

# 4.5Ω Quad SPDT Analog Switch 4-Channel 2:1 Multiplexer – Demultiplexer With Two Controls

## FEATURES

- **High Bandwidth: 300MHz**
- **High Speed: Typically 30ns**
- **Supply Range: +1.8V to +5.5V**
- **Low ON-State Resistance, 4.5Ω(TYP)**
- **Break-Before-Make Switching**
- **Rail-to-Rail Operation**
- **TTL/CMOS Compatible**
- **Extended Industrial Temperature Range: -40°C to +125°C**

## APPLICATIONS

- **Video Switching**
- **Relay Replacements**
- **USB Switching**
- **Battery-Operated Equipment**
- **Cell Phones**

## DESCRIPTION

The RS2299 is a bidirectional 4-channel single-pole double-throw (SPDT) analog switch with two control inputs, which is designed to operate from 1.8V to 5.5V. This device is also known as a 2 channel double-pole double-throw (DPDT) configuration.

The RS2299 device can handle both analog and digital signals. It features high-bandwidth (300MHz) and low on-resistance (4.5Ω TYP).

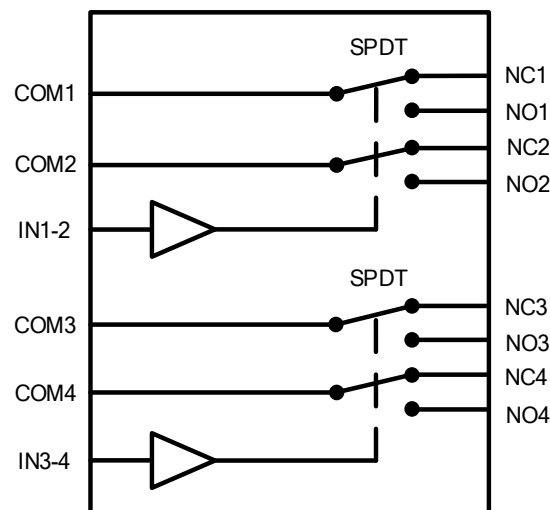
Applications include signal gating, chopping, modulation or demodulation (modem), and signal multiplexing for analog-to-digital and digital-to-analog conversion systems.

**Device Information (1)**

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS2299	QFN3X3-16	3.00mm×3.00mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

## Functional Block Diagram

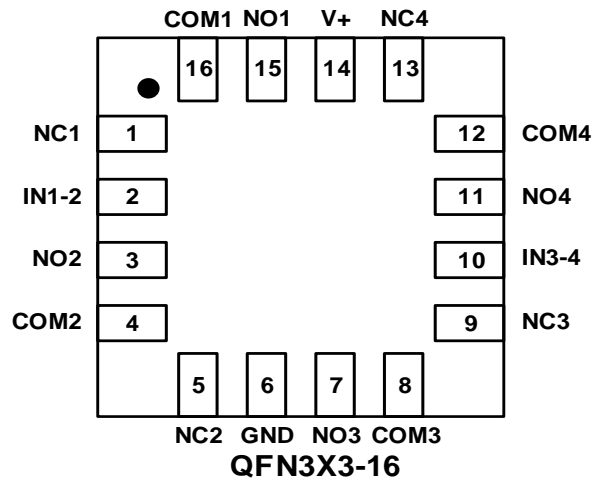


## Revision History

Note: Page numbers for previous revisions may differ from page numbers in the current version.

VERSION	Change Date	Change Item
C.4.1	2024/03/08	<ol style="list-style-type: none"><li>1. Added the TAPE AND REEL INFORMATION</li><li>2. Change Thermal Information on Page 2@RevC.4</li><li>3. Modify packaging naming</li></ol>

## PIN CONFIGURATIONS(TOP VIEW)



## PIN DESCRIPTION

NAME	PIN	FUNCTION
	QFN3X3-16	
V+	14	Power Supply
GND	6	Ground
IN1-2	2	Digital Control Pin
IN3-4	10	Digital Control Pin
COMx	16, 4, 8, 12	Common Terminal
NOx	15, 3, 7, 11	Normally-Open Terminal
NCx	1, 5, 9, 13	Normally-Closed Terminal

## FUNCTION TABLE

IN1-2	NO1 and NO2	NC1 and NC2
0	OFF	ON
1	ON	OFF

IN3-4	NO3 and NO4	NC3 and NC4
0	OFF	ON
1	ON	OFF

## SPECIFICATIONS

### Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

SYMBOL	PARAMETER	MIN	MAX	UNIT
V <sub>+</sub>	Supply Voltage	-0.3	6.0	V
V <sub>IN</sub>	Input Voltage <sup>(2)</sup>	-0.3	6.0	
	Analog, Digital Voltage Range	-0.3	V <sub>CC</sub> +0.3	
	Continuous Current NO, NC, or COM	-300	300	mA
I <sub>PEAK</sub>	Peak Current NO, NC, or COM	-500	500	
T <sub>J</sub>	Junction Temperature	-40	150	°C
T <sub>stg</sub>	Storage temperature	-65	150	

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) All voltages are with respect to ground, unless otherwise specified.

