



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

Symbol	Parameter	N Channel	P Channel	Unit	
<b>Common Ratings</b>					
$V_{DSS}$	Drain-Source Voltage	30	-30	V	
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$		
$T_J$	Maximum Junction Temperature	150		$^\circ\text{C}$	
$T_{STG}$	Storage Temperature Range	-55 to 150			
$I_S$	Diode Continuous Forward Current	2	-2	A	
$I_{DP}$	Pulse Drain Current Tested	$V_{GS}=10\text{V(N)}, V_{GS}=-10\text{V(P)}$			
$I_D$	Continuous Drain Current	$T_A=25^\circ\text{C}$	8		-5
		$T_A=70^\circ\text{C}$	6.4	-4	
$P_D$	Maximum Power Dissipation	$T_A=25^\circ\text{C}$	2	2	W
		$T_A=70^\circ\text{C}$	1.3	1.3	
$R_{\theta JL}$	Thermal Resistance-Junction to Lead	Steady State	50	50	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	$t \leq 10\text{s}$	62.5	62.5	
		Steady State	110	110	
$I_{AS}$	Avalanche Current, Single pulse	L=0.1mH	9	16	A
		L=0.5mH	7.2	7.8	
$E_{AS}$	Avalanche Energy, Single pulse	L=0.1mH	4	12	mJ
		L=0.5mH	12	15	

## N Channel Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	N Channel			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	30	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =24V, V <sub>GS</sub> =0V T <sub>J</sub> =85°C	-	-	1	μA
			-	-	30	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	1.5	1.8	2.3	V
I <sub>GSS</sub>	Gate Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
R <sub>DS(ON)</sub> <sup>a</sup>	Drain-Source On-state Resistance	V <sub>GS</sub> =10V, I <sub>DS</sub> =8A	-	17	21	mΩ
		V <sub>GS</sub> =4.5V, I <sub>DS</sub> =5A	-	23	30	
<b>Diode Characteristics</b>						
V <sub>SD</sub> <sup>a</sup>	Diode Forward Voltage	I <sub>SD</sub> =1A, V <sub>GS</sub> =0V	-	0.75	1.1	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>DS</sub> =8A, dI <sub>SD</sub> /dt=100A/μs	-	12	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge		-	3.5	-	nC
<b>Dynamic Characteristics<sup>b</sup></b>						
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz	-	1.5	-	Ω
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, Frequency=1.0MHz	-	410	-	pF
C <sub>oss</sub>	Output Capacitance		-	70	-	
C <sub>riss</sub>	Reverse Transfer Capacitance		-	40	-	
t <sub>d(ON)</sub>	Turn-on Delay Time		V <sub>DD</sub> =15V, R <sub>L</sub> =15Ω, I <sub>DS</sub> =1A, V <sub>GEN</sub> =10V, R <sub>G</sub> =6Ω	-	5.2	-
t <sub>r</sub>	Turn-on Rise Time	-		8.6	-	
t <sub>d(OFF)</sub>	Turn-off Delay Time	-		13.5	-	
t <sub>f</sub>	Turn-off Fall Time	-		3.4	-	
<b>Gate Charge Characteristics<sup>b</sup></b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =15V, V <sub>GS</sub> =10V, I <sub>DS</sub> =8A	-	8.1	13	nC
Q <sub>g</sub>	Total Gate Charge		-	3.9	5.5	
Q <sub>gth</sub>	Threshold Gate Charge	V <sub>DS</sub> =15V, V <sub>GS</sub> =4.5V, I <sub>DS</sub> =8A	-	0.73	-	
Q <sub>gs</sub>	Gate-Source Charge		-	1.5	-	
Q <sub>gd</sub>	Gate-Drain Charge		-	1.6	-	

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

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

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

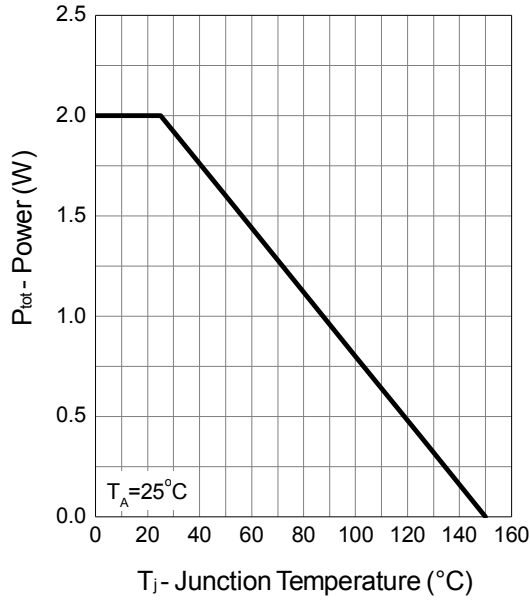
Symbol	Parameter	Test Conditions	P Channel			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=-250\mu A$	-30	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-24V, V_{GS}=0V$	-	-	-1	$\mu A$
		$T_J=85^\circ C$	-	-	-30	mA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=-250\mu A$	-1.3	-1.8	-2.3	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=-10V, I_{DS}=-5A$	-	42	53	m $\Omega$
		$V_{GS}=-4.5V, I_{DS}=-3A$	-	62	83	
<b>Diode Characteristics</b>						
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=-1A, V_{GS}=0V$	-	-0.75	-1	V
$t_{rr}$	Reverse Recovery Time	$I_{DS}=-5A, di_{SD}/dt=100A/\mu s$	-	16	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	10	-	nC
<b>Dynamic Characteristics</b> <sup>b</sup>						
$R_G$	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1MHz$	-	3.8	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=-15V,$ Frequency=1.0MHz	-	420	-	pF
$C_{oss}$	Output Capacitance		-	77	-	
$C_{riss}$	Reverse Transfer Capacitance		-	55	-	
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=-15V, R_L=15\Omega,$ $I_{DS}=-1A, V_{GEN}=-10V,$ $R_G=6\Omega$	-	8	-	ns
$t_r$	Turn-on Rise Time		-	10	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	18	-	
$t_f$	Turn-off Fall Time		-	8	-	
<b>Gate Charge Characteristics</b> <sup>b</sup>						
$Q_g$	Total Gate Charge	$V_{DS}=-15V, V_{GS}=-10V,$ $I_{DS}=-5A$	-	9.5	-	nC
$Q_{gs}$	Gate-Source Charge		-	1.7	-	
$Q_{gd}$	Gate-Drain Charge		-	2	-	

