

MG1500FXF1US63

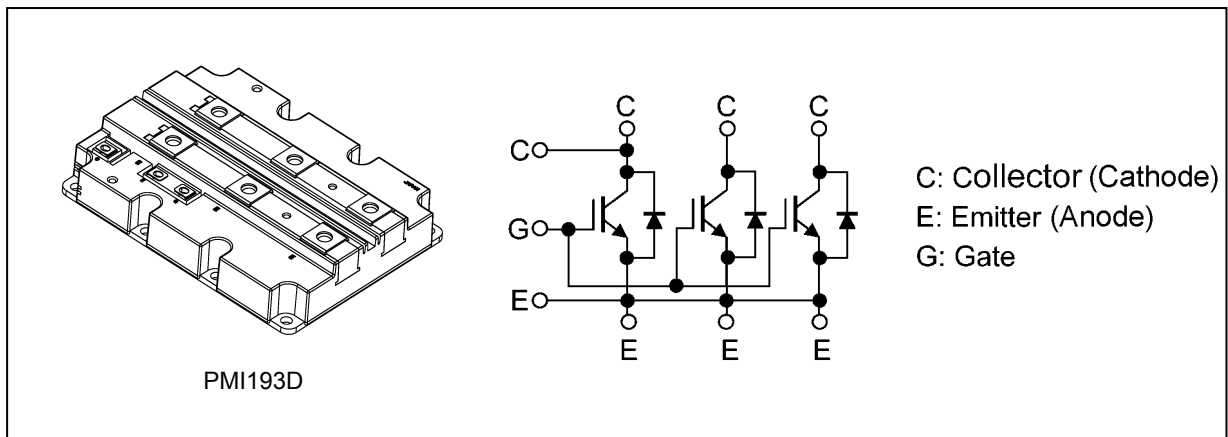
1. Applications

- High-Power Switching
- Motor Controllers

2. Features

- (1) Enhancement mode.
- (2) Electrodes are isolated from case.

3. Packaging and Internal Circuit Pin Assignment (Note)



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

2016-05

4. Absolute Maximum Ratings (Note) ($T_c = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Note	Test Condition	Rating	Unit
Collector-emitter voltage	V_{CES}			3300	V
Gate-emitter voltage	V_{GES}			± 20	V
Collector current (DC)	I_C		$T_c = 100^\circ\text{C}$	1500	A
Collector current (pulsed)	I_{CP}	(Note 2)		3000	A
Diode forward current (DC)	I_F			1500	A
Diode forward current (pulsed)	I_{FP}	(Note 2)		3000	A
Non-repetitive peak forward surge current	I_{FSM}		10 ms (half-sine wave)	10	kA
Collector power dissipation	P_C	(Note 1)		15600	W
Junction temperature	T_j			-40 to 150	$^\circ\text{C}$
Storage temperature	T_{stg}			-40 to 150	$^\circ\text{C}$
Isolation voltage	V_{isol}		AC 1min	6000	V
Mounting torque	TOR		Terminal: M4/M8	2/7	N · m
			Mounting: M6	4	N · m

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: In addition to the above remarks, refer to the application notes.

Note 2: Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed maximum T_j rating.

5. Thermal Characteristics (Note)

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: Customers must also refer to and comply with the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and the instructions for the application with which the Product will be used with or for.

