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74VCX86

Low Voltage Quad 2-Input Exclusive-OR Gate with 3.6V Tolerant Inputs and Outputs

General Description

The VCX86 contains four 2-input exclusive OR gates. This product is designed for low voltage (1.2V to 3.6V) V_{CC} applications with I/O compatibility up to 3.6V

The 74VCX86 is fabricated with an advanced CMOS technology to achieve high-speed operation while maintaining low CMOS power dissipation.

Features

- 1.2V to 3.6V V_{CC} supply operation
- 3.6V tolerant inputs and outputs
- t_{PD}
3.0 ns max for 3.0V to 3.6V V_{CC}
- Power-off high impedance inputs and outputs
- Static Drive (I_{OH}/I_{OL})
 ± 24 mA @ 3.0V V_{CC}
- Uses proprietary noise/EMI reduction circuit
- Latchup performance exceeds JEDEC 78 conditions
- ESD performance:
Human body model > 2000V
Machine model > 250V
- Leadless Pb-Free DQFN package

Ordering Code:

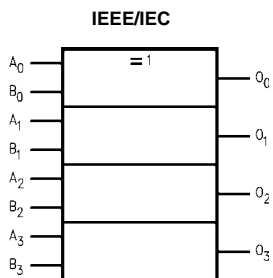
| Order Number | Package Number | Package Description |
|------------------------|----------------|---|
| 74VCX86M | M14A | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| 74VCX86BQX (Note 1) | MLP014A | Pb-Free 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm |
| 74VCX86MTC | MTC14 | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.
Pb-Free package per JEDEC J-STD-020B.

Note 1: DQFN package available in Tape and Reel only.

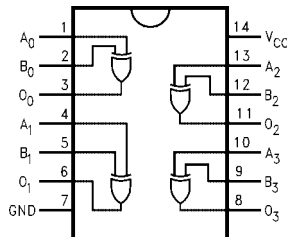
74VCX86 Low Voltage Quad 2-Input Exclusive-OR Gate with 3.6V Tolerant Inputs and Outputs

Logic Symbol



Connection Diagrams

Pin Assignments for SOIC and TSSOP

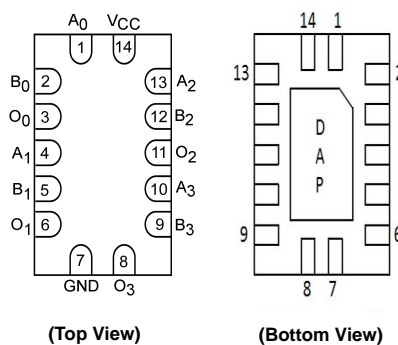


Pin Descriptions

| Pin Names | Description |
|---------------------------------|-------------|
| A _n , B _n | Inputs |
| O _n | Outputs |
| DAP | No Connect |

Note: DAP (Die Attach Pad)

Pad Assignments for DQFN



Absolute Maximum Ratings (Note 2)

| | |
|---|-------------------------|
| Supply Voltage (V_{CC}) | -0.5V to +4.6V |
| DC Input Voltage (V_I) | -0.5V to +4.6V |
| Output Voltage (V_O) | |
| HIGH or LOW State (Note 3) | -0.5V to V_{CC} +0.5V |
| $V_{CC} = 0V$ | -0.5V to +4.6V |
| DC Input Diode Current (I_{IK}) $V_I < 0V$ | -50 mA |
| DC Output Diode Current (I_{OK}) | |
| $V_O < 0V$ | -50 mA |
| $V_O > V_{CC}$ | +50 mA |
| DC Output Source/Sink Current (I_{OH}/I_{OL}) | ± 50 mA |
| DC V_{CC} or GND Current per Supply Pin (I_{CC} or Ground) | ± 100 mA |
| Storage Temperature Range (T_{STG}) | -65°C to +150°C |

Recommended Operating Conditions (Note 4)

| | |
|---|-------------------|
| Power Supply | |
| Operating | 1.2V to 3.6V |
| Input Voltage | -0.3V to +3.6V |
| Output Voltage (V_O) | |
| HIGH or LOW State | 0V to V_{CC} |
| Output Current in I_{OH}/I_{OL} | |
| $V_{CC} = 3.0V$ to 3.6V | ± 24 mA |
| $V_{CC} = 2.3V$ to 2.7V | ± 18 mA |
| $V_{CC} = 1.65V$ to 2.3V | ± 6 mA |
| $V_{CC} = 1.4V$ to 1.6V | ± 2 mA |
| $V_{CC} = 1.2V$ | ± 100 μA |
| Free Air Operating Temperature (T_A) | -40°C to +85°C |
| Minimum Input Edge Rate ($\Delta t/\Delta V$) | |
| $V_{IN} = 0.8V$ to 2.0V, $V_{CC} = 3.0V$ | 10 ns/V |

Note 2: The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 3: I_O Absolute Maximum Rating must be observed.

