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MM74HCT04 Hex Inverter

Features

- TTL, LS pin-out and threshold compatible
- Fast switching: t_{PLH} , t_{PHL} = 12 ns (typ)
- Low power: 10 μ W at DC, 3.7 mW at 5 MHz
- High fanout: \geq 10 LS loads
- Inverting, triple buffered

General Description

The MM74HCT04 is a logic function fabricated by using advanced silicon-gate CMOS technology which provides the inherent benefits of CMOS—low quiescent power and wide power supply range. This device is input and output characteristic as well as pin-out compatible with standard 74LS logic families. The MM74HCT04, triple buffered, hex inverters, features low power dissipation and fast switching times. All inputs are protected from static discharge by internal diodes to V_{CC} and ground.

MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices. These parts are also plug-in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

Ordering Information

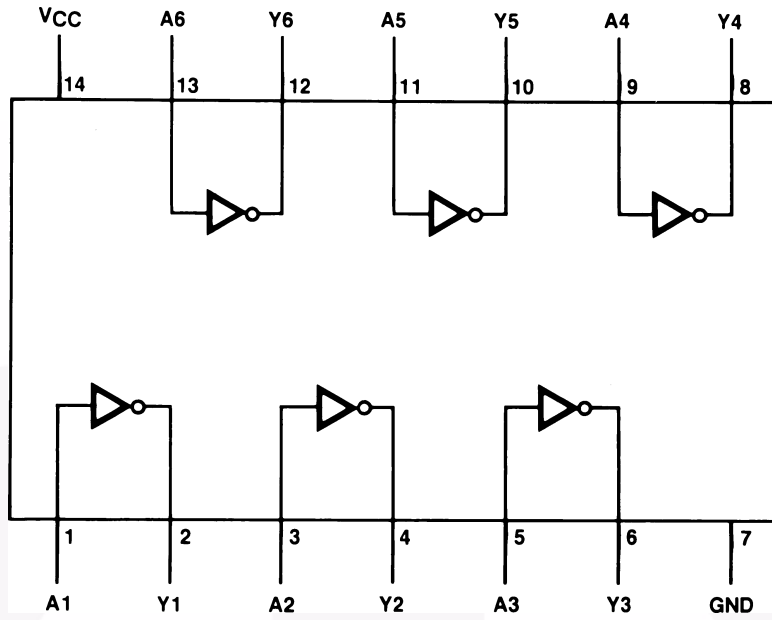
| Order Number | Package Number | Package Description |
|--------------|----------------|--|
| MM74HCT04M | M14A | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| MM74HCT04SJ | M14D | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| MM74HCT04MTC | MTC14 | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| MM74HCT04N | N14A | 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |

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 Diagram

Pin Assignments for DIP, SOIC, SOP and TSSOP



Top View



Absolute Maximum Ratings⁽¹⁾

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 | -0.5 to +7.0V |
| V_{IN} | DC Input Voltage | -1.5 to $V_{CC}+1.5V$ |
| V_{OUT} | DC Output Voltage | -0.5 to $V_{CC}+0.5V$ |
| I_{IK}, I_{OK} | Clamp Diode Current | $\pm 20mA$ |
| I_{OUT} | DC Output Current, per pin | $\pm 25mA$ |
| I_{CC} | DC V_{CC} or GND Current, per pin | $\pm 50mA$ |
| T_{STG} | Storage Temperature Range | -65°C to +150°C |
| P_D | Power Dissipation Note 2 | 600mW |
| | S.O. Package only | 500mW |
| T_L | Lead Temperature (Soldering 10 seconds) | 260°C |

Notes:

1. Unless otherwise specified all voltages are referenced to ground.
2. Power Dissipation temperature derating — plastic "N" package: -12mW/°C from 65°C to 85°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 | Min. | Max. | Units |
|-------------------|-----------------------------|------|----------|-------|
| V_{CC} | Supply Voltage | 4.5 | 5.5 | V |
| V_{IN}, V_{OUT} | DC Input or Output Voltage | 0 | V_{CC} | V |
| T_A | Operating Temperature Range | -40 | +85 | °C |
| t_r, t_f | Input Rise or Fall Times | | 500 | ns |

