

## Automotive P-Channel 30 V (D-S) 175 °C MOSFET

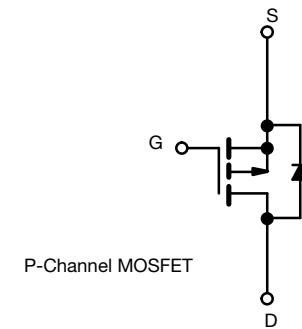
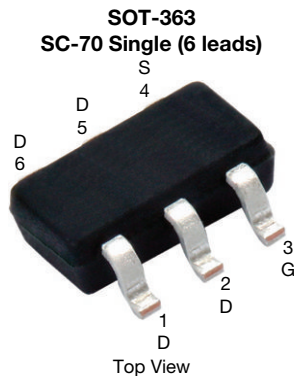
 AUTOMOTIVE  
GRADE

**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

PRODUCT SUMMARY	
$V_{DS}$ (V)	-30
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = -10$ V	0.175
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = -4.5$ V	0.300
$I_D$ (A)	-3
Configuration	Single
Package	SC-70

### FEATURES

- TrenchFET® power MOSFET
- AEC-Q101 qualified °
- 100 %  $R_g$  and UIS tested
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**Marking Code:** 9E

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current	$I_D$	$T_C = 25$ °C	-3
		$T_C = 125$ °C	-1.8
Continuous Source Current (Diode Conduction)	$I_S$	-3.7	A
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	-12	mJ
Single Pulse Avalanche Current	$I_{AS}$	-6	
Single Pulse Avalanche Energy	$E_{AS}$	1.8	
Maximum Power Dissipation <sup>a</sup>	$P_D$	$T_C = 25$ °C	3
		$T_C = 125$ °C	1
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to 175	°C

THERMAL RESISTANCE RATINGS			
PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-Ambient	$R_{thJA}$	130	°C/W
Junction-to-Foot (Drain)	$R_{thJF}$	50	

### Notes

- Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %.
- When mounted on 1" square PCB (FR4 material).
- Parametric verification ongoing.



SPECIFICATIONS ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$		-30	-	-	V
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$		-1	-1.5	-2	
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = -30\text{ V}$	-	-	-1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$	$V_{DS} = -30\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$	-	-	-50	
		$V_{GS} = 0\text{ V}$	$V_{DS} = -30\text{ V}$ , $T_J = 175\text{ }^\circ\text{C}$	-	-	-150	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{GS} = -10\text{ V}$	$V_{DS} \leq -5\text{ V}$	-5	-	-	A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$	$I_D = -2\text{ A}$	-	0.125	0.175	$\Omega$
		$V_{GS} = -10\text{ V}$	$I_D = -2\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$	-	-	0.252	
		$V_{GS} = -10\text{ V}$	$I_D = -2\text{ A}$ , $T_J = 175\text{ }^\circ\text{C}$	-	-	0.294	
		$V_{GS} = -4.5\text{ V}$	$I_D = -1.6\text{ A}$	-	0.230	0.300	
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = -10\text{ V}$ , $I_D = -2\text{ A}$		-	3	-	S
<b>Dynamic <sup>b</sup></b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$	$V_{DS} = -25\text{ V}$ , $f = 1\text{ MHz}$	-	164	205	$\mu\text{F}$
Output Capacitance	$C_{oss}$			-	44	55	
Reverse Transfer Capacitance	$C_{rss}$			-	28	35	
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{GS} = -4.5\text{ V}$	$V_{DS} = -15\text{ V}$ , $I_D = -2.2\text{ A}$	-	4.2	6.5	nC
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			-	0.7	-	
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$			-	1	-	
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		4.5	12.5	18.5	$\Omega$
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = -15\text{ V}$ , $R_L = 15\text{ }\Omega$ $I_D \cong -1\text{ A}$ , $V_{GEN} = -10\text{ V}$ , $R_g = 1\text{ }\Omega$		-	5	8	ns
Rise Time <sup>c</sup>	$t_r$			-	8	12	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			-	11	17	
Fall Time <sup>c</sup>	$t_f$			-	8	12	
<b>Source-Drain Diode Ratings and Characteristics <sup>b</sup></b>							
Pulsed Current <sup>a</sup>	$I_{SM}$			-	-	-12	A
Forward Voltage	$V_{SD}$	$I_F = -1.2\text{ A}$ , $V_{GS} = 0\text{ V}$		-	-0.85	-1.2	V

