SOTINY™ Low Voltage SPDT Analog Switch
2:1 Mux/Demux Bus Switch

Product Features

- CMOS Technology for Bus and Analog Applications
- SOTINY Package Technology: 6-pin, Thin Dual Flat in Line (TDFN) package, SC70 Package
- Low ON Resistance: 8 ohms at 3.0V
- Wide V_{CC} Range: 1.65V to 5.5V
- Rail-to-Rail Signal Range
- Control Input Overvoltage Tolerance: 5.5V min.
- Fast Transition Speed: 5.2ns max. at 5V
- High Off Isolation: 57dB at 10MHz
- 54dB (10MHz) Crosstalk Rejection Reduces Signal Distortion
- Break-Before-Make Switching
- High Bandwidth: 250 MHz
- Extended Industrial Temperature Range: –40°C to 85°C
- Improved Direct Replacement for NC7SB3157

Applications

- Cell Phones
- PDAs
- Portable Instrumentation
- Battery Powered Communications
- Computer Peripherals

Description

The PI5A3157 is a high-bandwidth, fast single-pole double-throw (SPDT) CMOS switch. It can be used as an analog switch or as a low-delay bus switch. Specified over a wide operating power supply voltage range, 1.65V to 5.5V, the PI5A3157 has a maximum ON resistance of 12 ohms at 1.65V, 9 ohms at 2.3V & 6 ohms at 4.5V.

Break-before-make switching prevents both switches being enabled simultaneously. This eliminates signal disruption during switching.

The control input, S, tolerates input drive signals up to 5.5V, independent of supply voltage.

PI5A3157 is an improved direct replacement for the NC7SB3157.

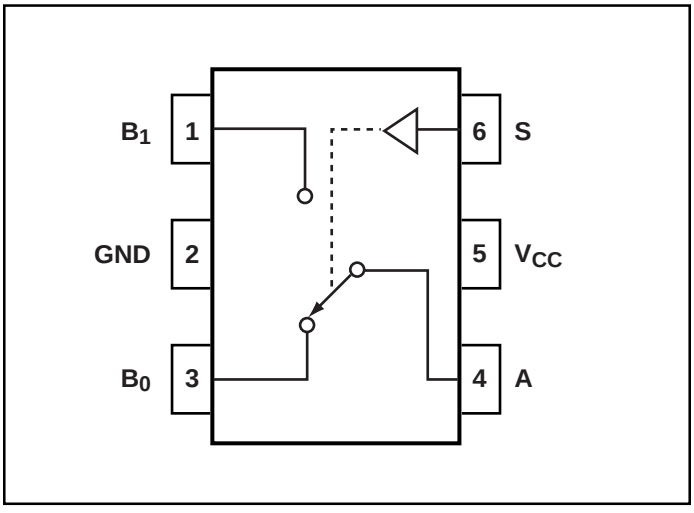
Pin Description

Pin Number	Name	Description
1	B1	Data Port
2	GND	Ground
3	B0	Data Port (Normally Closed)
4	A	Common Output/Data Port
5	V_{CC}	Positive Power Supply
6	S	Logic Control

Logic Function Table

Logic Input (S)	Function
0	B_0 Connected to A
1	B_1 Connected to A

Connection Diagram



Absolute Maximum Ratings(1)

Supply Voltage V_{CC} ..... –0.5V to +7V
DC Switch Voltage (V_S)(2) ..... –0.5V to V_{CC} +0.5V
DC Input Voltage (V_{IN})(2) ..... –0.5V to +7.0V
DC Output Current (V_{OUT}) 128mA
DC V_{CC} or Ground Current (I_{CC}/I_{GND}) ..... ±100mA
Storage Temperature Range (T_{STG}) ..... –65°C to +150°C
Junction Temperature under Bias (T_J) ..... 150°C
Junction Lead Temperature (T_L)
(Soldering, 10 seconds) ..... 260°C
Power Dissipation (P_D) @ +85°C 180mW

Recommended Operating Conditions(3)

