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# 74LVX3245

## 8-Bit, Dual-Supply Translating Transceiver with 3-State Outputs

### Features

- Bidirectional Interface Between 3 V and 5 V Buses
- Inputs Compatible with TTL Level
- 3 V Data Flow at A-Port and 5 V Data Flow at B-Port
- Outputs Source / Sink: 24 mA
- Guaranteed Simultaneous Switching Noise Level and Dynamic Threshold Performance
- Implements Proprietary EMI Reduction Circuitry
- Functionally Compatible with the 74 Series 245

### Description

The 74LVX3245 is a dual-supply, 8-bit translating transceiver designed to interface between a 3 V bus and a 5 V bus in a mixed 5 V supply environment. The Transmit/ Receive (T/R) input determines the direction of data flow. Transmit (active-HIGH) enables data from A-ports to B-ports; receive (active-LOW) enables data from B-ports to A-ports. The output enable input, when HIGH, disables both A- and B-ports by placing them in a high-impedance condition. The A-port interfaces with the 3 V bus; the B-port interfaces with the 5 V bus.

The 74LVX3245 is suitable for mixed-voltage applications, such as notebook computers using 3.3 V CPU and 5V peripheral components.

### Related Resources

- [AN-5001 — Using Fairchild's LVX Low-Voltage Dual-Supply CMOS Translating Transceivers](#)

### Ordering Information

| Part Number   | Operating Temperature Range | Package  | Packing Method |
|---------------|-----------------------------|--|----------------|
| 74LVX3245QSC  | -40 to +85°C                | 24-Lead Quarter-Size Outline Package (QSOP), JEDEC MO-137, 0.150" Wide       | Tubes          |
| 74LVX3245QSCX |                             |  | Tape and Reel  |
| 74LVX3245MTC  |                             | 24-Lead Thin-Shrink Small-Outline Package (TSSOP), JEDEC MO-153, 4.4 mm Wide | Tubes          |
| 74LVX3245MTCX |                             |  | Tape and Reel  |

### Logic Symbol

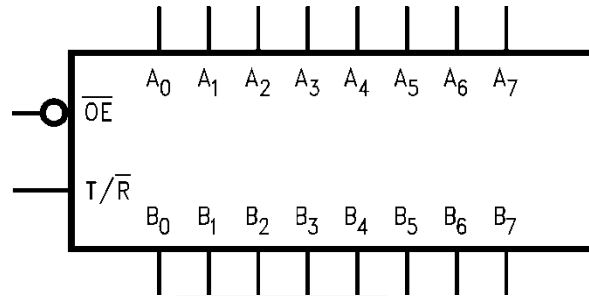


Figure 1. Logic Symbol

### Pin Configuration

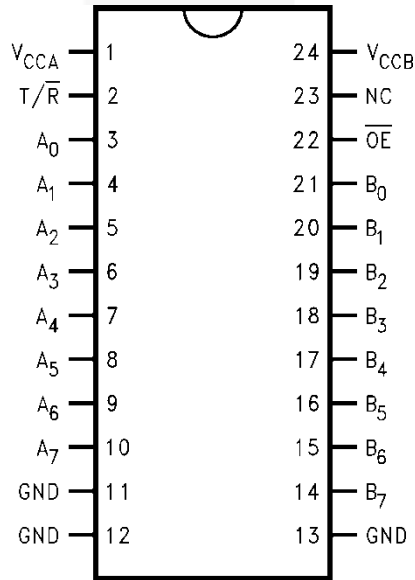
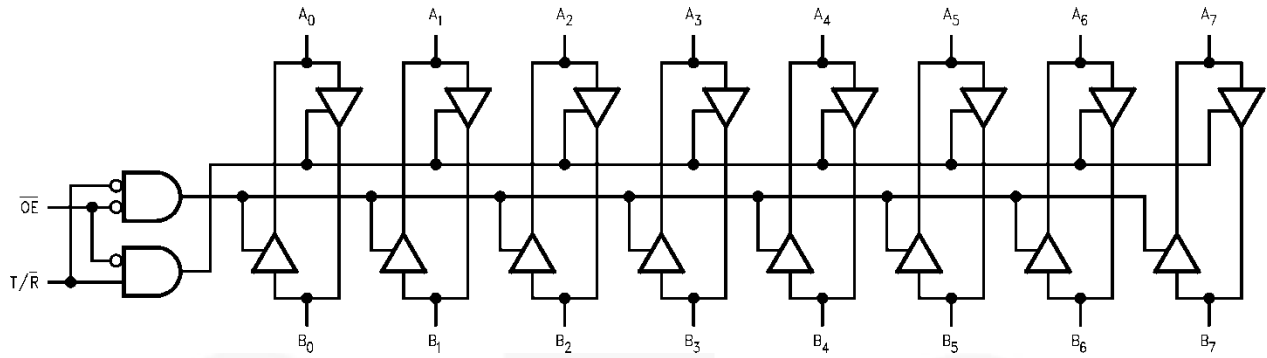