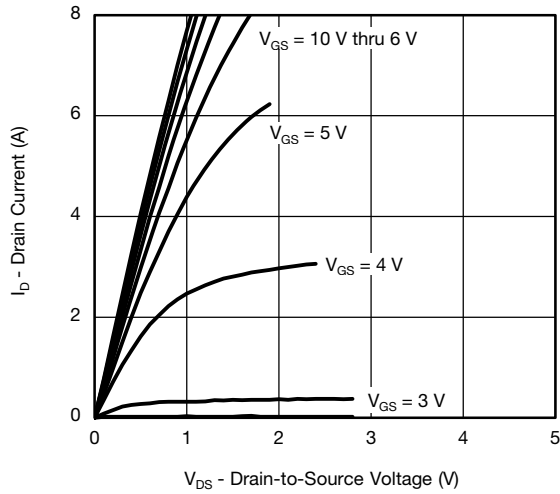
**Notes**

- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

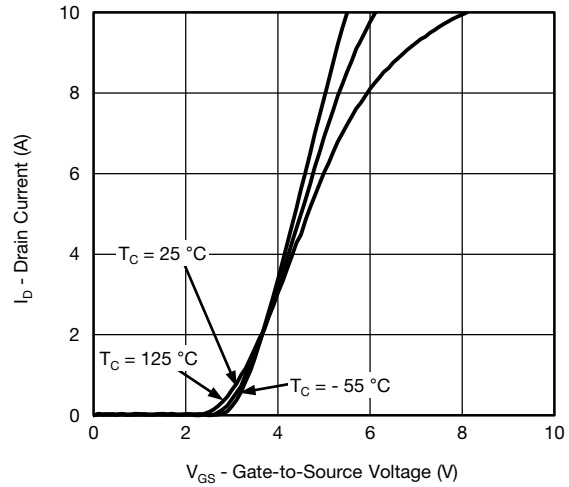
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



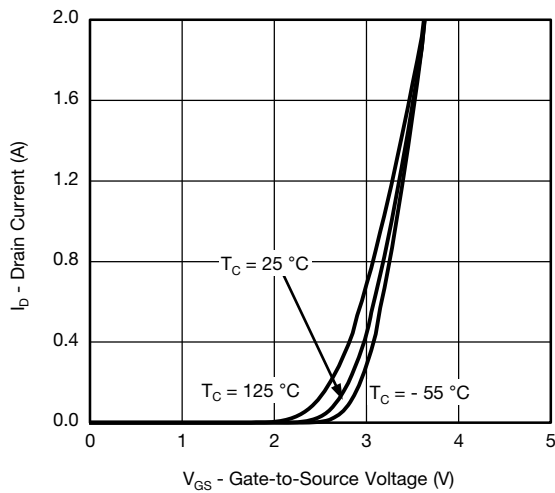
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



