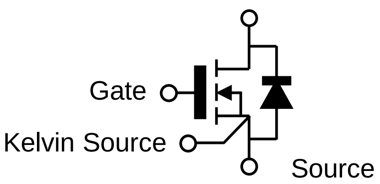
Silicon Carbide MOSFET

650V, 100mΩ SiC MOSFET – Falcon Series

RoHS COMPLIANT LEAD FREE · HAL FREE

Product Information:



TOLL PDFN8x8 TO-263-7L

Terminal	Packaging Type		
	TOLL	PDFN 8x8	TO-263-7L
Gate	1	1	1
Drain	Tab	5	Tab
Kelvin Source	2	2	2
Source	3~8	3, 4	3~7

Features

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

Benefits

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

Potential Applications

- Switching Mode Power Supply
- PFC & DC/DC Converter
- Charging Station
- Motor Driver
- Renewable Energy
- Power Inverter

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}	15~18	
Drain-Source On-State Resistance	$R_{DS(on)}$	100	mΩ
Continuous Drain Current	I_D	20.6	A
Pulse Drain Current	$I_{D,\ pulse}$	68	
Power Dissipation	P_{tot}	83	W
Avalanche Energy	E_{AS}	300	mJ
Gate Charge	Q_G	43	nC
Output Capacitive Charge	Q_{oss}	40.8	
Junction & Storage Temperature	T_j, T_{stg}	-55 to 175	°C

Part Number	Package	Marking
FF06100F	TOLL	FF06100
FF06100G	PDFN 8 x 8	FF06100
FF06100J-7	TO-263-7L	FF06100

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}	650	--	--	V	V_{GS}=0V, I_D=100μA
Continuous Drain Current	I_D	--	--	20.6 15	A	V_{GS}=18V, T_C=25°C V_{GS}=18V, T_C=100°C
Pulse Drain Current	$I_{D,\ pulse}$	--	--	68	A	Per Fig. 12
Continuous Body Diode Current	I_S	--	--	15.7	A	V_{GS}=0V, T_C=25°C
Avalanche Energy, Single Pulse	E_{AS}	--	--	300	mJ	L=25mH
Operate Gate Source Voltage	$V_{GS,\ op}$	-8~0	--	15~18	V	Recommended operating values
Transient Gate Source Voltage	$V_{GS,\ tran.}$	-10	--	22	V	Transient operating limit (AC f > 1Hz, pulse width < 100ns)
Power Dissipation	P_{tot}	--	--	83	W	T_c =25°C
Junction Temperature	T_j	-55	--	175	°C	--
Storage Temperature	T_{stg}	-55	--	175	°C	--
Soldering Temperature	T_L	--	--	260	°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	$V_{(BR)DSS}$	650 --	-- 750	--	V	V_{GS}=0V, I_D=100μA, T_j=25°C V_{GS}=0V, I_D=100μA, T_j=175°C
Drain-Source On-State Resistance	$R_{DS(on)}$	--	100 115	--	mΩ	V_{GS}=18V, I_D=10A, T_j=25°C V_{GS}=18V, I_D=10A, T_j=100°C
Gate-Source Threshold Voltage	V_{th}	--	2.2	--	V	V_{GS}=V_{DS} ,I_D=14mA
Zero Gate Voltage Drain Current	I_{DSS}	--	1	--	μA	V_{DS}=650V, V_{GS}=0V, T_j=25°C
Gate-Source Leakage Current	I_{GSS}	--	--	100	nA	V_{GS}=18V, V_{DS}=0V
Body Diode Forward Voltage	V_{SD}	--	2.95 2.65	--	V	V_{GS}=0V, I_S=5A, T_j=25°C V_{GS}=0V, I_S=5A, T_j=175°C
AC Characteristics (at T_j = 25°C, unless otherwise specified)						
Input Capacitance	C_{iss}	--	1000	--	pF	V_{DS}=400V, V_{GS}=0V, f=250kHz, V_{AC}=25mV
Output Capacitance	C_{oss}	--	74	--	pF	
Reverse Capacitance	C_{rss}	--	9	--	pF	
Effective Output Capacitance, energy related	$C_{o(er)}$[1]	--	79.6	--	pF	
Effective Output Capacitance, time related	$C_{o(tr)}$[2]	--	102	--	pF	
C_{oss} Stored Energy	E_{oss}	--	6.35	--	μJ	
Output Capacitive Charge	Q_{oss}	--	40.8	--	nC	
Internal Gate Resistance	$R_{G,\ int.}$	--	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}	--	6.4	--	nC	V_{DS}=400V, V_{GS}=0V/15V, I_D=5A
Gate to Drain Charge	Q_{GD}	--	8.5	--		
Total Gate Charge	Q_G	--	43	--		
Inductive Load						
Turn On Delay Time	$t_{d(on)}$	--	24	--	ns	V_{DS}=400V, I_D=13.5A, V_{GS}=-3/+15V, $R_{G(ext.)}$= 2.7Ω External SiC Diode as an FWD
Rise Time	t_r	--	33	--		
Turn Off Delay Time	$t_{d(off)}$	--	23	--		
Fall Time	t_f	--	11	--		
Turn On Switching Energy	E_{on}	--	107	--	µJ	
Turn Off Switching Energy	E_{off}	--	26	--		
Resistive Load						
Turn On Delay Time	$t_{d(on)}$	--	11	--	ns	V_{DS}=400V, I_D=10A, V_{GS}=-3/+15V, $R_{G(ext.)}$= 2.7Ω R_L=40Ω,
Rise Time	t_r	--	15	--		
Turn Off Delay Time	$t_{d(off)}$	--	25	--		
Fall Time	t_f	--	11	--		
Body Diode Characteristics						
Reverse Recovery Charge	Q_{rr}	--	47	--	nC	V_{GS}=0V, I_S=5A, V_{DS}=400V, di/dt=300A/µs *Q_{rr} herein excluded the Q_{oss} value.
Reverse Recovery Time	t_{rr}	--	43	--	ns	
Peak Reverse Recovery Current	I_{rrm}	--	1.95	--	A	

