



Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (\_), the underscore (\_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (\_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at [www.onsemi.com](http://www.onsemi.com). Please email any questions regarding the system integration to [Fairchild\\_questions@onsemi.com](mailto:Fairchild_questions@onsemi.com).

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.



# 74VCX00

## Low Voltage Quad 2-Input NAND Gate with 3.6V Tolerant Inputs and Outputs

### Features

- 1.2V to 3.6V  $V_{CC}$  supply operation
- 3.6V tolerant inputs and outputs
- $t_{PD}$ 
  - 2.8ns max. for 3.0V to 3.6V  $V_{CC}$
- Power-off high impedance inputs and outputs
- Static Drive ( $I_{OH}/I_{OL}$ )
  - $\pm 24mA$  @ 3.0V  $V_{CC}$
- Uses proprietary noise/EMI reduction circuitry
- Latchup performance exceeds JEDEC 78 conditions
- ESD performance:
  - Human body model > 2000V
  - Machine model > 250V
- Leadless DQFN package

### General Description

The VCX00 contains four 2-input NAND 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 VCX00 is fabricated with an advanced CMOS technology to achieve high-speed operation while maintaining low CMOS power dissipation.


### Ordering Information

| Order Number              | Package Number | Package Description   |
|---------------------------|----------------|---|
| 74VCX00M                  | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow                |
| 74VCX00BQX <sup>(1)</sup> | MLP14A         | 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm |
| 74VCX00MTC                | MTC14          | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide                 |

#### Note:

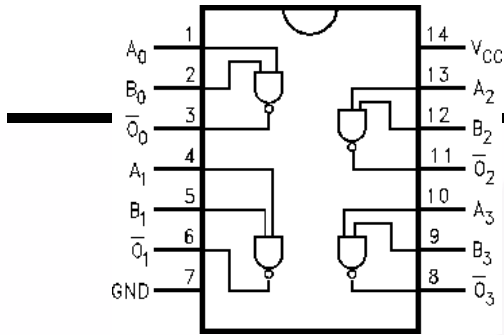
1. DQFN package available in Tape and Reel only.

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.

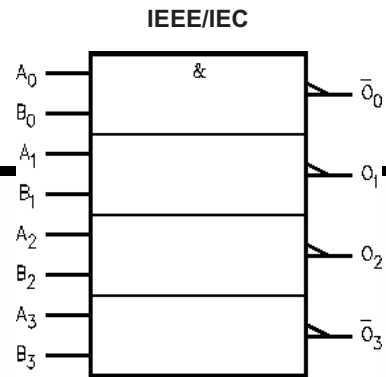
 All packages are lead free per JEDEC: J-STD-020B standard.

### Connection Diagrams

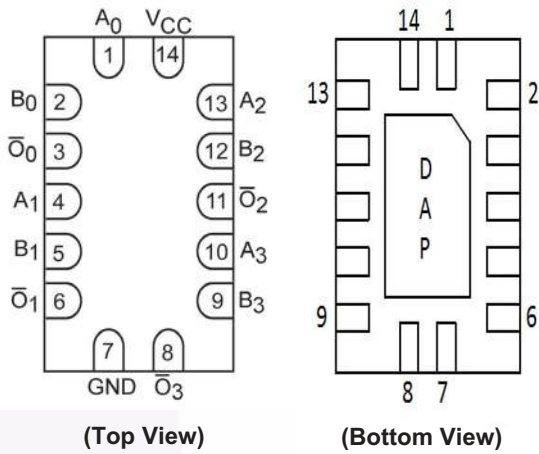
Pin Assignments for SOIC and TSSOP



### Logic Symbol



Pad Assignments for DQFN



### Pin Description

| Pin Names   | Description |
|-------------|-------------|
| $A_n, B_n$  | Inputs      |
| $\bar{O}_n$ | Outputs     |
| DAP         | No Connect  |

Note: DAP (Die Attach Pad)

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol            | Parameter   | Rating                   |
|-------------------|---|--------------------------|
| $V_{CC}$          | Supply Voltage  | -0.5V to +4.6V           |
| $V_I$             | DC Input Voltage                                      | -0.5V to 4.6V            |
| $V_O$             | DC Output Voltage<br>HIGH or LOW State <sup>(2)</sup> | -0.5V to $V_{CC} + 0.5V$ |
|                   | $V_{CC} = 0V$   | -0.5V to 4.6V            |
| $I_{IK}$          | DC Input Diode Current, $V_I < 0V$                    | -50mA                    |
| $I_{OK}$          | DC Output Diode Current<br>$V_O < 0V$                 | -50mA                    |
|                   | $V_O > V_{CC}$  | +50mA                    |
| $I_{OH} / I_{OL}$ | DC Output Source/Sink Current                         | $\pm 50mA$               |
| $I_{CC}$ or GND   | DC $V_{CC}$ or Ground Current per Supply Pin          | $\pm 100mA$              |
| $T_{STG}$         | Storage Temperature Range                             | -65°C to +150°C          |

**Note:**

2.  $I_O$  Absolute Maximum Rating must be observed.

