

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter		N Channel	P Channel	Unit	
Common Ratings						
V _{DSS}	Drain-Source Voltage		30	-30	V	
V _{GSS}	Gate-Source Voltage		±20	±20		
T _J	Maximum Junction Temperature		150		°C	
T _{STG}	Storage Temperature Range		-55 to 150			
I _S	Diode Continuous Forward Current		1	-1	A	
I _{DM} ^a	Pulse Drain Current Tested	V _{GS} =10V(N),V _{GS} =-10V(P)	22	-16	A	
I _D	Continuous Drain Current		T _A =25°C	5.6		-4.2
			T _A =70°C	4.5		-3.3
P _D ^d	Maximum Power Dissipation	T _A =25°C	1.6	1.6	W	
		T _A =70°C	1	1		
R _{θJA}	Thermal Resistance-Junction to Ambient	t ≤ 10s	80	80	°C/W	
		Steady State ^b	120	120		
I _{AS} ^c	Avalanche Current, Single pulse	L=0.5mH	6	-7	A	
E _{AS} ^c	Avalanche Energy, Single pulse	L=0.5mH	9	12.25	mJ	

Note a : Pulse width limited by max. junction temperature.

Note b : $R_{\theta JA}$ steady state $t=999\text{s}$. $R_{\theta JA}$ is measured with the device mounted on 1in^2 , FR-4 board with 2oz. Copper.

Note c : UIS tested and pulse width limited by maximum junction temperature 150°C (initial temperature $T_J=25^\circ\text{C}$).

Note d : $t < 10\text{s}$.

N Channel Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	N Channel			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =250μA	30	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =24V, V _{GS} =0V	-	-	1	μA
		T _J =85°C	-	-	30	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250μA	1.3	1.8	2.5	V
I _{GSS}	Gate Leakage Current	V _{GS} =±20V, V _{DS} =0V	-	-	±10	μA
R _{DS(ON)} ^e	Drain-Source On-state Resistance	V _{GS} =10V, I _{DS} =5.6A	-	24	29	mΩ
		V _{GS} =4.5V, I _{DS} =5A	-	30	39	
Diode Characteristics						
V _{SD} ^e	Diode Forward Voltage	I _{SD} =1A, V _{GS} =0V	-	0.75	1.1	V
t _{rr}	Reverse Recovery Time	I _{DS} =5.6A, dI _{SD} /dt=100A/μs	-	9.5	-	ns
Q _{rr}	Reverse Recovery Charge		-	3.9	-	nC
Dynamic Characteristics ^f						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	-	3	4.2	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, Frequency=1.0MHz	-	330	430	pF
C _{oss}	Output Capacitance		-	60	78	
C _{rss}	Reverse Transfer Capacitance		-	35	46	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =15V, R _L =15Ω, I _{DS} =1A, V _{GEN} =10V, R _G =6Ω	-	7.5	-	ns
t _r	Turn-on Rise Time		-	10	-	
t _{d(OFF)}	Turn-off Delay Time		-	15	-	
t _f	Turn-off Fall Time		-	4	-	
Gate Charge Characteristics ^f						
Q _g	Total Gate Charge	V _{DS} =15V, V _{GS} =10V, I _{DS} =5.6A	-	7	9.1	nC
Q _g	Total Gate Charge	V _{DS} =15V, V _{GS} =4.5V, I _{DS} =5.6A	-	3.5	-	
Q _{gs}	Gate-Source Charge		-	1.2	-	
Q _{gd}	Gate-Drain Charge		-	1.2	-	

Note e : Pulse test ; pulse width≤300μs, duty cycle≤2%.

Note f : Guaranteed by design, not subject to production testing.

