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Buffer with Open Drain Output

NL17SG07

The NL17SG07 MiniGate™ is an advanced high-speed CMOS Buffer with Open Drain Output in ultra-small footprint.

The NL17SG07 input structures provides protection when voltages up to 5.5 V are applied with V_{CC} greater than or equal to 0.9 volts, otherwise the protection is up to 4.6 volts regardless of the supply voltage.

Features

- Wide Operating V_{CC} Range: 0.9 V to 3.6 V
- High Speed: $t_{PD} = 2.5$ ns (Typ) at $V_{CC} = 3.0$ V, $C_L = 15$ pF
- Low Power Dissipation: $I_{CC} = 0.5$ μ A (Max) at $T_A = 25^\circ$ C
- 5.5 V Overvoltage Tolerant (OVT) Input Pins ($V_{CC} \geq 0.9$ V)
- Ultra-Small Packages
- These are Pb-Free and Halide-Free Devices

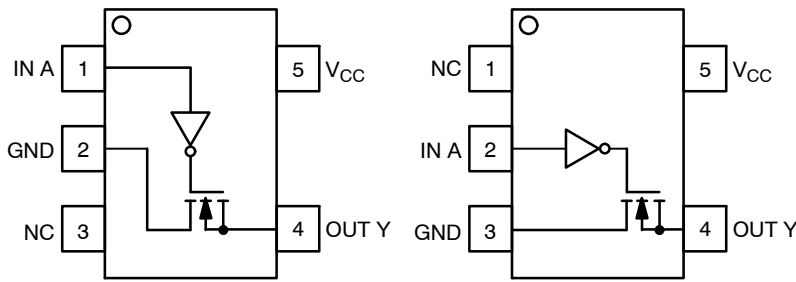


Figure 1. SOT-953
(Top View)

Figure 2. SC-88A
(Top View)

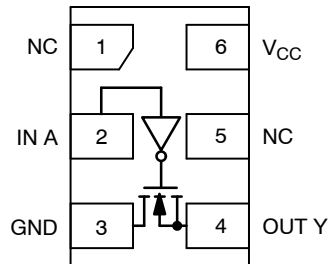


Figure 3. UDFN
(Top View)

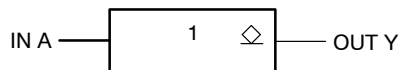


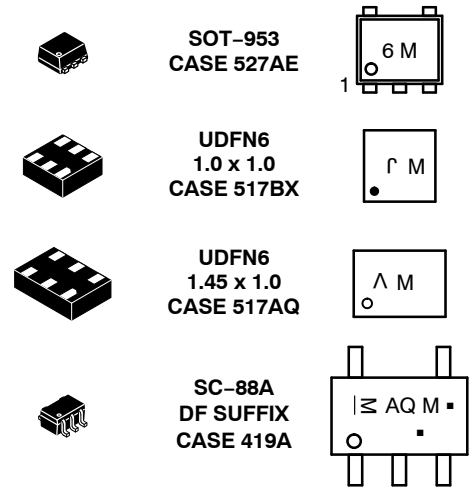
Figure 4. Logic Symbol



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MARKING DIAGRAMS



M = Date Code*
▪ = Pb-Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or position may vary depending upon manufacturing location.

PIN ASSIGNMENT

PIN	SOT-953	SC-88A	UDFN6
1	IN A	NC	NC
2	GND	IN A	IN A
3	NC	GND	GND
4	OUT Y	OUT Y	OUT Y
5	V_{CC}	V_{CC}	NC
6	-	-	V_{CC}

FUNCTION TABLE

Input A	Output Y
L	L
H	Z

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

NL17SG07

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage	-0.5 to +5.5	V
V_{IN}	DC Input Voltage	$V_{CC} \geq 0.9\text{ V}$ $V_{CC} < 0.9\text{ V}$	V -0.5 to +5.5 -0.5 to +4.6
V_{OUT}	DC Output Voltage	-0.5 to $V_{CC} + 0.5$	V
I_{IK}	DC Input Diode Current	$V_{IN} < \text{GND}$	-20 mA
I_{OK}	DC Output Diode Current	$V_{OUT} < \text{GND}$	-20 mA
I_{OUT}	DC Output Source/Sink Current	± 20	mA
I_{CC}	DC Supply Current per Supply Pin	± 20	mA
I_{GND}	DC Ground Current per Ground Pin	± 20	mA
T_{STG}	Storage Temperature Range	-65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
T_J	Junction Temperature Under Bias	+150	°C
MSL	Moisture Sensitivity	Level 1	
F_R	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in
V_{ESD}	ESD Withstand Voltage	Human Body Model (Note 2) Machine Model (Note 3)	>2000 >100 V
$I_{LATCHUP}$	Latch-up Performance above V_{CC} and below GND at 125°C (Note 4)	± 75	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
2. Tested to EIA/JESD22-A114-A.
3. Tested to EIA/JESD22-A115-A.
4. Tested to EIA/JESD78.

RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics	Min	Max	Unit
V_{CC}	Positive DC Supply Voltage	0.9	3.6	V
V_{IN}	Digital Input Voltage	0.0	3.6	V
V_{OUT}	Output Voltage	Output at High or Low State Tri-State Mode (Note 5) Power-Down Mode ($V_{CC} = 0\text{ V}$)	0.0 0.0 0.0	V_{CC} 3.6 3.6 V
T_A	Operating Temperature Range	-55	+125	°C
$\Delta t / \Delta V$	Input Transition Rise or Fall Rate	$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	0	10 ns/V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

5. Applicable to devices with outputs that may be tri-stated.

NL17SG07

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V _{CC} (V)	T _A = 25°C			-55°C ≤ T _A ≤ 125°C		Unit	
				Min	Typ	Max	Min	Max		
V _{IH}	High-Level Input Voltage		0.9	V _{CC}			V _{CC}		V	
			1.1 to 1.3	0.70 x V _{CC}			0.70 x V _{CC}			
			1.4 to 1.6	0.65 x V _{CC}			0.65 x V _{CC}			
			1.65 to 1.95	0.65 x V _{CC}			0.65 x V _{CC}			
			2.3 to 2.7	1.7			1.7			
			3.0 to 3.6	2.0			2.0			
V _{IL}	Low-Level Input Voltage		0.9			GND		GND	V	
			1.1 to 1.3			0.30 x V _{CC}		0.30 x V _{CC}		
			1.4 to 1.6			0.35 x V _{CC}		0.35 x V _{CC}		
			1.65 to 1.95			0.35 x V _{CC}		0.35 x V _{CC}		
			2.3 to 2.7			0.7		0.7		
			3.0 to 3.6			0.8		0.8		
V _{OL}	Low-Level Output Voltage	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 20 μA	0.9			0.1		0.1	V
			I _{OL} = 0.3 mA	1.1 to 1.3			0.25 x V _{CC}		0.25 x V _{CC}	
			I _{OL} = 1.7 mA	1.4 to 1.6			0.25 x V _{CC}		0.25 x V _{CC}	
			I _{OL} = 3.0 mA	1.65 to 1.95			0.45		0.45	
			I _{OL} = 4.0 mA	2.3 to 2.7			0.4		0.4	
			I _{OL} = 8.0 mA	3.0 to 3.6			0.4		0.4	
I _{IN}	Input Leakage Current	0 ≤ V _{IN} ≤ 3.6 V	0 to 3.6			±0.1		±1.0	μA	
I _{CC}	Quiescent Supply Current	V _{IN} = V _{CC} or GND	3.6			0.5		10	μA	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0$ ns)

