

## N and P-Channel Enhancement Mode MOSFET

### Features

- N-Channel**

20V / 5A

$$R_{DS(ON)} = 58m\Omega(\text{max.}) @ V_{GS} = 4.5V$$

$$R_{DS(ON)} = 74m\Omega(\text{max.}) @ V_{GS} = 2.5V$$

$$R_{DS(ON)} = 95m\Omega(\text{max.}) @ V_{GS} = 1.8V$$

- P-Channel**

-20V / -3.3A

$$R_{DS(ON)} = 85m\Omega(\text{max.}) @ V_{GS} = -4.5V$$

$$R_{DS(ON)} = 120m\Omega(\text{max.}) @ V_{GS} = -2.5V$$

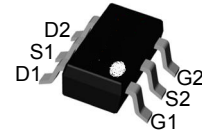
$$R_{DS(ON)} = 210m\Omega(\text{max.}) @ V_{GS} = -1.8V$$

- Reliable and Rugged
- Lead Free and Green Devices Available (RoHSCompliant)

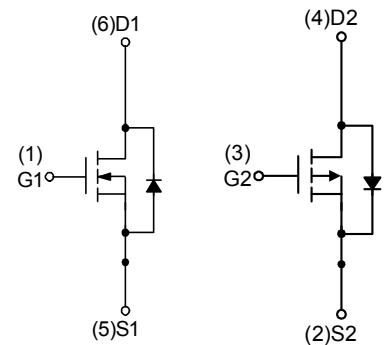
### Applications

- Power Management in Notebook Computer, Portable Equipment and Battery Powered Systems.

### Pin Description



Top View of TSOP6



N-Channel

P-Channel

### Marking

Marking	F4****
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### 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	20	-20	V	
$V_{GSS}$	Gate-Source Voltage	$\pm 12$	$\pm 12$	V	
$I_D$	Continuous Drain Current	$T_A = 25^\circ\text{C}$	5	-3.3	A
		$T_A = 70^\circ\text{C}$	4	-2.6	
$I_{DM}$	Pulsed Drain Current	$V_{GS} = 10V$	20	-13	
$I_S$	Diode Continuous Forward Current	1			
$T_J$	Maximum Junction Temperature	150		$^\circ\text{C}$	
$T_{STG}$	Storage Temperature Range	-55 to 150			
$P_D$	Maximum Power Dissipation	$T_A = 25^\circ\text{C}$	1.4	W	
		$T_A = 70^\circ\text{C}$	0.9		
$R_{\theta JA}^*$	Thermal Resistance-Junction to Ambient	$t \leq 10s$	90	$^\circ\text{C/W}$	
		Steady State	125		

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

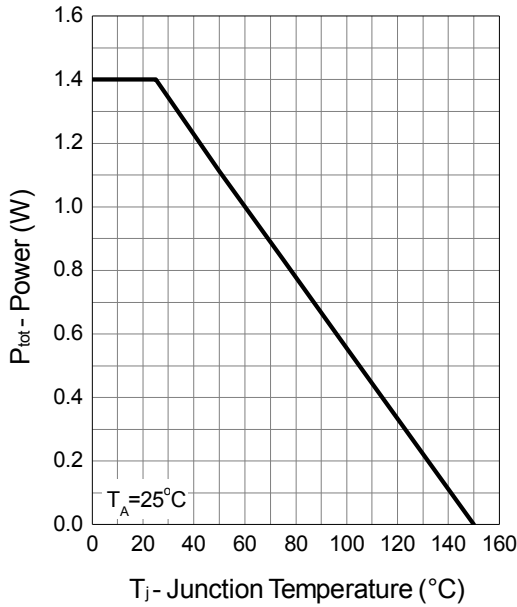
Symbol	Parameter	Test Conditions	N Channel			Unit	
			Min.	Typ.	Max.		
<b>Static Characteristics</b>							
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=250\mu A$	20	-	-	V	
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=16V, V_{GS}=0V$	-	-	1	$\mu A$	
		$T_J=85^\circ C$	-	-	30		
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	0.5	0.7	1	V	
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 12V, V_{DS}=0V$	-	-	$\pm 100$	nA	
$R_{DS(ON)}^a$	Drain-Source On-State Resistance	$V_{GS}=4.5V, I_{DS}=5A$	-	40	58	m $\Omega$	
		$V_{GS}=2.5V, I_{DS}=4A$	-	50	74		
		$V_{GS}=1.8V, I_{DS}=1A$	-	80	95		
<b>Diode Characteristics</b>							
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=1A, V_{GS}=0V$	-	0.75	1.1	V	
$t_{rr}$	Reverse Recovery Time	$I_{SD}=5A, di_{SD}/dt=100A/\mu s$	-	10.5	-	ns	
$Q_{rr}$	Reverse Recovery Charge		-	3.2	-	nC	
<b>Dynamic Characteristics<sup>b</sup></b>							
$R_g$	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1MHz$	-	2.2	-	$\Omega$	
$C_{iss}$	Input Capacitance	$V_{GS}=0V, V_{DS}=10V, \text{Frequency}=1.0MHz$	-	275	-	pF	
$C_{oss}$	Output Capacitance		-	70	-		
$C_{rss}$	Reverse Transfer Capacitance		-	60	-		
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=10V, R_L=10\Omega, I_{DS}=1A, V_{GEN}=10V, R_G=6\Omega$	-	2.4	-	ns	
$T_r$	Turn-on Rise Time		-	13	-		
$t_{d(OFF)}$	Turn-off Delay Time		-	15.5	-		
$T_f$	Turn-off Fall Time		-	3	-		
<b>Gate Charge Characteristics<sup>b</sup></b>							
$Q_g$	Total Gate Charge	$V_{DS}=10V, I_{DS}=5A$	$V_{GS}=4.5V,$	-	4.5	-	nC
			$V_{GS}=10V$	-	9	-	
$Q_{gs}$	Gate-Source Charge	$V_{DS}=10V, V_{GS}=10V, I_{DS}=5A$	-	0.3	-		
$Q_{gd}$	Gate-Drain Charge		-	2	-		
$Q_{gth}$	Threshold Gate Charge		-	0.1	-		

