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74VHC153

Dual 4-Input Multiplexer

Features

- High Speed: $t_{PD} = 5.0ns$ at $T_A = 25^\circ C$
- Low power dissipation: $I_{CC} = 4\mu A$ (Max.) at $T_A = 25^\circ C$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (Min.)
- Power down protection is provided on all inputs
- Pin and function compatible with 74HC153

General Description

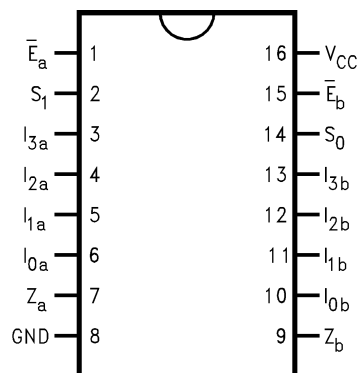
The VHC153 is an advanced high-speed CMOS device fabricated with silicon gate CMOS technology. It achieves the high-speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. The VHC153 is a high-speed Dual 4-Input Multiplexer with common select inputs and individual enable inputs for each section. It can select two lines of data from four sources. The two buffered outputs present data in the true (non-inverted) form. In addition to multiplexer operation, the VHC153 can act as a function generator and generate any two functions of three variables. An input protection circuit insures that 0V to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery backup. This circuit prevents device destruction due to mismatched supply and input voltages.

Ordering Information

| Order Number | Package Number | Package Description |
|--------------|----------------|--|
| 74VHC153M | M16A | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| 74VHC153SJ | M16D | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74VHC153MTC | MTC16 | 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering number.

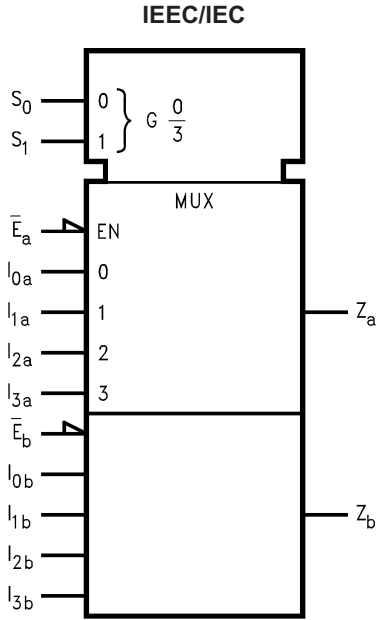
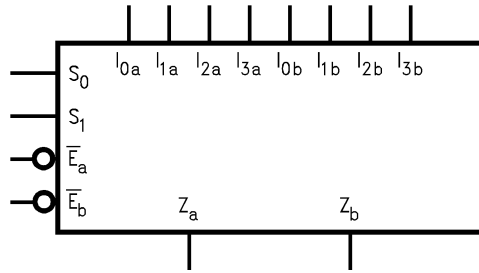
Connection Diagram



Pin Description

| Pin Names | Description |
|-----------------|----------------------|
| $I_{0a}-I_{3a}$ | Side A Data Inputs |
| $I_{0b}-I_{3b}$ | Side B Data Inputs |
| S_0, S_1 | Common Select Inputs |
| \bar{E}_a | Side A Enable Input |
| \bar{E}_b | Side B Enable Input |
| Z_a | Side A Output |
| Z_b | Side B Output |

Logic Symbols



Functional Description

The VHC153 is a dual 4-input multiplexer. It can select two bits of data from up to four sources under the control of the common Select inputs (S_0, S_1). The two 4-input multiplexer circuits have individual active-LOW Enables (\bar{E}_a, \bar{E}_b) which can be used to strobe the outputs independently. When the Enables (\bar{E}_a, \bar{E}_b) are HIGH, the corresponding outputs (Z_a, Z_b) are forced LOW. The VHC153 is the logic implementation of a 2-pole, 4-position switch, where the position of the switch is determined by the logic levels supplied to the Select inputs. The logic equations for the outputs are shown below.

