

0.6Ω Quad SPDT Analog Switch 4-Channel 2:1 Multiplexer – Demultiplexer With Two Controls

FEATURES

- **Bandwidth: 30MHz**
- **High Speed, Typically 50ns**
- **Supply Range: +1.8V to +5.5V**
- **Low ON-State Resistance, 0.6Ω(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

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

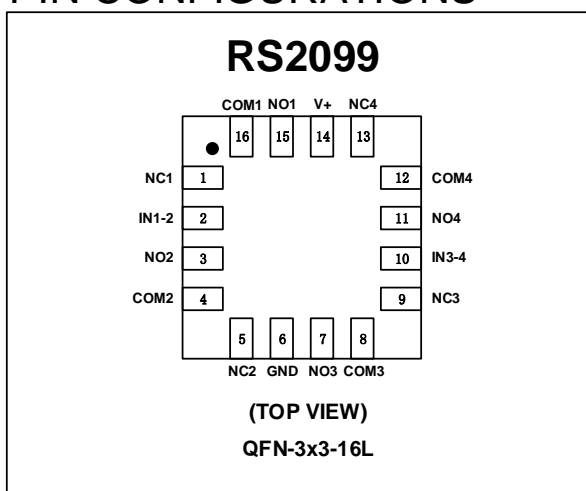
DESCRIPTION

The RS2099 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 channels double-pole double-throw (DPDT) configuration.

The RS2099 device can handle both analog and digital signals. It features bandwidth(30MHz) and low on-resistance (0.6Ω TYP).

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

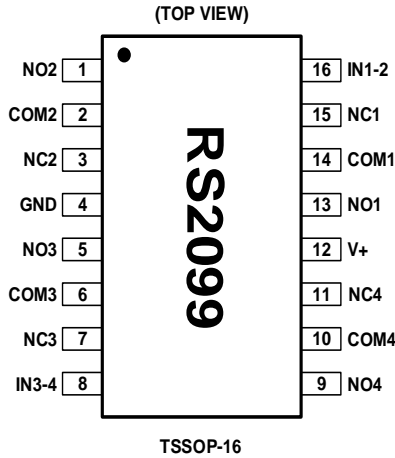
PIN CONFIGURATIONS



PIN DESCRIPTION

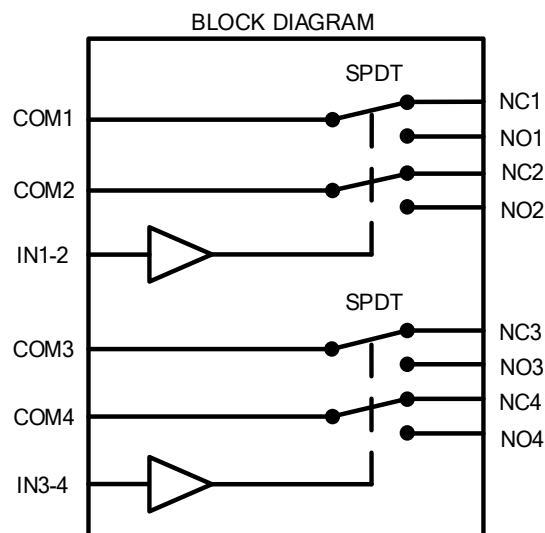
NAME	PIN	FUNCTION
V+	14	Power Supply
GND	6	Ground
IN1-2	2	Digital Control Pin
IN3-4	10	Digital Control Pin
COMx	16,4,8,12	Common Terminal
NOx	15,3,7,11	Normally-Open Terminal
NCx	1,5,9,13	Normally-Closed Terminal

PIN CONFIGURATIONS



PIN DESCRIPTION

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



SPECIFICATIONS

Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

SYMBOL	PARAMETER	MIN	MAX	UNIT
V+	Supply Voltage	-0.3	6.0	V
V _{IN}	Input Voltage (All inputs)	-0.3	(V ₊) +0.3	
I _{IN}	Continuous Current NO, NC or COM	-500	+500	mA
I _{PEAK}	Peak Current NO, NC, or COM	-800	+800	
T _J	Junction Temperature		150	°C
T _{stg}	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.

