Low-Voltage SPDT Analog Switch, 2:1 Multiplexer / Demultiplexer Bus Switch

Features

- 1.65V to 5.5V Single Supply Operation
- Low ON-State Resistance: 4.5Ω(Typ.)
- -3dB Bandwidth: 300 MHz Typical
- Low Power Consumption
- Fast Switching Speed
- Break-Before-Make Operation
- Rail-to-Rail Operation
- TTL/CMOS Logic Compatible
- Supports Analog and Digital Signals
- Small Packaging: SOT23-6, SC70-6
- Extended Industrial Temperature Range: -40°C to +125°C

Applications

- Multiple-Purpose Signal Switching
- MP3/PDA
- Portable Devices
- Set-Top Box
- Signal Gating, Multiplexer/Demultiplexer
- Signal Modulation or Demodulation
- Sample and Hold Systems
- Telecom Signal Switching
- Battery Power Systems

General Description

The COS3157 is a low voltage, high bandwidth single-pole / double-throw (SPDT) CMOS analog switch or 2:1 multiplexer / demultiplexer with single output enable control pin. The device can pass signals with rail-to-rail swing from a single supply 1.65V to 5.5V. The switches conduct equally well in both directions when it is on. The output enable pin place the signal paths in high impedance which isolates the bus when it is not in use and thus consume less current.

The COS3157 offers low ON-state resistance and high bandwidth with the break-before-make feature which prevents signal distortion during the transferring of a signal from one channel to another. The device is well suitable for the switching of high-speed signals in handset and consumer applications.
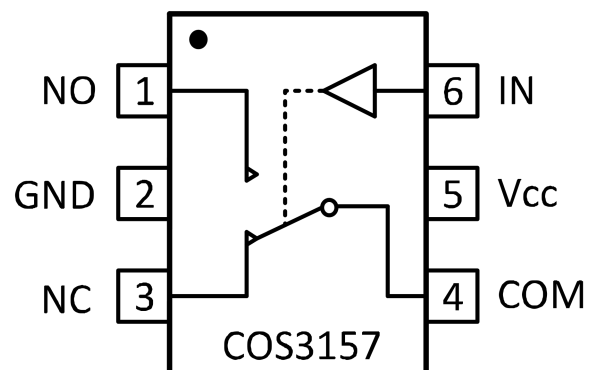
Pin Diagram

1. Pin Configuration and Functions

(a) Pin Diagram

(b) Simplified Schematic
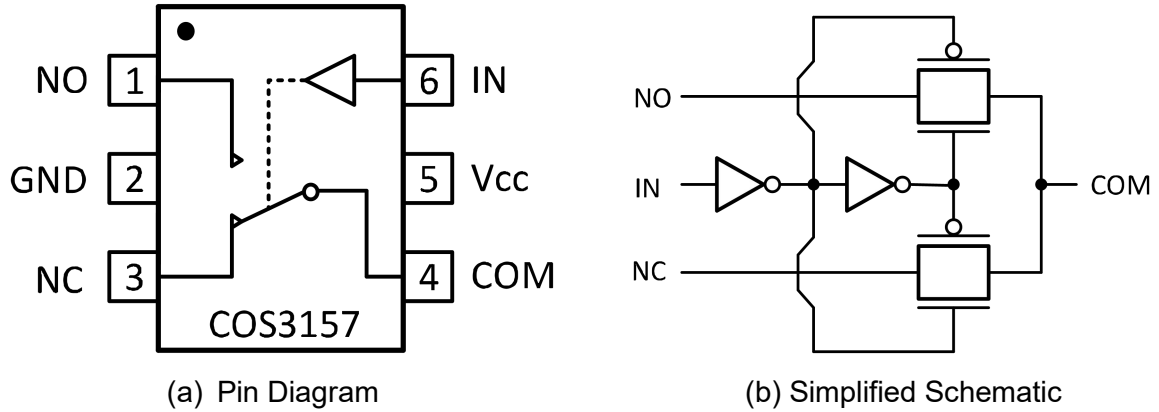
Truth Table

IN	NO	NC
0	OFF	ON
1	ON	OFF

Pin Description

PIN	NAME	FUNCTION
1	NO	Normally Open Terminal
2	GND	Ground
3	NC	Normally Closed Terminal
4	COM	Common Terminal
5	V_{CC}	Power supply
6	IN	Digital Control Pin, must be held HIGH or LOW

