

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 with 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

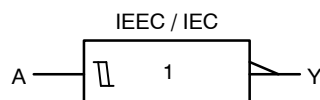
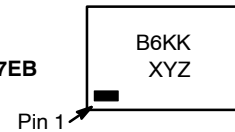


Figure 1. Logic Symbol

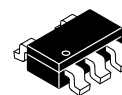
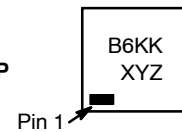
MARKING DIAGRAMS



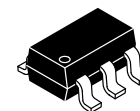
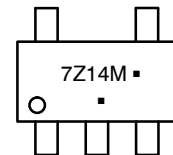
SIP6
CASE 127EB



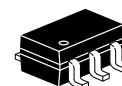
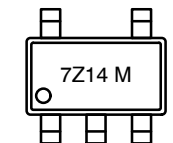
UDFN6
CASE 517DP



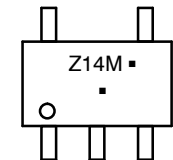
SC-74A
CASE 318BQ



SOT23-5
CASE 527AH



SC-88A
CASE 419A-02



- 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)

ORDERING INFORMATION

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

NC7SZ14

Pin Configurations

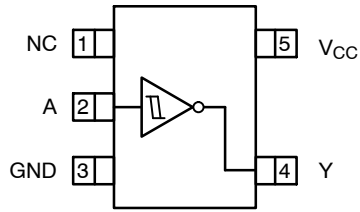


Figure 2. SOT23-5, SC-88A and SC-74A (Top View)

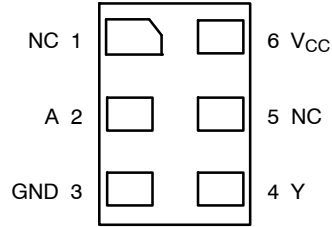


Figure 3. MicroPak (Top Through View)

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 | |

NC7SZ14

DC ELECTRICAL CHARACTERISTICS (continued)

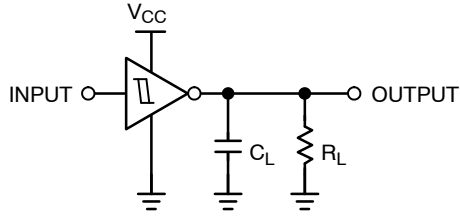
| Symbol | Parameter | V _{CC} (V) | Conditions | T _A = +25°C | | | T _A = -40 to +85°C | | Unit | |
|------------------|---------------------------|---------------------|---|--------------------------|------|------|-------------------------------|------|------|------|
| | | | | Min | Typ | Max | Min | 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:
 $I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CCstatic})$.

NC7SZ14



NOTE:
4. C_L includes load and stray capacitance;
Input PRR = 1.0 MHz; $t_W = 500$ ns

Figure 4. AC Test Circuit

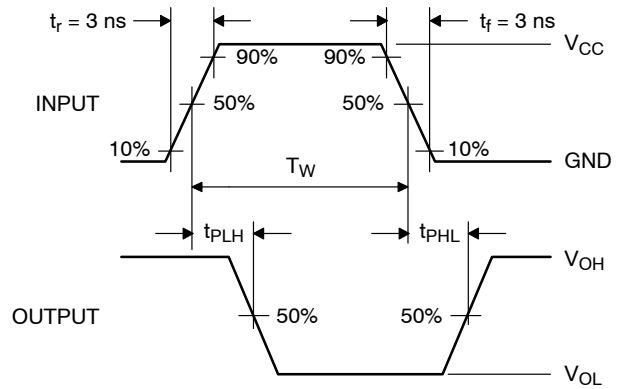
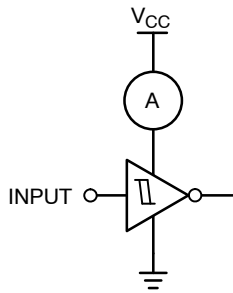


Figure 5. AC Waveforms



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 |
| NC7SZ14M5X-L22090 | 7Z14 | -40 to +85°C | SOT23-5 | 3000 / Tape & Reel |
| NC7SZ14P5X | Z14 | -40 to +85°C | SC-88A | 3000 / Tape & Reel |
| NC7SZ14P5X-L22057 | Z14 | -40 to +85°C | SC-88A | 3000 / Tape & Reel |
| NC7SZ14L6X | B6 | -40 to +85°C | SIP6, MicroPak | 5000 / Tape & Reel |
| NC7SZ14L6X-L22175 | B6 | -40 to +85°C | SIP6, MicroPak | 5000 / Tape & Reel |
| NC7SZ14FHX | B6 | -40 to +85°C | UDFN6, MicroPak2 | 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.

