

# FSA3157B

## Low-Voltage SPDT Analog Switch or 2:1 Multiplexer / De-multiplexer Bus Switch

### Features

- Useful in Both Analog and Digital Applications
- Ultra-Small, MicroPak™ Leadless Package
- Low On Resistance: <math><10\Omega</math> Typical at 3.3V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range: 1.65V to 5.5V
- Rail-to-Rail Signal Handling
- Power-Down, High-Impedance Control Input
- Over-Voltage Tolerance of Control Input to 7.0V
- Break-Before-Make Enable Circuitry
- 250MHz, 3dB Bandwidth

### Description

The FSA3157B is a high-performance, Single-Pole / Double-Throw (SPDT) analog switch or 2:1 multiplexer / de-multiplexer bus switch.

The device is fabricated with advanced sub-micron CMOS technology to achieve high-speed enable and disable times and low on resistance. The break-before-make select circuitry prevents disruption of signals on the B Port due to both switches temporarily being enabled during select pin switching. The device is specified to operate over the 1.65 to 5.5V  $V_{CC}$  operating range. The control input tolerates voltages up to 5.5V, independent of the  $V_{CC}$  operating range.

### Ordering Information

Part Number	Operating Temperature Range	Top Mark	Package	Packing Method
FSA3157BL6X	-40 to +85°C	7G	6-Lead, MicroPak™ 1.0mm Wide Package	5000 Units on Tape and Reel
FSA3157BFHX	-40 to +85°C	7G	6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch	5000 Units on Tape and Reel

## Analog Symbols

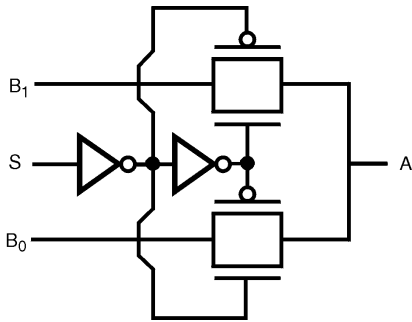


Figure 1. Logic Symbol

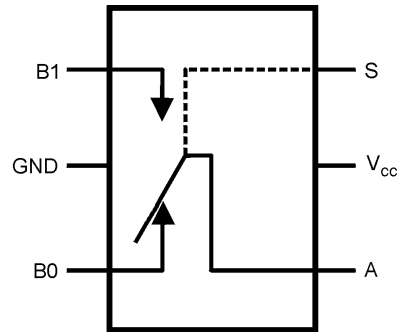


Figure 2. Analog Symbol

## Pin Configuration

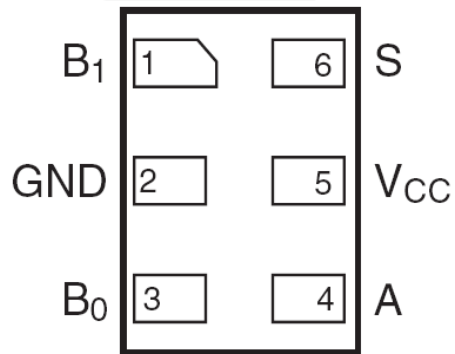


Figure 3. Pad Assignments

## Function Table

Input (S)	Function
Logic Level LOW	B <sub>0</sub> Connected to A
Logic Level HIGH	B <sub>1</sub> Connected to A

## Pin Descriptions

Pin#	Name	Description
1	B <sub>1</sub>	Data Ports
2	GND	Ground
3	B <sub>0</sub>	Data Ports
4	A	Data Ports
5	V <sub>CC</sub>	Power Supply
6	S	Control Input

## 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 <sup>(1)</sup>	-0.5	$V_{CC}+0.5$	V
$V_{IN}$	DC Input Voltage <sup>(1)</sup>	-0.5	7.0	V
$I_{IK}$	DC Input Diode Current at $V_{IN} < 0V$	-50		mA
$I_{OUT}$	DC Output Current		128	mA
$I_{CC/GND}$	DC $V_{CC}$ or Ground Current		$\pm 100$	mA
$T_{STG}$	Storage Temperature Range	-65	+150	°C
$T_J$	Junction Temperature Under Bias		+150	°C
$T_L$	Junction Lead Temperature (Soldering, 10 seconds)		+260	°C
$P_D$	Power Dissipation at +85°C		180	mW
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114		5 kV