ESD Ratings

		VALUE	UNIT	
V _(ESD)	Electrostatic discharge	Human-body model (HBM)	±1000	V
		Machine Model (MM)	±100	V

Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted) ⁽³⁾

SYMBOL	PARAMETER	MIN	MAX	UNIT
V _{CC}	Supply Voltage	1.8	5.5	V
T _A	Operating temperature	-40	+125	°C

Thermal Information

THERMAL METRIC		RS2099		UNIT
		16 PINS		
		TSSOP-16	QFN3x3-16L	
R _{θJA}	Junction-to-ambient thermal resistance	110	41	°C/W
R _{θJC(top)}	Junction-to-case(top) thermal resistance	45.3	53.3	°C/W
R _{θJB}	Junction-to-board thermal resistance	56.9	26.6	°C/W
Ψ _{JT}	Junction-to-top characterization parameter	5.4	1.7	°C/W
Ψ _{JB}	Junction-to-board characterization parameter	56.3	26.6	°C/W
R _{θJC(bot)}	Junction-to-case(bottom) thermal resistance	N/A	11.6	°C/W

PACKAGE/ORDERING INFORMATION

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING ⁽¹⁾	PACKAGE OPTION
RS2099	RS2099XTQC16	-40°C ~125°C	QFN-3x3-16L	RS2099	Tape and Reel,5000
RS2099	RS2099XTSS16	-40°C ~125°C	TSSOP-16	RS2099	Tape and Reel,4000

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°C (unless otherwise noted))

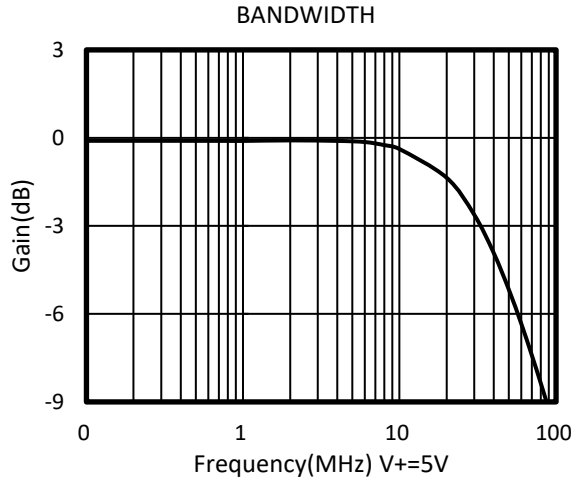
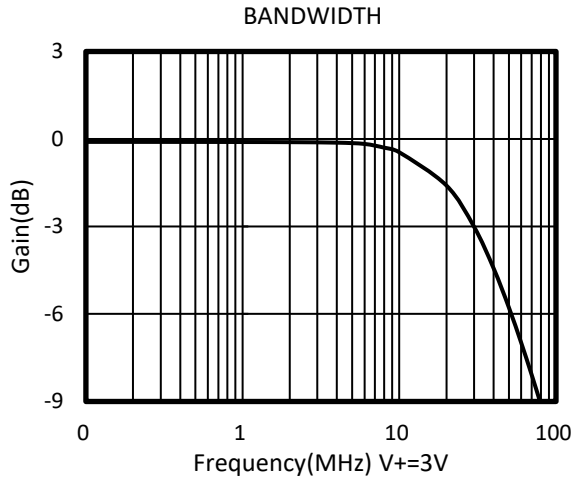
PARAMETER	SYMBOL	CONDITIONS	V+	T _A	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{NO} , V_{NC} , V_{COM}			FULL	0		V_+	V
On-Resistance	R_{ON}	V_{NO} or $V_{NC} = V_+/2$, $I_{COM} = -10\text{mA}$, Switch ON, See Figure 1	5V	+25°C		0.6	1.0	Ω
				FULL			1.2	Ω
			3.3V	+25°C		1.0	1.5	Ω
				FULL			1.7	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_{NO} or $V_{NC} = V_+/2$, $I_{COM} = -10\text{mA}$, Switch ON, See Figure 1	5V	+25°C		0.04	0.1	Ω
				FULL			0.12	Ω
			3.3V	+25°C		0.04	0.1	Ω
				FULL			0.12	Ω
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 1	5V	+25°C		0.18	0.3	Ω
				FULL			0.4	Ω
			3.3V	+25°C		0.54	0.7	Ω
				FULL			0.8	Ω
NC,NO OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NO} or $V_{NC} = 0.3\text{V}$, $V_+/2$ $V_{COM} = V_+/2$, 0.3V See Figure 2	1.8 to 5.5V	FULL			1	μA
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 $V_{COM} = \text{Open}$, 0.3V See Figure 2	1.8 to 5.5V	FULL			1	μA
DIGITAL CONTROL INPUTS⁽¹⁾								
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	μA