### ESD Ratings

		VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human-body model (HBM)	±1000
		Machine Model (MM)	±100

### Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNIT
V <sub>CC</sub>	Supply Voltage	1.8	5.5	V
T <sub>A</sub>	Operating temperature	-40	+125	°C

### Thermal Information

THERMAL METRIC		RS2299	UNIT
		16PINS	
		QFN3X3-16	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	51.9	°C/W
R <sub>θJC(top)</sub>	Junction-to-case(top) thermal resistance	53.3	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	26.6	°C/W
Ψ <sub>JT</sub>	Junction-to-top characterization parameter	1.7	°C/W
Ψ <sub>JB</sub>	Junction-to-board characterization parameter	26.6	°C/W
R <sub>θJC(bot)</sub>	Junction-to-case(bottom) thermal resistance	11.6	°C/W

**PACKAGE/ORDERING INFORMATION**

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING <sup>(1)</sup>	PACKAGE OPTION
RS2299	RS2299XTQC16	-40°C ~125°C	QFN3X3-16	RS2299	Tape and Reel,5000

## NOTE:

- (1) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

## ELECTRICAL CHARACTERISTICS

$V_+ = 5.0\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	$V_+$	$T_A$	MIN	TYP	MAX	UNIT
<b>ANALOG SWITCH</b>								
Analog Signal Range	$V_{NO}, V_{NC}, V_{COM}$			FULL	0		$V_+$	V
On-Resistance	$R_{ON}$	$V_{NO}$ or $V_{NC} = V_+/2$ , $I_{COM} = -10\text{mA}$ , Switch ON, See Figure 4	5V	+25°C		4.5	8	$\Omega$
				FULL			8.5	$\Omega$
			3.3V	+25°C		7	10	$\Omega$
				FULL			10.5	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_{NO}$ or $V_{NC} = V_+/2$ , $I_{COM} = -10\text{mA}$ , Switch ON, See Figure 4	5V	+25°C		0.15	0.3	$\Omega$
				FULL			0.4	$\Omega$
			3.3V	+25°C		0.15	0.3	$\Omega$
				FULL			0.4	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+/2$ , $I_{COM} = -10\text{mA}$ , Switch ON, See Figure 4	5V	+25°C		2	3	$\Omega$
				FULL			3.3	$\Omega$
			3.3V	+25°C		3	4	$\Omega$
				FULL			4.3	$\Omega$
NC,NO OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NO}$ or $V_{NC} = 0.3\text{V}$ , $V_+/2$ $V_{COM} = V_+/2$ , $0.3\text{V}$ See Figure 5	1.8 to 5.5V	FULL			1	$\mu\text{A}$
NC,NO,COM ON Leakage Current	$I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_{NO}$ or $V_{NC} = 0.3\text{V}$ , Open $V_{COM} = \text{Open}$ , $0.3\text{V}$ See Figure 6	1.8 to 5.5V	FULL			1	$\mu\text{A}$
<b>DIGITAL CONTROL INPUTS<sup>(1)</sup></b>								
Input High Voltage	$V_{INH}$		5V	FULL	1.5			V
			3.3V	FULL	1.3			V
Input Low Voltage	$V_{INL}$		5V	FULL			0.6	V
			3.3V	FULL			0.5	V
Input Leakage Current	$I_{IN}$	$V_{IN} = V_{IO}$ or 0	1.8 to 5.5V	FULL			1	$\mu\text{A}$

(1) All unused digital inputs of the device must be held at  $V_{IO}$  or GND to ensure proper device operation.

**ELECTRICAL CHARACTERISTICS (continued)**
 $V_+ = 5.0\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	$V_+$	$T_A$	MIN	TYP	MAX	UNIT
<b>DYNAMIC CHARACTERISTICS</b>								
Turn-On Time	$t_{ON}$	$V_{COM} = V_+$ , $R_L = 300\Omega$ , $C_L = 35\text{pF}$ , See Figure 8	5V	$+25^\circ\text{C}$		30		ns
			3.3V			40		
Turn-Off Time	$t_{OFF}$	$V_{COM} = V_+$ , $R_L = 300\Omega$ , $C_L = 35\text{pF}$ , See Figure 8	5V	$+25^\circ\text{C}$		25		ns
			3.3V			30		
Break-Before-Make Time Delay	$t_{BBM}$	$V_{NO1} = V_{NC1} = V_{NO2} = V_{NC2} = 3\text{V}$ , $R_L = 300\Omega$ , $C_L = 35\text{pF}$ , See Figure 9	5V	$+25^\circ\text{C}$		5		ns
			3.3V			8		
Off Isolation	$O_{ISO}$	$R_L = 50\Omega$ , Switch OFF, See Figure 11	$f = 10\text{MHz}$	$+25^\circ\text{C}$		-52		dB
			$f = 1\text{MHz}$			-71		
-3dB Bandwidth	BW	Switch ON, $R_L = 50\Omega$ , See Figure 10		$+25^\circ\text{C}$		300		MHz
NC, NO OFF Capacitance	$C_{NC(OFF)}$ , $C_{NO(OFF)}$	$V_{NC}$ or $V_{NO} = V_+/2$ or GND, Switch OFF See Figure 7		$+25^\circ\text{C}$		5		pF
NC, NO, COM ON Capacitance	$C_{NC(ON)}$ , $C_{NO(ON)}$ , $C_{COM(ON)}$	$V_{NC}$ or $V_{NO} = V_+/2$ or GND, Switch ON See Figure 7		$+25^\circ\text{C}$		15		pF
<b>POWER REQUIREMENTS</b>								
Power Supply Range	$V_+$			FULL	1.8		5.5	V
Power Supply Current	$I_+$	$V_{IN} = \text{GND}$	5.5V	FULL			1	$\mu\text{A}$
		$V_{IN} = V_+$	5.5V	FULL			1	$\mu\text{A}$

