1-Ω Dual SPDT Analog Switch, 2:1 Multiplexer / 1:2 Demultiplexer

Features

- 1.8V to 5.5V Single Supply Operation
- Low ON-State Resistance: 1Ω (typ)
- -3dB Bandwidth: 90 MHz
- Fast Switching Speed
- Break-Before-Make Operation
- Rail-to-Rail Operation
- TTL/CMOS Logic Compatible
- Supports Analog and Digital Signals
- Small Packaging: MSOP10, DFN10-3x3
- Extended Industrial Temperature Range: -40°C to +125°C

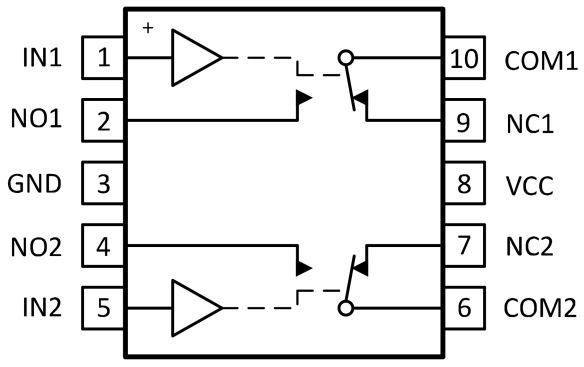
Applications

- Computer Peripherals
- Audio and Video Signal Switching
- Portable Devices
- Communication Circuits
- Signal Gating, Multiplexer/Demultiplexer
- Signal Modulation or Demodulation
- Sample and Hold Systems
- Telecom Signal Switching
- Battery Power Systems

General Description

The COS5A23159 is a low voltage dual channel, bidirectional, single-pole double-throw (SPDT) CMOS analog switch. The device can pass signals with rail-to-rail swing from a single supply 1.8V to 5.5V . The switches conduct equally well in both directions when it is on. The digital inputs have 0.8V to 2.4V logic thresholds, ensuring TTL/CMOS logic compatibility when using a +5V supply.

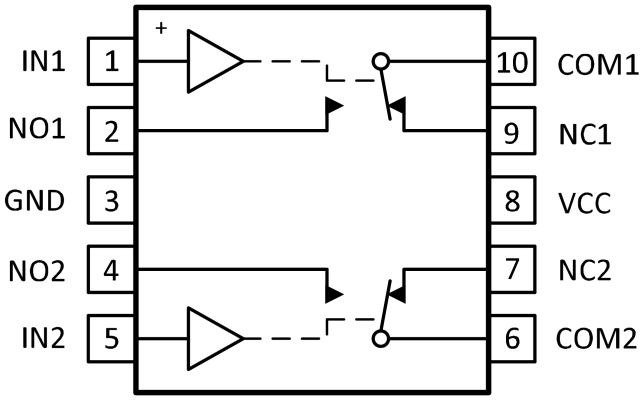
The COS5A23159 offers low ON-state resistance and excellent ON-state resistance matching with the break-before-make feature which prevents signal distortion during the transferring of a signal from one channel. The device is suitable for a wide variety of low power applications including signal gating, chopping, modulation and multiplexing.



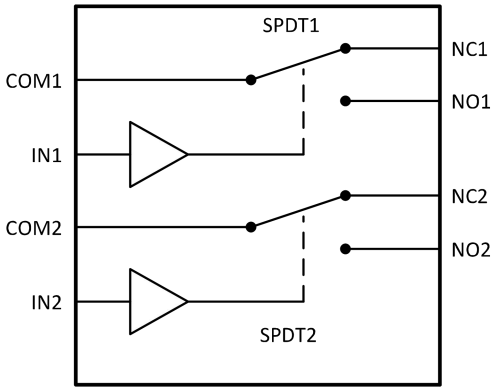
Pin Diagram

Rev1.0

1. Pin Configuration and Functions



(a) Pin Diagram



(b) Simplified Schematic

Truth Table

IN Logic	NC to COM, COM to NC	NO to COM, COM to NO
L	On	Off
H	Off	On

Pin Description

PIN			FUNCTION
NO.	NAME	I/O	
1	IN1	I	Logic control input
2	NO1	I/O	Normally open terminal. Can be an input or output
3	GND	-	Ground
4	NO2	I/O	Normally open terminal. Can be an input or output
5	IN2	I	Logic control input
6	COM2	I/O	Common terminal. Can be an input or output
7	NC2	I/O	Normally closed terminal. Can be an input or output
8	VCC	-	Power supply
9	NC1	I/O	Normally closed terminal. Can be an input or output
10	COM2	I/O	Common terminal. Can be an input or output

