

# MM74HCT14

## Hex Inverting Schmitt Trigger

### Features

- Typical propagation delay: 13ns
- Wide power supply range: 2V–6V
- Low quiescent current: 10µA maximum
- Low input current: 1µA maximum
- Fanout of 10 LS-TTL loads
- Typical hysteresis voltage: 0.9V at  $V_{CC} = 4.5V$
- TTL, LS pin-out and input threshold compatible

### General Description


The MM74HCT14 utilizes advanced silicon-gate CMOS technology to achieve the low power dissipation and high noise immunity of standard CMOS, as well as the capability to drive 10 LS-TTL loads.

The 74HCT logic family is functionally and pinout 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

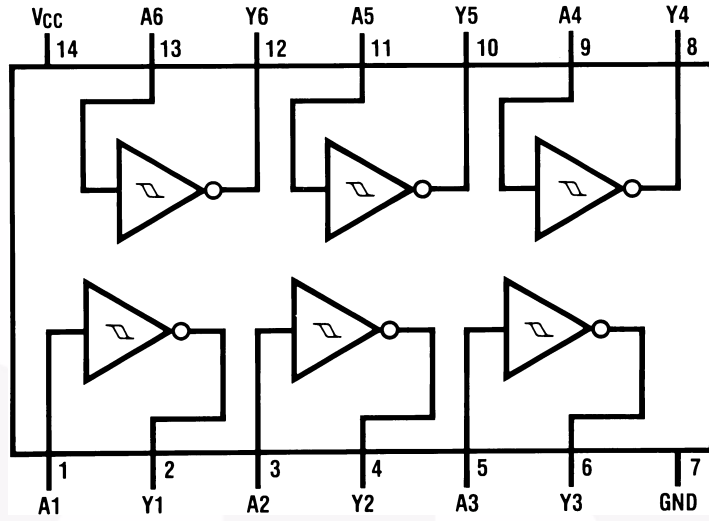
Order Number	Package Number	Package Description
MM74HCT14M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74HCT14SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HCT14MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HCT14N	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.

