BMF240R12E2G3

SiC MOSFET Module

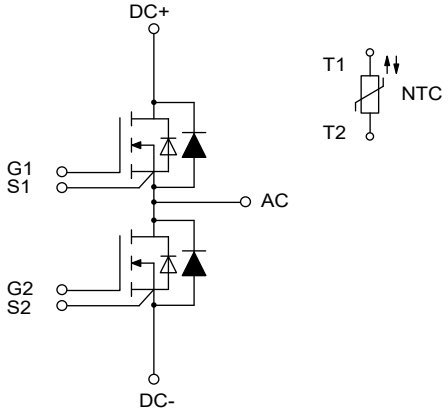
Product Summary

V_{DSS}	1200 V
I_D (T_C=65°C)	240 A
$R_{DS(on).typ}$(T_{vj}=25°C)	5.5mΩ@V_{GS}=18 V

Package: Pcore ™ 2 E2B

Half Bridge Module
SiC 1200V MOSFET

Schematic Diagram



Electrical Features

- Low $R_{DS(on)}$
- High current density
- Low inductance design
- Low switching losses
- Less susceptible to malfunction due to high threshold voltage: $V_{GS(th).typ}$ = 4.0
- Built-in SiC schottky barrier diode
- Zero Reverse Recovery from Diodes
- Low diode forward voltage

Mechanical Features

- Intergrated NTC temperature sensor
- Press-FIT contact technology
- Rugged mounting due to intergrated mouting clamps
- Si_3N_4 ceramic substrate with excelent power cycling capability

Halogen

RoHS

Potential Applications

- High Frequency converter/Inverters
- DC-DC Converters
- EV Chargers
- UPS systems
- Solar applications

Note: This module is under development. Therefore, this preliminary specification might be changed in near future.If you use these data for various calculation, please contact us.

Maximum Ratings(at T_{vj}=25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Maximum Ratings	Unit
V_{DSS}	Drain-source voltage, gate-source short-circuited		1200	V
$\|+V_{GSS}\|$	Gate-source voltage, drain-source short-circuited	DC	25	
$\|-V_{GSS}\|$		DC	10	
$\|I_D\|$	Drain current	Continuous T_C=65°C	240	A
$\|I_{DM}\|$		Pulsed	480	
$\|-I_D\|$ (*1)		Continuous T_C=65°C	240	
$\|I_{DRM}\|$		Pulsed	480	
P_D	Power dissipation	T_{vjop}=150°C, T_C=25°C	862	W
T_{vj}	Virtual junction temperature		175	°C
T_{vjop}	Operating virtual junction temperature (under switching conditions)		150	
T_{stg}	Storage temperature		-40~125	
V_{ISOL}	Isolation test voltage	RMS, AC, 50Hz, 1min	3000	V

(*1) Only for Body diode

Recommended values

Symbol	Parameter	Test Conditions	Values	Unit
$V_{GS(on)}$	On-state gate voltage		18…20	V
$V_{GS(off)}$	Off-state gate voltage		-4…0	V

Electrical properties of MOSFET (at T_{vj}= 25°C unless otherwise specified)

Symbol	Parameter	Test Conditions		Characteristics			Unit
				Min.	Typ.	Max.	
I_{DSS}	Drain current, with gate short-circuited to source	V_{GS}=0V V_{DS}=1200V		-	6	120	uA
$\|+I_{GSS}\|$	Gate leakage current, with drain short-circuited to source	V_{DS}=0V V_{GS}=25V		-	-	0.6	uA
$\|-I_{GSS}\|$		V_{DS}=0V V_{GS}=-10V		-	-	0.6	
$V_{GS(th)}$	Gate-source threshold voltage	V_{DS}=10V I_D =78mA	T_{vj}=25°C	3.0	4.0	5.0	V
$R_{DS(on)}$ (including terminals)	Drain-source on-state resistance	V_{GS}=18V I_D =240A	T_{vj}=25°C	-	5.5	7.50	mΩ
			T_{vj}=150°C	-	8.4	-	
$R_{DS(on)}$ (@chip)		V_{GS}=18V I_D =240A	T_{vj}=25°C	-	5.0	6.9	
			T_{vj}=150°C	-	7.3	-	
C_{iss}	Input capacitance	V_{GS} =0V V_{DS} =800V f =100kHz		-	17.6	-	nF
C_{oss}	Output capacitance			-	0.9	-	
C_{rss}	Reverse transfer capacitance			-	0.03	-	
E_{oss}	C_{oss} stored energy	V_{DS}=800V, V_{GS}= 0V			340.8		μJ
$R_{G(int)}$	Internal gate resistance	f =1MHz, open drain		-	0.37	-	Ω
Q_G	Total gate charge	V_{DS}=800V, I_D=240A, V_{GS}=18V/-4V		-	492	-	nC
$t_{d(on)}$	Turn-on delay time	V_{GS} =+18V/-4V; V_{DS} =800V I_D =240A $R_{G(on)}$ =2.2Ω $R_{G(off)}$ =2.2Ω $L\sigma$ =20nH $C_{gs(ext)}$ =10nF E_{on} includes diode reverse recovery	T_{vj}=25°C	-	51.0	-	ns
			T_{vj}=150°C	-	40.0	-	
t_r	Rise time		T_{vj}=25°C	-	31.0	-	
			T_{vj}=150°C	-	30.0	-	
$t_{d(off)}$	Turn-off delay time		T_{vj}=25°C	-	49.5	-	
			T_{vj}=150°C	-	55.3	-	
t_f	Fall time		T_{vj}=25°C	-	23.5	-	
			T_{vj}=150°C	-	27.0	-	
E_{on}	Turn-on switching energy		T_{vj}=25°C	-	9.3	-	mJ
			T_{vj}=150°C	-	8.6	-	
E_{off}	Turn-off switching energy		T_{vj}=25°C	-	1.0	-	
			T_{vj}=150°C	-	0.8	-	

