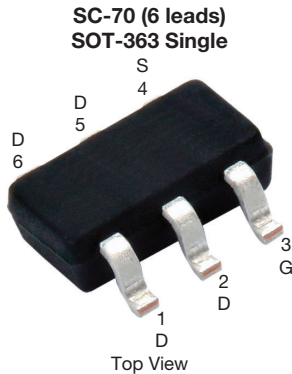


## Dual P-Channel 12 V (D-S) MOSFET


**Marking Code: DE**

PRODUCT SUMMARY	
$V_{DS}$ (V)	-12
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -4.5$ V	0.390
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -2.5$ V	0.535
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -1.8$ V	0.710
$Q_g$ typ. (nC)	1.7
$I_D$ (A) <sup>d</sup>	-1.3
Configuration	Dual

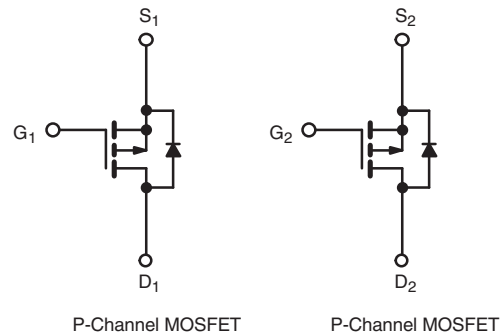
**FEATURES**

- TrenchFET® power MOSFET
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


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

**APPLICATIONS**

- Load switch for portable devices



ORDERING INFORMATION	
Package	SC70-6
Lead (Pb)-free	Si1965DH-T1-E3
Lead (Pb)-free and halogen-free	Si1965DH-T1-GE3

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-source voltage	$V_{DS}$	-12	V	
Gate-source voltage	$V_{GS}$	$\pm 8$	V	
Continuous drain current ( $T_J = 150$ °C)	$T_C = 25$ °C	-1.3 <sup>a</sup>	A	
	$T_C = 70$ °C	-1.2		
	$T_A = 25$ °C	-1.14 <sup>b, c</sup>		
	$T_A = 70$ °C	-0.9 <sup>b, c</sup>		
Pulsed drain current	$I_{DM}$	-3	A	
Continuous source-drain diode current	$T_C = 25$ °C	-1	A	
	$T_A = 25$ °C	-0.6 <sup>b, c</sup>		
Maximum power dissipation	$T_C = 25$ °C	1.25	W	
	$T_C = 70$ °C	0.8		
	$T_A = 25$ °C	0.74 <sup>b, c</sup>		
	$T_A = 70$ °C	0.47 <sup>b, c</sup>		
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +150	°C	

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient <sup>b, d</sup>	$R_{thJA}$	130	170	°C/W
Maximum junction-to-foot (drain)	$R_{thJF}$	80	100	

**Notes**

- Package limited
- Surface mounted on 1" x 1" FR4 board
- $t = 5$  s
- Maximum under steady state conditions is 220 °C/W



SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-12	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$	-	-14	-	mV/ $^\circ\text{C}$
$V_{GS(th)}$ temperature coefficient	$\Delta V_{GS(th)}/T_J$		-	2	-	
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-0.4	-	-1.0	V
Gate-source leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$	-	-	$\pm 100$	nA
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = -12\text{ V}, V_{GS} = 0\text{ V}$	-	-	-1	$\mu\text{A}$
		$V_{DS} = -12\text{ V}, V_{GS} = 0\text{ V}, T_J = 85\text{ }^\circ\text{C}$	-	-	-10	
On-state drain current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq -5\text{ V}, V_{GS} = -4.5\text{ V}$	-3	-	-	A
Drain-source on-state resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -1.0\text{ A}$	-	0.315	0.390	$\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -0.86\text{ A}$	-	0.425	0.535	
		$V_{GS} = -1.8\text{ V}, I_D = -0.25\text{ A}$	-	0.550	0.710	
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -6\text{ V}, I_D = -1.0\text{ A}$	-	2.5	-	S
<b>Dynamic <sup>b</sup></b>						
Input capacitance	$C_{iss}$	$V_{DS} = -6\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	120	-	pF
Output capacitance	$C_{oss}$		-	41	-	
Reverse transfer capacitance	$C_{rss}$		-	25	-	
Total gate charge	$Q_g$	$V_{DS} = -6\text{ V}, V_{GS} = -8\text{ V}, I_D = -1.1\text{ A}$	-	2.8	4.2	nC
		$V_{DS} = -6\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -1.1\text{ A}$	-	1.7	2.6	
Gate-source charge	$Q_{gs}$	$V_{DS} = -6\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -1.1\text{ A}$	-	0.3	-	nC
Gate-drain charge	$Q_{gd}$		-	0.4	-	
Gate resistance	$R_g$	$f = 1\text{ MHz}$	-	7.5	-	$\Omega$
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -6\text{ V}, R_L = 6.7\text{ }\Omega$ $I_D \cong -0.9\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$	-	12	20	ns
Rise time	$t_r$		-	27	40	
Turn-off delay time	$t_{d(off)}$		-	15	25	
Fall time	$t_f$		-	10	15	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -6\text{ V}, R_L = 6.7\text{ }\Omega$ $I_D \cong -0.9\text{ A}, V_{GEN} = -8\text{ V}, R_g = 1\text{ }\Omega$	-	2	5	ns
Rise time	$t_r$		-	12	20	
Turn-off delay time	$t_{d(off)}$		-	12	20	
Fall time	$t_f$		-	10	15	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous source-drain diode current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	-	-	-1.0	A
Pulse diode forward current <sup>a</sup>	$I_{SM}$		-	-	-3.0	
Body diode voltage	$V_{SD}$	$I_S = -0.9\text{ A}$	-	-0.8	-1.2	V
Body diode reverse recovery time	$t_{rr}$	$I_F = -0.9\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$	-	20	40	ns
Body diode reverse recovery charge	$Q_{rr}$		-	10	20	nC
Reverse recovery fall time	$t_a$		-	9.5	-	ns
Reverse recovery rise time	$t_b$		-	11.5	-	

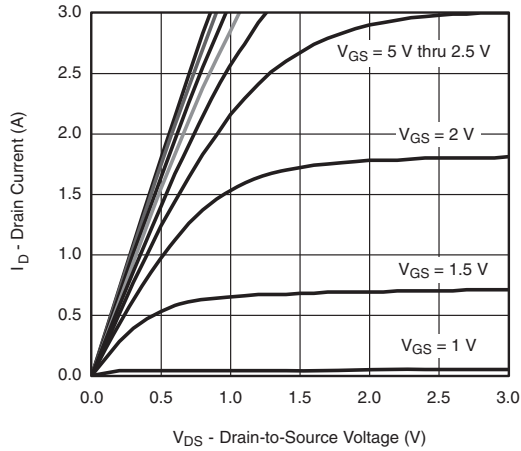
**Notes**

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

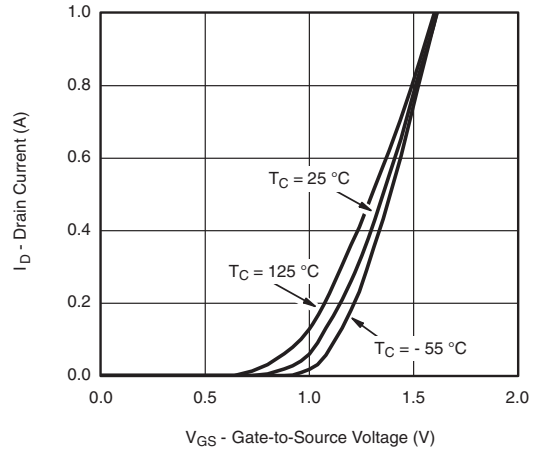
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



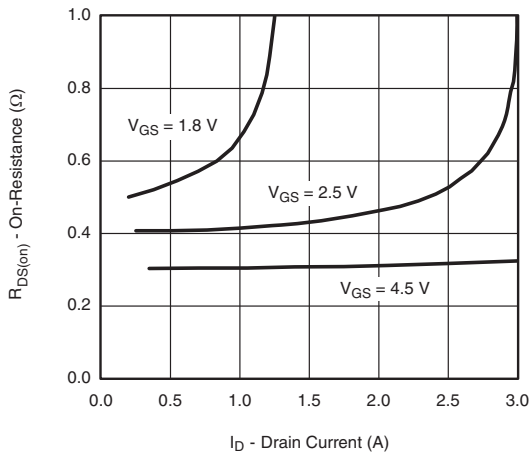
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



