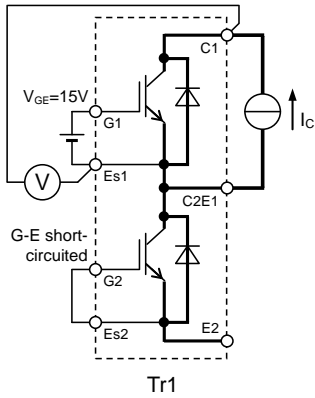
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ± 1 mm

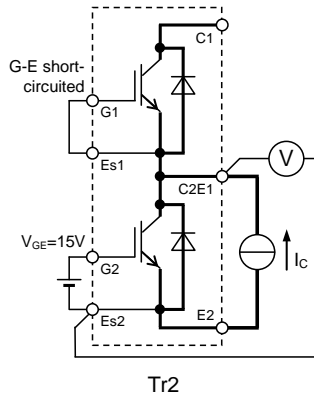


Tr1/Tr2: IGBT, Di1/Di2: FWD

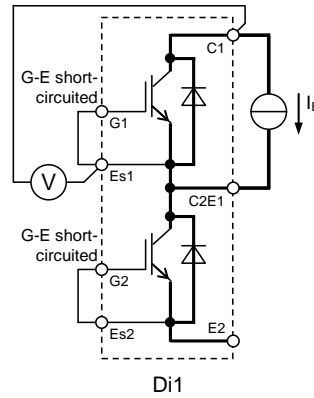
TEST CIRCUIT



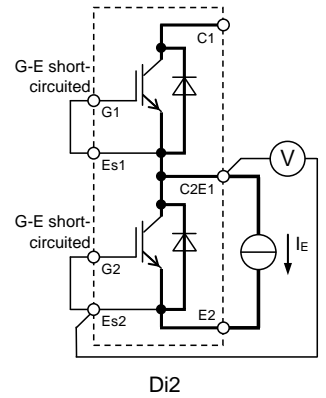
V_{CEsat} test circuit



Tr2



Di1



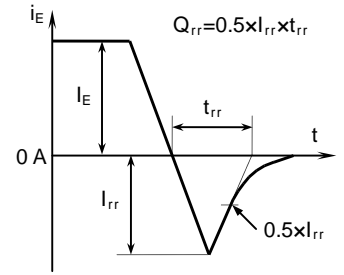
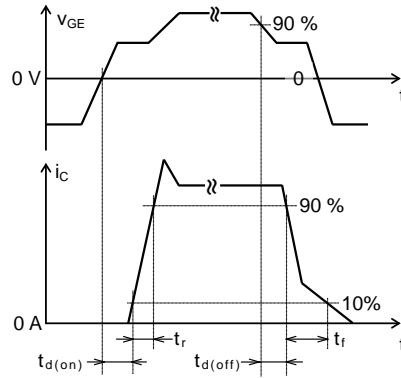
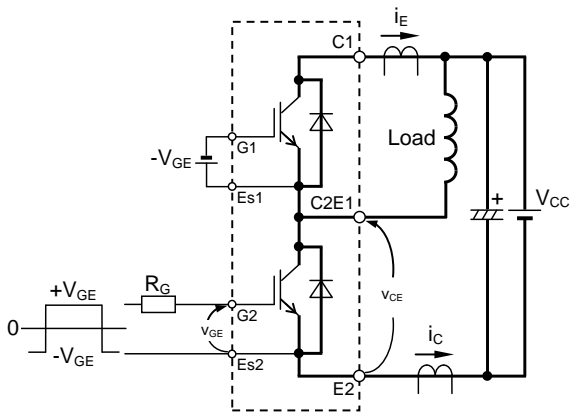
Di2

