Press Pack IEGT　Silicon N-Channel IEGT

ST1000GXH35

1. Applications

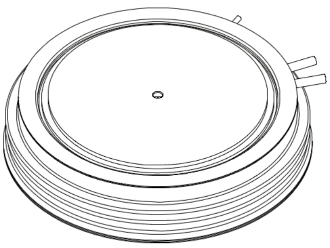
- Electric power transmission and distribution
- Motor Controllers
- High-Power Switching

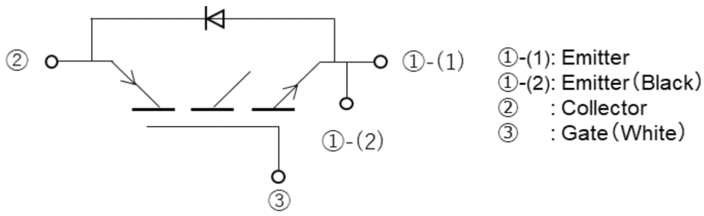
2. Features

(1) High reliability due to hermetic sealing structure.

(2) Double side cooling type.

3. Packaging and Internal Circuit





Start of commercial production
2024-02

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

Characteristics	Symbol	Note	Test Condition	Rating	Unit
Collector-emitter voltage	V_{CES}			4500	V
Gate-emitter voltage	V_{GES}			±20	V
Collector current (DC)	I_C		T_f = 108 °C	1000	A
Collector current (pulsed)	I_{CP}	(Note 1)		2000	A
Diode forward current (DC)	I_F		T_f = 15 °C	1000	A
Diode forward current (pulsed)	I_{FP}	(Note 1)		2000	A
Non-repetitive peak forward surge current	I_{FSM}		10 ms half-sine wave, V_R = 0V, T_j = 150 °C	6	kA
Collector power dissipation	P_C	(Note 2)	Transistor part, T_f = 25 °C	8928	W
Power dissipation	P_D	(Note 2)	Diode part, T_f = 25 °C	3571	W
Junction temperature	T_j			-40 to 150	°C
Operating junction temperature	$T_{j(opr)}$			-40 to 125	°C
Storage temperature	T_{stg}			-40 to 125	°C
Mounting force	—			28 to 35	kN

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

Note 2: Refer to the application notes.

5. Thermal Characteristics (Note)

Characteristics	Symbol	Note	Test Condition		Max	Unit
Thermal resistance (junction-to-fin)	$R_{th(j-f)}$	(Note 3)	Transistor part	Double side	14.0	K/kW
Thermal resistance (junction-to-fin)	$R_{th(j-f)}$	(Note 3)	Diode part	Double side	35.0	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 3: Conductive thermal compound is added.