Electrical properties of Body Diode (at T_{vj}= 25°C unless otherwise specified)

Symbol	Parameter	Test Conditions		Characteristics			Unit
				Min.	Typ.	Max.	
V_{SD} (including terminals)	Diode forward on voltage	V_{GS}=-4V, I_{SD} =240A	T_{vj}=25°C	-	2.05	-	V
			T_{vj}=150°C	-	3.10	-	
V_{SD} (@chip)		V_{GS}=-4V, I_{SD} =240A	T_{vj}=25°C	-	1.90	-	
			T_{vj}=150°C	-	2.80	-	
V_{SD} (including terminals)	Diode forward on voltage	V_{GS}=+18V, I_{SD} =240A	T_{vj}=25°C	-	1.25	-	V
			T_{vj}=150°C	-	1.85	-	
V_{SD} (@chip)		V_{GS}=+18V, I_{SD} =240A	T_{vj}=25°C	-	1.08	-	
			T_{vj}=150°C	-	1.56	-	
t_{rr}	Reverse recovery time	V_{GS} =+18V/-4V; V_{DS} =800V; I_D =240A; $R_{G(on)}$ =2.2Ω; $R_{G(off)}$ =2.2Ω; $L\sigma$ =20nH; $C_{gs(ext)}$ =10nF	T_{vj}=25°C	-	16.8	-	ns
			T_{vj}=150°C	-	17.0	-	
Q_{rr}	Reverse recovered charge		T_{vj}=25°C	-	1.1	-	μC
			T_{vj}=150°C	-	1.2	-	
I_{rrm}	Peak reverse recovery current		T_{vj}=25°C	-	112.4	-	A
			T_{vj}=150°C	-	118.0	-	
E_{rr}	Reverse recovery energy		T_{vj}=25°C	-	10.7	-	uJ
			T_{vj}=150°C	-	13.0	-	

Thermal properties

Symbol	Parameter	Test Conditions	Characteristics			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)}$	Thermal resistance junction to case (1device)	Per MOSFET	-	0.116	-	K/W

NTC Thermistor

Symbol	Parameter	Test Conditions	Characteristics			Unit
			Min.	Typ.	Max.	
R_{25}	Nominal resistance	T_{NTC}=25±0.01°C	-	5	-	kΩ
$\Delta R/R$	Deviation of R_{25}	T_{NTC}=25±0.01°C	-3	-	3	%
$R_{25/50}$	B-Value	$R_{50} = R_{25} \exp [B_{25/50}(1/T_{50} - 1/T_{25})]$	-	3375	-	K
δ	Power Dissipation Constant	T_{NTC}=25±0.5°C	-	1.2	-	mW/°C
P_r	Power Dissipation	T_{NTC}=25±0.5°C	-	-	60	mW

Module

Symbol	Parameter	Note or test Condition	Characteristics			Unit
			Min.	Typ.	Max.	
	Internal isolation	basic insulation	-	Si_3N_4	-	
d_{Creep}	Creepage distance	terminal to heatsink	-	11.5	-	mm
		terminal to terminal	-	6.3	-	
d_{Clear}	Clearance	terminal to heatsink	-	10.0	-	mm
		terminal to terminal	-	5.0	-	
CTI	Comperative tracking index		-	>175	-	
L_p	Stray inductance module		-	TBD	-	nH
$R_{DD'+SS'}$	Module lead resistance, terminals - chip	T_C =25°C, per switch	-	0.53	-	mΩ
F	Mounting force per clamp		40.00	-	80.0	N
G	Weight		-	40	-	g

