

## 4 $\Omega$ High Speed Low Voltage Quad SPDT Analog Switch

### Features

- Wide Power Supply Range: 1.8V to 5.5V
- On-Resistance: 4  $\Omega$  (TYP)
- Low On-Resistance Flatness
- -3dB Bandwidth: 400MHz
- Break-Before-Make Switching
- Rail-to-Rail Signal Range
- High Off-Isolation: -78dB (f=1MHz)
- Crosstalk Rejection: -98dB (f=1MHz)
- Operation Temperature Range:  
-40°C to +125°C
- Available in QFN3x3-16L package

### Applications

- Communication Systems
- Cell Phones
- Portable Electronic Devices
- Audio Signal Routing
- Audio & Video Signal Routing
- PCMCIA Cards
- Computer Peripherals
- Modems

### Function Table

IN12	NC1 and NC2	NO1 and NO2
0	ON	OFF
1	OFF	ON

IN34	NC3 and NC4	NO3 and NO4
0	ON	OFF
1	OFF	ON

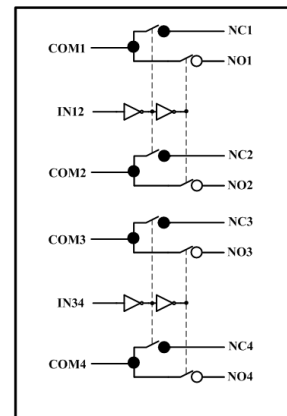
### Description

The BL1558 is a 4-channel single-pole double-throw (SPDT) analog switch with two control inputs, which is designed to operate from 1.8 to 5.5V. This device is also known as a dual double-pole double-throw (DPDT) configuration with two logic control inputs.

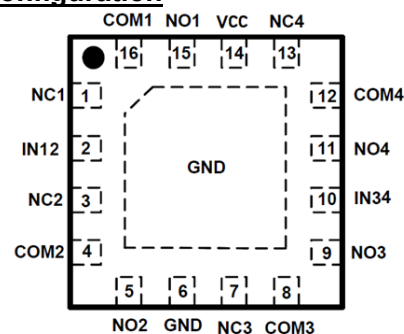
The BL1558 can handle both analog and digital signals. It features high-bandwidth (400MHz) and low on-resistance (4  $\Omega$  TYP).

The BL1558 is available in QFN3x3-16L package.

### Block Diagram



### Pin Configuration



TOP View  
QFN3x3-16L

### Ordering Information

Order No.	Package	Packing
BL1558QN	QFN3x3-16L	Tape and Reel, 3000

**Pin Description**

NAME	PIN	FUNCTION
VCC	14	Power Supply
GND	6	Ground
IN12	2	Digital Control Pin for channel 1 and 2
IN34	10	Digital Control Pin for channel 3 and 4
COMx	16,4,8,12	Common Terminal
NOx	15,5,9,11	Normally-Open Terminal
NCx	1,3,7,13	Normally-Closed Terminal

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Min	Max	Units
DC Supply Voltage	VCC	-0.5	6	V
DC Switch Voltage	V <sub>NCx</sub> / V <sub>NOx</sub> / V <sub>COMx</sub>	-0.5	V <sub>SUP</sub> + 0.3	V
DC Input Voltage	V <sub>INx</sub>	-0.5	6	V
Continuous Current	I <sub>(NCx/NOx/COMx)</sub>	-200	+200	mA
Peak Current <sup>(1)</sup>	I <sub>PEAK(NCx/NOx/COMx)</sub>	-300	+300	mA
Storage Temperature Range	T <sub>STG</sub>	-65	150	°C

**Notes:**

- (1) Pulsed at 1ms, 50% duty circle
- (2) Stress beyond above listed "Absolute Maximum Ratings" may lead permanent damage to the device.  
 These are stress ratings only and operations of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
- (3) Control input(V<sub>INx</sub>) must be held HIGH or LOW, and mustn't be floated.

