

FSTD3125 — 4-Bit Bus Switch with Level Shifting

Features

- 4Ω Switch Connection between Two Ports
- Minimal Propagation Delay through the Switch
- Low I_{CC}
- Zero Bounce in Flow-through Mode
- Control Inputs Compatible with TTL Level
- TruTranslation Voltage Translation from 5.0V Inputs to 3.3V Outputs

Description

Fairchild switch FSTD3125 provides four 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. A diode to V_{CC} has been integrated into the circuit to allow for level shifting between 5V inputs and 3.3V outputs.

The device is organized as four one-bit switches with separate /OE inputs. When /OE is LOW, the switch is ON and port A is connected to port B. When /OE is HIGH, the switch is OPEN and a high-impedance state exists between the two ports.

Ordering Information

Part Number	Operating Temperature Range	Package	Packing Method
FSTD3125MTCX	-40 to 85°C	14-Lead, Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4mm Wide	Tape and Reel

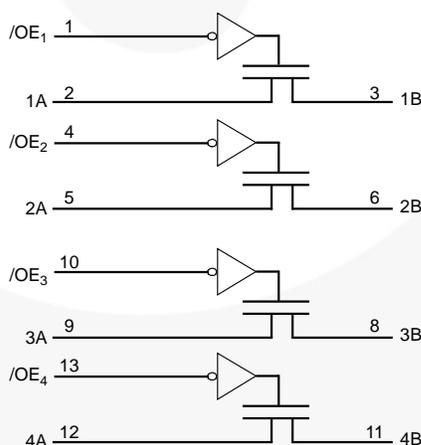


Figure 1. Logic Diagram

Pin Configuration

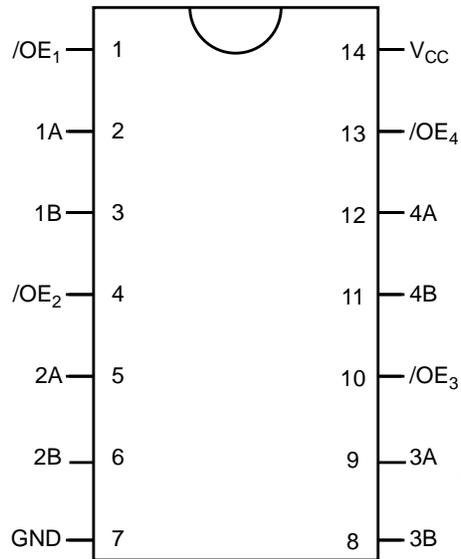


Figure 2. Pin Assignments

Pin Descriptions

Pin #	Pin Names	Description
1, 4, 10, 13	$\overline{OE}_1, \overline{OE}_2, \overline{OE}_3, \overline{OE}_4$	Bus Switch Enables
2, 5, 9, 12	1A, 2A, 3A, 4A	Bus A
3, 6, 8, 11	1B, 2B, 3B, 4B	Bus B
14	V_{CC}	Supply Voltage
7	GND	Ground

Truth Table

Inputs	Inputs/Outputs
\overline{OE}	A, B
LOW	A = B
HIGH	High Impedance

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply Voltage	-0.5	7.0	V
V_S	DC Switch Voltage	-0.5	7.0	V
V_{IN}	DC Input Voltage ⁽¹⁾	-0.5	7.0	V
I_{IK}	DC Input Diode Current, $V_{IN} < 0V$		-50	mA
I_{OUT}	DC Output Sink Current		128	mA
I_{CC} / I_{GND}	DC V_{CC} / GND Current		± 100	mA
T_{STG}	Storage Temperature Range	-65	+150	°C

Note:

- The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter		Min.	Max.	Unit
V_{CC}	Power Supply Operating		4.5	5.5	V
V_{IN}	Input Voltage		0	5.5	V
V_{OUT}	Output Voltage		0	5.5	V
t_r, t_f	Input Rise and Fall Time	Switch Control Input ⁽²⁾	0	5	ns/V
		Switch I/O	0	DC	
T_A	Operating Temperature, Free Air		-40	+85	°C

Note:

- Unused control inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Typical values are at $V_{CC} = 5.0V$ and $T_A = 25^\circ C$.