Fig.1 T_{vj} =25°C Typical Output Characteristics

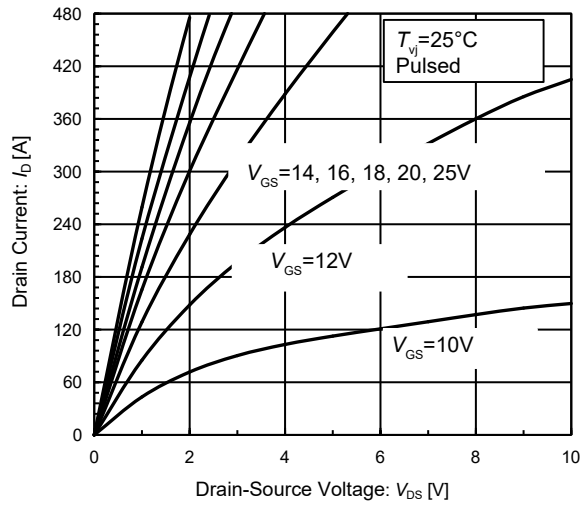


Fig.2 T_{vj} = 150°C Typical Output Characteristics

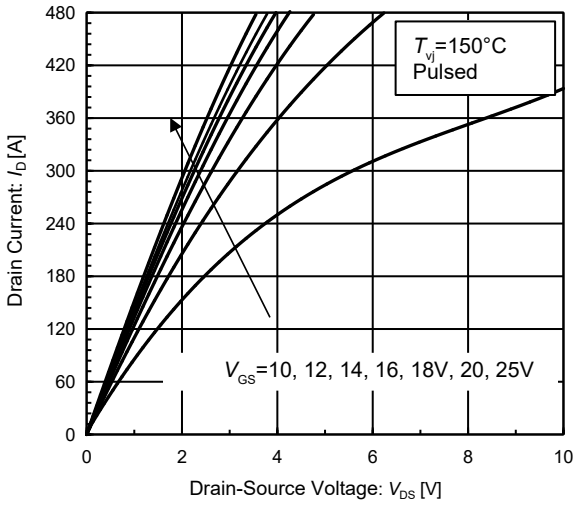


Fig.3 T_{vj} = 25°C 3rd Quadrant Characteristics

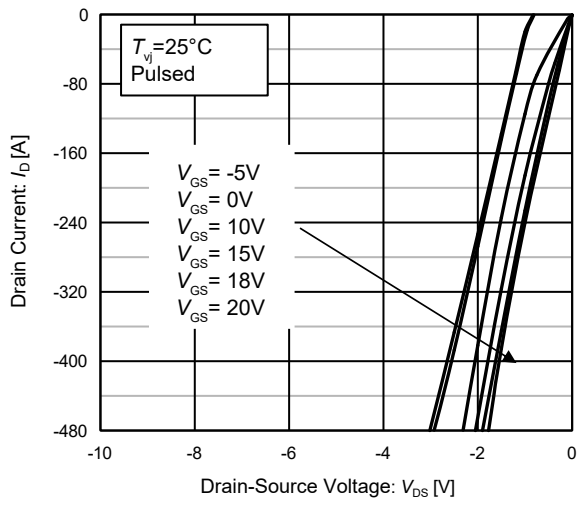


Fig.4 T_{vj} = 150°C 3rd Quadrant Characteristics

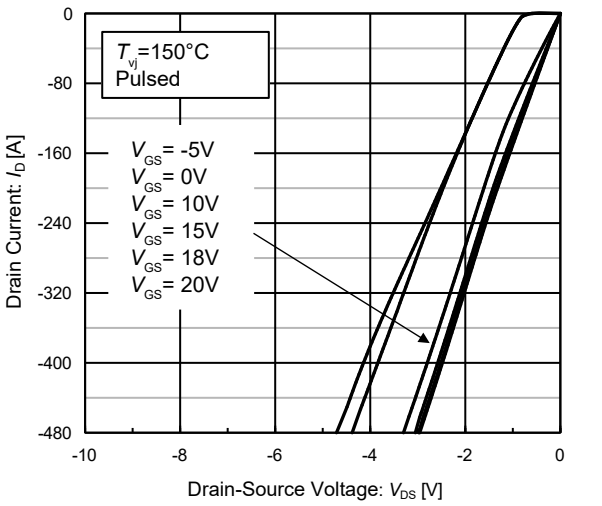


Fig.5 Typical Gate Threshold Voltage vs. Junction Temperature

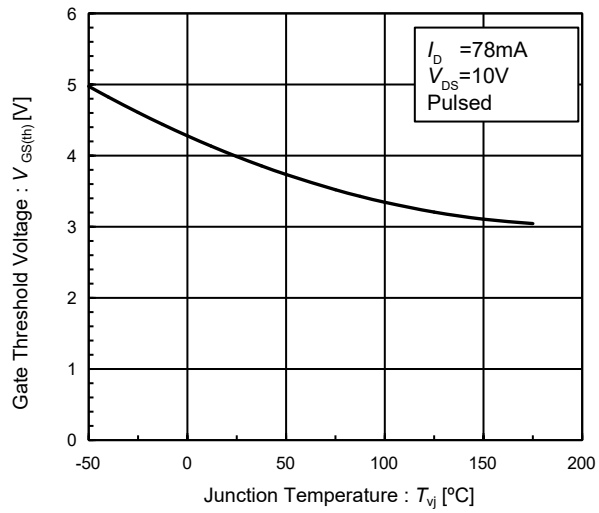


Fig.6 Typical Static Drain-Source On-State Resistance vs. Junction Temperature

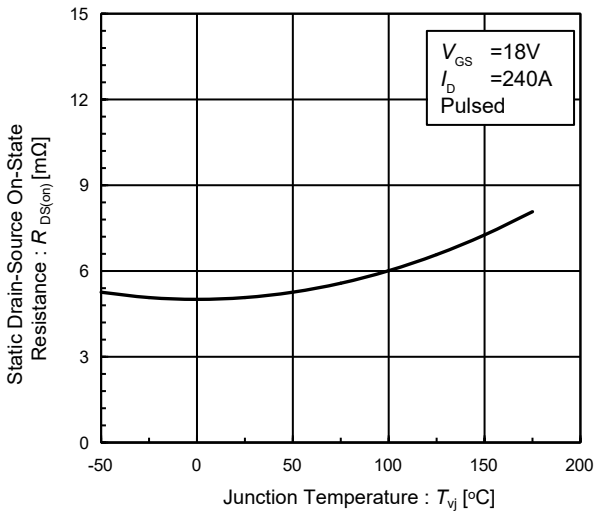


Fig.7 Typical Static Source-Drain Voltag vs. Junction Temperature(V_{GS}=-4V, chip)

