MITSUBISHI ELECTRIC

<IGBT Modules>

CM600HA-34S

HIGH POWER SWITCHING USE
INSULATED TYPE

single pack

Collector current I_C ..... **600** A
Collector-emitter voltage V_{CES} ..... **1700** V
Maximum junction temperature T_{vjmax} ..... **175** °C

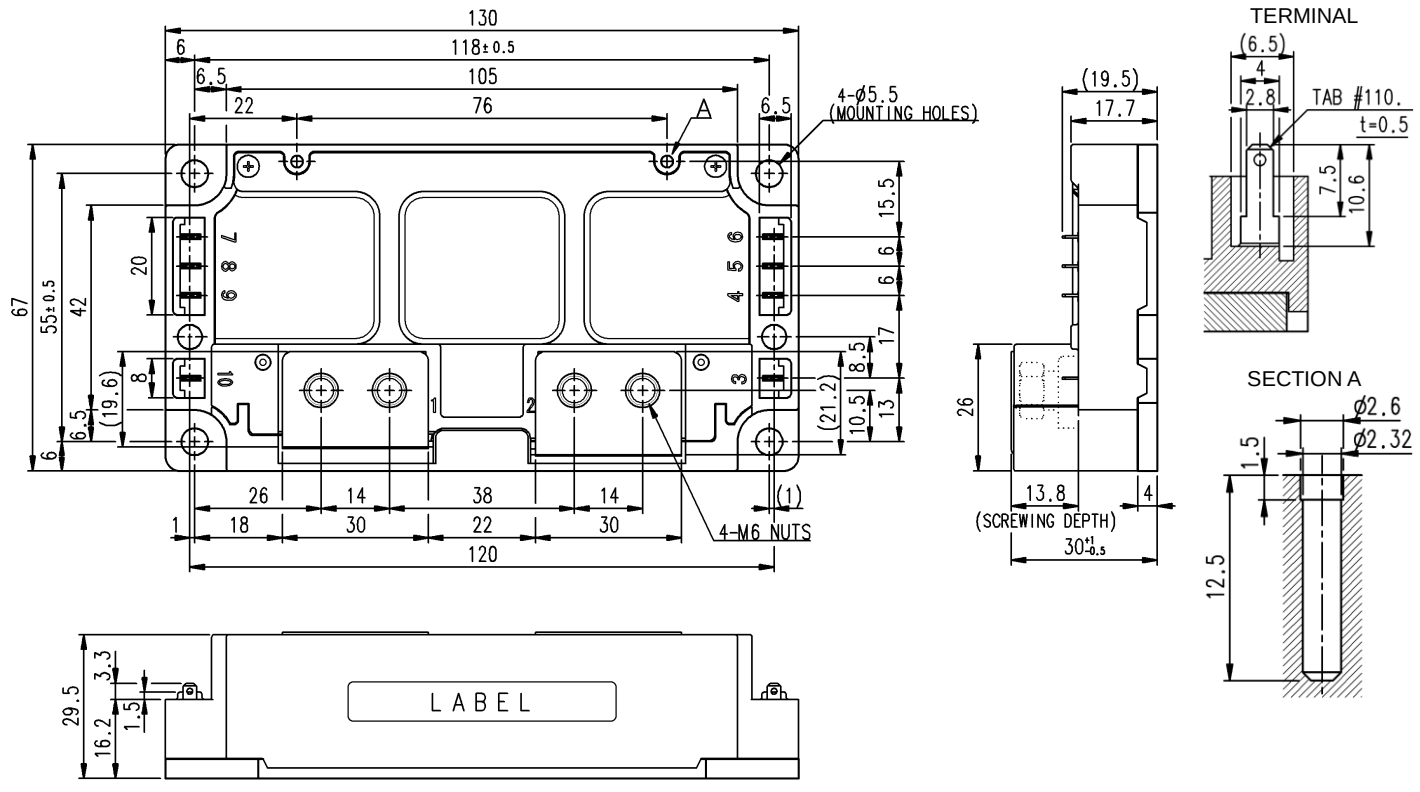
- ●Flat base Type
- ●Copper base plate
- ●Tin plating pin terminals
- ●RoHS Directive compliant
- ●Recognized under UL1557, File E323585

APPLICATION

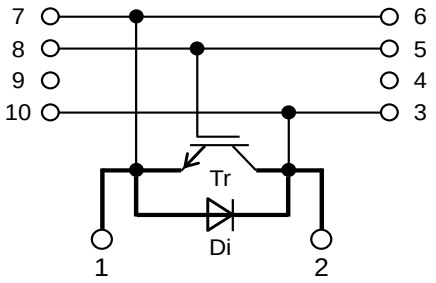
AC Motor Control, Motion/Servo Control, Power supply, Photovoltaic power, Wind power, etc.

OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm



INTERNAL CONNECTION



Terminal code

1: E
2: C
3: C_S
4: NC
5: G
6: E_S
7: E_S
8: G
9: NC
10: C_S

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
over 400	to 1000	±2.0
over 1000	to 2000	±3.0
over 2000	to 4000	±4.0

MAXIMUM RATINGS (T_{vj}=25 °C, unless otherwise specified)

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=111 °C (Note2, 4)	600	A
I_{CRM}		Pulse, Repetitive (Note3)	1200	
P_{tot}	Total power dissipation	T_C=25 °C (Note2, 4)	4285	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	4000	V
T_{vjmax}	Maximum junction temperature	Instantaneous event (overload)	175	°C
T_{Cmax}	Maximum case temperature	(Note4)	125	
T_{vjop}	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	°C
T_{stg}	Storage temperature	-	-40 ~ +125	

ELECTRICAL CHARACTERISTICS (T_{vj}=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 the figure of test circuit (Note5)	T_{vj}=25 °C	-	2.10	2.60	V
			T_{vj}=125 °C	-	2.35	-	
			T_{vj}=150 °C	-	2.45	-	
V_{CEsat} (Chip)		I_C=600 A, V_{GE}=15 V, (Note5)	T_{vj}=25 °C	-	2.00	2.50	V
			T_{vj}=125 °C	-	2.25	-	
			T_{vj}=150 °C	-	2.35	-	
C_{ies}	Input capacitance	V_{CE}=10 V, G-E short-circuited		-	-	140	nF
C_{oes}	Output capacitance			-	-	15	
C_{res}	Reverse transfer capacitance			-	-	2.5	
Q_G	Gate charge	V_{CC}=1000 V, I_C=600 A, V_{GE}=15 V		-	2.52	-	μC
$t_{d(on)}$	Turn-on delay time	V_{CC}=1000 V, I_C=600 A, V_{GE}=±15 V, R_G=0 Ω, Inductive load		-	-	900	ns
t_r	Rise time			-	-	300	
$t_{d(off)}$	Turn-off delay time			-	-	900	
t_f	Fall time			-	-	400	
V_{EC} (Note.1) (Terminal)	Emitter-collector voltage	I_E=600 A, G-E short-circuited, Refer to the figure of test circuit (Note5)	T_{vj}=25 °C	-	2.10	2.60	V
			T_{vj}=125 °C	-	2.20	-	
			T_{vj}=150 °C	-	2.15	-	
V_{EC} (Note.1) (Chip)		I_E=600 A, G-E short-circuited, (Note5)	T_{vj}=25 °C	-	2.00	2.50	V
			T_{vj}=125 °C	-	2.10	-	
			T_{vj}=150 °C	-	2.05	-	
t_{rr} (Note1)	Reverse recovery time	V_{CC}=1000 V, I_E=600 A, V_{GE}=±15 V, R_G=0 Ω, Inductive load		-	-	500	ns
Q_{rr} (Note1)	Reverse recovery charge			-	120	-	μC
E_{on}	Turn-on switching energy per pulse	V_{CC}=1000 V, I_C=I_E=600 A, V_{GE}=±15 V, R_G=0 Ω, T_{vj}=150 °C, Inductive load		-	287	-	mJ
E_{off}	Turn-off switching energy per pulse			-	154	-	
E_{rr} (Note1)	Reverse recovery energy per pulse			-	152	-	mJ
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, T_C=25 °C (Note4)		-	0.2	-	mΩ
r_g	Internal gate resistance	-		-	3.67	-	Ω

THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance	Junction to case, IGBT (Note4)	-	-	35	K/kW
$R_{th(j-c)D}$		Junction to case, FWD (Note4)	-	-	53.4	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, Thermal grease applied (Note4, 6)	-	18	-	K/kW

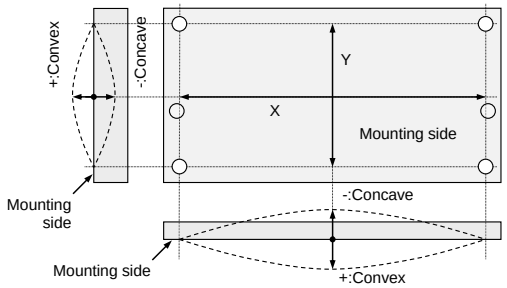
MECHANICAL CHARACTERISTICS

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 torque	Mounting to heat sink M 5 screw	2.5	3.0	3.5	N·m
d_s	Creepage distance	Terminal to terminal	22.0	-	-	mm
		Terminal to base plate	21.9	-	-	
d_a	Clearance	Terminal to terminal	16.5	-	-	mm
		Terminal to base plate	12.5	-	-	
e_c	Flatness of base plate	On the centerline X, Y (Note7)	-50	-	+100	μm
m	mass	-	-	490	-	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.