V_{EC} test circuit

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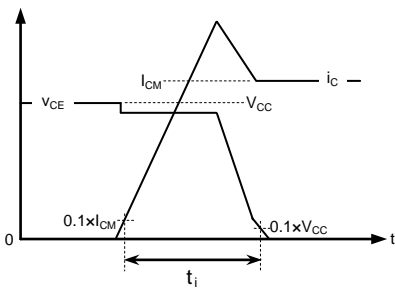
HIGH POWER SWITCHING USE
INSULATED TYPE

TEST CIRCUIT AND WAVEFORMS

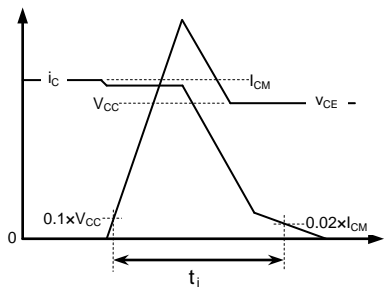


Switching characteristics test circuit and waveforms

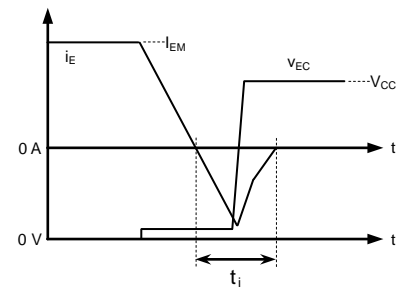
t_{rr} , Q_{rr} test waveform



IGBT Turn-on switching energy



IGBT Turn-off switching energy



FWDi Reverse recovery energy

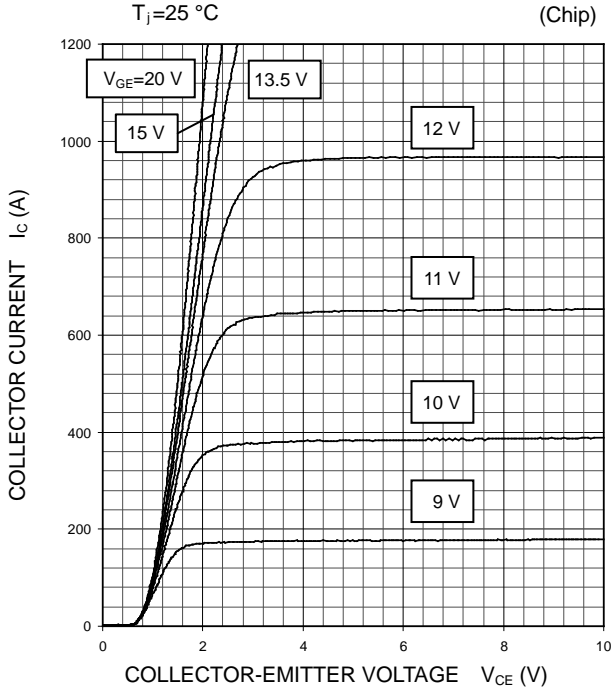
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

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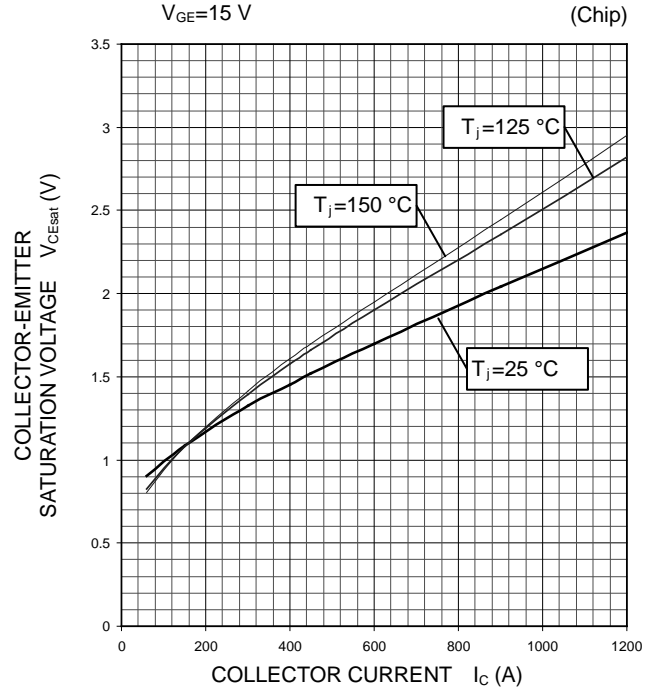
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