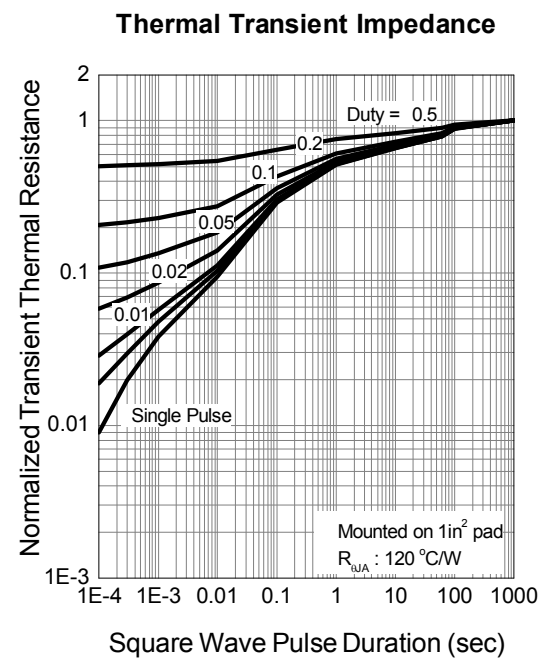
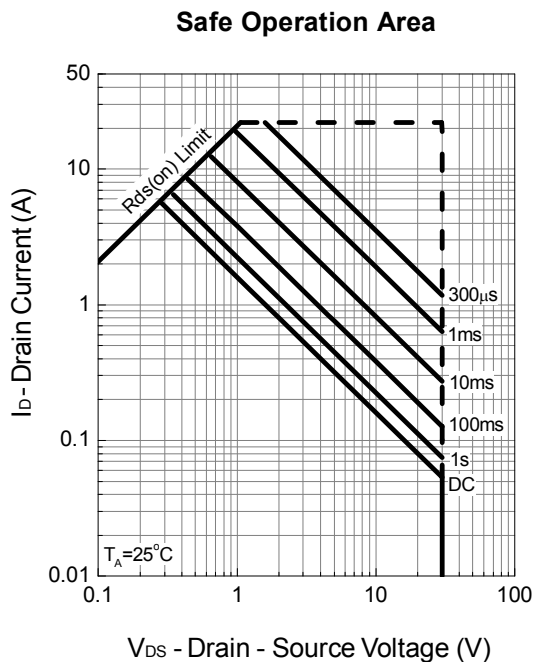
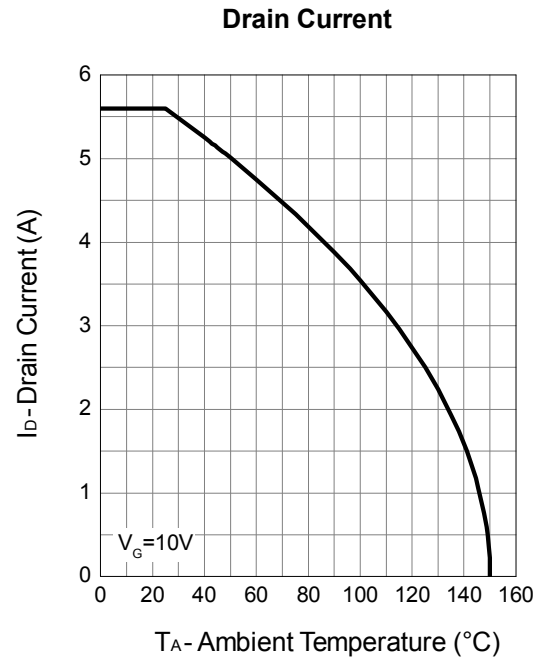
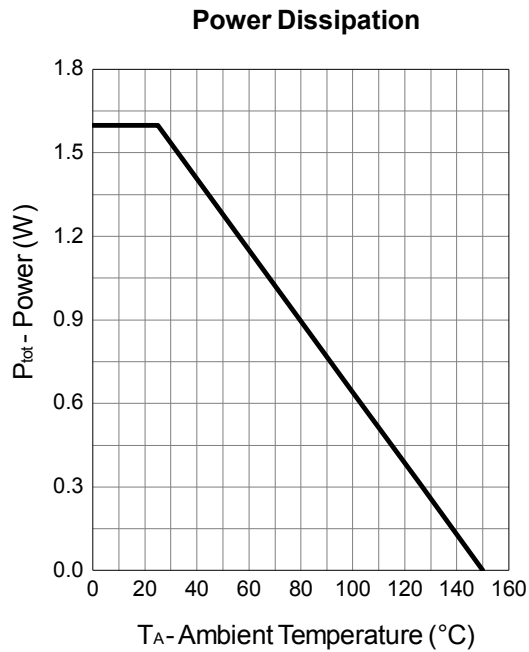
P Channel Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	P Channel			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =-250μA	-30	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-24V, V _{GS} =0V	-	-	-1	μA
		T _J =85°C	-	-	-30	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =-250μA	-1.3	-1.8	-2.3	V
I _{GSS}	Gate Leakage Current	V _{GS} =±20V, V _{DS} =0V	-	-	±10	μA
R _{DS(ON)} ^e	Drain-Source On-state Resistance	V _{GS} =-10V, I _{DS} =-3A	-	50	63	mΩ
		V _{GS} =-4.5V, I _{DS} =-2A	-	74	100	
Diode Characteristics						
V _{SD} ^e	Diode Forward Voltage	I _{SD} =-1.2A, V _{GS} =0V	-	-0.75	-1	V
t _{rr}	Reverse Recovery Time	I _{DS} =-3A, dI _{SD} /dt=100A/μs	-	14.5	-	ns
Q _{rr}	Reverse Recovery Charge		-	7.3	-	nC
Dynamic Characteristics ^f						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	-	10	20	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-15V, Frequency=1.0MHz	-	355	460	pF
C _{oss}	Output Capacitance		-	67	-	
C _{rss}	Reverse Transfer Capacitance		-	48	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =-15V, R _L =15Ω, I _{DS} =-1A, V _{GEN} =-10V, R _G =6Ω	-	8	14.5	ns
t _r	Turn-on Rise Time		-	11	20	
t _{d(OFF)}	Turn-off Delay Time		-	23	42	
t _f	Turn-off Fall Time		-	29	52	
Gate Charge Characteristics ^f						
Q _g	Total Gate Charge	V _{DS} =-15V, V _{GS} =-10V, I _{DS} =-3A	-	8.3	11.6	nC
Q _g	Total Gate Charge	V _{DS} =-15V, V _{GS} =-4.5V, I _{DS} =-3A	-	4.1	5.8	
Q _{gs}	Gate-Source Charge		-	1.5	-	
Q _{gd}	Gate-Drain Charge		-	1.8	-	

Note e : Pulse test; pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.