**RECOMMENDED OPERATING CONDITIONS**

DC Supply Voltage (V <sub>CC</sub> )	1.8V to 5.5V
Switch Input Voltage (V <sub>S</sub> )	0V to V <sub>CC</sub>
Control Input Voltage (V <sub>IN</sub> )	0V to V <sub>CC</sub>
Operation Temperature (T <sub>A</sub> )	-40°C to +125°C

**DC ELECTRICAL CHARACTERISTICS**

 (  $V_{CC}=5V$ ,  $T_A=-40^{\circ}C$  to  $+125^{\circ}C$ . Typical values are at  $V_{CC}=+25^{\circ}C$ , unless otherwise noted )

PARAMETER	SYMBOL	CONDITIONS	TA	MIN	TYP	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	$V_{NO}, V_{NC}, V_{COM}$		$-40\sim+125^{\circ}C$	0		VCC	V
On-Resistance	$R_{ON}$	$V_{CC}=5V, I_{COM} = -10mA, V_{NO}$ or $V_{NC}=3.5V$	$+25^{\circ}C$		4	7.5	$\Omega$
			$-40\sim+125^{\circ}C$			8	
On-Resistance Match Between Channels <sup>(1)</sup>	$\Delta R_{ON}$	$V_{CC}=5V, I_{COM} = -10mA, V_{NO}$ or $V_{NC}=3.5V$	$+25^{\circ}C$		0.15	0.5	$\Omega$
			$-40\sim+125^{\circ}C$			0.7	
On-Resistance Flatness <sup>(2)</sup>	$R_{FLAT(ON)}$	$V_{CC}=5V, I_{COM} = -10mA, V_{NO}$ or $V_{NC}=0\sim V_{CC}$	$+25^{\circ}C$		1	2	$\Omega$
			$-40\sim+125^{\circ}C$			2.2	
NC or NO OFF Leakage Current	$I_{NC(OFF)}, I_{NOFF}$	$V_{CC} = 5.5V; V_{NO}$ or $V_{NC} = 3.3V/0.3V; V_{COM} = 0.3V/3.3V$	$+25^{\circ}C$		0.01	0.1	$\mu A$
			$-40\sim+125^{\circ}C$			1	
NC,NO,COM ON Leakage Current	$I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_{CC} = 5.5V; V_{COM} = 0.3V/3.3V; V_{NO}$ or $V_{NC} = 0.3V/3.3V$ , or floating	$+25^{\circ}C$		0.01	0.1	$\mu A$
			$-40\sim+125^{\circ}C$			1	
<b>DIGITAL CONTROL INPUTS</b>							
Input High Voltage	$V_{IH}$	$V_{CC}=5.5V$	$-40\sim+125^{\circ}C$	1.7			V
Input Low Voltage	$V_{IL}$	$V_{CC}=5.5V$	$-40\sim+125^{\circ}C$			0.6	V
Input Leakage Current	$I_{IN}$	$V_{CC}=5.5V, V_{IN} = 0$ or $5.5V$	$-40\sim+125^{\circ}C$		0.01	1	$\mu A$
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	$t_{ON}$	$V_{NO}$ or $V_{NC} = 3.0V, R_L = 50\Omega; C_L = 35pF, V_{IH}=1.5V, V_{IL}=0V$ (50% to 50%)	$+25^{\circ}C$		30		ns
Turn-Off Time	$t_{OFF}$	$V_{NO}$ or $V_{NC} = 3.0V, R_L = 50\Omega; C_L = 35pF, V_{IH}=1.5V, V_{IL}=0V$ (50% to 50%)	$+25^{\circ}C$		35		ns
Break-Before-Make Time Delay	$t_{BBM}$	$V_{A1}$ or $V_{A2} = 3.0V, R_L = 50\Omega; C_L = 35pF(90\% \text{ to } 90\%)$	$+25^{\circ}C$		15		ns
-3dB Bandwidth	BW	Signal = 0dBm, $R_L = 50\Omega, C_L = 5pF$	$+25^{\circ}C$		400		MHz
Off Isolation <sup>(3)</sup>	$O_{ISO}$	$R_L = 50\Omega, C_L = 5pF, \text{Signal} = 0dBm$	$f = 1MHz$	$+25^{\circ}C$		-78	dB
			$f = 10MHz$	$+25^{\circ}C$		-58	dB

