

MM74HC04 Hex Inverter

Features

- Typical propagation delay: 8ns
- Fan out of 10 LS-TTL loads
- Quiescent power consumption: 10μW maximum at room temperature
- Low input current: 1μA maximum

General Description


The MM74HC04 inverters utilize advanced silicon-gate CMOS technology to achieve operating speeds similar to LS-TTL gates with the low power consumption of standard CMOS integrated circuits.

The MM74HC04 is a triple buffered inverter. It has high noise immunity and the ability to drive 10 LS-TTL loads. The 74HC logic family is functionally as well as pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Ordering Information

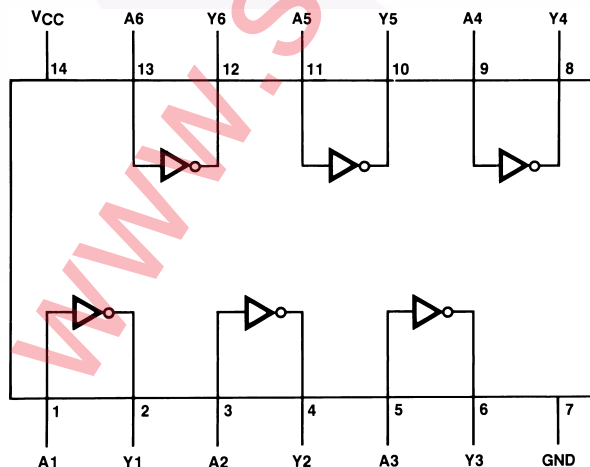
| Order Number | Package Number | Package Description |
|--------------|----------------|--|
| MM74HC04M | M14A | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| MM74HC04SJ | M14D | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| MM74HC04MTC | MTC14 | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| MM74HC04N | 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

Logic Diagram

1 of 6 Inverters



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 | 2 | 6 | 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 $V_{CC} = 2.0V$ | | 1000 | ns |
| | $V_{CC} = 4.5V$ | | 500 | ns |
| | $V_{CC} = 6.0V$ | | 400 | ns |

DC Electrical Characteristics⁽³⁾

| Symbol | Parameter | V _{CC} (V) | Conditions | T _A = 25°C | | T _A = -40°C to 85°C | T _A = -55°C to 125°C | Units |
|-----------------|-----------------------------------|---------------------|---|--|-------------------|-----------------------------------|------------------------------------|-------|
| | | | | Typ. | Guaranteed Limits | | | |
| V _{IH} | Minimum HIGH Level Input Voltage | 2.0 | | | 1.5 | 1.5 | 1.5 | V |
| | | 4.5 | | | 3.15 | 3.15 | 3.15 | |
| | | 6.0 | | | 4.2 | 4.2 | 4.2 | |
| V _{IL} | Maximum LOW Level Input Voltage | 2.0 | | | 0.5 | 0.5 | 0.5 | V |
| | | 4.5 | | | 1.35 | 1.35 | 1.35 | |
| | | 6.0 | | | 1.8 | 1.8 | 1.8 | |
| V _{OH} | Minimum HIGH Level Output Voltage | 2.0 | V _{IN} = V _{IL} , I _{OUT} ≤ 20μA | 2.0 | 1.9 | 1.9 | 1.9 | V |
| | | 4.5 | | 4.5 | 4.4 | 4.4 | 4.4 | |
| | | 6.0 | | 6.0 | 5.9 | 5.9 | 5.9 | |
| | | 4.5 | V _{IN} = V _{IL} , I _{OUT} ≤ 4.0mA | 4.2 | 3.98 | 3.84 | 3.7 | |
| | | 6.0 | | V _{IN} = V _{IL} , I _{OUT} ≤ 5.2mA | 5.7 | 5.48 | 5.34 | |
| V _{OL} | Maximum LOW Level Output Voltage | 2.0 | V _{IN} = V _{IH} , I _{OUT} ≤ 20μA | | 0 | 0.1 | 0.1 | 0.1 |
| | | 4.5 | | 0 | 0.1 | 0.1 | 0.1 | |
| | | 6.0 | | 0 | 0.1 | 0.1 | 0.1 | |
| | | 4.5 | V _{IN} = V _{IH} , I _{OUT} ≤ 4.0mA | 0.2 | 0.26 | 0.33 | 0.4 | |
| | | 6.0 | | V _{IN} = V _{IH} , I _{OUT} ≤ 5.2mA | 0.2 | 0.26 | 0.33 | 0.4 |
| I _{IN} | Maximum Input Current | 6.0 | V _{IN} = V _{CC} or GND | | | ±0.1 | ±1.0 | ±1.0 |
| I _{CC} | Maximum Quiescent Supply Current | 6.0 | V _{IN} = V _{CC} or GND, I _{OUT} = 0μA | | 2.0 | 20 | 40 | μA |