2. Package/Ordering Information

Order Number	Package	Package Option	Marking Information
COS5A23159	MSOP10	Tape and Reel, 3000	COS23159
COS5A23159DN	DFN10-3x3	Tape and Reel, 3000	COS23159

3. Product Specification

3.1 Absolute Maximum Ratings (1)

Parameter	Min	Max	Unit
Supply voltage range (V_{CC})	-0.5	6.0	V
Analog voltage range (V_{NC}, V_{NO}, V_{COM})	-0.5	V_{CC} + 0.5	V
Digital input voltage range (V_{IN})	-0.5	6.0	V
Continuous current into any terminal	-200	200	mA
Peak current into any terminal	-400	400	mA
Operating junction temperature	-40	+125	°C
Storage temperature	-55	+150	°C

(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)	160 (MSOP10)	°C/W

3.3 Recommended Operating Conditions

Parameter	Min	Max	Unit
V_{CC}	1.8	5.5	V
V_{NC}, V_{NO}, V_{COM}	0	V_{CC}	
V_{IN}	0	V_{CC}	

3.4 Electrical Characteristics

(V_{CC}=4.5V to 5.5V, T_A=-40°C to 85°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Analog Switch						
Analog signal range	V_{COM}, V_{NO}, V_{NC},		0		V_{CC}	V
Peak On-resistance	R_{peak}	V_{NC} or V_{NO} = 0 to V_{CC}, I_{COM} = -10mA, Switch On, See Figure 1		0.8	1.5	Ω
On-state resistance	R_{on}	V_{NC} or V_{NO} = 2.5V, I_{COM} = -10mA, Switch On, See Figure 1		0.7	1.1	Ω
On-state resistance match between channels	ΔR_{on}	V_{NC} or V_{NO} = 2.5V, I_{COM} = -10mA, Switch On, See Figure 1		0.05	0.1	Ω
On-state resistance flatness	$R_{on(flat)}$	V_{NC} or V_{NO} = 0 to V_{CC}, I_{COM} = -10mA, Switch On, See Figure 1		0.1	0.35	Ω
NO, NC OFF leakage current	$I_{NO(OFF)}$, $I_{NC(OFF)}$	V_{COM} = 1V to 4.5V, V_{NO} or V_{NC} = 1V Or V_{COM} = 1V to 4.5V, V_{NO} or V_{NC} = 4.5V, Switch OFF, See Figure 2	-100	2	100	nA
NO, NC ON leakage current	$I_{NO(ON)}$, $I_{NC(ON)}$	V_{COM} = Open, V_{NO} or V_{NC} = 1V Or V_{COM} = Open, V_{NO} or V_{NC} = 4.5V, Switch ON, See Figure 3	-100	2	100	nA
COM OFF leakage current	$I_{COM(OFF)}$	V_{NO} or V_{NC} = 0 to 5.5V, V_{COM} = 5.5V to 0, Switch OFF, See Figure 2	-2	0.1	2	μA
COM ON leakage current	$I_{COM(ON)}$	V_{NO} or V_{NC} = Open, V_{COM} = 1V, Or V_{NO} or V_{NC} = Open, V_{COM} = 4.5V, Switch ON, See Figure 3	-100	2	100	nA