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

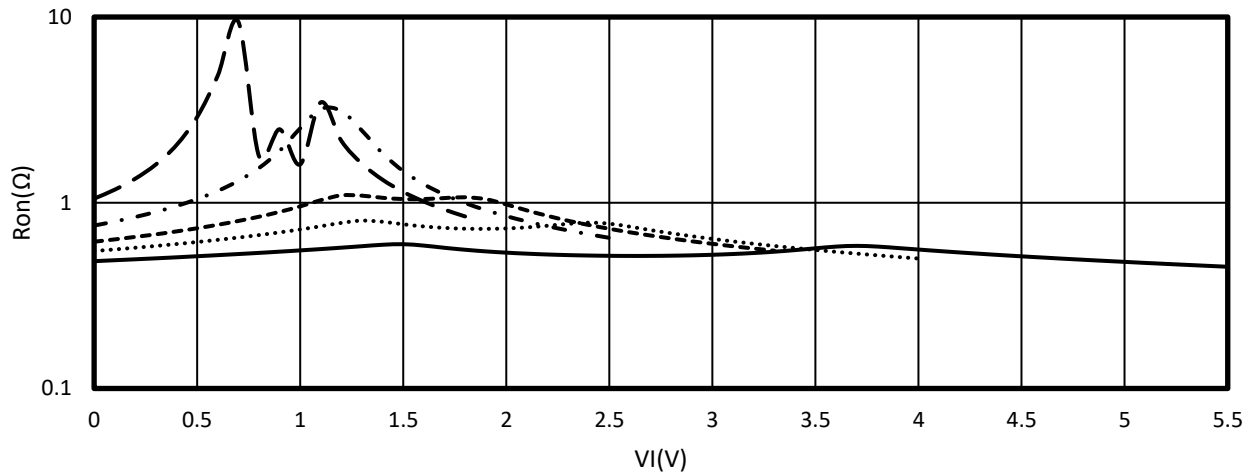
ELECTRICAL CHARACTERISTICS (continued)
 $V_+ = 5.0\text{ V}$, TEMP= -40°C to 125°C (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	V+	TEMP	MIN	TYP	MAX	UNITS
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	$V_{COM} = V_+$, $R_L = 300\Omega$, $C_L = 35\text{pF}$, See Figure 5	5V	+25°C		50		ns
			3.3V			50		
Turn-Off Time	t_{OFF}	$V_{COM} = V_+$, $R_L = 300\Omega$, $C_L = 35\text{pF}$, See Figure 5	5V	+25°C		15		ns
			3.3V			17		
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 6	5V	+25°C		10		ns
			3.3V			11		
Off Isolation	O_{ISO}	$R_L = 50\Omega$, Switch OFF, See Figure 8	f = 10MHz	+25°C		-68		dB
			f = 1MHz	+25°C		-86		dB
-3dB Bandwidth	BW	Switch ON, $R_L = 50\Omega$ See Figure 7		+25°C		30		MHz
NC,NO OFF Capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO}=V_+/2$ or GND, Switch OFF See Figure 4		+25°C		80		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 4		+25°C		350		pF
POWER REQUIREMENTS								
Power Supply Range	V_+			FULL	1.8		5.5	V
Power Supply Current	I_+	$V_{IN} = \text{GND or } V_+$	5.5V	FULL			1	μA

TYPICAL CHARACTERISTICS



Typical ron as a Function of Input Voltage (VI) for VI = 0 to V+



— V+=5.5V
..... V+=4V
- - - V+=3.3V
- · - V+=2.5V
- - - V+=1.8V

Parameter Measurement Information

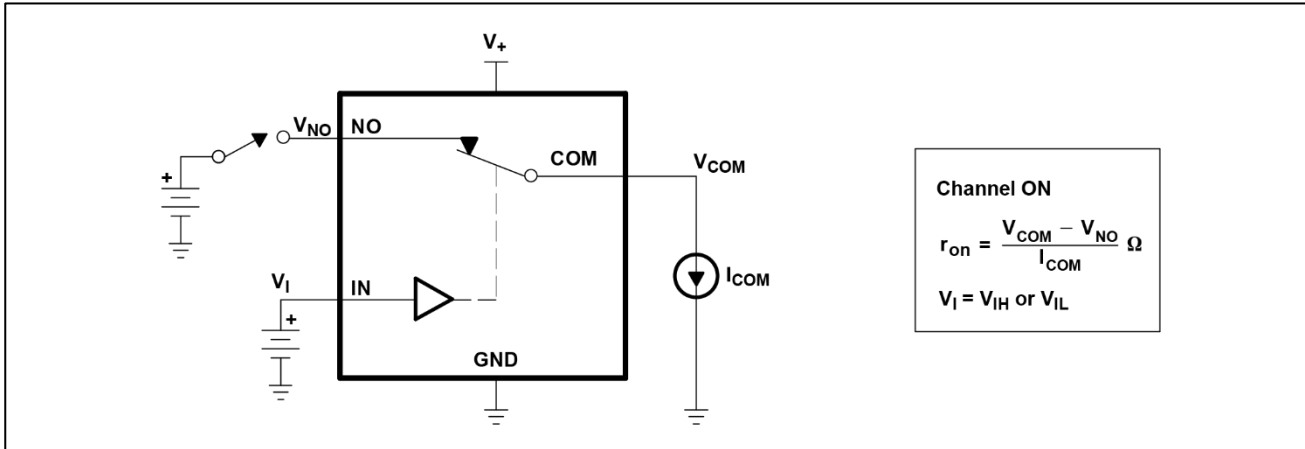


Figure 1.ON-State Resistance (r_{on})