6. Electrical Characteristics

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate-emitter leakage current	I_{GES}	V_{GE} = ±20 V, V_{CE} = 0 V, T_j = 25 °C	—	—	±100	nA
Collector-emitter cut-off current	I_{CES}	V_{CE} = 4500 V, V_{GE} = 0 V, T_j = 25 °C	—	—	0.1	mA
Gate-emitter cut-off voltage	$V_{GE(off)}$	I_C = 1.0 A, V_{CE} = 5 V, T_j = 25 °C	6.70	7.20	7.70	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	I_C = 1000 A, V_{GE} = 15 V, T_j = 25 °C	—	2.05	—	V
		I_C = 1000 A, V_{GE} = 15 V, T_j = 150 °C	—	2.50	2.95	
Input capacitance	C_{ies}	V_{CE} = 10 V, V_{GE} = 0 V, f = 100 kHz, T_j = 25 °C	—	145	—	nF
Switching time (turn-on delay time)	$t_{d(on)}$	V_{CC} = 2800 V, I_C = 1000 A, V_{GE} = ±15 V , $R_{G(on)}$ = 5.6 Ω, $R_{G(off)}$ = 91 Ω, T_j = 150 °C, Diode side: ST1000GXH35 T_j = 150 °C (Inductive load, L_s ≈ 300 nH) See Fig. 6.1 and Fig. 6.2	—	0.36	—	μs
Switching time (rise time)	t_r		—	0.26	—	μs
Switching time (turn-on time)	t_{on}		—	0.62	—	μs
Switching time (turn-off delay time)	$t_{d(off)}$		—	9.80	—	μs
Switching time (fall time)	t_f		—	2.25	—	μs
Switching time (turn-off time)	t_{off}		—	12.05	—	μs