Digital Control Input (IN1, IN2)						
Input logic high	V_{IH}		2.4		5.5	V
Input logic low	V_{IL}		0		0.8	V
Input leakage current	I_{IH}, I_{IL}	V_{IN} = 0 or 5.5	-100		100	nA
Switch Dynamic Characteristics						
Turn-on time	t_{ON}	V_{COM} = V_{CC}, R_L=50Ω, C_L = 35pF, See Figure 5		8	16	ns
Turn-off time	t_{OFF}	V_{COM} = V_{CC}, R_L=50Ω, C_L = 35pF, See Figure 5		5	8	ns
Break-Before-Make Delay	t_{BBM}	V_{NO} or V_{NC}= V_{CC}, R_L=50Ω, C_L = 35pF, See Figure 6	1		14	ns
Charge Injection	Q	V_{GEN} =0V, R_{GEN}=0, C_L = 1 nF, See Figure 10		-7		pC
NO or NC OFF Capacitance	C_{OFF}	V_{NC} = V_{NO} = V_{CC} or GND, Switch OFF, See Figure 4		15		pF
NO or NC ON Capacitance	C_{ON}	V_{NC} = V_{NO} = V_{CC} or GND, Switch ON, See Figure 4		55		pF
COM ON-Capacitance	C_{COM}	V_{COM} = V_{CC} or GND, Switch ON, See Figure 4		55		pF
Digital Input Capacitance	C_I	V_{IN} = V_{NO} or GND, See Figure 4		2		pF
OFF-Isolation	V_{ISO}	R_L = 50Ω, C_L = 15pF, V_{NC} = 1V_{RMS}, f = 1MHz Switch OFF, See Figure 7		-64		dB
Crosstalk	X_{TALK}	R_L = 50Ω, C_L = 15pF, V_{NC} = 1V_{RMS}, f = 1MHz Switch ON, See Figure 8		-64		dB
Bandwidth	BW	R_L = 50Ω, C_L = 15pF, V_{NC} = 1V_{RMS}, f = 1MHz Switch ON, See Figure 9		90		MHz
Total Harmonic Distortion	THD	R_L = 600Ω, C_L = 50pF, f = 20 Hz to 20kHz Switch ON, See Figure 11		0.005		%
Power Supply						
V_{CC} supply current	I_{CC}	V_{IN} = 0 or V_{CC}, Switch ON or OFF			0.1	μA

4. Test Circuits and Timing Diagrams

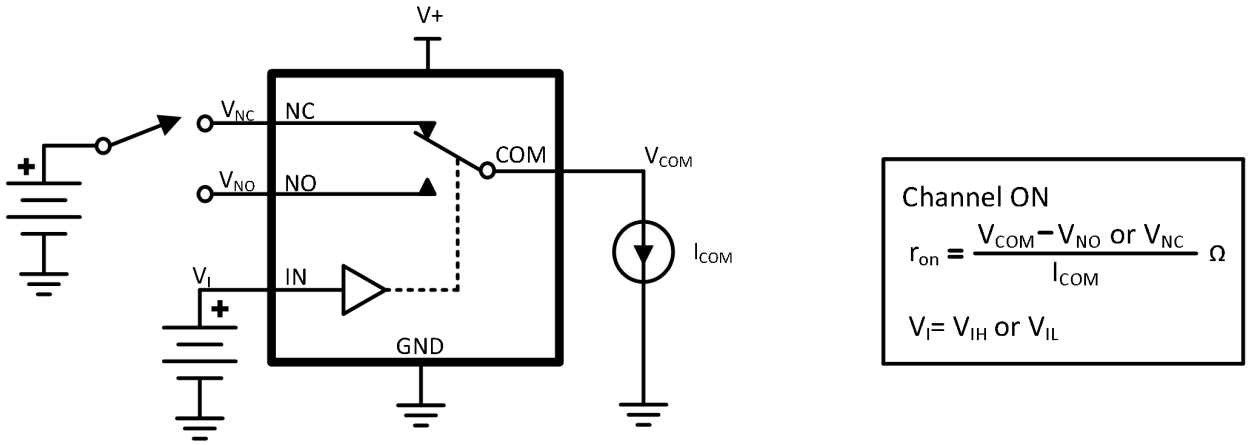


Figure 1. ON-State Resistance (R_{ON})

