IEGT Module Silicon N-Channel IEGT

MG1500FXF1US71

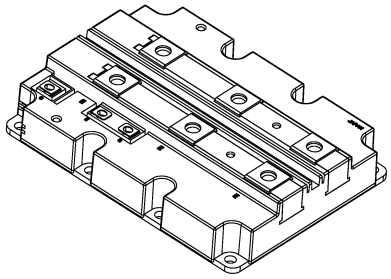
1. Applications

- High-Power Switching
- Motor Controllers

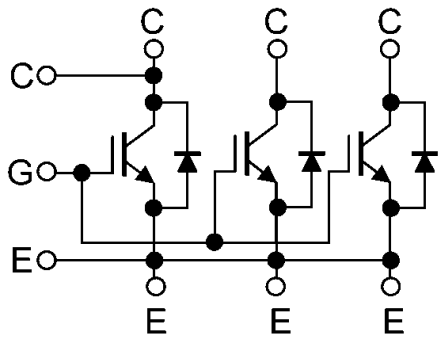
2. Features

(1) Enhancement mode.
(2) Electrodes are isolated from case.
(3) Embedded Silicon carbide diode.

3. Packaging and Internal Circuit Pin Assignment (Note)



PMI193D



C: Collector
E: Emitter
G: Gate

Note: Although main E-terminals are connected internally, they cannot lead rating current.
Please connect main E-terminals and C-terminals individually with conductive wire capable of leading rating current.

Start of commercial production
2014-04

2015-12-25
Rev.1.0

4. Absolute Maximum Ratings (Note) (Unless otherwise specified, T_C = 25 °C)

Characteristics	Symbol	Note	Test Condition	Rating	Unit
Collector-emitter voltage	V_{CES}			3300	V
Gate-emitter voltage	V_{GES}			±20	V
Collector current (RMS)	$I_{C(RMS)}$	(Note 1)		1500	A
Collector current (pulsed)	I_{CP}	(Note 2)	Peak turn-off current	3000	A
Non-repetitive peak forward surge current	I_{FSM}		10 ms (half-sine wave)	10	kA
Collector power dissipation	P_C			15600	W
Junction temperature	T_j			-40 to 150	°C
Storage temperature	T_{stg}			-40 to 150	°C
Isolation voltage	V_{isol}		AC 1 min	6000	V
Mounting torque	TOR		Terminal: M4/M8	2/7	N · m
			Mounting: M6	4	

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: T_c = 100 °C, without switching losses.

Note 2: $V_{CP} \leq 3300$ V, $V_{CC} \leq 2300$ V, $V_{GE} = \pm 15$ V, $R_{G(off)} = 2.4\ \Omega$, $T_j \leq 150$ °C, $L_s \approx 85$ nH.

5. Thermal Characteristics

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Thermal resistance (junction-to-case)	$R_{th(j-c)}$		Transistor part	—	—	8.0	K/kW
	$R_{th(j-c)}$		Diode part	—	—	16	
Thermal resistance (case-to-fin)	$R_{th(c-f)}$	(Note 1)	Per module	—	6.0	—	K/kW

Note 1: The heat radiation grease is recommended for use with semiconductor devices.
Apply a thin, even (100 to 200 μm) coating of grease.

