

## 74LVX74

# Low Voltage Dual D-Type Positive Edge-Triggered Flip-Flop

### Features

- Input voltage level translation from 5V to 3V
- Ideal for low power/low noise 3.3V applications
- Guaranteed simultaneous switching noise level and dynamic threshold performance

### General Description

The LVX74 is a dual D-type flip-flop with Asynchronous Clear and Set inputs and complementary (Q,  $\bar{Q}$ ) outputs. Information at the input is transferred to the outputs on the positive edge of the clock pulse. After the Clock Pulse input threshold voltage has been passed, the Data input is locked out and information present will not be transferred to the outputs until the next rising edge of the Clock Pulse input.

Asynchronous Inputs:

- LOW input to  $\bar{S}_D$  (Set) sets Q to HIGH level
- LOW input to  $\bar{C}_D$  (Clear) sets Q to LOW level
- Clear and Set are independent of clock
- Simultaneous LOW on  $\bar{C}_D$  and  $\bar{S}_D$  makes both Q and  $\bar{Q}$  HIGH

### Ordering Information

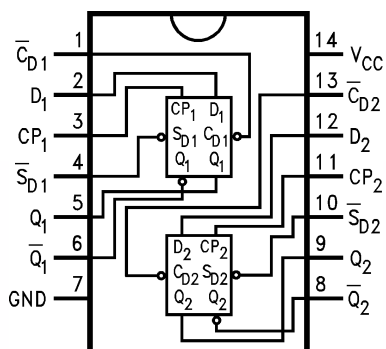
| Order Number | Package Number | Package Description                                                          |
|--------------|----------------|------------------------------------------------------------------------------|
| 74LVX74M     | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| 74LVX74SJ    | M14D           | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                |
| 74LVX74MTC   | MTC14          | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm 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.

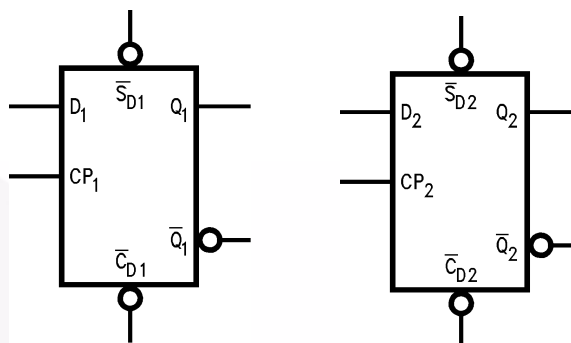
## Connection Diagram



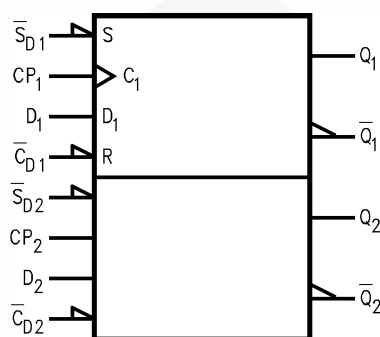
## Pin Description

| Pin Names                                  | Description         |
|--------------------------------------------|---------------------|
| $D_1, D_2$                                 | Data Inputs         |
| $CP_1, CP_2$                               | Clock Pulse Inputs  |
| $\overline{C}_{D1}, \overline{C}_{D2}$     | Direct Clear Inputs |
| $\overline{S}_{D1}, \overline{S}_{D2}$     | Direct Set Inputs   |
| $Q_1, \overline{Q}_1, Q_2, \overline{Q}_2$ | Outputs             |

## Logic Symbols



## IEEE/IEC



## Truth Table

(Each Half)

| Inputs           |                  |    |   | Outputs |                  |
|------------------|------------------|----|---|---------|------------------|
| $\overline{S}_D$ | $\overline{C}_D$ | CP | D | Q       | $\overline{Q}$   |
| L                | H                | X  | X | H       | L                |
| H                | L                | X  | X | L       | H                |
| L                | L                | X  | X | H       | H                |
| H                | H                | ↗  | H | H       | L                |
| H                | H                | ↘  | L | L       | H                |
| H                | H                | L  | X | $Q_0$   | $\overline{Q}_0$ |

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

↗ = LOW-to-HIGH Clock Transition

$Q_0(\overline{Q}_0)$  = Previous Q( $\overline{Q}$ ) before LOW-to-HIGH Transition of Clock

