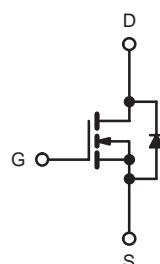
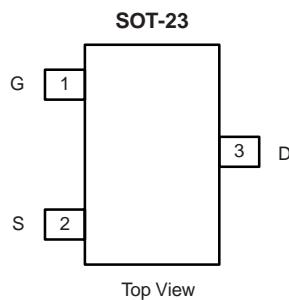


2N7002BK,215-VB Datasheet

N-Channel 60-V (D-S) MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (mA)
60	2.8 at $V_{GS} = 10$ V	250



N-Channel MOSFET

FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Low Threshold: 2 V (typ.)
- Low Input Capacitance: 25 pF
- Fast Switching Speed: 25 ns
- Low Input and Output Leakage
- Trench Power MOSFET
- Compliant to RoHS Directive 2002/95/EC



BENEFITS

- Low Offset Voltage
- Low-Voltage Operation
- Easily Driven Without Buffer
- High-Speed Circuits
- Low Error Voltage

APPLICATIONS

- Direct Logic-Level Interface: TTL/CMOS
- Drivers: Relays, Solenoids, Lamps, Hammers, Display, Memories, Transistors, etc.
- Battery Operated Systems
- Solid-State Relays

ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current ($T_J = 150$ °C) ^b	I_D	250	mA
		150	
Pulsed Drain Current ^a	I_{DM}	800	
Power Dissipation ^b	P_D	0.30	W
		0.13	
Maximum Junction-to-Ambient ^b	R_{thJA}	350	°C/W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 150	°C

Notes:

a. Pulse width limited by maximum junction temperature.
 b. Surface Mounted on FR4 board.

* Pb containing terminations are not RoHS compliant, exemptions may apply.

