
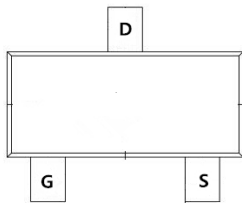


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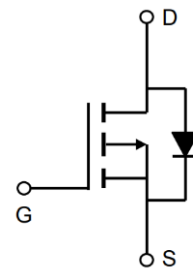
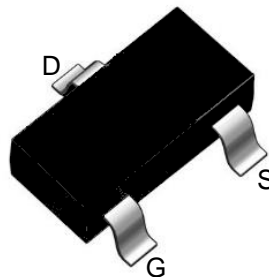
P-Channel Enhancement Mosfet

<p><b>General Description</b></p> <ul style="list-style-type: none"> <li>• Low <math>R_{DS(ON)}</math></li> <li>• RoHS and Halogen-Free Compliant</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Load switch</li> <li>• PWM</li> </ul>	<p><b>General Features</b></p> <p><math>V_{DS} = -20V, I_D = -4.0A</math></p> <p><math>R_{DS(ON)} = 32 m\Omega</math> (Typ.) @ <math>V_{GS} = -4.5V</math></p> <p>100% UIS Tested 100% <math>R_g</math> Tested</p> 
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I:SOT-23



Marking: 3415



**Absolute Maximum Ratings:** ( $T_C = 25^\circ C$  unless otherwise noted)

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	-20	V
$V_{GS}$	Gate-Source Voltage	$\pm 12$	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V^1$	-4.0	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V^1$	-2.8	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	-15	A
$P_D @ T_A = 25^\circ C$	Total Power Dissipation <sup>3</sup>	0.90	W
$P_D @ T_A = 70^\circ C$	Total Power Dissipation <sup>3</sup>	0.54	W
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ C$

**Thermal Data**

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	---	120	$^\circ C / W$
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup> ( $t \leq 10s$ )	---	95	$^\circ C / W$

Electrical Characteristics ( $T_J=25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-20	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	$BV_{DSS}$ Temperature Coefficient	Reference to $25^{\circ}\text{C}$ , $I_D=-1\text{mA}$	---	-0.014	---	V/ $^{\circ}\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=-4.5V, I_D=-4.9A$	---	32	40	m $\Omega$
		$V_{GS}=-2.5V, I_D=-3.4A$	---	42	60	
		$V_{GS}=-1.8V, I_D=-2A$	---	---	---	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=-250\mu A$	-0.5	-0.7	-1.0	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	3.95	---	mV/ $^{\circ}\text{C}$
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=-16V, V_{GS}=0V, T_J=25^{\circ}\text{C}$	---	---	-1	uA
		$V_{DS}=-16V, V_{GS}=0V, T_J=55^{\circ}\text{C}$	---	---	-5	
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 12V, V_{DS}=0V$	---	---	$\pm 100$	nA
$g_{fs}$	Forward Transconductance	$V_{DS}=-5V, I_D=-3A$	---	12.8	---	S
$Q_g$	Total Gate Charge (-4.5V)	$V_{DS}=-15V, V_{GS}=-4.5V, I_D=-3A$	---	9.2	14.3	nC
$Q_{gs}$	Gate-Source Charge		---	1.89	2.6	
$Q_{gd}$	Gate-Drain Charge		---	3.1	4.3	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-10V, V_{GS}=-4.5V, R_G=3.3\Omega, I_D=-3A$	---	5.6	11.2	ns
$T_r$	Rise Time		---	40.8	73	
$T_{d(off)}$	Turn-Off Delay Time		---	33.6	67	
$T_f$	Fall Time		---	18	36	
$C_{iss}$	Input Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1\text{MHz}$	---	757	1200	pF
$C_{oss}$	Output Capacitance		---	104	160	
$C_{rss}$	Reverse Transfer Capacitance		---	98	151	

## Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_S$	Continuous Source Current <sup>1,4</sup>	$V_G=V_D=0V, \text{Force Current}$	---	---	-4.0	A
$I_{SM}$	Pulsed Source Current <sup>2,4</sup>		---	---	-10	A
$V_{SD}$	Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V, I_S=-1A, T_J=25^{\circ}\text{C}$	---	---	-1	V
$t_{rr}$	Reverse Recovery Time	$I_F=-3A, di/dt=100A/\mu s,$	---	21.8	---	nS
$Q_{rr}$	Reverse Recovery Charge	$T_J=25^{\circ}\text{C}$	---	6.9	---	nC

Note :

1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.2. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ 3. The power dissipation is limited by  $150^{\circ}\text{C}$  junction temperature4. The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications, should be limited by total power dissipation.

## Typical Performance Characteristics

Figure 1: Output Characteristics

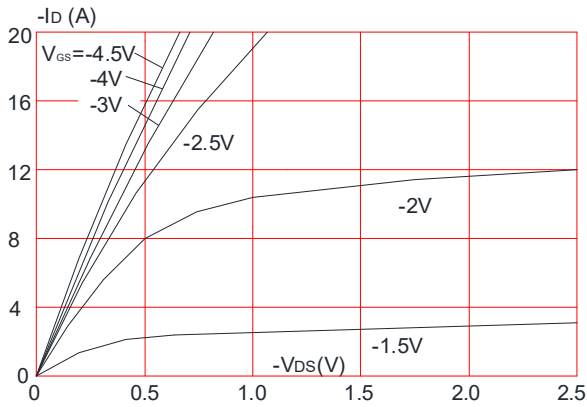


Figure 2: Typical Transfer Characteristics

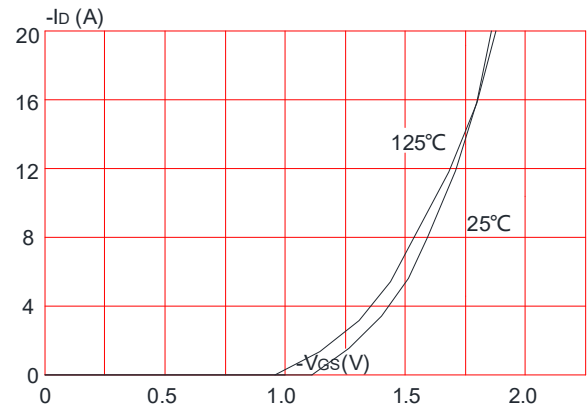


Figure 3: On-resistance vs. Drain Current

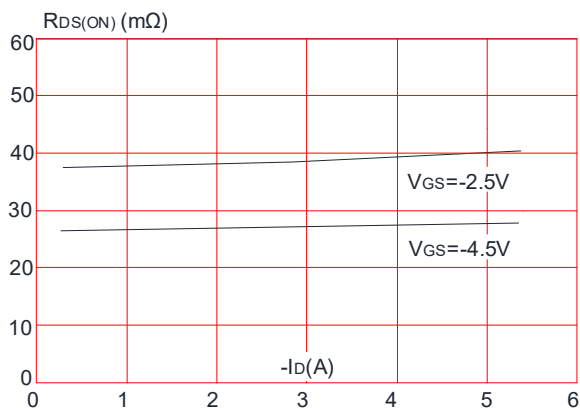


Figure 4: Body Diode Characteristics

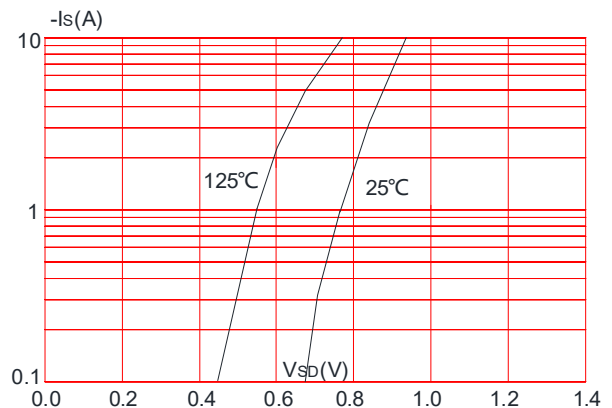


Figure 5: Gate Charge Characteristics

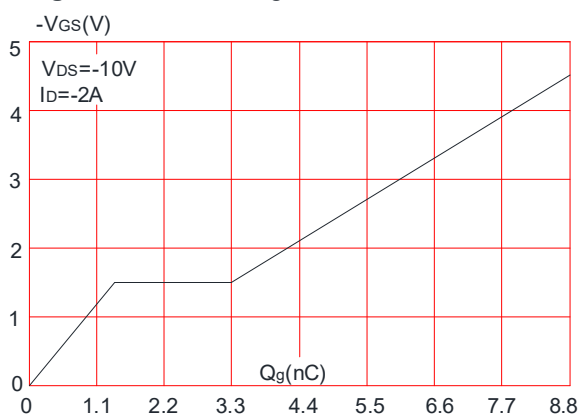
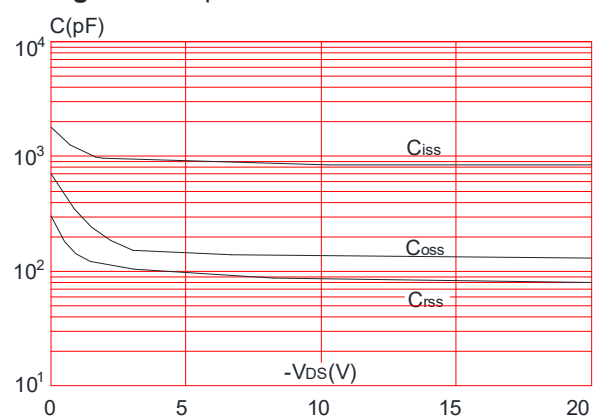


Figure 6: Capacitance Characteristics



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Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

