

High-Power Module Silicon Carbide N-Channel MOSFET

MG800FXF2YMS3

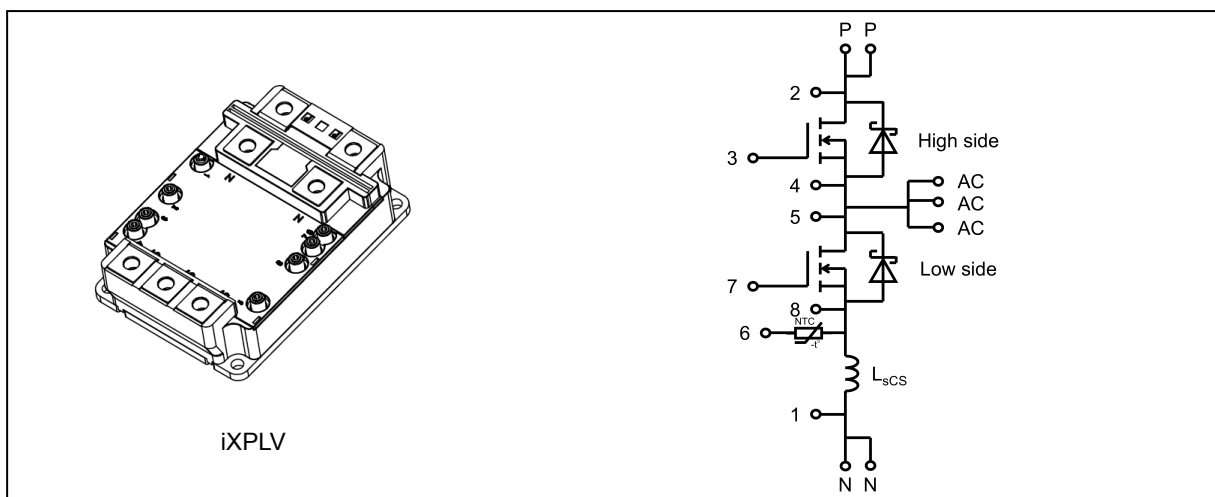
1. Applications

- High-Power Switching
- Motor Controllers (including rail traction)

2. Features

- (1) $V_{DSS} = 3300\text{ V}$, $I_D = 800\text{ A}$ All SiC MOSFET Module(Low loss & High speed switching)
- (2) Low stray inductance, low thermal resistance, maximum $T_{ch} = 175\text{ }^{\circ}\text{C}$
- (3) Equipped with current sensing terminal & build in thermistor
- (4) New generation standard package(Compact & easily handled by paralleling)
- (5) Electrodes are isolated from metal base plate.

3. Packaging and Internal Circuit (Note)



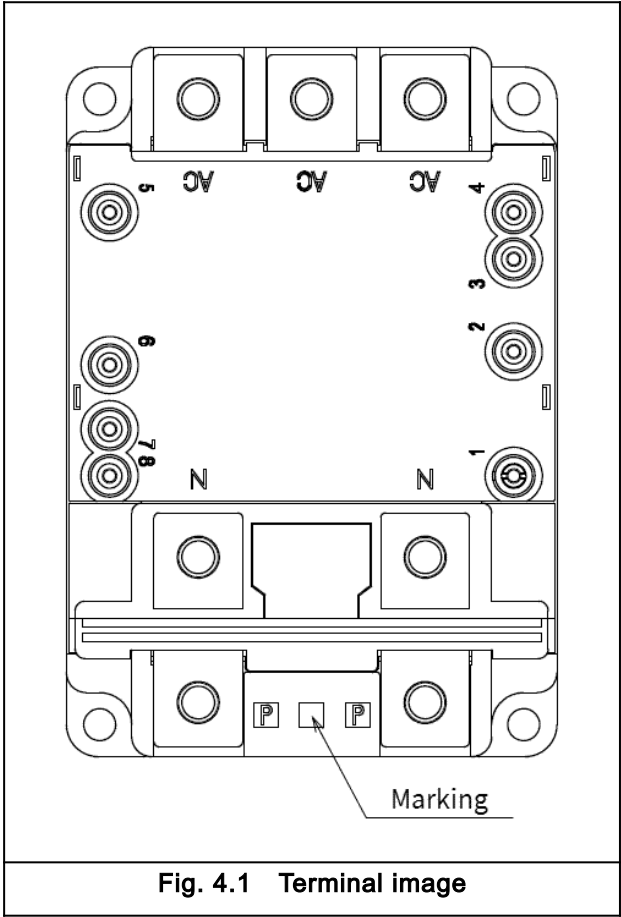
(Note) P and N terminals should be fastened by two screws each and AC terminals should be fastened by three screws.