Symbol	Parameter	Test Condition	V_{CC} (V)	$T_A = 25^\circ\text{C}$			$T_A = -55^\circ\text{C to } +125^\circ\text{C}$		Unit		
				Min	Typ	Max	Min	Max			
t_{PZL}	Propagation Delay, Enable Time, A to Y	$C_L = 10$ pF, $R_1 = R_L = 5$ k Ω	0.9	–	12	–	–	–	ns		
			1.1 to 1.3	–	5.5	6.8	–	8.8			
			1.4 to 1.6	–	4.0	5.7	–	7.3			
			1.65 to 1.95	–	3.3	3.9	–	5.9			
			2.3 to 2.7	–	2.7	3.3	–	4.5			
			3.0 to 3.6	–	2.4	2.9	–	3.7			
		$C_L = 15$ pF, $R_1 = R_L = 5$ k Ω	0.9	–	12.5	–	–	–	ns		
			1.1 to 1.3	–	5.8	7.0	–	9.0			
			1.4 to 1.6	–	4.1	6.0	–	7.4			
			1.65 to 1.95	–	3.4	4.0	–	6.2			
			2.3 to 2.7	–	2.8	3.4	–	4.6			
		$C_L = 30$ pF, $R_1 = R_L = 5$ k Ω	0.9	–	13.2	–	–	–	ns		
			1.1 to 1.3	–	6.2	7.4	–	9.4			
			1.4 to 1.6	–	4.5	6.2	–	7.6			
			1.65 to 1.95	–	3.5	4.2	–	6.4			
			2.3 to 2.7	–	3.0	3.6	–	4.7			
		t_{PLZ}	Propagation Delay, Disable Time, A to Y	$C_L = 10$ pF, $R_1 = R_L = 5$ k Ω	0.9	–	8.0	–	–	–	ns
					1.1 to 1.3	–	6.5	10.9	–	11.5	
					1.4 to 1.6	–	5.2	7.2	–	8.3	
					1.65 to 1.95	–	4.9	7.0	–	7.8	
					2.3 to 2.7	–	3.8	6.5	–	7.3	
3.0 to 3.6	–				3.5	6.2	–	6.8			
$C_L = 15$ pF, $R_1 = R_L = 5$ k Ω	0.9			–	11.1	–	–	–	ns		
	1.1 to 1.3			–	9.0	13.4	–	14			
	1.4 to 1.6			–	7.9	10	–	10.8			
	1.65 to 1.95			–	7.6	9.5	–	10.5			
	2.3 to 2.7			–	6.3	7.8	–	10			
$C_L = 30$ pF, $R_1 = R_L = 5$ k Ω	0.9			–	16.2	–	–	–	ns		
	1.1 to 1.3			–	14	18.4	–	20			
	1.4 to 1.6			–	13	15	–	16			
	1.65 to 1.95			–	12.5	14.5	–	15.8			
	2.3 to 2.7			–	11.2	13.5	–	15.4			
C_{IN}	Input Capacitance				0 to 3.6	–	3	–	–	–	pF
C_{PD}	Power Dissipation Capacitance (Note 6)				0.9 to 3.6	–	4	–	–	–	pF

6. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the dynamic operating current consumption without load. Average operating current can be obtained by the equation: $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$. C_{PD} is used to determine the no-load dynamic power consumption; $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.

NL17SG07

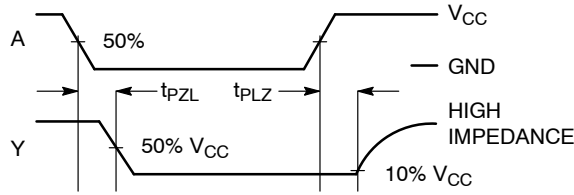
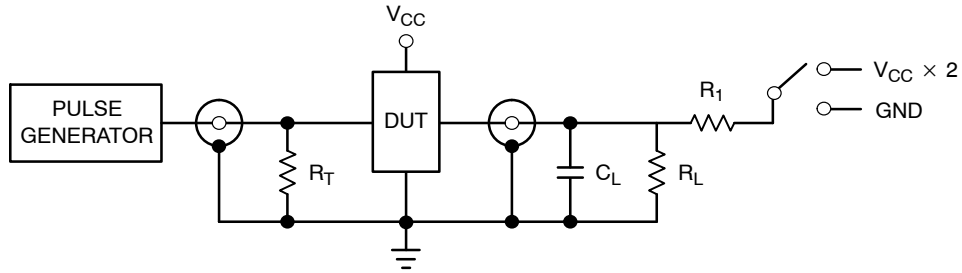


Figure 5. Switching Waveform



Test	Switch
t_{pZL}	$V_{CC} \times 2$
t_{pLZ}	$V_{CC} \times 2$

Figure 6. Test Circuit

ORDERING INFORMATION

Device	Package	Shipping [†]
NL17SG07P5T5G	SOT-953 (Pb-Free)	8000 / Tape & Reel
NL17SG07DFT2G	SC-88A (Pb-Free)	3000 / Tape & Reel
NL17SG07AMUTCG	UDFN6 1.45x1 mm (Pb-Free)	3000 / Tape & Reel
NL17SG07CMUTBG*	UDFN6 1x1 mm (Pb-Free)	3000 / Tape & Reel
NL17SG07MU3TBG*	UDFN6 1x1 mm (Pb-Free)	3000 / Tape & Reel

