

# TinyLogic UHS Two-Input OR Gate

## NC7SZ32

### Description

The NC7SZ32 is a single two-input OR gate from ON Semiconductor's Ultra-High Speed (UHS) series of TinyLogic. The device is fabricated with advanced CMOS technology to achieve ultra-high speed with high output drive while maintaining low static power dissipation over a broad  $V_{CC}$  operating range. The device is specified to operate over the 1.65 V to 5.5 V  $V_{CC}$  operating range. The inputs and output are high impedance when  $V_{CC}$  is 0 V. Inputs tolerate voltages up to 5.5 V, independent of  $V_{CC}$  operating voltage.

### Features

- Ultra-High Speed:  $t_{PD} = 2.4$  ns (Typical) into 50 pF at 5 V  $V_{CC}$
- High Output Drive:  $\pm 24$  mA at 3 V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range: 1.65 V to 5.5 V
- Matches Performance of LCX Operated at 3.3 V  $V_{CC}$
- Power Down High-Impedance Inputs / Outputs
- Over-Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise / EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Space-Saving SC-74A and SC-88A Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

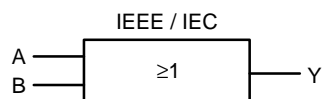


Figure 1. Logic Symbol



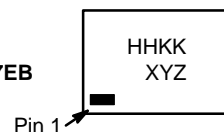
ON Semiconductor®

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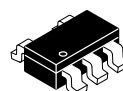
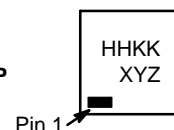
### MARKING DIAGRAMS



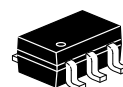
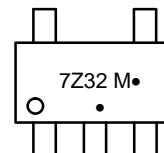
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CASE 127EB



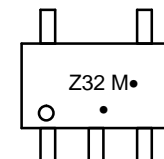
UDFN6  
CASE 517DP



SC-74A  
CASE 318BQ



SC-88A  
CASE 419A-02



HH, 7Z32, Z32 = Specific Device Code  
KK = 2-Digit Lot Run Traceability Code  
XY = 2-Digit Date Code Format  
Z = Assembly Plant Code  
M = Date Code  
• = Pb-Free Package  
(Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

NC7SZ32

Pin Configurations

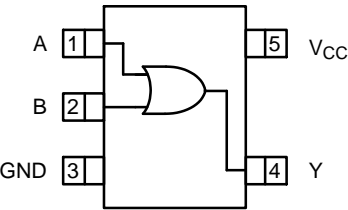


Figure 2. SC-88A and SC-74A (Top View)

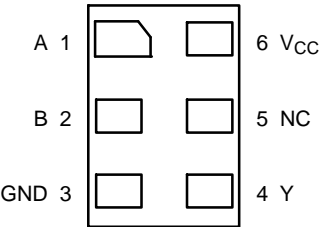


Figure 3. MicroPak (Top Through View)

PIN DEFINITIONS

Pin # SC-88A / SC74A	Pin # MicroPak	Name	Description
1	1	A	Input
2	2	B	Input
3	3	GND	Ground
4	4	Y	Output
5	6	V <sub>CC</sub>	Supply Voltage
	5	NC	No Connect

FUNCTION TABLE (Y = A + B)

Inputs		Output
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	H

H = HIGH Logic Level  
L = LOW Logic Level

# ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Min	Max	Unit
V <sub>CC</sub>	Supply Voltage		−0.5	6.5	V
V <sub>IN</sub>	DC Input Voltage		−0.5	6.5	V
V <sub>OUT</sub>	DC Output Voltage		−0.5	6.5	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < 0 V	−	−50	mA
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < 0 V	−	−50	mA
I <sub>OUT</sub>	DC Output Current		−	±50	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current		−	±50	mA
T <sub>STG</sub>	Storage Temperature Range		−65	+150	°C
T <sub>J</sub>	Junction Temperature Under Bias		−	+150	°C
T <sub>L</sub>	Junction Lead Temperature (Soldering, 10 Seconds)		−	+260	°C
P <sub>D</sub>	Power Dissipation in Still Air	SC−74A	−	390	mW
		SC−88A	−	332	
		MicroPak−6	−	812	
		MicroPak2™−6	−	812	
ESD	Human Body Model, JEDEC: JESD22−A114		−	4000	V
	Charge Device Model, JEDEC: JESD22−C101		−	2000	

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.

# RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage Operating		1.65	5.50	V
	Supply Voltage Data Retention		1.50	5.50	
V <sub>IN</sub>	Input Voltage		0	5.5	V
V <sub>OUT</sub>	Output Voltage		0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature		−40	+85	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Times	V <sub>CC</sub> = 1.8 V, 2.5 V ±0.2 V	0	20	ns/V
		V <sub>CC</sub> = 3.3 V ±0.3 V	0	10	
		V <sub>CC</sub> = 5.0 V ±0.5 V	0	5	
θ <sub>JA</sub>	Thermal Resistance	SC−74A	−	320	°C/W
		SC−88A	−	377	
		MicroPak−6	−	154	
		MicroPak2−6	−	154	

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.

1. Unused inputs must be held HIGH or LOW. They may not float.

# NC7SZ32

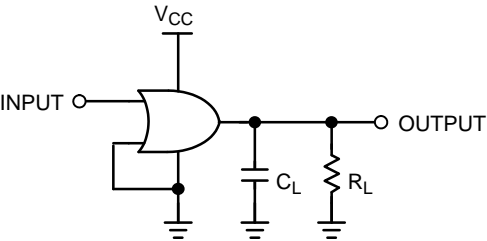
## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
V <sub>IH</sub>	HIGH Level Input Voltage	1.65 to 1.95		0.65 V <sub>CC</sub>	–	–	0.65 V <sub>CC</sub>	–	V
		2.30 to 5.50		0.70 V <sub>CC</sub>	–	–	0.70 V <sub>CC</sub>	–	
V <sub>IL</sub>	LOW Level Input Voltage	1.65 to 1.95		–	–	0.35 V <sub>CC</sub>	–	0.35 V <sub>CC</sub>	V
		2.30 to 5.50		–	–	0.30 V <sub>CC</sub>	–	0.30 V <sub>CC</sub>	
V <sub>OH</sub>	HIGH Level Output Voltage	1.65	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OH</sub> = –100 µA	1.55	1.65	–	1.55	–	V
		1.80		1.70	1.80	–	1.70	–	
		2.30		2.20	2.30	–	2.20	–	
		3.00		2.90	3.00	–	2.90	–	
		4.50		4.40	4.50	–	4.40	–	
		1.65	I <sub>OH</sub> = –4 mA	1.29	1.52	–	1.29	–	
		2.30	I <sub>OH</sub> = –8 mA	1.90	2.15	–	1.90	–	
		3.00	I <sub>OH</sub> = –16 mA	2.40	2.80	–	2.40	–	
		3.00	I <sub>OH</sub> = –24 mA	2.30	2.68	–	2.30	–	
		4.50	I <sub>OH</sub> = –32 mA	3.80	4.20	–	3.80	–	
V <sub>OL</sub>	LOW Level Output Voltage	1.65	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OL</sub> = 100 µA	–	0.00	0.10	–	0.10	V
		1.80		–	0.00	0.10	–	0.10	
		2.30		–	0.00	0.10	–	0.10	
		3.00		–	0.00	0.10	–	0.10	
		4.50		–	0.00	0.10	–	0.10	
		1.65	I <sub>OL</sub> = 4 mA	–	0.80	0.24	–	0.24	
		2.30	I <sub>OL</sub> = 8 mA	–	0.10	0.30	–	0.30	
		3.00	I <sub>OL</sub> = 16 mA	–	0.15	0.40	–	0.40	
		3.00	I <sub>OL</sub> = 24 mA	–	0.22	0.55	–	0.55	
		4.50	I <sub>OL</sub> = 32 mA	–	0.22	0.55	–	0.55	
I <sub>IN</sub>	Input Leakage Current	1.65 to 5.50	V <sub>IN</sub> = 5.5 V, GND	–	–	±1	–	±10	µA
I <sub>OFF</sub>	Power Off Leakage Current	0	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V	–	–	1	–	10	µA
I <sub>CC</sub>	Quiescent Supply Current	1.65 to 5.50	V <sub>IN</sub> = 5.5 V, GND	–	–	2.0	–	20	µA

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay (Figure 4, 5)	1.65	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	–	5.5	12.0	–	12.7	ns
		1.80		–	4.6	10.0	–	10.5	
		2.50 ±0.30		–	3.0	7.0	–	7.5	
		3.30 ±0.30		–	2.4	4.7	–	5.0	
		5.00 ±0.50		–	1.9	4.1	–	4.4	
		3.30 ±0.30	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	–	3.0	5.2	–	5.5	
		5.00 ±0.50		–	2.4	4.5	–	4.8	
C <sub>IN</sub>	Input Capacitance	0.00		–	4	–	–	–	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 2) (Figure 6)	3.30		–	20	–	–	–	pF
		5.00		–	26	–	–	–	

2. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression:  
 $I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CCstatic})$ .