Start of commercial production
2023-10

4. Terminal

Terminal No.	Connection
P	P (main terminal)
N	N (main terminal)
AC	AC (main terminal)
1	N (sense) / Current sense
2	P (sense)
3	High side gate
4	High side source sense
5	AC (sense)
6	Thermistor
7	Low side gate
8	Low side source sense

Marking	High side	Low side
A	MOSFET	MOSFET



5. Absolute Maximum Ratings (Note, Note 1) ($T_c = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

Characteristics	Symbol	Note	Test Condition	Rating	Unit
Drain-source voltage	V_{DS}			3300	V
Gate-source voltage	V_{GS}			+ 25 / - 10	V
Drain current (DC)	I_D	(Note 2)		800	A
Drain current (pulsed)	I_{DP}	(Note 2)		1600	A
Power dissipation	P_D	(Note 2)		4680	W
Source current (DC)	I_S	(Note 2)		800	A
Source current (pulsed)	I_{SP}	(Note 2)		1600	A
Channel temperature	T_{ch}			175	$^{\circ}\text{C}$
Storage temperature	T_{stg}			- 40 to 150	$^{\circ}\text{C}$
Isolation voltage	V_{isol}		AC , 60 s	6000	Vrms
Mounting torque	TOR	(Note 3)	Main terminal: M8	9.1	N · m
		(Note 4)	Signal terminal: M3	1.0	N · m
		(Note 5)	Mounting: M6	5.2	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: refer to the application notes.

Note 2: Ensure that the channel temperature does not exceed 175 $^{\circ}\text{C}$.

Note 3: The recommended tightening torque for the main terminal (M8) is 7.0 N · m.

Note 4: The recommended tightening torque for the signal terminal (M3) is 0.8 N · m.

Note 5: The recommended tightening torque for installation (M6) is 4.0 N · m.

6. Thermal Characteristics

Characteristics	Symbol	Note	Min	Typ.	Max	Unit
Thermal resistance (channel-to-case)	$R_{th(ch-c)}$	(Note 1)	—	—	0.032	K/W
Thermal resistance (case-to-fin)	$R_{th(c-f)}$	(Note 2)	—	0.0026	—	K/W

Note 1: The value per half a module.

Note 2: The value per module.

Apply 50 μm of 3 W/m · K grease between the case and fin while taking care not to create a void, and tighten to the recommended torque before use.

