

# MM74HC74A

## Dual D-Type Flip-Flop with Preset and Clear

### Features

- Typical propagation delay: 20ns
- Wide power supply range: 2V–6V
- Low quiescent current: 40µA maximum (74HC Series)
- Low input current: 1µA maximum
- Fanout of 10 LS-TTL loads

### General Description

The MM74HC74A utilizes advanced silicon-gate CMOS technology to achieve operating speeds similar to the equivalent LS-TTL part. It possesses the high noise immunity and low power consumption of standard CMOS integrated circuits, along with the ability to drive 10 LS-TTL loads.

This flip-flop has independent data, preset, clear, and clock inputs and Q and  $\bar{Q}$  outputs. The logic level present at the data input is transferred to the output during the positive-going transition of the clock pulse. Preset and clear are independent of the clock and accomplished by a low level at the appropriate input.

The 74HC 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

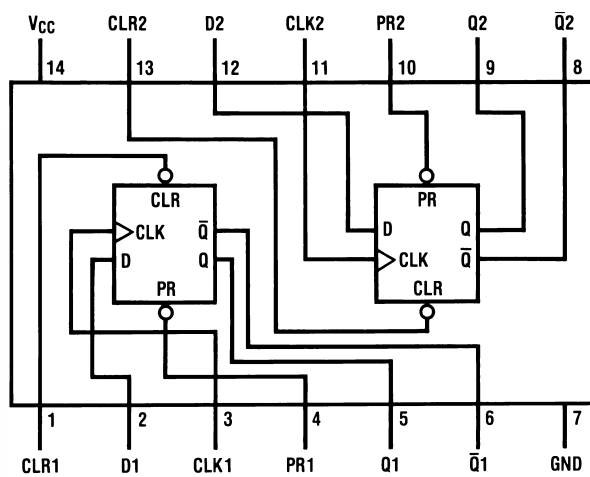
| Order Number | Package Number | Package Description                                                          |
|--------------|----------------|------------------------------------------------------------------------------|
| MM74HC74AM   | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| MM74HC74ASJ  | M14D           | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                |
| MM74HC74AMTC | MTC14          | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  |
| MM74HC74AN   | 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

## Truth Table

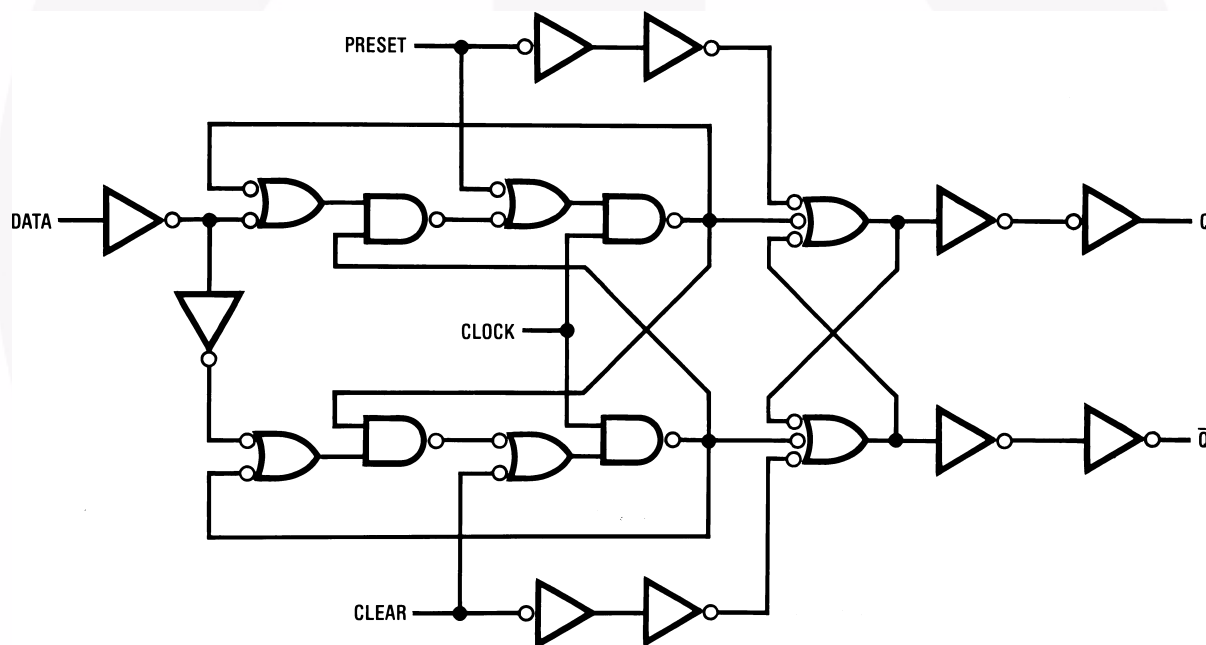
| Inputs |     |     |   | Outputs          |                  |
|--------|-----|-----|---|------------------|------------------|
| PR     | CLR | CLK | D | Q                | $\bar{Q}$        |
| L      | H   | X   | X | H                | L                |
| H      | L   | X   | X | L                | H                |
| L      | L   | X   | X | H <sup>(1)</sup> | H <sup>(1)</sup> |
| H      | H   | ↑   | H | H                | L                |
| H      | H   | ↑   | L | L                | H                |
| H      | H   | L   | X | Q <sub>0</sub>   | $\bar{Q}_0$      |