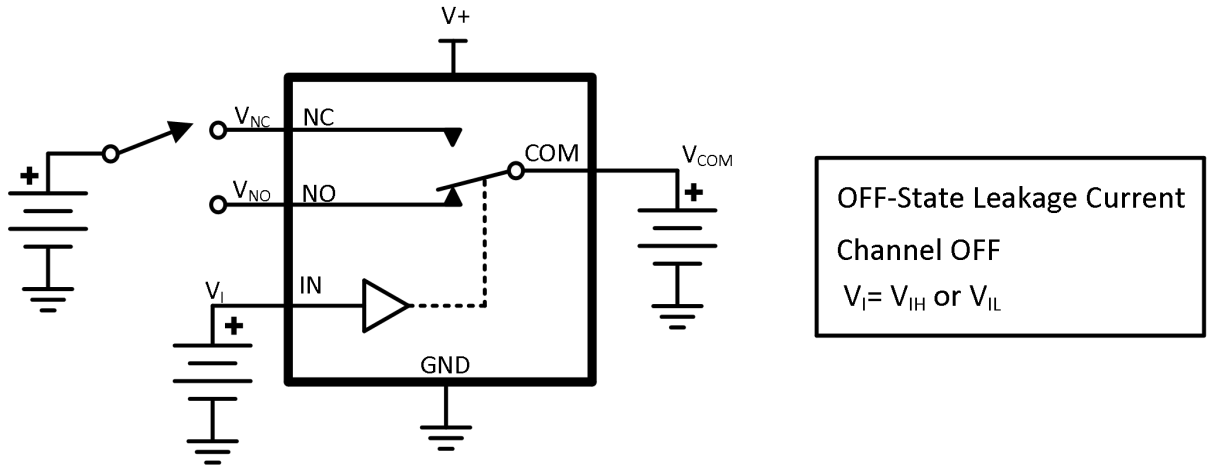


Figure 2. OFF-State Leakage Current

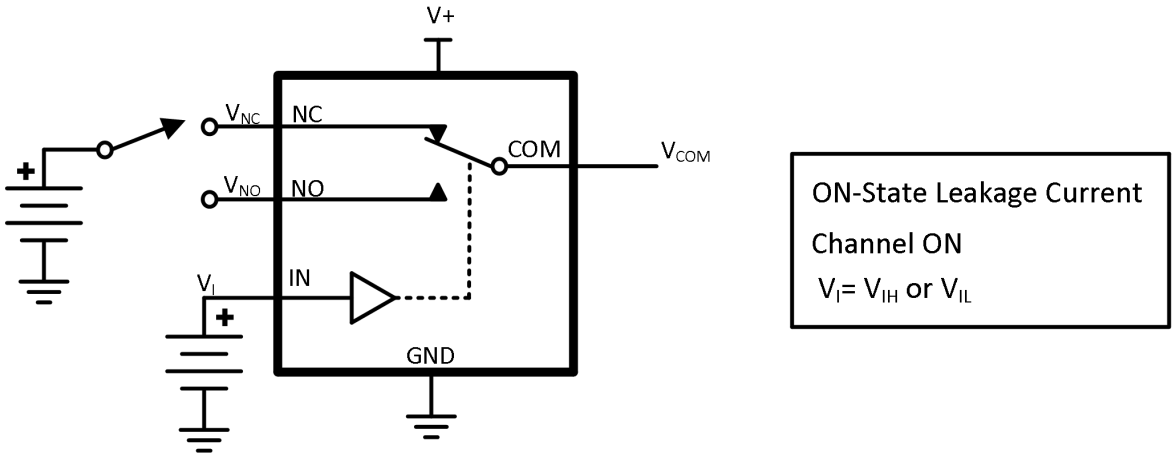


Figure 3. ON-State Leakage Current