### TYPICAL CHARACTERISTICS

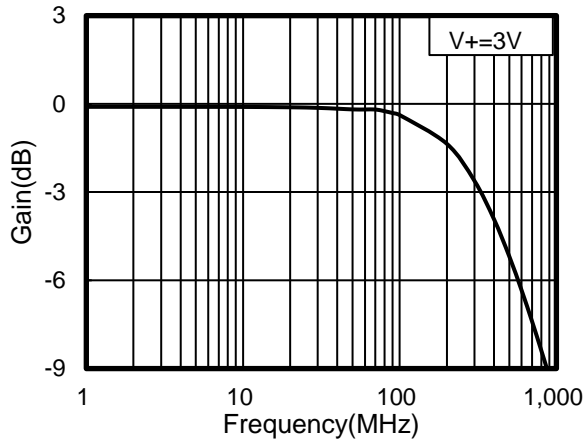


Figure 1. Bandwidth vs Frequency

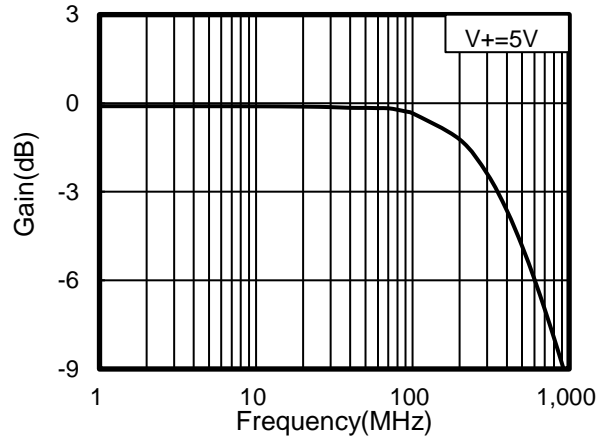


Figure 2. Bandwidth vs Frequency

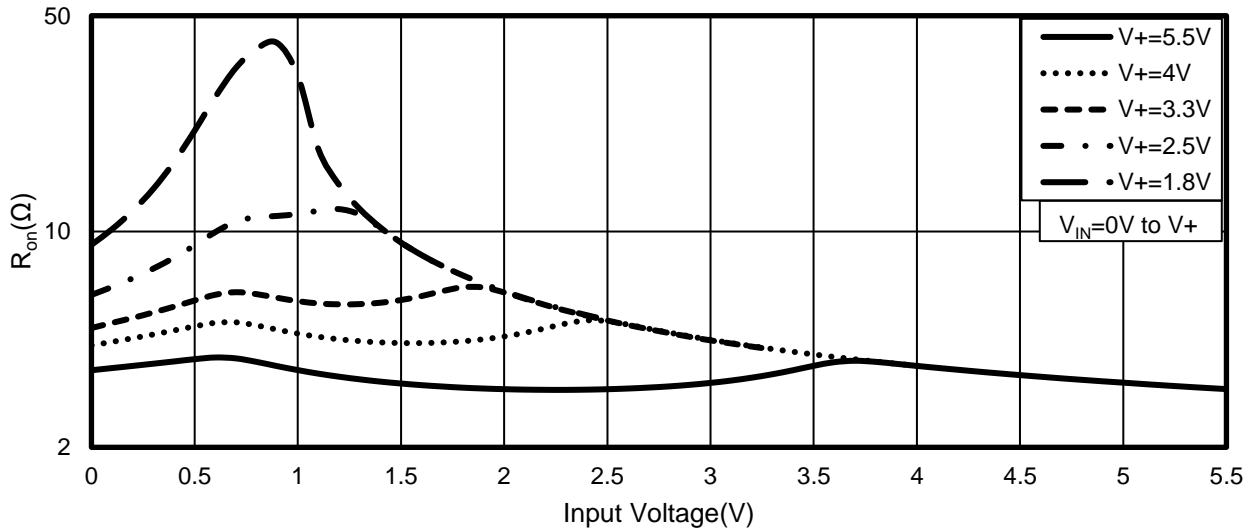


Figure 3. Typical Ron as a Function of Input Voltage