Note 4: Floating or unused inputs must be held HIGH or LOW.

DC Electrical Characteristics

| Symbol | Parameter | Conditions | V_{CC} (V) | Min | Max | Units |
|----------|---------------------------|---------------------------|-----------------|----------------------|----------------------|-------|
| V_{IH} | HIGH Level Input Voltage | | 2.7 - 3.6 | 2.0 | | V |
| | | | 2.3 - 2.7 | 1.6 | | |
| | | | 1.65 - 2.3 | $0.65 \times V_{CC}$ | | |
| | | | 1.4 - 1.6 | $0.65 \times V_{CC}$ | | |
| | | | 1.2 | $0.65 \times V_{CC}$ | | |
| V_{IL} | LOW Level Input Voltage | | 2.7 - 3.6 | | 0.8 | V |
| | | | 2.3 - 2.7 | | 0.7 | |
| | | | 1.65 - 2.3 | | $0.35 \times V_{CC}$ | |
| | | | 1.4 - 1.6 | | $0.35 \times V_{CC}$ | |
| | | | 1.2 | | | |
| V_{OH} | HIGH Level Output Voltage | $I_{OH} = -100 \mu A$ | 2.7 - 3.6 | $V_{CC} - 0.2$ | | V |
| | | $I_{OH} = -12 \text{ mA}$ | 2.7 | 2.2 | | |
| | | $I_{OH} = -18 \text{ mA}$ | 3.0 | 2.4 | | |
| | | $I_{OH} = -24 \text{ mA}$ | 3.0 | 2.2 | | |
| | | $I_{OH} = -100 \mu A$ | 2.3 - 2.7 | $V_{CC} - 0.2$ | | |
| | | $I_{OH} = -6 \text{ mA}$ | 2.3 | 2.0 | | |
| | | $I_{OH} = -12 \text{ mA}$ | 2.3 | 1.8 | | |
| | | $I_{OH} = -18 \text{ mA}$ | 2.3 | 1.7 | | |
| | | $I_{OH} = -100 \mu A$ | 1.65 - 2.3 | $V_{CC} - 0.2$ | | |
| | | $I_{OH} = -6 \text{ mA}$ | 1.65 | 1.25 | | |
| | | $I_{OH} = -100 \mu A$ | 1.4 - 1.6 | $V_{CC} - 0.2$ | | |
| | | $I_{OH} = -2 \text{ mA}$ | 1.4 | 1.05 | | |
| | | $I_{OH} = -100 \mu A$ | 1.2 | $V_{CC} - 0.2$ | | |