Thermal Characteristics:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Thermal Impedance, junction-case	$R_{th\text{-}jc}$	--	1.8	--	K/W	--
Thermal Impedance, junction-ambient	$R_{th\text{-}ja}$	--	--	--		Device on PCB, with 6 cm² of cooling area

Electrical Characteristics Diagrams

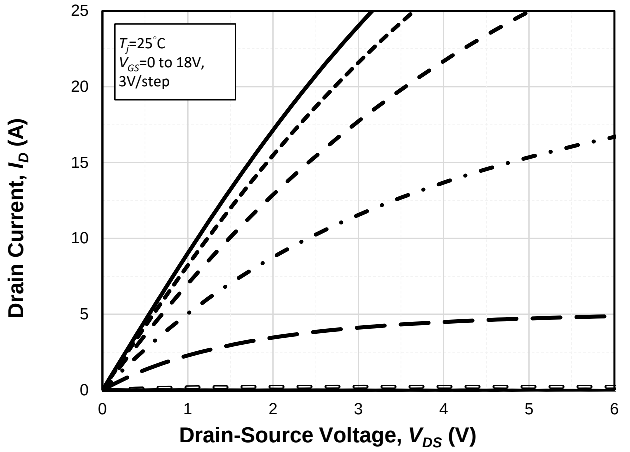


Fig. 1 Typical Output Characteristics at T_j=25°C

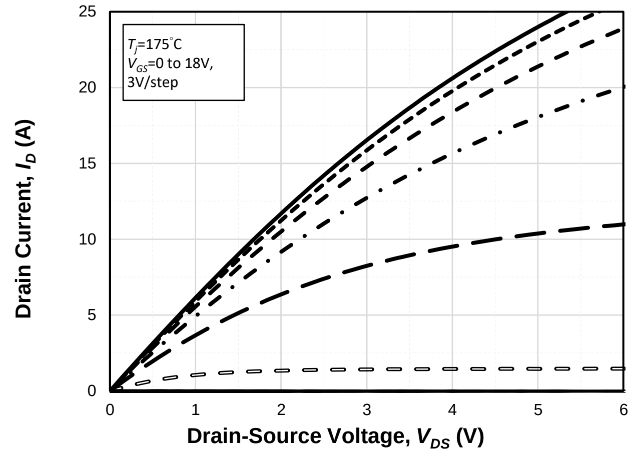


Fig. 2 Typical Output Characteristics at T_j=175°C

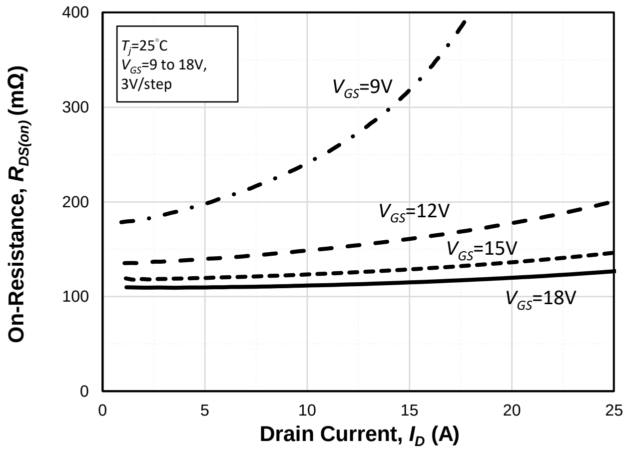


