

P-Channel 8 V (D-S) MOSFET

PRODUCT SUMMARY

V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A) ^c	Q _g (Typ.)
- 8	0.336 at V _{GS} = - 4.5 V	- 0.9	1 nC
	0.450 at V _{GS} = - 2.5 V	- 0.7	
	0.650 at V _{GS} = - 1.8 V	- 0.5	

FEATURES

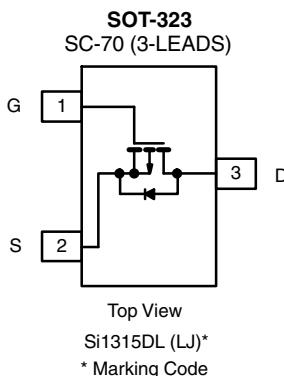
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT
HALOGEN
FREE

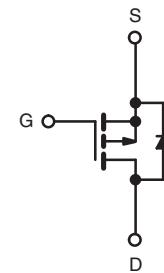
APPLICATIONS

- Load Switch for Portable Devices
- DC/DC Converters



Top View
Si1315DL (LJ)*

* Marking Code



Ordering Information: Si1315DL-T1-GE3 (Lead (Pb)-free and Halogen-free)

P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V _{DS}	- 8	V
Gate-Source Voltage	V _{GS}	± 8	
Continuous Drain Current (T _J = 150 °C)	I _D	- 0.9	A
		- 0.7	
		- 0.8 ^{a, b}	
		- 0.7 ^{a, b}	
Pulsed Drain Current	I _{DM}	- 3	A
Continuous Source-Drain Diode Current	I _S	- 0.3	
		- 0.25	
Maximum Power Dissipation	P _D	0.4	W
		0.2	
		0.3 ^{a, b}	
		0.2 ^{a, b}	
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 50 to 150	°C
Soldering Recommendations (Peak Temperature)		260	

Notes:

a. Surface mounted on 1" x 1" FR4 board.

b. t = 10 s.

c. Based on T_C = 25 °C.

Thermal Resistance Ratings

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{a, b}	$t \leq 10 \text{ s}$	R_{thJA}	315	375
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	285	340

Notes:

- a. Surface mounted on 1" x 1" FR4 board.
- b. Maximum under steady state conditions is 430 °C/W.