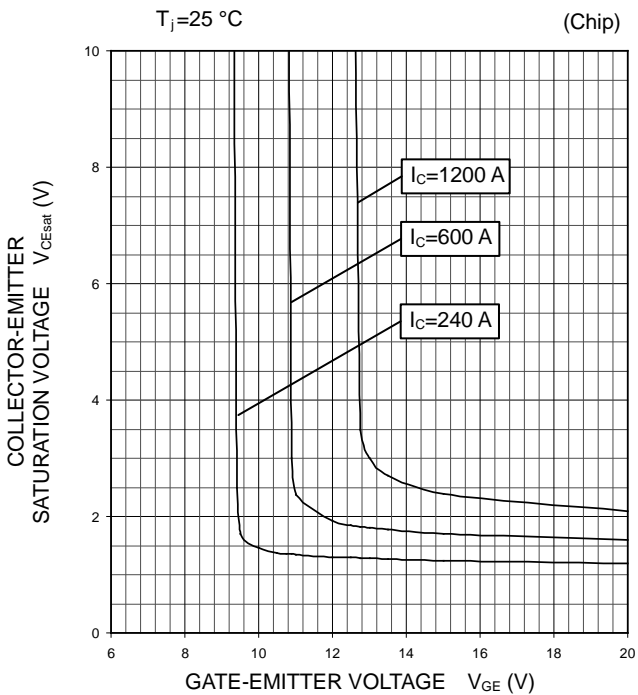
OUTPUT CHARACTERISTICS
(TYPICAL)



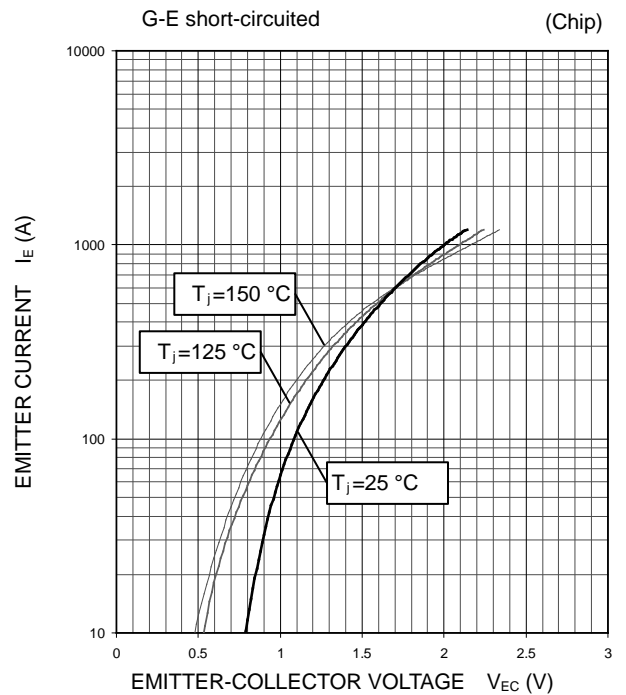
COLLECTOR-EMITTER SATURATION
VOLTAGE CHARACTERISTICS
(TYPICAL)



COLLECTOR-EMITTER SATURATION
VOLTAGE CHARACTERISTICS
(TYPICAL)



FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)