### Note:

- Input and output negative voltage ratings may be exceeded if 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	
$V_{CC}$	Supply Voltage Operating	1.65	5.50	V	
$V_{IN}$	Control Input Voltage <sup>(2)</sup>	0	$V_{CC}$	V	
$V_{IN}$	Switch Input Voltage <sup>(2)</sup>	0	$V_{CC}$	v	
$V_{OUT}$	Output Voltage <sup>(2)</sup>	0	$V_{CC}$	V	
$T_A$	Operating Temperature	-40	+85	°C	
$t_r, t_f$	Input Rise and Fall Time	Control Input $V_{CC}=2.3V-3.6V$	0	10	ns/V
		Control Input $V_{CC}=4.5V-5.5V$	0	5	

### Note:

- Control input must be held HIGH or LOW; it must not float.

## Electrical Characteristics

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> =+25°C			T <sub>A</sub> =-40 to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
V <sub>IH</sub>	High Level Input Voltage		1.65 to 1.95	0.75V <sub>CC</sub>			0.75V <sub>CC</sub>		V
			2.30 to 5.50	0.7V <sub>CC</sub>			0.7V <sub>CC</sub>		
V <sub>IL</sub>	Low Level Input Voltage		1.65 to 1.95			0.25V <sub>CC</sub>		0.25V <sub>CC</sub>	V
			2.30 to 5.50			0.3V <sub>CC</sub>		0.3V <sub>CC</sub>	
I <sub>IN</sub>	Input Leakage Current	0 ≤ V <sub>IN</sub> ≤ 5.5V	0 to 5.50		±0.05	±0.1		±1	μA
I <sub>OFF</sub>	Off State Leakage Current	0 ≤ A, B ≤ V <sub>CC</sub>	1.65 to 5.50		±0.05	±0.1		±1	μA
R <sub>ON</sub>	Switch On Resistance <sup>(3)</sup>	V <sub>IN</sub> =0V, I <sub>O</sub> =30mA	4.50		3.0	7.0		7.0	Ω
		V <sub>IN</sub> =2.4V, I <sub>O</sub> =-30mA			5.0	12.0		12.0	
		V <sub>IN</sub> =4.5V, I <sub>O</sub> =-30mA			7.0	15.0		15.0	
		V <sub>IN</sub> =0V, I <sub>O</sub> =24mA	3.00		4.0	9.0		9.0	
		V <sub>IN</sub> =3V, I <sub>O</sub> =-24mA			10.0	20.0		20.0	
		V <sub>IN</sub> =0V, I <sub>O</sub> =8mA	2.30		5.0	12.0		12.0	
		V <sub>IN</sub> =2.3V, I <sub>O</sub> =-8mA			13.0	30.0		30.0	
		V <sub>IN</sub> =0V, I <sub>O</sub> =4mA	1.65		6.5	20.0		20.0	
V <sub>IN</sub> =1.65V, I <sub>O</sub> =-4mA		17.0		50.0		50.0			
I <sub>CC</sub>	Quiescent Supply Current: All Channels On or Off	V <sub>IN</sub> =V <sub>CC</sub> or GND I <sub>OUT</sub> =0	5.50			1		10	μA
	Analog Signal Range		V <sub>CC</sub>	0		V <sub>CC</sub>	0	V <sub>CC</sub>	V
R <sub>RANGE</sub>	On Resistance Over Signal Range <sup>(3,7)</sup>	I <sub>A</sub> =-30mA, 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	4.50					25	Ω
		I <sub>A</sub> =-24mA, 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	3.00					50	
		I <sub>A</sub> =-8mA, 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	2.30					100	
		I <sub>A</sub> =-4mA, 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	1.65					300	
ΔR <sub>ON</sub>	On Resistance Match Between Channels <sup>(3,4)</sup>	I <sub>A</sub> =-30mA, V <sub>Bn</sub> =3.15	4.50		0.15				Ω
		I <sub>A</sub> =-24mA, V <sub>Bn</sub> =2.1	3.00		0.20				
		I <sub>A</sub> =-8mA, V <sub>Bn</sub> =1.6	2.30		0.50				
		I <sub>A</sub> =-4mA, V <sub>Bn</sub> =1.15	1.65		0.50				
R <sub>FLAT</sub>	On Resistance Flatness <sup>(3,4,6)</sup>	I <sub>A</sub> =-30mA, 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	5.00		6				Ω
		I <sub>A</sub> =-24mA, 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	3.00		12				
		I <sub>A</sub> =-8mA, 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	2.50		28				
		I <sub>A</sub> =-4mA, 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	1.80		125				

### Notes:

- 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 two (A or B Ports).
- Parameter is characterized, but not tested in production.
- ΔR<sub>ON</sub> = R<sub>ON</sub> maximum – R<sub>ON</sub> minimum measured at identical V<sub>CC</sub>, temperature, and voltage levels.
- Flatness is defined as the difference between the maximum and minimum value of on resistance over the specified range of conditions.
- Guaranteed by design.

