

# 74LCX14

## Low Voltage Hex Inverter with 5V Tolerant Schmitt Trigger Inputs

### Features

- 5V tolerant inputs
- 2.3V–3.6V  $V_{CC}$  specifications provided
- 6.5ns  $t_{PD}$  max. ( $V_{CC} = 3.3V$ ), 10 $\mu$ A  $I_{CC}$  max.
- Power down high impedance inputs and outputs
- $\pm 24mA$  output drive ( $V_{CC} = 3.0V$ )
- Implements proprietary noise/EMI reduction circuitry
- Latch-up performance exceeds JEDEC 78 conditions
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V
- Leadless DQFN package

### General Description

The LCX14 contains six inverter gates each with a Schmitt trigger input. They are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals. In addition, they have a greater noise margin than conventional inverters.

The LCX14 has hysteresis between the positive-going and negative-going input thresholds (typically 1.0V) which is determined internally by transistor ratios and is essentially insensitive to temperature and supply voltage variations.

The inputs tolerate voltages up to 7V allowing the interface of 5V, 3V and 2.5V systems.

The 74LCX14 is fabricated with advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

### Ordering Information

| Order Number              | Package Number | Package Description                                                                         |
|---------------------------|----------------|---------------------------------------------------------------------------------------------|
| 74LCX14M                  | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow                |
| 74LCX14SJ                 | M14D           | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                               |
| 74LCX14BQX <sup>(1)</sup> | MLP14A         | 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm |
| 74LCX14MTC                | 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.

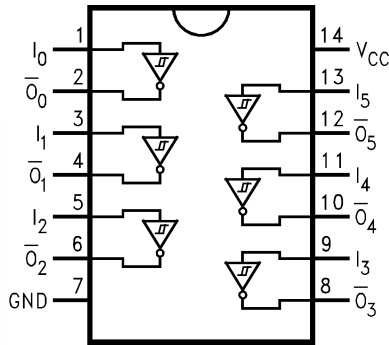
Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.



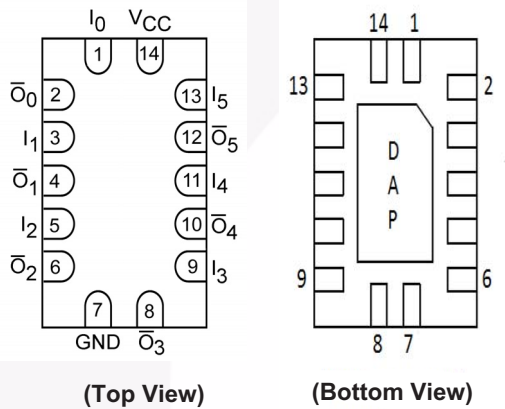
All packages are lead free per JEDEC: J-STD-020B standard.

Connection Diagrams

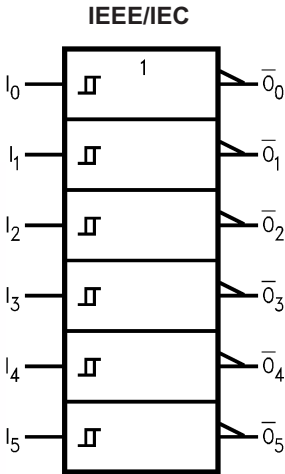
Pin Assignments for SOIC, SOP, and TSSOP



Pad Assignments for DQFN



Logic Symbol



Truth Table

| Input | Output         |
|-------|----------------|
| A     | $\overline{O}$ |
| L     | H              |
| H     | L              |

Pin Description

| Pin Names        | Description |
|------------------|-------------|
| $I_n$            | Inputs      |
| $\overline{O}_n$ | 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 +7.0V           |
| $V_I$     | DC Input Voltage                                              | −0.5V to +7.0V           |
| $V_O$     | DC Output Voltage, Output in HIGH or LOW State <sup>(2)</sup> | −0.5V to $V_{CC} + 0.5V$ |
| $I_{IK}$  | DC Input Diode Current, $V_I < GND$                           | −50mA                    |
| $I_{OK}$  | DC Output Diode Current<br>$V_O < GND$                        | −50mA                    |
|           | $V_O > V_{CC}$                                                | +50mA                    |
| $I_O$     | DC Output Source/Sink Current                                 | ±50mA                    |
| $I_{CC}$  | DC Supply Current per Supply Pin                              | ±100mA                   |
| $I_{GND}$ | DC Ground Current per Ground Pin                              | ±100mA                   |
| $T_{STG}$ | Storage Temperature                                           | −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                              | Min. | Max.     | Units |
|-------------------|----------------------------------------|------|----------|-------|
| $V_{CC}$          | Supply Voltage<br>Operating            | 2.0  | 3.6      | V     |
|                   | Data Retention                         | 1.5  | 3.6      |       |
| $V_I$             | Input Voltage                          | 0    | 5.5      | V     |
| $V_O$             | Output Voltage, HIGH or LOW State      | 0    | $V_{CC}$ | V     |
| $I_{OH} / I_{OL}$ | Output Current<br>$V_{CC} = 3.0V-3.6V$ |      | ±24      | mA    |
|                   | $V_{CC} = 2.7V-3.0V$                   |      | ±12      |       |
|                   | $V_{CC} = 2.3V-2.7V$                   |      | ±8       |       |

