

## 2SJ209-T1B-A-VB Datasheet

### P-Channel 100-V (D-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)	$Q_g$ (Typ.)
- 100	0.50 at $V_{GS} = - 10$ V	- 1.5	7.7
	0.56 at $V_{GS} = - 6.0$ V	- 1.4	

#### FEATURES

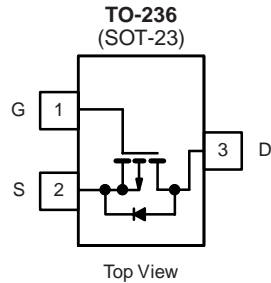
- Halogen-free According to IEC 61249-2-21 Available
- Trench Power MOSFET
- Ultra Low On-Resistance
- Small Size



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

#### APPLICATIONS

- Active Clamp Circuits in DC/DC Power Supplies



#### ABSOLUTE MAXIMUM RATINGS $T_A = 25^\circ\text{C}$ , unless otherwise noted

Parameter		Symbol	5 s	Steady State	Unit
Drain-Source Voltage		$V_{DS}$	- 100		V
Gate-Source Voltage		$V_{GS}$	$\pm 20$		
Continuous Drain Current ( $T_J = 150\text{ }^{\circ}\text{C}$ ) <sup>a, b</sup>	$T_A = 25\text{ }^{\circ}\text{C}$	$I_D$	- 1.65	- 1.5	A
	$T_A = 70\text{ }^{\circ}\text{C}$		- 1.55	- 1.4	
Pulsed Drain Current		$I_{DM}$	- 3.0		
Continuous Source Current (Diode Conduction) <sup>a, b</sup>		$I_S$	- 1.4	- 1.0	
Single Pulse Avalanche Current	L = 1.0 mH	$I_{AS}$	4.5		mJ
Single Pulse Avalanche Energy		$E_{AS}$	1.01		
Maximum Power Dissipation <sup>a, b</sup>	$T_A = 25\text{ }^{\circ}\text{C}$	$P_D$	2.0	0.85	W
	$T_A = 70\text{ }^{\circ}\text{C}$		1.0	0.58	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to 150		$^{\circ}\text{C}$

#### THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a</sup>	t ≤ 5 s	R <sub>thJA</sub>	75	100	°C/W
	Steady State		120	166	
Maximum Junction-to-Foot (Drain)	Steady State	R <sub>thJF</sub>	40	50	

Notes:

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

b. Pulse width limited by maximum junction temperature.

SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$	- 100			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$	- 1.0		- 3.0	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -100\text{ V}$ , $V_{GS} = 0\text{ V}$			- 1	$\mu\text{A}$
		$V_{DS} = -100\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 55\text{ }^{\circ}\text{C}$			- 10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq -15\text{ V}$ , $V_{GS} = 10\text{ V}$	- 1.6			A
Drain-Source On-Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$ , $I_D = -0.5\text{ A}$		0.50		$\Omega$
		$V_{GS} = -6.0\text{ V}$ , $I_D = -0.5\text{ A}$		0.56		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}$ , $I_D = -0.5\text{ A}$		2.2		S
Diode Forward Voltage	$V_{SD}$	$I_S = -1.0\text{ A}$ , $V_{GS} = 0\text{ V}$		0.7	- 1.2	V
Dynamic <sup>b</sup>						
Total Gate Charge	$Q_g$	$V_{DS} = -50\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D \cong -0.5\text{ A}$		7.7	12	nC
Gate-Source Charge	$Q_{gs}$			1.5		
Gate-Drain Charge	$Q_{gd}$			2.5		
Gate Resistance	$R_g$	$f = 1.0\text{ MHz}$		9		$\Omega$
Input Capacitance	$C_{iss}$	$V_{DS} = -25\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		520		pF
Output Capacitance	$C_{oss}$			40		
Reverse Transfer Capacitance	$C_{rss}$			20		
Switching <sup>c</sup>						
Turn-On Time	$t_{d(on)}$	$V_{DD} = -50\text{ V}$ , $R_L = 75\text{ }\Omega$ $I_D \cong -1.0\text{ A}$ , $V_{GEN} = -10\text{ V}$ $R_g = 6\text{ }\Omega$		7	11	ns
	$t_r$			11	17	
Turn-Off Time	$t_{d(off)}$			16	25	
	$t_f$			11	17	
Body Diode Reverse Recovery Charge	$Q_{rr}$	$I_F = 0.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		90	135	nC