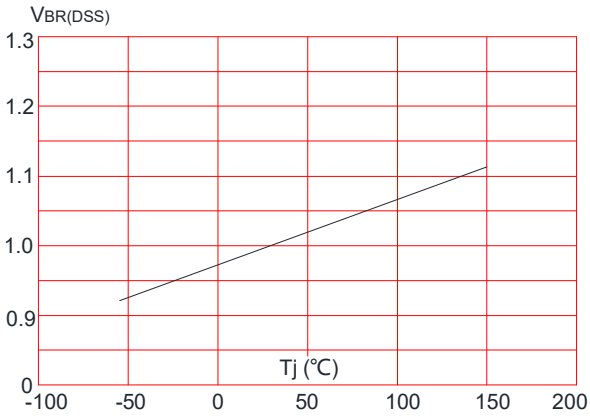


Figure 8: Normalized on Resistance vs. Junction Temperature

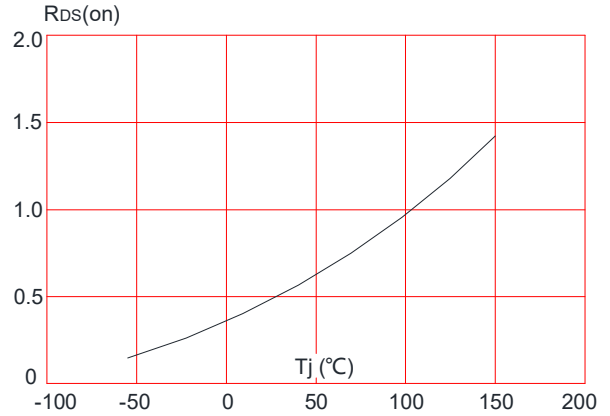


Figure 9: Maximum Safe Operating Area

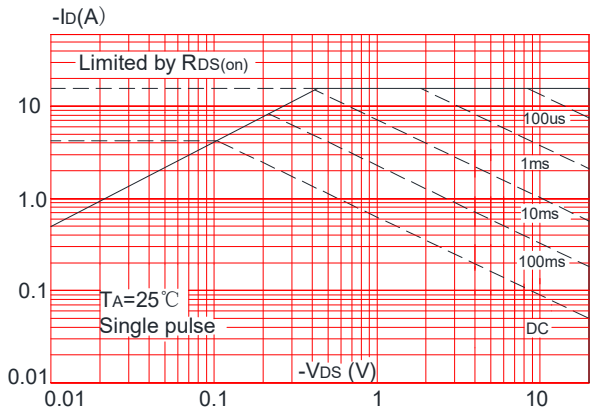


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

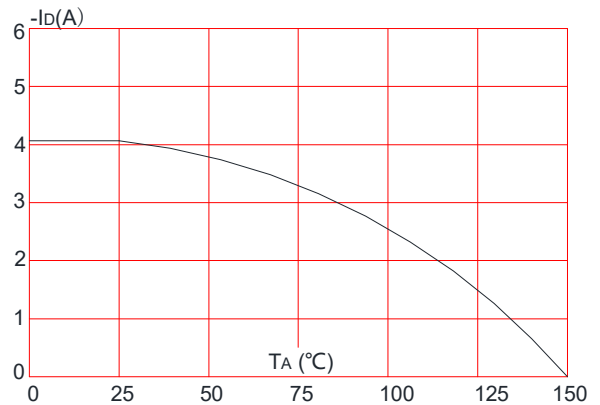
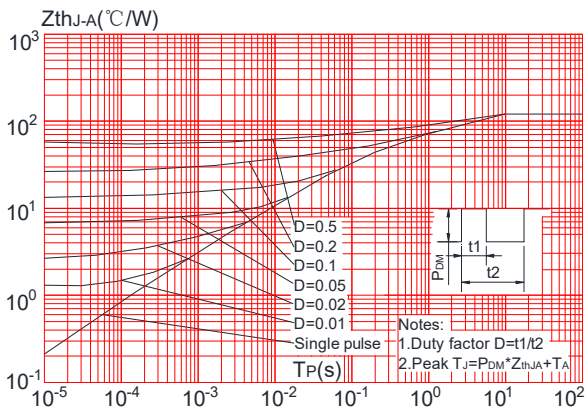