Forward voltage	V_F	I_F = 1000 A, T_j = 25 °C	—	2.95	—	V
		I_F = 1000 A, T_j = 150 °C	—	3.10	3.85	
Reverse recovery current	I_{rr}	V_{CC} = 2800 V, I_F = 1000 A, V_{GE} = -15 V, T_j = 150 °C Drive side: ST1000GXH35 di/dt ≈ 3000 A/μs, T_j = 150 °C (Inductive load, L_s ≈ 300 nH) See Fig. 6.3 and Fig. 6.4	—	1250	—	A
Reverse recovery time	t_{rr}		—	1.06	—	μs
Turn-on switching loss	E_{on}	V_{CC} = 2800 V, I_C = 1000 A, V_{GE} = ±15 V , $R_{G(on)}$ = 5.6 Ω, $R_{G(off)}$ = 91 Ω, T_j = 150 °C, Diode side: ST1000GXH35 T_j = 150 °C (Inductive load, L_s ≈ 300 nH) See Fig. 6.1 and Fig. 6.2	—	3.75	—	J
Turn-off switching loss	E_{off}		—	5.25	—	J
Reverse recovery loss	E_{rr}	V_{CC} = 2800 V, I_F = 1000 A, V_{GE} = -15 V, T_j = 150 °C Drive side: ST1000GXH35 di/dt ≈ 3000 A/μs, T_j = 150 °C (Inductive load, L_s ≈ 300 nH) See Fig. 6.3 and Fig. 6.4	—	1.70	—	J
Short-circuit pulse width	t_{psc}	V_{CC} = 3400 V, V_{GE} = ±15 V, $R_{G(on)}$ = 5.6 Ω, $R_{G(off)}$ = 91 Ω, L_s ≈ 150 nH, T_j = 125 °C	—	—	10	μs

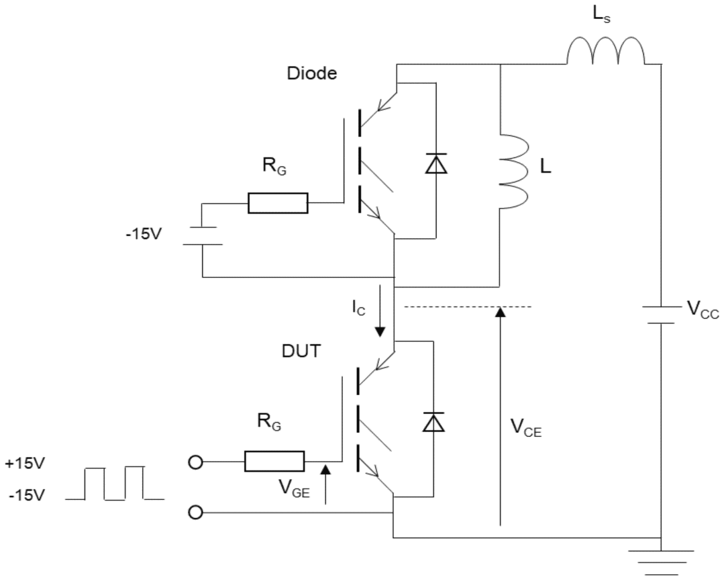
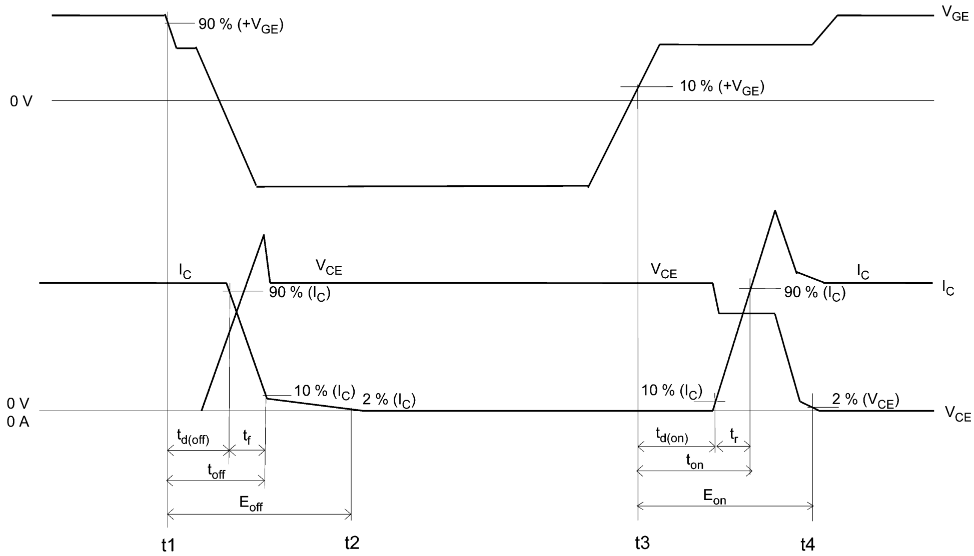


