20-BIT BUS SWITCH   *IDT74FST32XL2384*

FEATURES:
- **Bus switches provide zero delay paths**
- **Low switch on-resistance; 28Ω**
- **TTL-compatible input and output levels**
- **ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)**
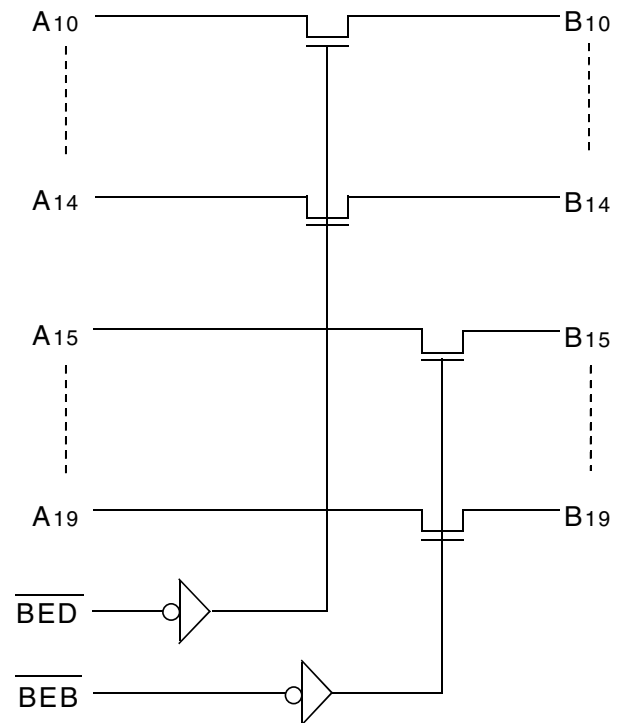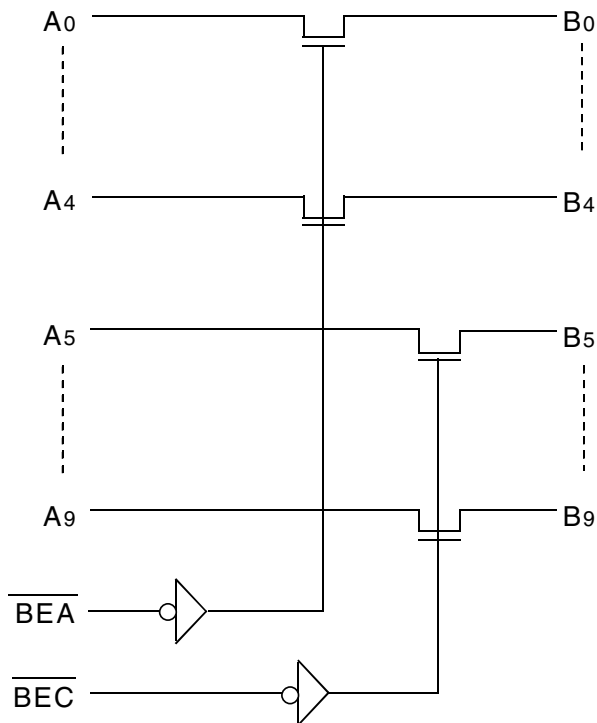- **Available in TSSOP package**

DESCRIPTION:

The FST32XL2384 belongs 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 V_{CC} applied, the device has hot insertion capability.
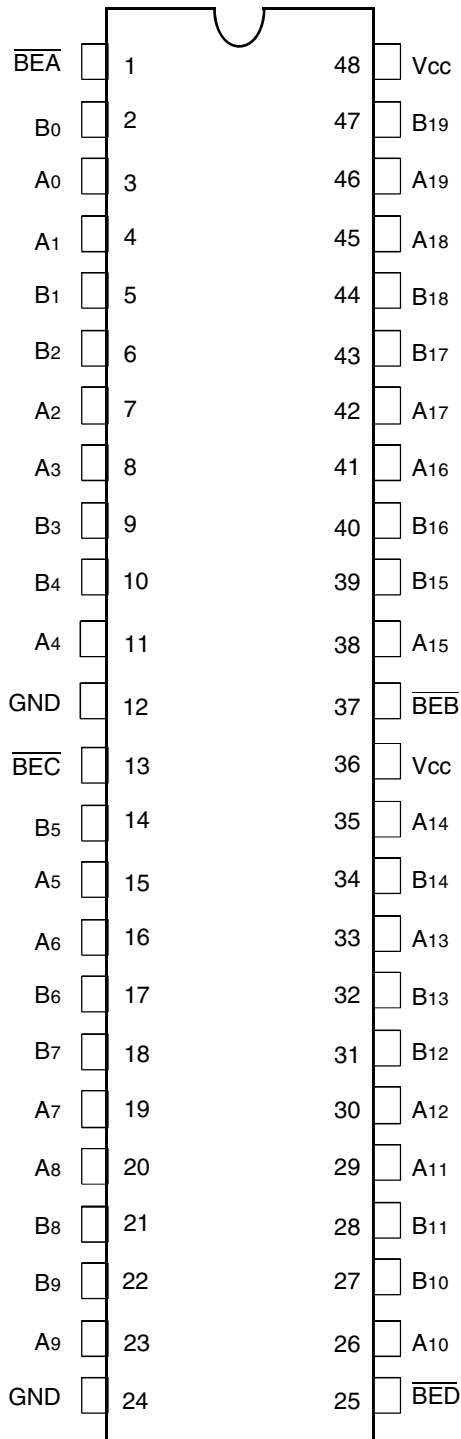
The low on-resistance and simplicity of the connection between input and output ports reduces the delay in this path to close to zero.

The FST32XL2384 is a 20-bit TTL-compatible bus switch. The $\overline{BEx}$ pins provide enable control.

FUNCTIONAL BLOCK DIAGRAM

INDUSTRIAL TEMPERATURE RANGE   March 2009

DSC-4708/4

PIN CONFIGURATION

$\overline{BEA}$	1	48	Vcc
B_0	2	47	B_{19}
A_0	3	46	A_{19}
A_1	4	45	A_{18}
B_1	5	44	B_{18}
B_2	6	43	B_{17}
A_2	7	42	A_{17}
A_3	8	41	A_{16}
B_3	9	40	B_{16}
B_4	10	39	B_{15}
A_4	11	38	A_{15}
GND	12	37	$\overline{BEB}$
$\overline{BEC}$	13	36	Vcc
B_5	14	35	A_{14}
A_5	15	34	B_{14}
A_6	16	33	A_{13}
B_6	17	32	B_{13}
B_7	18	31	B_{12}
A_7	19	30	A_{12}
A_8	20	29	A_{11}
B_8	21	28	B_{11}
B_9	22	27	B_{10}
A_9	23	26	A_{10}
GND	24	25	$\overline{BED}$

TSSOP
TOP VIEW

ABSOLUTE MAXIMUM RATINGS[1]

Symbol	Description	Max	Unit
V_{TERM}[2]	Terminal Voltage with Respect to GND	−0.5 to +7	V
T_{STG}	Storage Temperature	−65 to +150	°C
I_{OUT}	Maximum Continuous Channel Current	128	mA

NOTES:
1. 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.
2. Vcc, Control, and Switch terminals.

CAPACITANCE[1]

Symbol	Parameter	Conditions[2]	Typ.	Unit
C_{IN}	Control Input Capacitance		4	pF
$C_{I/O}$	Switch Input/Output Capacitance	Switch Off	8	pF

NOTES:
1. Capacitance is characterized but not tested.
2. $T_A = 25°C$, f = 1MHz, $V_{IN} = 0V$, $V_{OUT} = 0V$.

PIN DESCRIPTION

Pin Names	I/O	Description
A_0 - A_{19}	I/O	Bus A
B_0 - B_{19}	I/O	Bus B
$\overline{BEA}$	I	Enable, 0-4
$\overline{BEB}$	I	Enable, 15-19
$\overline{BEC}$	I	Enable, 5-9
$\overline{BED}$	I	Enable, 10-14

FUNCTION TABLE[1]

$\overline{BEA}$	$\overline{BEB}$	B_0 - B_4	B_{15} - B_{19}	Description
H	H	Z	Z	Disconnect
L	H	A_0 - A_4	Z	Connect
H	L	Z	A_{15} - A_{19}	Connect
L	L	A_0 - A_4	A_{15} - A_{19}	Connect

$\overline{BEC}$	$\overline{BED}$	B_0 - B_4	B_{15} - B_{19}	Description
H	H	Z	Z	Disconnect
L	H	A_5 - A_9	Z	Connect
H	L	Z	A_{10} - A_{14}	Connect
L	L	A_5 - A_9	A_{10} - A_{14}	Connect

