Integrated Device Technology, Inc.

9-BIT BUS EXCHANGE SWITCH

IDT74FST163209
ADVANCE INFORMATION

FEATURES:

- Bus switches provide zero delay paths
- Extended commercial range of –40°C to +85°C
- Low switch on-resistance:
  FST163xxx – 4Ω
- 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

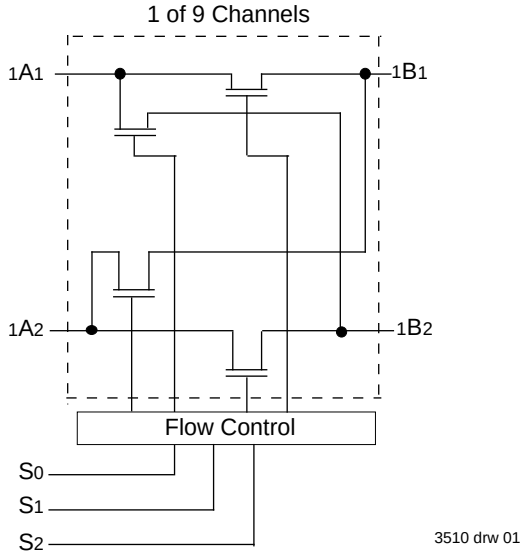
DESCRIPTION:

The FST163209 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 FST163209 provides four 9-bit TTL- compatible ports that support 2 way bus exchange. The S_{0-2} pins control the bus exchange and switch enable functions.

FUNCTIONAL BLOCK DIAGRAM



PIN DESCRIPTION

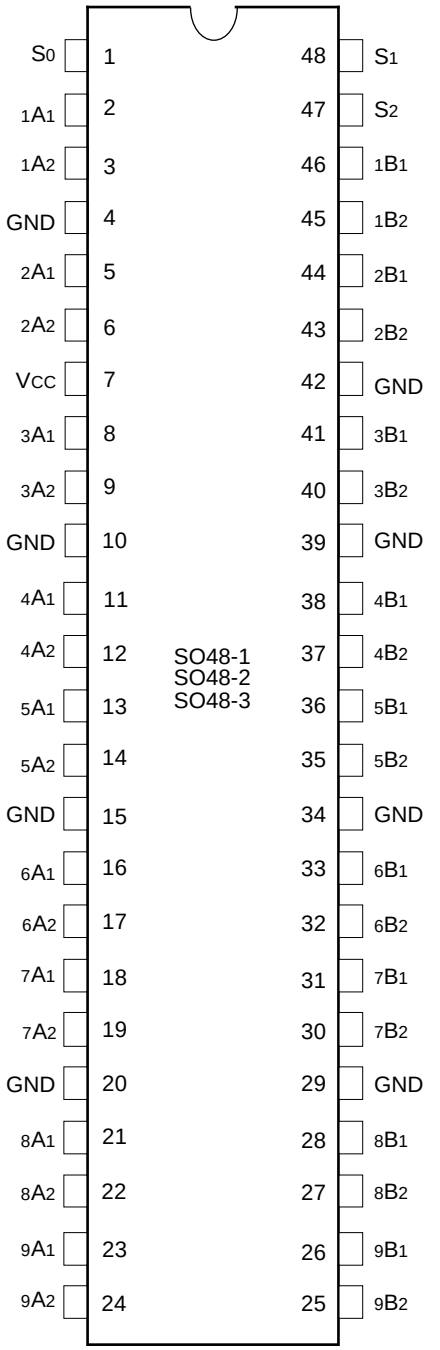
Pin Names	I/O	Description
A_1, A_2 B_1, B_2	I/O	Buses A_1, A_2, B_1, B_2
S_{0-2}	I	Control Pins for Mux and Switch Enable Functions

3510 tbl 01

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PIN CONFIGURATION



SSOP/ TSSOP/TVSOP TOP VIEW

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ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Description	Max.	Unit
V_{TERM}(2)	Terminal Voltage with Respect to GND	–0.5 to +7.0	V
T_{STG}	Storage Temperature	–65 to +150	°C
I_{OUT}	Maximum Continuous Channel Current	128	mA

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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 condiitions for extended periods may affect reliability.
2. V_{CC}, 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		pF

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NOTES:

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

FUNCTION TABLE

S_2	S_1	S_0	A_1	A_2	Function
L	L	L	Z	Z	Disconnect
L	L	H	B_1	Z	A_1 to B_1
L	H	L	B_2	Z	A_1 to B_2
L	H	H	Z	B_1	A_2 to B_1
H	L	L	Z	B_2	A_2 to B_2
H	L	H	Z	Z	Disconnect
H	H	L	B_1	B_2	A_1 to B_1, A_2 to B_2
H	H	H	B_2	B_1	A_1 to B_2, A_2 to B_1

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DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Commercial: T_A = –40°C to +85°C, V_{CC} = 5.0V ±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} = Max.	V_I = V_{CC}	—	—	±1	µA
I_{IL}	Input LOW Voltage		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} = 0.0V I_{ON} = 64mA		—	4	7	Ω
		V_{CC} = Min. V_{IN} = 0.0V I_{ON} = 30mA		—	4	7	Ω
		V_{CC} = Min. V_{IN} = 2.4V I_{ON} = 15mA		—	6	15	Ω
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_{IN} = GND or V_{CC}		—	0.1	3	µA

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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 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.

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]	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 3 Select Pins Toggling (9 Switches Toggling) fi = 10MHz 50% Duty Cycle	V_{IN} = V_{CC} V_{IN} = GND	—	2.7	3.6	mA
			V_{IN} = 3.4 V_{IN} = GND	—	3.5	5.9	

3510 tbl 06

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 I_{CC} 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 = Input Frequency
   N = Number of Switches Toggling at fi
   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°C to +85°C, V_{CC} = 5.0V ±10%

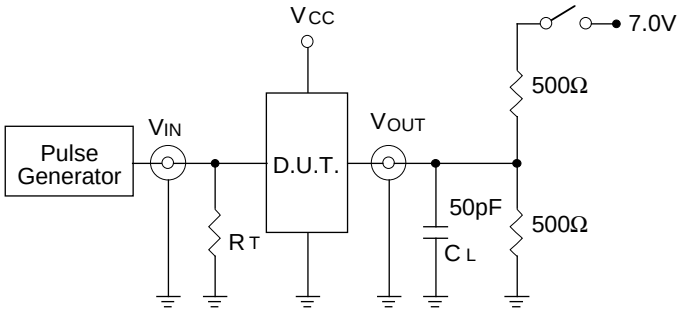
Symbol	Description	Condition[1]	Min.[2]	Typ.	Max.	Unit
t_{PLH} t_{PHL}	Data Propagation Delay A to B, B to A[3,4]	C_L = 50pF R_L = 500Ω	—	—	0.25	ns
t_{BX}	Switch Multiplex Delay S to A, B		1.5	—	6.5	ns
t_{PZH} t_{PZL}	Switch Turn on Delay S to A, B		1.5	—	6.5	ns
t_{PHZ} t_{PLZ}	Switch Turn off Delay S to A, B		1.5	—	7	ns
$\lvert Q_{CI} \rvert$	Charge Injection, Typical[5,7]		—	1.5	—	pC
$\lvert Q_{DCI} \rvert$	Charge Injection, Typical[6,7]		—	0.5	—	

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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. Measured at switch turn off through bus multiplexer, (e.g.- A_1 to B_1 = >A_1 to B_2), load = 50 pF in parallel with 10 MΩ scope probe, V_{IN} at A = 0.0 volts. Charge injection is reduced because the injection from the turn off of the A to C switch is compensated by the turn on of the B to C switch.
7. Characterized parameter. Not 100% tested.

TEST CIRCUITS AND WAVEFORMS

TEST CIRCUITS FOR ALL OUTPUTS



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SWITCH POSITION

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

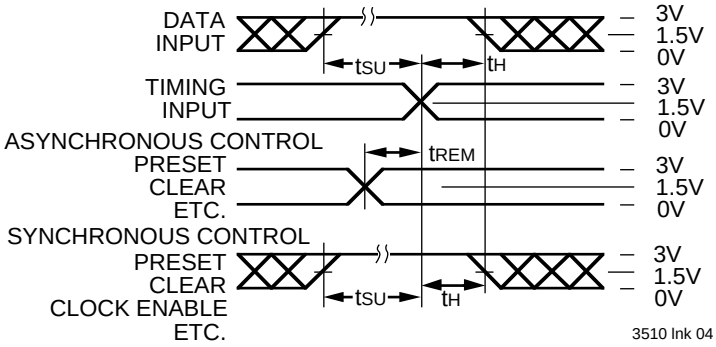
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DEFINITIONS:

C_L= Load capacitance: includes jig and probe capacitance.