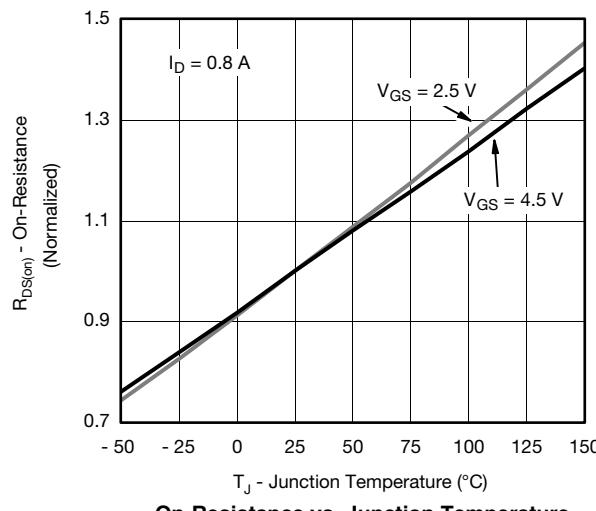
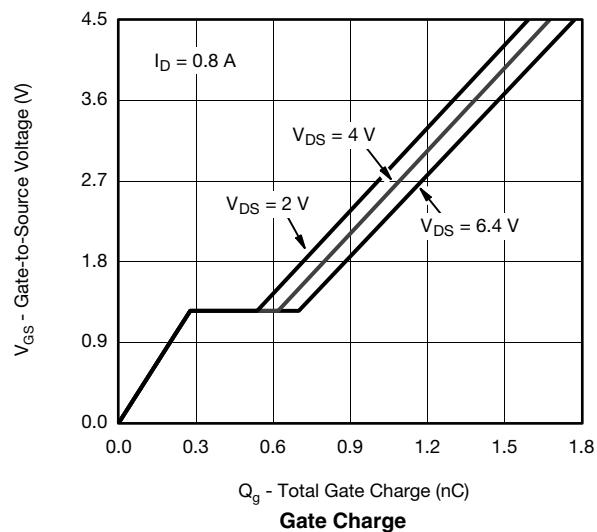
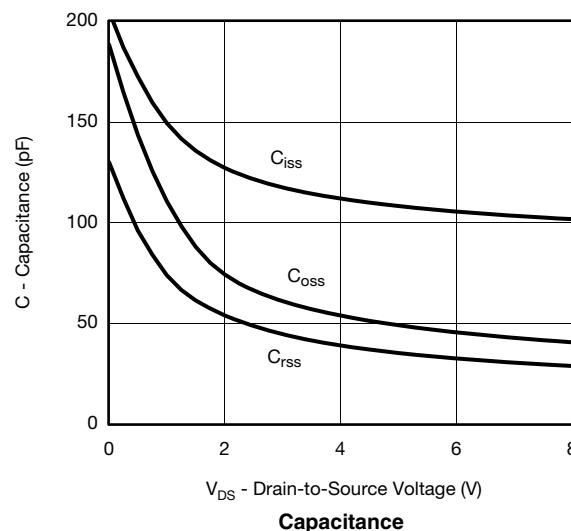
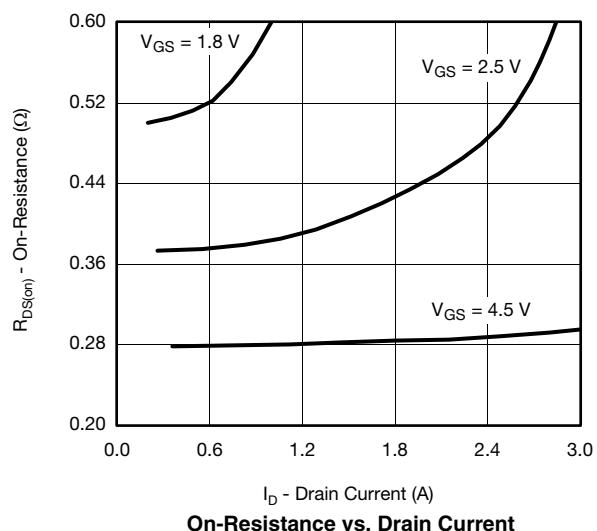
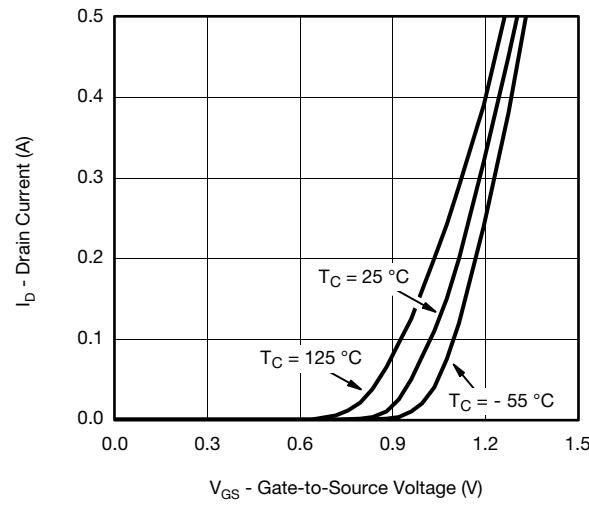
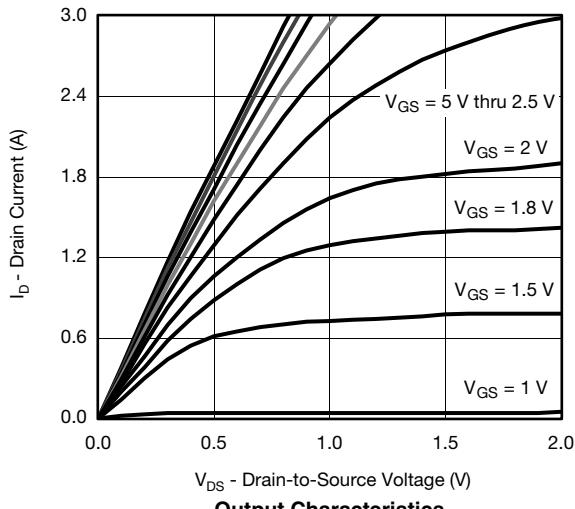
Specifications ($T_J = 25 \text{ }^{\circ}\text{C}$, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0 \text{ V}, I_D = - 250 \mu\text{A}$	- 8			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = - 250 \mu\text{A}$		- 7.6		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			2.0		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = - 250 \mu\text{A}$	- 0.4		- 0.8	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}	$V_{DS} = - 8 \text{ V}, V_{GS} = 0 \text{ V}$		- 1		μA
		$V_{DS} = - 8 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 55 \text{ }^{\circ}\text{C}$			- 10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \leq - 5 \text{ V}, V_{GS} = - 4.5 \text{ V}$	- 2			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = - 4.5 \text{ V}, I_D = - 0.8 \text{ A}$		0.280	0.336	Ω
		$V_{GS} = - 2.5 \text{ V}, I_D = - 0.5 \text{ A}$		0.375	0.450	
		$V_{GS} = - 1.8 \text{ V}, I_D = - 0.3 \text{ A}$		0.500	0.650	
Forward Transconductance ^a	g_{fs}	$V_{DS} = - 5 \text{ V}, I_D = - 0.8 \text{ A}$		3		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = - 4 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		112		pF