### Parameter Measurement Information

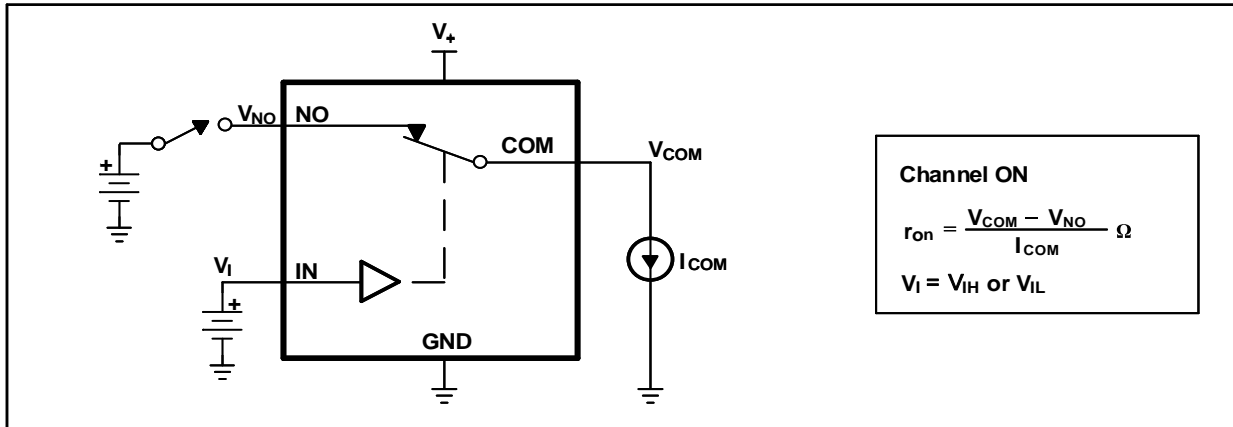


Figure 4. ON-State Resistance ( $R_{on}$ )

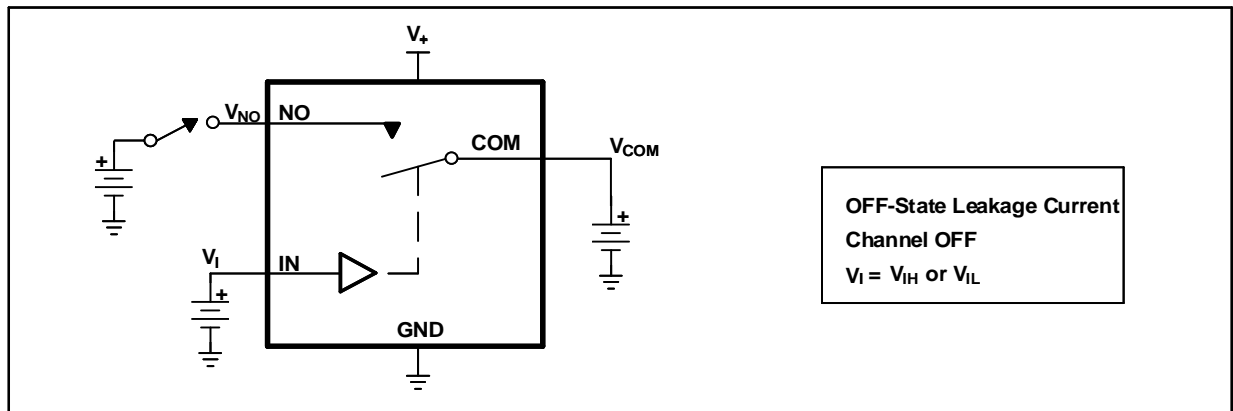


Figure 5. OFF-State Leakage Current ( $I_{COM (OFF)}$ ,  $I_{NO (OFF)}$ )

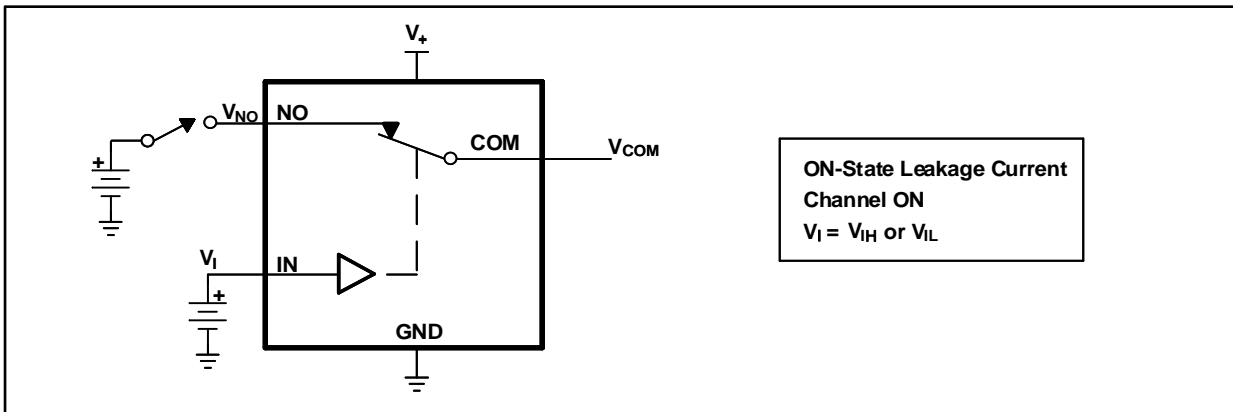


Figure 6. ON-State Leakage Current ( $I_{COM (ON)}$ ,  $I_{NO (ON)}$ )

