



N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY						
V _{DS} (V)	$R_{DS(on)}(\Omega)$	I _D (A)	Q _g (Typ.)			
20	$0.057 \text{ at V}_{GS} = 4.5 \text{ V}$	2.9	3.5			
	0.075 at V _{GS} = 2.5 V	2.6	3.3			

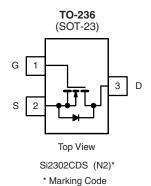
FEATURES

- TrenchFET® Power MOSFET
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



APPLICATIONS

- · Load Switching for Portable Devices
- DC/DC Converter



Ordering Information: Si2302CDS-T1-E3 (Lead (Pb)-free)

Si2302CDS-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C, unless otherwise noted)						
Parameter		Symbol	5 s	Steady State	Unit	
Drain-Source Voltage		V _{DS}	20		V	
Gate-Source Voltage		V _{GS}	± 8			
Continuo Desir Comment /T 150 00\8	T _A = 25 °C	- I _D	2.9	2.6		
Continuous Drain Current (T _J = 150 °C) ^a	T _A = 70 °C		2.3	2.1		
Pulsed Drain Current ^b		I _{DM}	10		Α	
Continuous Source Current (Diode Conduction) ^a		I _S	0.72	0.6		
Daniel Discharge	T _A = 25 °C	P _D	0.86	0.71	W	
Power Dissipation ^a	T _A = 70 °C		0.55	0.46		
Operating Junction and Storage Temperature Range		T _J , T _{stg}	- 55 to 150		°C	

THERMAL RESISTANCE RATINGS					
Parameter	Symbol	Typical	Maximum	Unit	
Manimum lumation to Ambient?	t ≤ 5 s	R_{thJA}	120	145	°C/W
Maximum Junction-to-Ambient ^a	Steady State		140	175	
Maximum Junction-to-Foot	Steady State	R_{thJF}	62	78	

Notes:

- a. Surface mounted on 1" x 1" FR4 board.
- b. Pulse width limited by maximum junction temperature.

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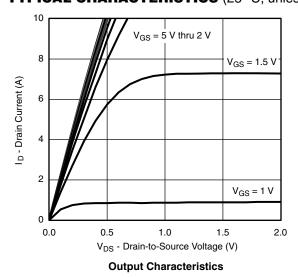
SPECIFICATIONS (T _A = 25 °C, unless otherwise noted)							
			Limits				
Parameter	Symbol	Test Conditions	Min.	Тур.	Max.	Unit	
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0 \text{ V}, I_{D} = 250 \mu\text{A}$	20			V	
Gate-Threshold Voltage	V _{GS(th)}	$V_{DS} = V_{GS}$, $I_D = 250 \mu A$	0.40		0.85	V	
Gate-Body Leakage	I _{GSS}	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 8 \text{ V}$			± 100	nA	
		V _{DS} = 20 V, V _{GS} = 0 V			0.1		
Zero Gate Voltage Drain Current	I _{DSS}	$V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}, T_{J} = 50 \text{ °C}$			4	μΑ	
		$V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}, T_{J} = 70 ^{\circ}\text{C}$			15		
On-State Drain Current ^a	I _{D(on)}	$V_{DS} \ge 10 \text{ V}, V_{GS} = 4.5 \text{ V}$	6			Α	
	D	$V_{GS} = 4.5 \text{ V}, I_D = 3.6 \text{ A}$		0.045	0.057	Ω	
Drain-Source On-Resistance ^a	R _{DS(on)}	$V_{GS} = 2.5 \text{ V}, I_D = 3.1 \text{ A}$		0.056	0.075		
Forward Transconductance ^a	9 _{fs}	$V_{DS} = 5 \text{ V}, I_{D} = 3.6 \text{ A}$		13		S	
Diode Forward Voltage	V_{SD}	I _S = 0.95 A, V _{GS} = 0 V		0.7	1.2	V	
Dynamic ^b			•	•	•		
Total Gate Charge	Q_g			3.5	5.5		
Gate-Source Charge	Q_{gs}	$V_{DS} = 10 \text{ V}, V_{GS} = 4.5 \text{ V}, I_{D} = 3.6 \text{ A}$		0.6		nC	
Gate-Drain Charge	Q_{gd}			0.45			
Gate Resistance	R_{g}	f = 1 MHz	2	4	8	Ω	
Switching							
Turn-On Delay Time	t _{d(on)}			8	15		
Rise Time	t _r	V_{DD} = 10 V, R_L = 2.78 Ω		7	15		
Turn-Off Delay Time	t _{d(off)}	$\text{I}_\text{D}\cong 3.6~\text{A},~\text{V}_\text{GEN}=4.5~\text{V},~\text{R}_g=1~\Omega$		30	45	ns	
Fall Time	t _f			7	15		
Source-Drain Reverse Recovery Time	t _{rr}	I _E = 3.6 A, dI/dt = 100 A/μs		8.5	15		
Body Diode Reverse Recovery Charge	Q _{rr}	$I_F = 3.0 \text{ A}$, $U/UI = 100 \text{ A}/\mu\text{S}$		2	4	nC	

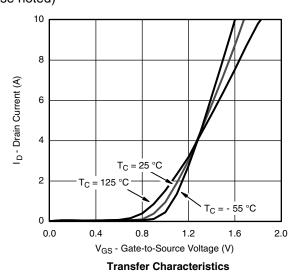
Notes:

- 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)

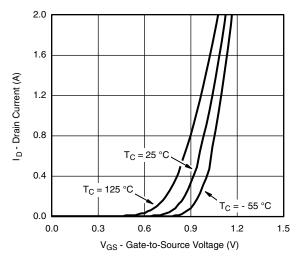




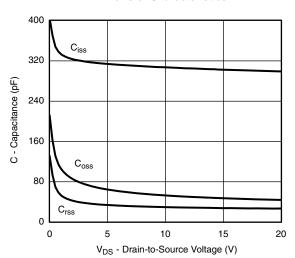
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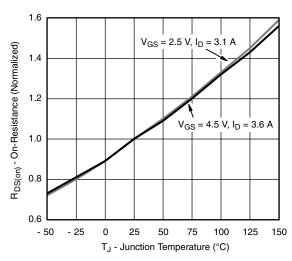
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



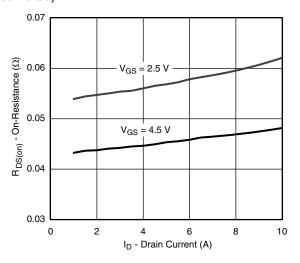
Transfer Characteristics



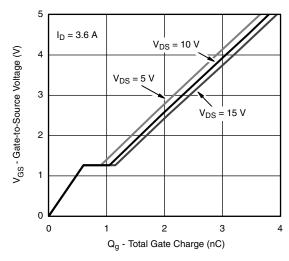
Capacitance



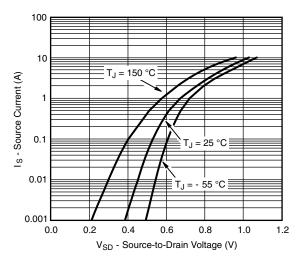
On-Resistance vs. Junction Temperature



On-Resistance vs. Drain Current



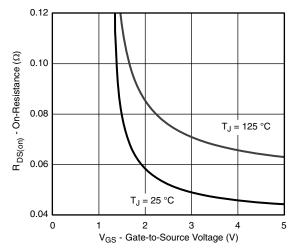
Gate Charge



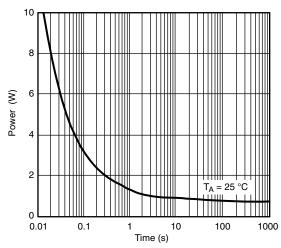
Source-Drain Diode Forward Voltage

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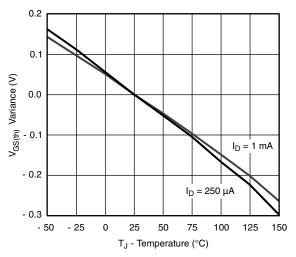
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



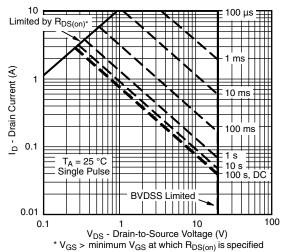
On-Resistance vs. Gate-to-Source Voltage



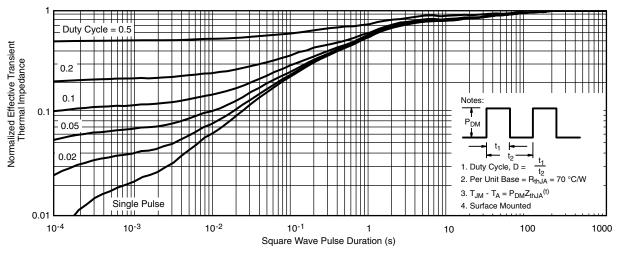
Single Pulse Power



Threshold Voltage



Safe Operating Area, Junction-to-Ambient

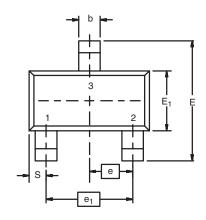


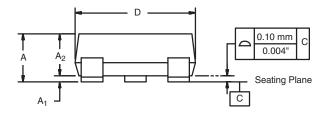
Normalized Thermal Transient Impedance, Junction-to-Ambient

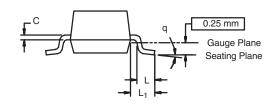
Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?68645.



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







Dim	MILLIN	IETERS	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	0.95 BSC		0.0374 Ref		
e ₁	1.90 BSC		0.0748 Ref		
L	0.40	0.60	0.016	0.024	
L ₁	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

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.

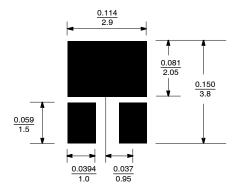


FIGURE 1. Footprint With Copper Spreading

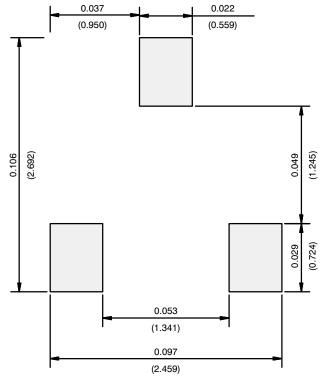
Since surface-mounted packages are small, and reflow soldering is the most common way in which these are affixed to the PC board, "thermal" connections from the planar copper to the pads have not been used. Even if additional planar copper area is used, there should be no problems in the soldering process. 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)

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APPLICATION NOTE



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Revision: 02-Oct-12 Document Number: 91000

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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