Output Capacitance	C_{oss}			54		
Reverse Transfer Capacitance	C_{rss}			40		
Total Gate Charge	Q_g	$V_{DS} = - 4 \text{ V}, V_{GS} = - 4.5 \text{ V}, I_D = - 0.8 \text{ A}$		1.7	3.4	nC
Gate-Source Charge	Q_{gs}	$V_{DS} = - 4 \text{ V}, V_{GS} = - 2.5 \text{ V}, I_D = - 0.8 \text{ A}$		1	2	
Gate-Drain Charge	Q_{gd}			0.3		
Gate Resistance	R_g		$f = 1 \text{ MHz}$	1.4	7	14
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = - 4 \text{ V}, R_L = 5.7 \Omega$ $I_D \approx - 0.7 \text{ A}, V_{GEN} = - 4.5 \text{ V}, R_g = 1 \Omega$		10	20	ns
Rise Time	t_r			15	23	
Turn-Off Delay Time	$t_{d(off)}$			14	21	
Fall Time	t_f			8	16	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = - 4 \text{ V}, R_L = 5.7 \Omega$ $I_D \approx - 0.7 \text{ A}, V_{GEN} = - 8 \text{ V}, R_g = 1 \Omega$		5	10	ns
Rise Time	t_r			10	20	
Turn-Off Delay Time	$t_{d(off)}$			12	20	
Fall Time	t_f			7	14	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25 \text{ }^{\circ}\text{C}$			- 0.3	A
Pulse Diode Forward Current ^a	I_{SM}				- 3	
Body Diode Voltage	V_{SD}	$I_F = - 0.7 \text{ A}$		- 0.8	- 1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = - 0.7 \text{ A}, dI/dt = 100 \text{ A}/\mu\text{s}, T_J = 25 \text{ }^{\circ}\text{C}$		14	21	ns
Body Diode Reverse Recovery Charge	Q_{rr}			4	8	
Reverse Recovery Fall Time	t_a			8		nC
Reverse Recovery Rise Time	t_b			6		

