

## N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)	Q <sub>g</sub> (Typ.)
20	0.091 at V <sub>GS</sub> = 4.5 V	1.3 <sup>a</sup>	3.5
	0.124 at V <sub>GS</sub> = 2.5 V	1.1	

### FEATURES

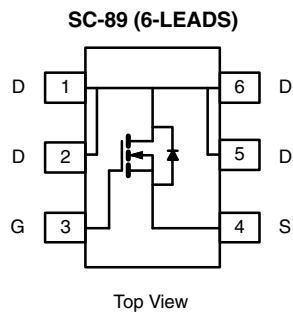
- TrenchFET<sup>®</sup> Power MOSFET
- 100 % R<sub>g</sub> and UIS Tested
- Material categorization:  
For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



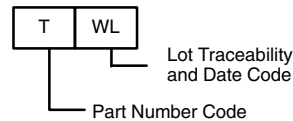
**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

- Load Switch for Portable Devices



#### Marking Code



**Ordering Information:** Si1058X-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)				
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	V <sub>DS</sub>	20	V	
Gate-Source Voltage	V <sub>GS</sub>	± 12		
Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>	T <sub>A</sub> = 25 °C	1.3 <sup>b, c</sup>	A	
	T <sub>A</sub> = 70 °C	1.03 <sup>b, c</sup>		
Pulsed Drain Current	I <sub>DM</sub>	6		
Avalanche Current	L = 0.1 mH	I <sub>AS</sub>	7	
Repetitive Avalanche Energy		E <sub>AS</sub>	2.45	mJ
Continuous Source-Drain Diode Current	T <sub>A</sub> = 25 °C	I <sub>S</sub>	0.2 <sup>b, c</sup>	A
Maximum Power Dissipation <sup>a</sup>	T <sub>A</sub> = 25 °C	P <sub>D</sub>	0.236 <sup>b, c</sup>	W
	T <sub>A</sub> = 70 °C		0.151 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C	

THERMAL RESISTANCE RATINGS					
Parameter	Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient <sup>b, d</sup>	R <sub>thJA</sub>	t ≤ 5 s	440	530	°C/W
		Steady State	540	650	

**Notes:**

- Based on T<sub>C</sub> = 25 °C.
- Surface mounted on 1" x 1" FR4 board.
- t = 5 s.
- Maximum under steady state conditions is 650 °C/W.

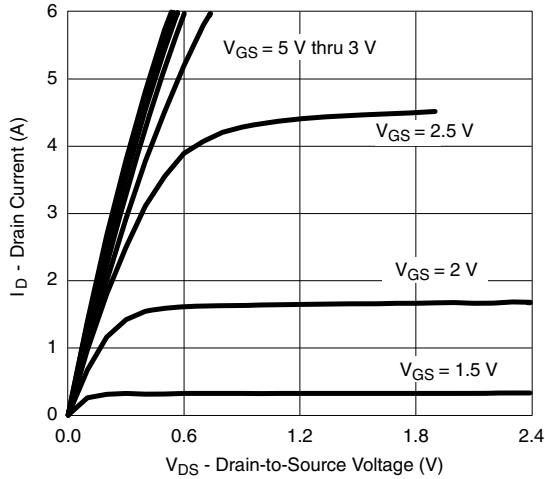
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	20			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		18.9		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			-3.6		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.7		1.55	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 85\text{ }^\circ\text{C}$			10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 4.5\text{ V}$	6			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 1.3\text{ A}$		0.076	0.091	$\Omega$
		$V_{GS} = 2.5\text{ V}, I_D = 1.1\text{ A}$		0.103	0.124	
Forward Transconductance	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 1.3\text{ A}$		5.5		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		380		pF
Output Capacitance	$C_{oss}$			75		
Reverse Transfer Capacitance	$C_{rss}$			45		
Total Gate Charge	$Q_g$	$V_{DS} = 10\text{ V}, V_{GS} = 5\text{ V}, I_D = 1.3\text{ A}$		3.9	5.9	nC
		$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 1.3\text{ A}$		3.51	5.3	
Gate-Source Charge	$Q_{gs}$			0.82		
Gate-Drain Charge	$Q_{gd}$		0.61			
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		4.3	5.6	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 15\text{ }\Omega$ $I_D \cong 1\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		8	12	ns
Rise Time	$t_r$			20	30	
Turn-Off Delay Time	$t_{d(off)}$			13	18	
Fall Time	$t_f$			6	9	
<b>Drain-Source Body Diode Characteristics</b>						
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				6	
Body Diode Voltage	$V_{SD}$	$I_S = 1\text{ A}$		0.8	1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 1\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		10.4	16	nC
Body Diode Reverse Recovery Charge	$Q_{rr}$			3.7	5.7	ns
Reverse Recovery Fall Time	$t_a$			6.5		
Reverse Recovery Rise Time	$t_b$			3.9		

