

# 74FST3400

## 4-Bit, 4-Port Bus Exchange Switch

The ON Semiconductor 74FST3400 is a 4-bit, 4-port bus exchange switch. The device is CMOS TTL compatible when operating between 4 and 5.5 Volts. The device exhibits extremely low  $R_{ON}$  and adds nearly zero propagation delay. The device adds no noise or ground bounce to the system.

- $R_{ON} < 4 \Omega$  Typical
- Less Than 0.25 ns–Max Delay Through Switch
- Nearly Zero Standby Current
- No Circuit Bounce
- Control Inputs are TTL/CMOS Compatible
- Pin-For-Pin Compatible With QS3400, FST3400, CBT3400
- All Popular Packages: SOIC–24, TSSOP–24, QSOP–24

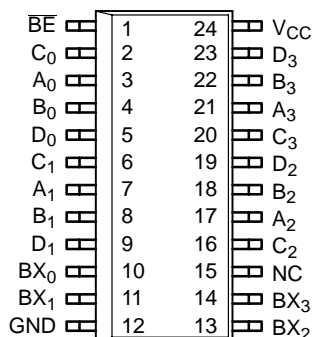


Figure 1. 24-Lead Pinout

### TRUTH TABLE

| BE | BX <sub>0</sub>     | BX <sub>1</sub> | BX <sub>2</sub> | BX <sub>3</sub> | A0–3 | B0–3 | Function   |
|----|---------------------|-----------------|-----------------|-----------------|------|------|------------|
| H  | X                   | X               | X               | X               | Hi–Z | Hi–Z | Disconnect |
| L  | BX <sub>i</sub> = L |                 |                 |                 | C0–3 | D0–3 | Connect    |
| L  | BX <sub>i</sub> = H |                 |                 |                 | D0–3 | C0–3 | Exchange   |

NOTE: H = HIGH Voltage Level, L = LOW Voltage Level, X = Don't Care, Hi–Z = High Impedance, i = 0, 1, 2 or 3

### PIN NAMES

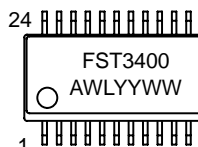
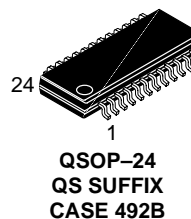
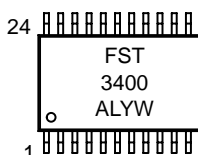
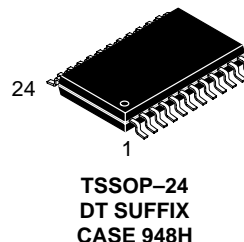
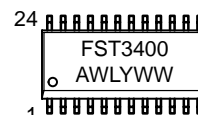
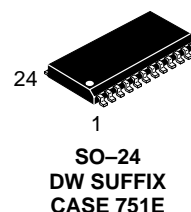
| Pin                               | Description                   |
|-----------------------------------|-------------------------------|
| BE                                | Bus Enable Input (Active LOW) |
| Ax, Bx, Cx, Dx                    | Bus A, Bus B, Bus C, Bus D    |
| OE <sub>1</sub> , OE <sub>2</sub> | Bus Exchange (Bit 0)          |
| OE <sub>1</sub> , OE <sub>2</sub> | Bus Exchange (Bit 1)          |
| OE <sub>1</sub> , OE <sub>2</sub> | Bus Exchange (Bit 2)          |
| OE <sub>1</sub> , OE <sub>2</sub> | Bus Exchange (Bit 3)          |
| OE <sub>1</sub> , OE <sub>2</sub> | No Connect                    |
| OE <sub>1</sub> , OE <sub>2</sub> | Ground                        |
| OE <sub>1</sub> , OE <sub>2</sub> | Power                         |