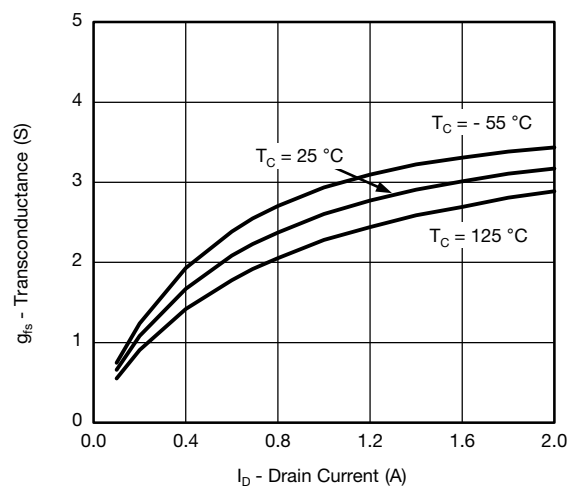
**Output Characteristics**



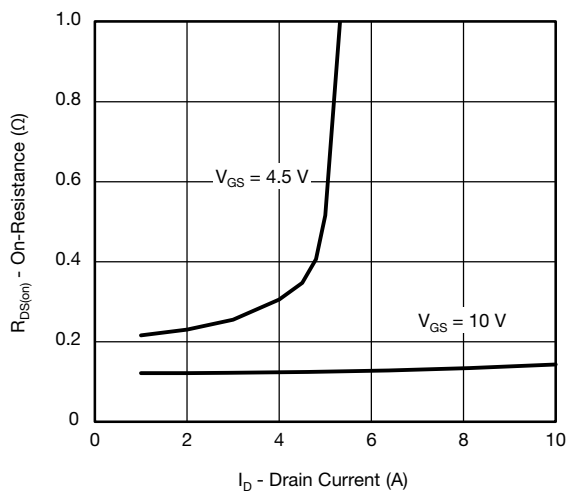
**Transfer Characteristics**



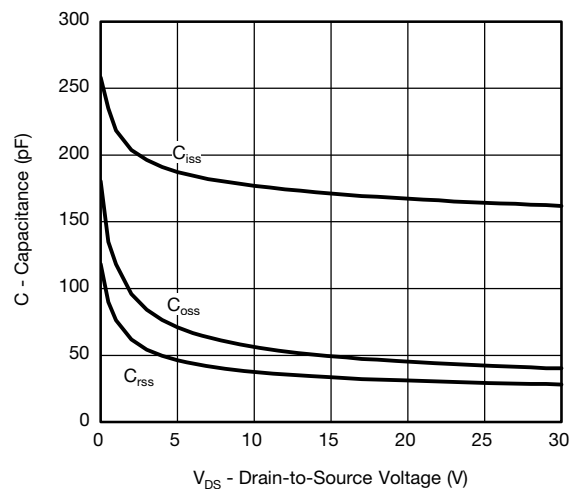
**Transfer Characteristics**



**Transconductance**

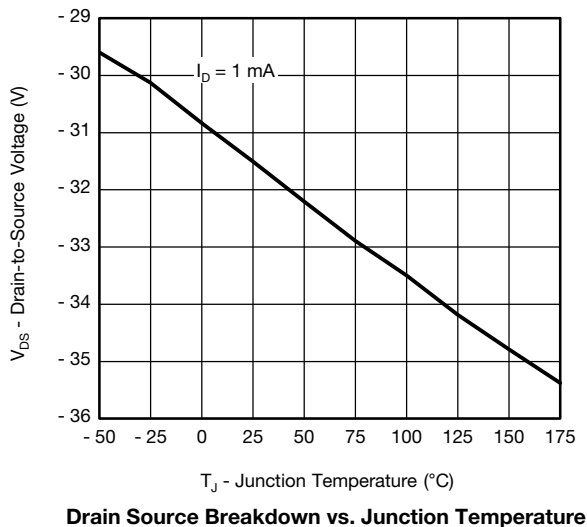