6. Electrical Characteristics (Unless otherwise specified, T_C = 25 °C)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Gate-emitter leakage current	I_{GES}		V_{GE} = ±20 V, V_{CE} = 0 V	—	—	±100	nA
Collector-emitter cut-off current	I_{CES}		V_{CE} = 3300 V, V_{GE} = 0 V, T_j = 150 °C	—	—	60	mA
Gate-emitter cut-off voltage	$V_{GE(off)}$		I_C = 1.5 A, V_{CE} = 5 V, T_j = 150 °C	3.8	4.3	4.7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		I_C = 1500 A, V_{GE} = 15 V, T_j = 150 °C	—	3.2	3.8	V
Input capacitance	C_{ies}		V_{CE} = 10 V, V_{GE} = 0 V, f = 100 kHz	—	175	—	nF
Switching time (turn-on delay time)	$t_{d(on)}$		V_{CC} = 1800 V, I_C = 1500 A, V_{GE} = ±15 V, $R_{G(on)}$ = 1.0 Ω, $R_{G(off)}$ = 2.4 Ω, T_j = 150 °C (Inductive load, L_s ≈ 85 nH) See Fig. 6.1, 6.2	—	0.6	—	μs
Switching time (rise time)	t_r			—	0.15	—	μs
Switching time (turn-on time)	t_{on}			—	0.75	—	μs
Switching time (turn-off delay time)	$t_{d(off)}$			—	2.8	—	μs
Switching time (fall time)	t_f			—	1.7	—	μs
Switching time (turn-off time)	t_{off}			—	4.5	—	μs
Forward voltage	V_F		I_F = 1500 A, V_{GE} = 0 V, T_j = 150 °C	—	3.6	4.6	V
Reverse recovery charge	Q_{rr}		V_{CC} = 1800 V, I_F = 1500 A, V_{GE} = -15 V, $R_{G(on)}$ = 1.0 Ω, T_j = 150 °C (Inductive load, L_s ≈ 85 nH) See Fig. 6.1, 6.3	—	40	—	μC
Peak reverse recovery current	I_{rr}			—	450	—	A
Reverse recovery time	t_{rr}			—	0.14	—	μs
Turn-on switching loss	E_{on}		V_{CC} = 1800 V, I_C = 1500 A, V_{GE} = ±15 V, $R_{G(on)}$ = 1.0 Ω, $R_{G(off)}$ = 2.4 Ω, T_j = 150 °C (Inductive load, L_s ≈ 85 nH) See Fig. 6.1, 6.2	—	0.7	—	J
Turn-off switching loss	E_{off}			—	2.5	—	J
Reverse recovery loss	E_{dsw}		V_{CC} = 1800 V, I_F = 1500 A, V_{GE} = -15 V, $R_{G(on)}$ = 1.0 Ω, T_j = 150 °C (Inductive load, L_s ≈ 85 nH) See Fig. 6.1, 6.3	—	0.07	—	J

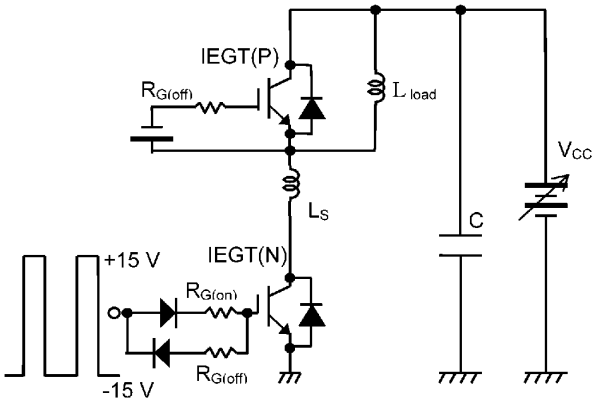


Fig. 6.1 Inductive Load Switching Test Circuit

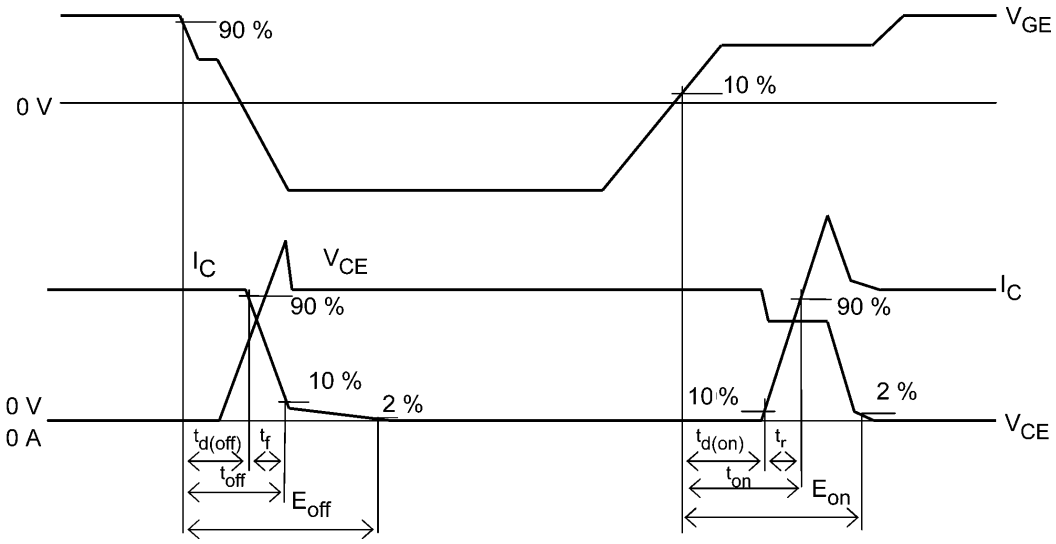


Fig. 6.2 Timing Chart (Transistor part)