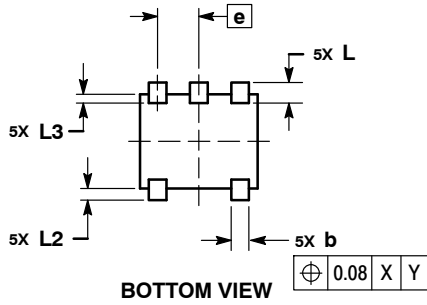
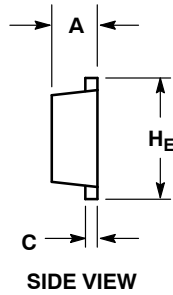
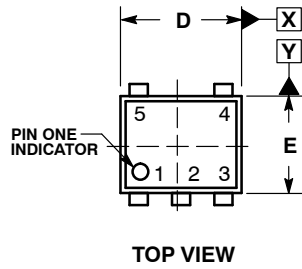
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*In Development

NL17SG07

PACKAGE DIMENSIONS

SOT-953
CASE 527AE
ISSUE E

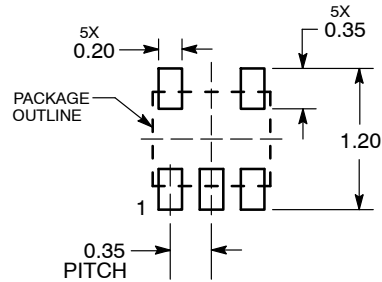


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.34	0.37	0.40
b	0.10	0.15	0.20
C	0.07	0.12	0.17
D	0.95	1.00	1.05
E	0.75	0.80	0.85
e	0.35 BSC		
HE	0.95	1.00	1.05
L	0.175 REF		
L2	0.05	0.10	0.15
L3	---	---	0.15

SOLDERING FOOTPRINT*



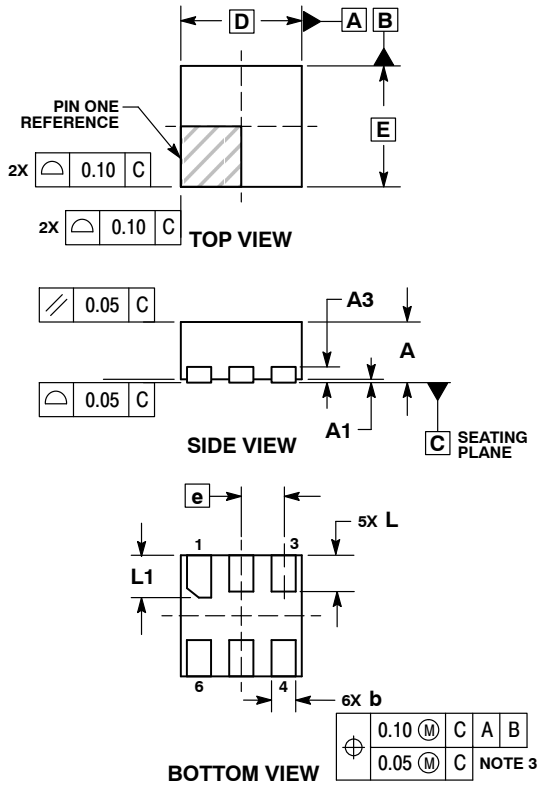
DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NL17SG07

PACKAGE DIMENSIONS

UDFN6 1.0x1.0, 0.35P
CASE 517BX
ISSUE O

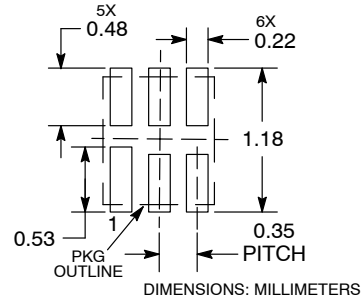


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP.
4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

MILLIMETERS		
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13 REF	
b	0.12	0.22
D	1.00 BSC	
E	1.00 BSC	
e	0.35 BSC	
L	0.25	0.35
L1	0.30	0.40

