



P-Channel 12 V (D-S) MOSFET

MOSFET PRODUCT SUMMARY					
V _{DS} (V)	$R_{DS(on)}\left(\Omega\right)$ Max.	I _D (A) ^a	Q _g (Typ.)		
	0.028 at V _{GS} = - 4.5 V	- 6 ^e			
	0.032 at V _{GS} = - 3.7 V	- 6 ^e			
- 12	0.040 at V _{GS} = - 2.5 V	- 6 ^e	9 nC		
	0.063 at V _{GS} = - 1.8 V	- 4.5			
	0.150 at V _{GS} = - 1.5 V	- 3.6			

FEATURES

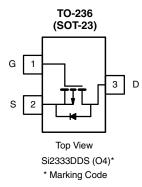
- TrenchFET® Power MOSFET
- 100 % R_g Tested
- Material categorization: For definitions of compliance please see www.vishav.com/doc?99912



HALOGEN FREE

APPLICATIONS

- Smart Phones and Tablet PCs
 - Load Switch
 - Battery Switch



Ordering Information: Si2333DDS-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS $(T_A$	= 25 °C, unless ot	herwise noted)		
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage		V _{DS}	- 12	V
Gate-Source Voltage	V_{GS}	± 8	1 °	
	T _C = 25 °C		- 6 ^e	
Continuous Drain Current (T _{.1} = 150 °C)	T _C = 70 °C	L_	- 5.2	
Continuous Diain Guiterit (1) = 130 G)	T _A = 25 °C	I _D	- 5 ^{b, c}	
	T _A = 70 °C		- 4 ^{b, c}	Α
Pulsed Drain Current (t = 300 μs)	I _{DM}	- 20	7	
Continuous Source-Drain Diode Current	T _C = 25 °C	I _S	- 1.4	
Continuous Source-Diain Diode Current	T _A = 25 °C	'S	- 0.63 ^{b, c}	
	T _C = 25 °C		1.7	
Maximum Power Dissipation	T _C = 70 °C	P_{D}	1.1	w
Maximum i Ower Dissipation	T _A = 25 °C	• В	1.20 ^{b, c}	
	T _A = 70 °C		0.6 ^{b, c}	
Operating Junction and Storage Temperature Range	T _J , T _{sta}	- 55 to 150	°C	

THERMAL RESISTANCE RATINGS							
Parameter		Symbol	Typical	Maximum	Unit		
Maximum Junction-to-Ambient ^{b, d}	≤ 5 s	R _{thJA}	100	130	°C/W		
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	60	75	O/ V V		

- a. Based on T_C = 25 °C.
- b. Surface mounted on 1" x 1" FR4 board.
- c. t = 5 s.
- d. Maximum under steady state conditions is 175 °C/W.
- e. Package limited.