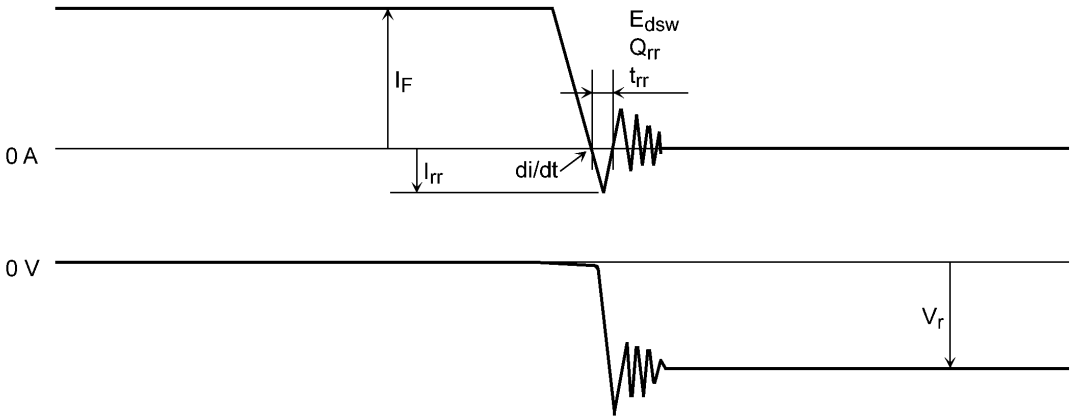


Fig. 6.3 Timing Chart (Diode part)