**Note:**

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

## DC Electrical Characteristics

| Symbol           | Parameter                             | V <sub>CC</sub> (V) | Conditions                               | T <sub>A</sub> = -40°C to +85°C |      | Units |
|------------------|---------------------------------------|---------------------|------------------------------------------|---------------------------------|------|-------|
|                  |                                       |                     |                                          | Min.                            | Max. |       |
| V <sub>t+</sub>  | Positive Input Threshold              | 2.5                 |                                          | 0.9                             | 1.7  | V     |
|                  |                                       | 3.0                 |                                          | 1.2                             | 2.2  |       |
| V <sub>t-</sub>  | Negative Input Threshold              | 2.5                 |                                          | 0.4                             | 1.1  | V     |
|                  |                                       | 3.0                 |                                          | 0.6                             | 1.5  |       |
| V <sub>H</sub>   | Hysteresis                            | 2.5                 |                                          | 0.3                             | 1.0  | V     |
|                  |                                       | 3.0                 |                                          | 0.4                             | 1.2  |       |
| V <sub>OH</sub>  | HIGH Level Output Voltage             | 2.3–3.6             | I <sub>OH</sub> = -100μA                 | V <sub>CC</sub> - 0.2           |      | V     |
|                  |                                       | 2.3                 | I <sub>OH</sub> = -8mA                   | 1.8                             |      |       |
|                  |                                       | 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                             |      |       |
| V <sub>OL</sub>  | LOW Level Output Voltage              | 2.3–3.6             | I <sub>OL</sub> = 100μA                  |                                 | 0.2  | V     |
|                  |                                       | 2.3                 | I <sub>OL</sub> = 8mA                    |                                 | 0.6  |       |
|                  |                                       | 2.7                 | I <sub>OL</sub> = 12mA                   |                                 | 0.4  |       |
|                  |                                       | 3.0                 | I <sub>OL</sub> = 16mA                   |                                 | 0.4  |       |
|                  |                                       | 3.0                 | I <sub>OL</sub> = 24mA                   |                                 | 0.55 |       |
| I <sub>I</sub>   | Input Leakage Current                 | 2.3–3.6             | 0 ≤ V <sub>I</sub> ≤ 5.5V                |                                 | ±5.0 | μA    |
| I <sub>OFF</sub> | Power-Off Leakage Current             | 0                   | V <sub>I</sub> or V <sub>O</sub> = 5.5V  |                                 | 10   | μA    |
| I <sub>CC</sub>  | Quiescent Supply Current              | 2.3–3.6             | V <sub>I</sub> = V <sub>CC</sub> or GND  |                                 | 10   | μA    |
|                  |                                       |                     | 3.6V ≤ V <sub>I</sub> ≤ 5.5V             |                                 | ±10  |       |
| ΔI <sub>CC</sub> | Increase in I <sub>CC</sub> per Input | 2.3–3.6             | V <sub>IH</sub> = V <sub>CC</sub> - 0.6V |                                 | 500  | μA    |

## AC Electrical Characteristics

| Symbol                                | Parameter                            | T <sub>A</sub> = −40°C to +85°C, R <sub>L</sub> = 500Ω  |      |                                                  |      |                                                         |      | Units |
|---------------------------------------|--------------------------------------|---------------------------------------------------------|------|--------------------------------------------------|------|---------------------------------------------------------|------|-------|
|                                       |                                      | V <sub>CC</sub> = 3.3V ± 0.3V,<br>C <sub>L</sub> = 50pF |      | V <sub>CC</sub> = 2.7V,<br>C <sub>L</sub> = 50pF |      | V <sub>CC</sub> = 2.5V ± 0.2V,<br>C <sub>L</sub> = 30pF |      |       |
|                                       |                                      | Min.                                                    | Max. | Min.                                             | Max. | Min.                                                    | Max. |       |
| t <sub>PHL</sub> , t <sub>PLH</sub>   | Propagation Delay                    | 1.5                                                     | 6.5  | 1.5                                              | 7.5  | 1.5                                                     | 7.8  | ns    |
| t <sub>OSHL</sub> , t <sub>OSLH</sub> | Output to Output Skew <sup>(4)</sup> |                                                         | 1.0  |                                                  |      |                                                         |      | ns    |

## Note:

4. 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>OSHL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>).

**Dynamic Switching Characteristics**

| Symbol    | Parameter                            | $V_{CC}$ (V) | Conditions                                                          | $T_A = 25^\circ\text{C}$ | Unit |
|-----------|--------------------------------------|--------------|---------------------------------------------------------------------|--------------------------|------|
|           |                                      |              |                                                                     | Typical                  |      |
| $V_{OLP}$ | Quiet Output Dynamic Peak $V_{OL}$   | 3.3          | $C_L = 50\text{pF}$ , $V_{IH} = 3.3\text{V}$ , $V_{IL} = 0\text{V}$ | 0.8                      | V    |
|           |                                      | 2.5          | $C_L = 30\text{pF}$ , $V_{IH} = 2.5\text{V}$ , $V_{IL} = 0\text{V}$ | 0.6                      |      |
| $V_{OLV}$ | Quiet Output Dynamic Valley $V_{OL}$ | 3.3          | $C_L = 50\text{pF}$ , $V_{IH} = 3.3\text{V}$ , $V_{IL} = 0\text{V}$ | -0.8                     | V    |
|           |                                      | 2.5          | $C_L = 30\text{pF}$ , $V_{IH} = 2.5\text{V}$ , $V_{IL} = 0\text{V}$ | -0.6                     |      |