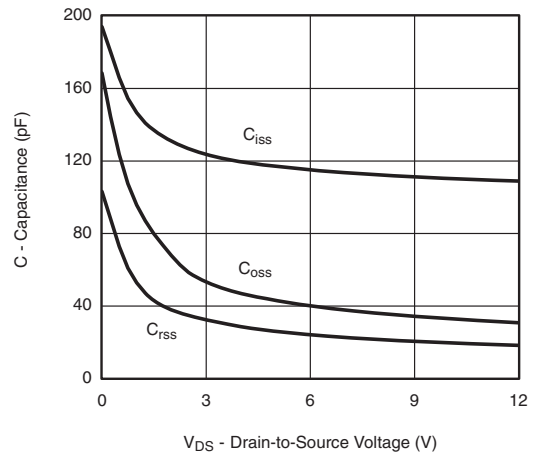
Output Characteristics



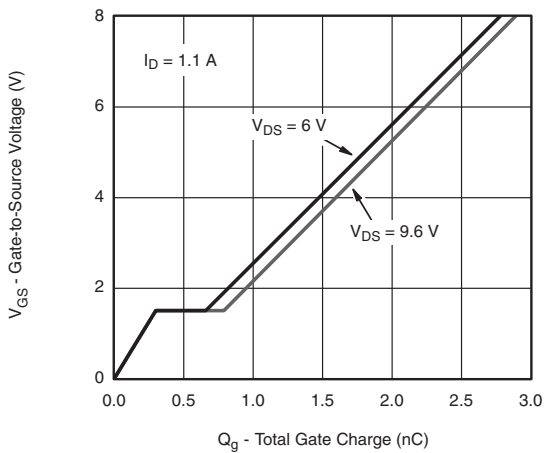
Transfer Characteristics



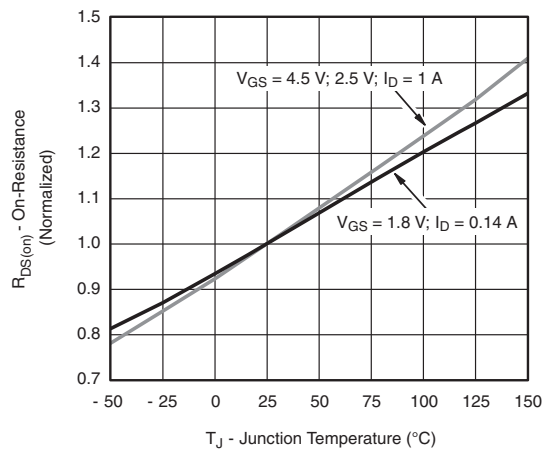
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