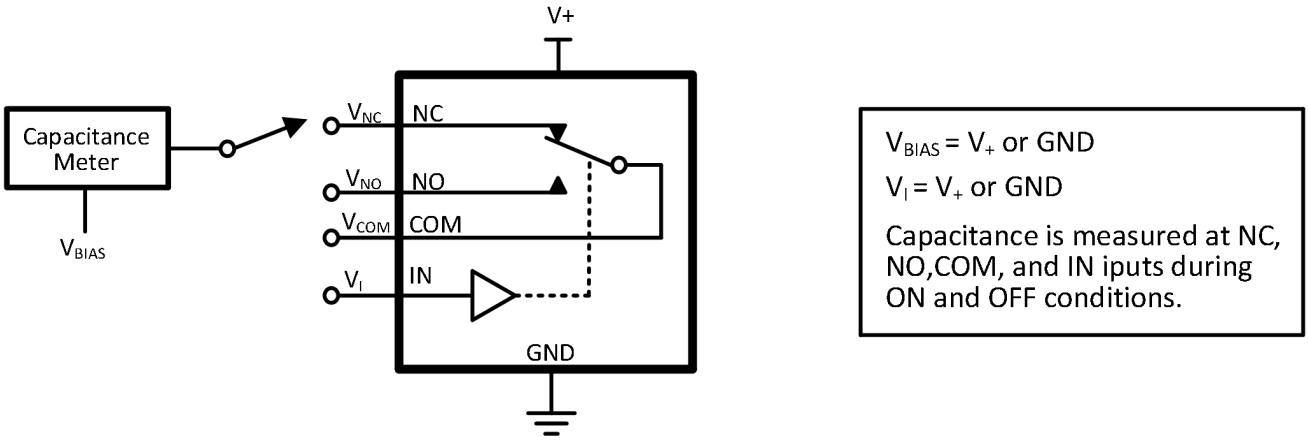


Figure 4. Capacitance

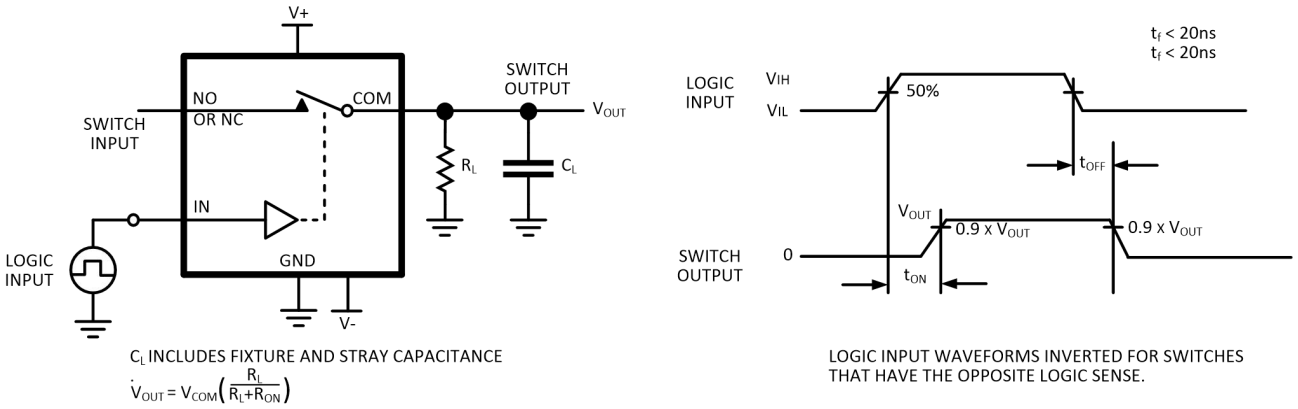


Figure 5. Turn-On (T_{ON}) and Turn-Off Time (T_{OFF})

