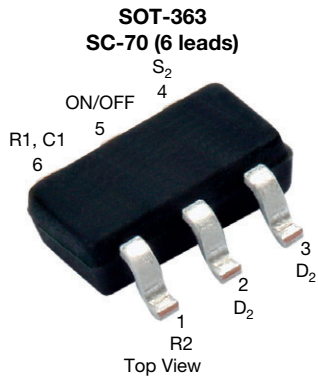


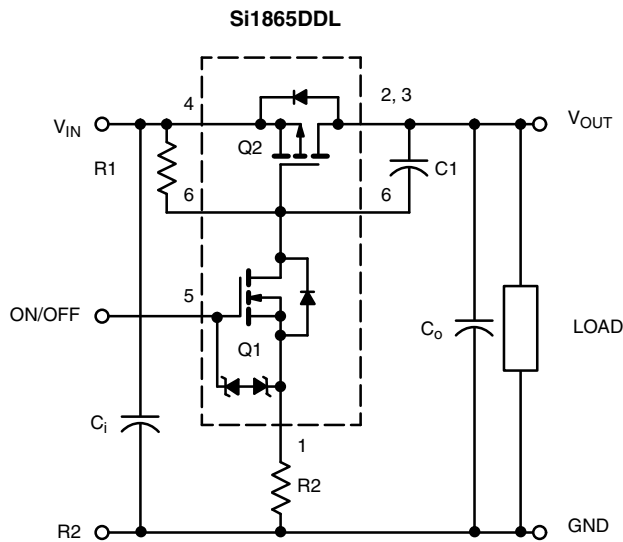
## Load Switch with Level-Shift



Marking Code: VD

PRODUCT SUMMARY	
$V_{DS}$ (V)	12
$R_{DS(on)}$ ( $\Omega$ ) at $V_{IN} = 4.5$ V	0.200
$R_{DS(on)}$ ( $\Omega$ ) at $V_{IN} = 2.5$ V	0.300
$R_{DS(on)}$ ( $\Omega$ ) at $V_{IN} = 1.8$ V	0.508
$I_D$ (A)	$\pm 1.1$
Configuration	Level-shift

### APPLICATION CIRCUITS



COMPONENTS		
R1	Pull-up resistor	Typical 10 k $\Omega$ to 1 M $\Omega$ <sup>a</sup>
R2	Optional slew-rate control	Typical 0 to 100 k $\Omega$ <sup>a</sup>
C1	Optional slew-rate control	Typical 1000 pF

**Note**

- a. Minimum R1 value should be at least 10 x R2 to ensure Q1 turn-on

### FEATURES

- Low  $R_{DS(on)}$  TrenchFET®
- 1.8 V to 12 V input
- 1.5 V to 8 V logic level control
- Low profile, small footprint SC-70-6 package
- 2000 V ESD protection on input switch,  $V_{ON/OFF}$
- Adjustable slew-rate
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



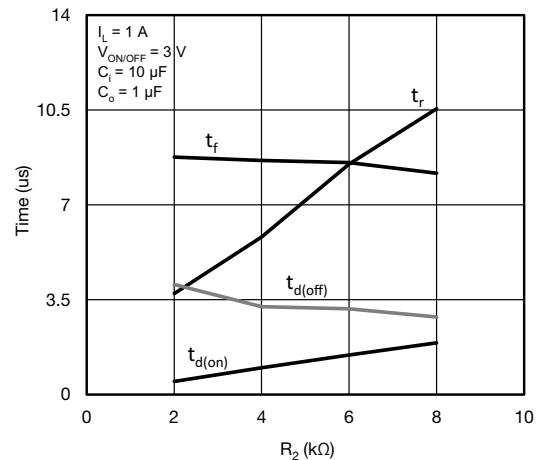
**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