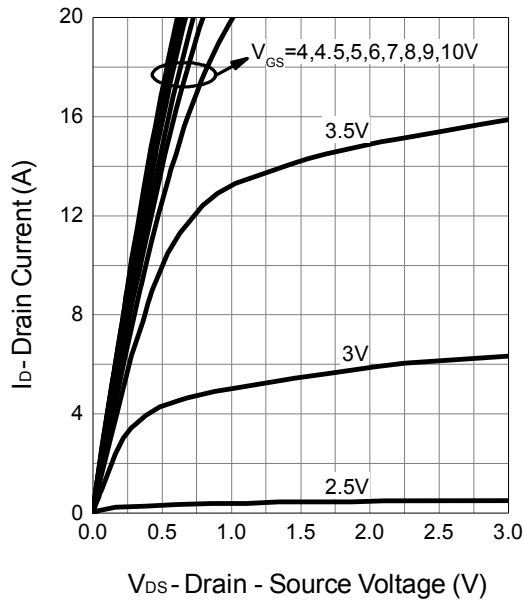
Note f : Guaranteed by design, not subject to production testing.

N Channel Typical Operating Characteristics

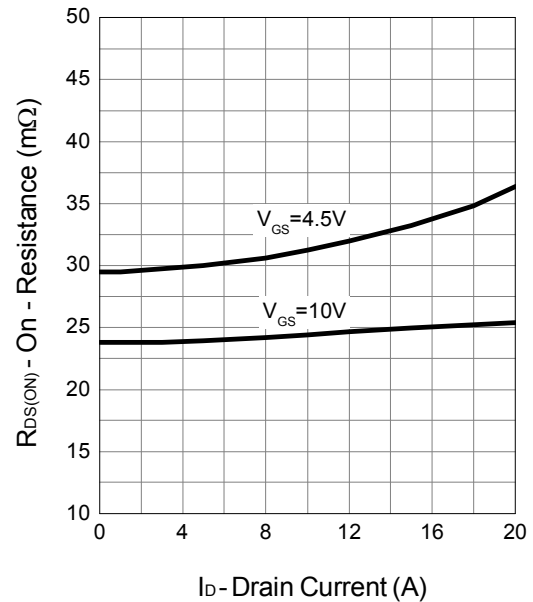


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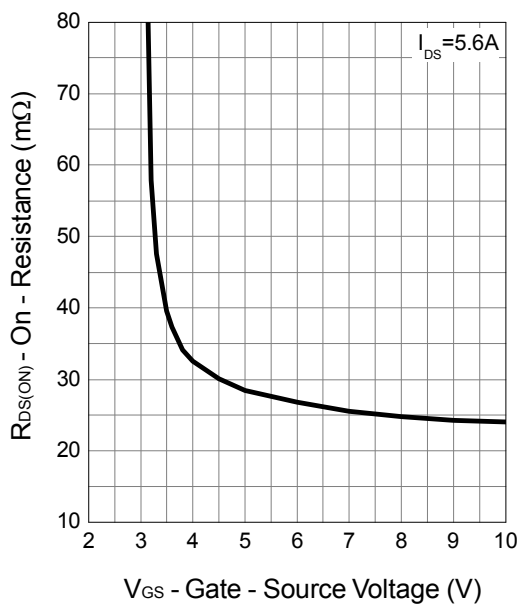
Output Characteristics