7. Characteristics Curves (Note)

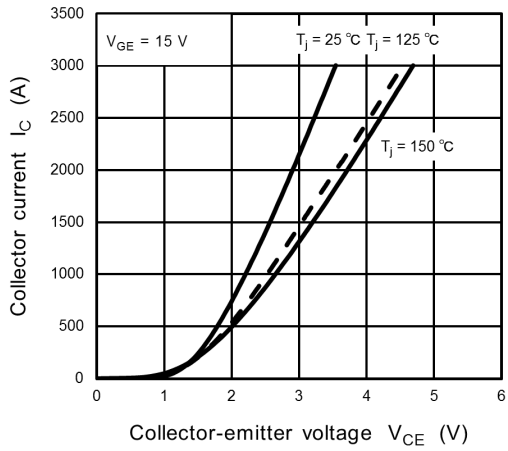


Fig. 7.1 I_C - V_{CE}

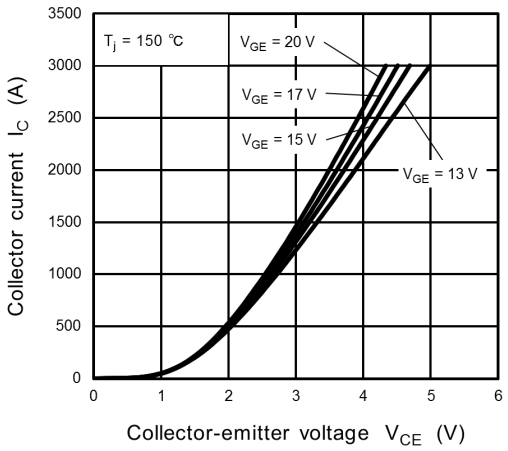


Fig. 7.2 Output characteristics

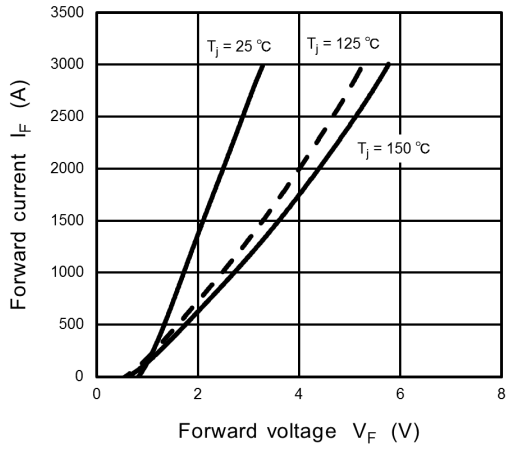


Fig. 7.3 I_F - V_F

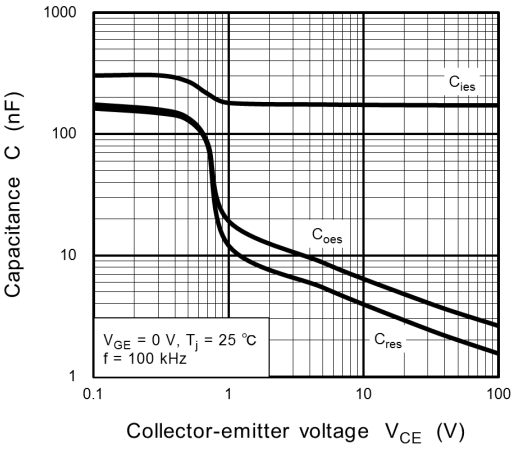


Fig. 7.4 C_{ies}, C_{oes}, C_{res} - V_{CE}

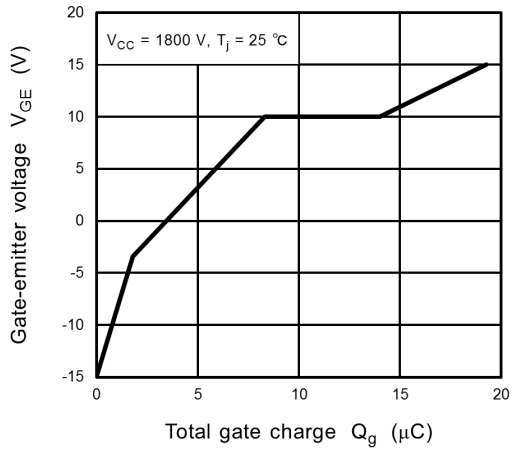


Fig. 7.5 V_{GE} - Q_g

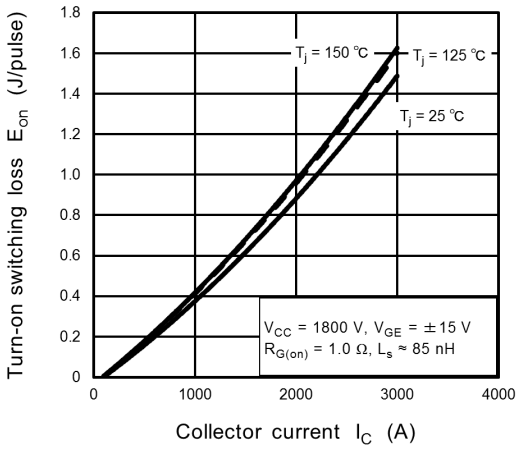


Fig. 7.6 E_{on} - I_C

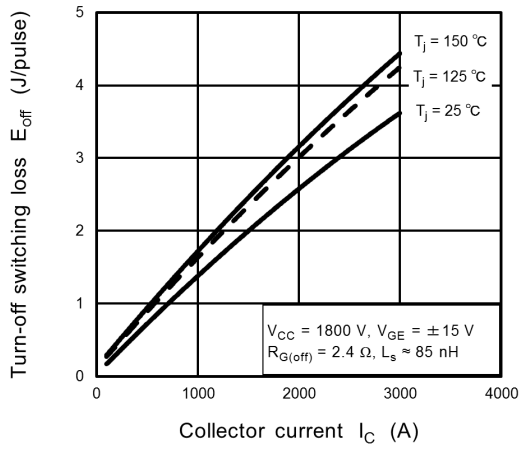


