TinyLogic UHS Inverter with Schmitt Trigger Input

NC7SZ14

Description

The NC7SZ14 is a single inverter with Schmitt trigger input from **onsemi**'s Ultra−High Speed (UHS) series of TinyLogic. The device is fabricated w ith advanced CMOS technology to achieve ultra−high speed with high output drive while maintaining low static power dissipation over a very broad V_{CC} operating range. The device is specified to operate over the 1.65 V to 5.5 V V_{CC} range. The inputs and outputs 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} = 3.7 ns (Typical) into 50 pF at 5 V V_{CC}
- High Output Drive: ±24 mA at 3 V V_{CC}
- Broad V_{CC} Operating Range: 1.65 V to 5.5 V
- Matches Performance of LCX when 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 SOT23−5, SC−74A and SC−88A Packages
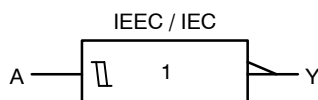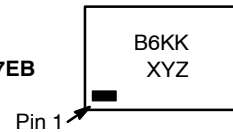- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

MARKING DIAGRAMS

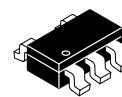|		
	SIP6 **CASE 127EB**	B6KK XYZ
	Pin 1	
	UDFN6 **CASE 517DP**	B6KK XYZ
	Pin 1	
	SC−74A **CASE 318BQ**	7Z14M ▪
	SOT23−5 **CASE 527AH**	7Z14 M
	SC−88A **CASE 419A−02**	Z14M ▪
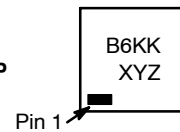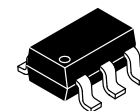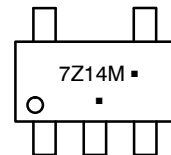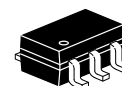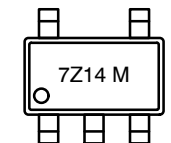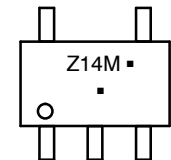
B6, 7Z14, Z14 = Specific Device Code
KK = 2−Digit Lot Run Traceability Code
XY = 2−Digit Date Code Format
Z = Assembly Plant Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

IEEC / IEC

A ──── | ⎍ 1 | ──── Y

Figure 1. Logic Symbol

ORDERING INFORMATION

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

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 5.
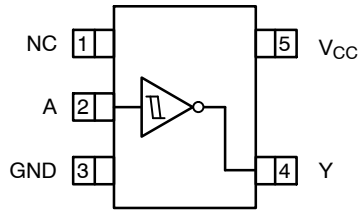
NC7SZ14

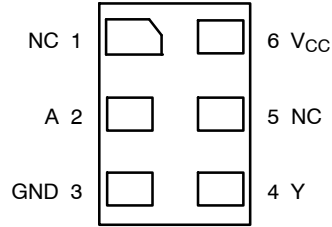**Pin Configurations**

Figure 2. SOT23−5, SC−88A and SC−74A
(Top View)

Figure 3. MicroPak (Top Through View)

PIN DEFINITIONS

Pin # SC−88A / SC74A/ SOT23−5	Pin # MicroPak	Name	Description
1	1, 5	NC	No Connect
2	2	A	Input
3	3	GND	Ground
4	4	Y	Output
5	6	V_{CC}	Supply Voltage

FUNCTION TABLE

Inputs	Output
A	**Y**
L	H
H	L

H = HIGH Logic Level
L = LOW Logic Level

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Min	Max	Unit
V_{CC}	Supply Voltage		−0.5	6.5	V
V_{IN}	DC Input Voltage		−0.5	6.5	V
V_{OUT}	DC Output Voltage		−0.5	6.5	V
I_{IK}	DC Input Diode Current	$V_{IN} < 0$ V	–	−50	mA
I_{OK}	DC Output Diode Current	$V_{OUT} < 0$ V	–	−50	mA
I_{OUT}	DC Output Current		–	±50	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current		–	±50	mA
T_{STG}	Storage Temperature Range		−65	+150	°C
T_J	Junction Temperature Under Bias		–	+150	°C
T_L	Junction Lead Temperature (Soldering, 10 Seconds)		–	+260	°C
P_D	Power Dissipation in Still Air	SC−74A / SOT23−5	–	390	mW
		SC−88A	–	332	
		MicroPak−6	–	812	
		MicroPak2™−6	–	812	
ESD	Human Body Model, JEDEC: JESD22−A114		–	2000	V
	Charge Device Model, JEDEC: JESD22−C101		–	1000	

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.