7. Electrical Characteristics (T_c = 25 °C, unless otherwise specified)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit	Fig. No
Gate-source leakage current	I _{GSS}		V _{GS} = + 25 V / - 10 V, V _{DS} = 0 V	—	—	±100	nA	—
Drain-source cut-off current	I _{DSS}		V _{DS} = 3300V, V _{GS} = 0 V	—	—	1	mA	—
Gate threshold voltage	V _{th}	(Note 1)	I _D = 0.8 A, V _{DS} = 10 V	3.7	4.8	5.8	V	—
Drain-source on-voltage (sense)	V _{DS(on)} sense		I _D = 800 A, V _{GS} = + 20 V, T _{ch} = 25 °C	—	1.3	—	V	—
			I _D = 800 A, V _{GS} = + 20 V, T _{ch} = 175 °C	—	3.6	5.2	V	—
Drain-source on-voltage (terminal)	V _{DS(on)} terminal		I _D = 800 A, V _{GS} = + 20 V, T _{ch} = 25 °C	—	1.4	—	V	—
Input capacitance	C _{iss}		V _{DS} = 1800 V, V _{GS} = 0 V, f = 100 kHz	—	173	—	nF	—
Internal gate resistance	r _{ig}		f = 1 MHz	—	2.75	—	Ω	—
Switching time (turn-on delay time)	t _{d(on)}	(Note 2)	Inductive load, V _{DD} = 1800 V, I _D = 800 A, V _{GS} = + 20 V / - 6 V, C _{gs} = 100 nF, R _{G(on)} = 1.5 Ω, R _{G(off)} = 3.6 Ω, T _{ch} = 175 °C, L _S ≈ 70 nH	—	0.57	—	μs	7.1
Switching time (rise time)	t _r			—	0.16	—	μs	7.2
Switching time (turn-on time)	t _{on}			—	0.73	—	μs	7.3
Switching time (turn-off delay time)	t _{d(off)}			—	1.80	—	μs	—
Switching time (fall time)	t _f			—	0.15	—	μs	—
Switching time (turn-off time)	t _{off}			—	1.95	—	μs	—
Turn-on switching loss	E _{on}			—	230	290	mJ	—
Turn-off switching loss	E _{off}			—	230	290	mJ	—
Source-drain on-voltage (sense)	V _{SD(on)} sense		I _S = 800 A, V _{GS} = + 20 V, T _{ch} = 25 °C	—	1.3	—	V	—
	V _{SD(on)} sense		I _S = 800 A, V _{GS} = + 20 V, T _{ch} = 175 °C	—	3.5	5.1	V	—
Source-drain on-voltage (terminal)	V _{SD(on)} terminal		I _S = 800 A, V _{GS} = + 20 V, T _{ch} = 25 °C	—	1.4	—	V	—
Source-drain off-voltage (sense)	V _{SD(off)} sense		I _S = 800 A, V _{GS} = - 6 V, T _{ch} = 25 °C	—	2.1	—	V	—
	V _{SD(off)} sense		I _S = 800 A, V _{GS} = - 6 V, T _{ch} = 175 °C	—	4.3	6.3	V	—
Source-drain off-voltage (terminal)	V _{SD(off)} terminal		I _S = 800 A, V _{GS} = - 6 V, T _{ch} = 25 °C	—	2.2	—	V	—
Reverse recovery time	t _{rr}	(Note 2)	Inductive load, I _S = 800 A, V _{DD} = 1800 V, V _{GS} = - 6 V, C _{gs} = 100 nF, Drive side R _{G(on)} = 1.5 Ω, T _{ch} = 175 °C, L _S ≈ 70 nH	—	0.08	—	μs	7.4
Reverse recovery loss	E _{rr}			—	12	—	mJ	7.5 7.6
Stray inductance	L _{SPN}		P terminal-N terminal	—	12	—	nH	—
Current sensing inductance	L _{SCS}		1 terminal-8 terminal	—	2.7	—	nH	—
Rated NTC resistance	R		T _c = 25 °C	3.5	5.0	6.5	kΩ	—
	R		T _c = 150 °C	125	165	205	Ω	—
NTC B value	B		T _{NTC} = 25 to 150 °C	—	3375	—	K	—

Note 1: Gate—source voltage (-10V) is applied 5ms before measurement.

Note 2: L_s is the sum of the stray inductance between the P and N terminals (L_{SPN}) and the stray inductance of external circuitry (L_{ext}) .

