

## MM74HCT04 Hex Inverter

### Features

- TTL, LS pin-out and threshold compatible
- Fast switching:  $t_{PLH}$ ,  $t_{PHL}$  = 12 ns (typ)
- Low power: 10  $\mu$ 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

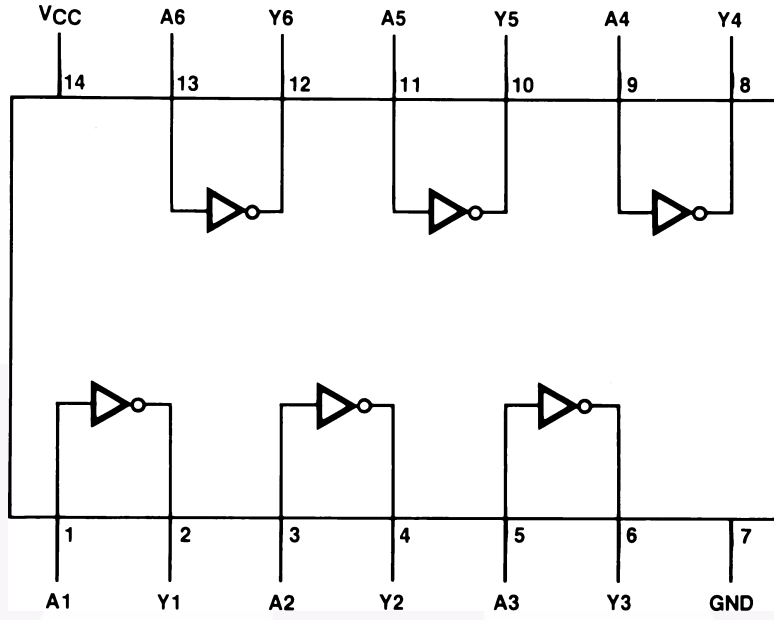
Order Number	Package Number	Package Description
MM74HCT04M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74HCT04SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HCT04MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 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<sup>(1)</sup>

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	$T_A = 25^\circ\text{C}$		$T_A = -40^\circ\text{C}$	$T_A = -55^\circ\text{C}$	Units
			Typ.	Guaranteed Limits		to $85^\circ\text{C}$	
$V_{IH}$	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 $V_{IL}$		$\pm 0.1$	$\pm 1.0$	$\pm 1.0$	$\mu\text{A}$
$I_{CC}$	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0\mu\text{A}$		2.0	20	40	$\mu\text{A}$
		$V_{IN} = 2.4\text{V}$ 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**

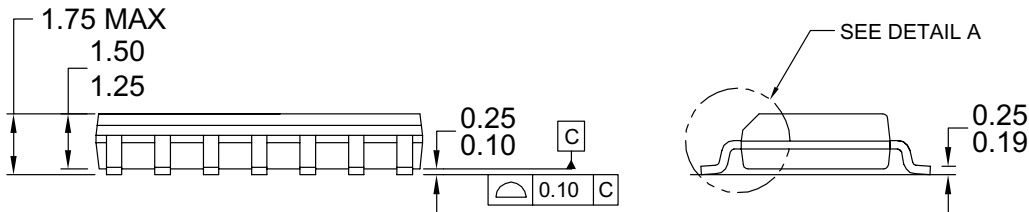
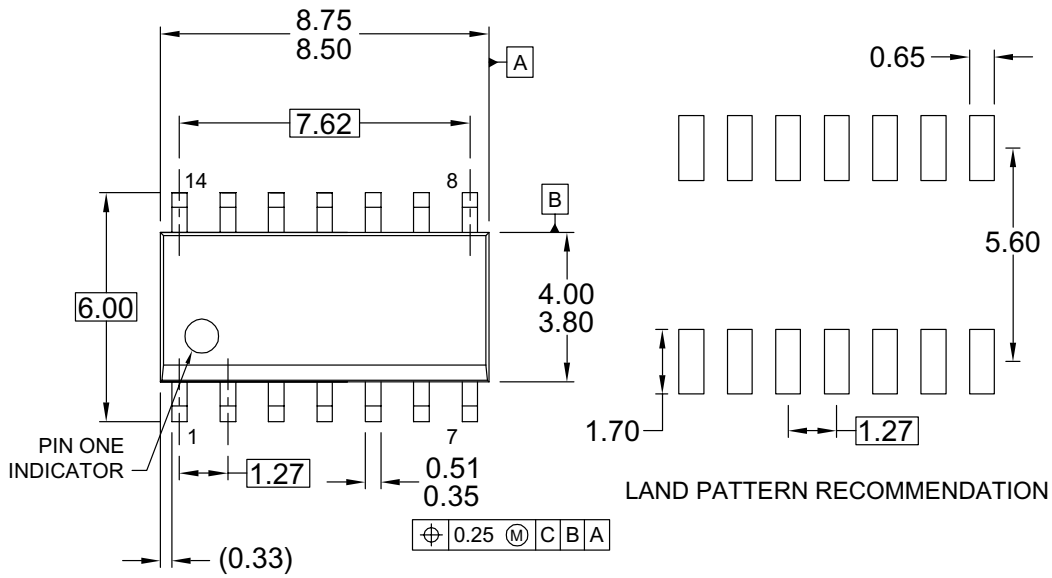
$V_{CC} = 5.0V \pm 10\%$ ,  $t_r = t_f = 6ns$ ,  $C_L = 50pF$  (unless otherwise noted)