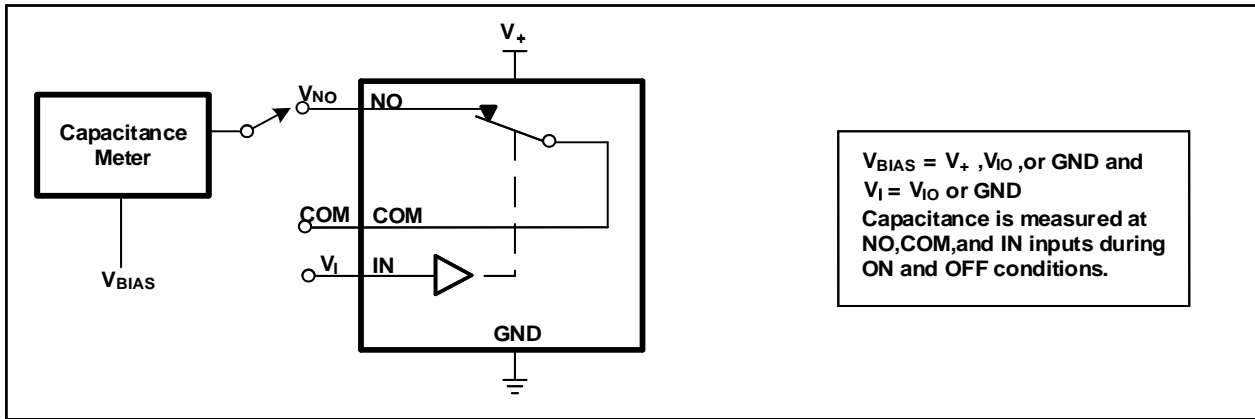


Figure 7. Capacitance ( $C_I$ ,  $C_{COM (OFF)}$ ,  $C_{COM (ON)}$ ,  $C_{NO (OFF)}$ ,  $C_{NO (ON)}$ )

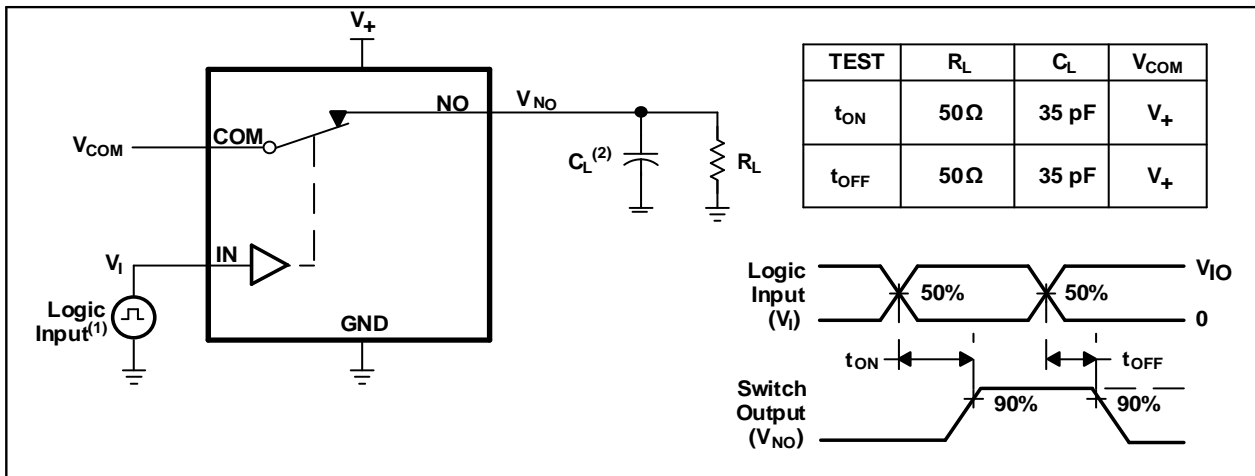


Figure 8. Turn-On ( $t_{ON}$ ) and Turn-Off Time ( $t_{OFF}$ )