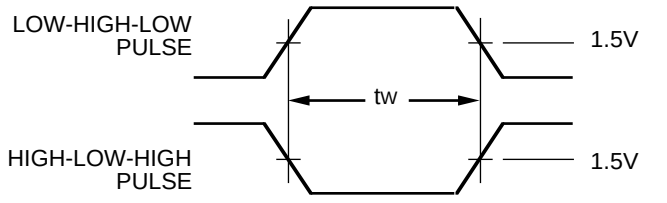
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

SET-UP, HOLD AND RELEASE TIMES



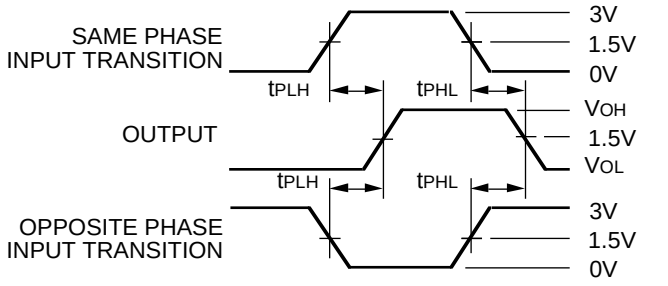
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PULSE WIDTH



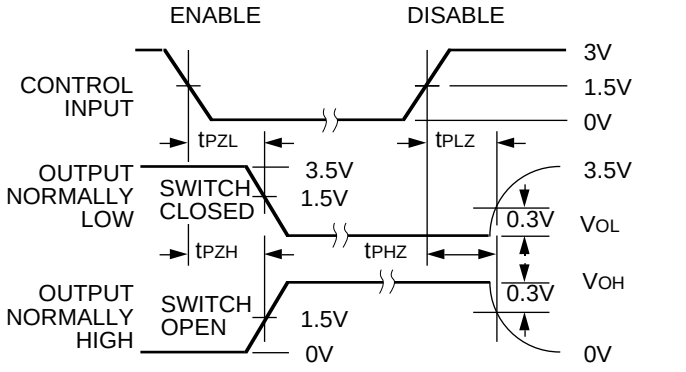
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PROPAGATION DELAY



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ENABLE AND DISABLE TIMES

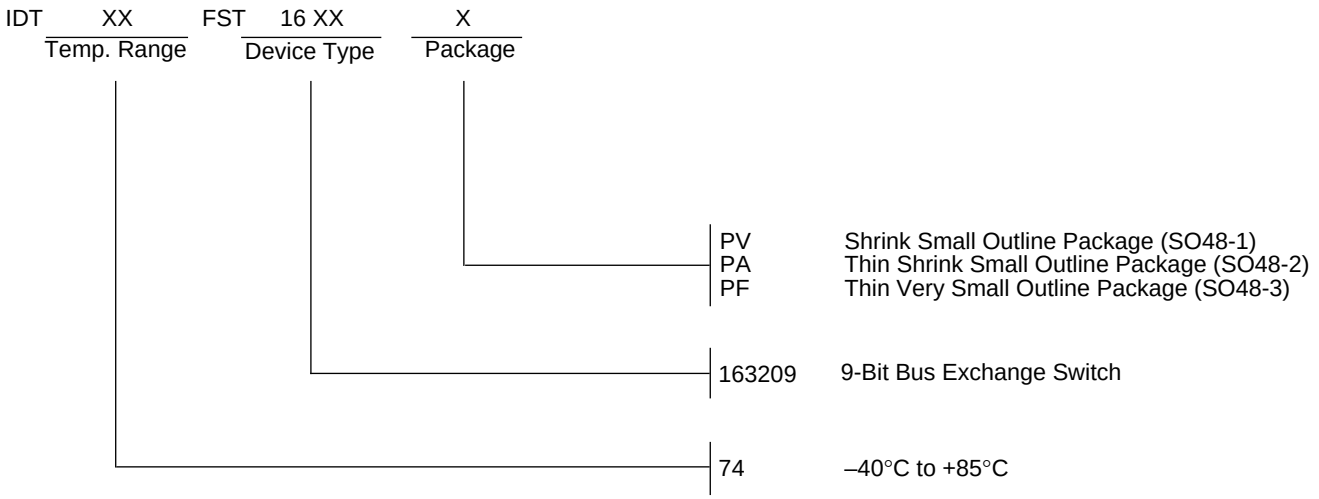


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NOTES:

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



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Integrated Device Technology, Inc. reserves the right to make changes to the specifications in this data sheet in order to improve design or performance and to supply the best possible product.

Integrated Device Technology, Inc.

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