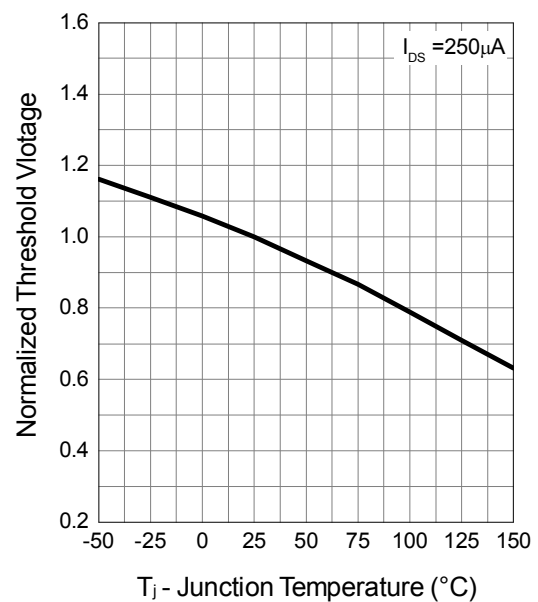
Drain-Source On Resistance



Gate-Source On Resistance

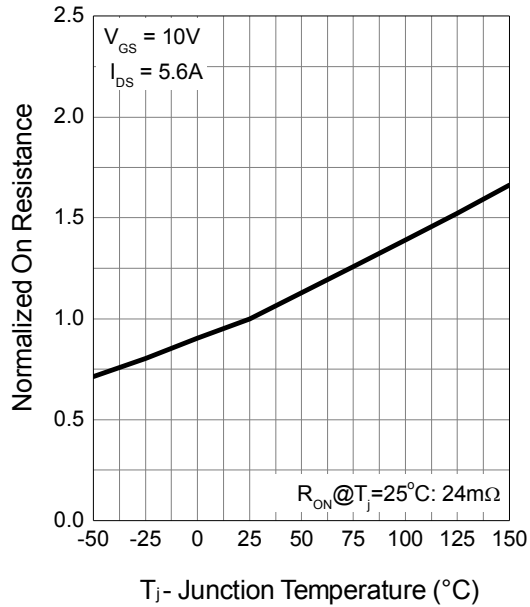


Gate Threshold Voltage

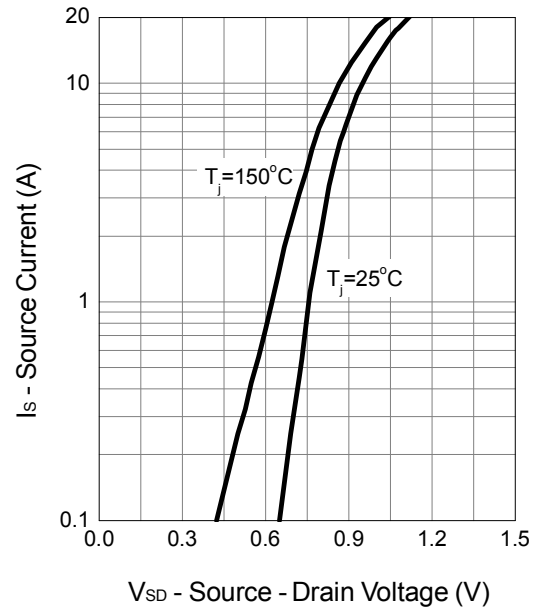


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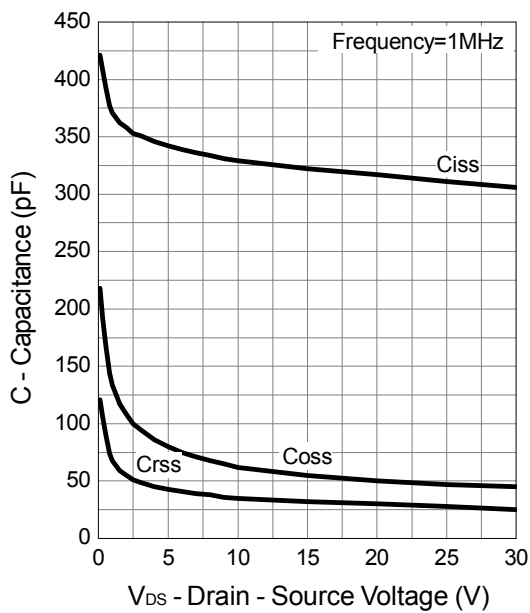
Drain-Source On Resistance