### Note:

Q<sub>0</sub> = the level of Q before the indicated input conditions were established.

1. This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (HIGH) level.

## Logic Diagram



## Absolute Maximum Ratings<sup>(2)</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                     | ±20mA                 |
| $I_{OUT}$        | DC Output Current, per pin              | ±25mA                 |
| $I_{CC}$         | DC $V_{CC}$ or GND Current, per pin     | ±50mA                 |
| $T_{STG}$        | Storage Temperature Range               | −65°C to +150°C       |
| $P_D$            | Power Dissipation<br>Note 3             | 600mW                 |
|                  | S.O. Package only                       | 500mW                 |
| $T_L$            | Lead Temperature (Soldering 10 seconds) | 260°C                 |

### Notes:

- Unless otherwise specified all voltages are referenced to ground.
- 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<br>$V_{CC} = 2.0V$ |      | 1000     | ns    |
|                   | $V_{CC} = 4.5V$                             |      | 500      | ns    |
|                   | $V_{CC} = 6.0V$                             |      | 400      | ns    |

DC Electrical Characteristics<sup>(4)</sup>

| Symbol          | Parameter                               | V <sub>CC</sub> (V) | Conditions                                                                            | T <sub>A</sub> = 25°C |                   | T <sub>A</sub> = -40°C<br>to 85°C | T <sub>A</sub> = -55°C<br>to 125°C | Units |
|-----------------|-----------------------------------------|---------------------|---------------------------------------------------------------------------------------|-----------------------|-------------------|-----------------------------------|------------------------------------|-------|
|                 |                                         |                     |                                                                                       | Typ.                  | Guaranteed Limits |                                   |                                    |       |
| V <sub>IH</sub> | Minimum HIGH<br>Level Input<br>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 <sub>IL</sub> | Maximum LOW<br>Level Input<br>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 <sub>OH</sub> | Minimum HIGH<br>Level Output<br>Voltage | 2.0                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 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 <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 4.0mA | 4.3                   | 3.98              | 3.84                              | 3.7                                |       |
|                 |                                         | 6.0                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 5.2mA | 5.2                   | 5.48              | 5.34                              | 5.2                                |       |
| V <sub>OL</sub> | Maximum LOW<br>Level Output<br>Voltage  | 2.0                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 20μA  | 0                     | 0.1               | 0.1                               | 0.1                                | V     |
|                 |                                         | 4.5                 |                                                                                       | 0                     | 0.1               | 0.1                               | 0.1                                |       |
|                 |                                         | 6.0                 |                                                                                       | 0                     | 0.1               | 0.1                               | 0.1                                |       |
|                 |                                         | 4.5                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 4.0mA | 0.2                   | 0.26              | 0.33                              | 0.4                                |       |
|                 |                                         | 6.0                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br>I <sub>OUT</sub>   ≤ 5.2mA  | 0.2                   | 0.26              | 0.33                              | 0.4                                |       |
| I <sub>IN</sub> | Maximum Input<br>Current                | 6.0                 | V <sub>IN</sub> = V <sub>CC</sub> or GND                                              |                       | ±0.1              | ±1.0                              | ±1.0                               | μA    |
| I <sub>CC</sub> | Maximum<br>Quiescent<br>Supply Current  | 6.0                 | V <sub>I</sub> N=V <sub>CC</sub> or GND,<br>I <sub>OUT</sub> = 0μA                    |                       | 4.0               | 40                                | 80                                 | μA    |