| DC Electrical Characteristics (Continued) | | | | | | | |
|---|---------------------------------------|--|------------------------|---------------------------------|-----------|-------|------------------|
| Symbol | Parameter | Conditions | V _{CC} (V) | Min | Max | Units | |
| V _{OL} | LOW Level Output Voltage | I _{OL} = 100 μA | 2.7 - 3.6 | | 0.2 | V | |
| | | I _{OL} = 12 mA | 2.7 | | 0.4 | | |
| | | I _{OL} = 18 mA | 3.0 | | 0.4 | | |
| | | I _{OL} = 24 mA | 3.0 | | 0.55 | | |
| | | I _{OL} = 100 μA | 2.3 - 2.7 | | 0.2 | | |
| | | I _{OL} = 12 mA | 2.3 | | 0.4 | | |
| | | I _{OL} = 18 mA | 2.3 | | 0.6 | | |
| | | I _{OL} = 100 μA | 1.65 - 2.3 | | 0.2 | | |
| | | I _{OL} = 6 mA | 1.65 | | 0.3 | | |
| | | I _{OL} = 100 μA | 1.4 - 1.6 | | 0.2 | | |
| I _{OL} = 2 mA | 1.4 | | 0.35 | | | | |
| I _{OL} = 100 μA | 1.2 | | 0.05 | | | | |
| I _I | Input Leakage Current | 0 ≤ V _I ≤ 3.6V | 1.2 - 3.6 | | ±5.0 | μA | |
| I _{OFF} | Power-OFF Leakage Current | 0 ≤ (V _I , V _O) ≤ 3.6V | 0 | | 10 | μA | |
| I _{CC} | Quiescent Supply Current | V _I = V _{CC} or GND V _{CC} ≤ (V _I) | 1.2 - 3.6 1.2 - 3.6 | | 20 ±20 | μA | |
| ΔI _{CC} | Increase in I _{CC} per Input | V _{IH} = V _{CC} - 0.6V | 2.7 - 3.6 | | 750 | μA | |
| AC Electrical Characteristics (Note 5) | | | | | | | |
| Symbol | Parameter | Conditions | V _{CC} (V) | T _A = -40°C to +85°C | | Units | Figure Number |
| | | | | Min | Max | | |
| t _{PHL} t _{PLH} | Propagation Delay | C _L = 30 pF, R _L = 500Ω | 3.3 ± 0.3 | 0.6 | 3.0 | ns | Figures 1, 2 |
| | | | 2.5 ± 0.2 | 0.8 | 3.9 | | |
| | | | 1.8 ± 0.15 | 1.0 | 7.8 | | |
| | | C _L = 15 pF, R _L = 2kΩ | 1.5 ± 0.1 | 1.0 | 15.6 | | Figures 3, 4 |
| 1.2 | 1.5 | 39 | | | | | |
| t _{OSSL} t _{OSLH} | Output to Output Skew (Note 6) | C _L = 30 pF, R _L = 500Ω | 3.3 ± 0.3 | | 0.5 | ns | |
| | | | 2.5 ± 0.2 | | 0.5 | | |
| | | | 1.8 ± 0.15 | | 0.75 | | |
| | | C _L = 15 pF, R _L = 2kΩ | 1.5 ± 0.1 | | 1.5 | | |
| 1.2 | | 1.5 | | | | | |
| <p>Note 5: For C_L = 50 pF, add approximately 300 ps to the AC maximum specification.</p> <p>Note 6: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t_{OSSL}) or LOW-to-HIGH (t_{OSLH}).</p> | | | | | | | |

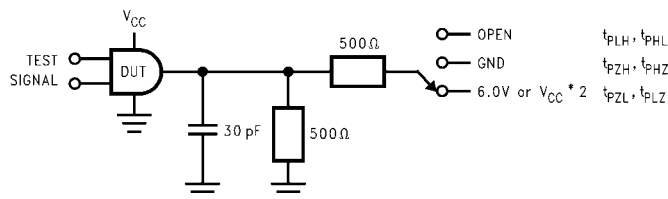
Dynamic Switching Characteristics

| Symbol | Parameter | Conditions | V _{CC} (V) | T _A = +25°C | Units |
|------------------|---|--|------------------------|------------------------|-------|
| | | | | Typical | |
| V _{OLP} | Quiet Output Dynamic Peak V _{OL} | C _L = 30 pF, V _{IH} = V _{CC} , V _{IL} = 0V | 1.8 | 0.25 | V |
| | | | 2.5 | 0.6 | |
| | | | 3.3 | 0.8 | |
| V _{OLV} | Quiet Output Dynamic Valley V _{OL} | C _L = 30 pF, V _{IH} = V _{CC} , V _{IL} = 0V | 1.8 | -0.25 | V |
| | | | 2.5 | -0.6 | |
| | | | 3.3 | -0.8 | |
| V _{OHV} | Quiet Output Dynamic Valley V _{OH} | C _L = 30 pF, V _{IH} = V _{CC} , V _{IL} = 0V | 1.8 | 1.5 | V |
| | | | 2.5 | 1.9 | |
| | | | 3.3 | 2.2 | |