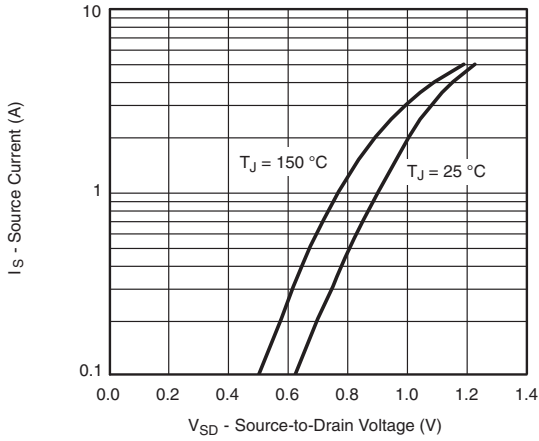
Gate Charge



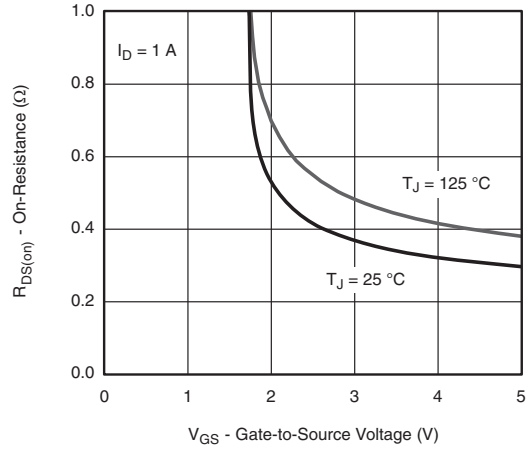
On-Resistance vs. Junction Temperature



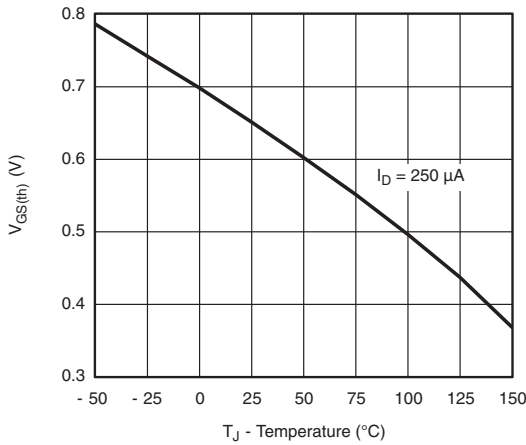
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



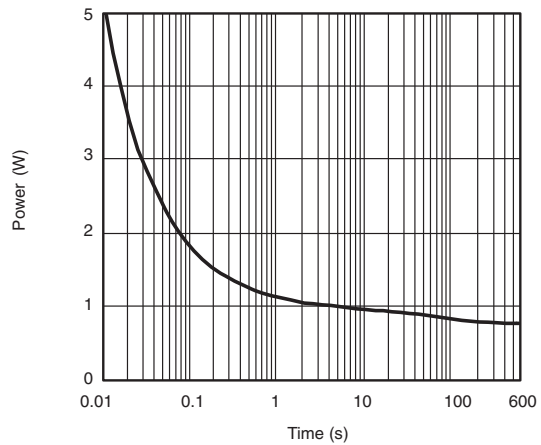
Source-Drain Diode Forward Voltage



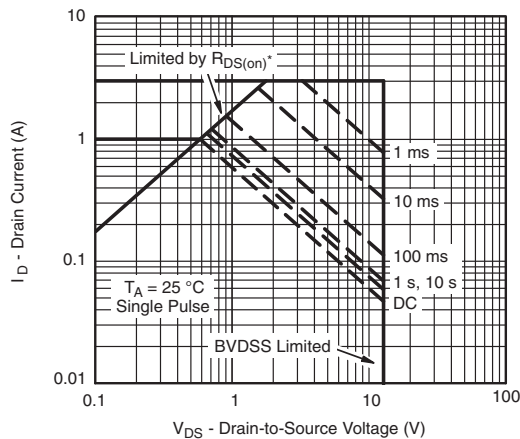
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



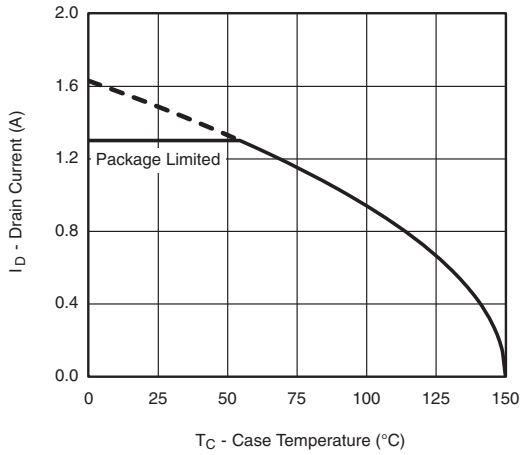
Single Pulse Power



Safe Operating Area, Junction-to-Ambient

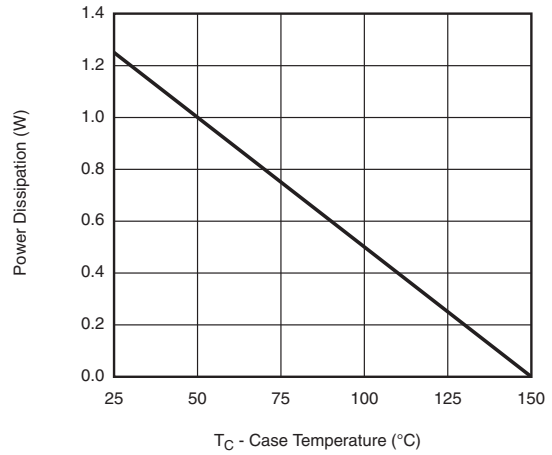


**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



$T_C$  - Case Temperature (°C)

**Current Derating <sup>a</sup>**



$T_C$  - Case Temperature (°C)

