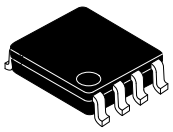
# TinyLogic UHS D-Type, Flip-Flop with Preset and Clear

# NC7SZ74



US8
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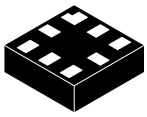


UQFN8
1.6X1.6, 0.5P
CASE 523AY

## Description

The NC7SZ74 is a single, D−type, CMOS flip−flop with preset and clear from **onsemi** ultra high−speed 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 of 1.65 V to 5.5 V $V_{CC}$. 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.

The signal level applied to the D input is transferred to the Q output during the positive−going transition of the CLK pulse.

## Features

- Ultra−High Speed: $t_{PD}$ 2.6 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
- Power Down High−Impedance Inputs/Outputs
- Over−Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise/EMI Reduction Circuitry

## CONNECTION DIAGRAM

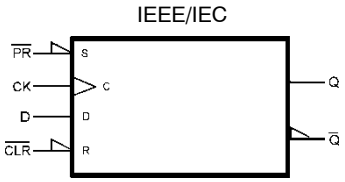
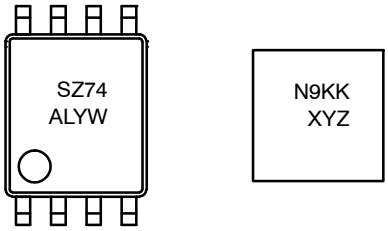


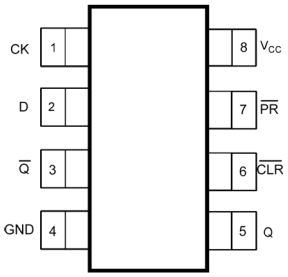

**Figure 1. Logic Symbol**

## MARKING DIAGRAMS

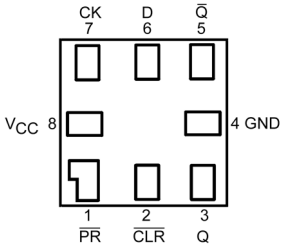



| | |
|---|---|
| SZ74, N9 | = Specific Device Code |
| A | = Assembly Site |
| L | = Wafer Lot Number |
| YW | = Assembly Start Wee |
| KK | = 2−Digit Lot Run Traceability Code |
| XY | = 2−Digit Date Code Format |
| Z | = Assembly Plant Code |

## PIN CONFIGURATIONS




**USB (Top View)**




**MicroPak™ (Top Through View)**

## ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

## PIN DEFINITIONS

| Pin # US8 | Pin # MicroPak | Name | Description |
|---|---|---|---|
| 1 | 7 | CK | Clock Pulse Input |
| 2 | 6 | D | Data Input |
| 3 | 5 | $\overline{Q}$ | Flip−Flop Output |
| 4 | 4 | GND | Ground |
| 5 | 3 | Q | Flip−Flop Output |
| 6 | 2 | $\overline{CLR}$ | Direct Clear Input |
| 7 | 1 | $\overline{PR}$ | Direct Preset Input |
| 8 | 8 | VCC | Supply Voltage |

## FUNCTION TABLE

| Inputs | | | | Output | | |
|---|---|---|---|---|---|---|
| $\overline{CLR}$ | $\overline{PR}$ | D | CK | Q | $\overline{Q}$ | Function |
| L | H | X | X | L | H | Clear |
| H | L | X | X | H | L | Preset |
| L | L | X | X | H | H | |
| H | H | L | ↑ | L | H | |
| H | H | H | ↑ | H | L | |
| H | H | X | ↓ | $Q_n$ | $\overline{Q}_n$ | No Change |