## AC Electrical Characteristics

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> =+25°C			T <sub>A</sub> =-40 to +85°C		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
t <sub>PLH</sub> , t <sub>PLH</sub>	Propagation Delay Bus-to-Bus <sup>(8)</sup>	V <sub>IN</sub> =OPEN	1.65 to 1.95			3.5		3.5	ns	Figure 10 Figure 11
			2.30 to 2.70			1.2		1.2		
			3.00 to 3.60			0.8		0.8		
			4.05 to 5.50			0.3		0.3		
t <sub>PZL</sub> , t <sub>PZH</sub>	Output Enable Time Turn-On Time (A to B <sub>n</sub> )	V <sub>IN</sub> =2X V <sub>CC</sub> for t <sub>PZL</sub> V <sub>IN</sub> =0V for t <sub>PZH</sub>	1.65 to 1.95	7.0		23.0		24.0	ns	Figure 10 Figure 11
			2.30 to 2.70	3.5		13.0		14.0		
			3.00 to 3.60	2.5		6.9		7.6		
			4.50 to 5.50	1.7		5.2		5.7		
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Output Disable Time Turn-Off Time (A Port to B Port)	V <sub>IN</sub> =2X V <sub>CC</sub> for t <sub>PLZ</sub> V <sub>IN</sub> =0V for t <sub>PHZ1</sub>	1.65 to 1.95	3.0		12.5		13.0	ns	Figure 10 Figure 11
			2.30 to 2.70	2.0		7.0		7.5		
			3.00 to 3.60	1.5		5.0		5.3		
			4.50 to 5.50	0.8		3.5		3.8		
t <sub>BBM</sub>	Break-Before-Make Time <sup>(9)</sup>		1.65 to 1.95	0.5			0.5		ns	Figure 12
			2.30 to 2.70	0.5			0.5			
			3.00 to 3.60	0.5			0.5			
			4.50 to 5.50	0.5			0.5			
Q	Charge Injection <sup>(9)</sup>	C <sub>L</sub> =0.1nF, V <sub>GEN</sub> =0V	5.00		7				pC	Figure 13
		R <sub>GEN</sub> =0Ω	3.30		3					
OIRR	Off Isolation <sup>(10)</sup>	R <sub>L</sub> =50Ω, f=10MHz	1.65 to 5.50		-57				dB	Figure 14
Xtalk	Crosstalk	R <sub>L</sub> =50Ω, f=10MHz	1.65 to 5.50		-54					Figure 15
BW	-3dB Bandwidth	R <sub>L</sub> =50Ω	1.65 to 5.50		250				dB	Figure 18
THD	Total Harmonic Distortion <sup>(9)</sup>	R <sub>L</sub> =600Ω, 0.5V <sub>PP</sub> , f=600Hz to 20KHz	5.00		.011				%	

### Notes:

8. 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 50pF load capacitance when driven by an ideal voltage source (zero output impedance).
9. Guaranteed by design.
10. Off Isolation = 20 log<sub>10</sub> [V<sub>A</sub> / V<sub>Bn</sub>].

## Capacitance

T<sub>A</sub> = +25°C, f=1MHz. Capacitance is characterized, but not tested in production.

Symbol	Parameter	Conditions	Typical	Units	Figure
C <sub>IN</sub>	Control Pin Input Capacitance	V <sub>CC</sub> =0V	2.3	pF	
C <sub>IO-B</sub>	B Port Off Capacitance	V <sub>CC</sub> =5.0V	6.5	pF	Figure 16
C <sub>IOA-ON</sub>	A Port Capacitance, Switch Enabled	V <sub>CC</sub> =5.0V	18.5	pF	Figure 17