2. Package and Ordering Information

Order Number	Package	Package Option	Marking Information
COS3157ST	SOT23-6	Tape and Reel, 3000	C3157
COS3157SC	SC70-6 (SOT363)	Tape and Reel, 3000	C3157

3. Product Specification

3.1 Absolute Maximum Ratings [1]

Parameter	Min	Max	Unit
Supply voltage range (V_{CC})	-0.3	6.0	V
Analog voltage range (V_{NC}, V_{NO}, V_{COM})	-0.3	V_{CC} + 0.3	V
Digital input voltage range (V_{IN})	-0.3	6.0	V
Continuous current into any terminal	-50	50	mA
Peak current into any terminal	-80	80	mA
Operating junction temperature	-40	+125	°C
Storage temperature	-55	+150	°C
ESD (HBM)	-2000	+2000	V
ESD (MM)	-400	+400	V

(1) 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.

3.2 Thermal Data

Parameter	Rating	Unit
Package Thermal Resistance, $R_{\theta JA}$ (Juntion-to-ambient)	190 (SOT23-6) 270 (SC70-6)	°C/W

3.3 Recommended Operating Conditions

Parameter	Min	Max	Unit
V_{CC}	1.65	5.5	V
V_{NC}, V_{NO}, V_{COM}	0	V_{CC}	
V_{IN}	0	V_{CC}	
T_A, Operating free-air temperature	-40	+85	°C

3.4 Electrical Characteristics

(V_{CC}=1.8V to 5.5V, T_A=-40ºC to 125ºC, Typical values are at V_{CC}=5.0V, T_A=+25ºC, unless otherwise noted)

Parameter	Symbol	Conditions	Vcc	T_A	Min.	Typ.	Max.	Unit
Analog Switch								
Analog signal range	V_{IS}			FULL	0		V_{CC}	V
On-state resistance	R_{ON}	V_{NO} or V_{NC} =V_{CC}/2, I_{COM} = -10mA, Switch On, See Figure 1	5V	+25ºC		4.5	8	Ω
				FULL			8.5	
			3.3V	+25ºC		7	10	Ω
				FULL			10.5	
On-state resistance match between channels	ΔR_{ON}	V_{NO} or V_{NC} =V_{CC}/2, I_{COM} = -10mA, Switch On, See Figure 1	5V	+25ºC		0.15	0.3	Ω
				FULL			0.4	
			3.3V	+25ºC		0.15	0.3	Ω
				FULL			0.4	
On-state resistance flatness	R_{ON}(flat)	V_{NO} or V_{NC}=0 to V_{CC}/2, I_{COM} = -10mA, Switch On, See Figure 1	5V	+25ºC		2	3	Ω
				FULL			3.5	
			3.3V	+25ºC		3	4	Ω
				FULL			4.5	
OFF-state leakage current	$I_{NC(OFF)}$ $I_{NO(OFF)}$	V_{NO} or V_{NC} = 0.3V, V_{CC}/2, V_{COM} =V_{CC}/2, 0.3V, Switch OFF, See Figure 2	1.8V to 5.5V	FULL			1	µA
Channel ON leakage current	$I_{NC(ON)}$ $I_{NO(ON)}$ $I_{COM(ON)}$	V_{NO} or V_{NC} = 0.3V, V_{CC}/2, V_{COM} =0.3V, V_{CC}/2, Switch ON, See Figure 3	1.8V to 5.5V	FULL			1	µA
Digital Control Input								
Input logic high	V_{IH}		5V	FULL	2.6			V
			3.3V	FULL	1.7			V
Input logic low	V_{IL}		5V	FULL			0.8	V
			3.3V	FULL			0.7	V
Input leakage current	I_{IH}, I_{IL}	V_{IN} = 0 or V_{IO}	1.8V to 5.5V	FULL			1	µA

