fast SiC semiconductor

FF07007M2

Product Datasheet

Silicon Carbide MOSFET

750V, 7mΩ SiC MOSFET – Falcon M2 Series

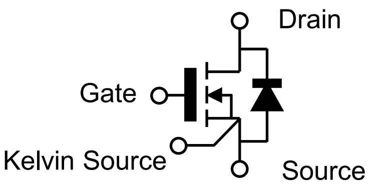
Features

- Optimized $R_{DS(on)}$ with Rapid Switching Behavior
- Compatible with Standard Gate Drivers
- Clean Kelvin-Source Switching Pin-out
- High Avalanche Endurance Capability
- Optimized for High Power Density Applications
- RoHS Compliant and Halogen Free

Potential Applications

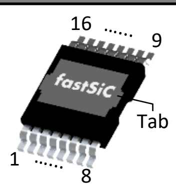
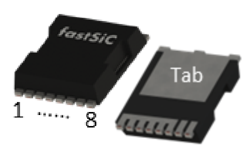
- Switching Mode Power Supply
- PFC & DC/DC Converter
- Portable Adaptor
- Renewable Energy
- Power Inverter
- Motor Driver

Product Information:



Benefits

- Higher System Efficiency
- Increase Parallel Device Convenience
- Enable High Temperature Application
- Allow High Frequency Operation
- Realize Compact and Lightweight Systems
- High Reliability

Product Information	Packaging Type	
	TOLT	TOLL
		
Gate	8	1
Drain	9-16, Tab	Tab
Source	1-6	3, 4, 5, 6, 7, 8
Kelvin Source	7	2
Part Number	FF07007M2K	FF07007M2F
Marking	FF07007M2	FF07007M2
Continuous Drain Current	266A	233A
Power Dissipation	1000W	750W

Key Performance Parameters

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS} @$T_{j(max)}$	750	V
Recommended Gate-Source Turn-On Voltage	V_{GS}	12~15	V
Drain-Source On-State Resistance	$R_{DS(on)}$	7	mΩ
Pulse Drain Current	$I_{D, pulse}$	590	A
Avalanche Energy	E_{AS}	3000	mJ
Gate Charge	Q_G	325.0	nC
Output Capacitive Charge	Q_{oss}	345.3	nC
Junction & Storage Temperature	T_j, T_{stg}	-55 to 175	°C

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

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions	
Drain-Source Voltage	V_{DSS}	750	--	--	V	V_{GS}=0V, I_D=1mA	
Continuous Drain Current	I_D	--	--	266	A	V_{GS}=15V, T_C=25°C	By package type[1]
				192	A	V_{GS}=15V, T_C=100°C	
Continuous Body Diode Current	I_S	--	--	187	A	V_{GS}=0V, T_C=25°C	
Pulse Drain Current	$I_{D, pulse}$	--	--	590	A	Per SOA	
Avalanche Energy, Single Pulse	E_{AS}	--	--	3000	mJ	L=25mH	
Operate Gate Source Voltage	$V_{GS, op}$	-8	--	12~15	V	Recommended operating values	
Transient Gate Source Voltage	$V_{GS, tran.}$	-9	--	19	V	Transient operating limit (AC f > 1Hz, pulse width < 100ns)	
Junction Temperature	T_j	-55	--	175	°C		
Storage Temperature	T_{stg}	-55	--	175	°C		
Soldering Temperature	T_L	--	--	260	°C		

[1] *Per figure section 2~6*

Electrical Characteristics:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
DC Characteristics (at T_j = 25°C, unless otherwise specified)						
Drain-source Breakdown Voltage	$V_{(BR)DSS}$	750	--	--	V	V_{GS}=0V, I_D=1mA, T_j=25°C
Drain-Source On-State Resistance	$R_{DS(on)}$	--	7	--	mΩ	V_{GS}=15V, I_D=80A, T_j=25°C
		--	10	--		V_{GS}=15V, I_D=80A, T_j=175°C
		--	8	--		V_{GS}=12V, I_D=80A, T_j=25°C
		--	11	--		V_{GS}=12V, I_D=80A, T_j=175°C
Gate-Source Threshold Voltage	V_{th}	--	2.5	--	V	V_{GS}=V_{DS}, I_D=100mA
Zero Gate Voltage Drain Current	I_{DSS}	--	<1	1000	μA	V_{DS}=750V, V_{GS}=0V, T_j=25°C
Gate-Source Leakage Current	I_{GSS}	--	--	100	nA	V_{GS}=15V, V_{DS}=0V
Body Diode Forward Voltage	V_{SD}	--	2.6	--	V	V_{GS}=0V, I_S=40A, T_j=25°C
		--	2.4	--		V_{GS}=0V, I_S=40A, T_j=175°C
AC Characteristics (at T_j = 25°C, unless otherwise specified)						
Input Capacitance	C_{iss}	--	11047.6	--	pF	V_{DS}=400V, V_{GS}=0V, f=250kHz, V_{AC}=25mV
Output Capacitance	C_{oss}	--	421.0	--	pF	
Reverse Capacitance	C_{rss}	--	24.4	--	pF	
Effective Output Capacitance, energy related	$C_{o(er)}$[1]	--	562.8	--	pF	
Effective Output Capacitance, time related	$C_{o(tr)}$[2]	--	863.8	--	pF	
C_{oss} Stored Energy	E_{oss}	--	45.0	--	μJ	
Output Capacitive Charge	Q_{oss}	--	345.3	--	nC	
Internal Gate Resistance	$R_{G, int.}$	--	1.6	--	Ω	f=1MHz, V_{AC}=25mV

[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 400V.
[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 400V.