**Note:**

4. 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 |
|-----------------------|-----------------------------------------------------------------|------------|------|------------------|-------|
| $f_{MAX}$             | Maximum Operating Frequency                                     |            | 72   | 30               | MHz   |
| $t_{PHL}$ , $t_{PLH}$ | Maximum Propagation,<br>Delay Clock to Q or $\bar{Q}$           |            | 10   | 30               | ns    |
| $t_{PHL}$ , $t_{PLH}$ | Maximum Propagation,<br>Delay Preset or Clear to Q or $\bar{Q}$ |            | 17   | 40               | ns    |
| $t_{REM}$             | Minimum Removal Time,<br>Preset or Clear to Clock               |            | 6    | 5                | ns    |
| $t_s$                 | Minimum Setup Time, Data to Clock                               |            | 10   | 20               | ns    |
| $t_H$                 | Minimum Hold Time, Clock to Data                                |            | 0    | 0                | ns    |
| $t_W$                 | Minimum Pulse Width Clock, Preset or Clear                      |            | 8    | 16               | ns    |

**AC Electrical Characteristics** $C_L = 50 \text{ pF}$ ,  $t_r = t_f = 6 \text{ ns}$  (unless otherwise specified)

| Symbol                              | Parameter                                            | Conditions      | V <sub>CC</sub> (V) | T <sub>A</sub> = 25°C | T <sub>A</sub> = −40°C to 85°C | T <sub>A</sub> = −55°C to 125°C | Units |     |
|-------------------------------------|------------------------------------------------------|-----------------|---------------------|-----------------------|--------------------------------|---------------------------------|-------|-----|
|                                     |                                                      |                 |                     | Typ.                  | Guaranteed Limits              |                                 |       |     |
| f <sub>MAX</sub>                    | Maximum Operating Frequency                          |                 | 2.0                 | 22                    | 6                              | 5                               | 4     | MHz |
|                                     |                                                      |                 | 4.5                 | 72                    | 30                             | 24                              | 20    |     |
|                                     |                                                      |                 | 6.0                 | 94                    | 35                             | 28                              | 24    |     |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Propagation Delay Clock to Q or Q̄           |                 | 2.0                 | 34                    | 110                            | 140                             | 165   | ns  |
|                                     |                                                      |                 | 4.5                 | 12                    | 22                             | 28                              | 33    |     |
|                                     |                                                      |                 | 6.0                 | 10                    | 19                             | 24                              | 28    |     |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Propagation Delay Preset or Clear to Q or Q̄ |                 | 2.0                 | 66                    | 150                            | 190                             | 225   | ns  |
|                                     |                                                      |                 | 4.5                 | 20                    | 30                             | 38                              | 45    |     |
|                                     |                                                      |                 | 6.0                 | 16                    | 26                             | 33                              | 38    |     |
| t <sub>REM</sub>                    | Minimum Removal Time, Preset or Clear to Clock       |                 | 2.0                 | 20                    | 50                             | 65                              | 75    | ns  |
|                                     |                                                      |                 | 4.5                 | 6                     | 10                             | 13                              | 15    |     |
|                                     |                                                      |                 | 6.0                 | 5                     | 9                              | 11                              | 13    |     |
| t <sub>s</sub>                      | Minimum Setup Time Data to Clock                     |                 | 2.0                 | 35                    | 80                             | 100                             | 120   | ns  |
|                                     |                                                      |                 | 4.5                 | 10                    | 16                             | 20                              | 24    |     |
|                                     |                                                      |                 | 6.0                 | 8                     | 14                             | 17                              | 20    |     |
| t <sub>H</sub>                      | Minimum Hold Time Clock to Data                      |                 | 2.0                 |                       | 0                              | 0                               | 0     | ns  |
|                                     |                                                      |                 | 4.5                 |                       | 0                              | 0                               | 0     |     |
|                                     |                                                      |                 | 6.0                 |                       | 0                              | 0                               | 0     |     |
| t <sub>W</sub>                      | Minimum, Pulse Width Clock, Preset or Clear          |                 | 2.0                 | 30                    | 80                             | 101                             | 119   | ns  |
|                                     |                                                      |                 | 4.5                 | 9                     | 16                             | 20                              | 24    |     |
|                                     |                                                      |                 | 6.0                 | 8                     | 14                             | 17                              | 20    |     |
| t <sub>TLH</sub> , t <sub>THL</sub> | Maximum Output Rise and Fall Time                    |                 | 2.0                 | 25                    | 75                             | 95                              | 110   | ns  |
|                                     |                                                      |                 | 4.5V                | 7                     | 15                             | 19                              | 22    |     |
|                                     |                                                      |                 | 6.0V                | 6                     | 13                             | 16                              | 19    |     |
| t <sub>r</sub> , t <sub>f</sub>     | Maximum Input Rise and Fall Time                     |                 | 2.0                 |                       | 1000                           | 1000                            | 1000  | ns  |
|                                     |                                                      |                 | 4.5                 |                       | 500                            | 500                             | 500   |     |
|                                     |                                                      |                 | 6.0                 |                       | 400                            | 400                             | 400   |     |
| C <sub>PD</sub>                     | Power Dissipation Capacitance <sup>(5)</sup>         | (per flip-flop) |                     | 80                    |                                |                                 |       | pF  |
| C <sub>IN</sub>                     | Maximum Input Capacitance                            |                 |                     | 5                     | 10                             | 10                              | 10    | pF  |