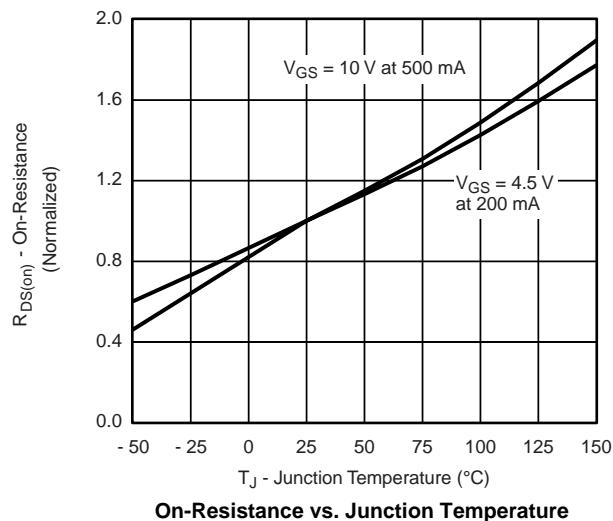
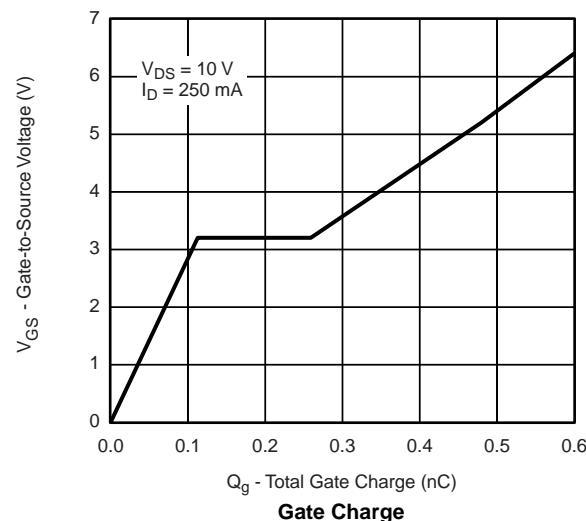
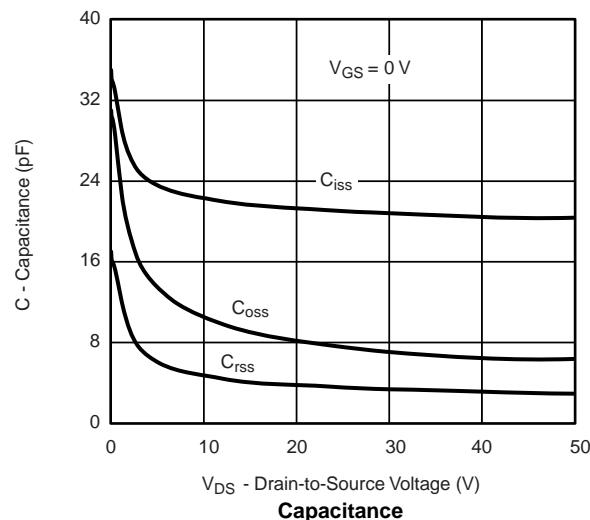
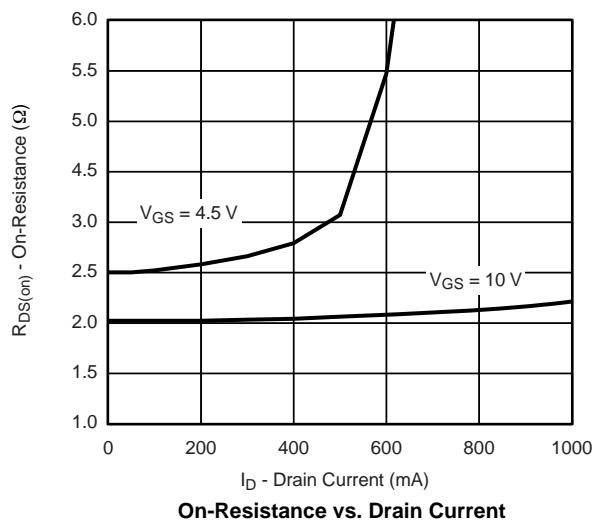
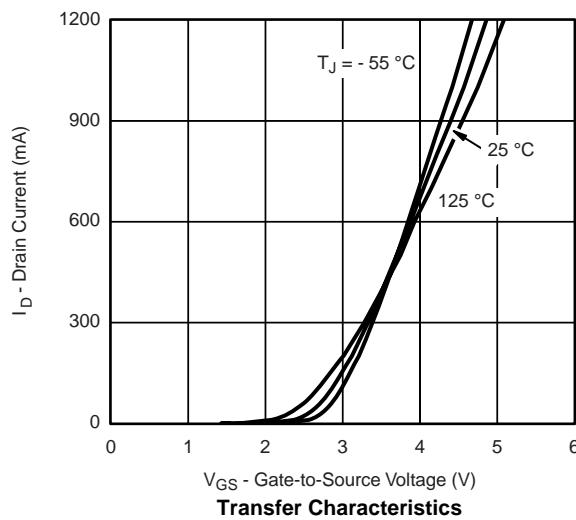
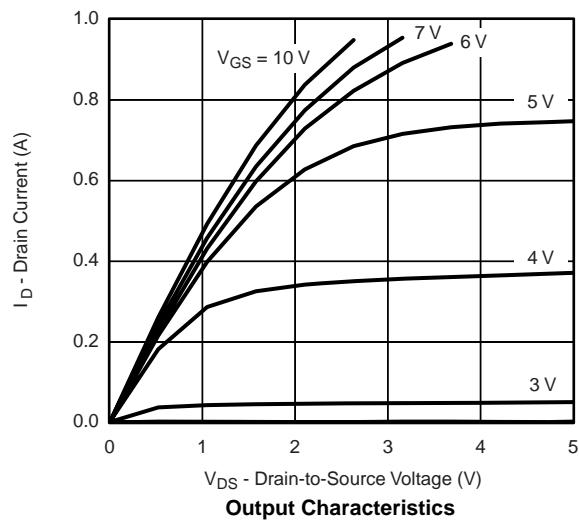
SPECIFICATIONS $T_A = 25^\circ\text{C}$, unless otherwise noted

