

# 74AC14, 74ACT14

## Hex Inverter with Schmitt Trigger Input

### Features

- $I_{CC}$  reduced by 50%
- Outputs source/sink 24mA
- 74ACT14 has TTL-compatible inputs

### General Description

The 74AC14 and 74ACT14 contain 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.

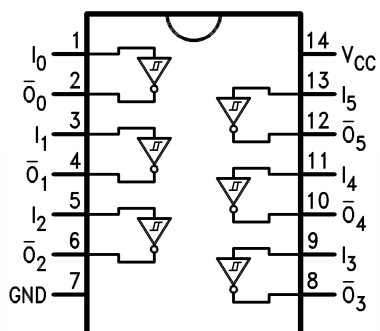
The 74AC14 and 74ACT14 have hysteresis between the positive-going and negative-going input thresholds (typically 1.0V) which is determined internally by transistor ratios and is essentially insensitive to temperature and supply voltage variations.

### Ordering Information

| Order Number | Package Number | Package Description                                                          |
|--------------|----------------|------------------------------------------------------------------------------|
| 74AC14SC     | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| 74AC14SJ     | M14D           | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                |
| 74AC14MTC    | MTC14          | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  |
| 74ACT14SC    | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| 74ACT14MTC   | MTC14          | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  |

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

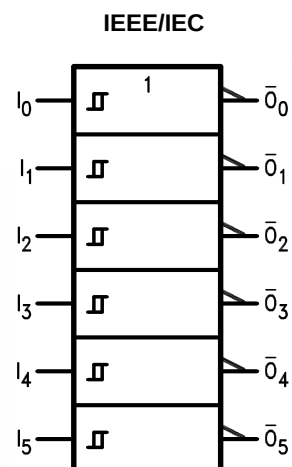
## Connection Diagram



## Pin Description

| Pin Names   | Description |
|-------------|-------------|
| $I_n$       | Inputs      |
| $\bar{O}_n$ | Outputs     |

## Logic Symbol



## Function Table

| Input | Output |
|-------|--------|
| A     | O      |
| L     | H      |
| H     | L      |

## 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           |
| $I_{IK}$              | DC Input Diode Current<br>$V_I = -0.5V$      | −20mA                    |
|                       | $V_I = V_{CC} + 1.5$                         | +20mA                    |
| $V_I$                 | DC Input Voltage                             | −0.5V to $V_{CC} + 1.5V$ |
| $I_{OK}$              | DC Output Diode Current<br>$V_O = -0.5V$     | −20mA                    |
|                       | $V_O = V_{CC} + 0.5V$                        | +20mA                    |
| $V_O$                 | DC Output Voltage                            | −0.5V to $V_{CC} + 0.5V$ |
| $I_O$                 | DC Output Source or Sink Current             | ±50mA                    |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current per Output Pin | ±50mA                    |
| $T_{STG}$             | Storage Temperature                          | −65°C to +150°C          |
| $T_J$                 | Junction Temperature                         | 140°C                    |

## Recommended Operating Conditions

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         |
|----------|-----------------------|----------------|
| $V_{CC}$ | Supply Voltage<br>AC  | 2.0V to 6.0V   |
|          | ACT                   | 4.5V to 5.5V   |
| $V_I$    | Input Voltage         | 0V to $V_{CC}$ |
| $V_O$    | Output Voltage        | 0V to $V_{CC}$ |
| $T_A$    | Operating Temperature | −40°C to +85°C |

## DC Electrical Characteristics for AC

| Symbol                         | Parameter                         | V <sub>CC</sub> | Conditions                               | T <sub>A</sub> = +25°C |                   | T <sub>A</sub> = −40°C<br>to +85°C | Units |
|--------------------------------|-----------------------------------|-----------------|------------------------------------------|------------------------|-------------------|------------------------------------|-------|
|                                |                                   | (V)             |                                          | Typ                    | Guaranteed Limits |                                    |       |
| V <sub>OH</sub>                | Minimum HIGH Level Output Voltage | 3.0             | I <sub>OUT</sub> = −50μA                 | 2.99                   | 2.9               | 2.9                                | V     |
|                                |                                   | 4.5             |                                          | 4.49                   | 4.4               | 4.4                                |       |
|                                |                                   | 5.5             |                                          | 5.49                   | 5.4               | 5.4                                |       |
|                                |                                   | 3.0             | I <sub>OH</sub> = 12mA                   |                        | 2.56              | 2.46                               |       |
|                                |                                   | 4.5             | I <sub>OH</sub> = 24mA                   |                        | 3.86              | 3.76                               |       |
|                                |                                   | 5.5             | I <sub>OH</sub> = 24mA <sup>(1)</sup>    |                        | 4.86              | 4.76                               |       |
| V <sub>OL</sub>                | Maximum LOW Level Output Voltage  | 3.0             | I <sub>OUT</sub> = 50μA                  | 0.002                  | 0.1               | 0.1                                | V     |
|                                |                                   | 4.5             |                                          | 0.001                  | 0.1               | 0.1                                |       |
|                                |                                   | 5.5             |                                          | 0.001                  | 0.1               | 0.1                                |       |
|                                |                                   | 3.0             | I <sub>OL</sub> = 12mA                   |                        | 0.36              | 0.44                               |       |
|                                |                                   | 4.5             | I <sub>OL</sub> = 24mA                   |                        | 0.36              | 0.44                               |       |
|                                |                                   | 5.5             | I <sub>OL</sub> = 24mA <sup>(1)</sup>    |                        | 0.36              | 0.44                               |       |
| I <sub>IN</sub> <sup>(3)</sup> | Maximum Input Leakage Current     | 5.5             | V <sub>I</sub> = V <sub>CC</sub> , GND   |                        | ±0.1              | ±1.0                               | μA    |
| V <sub>t+</sub>                | Maximum Positive Threshold        | 3.0             | T <sub>A</sub> = Worst Case              |                        | 2.2               | 2.2                                | V     |
|                                |                                   | 4.5             |                                          |                        | 3.2               | 3.2                                |       |
|                                |                                   | 5.5             |                                          |                        | 3.9               | 3.9                                |       |
| V <sub>t−</sub>                | Minimum Negative Threshold        | 3.0             | T <sub>A</sub> = Worst Case              |                        | 0.5               | 0.5                                | V     |
|                                |                                   | 4.5             |                                          |                        | 0.9               | 0.9                                |       |
|                                |                                   | 5.5             |                                          |                        | 1.1               | 1.1                                |       |
| V <sub>H(MAX)</sub>            | Maximum Hysteresis                | 3.0             | T <sub>A</sub> = Worst Case              |                        | 1.2               | 1.2                                | V     |
|                                |                                   | 4.5             |                                          |                        | 1.4               | 1.4                                |       |
|                                |                                   | 5.5             |                                          |                        | 1.6               | 1.6                                |       |
| V <sub>H(MIN)</sub>            | Minimum Hysteresis                | 3.0             | T <sub>A</sub> = Worst Case              |                        | 0.3               | 0.3                                | V     |
|                                |                                   | 4.5             |                                          |                        | 0.4               | 0.4                                |       |
|                                |                                   | 5.5             |                                          |                        | 0.5               | 0.5                                |       |
| I <sub>OLD</sub>               | Minimum Dynamic                   | 5.5             | V <sub>OLD</sub> = 1.65V Max.            |                        |                   | 75                                 | mA    |
| I <sub>OHD</sub>               | Output Current <sup>(2)</sup>     | 5.5             | V <sub>OHD</sub> = 3.85V Min.            |                        |                   | −75                                | mA    |
| I <sub>CC</sub> <sup>(3)</sup> | Maximum Quiescent Supply Current  | 5.5             | V <sub>IN</sub> = V <sub>CC</sub> or GND |                        | 2.0               | 20.0                               | μA    |

## Notes:

1. All outputs loaded; thresholds on input associated with output under test.
2. Maximum test duration 2.0ms, one output loaded at a time.
3.  $I_{IN}$  and  $I_{CC}$  @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V  $V_{CC}$ .

## DC Electrical Characteristics for ACT

| Symbol              | Parameter                                     | V <sub>CC</sub><br>(V) | Conditions                                                                                       | T <sub>A</sub> = +25°C |                   | T <sub>A</sub> = −40°C to +85°C |  | Units |
|---------------------|-----------------------------------------------|------------------------|--------------------------------------------------------------------------------------------------|------------------------|-------------------|---------------------------------|--|-------|
|                     |                                               |                        |                                                                                                  | Typ.                   | Guaranteed Limits |                                 |  |       |
| V <sub>IH</sub>     | Minimum HIGH Level Input Voltage              | 4.5                    | V <sub>OUT</sub> = 0.1V or<br>V <sub>CC</sub> − 0.1V                                             | 1.5                    | 2.0               | 2.0                             |  | V     |
|                     |                                               | 5.5                    |                                                                                                  | 1.5                    | 2.0               | 2.0                             |  |       |
| V <sub>IL</sub>     | Maximum LOW Level Input Voltage               | 4.5                    | V <sub>OUT</sub> = 0.1V or<br>V <sub>CC</sub> − 0.1V                                             | 1.5                    | 0.8               | 0.8                             |  | V     |
|                     |                                               | 5.5                    |                                                                                                  | 1.5                    | 0.8               | 0.8                             |  |       |
| V <sub>OH</sub>     | Minimum HIGH Level Output Voltage             | 4.5                    | I <sub>OUT</sub> = −50μA                                                                         | 4.49                   | 4.34              | 4.4                             |  | V     |
|                     |                                               | 5.5                    |                                                                                                  | 5.49                   | 5.4               | 5.4                             |  |       |
|                     |                                               | 4.5                    | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> ,<br>I <sub>OH</sub> = −24mA                |                        | 3.86              | 3.76                            |  |       |
|                     |                                               | 5.5                    | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> ,<br>I <sub>OH</sub> = −24mA <sup>(4)</sup> |                        | 4.86              | 4.76                            |  |       |
| V <sub>OL</sub>     | Maximum LOW Level Output Voltage              | 4.5                    | I <sub>OUT</sub> = 50μA                                                                          | 0.001                  | 0.1               | 0.1                             |  | V     |
|                     |                                               | 5.5                    |                                                                                                  | 0.001                  | 0.1               | 0.1                             |  |       |
|                     |                                               | 4.5                    | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> ,<br>I <sub>OL</sub> = 24mA                 |                        | 0.36              | 0.44                            |  |       |
|                     |                                               | 5.5                    | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> ,<br>I <sub>OL</sub> = 24mA <sup>(4)</sup>  |                        | 0.36              | 0.44                            |  |       |
| I <sub>IN</sub>     | Maximum Input Leakage Current                 | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> , GND                                                           |                        | ±0.1              | ±1.0                            |  | μA    |
| V <sub>H(MAX)</sub> | Maximum Hysteresis                            | 4.5                    | T <sub>A</sub> = Worst Case                                                                      |                        | 1.4               | 1.4                             |  | V     |
|                     |                                               | 5.5                    |                                                                                                  |                        | 1.6               | 1.6                             |  |       |
| V <sub>H(MIN)</sub> | Minimum Hysteresis                            | 4.5                    | T <sub>A</sub> = Worst Case                                                                      |                        | 0.4               | 0.4                             |  | V     |
|                     |                                               | 5.5                    |                                                                                                  |                        | 0.5               | 0.5                             |  |       |
| V <sub>t+</sub>     | Maximum Positive Threshold                    | 4.5                    | T <sub>A</sub> = Worst Case                                                                      |                        | 2.0               | 2.0                             |  | V     |
|                     |                                               | 5.5                    |                                                                                                  |                        | 2.0               | 2.0                             |  |       |
| V <sub>t−</sub>     | Minimum Negative Threshold                    | 4.5                    | T <sub>A</sub> = Worst Case                                                                      |                        | 0.8               | 0.8                             |  | V     |
|                     |                                               | 5.5                    |                                                                                                  |                        | 0.8               | 0.8                             |  |       |
| I <sub>CCT</sub>    | Maximum I <sub>CC</sub> /Input                | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> − 2.1V                                                          | 0.6                    |                   | 1.5                             |  | mA    |
| I <sub>OLD</sub>    | Minimum Dynamic Output Current <sup>(5)</sup> | 5.5                    | V <sub>OLD</sub> = 1.65V Max.                                                                    |                        |                   | 75                              |  | mA    |
| I <sub>OHD</sub>    |                                               | 5.5                    | V <sub>OHD</sub> = 3.85V Min.                                                                    |                        |                   | −75                             |  | mA    |
| I <sub>CC</sub>     | Maximum Quiescent Supply Current              | 5.5                    | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                         |                        | 2.0               | 20.0                            |  | μA    |

## Notes:

4. All outputs loaded; thresholds on input associated with output under test.
5. Maximum test duration 2.0ms, one output loaded at a time.

**AC Electrical Characteristics for AC**

| Symbol    | Parameter         | $V_{CC}$ (V) <sup>(6)</sup> | $T_A = +25^\circ\text{C}$ ,<br>$C_L = 50\text{pF}$ |      |      | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ ,<br>$C_L = 50\text{pF}$ |      | Units |
|-----------|-------------------|-----------------------------|----------------------------------------------------|------|------|--------------------------------------------------------------------------|------|-------|
|           |                   |                             | Min.                                               | Typ. | Max. | Min.                                                                     | Max. |       |
| $t_{PLH}$ | Propagation Delay | 3.3                         | 1.5                                                | 9.5  | 13.5 | 1.5                                                                      | 15.0 | ns    |
|           |                   | 5.0                         | 1.5                                                | 7.0  | 10.0 | 1.5                                                                      | 11.0 |       |
| $t_{PHL}$ | Propagation Delay | 3.3                         | 1.5                                                | 7.5  | 11.5 | 1.5                                                                      | 13.0 | ns    |
|           |                   | 5.0                         | 1.5                                                | 6.0  | 8.5  | 1.5                                                                      | 9.5  |       |

**Note:**

6. Voltage range 3.3 is  $3.3\text{V} \pm 0.3\text{V}$ . Voltage range 5.0 is  $5.0\text{V} \pm 0.5\text{V}$ .

**AC Electrical Characteristics for ACT**

| Symbol    | Parameter         | $V_{CC}$ (V) <sup>(7)</sup> | $T_A = +25^\circ\text{C}$ ,<br>$C_L = 50\text{pF}$ |      |      | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ ,<br>$C_L = 50\text{pF}$ |      | Units |
|-----------|-------------------|-----------------------------|----------------------------------------------------|------|------|--------------------------------------------------------------------------|------|-------|
|           |                   |                             | Min.                                               | Typ. | Max. | Min.                                                                     | Max. |       |
| $t_{PLH}$ | Propagation Delay | 5.0                         | 3.0                                                | 8.0  | 10.0 | 3.0                                                                      | 11.0 | ns    |
| $t_{PHL}$ | Propagation Delay | 5.0                         | 3.0                                                | 8.0  | 10.0 | 3.0                                                                      | 11.0 | ns    |

**Note:**

7. Voltage Range 5.0 is  $5.0\text{V} \pm 0.5\text{V}$ .

**Capacitance**

| Symbol   | Parameter                           | Conditions             | Typ  | Units |
|----------|-------------------------------------|------------------------|------|-------|
| $C_{IN}$ | Input Capacitance                   | $V_{CC} = \text{OPEN}$ | 4.5  | pF    |
| $C_{PD}$ | Power Dissipation Capacitance<br>AC | $V_{CC} = 5.0\text{V}$ | 25.0 | pF    |
|          | ACT                                 |                        | 80   |       |

## Physical Dimensions

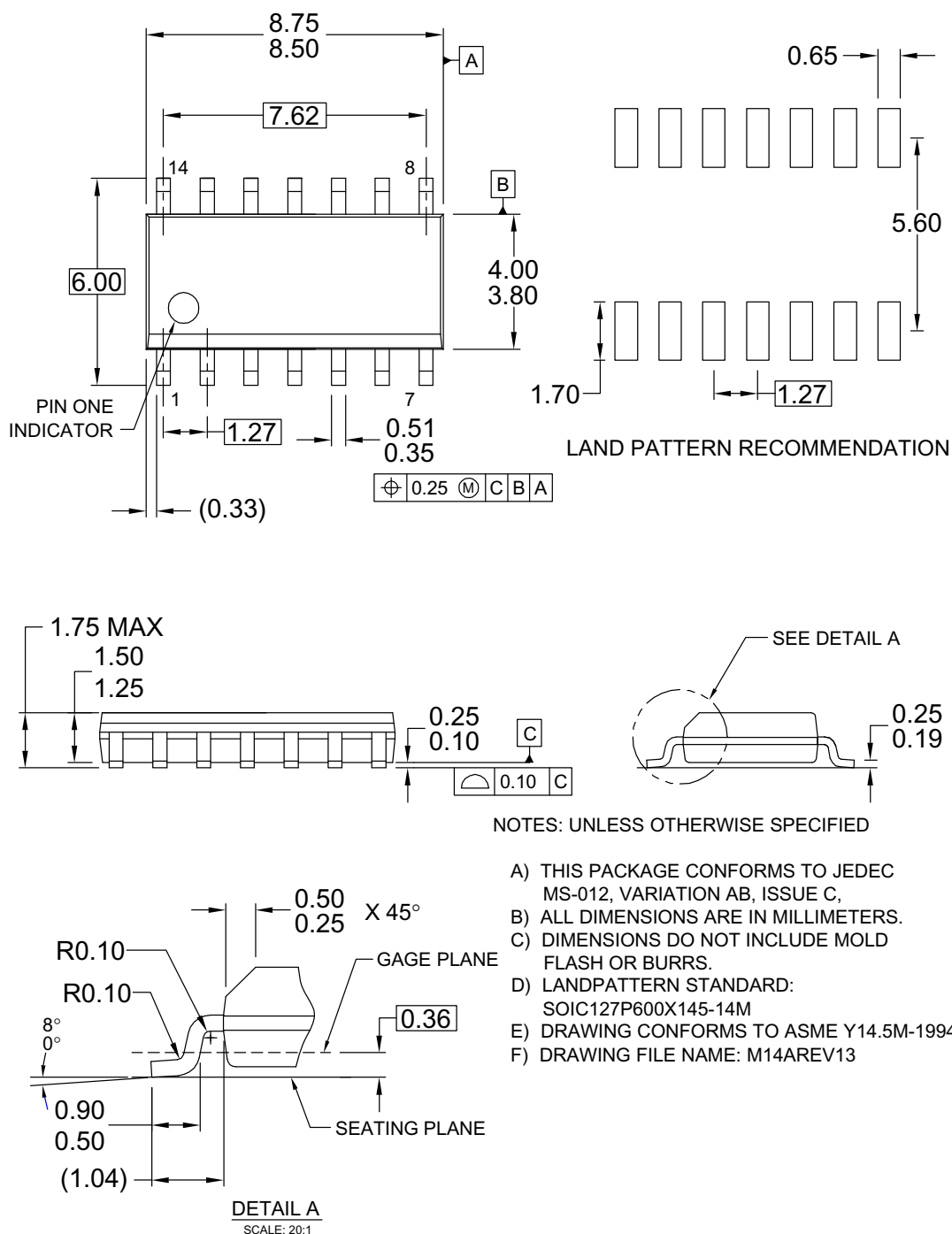


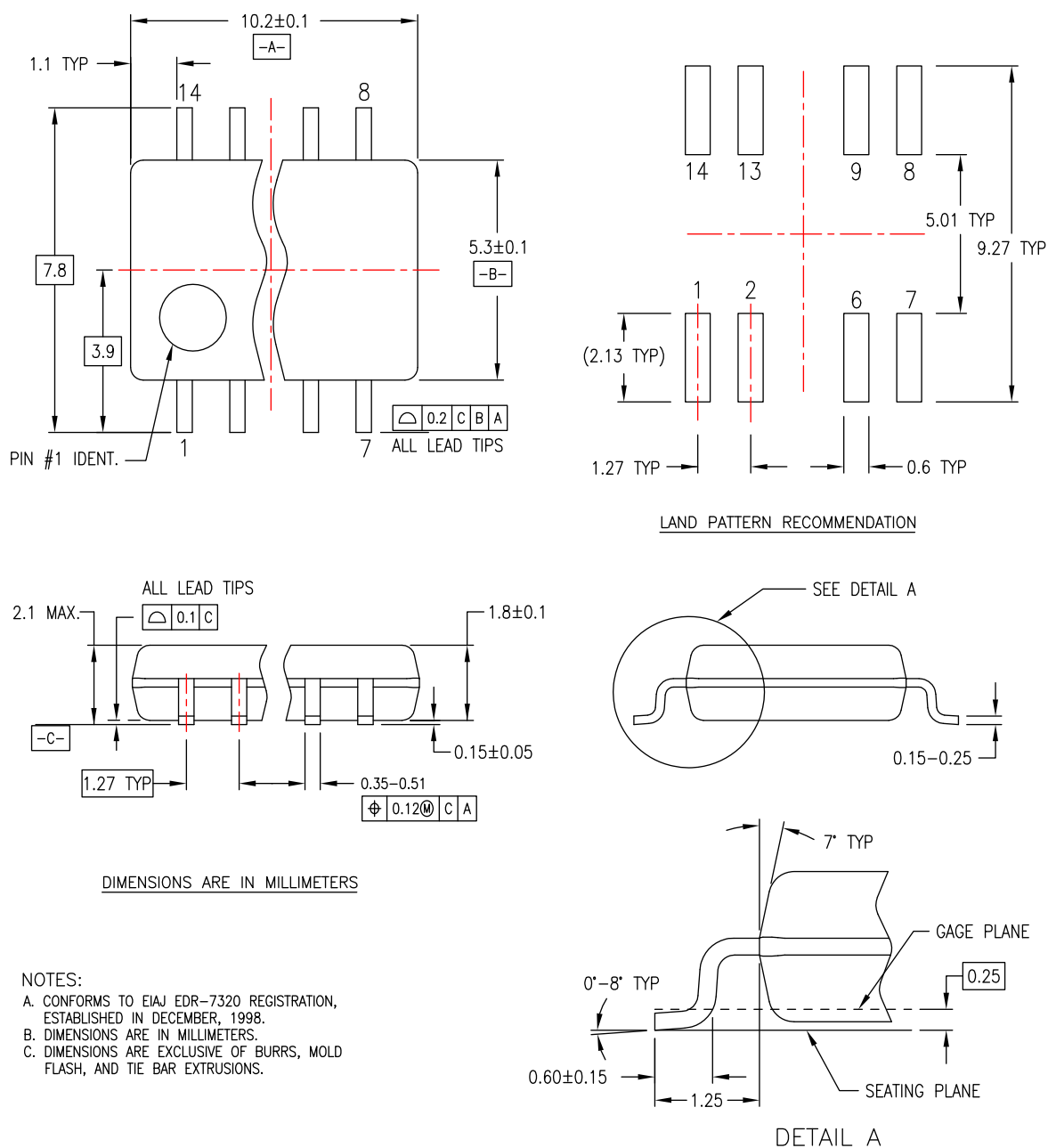
Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

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### Physical Dimensions (Continued)



M14DREVC

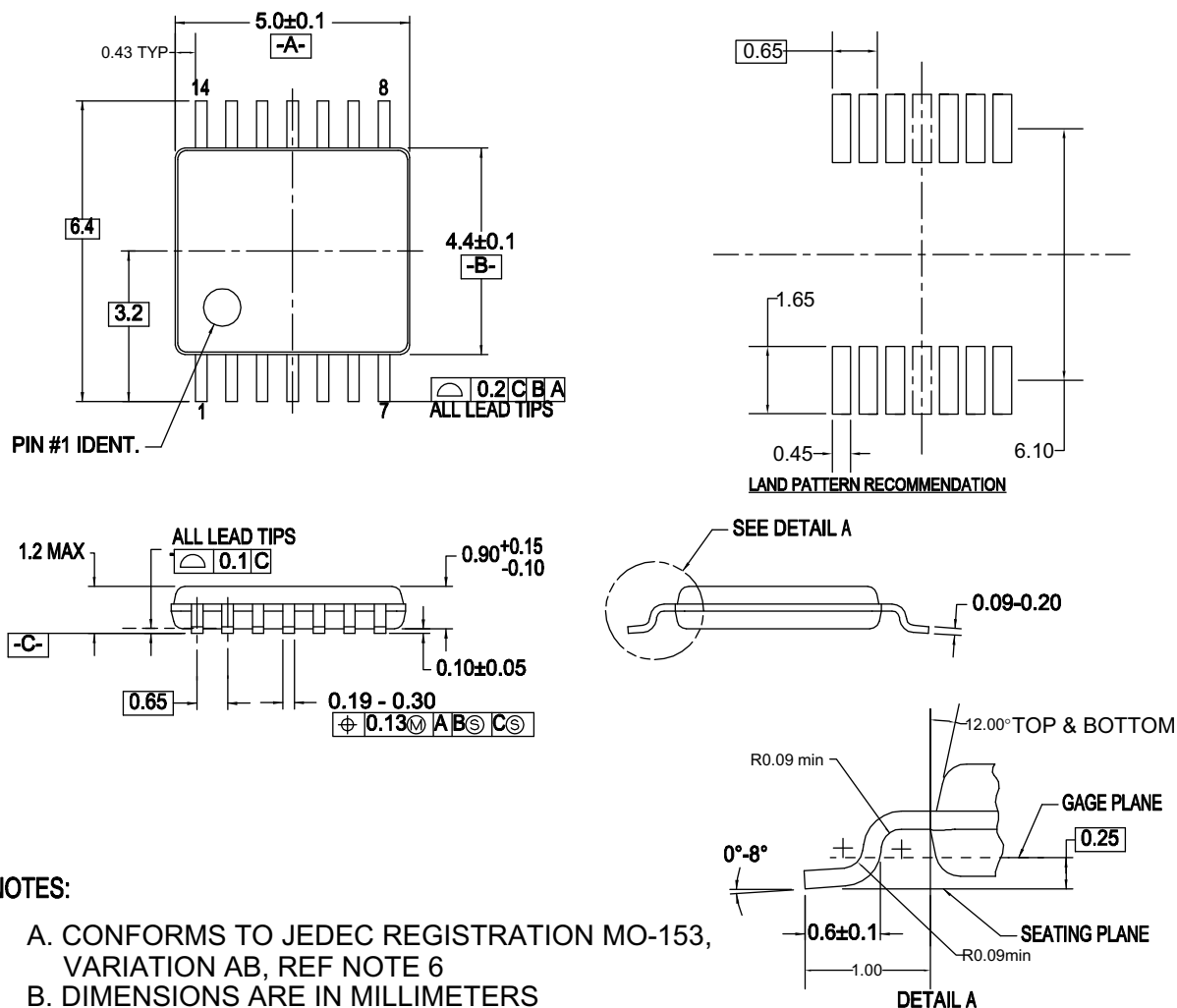
**Figure 2. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**

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## Physical Dimensions (Continued)



## 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, 1982
- E. LANDPATTERN STANDARD: SOP65P640X110-14M
- F. DRAWING FILE NAME: MTC14REV6

Figure 3. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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| AX-CAP™                                                                           | Global Power Resource™                                                            | PowerXS™                                                                          |                                                                                     |
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| CorePOWER™                                                                        | Gmax™                                                                             | QST™                                                                              | TinyBuck™                                                                           |
| CROSSVOLT™                                                                        | GTO™                                                                              | Quiet Series™                                                                     | TinyCalc™                                                                           |
| CTL™                                                                              | IntelliMAX™                                                                       | RapidConfigure™                                                                   | TinyLogic®                                                                          |
| Current Transfer Logic™                                                           | ISOPLANAR™                                                                        |  | TINYOPTO™                                                                           |
| DEUXPEED®                                                                         | MegaBuck™                                                                         | Saving our world, 1mW/kW at a time™                                               | TinyPower™                                                                          |
| Dual Cool™                                                                        | MICROCOUPLER™                                                                     | SignalWise™                                                                       | TinyPWM™                                                                            |
| EcoSPARK®                                                                         | MicroFET™                                                                         | SmartMax™                                                                         | TinyWire™                                                                           |
| EfficientMax™                                                                     | MicroPak™                                                                         | SMART START™                                                                      | TriFault Detect™                                                                    |
| ESBC™                                                                             | MicroPak2™                                                                        | SPM®                                                                              | TRUECURRENT®*                                                                       |
|  | MillerDrive™                                                                      | STEALTH™                                                                          | µSerDes™                                                                            |
| Fairchild®                                                                        | MotionMax™                                                                        | SuperFET®                                                                         |  |
| Fairchild Semiconductor®                                                          | Motion-SPM™                                                                       | SuperSOT™-3                                                                       | UHC®                                                                                |
| FACT Quiet Series™                                                                | mWSaver™                                                                          | SuperSOT™-6                                                                       | Ultra FRFET™                                                                        |
| FACT®                                                                             | OptoHit™                                                                          | SuperSOT™-8                                                                       | UniFET™                                                                             |
| FAST®                                                                             | OPTOLOGIC®                                                                        | SupreMOS®                                                                         | VCX™                                                                                |
| FastvCore™                                                                        | OPTOPLANAR®                                                                       | SyncFET™                                                                          | VisualMax™                                                                          |
| FETBench™                                                                         |  | Sync-Lock™                                                                        | XST™                                                                                |
| FlashWriter®                                                                      | PDP SPM™                                                                          |  |                                                                                     |
| FPST™                                                                             |                                                                                   |                                                                                   |                                                                                     |

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## 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.                                               |
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