Fig. 3 Typ. $R_{DS(on)}$ vs. I_D with Various V_{GS}

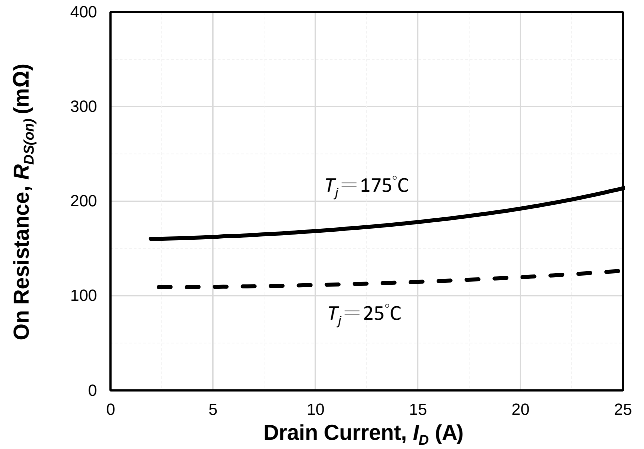


Fig. 4 Typ. $R_{DS(on)}$ vs. I_D with Various T_j, V_{GS}=18V

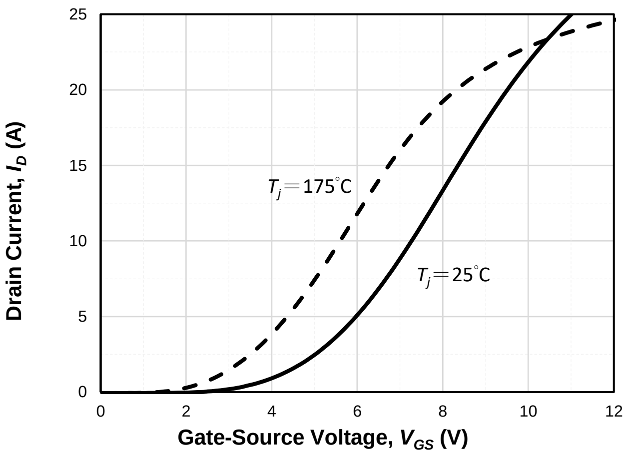


Fig. 5 Typ. I_D vs. V_{GS} with Various T_j, V_{DS}=10V

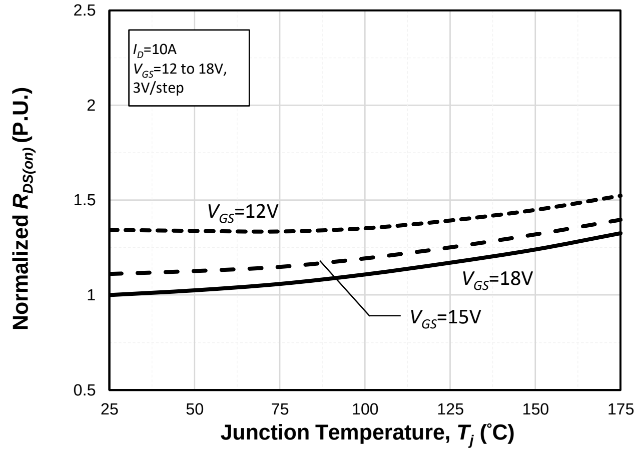


Fig. 6 Normalized $R_{DS(on)}$ vs. T_j with Various V_{GS}

Electrical Characteristics Diagrams

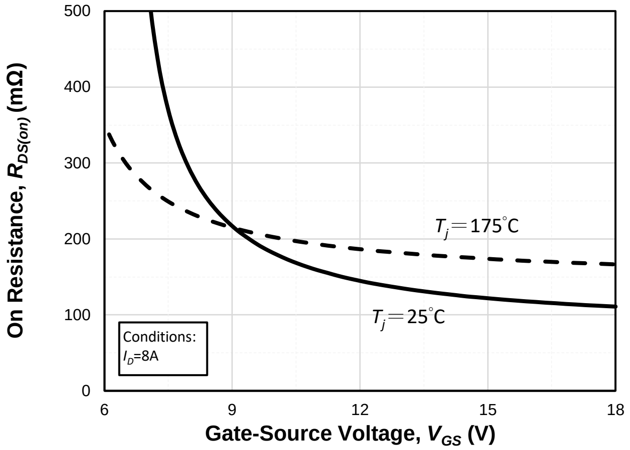


Fig. 7 Typ. $R_{DS(on)}$ vs. V_{GS} with Various T_j

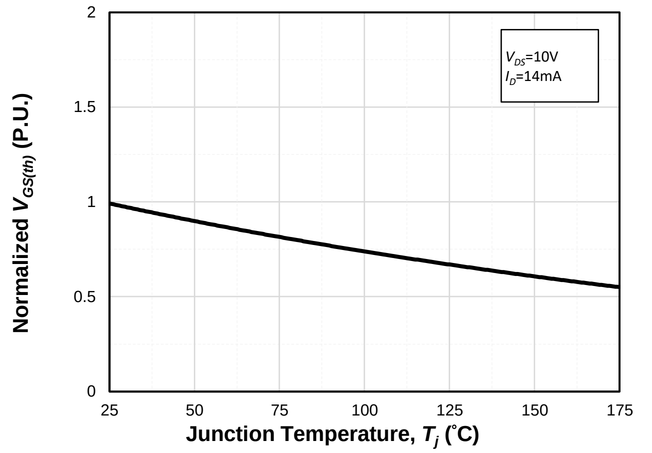