NC7SZ14

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	Supply Voltage Operating		1.65	5.5	V
	Supply Voltage Data Retention		1.5	5.5	
V_{IN}	Input Voltage		0	5.5	V
V_{OUT}	Output Voltage		0	V_{CC}	V
T_A	Operating Temperature		−40	+85	°C
θ_{JA}	Thermal Resistance	SC−74A / SOT23−5	–	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.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C			T_A = −40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
V_P	Positive Threshold Voltage	1.65		–	1.00	1.40	–	1.40	V
		1.80		–	1.10	1.50	–	1.50	
		2.30		–	1.40	1.80	–	1.80	
		3.00		–	1.75	2.20	–	2.20	
		4.50		–	2.45	3.10	–	3.10	
		5.50		–	2.90	3.60	–	3.60	
V_N	Negative Threshold Voltage	1.65		0.20	0.50	–	0.20	–	V
		1.80		0.25	0.55	–	0.25	–	
		2.30		0.40	0.75	–	0.40	–	
		3.00		0.60	1.00	–	0.60	–	
		4.50		1.00	1.43	–	1.00	–	
		5.50		1.20	1.70	–	1.20	–	
V_H	Hysteresis Voltage	1.65		0.10	0.48	0.90	0.10	0.90	V
		1.80		0.15	0.54	1.00	0.15	1.00	
		2.30		0.25	0.65	1.10	0.25	1.10	
		3.00		0.40	0.77	1.20	0.40	1.20	
		4.50		0.60	1.01	1.50	0.60	1.50	
		5.50		0.70	1.18	1.70	0.70	1.70	

DC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	V$_{CC}$ (V)	Conditions	T$_A$ = +25°C			T$_A$ = −40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
V$_{OH}$	HIGH Level Output Voltage	1.65	V$_{IN}$ = V$_P$ or V$_N$, I$_{OH}$ = −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$_{OH}$ = −4 mA	1.29	1.52	–	1.29	–	
		2.30	I$_{OH}$ = −8 mA	1.90	2.15	–	1.90	–	
		3.00	I$_{OH}$ = −16 mA	2.40	2.80	–	2.40	–	
		3.00	I$_{OH}$ = −24 mA	2.30	2.68	–	2.30	–	
		4.50	I$_{OH}$ = −32 mA	3.80	4.20	–	3.80	–	
V$_{OL}$	LOW Level Output Voltage	1.65	V$_{IN}$ = V$_P$ or V$_N$, I$_{OL}$ = 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$_{OL}$ = 4 mA	–	0.08	0.24	–	0.24	
		2.30	I$_{OL}$ = 8 mA	–	0.10	0.30	–	0.30	
		3.00	I$_{OL}$ = 16 mA	–	0.15	0.40	–	0.40	
		3.00	I$_{OL}$ = 24 mA	–	0.22	0.55	–	0.55	
		4.50	I$_{OL}$ = 32 mA	–	0.22	0.55	–	0.55	
I$_{IN}$	Input Leakage Current	1.65 to 5.5	V$_{IN}$ = 5.5 V, GND	–	–	±0.1	–	±1.0	μA
I$_{OFF}$	Power Off Leakage Current	0	V$_{IN}$ or V$_{OUT}$ = 5.5 V	–	–	1	–	10	μA
I$_{CC}$	Quiescent Supply Current	1.65 to 5.5	V$_{IN}$ = 5.5 V, GND	–	–	1.0	–	10	μA