DC Electrical Characteristics $V_{CC} = 5V \pm 10\%$ (unless otherwise specified)

| Symbol | Parameter | Conditions | $T_A = 25^\circ\text{C}$ | | $T_A = -40^\circ\text{C}$ to 85°C | $T_A = -55^\circ\text{C}$ to 125°C | Units |
|----------|-----------------------------------|---|--------------------------|-------------------|--|---|---------------|
| | | | Typ. | Guaranteed Limits | | | |
| V_{IH} | Minimum HIGH Level Input Voltage | | | 2.0 | 2.0 | 2.0 | V |
| V_{IL} | Maximum LOW Level Input Voltage | | | 0.8 | 0.8 | 0.8 | V |
| V_{OH} | Minimum HIGH Level Output Voltage | $V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 20\mu\text{A}$ | V_{CC} | $V_{CC} - 0.1$ | $V_{CC} - 0.1$ | $V_{CC} - 0.1$ | V |
| | | $V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 4.0\text{mA}$, $V_{CC} = 4.5\text{V}$ | 4.2 | 3.98 | 3.84 | 3.7 | |
| | | $V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 4.8\text{mA}$, $V_{CC} = 5.5\text{V}$ | 5.2 | 4.98 | 4.84 | 4.7 | |
| V_{OL} | Maximum LOW Level Voltage | $V_{IN} = V_{IH}$, $ I_{OUT} = 20\mu\text{A}$ | 0 | 0.1 | 0.1 | 0.1 | V |
| | | $V_{IN} = V_{IH}$, $ I_{OUT} = 4.0\text{mA}$, $V_{CC} = 4.5\text{V}$ | 0.2 | 0.26 | 0.33 | 0.4 | |
| | | $V_{IN} = V_{IH}$, $ I_{OUT} = 4.8\text{mA}$, $V_{CC} = 5.5\text{V}$ | 0.2 | 0.26 | 0.33 | 0.4 | |
| I_{IN} | Maximum Input Current | $V_{IN} = V_{CC}$ or GND, V_{IH} or V_{IL} | | ± 0.1 | ± 1.0 | ± 1.0 | μA |
| I_{CC} | Maximum Quiescent Supply Current | $V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0\mu\text{A}$ | | 2.0 | 20 | 40 | μA |
| | | $V_{IN} = 2.4\text{V}$ or $0.5\text{V}^{(3)}$ | | 0.3 | 0.4 | 0.5 | mA |

Note:3. This is measured per input with all other inputs held at V_{CC} or ground.

AC Electrical Characteristics

$V_{CC} = 5.0V$, $t_r = t_f = 6ns$, $C_L = 15pF$, $T_A = 25^\circ C$ (unless otherwise noted)

| Symbol | Parameter | Conditions | Typ. | Guaranteed Limit | Units |
|-----------------------|---------------------------|------------|------|------------------|-------|
| t_{PLH} , t_{PHL} | Maximum Propagation Delay | | 10 | 18 | ns |

AC Electrical Characteristics

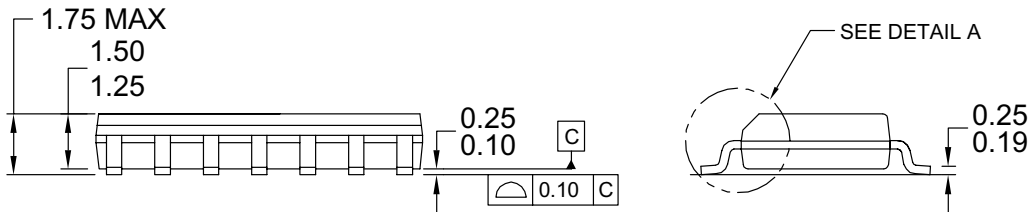
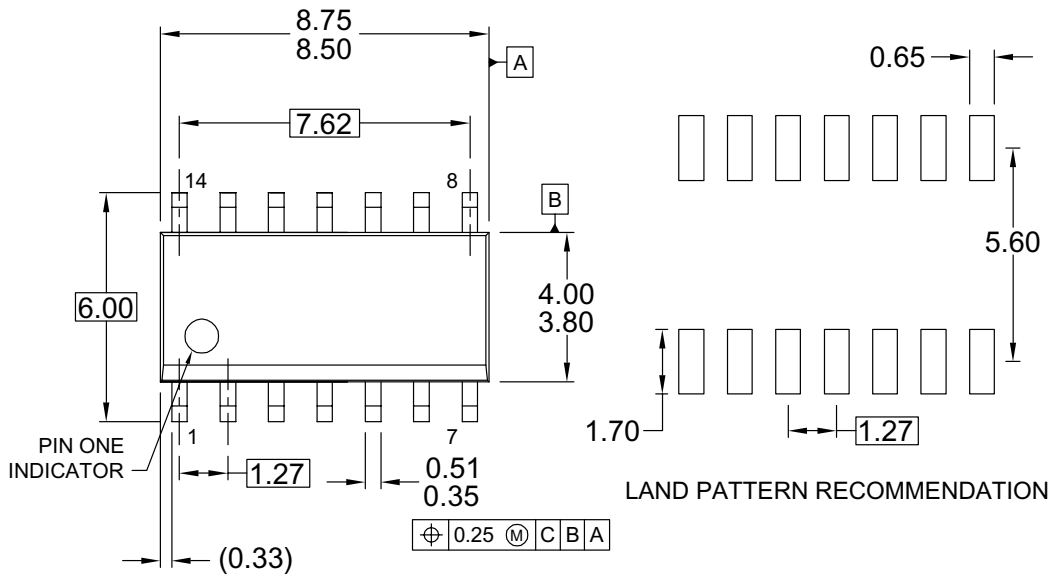
$V_{CC} = 5.0V \pm 10\%$, $t_r = t_f = 6ns$, $C_L = 50pF$ (unless otherwise noted)

