fast SiC semiconductor

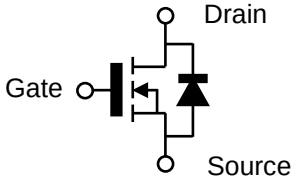
FF17900

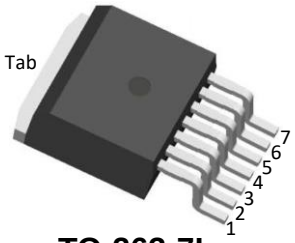
Product Datasheet

Silicon Carbide MOSFET

1700V, 900mΩ SiC MOSFET – Falcon Series

Product Information:





TO-263-7L

Features

- Low Capacitance for Rapid Switching Behavior
- High Avalanche Endurance Capability
- High Blocking Voltage with Low Leakage Current
- Optimized for High Voltage Applications
- Strong Latch-up Hardness
- RoHS Compliant and Halogen Free

Terminal	Pin Arrangement
Gate	1
Drain	Tab
Source	3, 4, 5, 6, 7
N/C	2

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
- Pulsed Power Applications
- Battery Management Systems
- Telecom Power
- Renewable Energy

Key Performance Parameters

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS} @$T_{j(max)}$	1700	V
Recommended Gate-Source Turn-On Voltage	V_{GS}	15~18	
Drain-Source On-State Resistance	$R_{DS(on)}$	900	mΩ
Continuous Drain Current	I_D	4.5	A
Pulse Drain Current	$I_{D,\ pulse}$	12	
Power Dissipation	P_{tot}	83	W
Avalanche Energy	E_{AS}	32	mJ
Gate Charge	Q_G	19	nC
Output Capacitive Charge	Q_{oss}	16.5	
Junction & Storage Temperature	T_j, T_{stg}	-55 to 175	°C

Part Number	Package	Marking
FF17900J-7	TO-263-7L	FF17900
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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}	1700	--	--	V	V_{GS}=0V, I_D=1mA
Continuous Drain Current	I_D	--	--	4.5 3.5	A	V_{GS}=18V, T_C=25°C V_{GS}=18V, T_C=100°C
Pulse Drain Current	$I_{D,\ pulse}$	--	--	12		Per Fig. 13
Continuous Body Diode Current	I_S	--	--	8.3		V_{GS}=0V, T_C=25°C
Avalanche Energy, Single Pulse	E_{AS}	--	--	32	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		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		
Soldering Temperature	T_L	--	--	260		

Electrical Characteristics:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
DC Characteristics (at T_j = 25°C, unless otherwise specified)						
Drain-source Breakdown Voltage	$V_{(BR)DSS}$	1700 --	-- 1800	-- --	V	V_{GS}=0V, I_D=1mA, T_j=25°C V_{GS}=0V, I_D=1mA, T_j=175°C
Drain-Source On-State Resistance	$R_{DS(on)}$	-- --	900 2000	1500 --	mΩ	V_{GS}=18V, I_D=0.5A, T_j=25°C V_{GS}=18V, I_D=0.5A, T_j=175°C
Gate-Source Threshold Voltage	V_{th}	--	2.5	--	V	V_{GS}=V_{DS}, I_D=1mA
Zero Gate Voltage Drain Current	I_{DSS}	--	<1	100	μA	V_{DS}=1700V, 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}	-- --	2.8 2.6	-- --	V	V_{GS}=0V, I_S=0.5A, T_j=25°C V_{GS}=0V, I_S=0.5A, T_j=175°C
AC Characteristics (at T_j = 25°C, unless otherwise specified)						
Input Capacitance	C_{iss}	--	266	--	pF	V_{DS}=1200V, V_{GS}=0V, f=250kHz, V_{AC}=25mV
Output Capacitance	C_{oss}	--	9.5	--		
Reverse Capacitance	C_{rss}	--	2.2	--		
Effective Output Capacitance, energy related	$C_{o(er)}$[1]	--	17.2	--		
Effective Output Capacitance, time related	$C_{o(tr)}$[2]	--	13.9	--		
C_{oss} Stored Energy	E_{oss}	--	12.3	--	μJ	
Output Capacitive Charge	Q_{oss}	--	16.5	--	nC	
Internal Gate Resistance	$R_{G,\ int.}$	--	7.2	--	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 1200V.
[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 1200V.