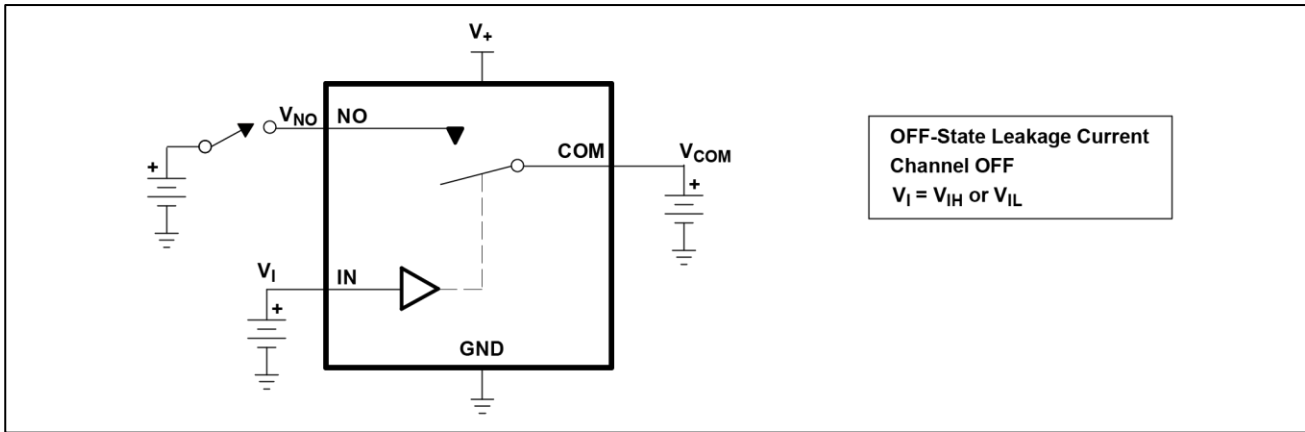


Figure 2.OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NO(OFF)}$)

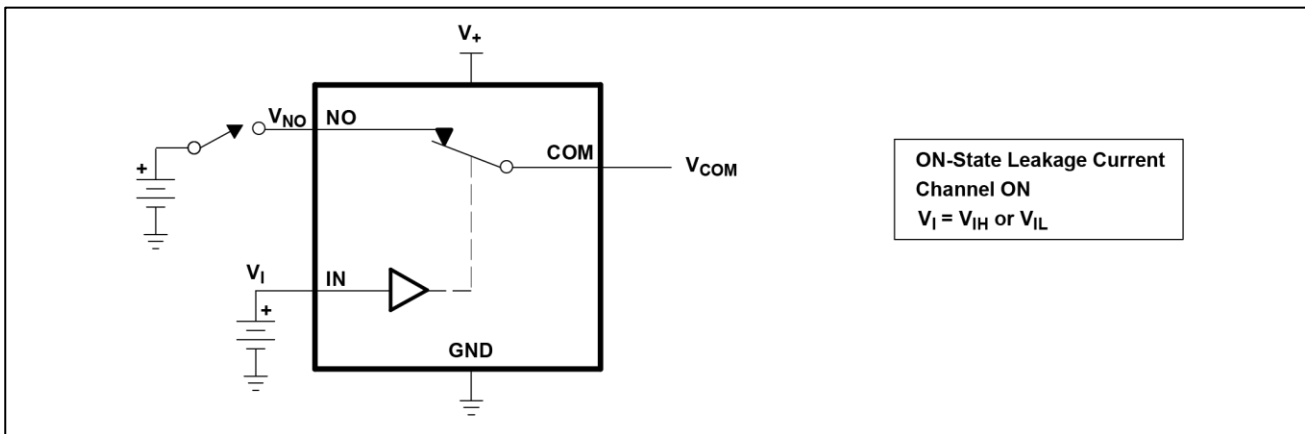


Figure 3.ON-State Leakage Current ($I_{COM(ON)}$, $I_{NO(ON)}$)