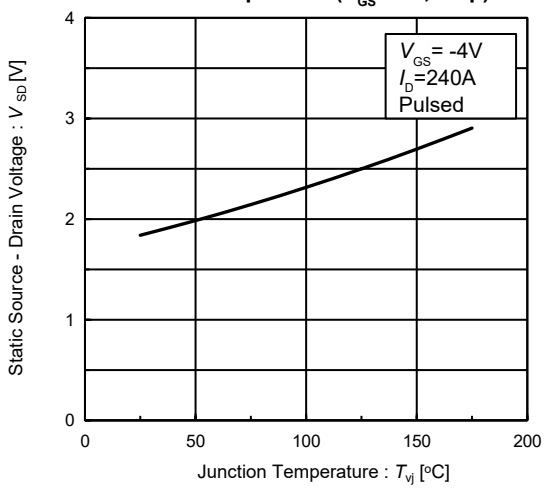


Fig.8 Typical Static Source-Drain Voltage vs. Junction Temperature (V_{GS}=+18V, chip)

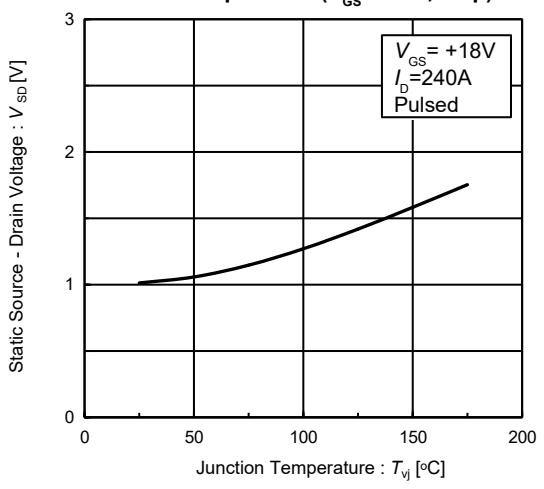


Fig.9 Typical Transfer Characteristics

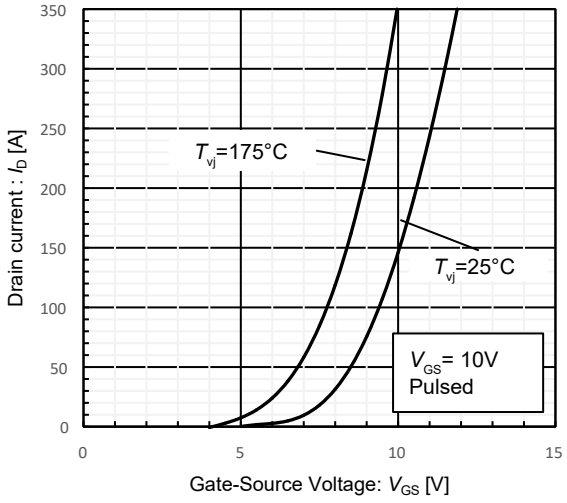


Fig.10 Typical Capacitance vs. Drain-Source Voltage

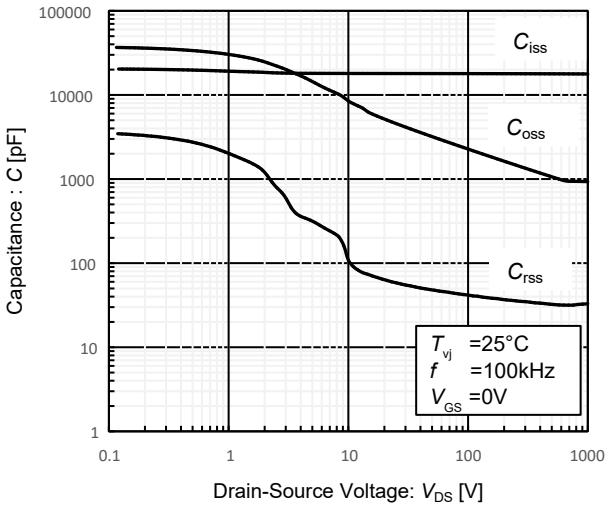


Fig.11 C_{oss} Stored Energy

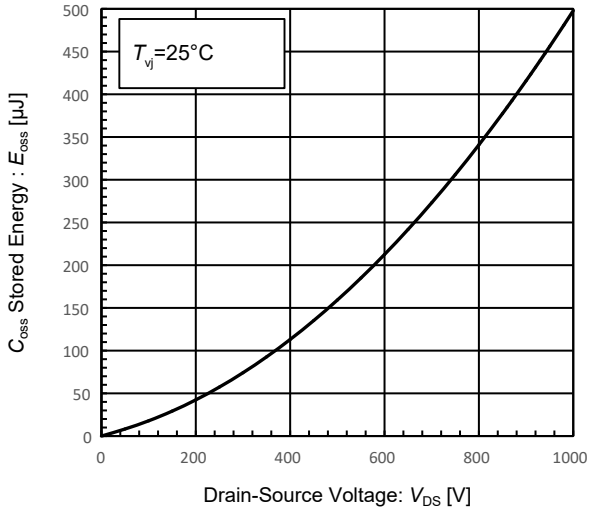


Fig.12 Dynamic Input Characteristics

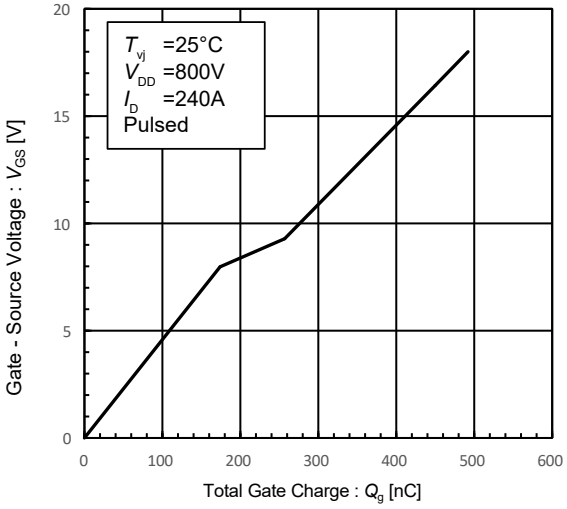


Fig.13 Typical Switching Loss vs. Drain Current

V_{DD}=800V, V_{GS}=+18/-4V, $R_{G(on)}$=2.2Ω, $R_{G(off)}$=2.2Ω, C_{gs}=10nF