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

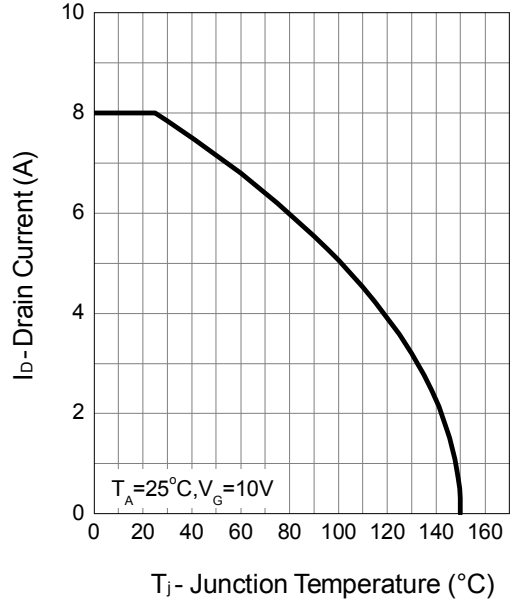
Note b : Guaranteed by design, not subject to production testing.

## N Channel Typical Operating Characteristics

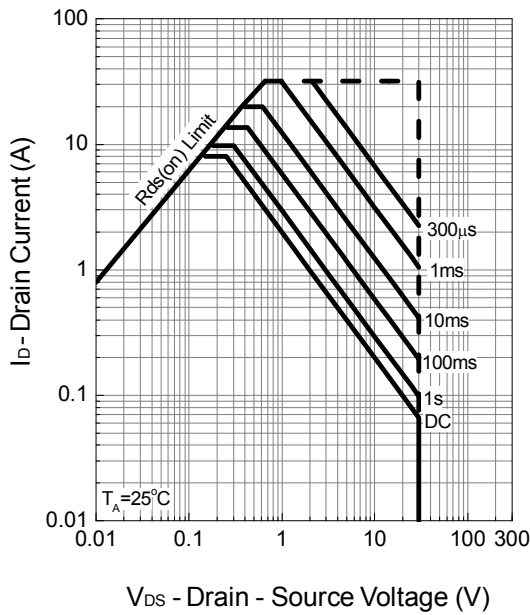
Power Dissipation