Crosstalk <sup>(4)</sup>	X <sub>TALK</sub>	RL = 50 Ω, CL=5pF	f = 1MHz	+25°C		-98		dB
			f = 10MHz	+25°C		-80		dB
NC,NO OFF Capacitance	C <sub>NC(OFF)</sub> , C <sub>NO(OFF)</sub>			+25°C		6		pF
NC,NO,COM ON Capacitance	C <sub>NC(ON)</sub> , C <sub>NO(ON)</sub> , C <sub>COM(ON)</sub>			+25°C		18		pF
Charge Injection	Q	CL = 1.0nF, VG = 0V, RG = 0Ω		+25°C		45		pC
<b>POWER REQUIREMENTS</b>								
Power Supply Current	I <sub>CC</sub>			-40~+125°C		0.01	1	uA

### DC ELECTRICAL CHARACTERISTICS

( V<sub>CC</sub>=2.7V, T<sub>A</sub>=-40°C to +125°C. Typical values are at V<sub>CC</sub>= +25°C, unless otherwise noted )

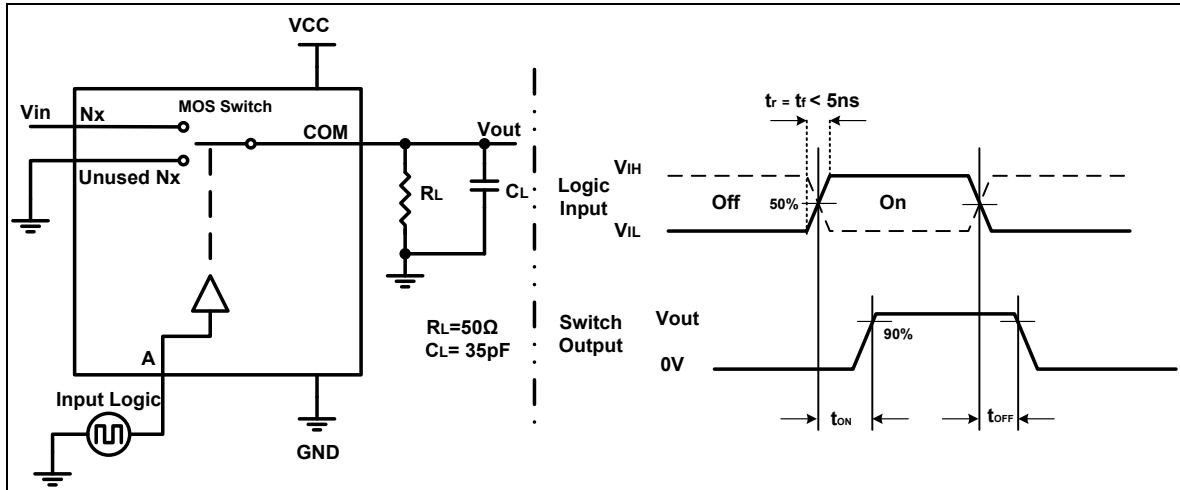
PARAMETER	SYMBOL	CONDITIONS	TA	MIN	TYP	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	V <sub>NO</sub> , V <sub>NC</sub> , V <sub>COM</sub>		-40~+125°C	0		V <sub>CC</sub>	V
On-Resistance	R <sub>ON</sub>	V <sub>CC</sub> =2.7V, I <sub>COM</sub> = - 10mA, V <sub>NO</sub> or V <sub>NC</sub> =1.5V	+25°C		8.8	12	Ω
			-40~+125°C			15	
On-Resistance Match Between Channels <sup>(1)</sup>	ΔR <sub>ON</sub>	V <sub>CC</sub> =2.7V, I <sub>COM</sub> = - 10mA, V <sub>NO</sub> or V <sub>NC</sub> =1.5V	+25°C		0.1	0.5	Ω
			-40~+125°C			0.7	
On-Resistance Flatness <sup>(2)</sup>	R <sub>FLAT(ON)</sub>	V <sub>CC</sub> =2.7V, I <sub>COM</sub> = - 10mA, V <sub>NO</sub> or V <sub>NC</sub> =0~V <sub>CC</sub>	+25°C		4.2	6	Ω
			-40~+125°C			7	
NC or NO OFF Leakage Current	I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	V <sub>CC</sub> = 3.6V; V <sub>NO</sub> or V <sub>NC</sub> = 0.3V, 3.3V; V <sub>COM</sub> = 0.3V, 3.3 V	+25°C		0.01	0.1	μA
			-40~+125°C			1	
NC,NO,COM ON Leakage Current	I <sub>NC(ON)</sub> , I <sub>NO(ON)</sub> , I <sub>COM(ON)</sub>	V <sub>CC</sub> = 3.6V; V <sub>COM</sub> = 0.3V, 3.3 V; V <sub>NO</sub> or V <sub>NC</sub> = 0.3V, 3.3V, or floating	+25°C		0.01	0.1	μA
			-40~+125°C			1	
<b>DIGITAL CONTROL INPUTS(1)</b>							
Input High Voltage	V <sub>IH</sub>	V <sub>IN</sub> = 3.6V	-40~+125°C	1.5			V
Input Low Voltage	V <sub>IL</sub>	V <sub>IN</sub> = 3.6V	-40~+125°C			0.5	V
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = 0 ~ 3.6V	-40~+125°C			1	μA
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 1.5V, R <sub>L</sub> = 300Ω; C <sub>L</sub> = 35pF, V <sub>IH</sub> =1.5V, V <sub>IL</sub> =0V	+25°C		40		ns