Notes:

- a. Pulse test; pulse width $\leq 300 \mu\text{s}$, 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.

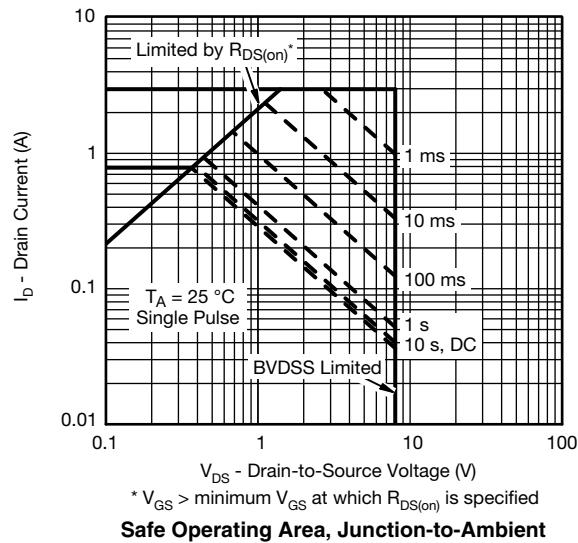
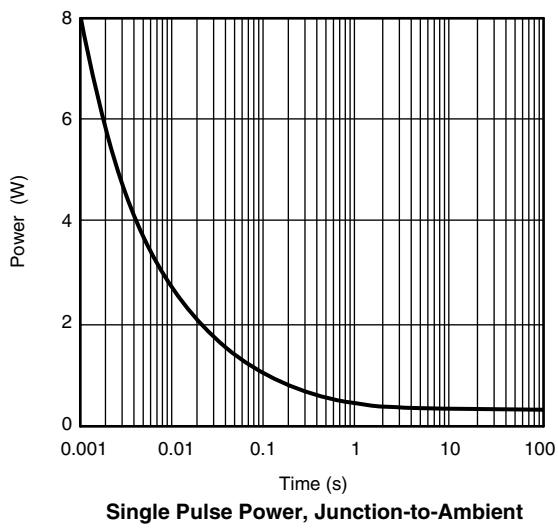
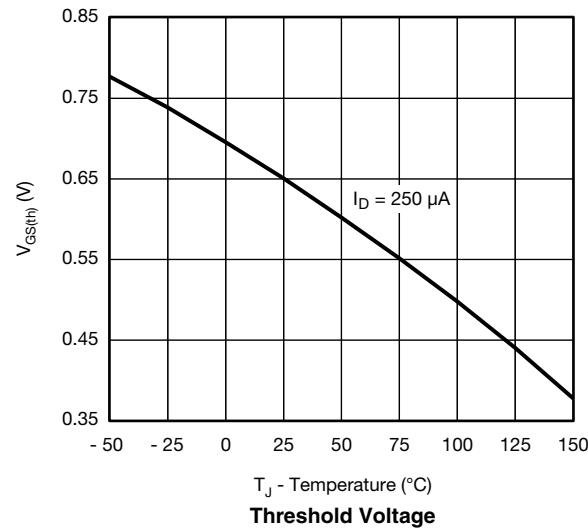
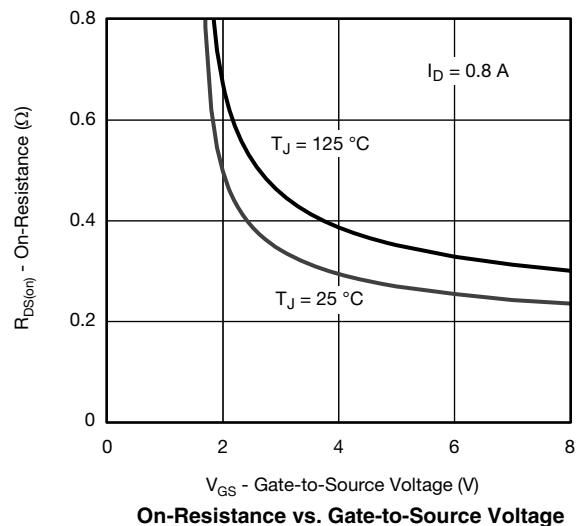
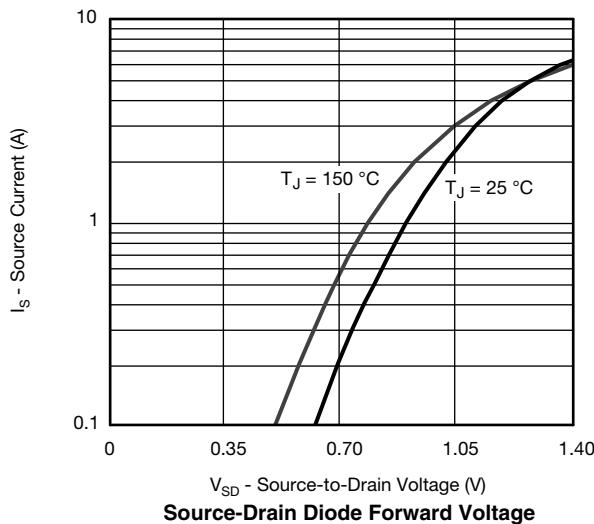
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)