Switching Characteristics:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Gate Characteristics						
Gate to Source Charge	Q_{GS}	--	2.3	--	nC	V_{DS}=1200V, V_{GS}=0V/15V, I_D=1A
Gate to Drain Charge	Q_{GD}	--	16.6	--		
Total Gate Charge	Q_G	--	19	--		
Inductive Load						
Turn On Delay Time	$t_{d(on)}$	--	30	--	ns	V_{DS}=1000V, I_D=1.5A, V_{GS}=-3/+15V, $R_{G(ext.)}$= 2.7Ω External SiC Diode as an FWD
Rise Time	t_r	--	44	--		
Turn Off Delay Time	$t_{d(off)}$	--	109	--		
Fall Time	t_f	--	182	--		
Turn On Switching Energy	E_{on}	--	140	--	µJ	
Turn Off Switching Energy	E_{off}	--	24	--		
Resistive Load						
Turn On Delay Time	$t_{d(on)}$	--	22	--	ns	V_{DS}=1000V, I_D=2A, V_{GS}=-3/+15V, R_G=2.7Ω R_L=500Ω
Rise Time	t_r	--	24	--		
Turn Off Delay Time	$t_{d(off)}$	--	48	--		
Fall Time	t_f	--	81	--		
Body Diode Characteristics						
Reverse Recovery Charge	Q_{rr}	--	7.9	--	nC	V_{GS}=0V, I_S=1A, V_{DS}=400V, di/dt=300A/µs *Q_{rr} herein excluded the Q_{oss} value.
Reverse Recovery Time	t_{rr}	--	33	--	ns	
Peak Reverse Recovery Current	I_{rrm}	--	0.5	--	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	$R_{th\text{-}ja}$	--	40	--		Device on PCB, with 6 cm² of cooling area