Switch Dynamic Characteristics

Turn-on time	t_{ON}	V_{NC} or $V_{NO}= V_{CC}$, $R_L=300\Omega$, $C_L = 35pF$, See Figure 4	5V	+25°C		26		ns
			3.3V			30		
Turn-off time	t_{OFF}	V_{NC} or $V_{NO}= V_{CC}$, $R_L=300\Omega$, $C_L = 35pF$, See Figure 4	5V	+25°C		8		ns
			3.3V			9		
Propagation delay	t_{PHL} t_{PLH}	$V_{IS} = 3V$, $R_L=300\Omega$, $C_L = 35pF$, See Figure 5	5V	+25°C		1.4		ns
			3.3V			1.3		
Break-before-make delay	t_{BBM}	$V_{IS} = 3V$, $R_L=300\Omega$, $C_L = 35pF$, See Figure 6	5V	+25°C		5		ns
			3.3V			8		
Charge injection	Q	$V_{GEN} =0V$, $R_{GEN}=0\Omega$, $C_L = 0.1nF$, See Figure 7	5V	+25°C		10		pC
			3.3V			3		
OFF-state capacitance	$C_{NC(OFF)}$ $C_{NO(OFF)}$	$V_{CC} = 3.3V$, $V_{I/O} = V_{CC}$ or 0, Switch OFF, See Figure 8		+25°C		6		pF
ON-state capacitance	$C_{NC(ON)}$ $C_{NO(ON)}$	$V_{CC} = 3.3V$, $V_{I/O} = V_{CC}$ or 0, Switch ON, See Figure 8		+25°C		15		pF
Digital input capacitance	C_I	$V_{CC} = 0V$, $V_{IN} = V_{CC}$ or 0, See Figure 8		+25°C		2		pF
OFF-isolation	V_{ISO}	$R_L = 50\Omega$, $C_L = 5pF$, $V_{I/O} = 0dBm$, f = 1MHz Switch OFF, See Figure 9		+25°C		-70		dB
Crosstalk	X_{TALK}	$R_L = 50\Omega$, $C_L = 5pF$, $V_{I/O} = 0dBm$, f = 1MHz Switch ON, See Figure 10		+25°C		-72		dB
Bandwidth	BW	$R_L = 50\Omega$, $C_L = 5pF$, $V_{I/O} = 0dBm$, f = 1MHz Switch ON, See Figure 11		+25°C		300		MHz

Power Supply

V_{CC} supply range	V_{CC}			FULL	1.65		5.5	V
V_{CC} supply current	I_{CC}	$I_{I/O} = 0$, Switch ON or OFF	5.5V	FULL			5	μA

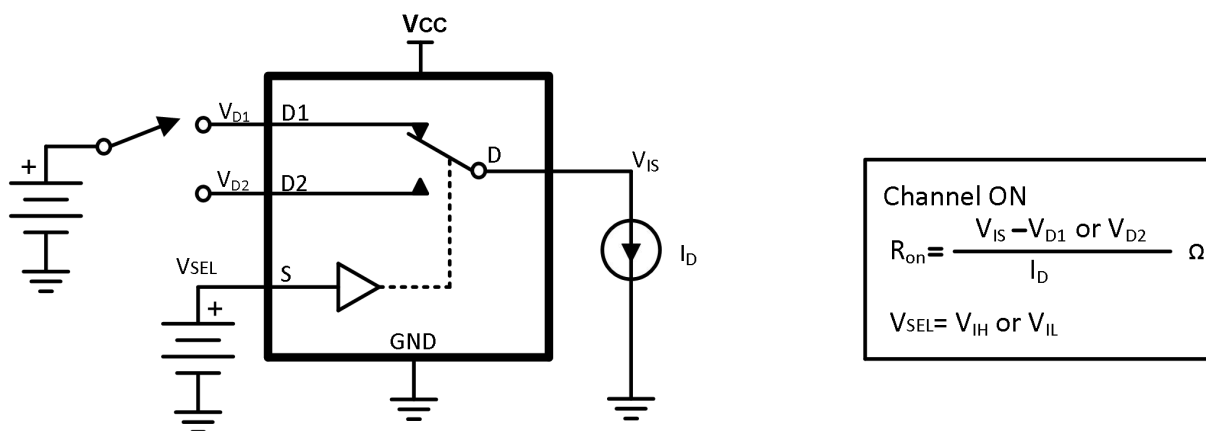## 4. Test Circuits and Timing Diagrams
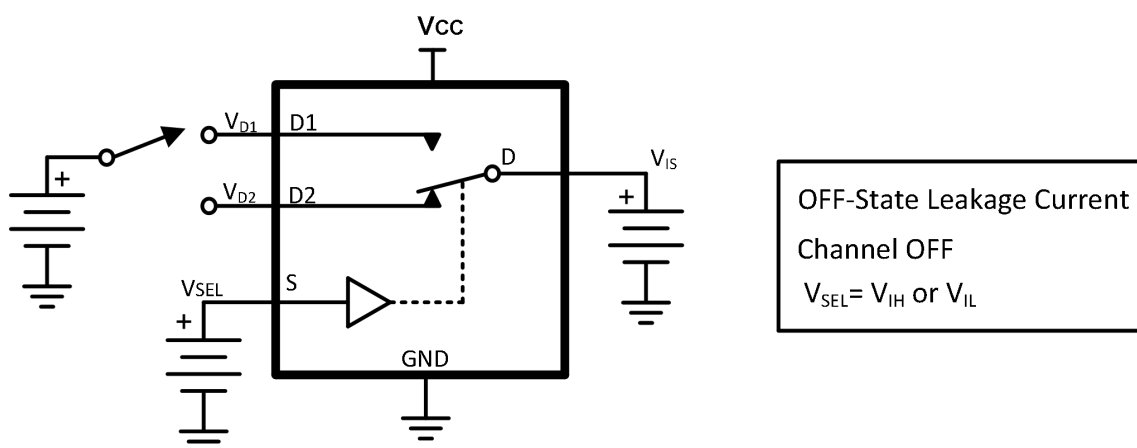