Figure 2. Pin Configuration

### Pin Definitions

| Pin #                          | Name  | Description                      |
|--------------------------------|---|----------------------------------|
| 1                              | V <sub>CCA</sub>  | Supply Voltage                   |
| 2                              | T/R   | Transmit/Receive Input           |
| 3, 4, 5, 6, 7, 8, 9, 10        | A <sub>0</sub> , A <sub>1</sub> , A <sub>2</sub> , A <sub>3</sub> , A <sub>4</sub> , A <sub>5</sub> , A <sub>6</sub> , A <sub>7</sub> | Port-A Inputs or 3-State Outputs |
| 11, 12, 13                     | GND   | Ground                           |
| 14, 15, 16, 17, 18, 19, 20, 21 | B <sub>7</sub> , B <sub>6</sub> , B <sub>5</sub> , B <sub>4</sub> , B <sub>3</sub> , B <sub>2</sub> , B <sub>1</sub> , B <sub>0</sub> | Port-B Inputs or 3-State Outputs |
| 22                             | /OE   | Output Enable Input              |
| 23                             | NC  | No Connect                       |
| 24                             | V <sub>CCB</sub>  | Supply Voltage                   |

**Logic Diagram**



**Figure 3. Logic Diagram**

**Table 1. Truth Table**

| Inputs |     | Outputs             |
|--------|-----|---------------------|
| /OE    | T/R |                     |
| L      | L   | Bus B Data to Bus A |
| L      | H   | Bus A Data to Bus B |
| H      | X   | HIGH-Z State        |

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

## 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                               |                               | Min.      | Max.                       | Unit               |
|-----------------------|---|-------------------------------|-----------|----------------------------|--------------------|
| $V_{CCA}, V_{CCB}$    | Supply Voltage                          |                               | -0.5      | 7.0                        | V                  |
| $V_{IN}$              | DC Input Voltage; (/OE, T/R )           |                               | -0.5      | $V_{CCA} + 0.5$            | V                  |
| $V_{I/O}$             | DC Input / Output Voltage               | $A_n$                         | -0.5      | $V_{CCA} \text{ to } +0.5$ | V                  |
|                       |   | $B_n$                         | -0.5      | $V_{CCB} \text{ to } +0.5$ |                    |
| $I_{IN}$              | DC Input Diode Current (/OE and T/R )   |                               |           | $\pm 20$                   | mA                 |
| $I_{OK}$              | DC Output Diode Current                 |                               |           | $\pm 50$                   | mA                 |
| $I_O$                 | DC Output Source or Sink Current        |                               |           | $\pm 50$                   | mA                 |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current           | Output Pin                    |           | $\pm 50$                   | mA                 |
|                       |   | Maximum Current at            | $I_{CCA}$ | $\pm 100$                  |                    |
|                       |   |                               | $I_{CCB}$ | $\pm 200$                  |                    |
| $T_{STG}$             | Storage Temperature Range               |                               | -65       | +150                       | $^{\circ}\text{C}$ |
| $I_{SINK}$            | DC Latch-Up Source or Sink Current      |                               |           | $\pm 300$                  | mA                 |
| $T_J$                 | Maximum Junction Temperature Under Bias |                               |           | +150                       | $^{\circ}\text{C}$ |
| ESD                   | Electrostatic Discharge Capability      | Human Body Model, JESD22-A114 |           | 2500                       | V                  |

## 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               |
|-----------------------|--|-------|------|-----------|--------------------|
| $V_{CCA}$             | Supply Voltage   |       | 2.7  | 3.6       | V                  |
| $V_{CCB}$             |  |       | 4.5  | 5.5       |                    |
| $V_I$                 | Input Voltage (/OE and T/R )   |       | 0    | $V_{CCA}$ | V                  |
| $V_{I/O}$             | DC Input / Output Voltage  | $A_n$ | 0    | $V_{CCA}$ | V                  |
|                       |  | $B_n$ | 0    | $V_{CCB}$ |                    |
| $T_A$                 | Operating Temperature, Free Air  |       | -40  | +85       | $^{\circ}\text{C}$ |
| $\Delta t / \Delta V$ | Minimum Input Edge Rate ( $V_{IN}$ from 30 to 70% of $V_{CC}$ , $V_{CC}$ at 3.0 V, 4.5 V, and 5.5 V) |       |      | 8         | ns/V               |