Switching Characteristics:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Gate Characteristics						
Gate to Source Charge	Q_{GS}	--	85.0	--	nC	V_{DS}=400V, V_{GS}=0V/+15V, I_D=80A
Gate to Drain Charge	Q_{GD}	--	69.1	--		
Total Gate Charge	Q_G	--	325.0	--		
Inductive Load						
Turn On Delay Time	$t_{d(on)}$	--	TBD	--	nC	
Rise Time	t_r	--	TBD	--		
Turn Off Delay Time	$t_{d(off)}$	--	TBD	--		
Fall Time	t_f	--	TBD	--		
Turn On Switching Energy	E_{on}	--	TBD	--		
Turn Off Switching Energy	E_{off}	--	TBD	--		
Body Diode Characteristics						
Forward Recovery Charge	Q_{fr}	--	TBD	--	nC	
Forward Recovery Time	t_{fr}	--	TBD	--	ns	
Peak Foreard Recovery Current	I_{frm}	--	TBD	--	A	

[1] Test are based on TO-220-3L PKG

Thermal Characteristics:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Thermal Impedance, junction-case	$R_{th\text{-}jc}$	--	0.15	--	K/W	*TOLT*
		--	0.20	--		*TOLL*
Thermal Impedance, junction-ambient	$R_{th\text{-}ja}$	--	40	--		*Device on PCB, with 6 cm² of cooling area*

