

# MM74HCT14

## Hex Inverting Schmitt Trigger

### Features

- Typical Propagation Delay: 13ns
- Wide Power Supply Range: 4.5V–5.5V
- Low Quiescent Current: 10µA Maximum
- Low Input Current: 1µA Maximum
- Fanout of 10 LS-TTL Loads
- Typical Hysteresis Voltage: 0.6V at  $V_{CC} = 4.5V$
- TTL, LS Pin-out and Input Threshold Compatible

### 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. Inputs are protected from damage due to static discharge by internal diode clamps to  $V_{CC}$  and ground.

### Ordering Information

| Part Number   | Operating Temperature Range |  Eco Status | Package                                                                        | Packing Method |
|---------------|-----------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|----------------|
| MM74HCT14M    | -40°C to +85°C              | RoHS                                                                                           | 14-Lead, Small-Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150in Narrow | Tube           |
| MM74HCT14MX   | -40°C to +85°C              | RoHS                                                                                           | 14-Lead, Small-Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150in Narrow | Tape & Reel    |
| MM74HCT14SJ   | -40°C to +85°C              | RoHS                                                                                           | 14-Lead, Small-Outline Package (SOP), EIAJ Type II, 5.3mm Wide                 | Tube           |
| MM74HCT14SJX  | -40°C to +85°C              | RoHS                                                                                           | 14-Lead, Small-Outline Package (SOP), EIAJ Type II, 5.3mm Wide                 | Tape & Reel    |
| MM74HCT14MTC  | -40°C to +85°C              | RoHS                                                                                           | 14-Lead, Thin-Shrink Small-Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide   | Tube           |
| MM74HCT14MTCX | -40°C to +85°C              | RoHS                                                                                           | 14-Lead, Thin-Shrink Small-Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide   | Tape & Reel    |
| MM74HCT14SN   | -40°C to +85°C              | RoHS                                                                                           | 14-Lead, Plastic Dual-Inline Package (PDIP), JEDEC MS-001, 0.300in Wide        | Tube           |

 For Fairchild's definition of Eco Status, please visit: [http://www.fairchildsemi.com/company/green/rohs\\_green.html](http://www.fairchildsemi.com/company/green/rohs_green.html).

## Connection Diagram

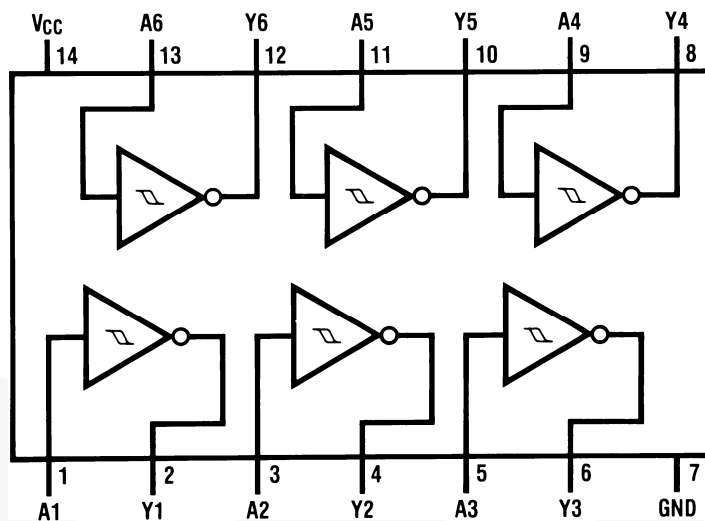


Figure 1. Pin Assignments

## Schematic Diagram

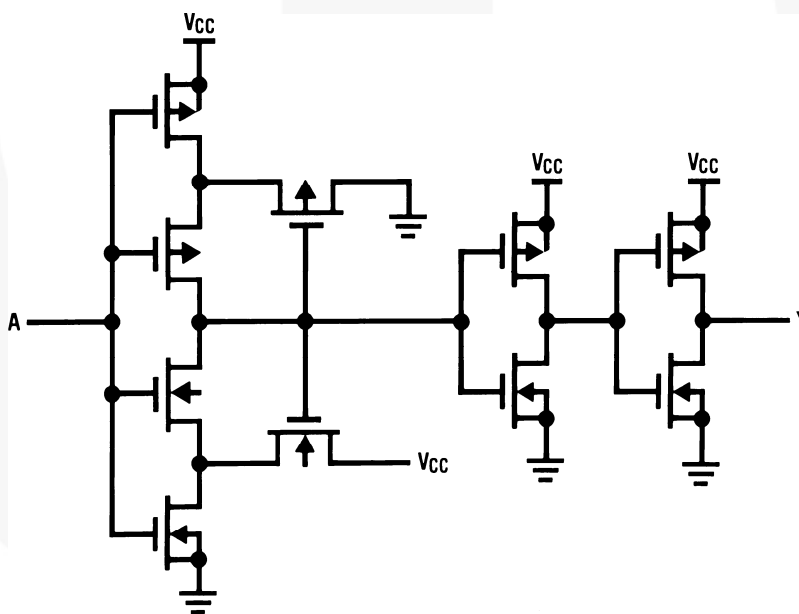


Figure 2. Schematic

## 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. Unless otherwise specified, all voltages are referenced to ground.