## Typical Performance Characteristics

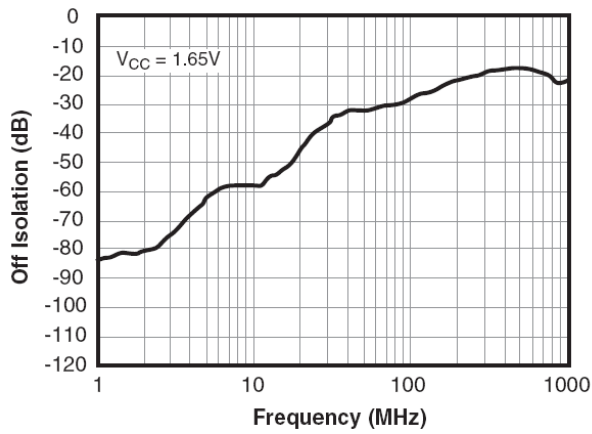


Figure 4. Off Isolation,  $V_{CC}=1.65V$

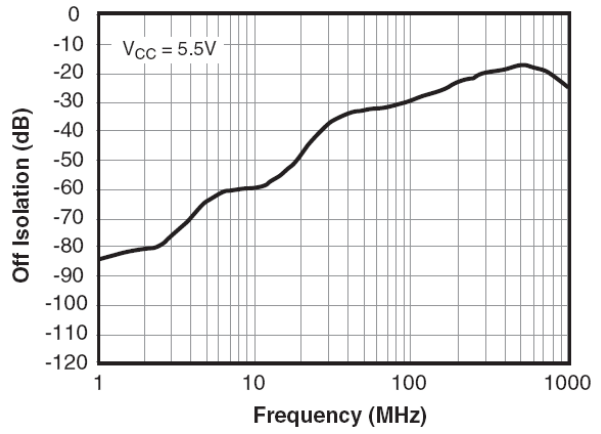


Figure 5. Off Isolation,  $V_{CC}=5.5V$

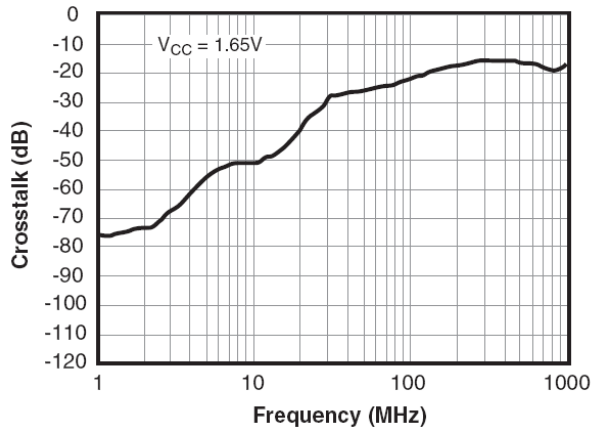


Figure 6. Crosstalk,  $V_{CC}=1.65V$

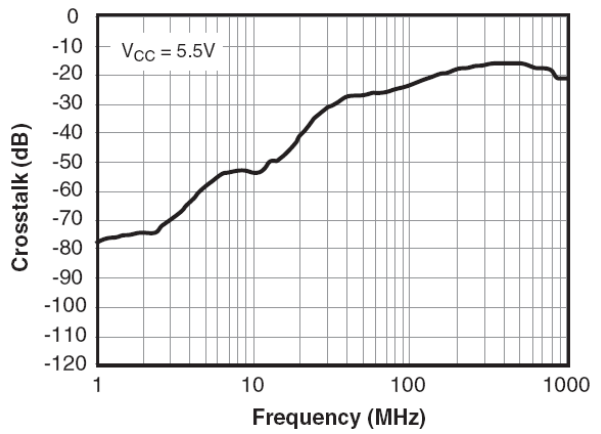


Figure 7. Crosstalk,  $V_{CC}=5.5V$

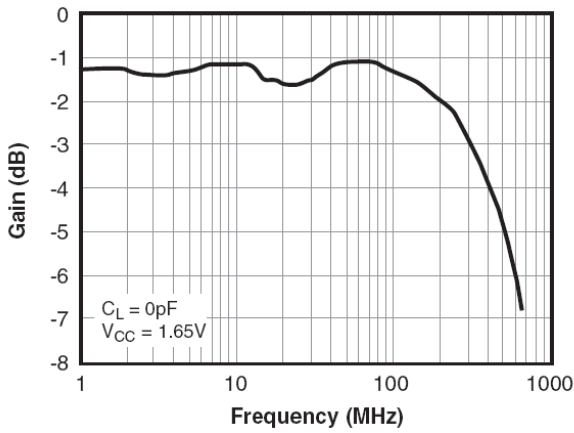