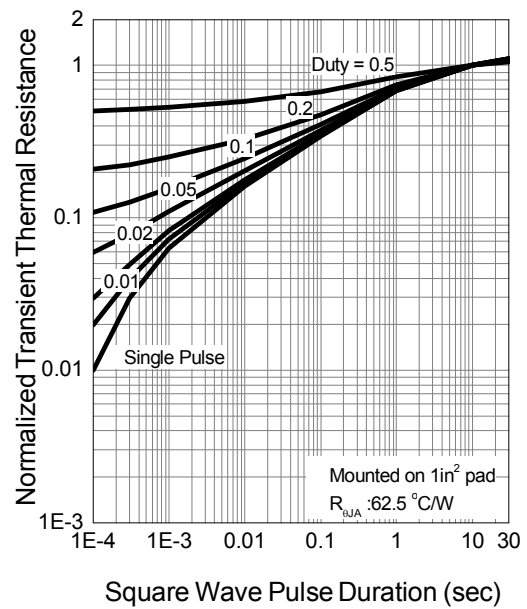
Drain Current



Safe Operation Area

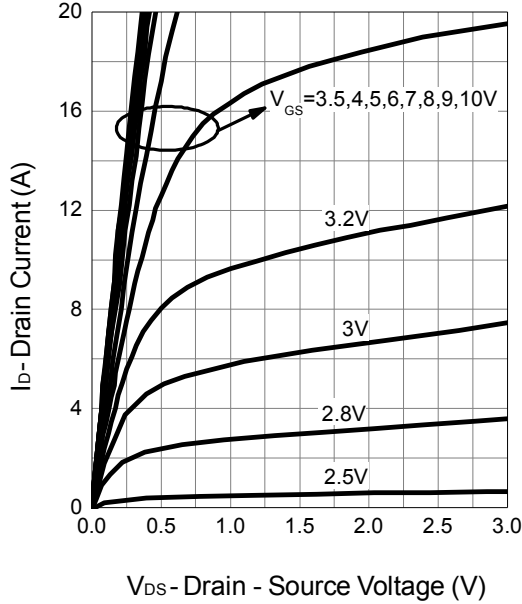


Thermal Transient Impedance

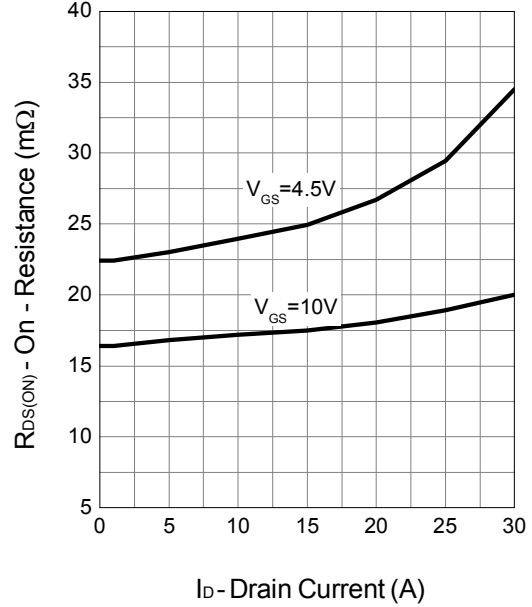


## N Channel Typical Operating Characteristics (Cont.)

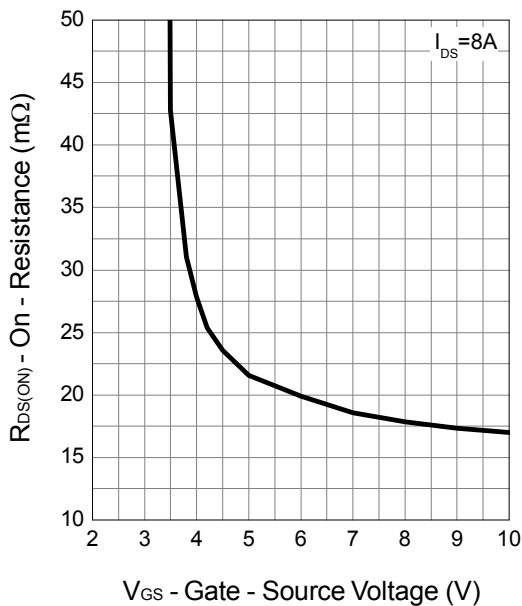