| Symbol        | Parameter                               | Min. | Max.           | Unit |
|---------------|-----------------------------------------|------|----------------|------|
| $V_{CC}$      | Supply Voltage                          | -0.5 | +7.0           | V    |
| $V_{IN}$      | DC Input Voltage                        | -1.5 | $V_{CC} + 1.5$ | V    |
| $V_{OUT}$     | DC Output Voltage                       | -0.5 | $V_{CC} + 0.5$ | V    |
| $I_K, I_{OK}$ | Clamp Diode Current                     |      | $\pm 20$       | mA   |
| $I_{OUT}$     | DC Output Current, Per Pin              |      | $\pm 25$       | mA   |
| $I_{CC}$      | DC $V_{CC}$ or GND Current, Per Pin     |      | $\pm 50$       | mA   |
| $T_{STG}$     | Storage Temperature Range               | -65  | +150           | °C   |
| $T_L$         | Lead Temperature (Soldering 10 Seconds) |      | +260           | °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.     | Unit |
|-------------------|-----------------------------|------|----------|------|
| $V_{CC}$          | 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   |

## DC Electrical Characteristics

| Symbol          | Parameter                            | Conditions                                                                   | V <sub>CC</sub> | T <sub>A</sub> =+25°C |                       | T <sub>A</sub> =-40°C<br>to +85°C | Units |
|-----------------|--------------------------------------|------------------------------------------------------------------------------|-----------------|-----------------------|-----------------------|-----------------------------------|-------|
|                 |                                      |                                                                              |                 | Typ.                  | Guaranteed Limits     |                                   |       |
| V <sub>T+</sub> | Positive-Going<br>Threshold Voltage  | Minimum                                                                      | 4.5             | 1.5                   | 1.2                   | 1.2                               | V     |
|                 |                                      |                                                                              | 5.5             | 1.7                   | 1.4                   | 1.4                               |       |
|                 |                                      | Maximum                                                                      | 4.5             | 1.5                   | 1.9                   | 1.9                               |       |
|                 |                                      |                                                                              | 5.5             | 1.7                   | 2.1                   | 2.1                               |       |
| V <sub>T-</sub> | Negative-Going<br>Threshold Voltage  | Minimum                                                                      | 4.5             | 0.9                   | 0.5                   | 0.5                               | V     |
|                 |                                      |                                                                              | 5.5             | 1.0                   | 0.6                   | 0.6                               |       |
|                 |                                      | Maximum                                                                      | 4.5             | 0.9                   | 1.2                   | 1.2                               |       |
|                 |                                      |                                                                              | 5.5             | 1.0                   | 1.4                   | 1.4                               |       |
| V <sub>H</sub>  | Hysteresis Voltage                   | Minimum                                                                      | 4.5             | 0.6                   | 0.4                   | 0.4                               | V     |
|                 |                                      |                                                                              | 5.5             | 0.7                   | 0.4                   | 0.4                               |       |
|                 |                                      | Maximum                                                                      | 4.5             | 0.6                   | 1.4                   | 1.4                               |       |
|                 |                                      |                                                                              | 5.5             | 0.7                   | 1.5                   | 1.5                               |       |
| V <sub>OH</sub> | Minimum HIGH Level<br>Output Voltage | V <sub>IN</sub> =V <sub>IL</sub> ,   I <sub>OUT</sub>   = 20μA               | 4.5             | 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              | 4.5             | 4.20                  | 3.98                  | 3.84                              |       |
|                 |                                      | V <sub>IN</sub> =V <sub>IL</sub> ,   I <sub>OUT</sub>   = 4.8mA              | 5.5             | 5.20                  | 4.98                  | 4.98                              |       |
| V <sub>OL</sub> | Maximum LOW Level<br>Voltage         | V <sub>IN</sub> =V <sub>IL</sub> ,   I <sub>OUT</sub>   = 20μA               | 4.5             | 0                     | 0.1                   | 0.1                               | V     |
|                 |                                      | V <sub>IN</sub> =V <sub>IL</sub> ,   I <sub>OUT</sub>   = 4.0mA              | 4.5             | 0.2                   | 0.26                  | 0.33                              |       |
|                 |                                      | V <sub>IN</sub> =V <sub>IL</sub> ,   I <sub>OUT</sub>   = 4.8mA              | 5.5             | 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> | 5.5             |                       | ±0.1                  | ±1.0                              | μA    |
| I <sub>CC</sub> | Maximum Quiescent<br>Supply Current  | V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0μA             | 5.5             |                       | 1.0                   | 10.0                              | μA    |
|                 |                                      | V <sub>IN</sub> = 2.4V or 0.5V                                               |                 |                       | 2.4                   | 2.4                               | mA    |