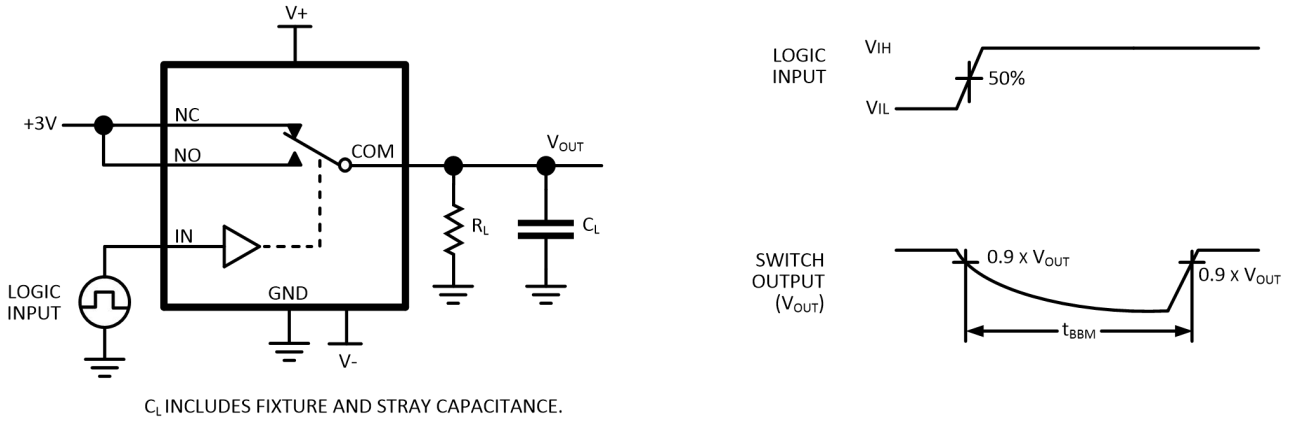
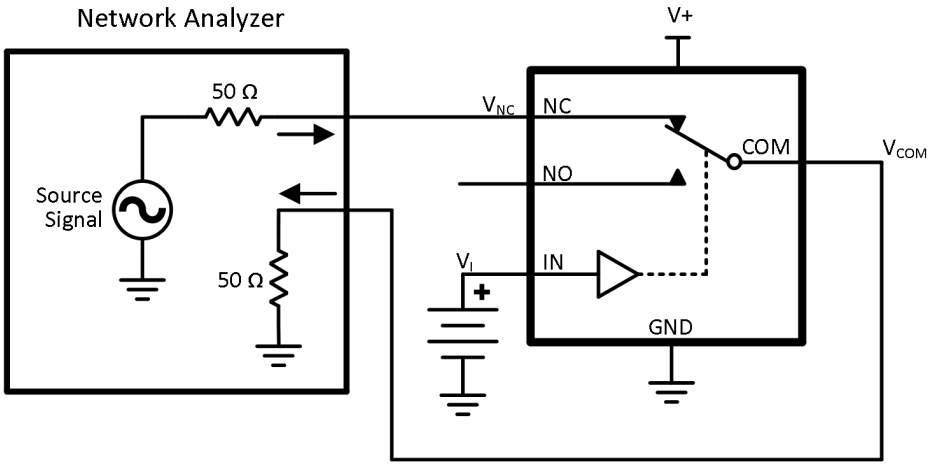


Figure 6. Break-Before-Make Time (T_{BBM})

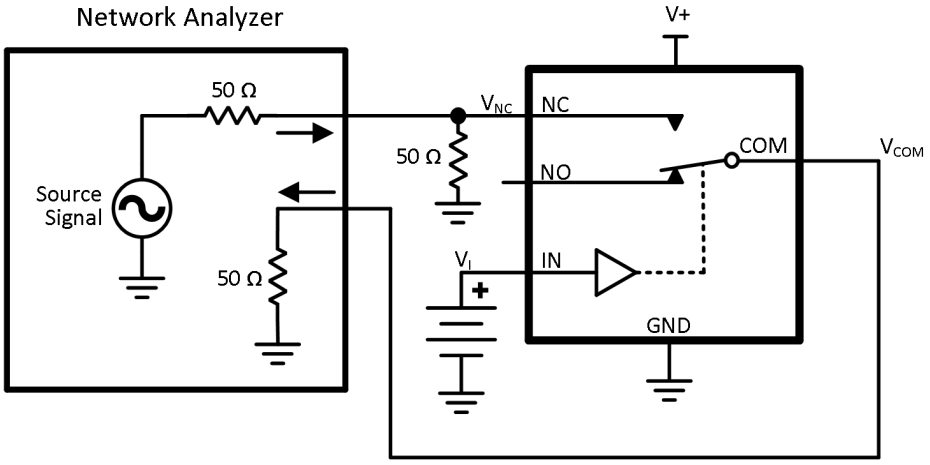


Channel ON: NC to COM
V_I= V_+ or GND

Network Analyzer Setup
Source Power = 0 dBm
(632-mV P-P at 50-Ω load)