Output Characteristics



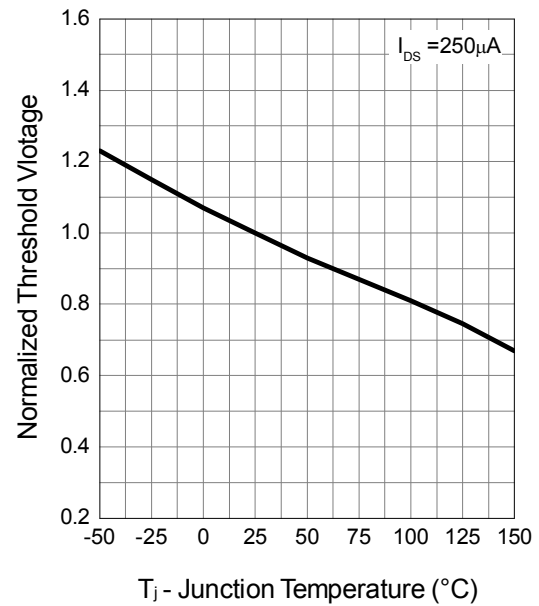
Drain-Source On Resistance



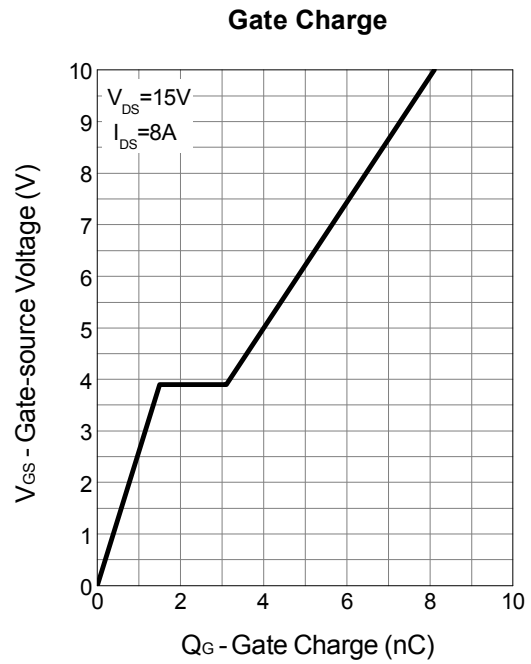
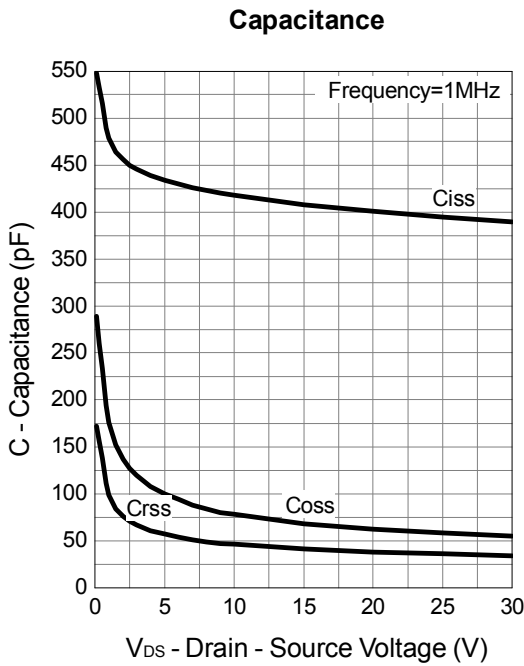
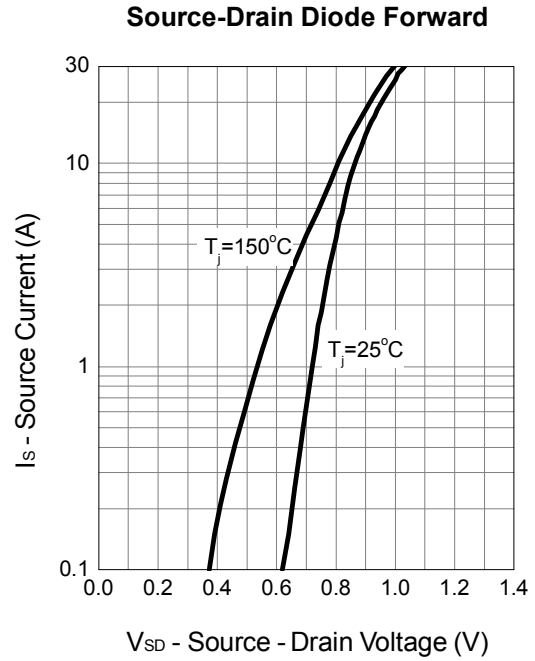
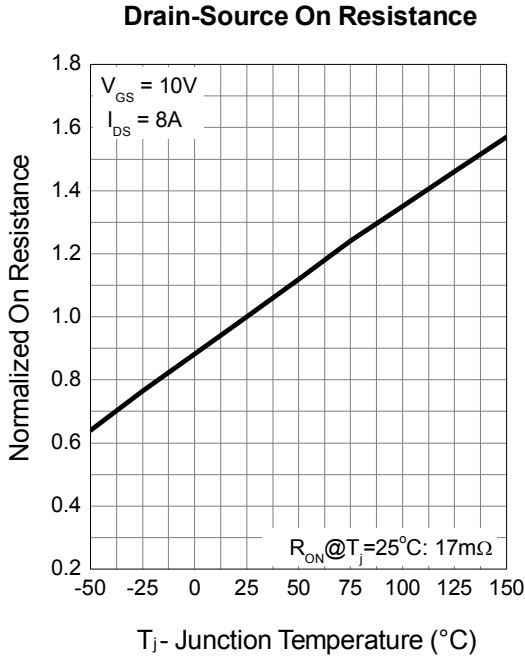
Gate-Source On Resistance