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MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



SIP6 1.45X1.0
CASE 127EB
ISSUE O

DATE 31 AUG 2016



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.

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MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



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.

| DIM | MILLIMETERS | |
|-----|-------------|------|
| | 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*



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.

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

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MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 2:1

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

DATE 11 APR 2023



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, SOLDERM/D.

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.

| 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 |

GENERIC MARKING DIAGRAM*



*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
- EMITTER
- BASE
- COLLECTOR
- COLLECTOR

STYLE 2:

- PIN 1. ANODE
- EMITTER
- BASE
- COLLECTOR
- CATHODE

STYLE 3:

- PIN 1. ANODE 1
- N/C
- ANODE 2
- CATHODE 2
- CATHODE 1

STYLE 4:

- PIN 1. SOURCE 1
- DRAIN 1/2
- SOURCE 1
- GATE 1
- GATE 2

STYLE 5:

- PIN 1. CATHODE
- COMMON ANODE
- CATHODE 2
- CATHODE 3
- CATHODE 4

STYLE 6:

- PIN 1. EMITTER 2
- BASE 2
- EMITTER 1
- COLLECTOR
- COLLECTOR 2/BASE 1

STYLE 7:

- PIN 1. BASE
- EMITTER
- BASE
- COLLECTOR
- COLLECTOR

STYLE 8:

- PIN 1. CATHODE
- COLLECTOR
- N/C
- BASE
- EMITTER

STYLE 9:

- PIN 1. ANODE
- CATHODE
- ANODE
- ANODE
- 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.

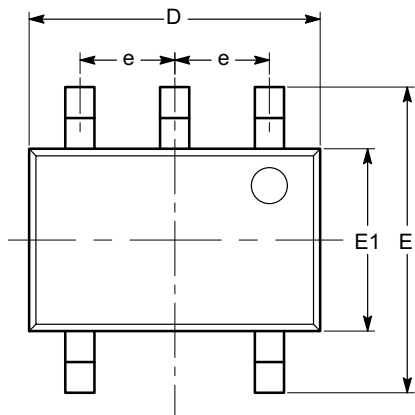
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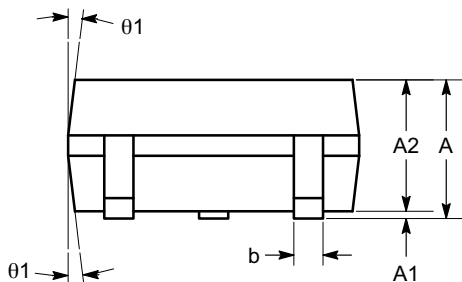
SC-88A (SC-70 5 Lead), 1.25x2
CASE 419AC-01
ISSUE A

DATE 29 JUN 2010

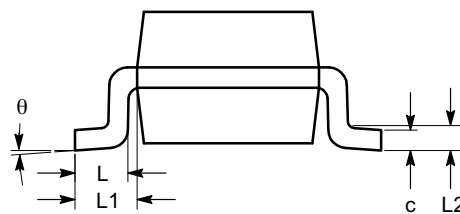


TOP VIEW

| 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 | 0° | | 8° |
| θ_1 | 4° | | 10° |



SIDE VIEW



END VIEW

Notes:

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

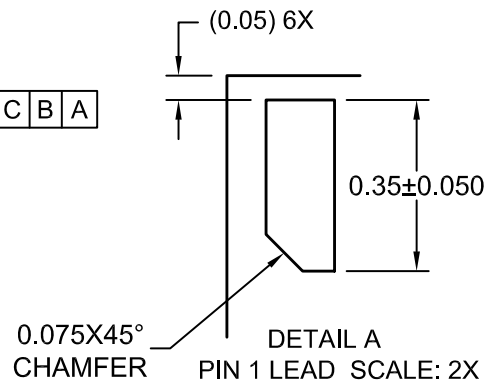
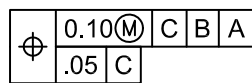
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CASE 517DP
ISSUE O

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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