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

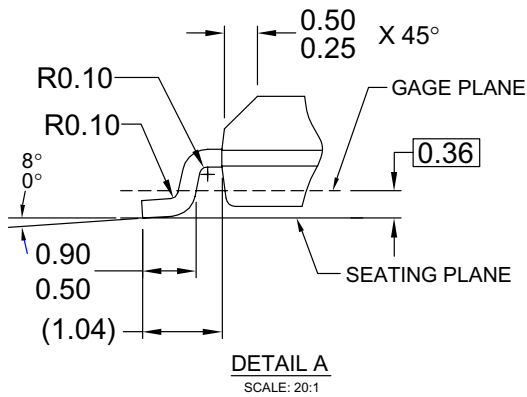
**Note:**

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

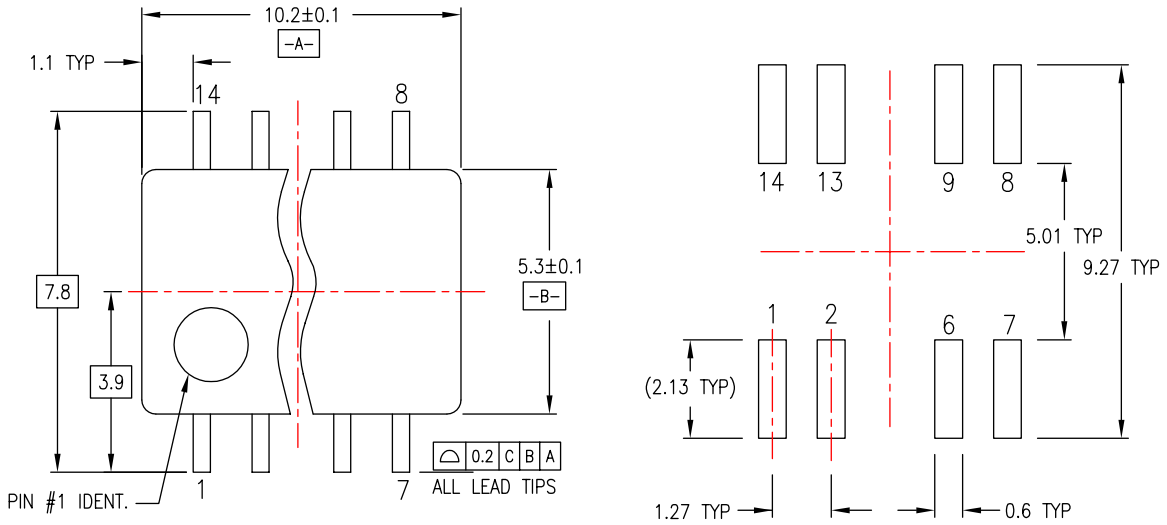
Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