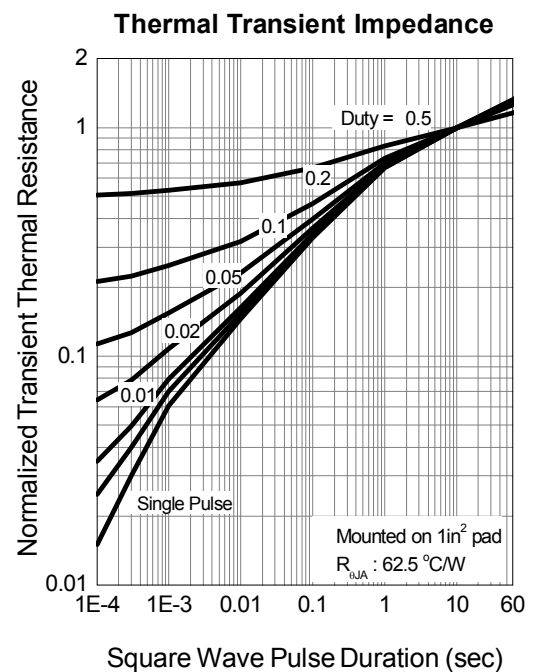
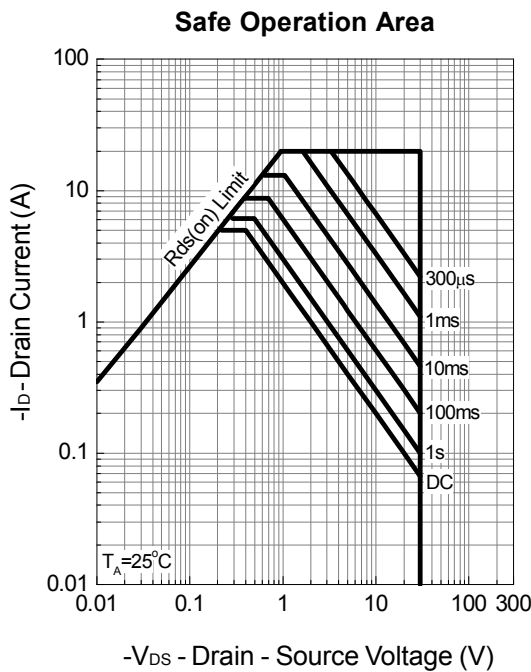
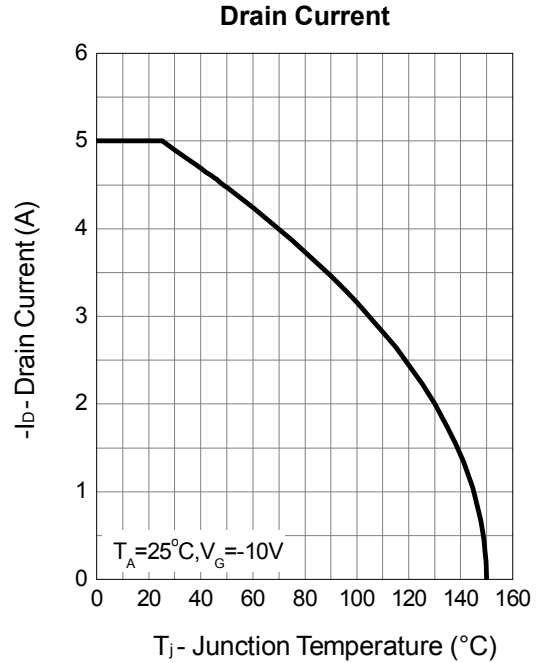
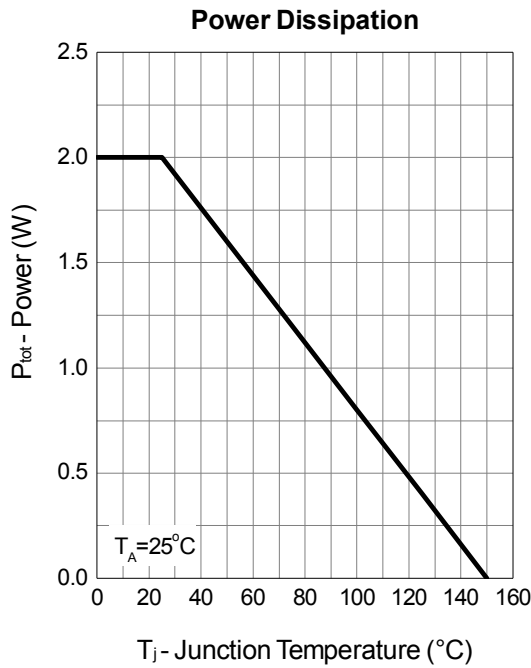
Gate Threshold Voltage