- Load switch with level-shift
- Slew-rate control
- Portable / consumer devices

### DESCRIPTION

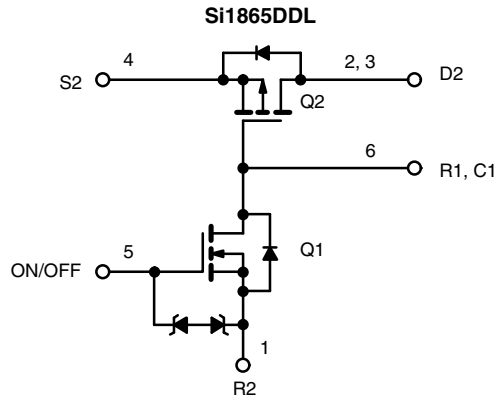
The Si1865DDL includes a p- and n-channel MOSFET in a single SC-70-6 package. The low on-resistance p-channel TrenchFET is tailored for use as a load switch. The n-channel, with an external resistor, can be used as a level-shift to drive the p-channel load-switch. The n-channel MOSFET has internal ESD protection and can be driven by logic signals as low as 1.5 V. The Si1865DDL operates on supply lines from 1.8 V to 12 V, and can drive loads up to 1.1 A.



Switching Variation R2 at  $V_{IN} = 2.5$  V,  $R1 = 20$  k $\Omega$

The Si1865DDL is ideally suited for high-side load switching in portable applications. The integrated n-channel level-shift device saves space by reducing external components. The slew rate is set externally so that rise-times can be tailored to different load types.

## FUNCTIONAL BLOCK DIAGRAM



ORDERING INFORMATION	
Package	SC-70
Lead (Pb)-free and halogen-free	Si1865DDL-T1-GE3

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Input voltage	$V_{IN}(V_{DS2})$	12	V
On/off voltage	$V_{ON/OFF}$	8	
Load current	Continuous <sup>a, b</sup>	$\pm 1.1$	A
	Pulsed <sup>b, c</sup>	$\pm 5$	
Continuous intrinsic diode conduction <sup>a</sup>	$I_S$	-0.3	
Maximum power dissipation <sup>a</sup>	$P_D$	0.357	W
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
ESD rating, MIL-STD-883D human body model (100 pF, 1500 $\Omega$ )	ESD	2	kV

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient (continuous current) <sup>a</sup>	$R_{thJA}$	290	350	$^\circ\text{C}/\text{W}$
Maximum junction-to-foot (Q2)	$R_{thJF}$	250	300	

SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Off Characteristics</b>						
Reverse leakage current	$I_{FL}$	$V_{IN} = 12\text{ V}, V_{ON/OFF} = 0\text{ V}$	-	-	1	$\mu\text{A}$
Diode forward voltage	$V_{SD}$	$I_S = -0.8\text{ A}$	-	-0.84	-1.2	V
<b>On Characteristics</b>						
Input voltage range	$V_{IN}$		1.8	-	12	V
On-resistance (p-channel)	$R_{DS(on)}$	$V_{ON/OFF} = 1.5\text{ V}, V_{IN} = 4.5\text{ V}, I_D = 1.1\text{ A}$	-	0.165	0.200	$\Omega$
		$V_{ON/OFF} = 1.5\text{ V}, V_{IN} = 2.5\text{ V}, I_D = 0.9\text{ A}$	-	0.250	0.300	
		$V_{ON/OFF} = 1.5\text{ V}, V_{IN} = 1.8\text{ V}, I_D = 0.2\text{ A}$	-	0.376	0.508	
On-state (p-channel) drain-current	$I_{D(on)}$	$V_{IN-OUT} \leq 0.2\text{ V}, V_{IN} = 5\text{ V}, V_{ON/OFF} = 1.5\text{ V}$	1	-	-	A
		$V_{IN-OUT} \leq 0.3\text{ V}, V_{IN} = 3\text{ V}, V_{ON/OFF} = 1.5\text{ V}$	1	-	-	

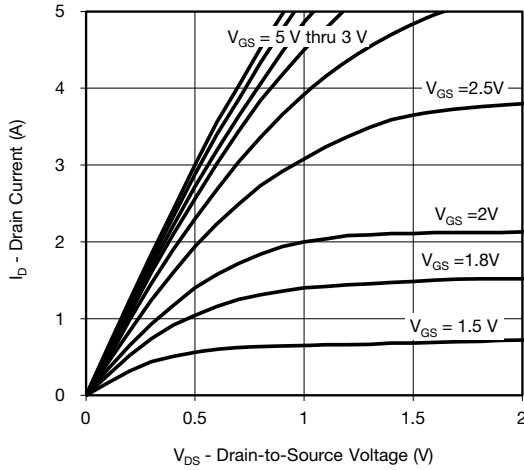
### Notes

- Surface mounted on FR4 board
- $V_{IN} = 12\text{ V}, V_{ON/OFF} = 8\text{ V}, T_A = 25\text{ }^\circ\text{C}$
- Pulse test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$