Fig. 8 Normalized V_{th} vs. T_j

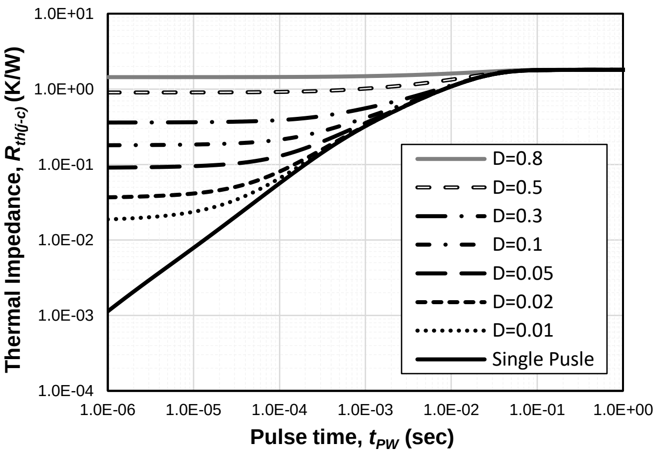


Fig. 9 Typ. Transient Thermal Impedance $R_{th\text{-}jc}$

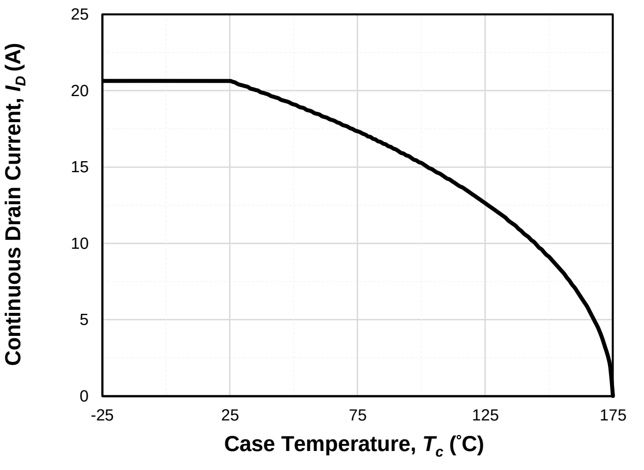


Fig. 10 Continuous I_D De-rating at V_{GS}=18V, T_j≤175˚C

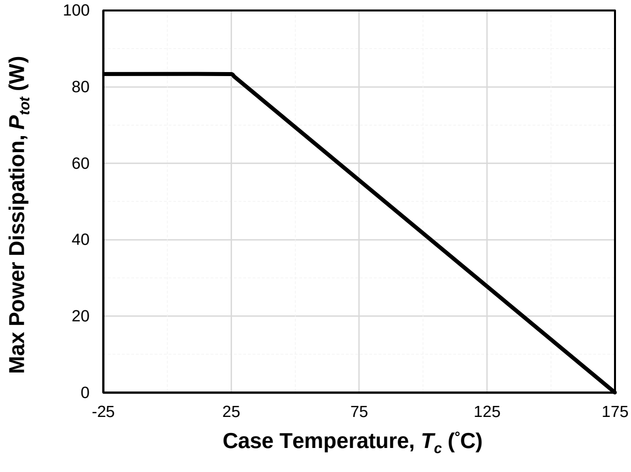


Fig. 11 Power Dissipation at V_{GS}=18V, T_j≤175˚C

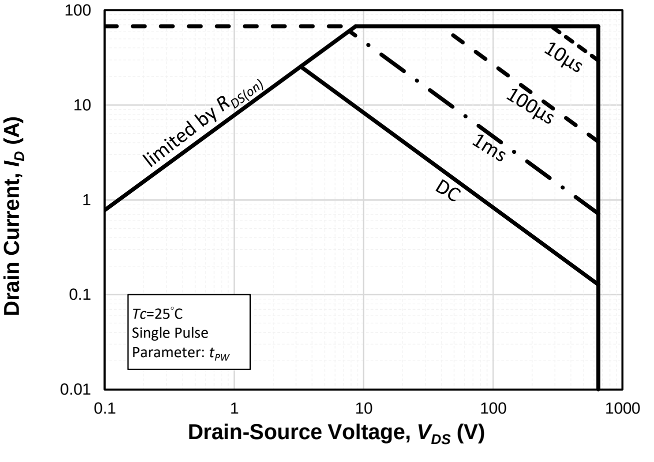


Fig. 12 Safe Operating Area at T_c=25˚C

Electrical Characteristics Diagrams

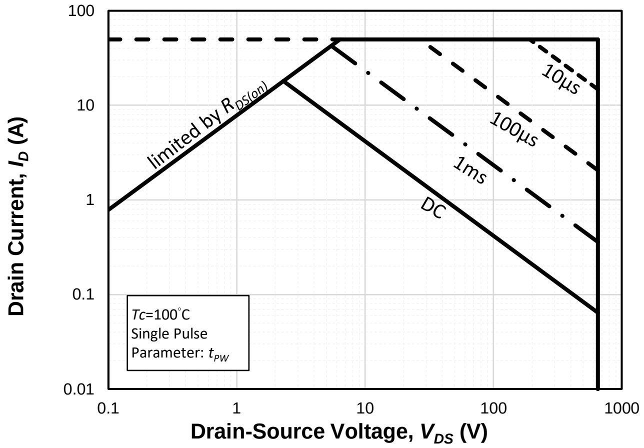


Fig. 13 Safe Operating Area at T_c=100˚C