| Symbol | Parameter | Conditions | $T_A = 25^\circ C$ | | $T_A = -40^\circ C$ to $85^\circ C$ | $T_A = -55^\circ C$ to $125^\circ C$ | Units |
|-----------------------|-----------------------------------|------------|--------------------|-------------------|--|---|-------|
| | | | Typ. | Guaranteed Limits | | | |
| t_{PLH} , t_{PHL} | Maximum Propagation Delay | | 14 | 20 | 25 | 30 | ns |
| t_{THL} , t_{TLH} | Maximum Output Rise and Fall Time | | 8 | 15 | 19 | 22 | ns |
| C_{PD} | Power Dissipation Capacitance | (4) | 20 | | | | pF |
| C_{IN} | Input Capacitance | | 5 | 10 | 10 | 10 | pF |

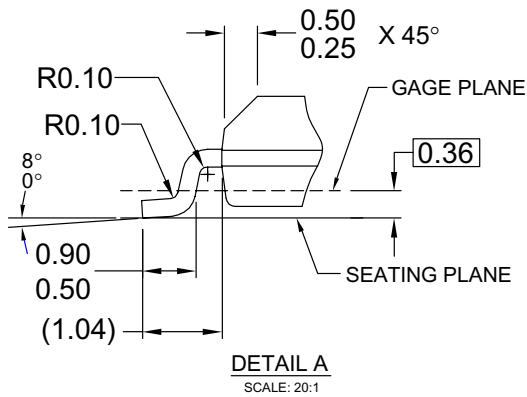
Note:

4. C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Physical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED



- A) THIS PACKAGE 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) LANDPATTERN STANDARD: SOIC127P600X145-14M
- E) DRAWING CONFORMS TO ASME Y14.5M-1994
- F) DRAWING FILE NAME: M14AREV13

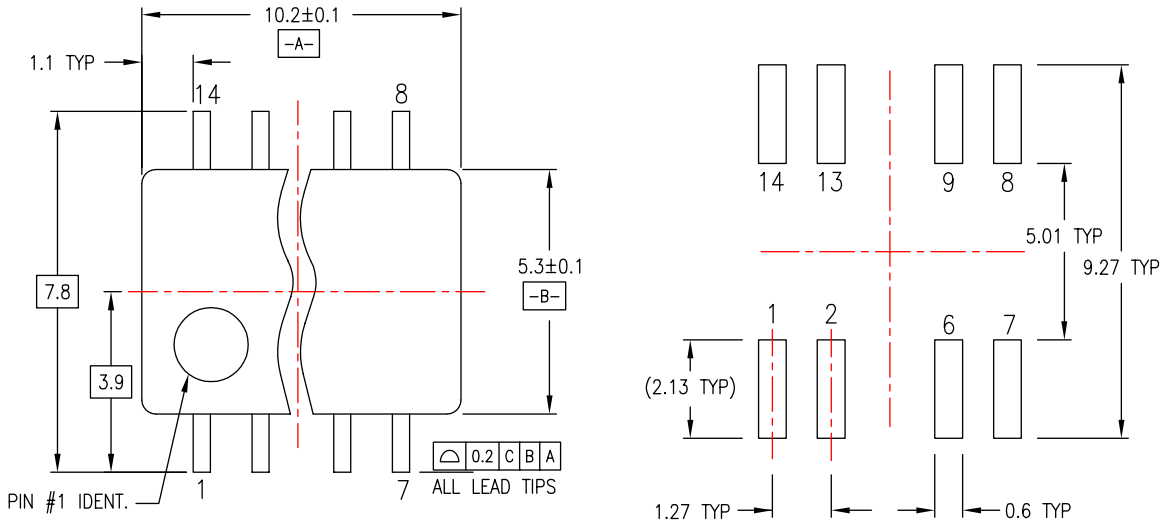
Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