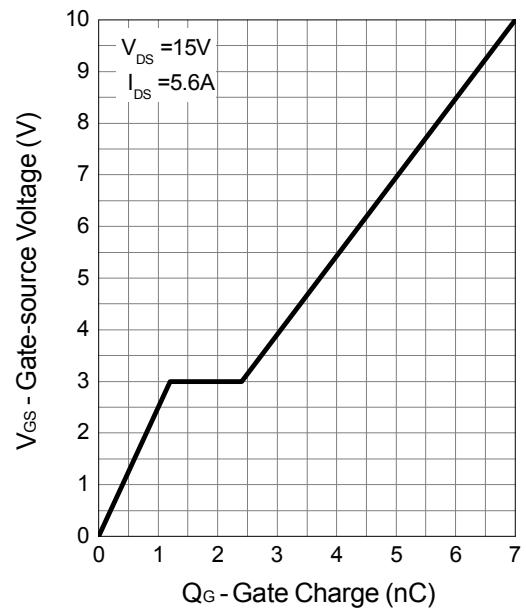
Source-Drain Diode Forward



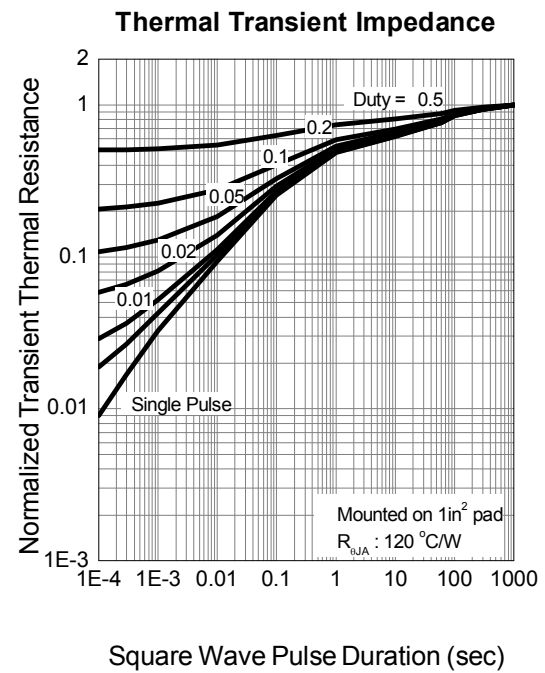
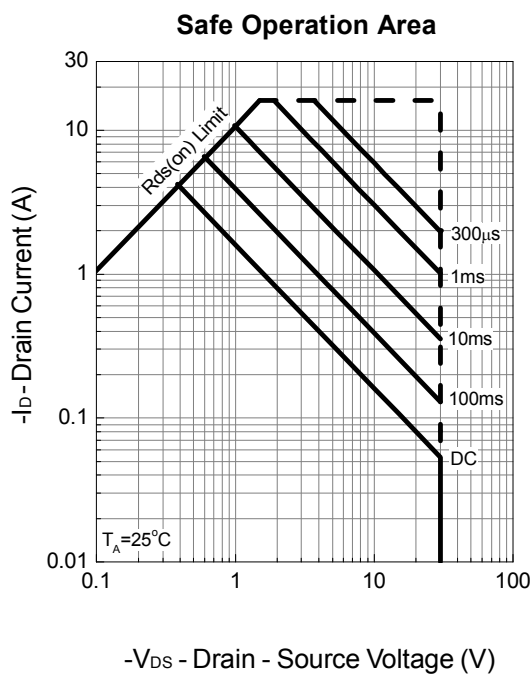
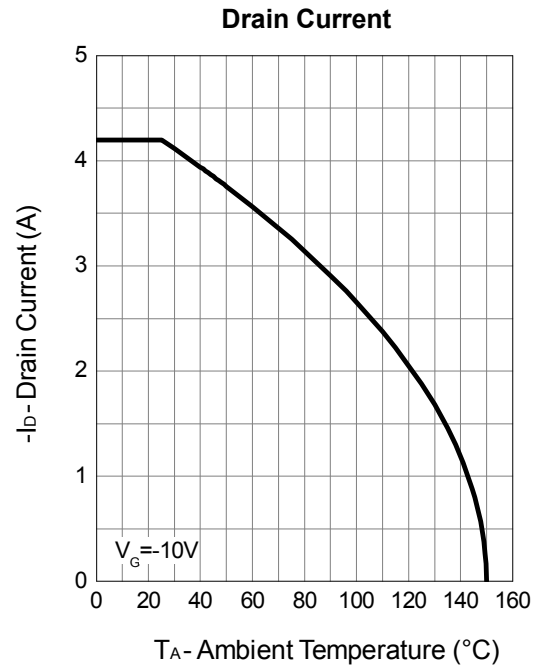
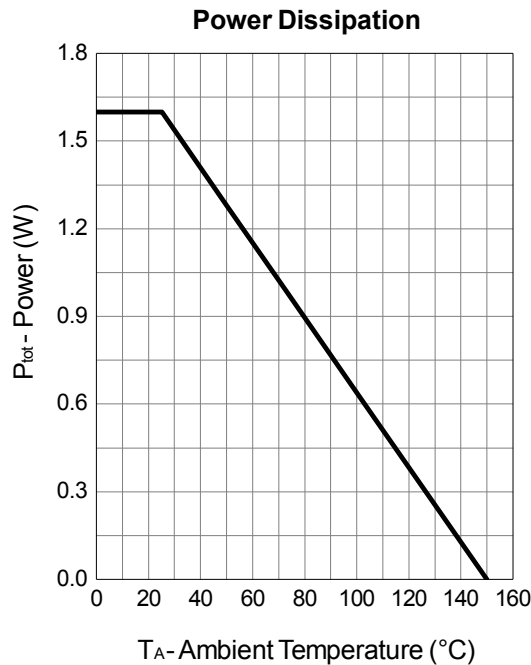
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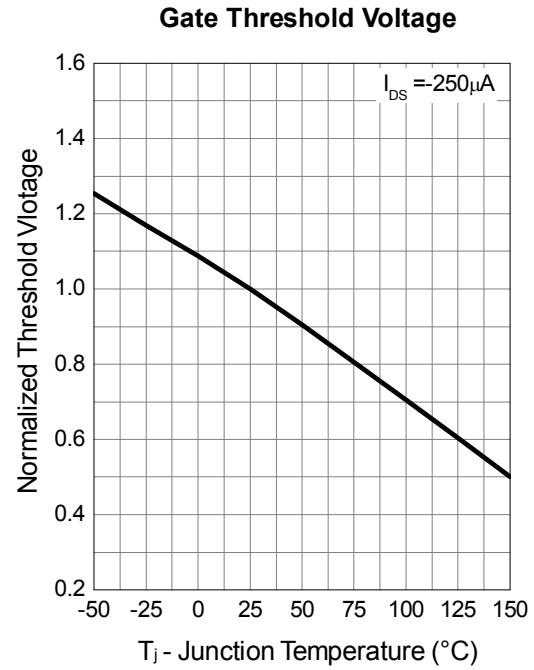
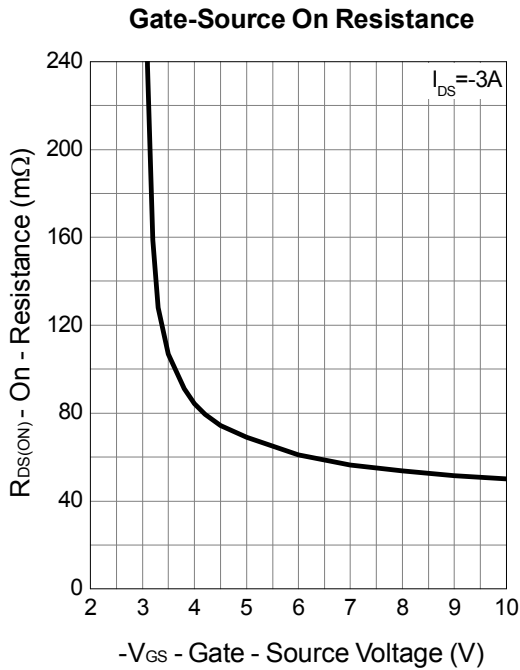
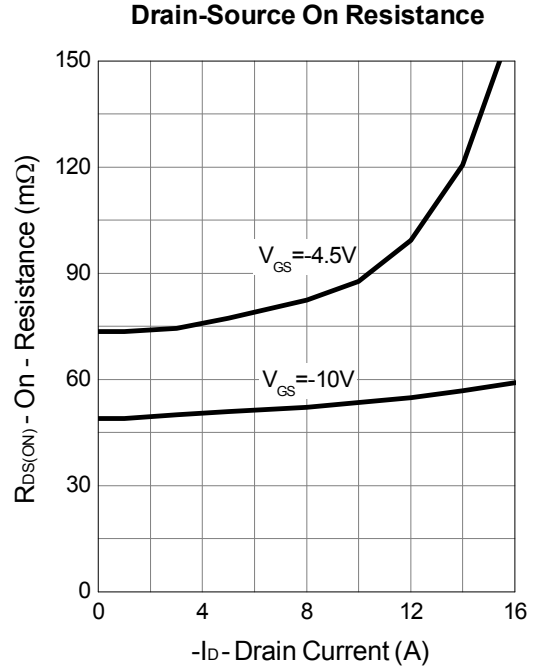
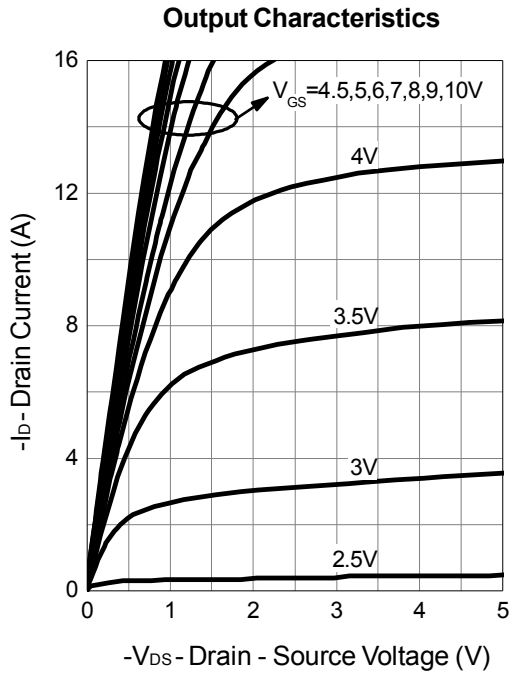
Gate Charge