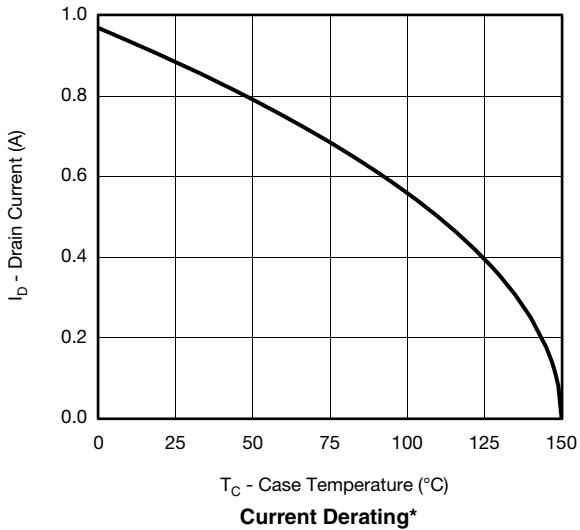
Si1315DL

Vishay Siliconix

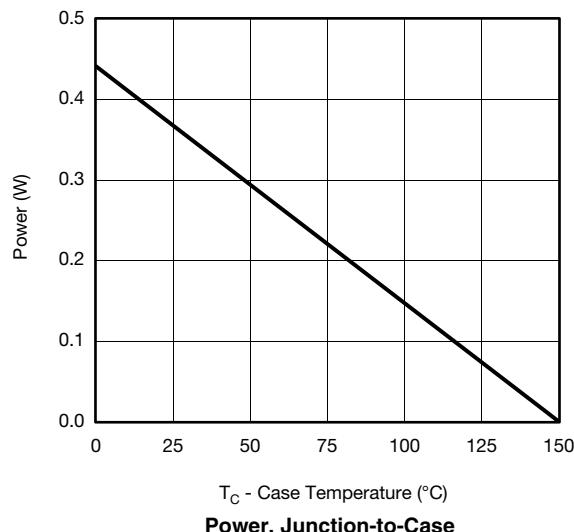


TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

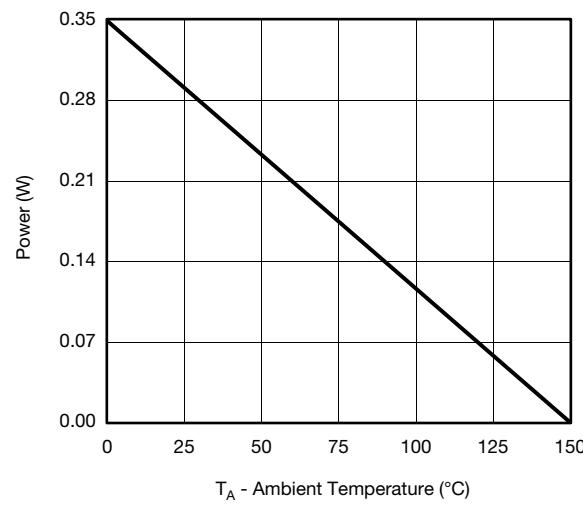


TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)
 T_C - Case Temperature (°C)

Current Derating*

 T_C - Case Temperature (°C)

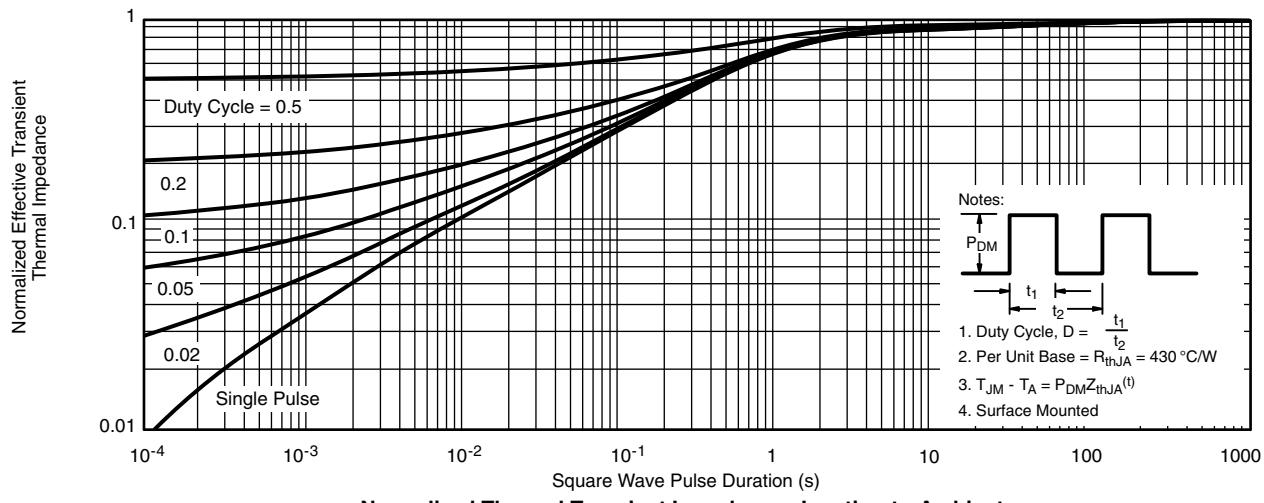
Power, Junction-to-Case

 T_A - Ambient Temperature (°C)