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MOSFET SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)							
Parameter	Symbol	Test Conditions	Min.	Тур.	Max.	Unit	
Static	T					1	
Drain-Source Breakdown Voltage	V_{DS}	$V_{DS} = 0 \text{ V}, I_{D} = -250 \mu\text{A}$	- 12			V	
V _{DS} Temperature Coefficient	$\Delta V_{DS}/T_{J}$	I _D = - 250 μΑ		- 8		mV/°C	
V _{GS(th)} Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			2.4			
Gate-Source Threshold Voltage	V _{GS(th)}	$V_{DS} = V_{GS}, I_D = -250 \mu A$	- 0.4		- 1	V	
Gate-Source Leakage	I _{GSS}	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 8 \text{ V}$			± 100	nA	
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = - 12 V, V _{GS} = 0 V			- 1	μА	
Zero Gate Voltage Drain Current	יטאא	V_{DS} = - 12 V, V_{GS} = 0 V, T_{J} = 55 °C		- 10			
On-State Drain Current ^a	I _{D(on)}	$V_{DS} \le$ - 5 V, V_{GS} = - 4.5 V	- 20			Α	
		V _{GS} = - 4.5 V, I _D = - 5 A		0.023	0.028		
		V _{GS} = - 3.7 V, I _D = - 4.6 A		0.026	0.032		
Drain-Source On-State Resistance ^a	R _{DS(on)}	$V_{GS} = -2.5 \text{ V}, I_D = -4.3 \text{ A}$		0.033	0.040	Ω	
		V _{GS} = - 1.8 V, I _D = - 1 A		0.048	0.063		
		V _{GS} = - 1.5 V, I _D = - 0.5 A		0.075	0.150		
Forward Transconductance ^a	9 _{fs}	V _{DS} = - 5 V, I _D = - 5 A		18		S	
Dynamic ^b							
Input Capacitance	C _{iss}			1275			
Output Capacitance	C _{oss}	$V_{DS} = -6 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		255		pF	
Reverse Transfer Capacitance	C _{rss}			236			
Total Cata Charga	0	$V_{DS} = -6 \text{ V}, V_{GS} = -8 \text{ V}, I_{D} = -5 \text{ A}$		23	35		
Total Gate Charge	Qg			14	21		
Gate-Source Charge	Q_{gs}	$V_{DS} = -6 \text{ V}, V_{GS} = -4.5 \text{ V}, I_{D} = -5 \text{ A}$		2.3		nC	
Gate-Drain Charge	Q_{gd}			3.6			
Gate Resistance	R_{g}	f = 1 MHz	1.9	9.5	19	Ω	
Turn-On Delay Time	t _{d(on)}			26	40		
Rise Time	t _r	V_{DD} = - 6 V, R_L = 6 Ω		24	40		
Turn-Off Delay Time	t _{d(off)}	$I_D = -4 \text{ A}, V_{GEN} = -4.5 \text{ V}, R_G = 1 \Omega$		45	70	ns	
Fall Time	t _f			20	35		
Drain-Source Body Diode Characteristi	cs						
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C			- 1.4		
Pulse Diode Forward Current ^a	I _{SM}				- 20	A	
Body Diode Voltage	V_{SD}	I _S = - 4 A		- 0.8	- 1.2	V	
Body Diode Reverse Recovery Time	t _{rr}			24	48	ns	
ody Diode Beverse Becovery Charge Qrr				8	16	nC	
Reverse Recovery Fall Time	t _a	$I_F = -4 \text{ A}, \text{ dI/dt} = 100 \text{ A/}\mu\text{s}, T_J = 25 ^{\circ}\text{C}$		9		†	
Reverse Recovery Rise Time	+	t _b		15		ns	

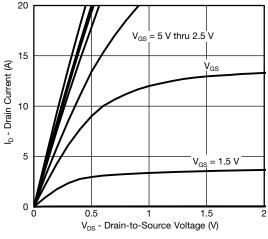
Notes:

- a. Pulse test; pulse width \leq 300 $\mu s,$ duty cycle \leq 2 %.
- b. Guaranteed by design, not subject to production testing.

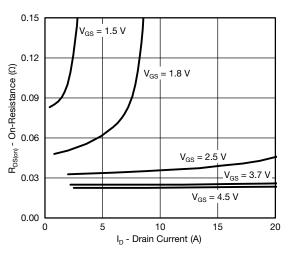
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



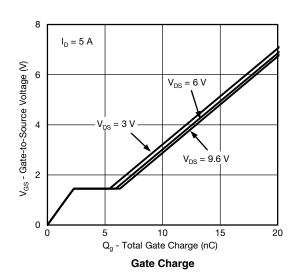
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