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

2. Junction temperature (T_{vj}) should not exceed T_{vjmax} rating.
3. Pulse width and repetition rate should be such that the device junction temperature (T_{vj}) dose not exceed T_{vjmax} 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 is measured by using thermally conductive grease of λ=0.9 W/(m·K)/$D_{(C-S)}$=100 μm.
7. The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



8. Use the following screws when mounting the printed circuit board (PCB) on the standoffs. PCB thickness (t1.0).

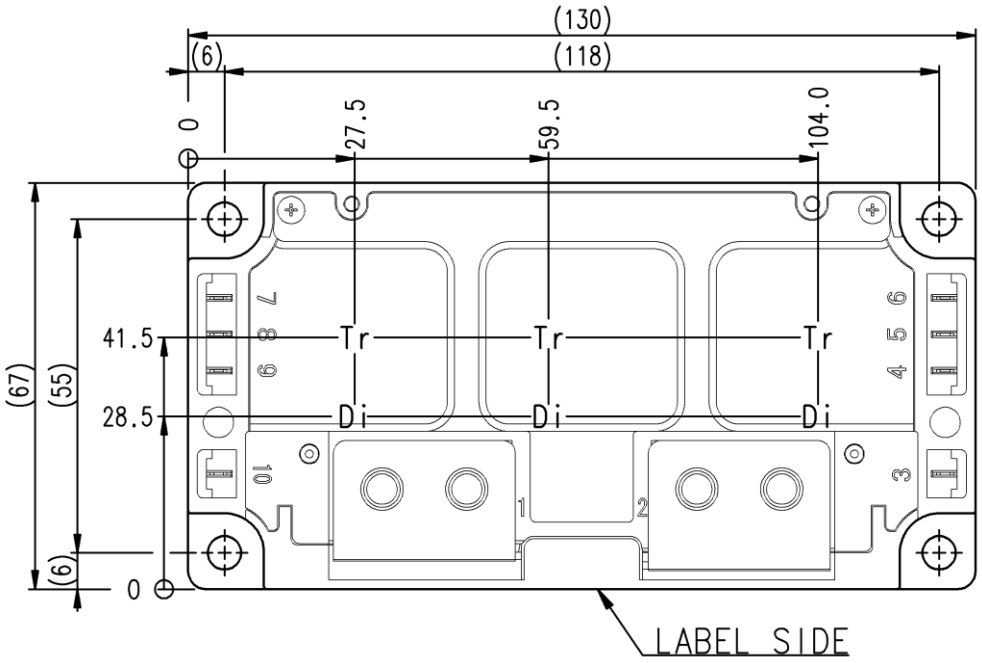
Type	Size	Tightening torque	Recommended tightening method
(1) PT®	K25×8	0.55 ± 0.055 N・m	by handwork (equivalent to 30 r/min ~ 600 r/min (by mechanical screw driver)
(2) PT®	K25×10	0.85 ± 0.085 N・m	
(3) DELTA PT®	25×8	0.55 ± 0.055 N・m	by mechanical screw driver)
(4) DELTA PT®	25×10	0.85 ± 0.085 N・m	
(5) B1 tapping screw	φ2.6×10 or φ2.6×12	0.85 ± 0.085 N・m	

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across C-E terminals	-	1000	1200	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	-	15	Ω