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V$_{CC}$ (V)	Conditions	T$_A$ = +25°C			T$_A$ = −40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
t$_{PLH}$, t$_{PHL}$	Propagation Delay (Figure 4, 5)	1.65	C$_L$ = 15 pF, R$_L$ = 1 MΩ	–	9.1	15.0	–	15.6	ns
		1.80		–	7.6	12.5	–	13.0	
		2.50 ±0.20		–	5.0	9.0	–	9.5	
		3.30 ±0.30		–	3.7	6.3	–	6.5	
		5.00 ±0.50		–	3.1	5.2	–	5.5	
		3.30 ±0.30	C$_L$ = 50 pF, R$_L$ = 500 Ω	–	4.4	7.2	–	7.5	
		5.00 ±0.50		–	3.7	5.9	–	6.2	
C$_{IN}$	Input Capacitance	0.00		–	4	–	–	–	pF
C$_{PD}$	Power Dissipation Capacitance (Note 2) (Figure 6)	3.30		–	24	–	–	–	pF
		5.00		–	30	–	–	–	

2. C$_{PD}$ is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I$_{CCD}$) at no output loading and operating at 50% duty cycle. C$_{PD}$ is related to I$_{CCD}$ dynamic operating current by the expression:
$$I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC}static).$$
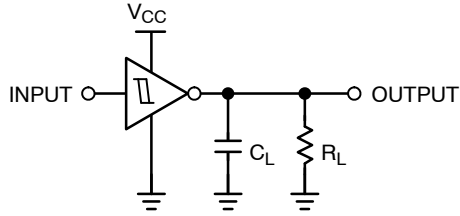
NOTE:
4. C_L includes load and stray capacitance; Input PRR = 1.0 MHz; t_W = 500 ns
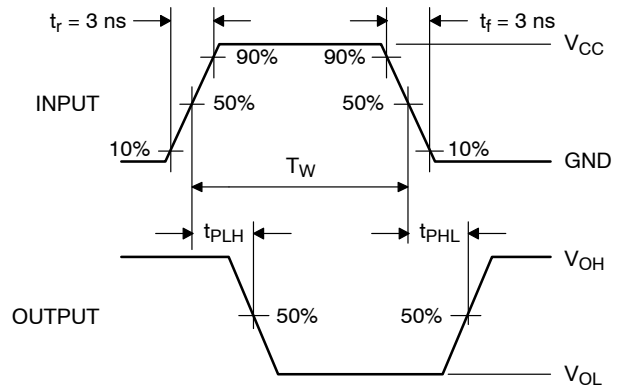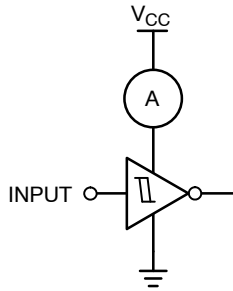
Figure 4. AC Test Circuit

Figure 5. AC Waveforms

NOTE:
3. Input = AC Waveform; $t_r = t_f$ = 1.8 ns; PRR = 10 MHz; Duty Cycle = 50%.

Figure 6. I$_{CCD}$ Test Circuit

ORDERING INFORMATION

Part Number	Top Mark	Operating Temperature	Packages	Shipping†
NC7SZ14M5X	7Z14	−40 to +85°C	SC−74A	3000 / Tape & Reel
NC7SZ14P5X	Z14	−40 to +85°C	SC−88A	3000 / Tape & Reel
NC7SZ14L6X	B6	−40 to +85°C	SIP6, MicroPak	5000 / Tape & Reel
NC7SZ14FHX	B6	−40 to +85°C	UDFN6, MicroPak2	5000 / Tape & Reel

DISCONTINUED (Note 5)

NC7SZ14M5X−L22090	7Z14	−40 to +85°C	SOT23−5	3000 / Tape & Reel
NC7SZ14P5X−L22057	Z14	−40 to +85°C	SC−88A	3000 / Tape & Reel
NC7SZ14L6X−L22175	B6	−40 to +85°C	SIP6, MicroPak	5000 / Tape & Reel
NC7SZ14FHX−L22175	B6	−40 to +85°C	UDFN6, MicroPak2	5000 / 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.
5. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on www.onsemi.com.

MicroPak and MicroPak2 are trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries.