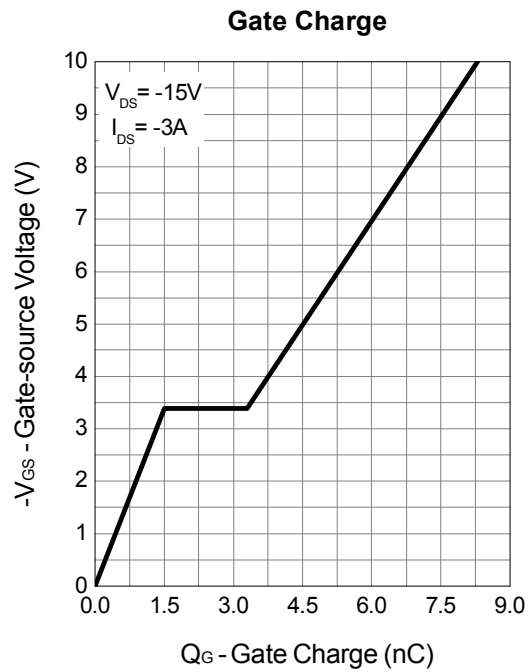
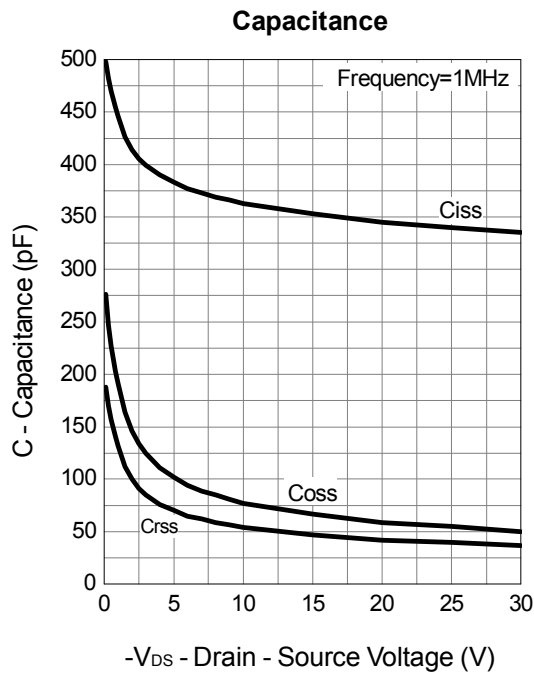
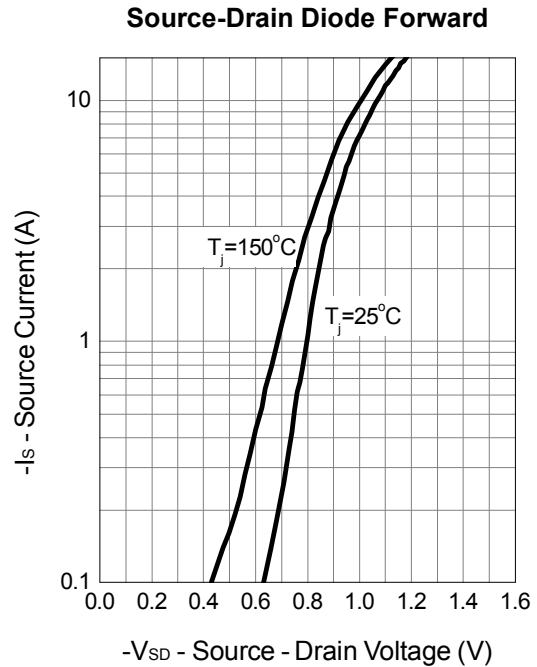
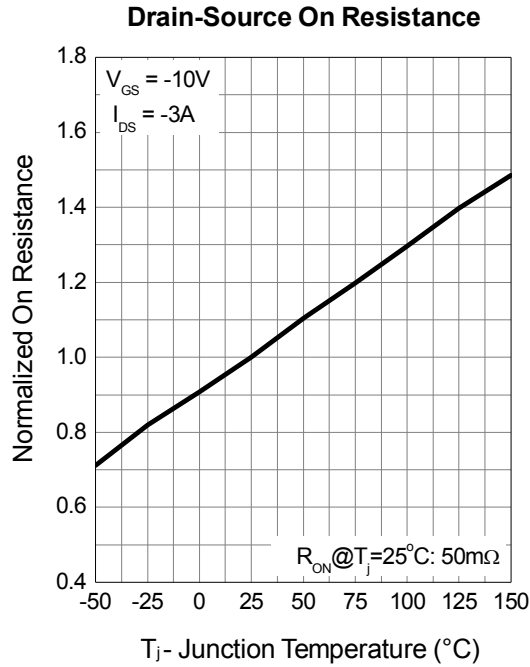
P Channel Typical Operating Characteristics