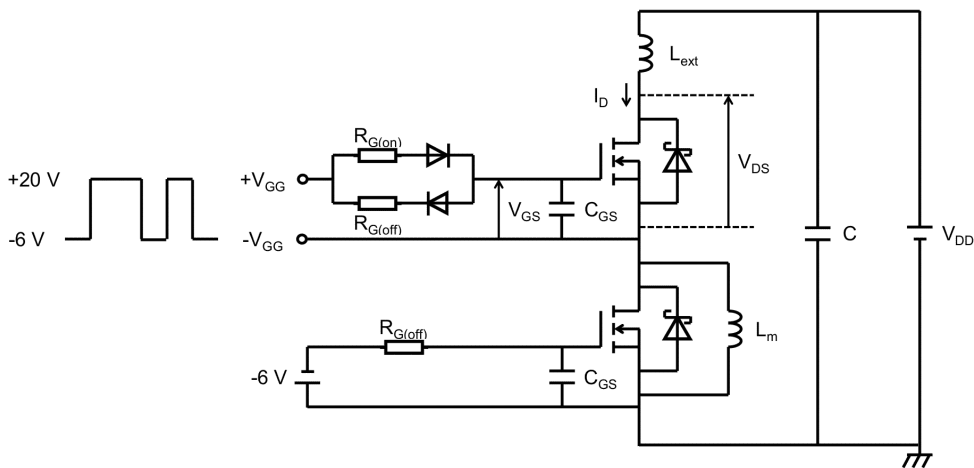


Fig. 7.1 Inductive Load Switching Test Circuit (High side Switching)

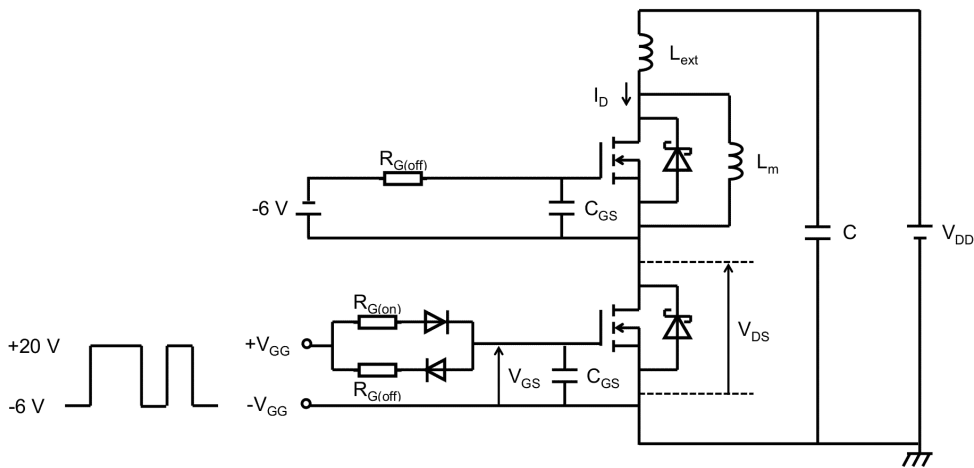


Fig. 7.2 Inductive Load Switching Test Circuit (Low side Switching)

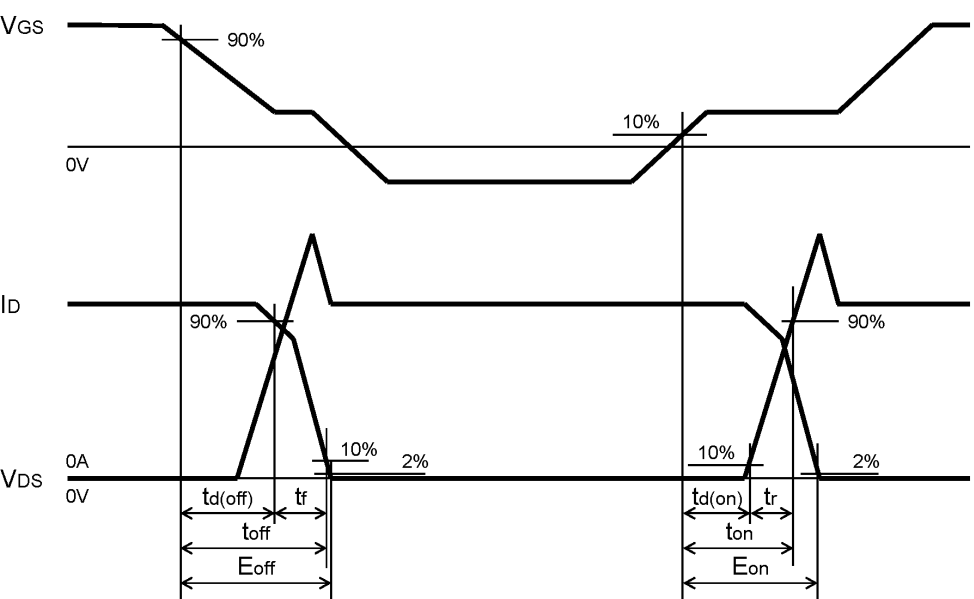


Fig. 7.3 Timing Chart (MOSFET part)