## Recommended Operating Conditions<sup>(3)</sup>

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

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

**Note:**

3. Floating or unused inputs must be held HIGH or LOW

## DC Electrical Characteristics

| Symbol           | Parameter                             | V <sub>CC</sub> (V) | Conditions  | Min                    | Max                       | Units |
|------------------|---------------------------------------|---------------------|---|------------------------|---------------------------|-------|
| V <sub>IH</sub>  | HIGH Level Input Voltage              | 2.7–3.6             |   | 2.0                    |                           | V     |
|                  |                                       | 2.3–2.7             |   | 1.6                    |                           |       |
|                  |                                       | 1.65–2.3            |   | 0.65 × V <sub>CC</sub> |                           |       |
|                  |                                       | 1.4–1.6             |   | 0.65 × V <sub>CC</sub> |                           |       |
|                  |                                       | 1.2                 |   | 0.65 × V <sub>CC</sub> |                           |       |
| V <sub>IL</sub>  | LOW Level Input Voltage               | 2.7–3.6             |   |                        | 0.8                       | V     |
|                  |                                       | 2.3–2.7             |   |                        | 0.7                       |       |
|                  |                                       | 1.65–2.3            |   |                        | 0.35 × V <sub>CC</sub>    |       |
|                  |                                       | 1.4–1.6             |   |                        | 0.35 × V <sub>CC</sub>    |       |
|                  |                                       | 1.2                 |   |                        | 0.05 × V <sub>CC</sub>    |       |
| V <sub>OH</sub>  | HIGH Level Output Voltage             | 2.7–3.6             | I <sub>OH</sub> = –100μA  | V <sub>CC</sub> – 0.2  |                           | V     |
|                  |                                       | 2.7                 | I <sub>OH</sub> = –12mA   | 2.2                    |                           |       |
|                  |                                       | 3.0                 | I <sub>OH</sub> = –18mA   | 2.4                    |                           |       |
|                  |                                       | 3.0                 | I <sub>OH</sub> = –24mA   | 2.2                    |                           |       |
|                  |                                       | 2.3–2.7             | I <sub>OH</sub> = –100μA  | V <sub>CC</sub> – 0.2  |                           |       |
|                  |                                       | 2.3                 | I <sub>OH</sub> = –6mA  | 2.0                    |                           |       |
|                  |                                       | 2.3                 | I <sub>OH</sub> = –12mA   | 1.8                    |                           |       |
|                  |                                       | 2.3                 | I <sub>OH</sub> = –18mA   | 1.7                    |                           |       |
|                  |                                       | 1.65–2.3            | I <sub>OH</sub> = –100μA  | V <sub>CC</sub> – 0.2  |                           |       |
|                  |                                       | 1.65                | I <sub>OH</sub> = –6mA  | 1.25                   |                           |       |
|                  |                                       | 1.4–1.6             | I <sub>OH</sub> = –100μA  | V <sub>CC</sub> – 0.2  |                           |       |
|                  |                                       | 1.4                 | I <sub>OH</sub> = –2mA  | 1.05                   |                           |       |
|                  |                                       | 1.2                 | I <sub>OH</sub> = –100μA  | V <sub>CC</sub> – 0.2  |                           |       |
| V <sub>OL</sub>  | LOW Level Output Voltage              | 2.7–3.6             | I <sub>OL</sub> = 100μA   |                        | 0.2                       | V     |
|                  |                                       | 2.7                 | I <sub>OL</sub> = 12mA  |                        | 0.4                       |       |
|                  |                                       | 3.0                 | I <sub>OL</sub> = 18mA  |                        | 0.4                       |       |
|                  |                                       | 3.0                 | I <sub>OL</sub> = 24mA  |                        | 0.55                      |       |
|                  |                                       | 2.3–2.7             | I <sub>OL</sub> = 100μA   |                        | 0.2                       |       |
|                  |                                       | 2.3                 | I <sub>OL</sub> = 12mA  |                        | 0.4                       |       |
|                  |                                       | 2.3                 | I <sub>OL</sub> = 18mA  |                        | 0.6                       |       |
|                  |                                       | 1.65–2.3            | I <sub>OL</sub> = 100μA   |                        | 0.2                       |       |
|                  |                                       | 1.65                | I <sub>OL</sub> = 6mA   |                        | 0.3                       |       |
|                  |                                       | 1.4–1.6             | I <sub>OL</sub> = 100μA   |                        | 0.2                       |       |
|                  |                                       | 1.4                 | I <sub>OL</sub> = 2mA   |                        | 0.35                      |       |
|                  |                                       | 1.2                 | I <sub>OL</sub> = 100μA   |                        | 0.05                      |       |
|                  |                                       | I <sub>I</sub>      | Input Leakage Current   | 1.4–3.6                | 0 ≤ V <sub>I</sub> ≤ 3.6V |       |
| I <sub>OZ</sub>  | 3-STATE Output Leakage                | 1.4–3.6             | 0 ≤ V <sub>O</sub> ≤ 3.6V,<br>V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> |                        | ±10                       | μA    |
| I <sub>OFF</sub> | Power-OFF Leakage Current             | 0                   | 0 ≤ (V <sub>I</sub> , V <sub>O</sub> ) ≤ 3.6V                                     |                        | 10                        | μA    |
| I <sub>CC</sub>  | Quiescent Supply Current              | 1.4–3.6             | V <sub>I</sub> = V <sub>CC</sub> or GND   |                        | 20                        | μA    |
|                  |                                       |                     | V <sub>CC</sub> ≤ (V <sub>I</sub> , V <sub>O</sub> ) ≤ 3.6V <sup>(4)</sup>        |                        | ±20                       |       |
| ΔI <sub>CC</sub> | Increase in I <sub>CC</sub> per Input | 2.7–3.6             | V <sub>IH</sub> = V <sub>CC</sub> – 0.6V  |                        | 750                       | μA    |