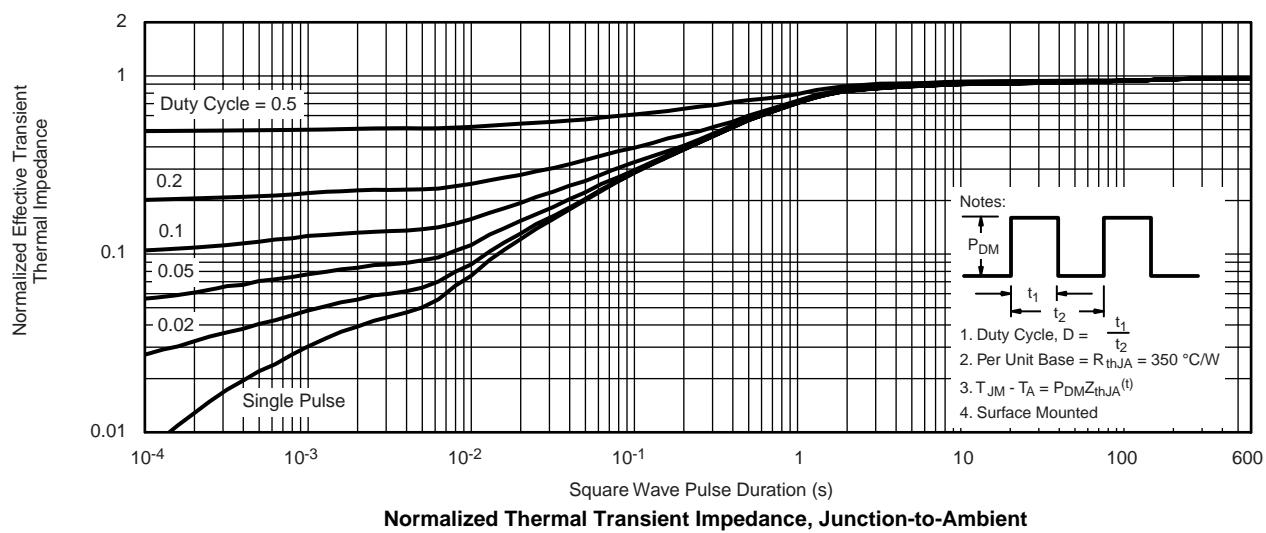
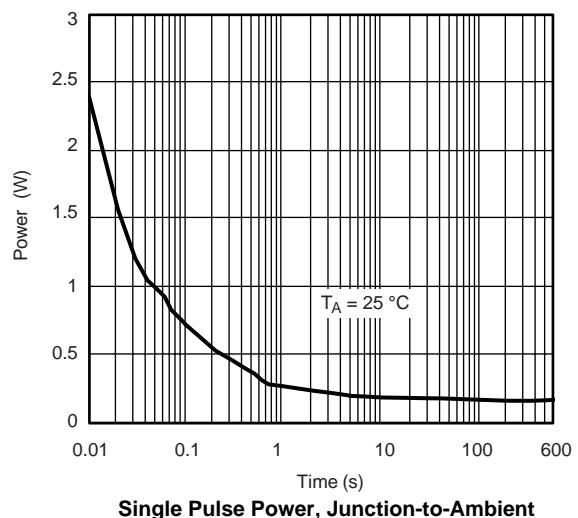
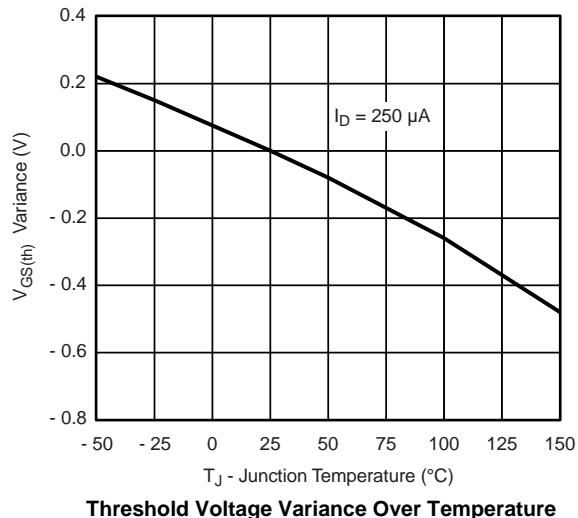
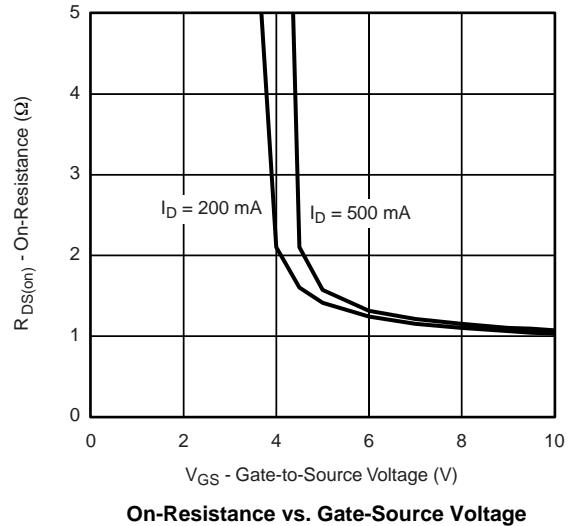
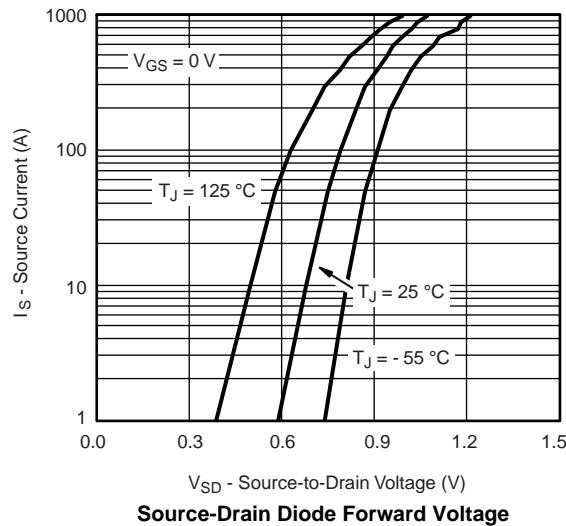
Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ. ^a	Max.	
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0 \text{ V}, I_D = 10 \mu\text{A}$	60			V
Gate-Threshold Voltage	$V_{GS(\text{th})}$	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	1		2.5	
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$			± 10	μA
		$V_{DS} = 0 \text{ V}, V_{GS} = \pm 15 \text{ V}$			1	
		$V_{DS} = 0 \text{ V}, V_{GS} = \pm 10 \text{ V}$			± 150	nA
		$V_{DS} = 0 \text{ V}, V_{GS} = \pm 10 \text{ V}, T_J = 85^\circ\text{C}$			± 1000	
		$V_{DS} = 0 \text{ V}, V_{GS} = \pm 5 \text{ V}$			± 100	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 60 \text{ V}, V_{GS} = 0 \text{ V}$			1	μA
		$V_{DS} = 60 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 125^\circ\text{C}$			500	