$$Z_a = \bar{E}_a \cdot (I_{0a} \cdot \bar{S}_1 \cdot \bar{S}_0 + I_{1a} \cdot \bar{S}_1 \cdot S_0 + I_{2a} \cdot S_1 \cdot S_0 + I_{3a} \cdot S_1 \cdot \bar{S}_0)$$

$$Z_b = \bar{E}_b \cdot (I_{0b} \cdot \bar{S}_1 \cdot \bar{S}_0 + I_{1b} \cdot \bar{S}_1 \cdot S_0 + I_{2b} \cdot S_1 \cdot S_0 + I_{3b} \cdot S_1 \cdot \bar{S}_0)$$

Truth Table

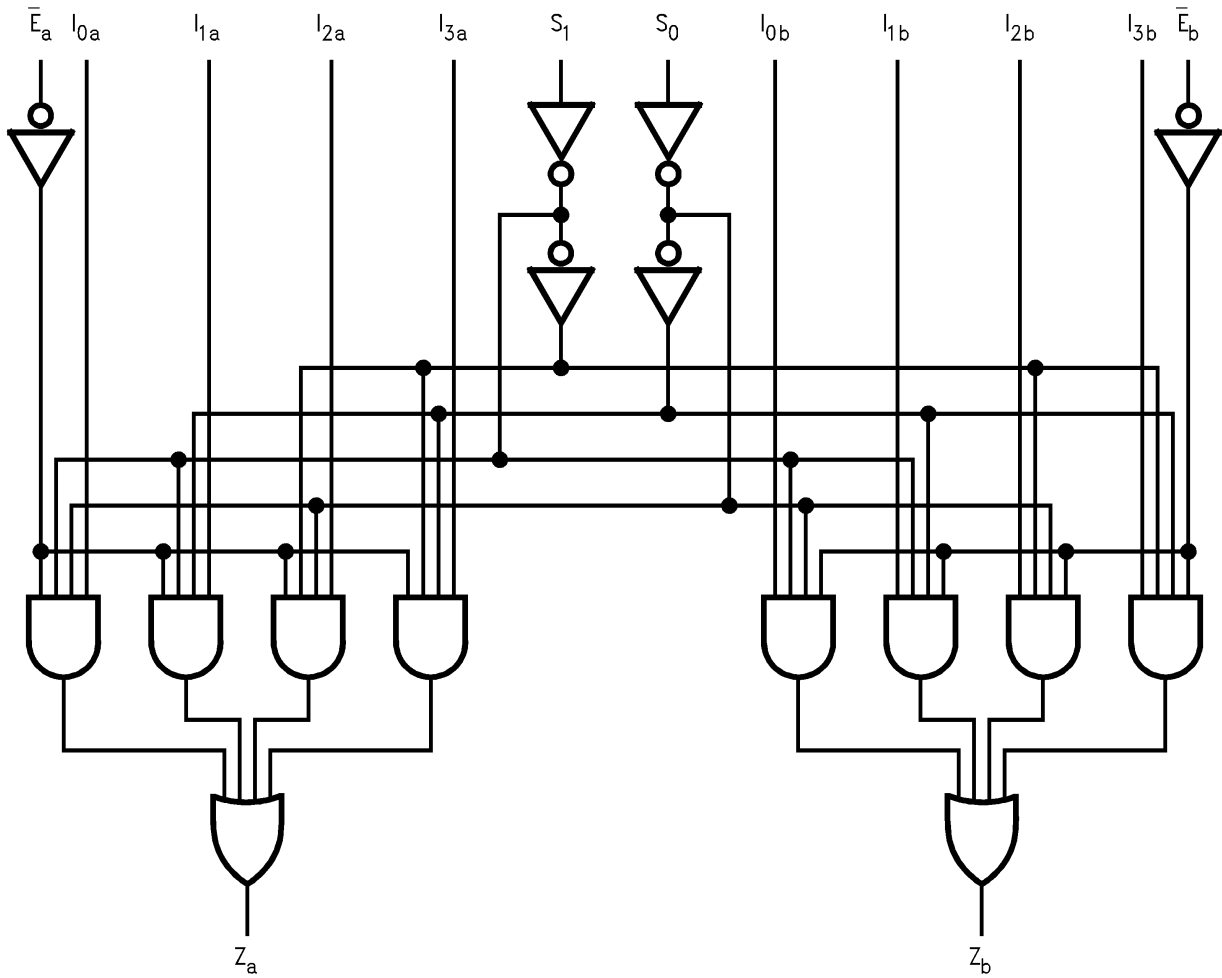
| Select | | Inputs (a or b) | | | | | Output |
|--------|-------|-----------------|-------|-------|-------|-------|--------|
| S_0 | S_1 | \bar{E} | I_0 | I_1 | I_2 | I_3 | |
| X | X | H | X | X | X | X | L |
| L | L | L | L | X | X | X | L |
| L | L | L | H | X | X | X | H |
| H | L | L | X | L | X | X | L |
| H | L | L | X | H | X | X | H |
| L | H | L | X | X | L | X | L |
| L | H | L | X | X | H | X | H |
| H | H | L | X | X | X | L | L |
| H | H | L | X | X | X | H | H |