Supply Voltage Operating (V_{CC}) . . . . . 1.65V to 5.5V
Control Input Voltage (V_{IN}) . . . . . 0V to V_{CC}
Switch Input Voltage (V_{IN}) . . . . . 0V to V_{CC}
Output Voltage (V_{OUT}) . . . . . 0V to V_{CC}
Operating Temperature (T_A) . . . . . –40°C to +85°C
Input Rise and Fall Time (t_r,t_f)
Control Input V_{CC} = 2.3V - 3.6V . . . . . 0ns/V to 10ns/V
Control Input V_{CC} = 4.5V - 5.5V . . . . . 0ns/V to 5ns/V
Thermal Resistance (θ_{JA}) . . . . . 350°C/W

Notes

1. Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied.
2. The input and output negative voltage ratings may be exceeded if the inut and output diode current ratings are observed.
3. Control input must be held HIGH or LOW; it must not float.

DC Electrical Characteristics (Over the Operating temperature range, T_A = –40°C to 85°C)

Parameter	Description	Test Conditions	Supply Voltage	Temp (°C)	Min.	Typ	Max.	Units
V_{IAR}	Analog Input Signal Range		V_{CC}	T_A = 25°C & –40°C to 85°C	0		V_{CC}	V
R_{ON}	ON Resistance(4)	I_O = 30mA, V_{IN} = 0V	4.5V	T_A = 25°C		4	6	Ω
		I_O = –30mA, V_{IN} = 2.4V				5	8	
		I_O = –30mA, V_{IN} = 4.5V				8	13	
R_{ON}		I_O = 30mA, V_{IN} = 0V	4.5V	T_A = –40°C to 85°C			6	
		I_O = –30mA, V_{IN} = 2.4V					8	
		I_O = –30mA, V_{IN} = 4.5V					13	
R_{ON}		I_O = 24mA, V_{IN} = 0V	3.0V	T_A = 25°C		5	8	
		I_O = –24mA, V_{IN} = 3.0V				12	19	
R_{ON}		I_O = 24mA, V_{IN} = 0V	3.0V	T_A = –40°C to 85°C			8	
		I_O = –24mA, V_{IN} = 3.0V					19	
R_{ON}		I_O = 8mA, V_{IN} = 0V	2.3V	T_A = 25°C		6	9	
		I_O = –8mA, V_{IN} = 2.3V				16	24	
R_{ON}		I_O = 30mA, V_{IN} = 0V	2.3V	T_A = –40°C to 85°C			9	
		I_O = –30mA, V_{IN} = 2.4V					24	
R_{ON}		I_O = 4mA, V_{IN} = 0V	1.65V	T_A = 25°C		8	12	
		I_O = –4mA, V_{IN} = 1.65V				27	39	
R_{ON}		I_O = 4mA, V_{IN} = 0V	1.65V	T_A = –40°C to 85°C			12	
		I_O = –4mA, V_{IN} = 1.65V					39	

DC Electrical Characteristics (Over the Operating temperature range, T_A = –40°C to 85°C) (continued)