8. Characteristics Curves (Note)

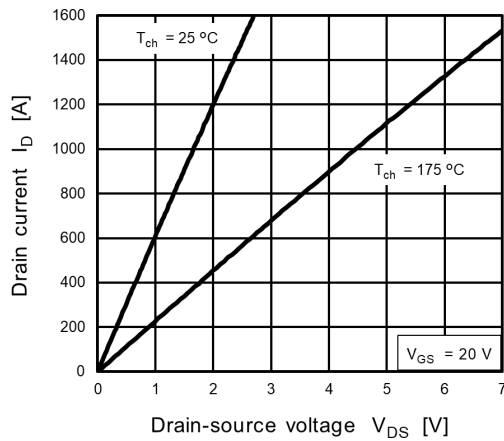


Fig. 8.1 $I_D - V_{DS}$ (Note 1)

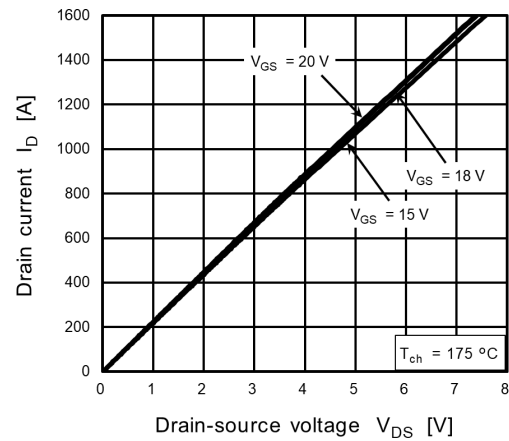


Fig. 8.2 $I_D - V_{DS}$ (Note 1)

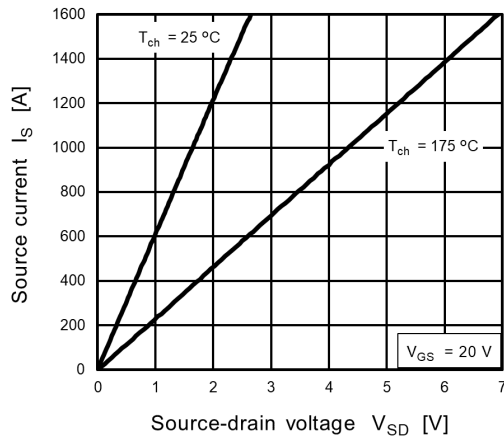


Fig. 8.3 $I_S - V_{SD}$ (Note 1)

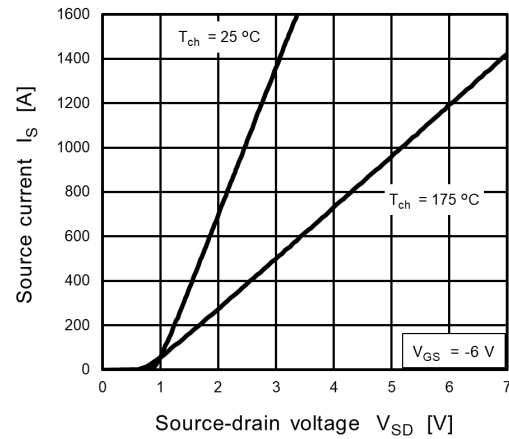


Fig. 8.4 $I_S - V_{SD}$ (Note 1)