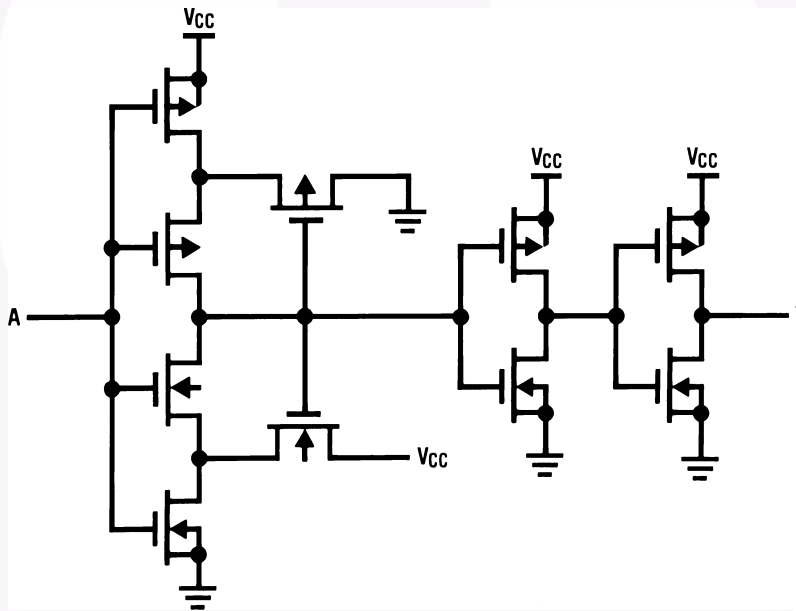
Connection Diagram

Pin Assignments for DIP, SOIC, SOP and TSSOP



Top View

Schematic Diagram



## 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
$T_L$	Lead Temperature (Soldering 10 seconds)	260°C

### Notes:

1. Unless otherwise specified all voltages are referenced to ground.

## 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

DC Electrical Characteristics<sup>(2)</sup>

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = 25°C		T <sub>A</sub> = -40°C to 85°C	Units
				Typ	Guaranteed Limits		
V <sub>T+</sub>	Positive Going Threshold Voltage	4.5	Minimum	1.5	1.2	1.2	V
		5.5		1.7	1.4	1.4	
		4.5	Maximum	1.5	1.9	1.9	
		5.5		1.7	2.1	2.1	
V <sub>T-</sub>	Negative Going Threshold Voltage	4.5	Minimum	0.9	0.5	0.5	V
		5.5		1.0	0.6	0.6	
		4.5	Maximum	0.9	1.2	1.2	
		5.5		1.0	1.4	1.4	
V <sub>H</sub>	Hysteresis Voltage	4.5	Minimum	0.6	0.4	0.4	V
		5.5		0.7	0.4	0.4	
		4.5	Maximum	0.6	1.4	1.4	
		5.5		0.7	1.5	1.5	
V <sub>OH</sub>	Minimum HIGH Level Output Voltage		V <sub>IN</sub> = V <sub>IL</sub> ,  I <sub>OUT</sub>   = 20μA	V <sub>CC</sub>	V <sub>CC</sub> - 0.1	V <sub>CC</sub> - 0.1	V
			V <sub>IN</sub> = V <sub>IL</sub> ,  I <sub>OUT</sub>   = 4.0mA, V <sub>CC</sub> = 4.5V	4.2	3.98	3.84	
			V <sub>IN</sub> = V <sub>IL</sub> ,  I <sub>OUT</sub>   = 4.8mA, V <sub>CC</sub> = 5.5V	5.2	4.98	4.98	
V <sub>OL</sub>	Maximum LOW Level Voltage		V <sub>IN</sub> = V <sub>IH</sub> ,  I <sub>OUT</sub>   = 20μA	0	0.1	0.1	V
			V <sub>IN</sub> = V <sub>IH</sub> ,  I <sub>OUT</sub>   = 4.0mA, V <sub>CC</sub> = 4.5V	0.2	0.26	0.33	
			V <sub>IN</sub> = V <sub>IH</sub> ,  I <sub>OUT</sub>   = 4.8mA, V <sub>CC</sub> = 5.5V	0.2	0.26	0.33	
I <sub>IN</sub>	Maximum Input Current		V <sub>IN</sub> = V <sub>CC</sub> or GND, V <sub>IH</sub> or V <sub>IL</sub>		±0.1	±1.0	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0μA		1.0	10	μA
		5.5	V <sub>IN</sub> = 2.4V or 0.5V <sup>(2)</sup>		2.4	2.4	mA

**Note:**

2. For a power supply of 5V ± 10% the worst case output voltages (V<sub>OH</sub>, and V<sub>OL</sub>) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V<sub>IH</sub> and V<sub>IL</sub> occur at V<sub>CC</sub> = 5.5V and 4.5V respectively. (The V<sub>IH</sub> value at 5.5V is 3.85V.) The worst case leakage current (I<sub>IN</sub>, I<sub>CC</sub>, and I<sub>OZ</sub>) 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		10	18	ns

**AC Electrical Characteristics** $V_{CC} = 5V \pm 10\%$ ,  $C_L = 50pF$ ,  $t_r = t_f = 6ns$  (unless otherwise specified)