**Note:**

4. Outputs disabled or 3-STATE only.

AC Electrical Characteristics<sup>(5)</sup>

| Symbol                                | Parameter                            | V <sub>CC</sub> (V) | Conditions                                   | T <sub>A</sub> = -40°C to +85°C |      | Units | Figure Number    |
|---------------------------------------|--------------------------------------|---------------------|--|---------------------------------|------|-------|------------------|
|                                       |                                      |                     |  | Min.                            | Max. |       |                  |
| t <sub>PHL</sub> , t <sub>PLH</sub>   | Propagation Delay                    | 3.3 ± 0.3           | C <sub>L</sub> = 30pF, R <sub>L</sub> = 500Ω | 0.6                             | 2.8  | ns    | Fig. 1<br>Fig. 2 |
|                                       |                                      | 2.5 ± 0.2           |  | 0.8                             | 3.7  |       |                  |
|                                       |                                      | 1.8 ± 0.15          |  | 1.0                             | 7.4  |       |                  |
|                                       |                                      | 1.5 ± 0.1           | C <sub>L</sub> = 15pF, R <sub>L</sub> = 2kΩ  | 1.0                             | 14.8 |       | Fig. 3<br>Fig. 4 |
|                                       |                                      | 1.2                 |  | 1.5                             | 37.0 |       |                  |
| t <sub>OSSL</sub> , t <sub>OSLH</sub> | Output to Output Skew <sup>(6)</sup> | 3.3 ± 0.3           | C <sub>L</sub> = 30pF, R <sub>L</sub> = 500Ω |                                 | 0.5  | ns    |                  |
|                                       |                                      | 2.5 ± 0.2           |  |                                 | 0.5  |       |                  |
|                                       |                                      | 1.8 ± 0.15          |  |                                 | 0.75 |       |                  |
|                                       |                                      | 1.5 ± 0.1           | C <sub>L</sub> = 15pF, R <sub>L</sub> = 2kΩ  |                                 | 1.5  |       |                  |
|                                       |                                      | 1.2                 |  |                                 | 1.5  |       |                  |

## Note:

5. For C<sub>L</sub> = 50pF, add approximately 300ps to the AC Maximum specification.
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<sub>OSSL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>).