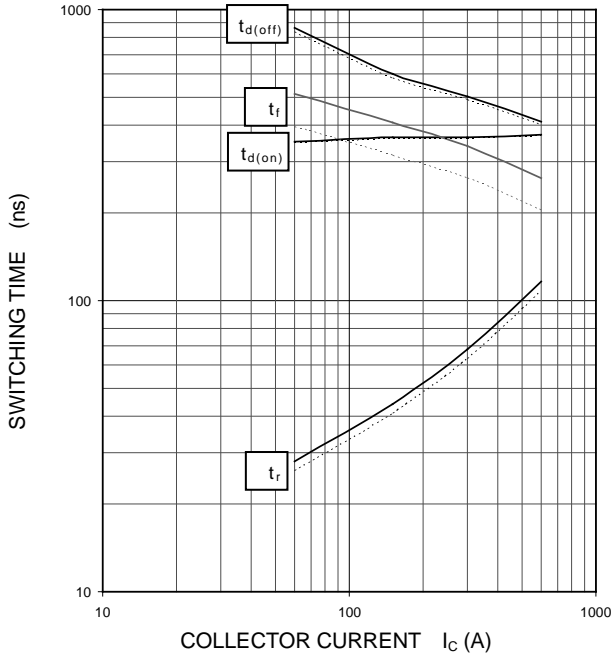
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HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

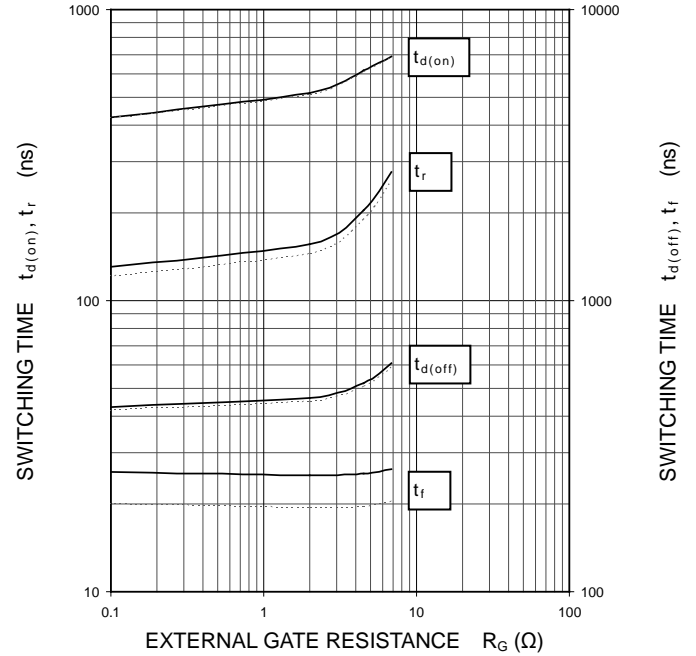
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$, INDUCTIVE LOAD
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



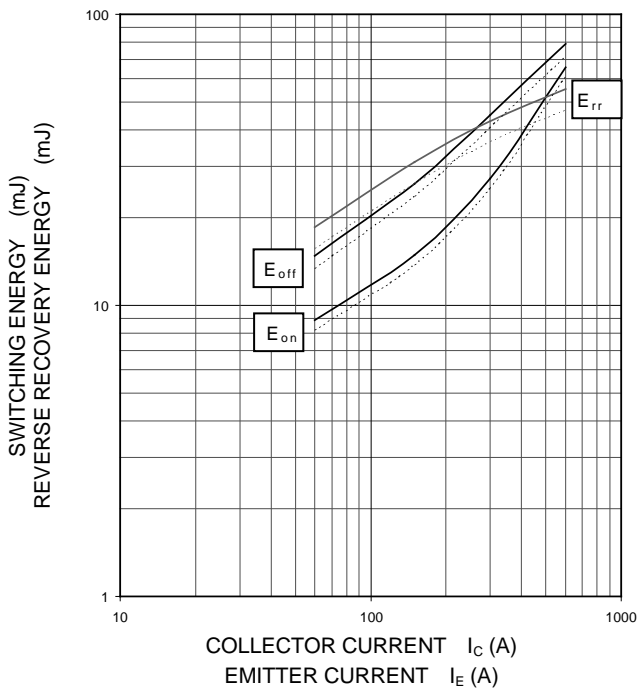
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $I_C=600\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