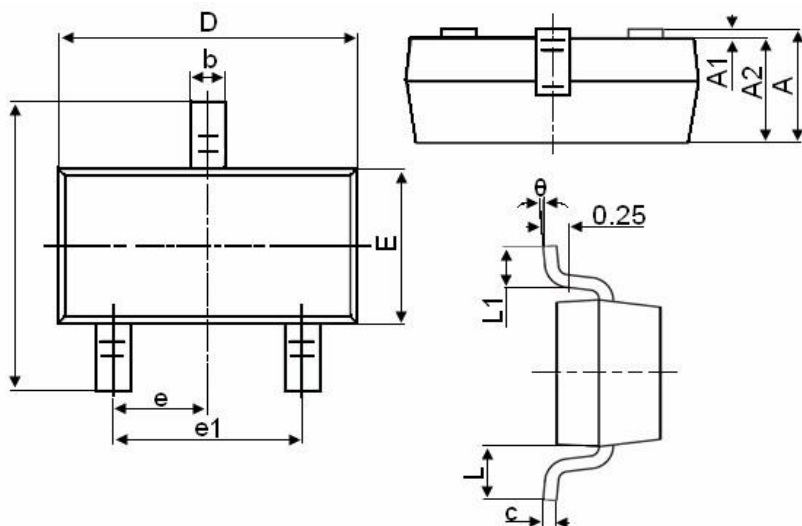


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



## Package Mechanical Data:SOT-23



Symbol	Dimensions in Millimeters	
	MIN.	MAX.
A	0.900	1.150
A1	0.000	0.100
A2	0.900	1.050
b	0.300	0.500
c	0.080	0.150
D	2.800	3.000
E	1.200	1.400
E1	2.250	2.550
e	0.950TYP	
e1	1.800	2.000
L	0.550REF	
L1	0.300	0.500
$\theta$	0°	8°