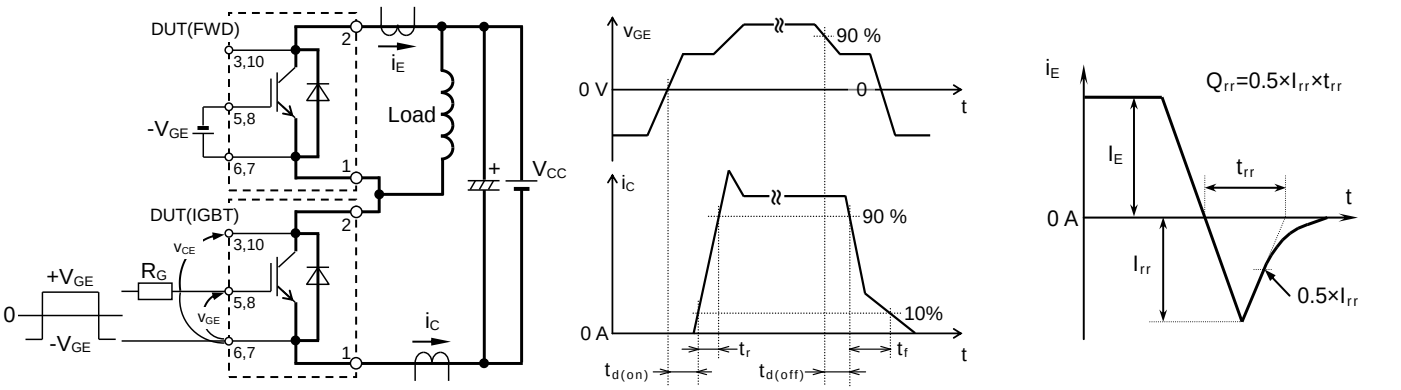
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm



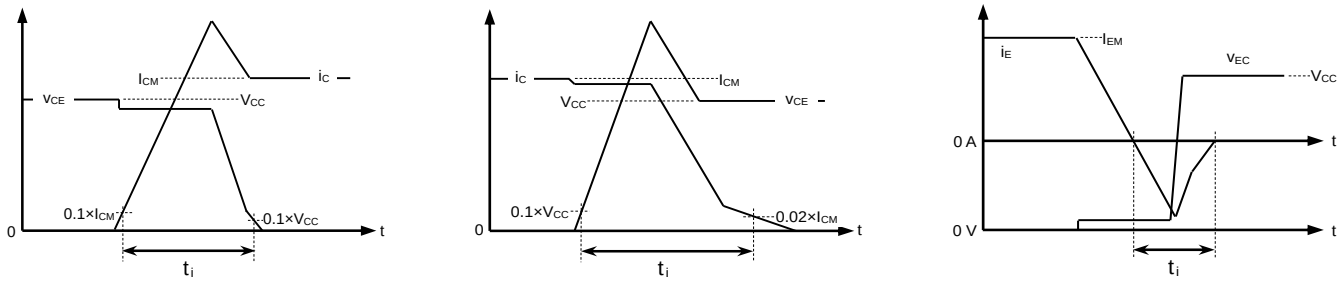
Tr: IGBT, Di: FWD

TEST CIRCUIT AND WAVEFORMS



Switching characteristics test circuit and waveforms

t_{rr}, Q_{rr} characteristics test waveform



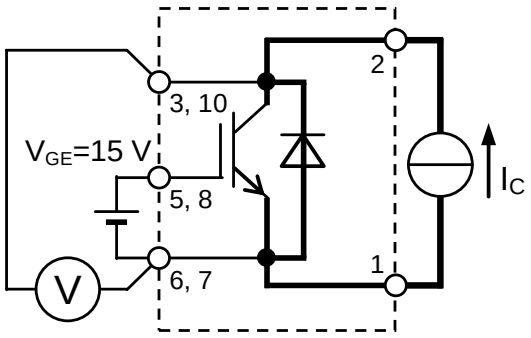
IGBT Turn-on switching energy

IGBT Turn-off switching energy

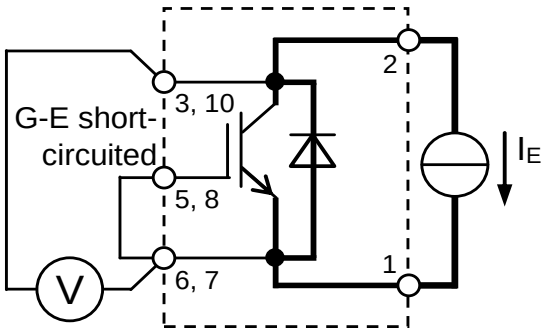
FWD Reverse recovery energy

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

TEST CIRCUIT



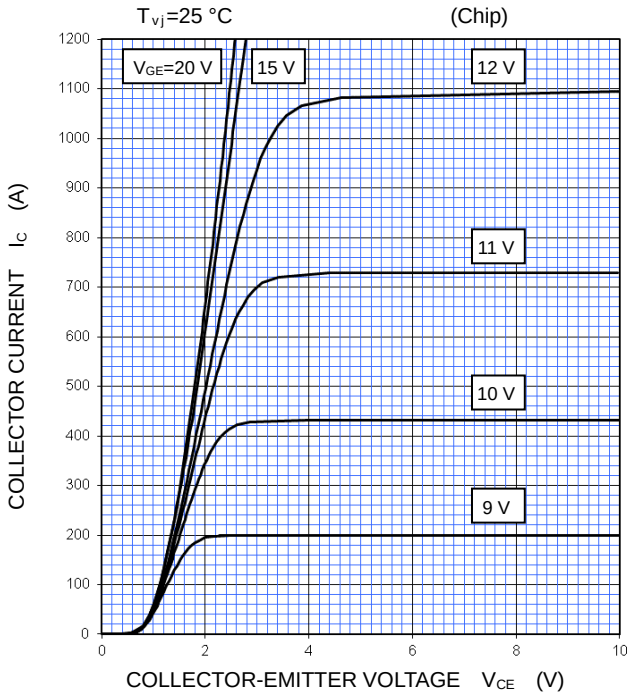
V_{CEsat} characteristics test circuit



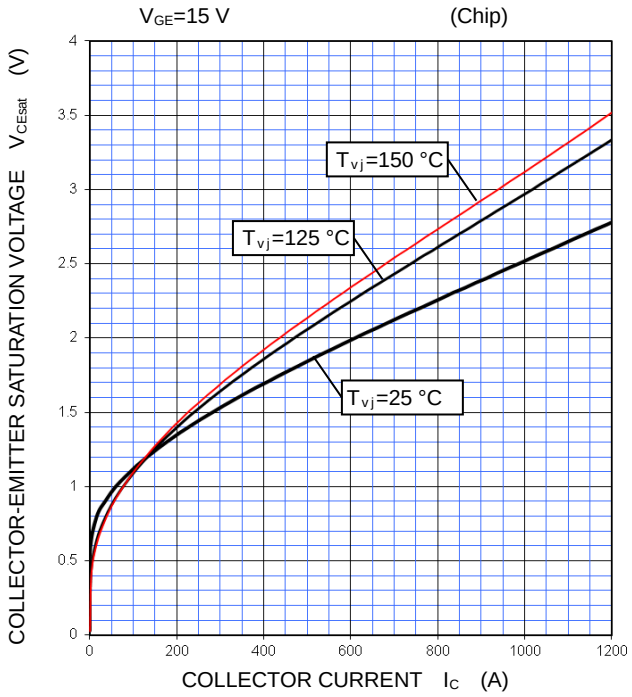
V_{EC} characteristics test circuit

PERFORMANCE CURVES

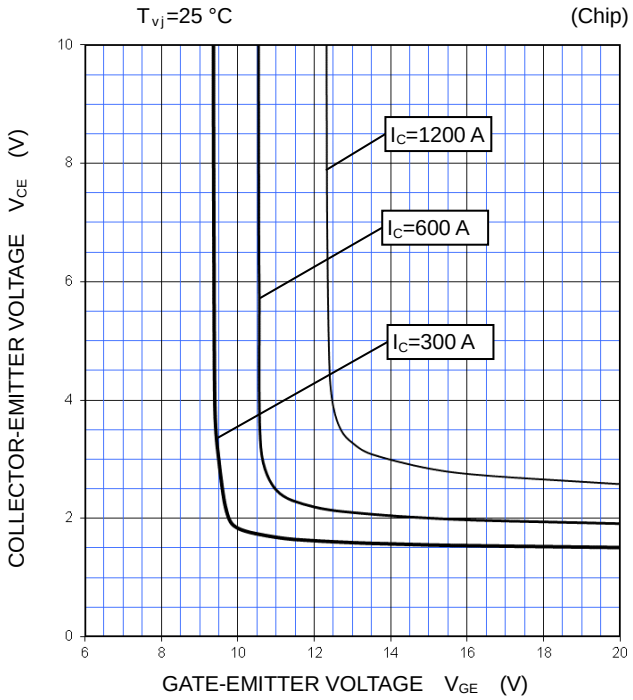
OUTPUT CHARACTERISTICS (TYPICAL)