### Note:

- Unused pins (inputs and I/O's) must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

| Symbol           | Parameter                                      |  | Conditions  | V <sub>CCA</sub><br>(V) | V <sub>CCB</sub><br>(V) | T <sub>A</sub> = -25°C |                   | T <sub>A</sub> = -40 to +85°C |    | Unit |
|------------------|--|--|---|-------------------------|-------------------------|------------------------|-------------------|-------------------------------|----|------|
|                  |  |  |   |                         |                         | Typ.                   | Guaranteed Limits |                               |    |      |
| V <sub>IHA</sub> | Minimum HIGH Level Input Voltage               | A <sub>n</sub> , T/R, /OE  | V <sub>OUT</sub> ≤ 0.1 V or ≥ V <sub>CC</sub> - 0.1 V | 3.6                     | 5.0                     |                        | 2.0               | 2.0                           | V  |      |
|                  |  |  |   | 2.7                     | 5.0                     |                        | 2.0               | 2.0                           |    |      |
| V <sub>IHB</sub> |  | B <sub>n</sub>   |   |                         | 3.3                     | 4.5                    |                   | 2.0                           |    | 2.0  |
|                  |  |  |   |                         | 3.3                     | 5.5                    |                   | 2.0                           |    | 2.0  |
| V <sub>ILA</sub> | Minimum LOW Level Input Voltage                | A <sub>n</sub> , T/R, /OE  | V <sub>OUT</sub> ≤ 0.1 V or ≥ V <sub>CC</sub> - 0.1 V | 3.6                     | 5.0                     |                        | 0.8               | 0.8                           | V  |      |
|                  |  |  |   | 2.7                     | 5.0                     |                        | 0.8               | 0.8                           |    |      |
| V <sub>ILB</sub> |  | B <sub>n</sub>   |   |                         | 3.3                     | 4.5                    |                   | 0.8                           |    | 0.8  |
|                  |  |  |   |                         | 3.3                     | 5.5                    |                   | 0.8                           |    | 0.8  |
| V <sub>OHA</sub> | Minimum HIGH Level Output Voltage              |  | I <sub>OUT</sub> = -100 μA                            | 3.0                     | 4.5                     | 2.99                   | 2.90              | 2.90                          | V  |      |
|                  |  |  | I <sub>OH</sub> = -24 mA                              | 3.0                     | 4.5                     | 2.65                   | 2.35              | 2.25                          |    |      |
|                  |  |  | I <sub>OH</sub> = -12 mA                              | 2.7                     | 4.5                     | 2.50                   | 2.30              | 2.20                          |    |      |
|                  |  |  | I <sub>OH</sub> = -24 mA                              | 2.7                     | 4.5                     | 2.30                   | 2.10              | 2.00                          |    |      |
| V <sub>OHB</sub> |  |  | I <sub>OUT</sub> = -100 μA                            | 3.0                     | 4.5                     | 4.50                   | 4.40              | 4.40                          |    |      |
|                  |  |  | I <sub>OH</sub> = -24 mA                              | 3.0                     | 4.5                     | 4.25                   | 3.86              | 3.76                          |    |      |
| V <sub>OLA</sub> | Minimum LOW Level Output Voltage               |  | I <sub>OUT</sub> = 100 μA                             | 3.0                     | 4.5                     | 0.002                  | 0.100             | 0.100                         | V  |      |
|                  |  |  | I <sub>OH</sub> = 24 mA                               | 3.0                     | 4.5                     | 0.210                  | 0.360             | 0.440                         |    |      |
|                  |  |  | I <sub>OH</sub> = 12 mA                               | 2.7                     | 4.5                     | 0.110                  | 0.360             | 0.440                         |    |      |
|                  |  |  | I <sub>OH</sub> = 24 mA                               | 2.7                     | 4.5                     | 0.220                  | 0.420             | 0.500                         |    |      |
| V <sub>OLB</sub> |  |  | I <sub>OUT</sub> = 100 μA                             | 3.0                     | 4.5                     | 0.002                  | 0.100             | 0.100                         |    |      |
|                  |  |  | I <sub>OH</sub> = 24 mA                               | 3.0                     | 4.5                     | 0.180                  | 0.360             | 0.440                         |    |      |
| I <sub>IN</sub>  | Maximum Input Leakage Current; /OE, T/R        | V <sub>IN</sub> = V <sub>CCB</sub> , GND   | 3.6   | 5.5                     |                         | ±0.1                   | ±1.0              | μA                            |    |      |
| I <sub>OZA</sub> | Maximum 3-State Output Leakage; A <sub>n</sub> | V <sub>IN</sub> = V <sub>IL</sub> , V <sub>IH</sub> ; /OE = V <sub>CCA</sub> ; V <sub>O</sub> = V <sub>CCA</sub> , GND | 3.6   | 5.5                     |                         | ±0.5                   | ±5.0              | μA                            |    |      |
| I <sub>OZB</sub> | Maximum 3-State Output Leakage; B <sub>n</sub> | V <sub>IN</sub> = V <sub>IL</sub> , V <sub>IH</sub> ; /OE = V <sub>CCA</sub> ; V <sub>O</sub> = V <sub>CCB</sub> , GND | 3.6   | 5.5                     |                         | ±0.5                   | ±5.0              | μA                            |    |      |
| ΔI <sub>CC</sub> | Maximum I <sub>CC</sub> T/Input at             | B <sub>n</sub>   | V <sub>IN</sub> = V <sub>CCB</sub> - 2.1 V            | 3.6                     | 5.5                     | 1.00                   | 1.35              | 1.50                          | mA |      |
|                  |  | A <sub>n</sub> , T/R, /OE  | V <sub>IN</sub> = V <sub>CCA</sub> - 0.6 V            | 3.6                     | 5.5                     |                        | 0.35              | 0.50                          |    |      |
| I <sub>CCA</sub> | Quiescent V <sub>CCA</sub> Supply Current      | A <sub>n</sub> = V <sub>CCA</sub> or GND, B <sub>n</sub> = V <sub>CCB</sub> or GND, /OE = GND, T/R = GND               | 3.6   | 5.5                     |                         | 5                      | 50                | μA                            |    |      |
| I <sub>CCB</sub> | Quiescent V <sub>CCB</sub> Supply Current      | A <sub>n</sub> = V <sub>CCA</sub> or GND, B <sub>n</sub> = V <sub>CCB</sub> or GND, /OE = GND, T/R = V <sub>CCA</sub>  | 3.6   | 5.5                     |                         | 8                      | 80                |                               |    |      |