H = HIGH Logic Level  Qn = No change in data  X = Immaterial  ↓= Falling Edge

L = LOW Logic Level  Z = High Impedance  ↑ = Rising Edge

## 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 Source/Sink 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 | US8<br>MicroPak−8 | −<br>− | 500<br>539 | mW |
| 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 |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage Operating | | 1.65 | 5.50 | V |
| | Supply Voltage Data Retention | | 1.50 | 5.50 | |
| $V_{IN}$ | Input Voltage | | 0 | 5.5 | V |
| $V_{OUT}$ | Output Voltage | Active State | 0 | $V_{CC}$ | V |
| | | 3−State | 0 | 5.5 | |
| $t_r$, $t_f$ | Input Rise and Fall Times | $V_{CC}$ = 1.8 V, 2.5 V ±0.2 V | 0 | 20 | ns/V |
| | | $V_{CC}$ = 3.3 V ±0.3 V | 0 | 10 | |
| | | $V_{CC}$ = 5.0 V ±0.5 V | 0 | 5 | |
| $T_A$ | Operating Temperature | | −40 | +85 | °C |
| $\theta_{JA}$ | Thermal Resistance | US8 | | 250 | °C/W |
| | | MicroPak−8 | | 232 | |

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.

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

## DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Vcc | Conditions | $T_A$ = +25°C | | | $T_A$ = −40 to +85°C | | Units |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | |
| $V_{IH}$ | HIGH Level Control Input Voltage | 1.65 to 1.95 | | 0.65 $V_{CC}$ | | | 0.65 $V_{CC}$ | | V |
| | | 2.30 to 5.50 | | 0.70 $V_{CC}$ | | | 0.70 $V_{CC}$ | | |
| $V_{IL}$ | LOW Level Control Input Voltage | 1.65 to 1.95 | | | | 0.35 $V_{CC}$ | | 0.35 $V_{CC}$ | V |
| | | 2.30 to 5.50 | | | | 0.30 $V_{CC}$ | | 0.30 $V_{CC}$ | |
| $V_{OH}$ | HIGH Level Output Voltage | 1.65 | $V_{IN}$ = $V_{IH}$, $I_{OH}$ = −100 μA | 1.55 | 1.65 | | 1.55 | | V |
| | | 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 Control Output Voltage | 1.65 | $V_{IN}$ = $V_{IH}$, $I_{OL}$ = 100 μA | | | 0.10 | | 0.10 | V |
| | | 2.30 | | | | 0.10 | | 0.10 | |
| | | 3.00 | | | | 0.10 | | 0.10 | |
| | | 4.50 | | | | 0.10 | | 0.10 | |
| | | 1.65 | $I_{OL}$ = 4 mA | | 0.10 | 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 | 0 ≤ $V_{IN}$ ≤ 5.5 V | | | ±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 5.50 | $V_{IN}$ = 5.5 V, GND | | | 1 | | 10 | μA |

