

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

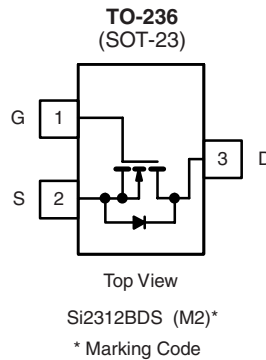
PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)	Q <sub>g</sub> (Typ.)
20	0.031 at V <sub>GS</sub> = 4.5 V	5.0	7.5
	0.037 at V <sub>GS</sub> = 2.5 V	4.6	
	0.047 at V <sub>GS</sub> = 1.8 V	4.1	

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 % R<sub>g</sub> Tested
- Compliant to RoHS Directive 2002/95/EC



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



Ordering Information: Si2312BDS-T1-E3 (Lead (Pb)-free)  
Si2312BDS-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted					
Parameter	Symbol	5 s	Steady State	Unit	
Drain-Source Voltage	V <sub>DS</sub>	20		V	
Gate-Source Voltage	V <sub>GS</sub>	± 8			
Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>	I <sub>D</sub>	T <sub>A</sub> = 25 °C	5.0	3.9	A
		T <sub>A</sub> = 70 °C	4.0	3.1	
Pulsed Drain Current <sup>b</sup>	I <sub>DM</sub>	15			
Avalanche Current <sup>b</sup>	I <sub>AS</sub>	13			
Single Avalanche Energy	E <sub>AS</sub>	8.45		mJ	
Continuous Source Current (Diode Conduction) <sup>a</sup>	I <sub>S</sub>	1.0	0.63	A	
Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>A</sub> = 25 °C	1.25	0.75	W
		T <sub>A</sub> = 70 °C	0.80	0.48	
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>a</sup>	R <sub>thJA</sub>	t ≤ 5 s	80	100	°C/W
		Steady State	120	166	
Maximum Junction-to-Foot	R <sub>thJF</sub>	50	60		

Notes:

- Surface mounted on 1" x 1" FR4 board.
- Pulse width limited by maximum junction temperature.

**SPECIFICATIONS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted

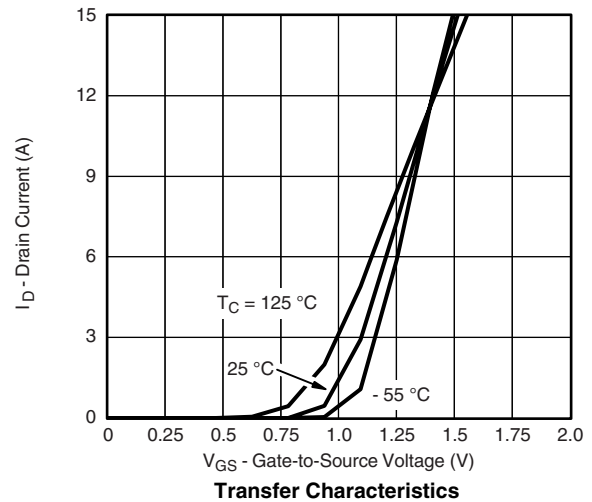
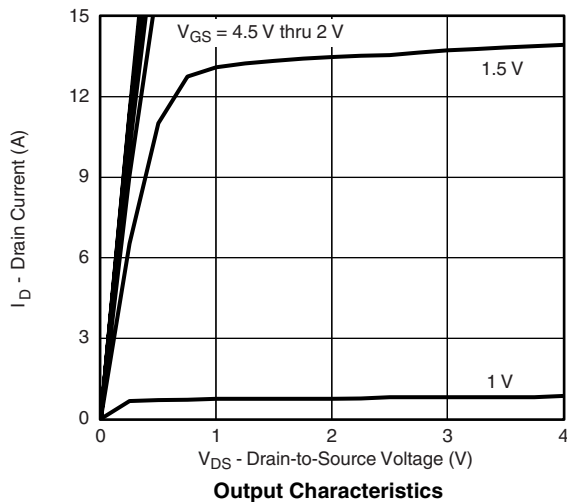
Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	20			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.45		0.85	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 70\text{ }^\circ\text{C}$			75	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 10\text{ V}, V_{GS} = 4.5\text{ V}$	15			A
Drain-Source On-Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 5.0\text{ A}$		0.025	0.031	$\Omega$
		$V_{GS} = 2.5\text{ V}, I_D = 4.6\text{ A}$		0.030	0.037	
		$V_{GS} = 1.8\text{ V}, I_D = 4.1\text{ A}$		0.036	0.047	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 5.0\text{ A}$		30		S
Diode Forward Voltage	$V_{SD}$	$I_S = 1.0\text{ A}, V_{GS} = 0\text{ V}$		0.8	1.2	V
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	$Q_g$	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 5.0\text{ A}$		7.5	12	nC
Gate-Source Charge	$Q_{gs}$			1.4		
Gate-Drain Charge	$Q_{gd}$			1.2		
Gate Resistance	$R_g$	$f = 1.0\text{ MHz}$	1.1	2.2	3.3	$\Omega$
<b>Switching</b>						
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 10\text{ }\Omega$ $I_D \cong 1.0\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 6\text{ }\Omega$		9	15	ns
Rise Time	$t_r$			30	45	
Turn-Off Delay Time	$t_{d(off)}$			35	55	
Fall Time	$t_f$			10	15	
Source-Drain Reverse Recovery Time	$t_{rr}$	$I_F = 1.0\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}$		13	25	nC
Body Diode Reverse Recovery Charge	$Q_{rr}$			4.5	7	