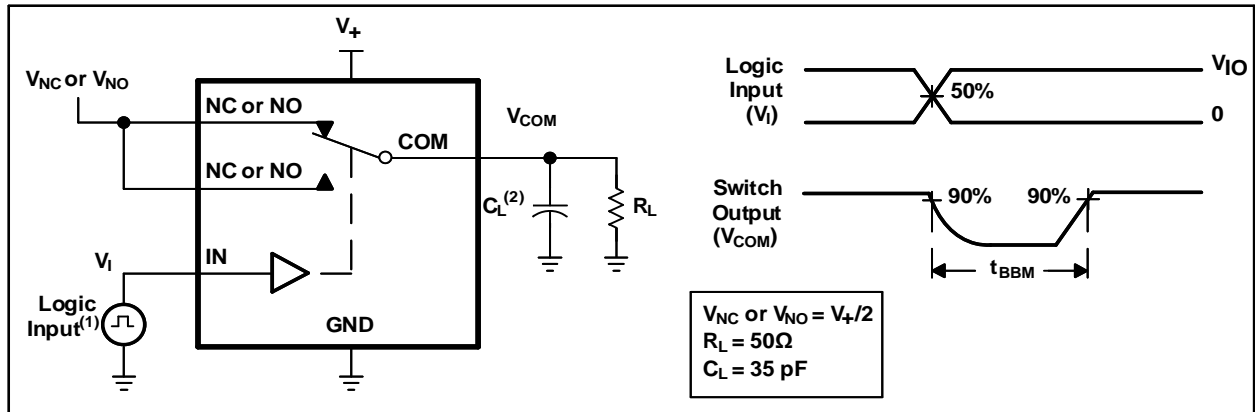


Figure 9. Break-Before-Make Time ( $t_{BBM}$ )

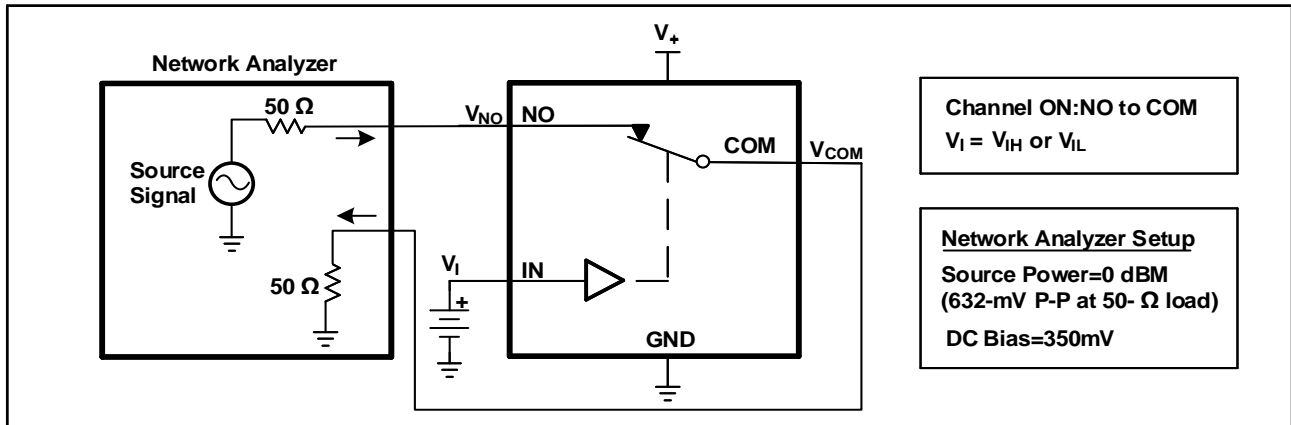


Figure 10. Bandwidth (BW)

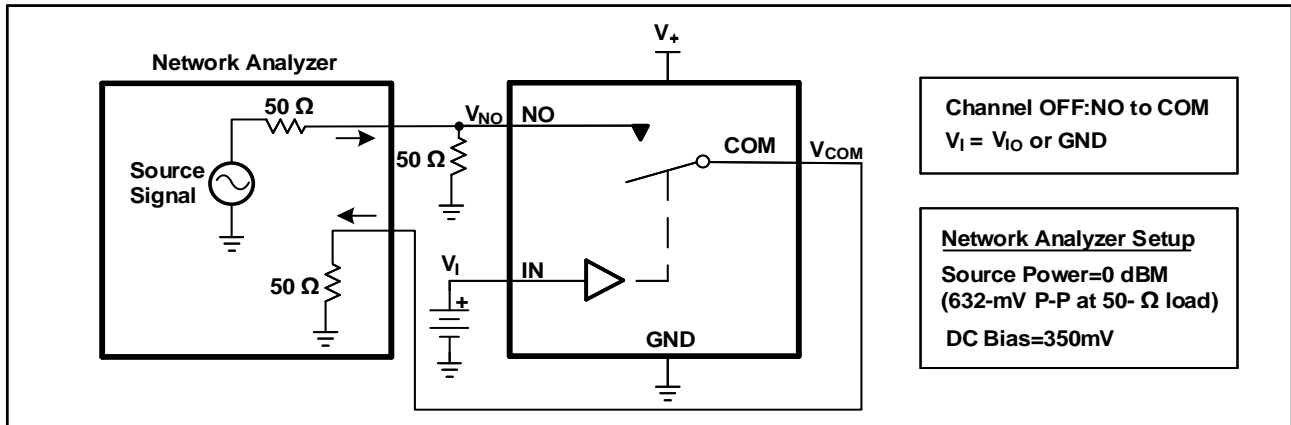


Figure 11. OFF Isolation ( $O_{Iso}$ )