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### MARKING DIAGRAMS



A = Assembly Location  
L, WL = Wafer Lot  
Y, YY = Year  
W, WW = Work Week

### ORDERING INFORMATION

| Device        | Package  | Shipping        |
|---------------|----------|-----------------|
| 74FST3400DW   | SO-24    | 48 Units/Rail   |
| 74FST3400DWR2 | SO-24    | 2500 Units/Reel |
| 74FST3400DT   | TSSOP-24 | 96 Units/Rail   |
| 74FST3400DTR2 | TSSOP-24 | 2500 Units/Reel |
| 74FST3400QS   | QSOP-24  | 96 Units/Rail   |
| 74FST3400QSR  | QSOP-24  | 2500 Units/Reel |

# 74FST3400

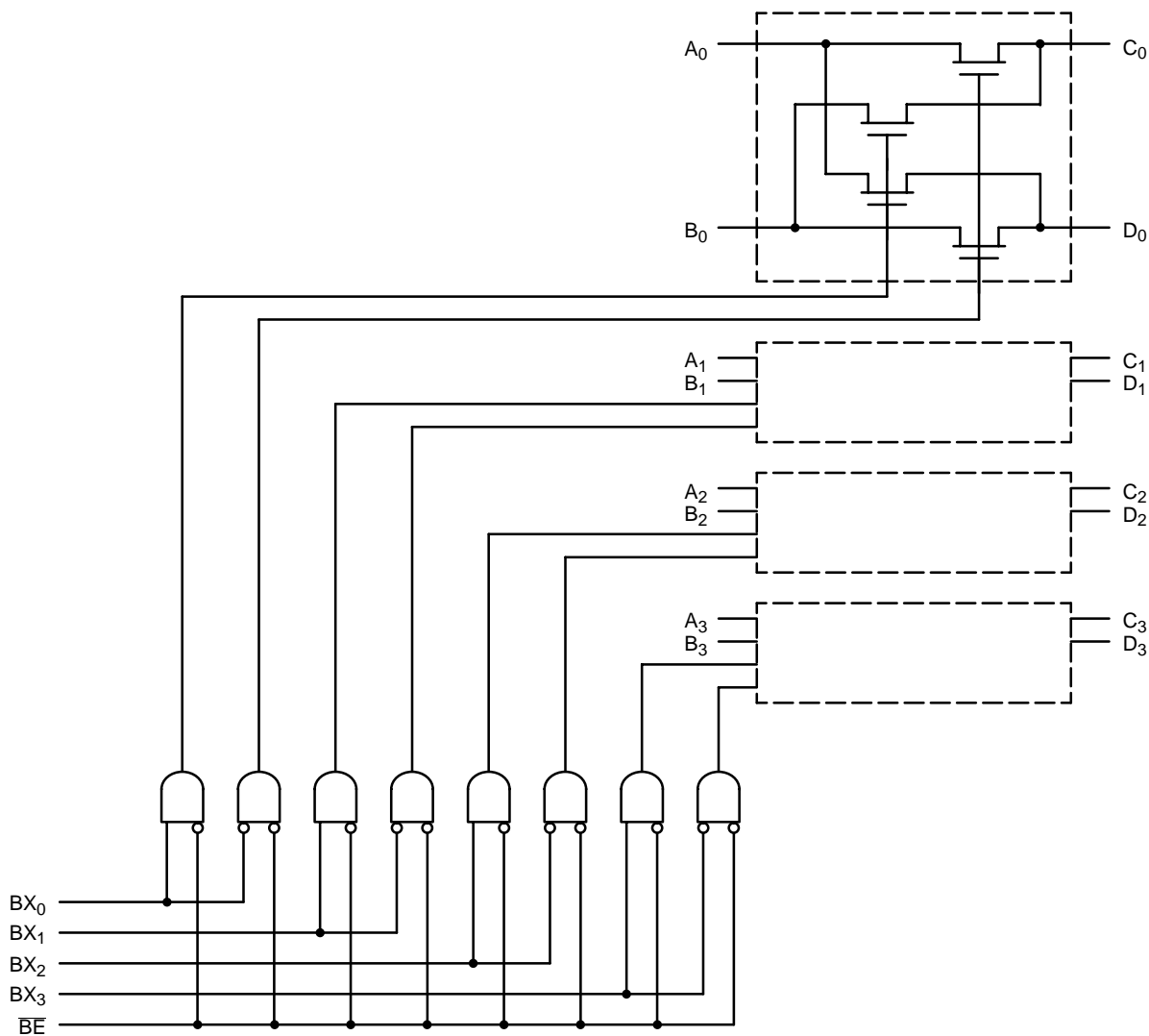


Figure 2. Logic Diagram

# 74FST3400

## MAXIMUM RATINGS

| Symbol                | Parameter   | Value                  | Unit |
|-----------------------|---|------------------------|------|
| V <sub>CC</sub>       | DC Supply Voltage   | − 0.5 to + 7.0         | V    |
| V <sub>I</sub>        | DC Input Voltage  | − 0.5 to + 7.0         | V    |
| V <sub>O</sub>        | DC Output Voltage   | − 0.5 to + 7.0         | V    |
| I <sub>IK</sub>       | DC Input Diode Current<br>V <sub>I</sub> < GND  | − 50                   | mA   |
| I <sub>OK</sub>       | DC Output Diode Current<br>V <sub>O</sub> < GND   | − 50                   | mA   |
| I <sub>O</sub>        | DC Output Sink Current  | 128                    | mA   |
| I <sub>CC</sub>       | DC Supply Current per Supply Pin  | ± 100                  | mA   |
| I <sub>GND</sub>      | DC Ground Current per Ground Pin  | ± 100                  | mA   |
| T <sub>STG</sub>      | Storage Temperature Range   | − 65 to + 150          | °C   |
| T <sub>L</sub>        | Lead Temperature, 1 mm from Case for 10 Seconds   | 260                    | °C   |