Parameter	Description	Test Conditions	SupplyVoltage	Temp (°C)	Min.	Typ	Max.	Units
ΔR_{ON}	ON Resistance Match Between Channels(4,5,6)	I_A = –30mA, V_{Bn} = 3.15V	4.5V	T_A = 25°C		0.15		Ω
		I_A = –24mA, V_{Bn} = 2.1V	3.0V			0.2		
		I_A = –8mA, V_{Bn} = 1.6V	2.3V			0.3		
		I_A = –4mA, V_{Bn} = 1.15V	1.65V			0.3		
R_{ONF}	ON Resistance Flatness (4,5,7)	I_A = –30mA, 0 ≤V_{Bn} ≤V_{CC}	5.0V	T_A = 25°C		6		Ω
		I_A = –24mA, 0 ≤V_{Bn} ≤V_{CC}	3.3V			12		
		I_A = –8mA, 0 ≤V_{Bn} ≤V_{CC}	2.5V			22		
		I_A = –4mA, 0 ≤V_{Bn} ≤V_{CC}	1.8V			90		
V_{IH}	Input High Voltage	Logic High Level	V_{CC} = 1.65V to 1.95V	T_A = 25°C & –40°C to 85°C	0.75V_{CC}			V
			V_{CC} = 2.3V to 5.5V		0.7V_{CC}			
V_{IL}	Input Low Voltage	Logic Low Level	V_{CC} = 1.65V to 1.95V				0.25V_{CC}	V
			V_{CC} = 2.3V to 5.5V				0.25V_{CC}	
	Input Leakage Current	0 ≤V_{IN} ≤5.5V	V_{CC} = 0V to 5.5V	T_A = 25°C			±0.1	µA
				T_A = –40°C to 85°C			±1.0	
I_{OFF}	OFF State Leakage Current	0 ≤V_{IN} ≤5.5V	V_{CC} = 1.65V to 5.5V	T_A = 25°C			±0.1	
				T_A = –40°C to 85°C			±10	
I_{CC}	Quiescent Supply Current	All channels ON or OFF, V_{IN} = V_{CC} or GND, I_{OUT} = 0	V_{CC} = 5.5V	T_A = 25°C			1	
				T_A = –40°C to 85°C			10	

Notes:

4. Measured by voltage drop between A and B pins at the indicated current through the device. ON resistance is determined by the lower of the voltages on two ports (A or B).
5. Parameter is characterized but not tested in production.
6. $\Delta R_{ON} = R_{ON}$ max – R_{ON} min. measured at identical V_{CC}, temperature and voltage levels.
7. Flatness is defined as difference between maximum and minimum value of ON resistance over the specified range of conditions.
8. Guaranteed by design.

Capacitance(12)

Parameter	Description	Test Conditions	Supply Voltage	Temp (°C)	Min.	Typ	Max.	Units
C_{IN}	Control Input	f = 1 MHz(12)	V_{CC} = 5.0V	T_A = 25°C		2.3		pF
C_{IO-B}	For B Port, Switch OFF					6.5		
C_{IOA-ON}	For A Port, Switch ON					18.5		