On-State Drain Current ^a	$I_{D(\text{on})}$	$V_{GS} = 10 \text{ V}, V_{DS} = 7.5 \text{ V}$	500			mA
		$V_{GS} = 4.5 \text{ V}, V_{DS} = 10 \text{ V}$	300			
Drain-Source On-Resistance ^a	$R_{DS(\text{on})}$	$V_{GS} = 10 \text{ V}, I_D = 200 \text{ mA}$		2.8		Ω
		$V_{GS} = 4.5 \text{ V}, I_D = 150 \text{ mA}$		3.1		
Forward Transconductance ^a	g_{fs}	$V_{DS} = 10 \text{ V}, I_D = 100 \text{ mA}$	100			mS
Diode Forward Voltage	V_{SD}	$I_S = 100 \text{ mA}, V_{GS} = 0 \text{ V}$			1.3	V
Dynamic^a						
Total Gate Charge	Q_g	$V_{DS} = 10 \text{ V}, V_{GS} = 4.5 \text{ V}$ $I_D \geq 150 \text{ mA}$		0.4	0.6	nC
Input Capacitance	C_{iss}	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}$ $f = 1 \text{ MHz}$		25		pF
Output Capacitance	C_{oss}			5		
Reverse Transfer Capacitance	C_{rss}			2.0		
Switching^{a, b, c}						
Turn-On Time	$t_{d(\text{on})}$	$V_{DD} = 30 \text{ V}, R_L = 150 \Omega$ $I_D \geq 200 \text{ mA}, V_{GEN} = 10 \text{ V}, R_G = 10 \Omega$			20	ns
Turn-Off Time	$t_{d(\text{off})}$				30	