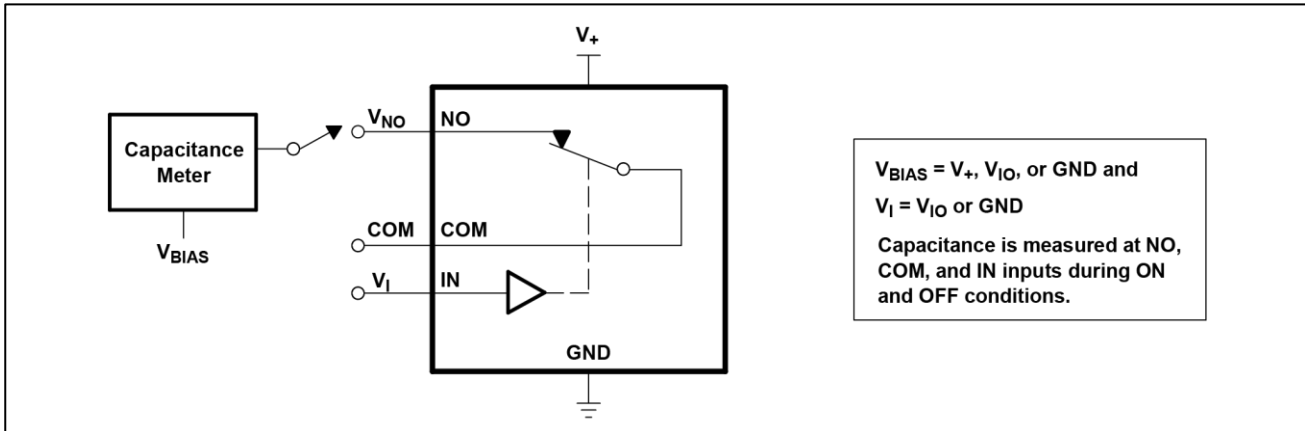


Figure 4. Capacitance (C_I , $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)