**Capacitance**

| Symbol    | Parameter                     | Conditions                                                                  | Typical | Units |
|-----------|-------------------------------|-----------------------------------------------------------------------------|---------|-------|
| $C_{IN}$  | Input Capacitance             | $V_{CC} = \text{Open}$ , $V_I = 0\text{V}$ or $V_{CC}$                      | 7       | pF    |
| $C_{OUT}$ | Output Capacitance            | $V_{CC} = 3.3\text{V}$ , $V_I = 0\text{V}$ or $V_{CC}$                      | 8       | pF    |
| $C_{PD}$  | Power Dissipation Capacitance | $V_{CC} = 3.3\text{V}$ , $V_I = 0\text{V}$ or $V_{CC}$ , $f = 10\text{MHz}$ | 25      | pF    |

# AC Loading and Waveforms (Generic for LCX Family)

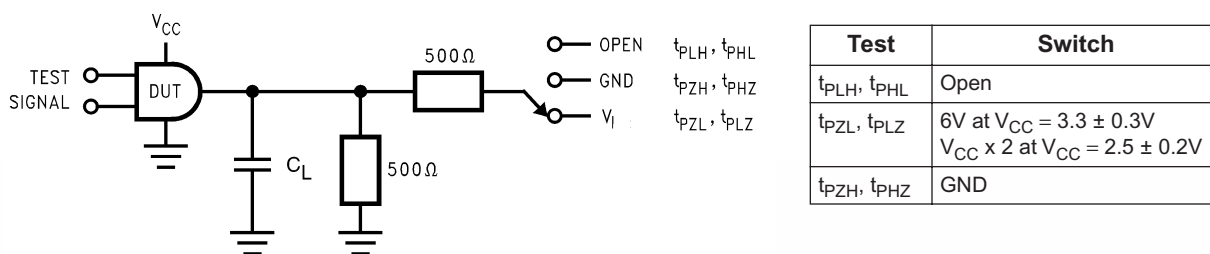
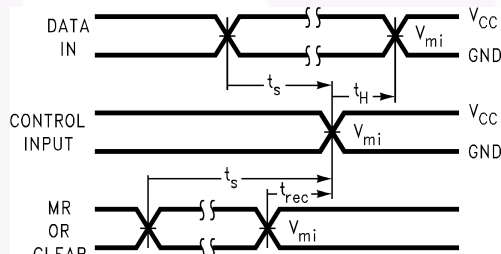
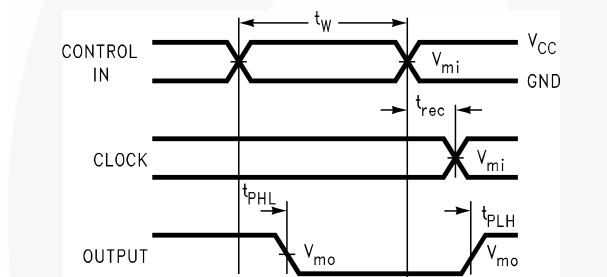
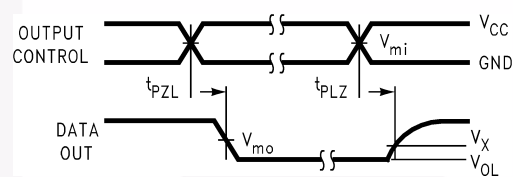
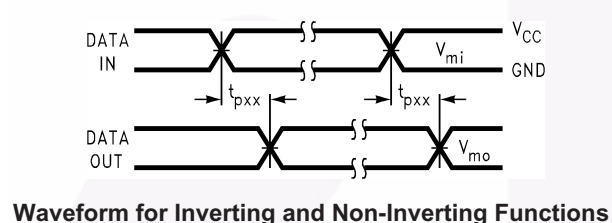
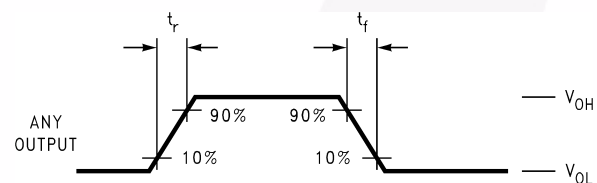
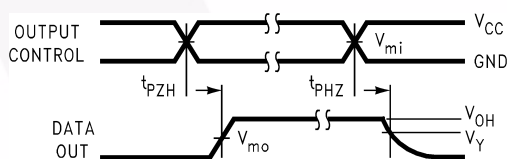


Figure 1. AC Test Circuit ( $C_L$  includes probe and jig capacitance)