Fig. 6.1 Test Circuit (Transistor part)



$E_{off} = \int_{t1}^{t2} I_C \times V_{CE}\, dt$ $E_{on} = \int_{t3}^{t4} I_C \times V_{CE}\, dt$

Fig. 6.2 Timing Chart (Transistor part)

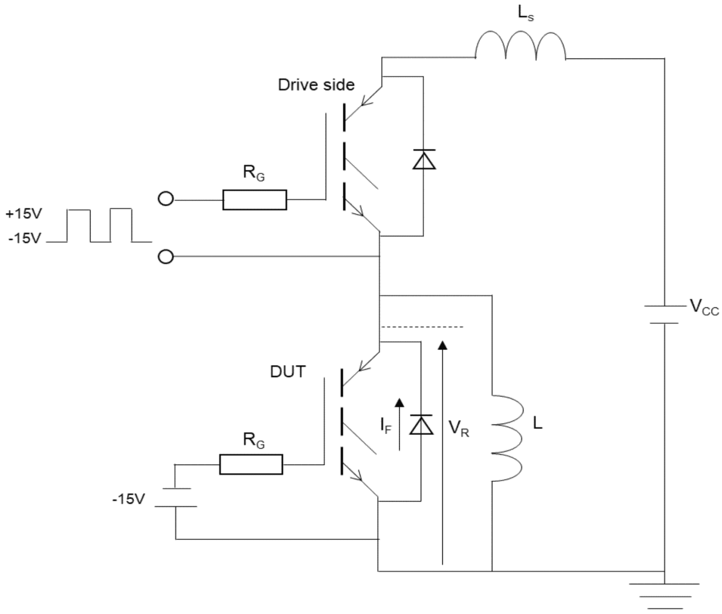
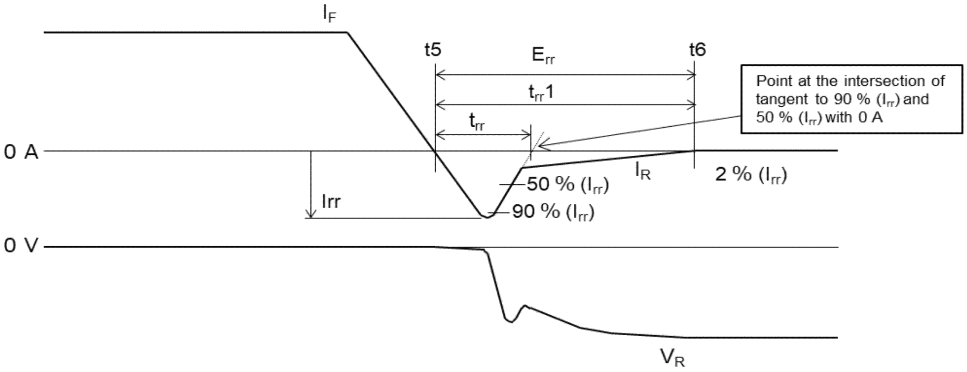