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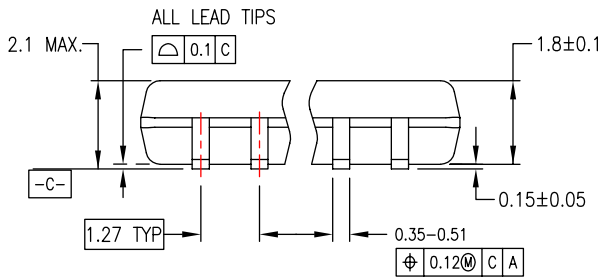
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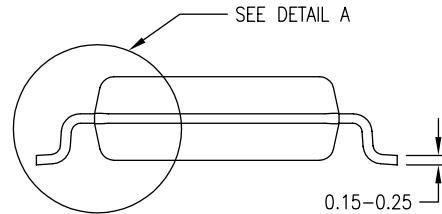
Physical Dimensions (Continued)



LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



DETAIL A

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

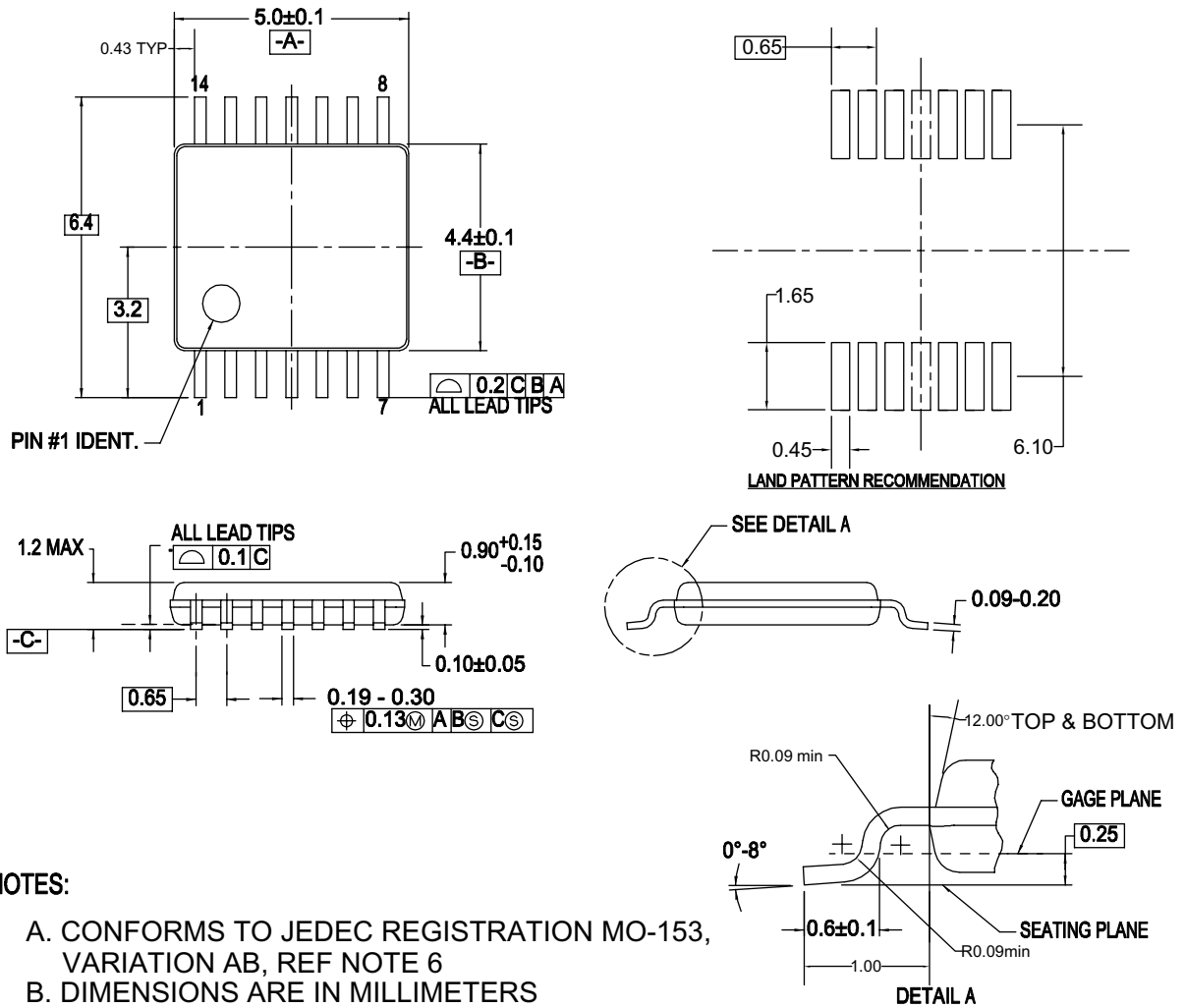
Figure 2. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide

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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

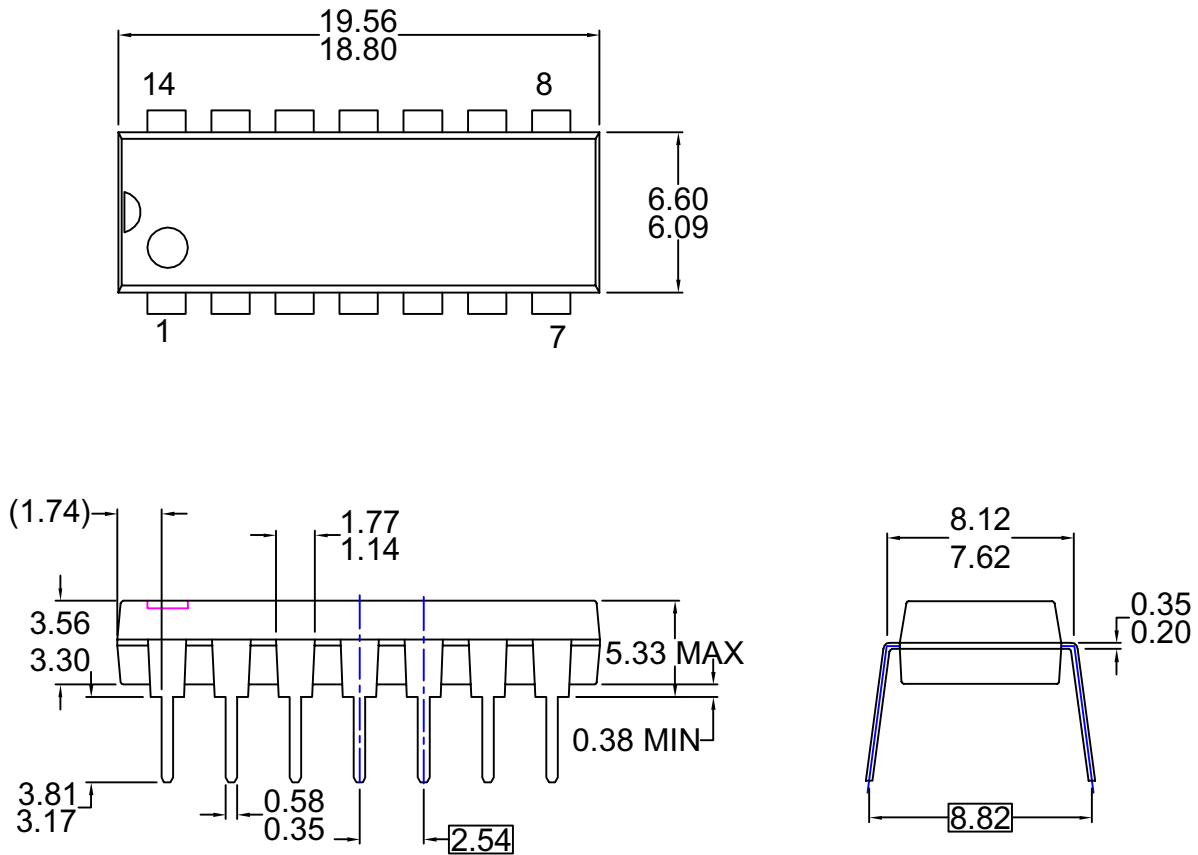
Figure 3. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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Physical Dimensions (Continued)



- NOTES: UNLESS OTHERWISE SPECIFIED**
- THIS PACKAGE CONFORMS TO
 - A) JEDEC MS-001 VARIATION BA
 - B) ALL DIMENSIONS ARE IN MILLIMETERS.
 - C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
 - D) DIMENSIONS AND TOLERANCES PER ASME Y14.5-1994
 - E) DRAWING FILE NAME: MKT-N14AREV7

Figure 4. 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

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