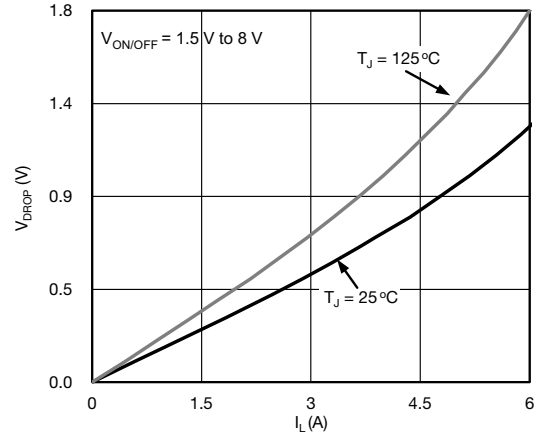
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



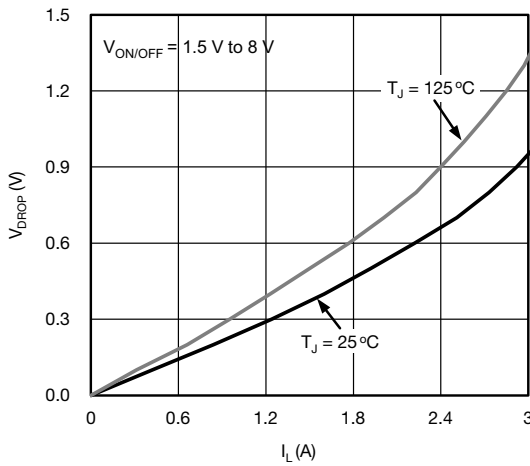
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



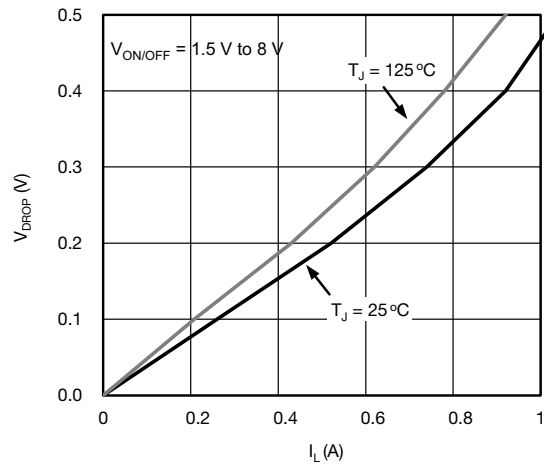
Output Characteristics



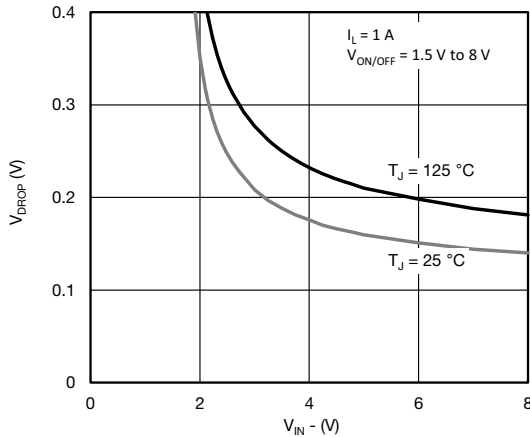
$V_{DROPP}$  vs.  $I_L$  at  $V_{IN} = 4.5\text{ V}$