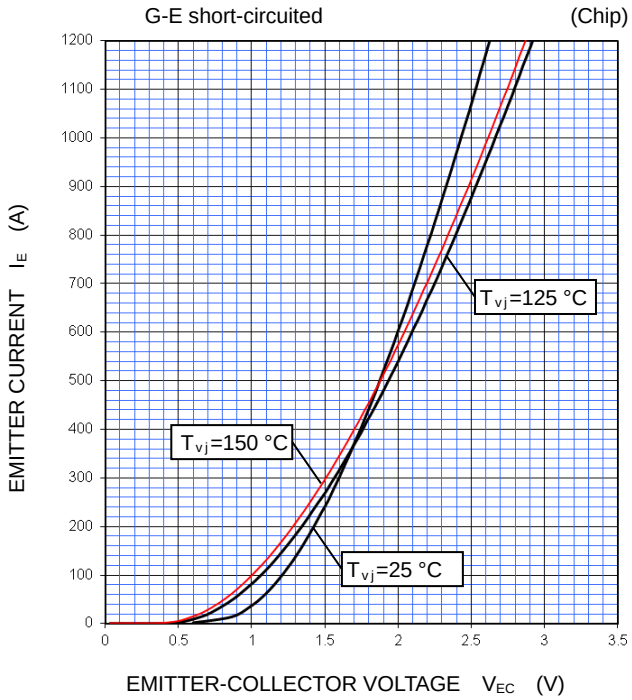
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS (TYPICAL)



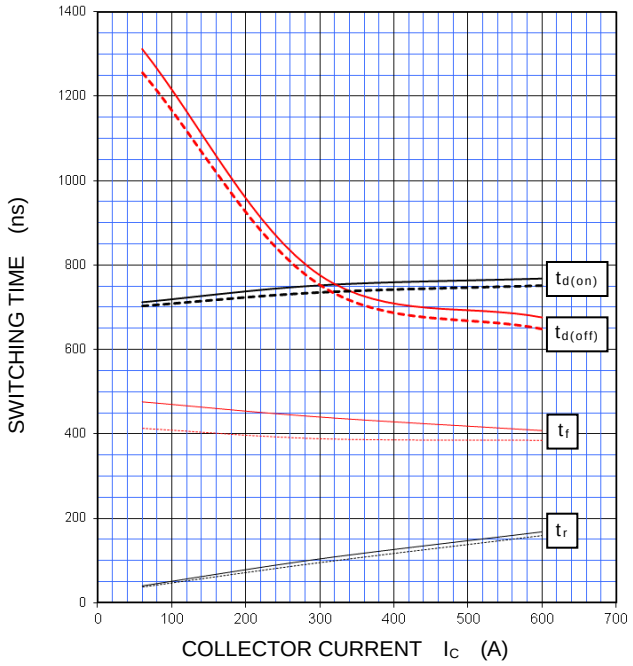
FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)



PERFORMANCE CURVES

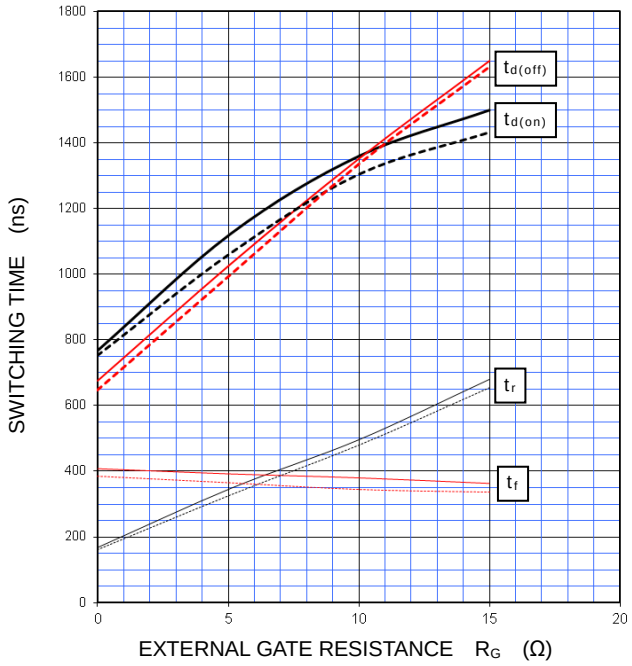
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=1000 V, V_{GE}=±15 V, R_G=0 Ω, INDUCTIVE LOAD
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C