Turn-Off Time	$t_{OFF}$	$V_{NO}$ or $V_{NC} = 1.5V$ , $R_L = 50\Omega$ ; $C_L = 35pF$ , $V_{IH}=1.5V, V_{IL}=0V$	+25°C		52		ns
Break-Before-Make Time Delay	$t_{BBM}$	$V_{NO}$ or $V_{NC} = 1.5V$ , $R_L = 50\Omega$ ; $C_L = 35pF$	+25°C		18		ns
-3dB Bandwidth	BW	Signal = 0dBm, $R_L = 50\Omega$ , $C_L = 5pF$	+25°C		350		MHz
Off Isolation <sup>(3)</sup>	$O_{ISO}$	$R_L = 50\Omega$ , $C_L = 5pF$ , Signal = 0dBm	f = 1MHz	+25°C		-73	dB
			f = 10MHz	+25°C		-50	dB
Crosstalk <sup>(4)</sup>	$X_{TALK}$	$R_L = 50\Omega$ , $C_L=5pF$	f = 1MHz	+25°C		-110	dB
			f = 10MHz	+25°C		-90	dB
NC,NO OFF Capacitance	$C_{NC(OFF)}$ , $C_{NO(OFF)}$		+25°C		6		pF
NC,NO,COM ON Capacitance	$C_{NC(ON)}$ , $C_{NO(ON)}$ , $C_{COM(ON)}$		+25°C		18		pF
Charge Injection	Q	$C_L = 1.0nF$ , $V_G = 0V$ , $R_G = 0\Omega$ ,	+25°C		30		pC
<b>POWER REQUIREMENTS</b>							
Power Supply Current	$I_{CC}$		-40~+125°C		0.01	1	uA