**Note:**

5.  $C_{PD}$  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

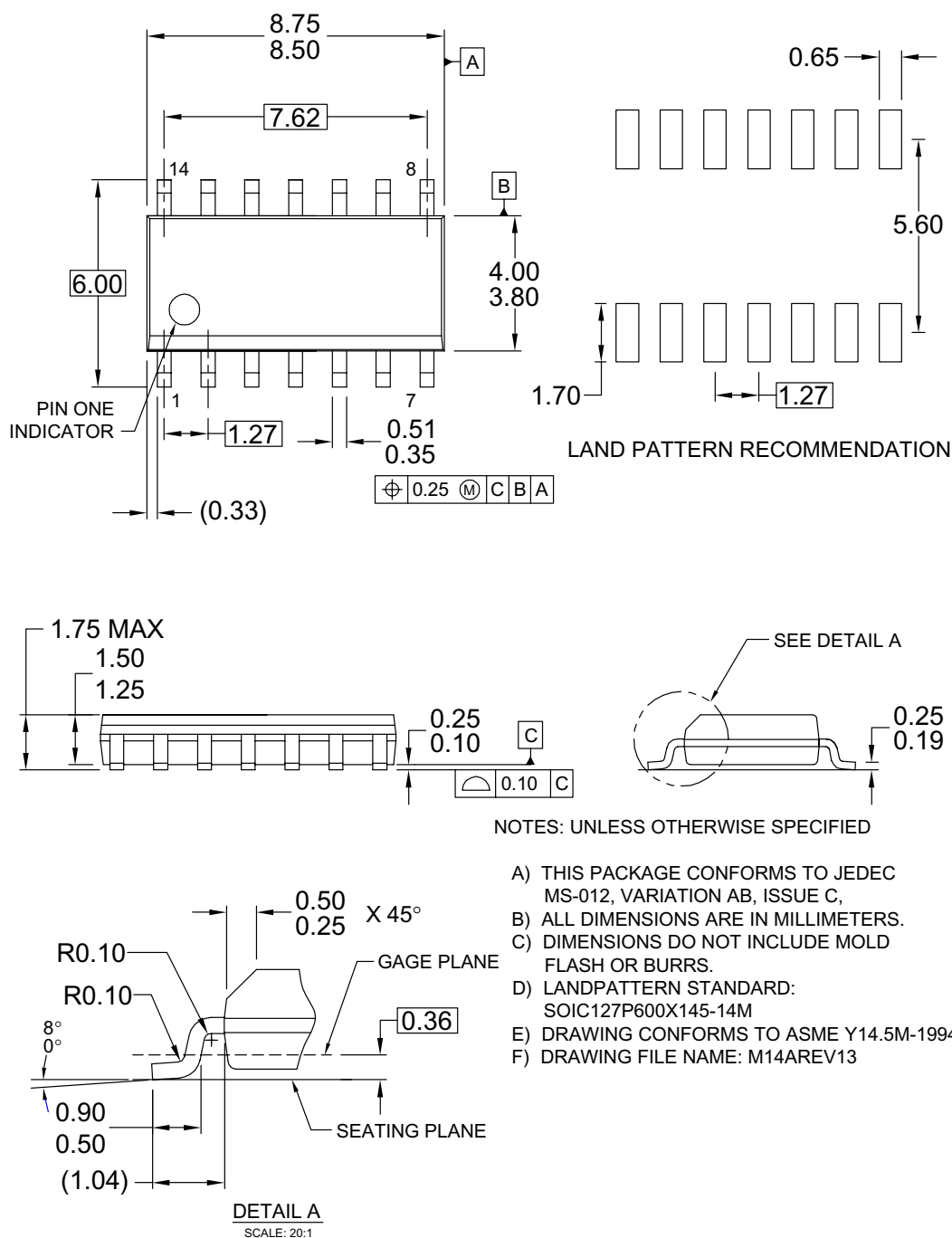


Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