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate-emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}, V_{CE} = 0\text{ V}, T_j = 25\text{ }^\circ\text{C}$	—	—	± 20	nA
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 3300\text{ V}, V_{GE} = 0\text{ V}, T_j = 150\text{ }^\circ\text{C}$	—	—	100	mA
Gate-emitter cut-off voltage	$V_{GE(off)}$	$I_C = 1.5\text{ A}, V_{CE} = 5\text{ V}, T_j = 150\text{ }^\circ\text{C}$	3.8	4.3	4.7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = 1500\text{ A}, V_{GE} = 15\text{ V}, T_j = 25\text{ }^\circ\text{C}$	—	2.6	—	V
		$I_C = 1500\text{ A}, V_{GE} = 15\text{ V}, T_j = 150\text{ }^\circ\text{C}$	—	3.2	3.8	V
Input capacitance	C_{ies}	$V_{CE} = 10\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}, T_j = 25\text{ }^\circ\text{C}$	—	215	—	nF
Switching time (turn-on delay time)	$t_{d(on)}$	$V_{CC} = 1800\text{ V}, I_C = 1500\text{ A},$ $V_{GE} = \pm 15\text{ V}, R_{G(on)} = 2.2\text{ }\Omega,$ $R_{G(off)} = 10\text{ }\Omega, T_j = 150\text{ }^\circ\text{C}$ (Inductive load, $L_s \approx 85\text{ nH}$) See Fig. 6.1 and Fig. 6.2.	—	0.6	—	μs
Switching time (rise time)	t_r		—	0.2	—	μs
Switching time (turn-on time)	t_{on}		—	0.8	—	μs
Switching time (turn-off delay time)	$t_{d(off)}$		—	5.6	—	μs
Switching time (fall time)	t_f		—	1.9	—	μs
Switching time (turn-off time)	t_{off}		—	7.5	—	μs
Forward voltage	V_F	$I_F = 1500\text{ A}, V_{GE} = 0\text{ V}, T_j = 25\text{ }^\circ\text{C}$	—	2.6	—	V
		$I_F = 1500\text{ A}, V_{GE} = 0\text{ V}, T_j = 150\text{ }^\circ\text{C}$	—	3.0	3.8	V
Reverse recovery charge	Q_{rr}	$V_{CC} = 1800\text{ V}, I_F = 1500\text{ A},$ $V_{GE} = -15\text{ V}, T_j = 150\text{ }^\circ\text{C}$	—	1300	—	μC
Peak reverse recovery current	I_{rr}	Drive side: $V_{GE} = \pm 15\text{ V}, R_{G(on)} = 2.2\text{ }\Omega$ (Inductive load, $L_s \approx 85\text{ nH}$)	—	2450	—	A
Reverse recovery time	t_{rr}	See Fig. 6.1 and Fig. 6.3.	—	0.6	—	μs
Turn-on switching loss	E_{on}	$V_{CC} = 1800\text{ V}, I_C = 1500\text{ A},$ $V_{GE} = \pm 15\text{ V}, R_{G(on)} = 2.2\text{ }\Omega,$ $R_{G(off)} = 10\text{ }\Omega, T_j = 150\text{ }^\circ\text{C}$ (Inductive load, $L_s \approx 85\text{ nH}$)	—	2.3	—	J
Turn-off switching loss	E_{off}	See Fig. 6.1 and Fig. 6.2.	—	3.7	—	J
Reverse recovery loss	E_{rr}	$V_{CC} = 1800\text{ V}, I_F = 1500\text{ A},$ $V_{GE} = -15\text{ V}, T_j = 150\text{ }^\circ\text{C}$ Drive side: $V_{GE} = \pm 15\text{ V}, R_{G(on)} = 2.2\text{ }\Omega$ (Inductive load, $L_s \approx 85\text{ nH}$) See Fig. 6.1 and Fig. 6.3.	—	1.6	—	J