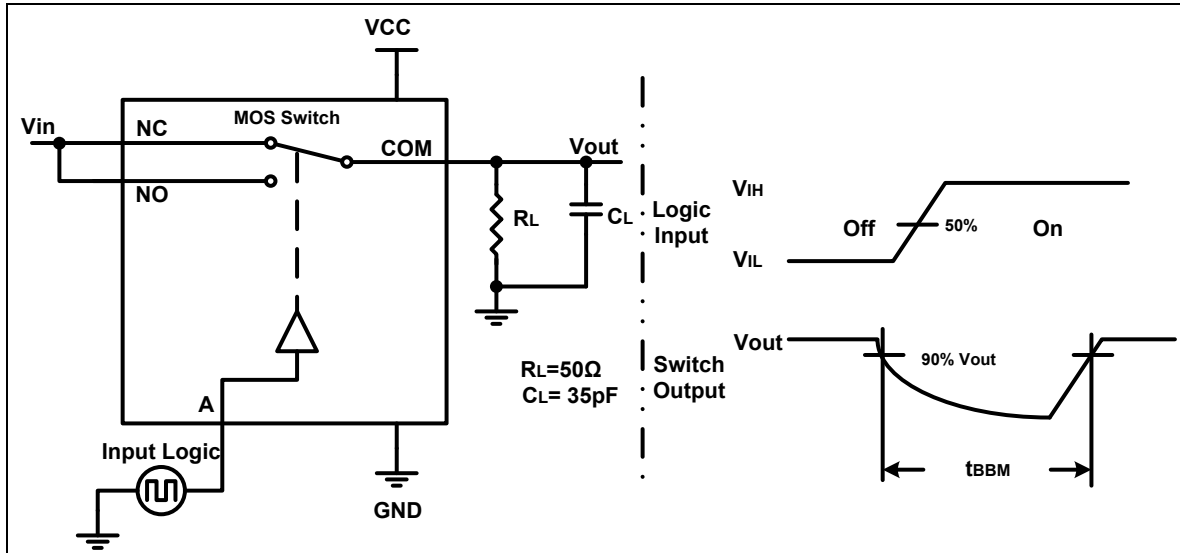
**Note:**

- (1)  $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$ , between channels
- (2) Flatness is defined as the difference between the maximum and minimum value of on resistance as measured over the specified analog signal ranges.
- (3) Off Channel Isolation =  $20\log_{10} [(V_{NO/NC})/V_{COM}]$
- (4) Between any two switches