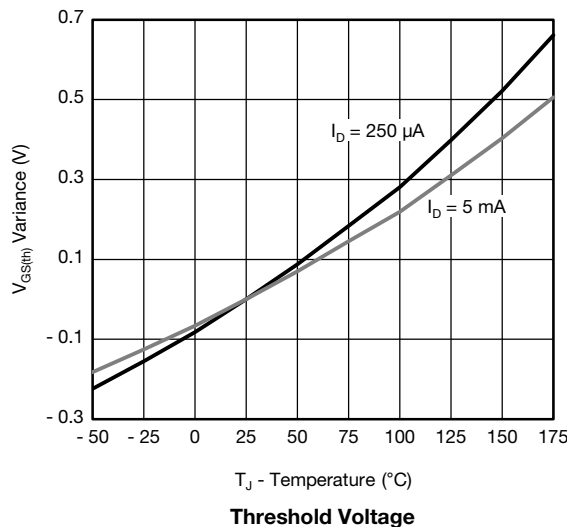
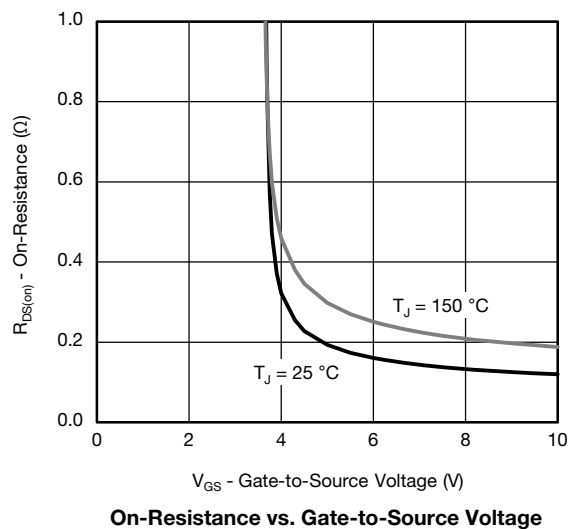
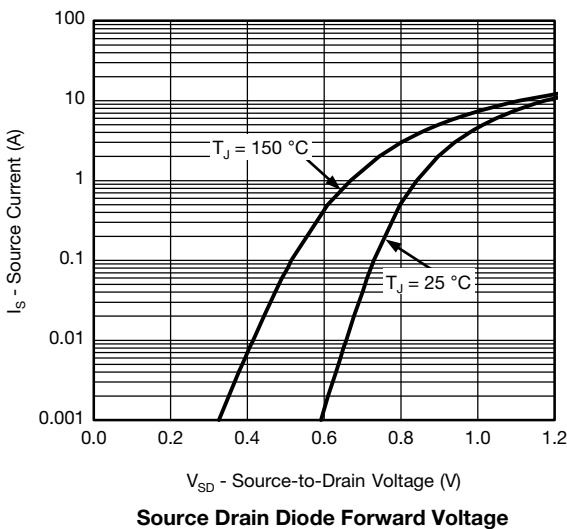
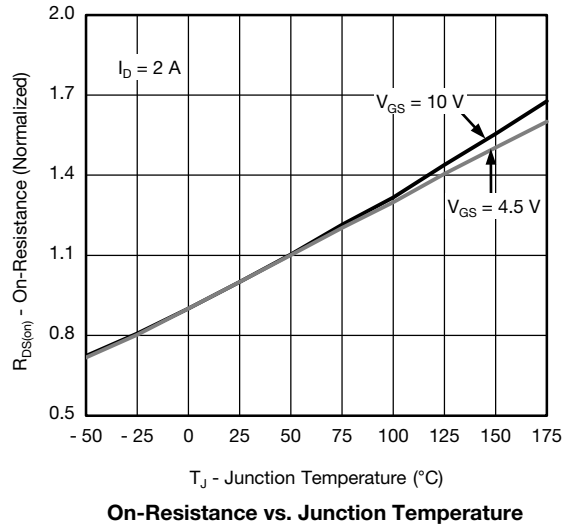
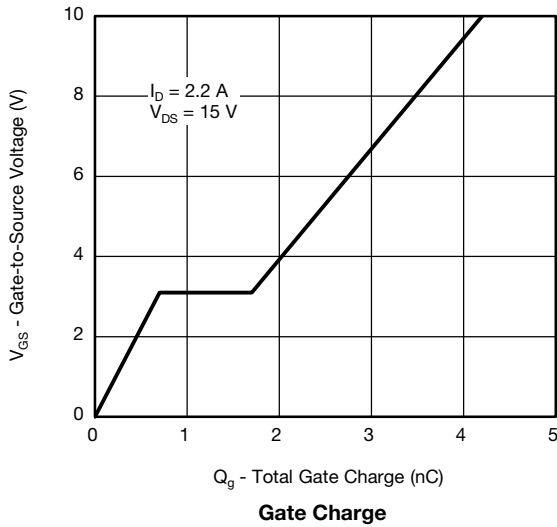