**AC Electrical Characteristics**

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

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

**AC Electrical Characteristics**

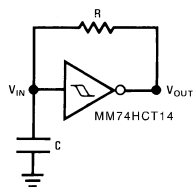
Unless otherwise specified,  $V_{CC} = 5V \pm 10\%$ ,  $C_L = 50pF$ ,  $t_r = t_f = 6ns$ .

| Symbol                              | Parameter                                    | Conditions | T <sub>A</sub> =+25°C |                   | T <sub>A</sub> =-40°C<br>to +85°C | Units |
|-------------------------------------|----------------------------------------------|------------|-----------------------|-------------------|-----------------------------------|-------|
|                                     |                                              |            | Typ.                  | Guaranteed Limits |                                   |       |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Propagation Delay                    |            |                       | 20                | 25                                | ns    |
| t <sub>TLH</sub> , t <sub>THL</sub> | Maximum Output Rise and Fall Time            |            | 9                     | 15                | 19                                | ns    |
| C <sub>PD</sub>                     | Power Dissipation Capacitance <sup>(1)</sup> | Per Gate   |                       | 25                |                                   | pF    |
| C <sub>IN</sub>                     | Maximum Input Capacitance                    |            | 5                     | 10                | 10                                | pF    |

**Note:**

1.  $C_{PD}$  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 Applications

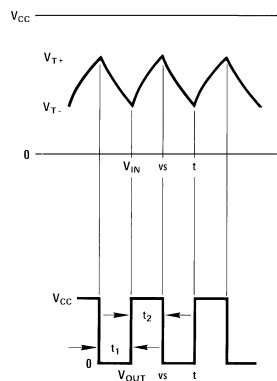


**Figure 3. Low Power Oscillator**

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

$$t_2 \approx RC \ln \frac{V_{CC} - V_{T-}}{V_{CC} - V_{T+}} \quad (1)$$

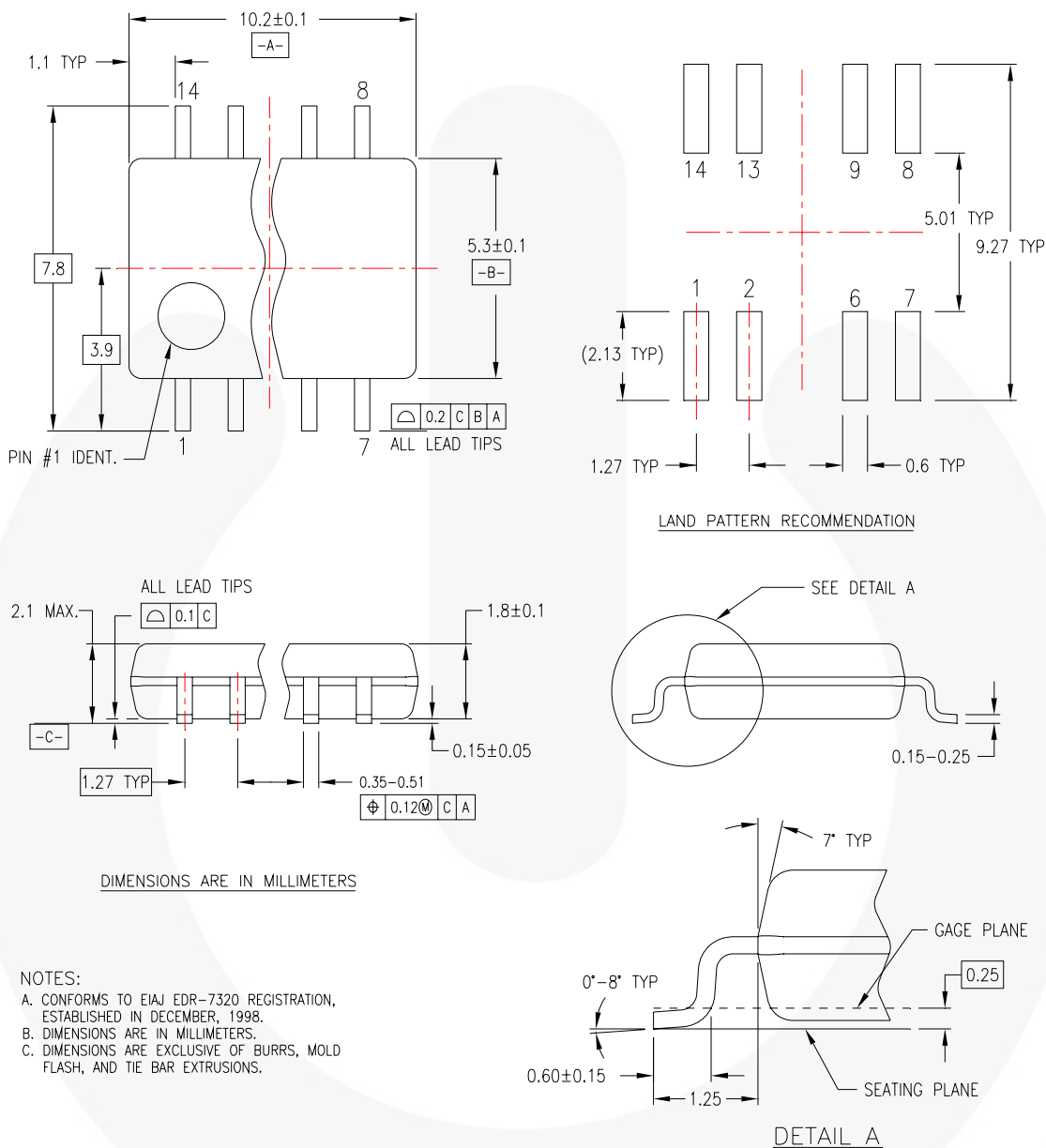
$$f \approx \frac{1}{RC \ln \frac{V_{T+}(V_{CC} - V_{T-})}{V_{T-}(V_{CC} - V_{T+})}} \quad (2)$$