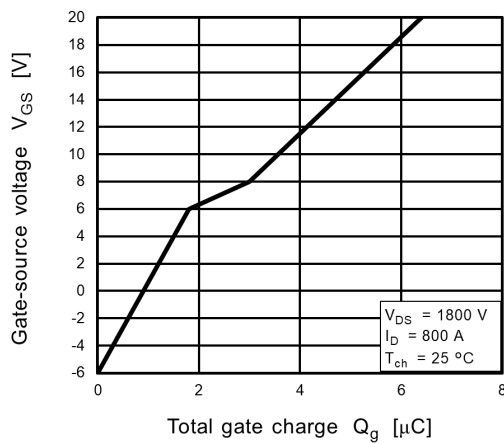


Fig. 8.5 $V_{GS} - Q_g$

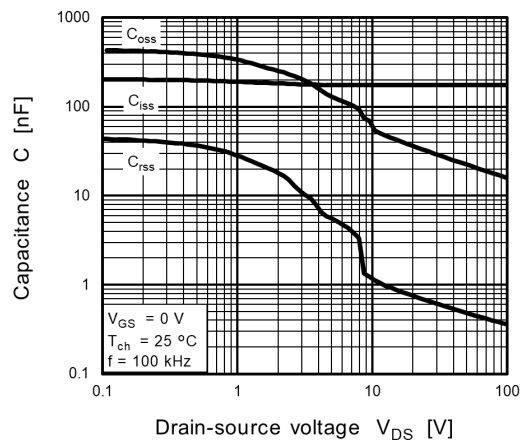


Fig. 8.6 $C_{iss}, C_{oss}, C_{rss} - V_{DS}$

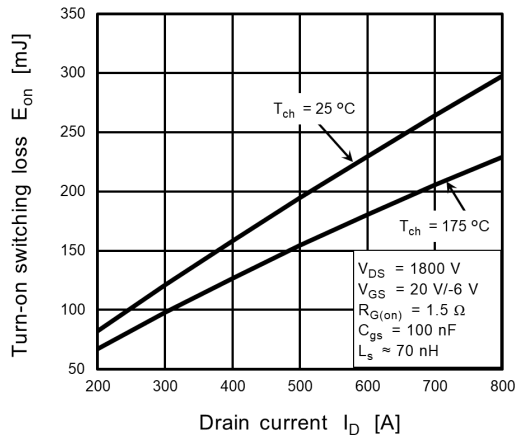


Fig. 8.7 $E_{on} - I_D$

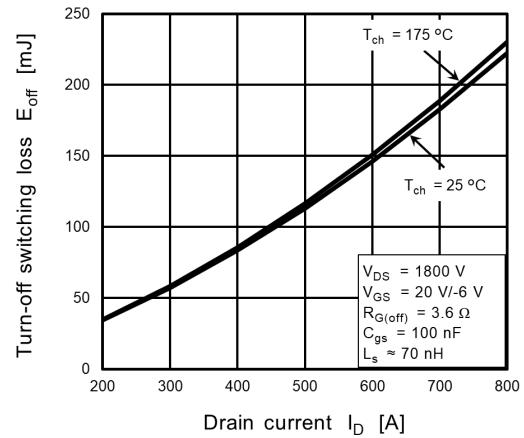


Fig. 8.8 $E_{off} - I_D$

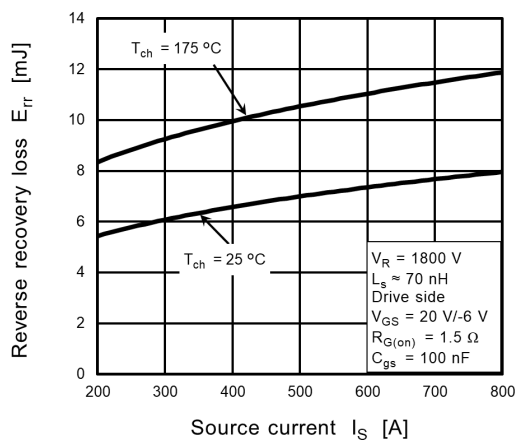