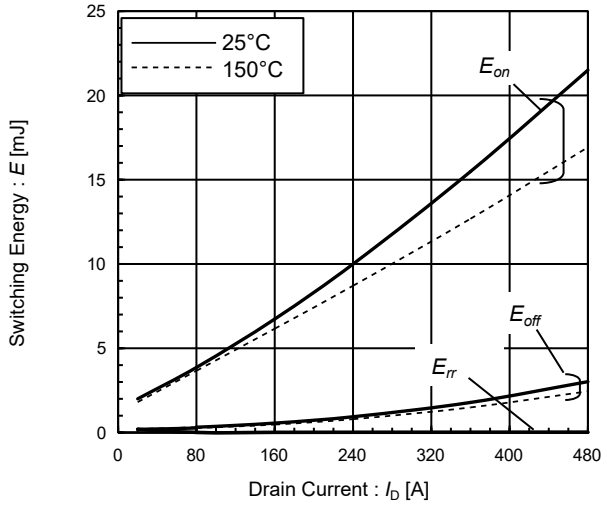


Fig.14 Typical Switching Loss vs. External Gate Resistance

V_{DD}=800V, V_{GS}=+18/-4V, I_D=240A, C_{gs}=10nF

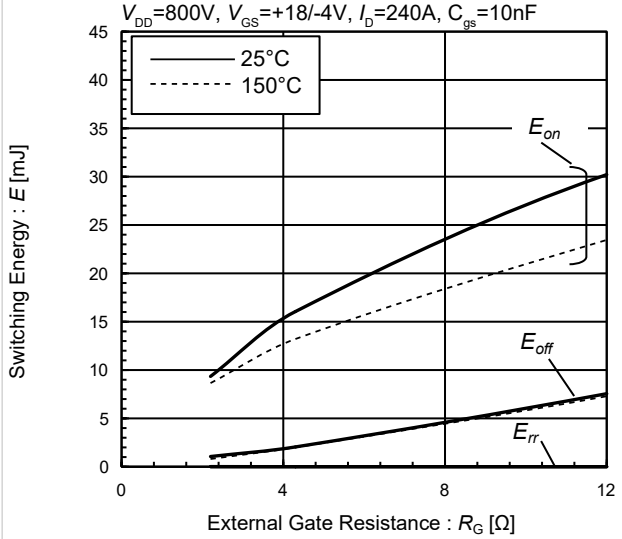


Fig.15 Typical Switching Time vs. Drain Current

V_{DD}=800V, V_{GS}=+18/-4V, $R_{G(on)}$=2.2Ω, $R_{G(off)}$=2.2Ω, C_{gs}=10nF

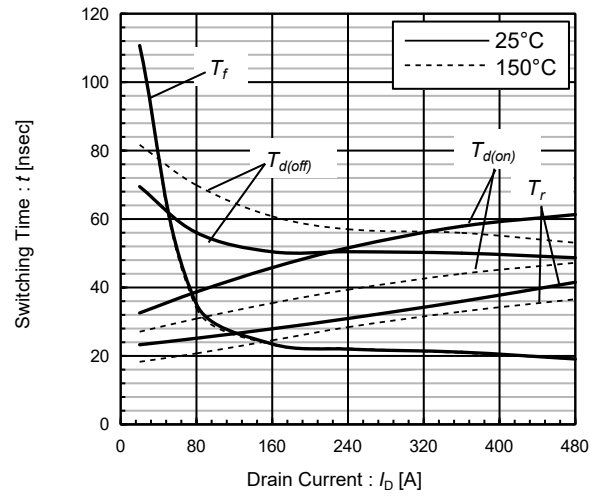


Fig.16 Typical Switching Time vs. External Gate Resistance

V_{DD}=800V, V_{GS}=+18/-4V, I_D=240A, C_{gs}=10nF

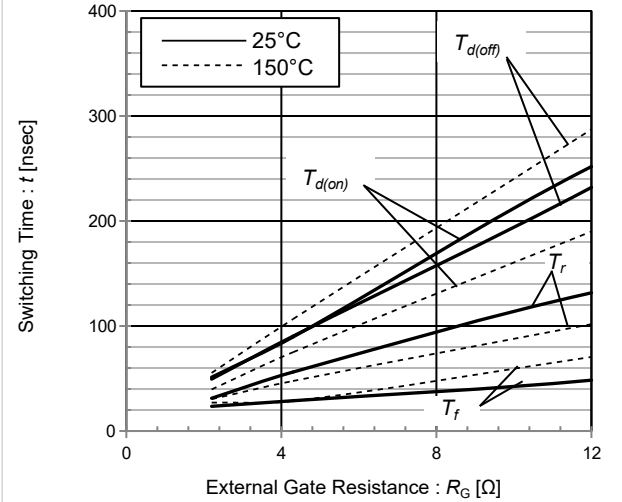


Fig.17 Reverse bias safe operating area (max)