DC Bias = 350 mV

Figure 7. Bandwidth (BW)

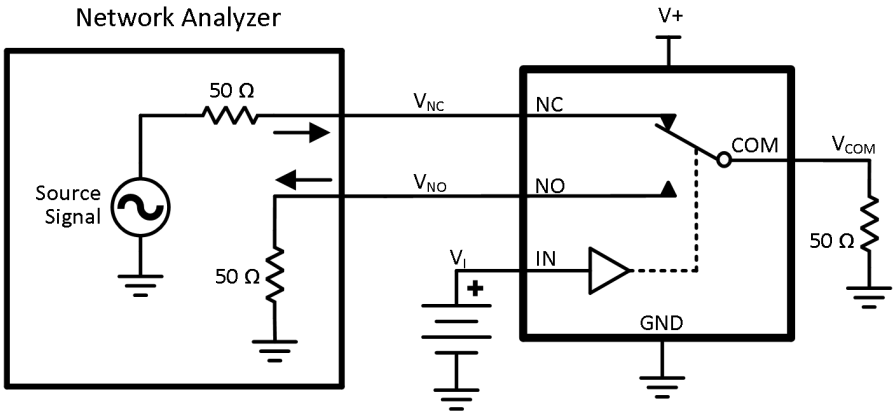


Channel OFF: NC to COM
V_I= V_+ or GND

Network Analyzer Setup
Source Power = 0 dBm
(632-mV P-P at 50-Ω load)

DC Bias = 350 mV

Figure 8. OFF Isolation (O_{ISO})



Channel ON: NC to COM
Channel OFF: NC to COM
V_I= V_+ or GND

Network Analyzer Setup
Source Power = 0 dBm
(632-mV P-P at 50-Ω load)

DC Bias = 350 mV

Figure 9. Crosstalk (X_{TALK})

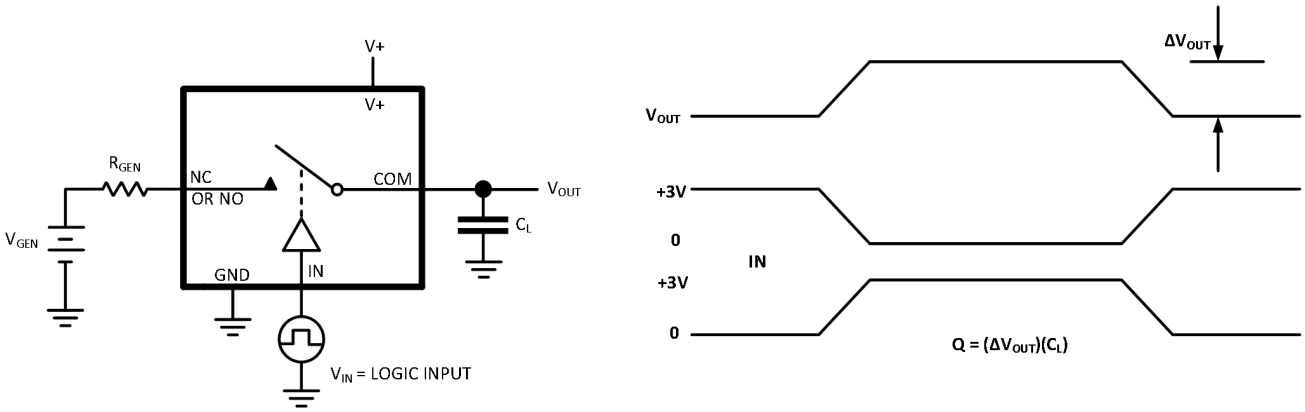


Figure 10. Charge Injection (Qc)