P Channel Typical Operating Characteristics (Cont.)

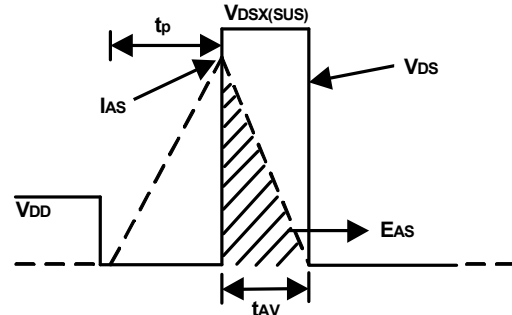
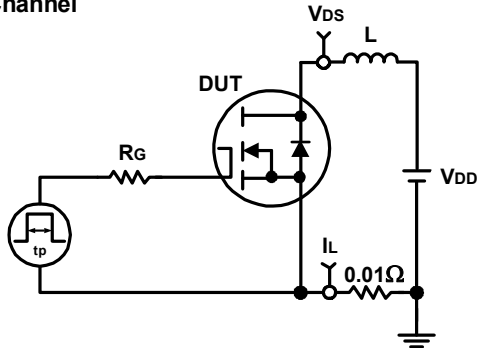


P Channel Typical Operating Characteristics (Cont.)

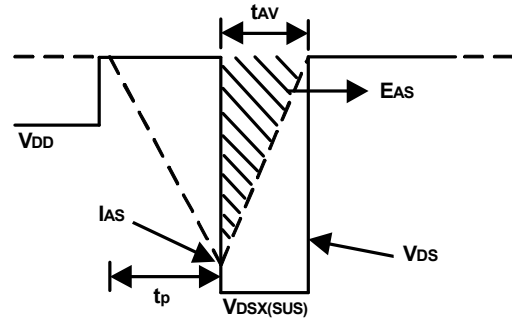
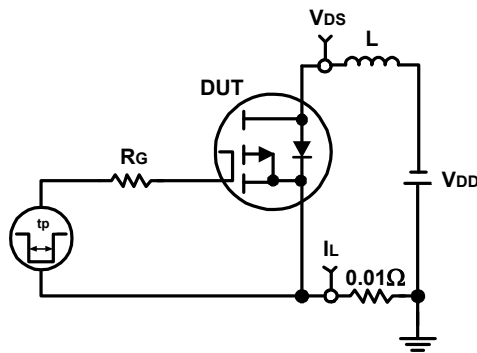


Avalanche Test Circuit and Waveforms

N Channel

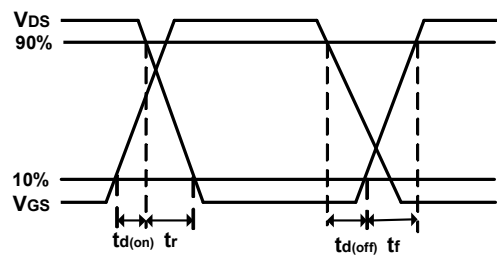
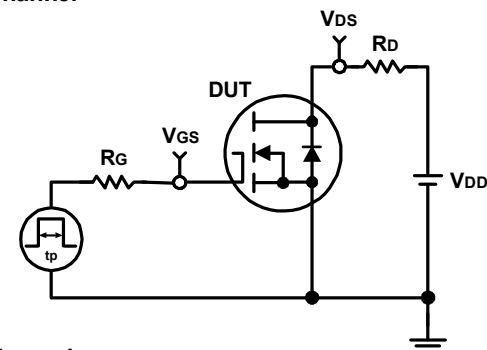