V_{GS}=+18/-4V, $R_{G(on)}$=TBD, $R_{G(off)}$=TBD, T_{vj}=150°C

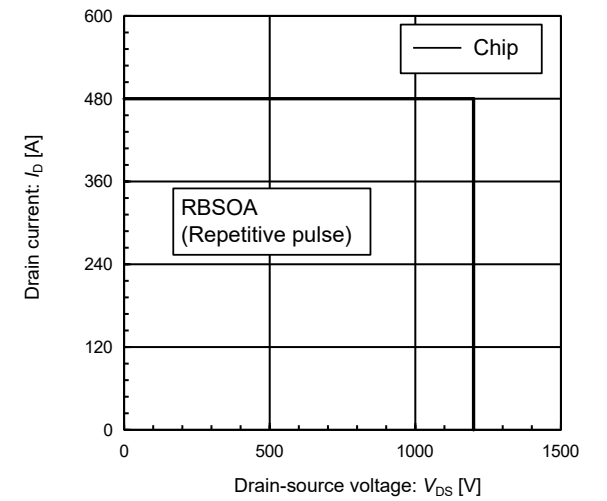


Fig.18 NTC Resistance vs. Temperature

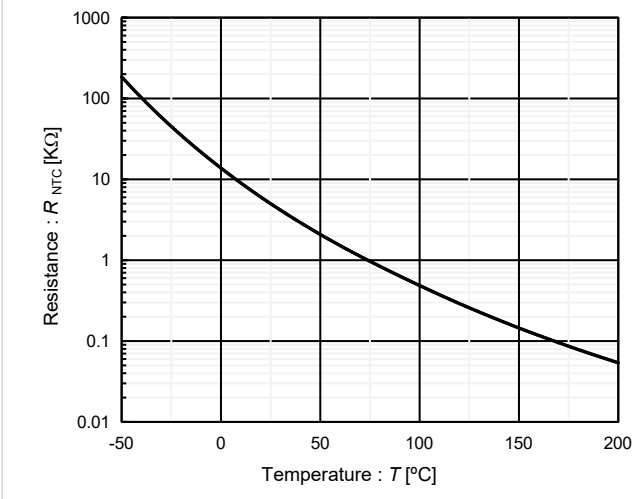


Fig.19 Typical Time and Peak Current vs. Drain Current

V_{DD}=800V, V_{GS}=+18/-4V, $R_{G(on)}$=2.2Ω, $R_{G(off)}$=2.2Ω, C_{gs}=10nF

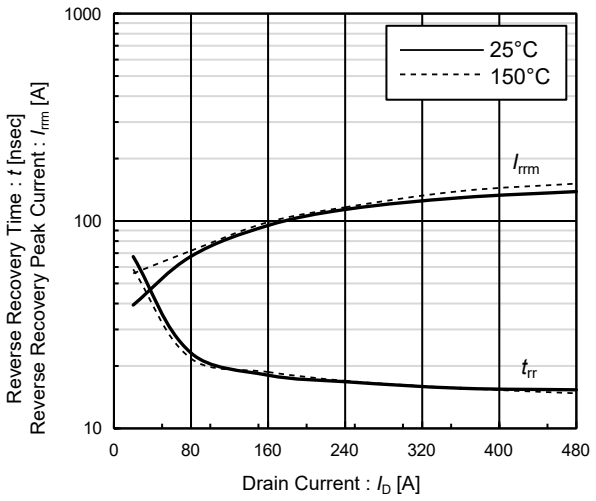


Fig.20 Typical Time and Peak Current vs. External Gate Resistance

V_{DD}=800V, V_{GS}=+18/-4V, I_D=240A, C_{gs}=10nF

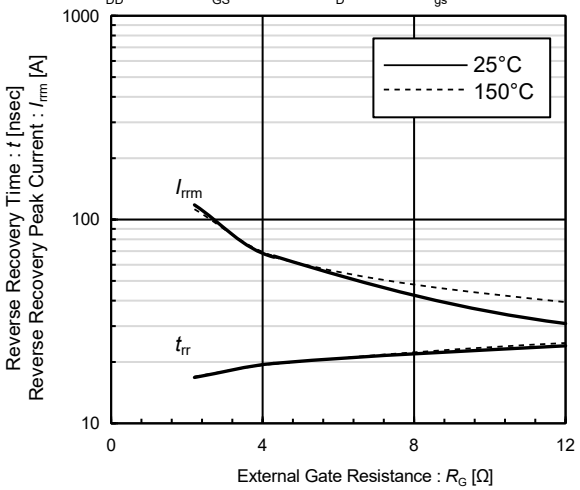
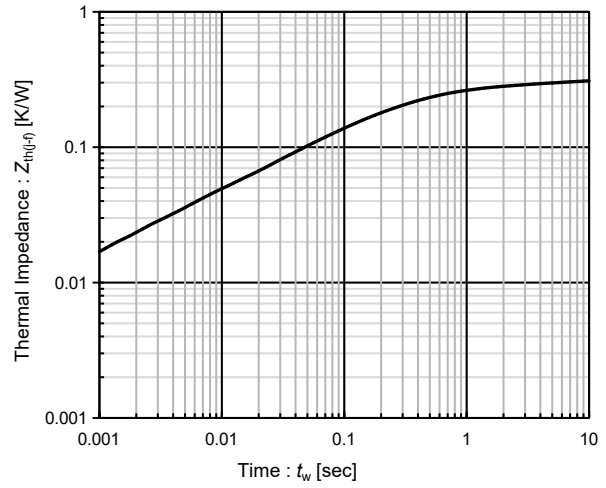