Propagation Delay, Pulse Width and  $t_{rec}$  Waveforms

Setup Time, Hold Time and Recovery Time for Logic



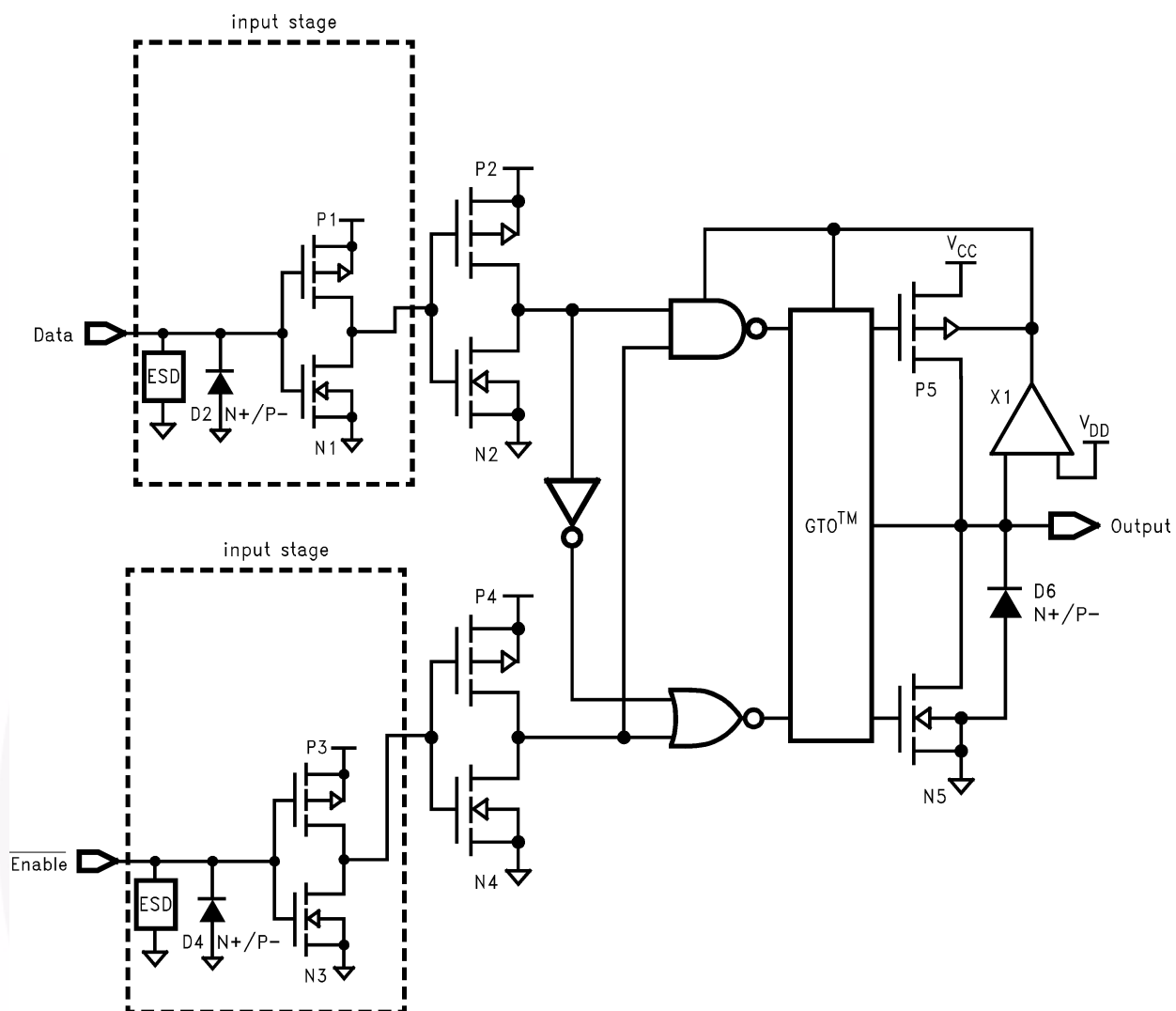
3-STATE Output Low Enable and Disable Times for Logic

$t_{rise}$  and  $t_{fall}$

| Symbol   | $V_{CC}$        |                 |                  |
|----------|-----------------|-----------------|------------------|
|          | $3.3V \pm 0.3V$ | 2.7V            | $2.5V \pm 0.2V$  |
| $V_{mi}$ | 1.5V            | 1.5V            | $V_{CC}/2$       |
| $V_{mo}$ | 1.5V            | 1.5V            | $V_{CC}/2$       |
| $V_x$    | $V_{OL} + 0.3V$ | $V_{OL} + 0.3V$ | $V_{OL} + 0.15V$ |
| $V_y$    | $V_{OH} - 0.3V$ | $V_{OH} - 0.3V$ | $V_{OH} - 0.15V$ |

Figure 2. Waveforms (Input Characteristics;  $f = 1MHz$ ,  $t_r = t_f = 3ns$ )