Continued on the following page...

**DC Electrical Characteristics** (Continued)

| Symbol            | Parameter   | Conditions | V <sub>CCA</sub><br>(V) | V <sub>CCB</sub><br>(V) | T <sub>A</sub> = -25°C | T <sub>A</sub> = -40 to +85°C |  | Unit |
|-------------------|---|------------|-------------------------|-------------------------|------------------------|-------------------------------|--|------|
|                   |   |            |                         |                         | Typ.                   | Guaranteed Limits             |  |      |
| V <sub>OLPA</sub> | Quiet Output Maximum<br>Dynamic V <sub>OL</sub> <sup>(2, 3)</sup> |            | 3.3                     | 5.0                     |                        | 0.8                           |  | V    |
| V <sub>OLPB</sub> |   |            |                         |                         |                        | 1.5                           |  |      |
| V <sub>OLVA</sub> | Quiet Output Minimum<br>Dynamic V <sub>OL</sub> <sup>(2, 3)</sup> |            | 3.3                     | 5.0                     |                        | -0.8                          |  | V    |
| V <sub>OLVB</sub> |   |            |                         |                         |                        | -1.2                          |  |      |
| V <sub>IHDA</sub> | Minimum HIGH Level<br>Dynamic Input<br>Voltage <sup>(2, 4)</sup>  |            | 3.3                     | 5.0                     |                        | 2.0                           |  | V    |
| V <sub>IHDB</sub> |   |            |                         |                         |                        | 2.0                           |  |      |
| V <sub>ILDA</sub> | Maximum LOW Level<br>Dynamic Input<br>Voltage <sup>(2, 4)</sup>   |            | 3.3                     | 5.0                     |                        | 0.8                           |  | V    |
| V <sub>ILDB</sub> |   |            |                         |                         |                        | 0.8                           |  |      |

**Notes:**

- Worst-case package.
- Maximum number of outputs defined as (n). Data inputs are driven 0 V to V<sub>CC</sub> level; one output at GND.
- Maximum number of data inputs (n) switching. (n-1) inputs switching 0 V to V<sub>CC</sub> level. Input-under-test switching; V<sub>CC</sub> level to threshold (V<sub>IHD</sub>), 0V to threshold (V<sub>ILD</sub>), f=1 MHz.