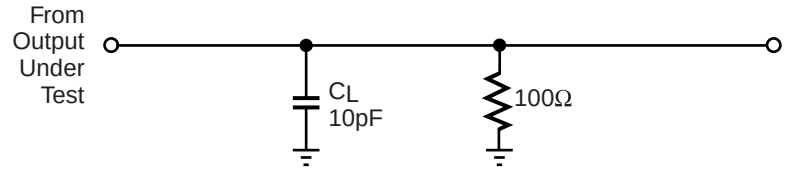
Switch and AC Characteristics

Parameter	Description	Test Conditions	Supply Voltage	Temp (°C)	Min.	Typ	Max.	Units
t_{PLH} t_{PHL}	Propagation Delay: A to Bn	See test circuit diagrams 1 and 2. V_I Open (10)	V_{CC} = 2.3V to 2.7V	T_A = 25°C & –40 to 85°C		1.2		ns
			V_{CC} = 3.0V to 3.6V			0.8		
			V_{CC} = 4.5V to 5.5V			0.3		
t_{PZL} t_{PZH}	Output Enable Turn ON Time: A to Bn	See test circuit diagrams 1 & 2. V_I = 2V_{CC} for T_{PZL}, V_I = 0V for t_{PZH}	V_{CC} = 1.65V to 1.95V	T_A = 25°C	7		23	
			V_{CC} = 2.3V to 2.7V		3.5		13	
			V_{CC} = 3.0V to 3.6V		2.5		6.9	
			V_{CC} = 4.5V to 5.5V		1.7		5.2	
t_{PZL} t_{PZH}	Output Enable Turn ON Time: A to Bn	See test circuit diagrams 1 and 2. V_I = 2V_{CC} for T_{PZL}, V_I = 0V for t_{PZH}	V_{CC} = 2.5V	T_A = 25°C & –40 to 85°C			24	
			V_{CC} = 3.3V				14	
			V_{CC} = 3.0V to 3.6V				7.6	
			V_{CC} = 4.5V to 5.5V				5.7	
t_{PLZ} t_{PHZ}	Output Disable Turn OFF Time: A to Bn	See test circuit diagrams 1 and 2. V_I = 2V_{CC} for T_{PZL}, V_I = 0V for t_{PZH}	V_{CC} = 1.65V to 1.95V	T_A = 25°C	3		12.5	
			V_{CC} = 2.3V to 2.7V		2		7	
			V_{CC} = 3.0V to 3.6V		1.5		5	
			V_{CC} = 4.5V to 5.5V		0.8		3.5	
t_{PLZ} t_{PHZ}	Output Disable Turn OFF Time: A to Bn	See test circuit diagrams 1 and 2. V_I = 2V_{CC} for T_{PZL}, V_I = 0V for t_{PZH}	V_{CC} = 2.5V	T_A = –40 to 85°C			13	
			V_{CC} = 3.3V				7.5	
			V_{CC} = 3.0V to 3.6V				5.3	
			V_{CC} = 4.5V to 5.5V				3.8	
t_{BM}	Break Before Make Time	See test circuit diagram 9.(9)	V_{CC} = 2.5V	T_A = 25°C & –40 to 85°C	0.5			
			V_{CC} = 3.3V		0.5			
			V_{CC} = 3.0V to 3.6V		0.5			
			V_{CC} = 4.5V to 5.5V		0.5			
Q	Charge Injection	C_L = 0.1nF, V_{GEN} = 0V, R_{GEN} = 0Ω. See test circuit 4.	V_{CC} = 5.0V	T_A = 25°C		7		pC
			V_{CC} = 3.3V			3		
OIRR	Off Isolation	R_L = 50Ω, V_{GEN} = 0V, R_{GEN} = 0Ω. See test circuit 5. (11)	V_{CC} = 1.65V to 5.5V	T_A = 25°C		–57		dB
X_{TALK}	Crosstalk Isolation	See test circuit 6.	V_{CC} = 1.65V to 5.5V	T_A = 25°C		–54		
f_{3dB}	–3dB Bandwidth	See test circuit 9	V_{CC} = 1.65V to 5.5V	T_A = 25°C		250		MHz

Notes:

9. Guaranteed by design.
10. Guaranteed by design but not production tested. The device contributes no other propagation delay other than the RC delay of the switch ON resistance and the 50pF load capacitance, whne driven by an ideal voltage source with zero output impedance.
11. Off Isolation = 20 Log_{10} [V_A / V_{Bn}] and is measured in dB.
12. T_A = 25°C, f = 1MHz. Capacitance is characterized but not tested in production.