Fig. 6.3 Test Circuit (Diode part)



$$E_{rr} = \int_{t5}^{t6} (I_R \times V_R)\, dt$$

Fig. 6.4 Timing Chart (Diode part)

7. Characteristics Curves (Note)

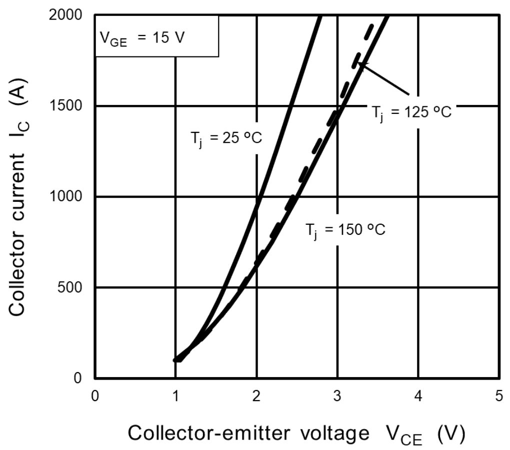


Fig. 7.1 I_C - V_{CE}

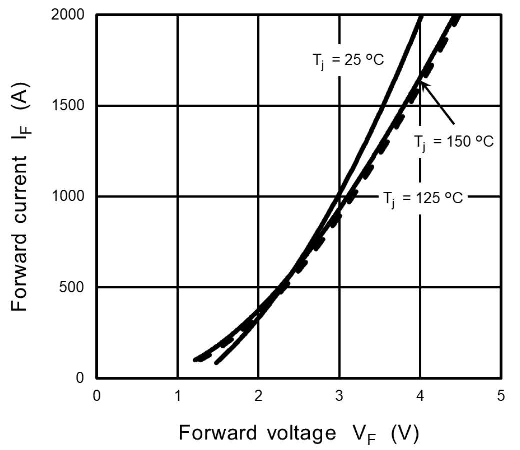


Fig. 7.2 I_F - V_F

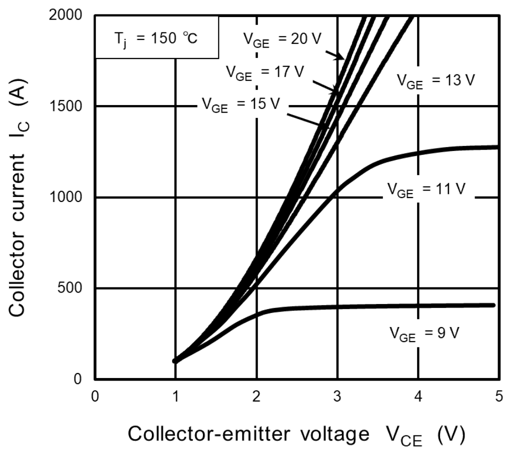


Fig. 7.3 I_C - V_{CE}

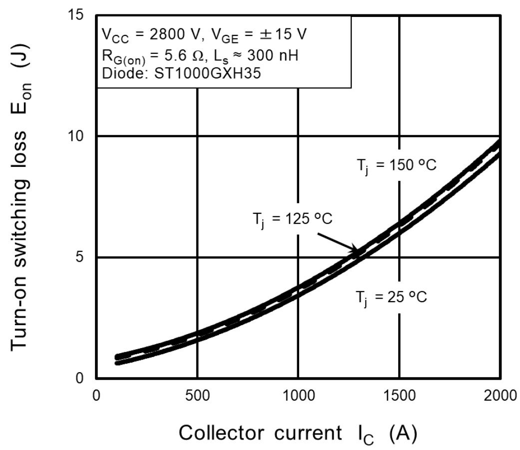


Fig. 7.4 E_{on} - I_C

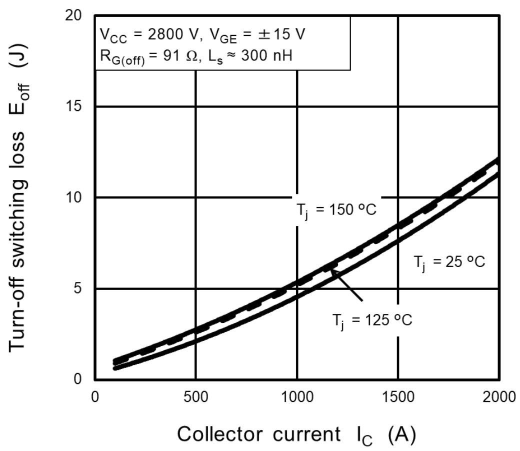