| T <sub>J</sub>        | Junction Temperature Under Bias   | + 150                  | °C   |
| θ <sub>JA</sub>       | Thermal Resistance<br>SOIC<br>TSSOP<br>QSOP   | 125<br>170<br>200      | °C/W |
| MSL                   | Moisture Sensitivity  | Level 1                |      |
| F <sub>R</sub>        | Flammability Rating<br>Oxygen Index: 28 to 34   | UL 94 V-0 @ 0.125 in   |      |
| V <sub>ESD</sub>      | ESD Withstand Voltage<br>Human Body Model (Note 1)<br>Machine Model (Note 2)<br>Charged Device Model (Note 3) | > 2000<br>> 200<br>N/A | V    |
| I <sub>LATCH-UP</sub> | Latch-Up Performance<br>Above V <sub>CC</sub> and Below GND at 85°C (Note 4)                                  | ± 500                  | mA   |

Maximum Ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum-rated conditions is not implied. Functional operation should be restricted to the Recommended Operating Conditions.

1. Tested to EIA/JESD22-A114-A.
2. Tested to EIA/JESD22-A115-A.
3. Tested to JESD22-C101-A.
4. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol          | Parameter   | Min  | Max     | Unit |
|-----------------|---|------|---------|------|
| V <sub>CC</sub> | Supply Voltage<br>Operating, Data Retention Only  | 4.0  | 5.5     | V    |
| V <sub>I</sub>  | Input Voltage<br>(Note 5)   | 0    | 5.5     | V    |
| V <sub>O</sub>  | Output Voltage<br>(HIGH or LOW State)   | 0    | 5.5     | V    |
| T <sub>A</sub>  | Operating Free-Air Temperature  | − 40 | + 85    | °C   |
| Δt/ΔV           | Input Transition Rise or Fall Rate<br>Switch I/O<br>Switch Control Input<br>V <sub>CC</sub> = 5.0 V ± 0.5 V | 0    | DC<br>5 | ns/V |

5. Unused control inputs may not be left open. All control inputs must be tied to a high or low logic input voltage level.

## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter                             | Conditions   | V <sub>CC</sub><br>(V) | T <sub>A</sub> = -40°C to +85°C |      |      | Unit |
|------------------|---------------------------------------|--|------------------------|---------------------------------|------|------|------|
|                  |                                       |  |                        | Min                             | Typ* | Max  |      |
| V <sub>IK</sub>  | Clamp Diode Resistance                | I <sub>IN</sub> = -18mA  | 4.5                    |                                 |      | -1.2 | V    |
| V <sub>IH</sub>  | High-Level Input Voltage              |  | 4.0 to 5.5             | 2.0                             |      |      | V    |
| V <sub>IL</sub>  | Low-Level Input Voltage               |  | 4.0 to 5.5             |                                 |      | 0.8  | V    |
| I <sub>I</sub>   | Input Leakage Current                 | 0 ≤ V <sub>IN</sub> ≤ 5.5 V                                    | 5.5                    |                                 |      | ±1.0 | μA   |
| I <sub>OZ</sub>  | OFF-STATE Leakage Current             | 0 ≤ A, B ≤ V <sub>CC</sub>                                     | 5.5                    |                                 |      | ±1.0 | μA   |
| R <sub>ON</sub>  | Switch On Resistance (Note 6)         | V <sub>IN</sub> = 0 V, I <sub>IN</sub> = 64 mA                 | 4.5                    |                                 | 4    | 7    | Ω    |
|                  |                                       | V <sub>IN</sub> = 0 V, I <sub>IN</sub> = 30 mA                 | 4.5                    |                                 | 4    | 7    |      |
|                  |                                       | V <sub>IN</sub> = 2.4 V, I <sub>IN</sub> = 15 mA               | 4.5                    |                                 | 8    | 15   |      |
|                  |                                       | V <sub>IN</sub> = 2.4 V, I <sub>IN</sub> = 15 mA               | 4.0                    |                                 | 11   | 20   |      |
| I <sub>CC</sub>  | Quiescent Supply Current              | V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0 | 5.5                    |                                 |      | 3    | μA   |
| ΔI <sub>CC</sub> | Increase In I <sub>CC</sub> per Input | One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND     | 5.5                    |                                 |      | 2.5  | mA   |

\*Typical values are at V<sub>CC</sub> = 5.0 V and T<sub>A</sub> = 25°C.

6. Measured by the voltage drop between A and B pins at the indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A or B) pins.

## AC ELECTRICAL CHARACTERISTICS

| Symbol                              | Parameter  | Conditions                                 | T <sub>A</sub> = −40°C to +85°C<br>C <sub>L</sub> = 50 pF, R <sub>U</sub> = R <sub>D</sub> = 500 Ω |      |                         |      | Unit |
|-------------------------------------|--|--|--|------|-------------------------|------|------|
|                                     |  |  | V <sub>CC</sub> = 4.5–5.5 V  |      | V <sub>CC</sub> = 4.0 V |      |      |
|                                     |  |  | Min  | Max  | Min                     | Max  |      |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Prop Delay Bus to Bus (Note 7)   | V <sub>I</sub> = OPEN                      |  | 0.25 |                         | 0.25 | ns   |
|                                     | Prop Delay, B <sub>Xn</sub> to A <sub>n</sub> , B <sub>n</sub> , C <sub>n</sub> or D <sub>n</sub>          |  | 1.0  | 5.3  |                         | 6.0  |      |
| t <sub>PZH</sub> , t <sub>PZL</sub> | Output Enable Time, B <sub>Xn</sub> to A <sub>n</sub> , B <sub>n</sub> , C <sub>n</sub> or D <sub>n</sub>  | V <sub>I</sub> = 7 V for t <sub>PZL</sub>  | 1.0  | 5.8  |                         | 6.5  | ns   |
|                                     | Output Enable Time, I <sub>OE</sub> to A <sub>n</sub> , B <sub>n</sub> , C <sub>n</sub> or D <sub>n</sub>  | V <sub>I</sub> = OPEN for t <sub>PZH</sub> | 1.0  | 5.8  |                         | 6.5  |      |
| t <sub>PHZ</sub> , t <sub>PLZ</sub> | Output Disable Time, B <sub>Xn</sub> to A <sub>n</sub> , B <sub>n</sub> , C <sub>n</sub> or D <sub>n</sub> | V <sub>I</sub> = 7 V for t <sub>PLZ</sub>  | 1.0  | 5.3  |                         | 6.2  | ns   |
|                                     | Output Disable Time, I <sub>OE</sub> to A <sub>n</sub> , B <sub>n</sub> , C <sub>n</sub> or D <sub>n</sub> | V <sub>I</sub> = OPEN for t <sub>PHZ</sub> | 1.0  | 5.3  |                         | 6.2  |      |

7. This parameter is guaranteed by design but is not tested. The bus switch contributes no propagation delay other than the RC delay of the typical On resistance of the switch and the 50 pF load capacitance, when driven by an ideal voltage source (zero output impedance).

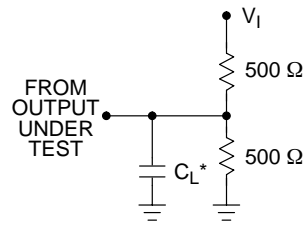
## CAPACITANCE (Note 8)

| Symbol           | Parameter                     | Conditions                                       | Typ | Max | Unit |
|------------------|-------------------------------|--|-----|-----|------|
| C <sub>IN</sub>  | Control Pin Input Capacitance | V <sub>CC</sub> = 5.0 V                          | 6   |     | pF   |
| C <sub>I/O</sub> | Port Input/Output Capacitance | V <sub>CC</sub> , $\overline{\text{OE}}$ = 5.0 V | 13  |     | pF   |

8. T<sub>A</sub> = +25°C, f = 1 MHz, Capacitance is characterized but not tested.

# 74FST3400

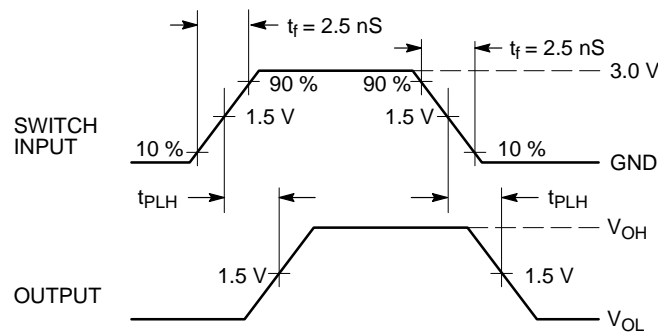
## AC Loading and Waveforms



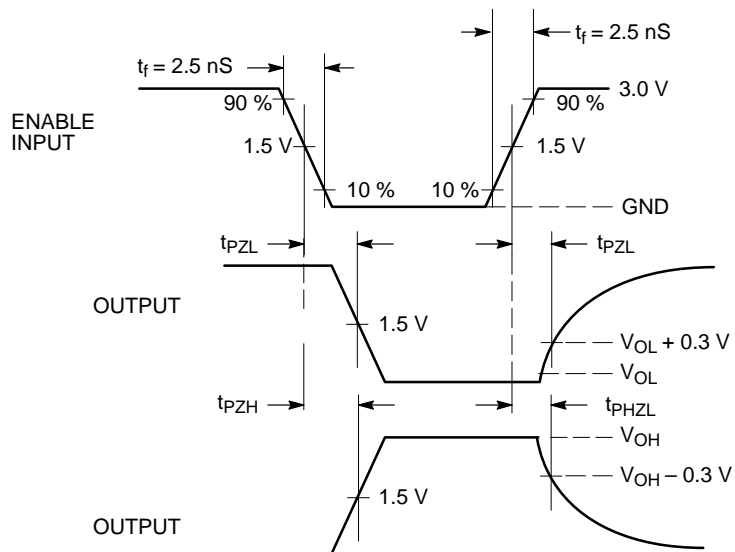
### NOTES:

1. Input driven by  $50\ \Omega$  source terminated in  $50\ \Omega$ .
  2.  $C_L$  includes load and stray capacitance.
- \* $C_L = 50\ \text{pF}$

**Figure 3. AC Test Circuit**



**Figure 4. Propagation Delays**

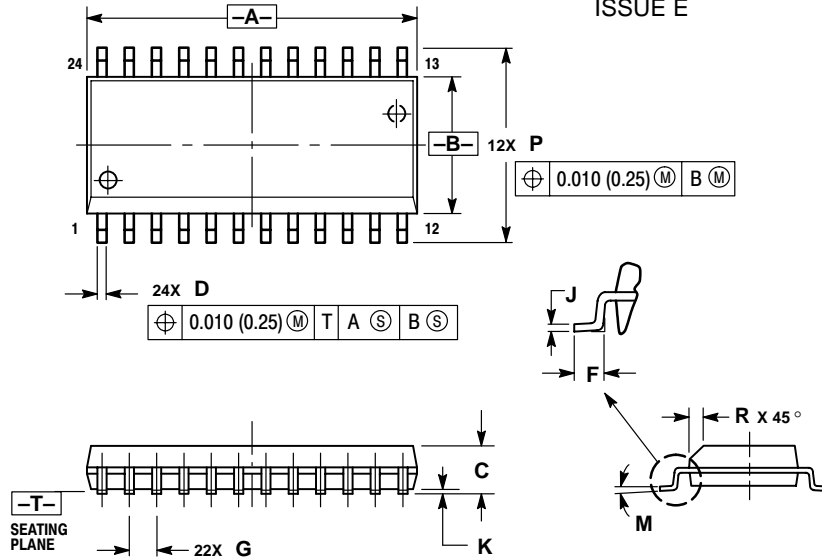


**Figure 5. Enable/Disable Delays**

# 74FST3400

## PACKAGE DIMENSIONS

SO-24  
D SUFFIX  
CASE 751E-04  
ISSUE E



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 15.25       | 15.54 | 0.601     | 0.612 |
| B   | 7.40        | 7.60  | 0.292     | 0.299 |
| C   | 2.35        | 2.65  | 0.093     | 0.104 |
| D   | 0.35        | 0.49  | 0.014     | 0.019 |
| F   | 0.41        | 0.90  | 0.016     | 0.035 |
| G   | 1.27 BSC    |       | 0.050 BSC |       |
| J   | 0.23        | 0.32  | 0.009     | 0.013 |
| K   | 0.13        | 0.29  | 0.005     | 0.011 |
| M   | 0°          | 8°    | 0°        | 8°    |
| P   | 10.05       | 10.55 | 0.395     | 0.415 |
| R   | 0.25        | 0.75  | 0.010     | 0.029 |

## PACKAGE DIMENSIONS

Figure 1: Mechanical drawing of the connector. The drawing includes three views: a top view, a side view, and a detail view. The top view shows a rectangular component with 24 pins (12 on each long side). Dimensions include overall length L, pin pitch 2X L/2, and pin diameter 0.10 (0.004). Surface finish requirements are specified as 0.15 (0.006) for the top and bottom surfaces. The side view shows the component's profile with dimensions C, D, G, and H. A section line N-N is indicated. The detail view shows a cross-section of the component with dimensions F, M, and N. A surface finish requirement of 0.25 (0.010) is specified for the detail view.

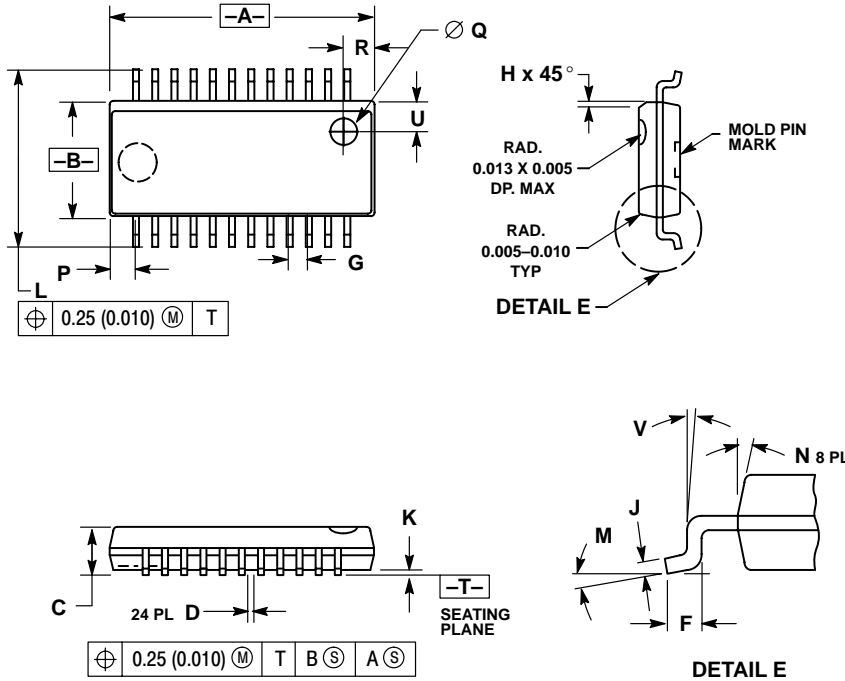
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

|     | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
| DIM | MIN         | MAX  | MIN       | MAX   |
| A   | 7.70        | 7.90 | 0.303     | 0.311 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 1.20 | ---       | 0.047 |
| D   | 0.05        | 0.15 | 0.002     | 0.006 |
| F   | 0.50        | 0.75 | 0.020     | 0.030 |
| G   | 0.65 BSC    |      | 0.026 BSC |       |
| H   | 0.27        | 0.37 | 0.011     | 0.015 |
| J   | 0.09        | 0.20 | 0.004     | 0.008 |
| J1  | 0.09        | 0.16 | 0.004     | 0.006 |
| K   | 0.19        | 0.30 | 0.007     | 0.012 |
| K1  | 0.19        | 0.25 | 0.007     | 0.010 |
| L   | 6.40 BSC    |      | 0.252 BSC |       |
| M   | 0°          | 8°   | 0°        | 8°    |

# 74FST3400


## PACKAGE DIMENSIONS

QSOP-24  
QS SUFFIX  
CASE 492B-01  
ISSUE O



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. THE BOTTOM PACKAGE SHALL BE BIGGER THAN THE TOP PACKAGE BY 4 MILS (NOTE: LEAD SIDE ONLY). BOTTOM PACKAGE DIMENSION SHALL FOLLOW THE DIMENSION STATED IN THIS DRAWING.
  4. PLASTIC DIMENSIONS DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 6 MILS PER SIDE.
  5. BOTTOM EJECTOR PIN WILL INCLUDE THE COUNTRY OF ORIGIN (COO) AND MOLD CAVITY I.D.

|     | INCHES    |        | MILLIMETERS |       |
|-----|-----------|--------|-------------|-------|
| DIM | MAX       | MIN    | MAX         | MIN   |
| A   | 0.337     | 0.344  | 8.56        | 8.74  |
| B   | 0.150     | 0.157  | 3.81        | 3.99  |
| C   | 0.061     | 0.068  | 1.55        | 1.73  |
| D   | 0.008     | 0.012  | 0.20        | 0.31  |
| F   | 0.016     | 0.035  | 0.41        | 0.89  |
| G   | 0.025 BSC |        | 0.64 BSC    |       |
| H   | 0.008     | 0.018  | 0.20        | 0.46  |
| J   | 0.0098    | 0.0075 | 0.249       | 0.191 |
| K   | 0.004     | 0.010  | 0.10        | 0.25  |
| L   | 0.230     | 0.244  | 5.84        | 6.20  |
| M   | 0°        | 8°     | 0°          | 8°    |
| N   | 0°        | 7°     | 0°          | 7°    |
| P   | 0.027     | 0.037  | 0.69        | 0.94  |
| Q   | 0.035 DIA |        | 0.89 DIA    |       |
| R   | 0.035     | 0.045  | 0.89        | 1.14  |
| U   | 0.035     | 0.045  | 0.89        | 1.14  |
| V   | 0°        | 8°     | 0°          | 8°    |

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