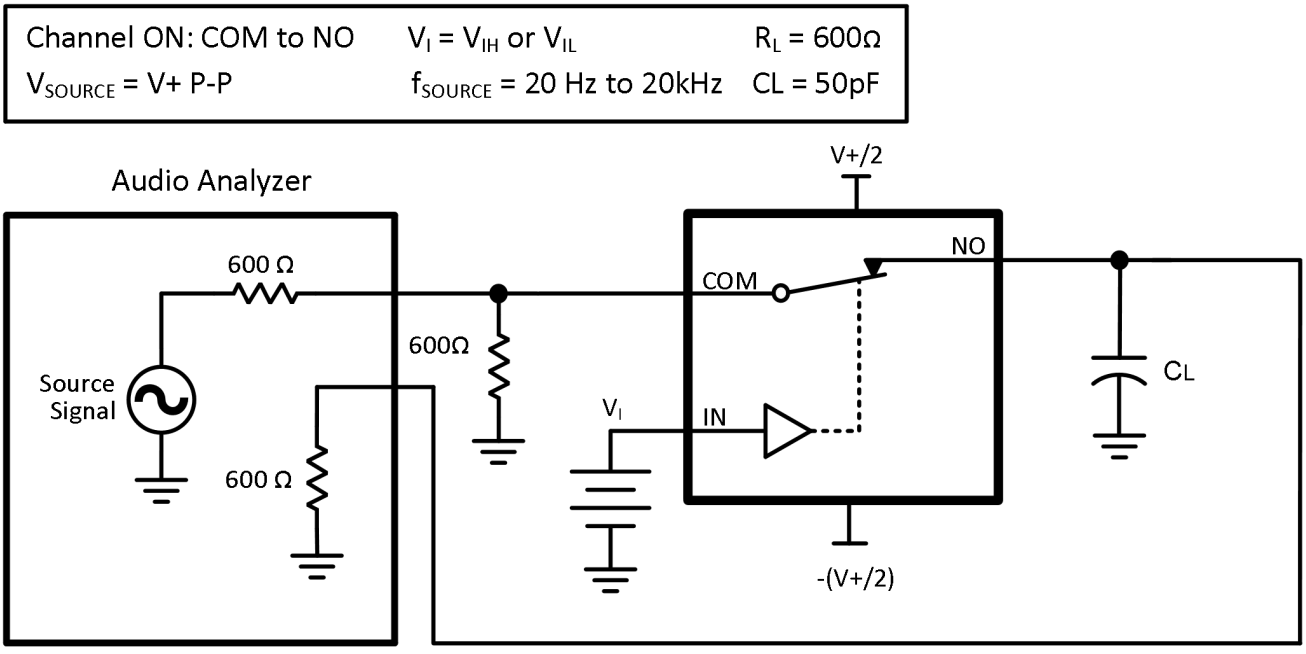
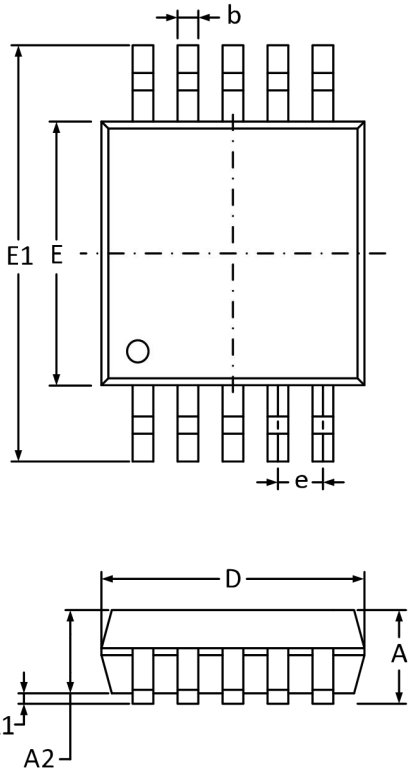
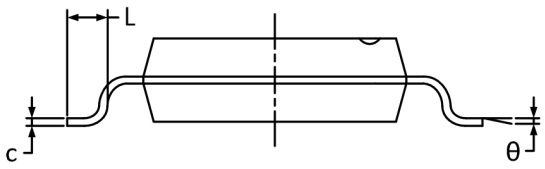


Figure 11. Total Harmonic Distortion (THD)

5. Package Information

5.1 MSOP10 (Package Outline Dimensions)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.500 BSC		0.020 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°