Electrical Characteristics Diagrams

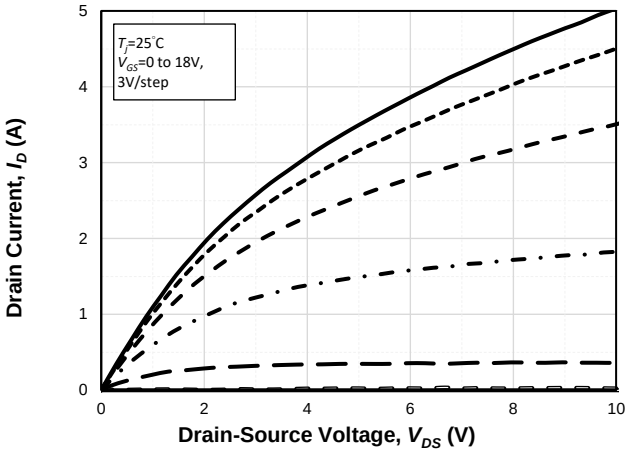


Fig. 1 Typical Output Characteristics at T_j=25˚C

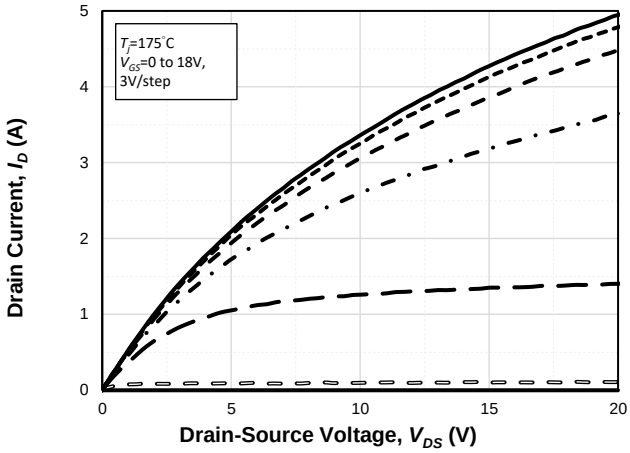


Fig. 2 Typical Output Characteristics at T_j=175˚C

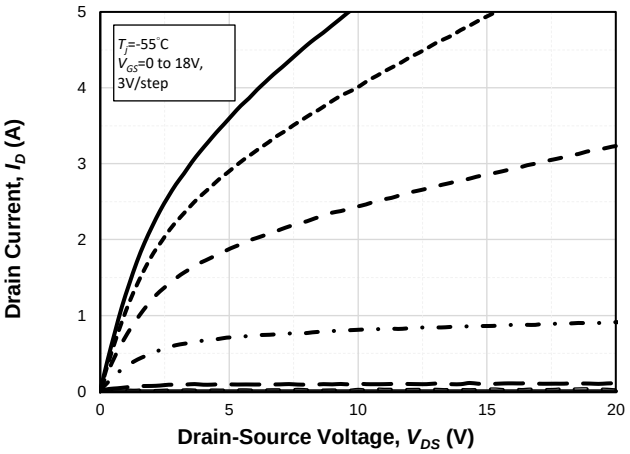


Fig. 3 Typical Output Characteristics at T_j=-55˚C

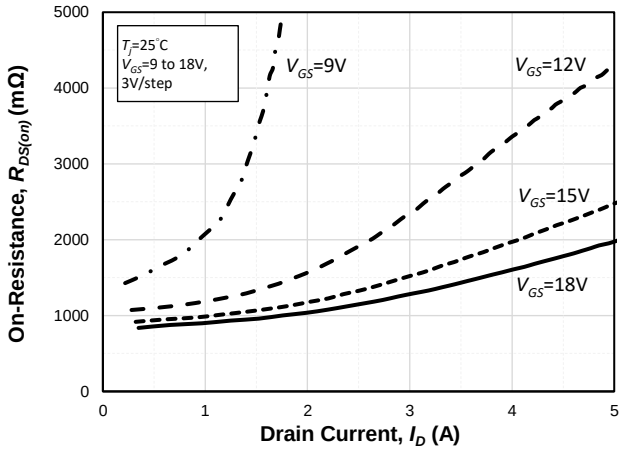


Fig. 4 Typ. $R_{DS(on)}$ vs. I_D with Various V_{GS}

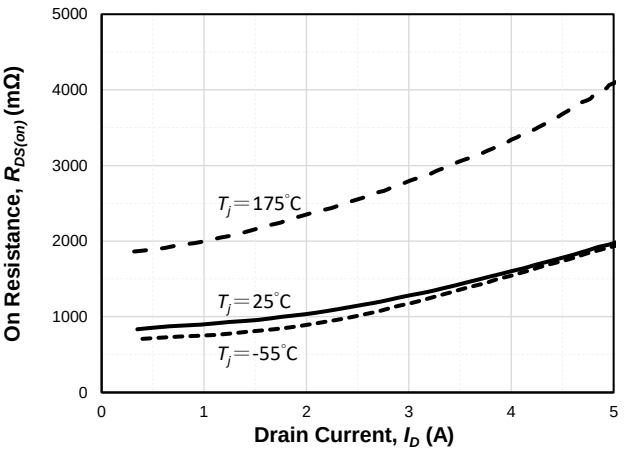


Fig. 5 Typ. $R_{DS(on)}$ vs. I_D with Various T_j, V_{GS}=18V

