Low-Voltage, 2.8Ω SPDT Analog Switch

1 Features

- CMOS Technology for Bus and Analog Applications
- Low ON Resistance: 3-ohms @ 2.7V
- Wide VCC Range: 1.65V to 5.5V
- Rail-to-Rail Signal Range
- Control Input Overvoltage Tolerance: 5.5V min.
- High Off Isolation: 57dB at 10MHz
- 54dB (10MHz) Crosstalk Rejection Reduces Signal Distortion
- Break-Before-Make Switching
- High Bandwidth: 300 MHz
- Extended Industrial Temperature Range: －40°C to 85°C

- Improved Direct Replacement for NC7SB4157
- Packaging (Pb-free & Green available):SC70-6,TDFN-6

2 Applications

- Battery-Operated Equipment
- Computer Peripheral
- Portable Systems
- Cell Phones
- PDAs

3 Description

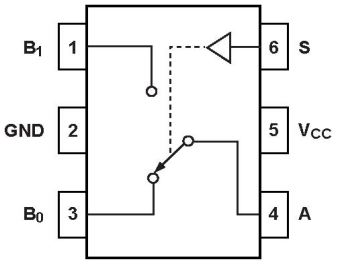
The MCS4157/4157B is a high-bandwidth, fast single-pole double-throw (SPDT) CMOS switch. It can be used as an analog switch or as a low-delay bus switch . Specified over a wide operating power supply voltage range, 1.65V to 5.5V, the MCS4157/4157B has a maximum ON resistance of 5. 1-ohms at 1.65V, 3.9-ohms at 2.3V & 2.85-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.

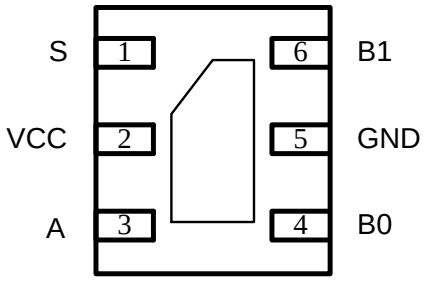
MCS4157/4157B is an improved direct replacement for the FSA4157/NC7SB4157

3. Connection Diagram(Top View)

SC70-6



TDFN-6



Pin Description

Name	Description
S	Logic Control
Vcc	Positive Power Supply
A	Common Output/Data Port
B0	Data Port (Normally Closed)
GND	Ground
B1	Data Port

Logic Function Table

Logic Input (S)	Function
0	B0 Connected to A
1	B1 Connected to A

5 Specifications

5.1 Absolute Maximum Ratings(1)

Condition	VALUE
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 VCC or Ground Current (I_{CC}/I_{GND})	±100mA
DC Output Current (V_{OUT})	128mA
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 (PD) @ +85°C	180mW

5.2 Recommended Operating Conditions(3)

Condition	VALUE
Supply Voltage Operating V_{CC}	1.65V to 5.5V
Control Input Voltage (V_{IN})	– 0.5V to V_{CC} +0.5V
Switch Input Voltage (V_{IN})	– 0.5V to +7.0V
Output Voltage (V_{OUT})	±100mA
Operating Temperature (T_A)	128mA
Thermal Resistance (θ_{JA})	– 65°C to +150°C

Note 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.
Note 2:The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.
Note 3:Control input must be held HIGH or LOW; it must not float.