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

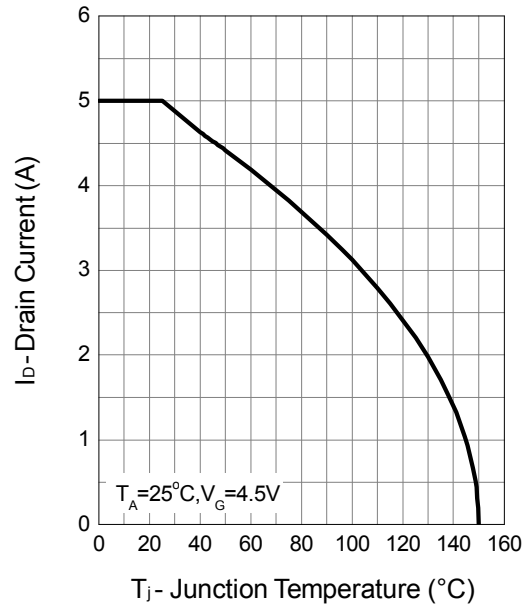
Symbol	Parameter	Test Conditions	P Channel			Unit	
			Min.	Typ.	Max.		
<b>Static Characteristics</b>							
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=-250\mu A$	-20	-	-	V	
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-16V, V_{GS}=0V$	-	-	-1	$\mu A$	
		$T_J=85^\circ C$	-	-	-30		
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=-250\mu A$	-0.5	-0.7	-1	V	
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 12V, V_{DS}=0V$	-	-	$\pm 100$	nA	
$R_{DS(ON)}^a$	Drain-Source On-State Resistance	$V_{GS}=-4.5V, I_{DS}=-3.3A$	-	65	85	m $\Omega$	
		$V_{GS}=-2.5V, I_{DS}=-2.1A$	-	90	120		
		$V_{GS}=-1.8V, I_{DS}=-1A$	-	130	210		
<b>Diode Characteristics</b>							
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=-1A, V_{GS}=0V$	-	-0.75	-1.1	V	
$t_{rr}$	Reverse Recovery Time	$I_{SD}=-3.3A, dI_{SD}/dt=100A/\mu s$	-	16	-	ns	
$Q_{rr}$	Reverse Recovery Charge		-	6	-	nC	
<b>Dynamic Characteristics<sup>b</sup></b>							
$R_g$	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1MHz$	-	10	-	$\Omega$	
$C_{iss}$	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=-10V,$ Frequency=1.0MHz	-	365	-	pF	
$C_{oss}$	Output Capacitance		-	75	-		
$C_{riss}$	Reverse Transfer Capacitance		-	60	-		
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=-10V, R_L=10\Omega,$ $I_{DS}=-1A, V_{GEN}=-10V,$ $R_G=6\Omega$	-	5.3	-	ns	
$T_r$	Turn-on Rise Time		-	14.2	-		
$t_{d(OFF)}$	Turn-off Delay Time		-	30	-		
$T_f$	Turn-off Fall Time		-	23	-		
<b>Gate Charge Characteristics<sup>b</sup></b>							
$Q_g$	Total Gate Charge	$V_{DS}=-10V,$ $I_{DS}=-3.3A$	$V_{GS}=-4.5V,$	-	4.5	-	nC
			$V_{GS}=-10V$	-	9.2	-	
$Q_{gs}$	Gate-Source Charge	$V_{DS}=-10V, V_{GS}=-10V,$ $I_{DS}=-3.3A$	-	0.7	-		
$Q_{gd}$	Gate-Drain Charge		-	1.8	-		
$Q_{gth}$	Threshold Gate Charge		-	0.3	-		