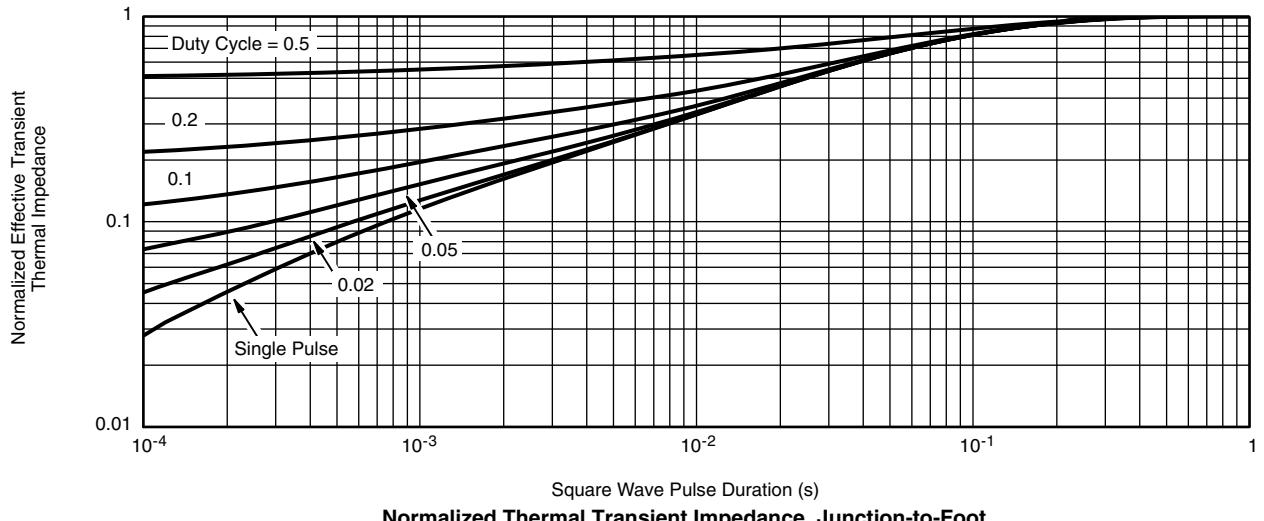
Power, Junction-to-Ambient

* 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.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

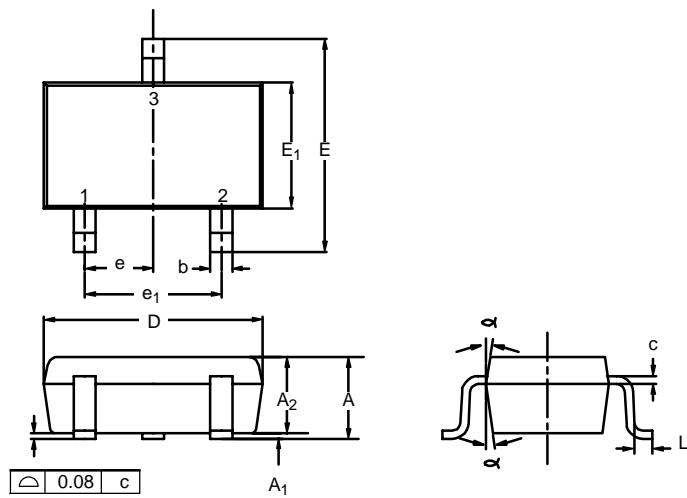


Normalized Thermal Transient Impedance, Junction-to-Ambient



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?67193.

SC-70: 3-LEADS


Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.90	—	1.10	0.035	—	0.043
A₁	—	—	0.10	—	—	0.004
A₂	0.80	—	1.00	0.031	—	0.039
b	0.25	—	0.40	0.010	—	0.016
c	0.10	—	0.25	0.004	—	0.010
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.80	2.10	2.40	0.071	0.083	0.094
E₁	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65BSC			0.026BSC		
e₁	1.20	1.30	1.40	0.047	0.051	0.055
L	0.10	0.20	0.30	0.004	0.008	0.012
α	7°Nom			7°Nom		

ECN: S-03946—Rev. C, 09-Jul-01
DWG: 5549

Single-Channel LITTLE FOOT® SC-70 3-Pin and 6-Pin MOSFET Recommended Pad Pattern and Thermal Performance

INTRODUCTION

This technical note discusses pin-outs, package outlines, pad patterns, evaluation board layout, and thermal performance for single-channel LITTLE FOOT power MOSFETs in the SC-70 package. These new Vishay Siliconix devices are intended for small-signal applications where a miniaturized package is needed and low levels of current (around 350 mA) need to be switched, either directly or by using a level shift configuration. Vishay provides these single devices with a range of on-resistance specifications and in both traditional 3-pin and new 6-pin versions. The new 6-pin SC-70 package enables improved on-resistance values and enhanced thermal performance compared to the 3-pin package.

PIN-OUT

Figure 1 shows the pin-out description and Pin 1 identification for the single-channel SC-70 device in both 3-pin and 6-pin configurations. The pin-out of the 6-pin device allows the use of four pins as drain leads, which helps to reduce on-resistance and junction-to-ambient thermal resistance.