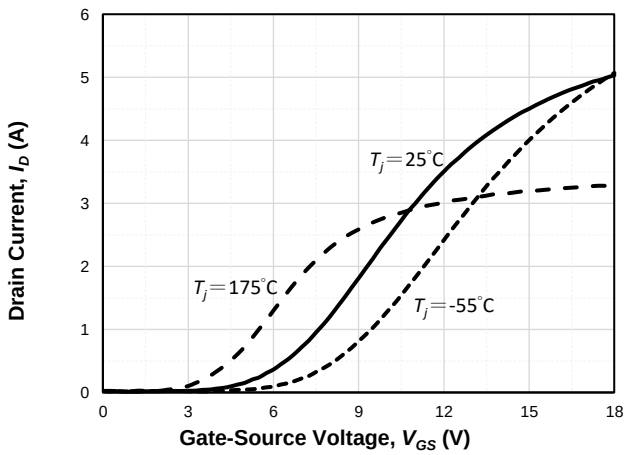


Fig. 6 Typ. I_D vs. V_{GS} with Various T_j, V_{DS}=10V

Electrical Characteristics Diagrams

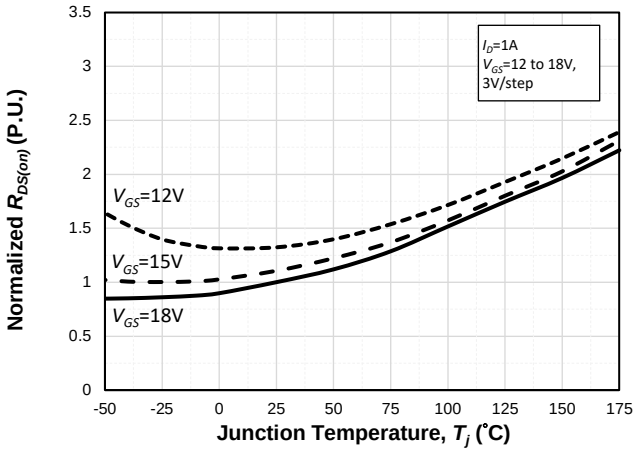


Fig. 7 Normalized $R_{DS(on)}$ vs. T_j with Various V_{GS}

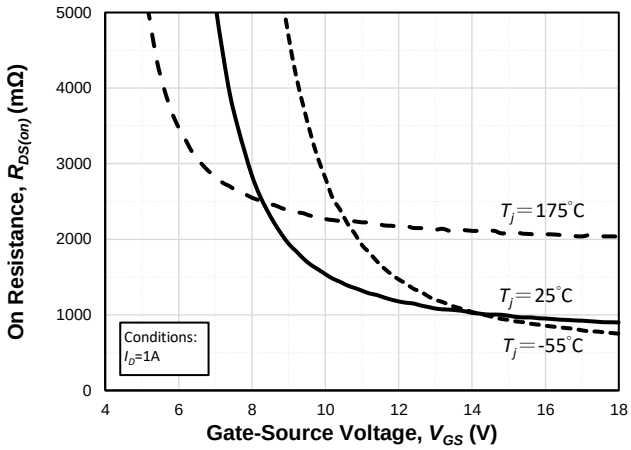


Fig. 8 Typ. $R_{DS(on)}$ vs. V_{GS} with Various T_j

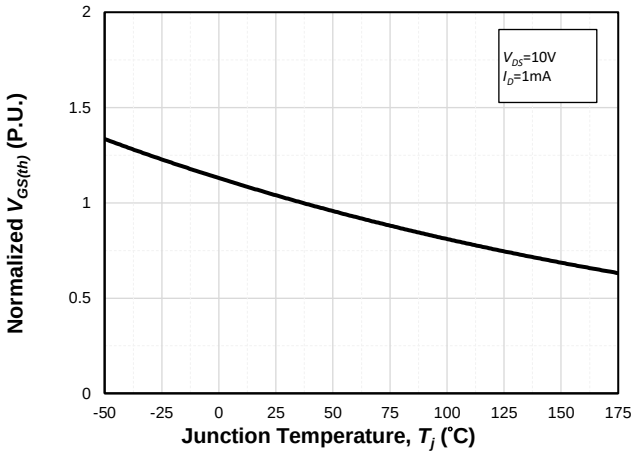


Fig. 9 Normalized V_{th} vs. T_j

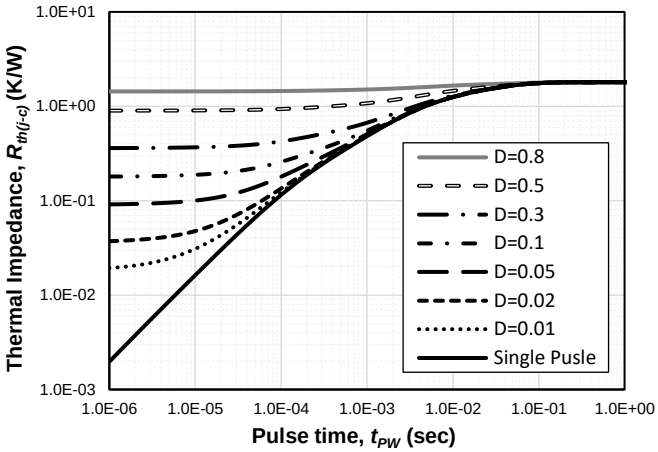


Fig. 10 Typ. Transient Thermal Impedance $R_{th\text{-}jc}$