## N Channel Typical Operating Characteristics

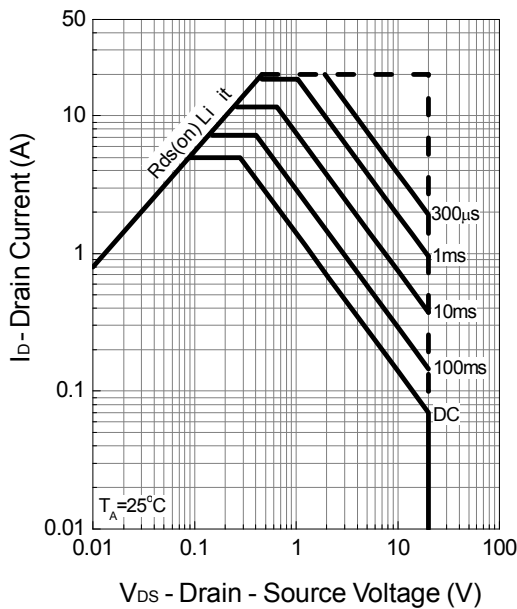
**Power Dissipation**



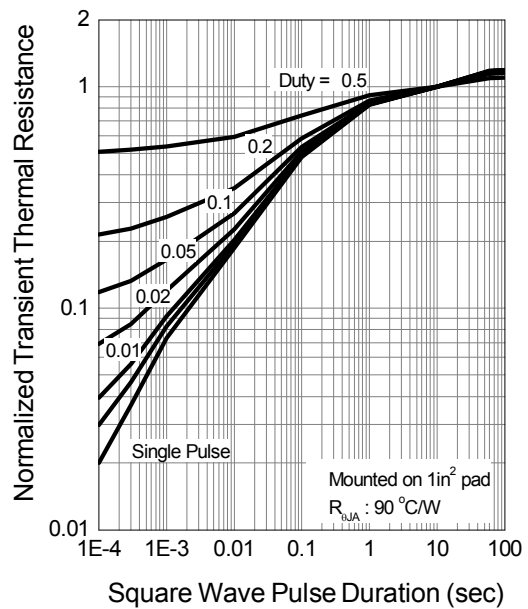
**Drain Current**



**Safe Operation Area**

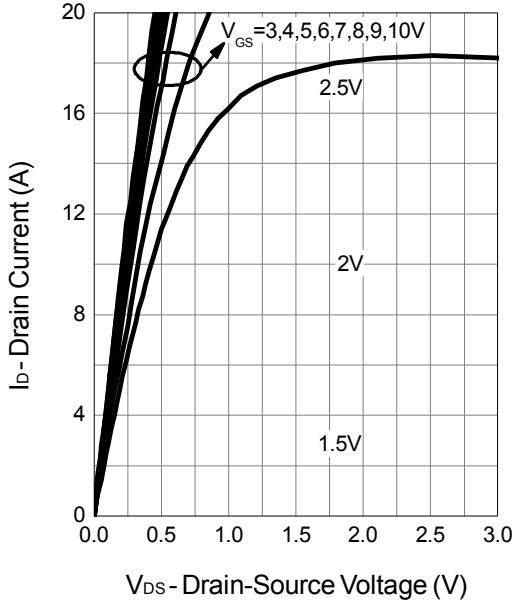


**Thermal Transient Impedance**

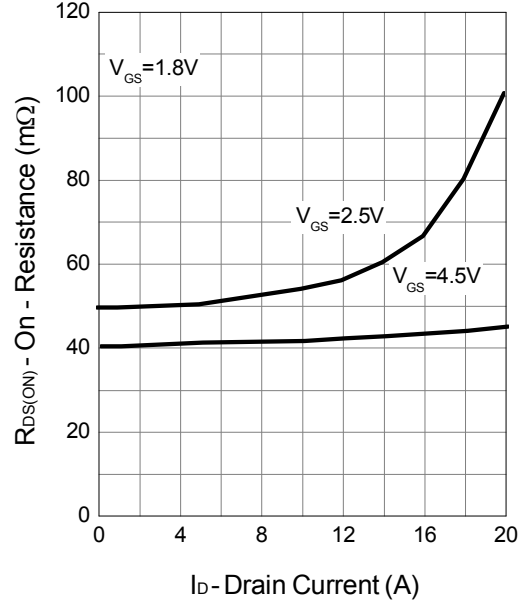