Figure 8. Bandwidth,  $V_{CC}=1.65V$

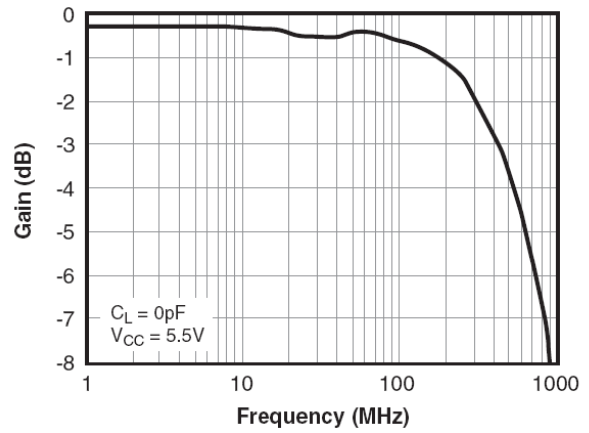
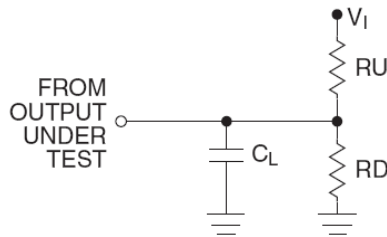


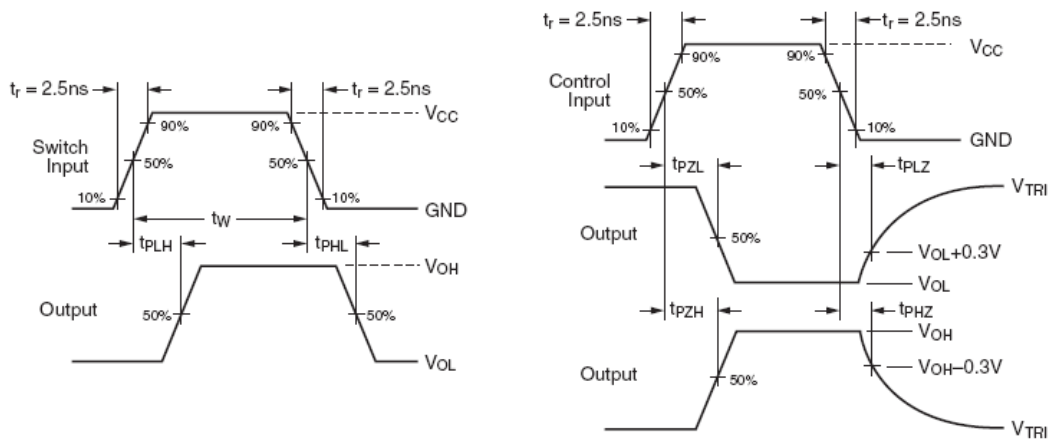
Figure 9. Bandwidth,  $V_{CC}=5.5V$

## AC Loading and Waveforms

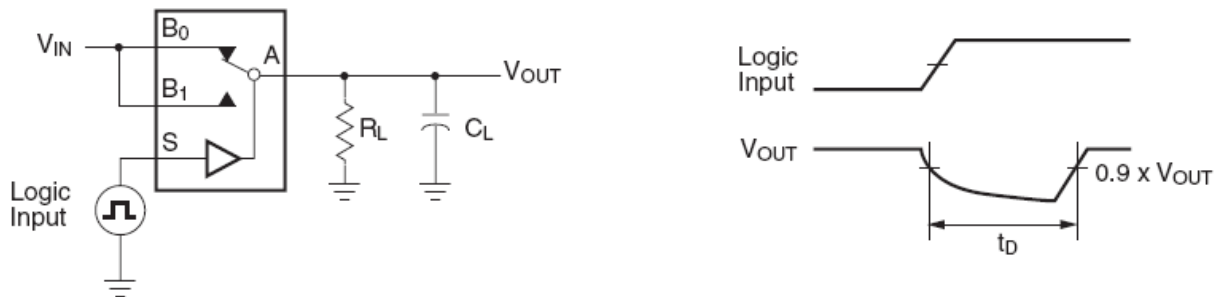


**Notes:**  
 Input driven by 50Ω source terminated in 50Ω  
 $C_L$  includes load and stray capacitance  
 Input PRR = 1.0 MHz;  $t_W = 500$  ns