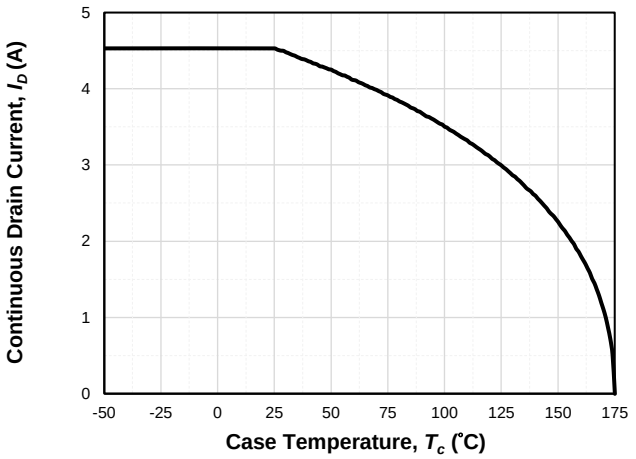


Fig. 11 Continuous I_D De-rating at V_{GS}=18V, T_j≤175˚C

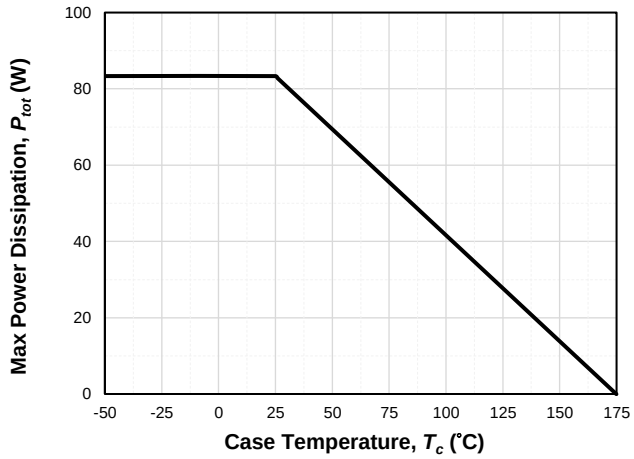


Fig. 12 Power Dissipation at V_{GS}=18V, T_j≤175˚C

Electrical Characteristics Diagrams

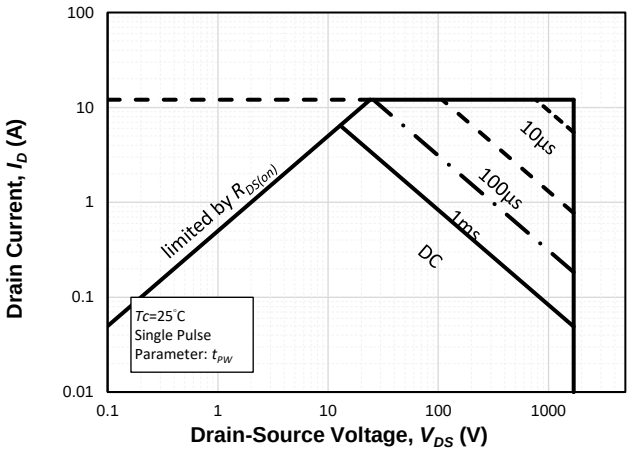


Fig. 13 Safe Operating Area at T_c=25˚C

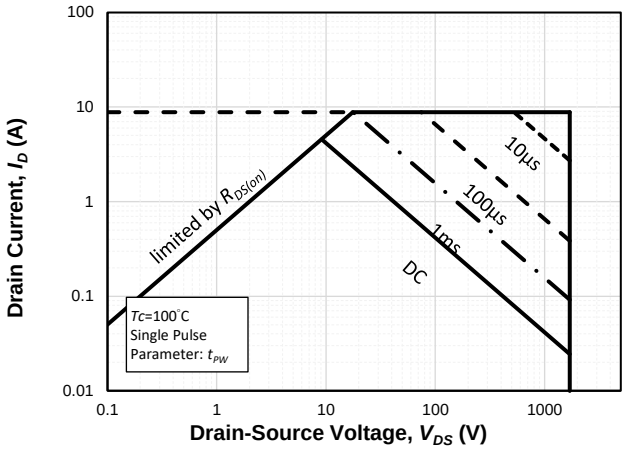


Fig. 14 Safe Operating Area at T_c=100˚C

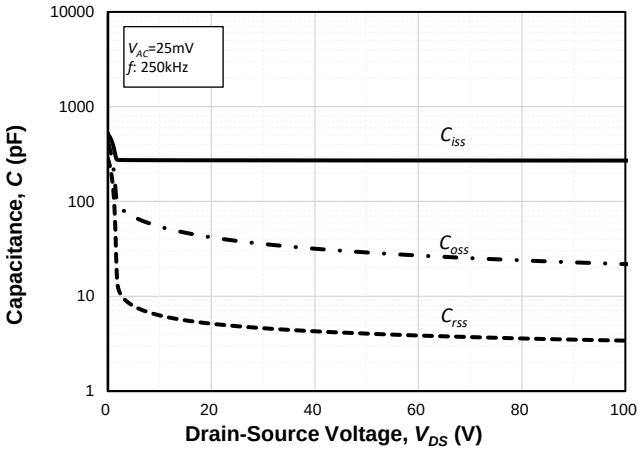


Fig. 15 Typ. Capacitance vs. V_{DS} at f_{sw}=250kHz, V_{DS}≤100V