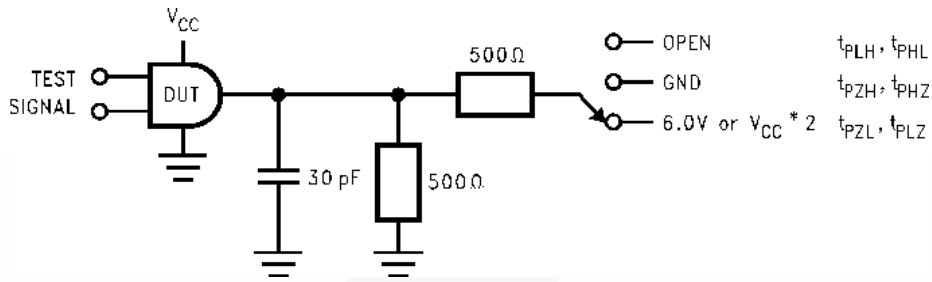
## Dynamic Switching Characteristics

| Symbol           | Parameter                                   | V <sub>CC</sub> (V) | Conditions   | T <sub>A</sub> = 25°C | Unit |
|------------------|---|---------------------|--|-----------------------|------|
|                  |   |                     |  | Typical               |      |
| V <sub>OLP</sub> | Quiet Output Dynamic Peak V <sub>OL</sub>   | 1.8                 | C <sub>L</sub> = 30pF, V <sub>IH</sub> = V <sub>CC</sub> ,<br>V <sub>IL</sub> = 0V | 0.25                  | V    |
|                  |   | 2.5                 |  | 0.6                   |      |
|                  |   | 3.3                 |  | 0.8                   |      |
| V <sub>OLV</sub> | Quiet Output Dynamic Valley V <sub>OL</sub> | 1.8                 | C <sub>L</sub> = 30pF, V <sub>IH</sub> = V <sub>CC</sub> ,<br>V <sub>IL</sub> = 0V | -0.25                 | V    |
|                  |   | 2.5                 |  | -0.6                  |      |
|                  |   | 3.3                 |  | -0.8                  |      |
| V <sub>OHV</sub> | Quiet Output Dynamic Valley V <sub>OH</sub> | 1.8                 | C <sub>L</sub> = 30pF, V <sub>IH</sub> = V <sub>CC</sub> ,<br>V <sub>IL</sub> = 0V | 1.5                   | V    |
|                  |   | 2.5                 |  | 1.9                   |      |
|                  |   | 3.3                 |  | 2.2                   |      |

## Capacitance

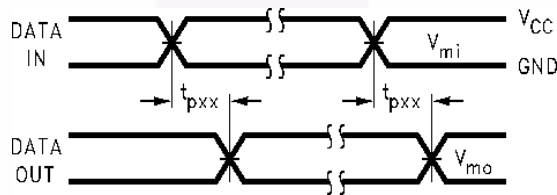
| Symbol           | Parameter                     | Conditions  | T <sub>A</sub> = +25°C | Units |
|------------------|-------------------------------|---|------------------------|-------|
|                  |                               |   | Typical                |       |
| C <sub>IN</sub>  | Input Capacitance             | V <sub>I</sub> = 0V or V <sub>CC</sub> , V <sub>CC</sub> = 1.8V, 2.5V or 3.3V             | 6                      | pF    |
| C <sub>OUT</sub> | Output Capacitance            | V <sub>I</sub> = 0V or V <sub>CC</sub> , V <sub>CC</sub> = 1.8V, 2.5V or 3.3V             | 7                      | pF    |
| C <sub>PD</sub>  | Power Dissipation Capacitance | V <sub>I</sub> = 0V or V <sub>CC</sub> , f = 10 MHz, V <sub>CC</sub> = 1.8V, 2.5V or 3.3V | 20                     | pF    |

**AC Loading and Waveforms** ( $V_{CC}$  3.3V  $\pm$  0.3V to 1.8V  $\pm$  0.15V)



| Test                  | Switch |
|-----------------------|--------|
| $t_{PLH}$ , $t_{PHL}$ | Open   |

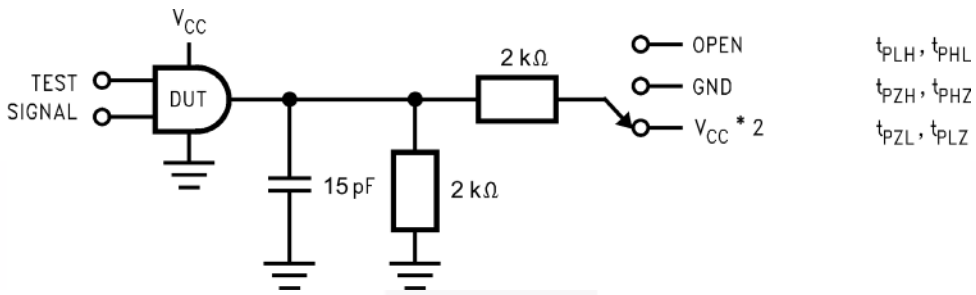
**Figure 1. AC Test Circuit**



| Symbol   | $V_{CC}$        |                 |                  |
|----------|-----------------|-----------------|------------------|
|          | 3.3V $\pm$ 0.3V | 2.5V $\pm$ 0.2V | 1.8V $\pm$ 0.15V |
| $V_{mi}$ | 1.5V            | $V_{CC} / 2$    | $V_{CC} / 2$     |
| $V_{mo}$ | 1.5V            | $V_{CC} / 2$    | $V_{CC} / 2$     |

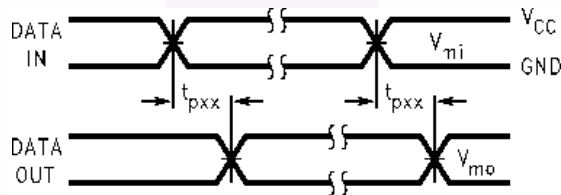
**Figure 2. Waveform for Inverting and Non-inverting Functions**