5.3 DC ELECTRICAL CHARACTERISTICS (TA = - 40°C to +85°C)

Parameter	Description	Test Conditions	Supply Voltage	Temp (ºC)	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_{out} = 100mA, B_0 or B_1=1.5V	2.7V	T_A = 25°C		3	4.5	Ω
R_{ON}	ON Resistance(4)	I_{out} = 100mA, B_0 or B_1=3.5V	4.5V	T_A = 25°C			3	
ΔR_{ON}	ON Resistance Match Between Channels(4,5,6)	I_{out} = 100mA, B_0=B_1=1.5V	2.7V	T_A = 25°C			0.75	Ω
R_{ONF}	ON Resistance(4,5,7) Flatness	I(A) = -100mA; B0 or B1= 0V, 1.5V, 1.5V	2.7V	T_A = 25°C			1.5	Ω
R_{ONF}	ON Resistance(4,5,7) Flatness	I(A) = -100mA; B0 or B1= 0V, 1.5V, 3.0V,	4.5V	T_A = 25°C			0.5	Ω
V_{IH}	Input High Voltage	Logic High Level	V_{CC} = 1.65V to 1.95V	T_A = 25°C & –40°C to 85°C	1.5			V
			V_{CC} = 2.3V to 5.5V		1.7			
V_{IL}	Input Low Voltage	Logic Low Level	V_{CC} = 1.65V to 1.95V				0.5	V
			V_{CC} = 2.3V to 5.5V				0.8	
I_{IN}	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	A=1V,4.5V, B0 or B1=4.5V, 1V	V_{CC} = 5.5V	T_A = 25°C	-2.0		2.0	
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	

Note 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)
Note 5: Parameter is characterized but not tested in production.
Note 6: DRON = RON max ~ RON min. measured at identical VCC, temperature and voltage levels.
Note 7: Flatness is defined as difference between maximum and minimum value of ON resistance over the specified range of conditions..
Note 8: Guaranteed by design.

5.4 CAPACITANCE [12]

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

5.5 SWITCH AND AC CHARACTERISTICS

Parameter	Description	Test Conditions	Supply Voltage	Temp (ºC)	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	diagrams 1 & 2. See test circuit 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 NOTIME: 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			
			VCC = 4.5V to 5.5V		0.5			

5.5 SWITCH AND AC CHARACTERISTICS (Cont.)

Parameter	Description	Test Conditions	Supply Voltage	Temp (ºC)	Min.	Typ	Max.	Units
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
			VCC = 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		300		MHz

Note 6: Guaranteed by design
Note 7: 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, when driven by an ideal voltage source with zero output impedance.
Note 8: Off Isolation = 20 Log10 [V_A / V_{Bn}] and is measured in dB.
Note 9: TA = 25°C, f = 1MHz. Capacitance is characterized but not tested in production.