Fig. 8.9 $E_{rr} - I_S$

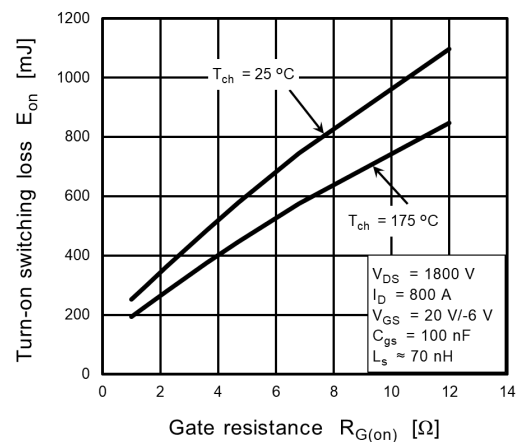


Fig. 8.10 $E_{on} - R_{G(on)}$

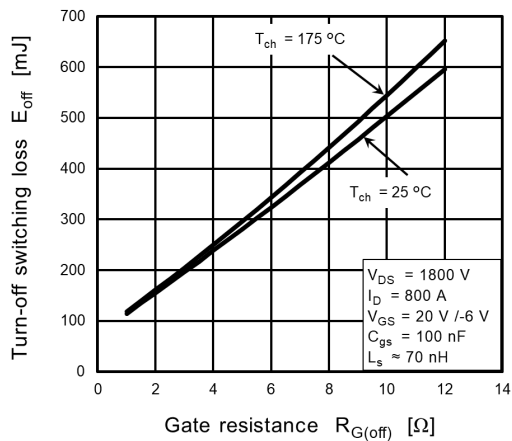


Fig. 8.11 $E_{off} - R_{G(off)}$

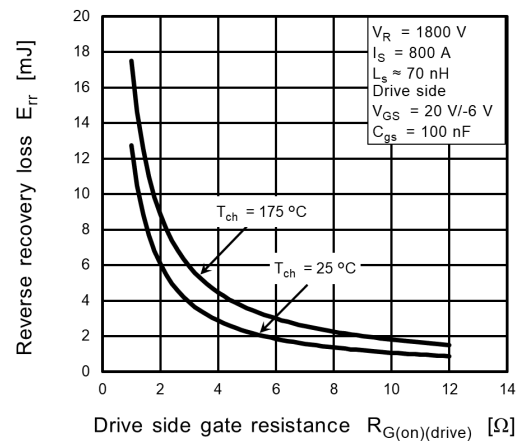


Fig. 8.12 $E_{rr} - R_{G(on)}$

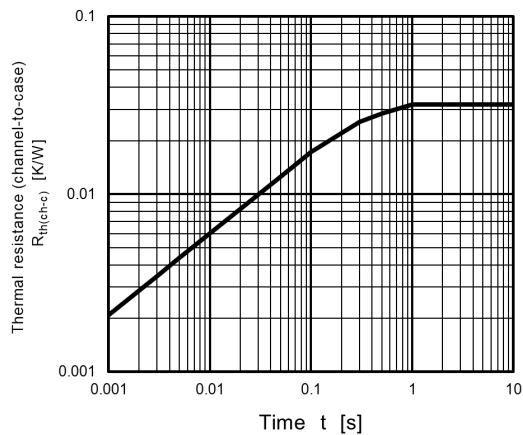


Fig. 8.13 $R_{th(ch-c)}$ - t
(Guaranteed Maximum)