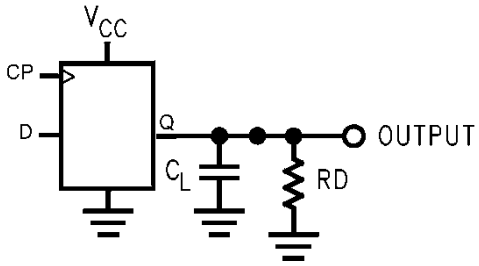
## AC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | $V_{CC}$ | Conditions | $T_A$ = +25°C | | | $T_A$ = −40 to +85°C | | Units | Figure |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | | |
| $f_{MAX}$ | Maximum Clock Frequency | 1.80 ±0.15 | $C_L$ = 15 pF, $R_D$ = 1 MΩ, $S_1$ = Open | 75 | | | 75 | | MHz | Figure 4 Figure 8 |
| | | 2.50 ±0.20 | | 150 | | | 150 | | | |
| | | 3.30 ±0.30 | | 200 | | | 200 | | | |
| | | 5.00 ±0.50 | | 250 | | | 250 | | | |
| | | 3.30 ±0.50 | $C_L$ = 50 pF, $R_D$ = 500 Ω, $S_1$ = Open | 175 | | | 175 | | | |
| | | 5.00 ±0.50 | | 200 | | | 200 | | | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay CK to Q, $\overline{Q}$ | 1.80 ±0.15 | $C_L$ = 15 pF, $R_D$ = 1 MΩ, $S_1$ = Open | | 6.5 | 12.5 | | 13.0 | ns | Figure 4 Figure 6 |
| | | 2.50 ±0.20 | | | 3.8 | 7.5 | | 8.0 | | |
| | | 3.30 ±0.30 | | | 2.8 | 6.5 | | 7.0 | | |
| | | 5.00 ±0.50 | | | 2.2 | 4.5 | | 5.0 | | |
| | | 3.30 ±0.30 | $C_L$ = 50 pF, $R_D$ = 500 Ω, $S_1$ = Open | | 3.4 | 7.0 | | 7.5 | | |
| | | 5.00 ±0.50 | | | 2.6 | 5.0 | | 5.5 | | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay $\overline{CLR}$, $\overline{PR}$ to Q, $\overline{Q}$ | 1.80 ±0.15 | $C_L$ = 15 pF, $R_L$ = 1 MΩ, $S_1$ = Open | | 6.5 | 14.0 | | 14.5 | ns | Figure 4 Figure 6 |
| | | 2.50 ±0.20 | | | 3.8 | 9.0 | | 9.5 | | |
| | | 3.30 ±0.30 | | | 2.8 | 6.5 | | 7.0 | | |
| | | 5.00 ±0.50 | | | 2.2 | 5.0 | | 5.5 | | |
| | | 3.30 ±0.30 | $C_L$ = 50 pF, $R_D$ = 500 Ω, $S_1$ = Open | | 3.4 | 7.0 | | 7.5 | | |
| | | 5.00 ±0.50 | | | 2.6 | 5.0 | | 5.5 | | |
| $t_S$ | Setup Time CK to D | 1.80 ±0.15 | $C_L$ = 15 pF, $R_L$ = 1 MΩ, $S_1$ = Open | 6.5 | | | 6.5 | | ns | Figure 4 Figure 7 |
| | | 2.50 ±0.20 | | 3.5 | | | 3.5 | | | |
| | | 3.30 ±0.30 | | 2.0 | | | 2.0 | | | |
| | | 5.00 ±0.50 | | 1.5 | | | 1.5 | | | |
| | | 3.30 ±0.30 | $C_L$ = 50 pF, $R_D$ = 500 Ω, $S_1$ = Open | 2.0 | | | 2.0 | | | |
| | | 5.00 ±0.50 | | 1.5 | | | 1.5 | | | |
| $t_H$ | Hold Time, CK to D | 1.80 ±0.15 | $C_L$ = 15 pF, $R_L$ = 1 MΩ, $S_1$ = Open | 0.5 | | | 0.5 | | ns | Figure 4 Figure 7 |
| | | 2.50 ±0.20 | | 0.5 | | | 0.5 | | | |
| | | 3.30 ±0.30 | | 0.5 | | | 0.5 | | | |
| | | 5.00 ±0.50 | | 0.5 | | | 0.5 | | | |
| | | 3.30 ±0.30 | $C_L$ = 50 pF, $R_D$ = 500 Ω, $S_1$ = Open | 0.5 | | | 0.5 | | | |
| | | 5.00 ±0.50 | | 0.5 | | | 0.5 | | | |
| $t_W$ | Pulse Width, CK, $\overline{PR}$, $\overline{CLR}$ | 1.80 ±0.15 | $C_L$ = 15 pF, $R_L$ = 1 MΩ, $S_1$ = Open | 6.0 | | | 6.0 | | ns | Figure 4 Figure 8 |
| | | 2.50 ±0.20 | | 4.0 | | | 4.0 | | | |
| | | 3.30 ±0.30 | | 3.0 | | | 3.0 | | | |
| | | 5.00 ±0.50 | | 2.0 | | | 2.0 | | | |
| | | 3.30 ±0.30 | $C_L$ = 50 pF, $R_D$ = 500 Ω, $S_1$ = Open | 3.0 | | | 3.0 | | | |
| | | 5.00 ±0.50 | | 2.0 | | | 2.0 | | | |
| $t_{REC}$ | Recover Time $\overline{CLR}$, $\overline{PR}$ to CK | 1.80 ±0.15 | $C_L$ = 15 pF, $R_L$ = 1 MΩ, $S_1$ = Open | 8.0 | | | 8.0 | | ns | Figure 7 |
| | | 2.50 ±0.20 | | 4.5 | | | 4.5 | | | |
| | | 3.30 ±0.30 | | 3.0 | | | 3.0 | | | |
| | | 5.00 ±0.50 | | 3.0 | | | 3.0 | | | |
| | | 3.30 ±0.30 | $C_L$ = 50 pF, $R_D$ = 500 Ω, $S_1$ = Open | 3.0 | | | 3.0 | | | |
| | | 5.00 ±0.50 | | 3.0 | | | 3.0 | | | |