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

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 |
| V_{IN} | DC Input Voltage | -0.5V to +7.0V |
| V_{OUT} | DC Output Voltage | -0.5V to $V_{CC} + 0.5V$ |
| I_{IK} | Input Diode Current | -20mA |
| I_{OK} | Output Diode Current | $\pm 20mA$ |
| I_{OUT} | DC Output Current | $\pm 25mA$ |
| I_{CC} | DC V_{CC} / GND Current | $\pm 50mA$ |
| T_{STG} | Storage Temperature | -65°C to +150°C |
| T_L | Lead Temperature (Soldering, 10 seconds) | 260°C |

Recommended Operating Conditions⁽¹⁾

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 +5.5V |
| V_{IN} | Input Voltage | 0V to +5.5V |
| V_{OUT} | Output Voltage | 0V to V_{CC} |
| T_{OPR} | Operating Temperature | -40°C to +85°C |
| t_r, t_f | Input Rise and Fall Time, $V_{CC} = 3.3V \pm 0.3V$ $V_{CC} = 5.0V \pm 0.5V$ | 0ns/V ~ 100ns/V 0ns/V ~ 20ns/V |

Note:

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

DC Electrical Characteristics

| Symbol | Parameter | V _{CC} (V) | Conditions | T _A = 25°C | | | T _A = -40°C to +85°C | | Units | |
|-----------------|---------------------------|---------------------|---|-------------------------|------------------------|-----------------------|---------------------------------|-----------------------|-------|---|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| V _{IH} | HIGH Level Input Voltage | 2.0 | | 1.50 | | | 1.50 | | V | |
| | | 3.0–5.5 | | 0.7 × V _{CC} | | | 0.7 × V _{CC} | | | |
| V _{IL} | LOW Level Input Voltage | 2.0 | | | | 0.50 | | 0.50 | V | |
| | | 3.0–5.5 | | | | 0.3 × V _{CC} | | 0.3 × V _{CC} | | |
| V _{OH} | HIGH Level Output Voltage | 2.0 | V _{IN} = V _{IH} or V _{IL} | I _{OH} = -50μA | 1.9 | 2.0 | | 1.9 | | V |
| | | 3.0 | | | 2.9 | 3.0 | | 2.9 | | |
| | | 4.5 | | | 4.4 | 4.5 | | 4.4 | | |
| | | 3.0 | | I _{OH} = -4mA | 2.58 | | | 2.48 | | |
| | | 4.5 | | | I _{OH} = -8mA | 3.94 | | | 3.80 | |
| V _{OL} | LOW Level Output Voltage | 2.0 | V _{IN} = V _{IH} or V _{IL} | I _{OL} = 50μA | | 0.0 | 0.1 | | 0.1 | V |
| | | 3.0 | | | | 0.0 | 0.1 | | 0.1 | |
| | | 4.5 | | | | 0.0 | 0.1 | | 0.1 | |
| | | 3.0 | | I _{OL} = 4mA | | | 0.36 | | 0.44 | |
| | | 4.5 | | | I _{OL} = 8mA | | | 0.36 | | |
| I _{IN} | Input Leakage Current | 0–5.5 | V _{IN} = 5.5V or GND | | | ±0.1 | | ±1.0 | μA | |
| I _{CC} | Quiescent Supply Current | 5.5 | V _{IN} = V _{CC} or GND | | | 4.0 | | 40.0 | μA | |