Parameter Measurement Information

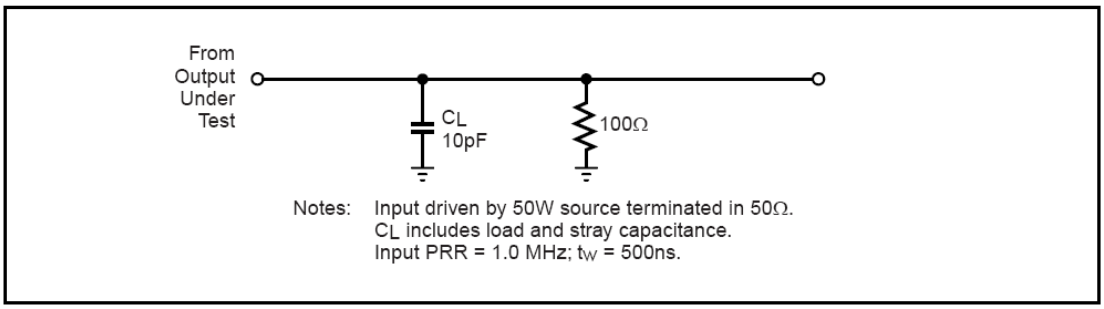


Figure 1. AC Test Circuit

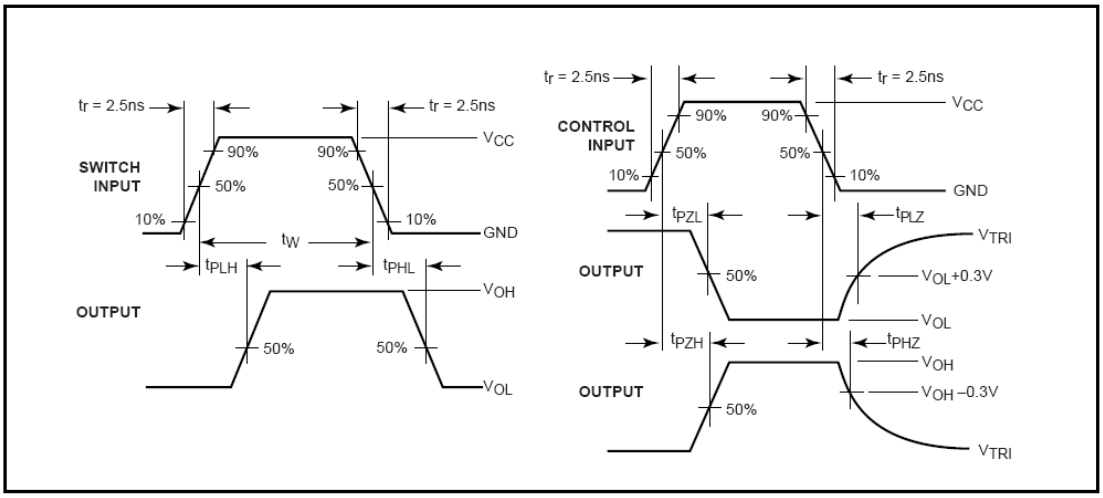


Figure 2. AC Waveforms

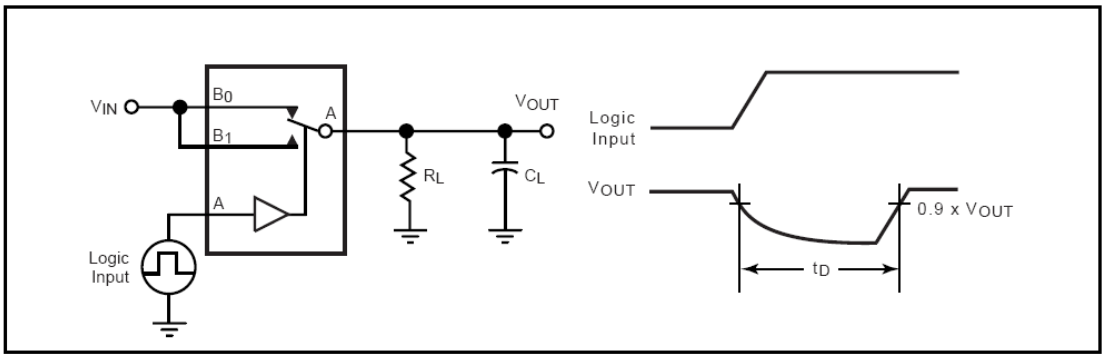


Figure 3. Break Before Make Interval Timing

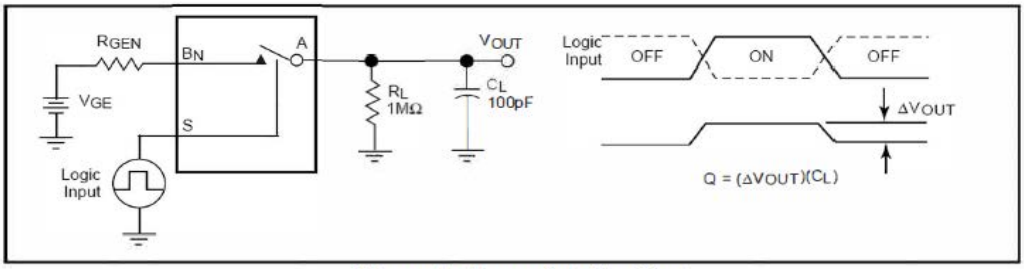


Figure 4. Charge Injection Test