Note:

3. For a power supply of 5V ±10% the worst case output voltages (V_{OH}, and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at V_{CC} = 5.5V and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN}, I_{CC}, and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.

AC Electrical Characteristics
 $V_{CC} = 5V$, $T_A = 25^\circ C$, $C_L = 15pF$, $t_r = t_f = 6ns$

| Symbol | Parameter | Conditions | Typ. | Guaranteed Limit | Units |
|-----------------------|---------------------------|------------|------|------------------|-------|
| t_{PHL} , t_{PLH} | Maximum Propagation Delay | | 8 | 15 | ns |

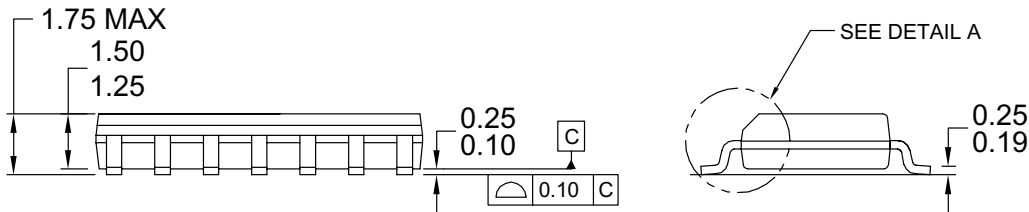
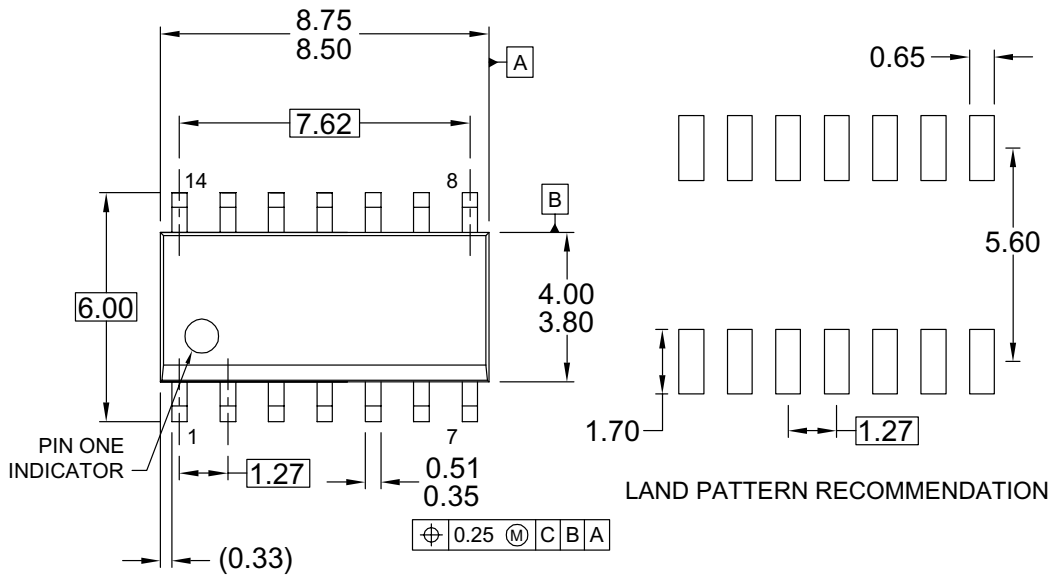
AC Electrical Characteristics
 $V_{CC} = 2.0V$ to $6.0V$, $C_L = 50pF$, $t_r = t_f = 6ns$ (unless otherwise specified)