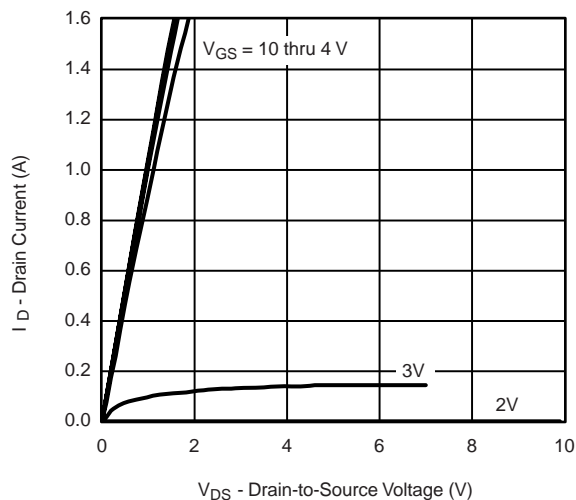
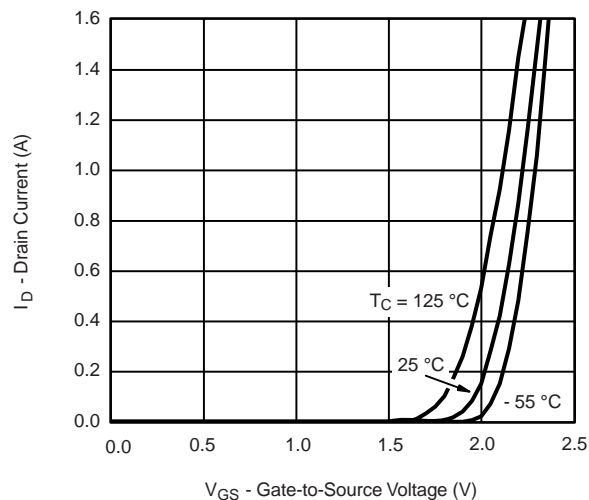
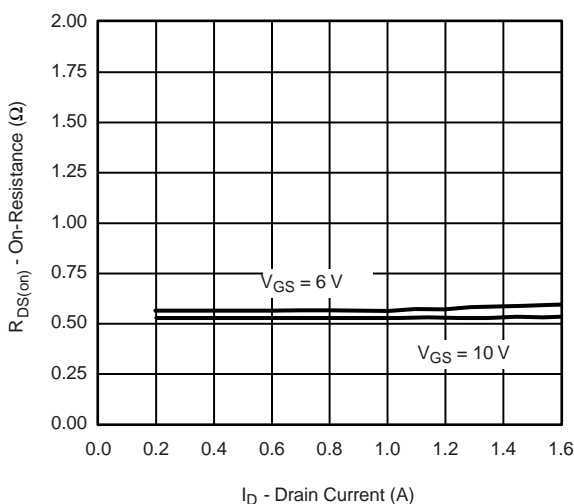