1. Electrical Characteristics Diagrams

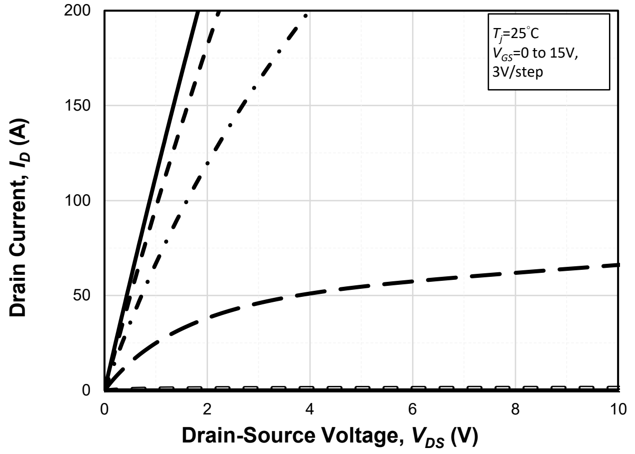


Fig. 1-1 Typical Output Characteristics at T_j=25°C

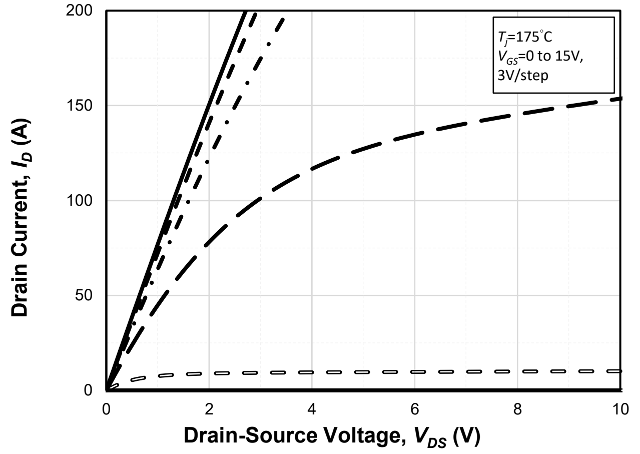


Fig. 1-2 Typical Output Characteristics at T_j=175°C

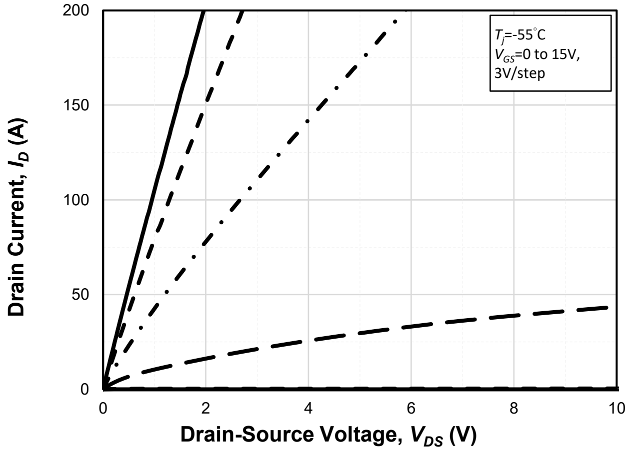


Fig. 1-3 Typical Output Characteristics at T_j=-55°C

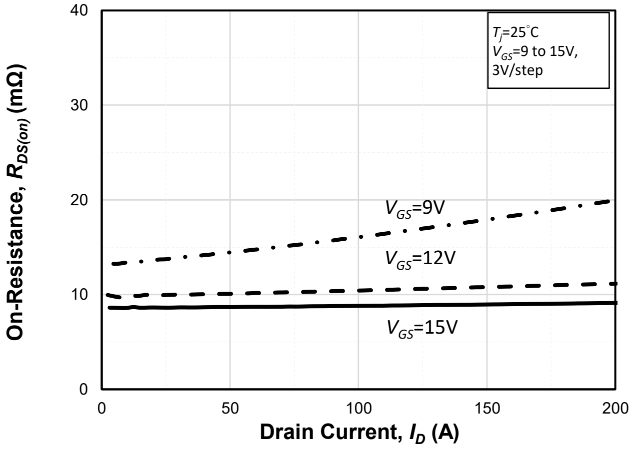


Fig. 1-4 Typ. $R_{DS(on)}$ vs. I_D with Various V_{GS}

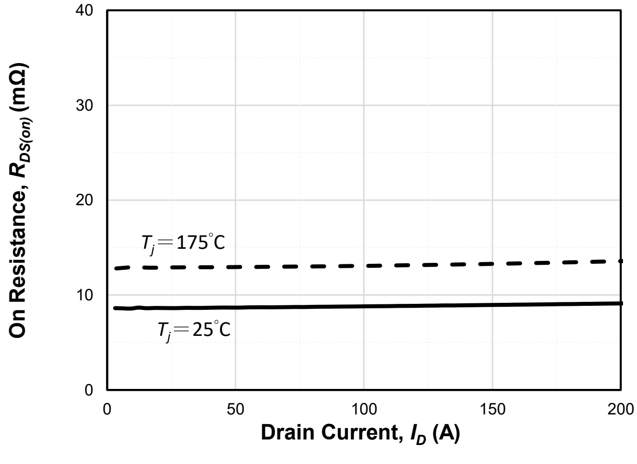


Fig. 1-5 Typ. $R_{DS(on)}$ vs. I_D with Various T_j, V_{GS}=15V

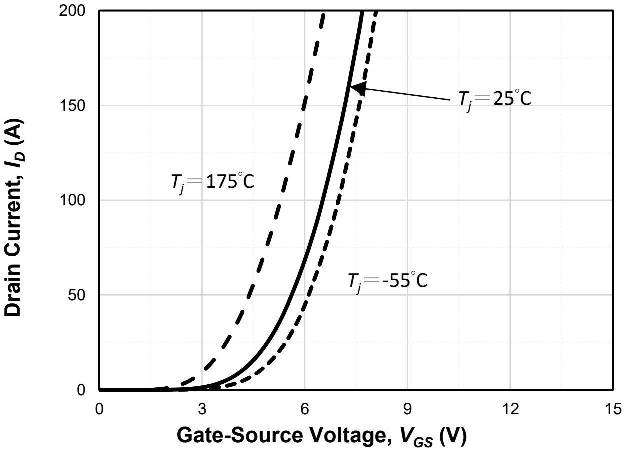


Fig. 1-6 Typ. I_D vs. V_{GS} with Various T_j, V_{DS}=10V

1. Electrical Characteristics Diagrams

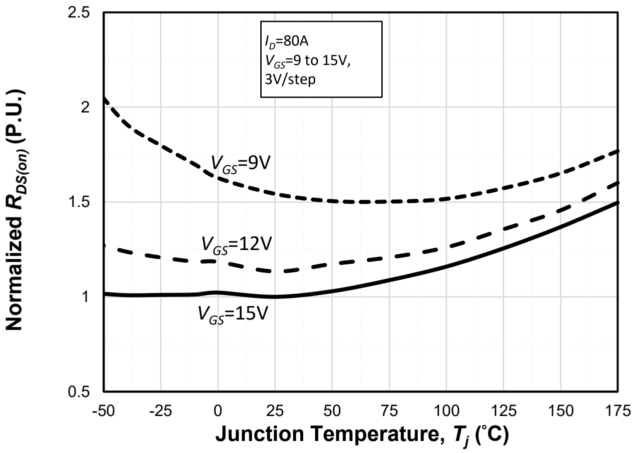