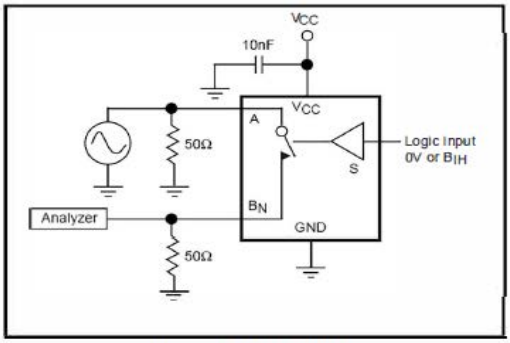


Figure 5. Off Isolation

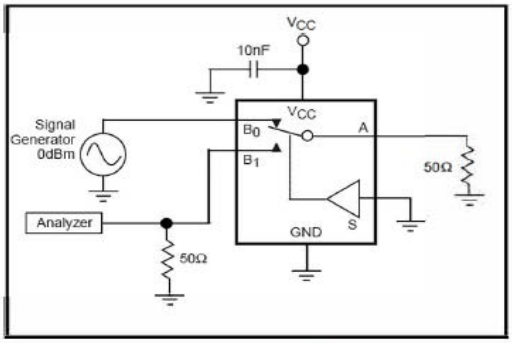


Figure 6. Crosstalk

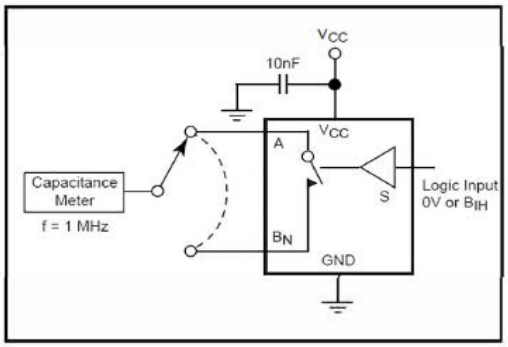


Figure 7. Channel Off Capacitance

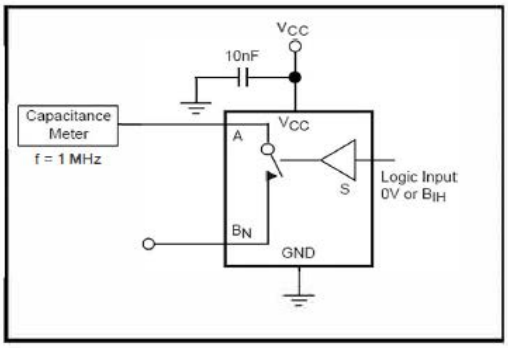


Figure 8. Channel On Capacitance

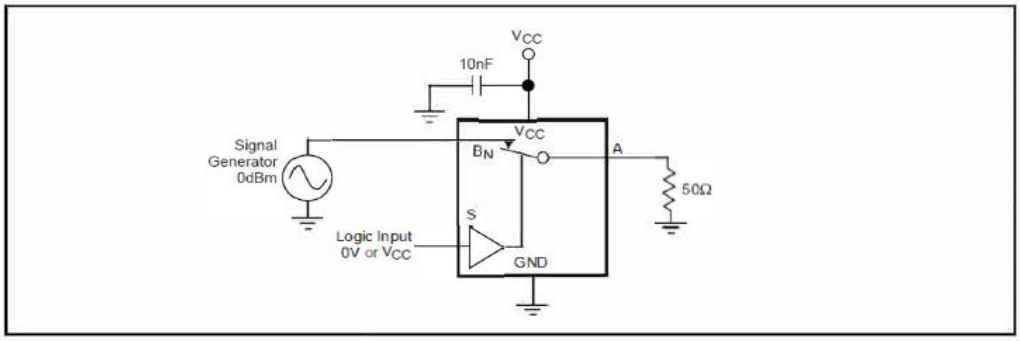