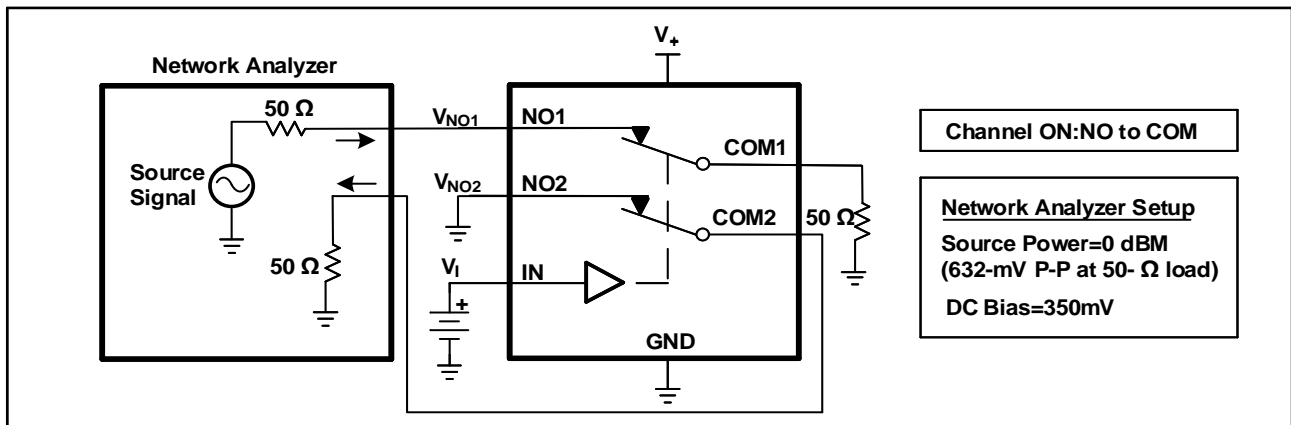


Figure 12. Crosstalk ( $X_{TALK}$ )

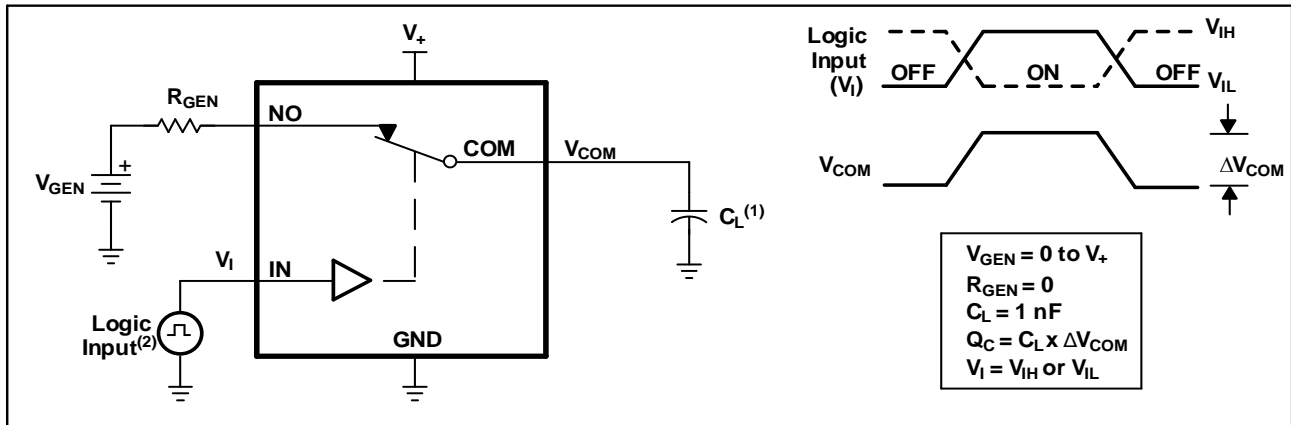


Figure 13. Charge Injection ( $Q_c$ )

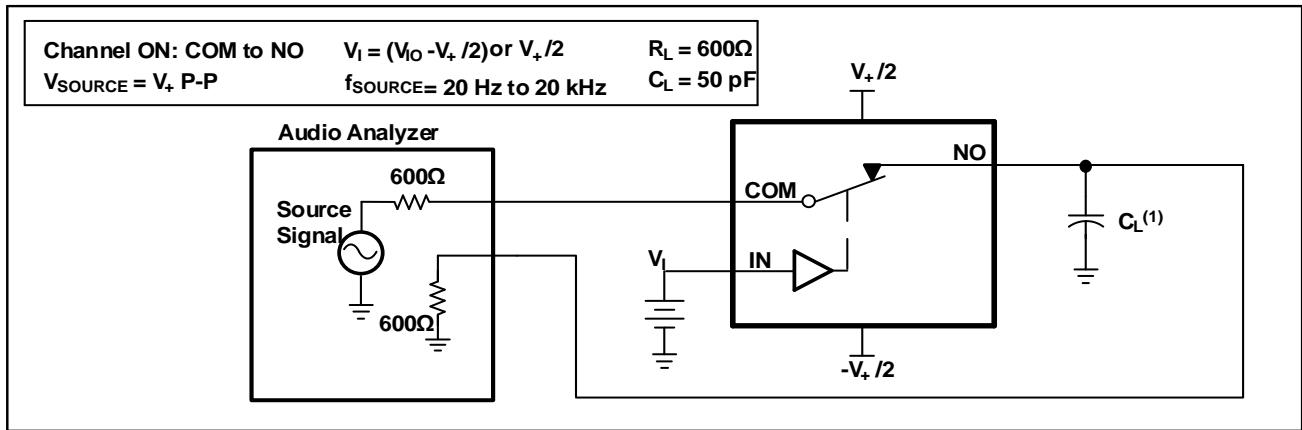
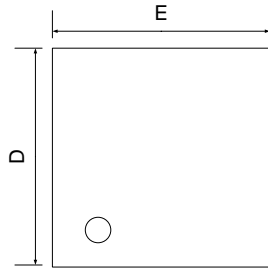