NOTE:  
3. C<sub>L</sub> includes load and stray capacitance.  
Input PRR = 10 MHz, t<sub>w</sub> = 500 ns

Figure 4. AC Test Circuit

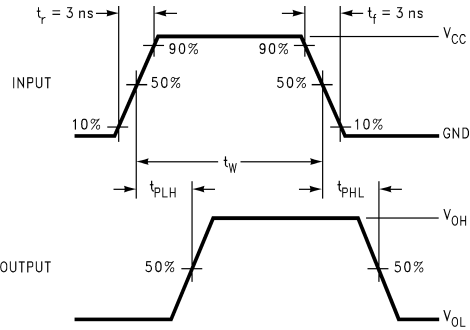
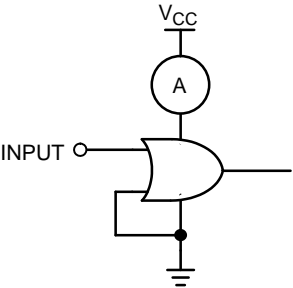


Figure 5. AC Waveforms



NOTE:  
4. Input = AC Waveform; t<sub>r</sub> = t<sub>f</sub> = 1.8 ns;  
PRR = 10 MHz; Duty Cycle = 50%.

Figure 6. I<sub>CCD</sub> Test Circuit

## NC7SZ32

### ORDERING INFORMATION

Part Number	Top Mark	Packages	Shipping <sup>†</sup>
NC7SZ32M5X	7Z32	SC-74A	3000 / Tape & Reel
NC7SZ32P5X	Z32	SC-88A	3000 / Tape & Reel
NC7SZ32L6X	HH	SIP6, MicroPak	5000 / Tape & Reel
NC7SZ32FHX	HH	UDFN6, MicroPak2	5000 / Tape & Reel

<sup>†</sup>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.