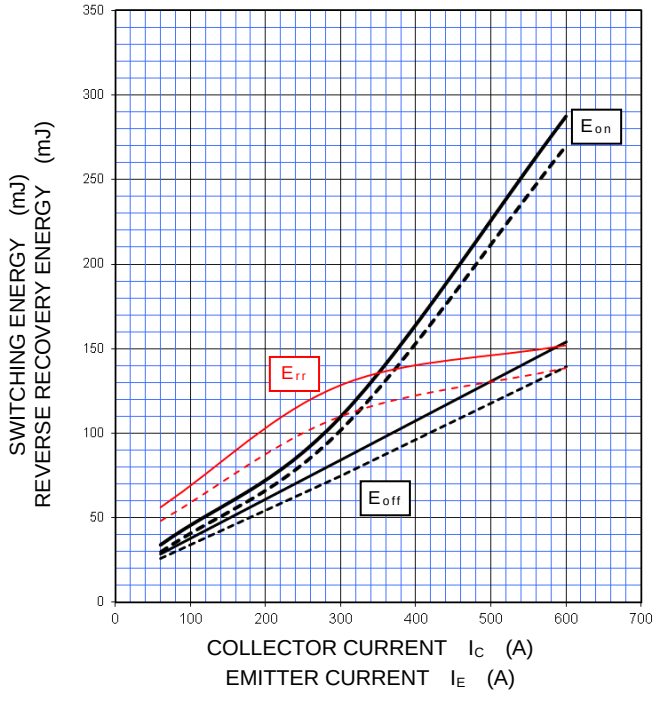
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=1000 V, V_{GE}=±15 V, I_C=600 A, INDUCTIVE LOAD
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C



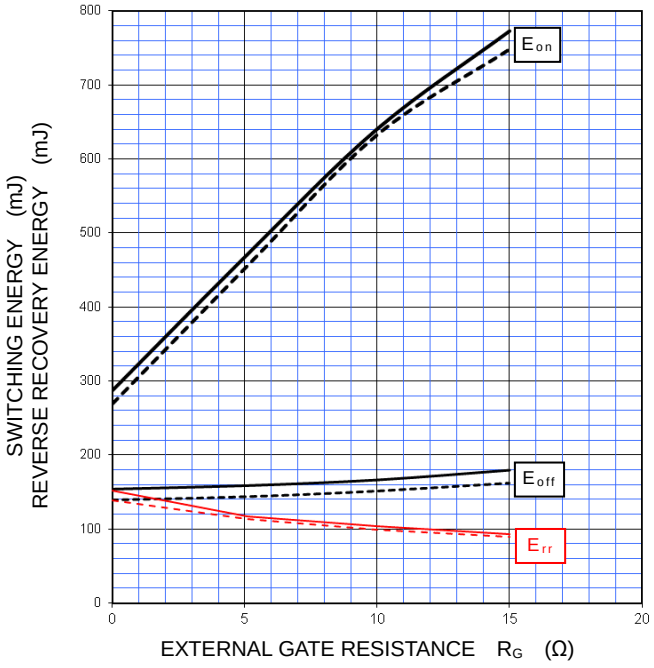
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=1000 V, V_{GE}=±15 V, R_G=0 Ω,
INDUCTIVE LOAD, PER PULSE
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

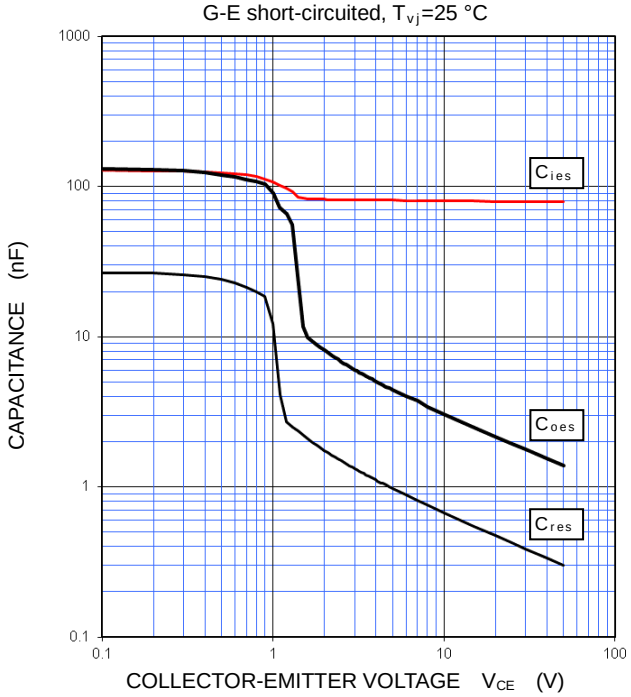
V_{CC}=1000 V, V_{GE}=±15 V, I_C/I_E=600 A,
INDUCTIVE LOAD, PER PULSE
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C