Notes:

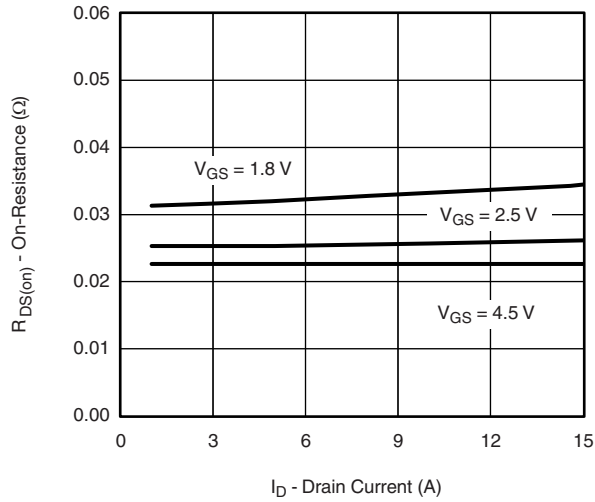
a. Pulse test: Pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

b. Guaranteed by design, not subject to production testing.

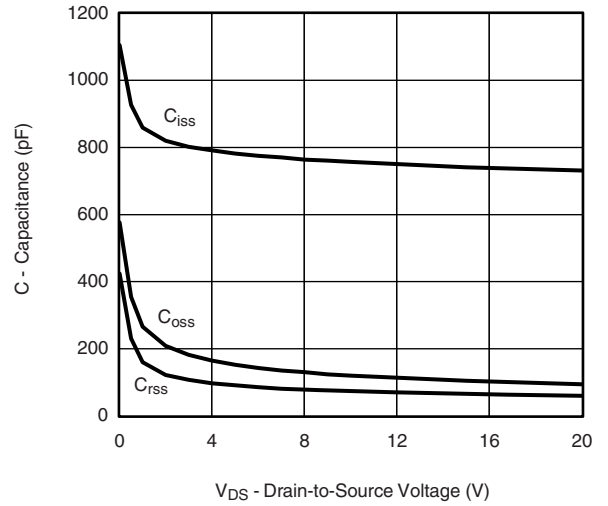
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

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

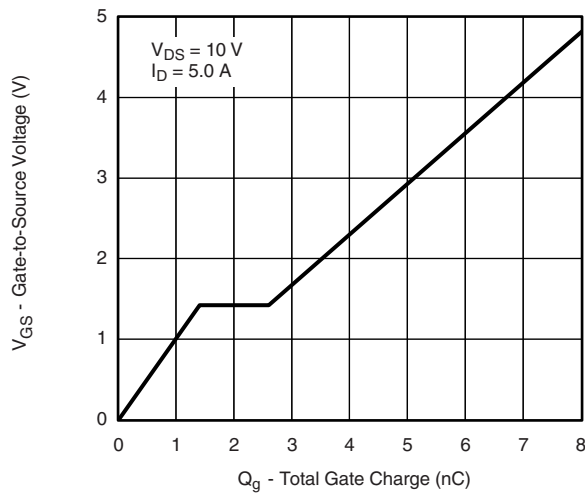
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