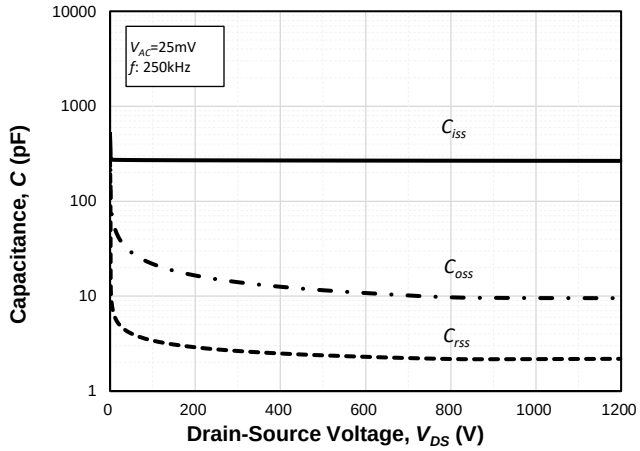


Fig. 16 Typ. Capacitance vs. V_{DS} at f_{sw}=250kHz, V_{DS}≤1200V

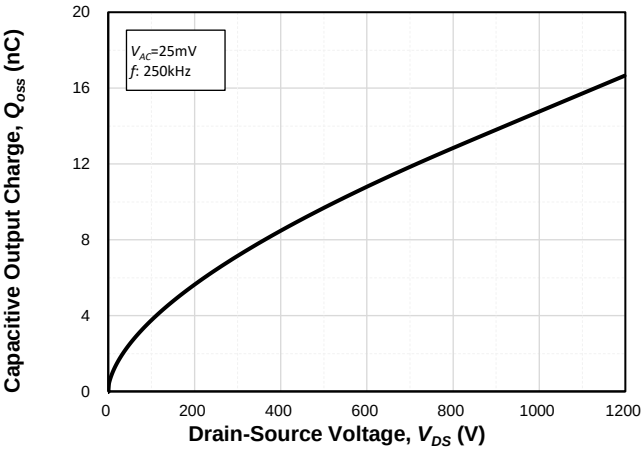


Fig. 17 Typ. Capacitive Output Charge at f_{sw}=250kHz

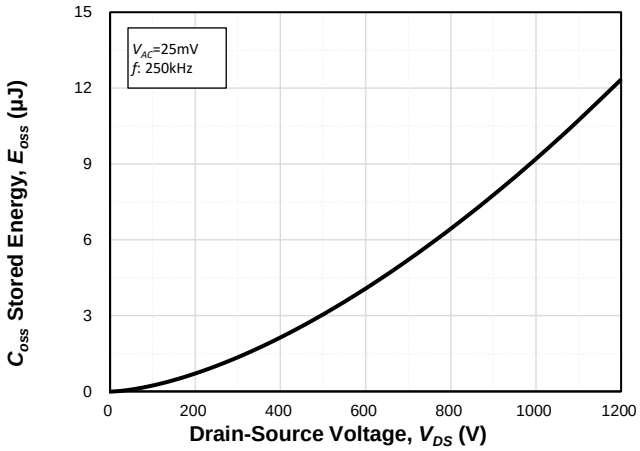


Fig. 18 Typ. C_{oss} Stored Energy at f_{sw}=250kHz

Electrical Characteristics Diagrams

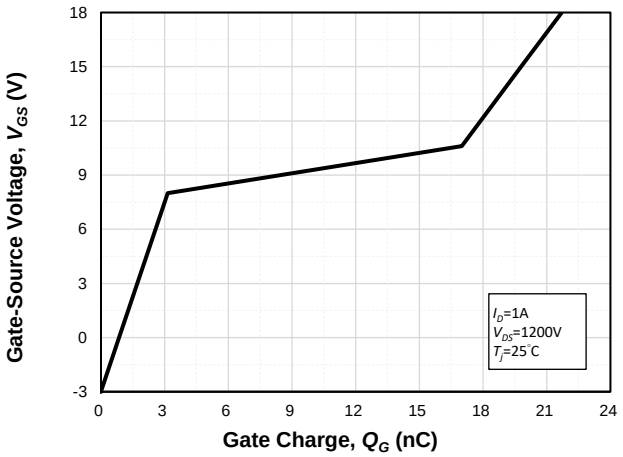


Fig. 19 Typ. Gate Charge at V_{DS}=1200V, I_D=1A

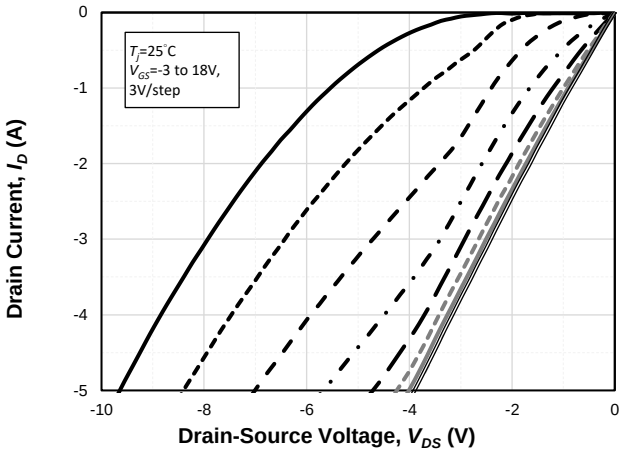


Fig. 20 Typical Forward Characteristics of Reverse Conduction at T_j=25˚C