## Notes:

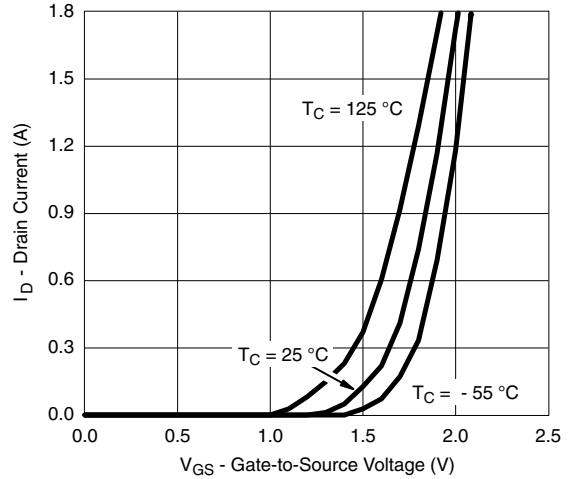
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
b. Guaranteed by design, not subject to production testing.

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.

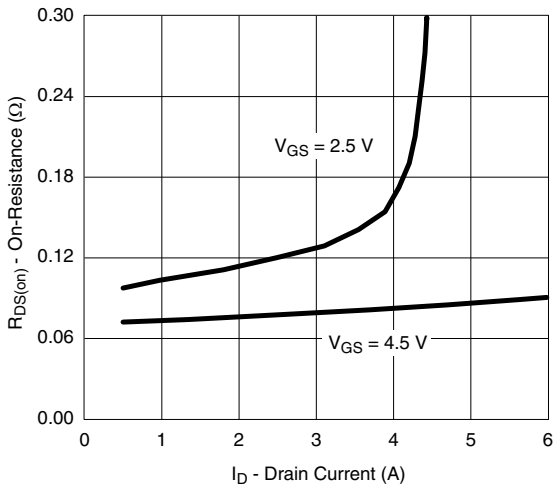
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



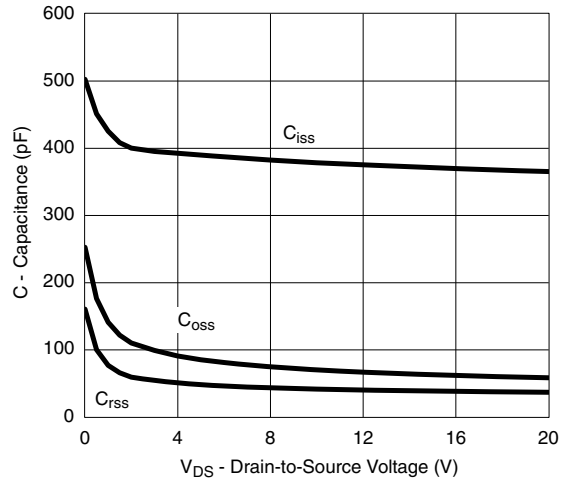
**Output Characteristics**



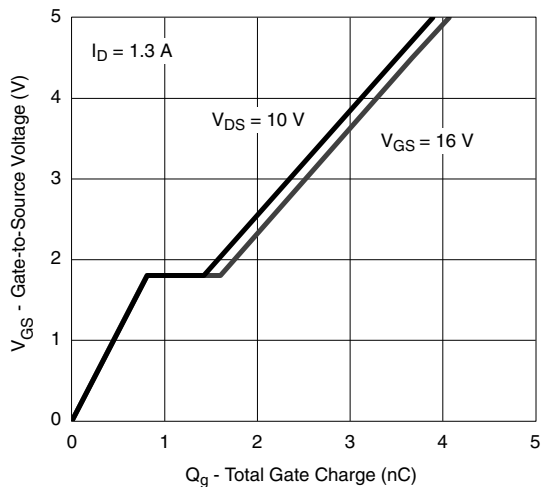
**Transfer Characteristics Curves vs. Temp.**