**Figure 4. Oscillator Input and Output Waveforms**



## Physical Dimensions



M14DREVC

Figure 6. 14-Lead, Small-Outline Package (SOP), EIAJ Type II, 5.3mm Wide

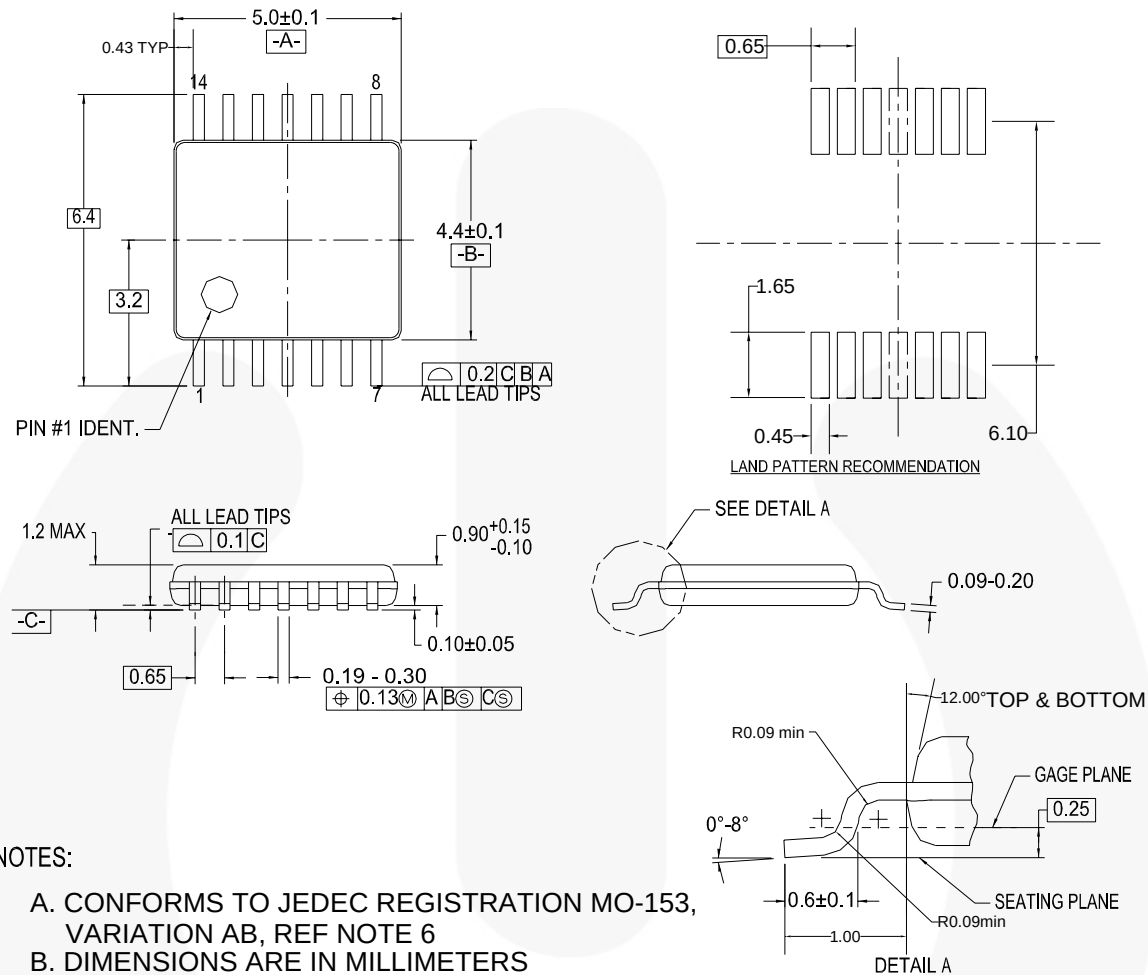
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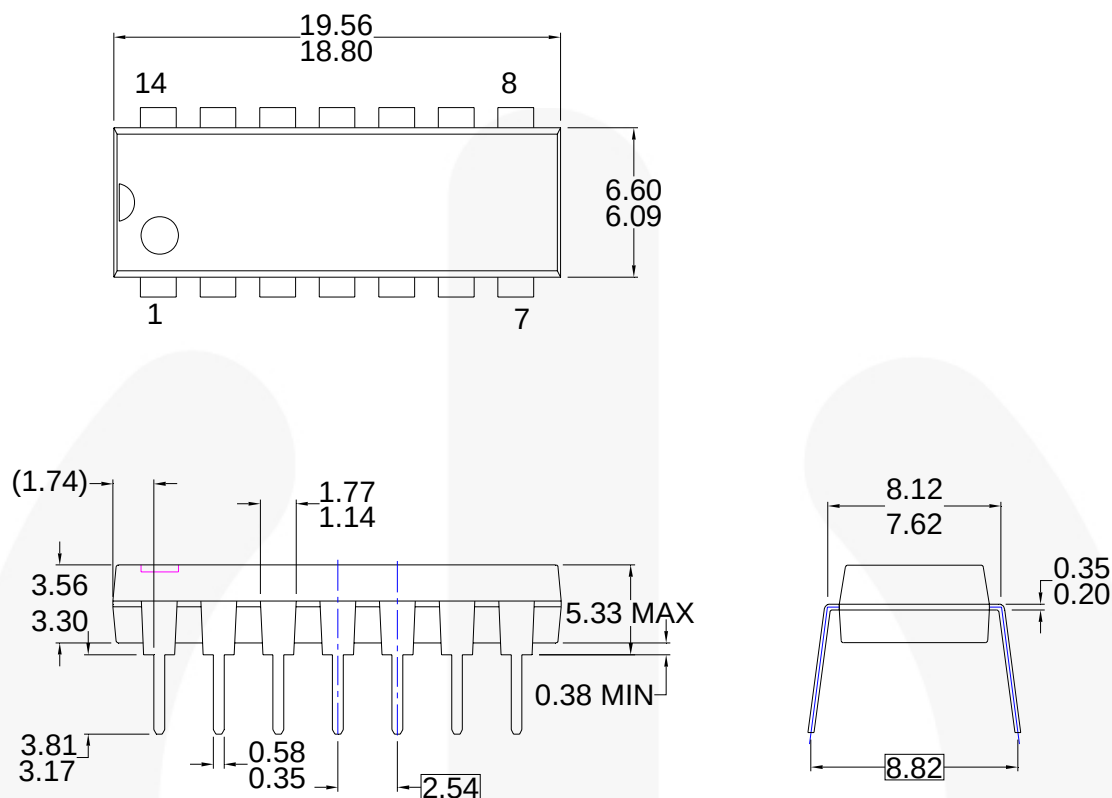


**Figure 7. 14-Lead, Thin-Shrink Small-Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide**

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**Figure 8. 14-Lead, Plastic Dual-Inline Package (PDIP), JEDEC MS-001, 0.300in Wide**

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