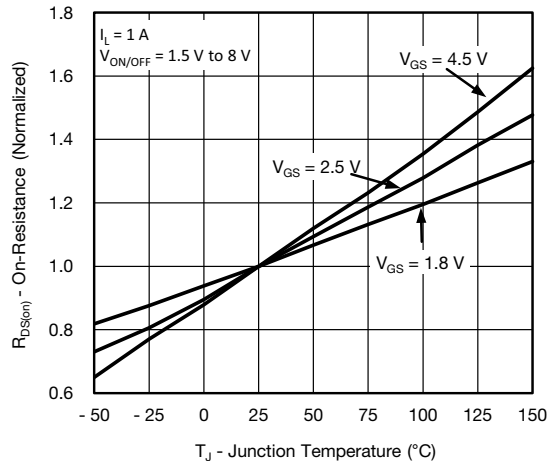
$V_{DROPP}$  vs.  $I_L$  at  $V_{IN} = 2.5\text{ V}$



$V_{DROPP}$  vs.  $I_L$  at  $V_{IN} = 1.8\text{ V}$



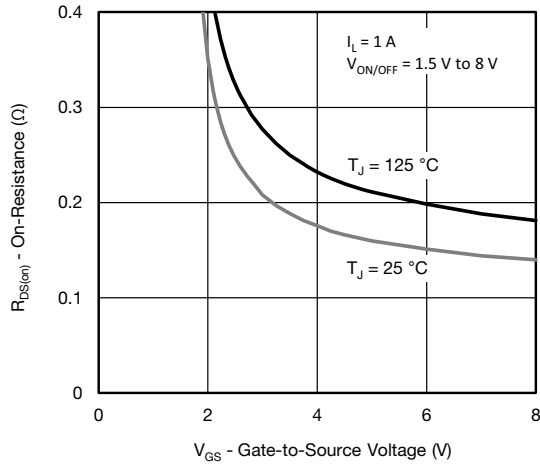
$V_{DROPP}$  vs.  $V_{IN}$  at  $I_L = 1\text{ A}$



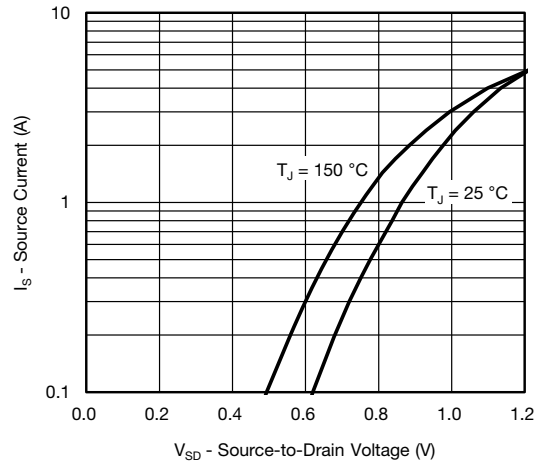
Normalized On-Resistance vs. Junction Temperature



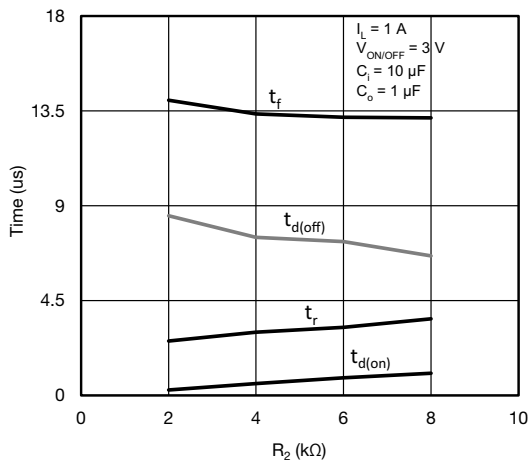
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