**N Channel Typical Operating Characteristics (Cont.)**

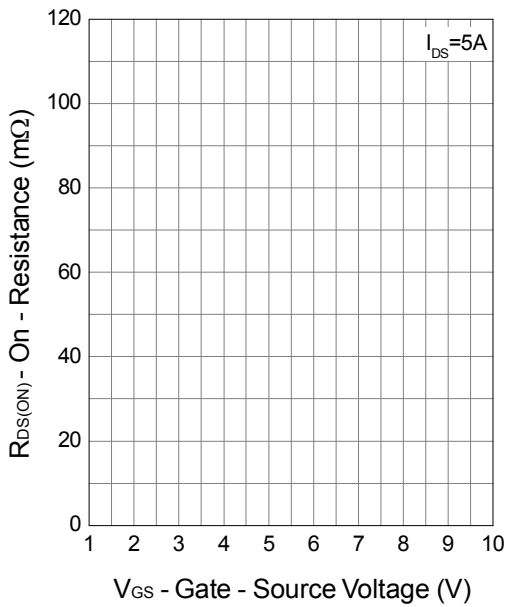
**Output Characteristics**



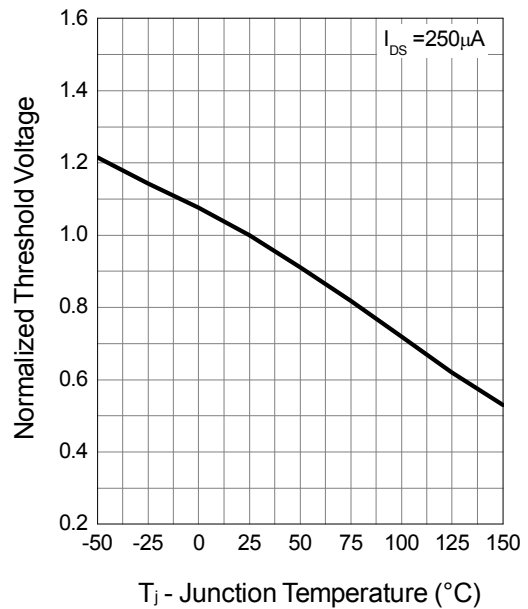
**Drain-Source On Resistance**



**Gate-Source On Resistance**

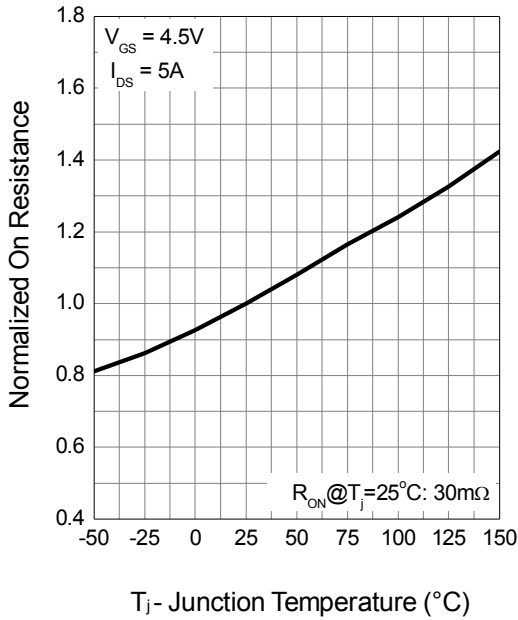


**Gate Threshold Voltage**

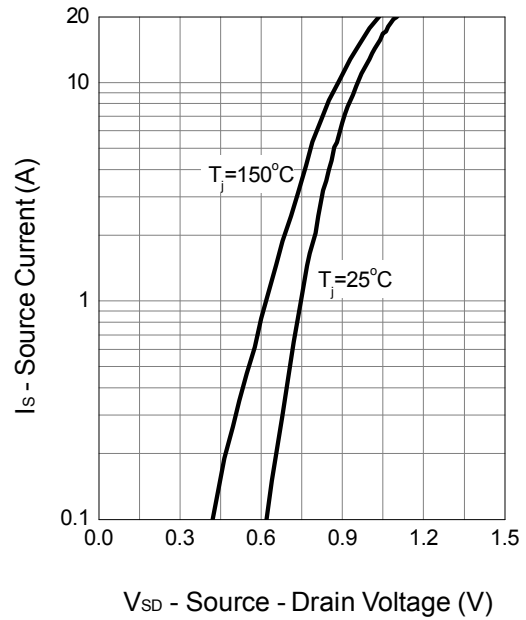