P Channel

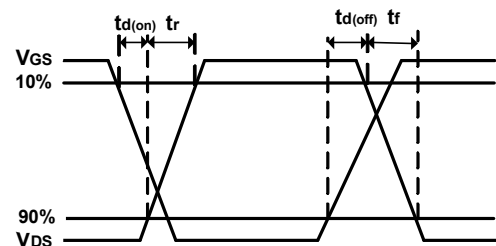
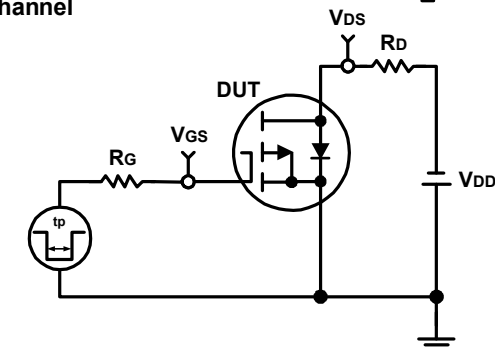


Switching Time Test Circuit and Waveforms

N Channel



P Channel



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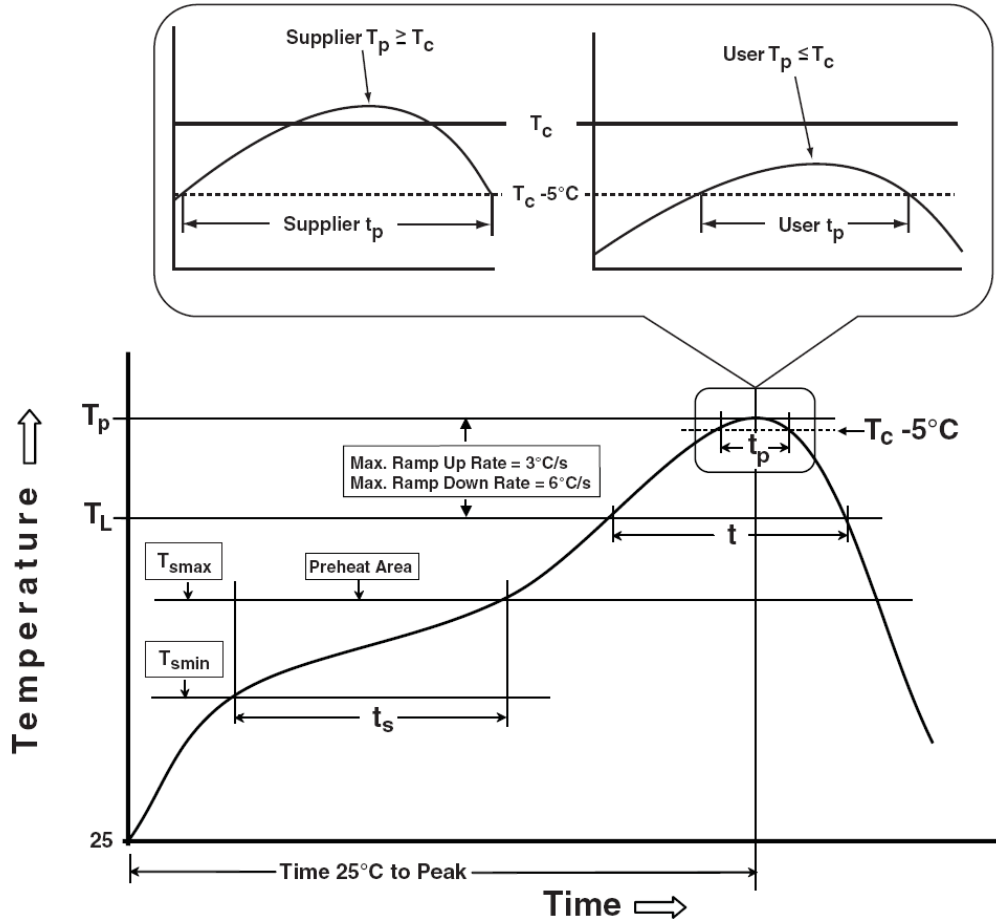
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Classification Profile



Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak		
Temperature min (T_{smin})	100 °C	150 °C
Temperature max (T_{smax})	150 °C	200 °C
Time (T_{smin} to T_{smax}) (t_s)	60-120 seconds	60-120 seconds
Average ramp-up rate (T_{smax} to T_p)	3 °C/second max.	3°C/second max.
Liquidous temperature (T_L)	183 °C	217 °C
Time at liquidous (t_L)	60-150 seconds	60-150 seconds
Peak package body Temperature (T_p)*	See Classification Temp in table 1	See Classification Temp in table 2
Time (t_p)** within 5°C of the specified classification temperature (T_c)	20** seconds	30** seconds
Average ramp-down rate (T_p to T_{smax})	6 °C/second max.	6 °C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile Temperature (T_p) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.		

Table 1. SnPb Eutectic Process – Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2. Pb-free Process – Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥2.5 mm	250 °C	245 °C	245 °C

Reliability Test Program

Test item	Method	Description
SOLDERABILITY	JESD-22, B102	5 Sec, 245°C
HTRB	JESD-22, A108	1000 Hrs, 80% of VDS max @ T_{jmax}
HTGB	JESD-22, A108	1000 Hrs, 100% of VGS max @ T_{jmax}
PCT	JESD-22, A102	168 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -65°C~150°C

Customer Service

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