**Figure 10. AC Test Circuit**

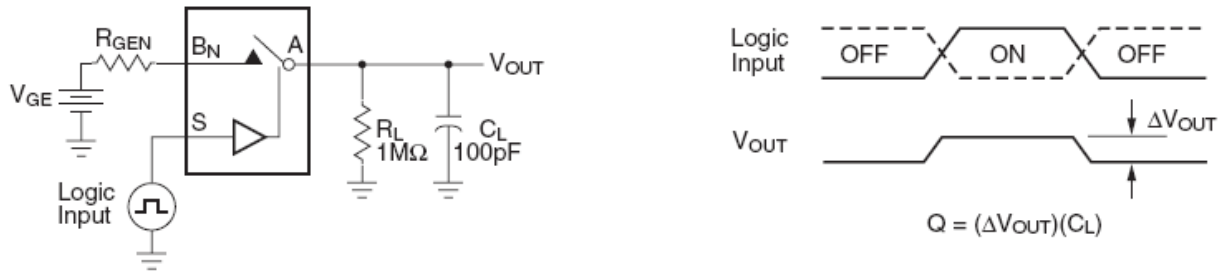


**Figure 11. AC Waveforms**

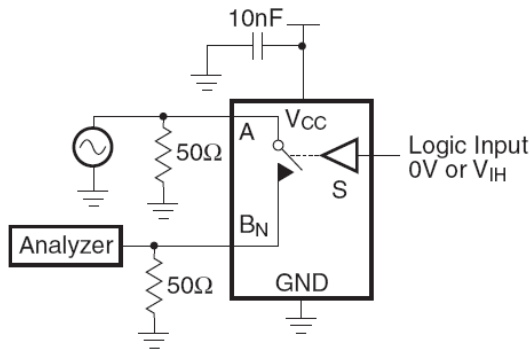


**Figure 12. Break-Before-Make Interval Timing**

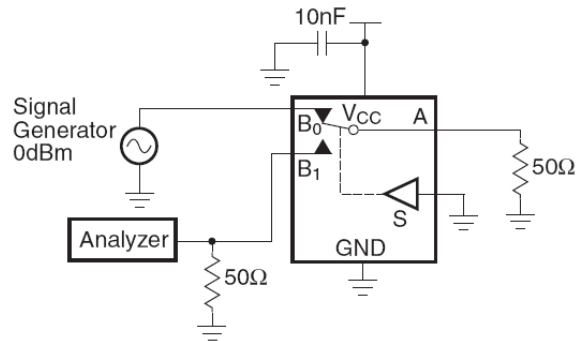
**AC Loading and Waveforms (Continued)**