RECOMMENDED SOLDERING FOOTPRINT*

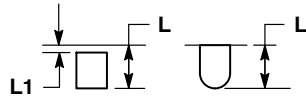
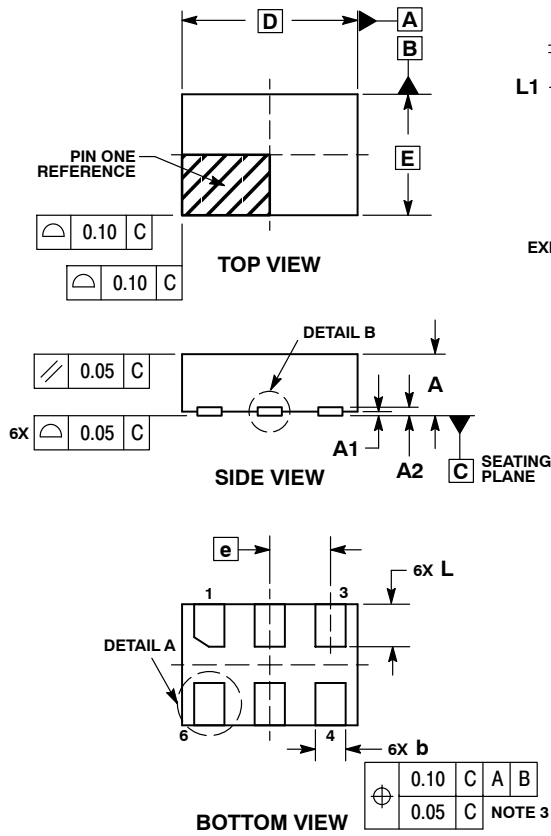


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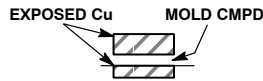
NL17SG07

PACKAGE DIMENSIONS

UDFN6 1.45x1.0, 0.5P
CASE 517AQ
ISSUE O



DETAIL A
OPTIONAL
CONSTRUCTIONS



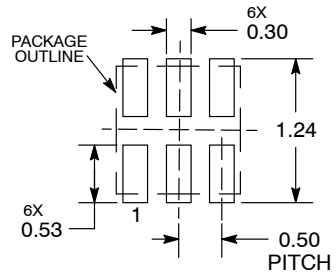
DETAIL B
OPTIONAL
CONSTRUCTIONS

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP.

MILLIMETERS		
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A2	0.07	REF
b	0.20	0.30
D	1.45	BSC
E	1.00	BSC
e	0.50	BSC
L	0.30	0.40
L1	---	0.15

MOUNTING FOOTPRINT



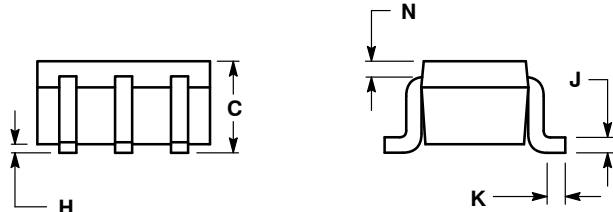
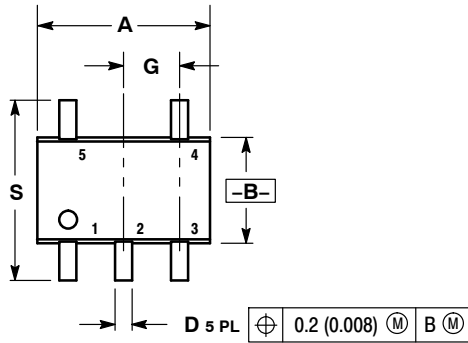
DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NL17SG07

PACKAGE DIMENSIONS

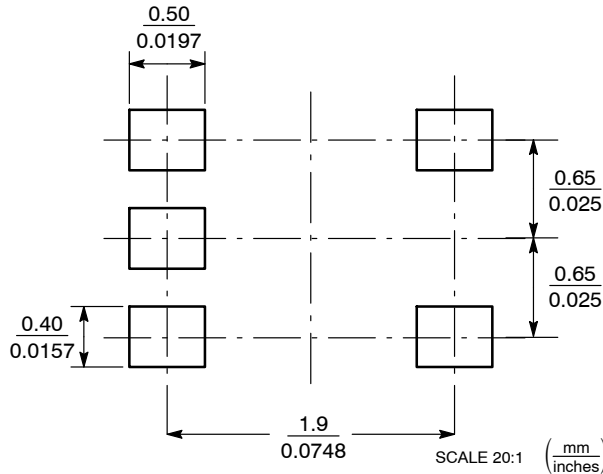
SC-88A (SC-70-5/SOT-353)
CASE 419A-02
ISSUE L



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
 4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

SOLDER FOOTPRINT*



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