**AC ELECTRICAL CHARACTERISTICS** (continued)

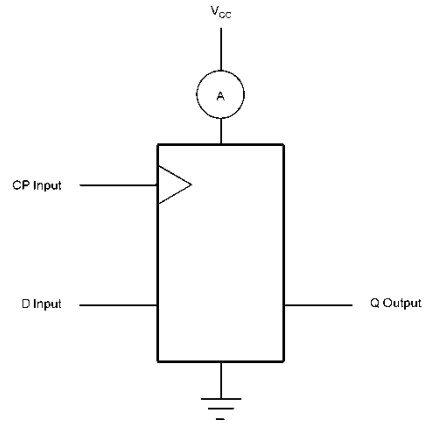
| Symbol | Parameter | $V_{CC}$ | Conditions | $T_A$ = +25°C | | | $T_A$ = −40 to +85°C | | Units | Figure |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | | |
| $C_{IN}$ | Input Capacitance | 0 | | | 3 | | | | pF | |
| $C_{OUT}$ | Output Capacitance | 0 | | | 4 | | | | pF | |
| $C_{PD}$ | Power Dissipation Capacitance (Note 1) | 3.30 | | | 10 | | | | pF | |
| | | 5.00 | | | 12 | | | | | |

1. $C_{PD}$ 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: $I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC}static)$.




2. $C_L$ includes load and stray capacitance. Input PRR = 1.0 MHz $t_w$ = 500 ns.

**Figure 2. AC Test Circuit**




3. CP input = AC Waveforms $t_r = t_f$ = 2.5 ns.
4. CP input PRR = 10 MHz; Duty Cycle = 50%.
5. D input PRR = 5 MHz; Duty Cycle = 50%.