## 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.

| Symbol                | Parameter                                | Rating                   |
|-----------------------|------------------------------------------|--------------------------|
| $V_{CC}$              | Supply Voltage                           | -0.5V to +7.0V           |
| $I_{IK}$              | DC Input Diode Current, $V_I = -0.5V$    | -20mA                    |
| $V_I$                 | DC Input Voltage                         | -0.5V to 7V              |
| $I_{OK}$              | DC Output Diode Current<br>$V_O = -0.5V$ | -20mA                    |
|                       | $V_O = V_{CC} + 0.5V$                    | +20mA                    |
| $V_O$                 | DC Output Voltage                        | -0.5V to $V_{CC} + 0.5V$ |
| $I_O$                 | DC Output Source or Sink Current         | $\pm 25mA$               |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current            | $\pm 50mA$               |
| $T_{STG}$             | Storage Temperature                      | -65°C to +150°C          |
| P                     | Power Dissipation                        | 180mW                    |

## Recommended Operating Conditions<sup>(1)</sup>

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                | Rating           |
|-----------------------|--------------------------|------------------|
| $V_{CC}$              | Supply Voltage           | 2.0V to 3.6V     |
| $V_I$                 | Input Voltage            | 0V to 5.5V       |
| $V_O$                 | Output Voltage           | 0V to $V_{CC}$   |
| $T_A$                 | Operating Temperature    | -40°C to +85°C   |
| $\Delta t / \Delta V$ | Input Rise and Fall Time | 0ns/V to 100ns/V |

### Note:

1. Unused inputs must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

| Symbol          | Parameter                 | V <sub>CC</sub> | Conditions                                                                        | T <sub>A</sub> = +25°C |      |      | T <sub>A</sub> = -40°C to +85°C |      | Units |
|-----------------|---------------------------|-----------------|-----------------------------------------------------------------------------------|------------------------|------|------|---------------------------------|------|-------|
|                 |                           |                 |                                                                                   | Min.                   | Typ. | Max. | Min.                            | Max. |       |
| V <sub>IH</sub> | HIGH Level Input Voltage  | 2.0             |                                                                                   | 1.5                    |      |      | 1.5                             |      | V     |
|                 |                           | 3.0             |                                                                                   | 2.0                    |      |      | 2.0                             |      |       |
|                 |                           | 3.6             |                                                                                   | 2.4                    |      |      | 2.4                             |      |       |
| V <sub>IL</sub> | LOW Level Input Voltage   | 2.0             |                                                                                   |                        |      | 0.5  |                                 | 0.5  | V     |
|                 |                           | 3.0             |                                                                                   |                        |      | 0.8  |                                 | 0.8  |       |
|                 |                           | 3.6             |                                                                                   |                        |      | 0.8  |                                 | 0.8  |       |
| V <sub>OH</sub> | HIGH Level Output Voltage | 2.0             | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> ,<br>I <sub>OH</sub> = -50μA | 1.9                    | 2.0  |      | 1.9                             |      | V     |
|                 |                           | 3.0             | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> ,<br>I <sub>OH</sub> = -50μA | 2.9                    | 3.0  |      | 2.9                             |      |       |
|                 |                           |                 | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> ,<br>I <sub>OH</sub> = -4mA  | 2.58                   |      |      | 2.48                            |      |       |
| V <sub>OL</sub> | LOW Level Output Voltage  | 2.0             | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> ,<br>I <sub>OL</sub> = 50μA  |                        | 0.0  | 0.1  |                                 | 0.1  | V     |
|                 |                           | 3.0             | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> ,<br>I <sub>OL</sub> = 50μA  |                        | 0.0  | 0.1  |                                 | 0.1  |       |
|                 |                           |                 | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> ,<br>I <sub>OL</sub> = 4mA   |                        |      | 0.36 |                                 | 0.44 |       |
| I <sub>IN</sub> | Input Leakage Current     | 3.6             | V <sub>IN</sub> = 5.5V or GND                                                     |                        |      | ±0.1 |                                 | ±1.0 | μA    |
| I <sub>CC</sub> | Quiescent Supply Current  | 3.6             | V <sub>IN</sub> = V <sub>CC</sub> or GND                                          |                        |      | 2.0  |                                 | 20.0 | μA    |

Noise Characteristics<sup>(2)</sup>

| Symbol           | Parameter                                    | V <sub>CC</sub> (V) | C <sub>L</sub> (pF) | T <sub>A</sub> = 25°C |       | Units |
|------------------|----------------------------------------------|---------------------|---------------------|-----------------------|-------|-------|
|                  |                                              |                     |                     | Typ.                  | Limit |       |
| V <sub>OLP</sub> | Quiet Output Maximum Dynamic V <sub>OL</sub> | 3.3                 | 50                  | 0.3                   | 0.5   | V     |
| V <sub>OLV</sub> | Quiet Output Minimum Dynamic V <sub>OL</sub> | 3.3                 | 50                  | -0.3                  | -0.5  | V     |
| V <sub>IHD</sub> | Minimum HIGH Level Dynamic Input Voltage     | 3.3                 | 50                  |                       | 2.0   | V     |
| V <sub>ILD</sub> | Maximum LOW Level Dynamic Input Voltage      | 3.3                 | 50                  |                       | 0.8   | V     |