Figure 1. ON-State Resistance (R_{ON})

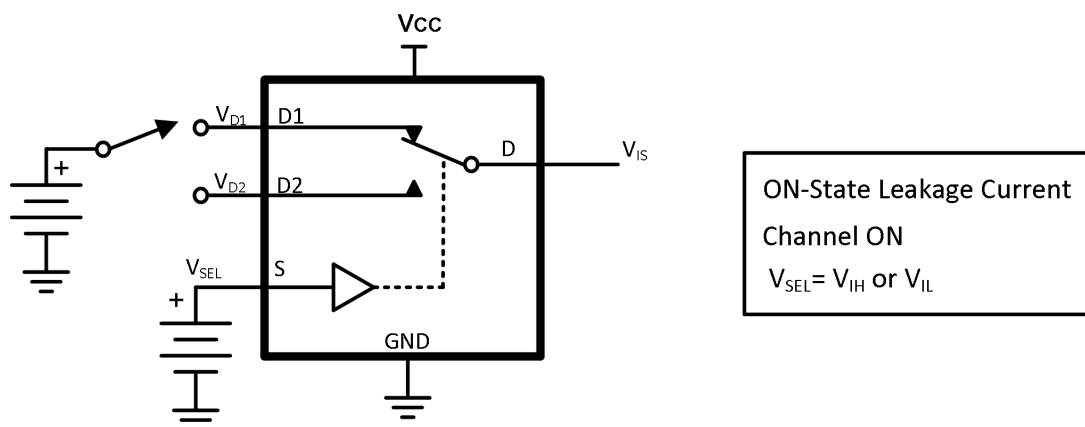Figure 2. OFF-State Leakage Current

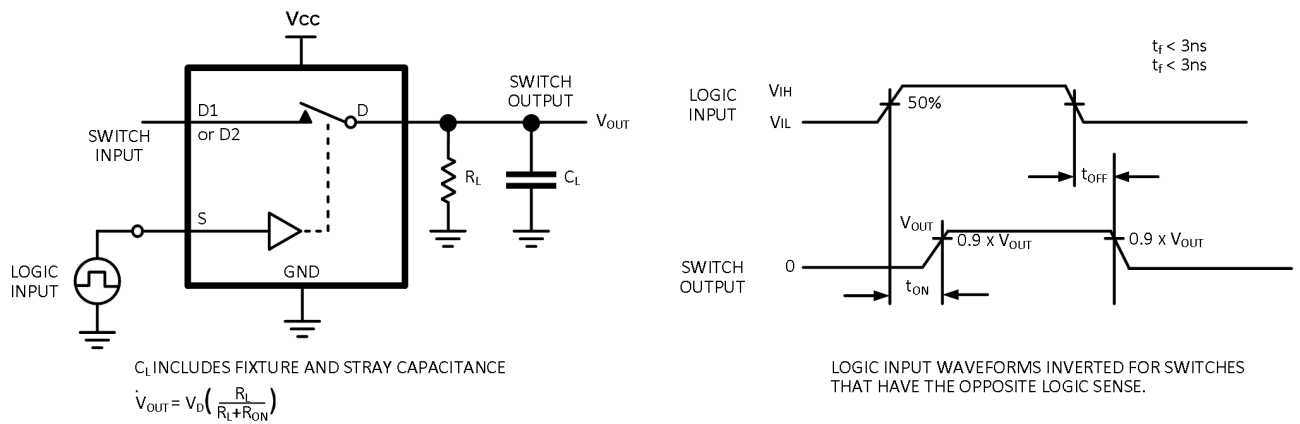Figure 