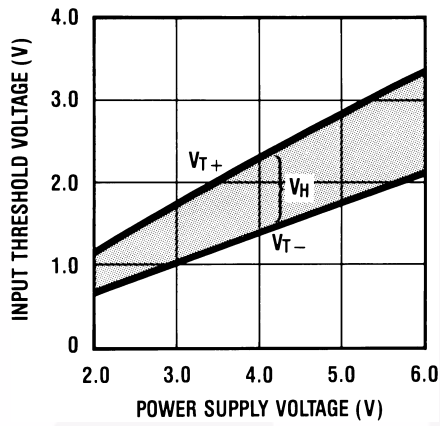
Symbol	Parameter	Conditions	$T_A = 25^\circ$		Units	
			Typ.	Guaranteed Limits		
$t_{PHL}$ , $t_{PLH}$	Maximum Propagation Delay			20	25	ns
$t_{TLH}$ , $t_{THL}$	Maximum Output Rise and Fall Time		9	15	19	ns
$C_{PD}$	Power Dissipation Capacitance <sup>(3)</sup>	(per gate)		25		pF
$C_{IN}$	Maximum Input Capacitance		5	10	10	pF

**Note:**

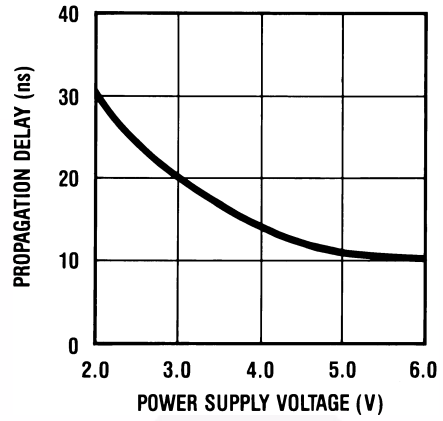
3.  $C_{PD}$  determines the no load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