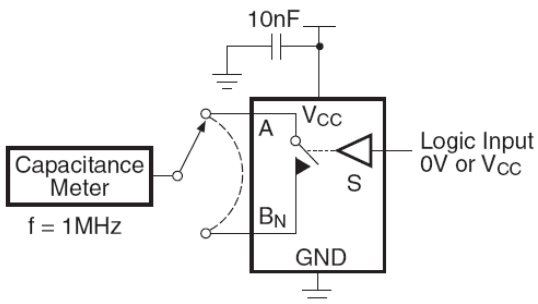
**Figure 13. Charge Injection Test**



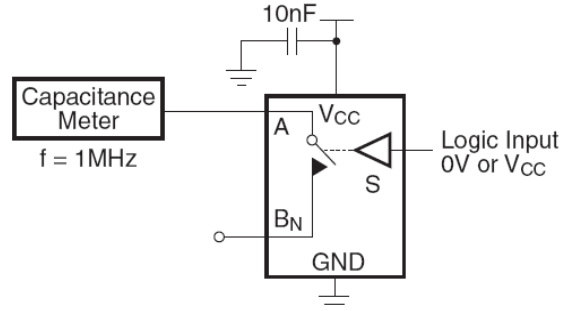
**Figure 14. Off Isolation**



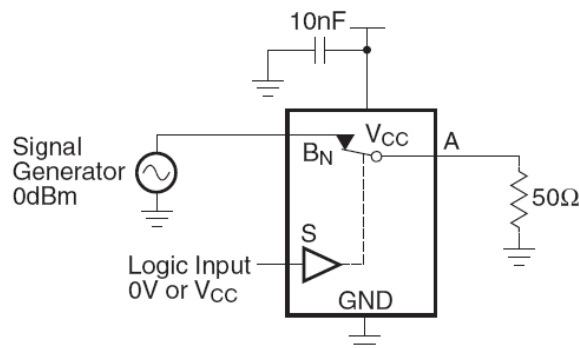
**Figure 15. Crosstalk**



**Figure 16. Channel Off Capacitance**



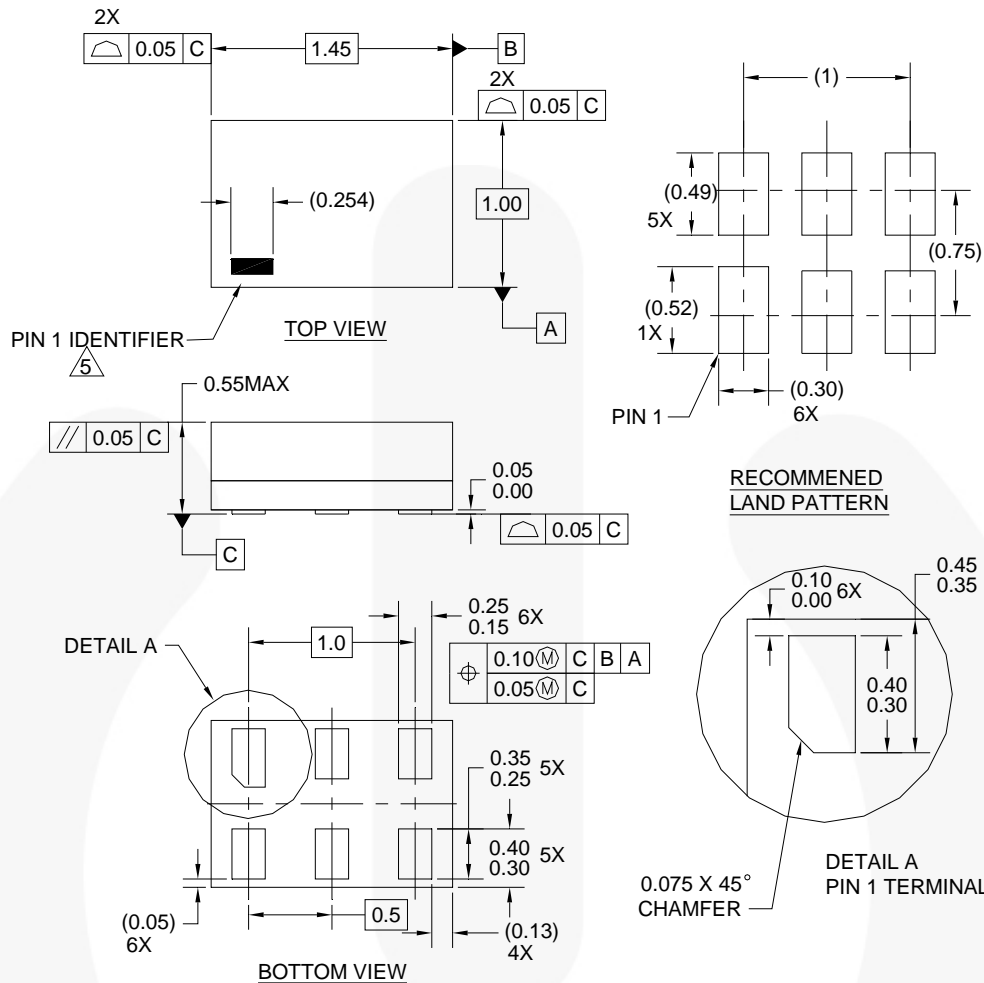
**Figure 17. Channel On Capacitance**



**Figure 18. Bandwidth**



## Physical Dimensions



### Notes:

1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994
4. FILENAME AND REVISION: MAC06AREV4
5. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