AC Electrical Characteristics

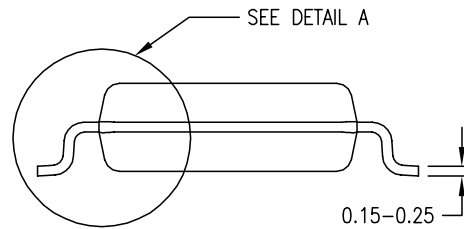
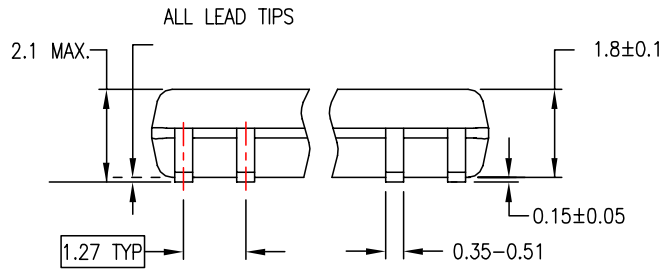
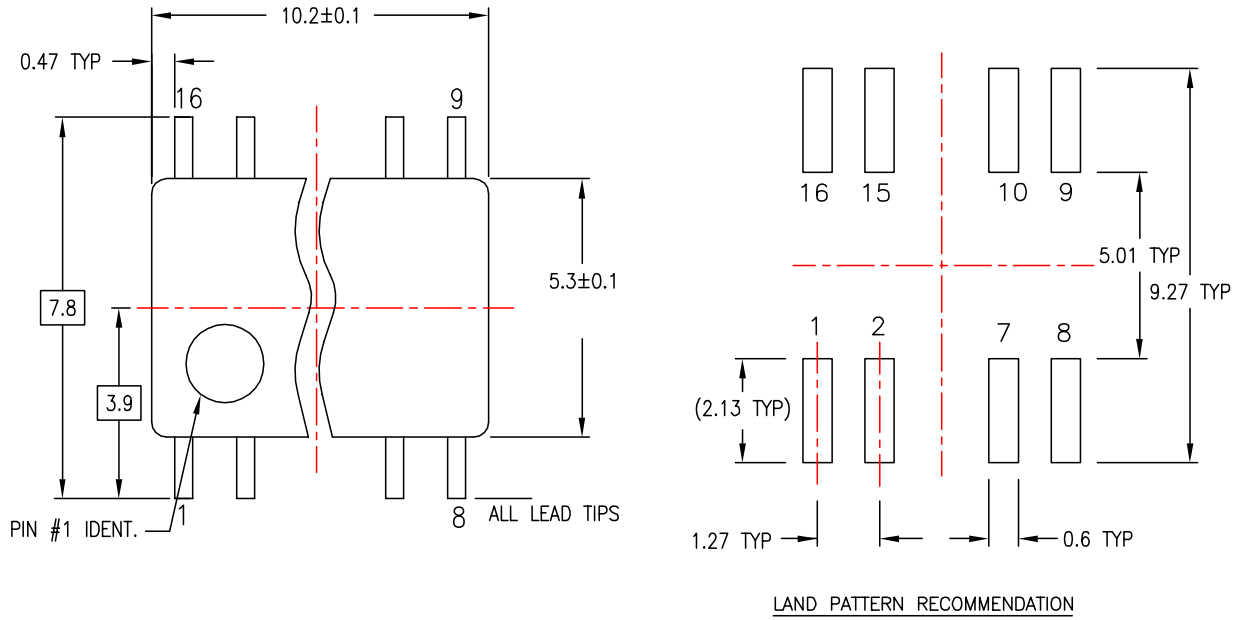
| Symbol | Parameter | V _{CC} (V) | Conditions | T _A = 25°C | | | T _A = -40°C to +85°C | | Units |
|-------------------------------------|---|---------------------|------------------------|-----------------------|------|------|---------------------------------|------|-------|
| | | | | Min. | Typ. | Max. | Min. | Max. | |
| t _{PLH} , t _{PHL} | Propagation Delay, I _n to Z _n | 3.3 ± 0.3 | C _L = 15pF | | 7.7 | 11.9 | 1.0 | 14.0 | ns |
| | | | C _L = 50pF | | 10.2 | 15.4 | 1.0 | 17.5 | |
| | | 5.0 ± 0.5 | C _L = 15pF | | 5.0 | 7.7 | 1.0 | 9.0 | ns |