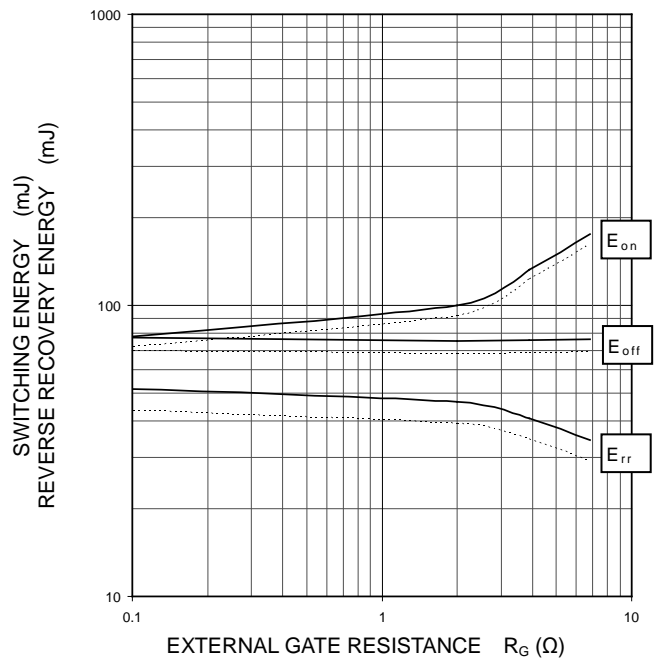
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$,
INDUCTIVE LOAD, PER PULSE
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $I_C/I_E=600\text{ A}$, $V_{GE}=\pm 15\text{ V}$,
INDUCTIVE LOAD, PER PULSE
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$