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# MECHANICAL CASE OUTLINE

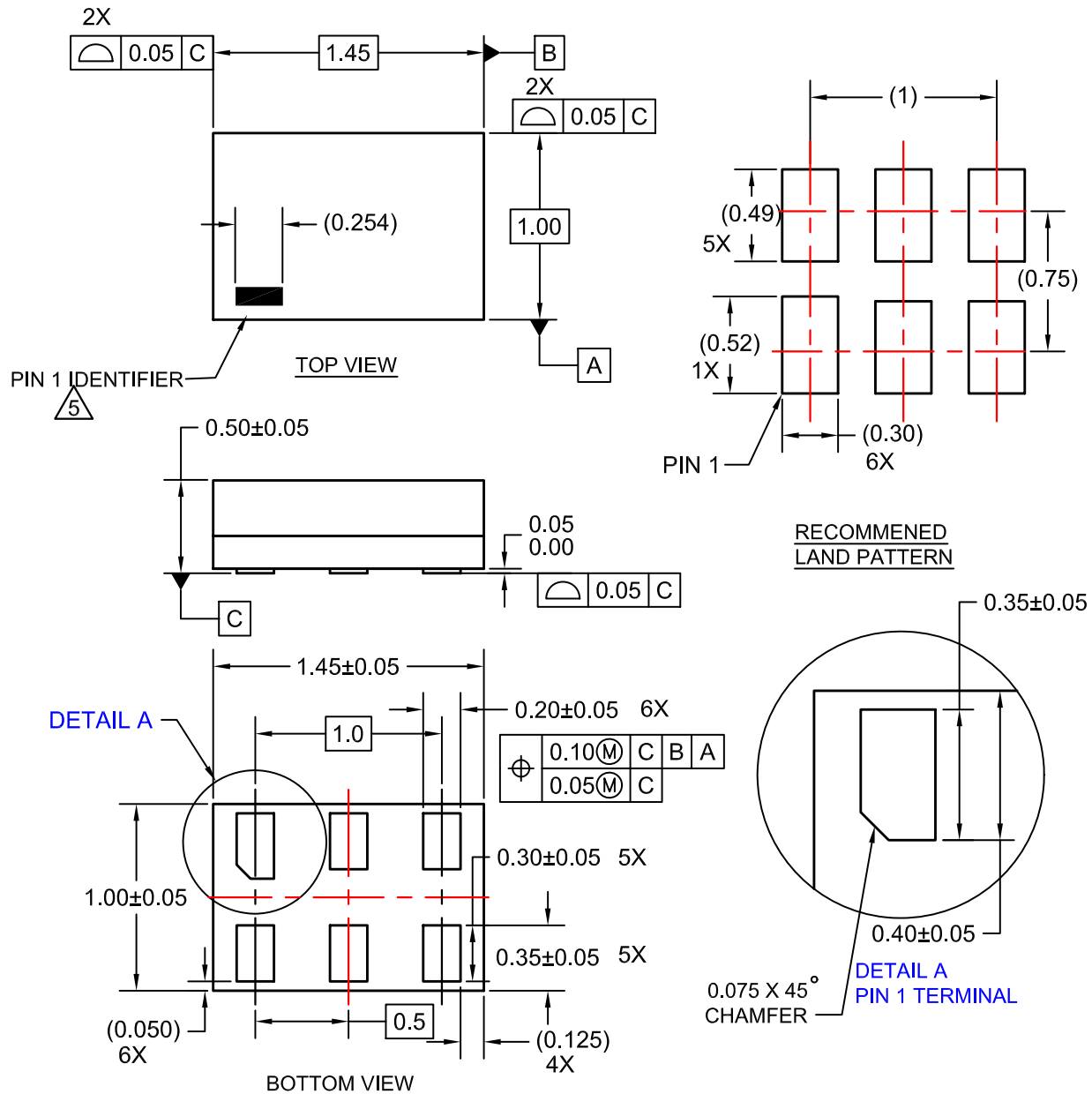
## PACKAGE DIMENSIONS

ON Semiconductor®

ON

SIP6 1.45X1.0  
CASE 127EB  
ISSUE O

DATE 31 AUG 2016



### NOTES:

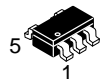
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2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

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DESCRIPTION:	SIP6 1.45X1.0	PAGE 1 OF 1

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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

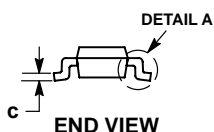
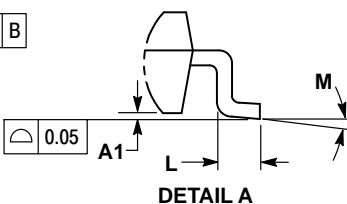
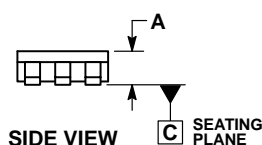
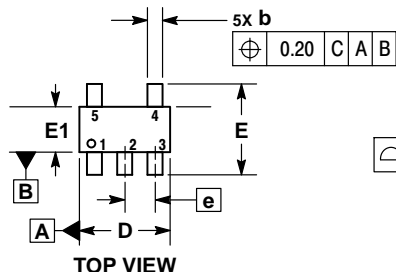
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SCALE 2:1

## SC-74A CASE 318BQ ISSUE B

DATE 18 JAN 2018

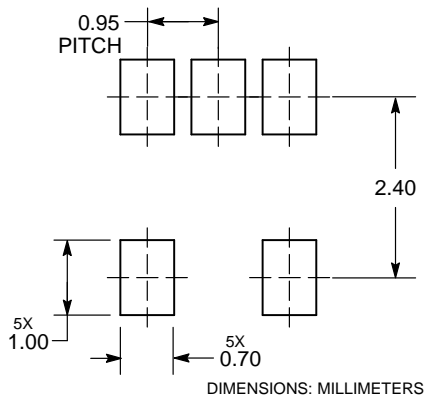


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.

