

# P-Channel 20-V (D-S) MOSFET

MOSFET PRODUCT SUMMARY					
V <sub>DS</sub> (V)	$R_{DS(on)}(\Omega)$	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)		
	0.035 at V <sub>GS</sub> = - 10 V	- 5 <sup>e</sup>			
- 20	0.043 at V <sub>GS</sub> = - 4.5 V	- 5 <sup>e</sup>	10 nC		
	0.061 at V <sub>GS</sub> = - 2.5 V	- 4.8			

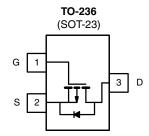
### **FEATURES**

- Halogen-free According to IEC 61249-2-21 **Definition**
- TrenchFET® Power MOSFET
- 100 % R<sub>g</sub> Tested
- Compliant to RoHS Directive 2002/95/EC



#### **APPLICATIONS**

- Load Switch
- PA Switch
- DC/DC Converters



ABSOLUTE MAXIMUM RATINGS $(T_A =$	= 25 °C, unless ot	herwise noted)		
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage		$V_{DS}$	- 20	V
Gate-Source Voltage		$V_{GS}$	± 12	•
	T <sub>C</sub> = 25 °C		- 5 <sup>e</sup>	
Continuous Drain Current (T <sub>.I</sub> = 150 °C)	T <sub>C</sub> = 70 °C	l <sub>D</sub>	- 4.8	
Continuous Brain Carrent (1) = 100 C)	T <sub>A</sub> = 25 °C		- 4.5 <sup>b, c</sup>	
	T <sub>A</sub> = 70 °C		- 3.5 <sup>b, c</sup>	Α
Pulsed Drain Current		I <sub>DM</sub>	- 18	
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C	I <sub>S</sub>	- 2.1	
Continuous Gource-Diam Blode Garrent	T <sub>A</sub> = 25 °C	'5	- 1.0 <sup>b, c</sup>	
	T <sub>C</sub> = 25 °C		2.5	
Maximum Power Dissipation	T <sub>C</sub> = 70 °C	P <sub>D</sub>	1.6	$\square$ w
Maximum Fower Dissipation	T <sub>A</sub> = 25 °C		1.25 <sup>b, c</sup>	• • • • • • • • • • • • • • • • • • • •
	T <sub>A</sub> = 70 °C		0.8 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C

THERMAL RESISTANCE RATINGS						
Parameter		Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient <sup>b, d</sup>	≤ 5 s	R <sub>thJA</sub>	75	100	°C/W	
Maximum Junction-to-Foot (Drain)	Steady State	$R_{thJF}$	40	50	] 5/**	

#### Notes:

- a. Based on  $T_C$  = 25 °C. b. Surface mounted on 1" x 1" FR4 board.
- d. Maximum under steady state conditions is 166 °C/W.
- e. Package limited.



Parameter	Symbol	Test Conditions	Min.	Тур.	Max.	Unit	
Static							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{DS} = 0 \text{ V}, I_{D} = -250 \mu\text{A}$	- 20			V	
V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$	J 050 vA		- 13.4		mV/°C	
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I <sub>D</sub> = - 250 μA		2.9		] IIIV/ (	
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}, I_{D} = -250 \mu\text{A}$	- 0.5		- 1.5	V	
Gate-Source Leakage	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 12 \text{ V}$			± 100	nA	
Zara Cata Valtaga Drain Current	1	$V_{DS} = -20 \text{ V}, V_{GS} = 0 \text{ V}$			- 1	μΑ	
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	$V_{DS} = -20 \text{ V}, V_{GS} = 0 \text{ V}, T_{J} = 55 \text{ °C}$			- 10		
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \le -5 \text{ V}, V_{GS} = -4.5 \text{ V}$	- 18			Α	
		V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 5.1 A		0.035			
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 4.5 A		0.043		Ω	
		V <sub>GS</sub> = - 2.5 V, I <sub>D</sub> = - 3.7 A		0.061		1	
Forward Transconductance <sup>a</sup> $g_{fs}$ $V_{DS} = -5 \text{ V}, I_D = -5.1 \text{ A}$			15		S		
Dynamic <sup>b</sup>							
Input Capacitance	C <sub>iss</sub>			835			
Output Capacitance	C <sub>oss</sub>			180		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>			155		1	
T. 10 . 0		V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 5.1 A		10			
Total Gate Charge	$Q_g$			6.4			
Gate-Source Charge	$Q_{gs}$	V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = - 2.5 V, I <sub>D</sub> = - 5.1 A		1.7		nC	
Gate-Drain Charge	$Q_{gd}$			3.4			
Gate Resistance	$R_{g}$	f = 1 MHz	0.9	4.4	8.8	Ω	
Turn-On Delay Time	t <sub>d(on)</sub>			22	33		
Rise Time	t <sub>r</sub>	$V_{DD} = -10 \text{ V, R}_{L} = 2.4 \Omega$		20	30		
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D = -4.1 \text{ A}, V_{GEN} = -4.5 \text{ V}, R_g = 1 \Omega$		28	42	ns ns	
Fall Time	t <sub>f</sub>			9	18		
<b>Drain-Source Body Diode Characteristi</b>	cs						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			- 2.1	^	
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				- 20	A	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = - 4.1 A		- 0.8	- 1.2	V	
Body Diode Reverse Recovery Time	t <sub>rr</sub>			23	35	ns	
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			12	20	nC	
Reverse Recovery Fall Time	t <sub>a</sub>	$I_F = -4.1 \text{ A, dI/dt} = 100 \text{ A/}\mu\text{s, T}_J = 25 ^{\circ}\text{C}$		15			
Reverse Recovery Rise Time	t <sub>b</sub>	<b>-</b>		8		ns	