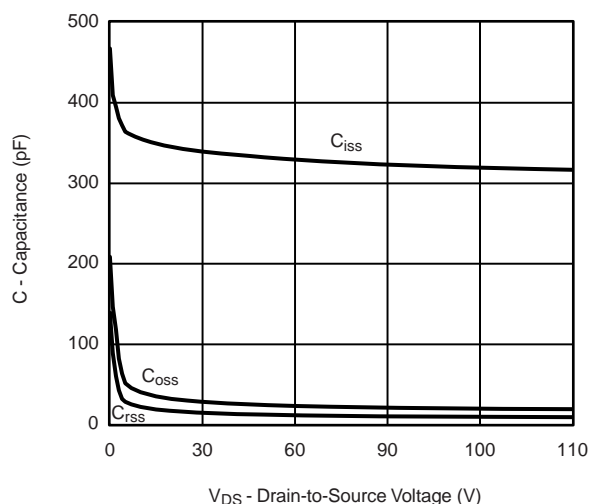
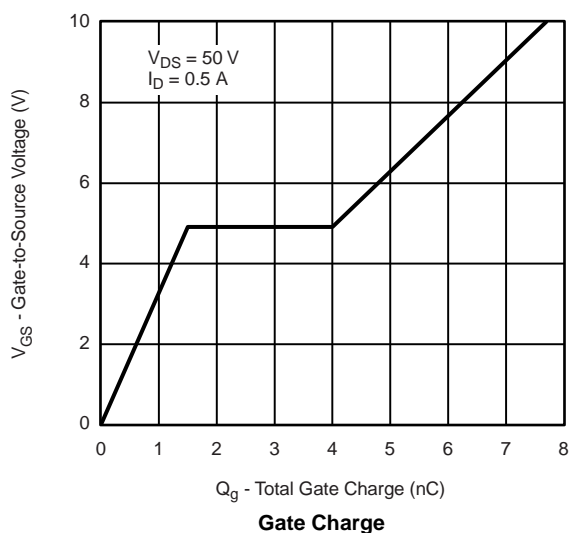
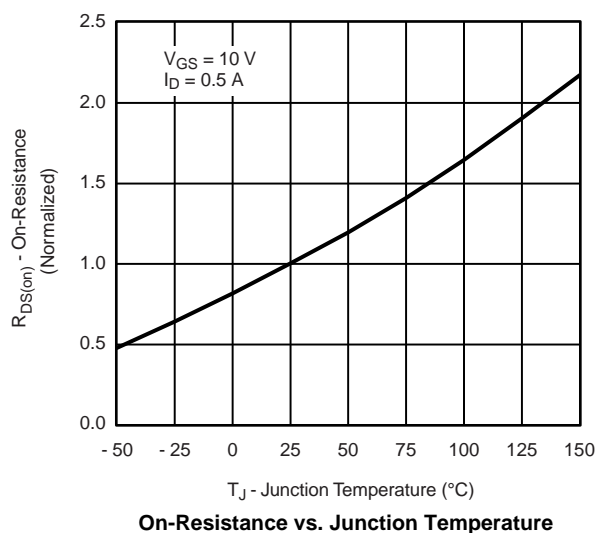
Notes:

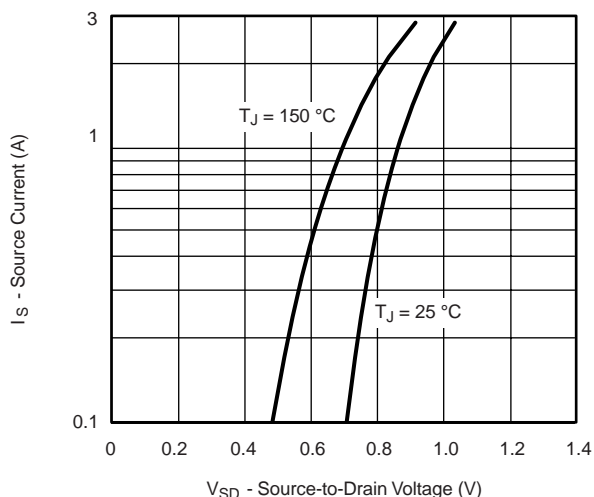
a. Pulse test:  $PW \leq 300\text{ }\mu\text{s}$  duty cycle  $\leq 2\%$ .

b. For DESIGN AID ONLY, not subject to production testing.

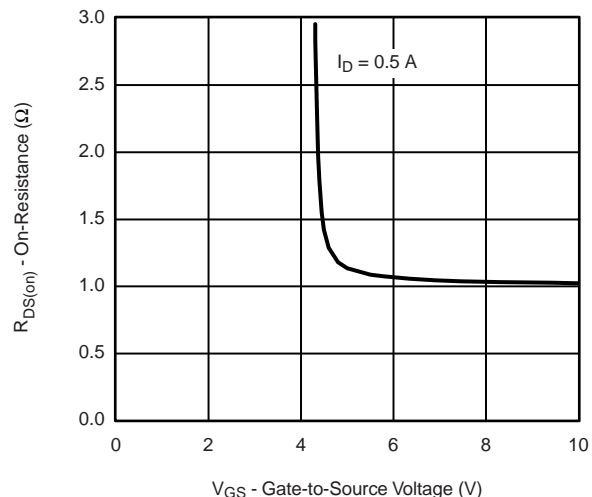
c. Switching time is essentially independent of operating temperature.

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.

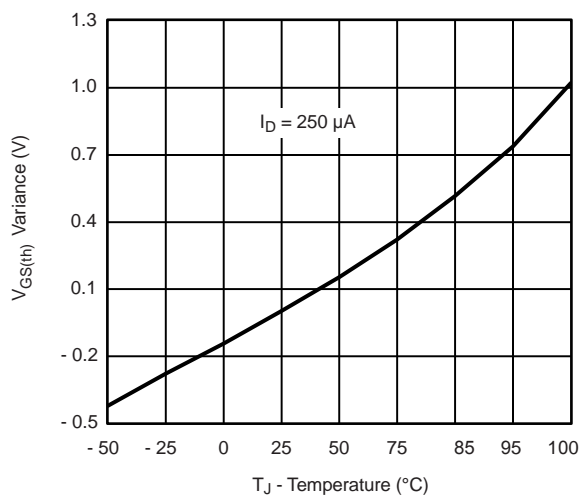
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Output Characteristics**

**Transfer Characteristics**

**On-Resistance vs. Drain Current**

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

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


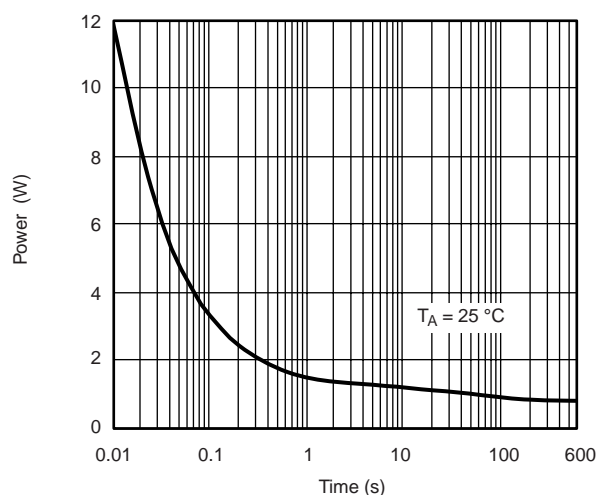
Source-Drain Diode Forward Voltage



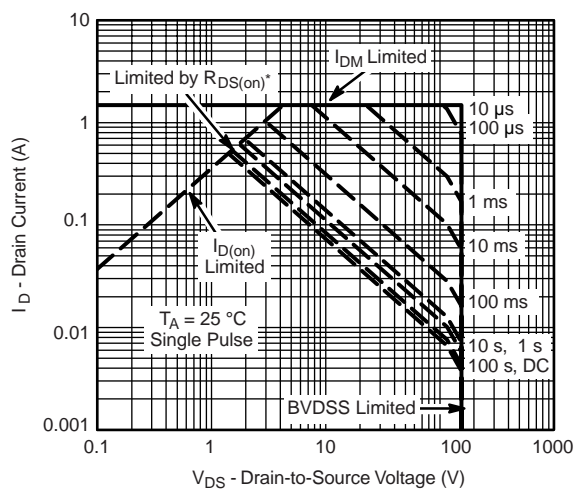
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