## AC Electrical Characteristics

| Symbol                  | Parameter  | $T_A=+25^\circ\text{C}$ , $C_L=50\text{ pF}$ ,<br>$V_{CCA}=3.3\text{ V}^{(5)}$ ,<br>$V_{CCB}=5.0\text{ V}^{(6)}$ |      |      | $T_A=-40\text{ to }+85^\circ\text{C}$ ,<br>$C_L=50\text{ pF}$ ,<br>$V_{CCA}=3.3\text{ V}^{(5)}$ ,<br>$V_{CCB}=5.0\text{ V}^{(6)}$ |      | $T_A=-40\text{ to }+85^\circ\text{C}$ ,<br>$C_L=50\text{ pF}$ ,<br>$V_{CCA}=2.7\text{ V}$ ,<br>$V_{CCB}=5.0\text{ V}$ |      | Unit |
|-------------------------|--|--|------|------|---|------|---|------|------|
|                         |  | Min.   | Typ. | Max. | Min.  | Max. | Min.  | Max. |      |
| $t_{PHL}$ , $t_{PLH}$   | Propagation Delay A to B                             | 1.0  | 5.4  | 8.0  | 1.0   | 8.5  | 1.0   | 9.0  | ns   |
|                         |  | 1.0  | 5.6  | 7.5  | 1.0   | 8.0  | 1.0   | 8.5  |      |
|                         | Propagation Delay B to A                             | 1.0  | 5.1  | 7.5  | 1.0   | 8.0  | 1.0   | 8.5  |      |
|                         |  | 1.0  | 5.7  | 7.5  | 1.0   | 8.0  | 1.0   | 8.5  |      |
| $t_{PZL}$ , $t_{PZH}$   | Output Enable Time /OE to B                          | 1.0  | 4.8  | 8.0  | 1.0   | 8.5  | 1.0   | 9.0  | ns   |
|                         |  | 1.0  | 6.3  | 8.5  | 1.0   | 9.0  | 1.0   | 9.5  |      |
|                         | Output Enable Time /OE to A                          | 1.0  | 6.3  | 8.5  | 1.0   | 9.0  | 1.0   | 9.5  |      |
|                         |  | 1.0  | 6.8  | 9.0  | 1.0   | 9.5  | 1.0   | 10.0 |      |
| $t_{PHZ}$ , $t_{PLZ}$   | Output Disable Time /OE to B                         | 1.0  | 5.3  | 7.5  | 1.0   | 8.0  | 1.0   | 8.5  | ns   |
|                         |  | 1.0  | 4.2  | 7.0  | 1.0   | 7.5  | 1.0   | 8.0  |      |
|                         | Output Disable Time /OE to A                         | 1.0  | 5.3  | 8.0  | 1.0   | 8.5  | 1.0   | 9.0  |      |
|                         |  | 1.0  | 3.7  | 6.5  | 1.0   | 7.0  | 1.0   | 7.5  |      |
| $t_{OSHL}$ , $t_{OSLH}$ | Output to Output Skew, Data to Output <sup>(7)</sup> |  | 1.0  | 1.5  |   | 1.5  |   | 1.5  | ns   |

## Notes:

- Voltage range 3.3 V is  $3.3\text{ V} \pm 0.3\text{ V}$ .
- Voltage range 5.0 V is  $5.0\text{ V} \pm 0.5\text{ V}$ .
- Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW ( $t_{OSHL}$ ) or LOW-to-HIGH ( $t_{OSLH}$ ). Parameter guaranteed by design.

## Capacitance

| Symbol    | Parameter                                    | Conditions   | Typ.   | Unit |    |
|-----------|--|--|--|------|----|
| $C_{IN}$  | Input Capacitance                            | $V_{CC} = \text{Open}$                                 | 4.5  | pF   |    |
| $C_{I/O}$ | Input / Output Capacitance                   | $V_{CCA} = 3.3\text{ V}$ ,<br>$V_{CCB} = 5.0\text{ V}$ | 15   | pF   |    |
| $C_{PD}$  | Power Dissipation Capacitance <sup>(8)</sup> | A to B   | $V_{CCA} = 3.3\text{ V}$ ,<br>$V_{CCB} = 5.0\text{ V}$ | 55   | pF |
|           |  | B to A   |  | 40   |    |

## Note:

- $C_{PD}$  is measured at 10 MHz.



## 8-Bit Dual-Supply Translating Transceiver

The 74LVX3245 is a dual-supply device capable of bi-directional signal translation. This level shifting ability provides an efficient interface between low-voltage CPU local bus with memory and a standard bus defined by 5 V I/O levels. The device control inputs can be controlled by the low-voltage CPU and core logic or a bus arbitrator with 5 V I/O levels.