## Note:

2. Input t<sub>r</sub> = t<sub>f</sub> = 3ns

## AC Electrical Characteristics

| Symbol                                | Parameter                                                                            | V <sub>CC</sub> (V) | C <sub>L</sub> (pF) | T <sub>A</sub> = +25°C |      |      | T <sub>A</sub> = -40°C to +85°C |      | Units |
|---------------------------------------|--------------------------------------------------------------------------------------|---------------------|---------------------|------------------------|------|------|---------------------------------|------|-------|
|                                       |                                                                                      |                     |                     | Min.                   | Typ. | Max. | Min.                            | Max. |       |
| t <sub>PLH</sub> , t <sub>PHL</sub>   | Propagation Delay, CP <sub>n</sub> to Q <sub>n</sub> or $\bar{Q}_n$                  | 2.7                 | 15                  |                        | 7.3  | 15   | 1.0                             | 18.5 | ns    |
|                                       |                                                                                      |                     | 50                  |                        | 9.8  | 18.5 | 1.0                             | 22   |       |
|                                       |                                                                                      | 3.3 ± 0.3           | 15                  |                        | 5.7  | 9.7  | 1.0                             | 11.5 |       |
|                                       |                                                                                      |                     | 50                  |                        | 8.2  | 13.2 | 1.0                             | 15   |       |
| t <sub>PLH</sub> , t <sub>PHL</sub>   | Propagation Delay, $\bar{C}_{Dn}$ to $\bar{S}_{Dn}$ to Q <sub>n</sub> or $\bar{Q}_n$ | 2.7                 | 15                  |                        | 8.4  | 15.6 | 1.0                             | 18.5 | ns    |
|                                       |                                                                                      |                     | 50                  |                        | 10.9 | 19.1 | 1.0                             | 22   |       |
|                                       |                                                                                      | 3.3 ± 0.3           | 15                  |                        | 6.6  | 10.1 | 1.0                             | 12   |       |
|                                       |                                                                                      |                     | 50                  |                        | 9.1  | 13.6 | 1.0                             | 15.5 |       |
| t <sub>W</sub>                        | CP <sub>n</sub> or $\bar{C}_{Dn}$ or $\bar{S}_{Dn}$ Pulse Width                      | 2.7                 |                     | 8.5                    |      |      | 10                              |      | ns    |
|                                       |                                                                                      | 3.3 ± 0.3           |                     | 6                      |      |      | 7                               |      |       |
| t <sub>S</sub>                        | Setup Time, D <sub>n</sub> to CP <sub>n</sub>                                        | 2.7                 |                     | 8.0                    |      |      | 9.5                             |      | ns    |
|                                       |                                                                                      | 3.3 ± 0.3           |                     | 5.5                    |      |      | 6.5                             |      |       |
| t <sub>H</sub>                        | Hold Time, D <sub>n</sub> to CP <sub>n</sub>                                         | 2.7                 |                     | 0.5                    |      |      | 0.5                             |      | ns    |
|                                       |                                                                                      | 3.3 ± 0.3           |                     | 0.5                    |      |      | 0.5                             |      |       |
| t <sub>REC</sub>                      | Recovery Time, $\bar{C}_{Pn}$ or $\bar{S}_{Dn}$ to CP <sub>n</sub>                   | 2.7                 |                     | 6.5                    |      |      | 7.5                             |      | ns    |
|                                       |                                                                                      | 3.3 ± 0.3           |                     | 5.0                    |      |      | 5.0                             |      |       |
| f <sub>MAX</sub>                      | Maximum Clock Frequency                                                              | 2.7                 | 15                  | 55                     | 135  |      | 50                              |      | MHz   |
|                                       |                                                                                      |                     | 50                  | 45                     | 60   |      | 40                              |      |       |
|                                       |                                                                                      | 3.3 ± 0.3           | 15                  | 95                     | 145  |      | 80                              |      |       |
|                                       |                                                                                      |                     | 50                  | 60                     | 85   |      | 50                              |      |       |
| t <sub>OSLH</sub> , t <sub>OSHL</sub> | Output to Output Skew <sup>(3)</sup>                                                 | 2.7                 | 50                  |                        |      | 1.5  |                                 | 1.5  | ns    |
|                                       |                                                                                      | 3.3                 |                     |                        |      | 1.5  |                                 | 1.5  |       |