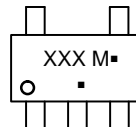
MILLIMETERS		
DIM	MIN	MAX
A	0.90	1.10
A1	0.01	0.10
b	0.25	0.50
c	0.10	0.26
D	2.85	3.15
E	2.50	3.00
E1	1.35	1.65
e	0.95 BSC	
L	0.20	0.60
M	0°	10°

### RECOMMENDED SOLDERING FOOTPRINT\*



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

### GENERIC MARKING DIAGRAM\*



XXX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package


(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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DESCRIPTION:	SC-74A	
		PAGE 1 OF 2



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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

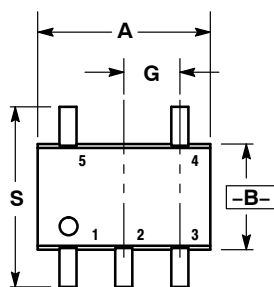
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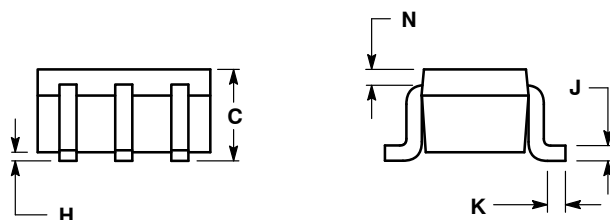
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SC-88A (SC-70-5/SOT-353)  
CASE 419A-02  
ISSUE L

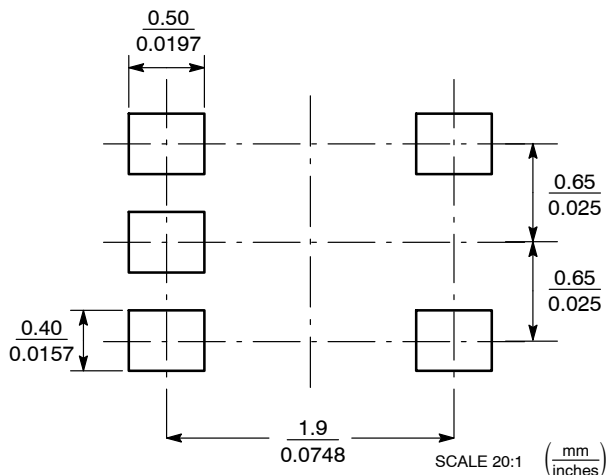
DATE 17 JAN 2013



D 5 PL  $\oplus 0.2 (0.008) \text{ (M)} \text{ (B (M))}$



### SOLDER FOOTPRINT

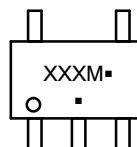


#### NOTES:

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

### GENERIC MARKING DIAGRAM\*



XXX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

STYLE 1:  
PIN 1. BASE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. COLLECTOR

STYLE 2:  
PIN 1. ANODE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. CATHODE

