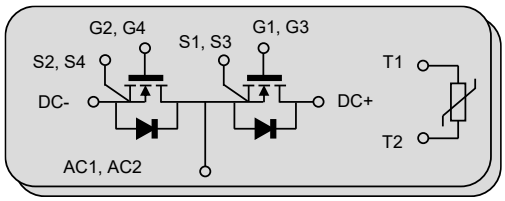
Full Silicon Carbide Power Module

1200V, 30mΩ, Full-Bridge Topology

Product Information:



Features

- Optimized $R_{DS(on)}$ with Rapid Switching Behavior
- Build with AEC-Q101 Qualified SiC MOSFETs
- Al_2O_3 Ceramic with integrated NTC
- High Avalanche Endurance Capability
- Pre-Applied Thermal Interface Material
- Optimized for High Power Density Applications
- RoHS Compliant and Halogen Free

Benefits

- Higher System Efficiency
- Industrial Standard Package Pin-out
- Enable High Temperature Application
- Allow High Frequency Operation
- Realize Compact and Lightweight Systems
- High Reliability

Potential Applications

- Uninterruptible Power Supplies
- Renewables
- EV Fast Charging Stations
- Industrial Power
- Power Inverter

Key Performance Parameters

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS} @$T_{j(max)}$	1200	V
Recommended Gate-Source Turn-On Voltage	V_{GS}	12~15	
Drain-Source On-State Resistance	$R_{DS(on)}$	30	mΩ
Nominal Drain Current	$I_{D,\ nom}$	40	A
Pulse Drain Current	$I_{D,\ pulse}$	145	
Power Dissipation	P_{tot}	187.5	W
Gate Charge	Q_G	171.5	nC
Output Capacitive Charge	Q_{oss}	135	
Junction & Storage Temperature	T_j, T_{stg}	-55 to 175	°C

Part Number	Package	Marking
FP12030FE1FB1T	FE1 Package + TIM	FP12030FE1FB1T

For further information about comparable products, please contact (www.fastsic.com).

Maximum Ratings: (T_j = 25°C, unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Drain-Source Voltage	V_{DSS}	1200	--	--	V	V_{GS}=0V
Continuous Drain Current	I_D	--	--	58 40	A	V_{GS}=15V, T_C=25°C V_{GS}=15V, T_C=100°C
Pulse Drain Current	$I_{D,\ pulse}$	--	--	145		T_C=25°C, per Fig.13
Operate Gate Source Voltage	$V_{GS,\ op}$	-8~0	--	12~15	V	Recommended operating values
Transient Gate Source Voltage	$V_{GS,\ tran.}$	-10	--	18		Transient operating limit (AC f > 1Hz, pulse width < 100ns)
Power Dissipation	P_{tot}	--	--	187.5	W	T_c=25°C

Electrical Characteristics:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
DC Characteristics (at T_j = 25°C, unless otherwise specified)						
Drain-source Breakdown Voltage	$V_{(BR)DSS}$	1200 --	-- 1200	-- --	V	V_{GS}=0V, T_j=25°C V_{GS}=0V, T_j=175°C
Drain-Source On-State Resistance	$R_{DS(on)}$	--	30 50	42 --	mΩ	V_{GS}=15V, I_D=30A, T_j=25°C V_{GS}=15V, I_D=30A, T_j=100°C
Gate-Source Threshold Voltage	V_{th}		2.8		V	V_{GS}=V_{DS} ,I_D=60mA
Zero Gate Voltage Drain Current	I_{DSS}	--	1	100	μA	V_{DS}=1200V, V_{GS}=0V, T_j=25°C
Gate-Source Leakage Current	I_{GSS}	--	--	100	nA	V_{GS}=15V, V_{DS}=0V
Internal Gate Resistance	$R_{G,\ int.}$	--	2.5	--	Ω	f=1MHz, V_{AC}=25mV
Body Diode Forward Voltage	V_{SD}	--	3.8		V	V_{GS}=0V, I_S=30A, T_j=25°C
AC Characteristics (at T_j = 25°C, unless otherwise specified)						
Input Capacitance	C_{iss}	--	4555	--	pF	V_{DS}=800V, V_{GS}=0V, f=250kHz, V_{AC}=25mV
Output Capacitance	C_{oss}	--	90	--		
Reverse Capacitance	C_{rss}	--	7.5	--		
Effective Output Capacitance, energy related	$C_{o(er)}$[1]	--	112	--		
Effective Output Capacitance, time related	$C_{o(tr)}$[2]	--	157	--		
C_{oss} Stored Energy	E_{oss}	--	38	--	μJ	
Output Capacitive Charge	Q_{oss}	--	135	--	μC	

[1] $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 800V.
[2] $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 800V.