**Figure 19. 6-Lead, MicroPak™ 1.0mm Wide Package**

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

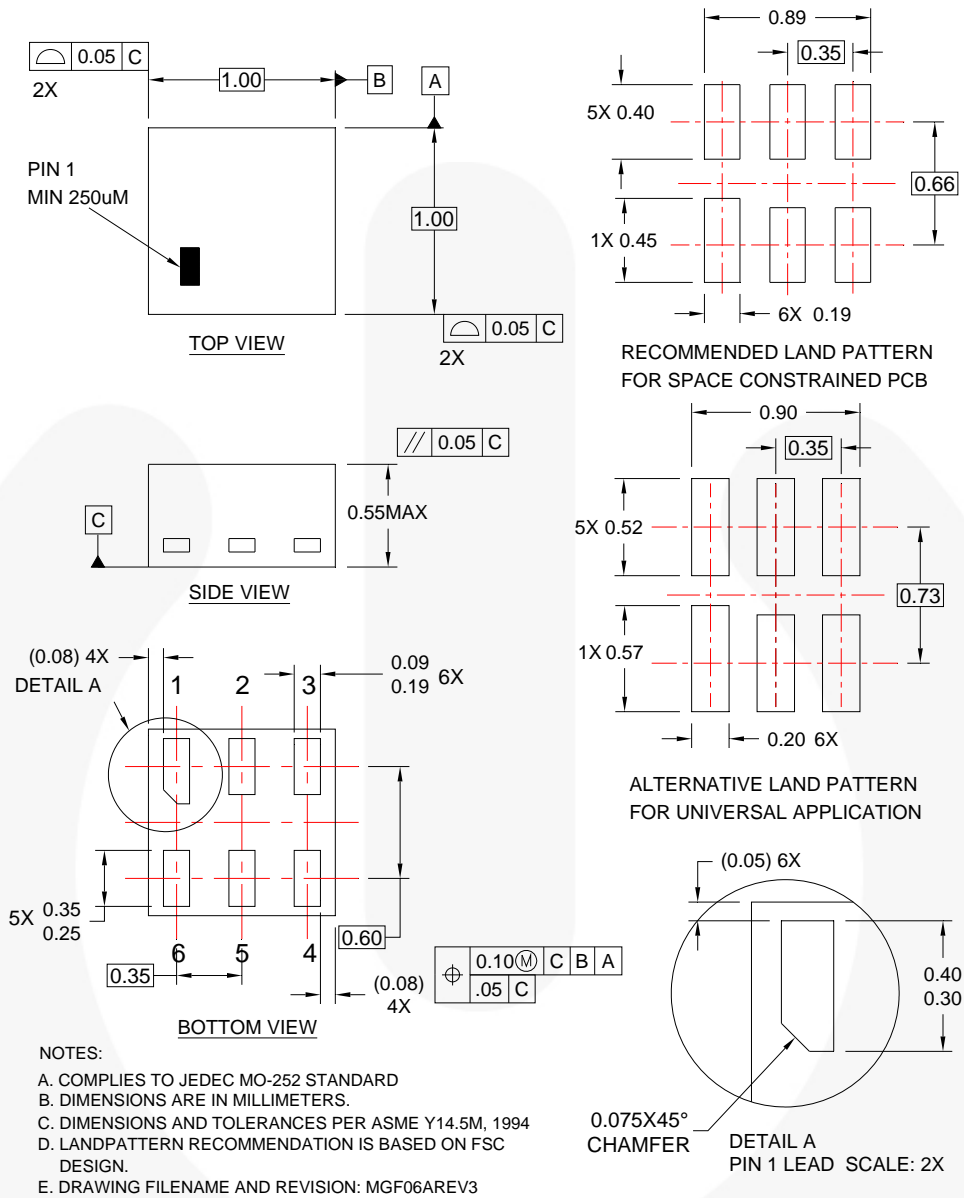
Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:  
<http://www.fairchildsemi.com/packaging/>.

## Tape and Reel Specifications

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:  
[http://www.fairchildsemi.com/products/logic/pdf/micropak\\_tr.pdf](http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf).

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
L6X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

## Physical Dimensions



**Figure 20. 6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch**

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## Tape and Reel Specifications

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:  
[http://www.fairchildsemi.com/packaging/MicroPAK2\\_6L\\_tr.pdf](http://www.fairchildsemi.com/packaging/MicroPAK2_6L_tr.pdf).

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
FHX	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed



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CROSSVOLT™  
CTL™  
Current Transfer Logic™  
DEUXPEED®  
Dual Cool™  
EcoSPARK®  
EfficientMax™  
ESBC™  
**F**®  
Fairchild®  
Fairchild Semiconductor®  
FACT Quiet Series™  
FACT®  
FAST®  
FastvCore™  
FETBench™  
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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™  
mWSaver™  
OptoHit™  
OPTOLOGIC®  
OPTOPLANAR®

PowerTrench®  
PowerXS™  
Programmable Active Droop™  
QFET®  
QS™  
Quiet Series™  
RapidConfigure™  
™  
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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™

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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](http://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.

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