3. ON-State Leakage Current

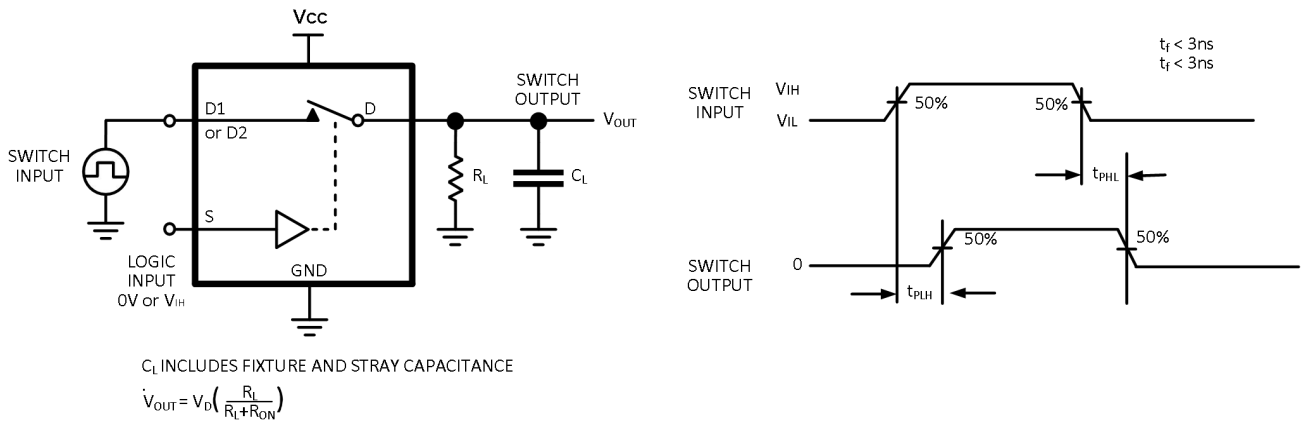Figure 4. Turn-On (T$_{ON}$) and Turn-Off Time (T$_{OFF}$)
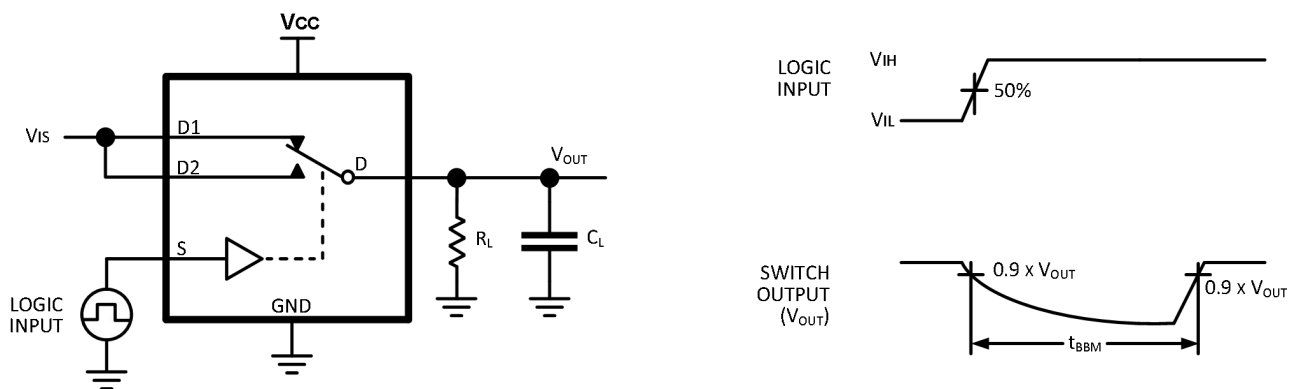