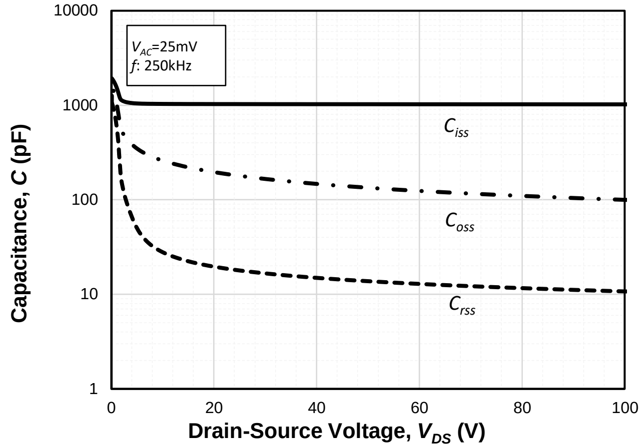


Fig. 14 Typ. Capacitance vs. V_{DS} at f_{sw}=250kHz, V_{DS}≤100V

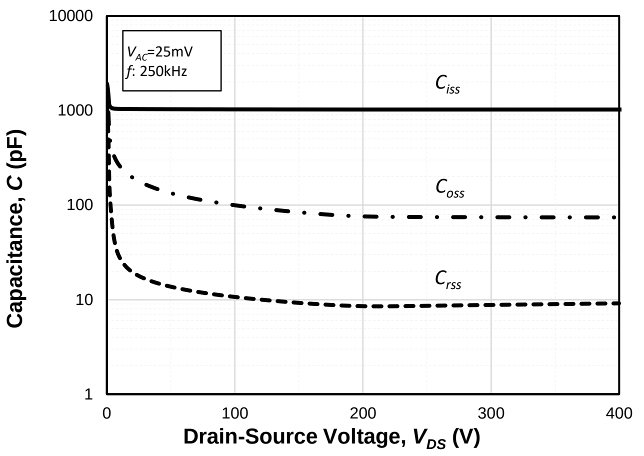


Fig. 15 Typ. Capacitance vs. V_{DS} at f_{sw}=250kHz, V_{DS}≤400V

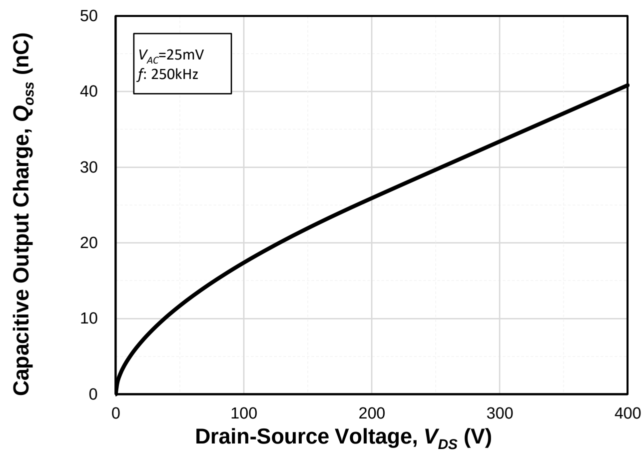


Fig. 16 Typ. Capacitive Output Charge at f_{sw}=250kHz

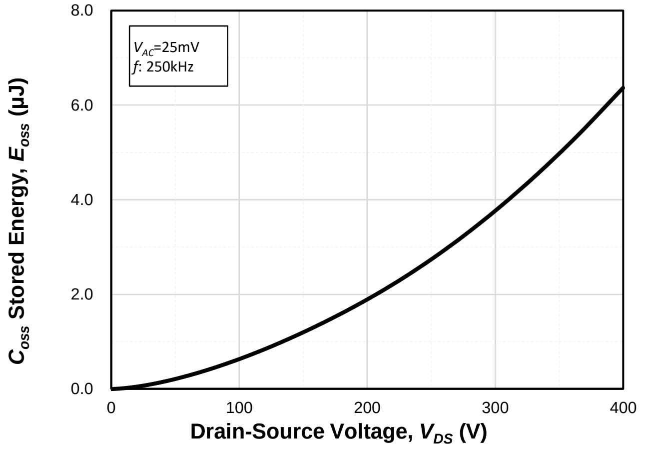


Fig. 17 Typ. C_{oss} Stored Energy at f_{sw}=250kHz

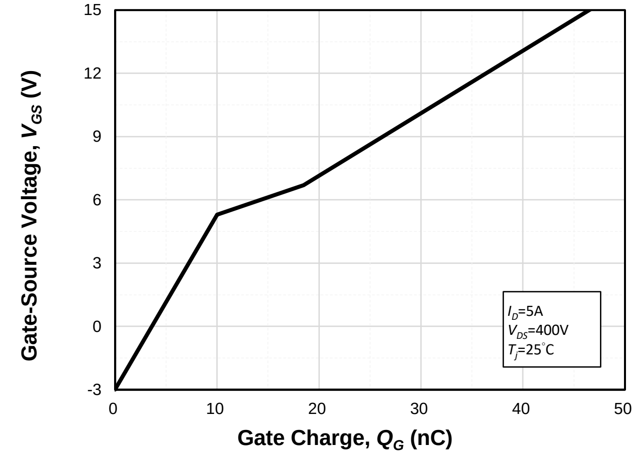


Fig. 18 Typ. Gate Charge at V_{DS}=400V, I_D=5A

Electrical Characteristics Diagrams