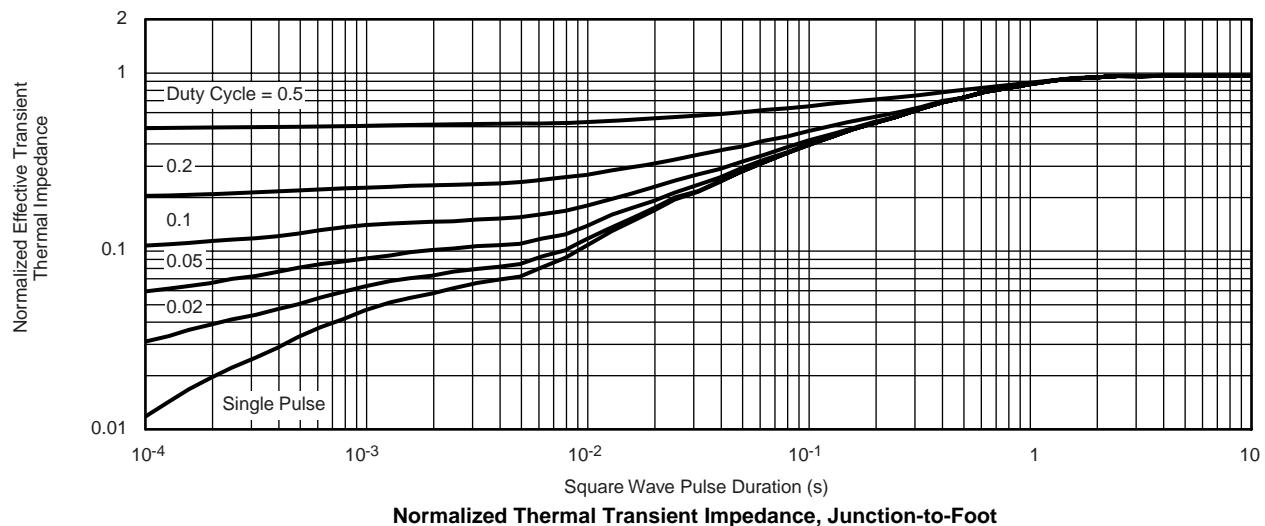
Notes:

- a. For DESIGN AID ONLY, not subject to production testing.
- b. Pulse test: PW $\leq 300 \mu\text{s}$ duty cycle $\leq 2\%$.
- 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


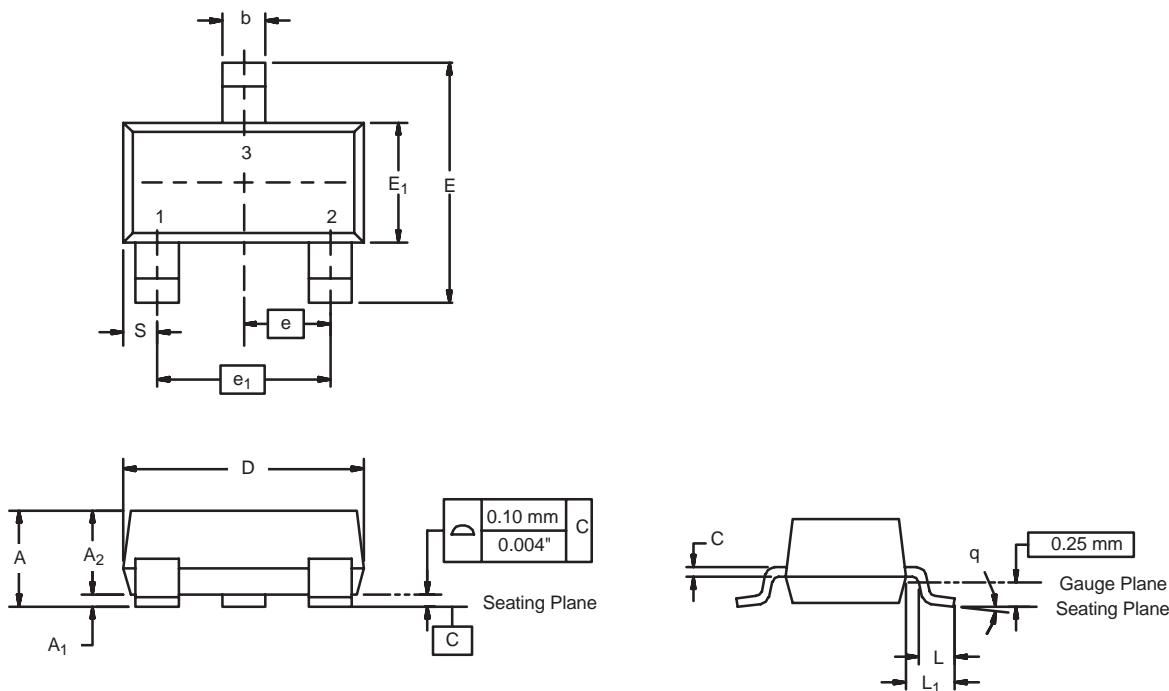
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted


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

Normalized Thermal Transient Impedance, Junction-to-Foot
Note

- The characteristics shown in the two graphs
 - Normalized Transient Thermal Impedance Junction-to-Ambient (25°C)
 - Normalized Transient Thermal Impedance Junction-to-Foot (25°C)

are given for general guidelines only to enable the user to get a "ball park" indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

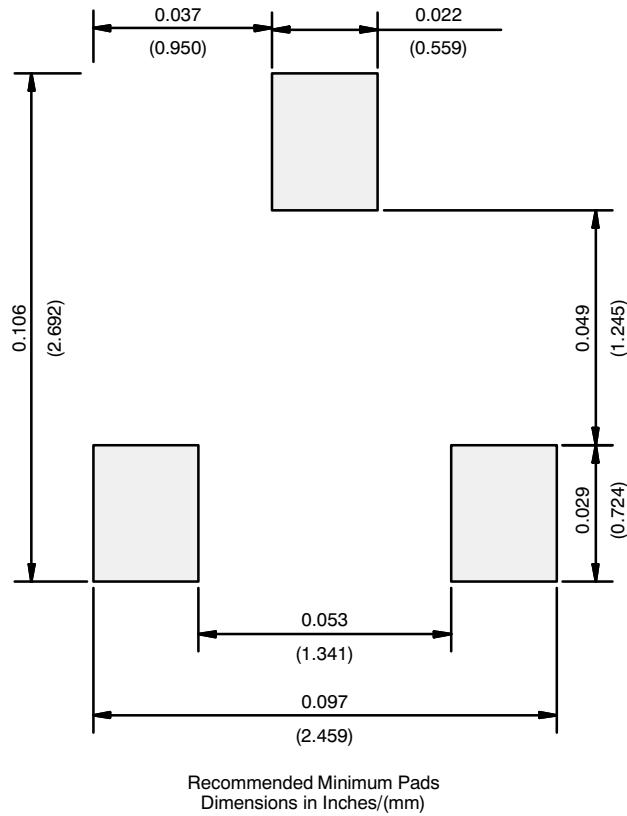
SOT-23 (TO-236): 3-LEAD



Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	0.89	1.12	0.035	0.044
A ₁	0.01	0.10	0.0004	0.004
A ₂	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 ₁	1.20	1.40	0.047	0.055
e	0.95 BSC		0.0374 Ref	
e ₁	1.90 BSC		0.0748 Ref	
L	0.40	0.60	0.016	0.024
L ₁	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



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