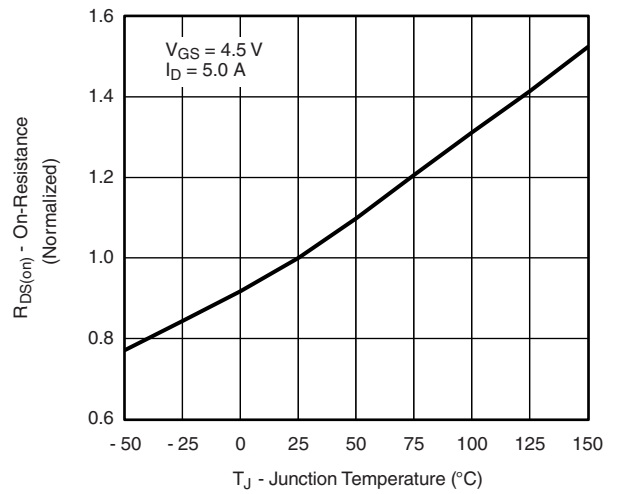
**On-Resistance vs. Drain Current**



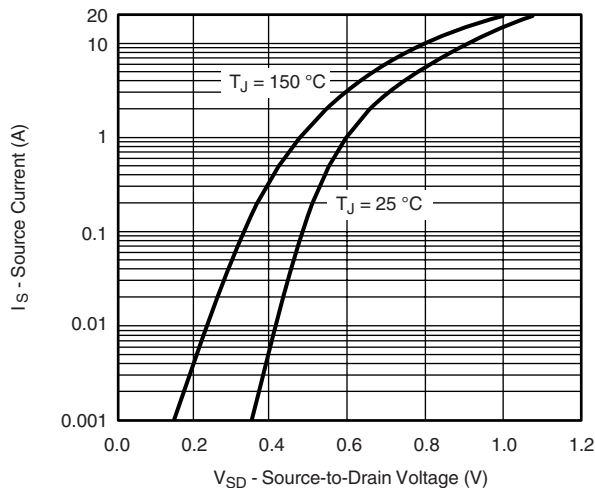
**Capacitance**



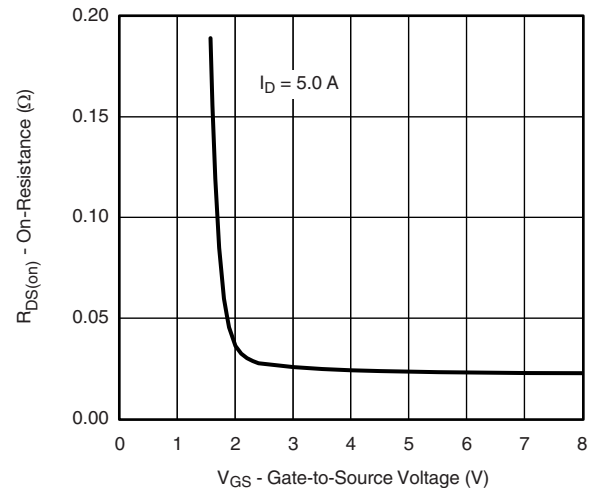