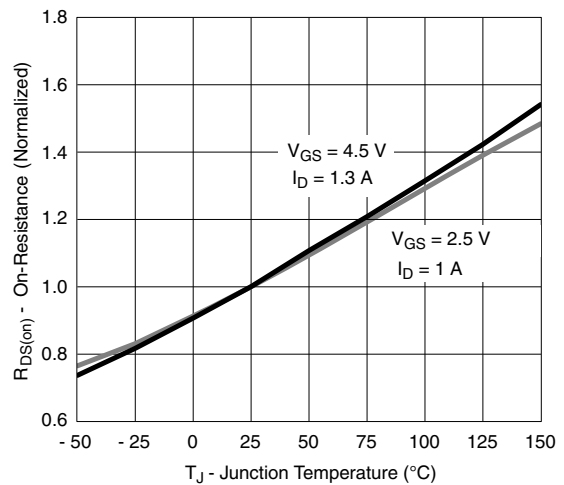
**On-Resistance vs. Drain Current**



**Capacitance**

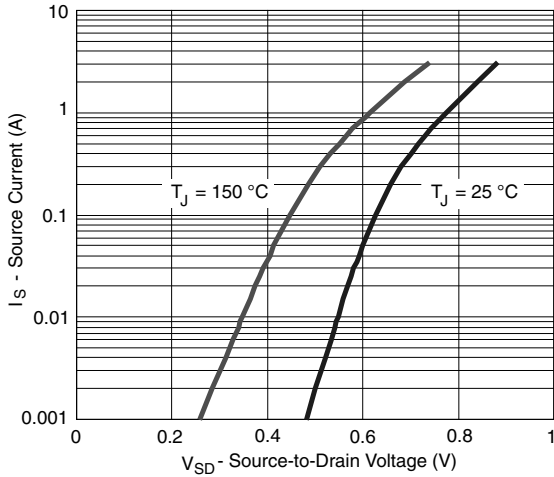


**Gate Charge**

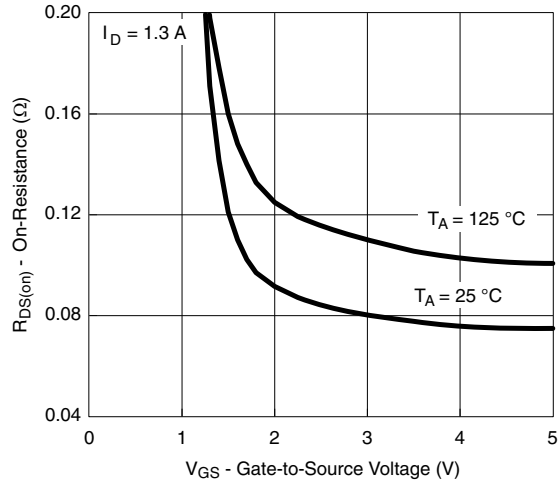


**On-Resistance vs. Junction Temperature**

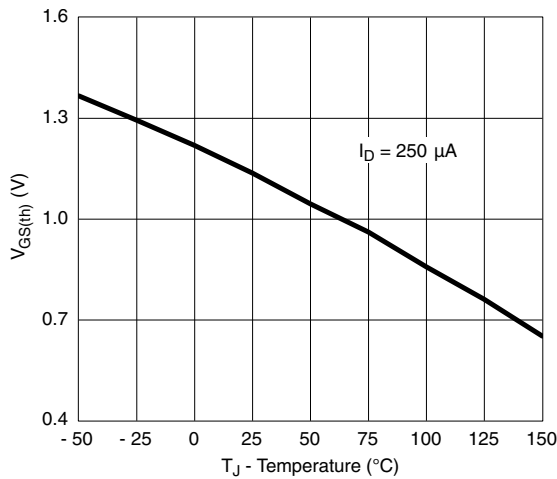
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