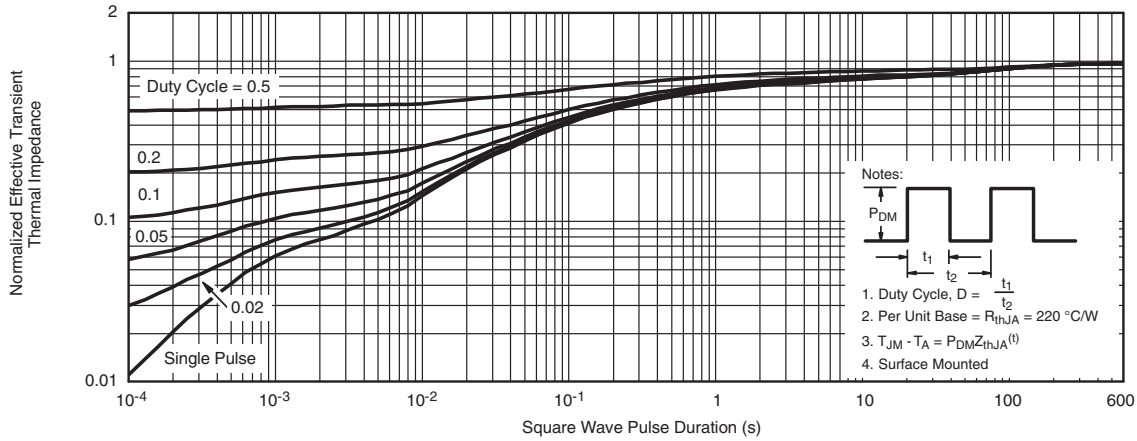
**Power, Junction-to-Foot**

**Note**

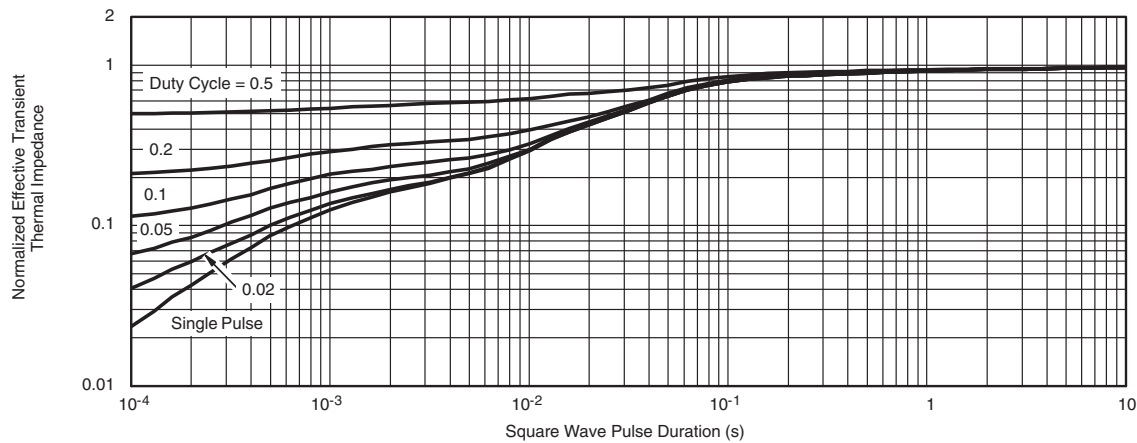
- a. The power dissipation  $P_D$  is based on  $T_J$  max. = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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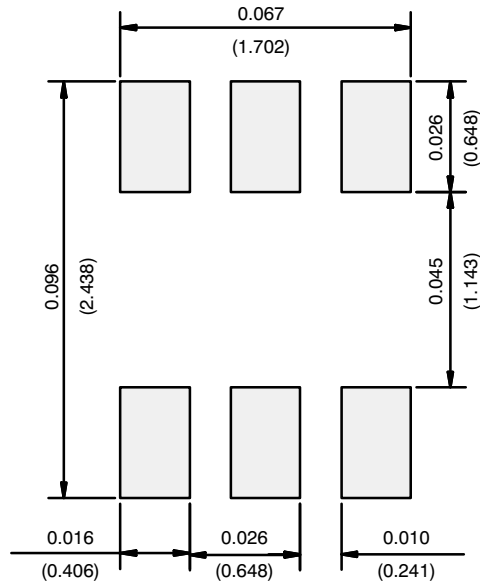
### SC-70: 6-LEADS



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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