### Typical Performance Characteristics

Input Threshold,  $V_{T+}$ ,  $V_{T-}$ , vs. Power Supply Voltage

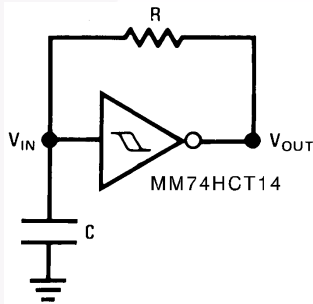


Propagation Delay vs. Power Supply



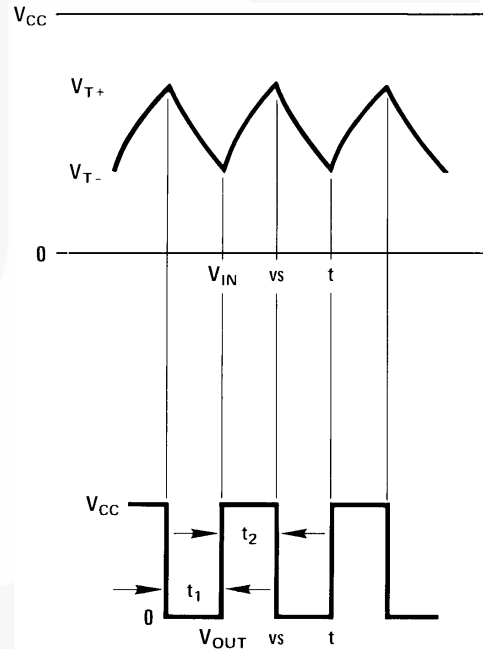
### Typical Applications

Low Power Oscillator



$$t_2 \approx RC \ln \frac{V_{CC} - V_{T-}}{V_{CC} - V_{T+}}$$

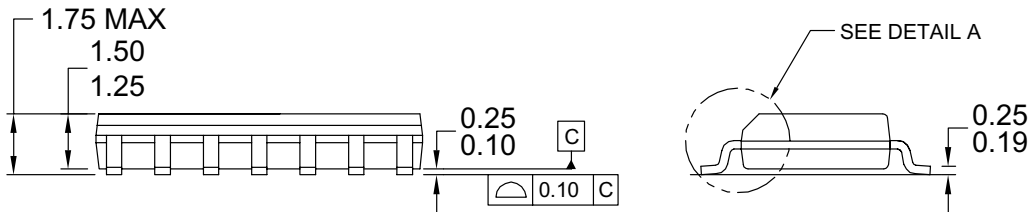
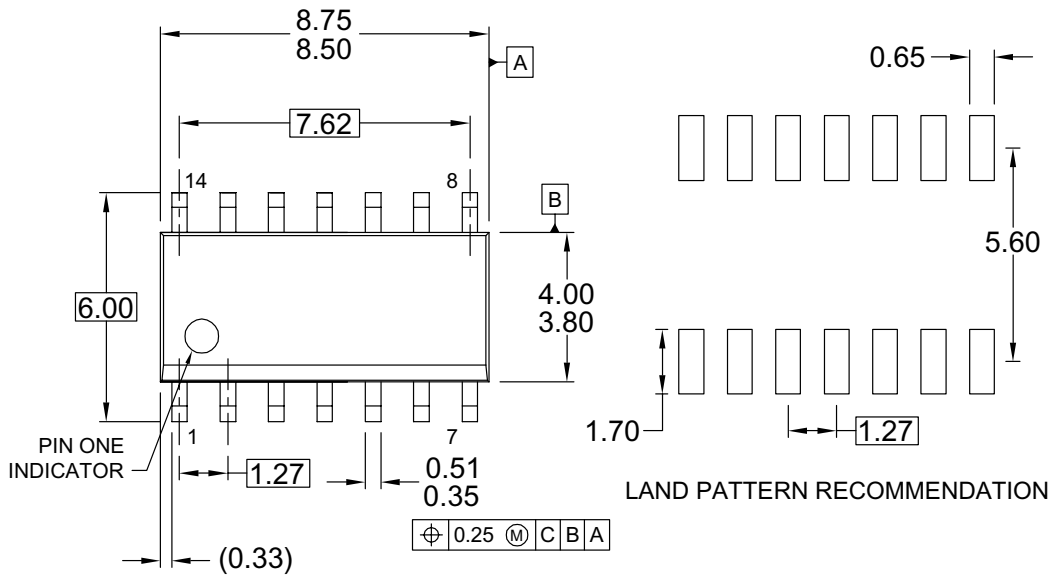
$$f \approx \frac{1}{RC \ln \frac{V_{T+}(V_{CC} - V_{T-})}{V_{T-}(V_{CC} - V_{T+})}}$$