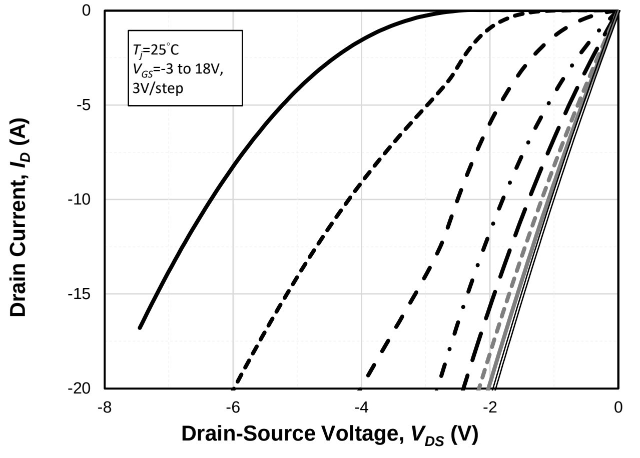


Fig. 19 Typical Forward Characteristics of Reverse Conduction at T_j=25°C

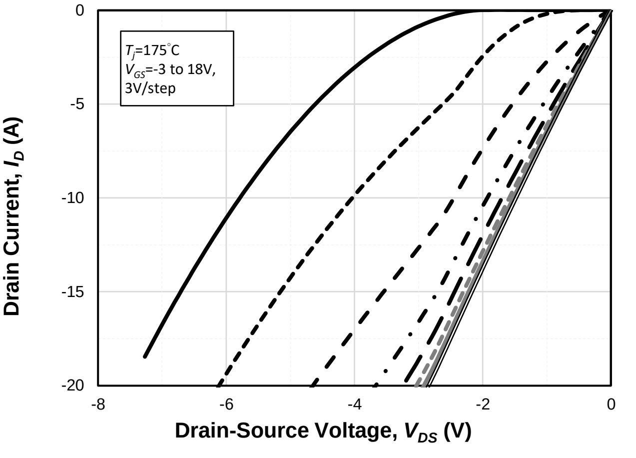


Fig. 20 Typical Forward Characteristics of Reverse Conduction at T_j=175°C

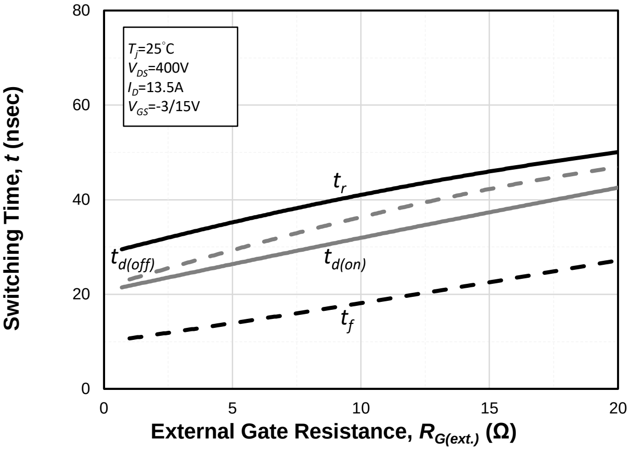


Fig. 21 Typ. Switching Time vs. $R_{G(ext.)}$

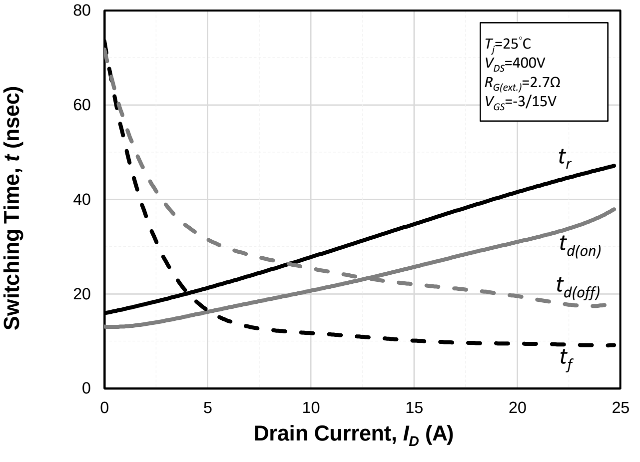


Fig. 22 Typ. Switching Time vs. I_D

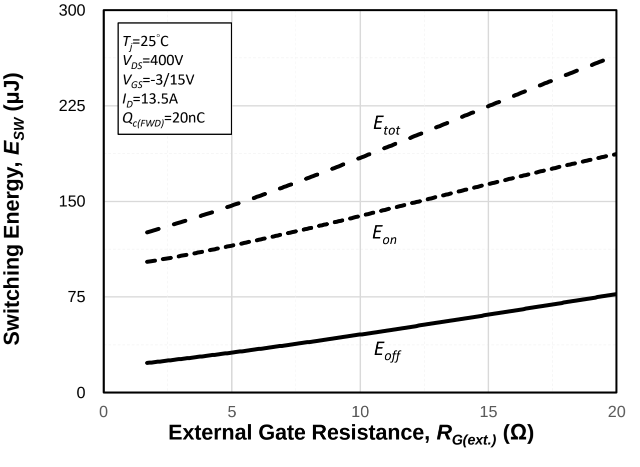


Fig. 23 Typ. Switching Energy vs. $R_{G(ext.)}$

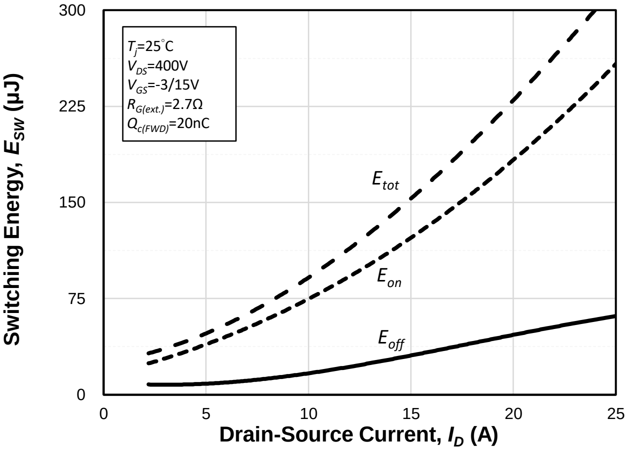