Capacitance

| Symbol | Parameter | Conditions | T _A = +25°C | Units |
|------------------|-------------------------------|---|------------------------|-------|
| | | | Typical | |
| C _{IN} | Input Capacitance | V _{CC} = 1.8, 2.5V or 3.3V, V _I = 0V or V _{CC} | 6 | pF |
| C _{OUT} | Output Capacitance | V _I = 0V or V _{CC} , V _{CC} = 1.8V, 2.5V or 3.3V | 7 | pF |
| C _{PD} | Power Dissipation Capacitance | V _I = 0V or V _{CC} , f = 10 MHz, V _{CC} = 1.8V, 2.5V or 3.3V | 20 | pF |

AC Loading and Waveforms (V_{CC} 3.3V ± 0.3V to 1.8V ± 0.15V)



| TEST | SWITCH |
|-------------------------------------|--------|
| t _{PLH} , t _{PHL} | Open |

FIGURE 1. AC Test Circuit

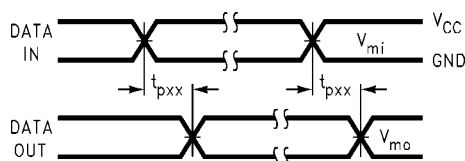
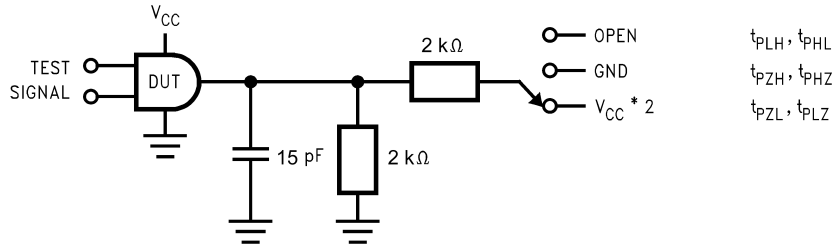


FIGURE 2. Waveform for Inverting and Non-Inverting Functions

| Symbol | V _{CC} | | |
|-----------------|-----------------|--------------------|--------------------|
| | 3.3V ± 0.3V | 2.5V ± 0.2V | 1.8V ± 0.15V |
| V _{mi} | 1.5V | V _{CC} /2 | V _{CC} /2 |
| V _{mo} | 1.5V | V _{CC} /2 | V _{CC} /2 |

AC Loading and Waveforms ($V_{CC} 1.5V \pm 0.1V$ to $1.2V$)



| TEST | SWITCH |
|--------------------|--|
| t_{PLH}, t_{PHL} | Open |
| t_{PZL}, t_{PLZ} | $V_{CC} \times 2$ at $V_{CC} = 1.5 \pm 0.1V$ |
| t_{PZH}, t_{PHZ} | GND |

FIGURE 3. AC Test Circuit

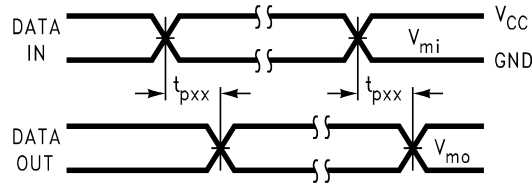


FIGURE 4. Waveform for Inverting and Non-Inverting Functions

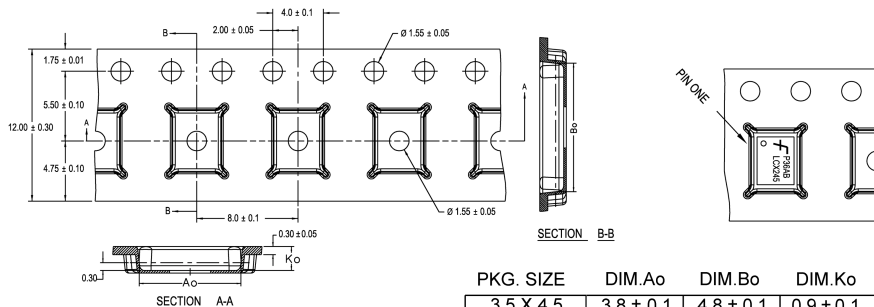
| Symbol | V_{CC} |
|----------|-----------------|
| | $1.5V \pm 0.1V$ |
| V_{mi} | $V_{CC}/2$ |
| V_{mo} | $V_{CC}/2$ |

Tape and Reel Specification

Tape Format for DQFN

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| BQX | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 2500/3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |

TAPE DIMENSIONS inches (millimeters)