SIP6 1.45X1.0
CASE 127EB
ISSUE O

DATE 31 AUG 2016

TOP VIEW

PIN 1 IDENTIFIER
⑤

RECOMMENED LAND PATTERN

DETAIL A

BOTTOM VIEW

0.075 X 45° CHAMFER

DETAIL A
PIN 1 TERMINAL

NOTES:

1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
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.

DOCUMENT NUMBER:	98AON13590G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	SIP6 1.45X1.0		PAGE 1 OF 1

SC−74A−5 3.00x1.50x0.95, 0.95P
CASE 318BQ
ISSUE C

DATE 26 FEB 2024

NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5−2018.
2. ALL DIMENSION ARE IN MILLIMETERS (ANGLES IN DEGREES).
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OF GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.

5X b
⊕ 0.20 Ⓜ C A B

TOP VIEW

SIDE VIEW

END VIEW

DETAIL A

DETAIL "A"
SCALE 2:1

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.01	0.18	0.10
A2	0.95 REF.		
b	0.25	0.37	0.50
c	0.10	0.18	0.26
D	2.85	3.00	3.15
E	2.75 BSC		
E1	1.35	1.50	1.65
e	0.95 BSC		
L	0.20	0.40	0.60
L1	0.62 REF.		
L2	0.25 BSC		
θ	0°	5°	10°

GENERIC MARKING DIAGRAM*

XXX M▪

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.

1.90
0.95
2.40
1.00
0.70

RECOMMENDED MOUNTING 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.

DOCUMENT NUMBER:	98AON66279G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SC−74A−5 3.00x1.50x0.95, 0.95P	PAGE 1 OF 1

SC−88A (SC−70−5/SOT−353)
CASE 419A−02
ISSUE M

DATE 11 APR 2023

SCALE 2:1

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. 419A−01 OBSOLETE. NEW STANDARD 419A−02
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.1016MM PER SIDE.

5X b

⊕ | 0.2 Ⓜ | B Ⓜ

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.80	0.95	1.10
A1	---	---	0.10
A3	0.20 REF		
b	0.10	0.20	0.30
c	0.10	---	0.25
D	1.80	2.00	2.20
E	2.00	2.10	2.20
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.10	0.15	0.30

0.50
0.65
0.40
0.65
1.90

RECOMMENDED
MOUNTING 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*

XXXM■

*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.

XXX = Specific Device Code
M = Date Code
■ = Pb−Free Package

(Note: Microdot may be in either location)

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.

DOCUMENT NUMBER:	**98ASB42984B**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**SC−88A (SC−70−5/SOT−353)**	**PAGE 1 OF 1**

SC−88A (SC−70 5 Lead), 1.25x2
CASE 419AC−01
ISSUE A

DATE 29 JUN 2010

SYMBOL	MIN	NOM	MAX
A	0.80		1.10
A1	0.00		0.10
A2	0.80		1.00
b	0.15		0.30
c	0.10		0.18
D	1.80	2.00	2.20
E	1.80	2.10	2.40
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.26	0.36	0.46
L1	0.42 REF		
L2	0.15 BSC		
θ	0º		8º
θ1	4º		10º

TOP VIEW
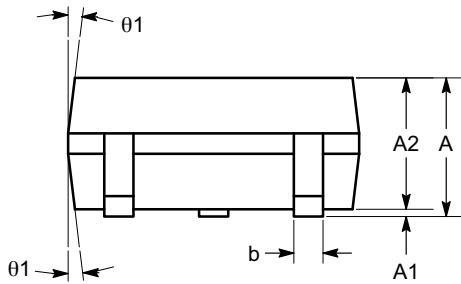
SIDE VIEW
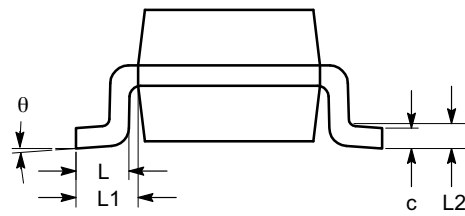
END VIEW

Notes:

(1) All dimensions are in millimeters. Angles in degrees.
(2) Complies with JEDEC MO-203.