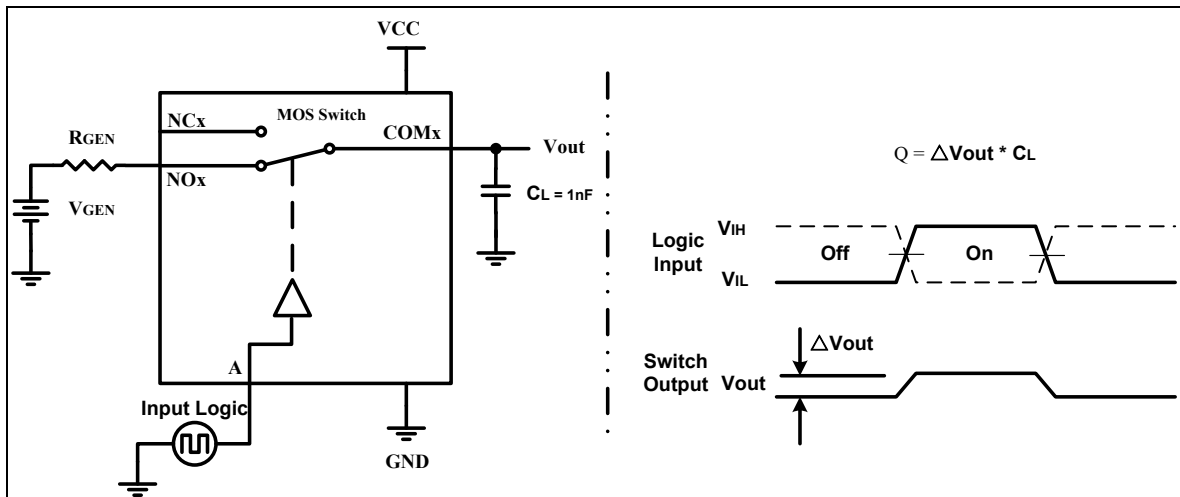
**TEST SETUP CIRCUITS**



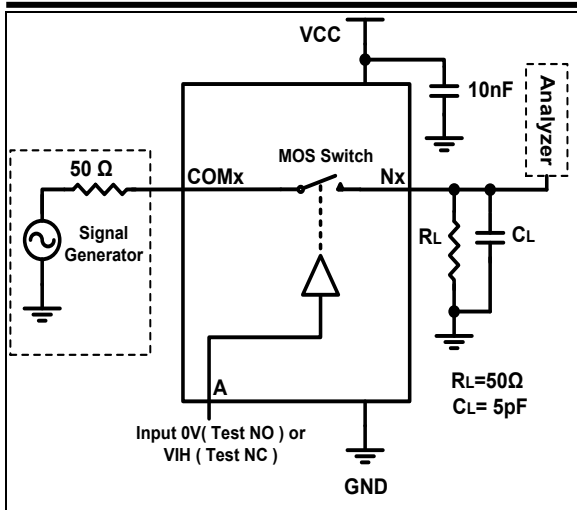
**Figure1. AC Test Circuit & Waveforms**



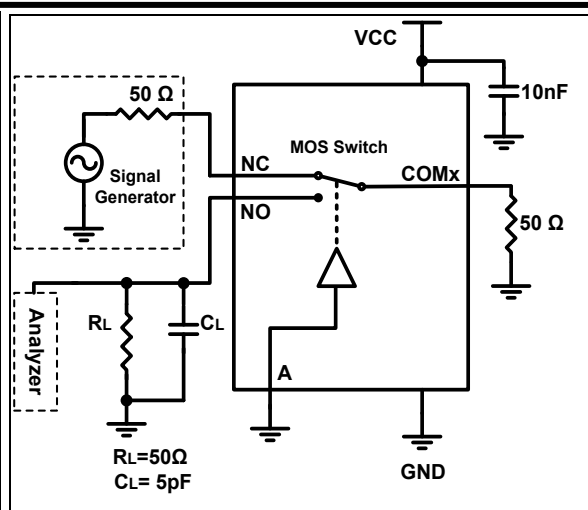
**Figure2. Break-Before-Make Time ( $t_{BBM}$ )**



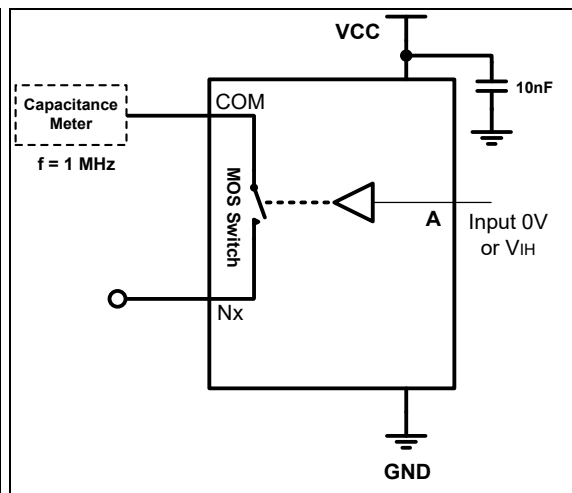
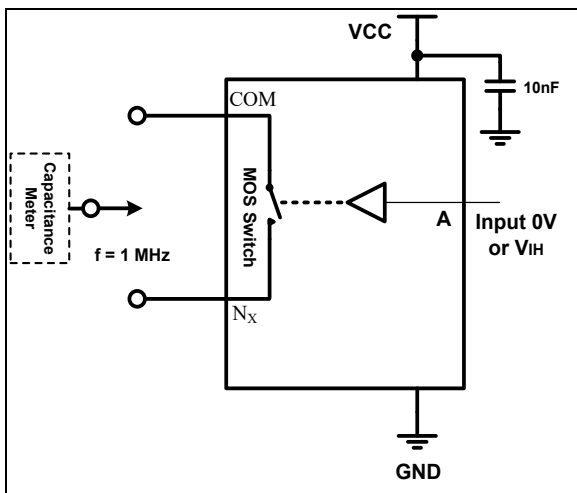
**Figure3. Charge Injection (Q)**