| | | | C _L = 50pF | | 6.5 | 9.7 | 1.0 | 11.0 | |
| t _{PLH} , t _{PHL} | Propagation Delay, S _n to Z _n | 3.3 ± 0.3 | C _L = 15pF | | 10.8 | 16.7 | 1.0 | 19.5 | ns |
| | | | C _L = 50pF | | 13.3 | 20.2 | 1.0 | 23.0 | |
| | | 5.0 ± 0.5 | C _L = 15pF | | 6.8 | 9.9 | 1.0 | 11.5 | ns |
| | | | C _L = 50pF | | 8.3 | 11.9 | 1.0 | 13.5 | |
| t _{PLH} , t _{PHL} | Propagation Delay, E _n to Z _n | 3.3 ± 0.3 | C _L = 15pF | | 6.3 | 10.1 | 1.0 | 12.0 | ns |
| | | | C _L = 50pF | | 8.8 | 13.6 | 1.0 | 15.5 | |
| | | 5.0 ± 0.5 | C _L = 15pF | | 4.4 | 6.4 | 1.0 | 7.5 | ns |
| | | | C _L = 50pF | | 5.9 | 8.4 | 1.0 | 9.5 | |
| C _{IN} | Input Capacitance | | V _{CC} = Open | | 4 | 10 | | 10 | pF |
| C _{PD} | Power Dissipation Capacitance | | (2) | | 20 | | | | pF |