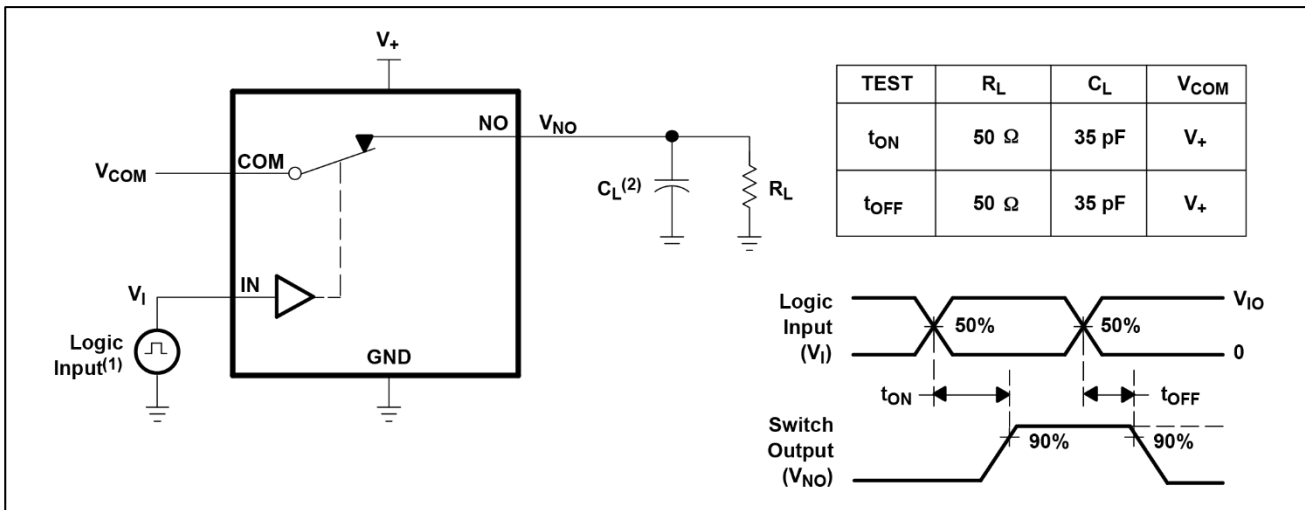


Figure 5. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

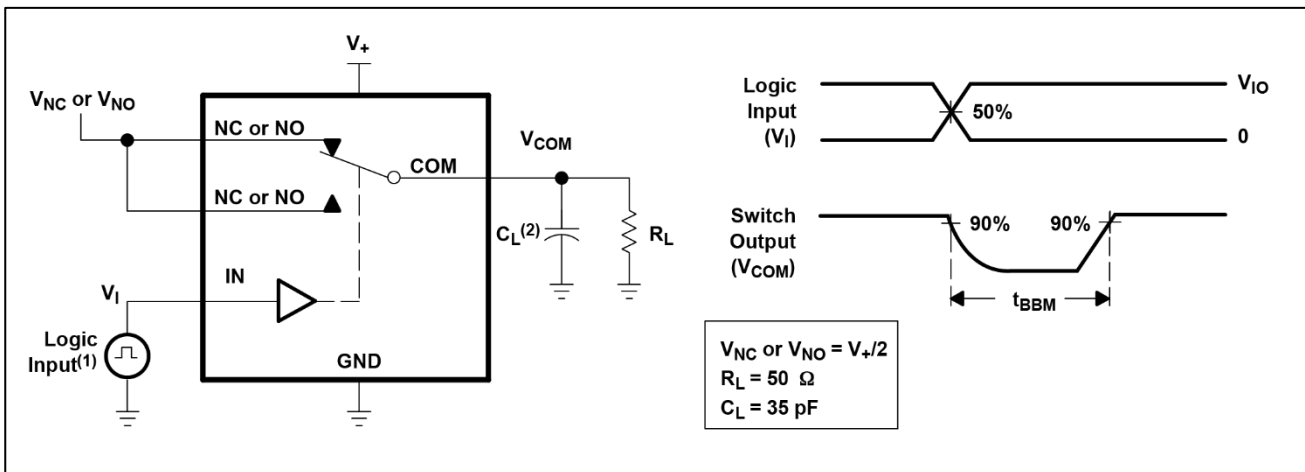


Figure 6. Break-Before-Make Time (t_{BBM})

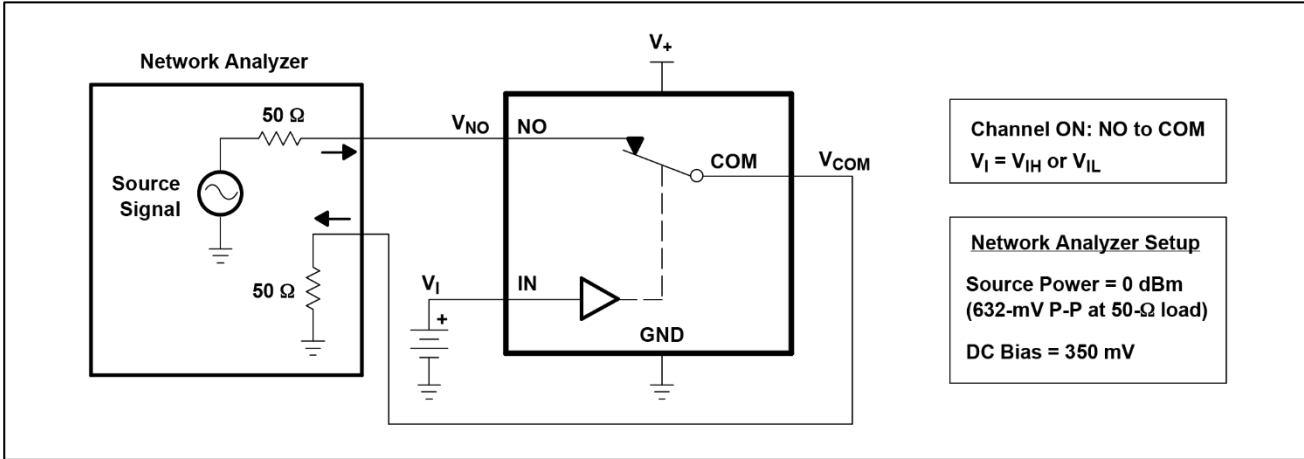


Figure 7. Bandwidth (BW)

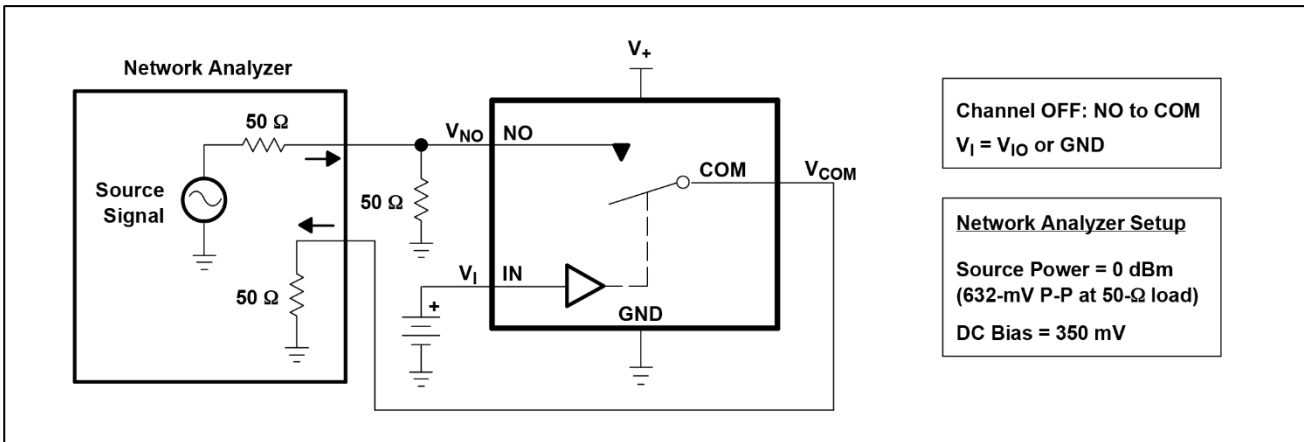


Figure 8. OFF Isolation (O_{Iso})