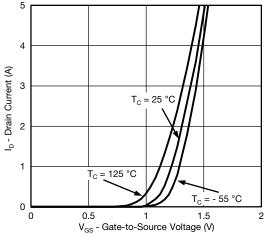




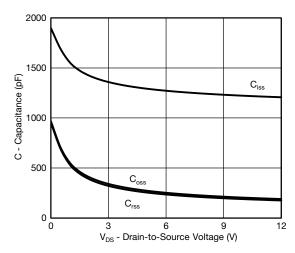


On-Resistance vs. Drain Current and Gate Voltage

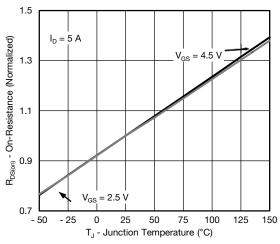




Transfer Characteristics



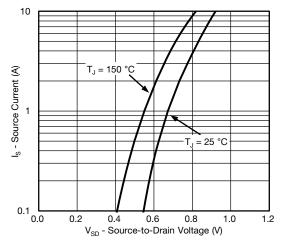
Capacitance



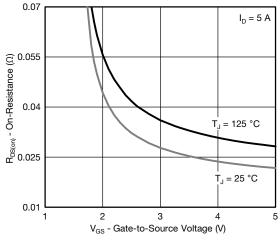
On-Resistance vs. Junction Temperature

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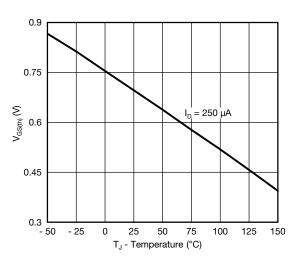
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



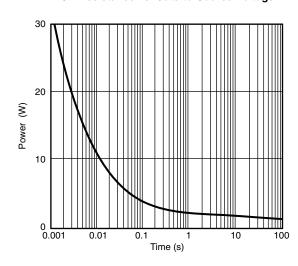
Source-Drain Diode Forward Voltage



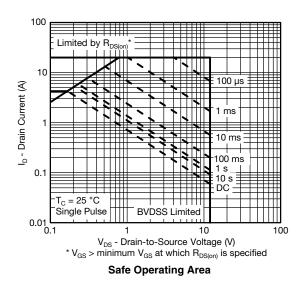
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

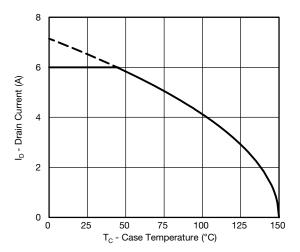


Single Pulse Power

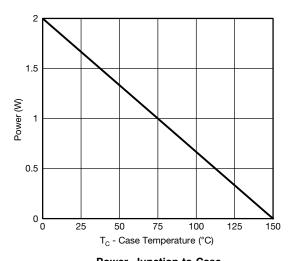


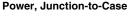


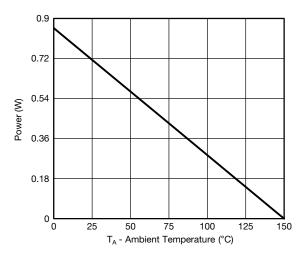
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating*





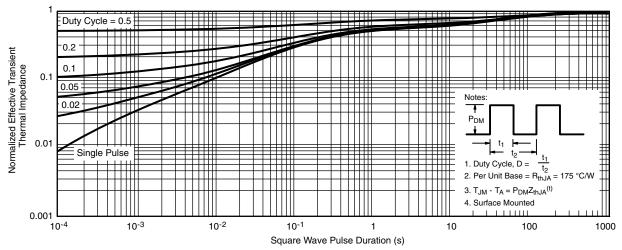


Power, Junction-to-Ambient

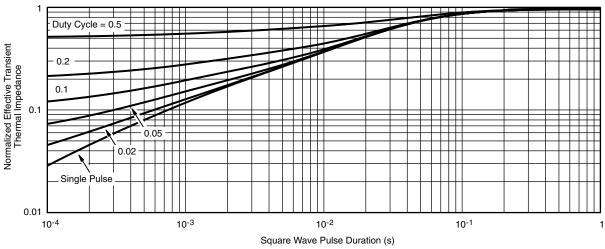
^{*} The power dissipation PD is based on TJ(max.) = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient

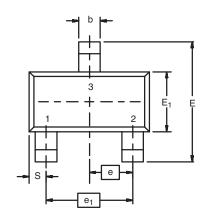


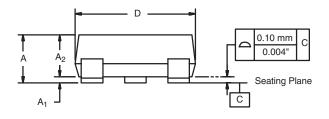
Normalized Thermal Transient Impedance, Junction-to-Foot

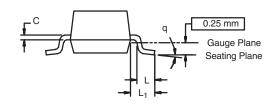
Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?63861.