## N Channel Typical Operating Characteristics (Cont.)

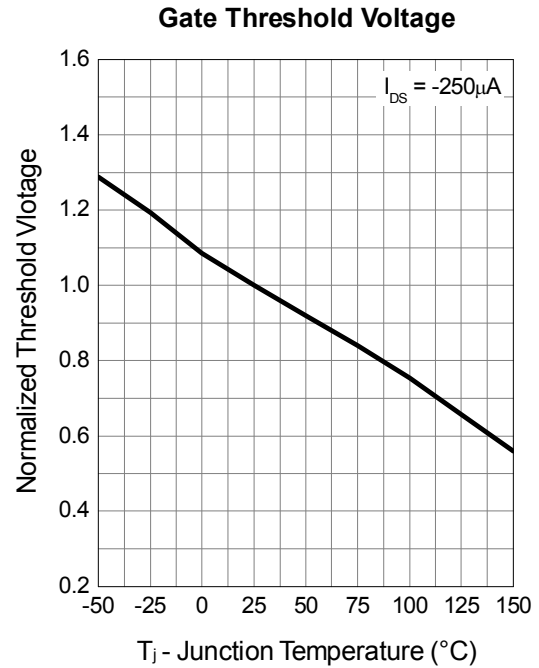
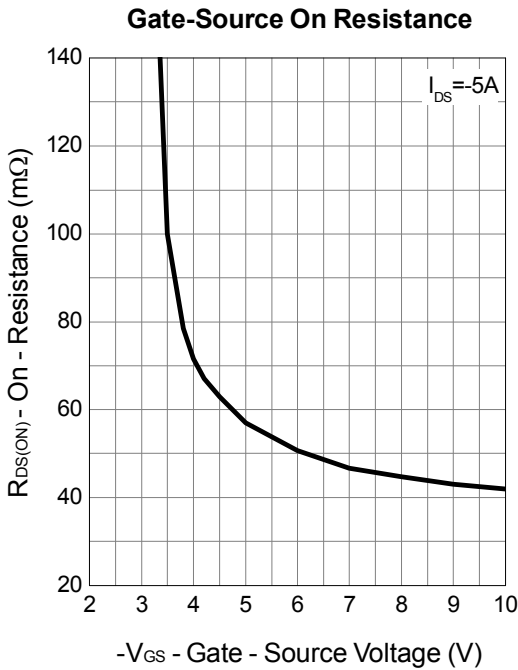
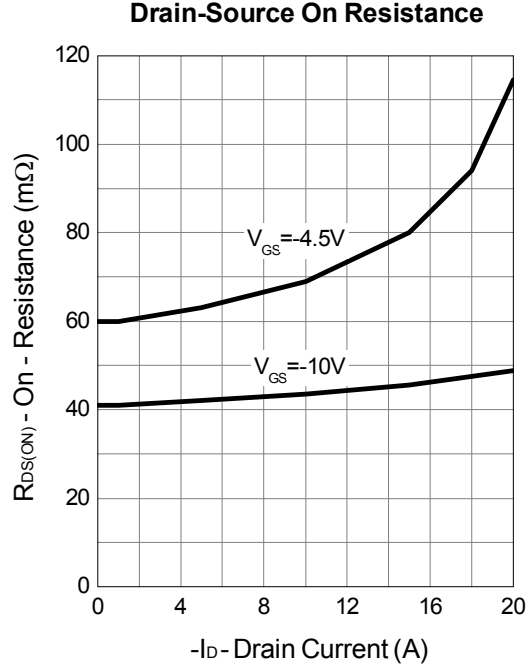
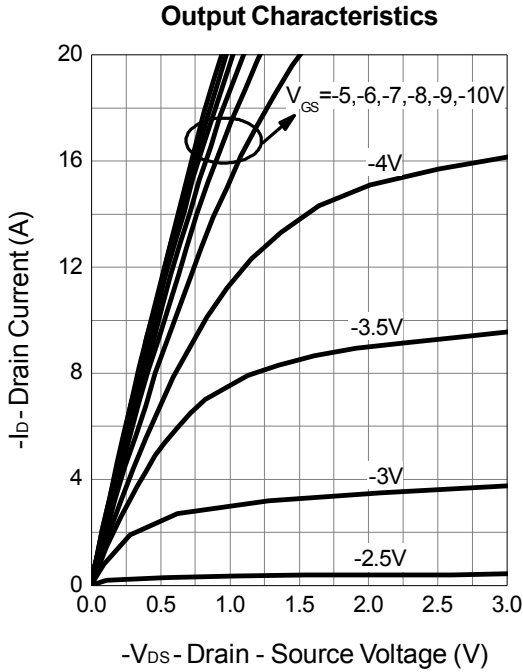