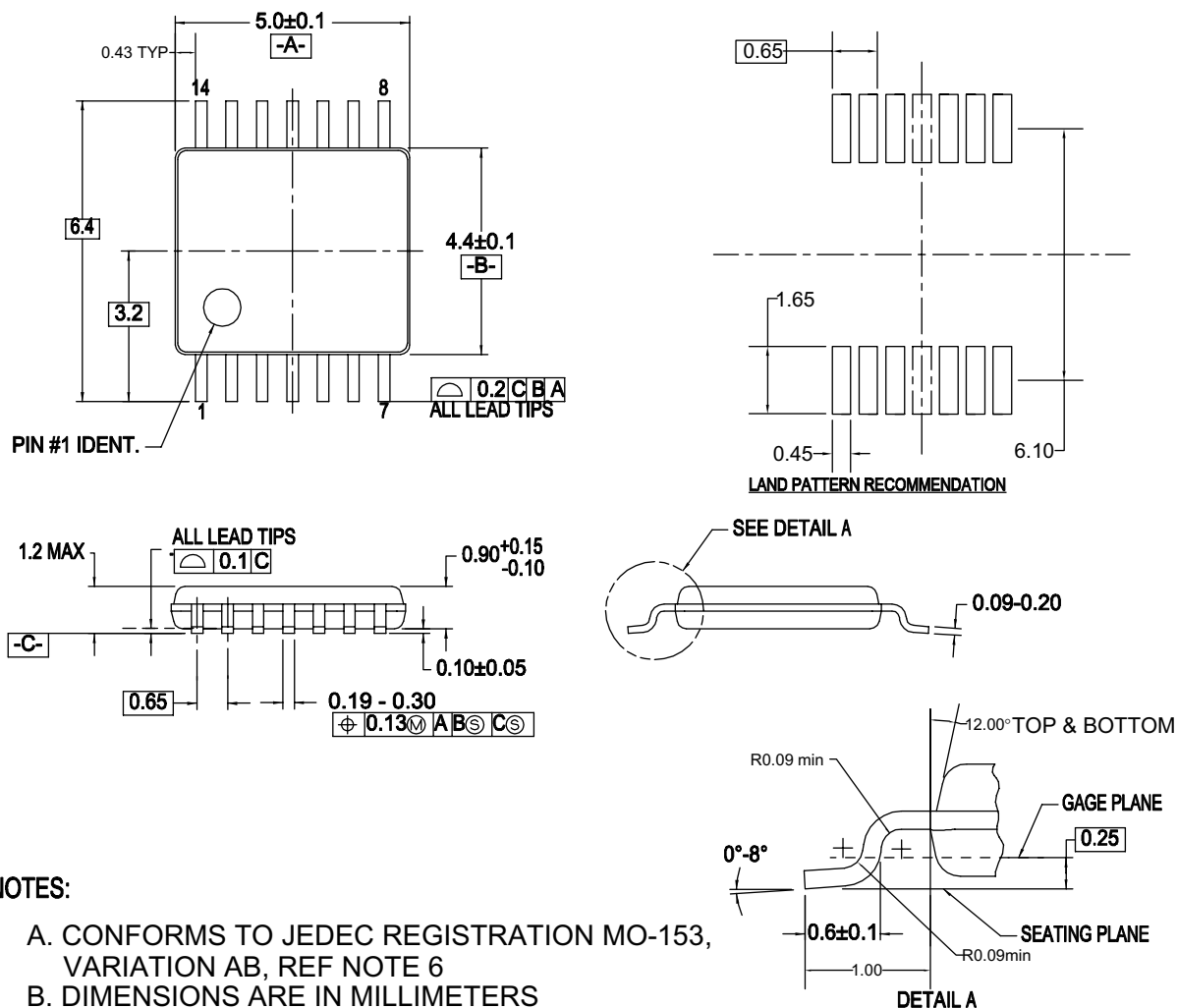
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## Physical Dimensions (Continued)