Symbol	Parameter	Condition	V_{CC} (V)	$T_A = -40$ to $+85^\circ C$			Unit
				Min.	Typ.	Max.	
V_{IK}	Clamp Diode Voltage	$I_{IN} = -18mA$	4.5			-1.2	V
V_{IH}	High-Level Input Voltage		4.5 to 5.5	2.0			V
V_{OH}	High-Level	Figure 5, Figure 6, and Figure 7	4.0 to 5.5				V
V_{IL}	Low-Level Input Voltage		4.5 to 5.5			0.8	V
I_{IN}	Input Leakage Current	$0 \leq V_{IN} \leq 5.5V$	5.5			± 1.0	μA
		$V_{IN} = 5.5V$	0			10	μA
I_{OZ}	Off-state Leakage Current	$0 \leq A, B \leq V_{CC}$	5.5			± 1.0	μA
R_{ON}	Switch On Resistance ⁽³⁾	$V_{IN} = 0V, I_{IN} = 64mA$	4.5		4	7	Ω
		$V_{IN} = 0V, I_{IN} = 30mA$	4.5		4	7	
		$V_{IN} = 2.4V, I_{IN} = 15mA$	4.5		35	50	
I_{CC}	Quiescent Supply Current	$/OE_1 = /OE_2 = GND$ $V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0$	5.5			1.5	μA
		$/OE_1 = /OE_2 = V_{CC}$ $V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0$				10	
ΔI_{CC}	Increase in I_{CC} per Input	One Input at 3.4V, Other Inputs at V_{CC} or GND	5.5			2.5	mA

Note:

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

AC Electrical Characteristics

$T_A = -40$ to $+85^\circ C$, $C_L = 50pF$, and $R_U = R_D = 500\Omega$.

Symbol	Parameter	Condition	$V_{CC} = 4.5 - 5.5V$		Unit	Figure
			Min.	Max.		
t_{PHL}, t_{PLH}	Propagation Delay, Bus-to-Bus ⁽⁴⁾	$V_{IN} = \text{Open}$		0.25	ns	Figure 3 Figure 4
t_{PZH}, t_{PZL}	Output Enable Time	$V_{IN} = 7V$ for t_{PZL} $V_{IN} = \text{Open}$ for t_{PZH}	1.0	6.1	ns	Figure 3 Figure 4
t_{PHZ}, t_{PLZ}	Output Disable Time	$V_{IN} = 7V$ for t_{PLZ} $V_{IN} = \text{Open}$ for t_{PHZ}	1.5	6.4	ns	Figure 3 Figure 4

Note:

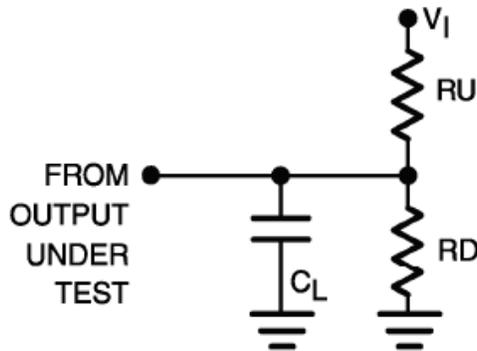
4. This parameter is guaranteed by design, but is not tested. The bus switch contributes no propagation delay other than the RC delay of the typical on resistance of the switch and the 50pF load capacitance when driven by an ideal voltage source (zero output impedance).

Capacitance

$T_A = +25^\circ C$, $f = 1MHz$. Capacitance is characterized, but not tested.

Symbol	Parameter	Condition	Typ.	Unit
C_{IN}	Control Pin Input Capacitance	$V_{CC} = 5.0V$	3	pF
$C_{I/O}$	Input/Output Capacitance	$V_{CC}, /OE = 5.0V$	6	pF

AC Loadings and Waveforms



Notes: Input driven by 50Ω source terminated in 50Ω .
 C_L includes load and stray capacitance.
 Input PRR = 1.0MHz, $t_w = 500\text{ns}$.