## P Channel Typical Operating Characteristics

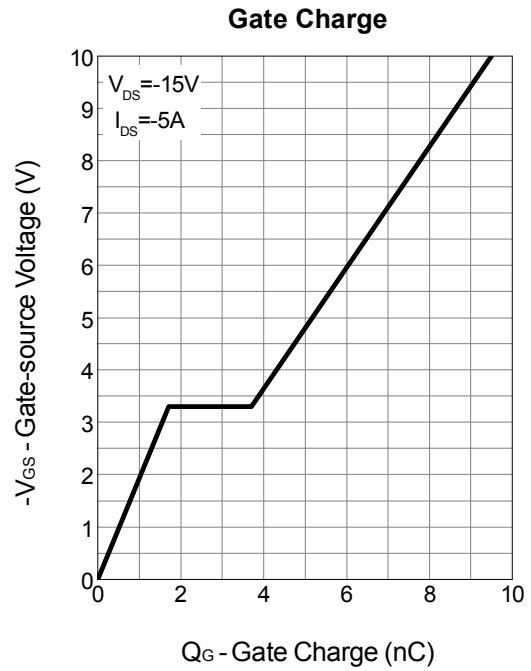
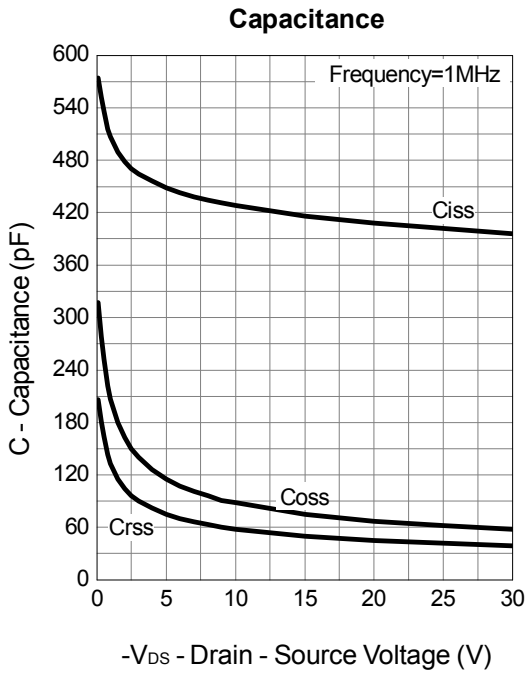
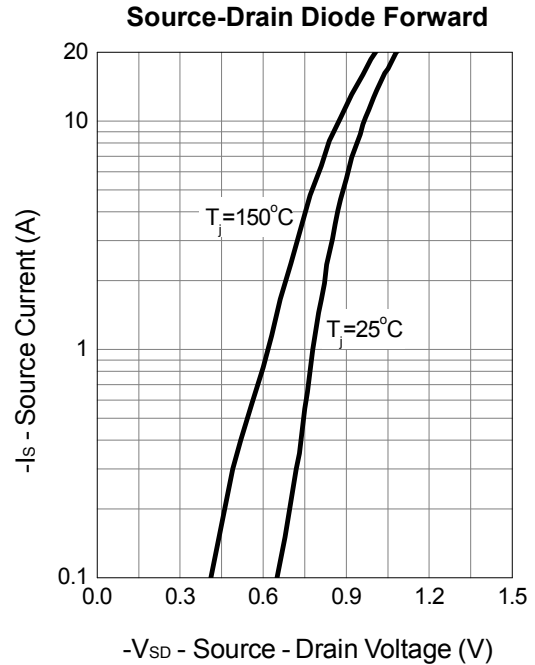
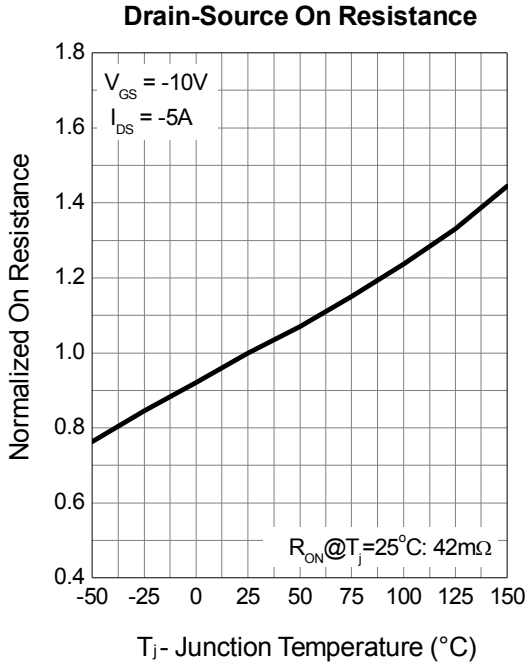




P Channel Typical Operating Characteristics (Cont.)

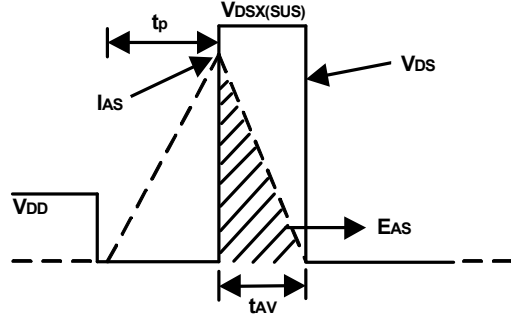
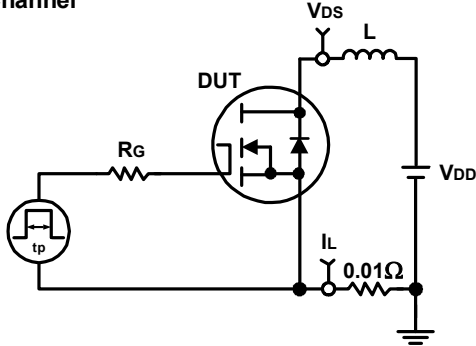


**P Channel Typical Operating Characteristics (Cont.)**

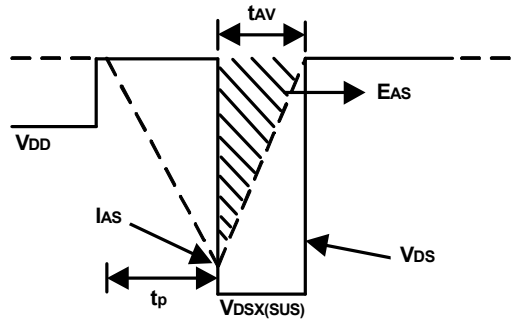
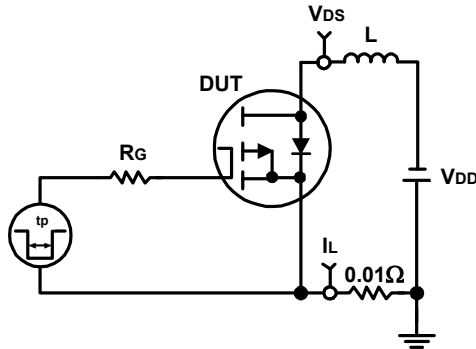