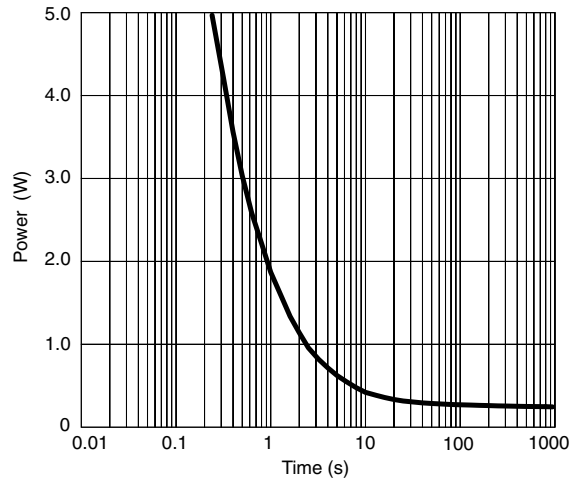
Source-Drain Diode Forward Voltage



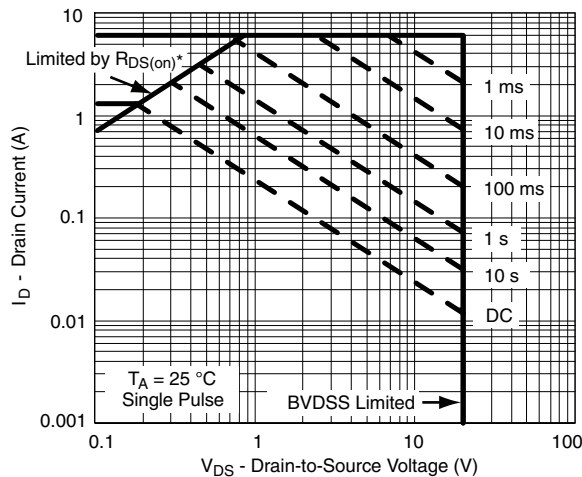
$R_{DS(on)}$  vs.  $V_{GS}$  vs. Temperature