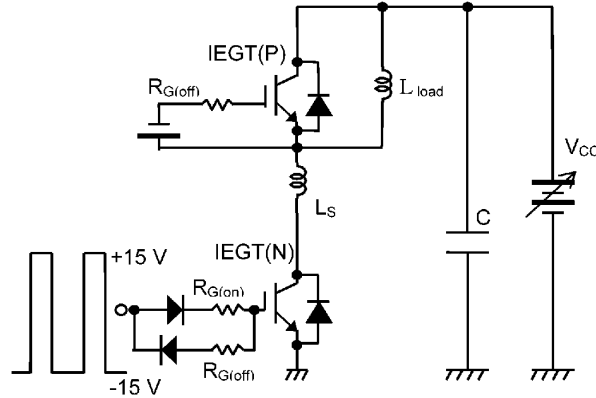


Fig. 6.1 Inductive Load Switching Test Circuit

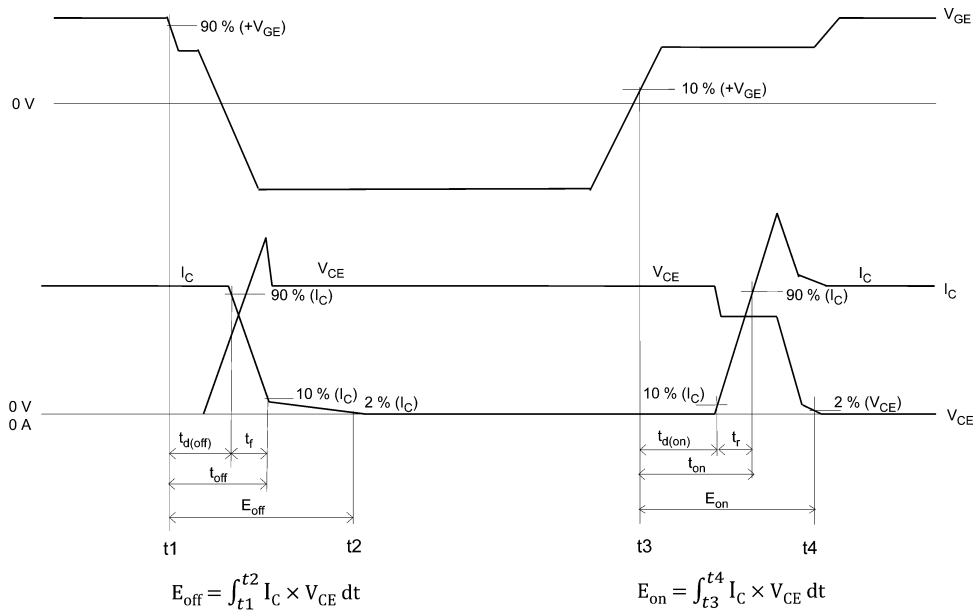


Fig. 6.2 Timing Chart (Transistor part)

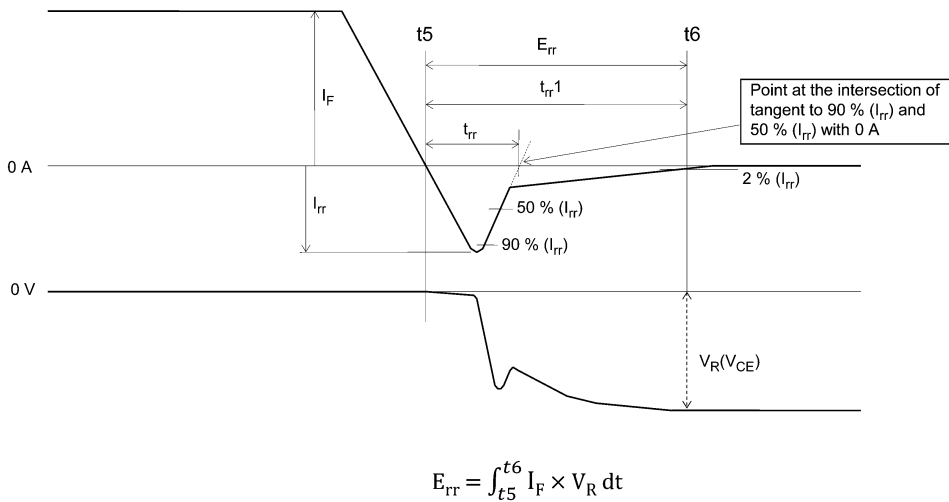


Fig. 6.3 Timing Chart (Diode part)