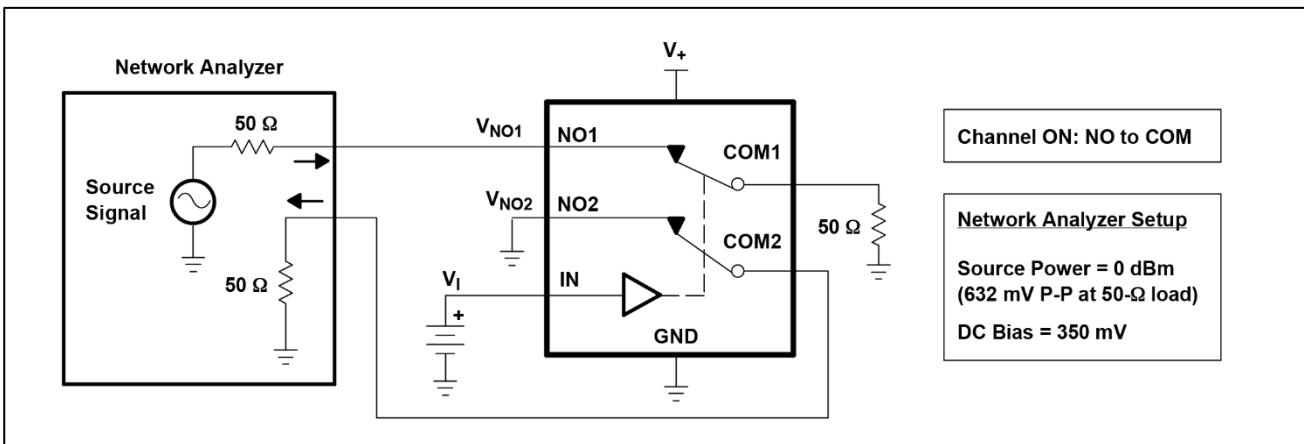


Figure 9. Crosstalk (X_{TALK})

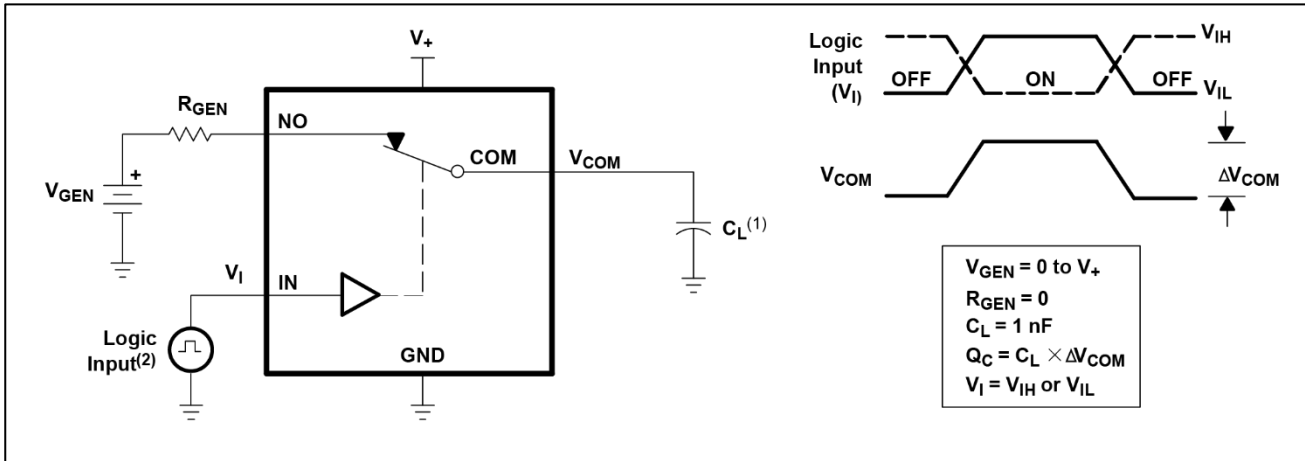


Figure 10. Charge Injection (Q_c)