**On-Resistance vs. Drain Current**



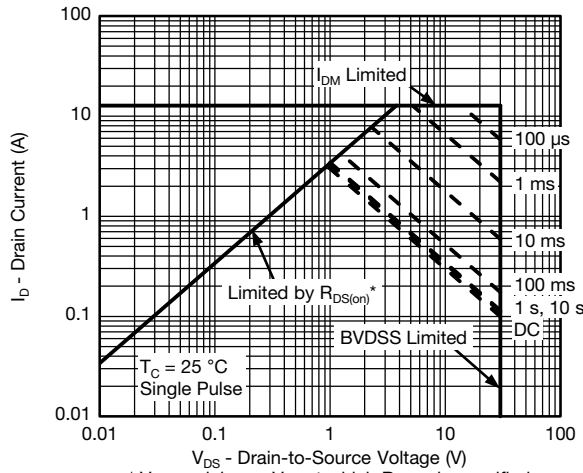
**Capacitance**

**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)

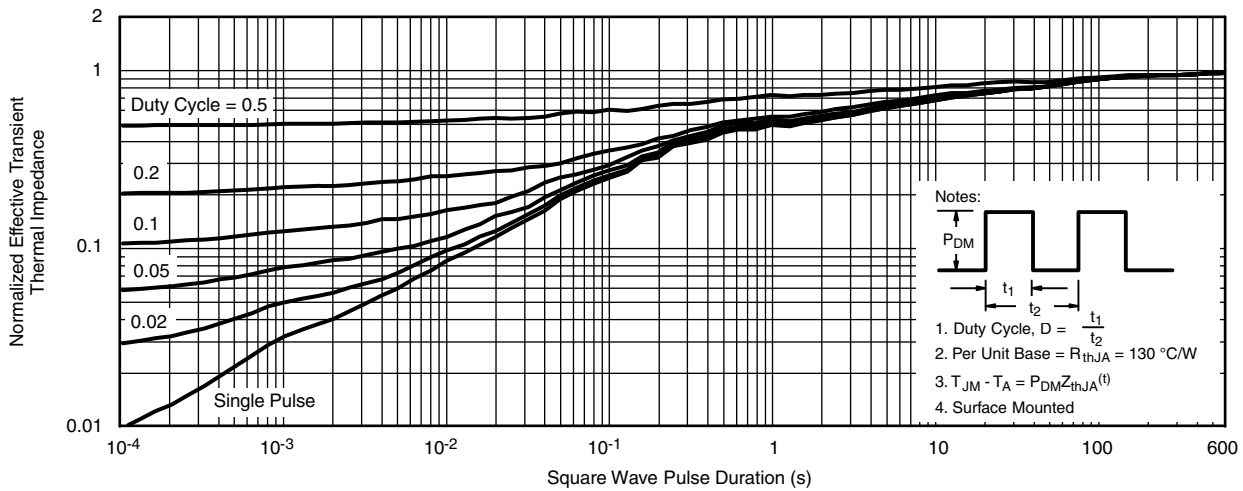




**THERMAL RATINGS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



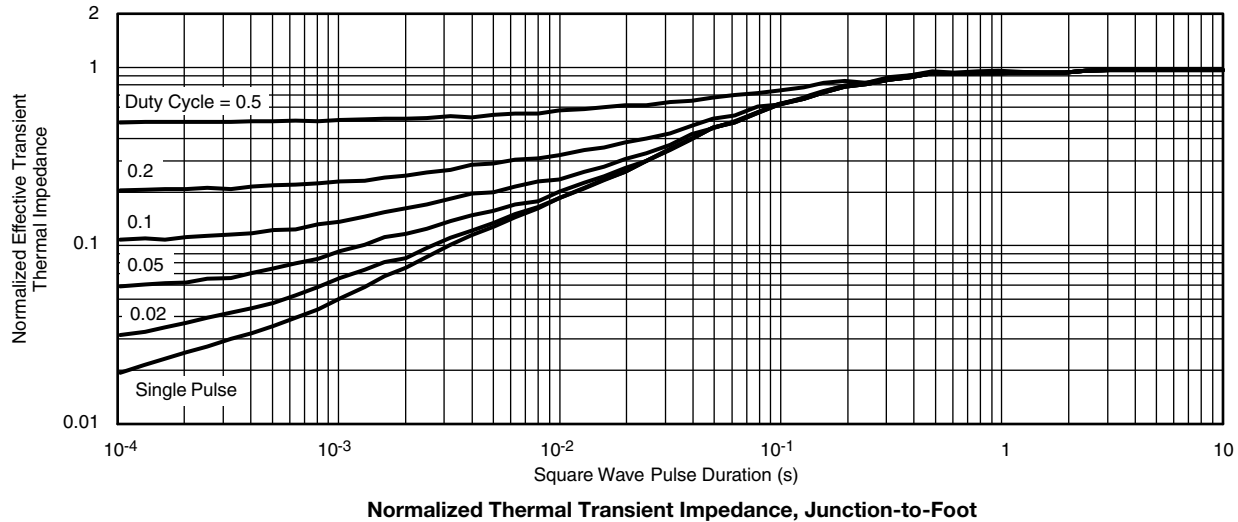
**Safe Operating Area**



**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**THERMAL RATINGS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