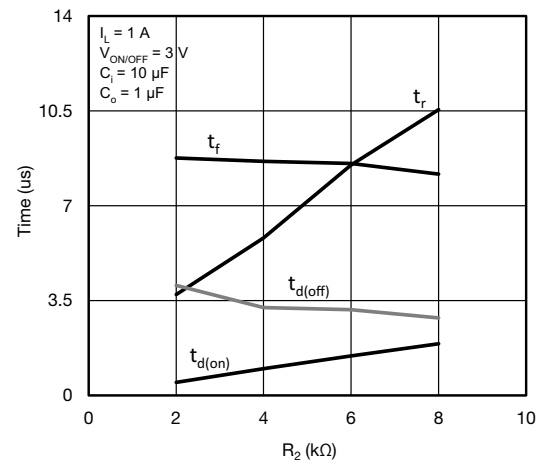
**On-Resistance vs. Input Voltage**



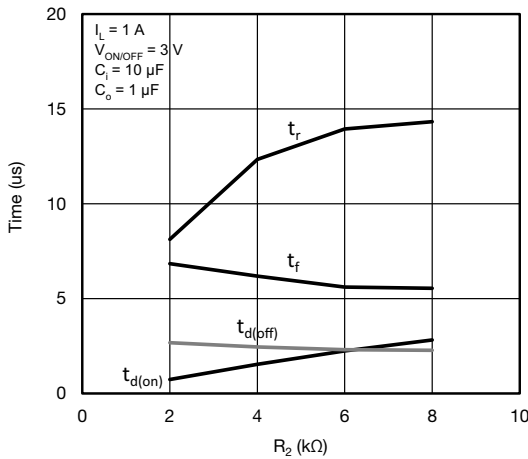
**Source-Drain Diode Forward Voltage**



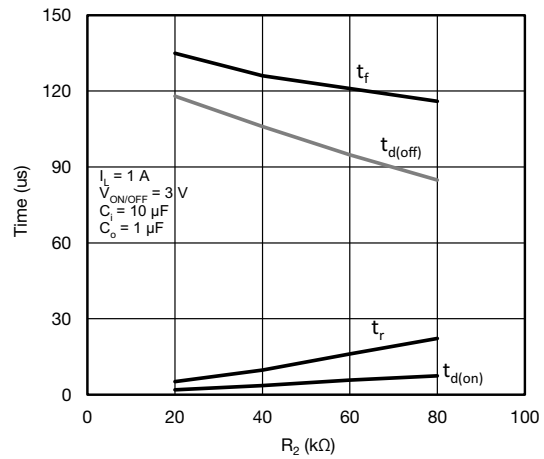
**Switching Variation  $R_2$  at  $V_{IN} = 4.5\text{ V}$ ,  $R_1 = 20\ \text{k}\Omega$**



**Switching Variation  $R_2$  at  $V_{IN} = 2.5\text{ V}$ ,  $R_1 = 20\ \text{k}\Omega$**



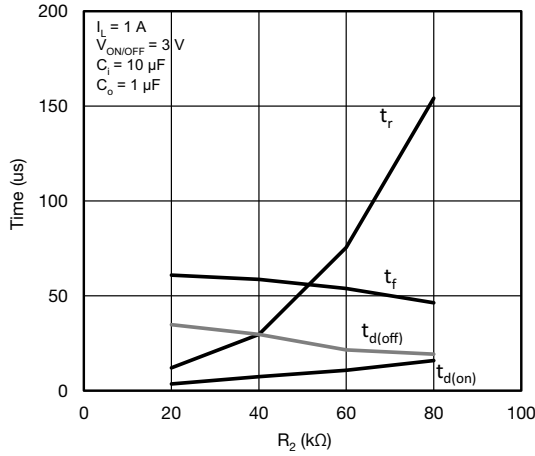
**Switching Variation  $R_2$  at  $V_{IN} = 1.8\text{ V}$ ,  $R_1 = 20\ \text{k}\Omega$**



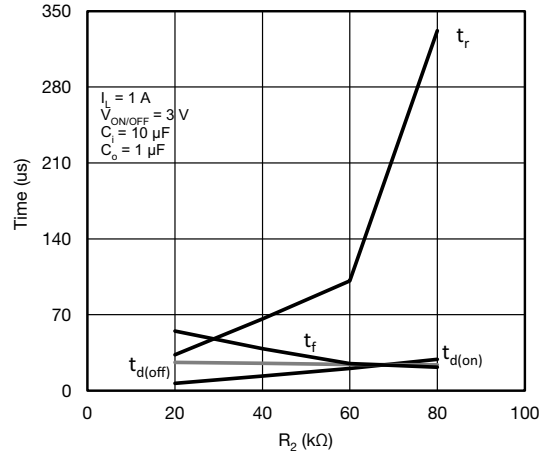
**Switching Variation  $R_2$  at  $V_{IN} = 4.5\text{ V}$ ,  $R_1 = 300\ \text{k}\Omega$**