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



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

Figure 3. AC Test Circuit



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

Figure 4. Waveform for Inverting and Non-Inverting Functions

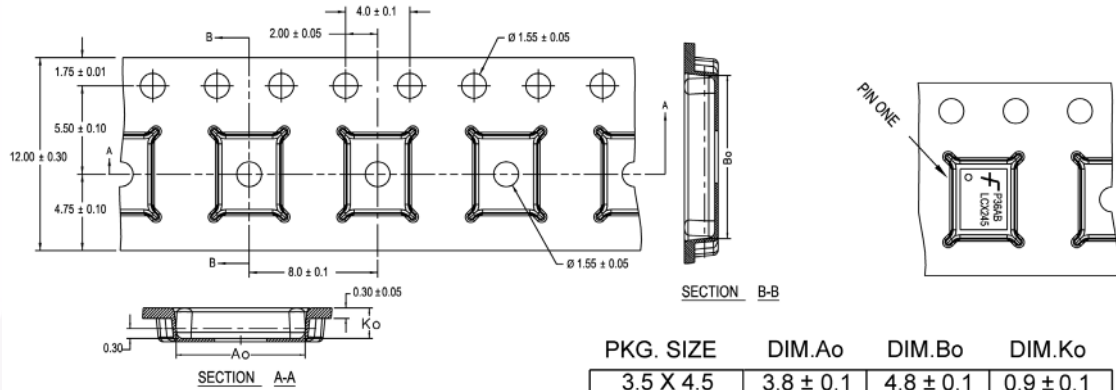


## Tape and Reel Specification

### Tape Format for DQFN

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

### Tape Dimensions inches (millimeters)



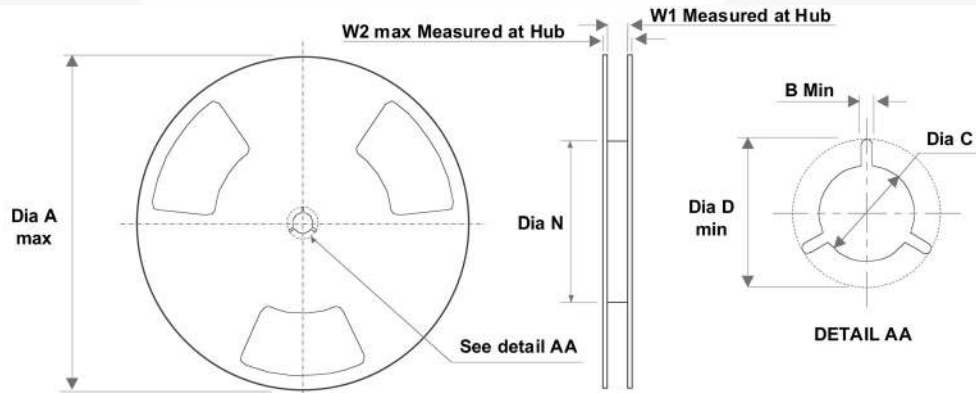
| PKG. SIZE | DIM.Ao    | DIM.Bo    | DIM.Ko    |
|-----------|-----------|-----------|-----------|
| 3.5 X 4.5 | 3.8 ± 0.1 | 4.8 ± 0.1 | 0.9 ± 0.1 |
| 3.0 X 3.0 | 3.3 ± 0.1 | 3.3 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 4.5 | 2.8 ± 0.1 | 4.8 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 3.5 | 2.8 ± 0.1 | 3.8 ± 0.1 | 0.9 ± 0.1 |
|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