Test Circuits and Timing Diagrams



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

Figure 1. AC Test Circuit

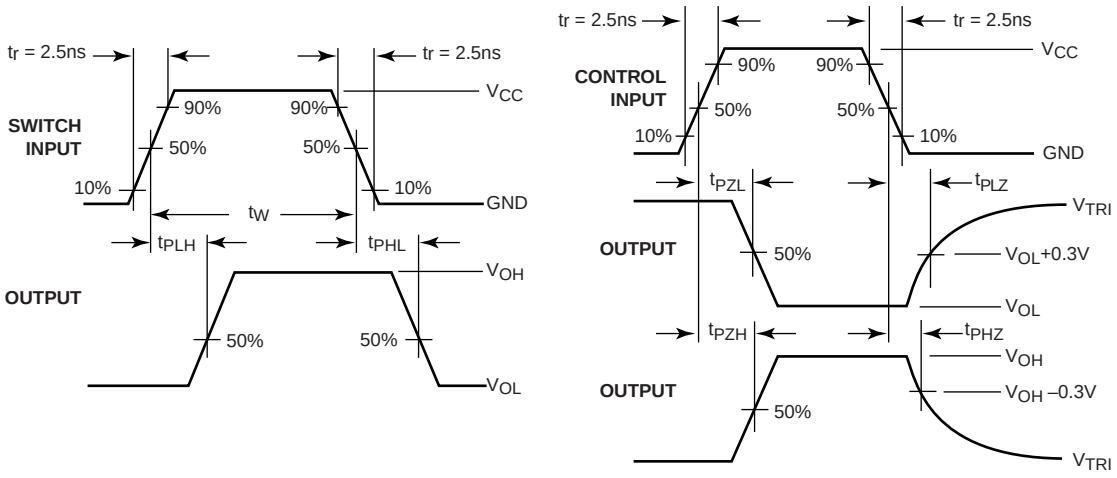


Figure 2. AC Waveforms

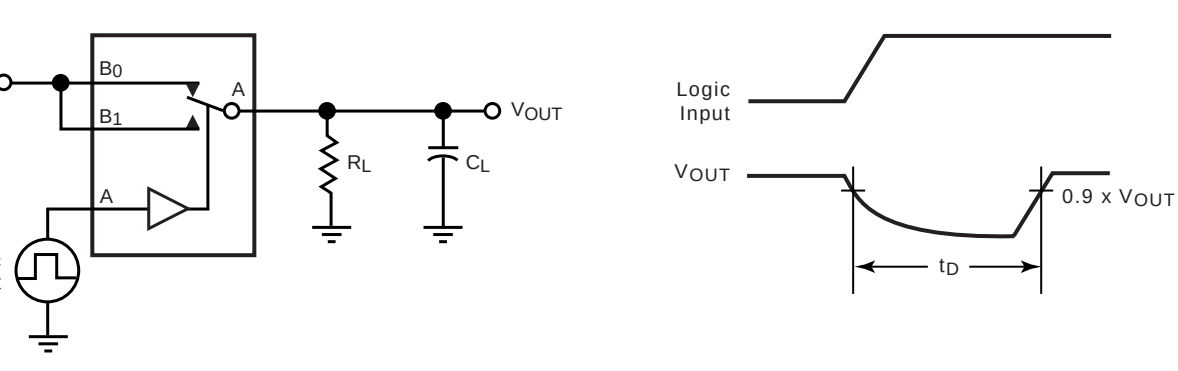