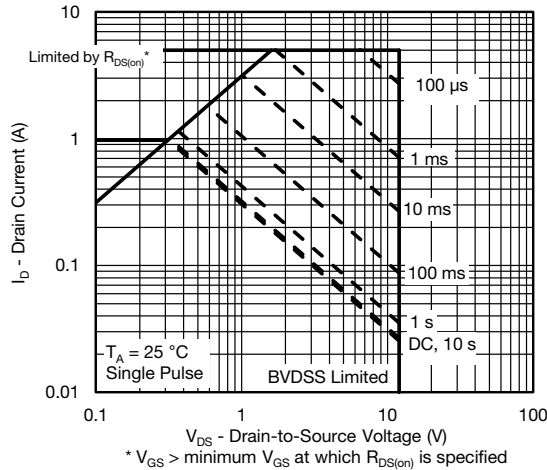
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



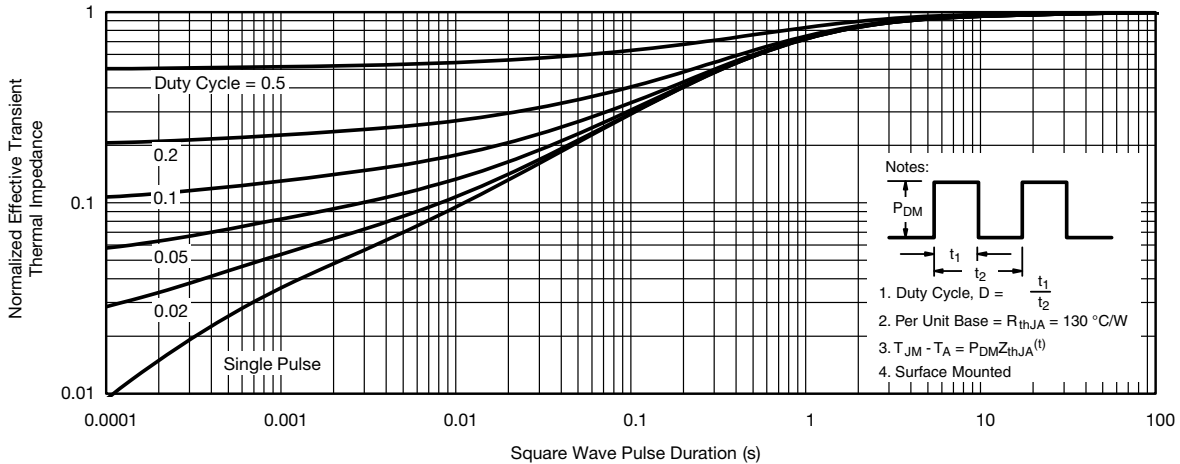
Switching Variation R2 at  $V_{IN} = 2.5 \text{ V}$ ,  $R_1 = 300 \text{ k}\Omega$



Switching Variation R2 at  $V_{IN} = 1.8 \text{ V}$ ,  $R_1 = 300 \text{ k}\Omega$



Safe Operating Area, Junction-to-Foot

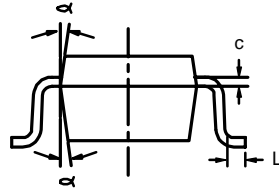


Normalized Thermal Transient Impedance, Junction-to-Ambient

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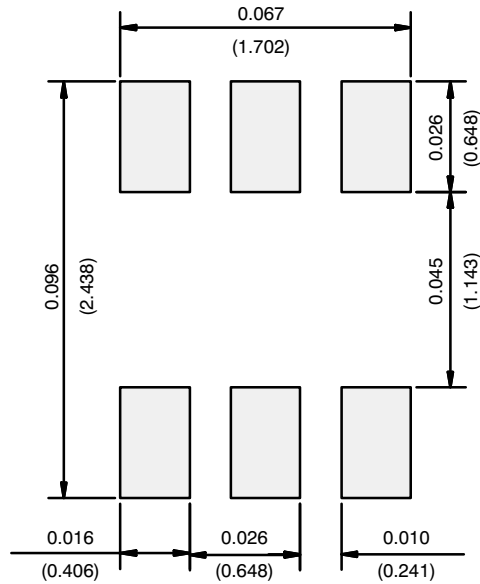
**SC-70: 6-LEADS**



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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