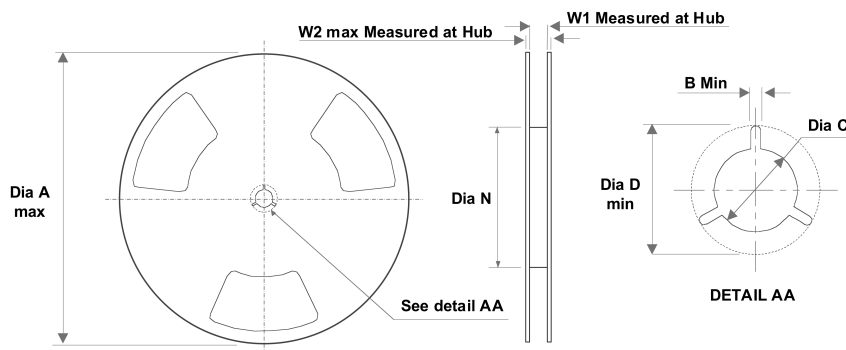
| PKG. SIZE | DIM.Ao | DIM.Bo | DIM.Ko |
|-----------|-----------|-----------|-----------|
| 3.5 X 4.5 | 3.8 ± 0.1 | 4.8 ± 0.1 | 0.9 ± 0.1 |
| 3.0 X 3.0 | 3.3 ± 0.1 | 3.3 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 4.5 | 2.8 ± 0.1 | 4.8 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 3.5 | 2.8 ± 0.1 | 3.8 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 3.0 | 2.8 ± 0.1 | 3.3 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 2.5 | 2.8 ± 0.1 | 2.8 ± 0.1 | 0.9 ± 0.1 |