Figure 3. Break Before Make Interval Timing

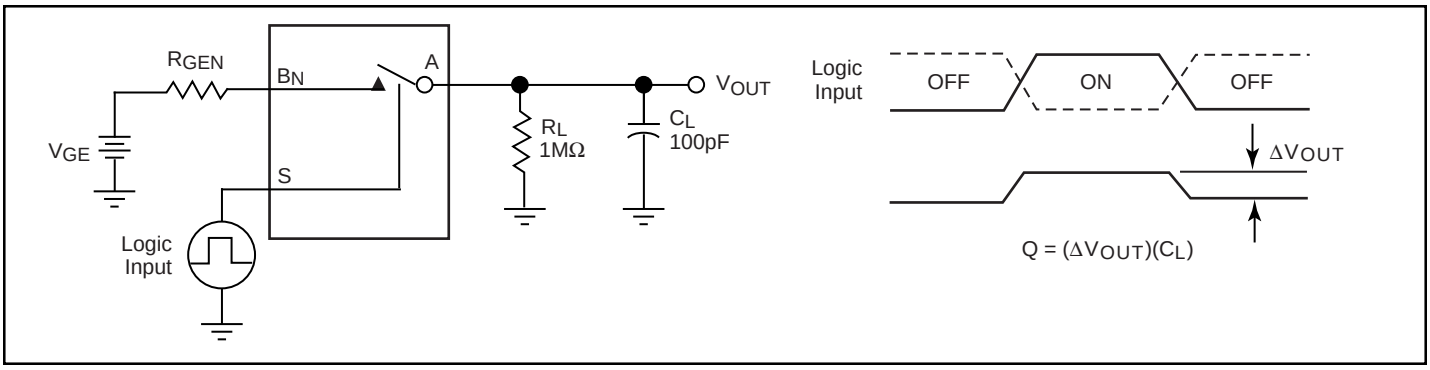


Figure 4. Charge Injection Test

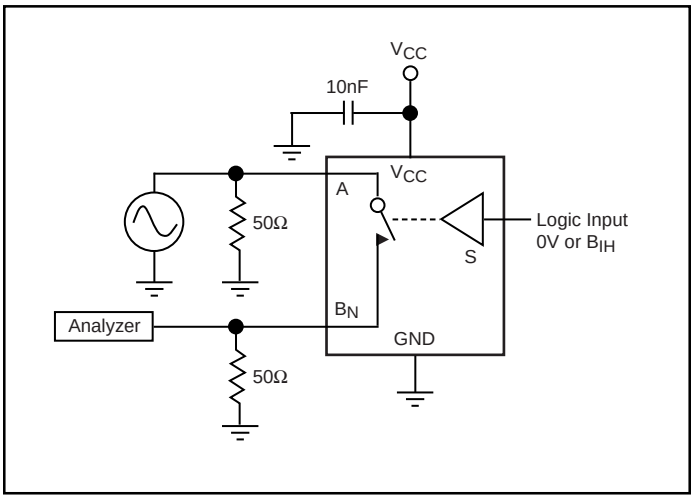


Figure 5. Off Isolation

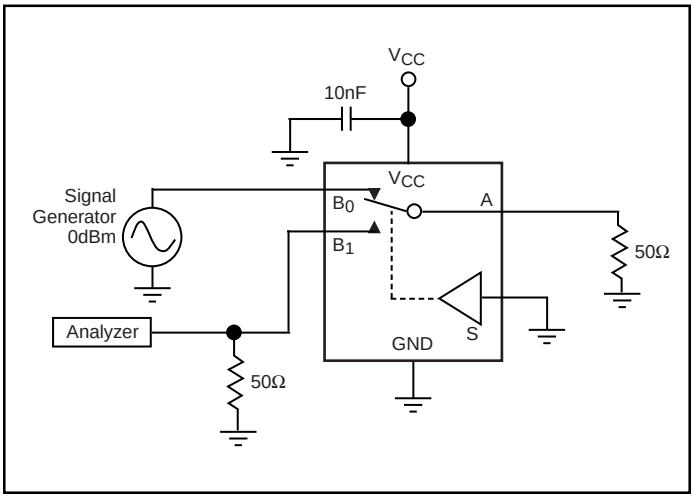


Figure 6. Crosstalk