Fig. 1-7 Normalized $R_{DS(on)}$ vs. T_j with Various V_{GS}

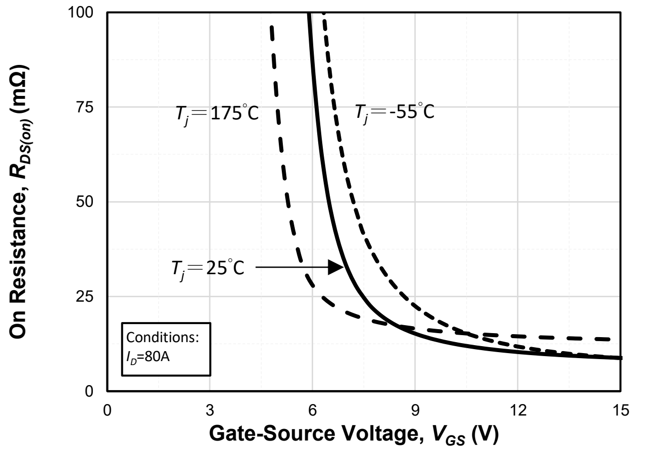


Fig. 1-8 Typ. $R_{DS(on)}$ vs. V_{GS} with Various T_j

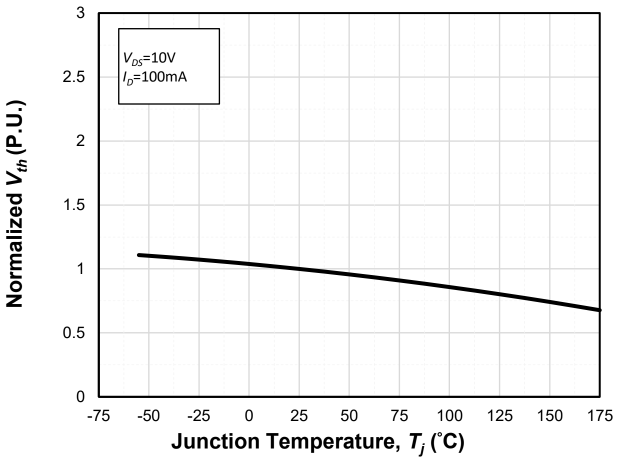


Fig. 1-9 Normalized V_{th} vs. T_j

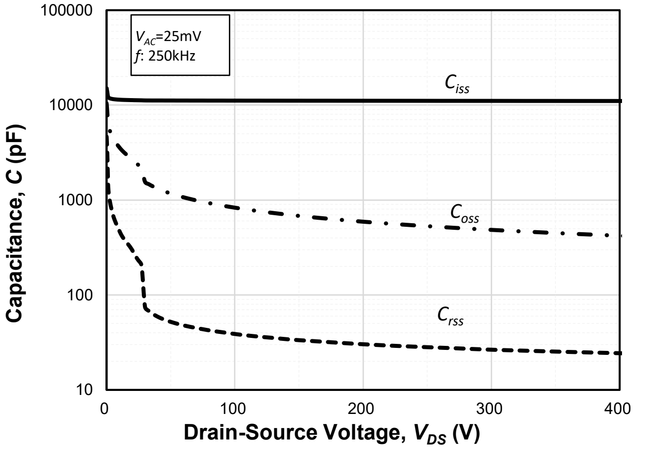


Fig. 1-10 Typ. Capacitance vs. V_{DS} at f_{sw}=250kHz

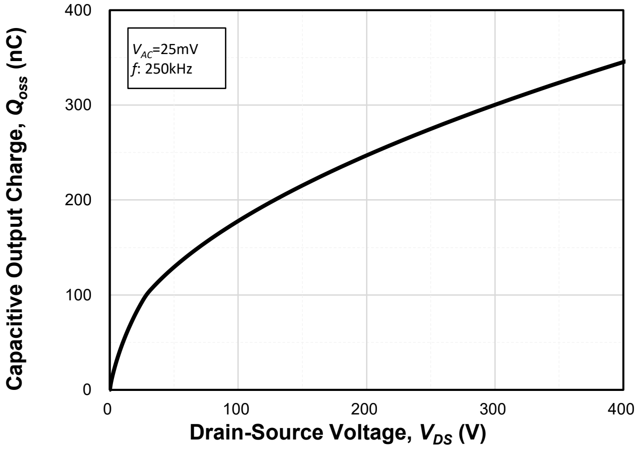


Fig. 1-11 Typ. Capacitive Output Charge at f_{sw}=250kHz

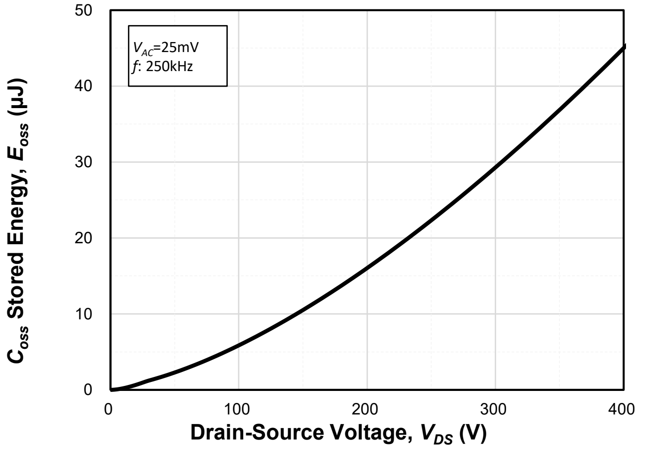


Fig. 1-12 Typ. CossStored Energy at fsw=250kHz

1. Electrical Characteristics Diagrams

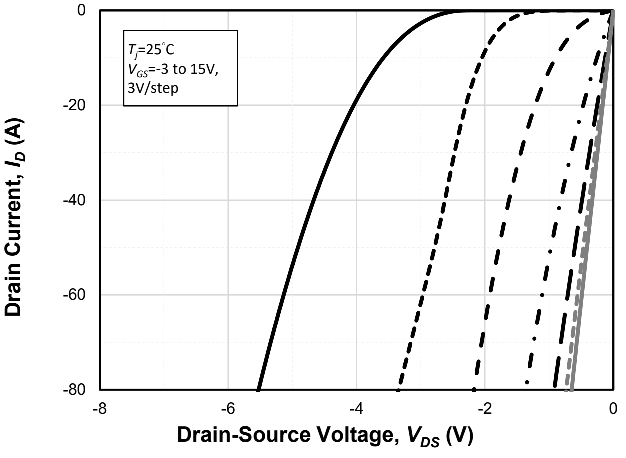


Fig. 1-13 Typical Forward Characteristics of Reverse Conduction at T_j=25°C

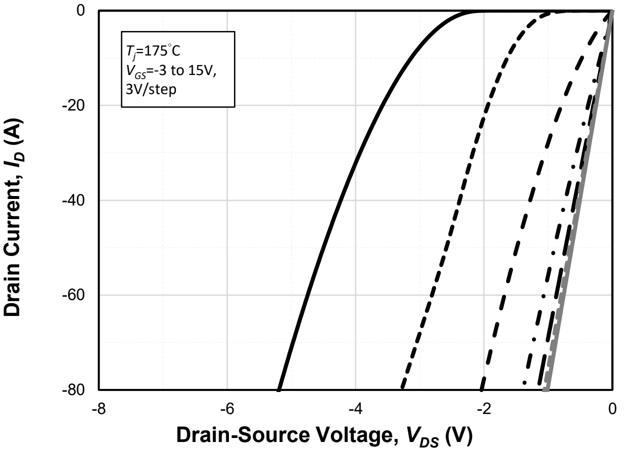