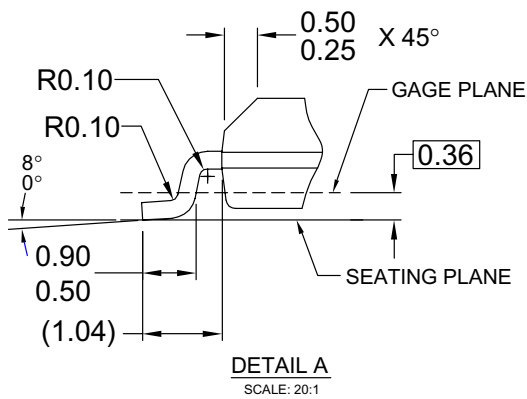
**Note:**

The equations assume  $t_1 + t_2 \gg t_{pd0} + t_{pd1}$

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

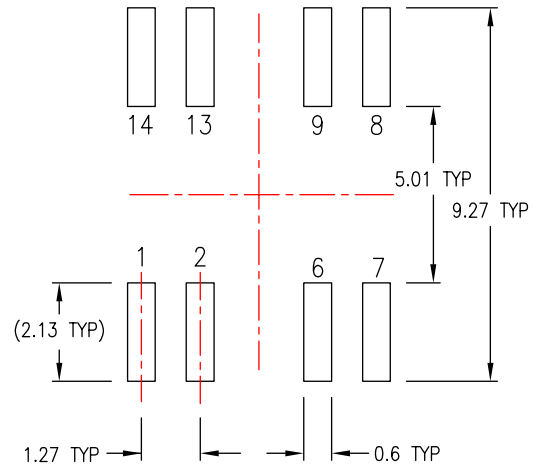
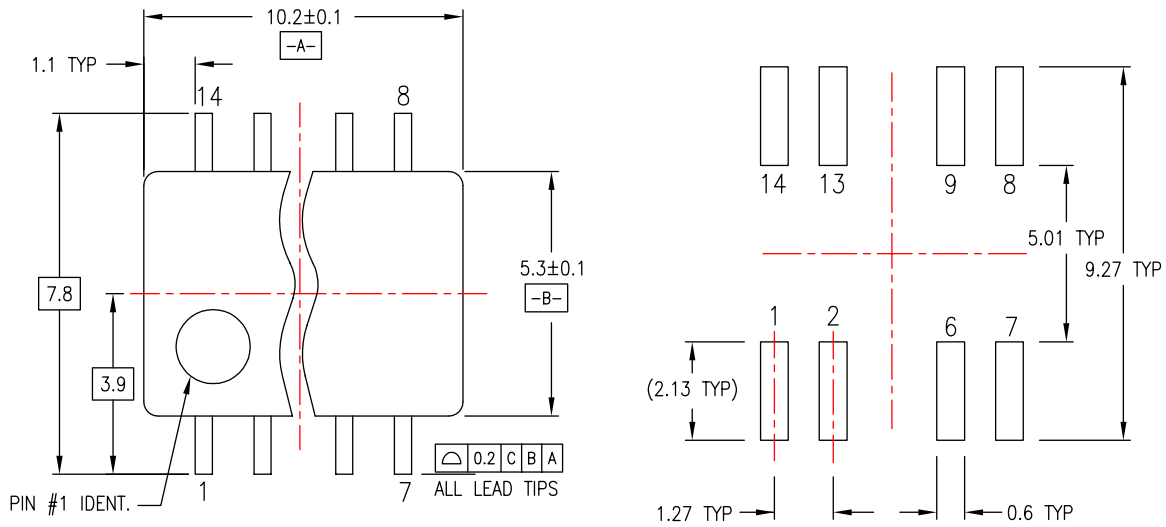
Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

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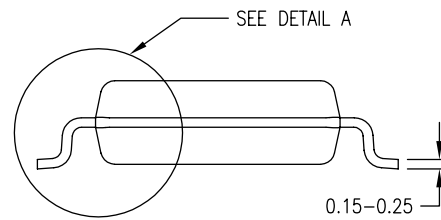
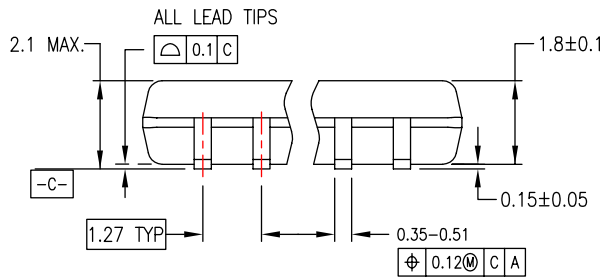
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Physical Dimensions (Continued)



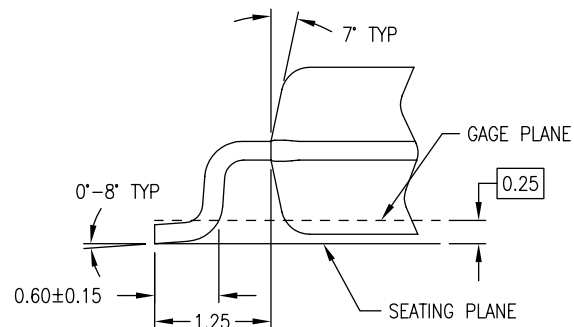
LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS

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.