**Figure 3. AC Test Circuit**

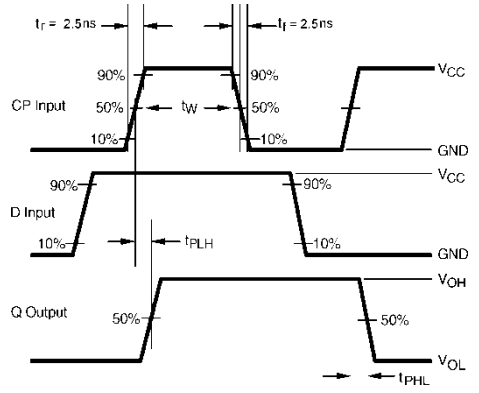



**Figure 4. AC Waveforms**

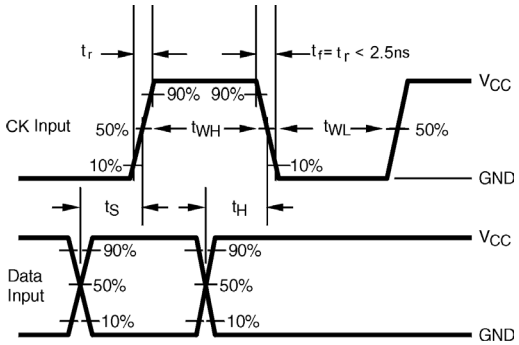



**Figure 5. AC Waveforms**

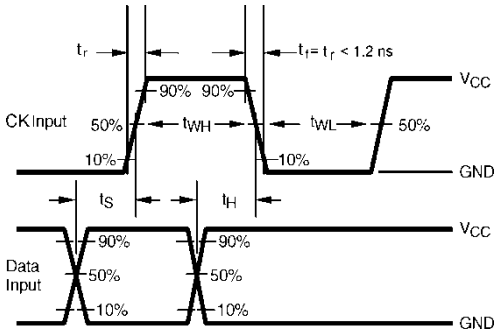



**Figure 6. AC Waveforms**

## ORDERING INFORMATION

| Part Number | Top Mark | Package | Packing Method† |
|---|---|---|---|
| NC7SZ74K8X | SZ74 | 8−Lead US8, JEDEC MO−187, Variation CA 3.1mm Wide | 3000 Units on Tape & Reel |
| NC7SZ74K8X−L22236 | SZ74 | 8−Lead US8, JEDEC MO−187, Variation CA 3.1mm Wide | 3000 Units on Tape & Reel |
| NC7SZ74L8X | N9 | 8−Lead MicroPak, 1.6 mm Wide | 5000 Units on Tape & Reel |
| NC7SZ74L8X−L22185 | N9 | 8−Lead MicroPak, 1.6 mm Wide | 5000 Units on 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

**UQFN8 1.6X1.6, 0.5P**
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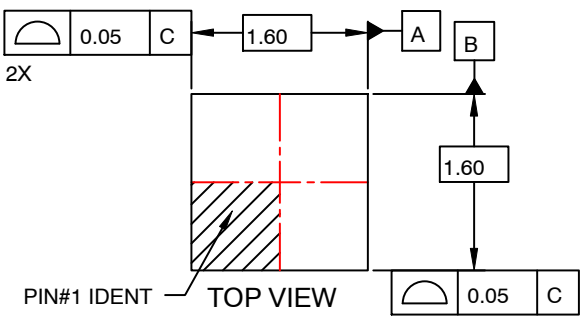
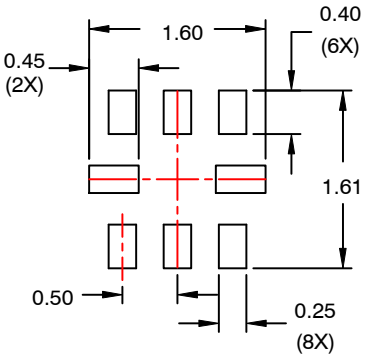
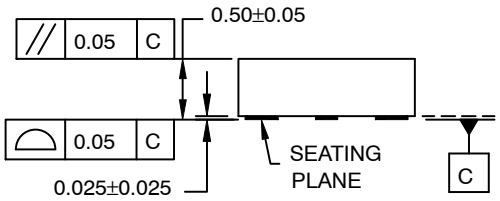



RECOMMENDED
LAND PATTERN




SIDE VIEW

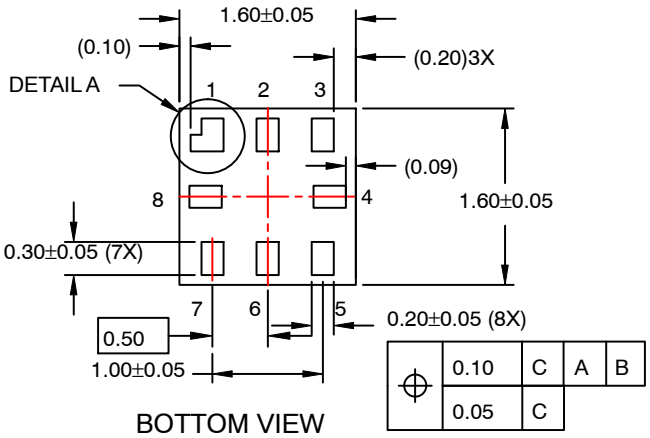
NOTES:

A. PACKAGE CONFORMS TO JEDEC MO−255 VARIATION UAAD.

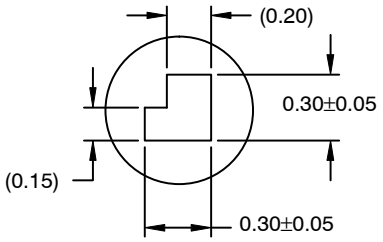
B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.