| Symbol | Parameter | V_{CC} (V) | 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_{PHL} , t_{PLH} | Maximum Propagation Delay | 2.0 | | 55 | 95 | 120 | 145 | ns |
| | | 4.5 | | 11 | 19 | 24 | 29 | |
| | | 6.0 | | 9 | 16 | 20 | 24 | |
| t_{TLH} , t_{THL} | Maximum Output Rise and Fall Time | 2.0 | | 30 | 75 | 95 | 110 | ns |
| | | 4.5 | | 8 | 15 | 19 | 22 | |
| | | 6.0 | | 7 | 13 | 16 | 19 | |
| C_{PD} | Power Dissipation Capacitance ⁽⁴⁾ | | (per gate) | 20 | | | | pF |
| C_{IN} | Maximum Input Capacitance | | | 5 | 10 | 10 | 10 | pF |

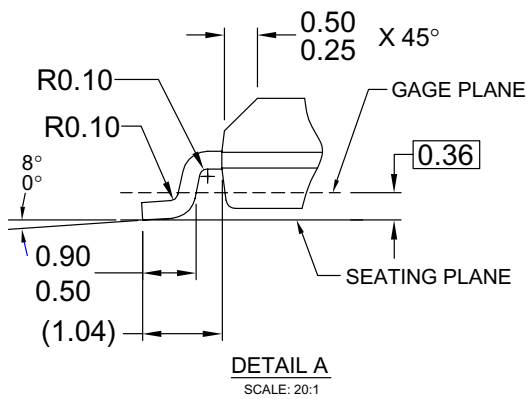
Note:

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

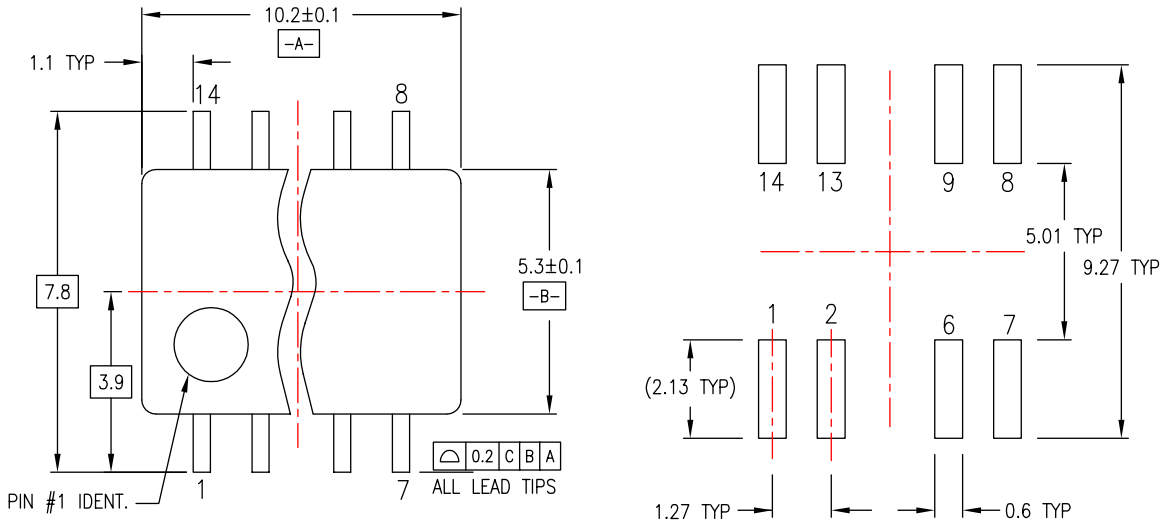
Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