Fig. 1-14 Typical Forward Characteristics of Reverse Conduction at T_j=175°C

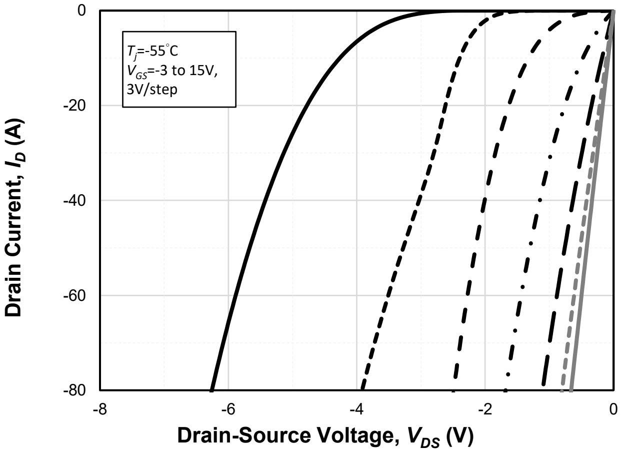


Fig. 1-15 Typical Forward Characteristics of Reverse Conduction at T_j=-55°C

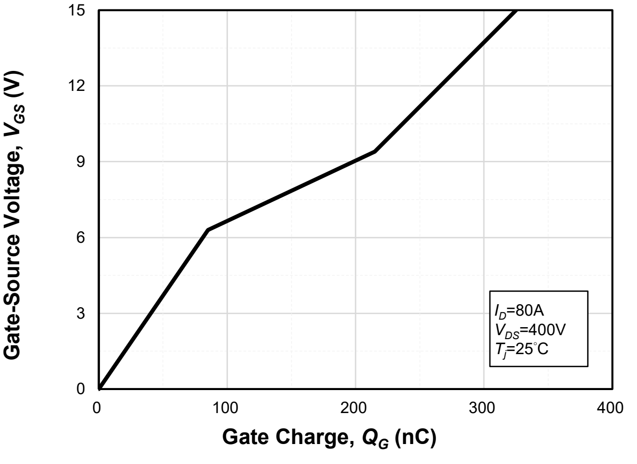


Fig. 1-16Typ. Gate Charge

2. Drain Power Dissipation

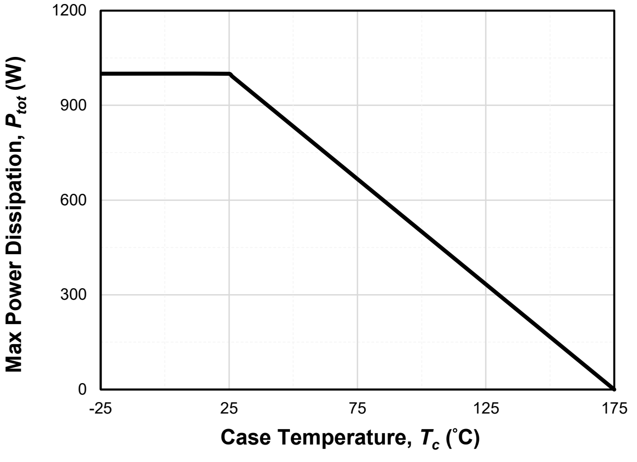


Fig. 2-1 Power Dissipation at V_{GS}=15V, T_j≤175˚C (TOLT)

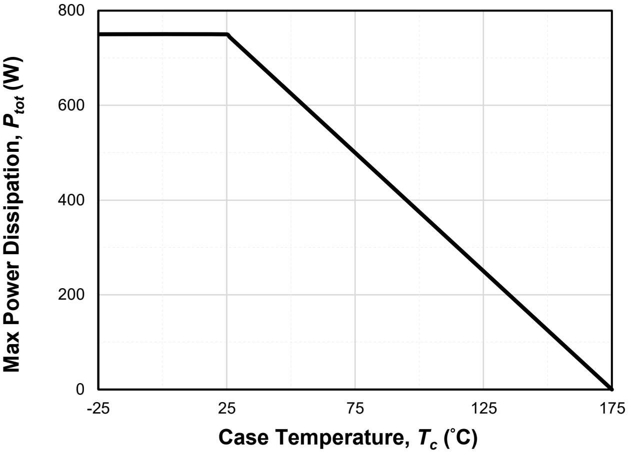


Fig. 2-2 Power Dissipation at V_{GS}=15V, T_j≤175˚C (TOLL)

3. Drain Current Dissipation

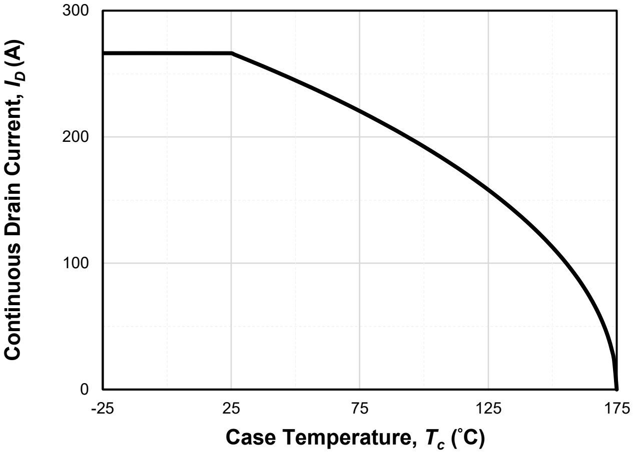


Fig. 3-1 Current Dissipation at V_{GS}=15V, T_j≤175˚C (TOLT)

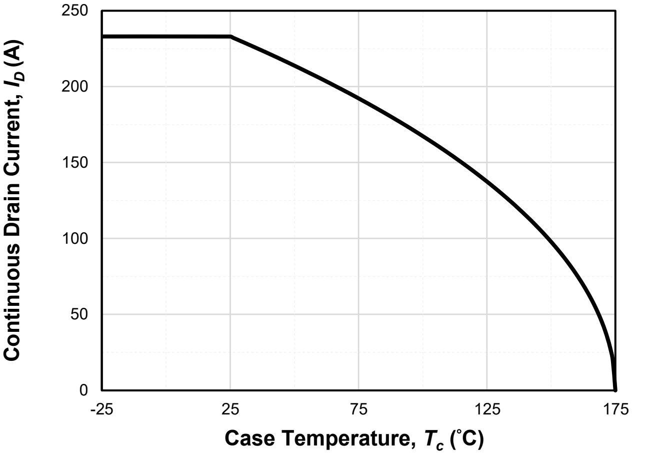


Fig. 3-2 Current Dissipation at V_{GS}=15V, T_j≤175˚C (TOLL)