D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.




BOTTOM VIEW




DETAIL A
SCALE : 2X

| | | |
|---|---|---|
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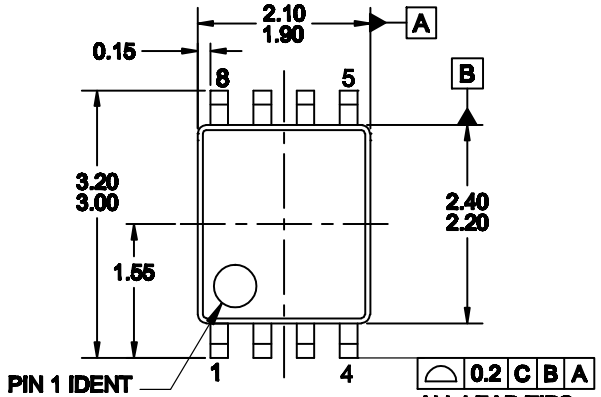
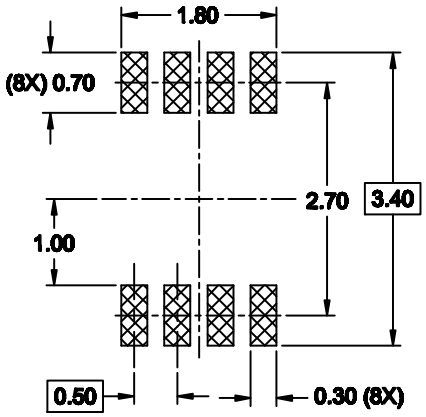
| **DESCRIPTION:** | **UQFN8 1.6X1.6, 0.5P** | **PAGE 1 OF 1** |

**US8**
CASE 846AN
ISSUE O

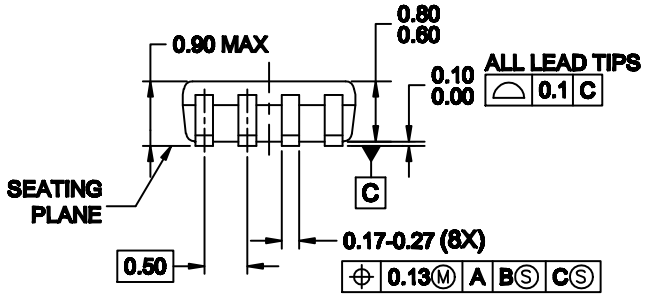
DATE 31 DEC 2016




**TOP VIEW**




**RECOMMENDED LAND PATTERN**




**SIDE VIEW**

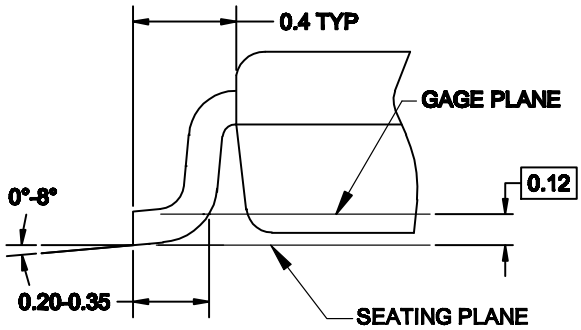
## NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-187

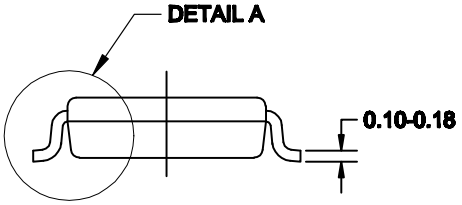
B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1994.




**DETAIL A**

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