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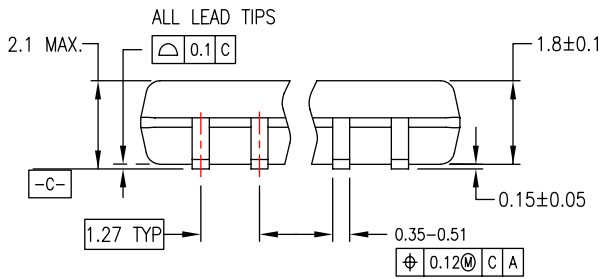
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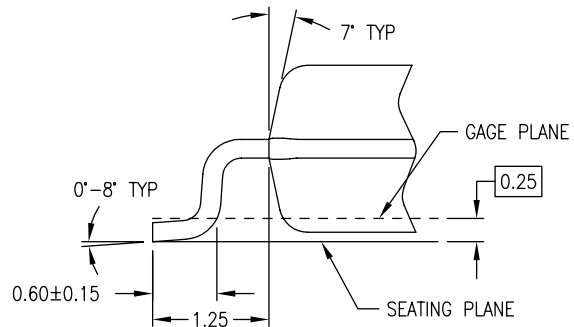
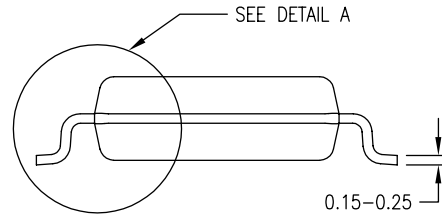
Physical Dimensions (Continued)



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

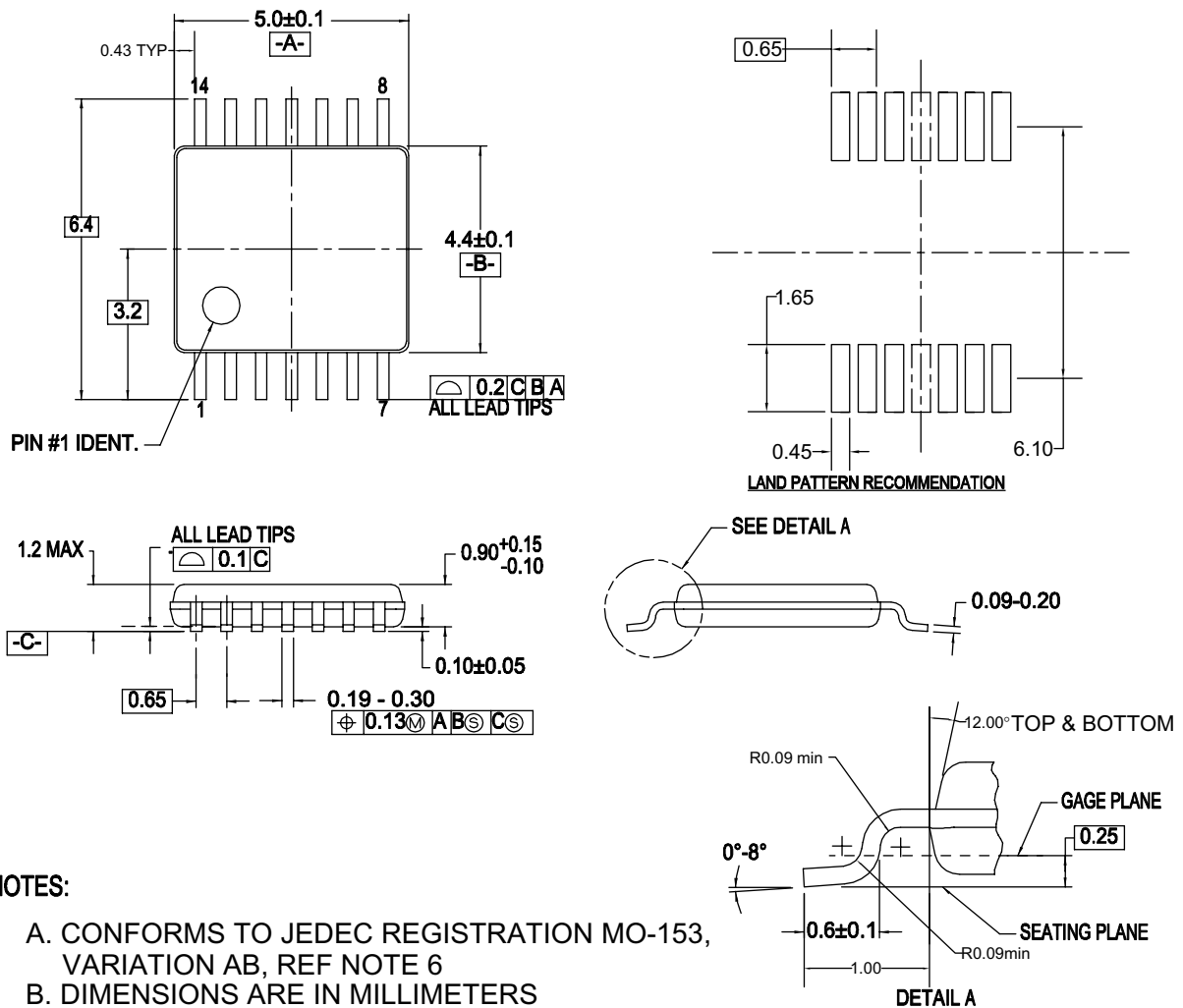
Figure 2. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide

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## Physical Dimensions (Continued)



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

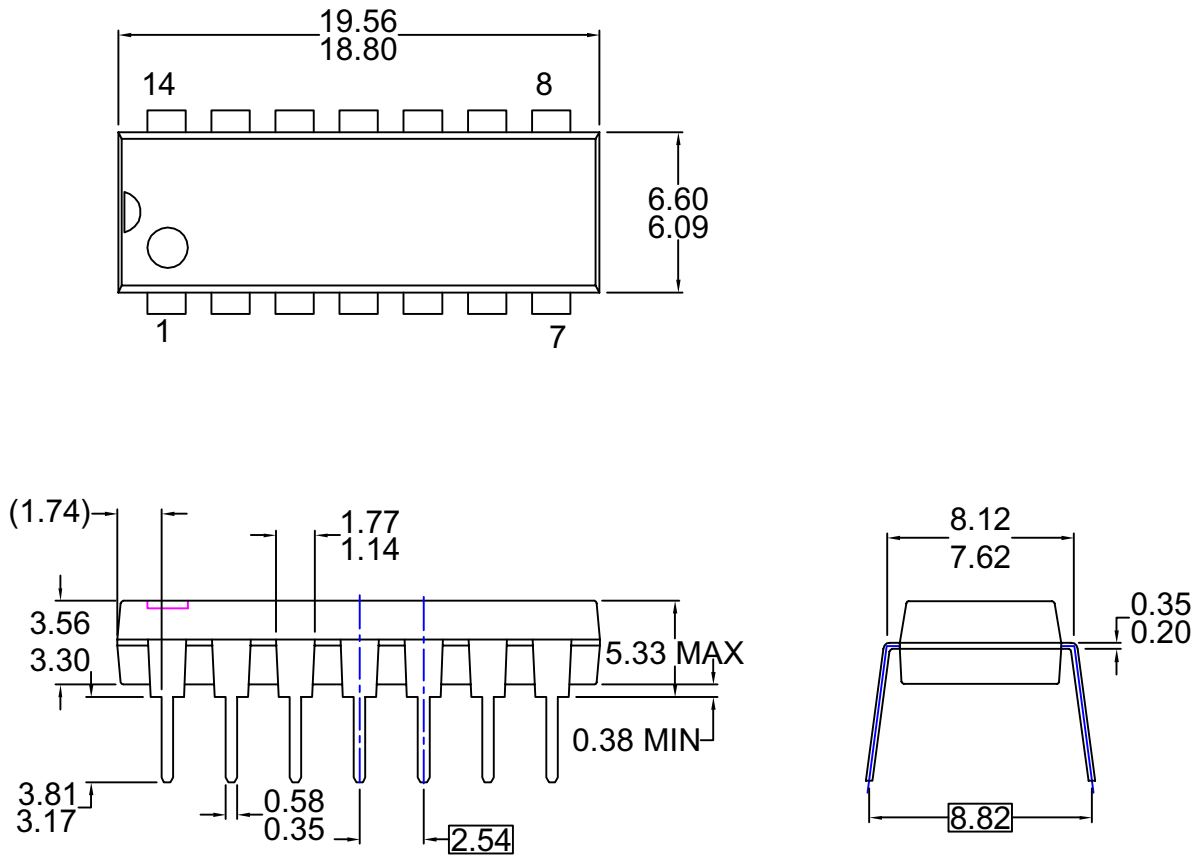
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## Physical Dimensions (Continued)



- 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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