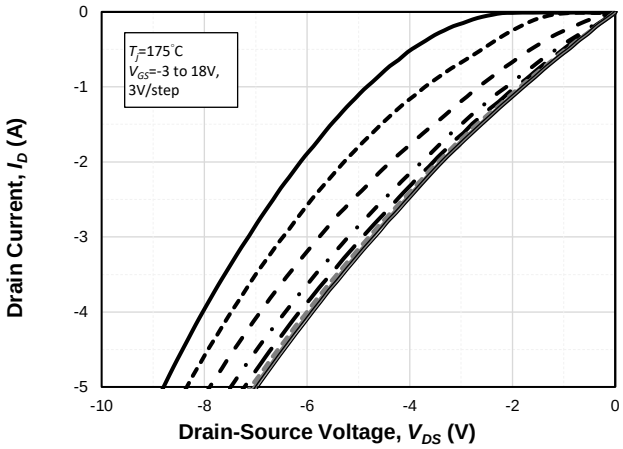


Fig. 21 Typical Forward Characteristics of Reverse Conduction at T_j=175˚C

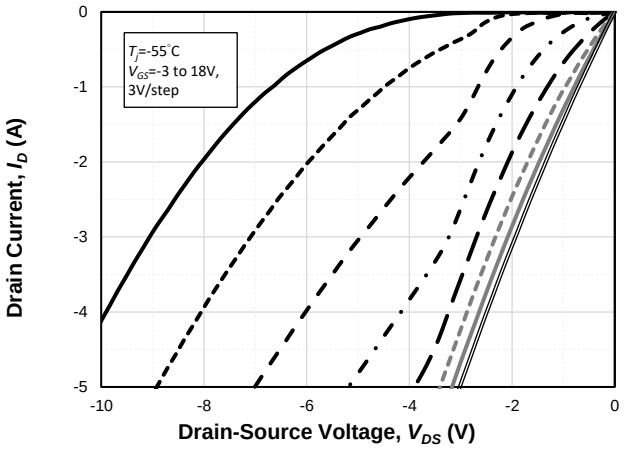


Fig. 22 Typical Forward Characteristics of Reverse Conduction at T_j=-55˚C

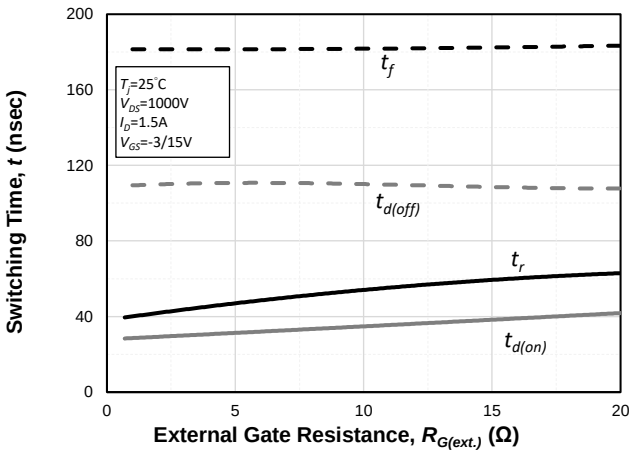


Fig. 23 Typ. Switching Time vs. $R_{G(ext.)}$

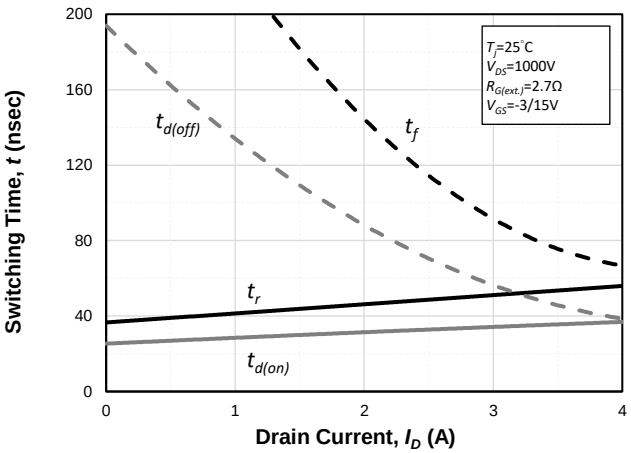


Fig. 24 Typ. Switching Time vs. I_D

Electrical Characteristics Diagrams

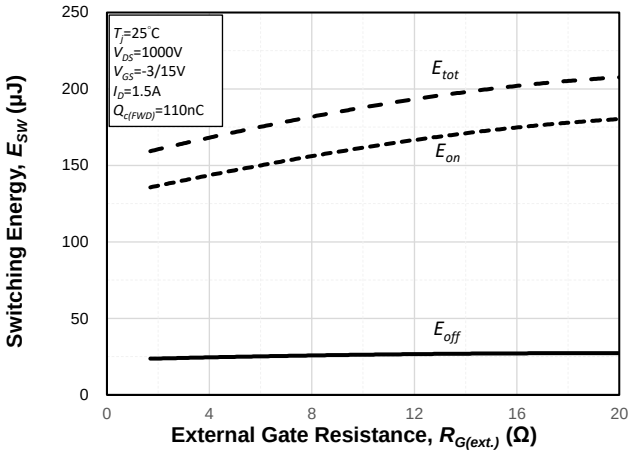