7. Characteristics Curves (Note)

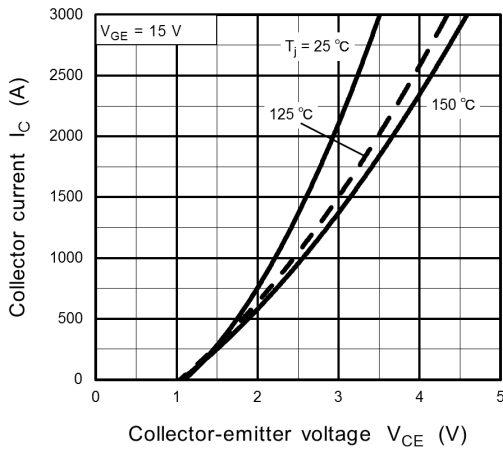


Fig. 7.1 $I_C - V_{CE}$

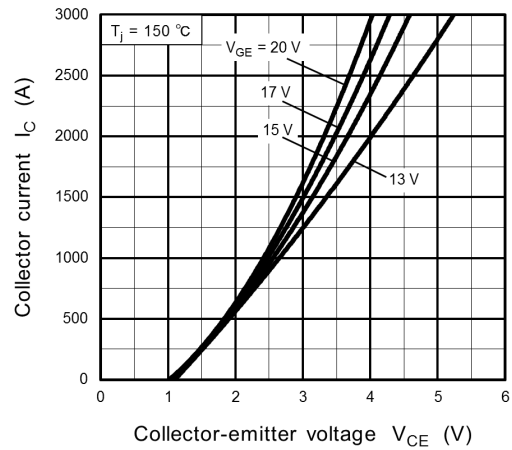


Fig. 7.2 $I_C - V_{CE}$

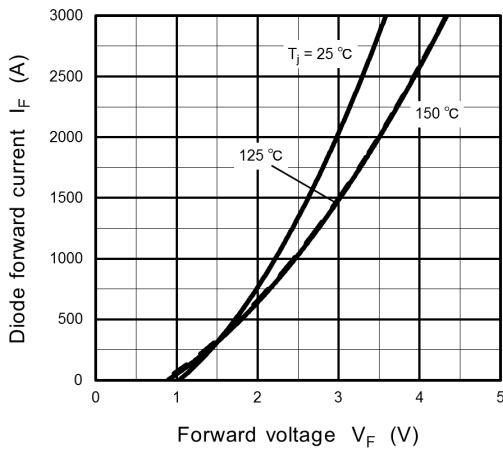


Fig. 7.3 $I_F - V_F$

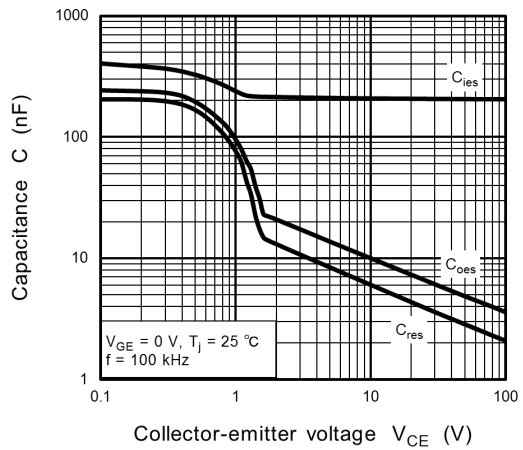


Fig. 7.4 Capacitance - V_{CE}

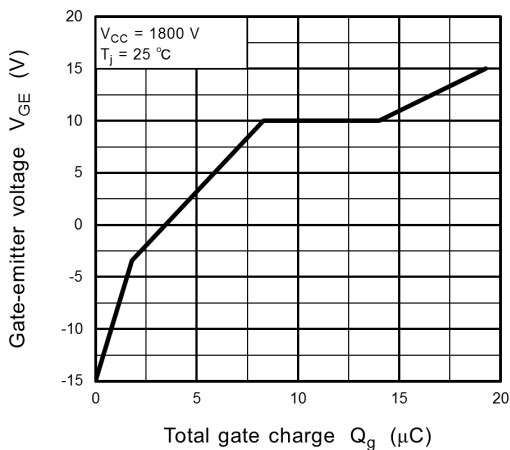


Fig. 7.5 $V_{GE} - Q_g$