Fig. 7.7 E_{off} - I_C

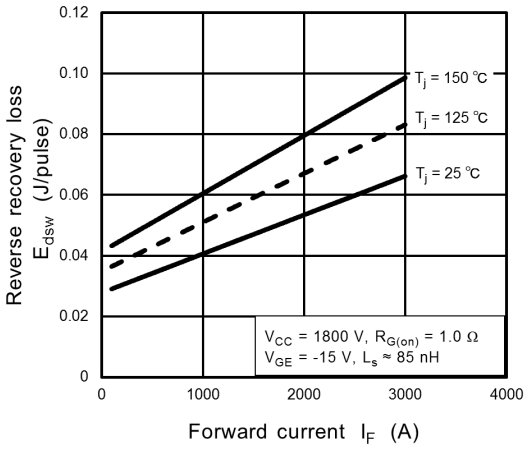


Fig. 7.8 E_{dsw} - I_F

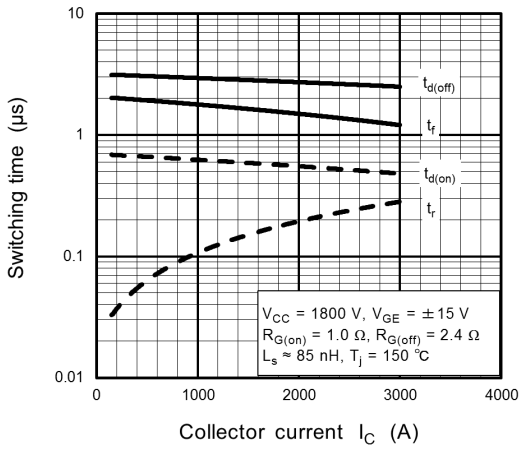


Fig. 7.9 $t_{d(on)}$, t_r, $t_{d(off)}$, t_f - I_C

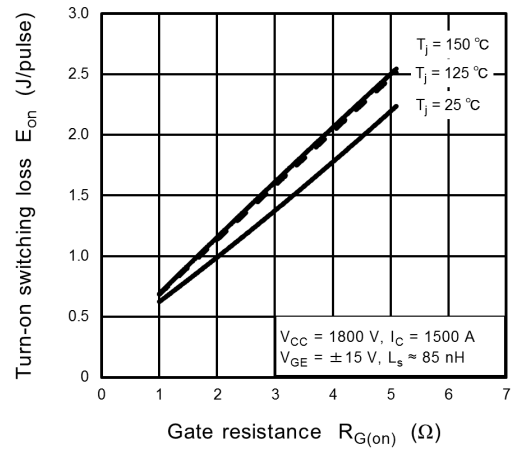


Fig. 7.10 E_{on} - $R_{G(on)}$

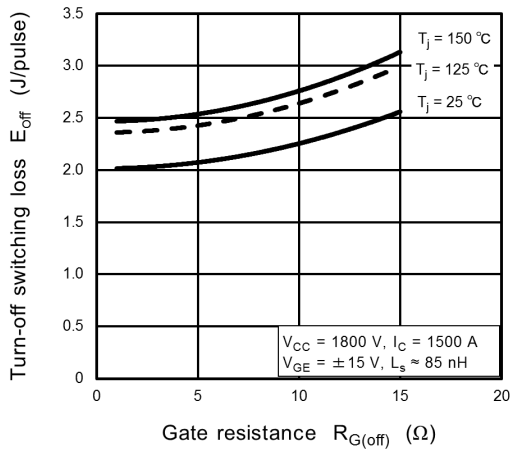


Fig. 7.11 E_{off} - $R_{G(off)}$

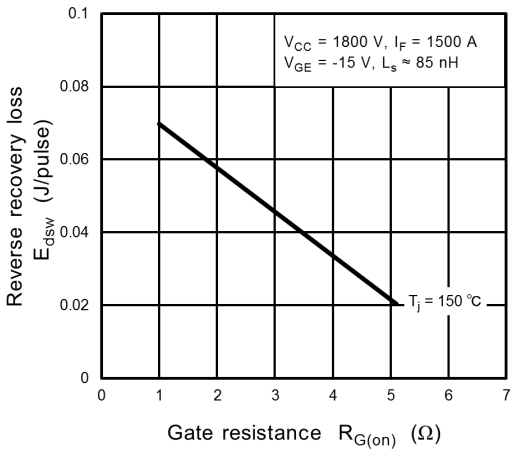


Fig. 7.12 E_{dsw} - $R_{G(on)}$

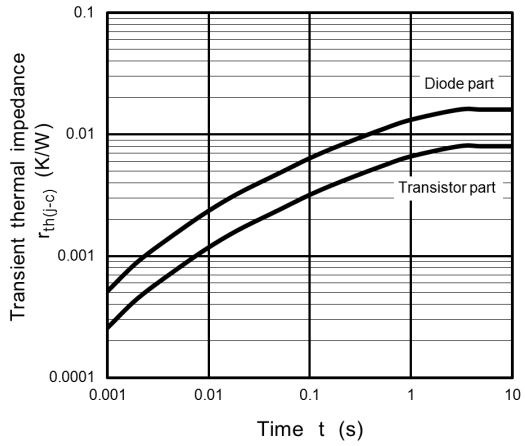


Fig. 7.13 $r_{th(j-c)}$ - t (Guaranteed Maximum)