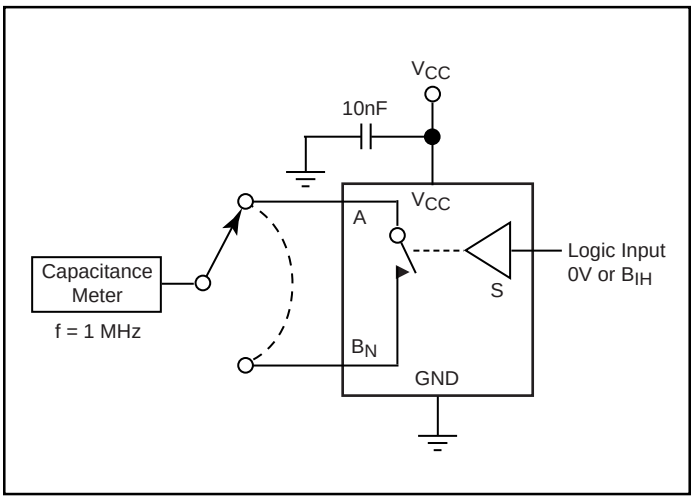


Figure 7. Channel Off Capacitance

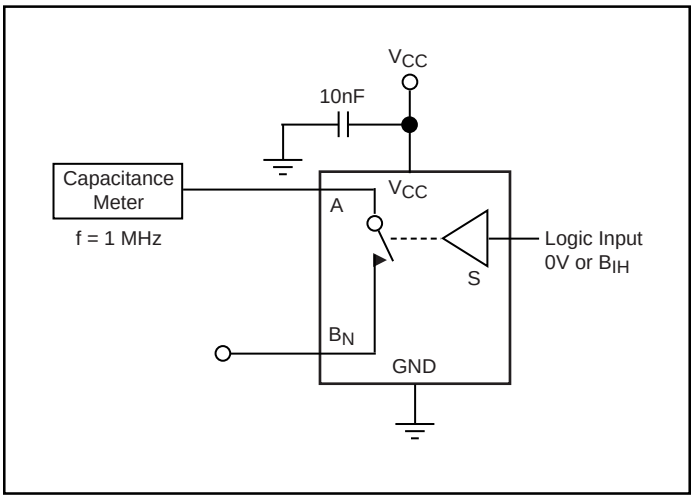


Figure 8. Channel On Capacitance

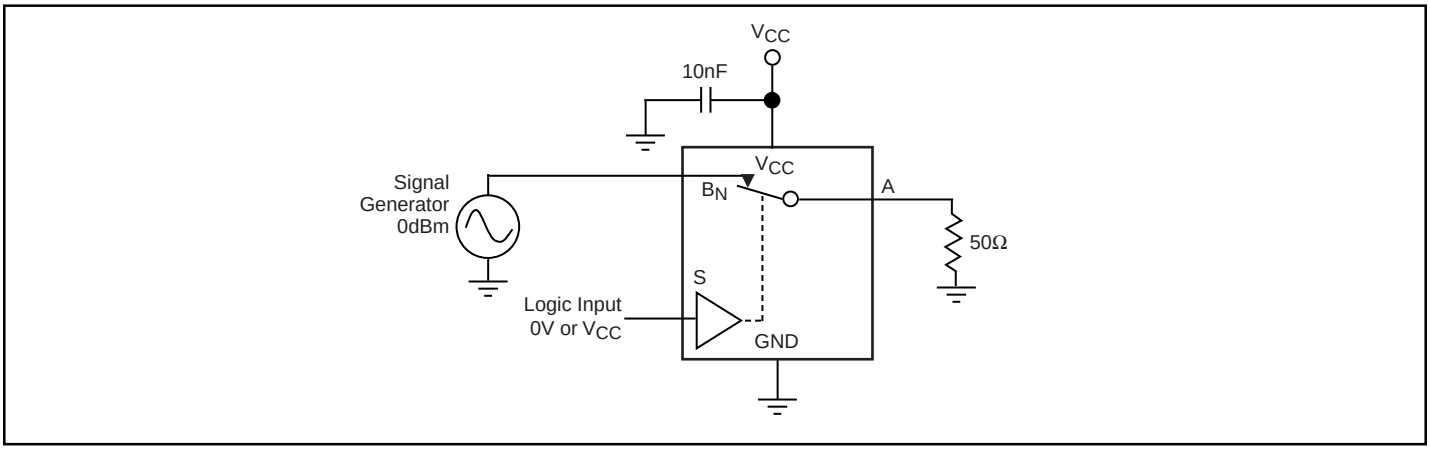
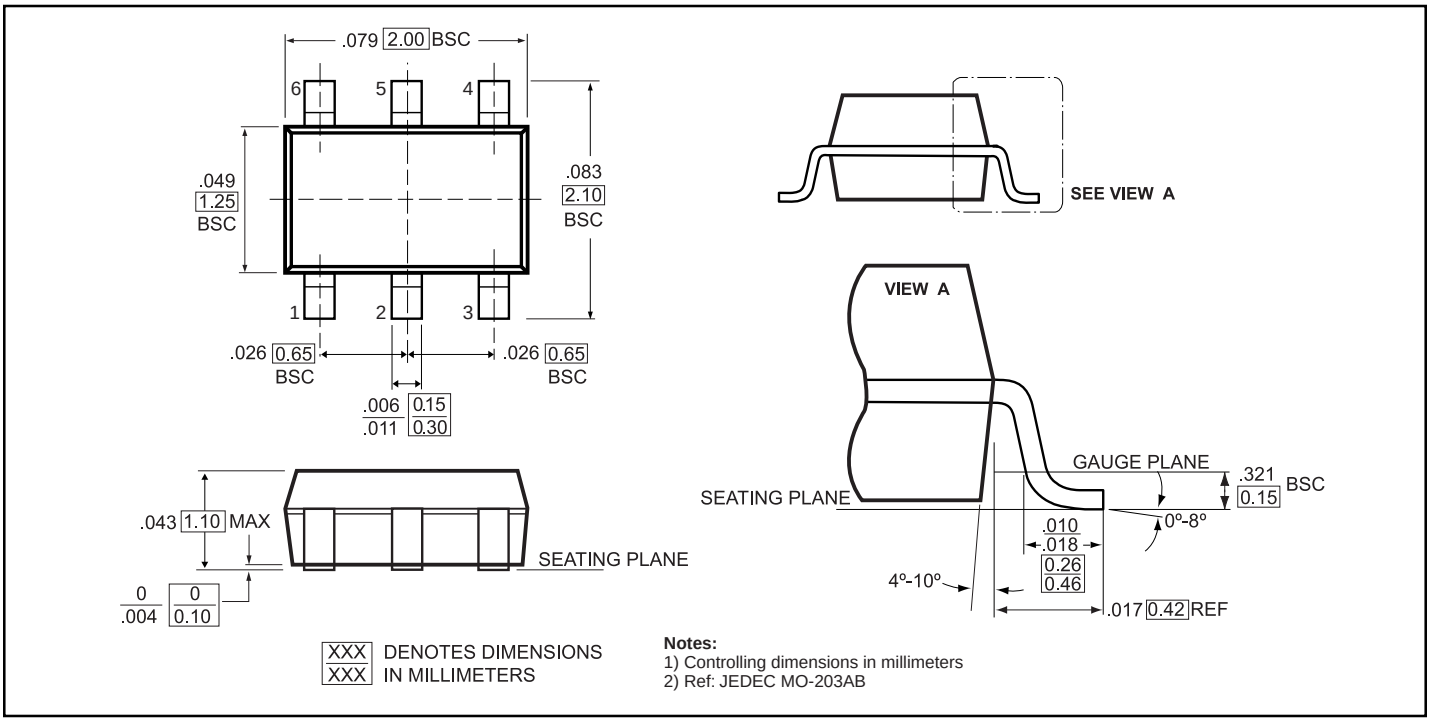