Fig. 25 Typ. Switching Energy vs. $R_{G(ext.)}$

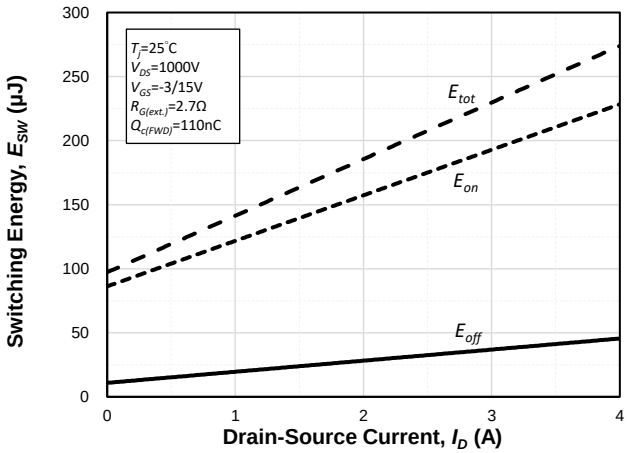
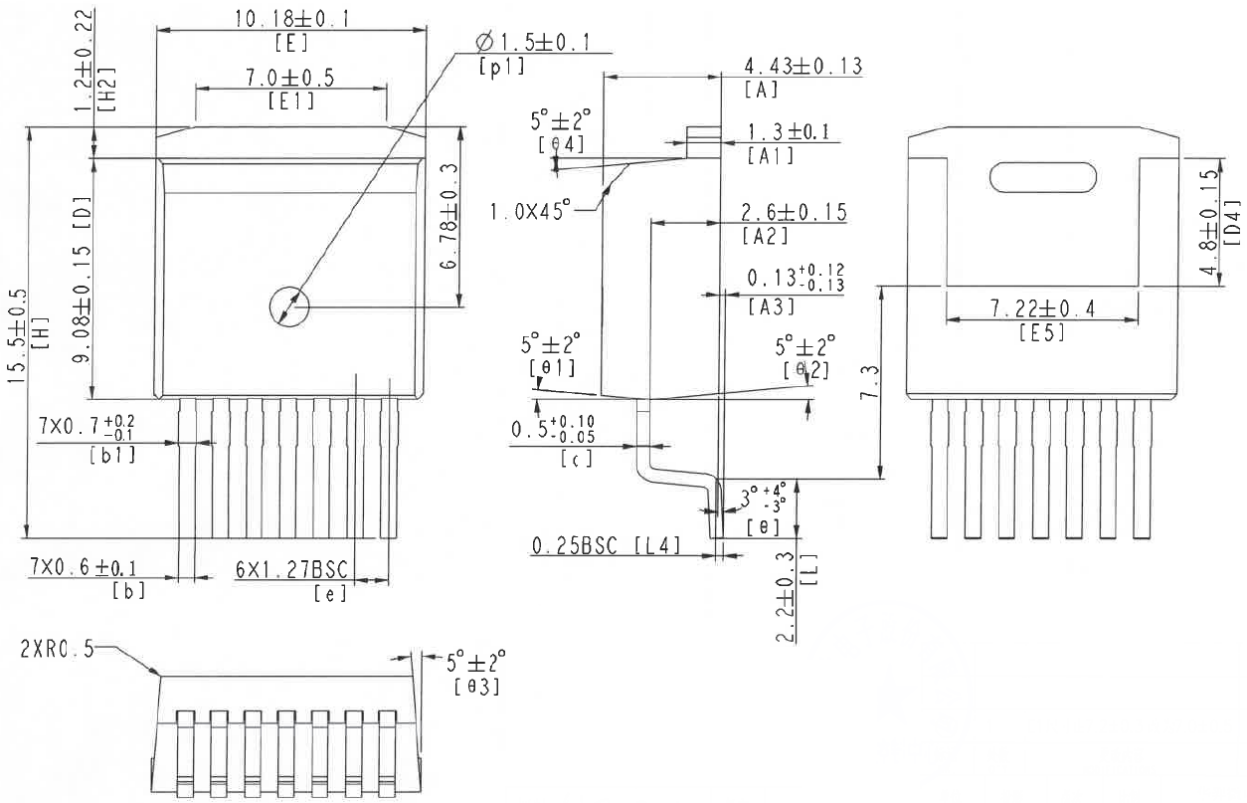


Fig. 26 Typ. Switching Energy vs. I_D

Package Outline (TO-263-7L)



Revision History

Date	Revision	Changes
21.10	Tentative	1st issue
22.12	Tentative	Revise “Kelvin Source” to “N/C”
23.03	Preliminary	Update electrical parameters and curves
23.07	Revision 1.0	Update to 1.0 version
24.05	Revision 1.1	Update the C-V curve

Important Note (Disclaimer)

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