Figure 3. AC Test Circuit

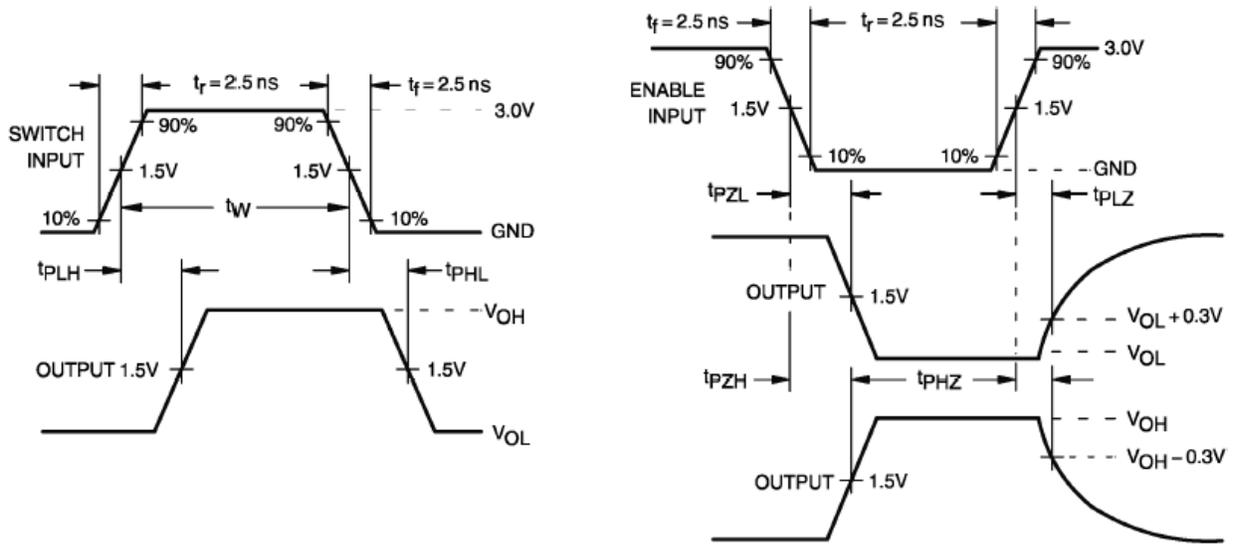


Figure 4. AC Waveforms

Performance Characteristics

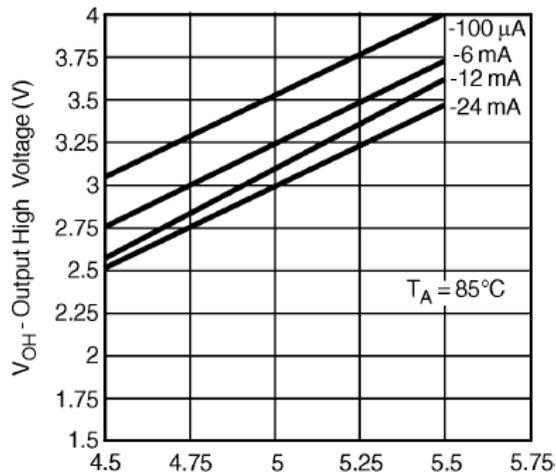


Figure 5. Output Voltage vs. Supply Voltage, $V_{IN} = V_{CC}$, $T_A = 85^\circ\text{C}$

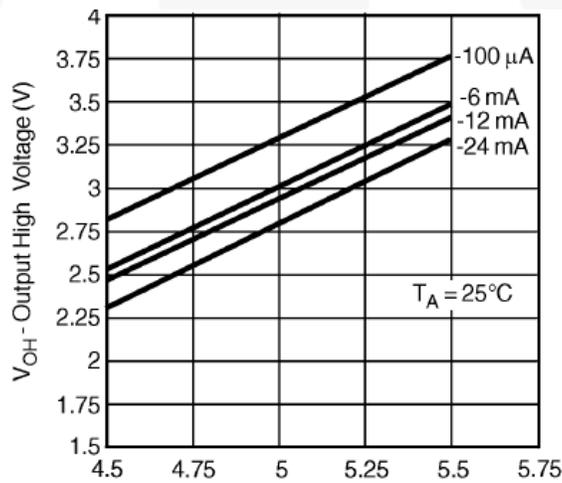


Figure 6. Output Voltage vs. Supply Voltage, $V_{IN} = V_{CC}$, $T_A = 25^\circ\text{C}$

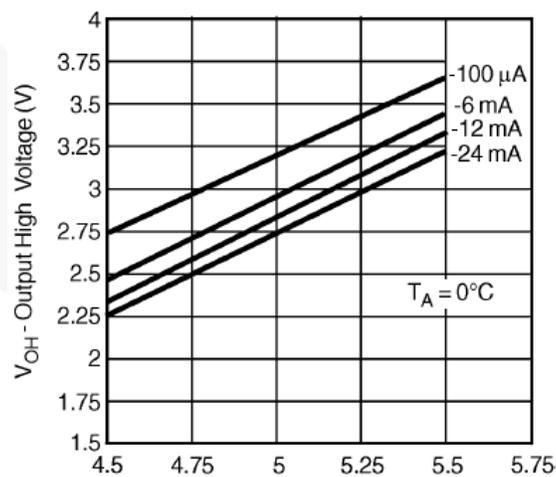


Figure 7. Output Voltage vs. Supply Voltage, $V_{IN} = V_{CC}$, $T_A = 0^\circ\text{C}$



TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

2Cool™
AccuPower™
AX-CAP™*
BitSiC™
Build it Now™
CorePLUS™
CorePOWER™
CROSSVOLT™
CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficientMax™
ESBC™
F®
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FlashWriter®*
FPS™

F-PFS™
FRFET®
Global Power Resource™
GreenBridge™
Green FPS™
Green FPS™ e-Series™
Gmax™
GTO™
IntelliMAX™
ISOPLANAR™
Making Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
Motion-SPM™
mWSaver™
OptoHiT™
OPTOLOGIC®
OPTOPLANAR®

PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
™
Saving our world, 1mW/W/kW at a time™
SignalWise™
SmartMax™
SMART START™
Solutions for Your Success™
SPM®
STEALTH™
SuperFET®
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS®
SyncFET™
Sync-Lock™
 SYSTEM GENERAL®*

The Power Franchise®
the **power** franchise
TinyBoost™
TinyBuck™
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TranSiC™
TriFault Detect™
TRUECURRENT®*
µSerDes™
 SerDes™
UHC®
Ultra FRFET™
UniFET™
VCX™
VisualMax™
VoltagePlus™
XS™

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I61