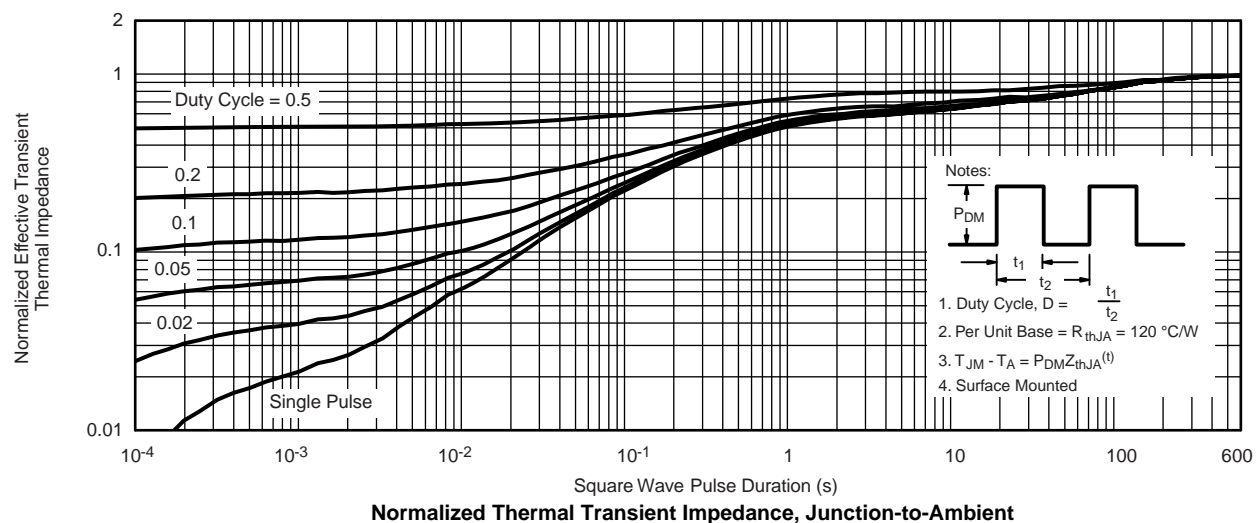


Single Pulse Power

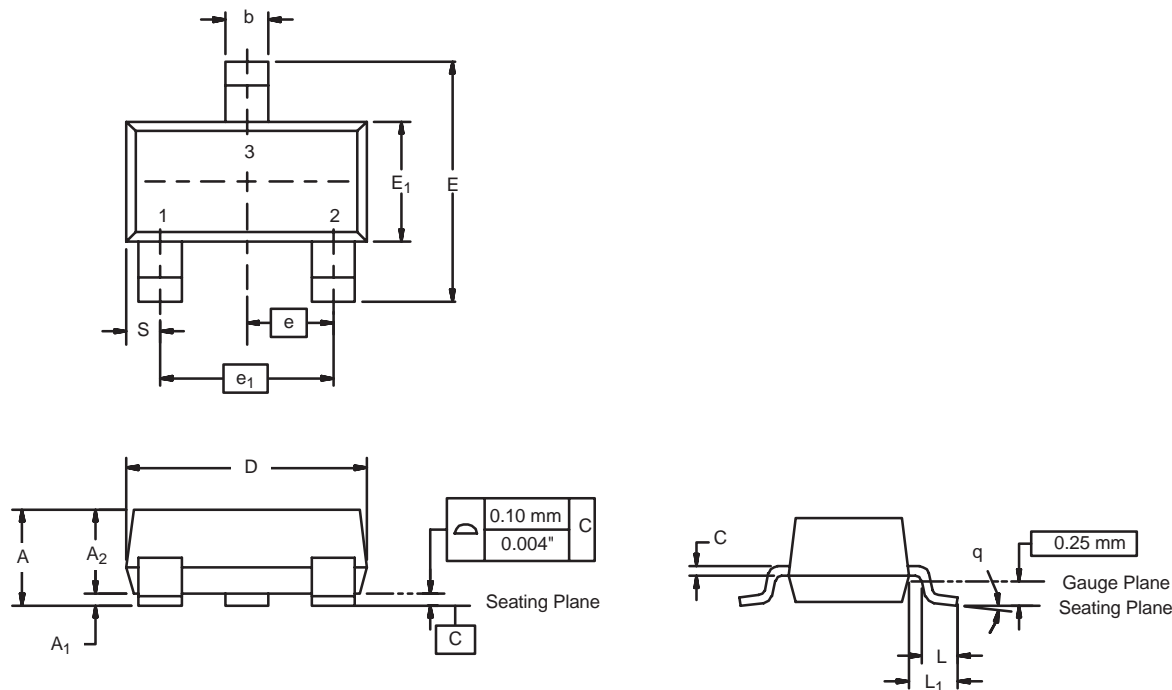


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

Safe Operating Area

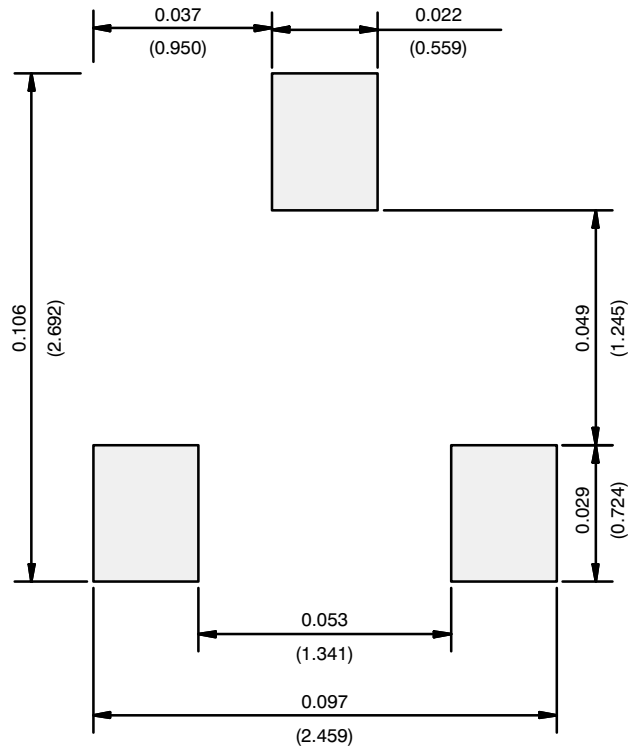
**THERMAL RATINGS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)


SOT-23 (TO-236): 3-LEAD



Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	0.89	1.12	0.035	0.044
A <sub>1</sub>	0.01	0.10	0.0004	0.004
A <sub>2</sub>	0.88	1.02	0.0346	0.040
b	0.35	0.50	0.014	0.020
c	0.085	0.18	0.003	0.007
D	2.80	3.04	0.110	0.120
E	2.10	2.64	0.083	0.104
E <sub>1</sub>	1.20	1.40	0.047	0.055
e	0.95 BSC		0.0374 Ref	
e <sub>1</sub>	1.90 BSC		0.0748 Ref	
L	0.40	0.60	0.016	0.024
L <sub>1</sub>	0.64 Ref		0.025 Ref	
S	0.50 Ref		0.020 Ref	
q	3°	8°	3°	8°
ECN: S-03946-Rev. K, 09-Jul-01 DWG: 5479				

## RECOMMENDED MINIMUM PADS FOR SOT-23



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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