Fig. 7.5 E_{off} - I_C

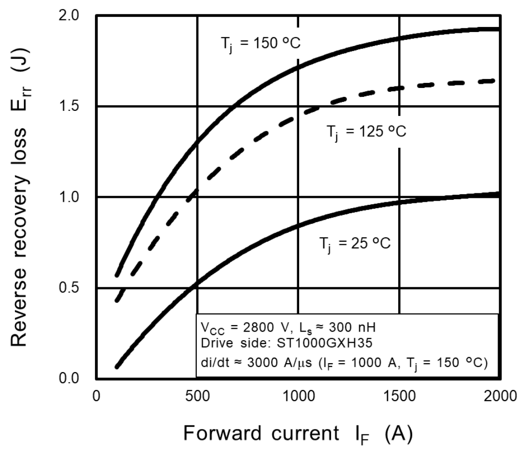


Fig. 7.6 E_{rr} - I_F

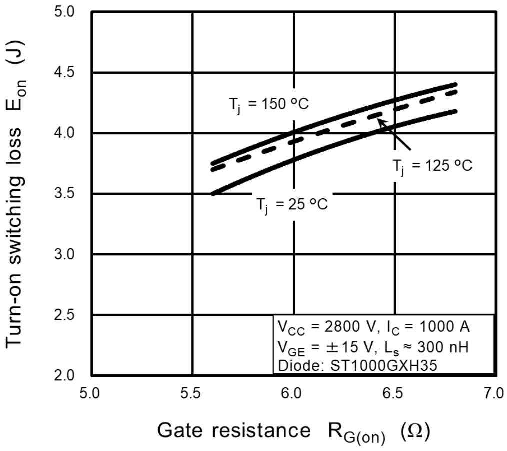


Fig. 7.7 E_{on} - $R_{G(on)}$

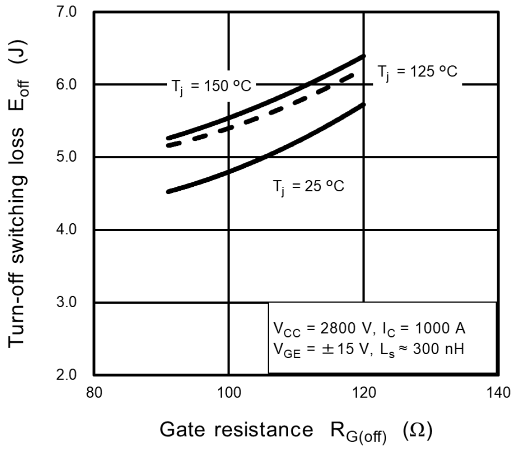


Fig. 7.8 E_{off} - $R_{G(off)}$

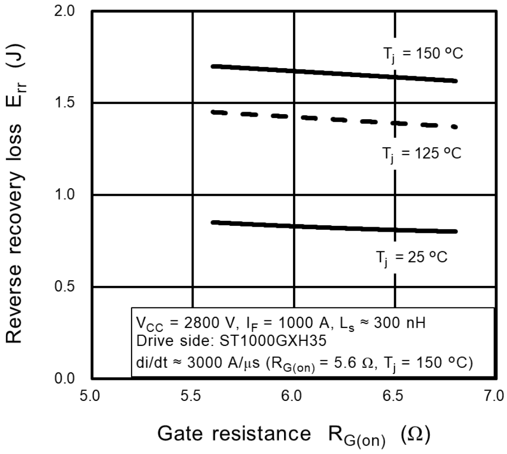


Fig. 7.9 E_{rr} - $R_{G(on)}$

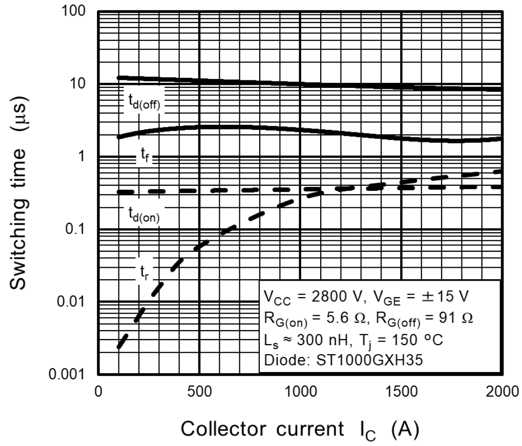


Fig. 7.10 Switching time - I_C

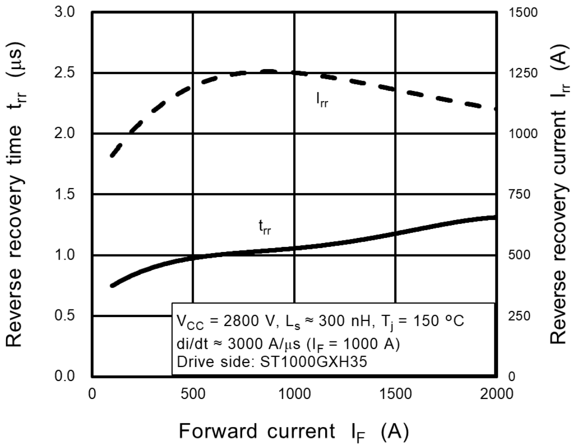