Note:

2. C_{PD} 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.) = C_{PD} • V_{CC} • f_{IN} + I_{CC}

Physical Dimensions (Continued)

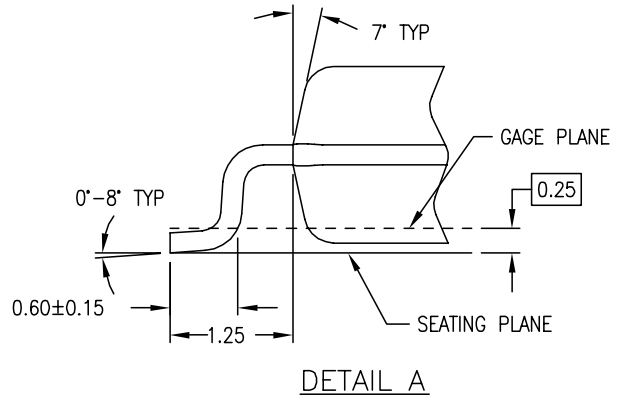
Dimensions are in millimeters unless otherwise noted.



DIMENSIONS ARE IN MILLIMETERS

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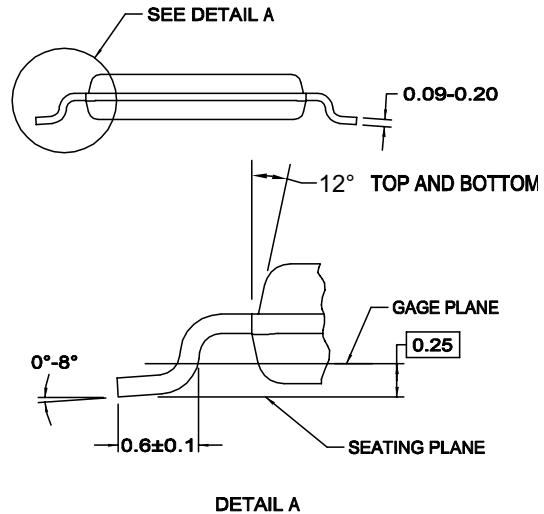
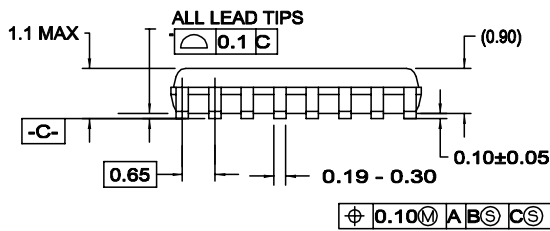
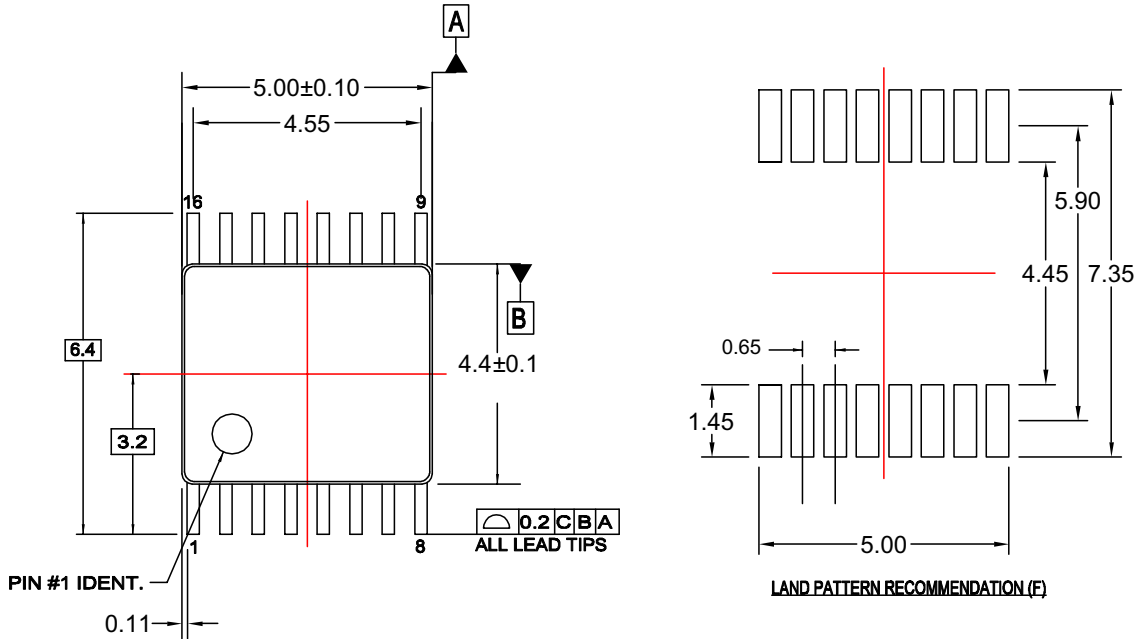


M16DREVC

**Figure 2. 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D**

Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.



NOTES:

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- E. DRAWING FILE NAME: MTC16REV4
- F. LAND PATTERN RECOMMENDATION PER IPC7351 - ID# TSOP65P640X110-16N


MTC16rev4

Figure 3. 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC16



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