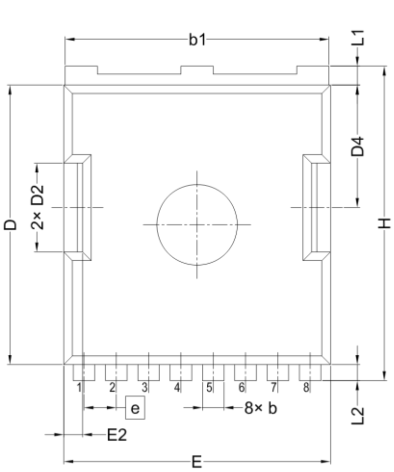
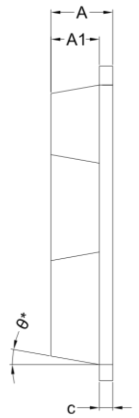
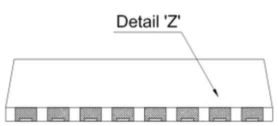


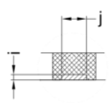
Fig. 24 Typ. Switching Energy vs. I_D

Package Outline (TOLL, MO-299B)

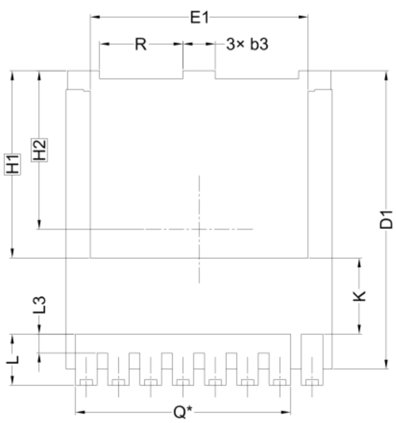


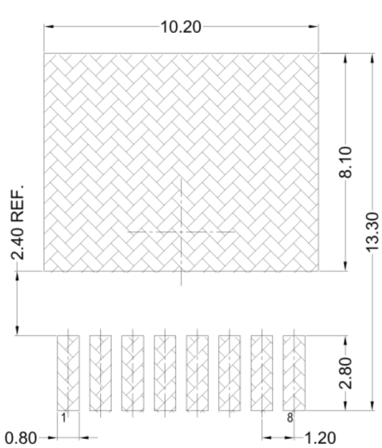






Detail 'Z'





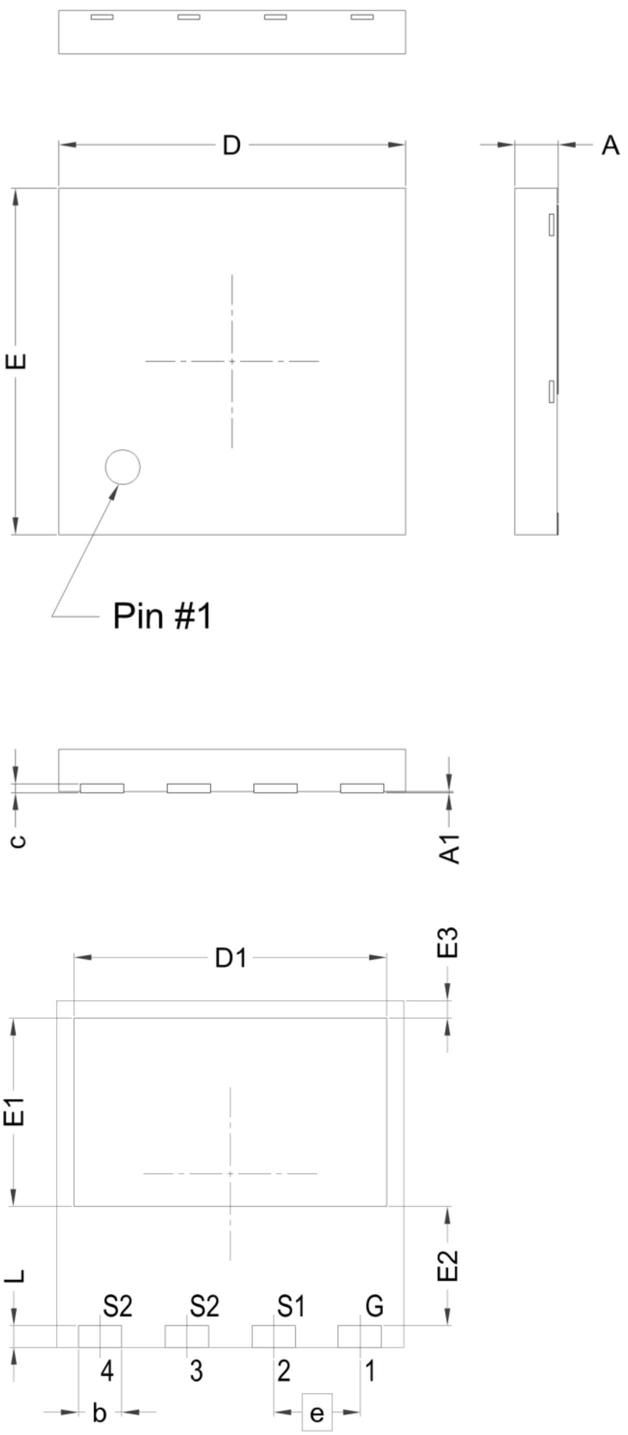
Land Pattern (Only for reference)

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	8.00 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.