## Avalanche Test Circuit and Waveforms

N Channel

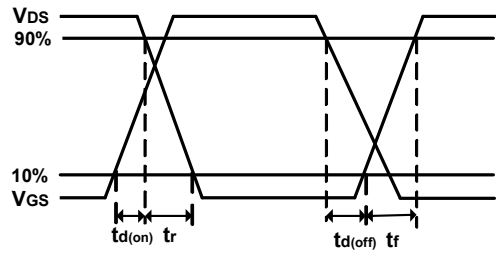
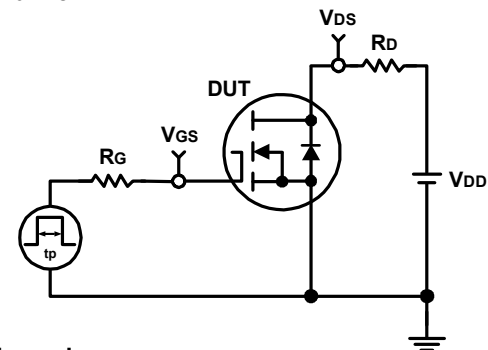


P Channel

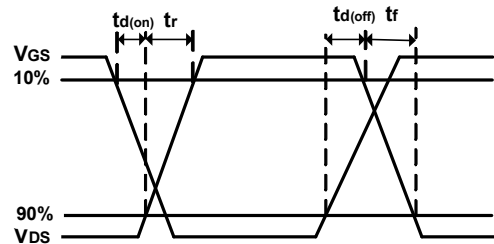
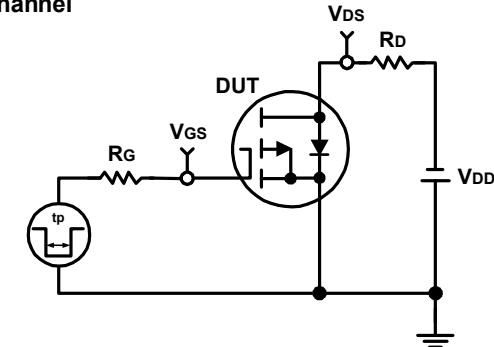


## Switching Time Test Circuit and Waveforms

N Channel



P Channel



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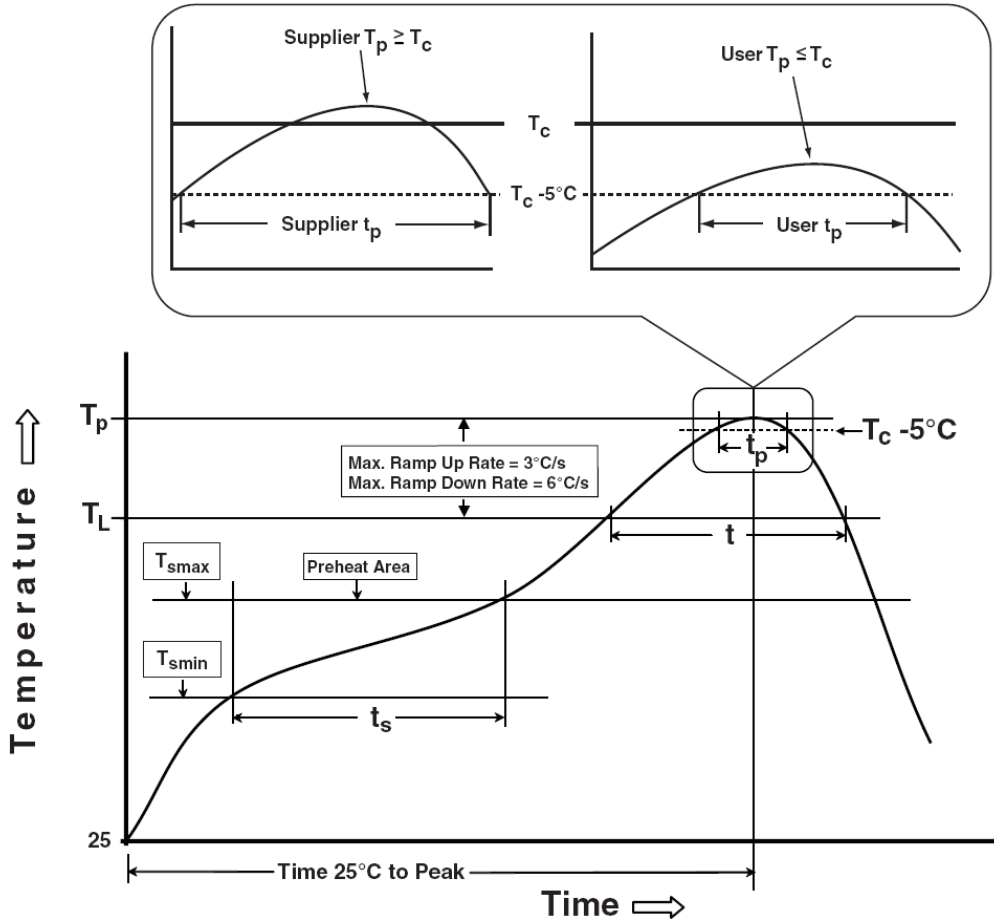
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Classification Profile



## Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat &amp; Soak</b>		
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 <sup>3</sup> <350	Volume mm <sup>3</sup> ≥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 <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >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 @ Tjmax
HTGB	JESD-22, A108	1000 Hrs, 100% of VGS max @ Tjmax
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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