NOTE:
1. H = HIGH Voltage Level
   L = LOW Voltage Level
   Z = High-Impedance

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Industrial: $T_A = -40°C$ to $+85°C$, $V_{CC} = 5.0V \pm 10\%$

Symbol	Parameter	Test Conditions[1]		Min.	Typ.[2]	Max.	Unit
V_{IH}	Input HIGH Voltage	Guaranteed Logic HIGH for Control Inputs		2	—	—	V
V_{IL}	Input LOW Voltage	Guaranteed Logic LOW for Control Inputs		—	—	0.8	V
I_{IH}	Input HIGH Current	V_{CC} = Max.	$V_I = V_{CC}$	—	—	±1	µA
I_{IL}	Input LOW Current		V_I = GND	—	—	±1	
I_{OZH}	High Impedance Output Current	V_{CC} = Max.	$V_O = V_{CC}$	—	—	±1	µA
I_{OZL}	(3-State Output Pins)		V_O = GND	—	—	±1	
I_{OS}	Short Circuit Current	V_{CC} = Max., V_O = GND[3]		—	300	—	mA
V_{IK}	Clamp Diode Voltage	V_{CC} = Min., I_{IN} = –18mA		—	–0.7	–1.2	V
R_{ON}	Switch On Resistance[4]	V_{CC} = Min., V_{IN} = 0V, I_{ON} = 30mA		20	28	40	Ω
		V_{CC} = Min., V_{IN} = 2.4V, I_{ON} = 15mA		20	35	48	
I_{OFF}	Input/Output Power Off Leakage	V_{CC} = 0V, V_{IN} or $V_O \leq 4.5V$		—	—	±1	µA
I_{CC}	Quiescent Power Supply Current	V_{CC} = Max., V_I = 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} = 5.0V, +25°C ambient.
3. Not more than one output should be shorted 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.

POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]		Min.	Typ.[2]	Max.	Unit
ΔI_{CC}	Quiescent Power Supply Current TTL Inputs HIGH	V_{CC} = Max. V_{IN} = 3.4V[3]		—	0.5	1.5	mA
I_{CCD}	Dynamic Power Supply Current[4,5]	V_{CC} = Max., Outputs Open Enable Pin Toggling 50% Duty Cycle	$V_{IN} = V_{CC}$ V_{IN} = GND	—	30	40	µA/ MHz/ Switch
I_C	Total Power Supply Current[6]	V_{CC} = Max., Outputs Open Enable Pins Toggling (20 Switches Toggling)	$V_{IN} = V_{CC}$ V_{IN} = GND	—	6	8	mA
		f_i = 10MHz 50% Duty Cycle	V_{IN} = 3.4V V_{IN} = GND	—	7	11	

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} = 5.0V, +25°C ambient.
3. Per TTL driven input (V_{IN} = 3.4V). All other inputs at V_{CC} or GND.
4. This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
5. Values for these conditions are examples of the Icc formula. These limits are guaranteed but not tested.
6. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
    $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_i N)$
    I_{CC} = Quiescent Current
    ΔI_{CC} = Power Supply Current for a TTL High Input (V_{IN} = 3.4V)
    D_H = Duty Cycle for TTL Inputs High
    N_T = Number of TTL Inputs at D_H
    I_{CCD} = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)
    f_i = Control Input Frequency
    N = Number of Control Inputs Toggling at f_i

All currents are in milliamps and all frequencies are in megahertz.

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

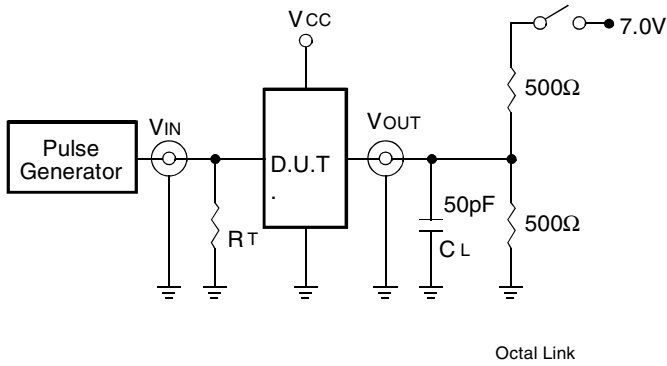Following Conditions Apply Unless Otherwise Specified:

Industrial: T_A = -40°C to +85°C, V_{CC} = 5.0V ± 10%

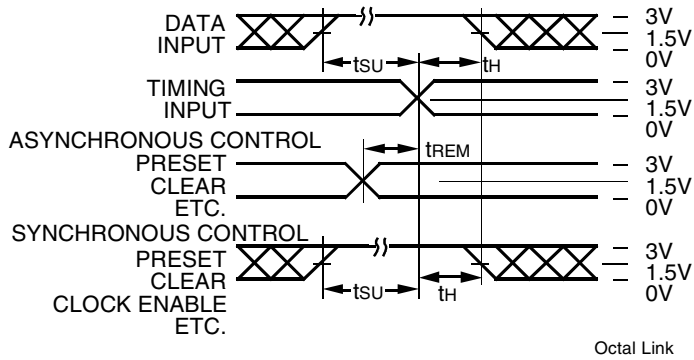| Symbol	Description[1]	Condition	Min.	Typ.	Max.	Unit
t_{PLH}	Data Propagation Delay	C_L = 50pF	—	—	1.25	ns
t_{PHL}	Ax to Bx, Bx to Ax[3,4]	R_L = 500Ω				
t_{PZH}	Switch Turn On Delay		1.5	—	7.5	ns
t_{PZL}	$\overline{BE}$x to Ax, Bx					
t_{PHZ}	Switch Turn Off Delay		1.5	—	5.5	ns
t_{PLZ}	$\overline{BE}$x to Ax, Bx[3]					
$|Q_{CI}|$	Charge Injection[5,6]		—	1.5	—	pC

NOTES:

1. See test circuit and waveforms.
2. Minimum limits guaranteed but not tested.
3. This parameter is guaranteed by design but not tested.
4. 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.
5. Measured at switch turn off, load = 50 pF in parallel with 10 MΩ scope probe, V_{IN} = 0.0 volts.
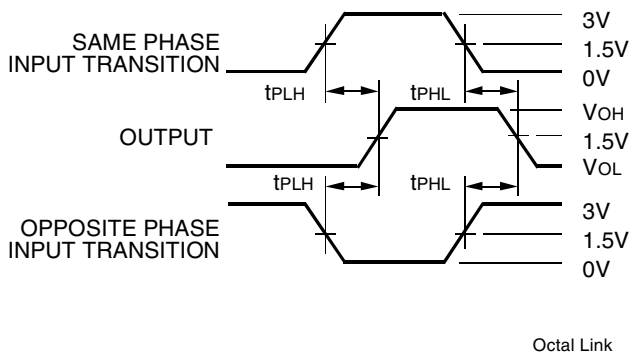6. Characterized parameter. Not 100% tested.

TEST CIRCUITS AND WAVEFORMS

VCC

7.0V

500Ω

Pulse Generator — VIN — D.U.T. — VOUT

50pF CL

500Ω

RT

Octal Link

Test Circuits for All Outputs

DATA INPUT — 3V / 1.5V / 0V

t_{SU} t_H

TIMING INPUT — 3V / 1.5V / 0V

ASYNCHRONOUS CONTROL PRESET CLEAR ETC. — t_{REM} — 3V / 1.5V / 0V

SYNCHRONOUS CONTROL PRESET CLEAR CLOCK ENABLE ETC. — 3V / 1.5V / 0V

t_{SU} t_H

Octal Link

Set-up, Hold, and Release Times

SAME PHASE INPUT TRANSITION — 3V / 1.5V / 0V

t_{PLH} t_{PHL}

OUTPUT — VOH / 1.5V / VOL

t_{PLH} t_{PHL}

OPPOSITE PHASE INPUT TRANSITION — 3V / 1.5V / 0V

Octal Link

Propagation Delay

SWITCH POSITION

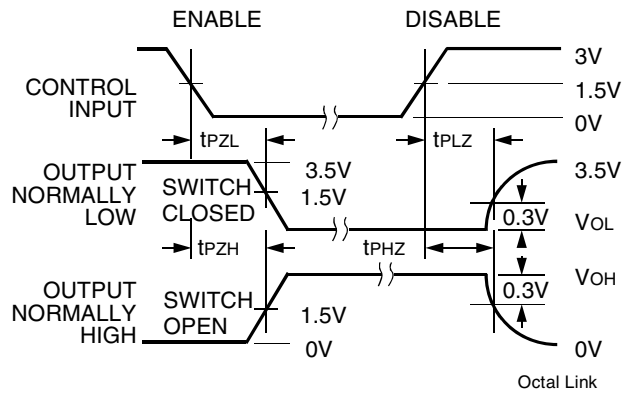| Test	Switch
Open Drain Disable Low Enable Low	Closed
All Other Tests	Open

DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.