DIMENSIONS ARE IN MILLIMETERS

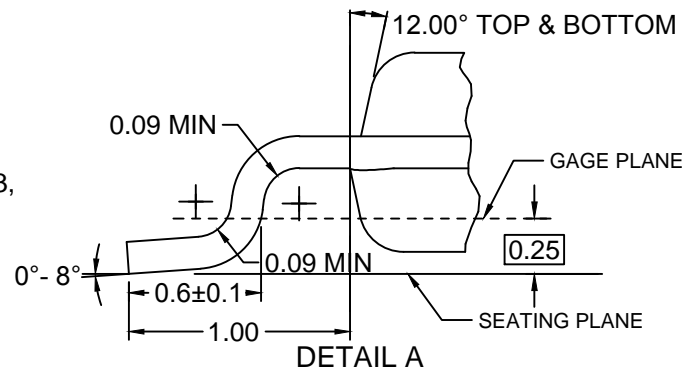
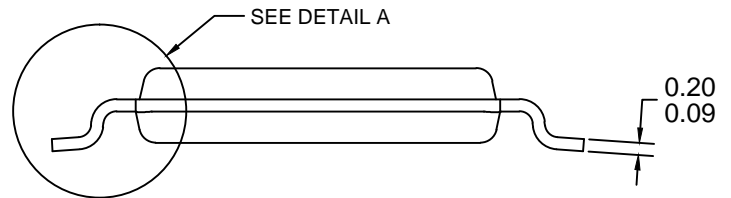
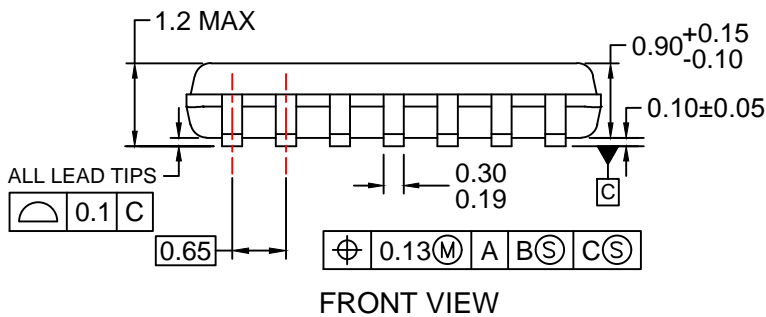
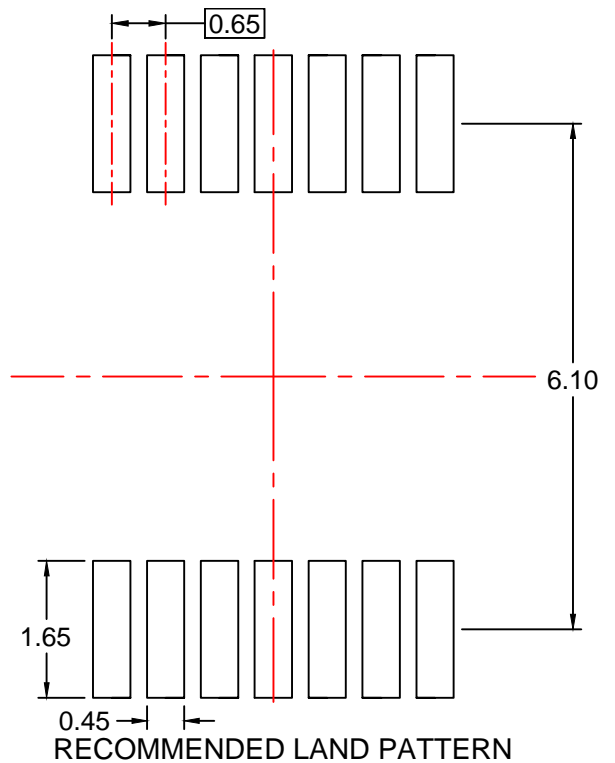
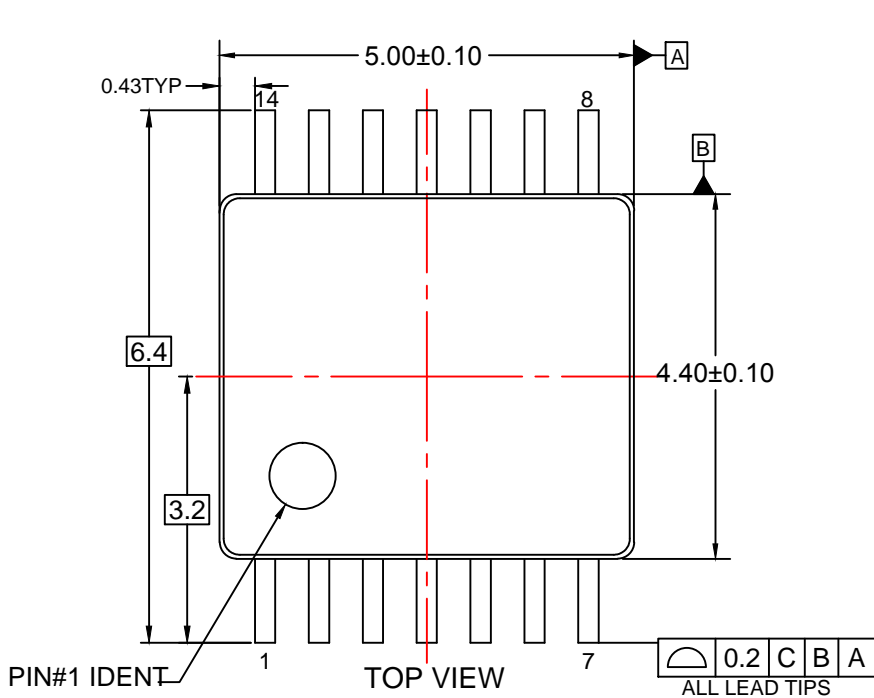
NOTES: unless otherwise specified

1. Cumulative pitch for feeding holes and cavities (chip pockets) not to exceed 0.008[0.20] over 10 pitch span.
2. Smallest allowable bending radius.
3. Thru hole inside cavity is centered within cavity.
4. Tolerance is $\pm 0.002[0.05]$ for these dimensions on all 12mm tapes.
5. Ao and Bo measured on a plane 0.120[0.30] above the bottom of the pocket.
6. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
7. Pocket position relative to sprocket hole measured as true position of pocket. Not pocket hole.
8. Controlling dimension is millimeter. Dimension in inches rounded.

REEL DIMENSIONS inches (millimeters)



| Tape Size | A | B | C | D | N | W1 | W2 |
|-----------|---------------|-----------------|------------------|------------------|----------------|-----------------|-----------------|
| 12 mm | 13.0 (330) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 7.008 (178) | 0.488 (12.4) | 0.724 (18.4) |



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 2009.
- E. LANDPATTERN STANDARD: SOP65P640X110-14M.
- F. DRAWING FILE NAME: MKT-MTC14rev7.



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