DOCUMENT NUMBER:	98AON34260E	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**SC−88A (SC−70 5 LEAD), 1.25X2**	PAGE 1 OF 1

UDFN6 1.0X1.0, 0.35P
CASE 517DP
ISSUE O

DATE 31 AUG 2016

TOP VIEW

PIN 1
MIN 250uM

SIDE VIEW

DETAIL A

BOTTOM VIEW
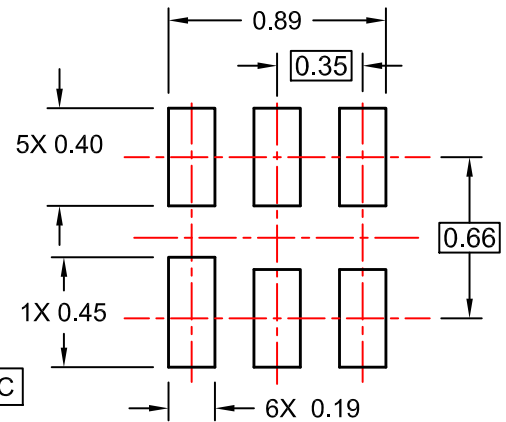
RECOMMENDED LAND PATTERN
FOR SPACE CONSTRAINED PCB
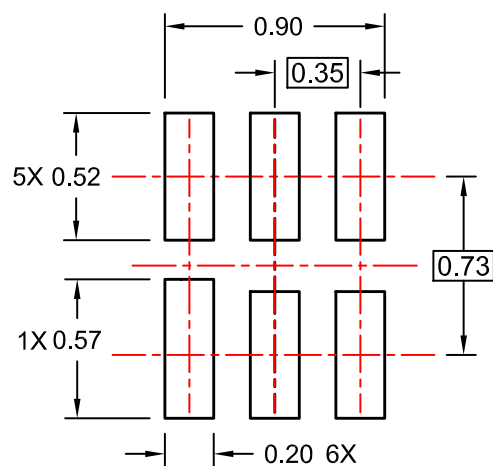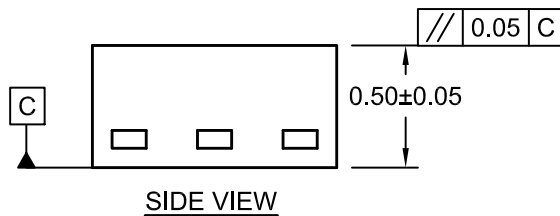
ALTERNATIVE LAND PATTERN
FOR UNIVERSAL APPLICATION

DETAIL A
PIN 1 LEAD SCALE: 2X
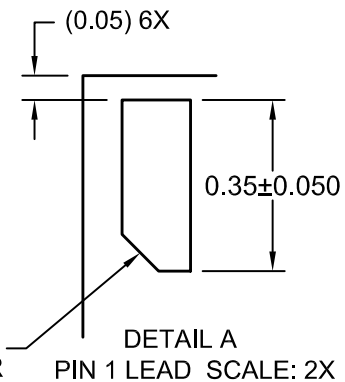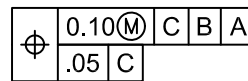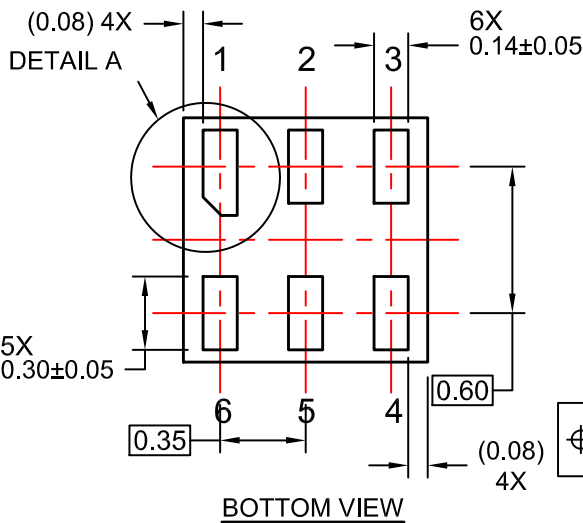
0.075X45°
CHAMFER

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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