R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

LOW-HIGH-LOW PULSE — 1.5V

t_W

HIGH-LOW-HIGH PULSE — 1.5V

Pulse Width Octal Link

ENABLE   DISABLE

CONTROL INPUT — 3V / 1.5V / 0V

t_{PZL} t_{PLZ}

OUTPUT NORMALLY LOW — SWITCH CLOSED — 3.5V / 1.5V — 3.5V / 0.3V / VOL

t_{PZH} t_{PHZ}

OUTPUT NORMALLY HIGH — SWITCH OPEN — 1.5V / 0V — 0.3V / VOH / 0V
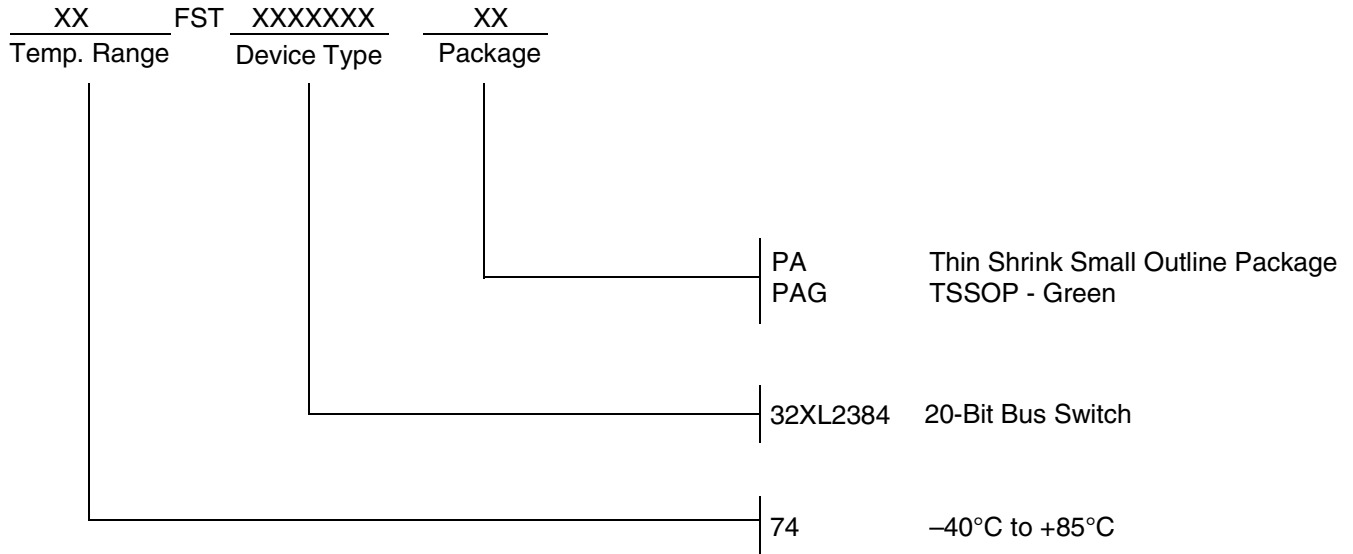
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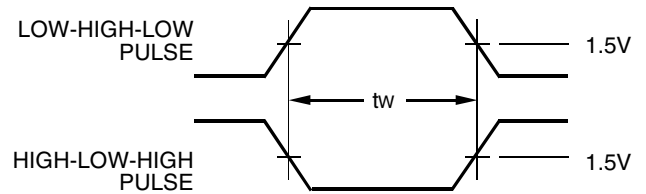
Enable and Disable Times

NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
2. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.

ORDERING INFORMATION

<u>XX</u>   FST <u>XXXXXXX</u>   <u>XX</u>
Temp. Range   Device Type   Package

PA	Thin Shrink Small Outline Package
PAG	TSSOP - Green

32XL2384	20-Bit Bus Switch

74	–40°C to +85°C