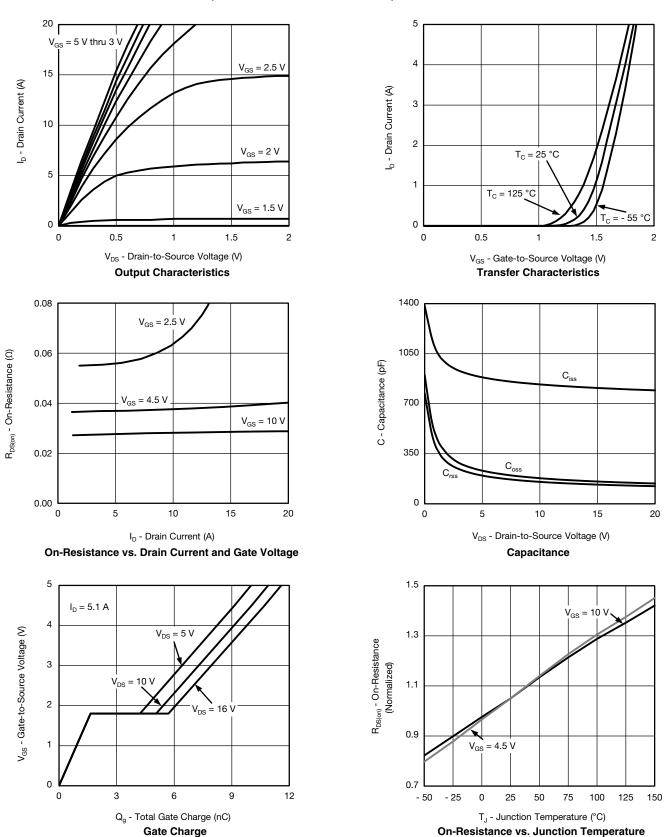
### Notes:

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

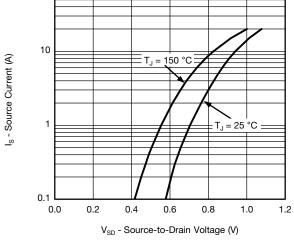
a. Pulse test; pulse width  $\leq$  300  $\mu s,$  duty cycle  $\leq$  2 %.

