

## FST3384A 10-Bit Low Power Extended Input Voltage Bus Switch

### General Description

The FST3384A provides 10 bits of high-speed CMOS TTL-compatible bus switches. The low on resistance of the switch allows inputs to be connected to outputs without adding propagation delay or generating additional ground bounce noise. The device is organized as two 5-bit switches with separate bus enable ( $\overline{BE}$ ) signals. When  $\overline{BE}$  is low, the switch is on and port A is connected to port B. When  $\overline{BE}$  is high, the switch is open and a high-impedance state exists between the two ports.

The FST3384A 10-bit bus switch is pin-for-pin and function compatible with the FST3384 device. It has the added feature of allowing extended negative input voltages on the I/O pins. The FST3384A bus switch, unlike most bus switches on the market, will not falsely turn on when  $\overline{BE}$  is high and negative undershoot voltages are encountered on the I/O pins. Thus it is "undershoot hardened" (see related application note) tolerating undershoots up to  $-1.5V$ .

Typical applications include IDE bus connector interfaces, PCI card interfaces, backplane card interfaces, and other noisy environments where switches are needed.

### Features

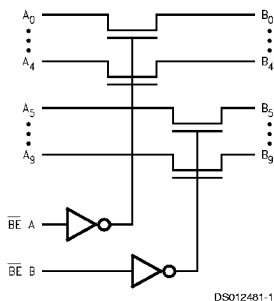
- Extended input voltage design tolerates input undershoots up to  $-1.5V$
- $10\Omega$  switch connection between two ports
- Ultra low power with  $2\ \mu A$  typical  $I_{CC}$
- Zero ground bounce in flow-through mode
- Control inputs compatible with TTL level
- Available in SOIC, QSOP and TSSOP

### Ordering Code:

| Order Number | Package Number | Package Description                                      |
|--------------|----------------|--|
| FST3384AWM   | M24B           | 24-Lead (0.300" Wide) Small Outline Package, SOIC JEDEC  |
| FST3384AQSC  | MQA24          | 24-Lead (0.150" Wide) Shrink Small Outline Package, QSOP |
| FST3384AMTC  | MTC24          | 24-Lead Thin Small Outline Package, TSSOP                |

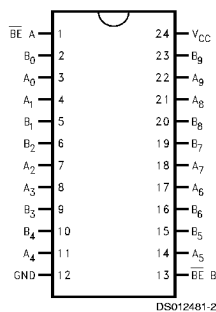
Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Logic Diagram



### Connection Diagram

Pin Assignment  
SOIC, QSOP and TSSOP



## Pin Descriptions

| Pin Names                          | Description       |
|------------------------------------|-------------------|
| $\overline{BE} A, \overline{BE} B$ | Bus Switch Enable |
| $A_0-A_9$                          | Bus A             |
| $B_0-B_9$                          | Bus B             |

## Truth Table

| $\overline{BE} A$ | $\overline{BE} B$ | $B_0-B_4$    | $B_5-B_9$    | Function   |
|-------------------|-------------------|--------------|--------------|------------|
| L                 | L                 | $A_0-A_4$    | $A_5-A_9$    | Connect    |
| L                 | H                 | $A_0-A_4$    | HIGH-Z State | Connect    |
| H                 | L                 | HIGH-Z State | $A_5-A_9$    | Connect    |
| H                 | H                 | HIGH-Z State | HIGH-Z State | Disconnect |

## Absolute Maximum Ratings (Note 1)

|   |                 |
|---|-----------------|
| Supply Voltage ( $V_{CC}$ )               | -0.5V to +7.0V  |
| DC Switch Voltage ( $V_S$ )               | -0.5 to +7.0V   |
| DC Input Input Voltage ( $V_I$ ) (Note 2) | -0.5 to +7.0V   |
| DC Input Diode Current with ( $V_I < 0$ ) | -20 mA          |
| DC Output ( $I_O$ ) Sink Current          | 120 mA          |
| Storage Temperature Range ( $T_{STG}$ )   | -65°C to +150°C |
| Power Dissipation                         | 0.5W            |

## Recommended Operating Conditions

|  |                |
|--|----------------|
| Supply Voltage ( $V_{CC}$ )              | 4.0V to 5.5V   |
| Free Air Operating Temperature ( $T_A$ ) | -40°C to +85°C |

**Note 1:** The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Note 2:** The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

## DC Electrical Characteristics

| Symbol          | Parameter                               | $V_{CC}$<br>(V) | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |                 |     | Units         | Conditions  |
|-----------------|---|-----------------|---|-----------------|-----|---------------|---|
|                 |   |                 | Min   | Typ<br>(Note 5) | Max |               |   |
| $V_{IK}$        | Maximum Clamp Diode Voltage             | 4.75            | -1.2  |                 |     | V             | $I_{IN} = -18\text{ mA}$  |
| $V_{IH}$        | Minimum High Level Input Voltage        | 4.75-5.25       | 2.0   |                 |     | V             |   |
| $V_{IL}$        | Maximum Low Level Input Voltage         | 4.75-5.25       | 0.8   |                 |     |               |   |
| $I_{IN}$        | Maximum Input Leakage Current           | 0               | 10  |                 |     | $\mu\text{A}$ | $0 \leq V_{IN} \leq 5.25\text{V}$                                 |
|                 |   | 5.25            | $\pm 1$   |                 |     |               |   |
| $I_{OZ}$        | Maximum 3-STATE I/O Leakage             | 5.25            | $\pm 10$  |                 |     | $\mu\text{A}$ | $0 \leq A, B \leq V_{CC}$   |
| $I_{OS}$        | Short Circuit Current                   | 4.75            | 100   |                 |     | mA            | $V_I(A), V_I(B) = 0\text{V}$ ,<br>$V_I(B), V_I(A) = 4.75\text{V}$ |
| $R_{ON}$        | Switch On Resistance (Note 3)           | 4.75            | 6   | 12              |     | $\Omega$      | $V_I = 0\text{V}$ , $I_{ON} = 30\text{ mA}$                       |
|                 |   |                 | 15  | 25              |     | $\Omega$      | $V_I = 2.4\text{V}$ , $I_{ON} = 15\text{ mA}$                     |
| $I_{CC}$        | Maximum Quiescent Supply Current        | 5.25            | 0.2   | 10              |     | $\mu\text{A}$ | $V_I = V_{CC}$ , GND<br>$I_O = 0$                                 |
| $\Delta I_{CC}$ | Increase in $I_{CC}$ per Input (Note 4) | 5.25            | 2.5   |                 |     | mA            | $V_{IN} = 3.15\text{V}$ , $I_O = 0$<br>Per Control Input          |

**Note 3:** Measured by voltage drop between A and B pin at indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A or B) pins.

**Note 4:** Per TTL driven Input ( $V_{IN} = 3.15\text{V}$ , control inputs only). A and B pins do not contribute to  $I_{CC}$ .

**Note 5:** All typical values are at  $V_{CC} = 5.0\text{V}$ ,  $T_A = 25^\circ\text{C}$ .

## AC Electrical Characteristics

| Symbol                               | Parameter   | V <sub>CC</sub><br>(V) | T <sub>A</sub> = -40°C to +85°C<br>C <sub>L</sub> = 50 pF |                 |      | Units |
|--------------------------------------|---|------------------------|---|-----------------|------|-------|
|                                      |   |                        | Min   | Typ<br>(Note 6) | Max  |       |
| T <sub>PLH</sub><br>T <sub>PHL</sub> | Data Propagation Delay<br>An to Bn or Bn to An<br>(Note 7)          | 4.75                   |   |                 | 0.50 | ns    |
| T <sub>PZL</sub><br>T <sub>PZH</sub> | Switch Enable Time<br>$\overline{BE}_A, \overline{BE}_B$ to An, Bn  | 4.75                   | 1.5   |                 | 6.8  | ns    |
| T <sub>PLZ</sub><br>T <sub>PHZ</sub> | Switch Disable Time<br>$\overline{BE}_A, \overline{BE}_B$ to An, Bn | 4.75                   | 1.5   |                 | 6.0  | ns    |

**Note 6:** All typical values are at V<sub>CC</sub> = 5.0V, T<sub>A</sub> = 25°C.

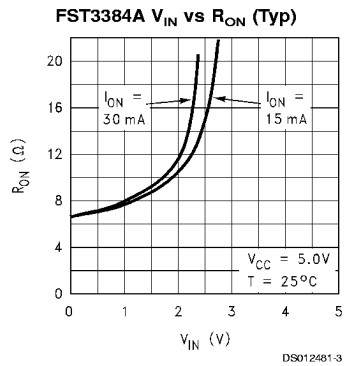
**Note 7:** This parameter is guaranteed by design but not tested. The bus switch contributes no propagation delay other than the RC delay of the On resistance of the switch and the load capacitance. The time constant for the switch and alone is of the order of 0.5 ns for 50 pF load. Since this time constant is much smaller than the rise/fall times of typical driving signals, it adds very little propagation delay to the system. Propagation delay of the bus switch when used in a system is determined by the driving circuit on the driving side of the switch and its interaction with the load on the driven side.

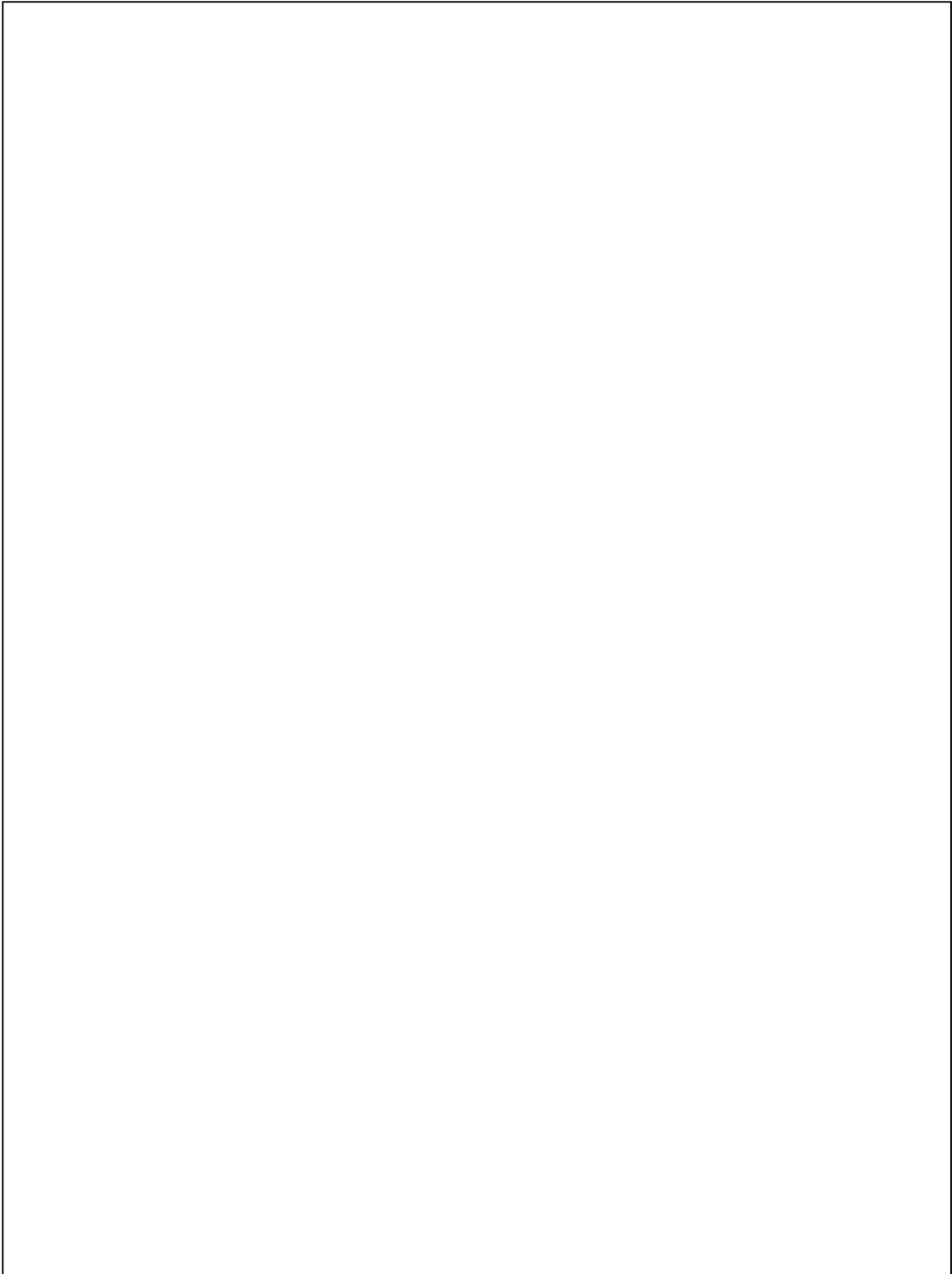
## Capacitance

(Note 8)

| Symbol                 | Parameter                 | Typ | Max | Units | Conditions             |
|------------------------|---------------------------|-----|-----|-------|------------------------|
| C <sub>IN</sub>        | Control Input Capacitance | 4   | 6   | pF    | V <sub>CC</sub> = 5.0V |
| C <sub>I/O</sub> (OFF) | Input/Output Capacitance  | 9   | 13  | pF    | V <sub>CC</sub> = 5.0V |

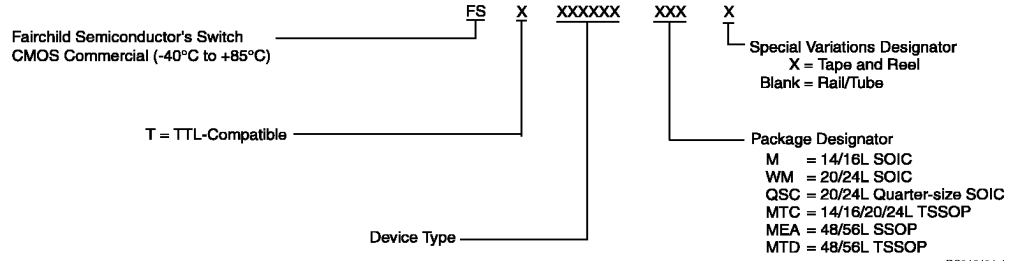
**Note 8:** Capacitance is characterized but not tested.





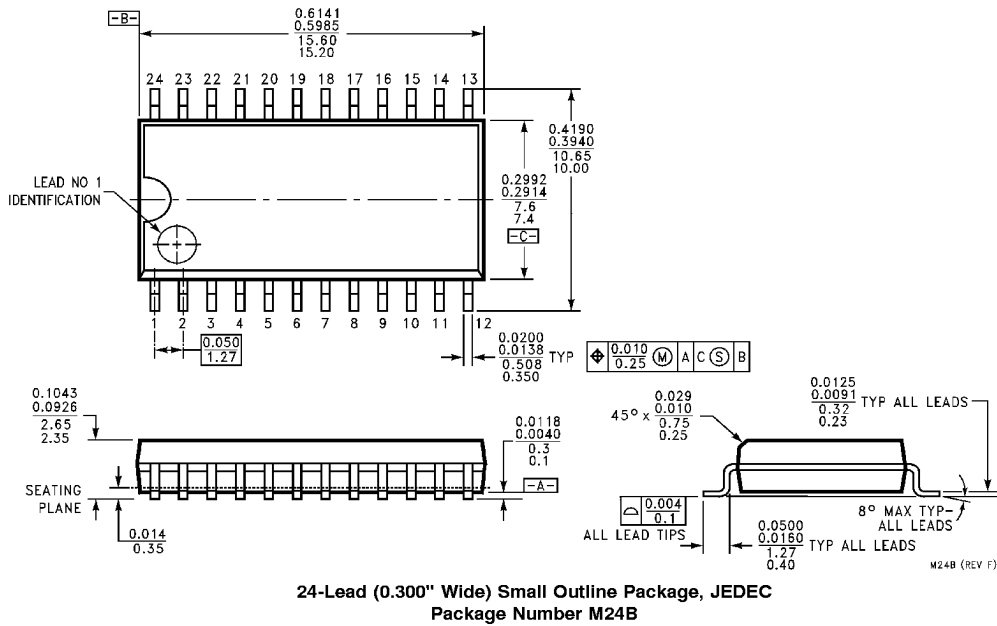
## Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:

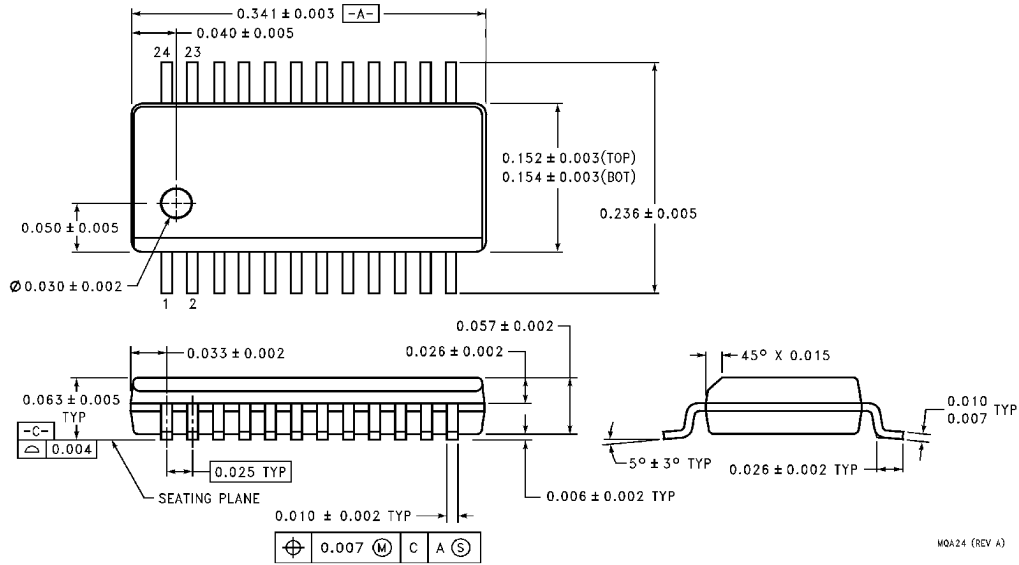


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## Physical Dimensions inches (millimeters) unless otherwise noted



**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



MQA24 (REV A)

**24-Lead (0.150" Wide) Shrink Small Outline Package, JEDEC (QSC)  
(also known as QSOP)  
Package Number MQA24**