**N Channel Typical Operating Characteristics (Cont.)**

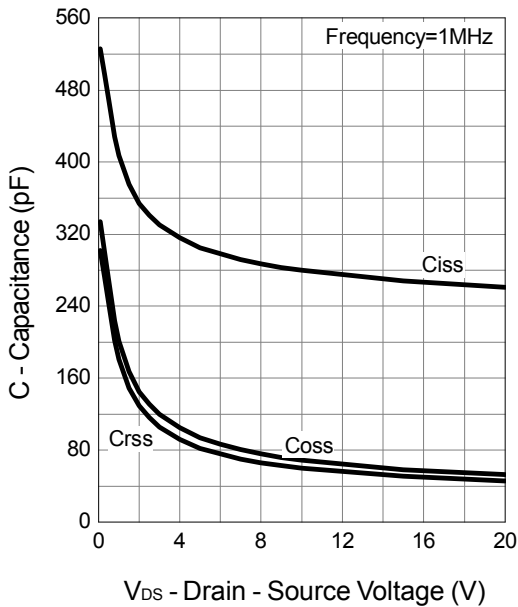
**Drain-Source On Resistance**



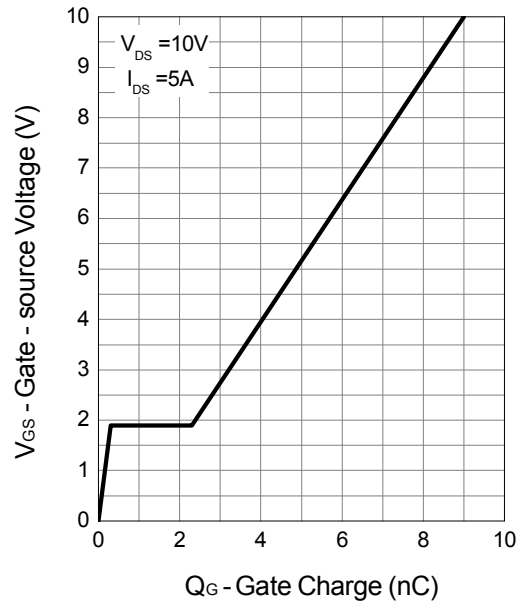
**Source-Drain Diode Forward**



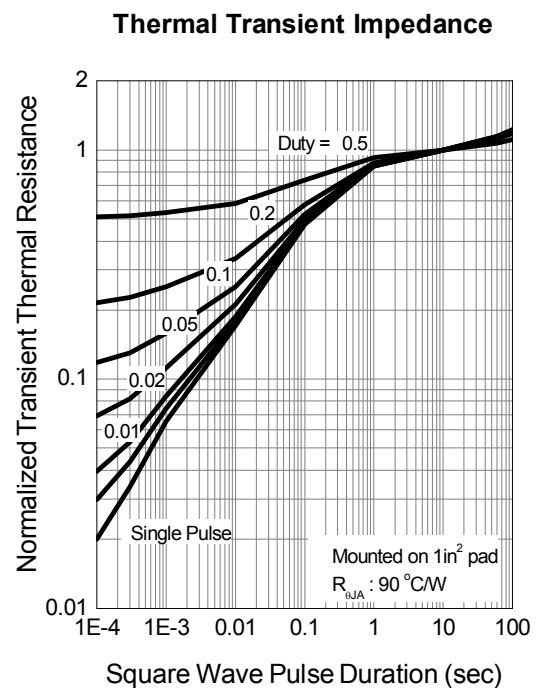
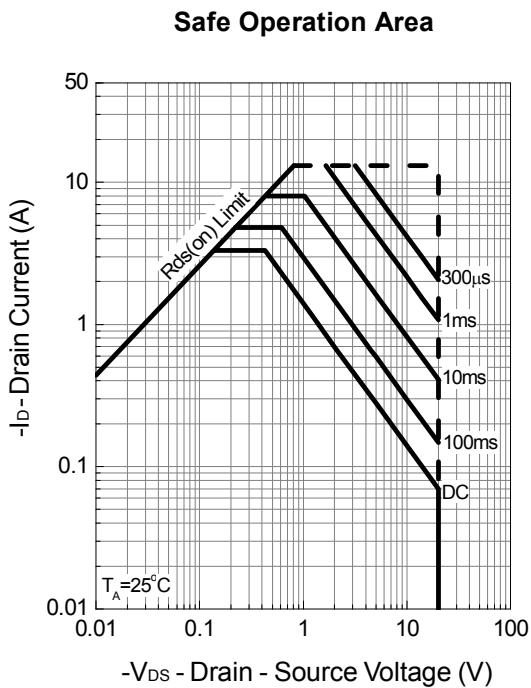
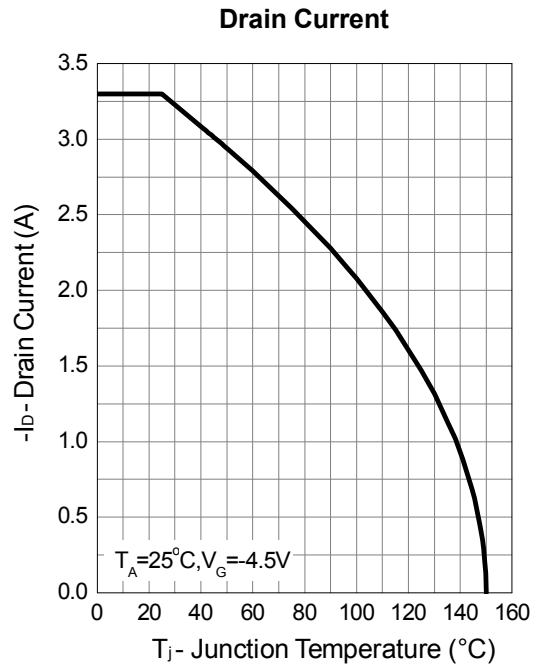
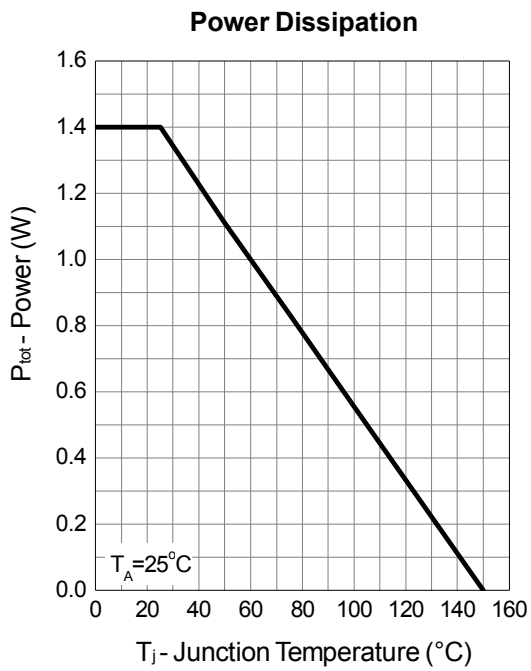
**Capacitance**