4. Body Diode Current Dissipation

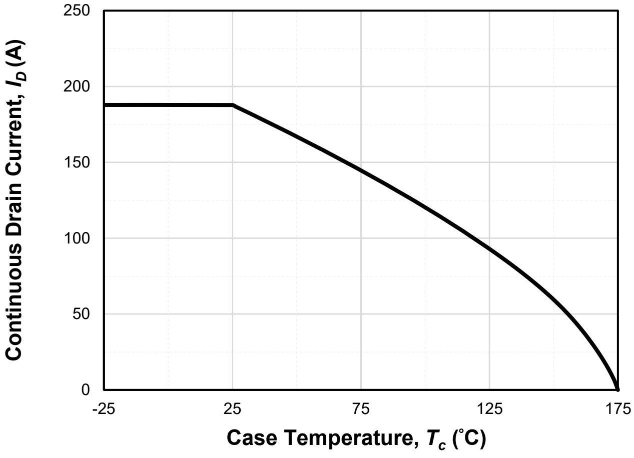


Fig. 4-1 Body Diode Current Dissipation at V_{GS}=0V, T_j≤175˚C (TOLT)

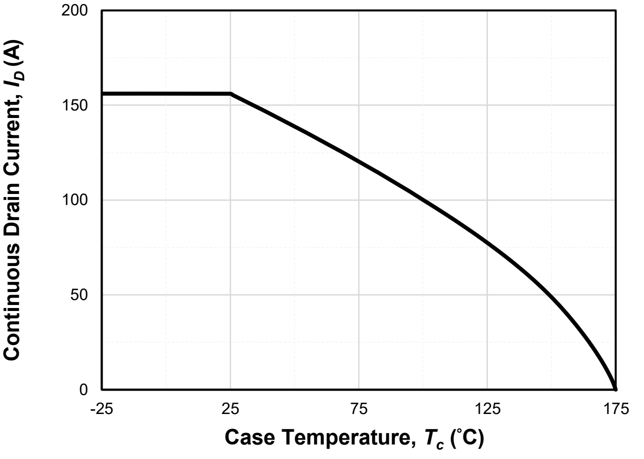


Fig. 4-2 Body Diode Current Dissipation at V_{GS}=0V, T_j≤175˚C (TOLL)

5. Thermal Impedance

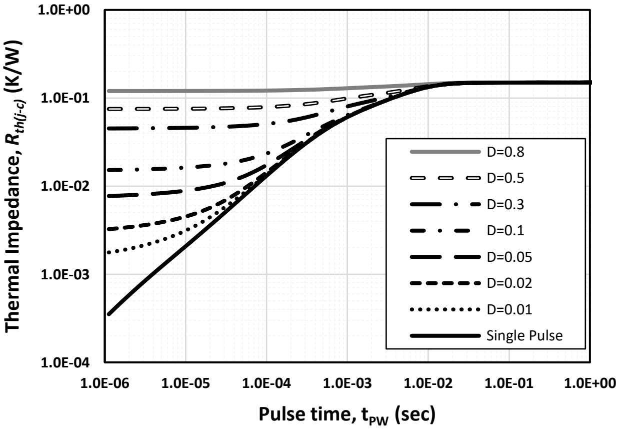


Fig. 5-1 Typ. Transient Thermal Impedance $R_{th\text{-}jc}$ (TOLT)

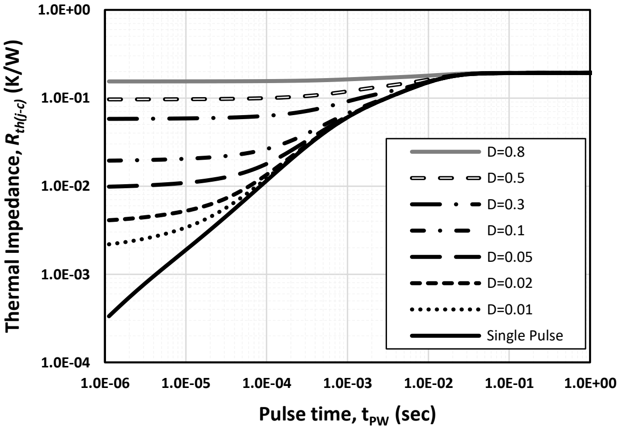


Fig. 5-2 Typ. Transient Thermal Impedance $R_{th\text{-}jc}$ (TOLL)

6. Safe Operating Area (25˚C)

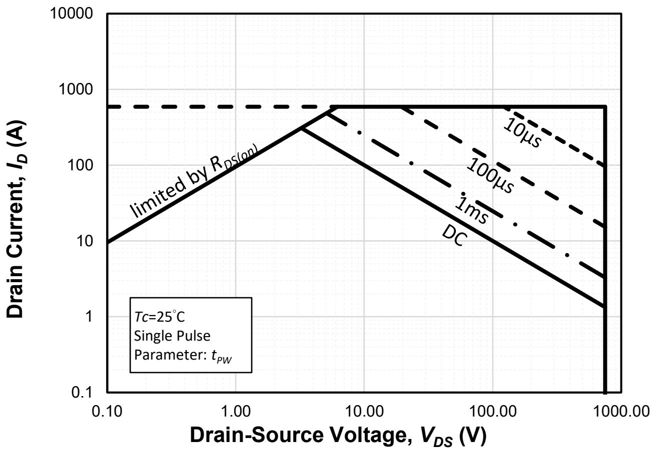


Fig. 6-1 Safe Operating Area at T_c=25˚C (TOLT)

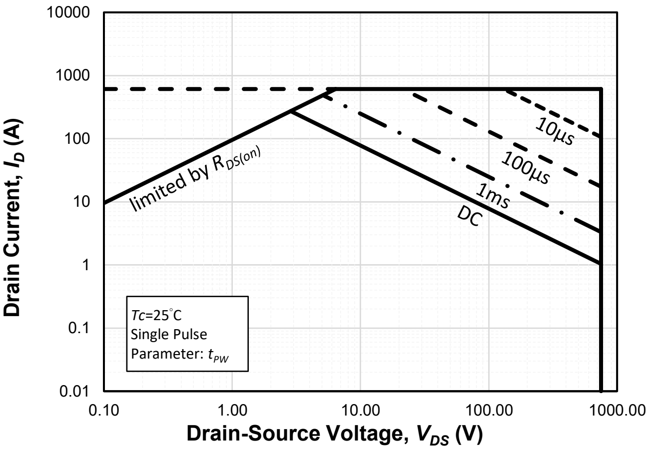


Fig. 6-2 Safe Operating Area at T_c=25˚C (TOLL)