Fig. 7.11 t_{rr}, I_{rr} - I_F

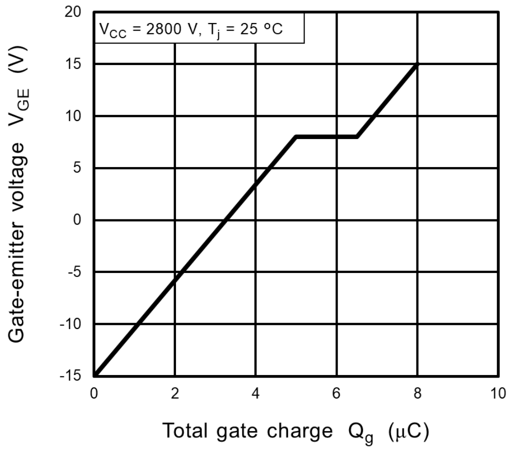


Fig. 7.12 V_{GE} - Q_g

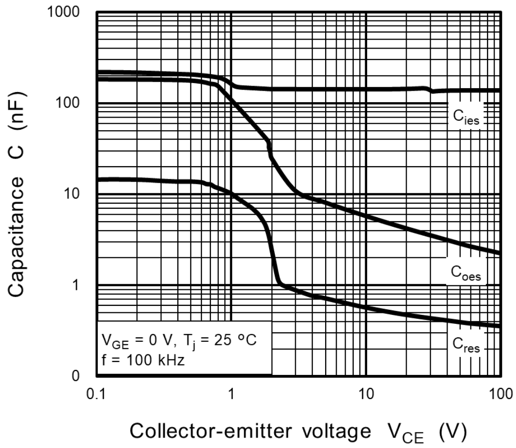


Fig. 7.13 Capacitance - V_{CE}

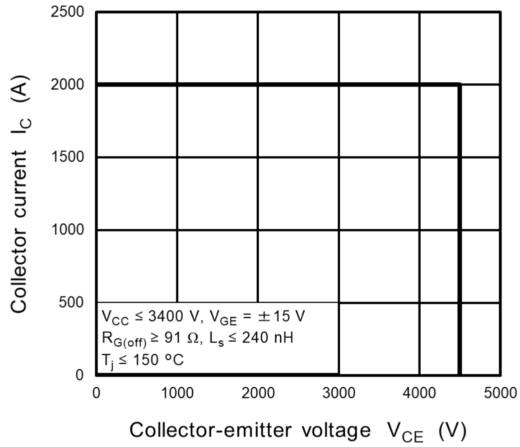


Fig. 7.14 RBSOA (Guaranteed value)

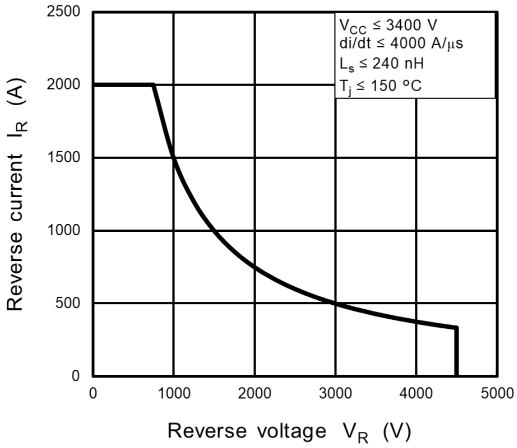


Fig. 7.15 RRSOA (Guaranteed value)

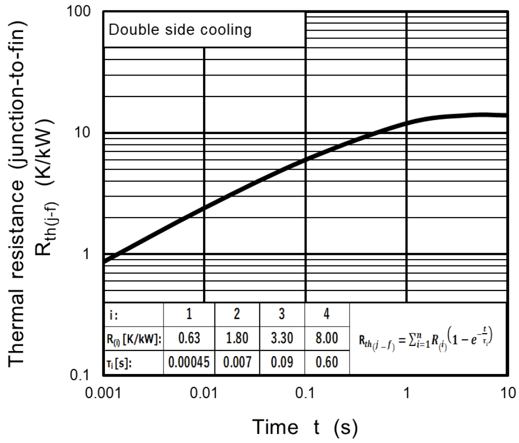


Fig. 7.16 $R_{th(j-f)}$ - t (Transistor part)(Guaranteed value)