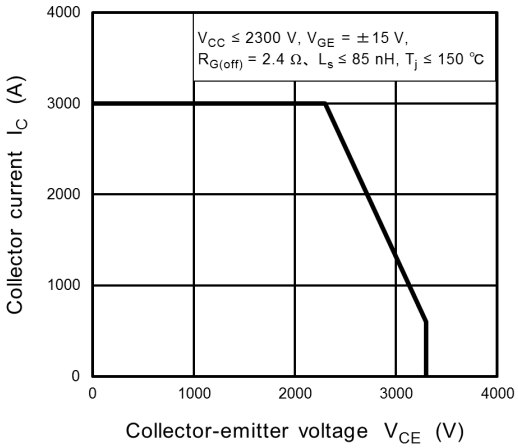
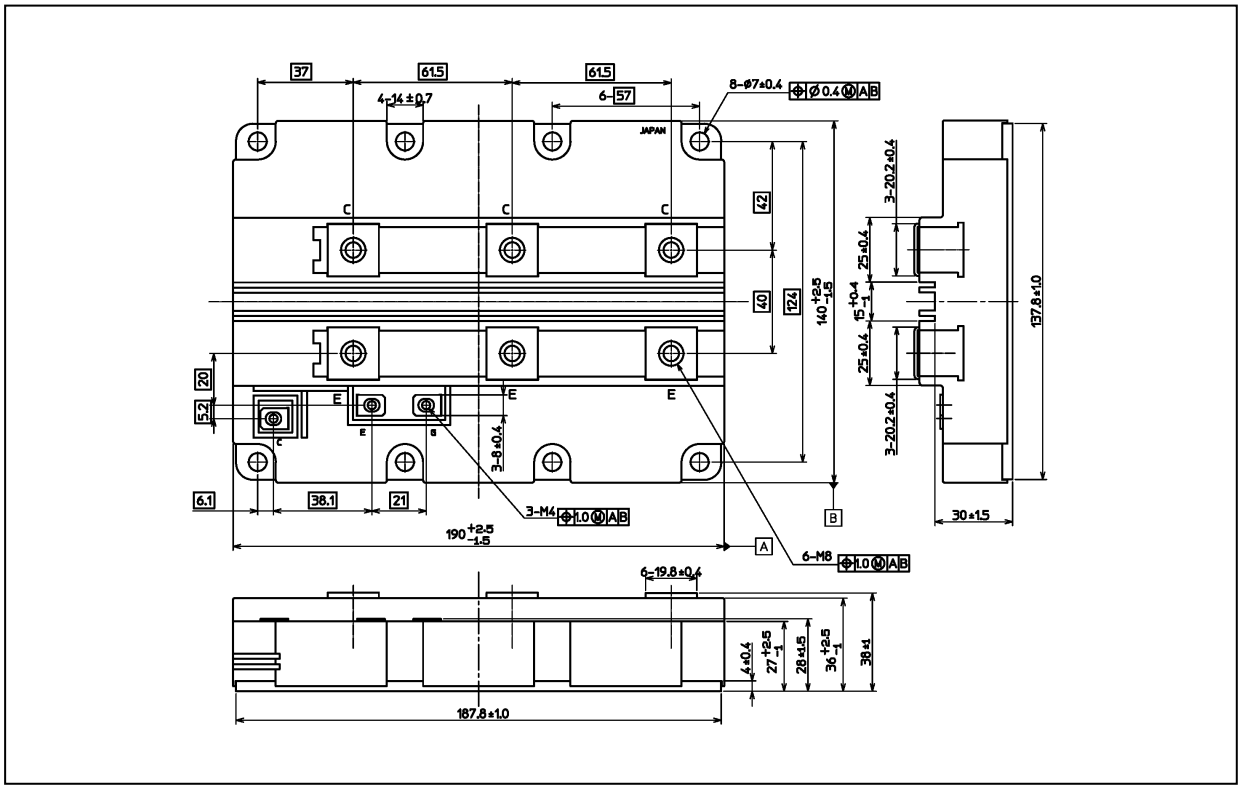


Fig. 7.14 RBSOA(Guaranteed Maximum)

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Package Dimensions

Unit: mm



Weight: 1200 g (typ.)

Package Name(s)
TOSHIBA: 2-193D1A
Nickname: PMI193D

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