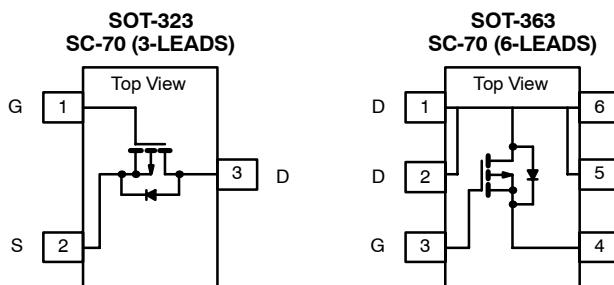


FIGURE 1.

For package dimensions see outline drawings:

SC-70 (3-Leads) (<http://www.vishay.com/doc?71153>)
 SC-70 (6-Leads) (<http://www.vishay.com/doc?71154>)

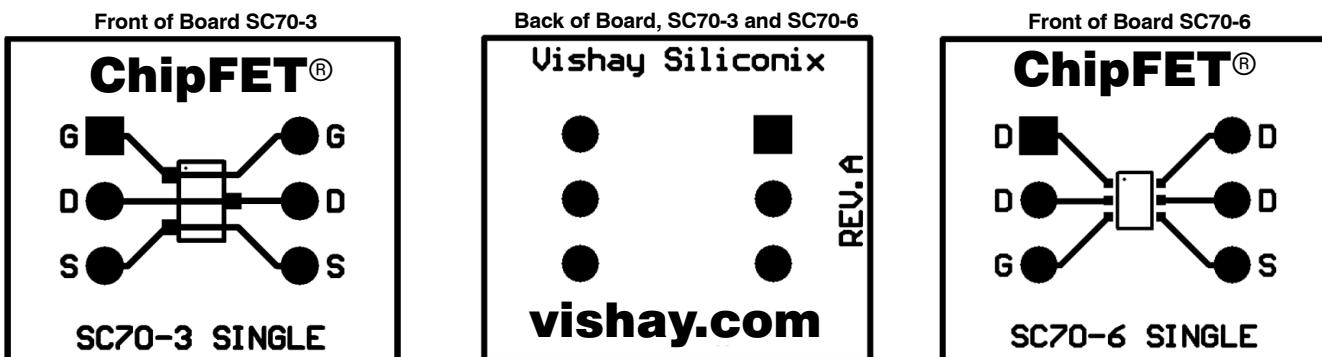


FIGURE 2.

THERMAL PERFORMANCE

Junction-to-Foot Thermal Resistance (the Package Performance)

Thermal performance for the 3-pin SC-70 measured as junction-to-foot thermal resistance is 285°C/W typical, 340°C/W maximum. Junction-to-foot thermal resistance for the 6-pin SC70-6 is 105°C/W typical, 130°C/W maximum — a nearly two-thirds reduction compared with the 3-pin device. The “foot” is the drain lead of the device as it connects with the body. This improved performance is obtained by the increase in drain leads from one to four on the 6-pin SC-70. Note that these numbers are somewhat higher than other LITTLE FOOT devices due to the limited thermal performance of the Alloy 42 lead-frame compared with a standard copper lead-frame.

Junction-to-Ambient Thermal Resistance (dependent on PCB size)

The typical R_{JA} for the single 3-pin SC-70 is 360°C/W steady state, compared with 180°C/W for the 6-pin SC-70. Maximum ratings are 430°C/W for the 3-pin device versus 220°C/W for the 6-pin device. All figures are based on the 1-inch square FR4 test board. The following table shows how the thermal resistance impacts power dissipation for the two different pin-outs at two different ambient temperatures.

SC-70 (3-PIN)	
Room Ambient 25 °C	Elevated Ambient 60 °C
$P_D = \frac{T_{J(max)} - T_A}{R_{JA}}$	$P_D = \frac{T_{J(max)} - T_A}{R_{JA}}$
$P_D = \frac{150^\circ\text{C} - 25^\circ\text{C}}{360^\circ\text{C}/\text{W}}$	$P_D = \frac{150^\circ\text{C} - 60^\circ\text{C}}{360^\circ\text{C}/\text{W}}$
$P_D = 347 \text{ mW}$	$P_D = 250 \text{ mW}$