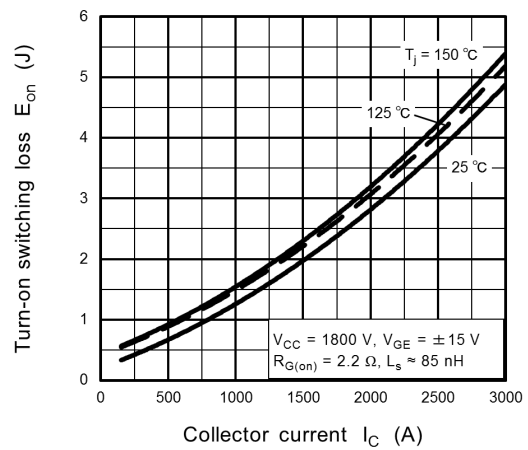


Fig. 7.6 $E_{on} - I_C$

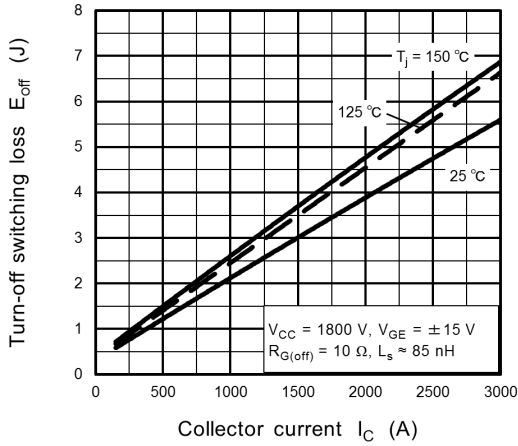


Fig. 7.7 $E_{off} - I_C$

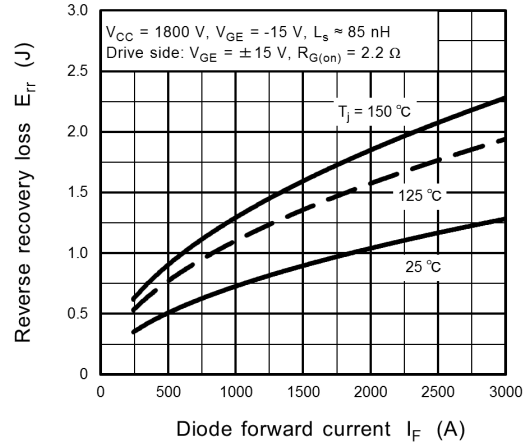


Fig. 7.8 $E_{rr} - I_F$

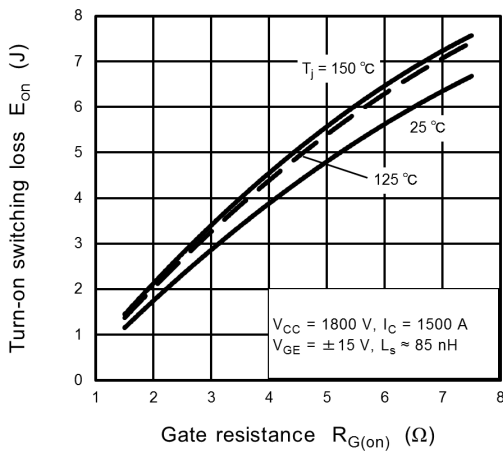


Fig. 7.9 $E_{on} - R_{G(on)}$

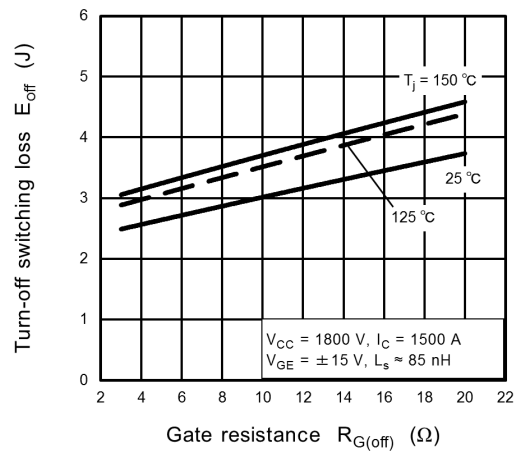


Fig. 7.10 $E_{off} - R_{G(off)}$