DETAIL A

M14DREVC

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

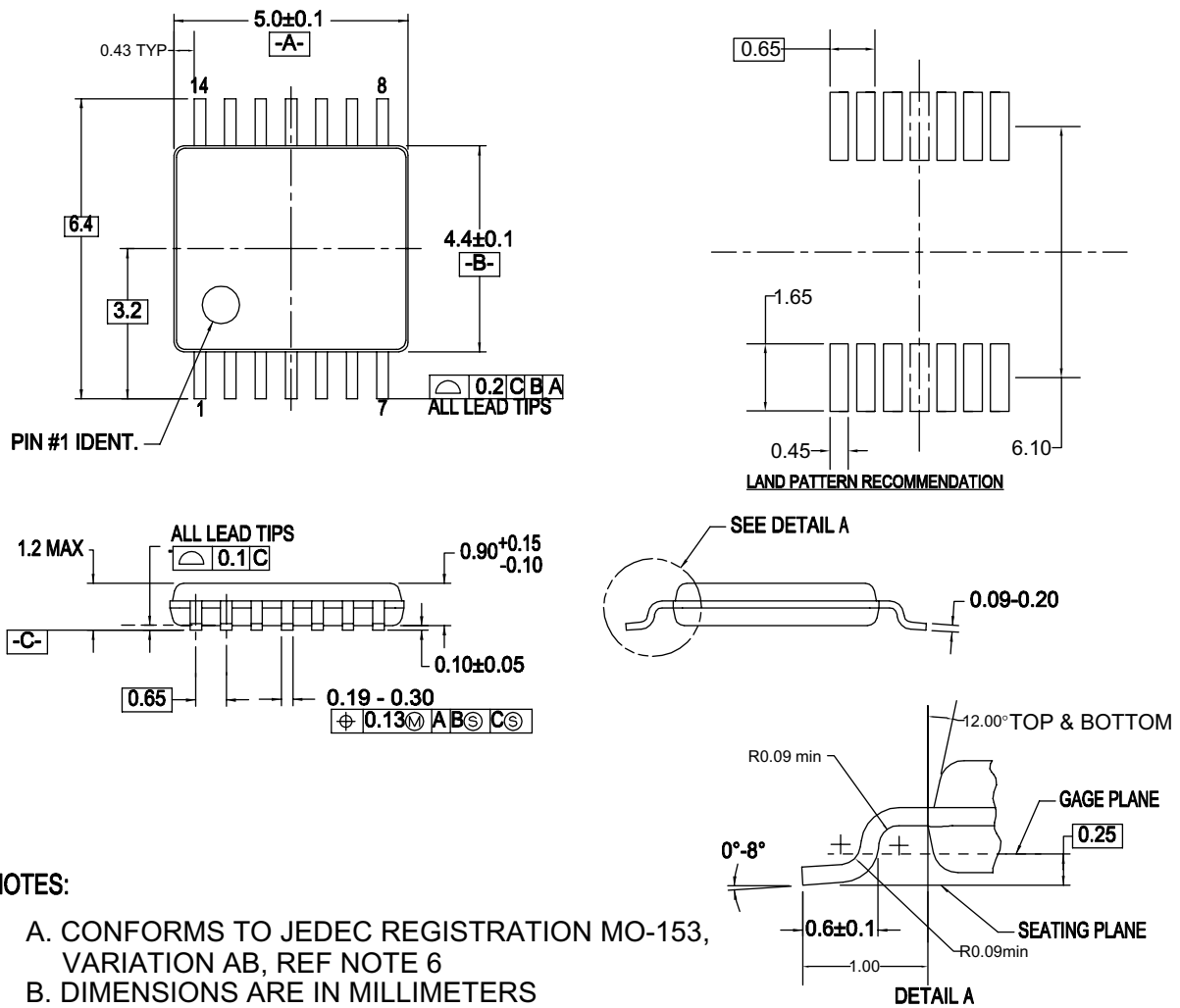
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Physical Dimensions (Continued)