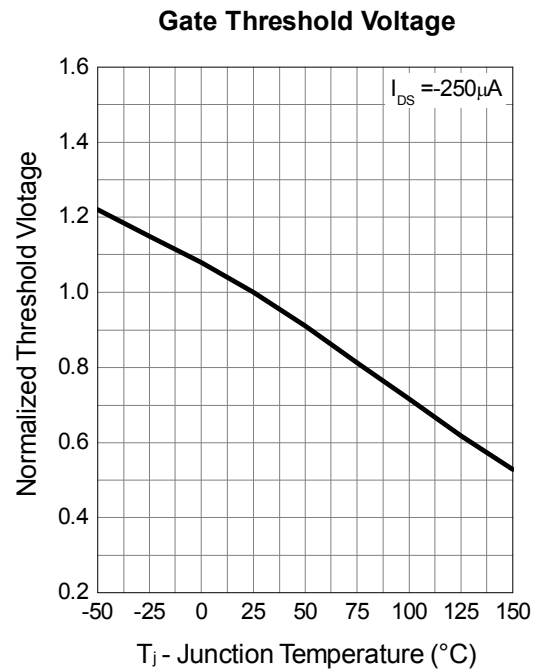
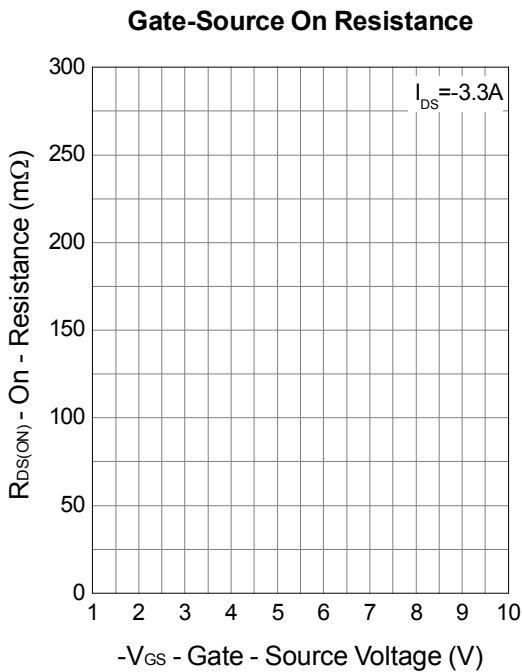
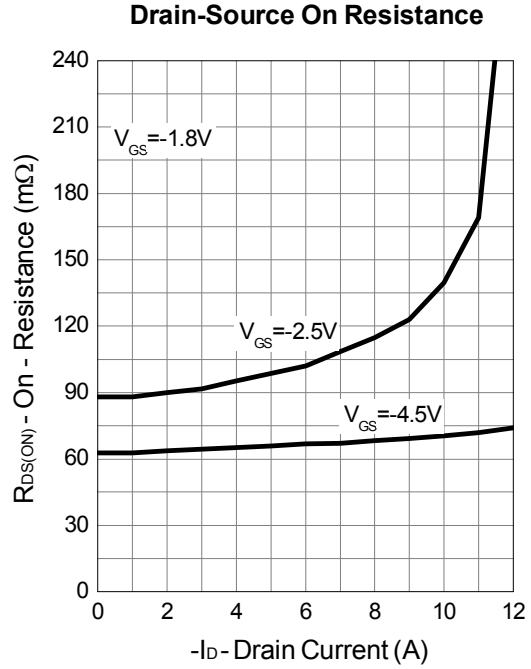
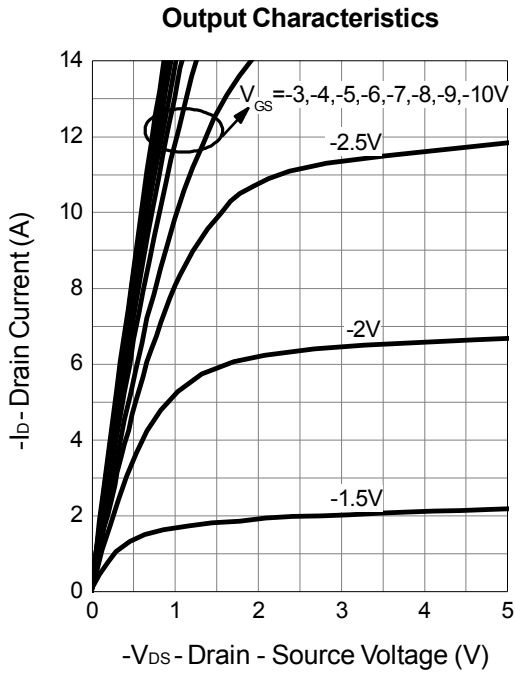
**Gate Charge**