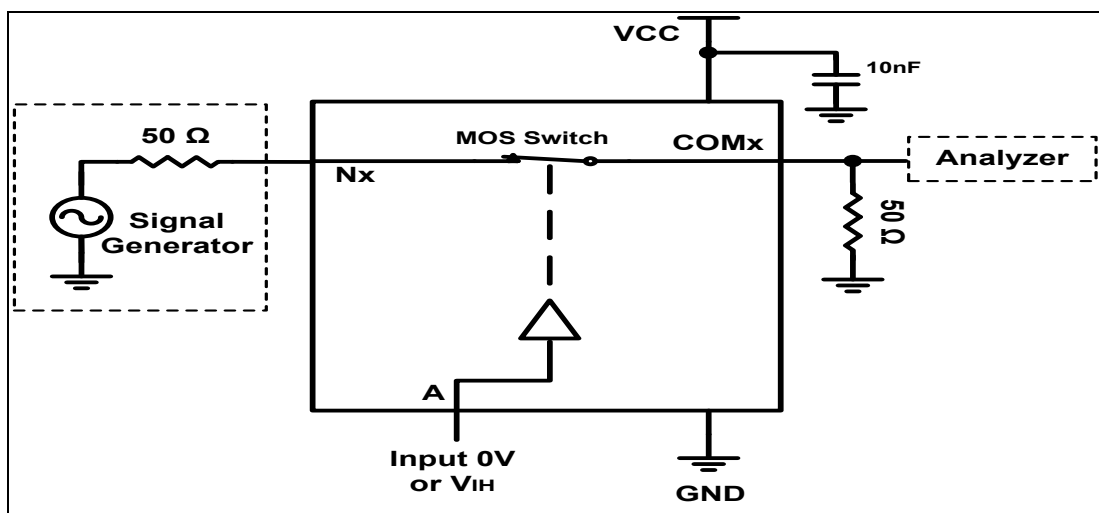
**Figure4. Off Isolation ( $V_{iso}$ )**



**Figure5. Cross Talk ( $V_{CT}$ )**



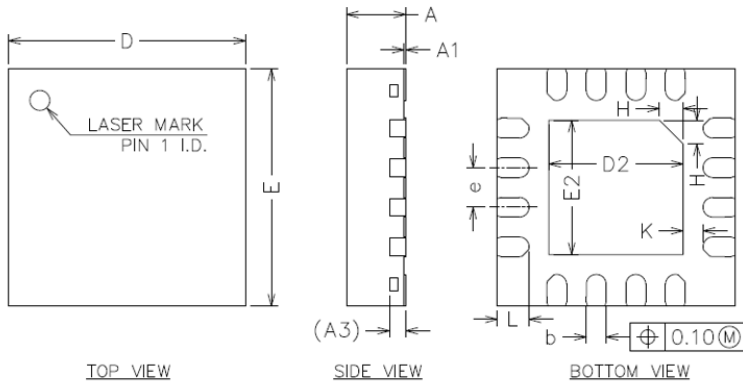
**Figure6. Channel Off Capacitance( $C_{OFF(NX)}$ ) Figure7. Channel On Capacitance( $C_{ON(NX)}$ )**



**Figure8. -3dB Bandwidth ( $f_{3dB}$ )**

**PACKAGE OUTLINE DIMENSIONS**

**QFN3x3-16L**



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	0.20REF		
b	0.20	0.25	0.30
D	2.95	3.00	3.05
E	2.95	3.00	3.05
D2	1.60	1.70	1.75
E2	1.60	1.70	1.75
e	0.40	0.50	0.60
H	0.30REF		
K	0.15	-	-
L	0.35	0.40	0.45