NOTES:

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- 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

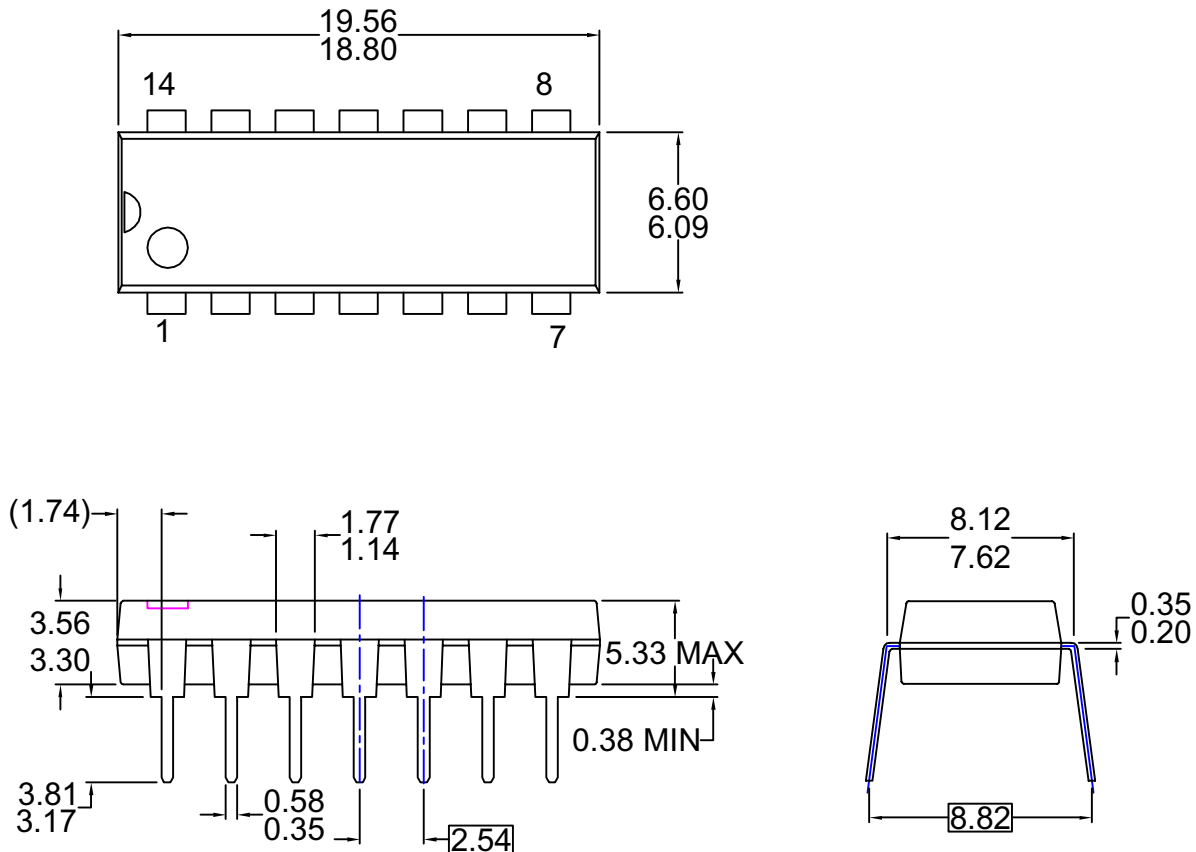
Figure 3. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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## Physical Dimensions (Continued)



- NOTES: UNLESS OTHERWISE SPECIFIED**  
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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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| FlashWriter <sup>®</sup> *  | OPTOPLANAR <sup>®</sup>                      | SuperSOT <sup>™</sup> 6                | Ultra FRFET <sup>™</sup>         |
|   |  | SuperSOT <sup>™</sup> 8                | UniFET <sup>™</sup>              |
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**Definition of Terms**

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