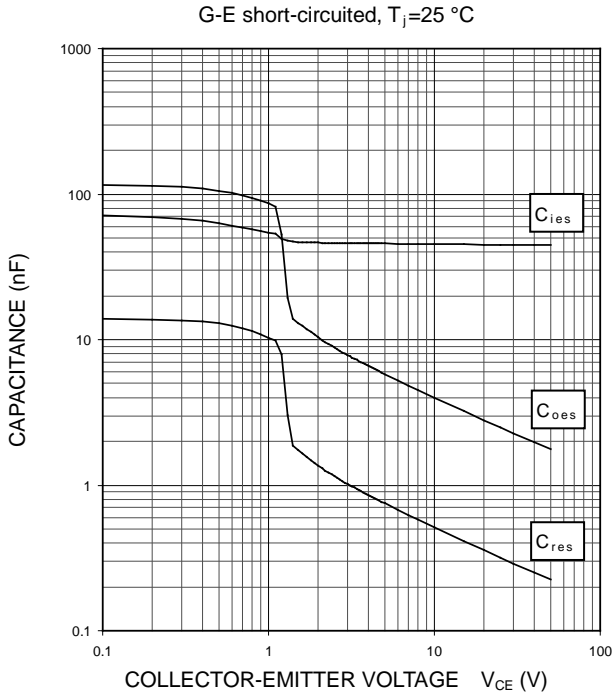


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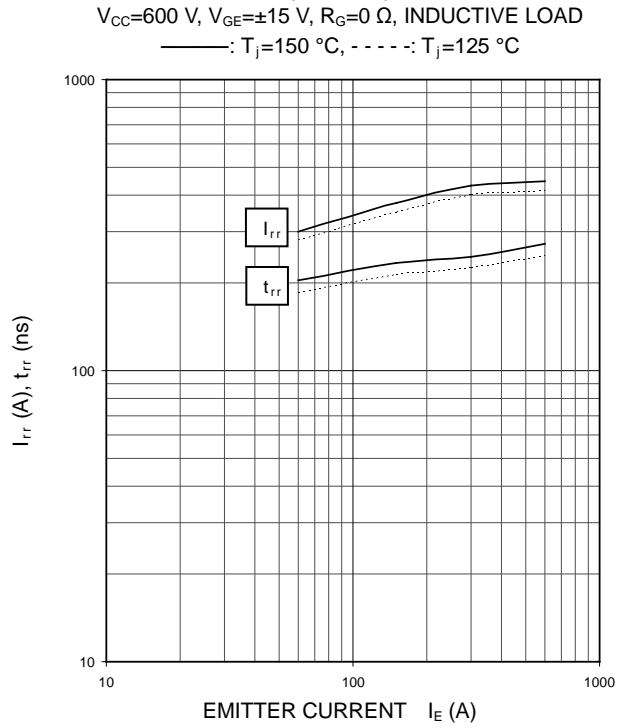
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PERFORMANCE CURVES

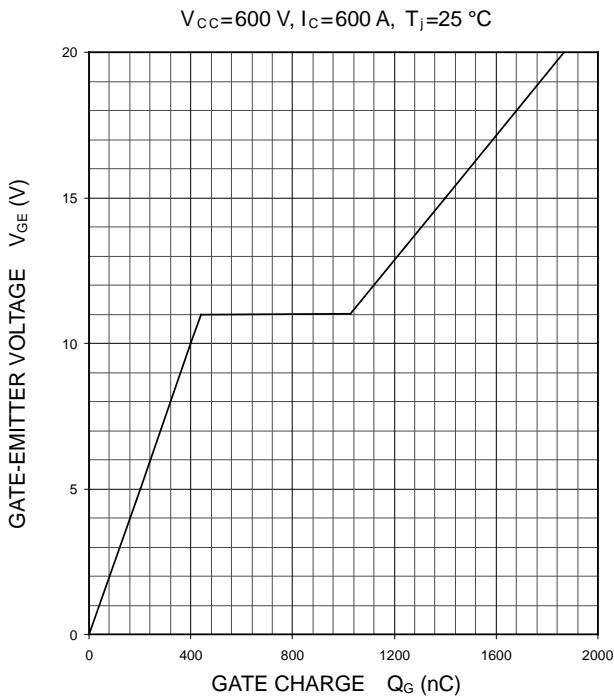
CAPACITANCE CHARACTERISTICS
(TYPICAL)



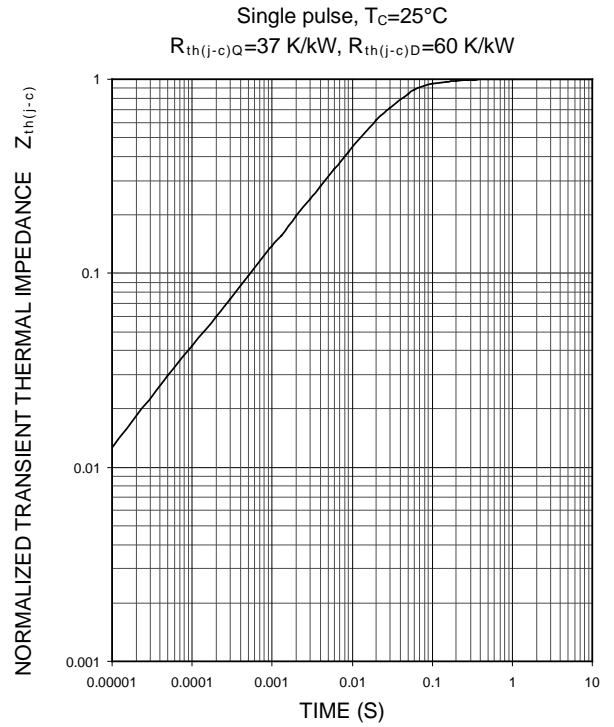
FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)



GATE CHARGE CHARACTERISTICS
(TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)



Keep safety first in your circuit designs!

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