## Note:

3. Parameter guaranteed by design  $t_{OSLH} = |t_{PLHm} - t_{PLHn}|$ ,  $t_{OSHL} = |t_{PHLm} - t_{PHLn}|$

## Capacitance

| Symbol          | Parameter                                    | T <sub>A</sub> = +25°C |      |      | T <sub>A</sub> = -40°C to +85°C |      | Units |
|-----------------|----------------------------------------------|------------------------|------|------|---------------------------------|------|-------|
|                 |                                              | Min.                   | Typ. | Max. | Min.                            | Max. |       |
| C <sub>IN</sub> | Input Capacitance                            |                        | 4    | 10   |                                 | 10   | pF    |
| C <sub>PD</sub> | Power Dissipation Capacitance <sup>(4)</sup> |                        | 25   |      |                                 |      | pF    |

## Note:

4. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:  $I_{CC(opr.)} = \frac{C_{PD} \times V_{CC} \times f_{IN} \times I_{CC}}{2 \text{ (per F/F)}}$

## Physical Dimensions

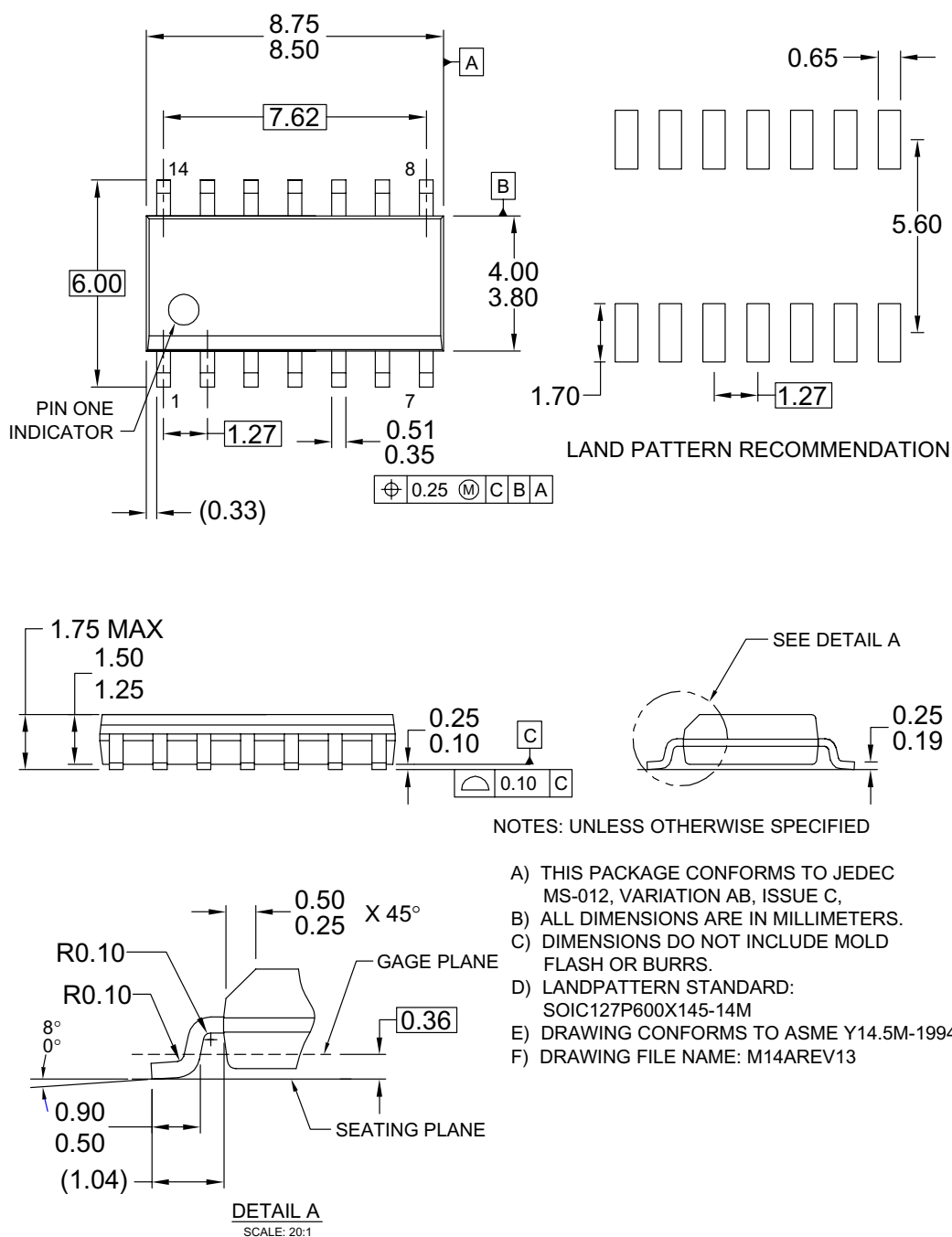


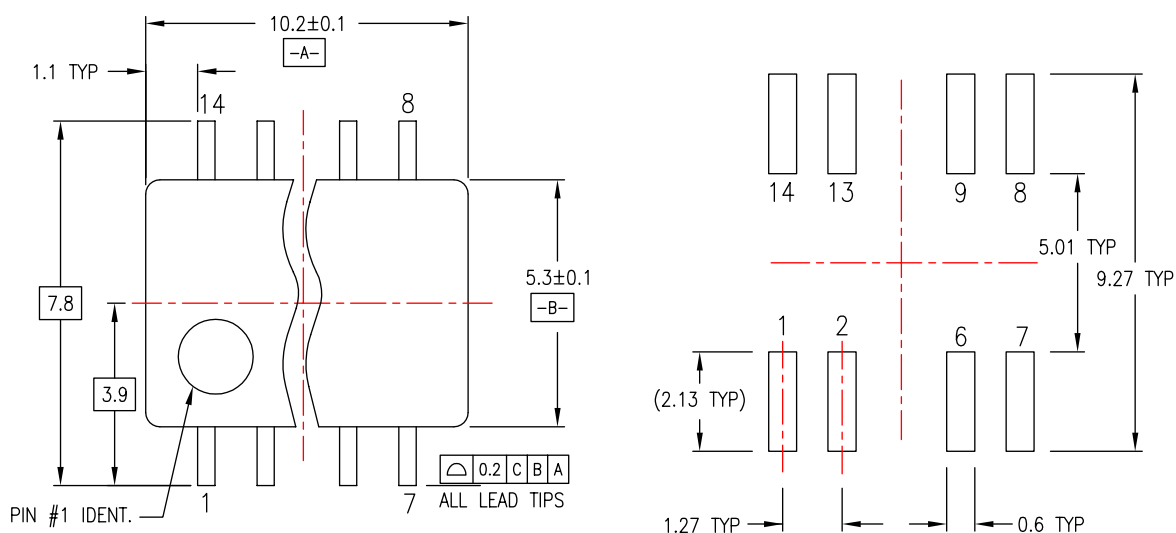
Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

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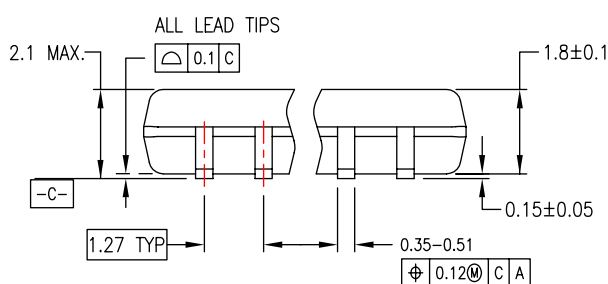
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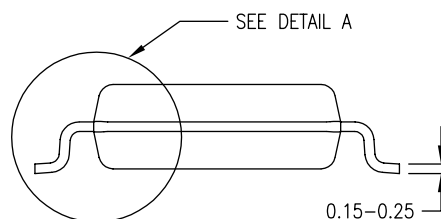
### Physical Dimensions (Continued)



LAND PATTERN RECOMMENDATION

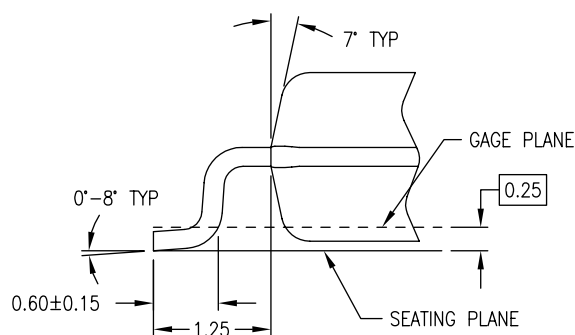


DIMENSIONS ARE IN MILLIMETERS



NOTES:

- 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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|                                                                                   |                                              | SuperSOT <sup>™</sup> 8                | Ultra FRFET <sup>™</sup>         |
|                                                                                   |                                              |                                        | UniFET <sup>™</sup>              |
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