## P Channel Typical Operating Characteristics

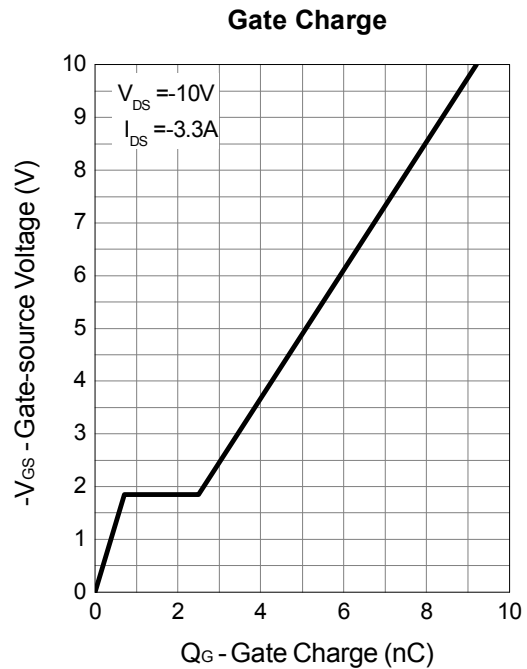
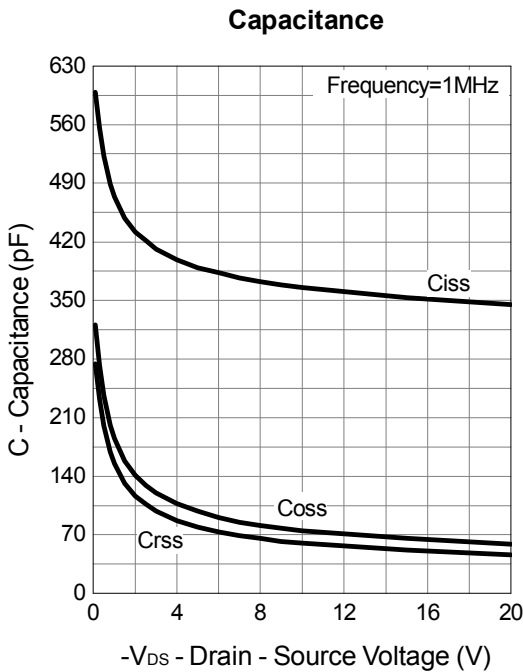
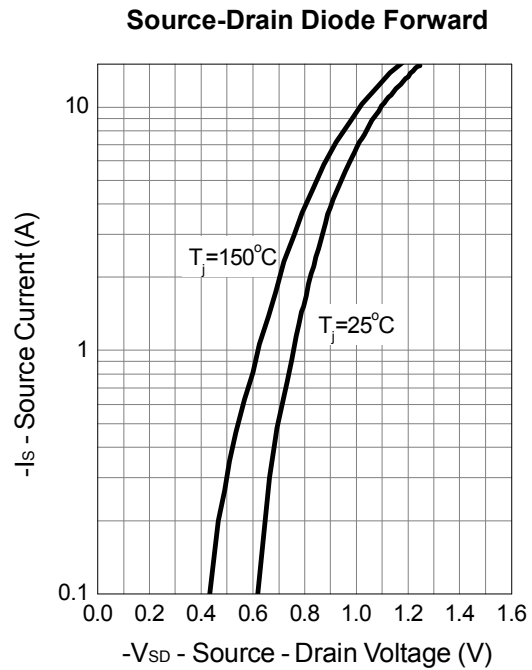
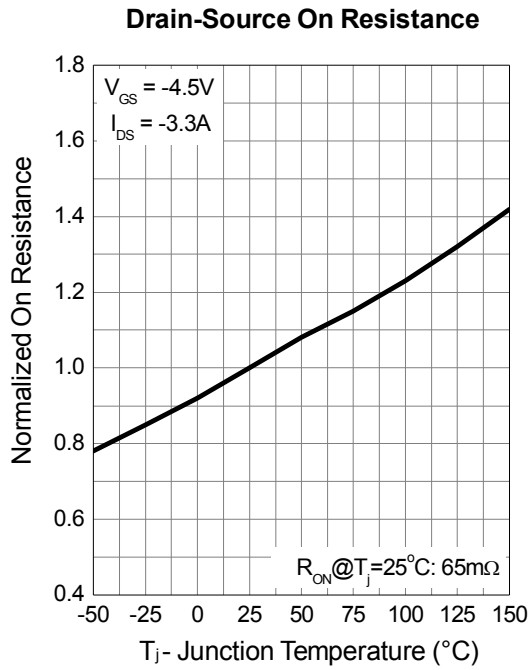


**P Channel Typical Operating Characteristics (Cont.)**



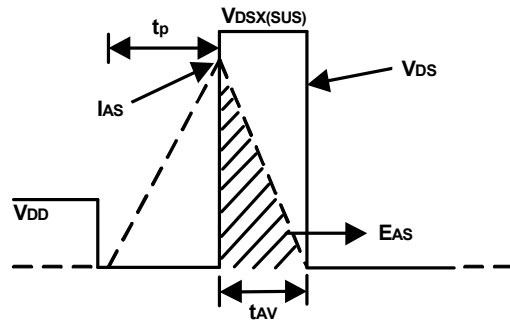
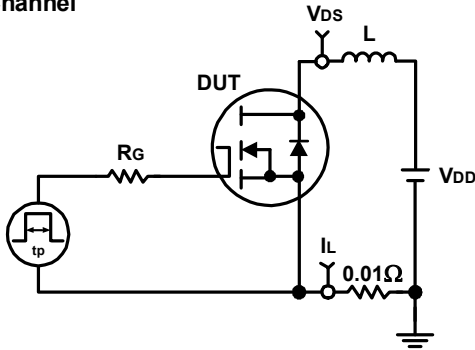


**P Channel Typical Operating Characteristics (Cont.)**

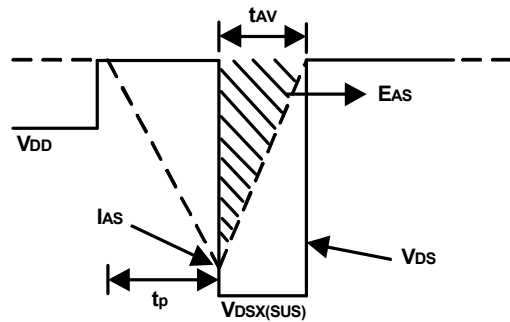
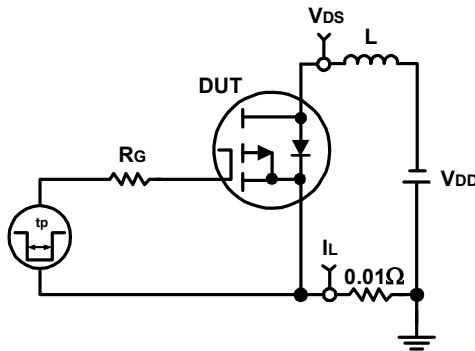