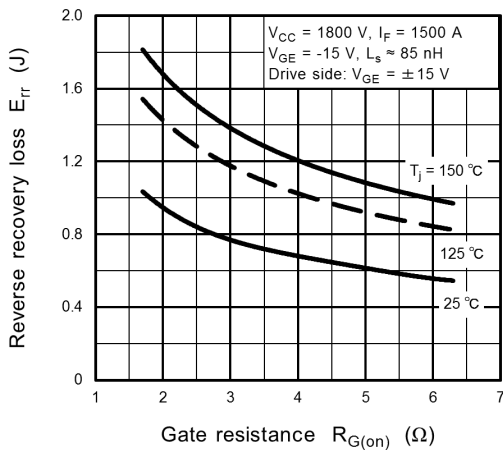


Fig. 7.11 $E_{rr} - R_{G(on)}$

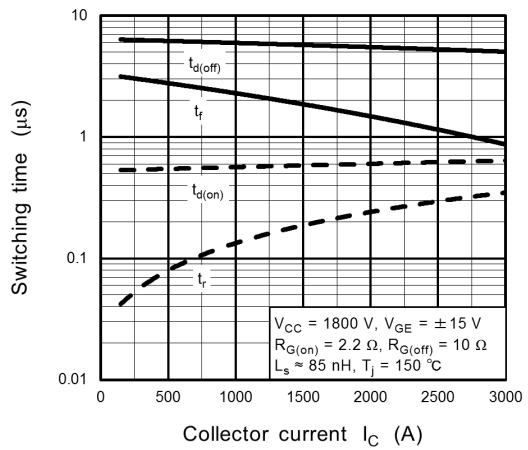


Fig. 7.12 Switching time - I_C

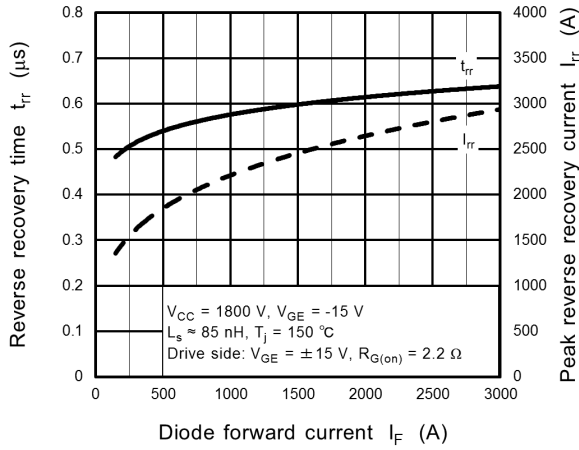


Fig. 7.13 t_{rr} , I_{rr} - I_F

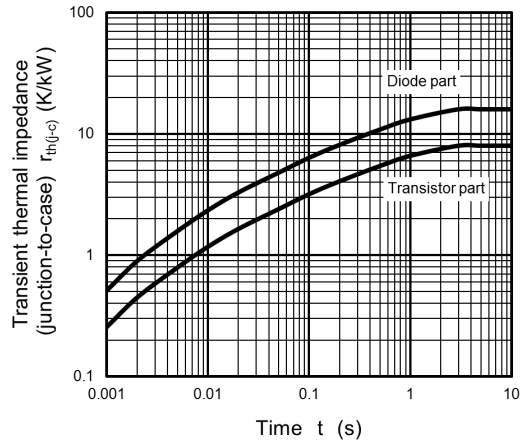


Fig. 7.14 $r_{th(j-c)}$ - t (Guaranteed value)

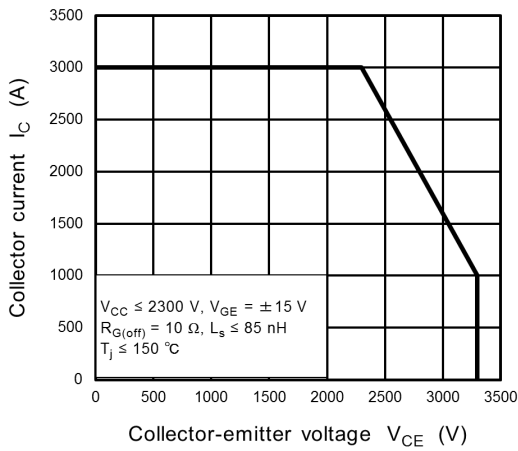


Fig. 7.15 RBSOA(Guaranteed value)