7. Safe Operating Area (100˚C)

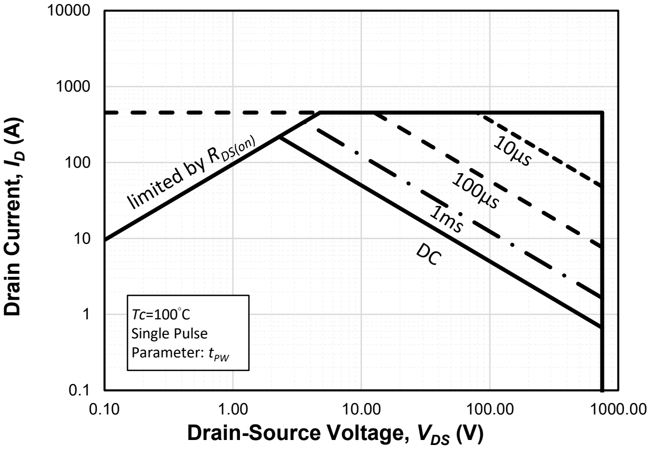


Fig. 7-1 Safe Operating Area at T_c=100˚C (TOLT)

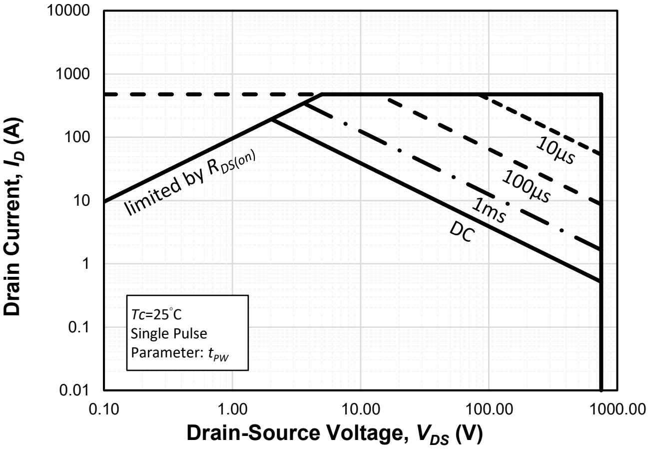
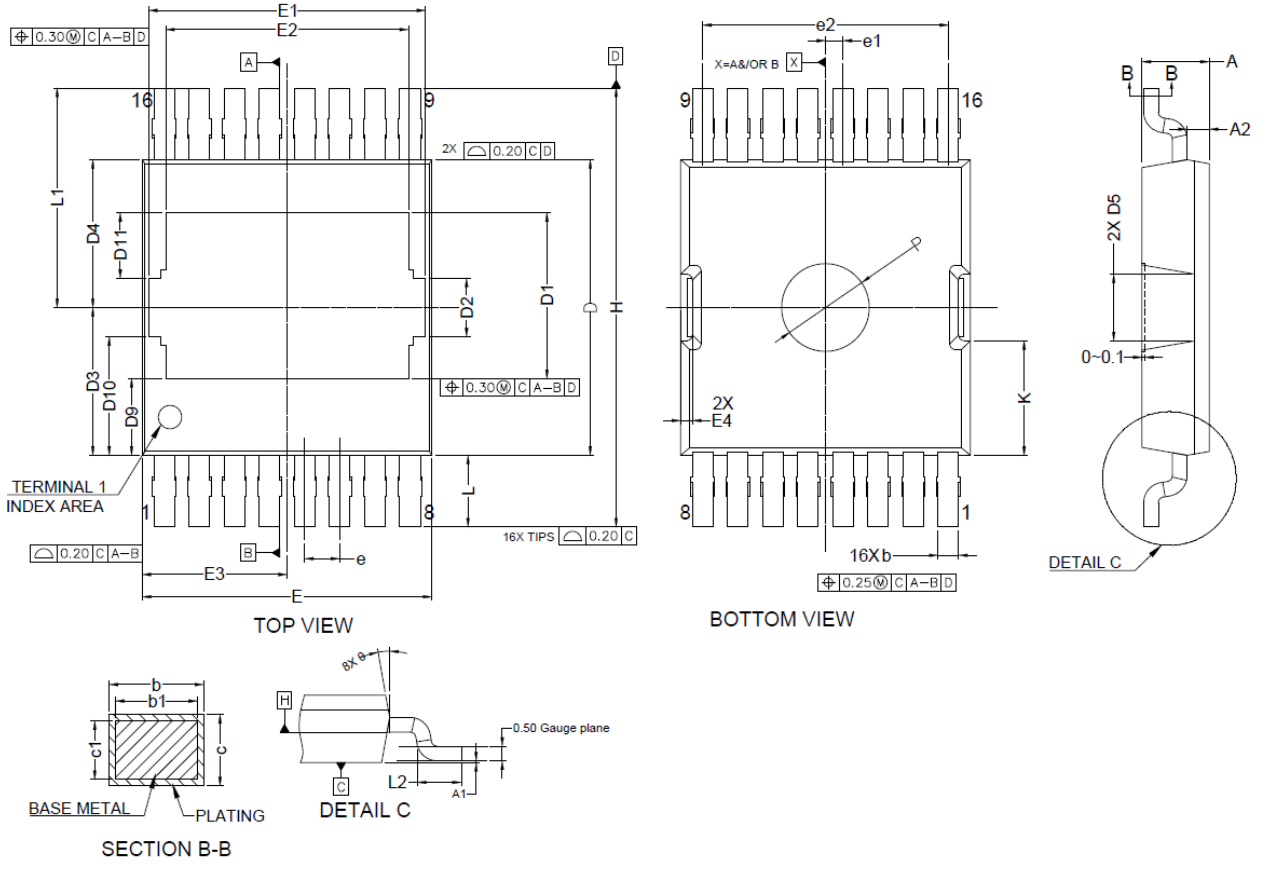