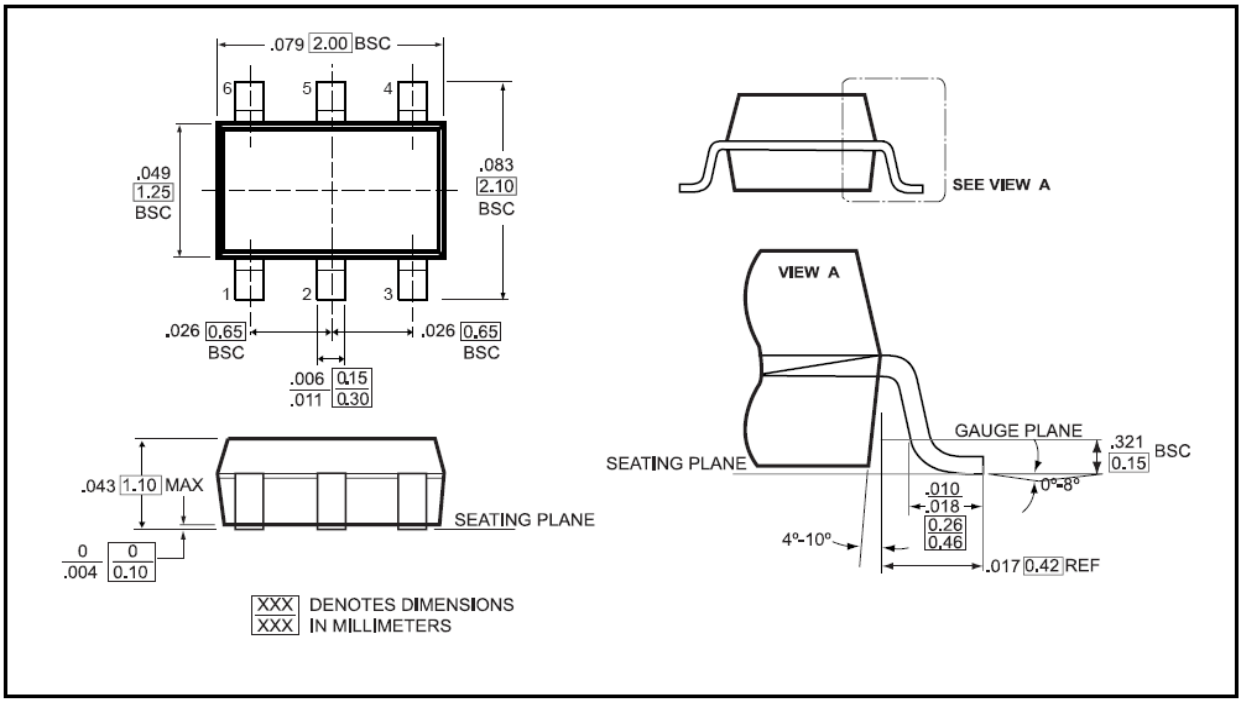
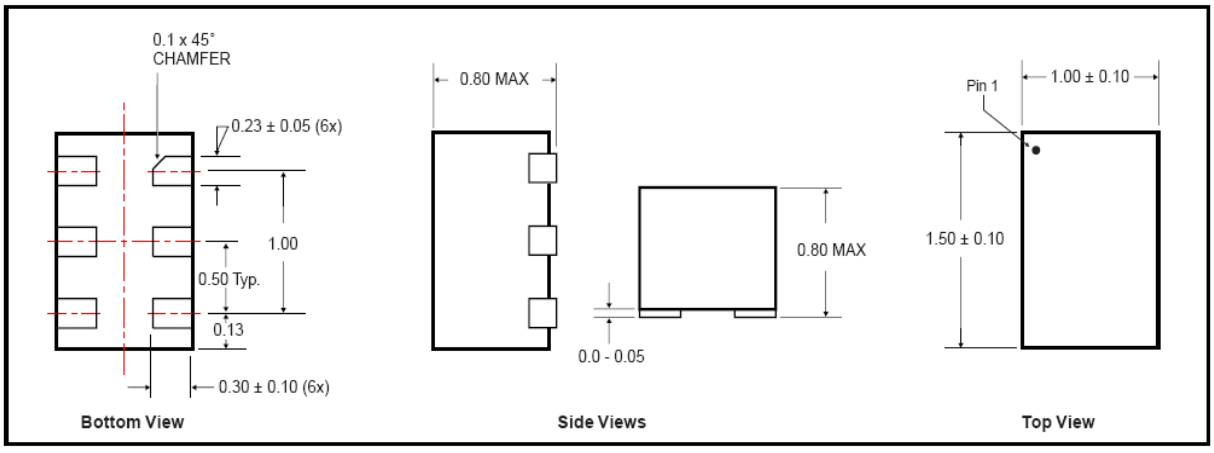


Figure 9. Bandwidth

Packaging Mechanical: 6-Pin SC70 (C)



Packaging Mechanical: 6-Pin TDFN



Ordering Code	Package Description	Temperature Range	Top Marking
MCS4157-CR	6-pin SC70	–40°C to +85°C	ABG
MCS4157-FR	6-pin TDFN 1.45X1	–40°C to +85°C	ABG