Switching Characteristics:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Gate Characteristics						
Gate to Source Charge	Q_{GS}	--	28.5	--	nC	V_{DS}=800V, V_{GS}=0V/15V, I_D=40A
Gate to Drain Charge	Q_{GD}	--	68	--		
Total Gate Charge	Q_G	--	171.5	--		
Turn On Delay Time	$t_{d(on)}$	--	38.4	--	ns	V_{DS}=800V, I_D=32A, V_{GS}=-3/+15V, $R_{G(ext.)}$= 5.1Ω External SiC Diode as an FWD
Rise Time	t_r	--	49.6	--		
Turn Off Delay Time	$t_{d(off)}$	--	75.2	--		
Fall Time	t_f	--	22.9	--		
Turn On Switching Energy	E_{on}	--	966	--	μJ	
Turn Off Switching Energy	E_{off}	--	194	--		

Thermal Characteristics:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Thermal Resistance, junction-case	$R_{th\text{-}jc}$	--	0.80		K/W	
Maximum junction Temperature	$T_{j,\ max}$	-40		175	˚C	
Operating Temperature	$T_{vj,\ op}$	-40		150		
Storage Temperature	T_{stg}	-40		125		

NTC Characteristics:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Resistance	R_{25}		5		kΩ	
B-value	B_{25_150}		3375		K	$R^*= R_{25}$ exp [B_{25_150}(1/T^* - 1/(298.15K))]

Package Characteristics:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Isolation Voltage*	V_{isol}	4			kV	AC, 50Hz (R.M.S), t=1minute
Stray Inductance	L_{sDS}		15		nH	
Comparative Tracking Index	CTI	400		600	--	IEC 60112 Cat. II
Weight	G				g	

*Isolation tests are based on “Basic insulation” and follow the rule of the standard IEC 61140 class 1.