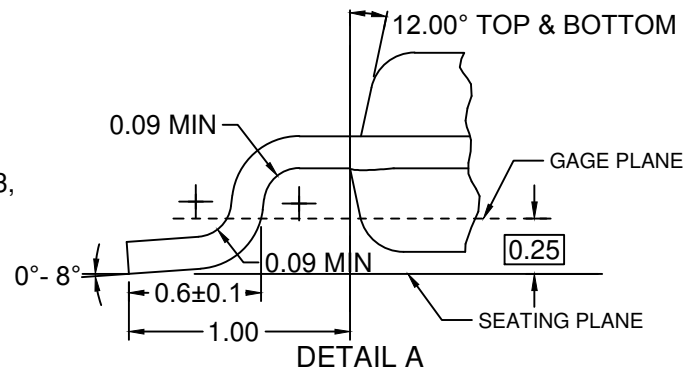
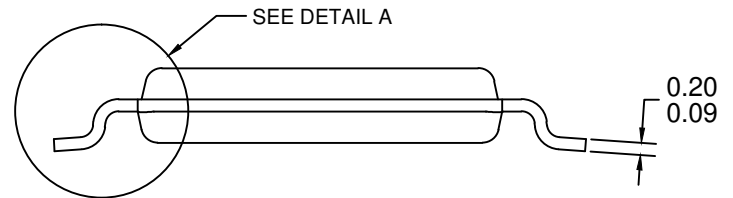
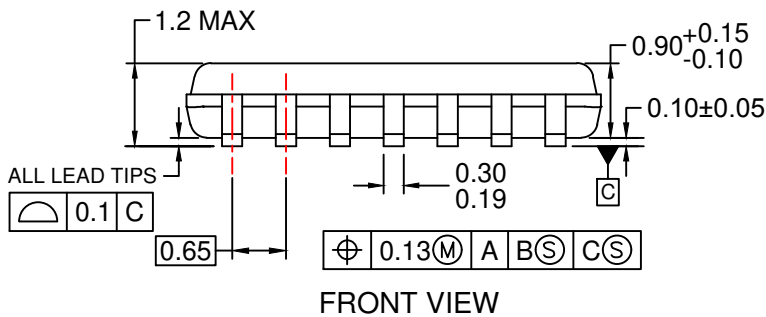
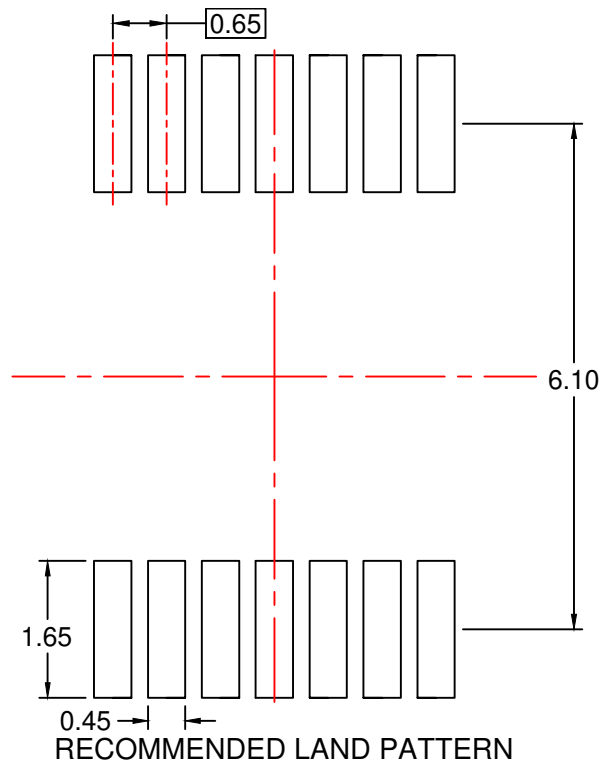
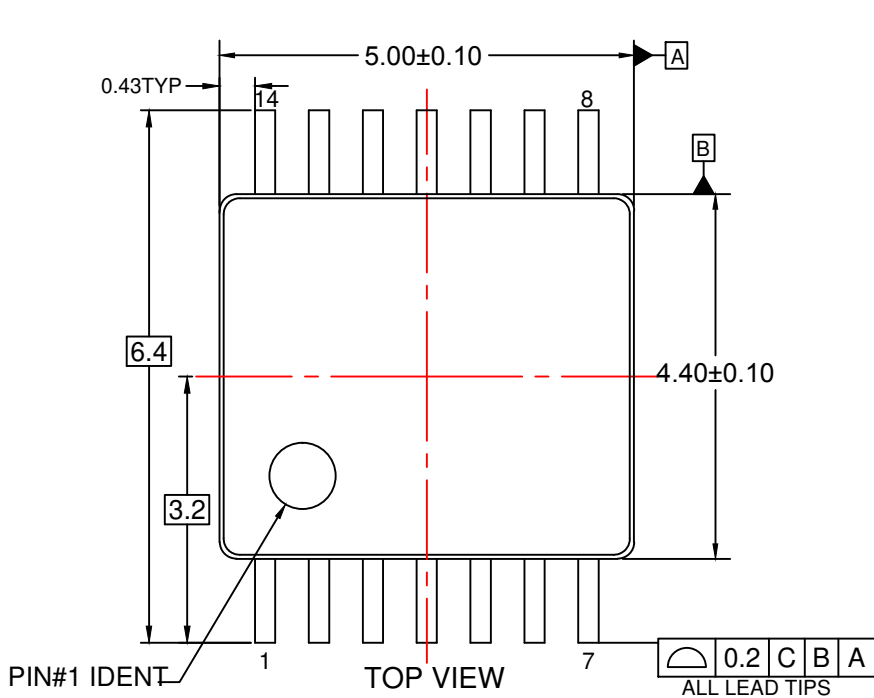
NOTES: unless otherwise specified

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)