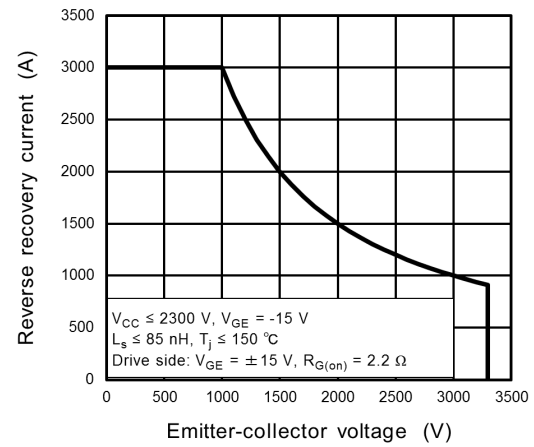
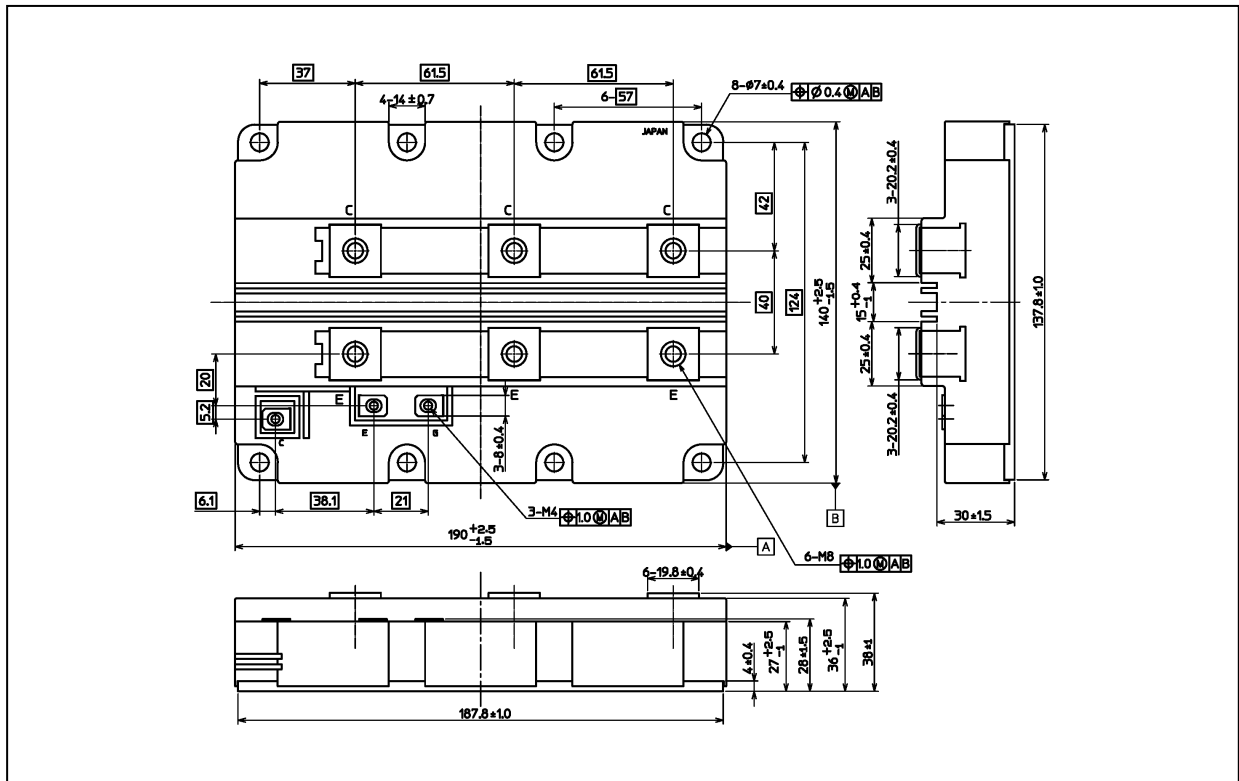


Fig. 7.16 RRSOA(Guaranteed value)

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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