## Avalanche Test Circuit and Waveforms

N Channel

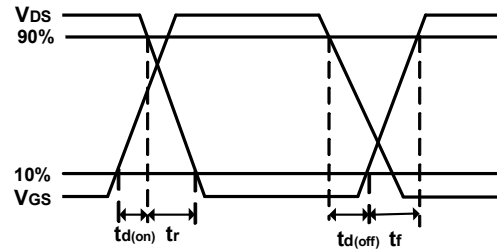
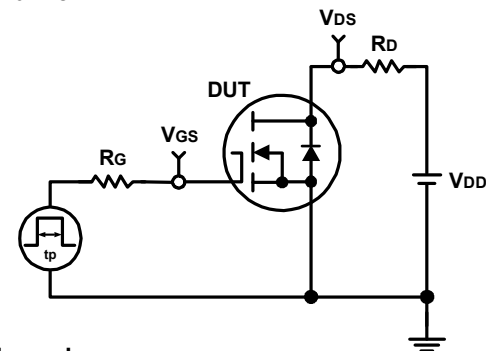


P Channel

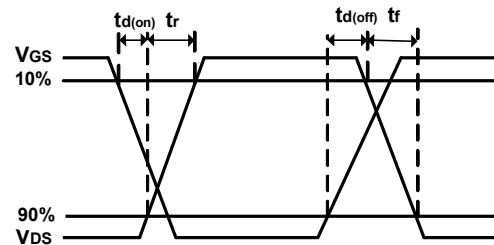
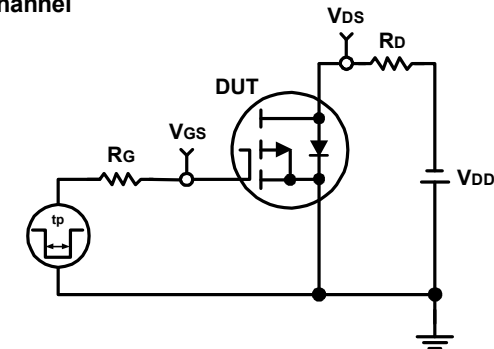


## Switching Time Test Circuit and Waveforms

N Channel

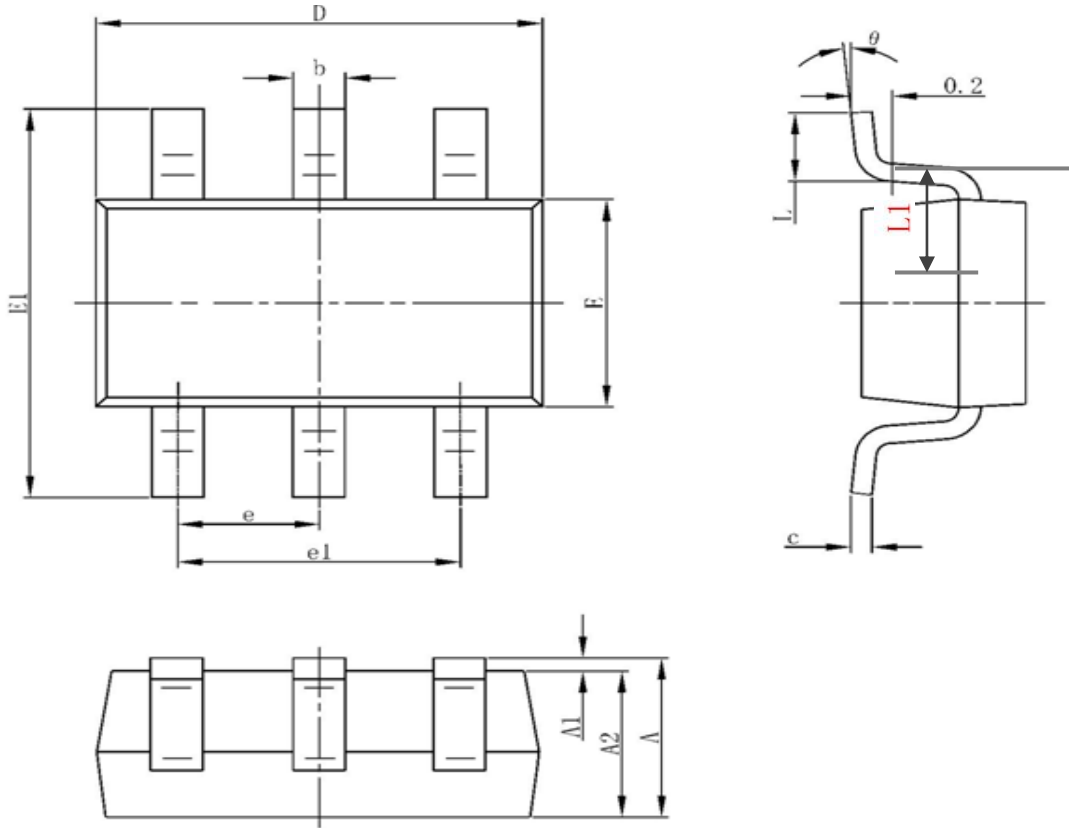


P Channel



Package Information

TSOP6



UNIT(mm)

Symbol	MIN	TYP	MAX
A	1.05		1.25
A1	0.01		0.15
A2	1.05		1.15
b	0.30		0.50
c	0.10		0.20
D	2.82		3.02
E	1.50		1.70
E1	2.65		2.95
e		0.95	
e 1	1.8		2.00
L	0.35		0.60
L1	0.55		0.70
$\theta$	0°		8°

## Attention

- Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress rating only and functional device operation is not implied. YiDeng Wei Semiconductor assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all YiDeng Wei Semiconductor products described or contained herein.
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