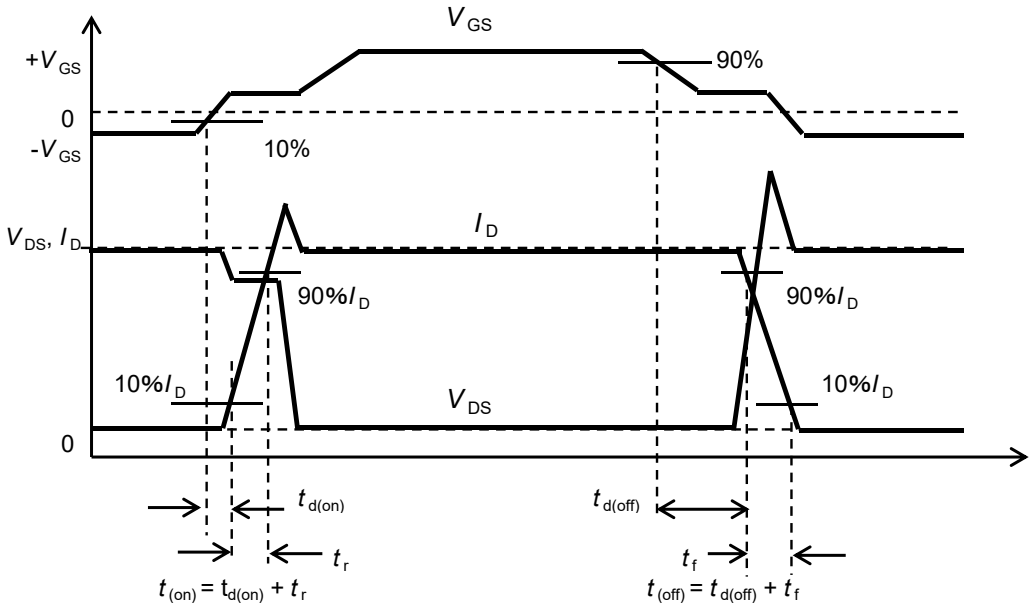
Fig.21 Transient Thermal Impedance

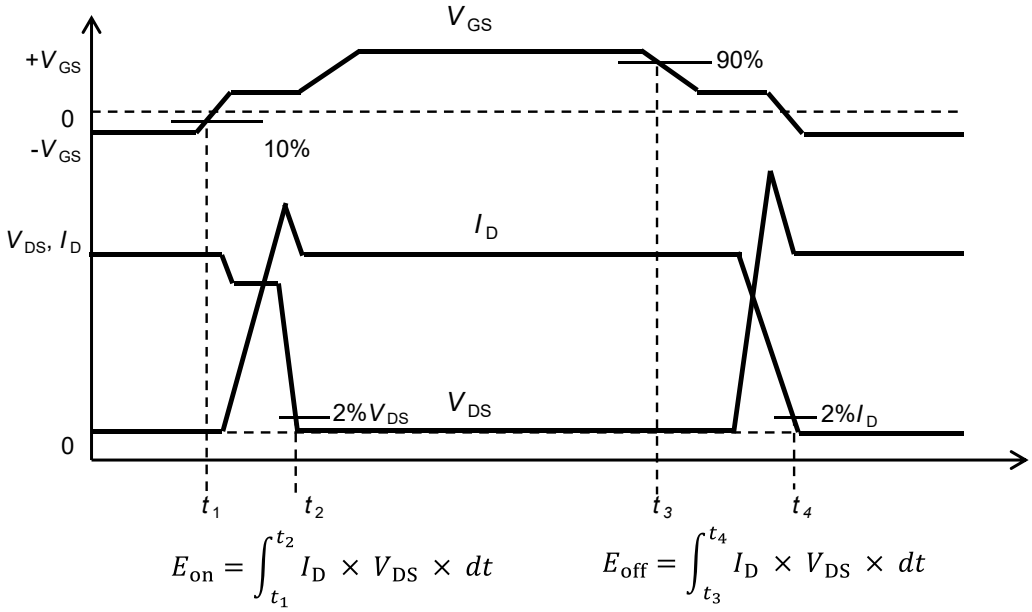
$Z_{th(j-h)}$ = f(t)