**Gate Charge**



**On-Resistance vs. Junction Temperature**

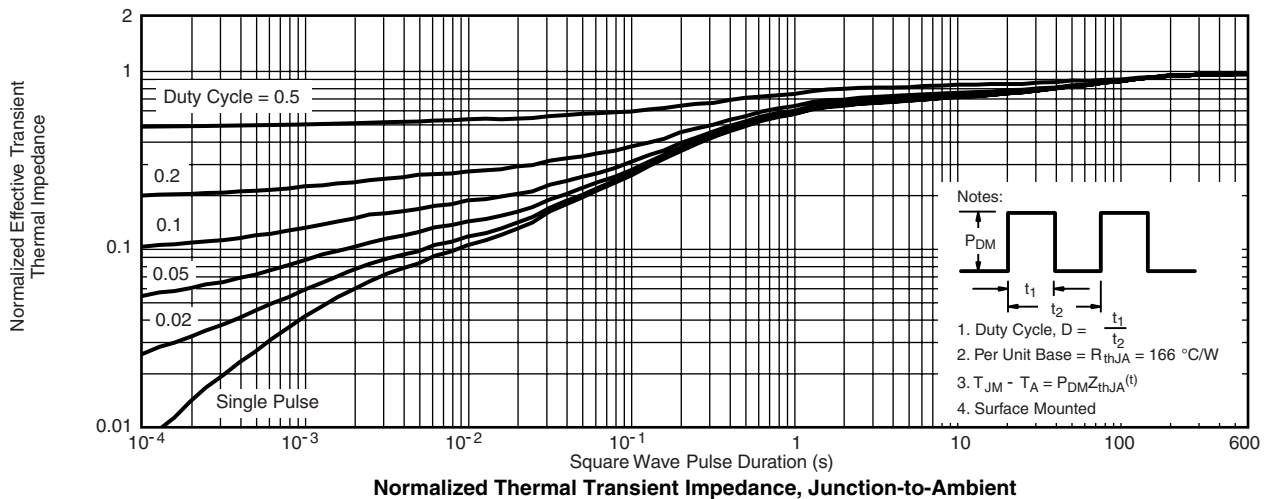
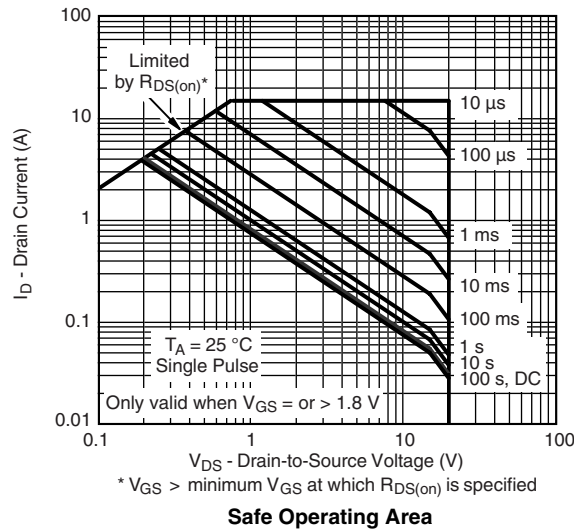
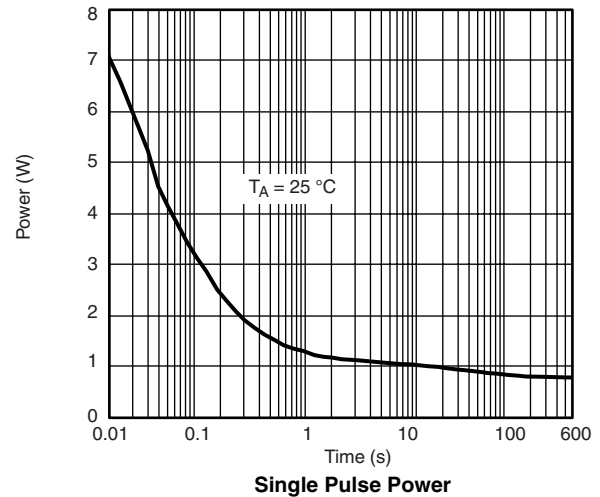
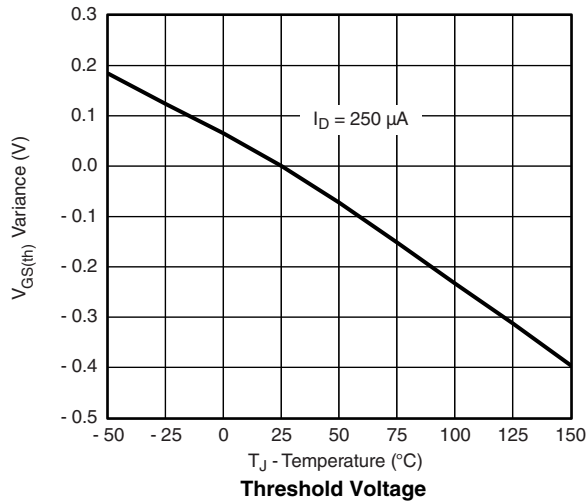