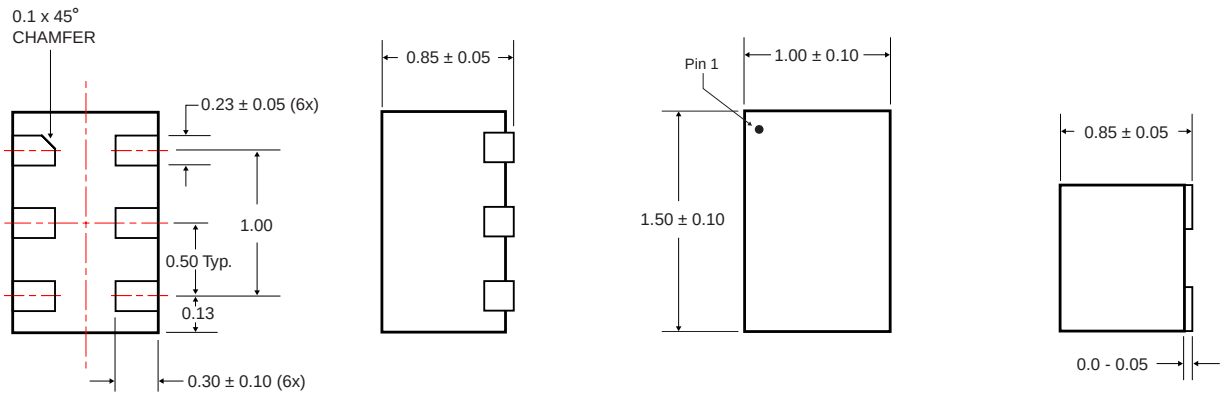
Figure 9. Bandwidth

6-Pin SC70 (C) Package



Notes:
1) Controlling dimensions in millimeters
2) Ref: JEDEC MO-203AB

6-Pin TDFN (ZA) Package



Ordering Information

Part Number	Package	Package Top Mark
PI5A3157CX	SC-70	A9D
PI5A3157ZAX	TDFN	9DZ