Figure 5. Propagation Delay
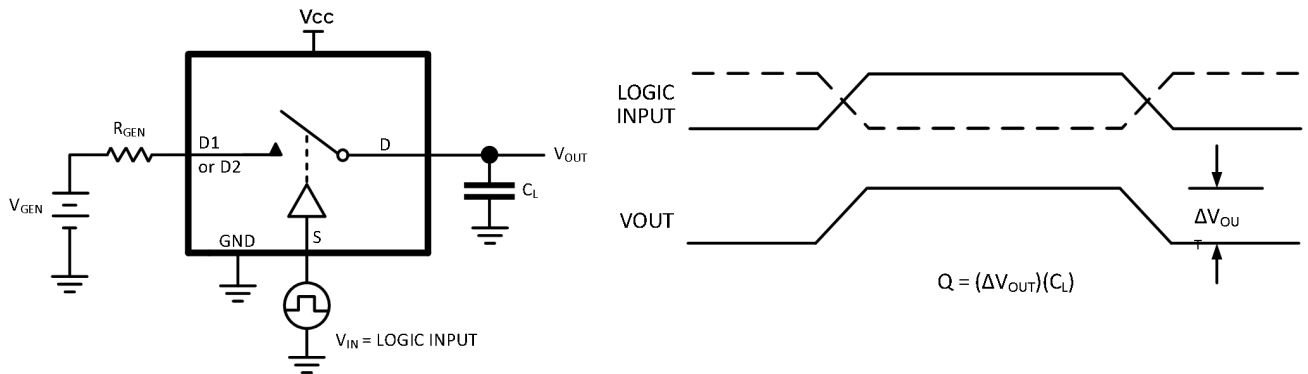

Figure 6. Break-Before-Make Time (T$_{BBM}$)

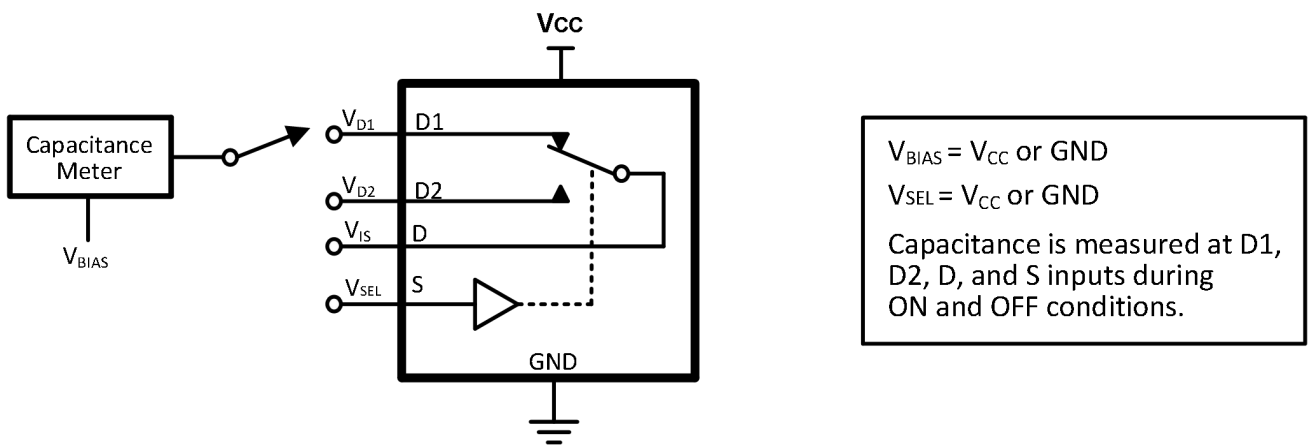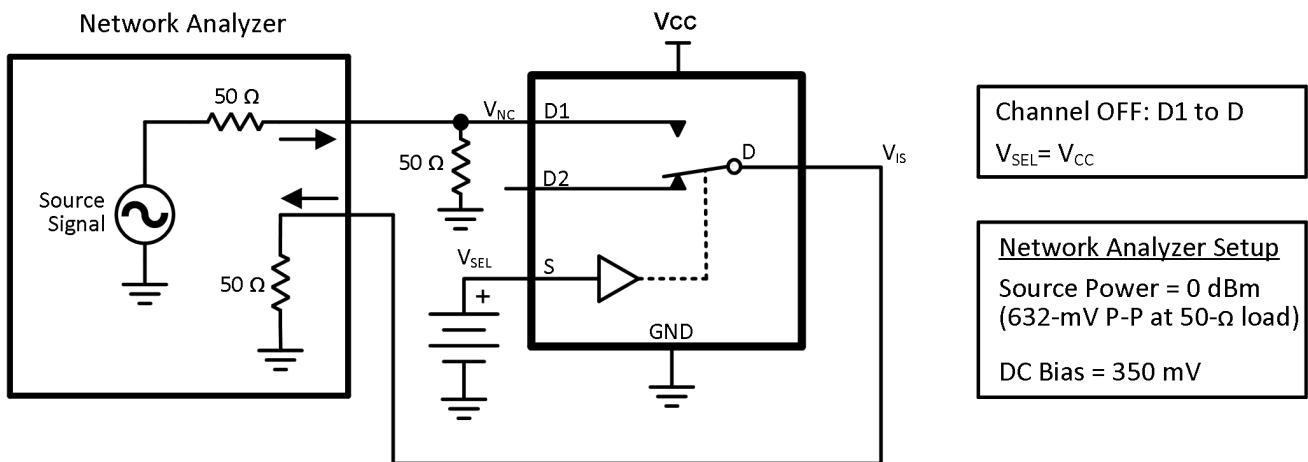Figure 7. Charge Injection (Qc)