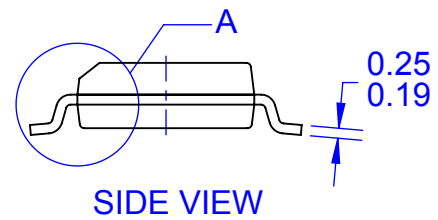
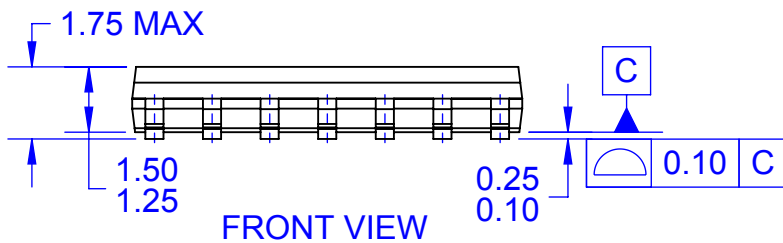
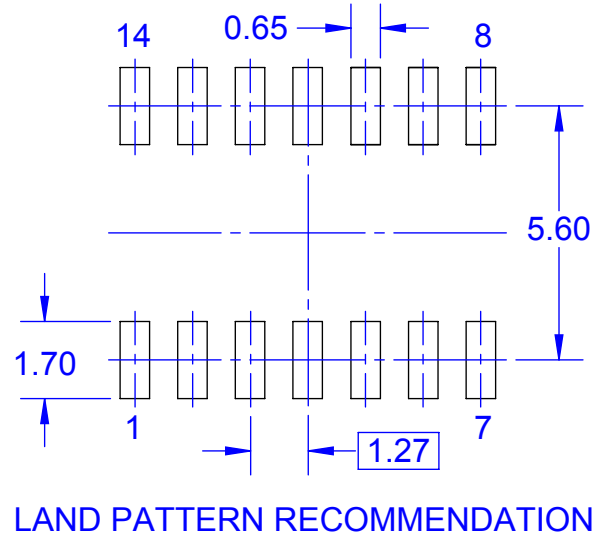
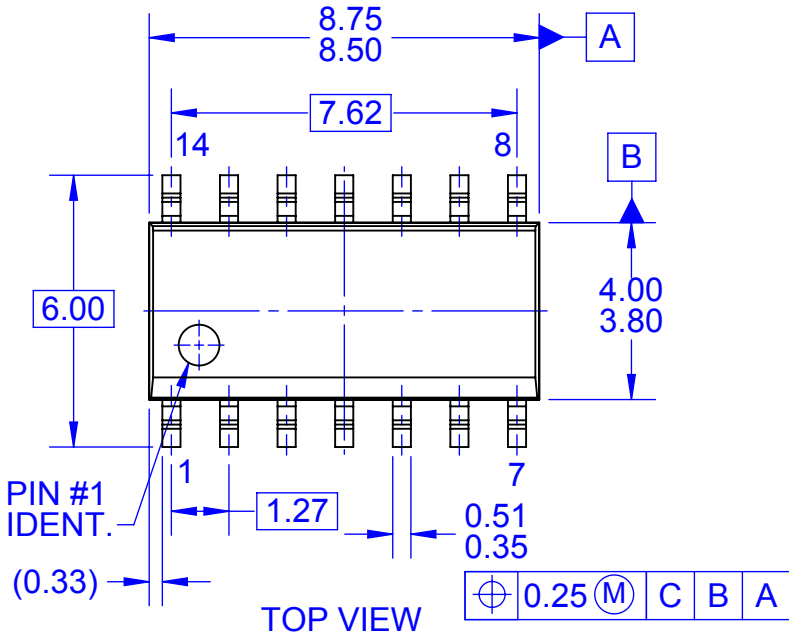
| Tape Size | A            | B            | C             | D             | N             | W1           | W2           |
|-----------|--------------|--------------|---------------|---------------|---------------|--------------|--------------|
| 12mm      | 13.0 (330.0) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 2.165 (55.00) | 0.488 (12.4) | 0.724 (18.4) |



NOTES:

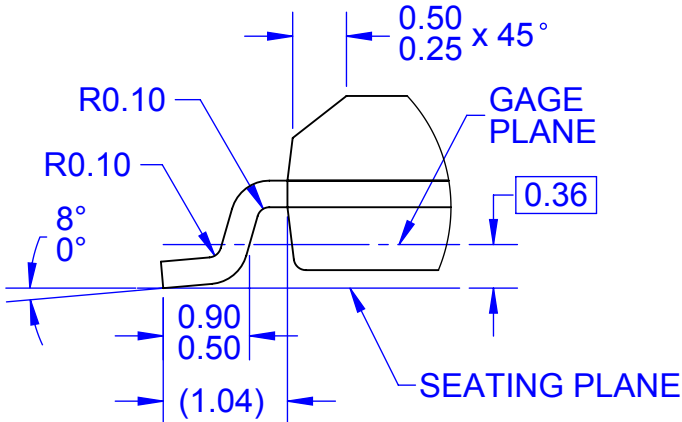
- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 2009.
- E. LANDPATTERN STANDARD: SOP65P640X110-14M.
- F. DRAWING FILE NAME: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