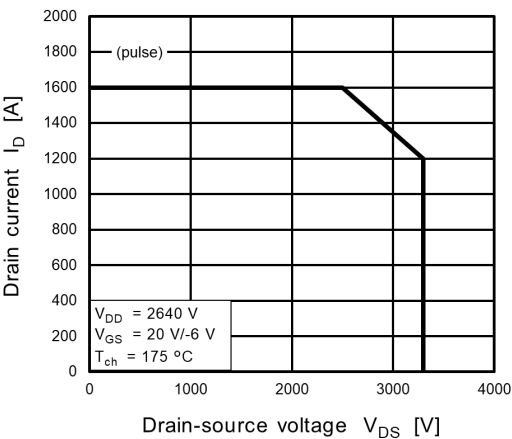


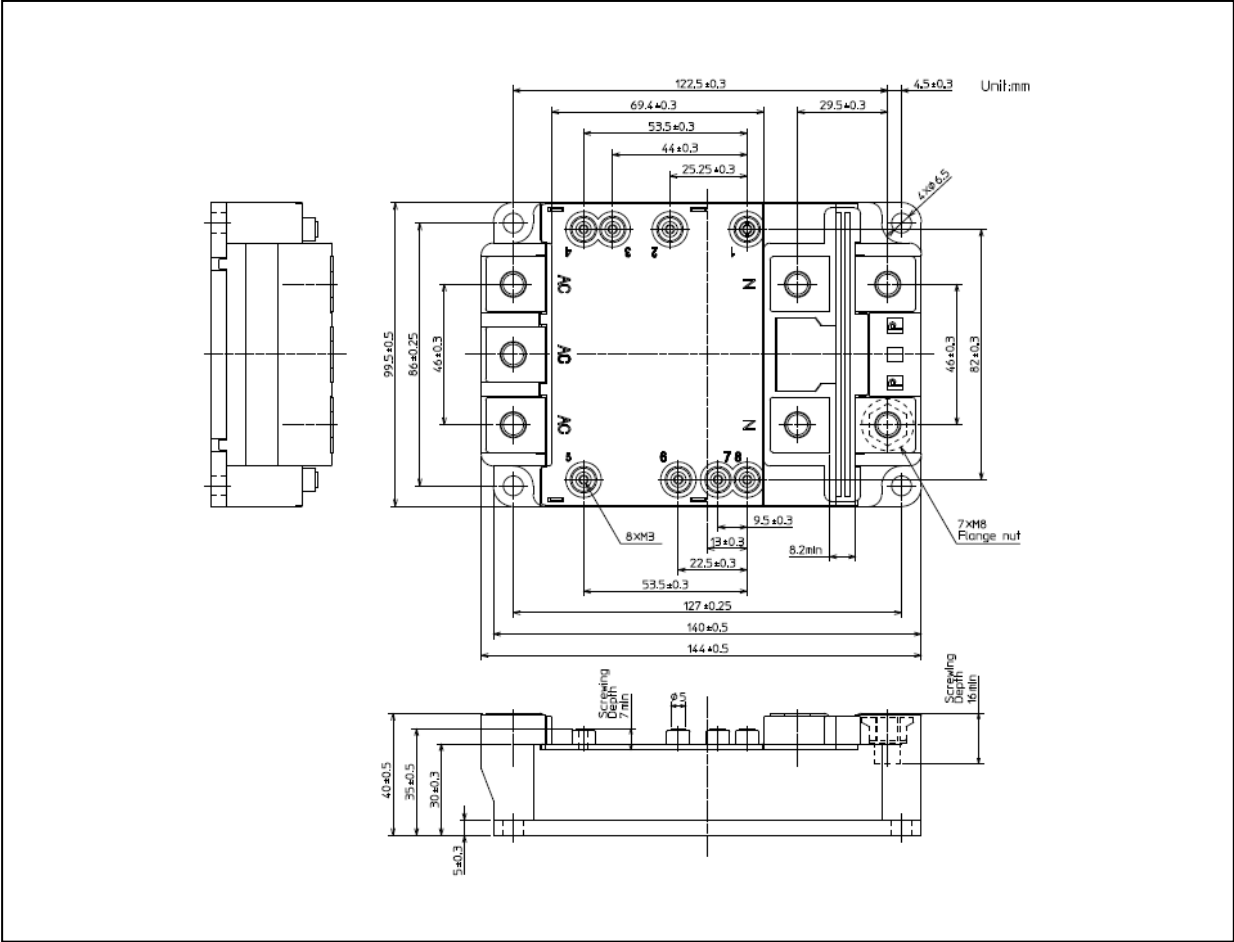
Fig. 8.14 Reverse bias safe operating area
(RBSOA)(Guaranteed Maximum)

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

Note 1: Source - drain voltage and Drain - source voltage are measured at sense terminals.

Package Dimensions

Unit: mm



Weight: 840 g (typ.)

Package Name(s)
TOSHIBA: 2-144A1A
Nickname: iXPLV

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