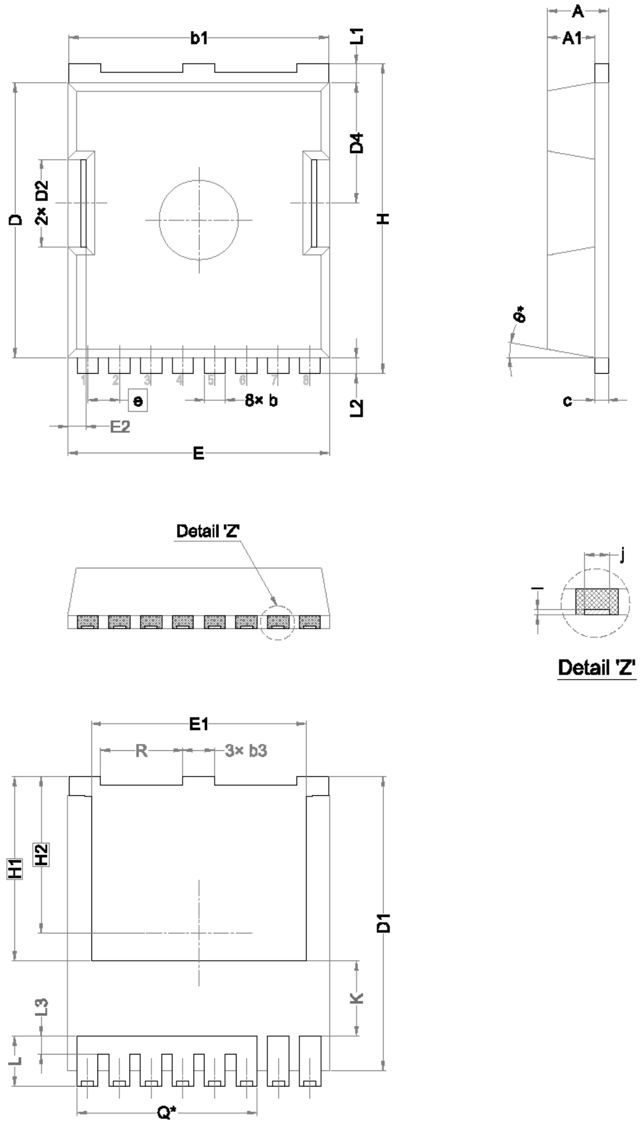
Fig. 7-2 Safe Operating Area at T_c=100˚C (TOLL)

Package Outline (TOLT)



SYMBOL	Dimension (Millimeters)			SYMBOL	Dimension (Millimeters)		
	MIN	TYP	MAX		MIN	TYP	MAX
A	2.2	2.275	2.35	E	9.7	9.9	10.1
A1	0.01	0.06	0.11	E1	9.26	9.46	9.66
A2	0.56	0.76	0.96	E2	8.1	8.3	8.5
b	0.6	0.725	0.85	E3	4.75	4.95	5.15
b1	0.6	0.7	0.8	E4	0.2	0.4	0.6
c	0.45	0.55	0.65	e	1.2 BSC.		
c1	0.45	0.525	0.6	e1	0.6 BSC.		
D	10	10.15	10.3	e2	8.4 BSC.		
D1	5.47	5.67	5.87	H	14.8	15	15.2
D2	1.8	2	2.2	K	3.71	3.91	4.11
D3	4.85	5.05	5.25	L	2.25	2.45	2.65
D4	5	5.065	5.13	L1	7.3	7.5	7.7
D5	2.08	2.28	2.48	L2	1.3	1.5	1.7
D9	2.42	2.62	2.82	R	0.07		--
D10	3.85	4.05	4.25	P	2.9	3	3.1
D11	2.04	2.24	2.44	θ	4°	7°	10°

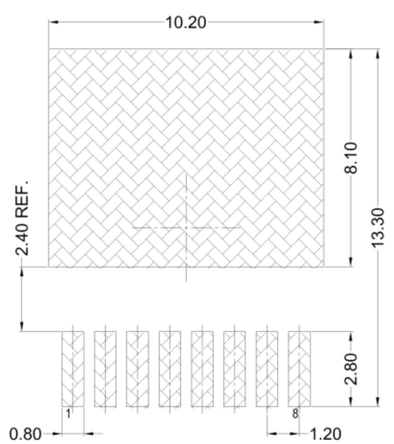
Package Outline (TOLL, MO-299B)



Symbol	Dimension (Millimeters)		
	Min.	Nom.	Max.
A	2.20	2.30	2.40
A1	1.70	1.80	1.90
b	0.70	0.80	0.90
b1	9.70	9.80	9.90
b3	1.10	1.20	1.30
c	0.40	0.50	0.60
D	10.28	10.38	10.48
D1	10.98	11.08	11.18
D2	3.20	3.30	3.40
D4	4.45	4.55	4.65
E	9.80	9.90	10.00
E1	8.00	8.10	8.20
E2	0.60	0.70	0.80
e	1.20 BSC.		
H	11.58	11.68	11.78
H1	6.95 BSC.		
H2	5.89 BSC.		
i	0.10 REF.		
j	0.46REF.		
K	2.80 REF.		
L	1.40	1.90	2.10
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	0.30	0.70	0.80
N	8		
Q	6.80 REF.		
R	3.00	3.10	3.20
θ	10° REF.		

Note:

1. Dimensions do not inclusive burrs and mold flash.
2. "*" is for reference.



Land Pattern (Only for reference)

Revision History

Date	Revision	Changes
25.10	Tentative	1st issue
25.12	Tentative	Add gate charge

Important Note (Disclaimer)

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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.

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