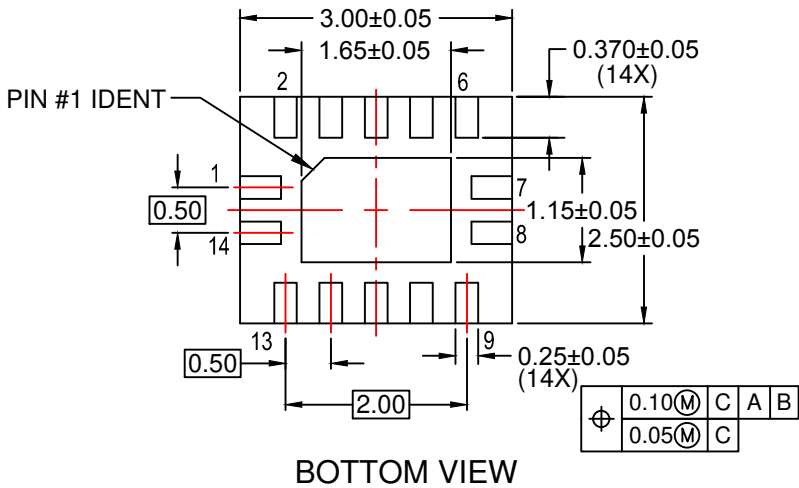
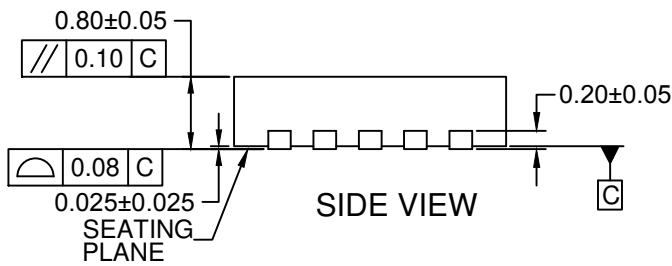
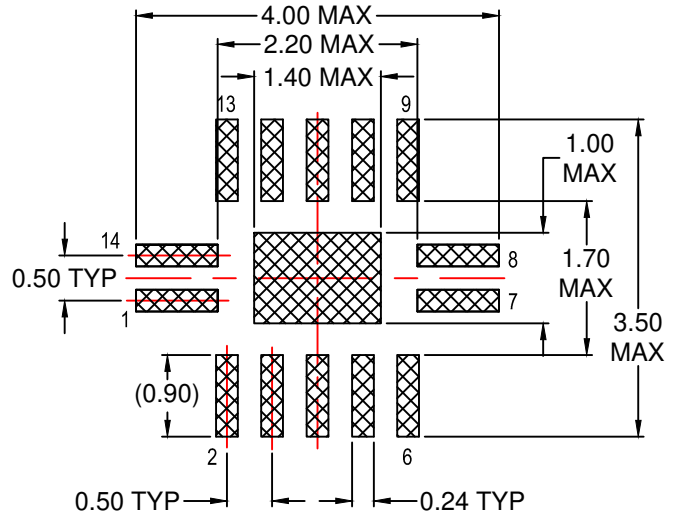
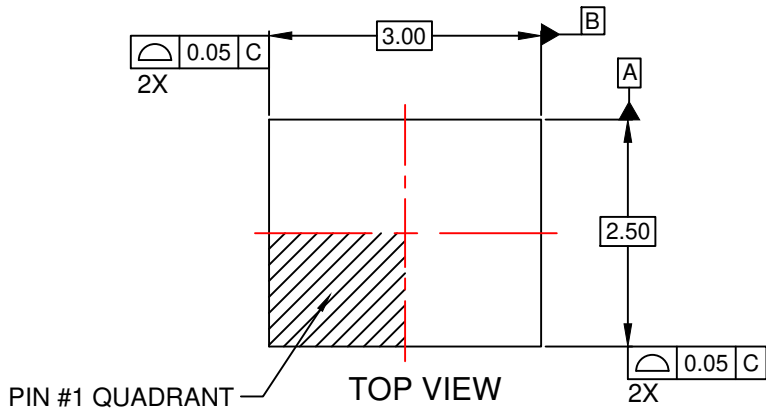




NOTES:

- A. CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS
- D. LAND PATTERN STANDARD: SOIC127P600X145-14M
- E. CONFORMS TO ASME Y14.5M, 2009
- D. DRAWING FILENAME: MKT-M14Arev14





**NOTES:**

- A. CONFORMS TO JEDEC REGISTRATION MO-241, VARIATION AA
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.
- E. DRAWING FILENAME: MKT-MLP14Arev2.



ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative