



Integrated Device Technology, Inc.

20-BIT BUS SWITCH

IDT74FST163384
IDT74FST1632384
ADVANCE INFORMATION

FEATURES:

- Bus switches provide zero delay paths
- Extended commercial range of -40°C to $+85^{\circ}\text{C}$
- Low switch on-resistance:
 FST163xxx – 5Ω
 FST1632xxx — 28Ω
- TTL-compatible input and output levels
- ESD > 2000V per MIL-STD-883, Method 3015;
 > 200V using machine model (C = 200pF, R = 0)
- Available in SSOP, TSSOP and TVSOP

DESCRIPTION:

The FST163384/1632384 belong to IDT's family of Bus switches. Bus switch devices perform the function of connecting or isolating two ports without providing any inherent

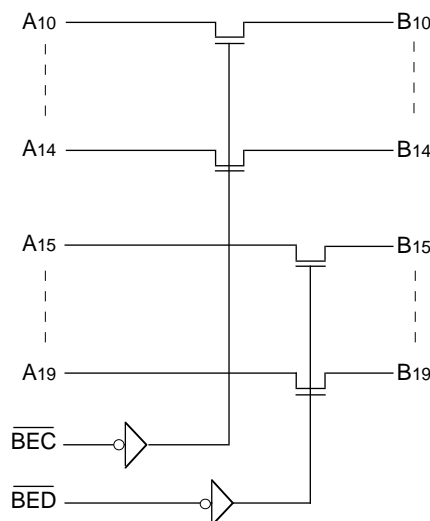
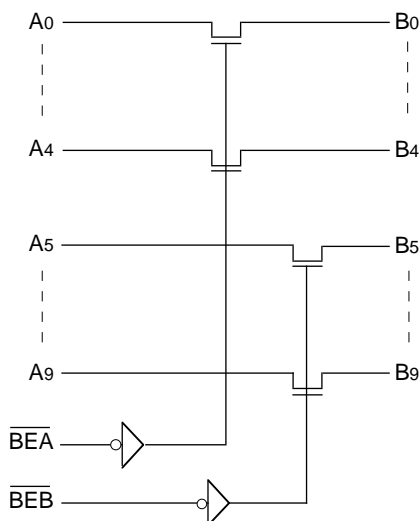
current sink or source capability. Thus they generate little or no noise of their own while providing a low resistance path for an external driver. These devices connect input and output ports through an n-channel FET. When the gate-to-source junction of this FET is adequately forward-biased the device conducts and the resistance between input and output ports is small. Without adequate bias on the gate-to-source junction of the FET, the FET is turned off, therefore with no VCC applied, the device has hot insertion capability.

The low on-resistance and simplicity of the connection between input and output ports reduces the delay in this path to close to zero.

The FST1632xxx integrates terminating resistors in the device, thus eliminating the need for external 25Ω series resistors.

The FST163384 and FST1632384 are 20-bit TTL-compatible bus switches. The BEx pins provide enable control.

FUNCTIONAL BLOCK DIAGRAM



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PIN DESCRIPTION

| Pin Names | I/O | Description |
|--|-----|--------------------------------|
| A0-19 | I/O | Bus A |
| B0-19 | I/O | Bus B |
| $\overline{\text{BEA}}$, $\overline{\text{BEB}}$, $\overline{\text{BEC}}$, $\overline{\text{BED}}$ | I | Bus Switch Enable (Active LOW) |

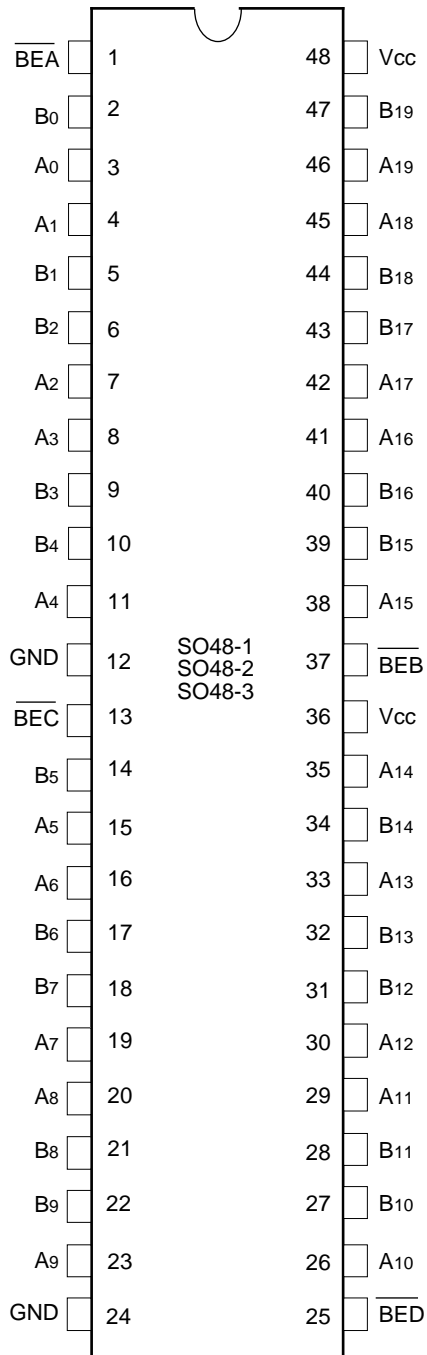
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COMMERCIAL TEMPERATURE RANGE

FEBRUARY 1997

PIN CONFIGURATION



SSOP/
TSSOP/TVSOP
TOP VIEW

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ABSOLUTE MAXIMUM RATINGS⁽¹⁾

| Symbol | Description | Max. | Unit |
|----------------------|--------------------------------------|--------------|------|
| VTERM ⁽²⁾ | Terminal Voltage with Respect to GND | -0.5 to +7.0 | V |
| TSTG | Storage Temperature | -65 to +150 | °C |
| IOUT | Maximum Continuous Channel Current | 128 | mA |

NOTES:

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- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
- Vcc, Control and Switch terminals.

FUNCTION TABLE

| \overline{BEA} | \overline{BEB} | B0-4 | B5-9 | Description |
|------------------|------------------|--------|--------|-------------|
| H | H | Hi-Z | Hi-Z | Disconnect |
| L | H | A0-4 | Hi-Z | Connect |
| H | L | Hi-Z | A5-9 | Connect |
| L | L | A0-4 | A5-9 | Connect |
| \overline{BEC} | \overline{BED} | B10-14 | B15-19 | Description |
| H | H | Hi-Z | Hi-Z | Disconnect |
| L | H | A10-14 | Hi-Z | Connect |
| H | L | Hi-Z | A15-19 | Connect |
| L | L | A10-14 | A15-19 | Connect |

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CAPACITANCE⁽¹⁾

| Symbol | Parameter | Conditions ⁽²⁾ | Typ. | Unit |
|------------------|---------------------------------|---------------------------|------|------|
| CIN | Control Input Capacitance | | 4 | pF |
| C _{I/O} | Switch Input/Output Capacitance | Switch Off | | pF |

NOTES:

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- Capacitance is characterized but not tested
- T_A = 25°C, f = 1MHz, V_{IN} = 0V, V_{OUT} = 0V

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Commercial: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 5.0\text{V} \pm 10\%$

| Symbol | Parameter | Test Conditions ⁽¹⁾ | Min. | Typ. ⁽²⁾ | Max. | Unit | |
|-----------|--|--|--------------------|---------------------|------|---------------|---------------|
| V_{IH} | Input HIGH Voltage | Guaranteed Logic HIGH for Control Inputs | 2.0 | — | — | V | |
| V_{IL} | Input LOW Voltage | Guaranteed Logic LOW for Control Inputs | — | — | 0.8 | V | |
| I_{IH} | Input HIGH Current | $V_{CC} = \text{Max.}$ | $V_I = V_{CC}$ | — | — | ± 1 | μA |
| I_{IL} | Input LOW Current | | $V_I = \text{GND}$ | — | — | ± 1 | |
| I_{OZH} | High Impedance Output Current (3-State Output pins) | $V_{CC} = \text{Max.}$ | $V_O = V_{CC}$ | — | — | ± 1 | μA |
| I_{OZL} | | | $V_O = \text{GND}$ | — | — | ± 1 | |
| I_{OS} | Short Circuit Current | $V_{CC} = \text{Max.}, V_O = \text{GND}^{(3)}$ | — | 300 | — | mA | |
| V_{IK} | Clamp Diode Voltage | $V_{CC} = \text{Min.}, I_{IN} = -18\text{mA}$ | — | -0.7 | -1.2 | V | |
| R_{ON} | Switch On Resistance ⁽⁴⁾ | $V_{CC} = \text{Min.}, V_{IN} = 0.0\text{V}$ $I_{ON} = 30\text{mA}$ | 163xxx | — | 5 | 7 | Ω |
| | | | 1632xxx | 20 | 28 | 40 | |
| | | $V_{CC} = \text{Min.}, V_{IN} = 2.4\text{V}$ $I_{ON} = 15\text{mA}$ | 163xxx | — | 10 | 15 | Ω |
| | | | 1632xxx | 20 | 35 | 48 | |
| I_{OFF} | Input/Output Power Off Leakage | $V_{CC} = 0\text{V}, V_{IN}$ or $V_O \leq 4.5\text{V}$ | — | — | 1 | μA | |
| I_{CC} | Quiescent Power Supply Current | $V_{CC} = \text{Max.}, V_{IN} = \text{GND}$ or V_{CC} | — | 0.1 | 3 | μA | |

NOTES:

1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at $V_{CC} = 5.0\text{V}$, $+25^{\circ}\text{C}$ ambient.
3. Not more than one output should be tested at one time. Duration of the test should not exceed one second.
4. Measured by voltage drop between ports at indicated current through the switch.

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POWER SUPPLY CHARACTERISTICS

| Symbol | Parameter | Test Conditions ⁽¹⁾ | | Min. | Typ. ⁽²⁾ | Max. | Unit |
|-----------------|---|--|-------------------------------------|------|---------------------|------|----------------------------|
| ΔI_{CC} | Quiescent Power Supply Current TTL Inputs HIGH | $V_{CC} = \text{Max.}$ $V_{IN} = 3.4V^{(3)}$ | | — | 0.5 | 1.5 | mA |
| I_{CCD} | Dynamic Power Supply Current ⁽⁴⁾ | $V_{CC} = \text{Max.}$ Outputs Open Enable Pin Toggling 50% Duty Cycle | $V_{IN} = V_{CC}$ $V_{IN} = GND$ | — | 30 | 40 | $\mu A/$ MHz/ Switch |
| I_C | Total Power Supply Current ⁽⁶⁾ | $V_{CC} = \text{Max.}$ Outputs Open Enable Pins Toggling (20 Switches Toggling) $f_i = 10\text{MHz}$ 50% Duty Cycle | $V_{IN} = V_{CC}$ $V_{IN} = GND$ | — | 6.0 | 8.0 | mA |
| | | | $V_{IN} = 3.4$ $V_{IN} = GND$ | — | 7.0 | 11.0 | |

NOTES:

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- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $V_{CC} = 5.0V$, $+25^\circ C$ ambient.
- Per TTL driven input ($V_{IN} = 3.4V$). All other inputs at V_{CC} or GND .
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed but not tested.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
 $I_C = I_{CC} + \Delta I_{CC} D_{HNT} + I_{CCD} (f_i N)$
 $I_{CC} = \text{Quiescent Current}$
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input } (V_{IN} = 3.4V)$
 $D_H = \text{Duty Cycle for TTL Inputs High}$
 $N_T = \text{Number of TTL Inputs at } D_H$
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$
 $f_i = \text{Input Frequency}$
 $N = \text{Number of Switches Toggling at } f_i$
 All currents are in milliamps and all frequencies are in megahertz.

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Commercial: $T_A = -40^\circ C$ to $+85^\circ C$, $V_{CC} = 5.0V \pm 10\%$

| Symbol | Description | Condition ⁽¹⁾ | Min. ⁽²⁾ | Typ. | 163384 | 1632384 | Unit |
|------------------------|---|--|---------------------|------|--------|---------|------|
| | | | | | Max. | | |
| t_{PLH} t_{PHL} | Data Propagation Delay A_i to B_i , B_i to $A_i^{(3,4)}$ | $C_L = 50\text{pF}$ $R_L = 500\Omega$ | — | — | 0.25 | 1.25 | ns |
| t_{PZH} t_{PZL} | Switch Turn on Delay B_{EX} to A_i , B_i | | 1.5 | — | 6.5 | 7.5 | ns |
| t_{PHZ} t_{PLZ} | Switch Turn off Delay B_{EX} to A_i , $B_i^{(3)}$ | | 1.5 | — | 5.5 | 5.5 | ns |
| $ Q_{CI} $ | Charge Injection ^(5,6) | | — | 1.5 | — | — | pC |

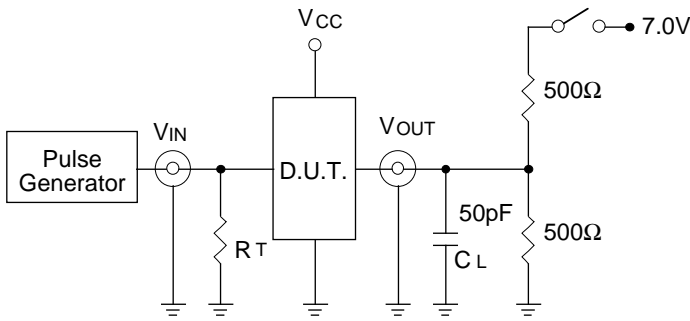
NOTES:

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- See test circuit and waveforms.
- Minimum limits guaranteed but not tested.
- 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 alone is of the order of 2.5ns for 50pF load. Since this time is constant and much smaller than the rise/fall times of typical driving signals, it adds very little propagation delay to the system. Propagation delay on 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.
- Measured at switch turn off, load = 50 pF in parallel with 10M Ω scope probe, $V_{IN} = 0.0$ volts.
- Characterized parameter. Not 100% tested.

TEST CIRCUITS AND WAVEFORMS

TEST CIRCUITS FOR ALL OUTPUTS



3473 Ink 03

SWITCH POSITION

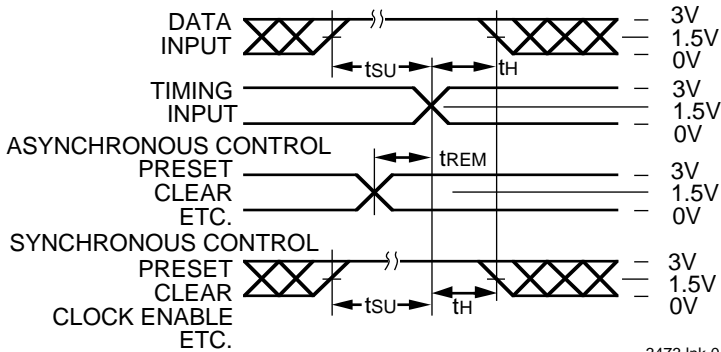
| Test | Switch |
|---|--------|
| Open Drain Disable Low Enable Low | Closed |
| All Other Tests | Open |

DEFINITIONS:

CL = Load capacitance: includes jig and probe capacitance.
RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.

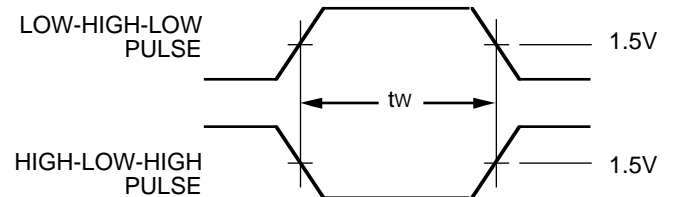
3473 Ink 08

SET-UP, HOLD AND RELEASE TIMES



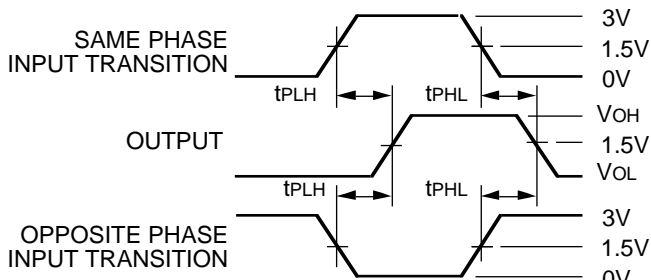
3473 Ink 04

PULSE WIDTH



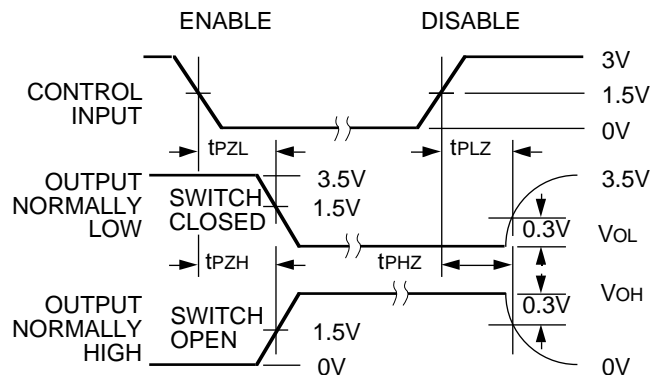
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PROPAGATION DELAY



3473 Ink 06

ENABLE AND DISABLE TIMES

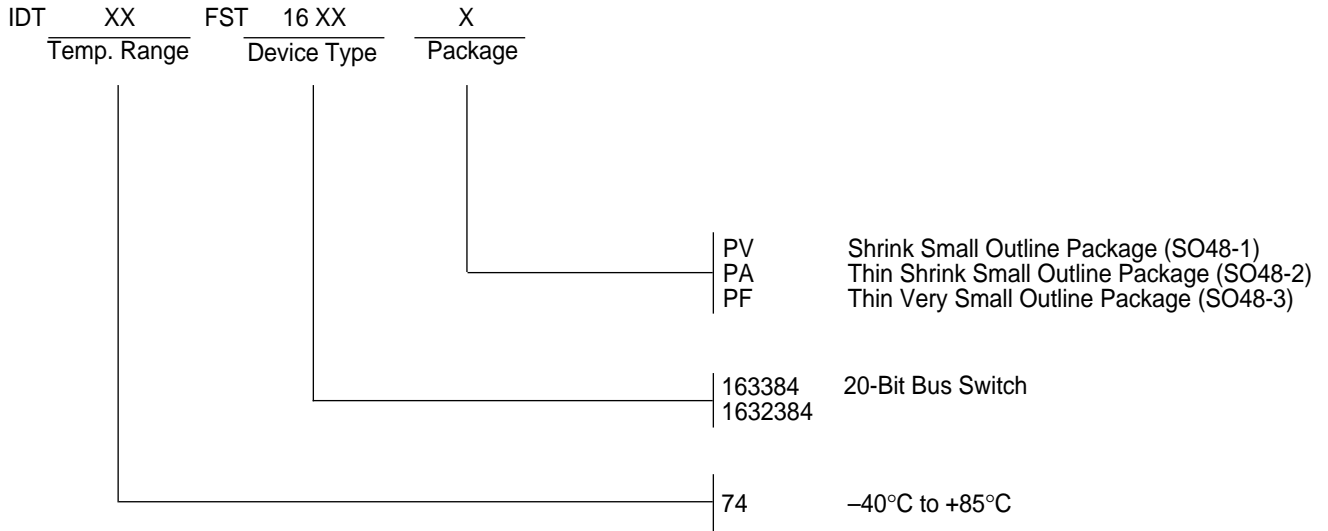


NOTES:

- Diagram shown for input Control Enable-LOW and input Control Disable-HIGH
- Pulse Generator for All Pulses: Rate $\leq 1.0\text{MHz}$; $t_f \leq 2.5\text{ns}$; $t_r \leq 2.5\text{ns}$

3473 Ink 07

ORDERING INFORMATION



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