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

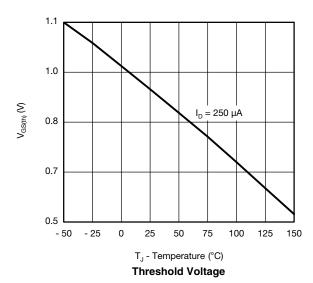


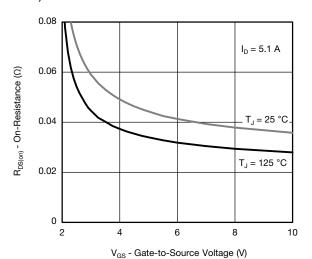




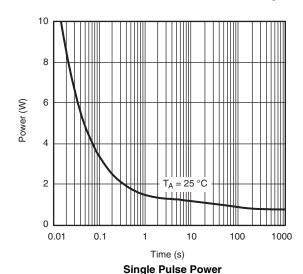


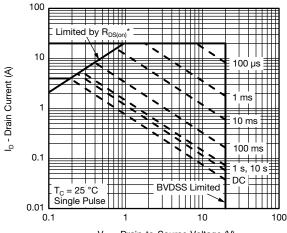
#### Source-Drain Diode Forward Voltage





On-Resistance vs. Gate-to-Source Voltage

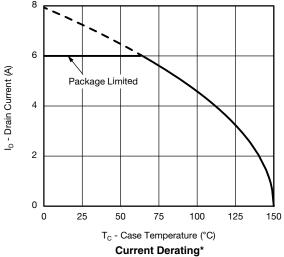




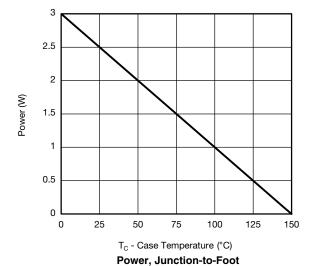
 $V_{DS} \text{ - Drain-to-Source Voltage (V)} \\ ^*V_{GS} \text{ > minimum } V_{GS} \text{ at which } R_{DS(on)} \text{ is specified}$ 

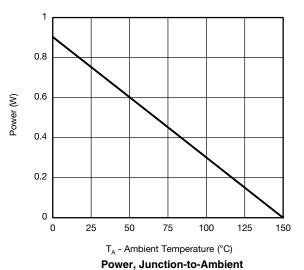
Safe Operating Area





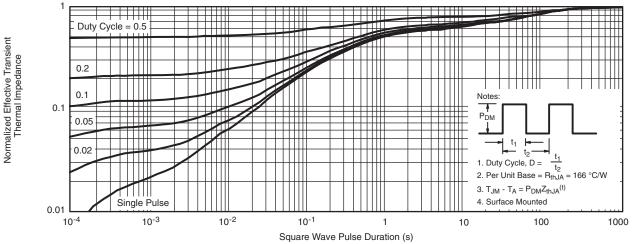




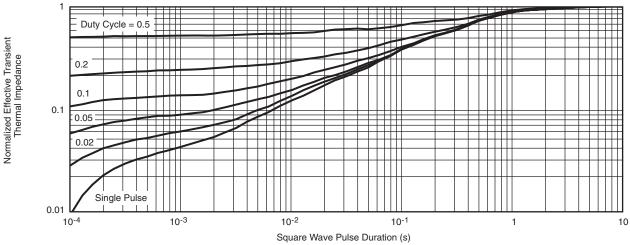


<sup>\*</sup> The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.





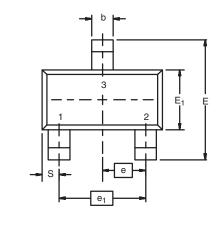


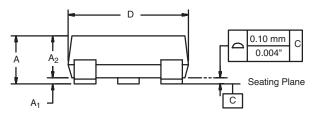


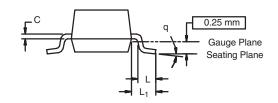
Normalized Thermal Transient Impedance, Junction-to-Foot



# SOT-23 (TO-236): 3-LEAD







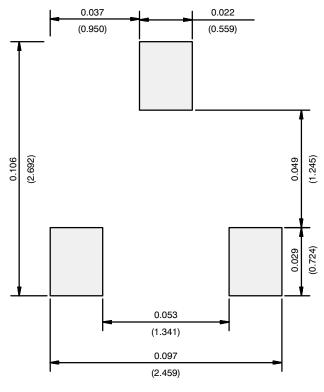
Dim	MILLIMETERS		INCHES		
	Min	Max	Min	Max	
Α	0.89	1.12	0.035	0.044	
A <sub>1</sub>	0.01	0.10	0.0004	0.004	
A <sub>2</sub>	0.88	1.02	0.0346	0.040	
b	0.35	0.50	0.014	0.020	
С	0.085	0.18	0.003	0.007	
D	2.80	3.04	0.110	0.120	
E	2.10	2.64	0.083	0.104	
E <sub>1</sub>	1.20	1.40	0.047	0.055	
е	0.95 BSC		0.0374 Ref		
e <sub>1</sub>	1.90	1.90 BSC		0.0748 Ref	
L	0.40	0.60	0.016	0.024	
L <sub>1</sub>	0.64 Ref		0.025 Ref		
S	0.50 Ref		0.020	Ref	
q	3°	8°	3°	8°	

ECN: S-03946-Rev. K, 09-Jul-01

DWG: 5479



## **RECOMMENDED MINIMUM PADS FOR SOT-23**



Recommended Minimum Pads Dimensions in Inches/(mm)

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