**Schematic Diagram** (Generic for LCX Family)

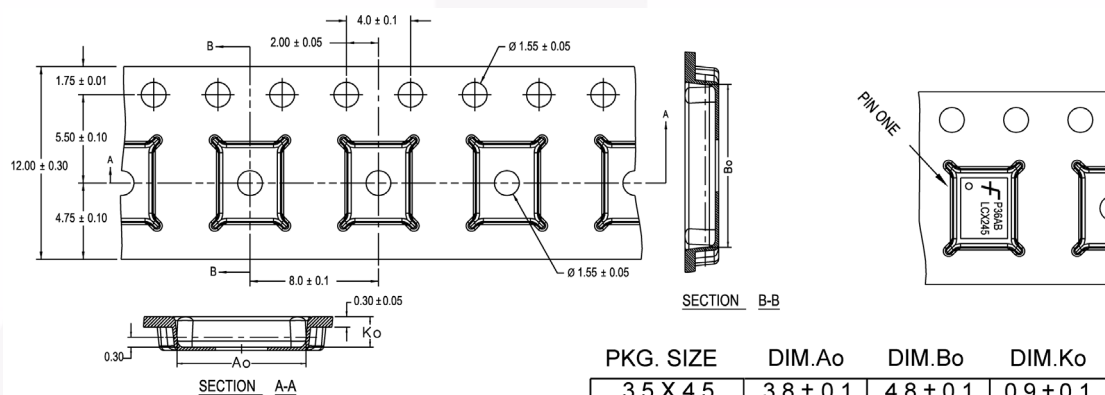


## Tape and Reel Specification

### 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            |

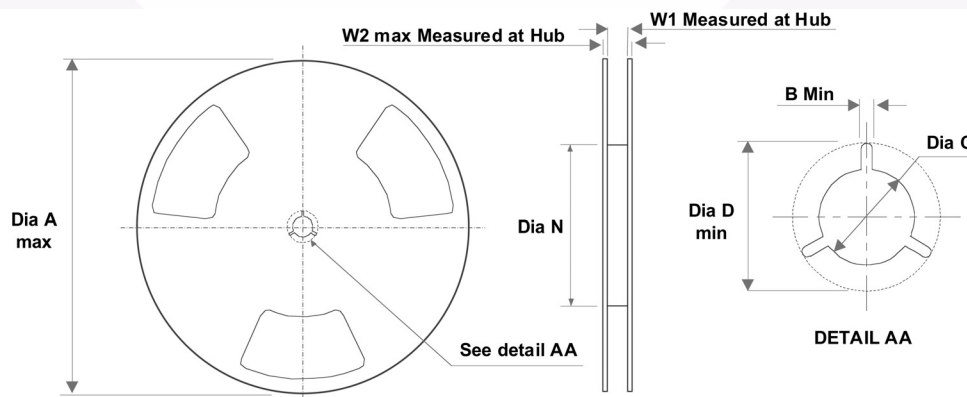
### Tape Dimensions inches (millimeters)