Electrical Characteristics Diagrams

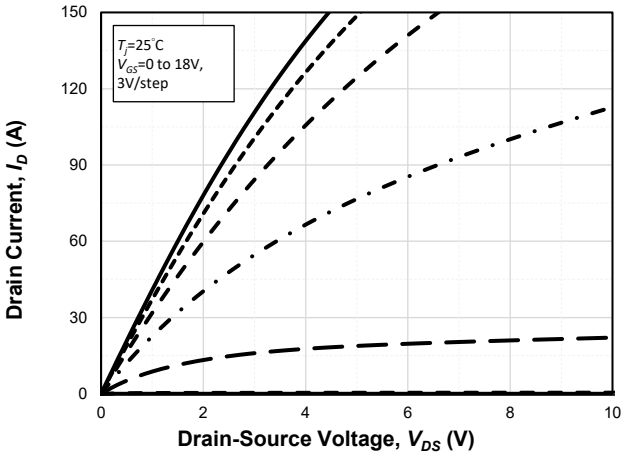


Fig. 1 Typical Output Characteristics at T_j=25°C

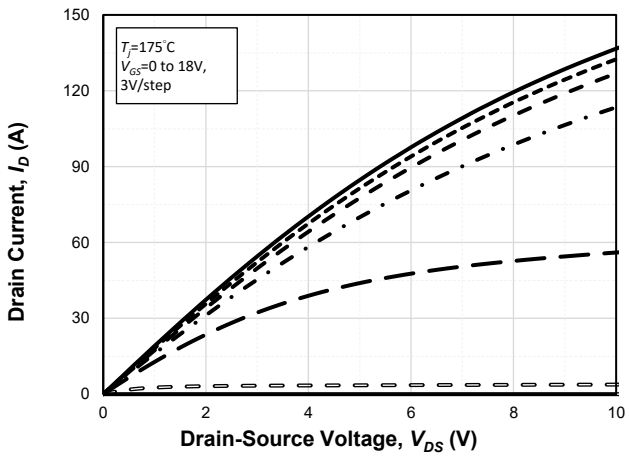


Fig. 2 Typical Output Characteristics at T_j=175°C

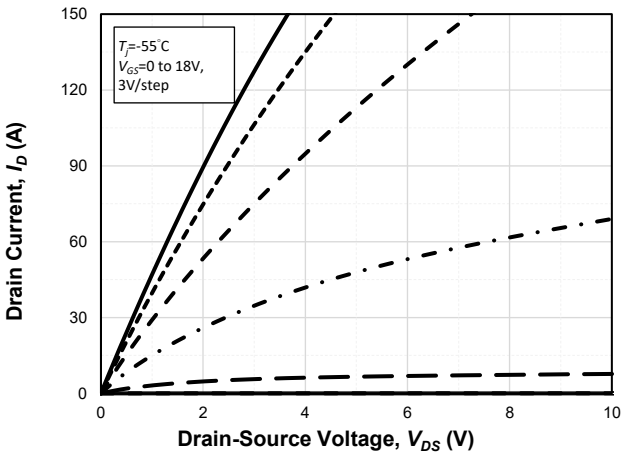


Fig. 3 Typical Output Characteristics at T_j=-55°C

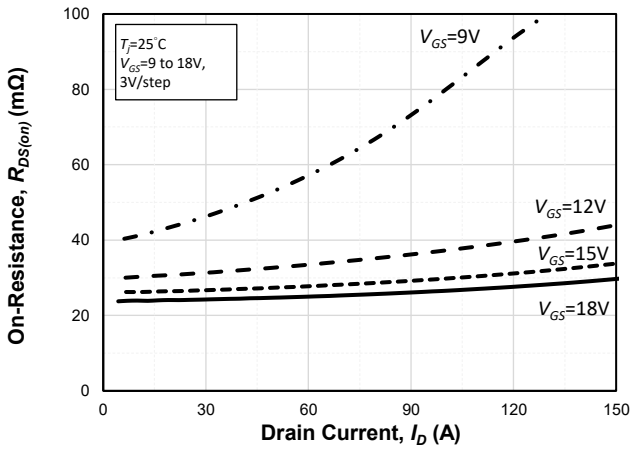


Fig. 4 Typ. $R_{DS(on)}$ vs. I_D with Various V_{GS}

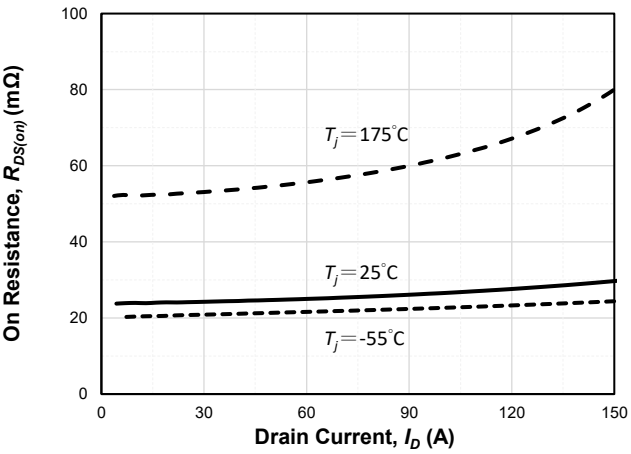


Fig. 5 Typ. $R_{DS(on)}$ vs. I_D with Various T_j, V_{GS}=15V

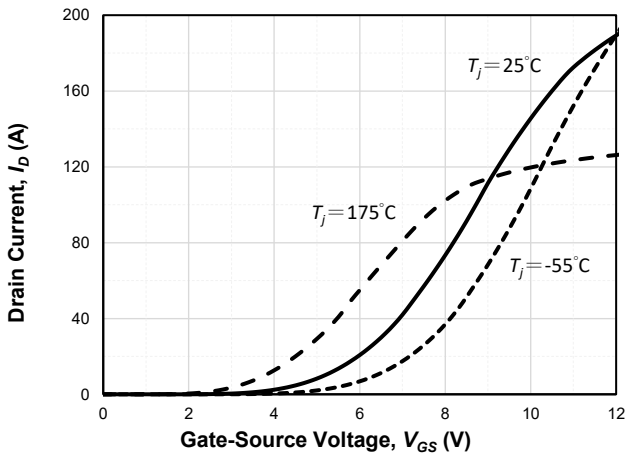


Fig. 6 Typ. I_D vs. V_{GS} with Various T_j, V_{DS}=10V

Electrical Characteristics Diagrams

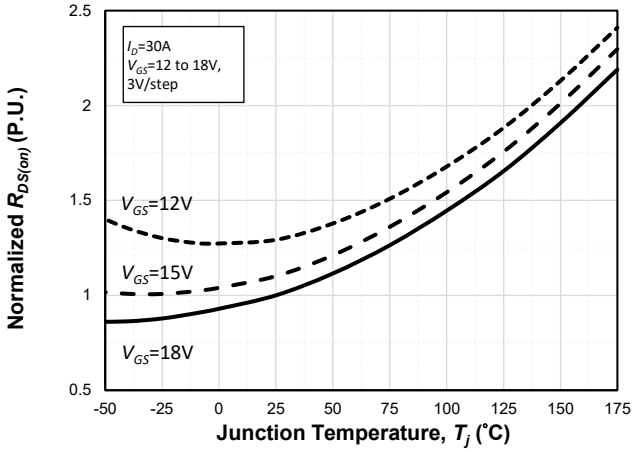


Fig. 7 Normalized $R_{DS(on)}$ vs. T_j with Various V_{GS}

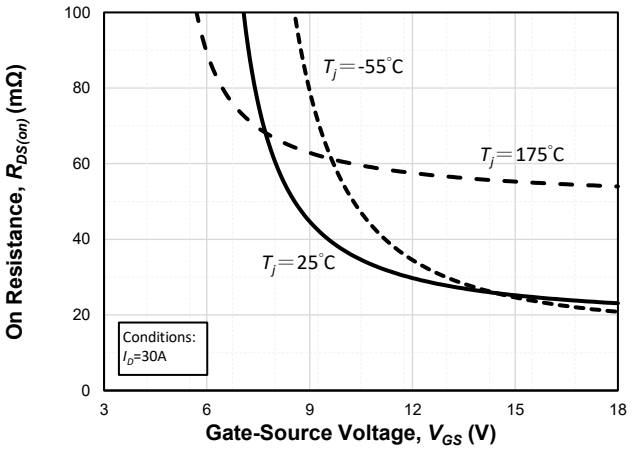


Fig. 8 Typ. $R_{DS(on)}$ vs. V_{GS} with Various T_j

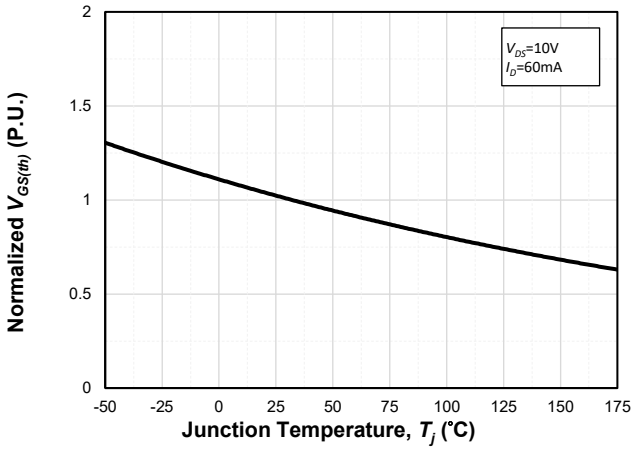


Fig. 9 Normalized V_{th} vs. T_j

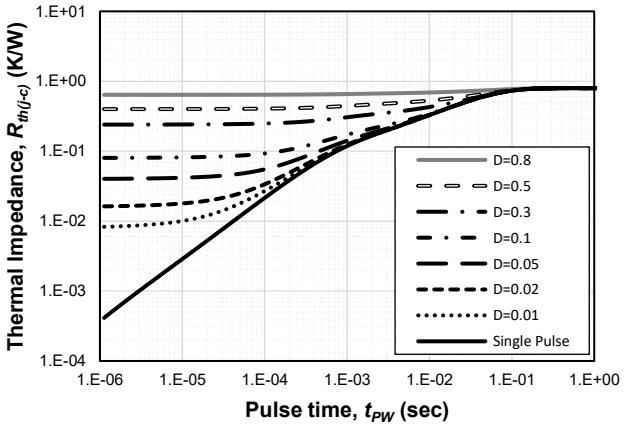


Fig. 10 Typ. Transient Thermal Impedance $R_{th\text{-}jc}$

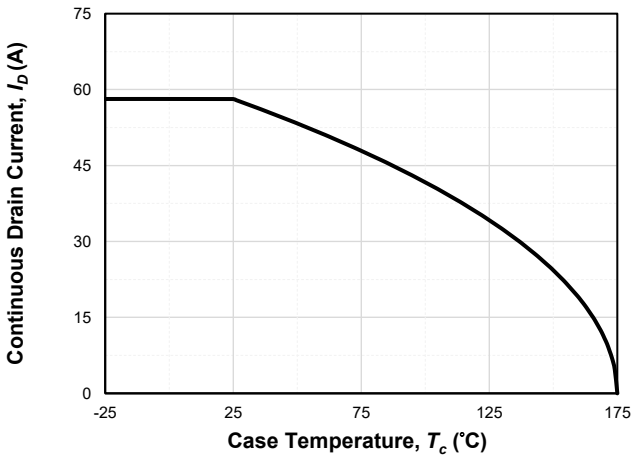


Fig. 11 Continuous I_D De-rating at V_{GS}=18V, T_j≤175°C

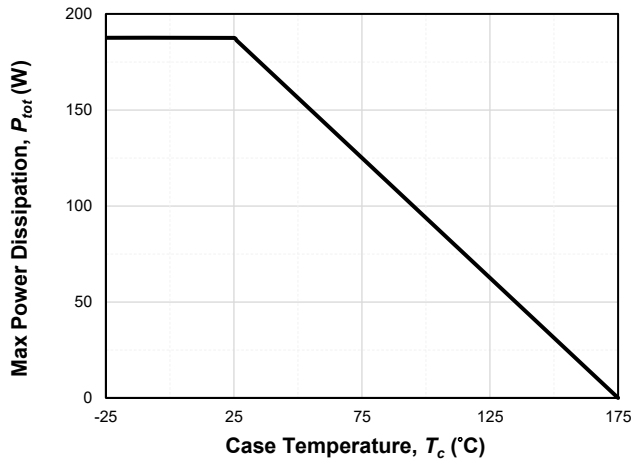


Fig. 12 Power Dissipation at V_{GS}=18V, T_j≤175°C

Electrical Characteristics Diagrams

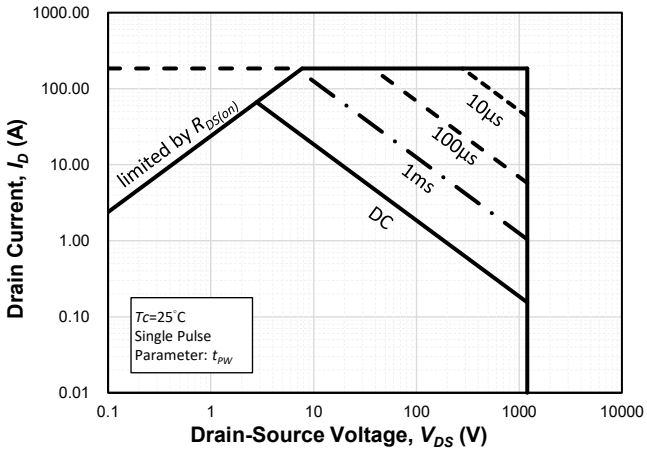


Fig. 13 Safe Operating Area at T_c=25°C

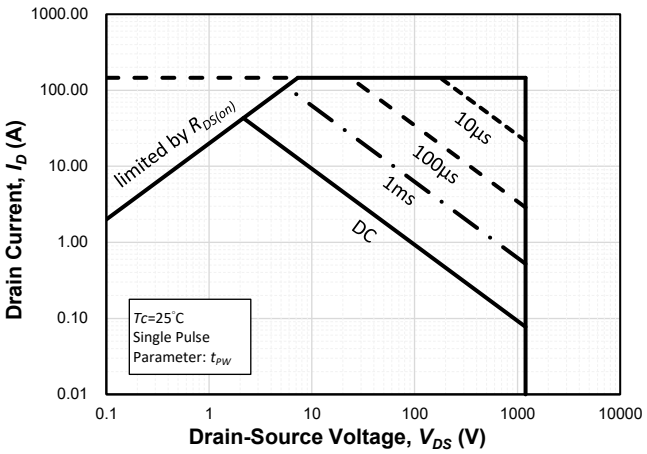


Fig. 14 Safe Operating Area at T_c=100°C

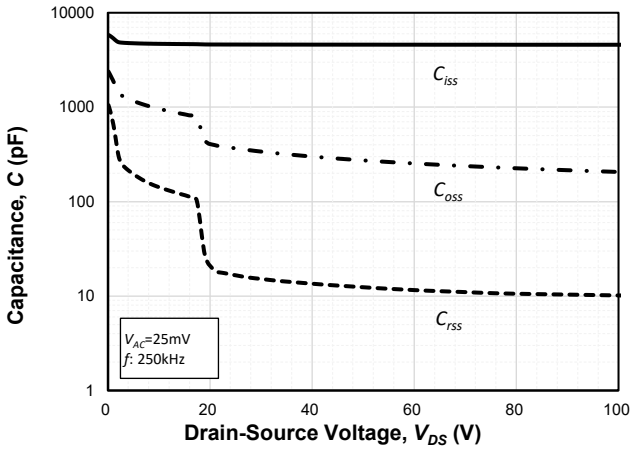


Fig. 15 Typ. Capacitance vs. V_{DS} at f_{sw}=250kHz, V_{DS}≤100V

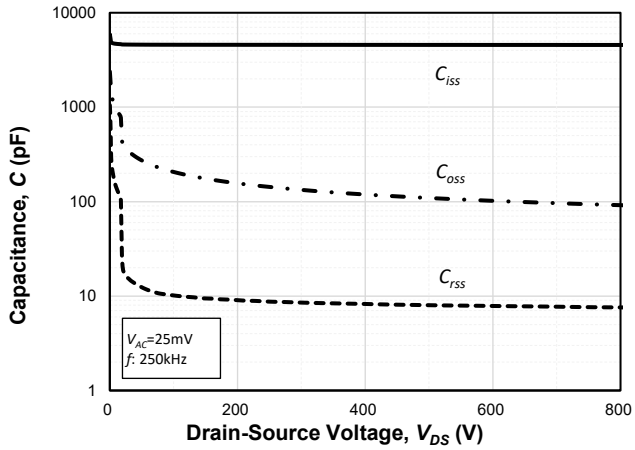


Fig. 16 Typ. Capacitance vs. V_{DS} at f_{sw}=250kHz, V_{DS}≤800V

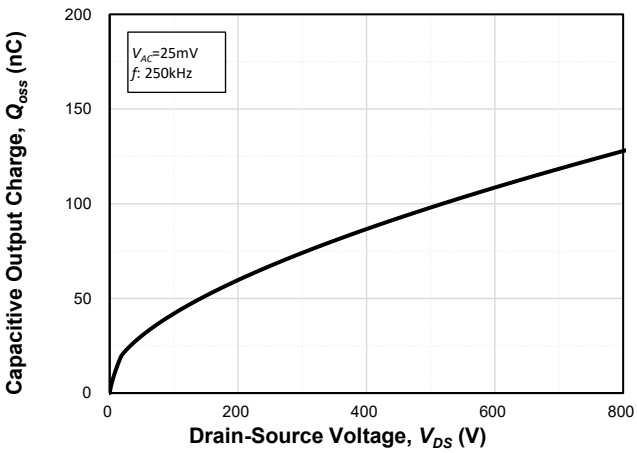


Fig. 17 Typ. Capacitive Output Charge at f_{sw}=250kHz

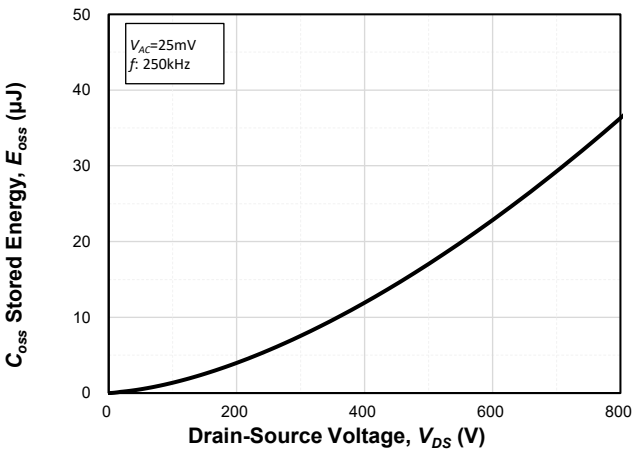


Fig. 18 Typ. C_{oss} Stored Energy at f_{sw}=250kHz

Electrical Characteristics Diagrams

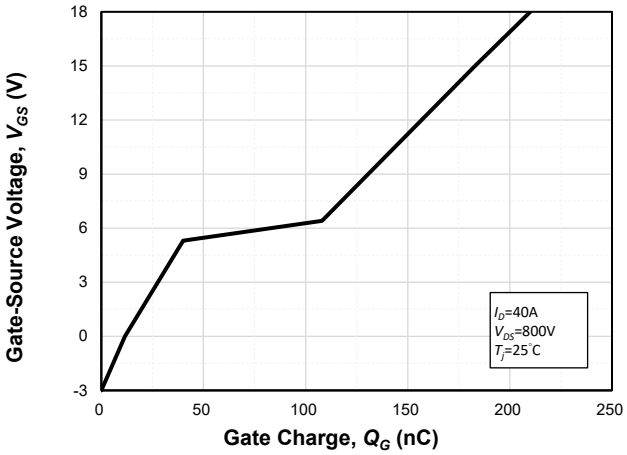


Fig. 19 Typ. Gate Charge at V_{DS}=800V, I_D=40A

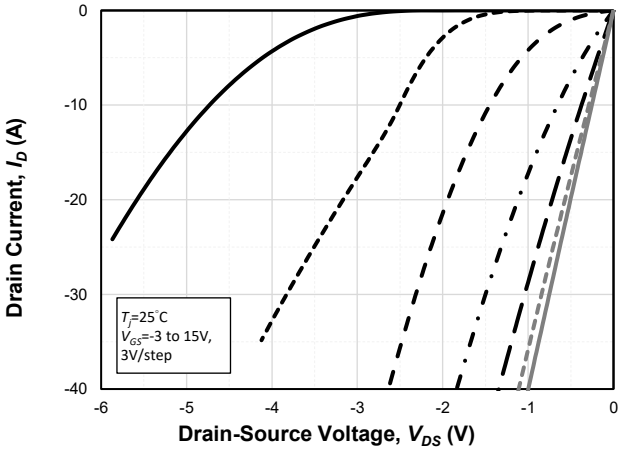


Fig. 20 Typical Forward Characteristics of Reverse Conduction at T_j=25°C

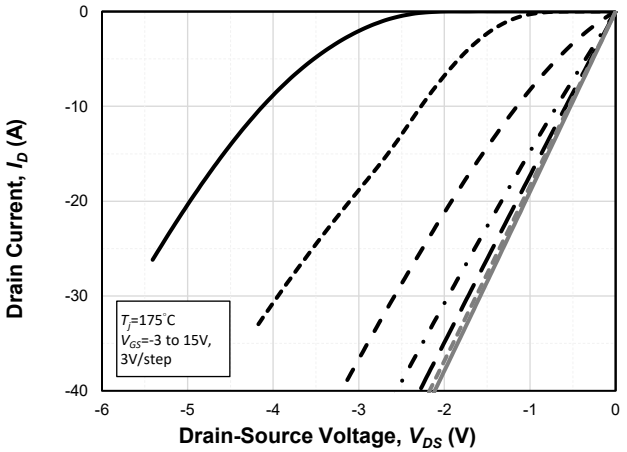


Fig. 21 Typical Forward Characteristics of Reverse Conduction at T_j=175°C

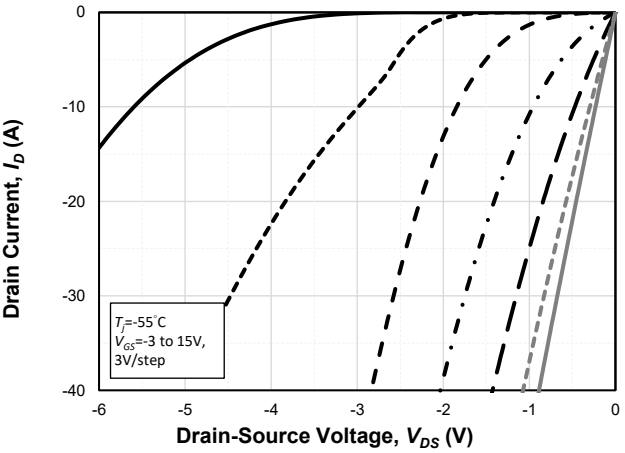


Fig. 22 Typical Forward Characteristics of Reverse Conduction at T_j=-55°C

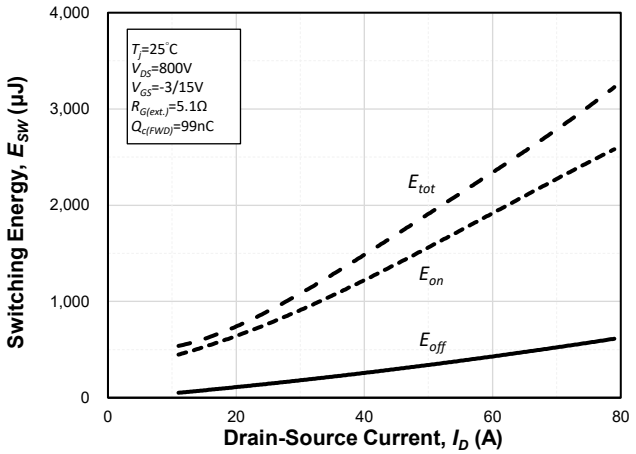
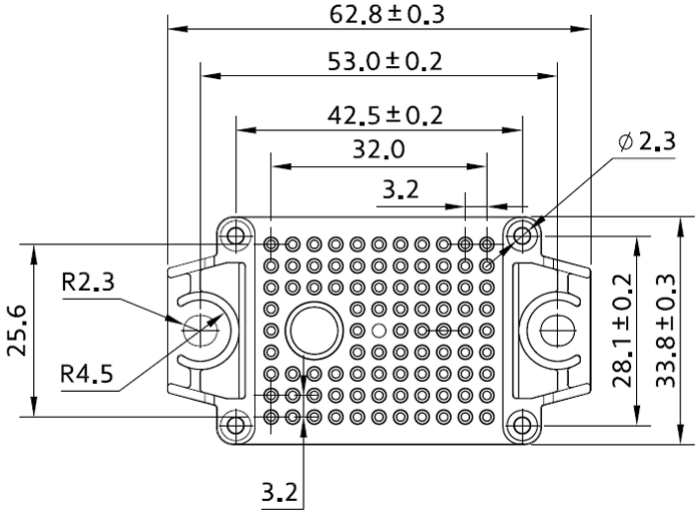
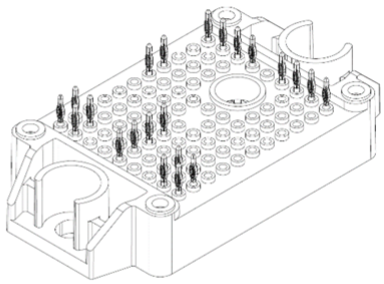
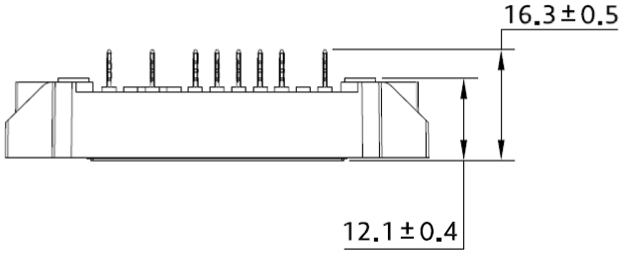