STYLE 3:  
PIN 1. ANODE 1  
2. N/C  
3. ANODE 2  
4. CATHODE 2  
5. CATHODE 1

STYLE 4:  
PIN 1. SOURCE 1  
2. DRAIN 1/2  
3. SOURCE 1  
4. GATE 1  
5. GATE 2

STYLE 5:  
PIN 1. CATHODE  
2. COMMON ANODE  
3. CATHODE 2  
4. CATHODE 3  
5. CATHODE 4

STYLE 6:  
PIN 1. EMITTER 2  
2. BASE 2  
3. EMITTER 1  
4. COLLECTOR  
5. COLLECTOR 2/BASE 1

STYLE 7:  
PIN 1. BASE  
2. EMITTER  
3. BASE  
4. COLLECTOR  
5. COLLECTOR

STYLE 8:  
PIN 1. CATHODE  
2. COLLECTOR  
3. N/C  
4. BASE  
5. EMITTER

STYLE 9:  
PIN 1. ANODE  
2. CATHODE  
3. ANODE  
4. ANODE  
5. ANODE

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

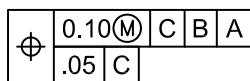
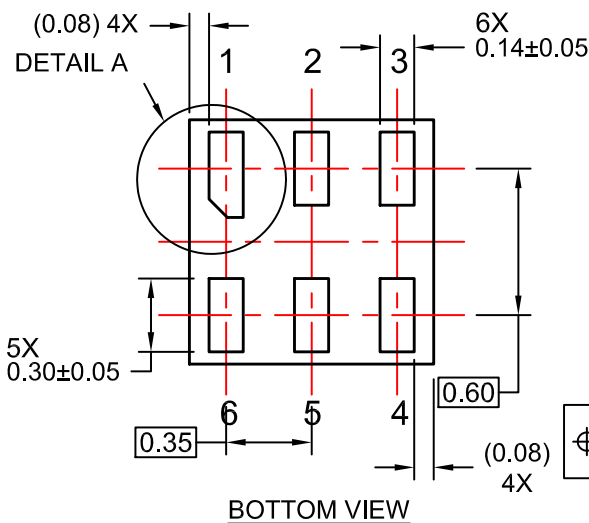
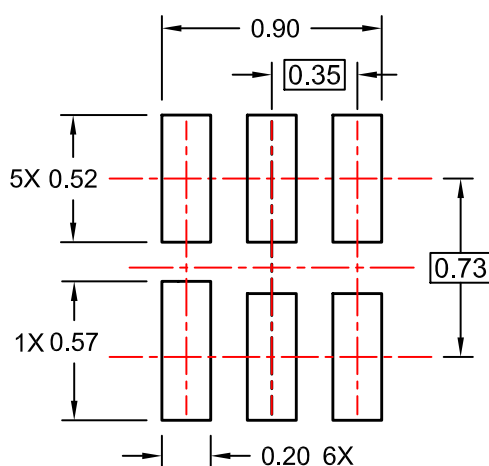
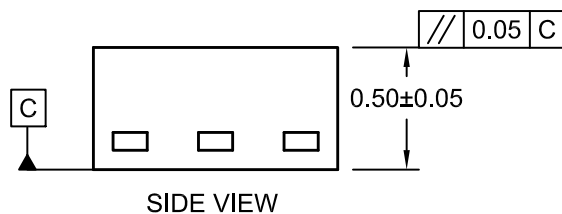
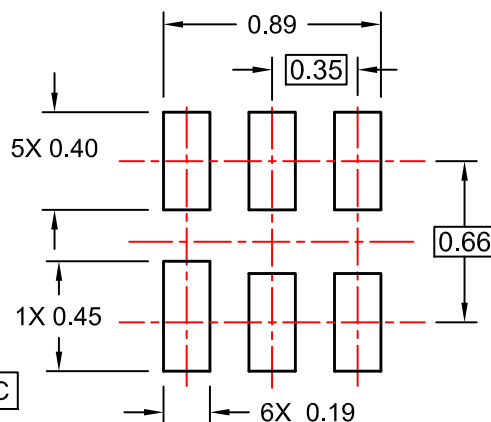
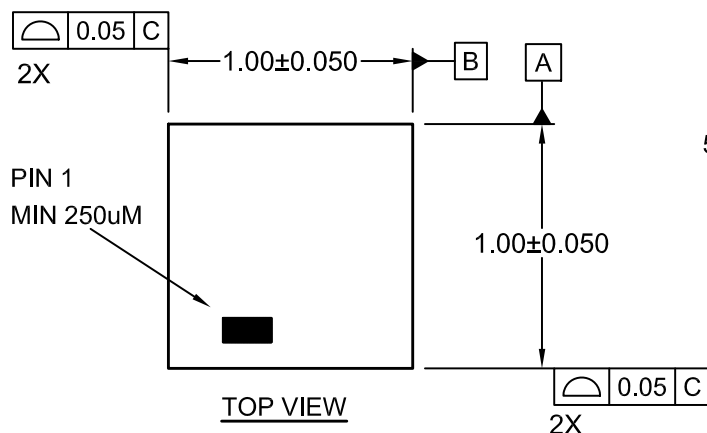
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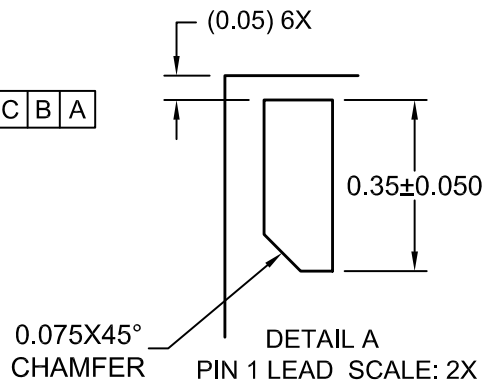
CASE 517DP  
ISSUE O

DATE 31 AUG 2016




#### NOTES:

- A. COMPLIES TO JEDEC MO-252 STANDARD
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009



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