PERFORMANCE CURVES

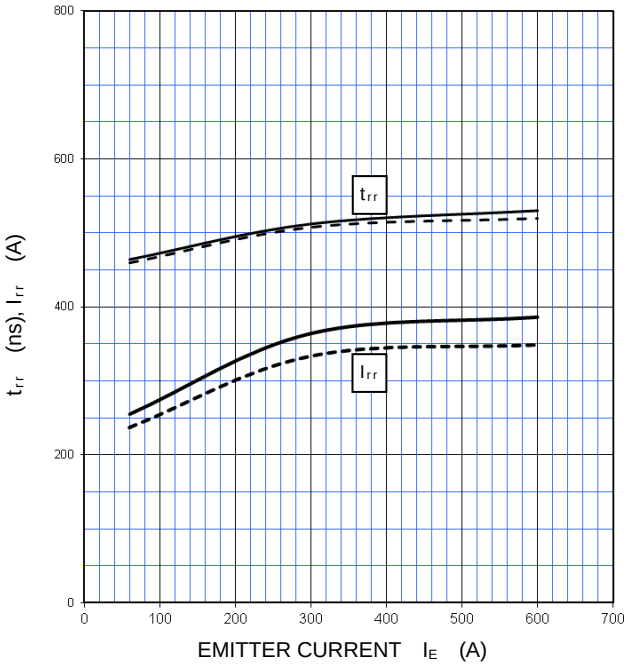
CAPACITANCE CHARACTERISTICS (TYPICAL)

G-E short-circuited, T_{vj}=25 °C



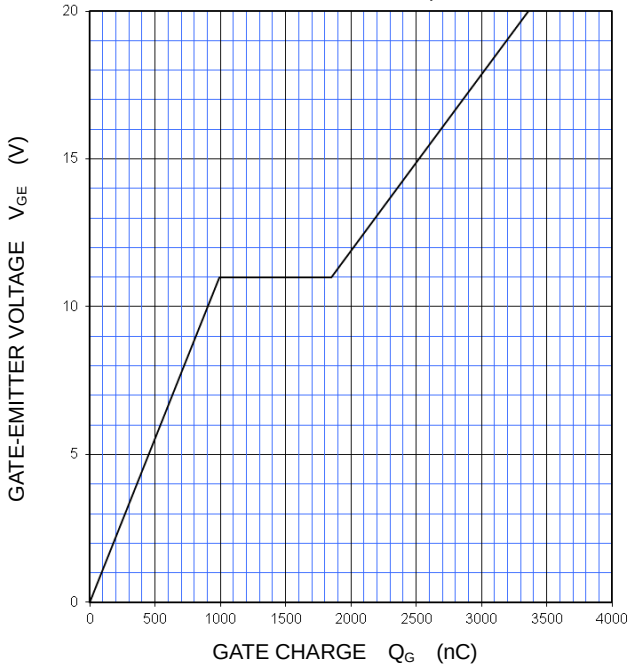
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

V_{CC}=1000 V, V_{GE}=±15 V, R_G=0 Ω, INDUCTIVE LOAD
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C



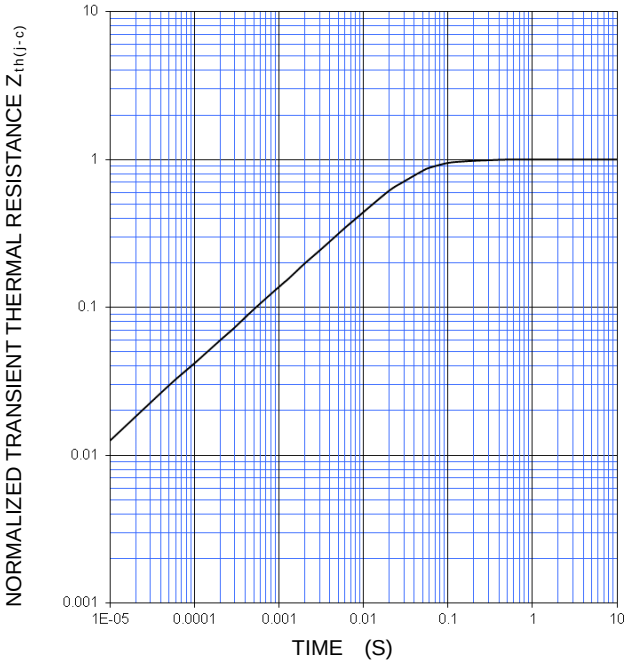
GATE CHARGE CHARACTERISTICS (TYPICAL)

V_{CC}=1000 V, I_C=600 A, T_{vj}=25 °C



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)

Single pulse, T_C=25 °C
$R_{th(j-c)Q}$=35 K/kW, $R_{th(j-c)D}$=53.4 K/kW



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