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) |



## Physical Dimensions

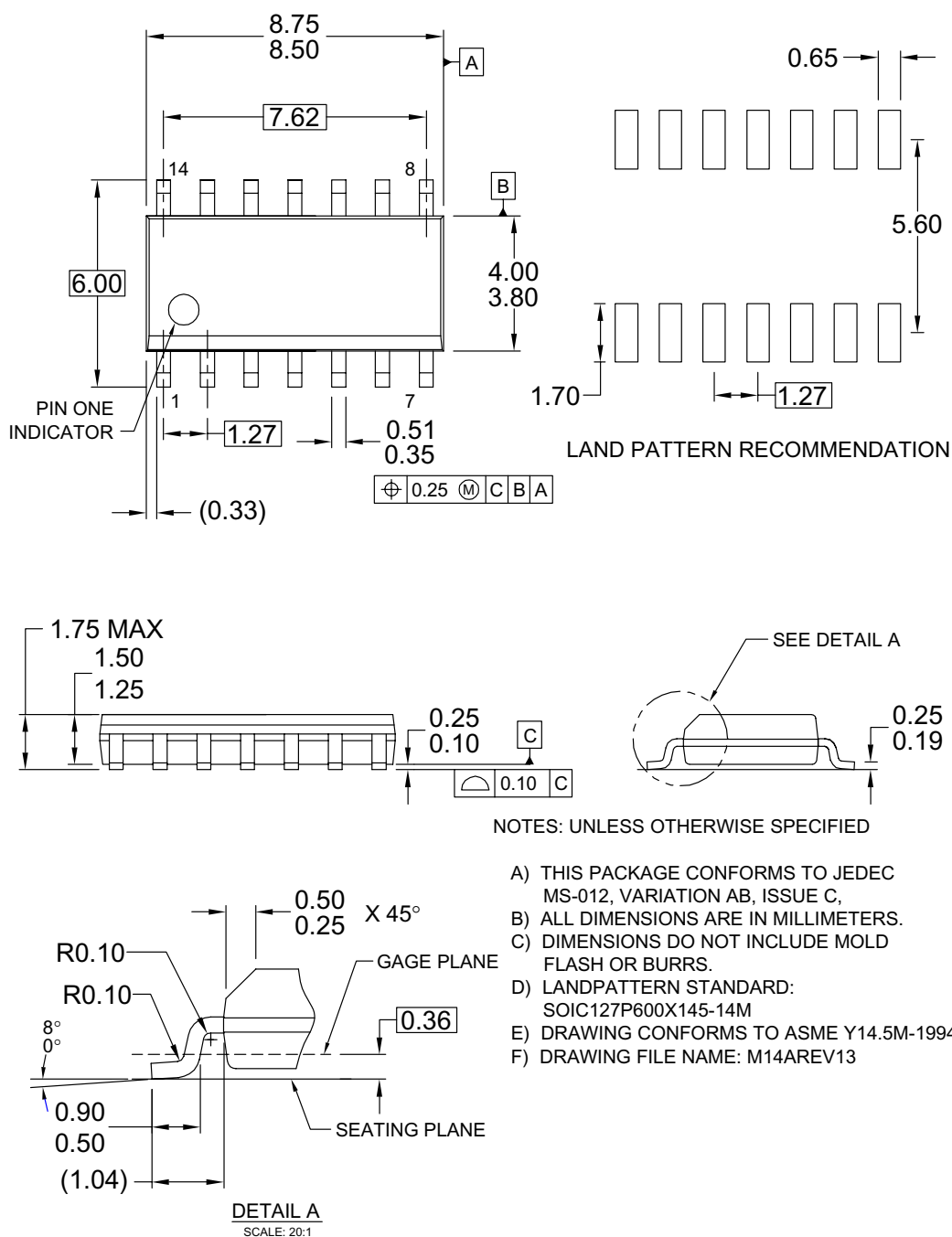


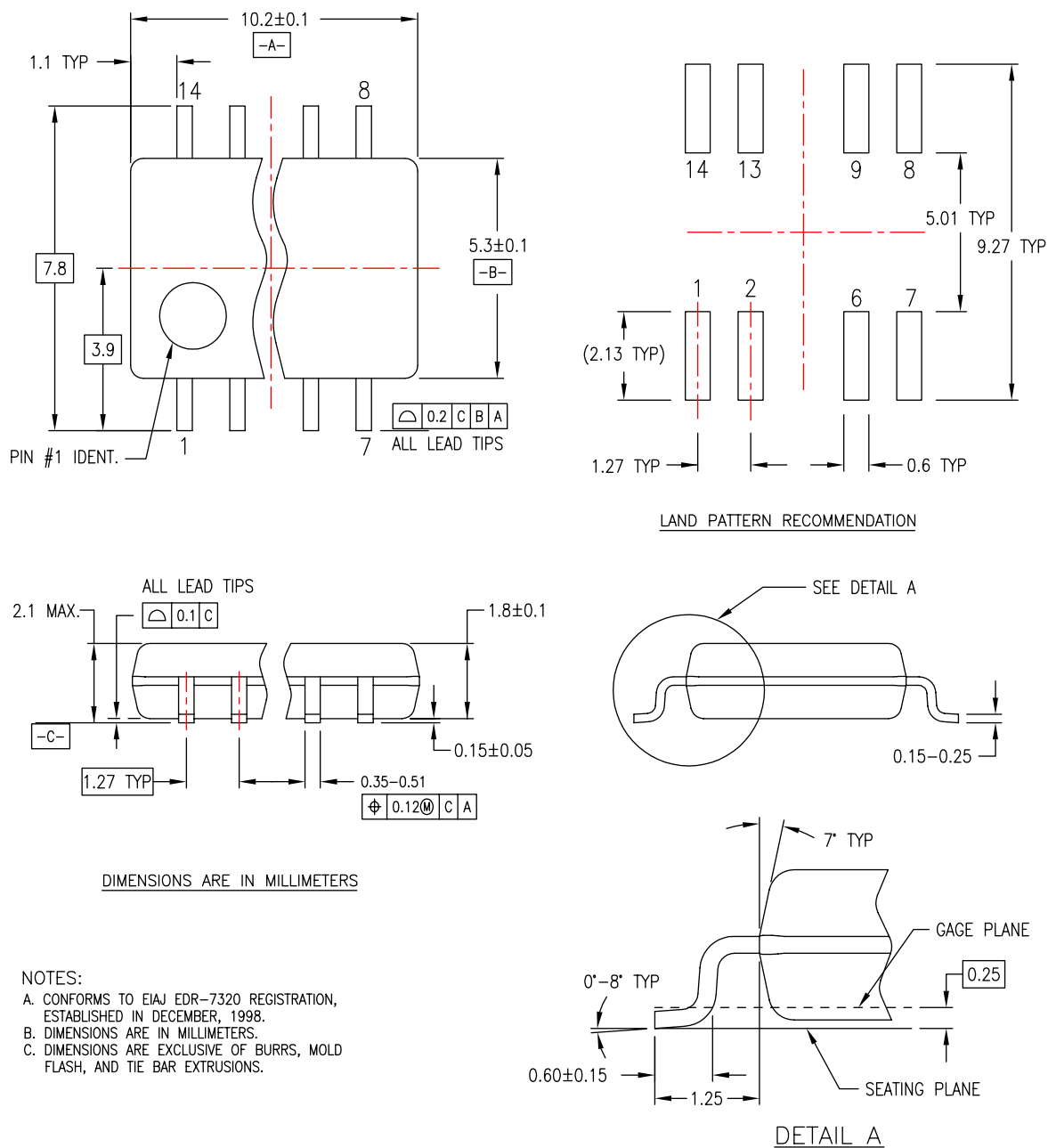
Figure 3. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

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# Physical Dimensions (Continued)



## NOTES:

- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M14DREVC

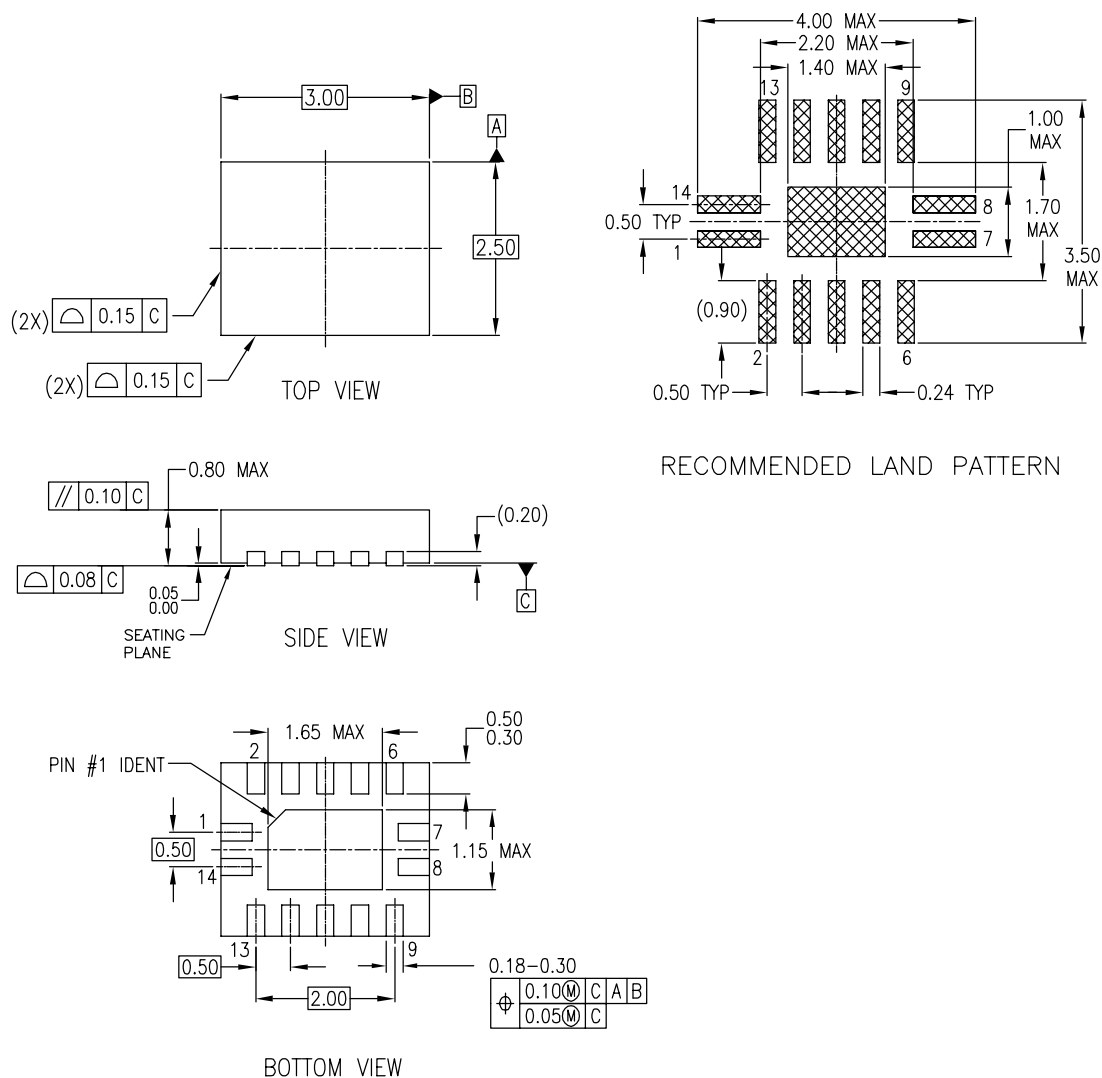
**Figure 4. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**

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## Physical Dimensions (Continued)



## NOTES:

- CONFORMS TO JEDEC REGISTRATION MO-241, VARIATION AA
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

MLP14ArevA

**Figure 5. 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm**

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## Physical Dimensions (Continued)

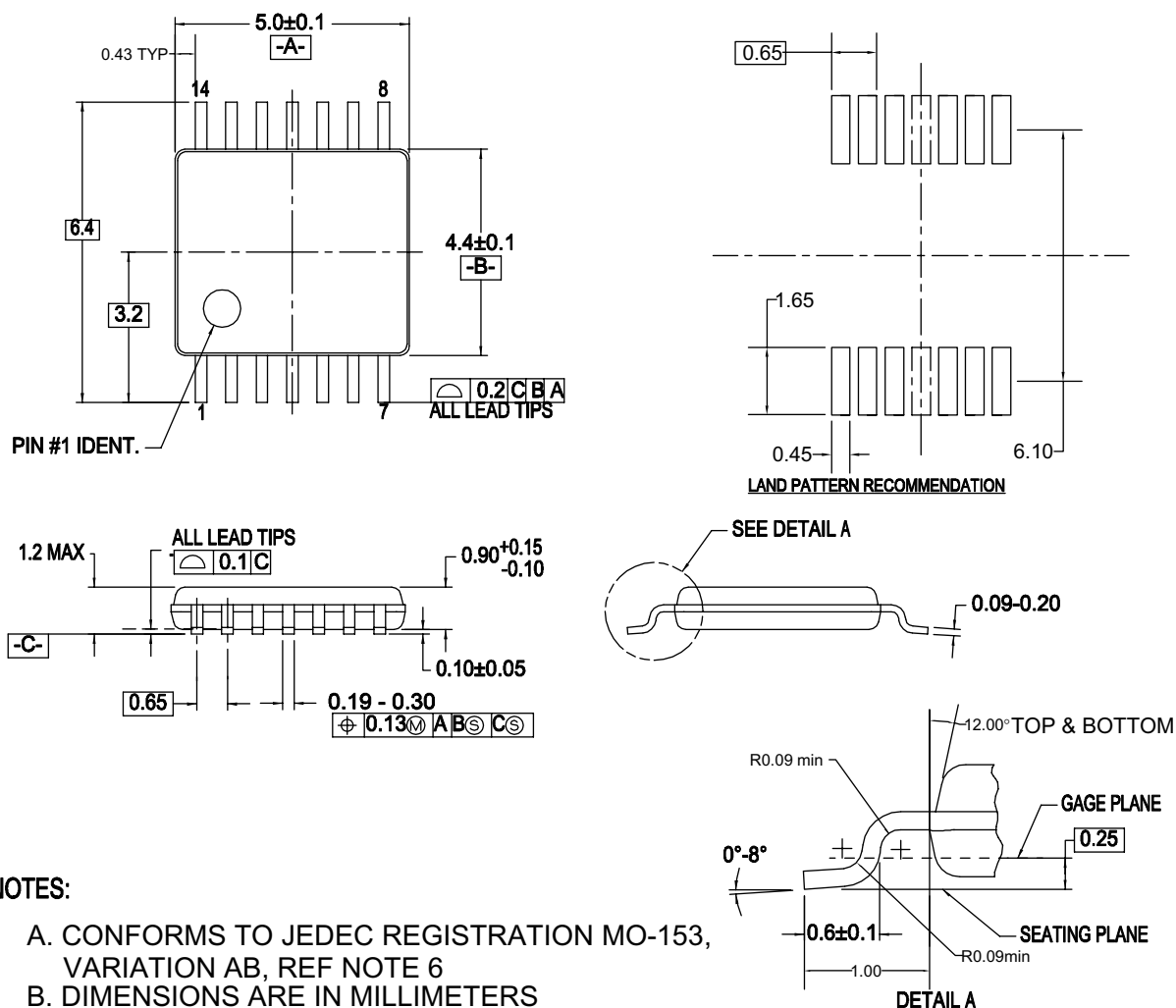


Figure 6. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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| AX-CAP®*                                                                          | FRFET®                                         | PowerXS™                                                                          |  |
| BitSiC™                                                                           | Global Power Resource <sup>SM</sup>            | PowerTrench®                                                                      | TinyBoost®                                                                          |
| Build it Now™                                                                     | GreenBridge™                                   | PowerXS™                                                                          | TinyBuck®                                                                           |
| CorePLUS™                                                                         | Green FPS™                                     | Programmable Active Droop™                                                        | TinyCalc™                                                                           |
| CorePOWER™                                                                        | Green FPS™ e-Series™                           | QFET®                                                                             | TinyLogic®                                                                          |
| CROSSVOLT™                                                                        | Gmax™                                          | QS™                                                                               | TINYOPTO™                                                                           |
| CTL™                                                                              | GTO™                                           | Quiet Series™                                                                     | TinyPower™                                                                          |
| Current Transfer Logic™                                                           | IntelliMAX™                                    | RapidConfigure™                                                                   | TinyPWM™                                                                            |
| DEUXPEED®                                                                         | ISOPLANAR™                                     |  | TinyWire™                                                                           |
| Dual Cool™                                                                        | Making Small Speakers Sound Louder and Better™ | Saving our world, 1mW/W/kW at a time™                                             | TranSiC™                                                                            |
| EcoSPARK®                                                                         | MegaBuck™                                      | SignalWise™                                                                       | TriFault Detect™                                                                    |
| EfficientMax™                                                                     | MICROCOUPLER™                                  | SmartMax™                                                                         | TRUECURRENT®*                                                                       |
| ESBC™                                                                             | MicroFET™                                      | SMART START™                                                                      | μSerDes™                                                                            |
|  | MicroPak™                                      | Solutions for Your Success™                                                       |  |
| Fairchild®                                                                        | MicroPak2™                                     | SPM®                                                                              | UHC®                                                                                |
| Fairchild Semiconductor®                                                          | MillerDrive™                                   | STEALTH™                                                                          | Ultra FRFET™                                                                        |
| FACT Quiet Series™                                                                | MotionMax™                                     | SuperFET®                                                                         | UniFET™                                                                             |
| FACT®                                                                             | mWSaver®                                       | SuperSOT™-3                                                                       | VCX™                                                                                |
| FAST®                                                                             | OptoHiT™                                       | SuperSOT™-6                                                                       | VisualMax™                                                                          |
| FastvCore™                                                                        | OPTOLOGIC®                                     | SuperSOT™-8                                                                       | VoltagePlus™                                                                        |
| FETBench™                                                                         | OPTOPLANAR®                                    | SupreMOS®                                                                         | XS™                                                                                 |
| FPS™                                                                              |                                                | SyncFET™                                                                          |                                                                                     |

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## ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, [www.fairchildsemi.com](http://www.fairchildsemi.com), under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status        | Definition                                                                                                                                                                                          |
|--------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                       |
| Preliminary              | First Production      | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production       | Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.                                               |
| Obsolete                 | Not In Production     | Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.                                                    |

Rev. I66

# AMEYA360

Components Supply Platform

Authorized Distribution Brand :



Website :

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