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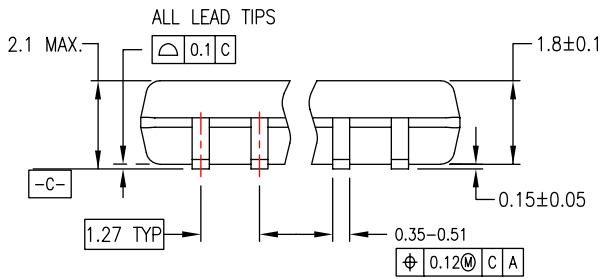
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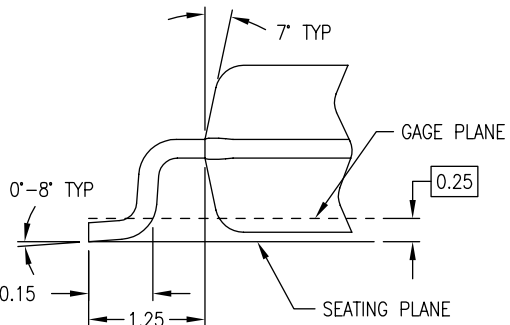
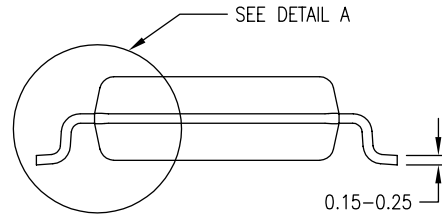
Physical Dimensions (Continued)



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.

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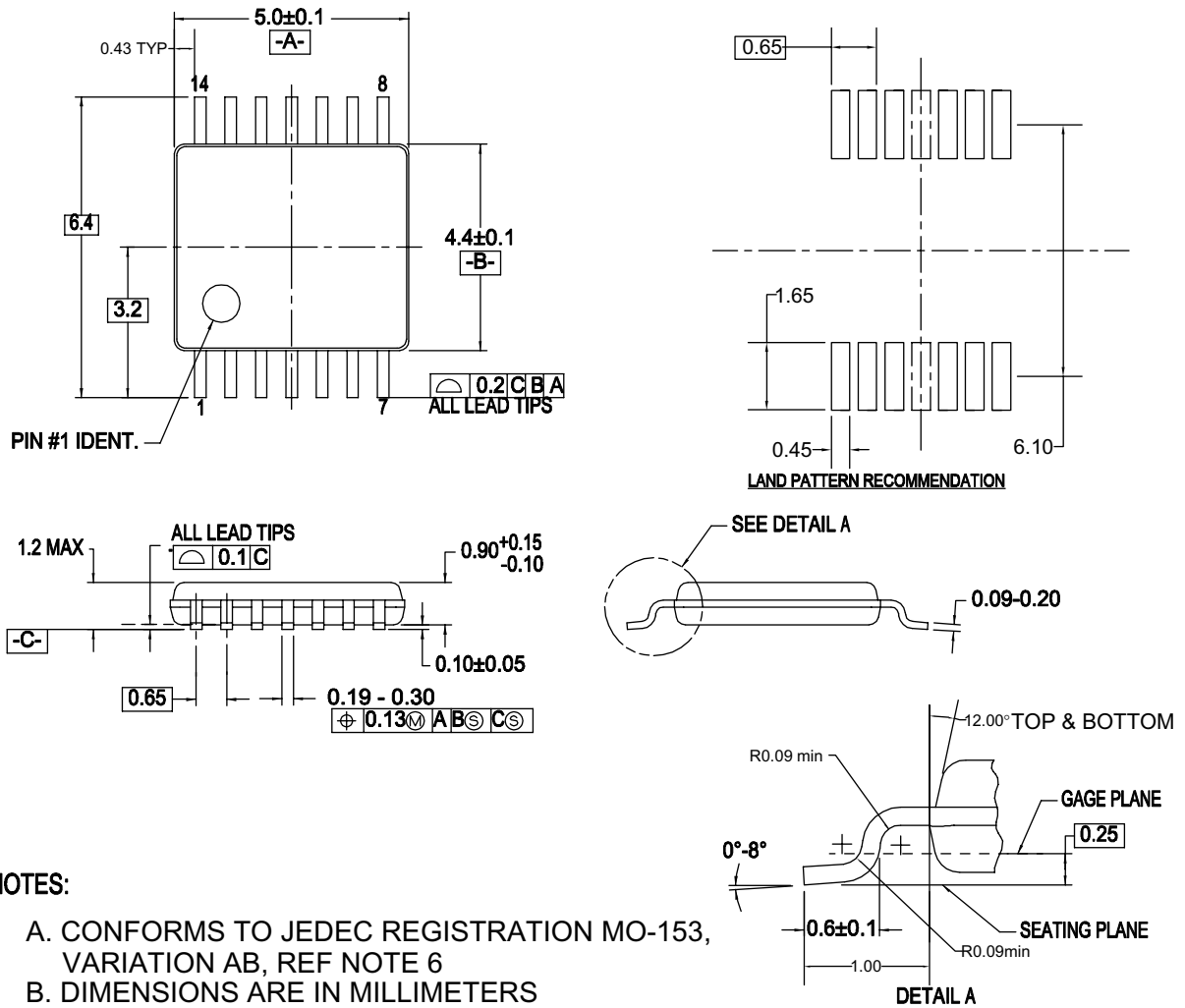
Figure 2. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide

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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

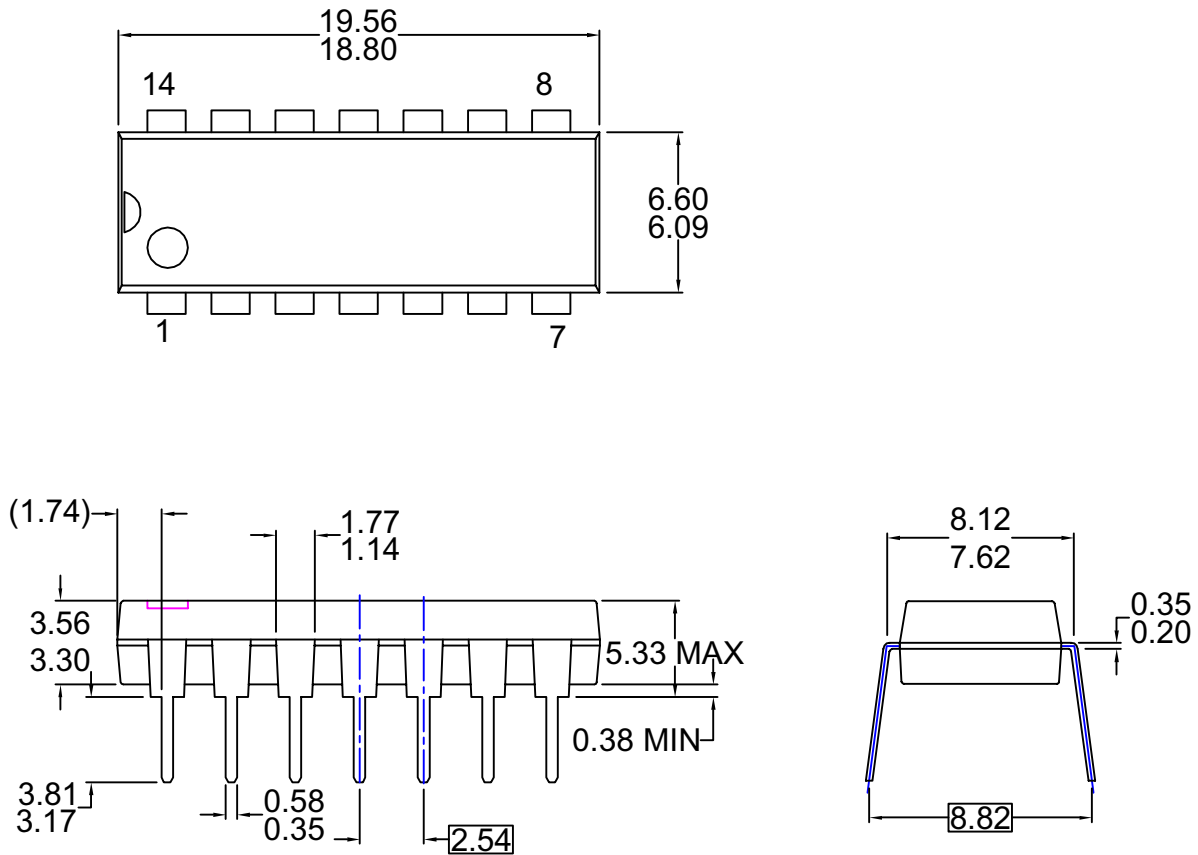
Figure 3. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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Physical Dimensions (Continued)



- NOTES: UNLESS OTHERWISE SPECIFIED**
- THIS PACKAGE CONFORMS TO
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 - 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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
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