**Source-Drain Diode Forward Voltage**



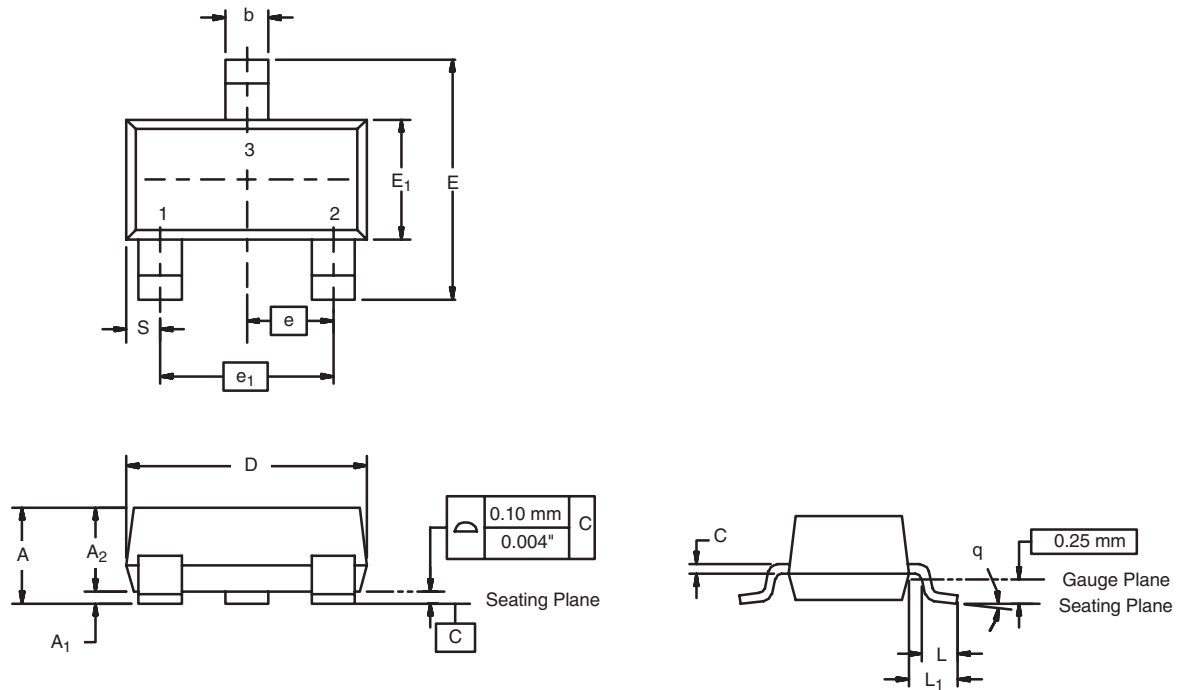
**On-Resistance vs. Gate-to-Source Voltage**

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



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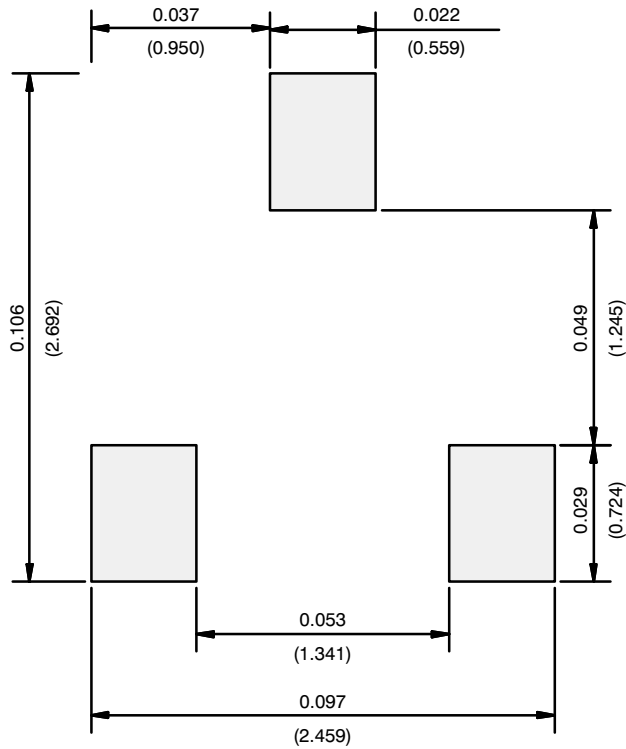
## SOT-23 (TO-236): 3-LEAD



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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