Manufactured on a sub-micron CMOS process, the 74LVX3245 is ideal for mixed voltage applications such as notebook computers using 3.3 V CPUs and 5 V peripheral devices.

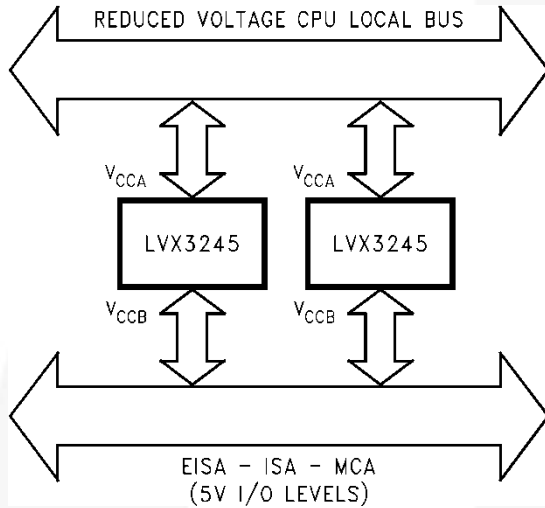


Figure 4. Application Example

## Power-Up Considerations

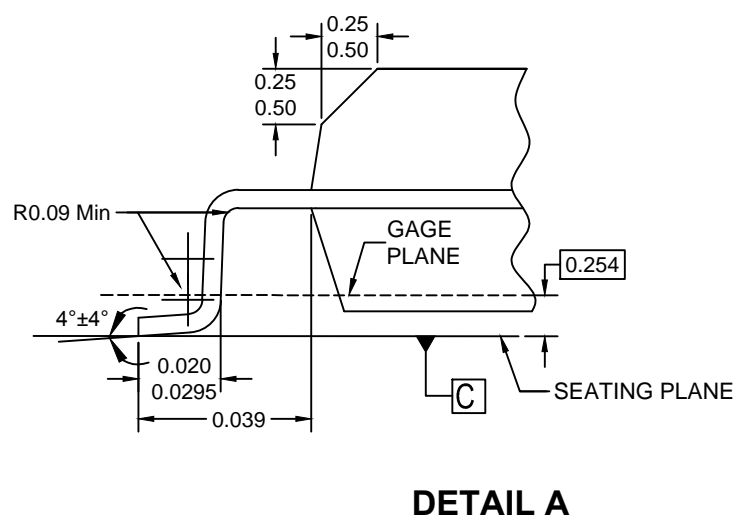
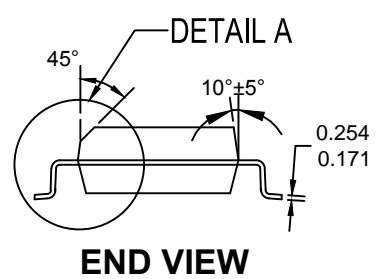
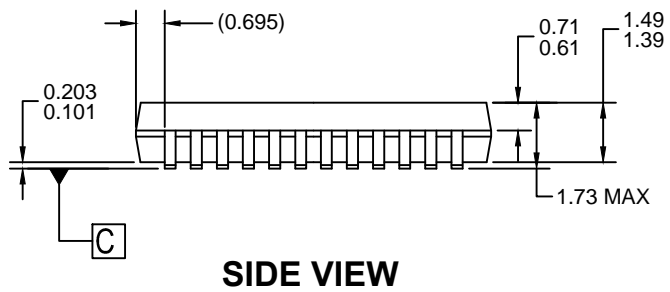
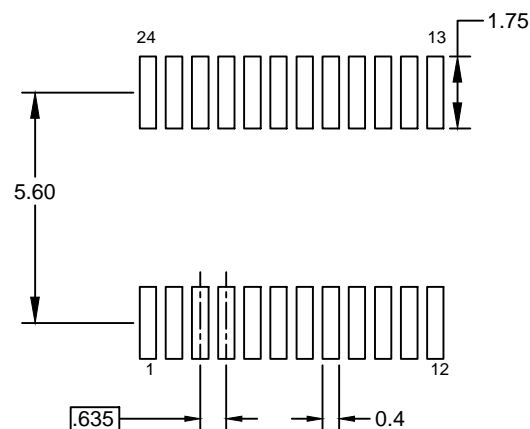
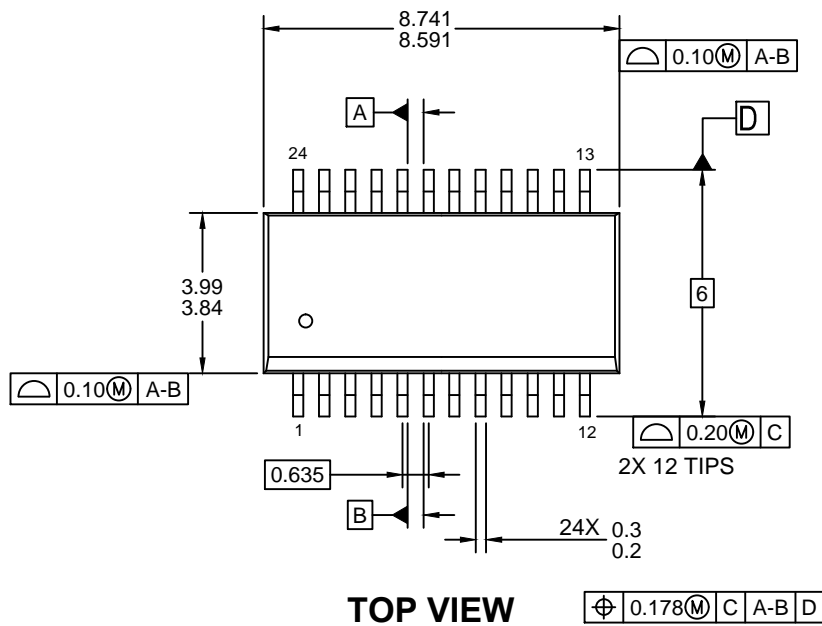
To ensure that the system does not experience unnecessary  $I_{CC}$  current draw, bus contention, or oscillations during power up; the following guidelines should be followed to (refer to Table 2):