Figure 8. Capacitance
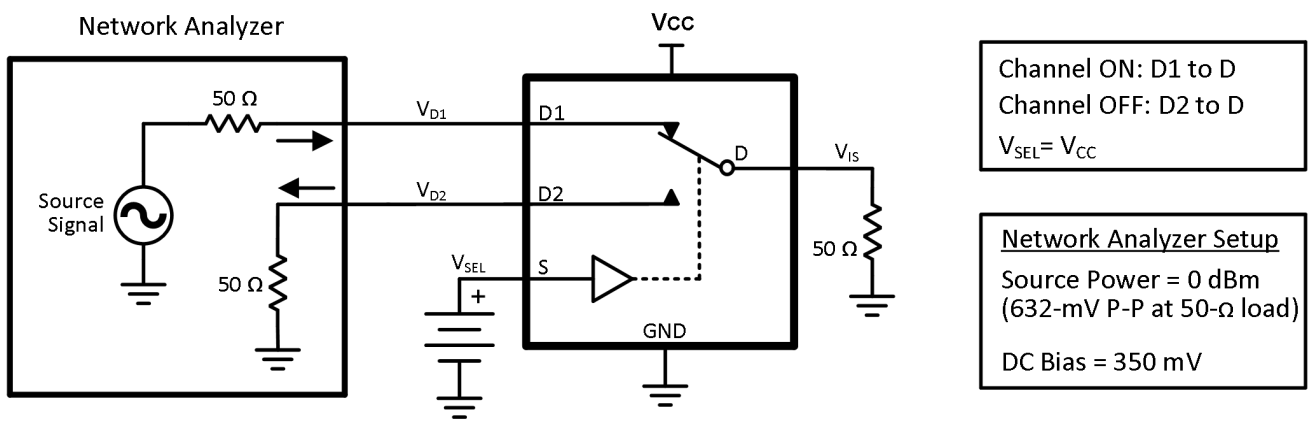

Figure 9. OFF Isolation (O_{ISO})
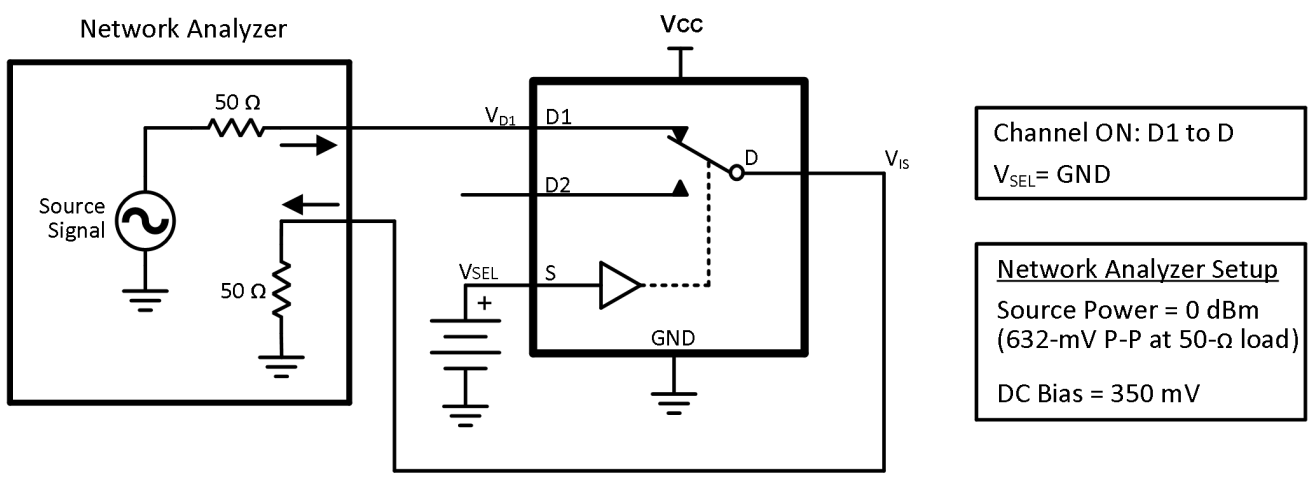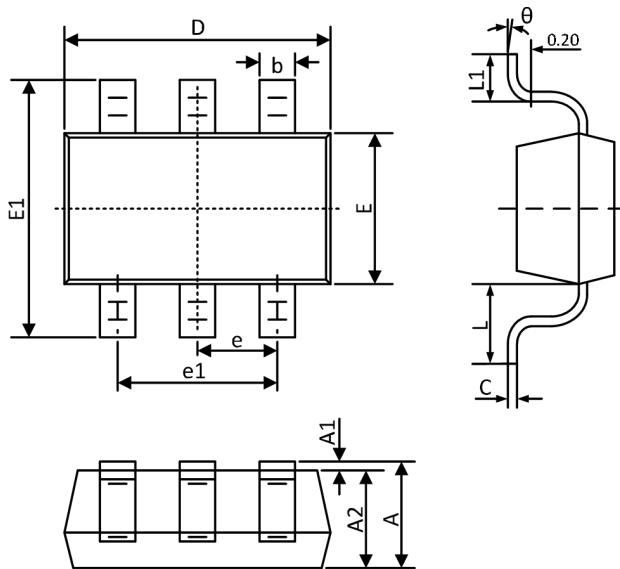
Figure 10. Crosstalk (X_{TALK})

Figure 11. Bandwidth (BW)

5. Package Information

5.1 SOT23-6 (Package Outline Dimensions)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.400	0.012	0.016
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.700REF		0.028REF	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

5.2 SC70-6 / SOT363 (Package Outline Dimensions)
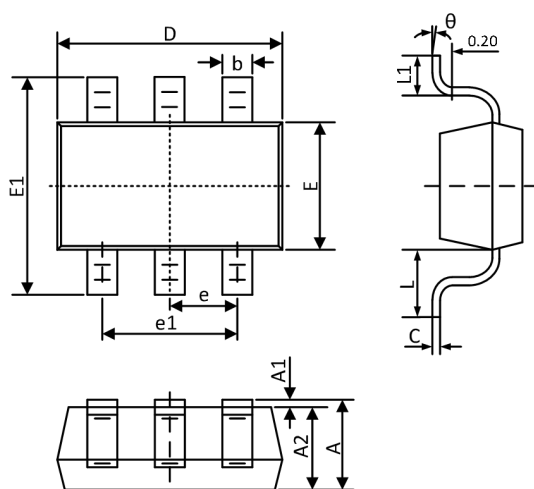
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026 TYP	
e1	1.300 BSC		0.051 BSC	
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°