Definition of Switching Parameter

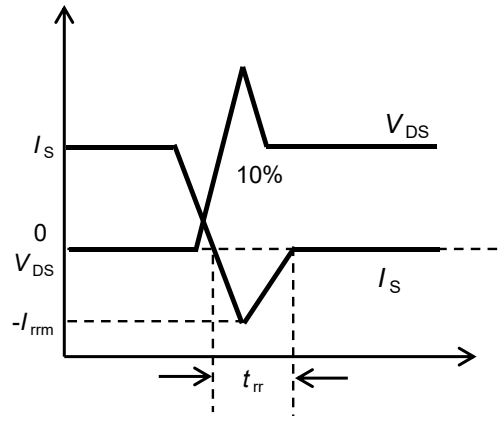
(i) MOSFET

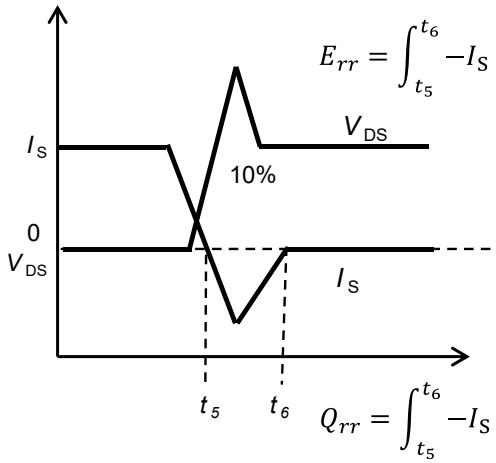




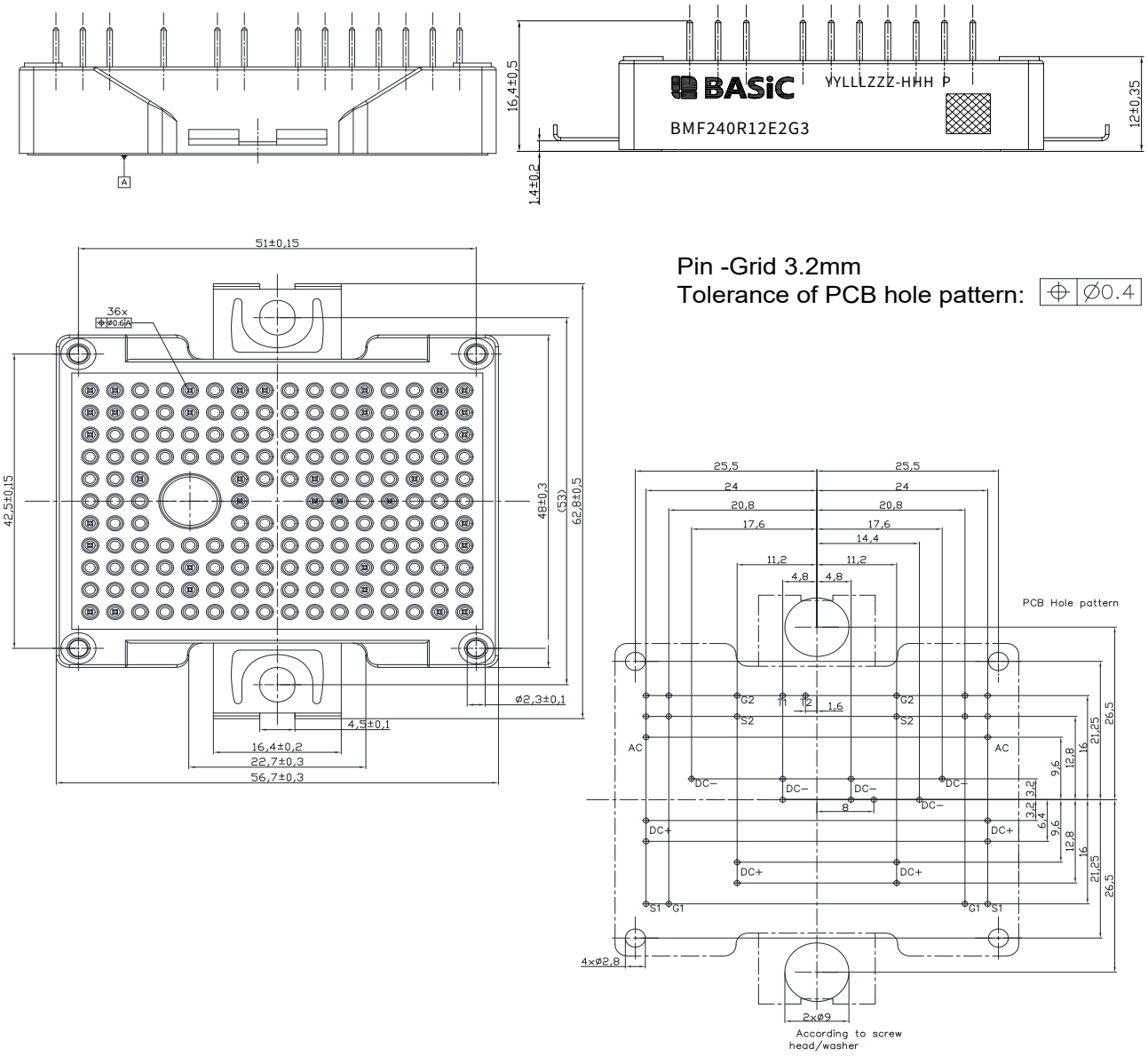
$$E_{on} = \int_{t_1}^{t_2} I_D \times V_{DS} \times dt \qquad E_{off} = \int_{t_3}^{t_4} I_D \times V_{DS} \times dt$$

(ii) Body Diode

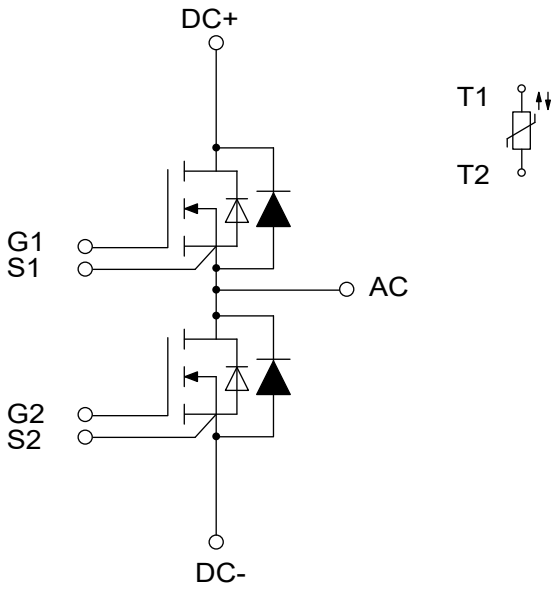




Package Dimensions (Unit: mm)



Equivalent Circuit



Revision History

Document Version	Date of Release	Description of Changes
Rev. 0.0	2023-08-02	Release of the initial datasheet.
Rev. 0.1	2024-03-29	Characteristics updated.

Information

For further information on technology, delivery terms and conditions and prices, please contact the nearest BASiC Semiconductor Office

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