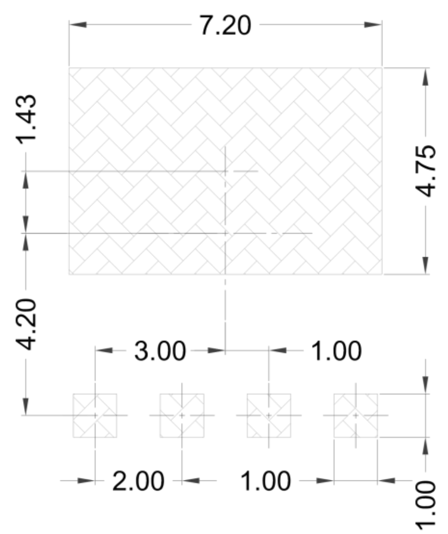
Package Outline (PDFN 8 x 8)



Symbol	Dimension (Millimeters)		
	Min.	Nom.	Max.
A	0.90	1.00	1.10
A1	0.00	-	0.05
b	0.90	1.00	1.10
c	0.10	0.20	0.30
D	7.90	8.00	8.10
D1	7.10	7.20	7.30
E	7.90	8.00	8.10
E1	4.25	4.35	4.45
E2	2.65	2.75	2.85
E3	0.30	0.40	0.50
e	2.00 BSC.		
L	0.40	0.50	0.60

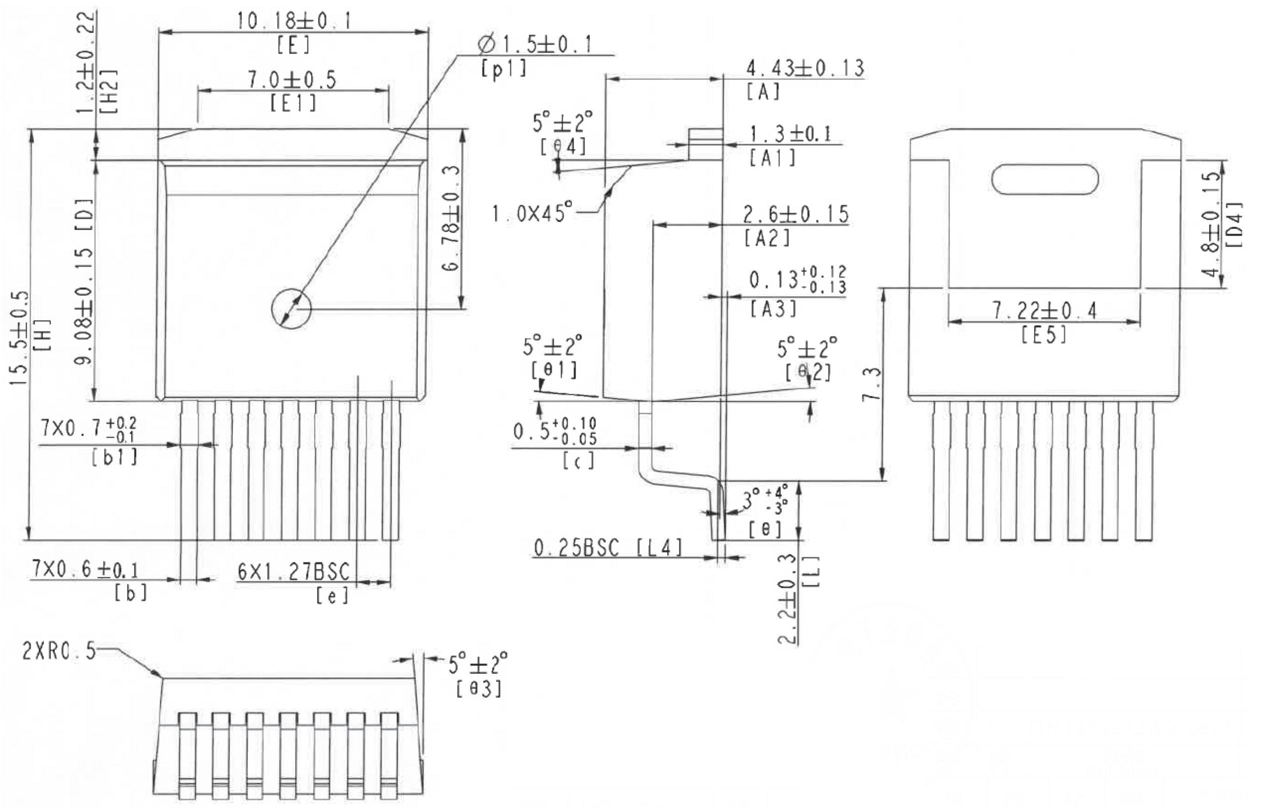
Note:

1. All dimensions are in mm.
2. Dimensions are not inclusive burrs and mold flash.



Land Pattern (Only for reference)

Package Outline (TO-263-7L)



Revision History

Date	Revision	Changes
21.11	Preliminary	1st issue
22.11	Preliminary	Update switching and thermal characteristics
23.05	Preliminary	Add package type

Important Note (Disclaimer)

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Published by:
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Hsinchu, Taiwan