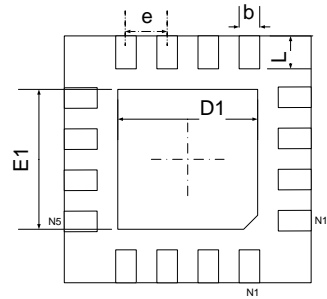
Figure 14. Total Harmonic Distortion (THD)

# PACKAGE OUTLINE DIMENSIONS

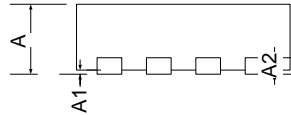
## QFN3X3-16



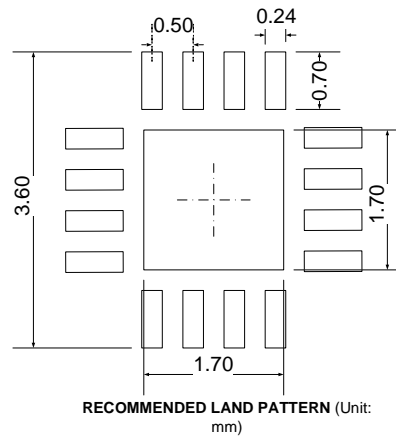
TOP VIEW



BOTTOM VIEW



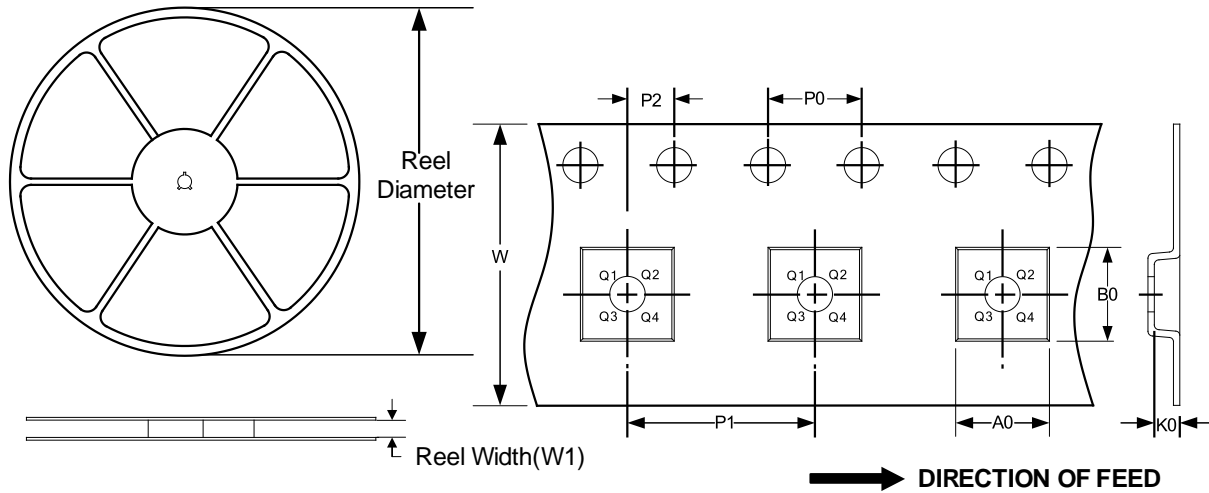
SIDE VIEW



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203		0.008	
b	0.180	0.300	0.007	0.012
D	2.900	3.100	0.114	0.122
D1	1.600	1.800	0.063	0.071
E	2.900	3.100	0.114	0.122
E1	1.600	1.800	0.063	0.071
e	0.500 TYP		0.020 TYP	
L	0.300	0.500	0.012	0.020

**TAPE AND REEL INFORMATION**  
**REEL DIMENSIONS**

**TAPE DIMENSION**



NOTE: The picture is only for reference. Please make the object as the standard.

**KEY PARAMETER LIST OF TAPE AND REEL**

Package Type	Reel Diameter	Reel Width(mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
QFN3X3-16	13"	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	Q1