- Power up the control side of the device first ( $V_{CCA}$ ).
- /OE should ramp with or ahead of  $V_{CCA}$ . This helps guard against bus contention.
- The Transmit/Receive (T/R) control pin should ramp with  $V_{CCA}$ . This ensures that the A-port data pins are configured as inputs. With  $V_{CCA}$  receiving power first, the I/O port should be configured as an input to help guard against bus contention and oscillations.
- A-side data inputs should be driven to a valid logic level. This prevents excessive current draw.

The above steps ensure that there are no bus contentions or oscillations, and therefore no excessive current draw occurs during the power-up cycling. These steps help prevent possible damage to the translator devices and potential damage to other system components.

Table 2. Low Voltage Translator Power-Up Sequencing

| Device    | $V_{CCA}$               | $V_{CCB}$           | T/R                 | /OE                 | A-Side I/O             | B-Side I/O | Floatable Pin Allowed |
|-----------|-------------------------|---------------------|---------------------|---------------------|------------------------|------------|-----------------------|
| 74LVX3245 | 3 V<br>(Power-Up First) | 5 V<br>Configurable | Ramp with $V_{CCA}$ | Ramp with $V_{CCA}$ | Logic 0 V or $V_{CCA}$ | Outputs    | No                    |



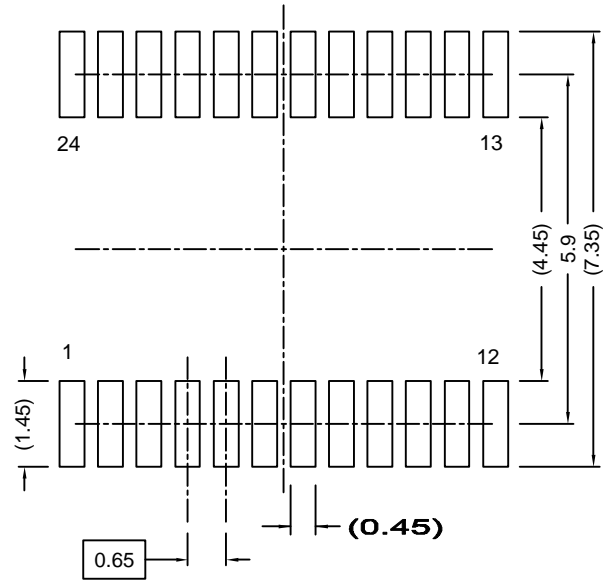
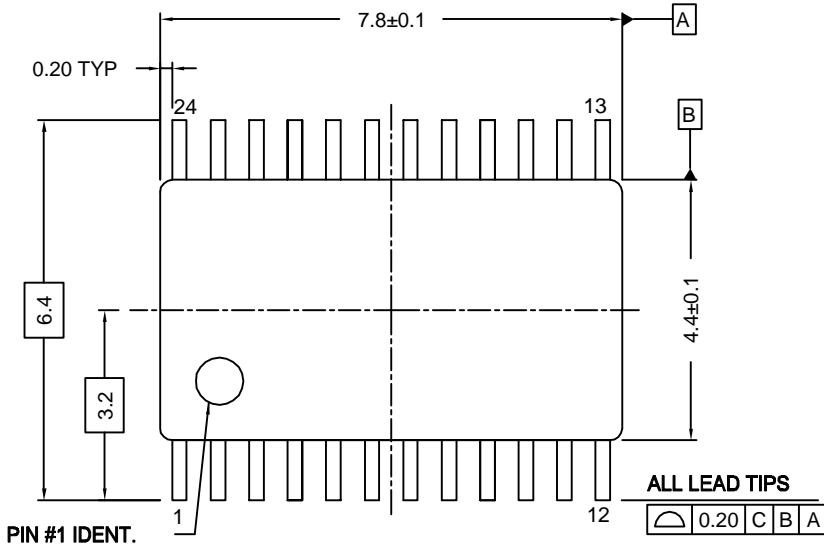
**NOTES :**