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







Dim	MILLIMETERS		INCHES		
	Min	Max	Min	Max	
Α	0.89	1.12	0.035	0.044	
A ₁	0.01	0.10	0.0004	0.004	
A ₂	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 ₁	1.20	1.40	0.047	0.055	
е	0.9	5 BSC	0.037	4 Ref	
e ₁	1.9	0 BSC	0.074	8 Ref	
L	0.40	0.60	0.016	0.024	
L ₁	0.6	64 Ref	0.025 Ref		
S	0.5	50 Ref 0.020 R) Ref	
q	3°	8°	3°	8°	
FCN: S-03946-Rev K 09-	lul-01	•			

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

DWG: 5479

Document Number: 71196 www.vishay.com 09-Jul-01





Mounting LITTLE FOOT® SOT-23 Power MOSFETs

Wharton McDaniel

Surface-mounted LITTLE FOOT power MOSFETs use integrated circuit and small-signal packages which have been been modified to provide the heat transfer capabilities required by power devices. Leadframe materials and design, molding compounds, and die attach materials have been changed, while the footprint of the packages remains the same.

See Application Note 826, Recommended Minimum Pad Patterns With Outline Drawing Access for Vishay Siliconix MOSFETs, (http://www.vishay.com/doc?72286), for the basis of the pad design for a LITTLE FOOT SOT-23 power MOSFET footprint. In converting this footprint to the pad set for a power device, designers must make two connections: an electrical connection and a thermal connection, to draw heat away from the package.

The electrical connections for the SOT-23 are very simple. Pin 1 is the gate, pin 2 is the source, and pin 3 is the drain. As in the other LITTLE FOOT packages, the drain pin serves the additional function of providing the thermal connection from the package to the PC board. The total cross section of a copper trace connected to the drain may be adequate to carry the current required for the application, but it may be inadequate thermally. Also, heat spreads in a circular fashion from the heat source. In this case the drain pin is the heat source when looking at heat spread on the PC board.

Figure 1 shows the footprint with copper spreading for the SOT-23 package. This pattern shows the starting point for utilizing the board area available for the heat spreading copper. To create this pattern, a plane of copper overlies the drain pin and provides planar copper to draw heat from the drain lead and start the process of spreading the heat so it can be dissipated into the ambient air. This pattern uses all the available area underneath the body for this purpose.

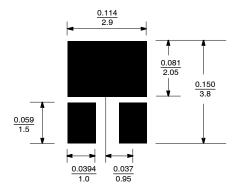


FIGURE 1. Footprint With Copper Spreading

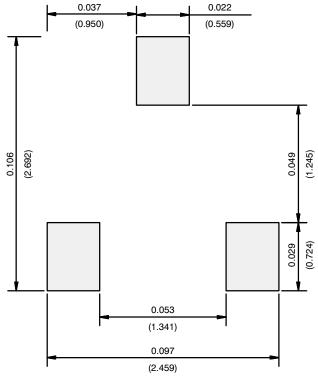
Since surface-mounted packages are small, and reflow soldering is the most common way in which these are affixed to the PC board, "thermal" connections from the planar copper to the pads have not been used. Even if additional planar copper area is used, there should be no problems in the soldering process. The actual solder connections are defined by the solder mask openings. By combining the basic footprint with the copper plane on the drain pins, the solder mask generation occurs automatically.

A final item to keep in mind is the width of the power traces. The absolute minimum power trace width must be determined by the amount of current it has to carry. For thermal reasons, this minimum width should be at least 0.020 inches. The use of wide traces connected to the drain plane provides a low-impedance path for heat to move away from the device.

Document Number: 70739 26-Nov-03



RECOMMENDED MINIMUM PADS FOR SOT-23



Recommended Minimum Pads Dimensions in Inches/(mm)

Return to Index

APPLICATION NOTE



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Revision: 02-Oct-12 Document Number: 91000

ПОСТАВКА ЭЛЕКТРОННЫХ КОМПОНЕНТОВ

многоканальный

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Офис по работе с юридическими лицами:

105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru moschip.ru_6 moschip.ru_4 moschip.ru_9