Threshold Voltage

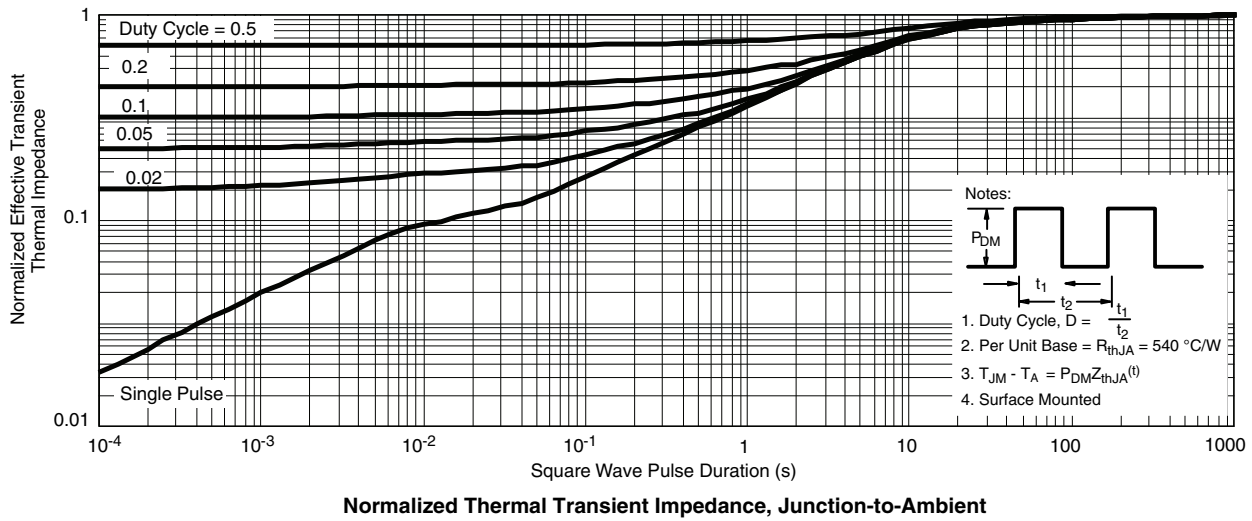


Single Pulse Power



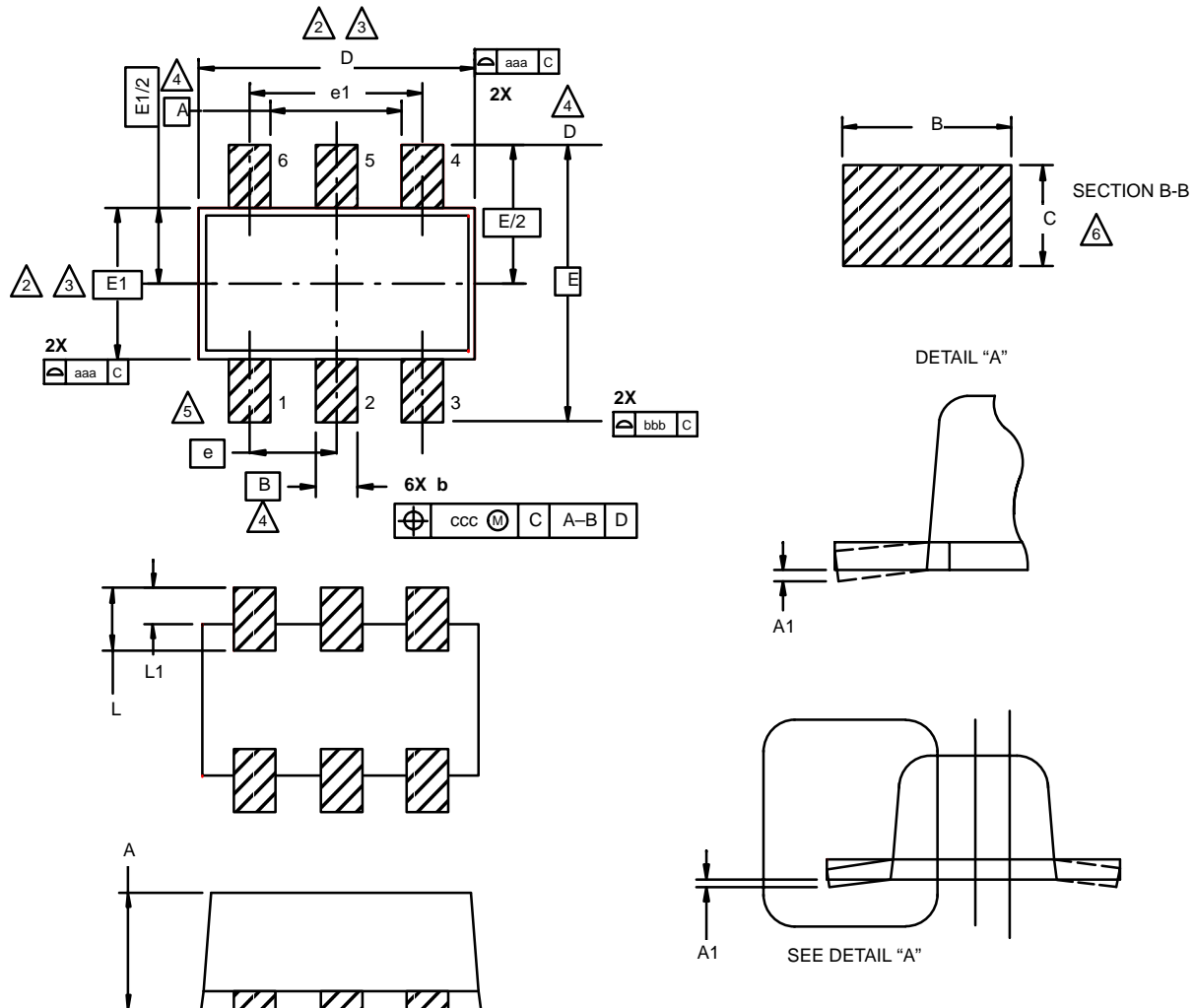
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified  
**Safe Operating Area, Junction-to-Ambient**

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



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### SC89: 6- LEADS (SOT-563F)



**NOTES:**

1. Dimensions in millimeters.

**2** Dimension D does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.15 mm per dimension E1 does not include interlead flash or protrusion, interlead flash or protrusion shall not exceed 0.15 mm per side.

**3** Dimensions D and E1 are determined at the outmost extremes of the plastic body exclusive of mold flash, the bar burrs, gate burrs and interlead flash, but including any mismatch between the top and the bottom of the plastic body.

**4** Datums A, B and D to be determined 0.10 mm from the lead tip.

**5** Terminal numbers are shown for reference only.

**6** These dimensions apply to the flat section of the lead between 0.08 mm and 0.15 mm from the lead tip.

Dim	MILLIMETERS		Note	Symbol	Tolerances Of Form And Position
	Min	Max			
A	0.56	0.60		aaa	0.10
A1	0.00	0.10		bbb	0.10
b	0.15	0.30		ccc	0.10
c	0.10	0.18			
D	1.50	1.70	2, 3		
E	1.55	1.70			
E1	1.20 BSC		2, 3		
e	0.50 BSC				
e1	1.00 BSC				
L	0.35 BSC				
L1	0.20 BSC				
ECN: E-00499—Rev. B, 02-Jul-01 DWG: 5880					

## RECOMMENDED MINIMUM PADS FOR SC-89: 6-Lead



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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