## NOTES:

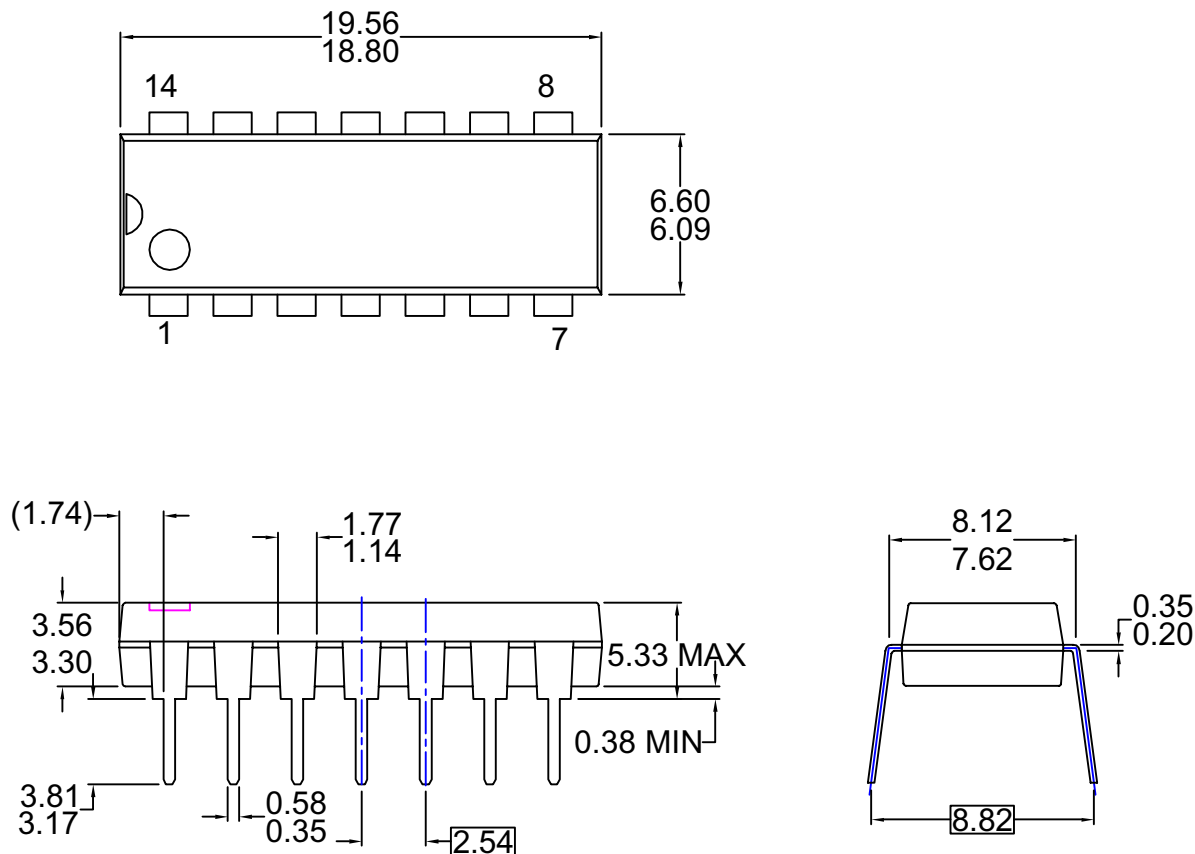
- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6
- B. DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982
- E. LANDPATTERN STANDARD: SOP65P640X110-14M
- F. DRAWING FILE NAME: 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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| FlashWriter <sup>®</sup> *                                                        | OPTOPLANAR <sup>®</sup>                      | SuperSOT <sup>™</sup> 6                | Ultra FRFET <sup>™</sup>         |
|                                                                                   |                                              | SuperSOT <sup>™</sup> 8                | UniFET <sup>™</sup>              |
|                                                                                   |                                              |                                        | VCX <sup>™</sup>                 |

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|--------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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