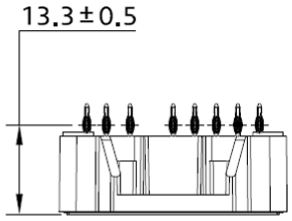
Fig. 23 Typ. Switching Energy vs. I_D

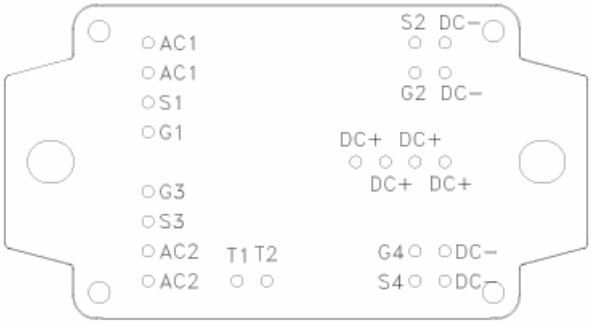
Package Outline

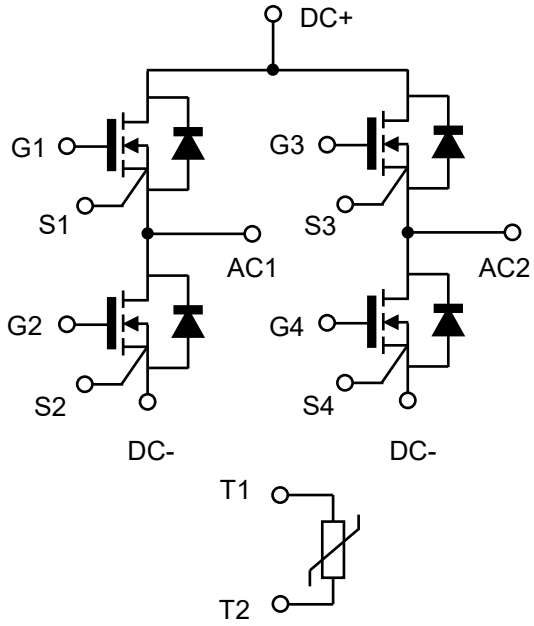












Note:

1. The information provided herein is subject to change without notice.
2. For other information that does not show on this datasheet, please contact us for inquiry.

Revision History

Date	Revision	Changes
25.03	Preliminary	1st issue
26.02	Preliminary	Update the insulation information

Important Note (Disclaimer)

Fast SiC Semiconductor Inc. (“FSS”) reserves the right to make changes and improvements to this product and the information provided in this document may be subject to change without prior notice. Buyers should contact FSS sales representatives to obtain the latest information on this product before placing order and are solely responsible for the selection and use of this product. In addition, any information given in this document is only intended to show the typical functions that can vary in different applications and shall not be regarded as a guarantee or warranty of conditions or characteristics.

This product is not designed or intended for use for applications in which the failure of the product could lead to personal injury, death or property damage, including but not limited to equipment used in medical systems, traffic communication or control systems, transportations (cars, ships, trains) and aerospace. FSS shall have no responsibility for any damages or injury arising from non-compliance with the recommended usage conditions provided herein.

Published by:
Fast SiC Semiconductor Inc.
Hsinchu, Taiwan