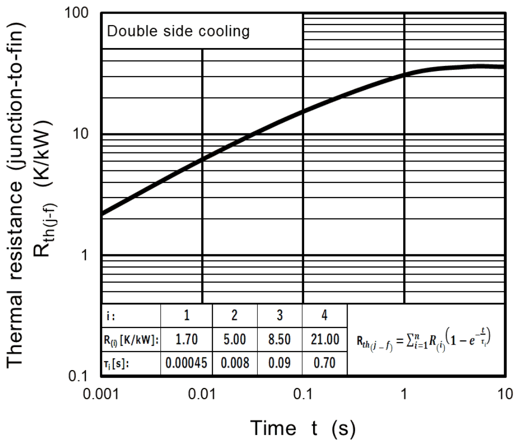
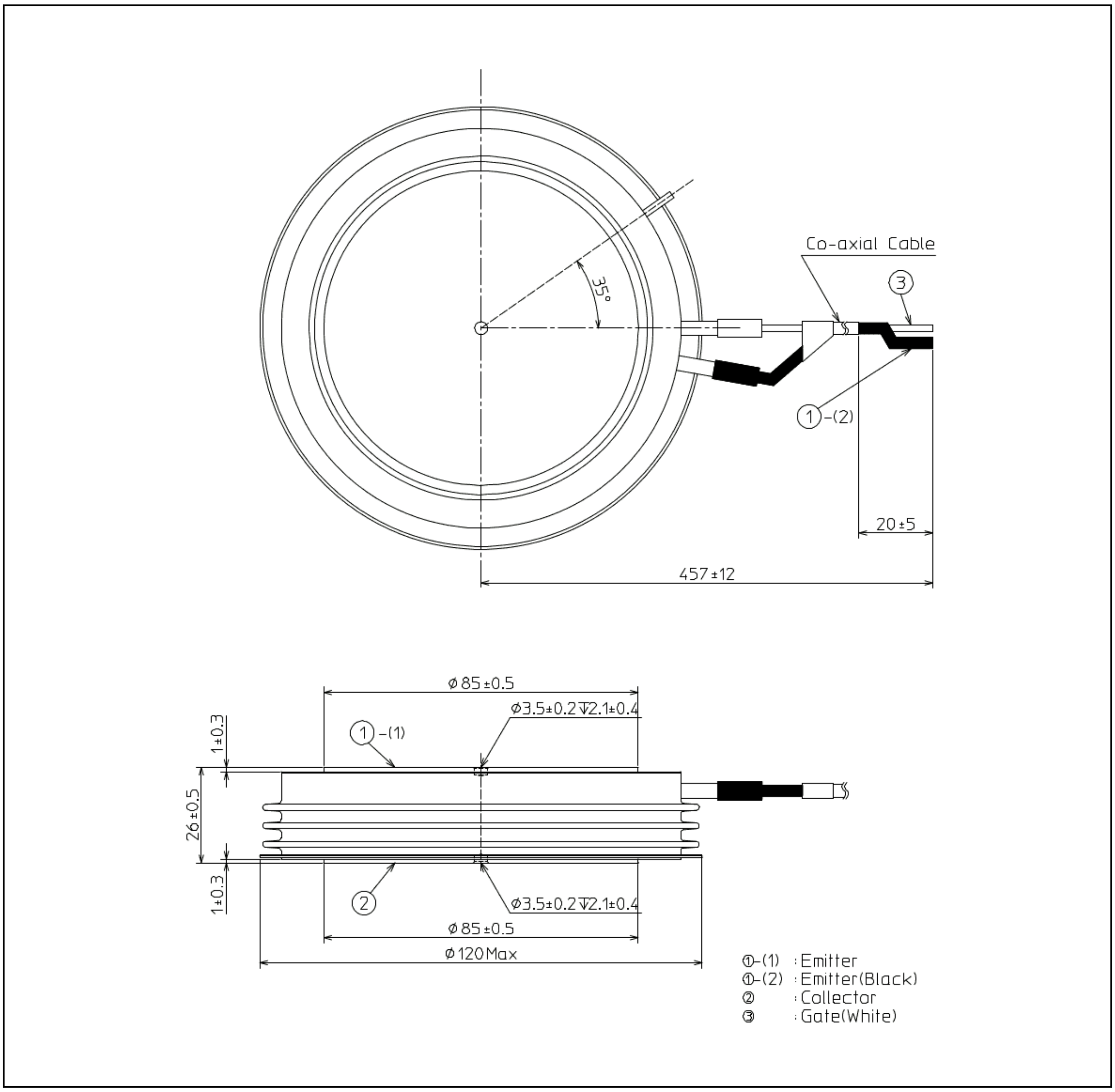


Fig. 7.17 $R_{th(j-f)}$ - t (Diode part)(Guaranteed value)

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

Package Dimensions

Unit: mm



Weight: 1400 g (typ.)

Package Name(s)
TOSHIBA: 2-120B1S

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