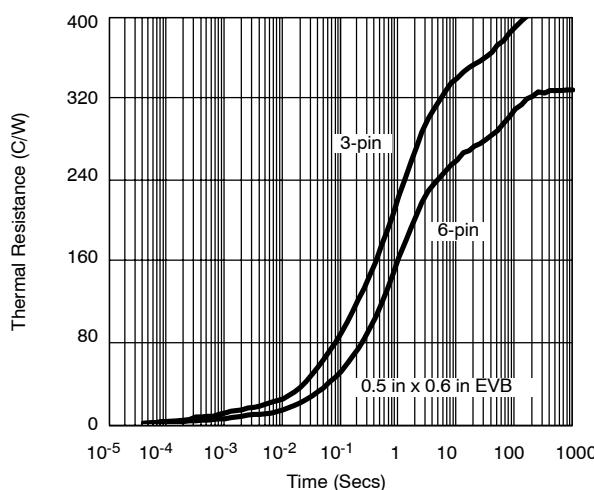


FIGURE 3. Comparison of SC70-3 and SC70-6 on EVB

SC-70 (6-PIN)

Room Ambient 25 °C	Elevated Ambient 60 °C
$P_D = \frac{T_{J(max)} - T_A}{R_{JA}}$	$P_D = \frac{T_{J(max)} - T_A}{R_{JA}}$
$P_D = \frac{150^\circ\text{C} - 25^\circ\text{C}}{180^\circ\text{C}/\text{W}}$	$P_D = \frac{150^\circ\text{C} - 60^\circ\text{C}}{180^\circ\text{C}/\text{W}}$
$P_D = 694 \text{ mW}$	$P_D = 500 \text{ mW}$

NOTE: Although they are intended for low-power applications, devices in the 6-pin SC-70 will handle power dissipation in excess of 0.5 W.

Testing

To aid comparison further, Figures 3 and 4 illustrate single-channel SC-70 thermal performance on two different board sizes and two different pad patterns. The results display the thermal performance out to steady state and produce a graphic account of the thermal performance variation between the two packages. The measured steady state values of R_{JA} for the single 3-pin and 6-pin SC-70 are as follows:

LITTLE FOOT SC-70		
	3-Pin	6-Pin
1) Minimum recommended pad pattern (see Figure 4) on the EVB.	410.31°C/W	329.7°C/W
2) Industry standard 1" square PCB with maximum copper both sides.	360°C/W	211.8°C/W

The results show that designers can reduce thermal resistance R_{JA} on the order of 20% simply by using the 6-pin device rather than the 3-pin device. In this example, a 80°C/W reduction was achieved without an increase in board area. If increasing board size is an option, a further 118°C/W reduction could be obtained by utilizing a 1-inch square PCB area.

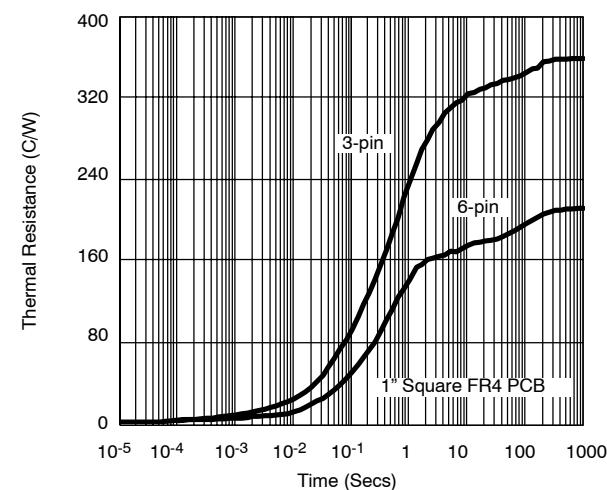
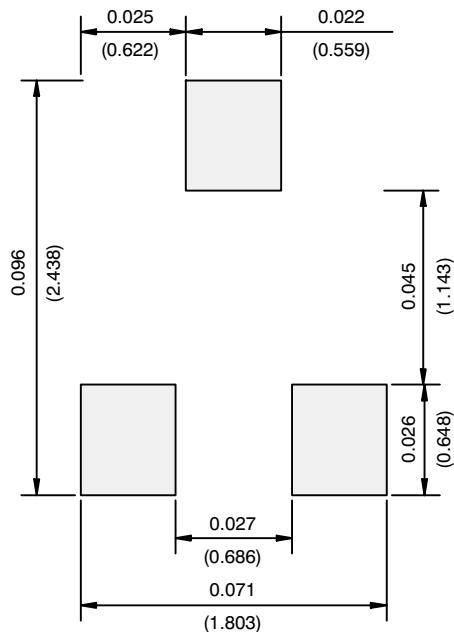


FIGURE 4. Comparison of SC70-3 and SC70-6 on 1" Square FR4 PCB

RECOMMENDED MINIMUM PADS FOR SC-70: 3-Lead

Recommended Minimum Pads
Dimensions in Inches/(mm)

[Return to Index](#)

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Vishay](#):

[SI1315DL-T1-GE3](#)