- A. THIS PACKAGE CONFORMS TO JEDEC M0-137 VARIATION AE
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 2009.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- E. LAND PATTERN STANDARD: SOP63P600X175-24M.
- F. DRAWING FILE NAME: MKT-MQA24rev3

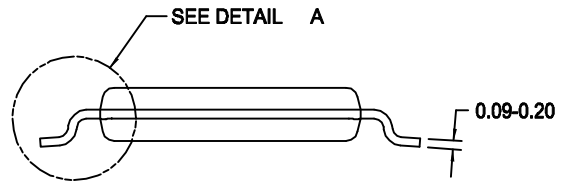
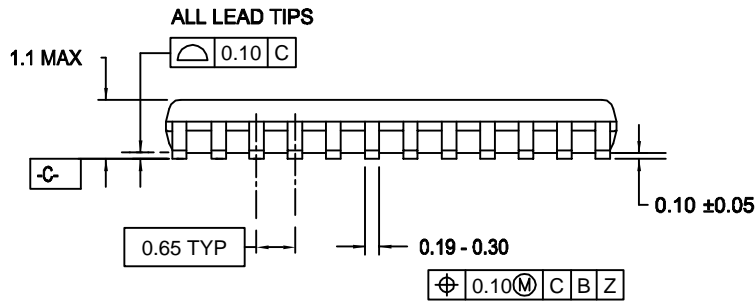


**REVISIONS**

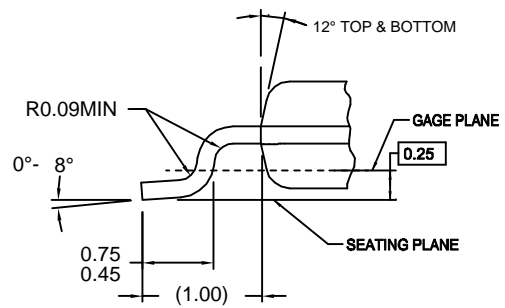
| LTR | DESCRIPTION  | EDCN          | DATE       | BY/APPD |
|-----|--|---------------|------------|---------|
| 4   | CHANGE TO FSPM DRAWING FORMAT<br>N LEAD SHIFT TOL. FROM 0.13MM TO 0.10MM | ECN-MTC24REV4 | 21/12/2006 | H.ALLEN |



**LAND PATTERN RECOMMENDATION**  
REFERENCE: TSOP65P640X110-24N



DIMENSIONS ARE IN MILLIMETERS



DETAIL A

**NOTES:**

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AD, DATE 10/97.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1994
- E. DRAWING FILE NAME: MTC24REV4

MTC24REV4

| APPROVALS                    | DATE       | FAIRCHILD SEMICONDUCTOR™                         |                   |                                    |                 |
|------------------------------|------------|--|-------------------|------------------------------------|-----------------|
| DRAWN<br><b>FEITAN</b>       | 8-10-99    | Bayan Lepas, FIZ,<br>11900, Penang, Malaysia.    |                   |                                    |                 |
| DFTG. CHK.<br><b>H.ALLEN</b> | 21-12-2006 | <b>24LD, TSSOP, JEDEC<br/>MO-153, 4.4MM WIDE</b> |                   |                                    |                 |
| ENGR. CHK.                   |            |  |                   |                                    |                 |
|                              |            | SCALE<br><b>N/A</b>                              | SIZE<br><b>A4</b> | DRAWING NUMBER<br><b>MKT-MTC24</b> | REV<br><b>4</b> |
|                              |            | DO NOT SCALE DRAWING                             |                   | SHEET 1 of 1                       |                 |

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