**Normalized Thermal Transient Impedance, Junction-to-Foot**

**Note**

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction-to-Foot (25 °C)
 are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

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REVISION HISTORY <sup>a</sup>		
REVISION	DATE	DESCRIPTION OF CHANGE
C	03-Dec-15	• Changed R <sub>g</sub> minimum

**Note**

a. As of April 2014



## SC-70

Ordering codes for the SQ rugged series power MOSFETs in the SC-70 package:

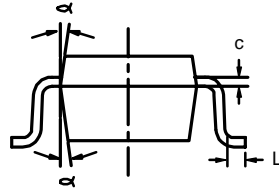
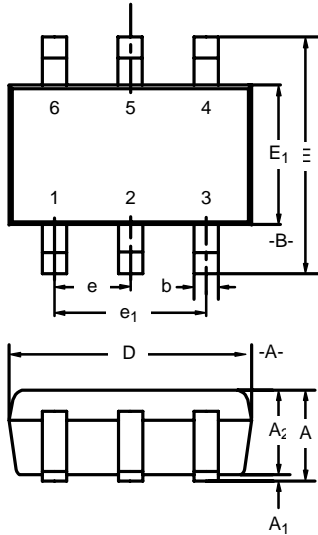
DATASHEET PART NUMBER	OLD ORDERING CODE <sup>a</sup>	NEW ORDERING CODE
SQ1421EDH	-	<b>SQ1421EDH-T1_GE3</b>
SQ1431EH	SQ1431EH-T1-GE3	<b>SQ1431EH-T1_GE3</b>
SQ1440EH	-	<b>SQ1440EH-T1_GE3</b>
SQ1470AEH	-	<b>SQ1470AEH-T1_GE3</b>
SQ1539EH	-	<b>SQ1539EH-T1_GE3</b>
SQ1563AEH	-	<b>SQ1563AEH-T1_GE3</b>
SQ1902AEL	-	<b>SQ1902AEL-T1_GE3</b>
SQ1912AEEH	-	<b>SQ1912AEEH-T1_GE3</b>
SQ1912EH	-	<b>SQ1912EH-T1_GE3</b>

**Note**

a. Old ordering code is obsolete and no longer valid for new orders

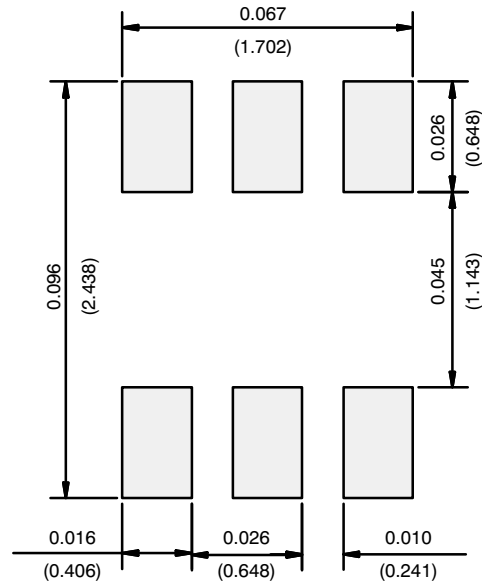


### SC-70: 6-LEADS



Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.90	–	1.10	0.035	–	0.043
A <sub>1</sub>	–	–	0.10	–	–	0.004
A <sub>2</sub>	0.80	–	1.00	0.031	–	0.039
b	0.15	–	0.30	0.006	–	0.012
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
E <sub>1</sub>	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65BSC			0.026BSC		
e <sub>1</sub>	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. B, 09-Jul-01						
DWG: 5550						

## RECOMMENDED MINIMUM PADS FOR SC-70: 6-Lead



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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