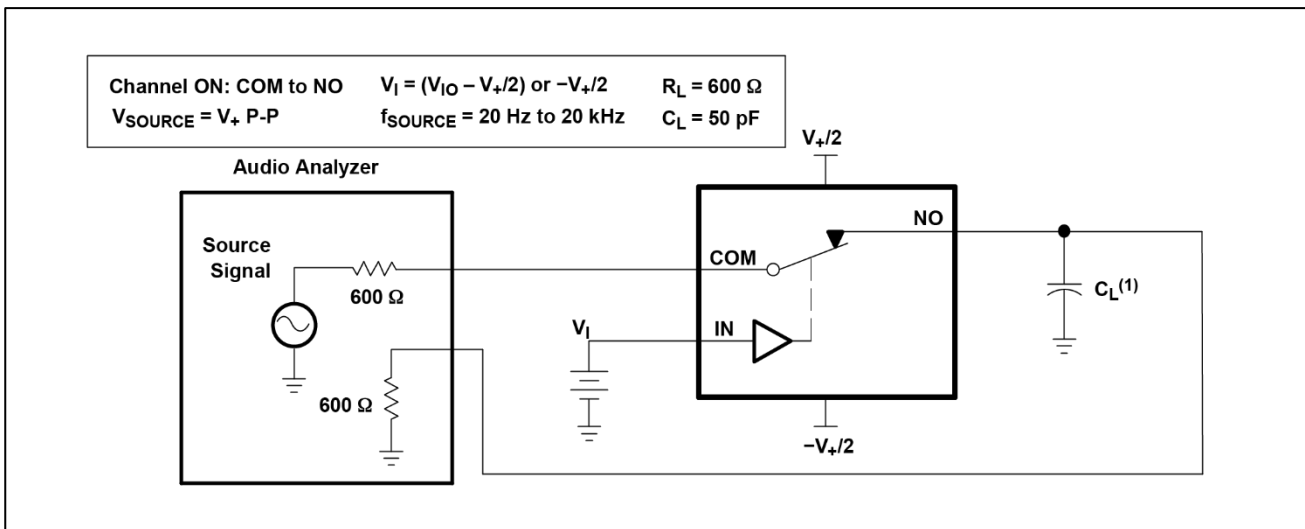
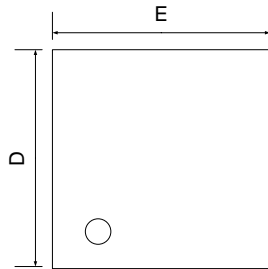


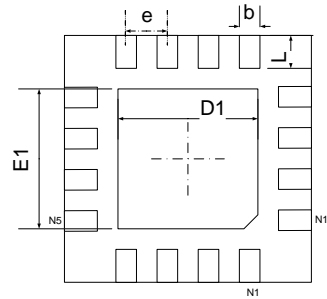
Figure 11. Total Harmonic Distortion (THD)

PACKAGE OUTLINE DIMENSIONS

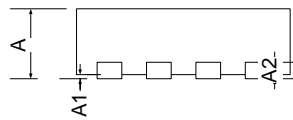
QFN-3x3-16L



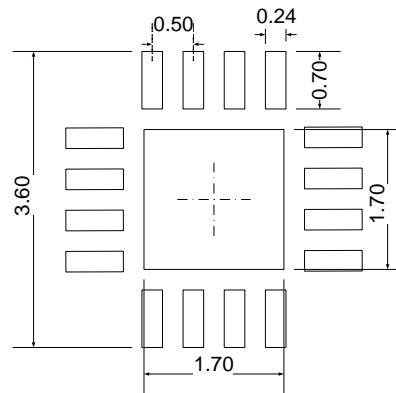
TOP VIEW



BOTTOM VIEW



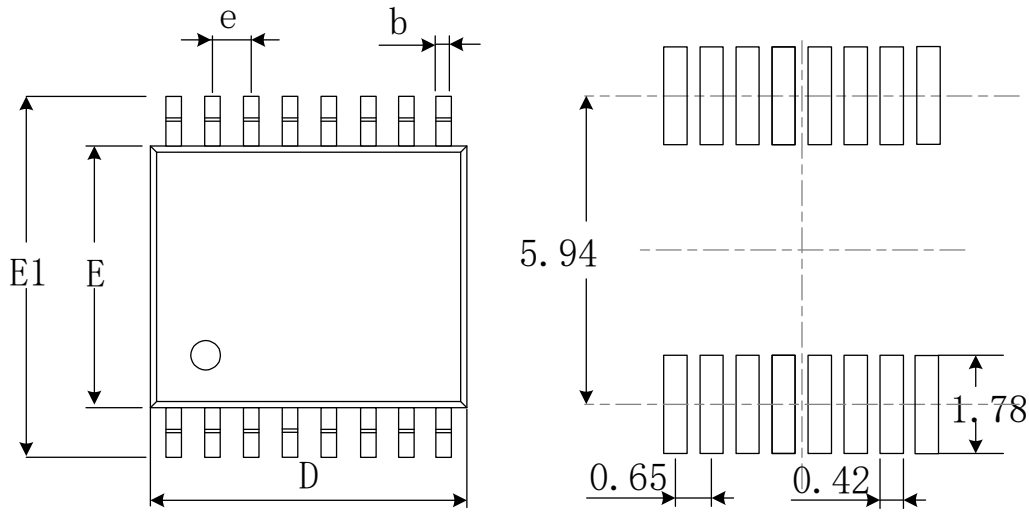
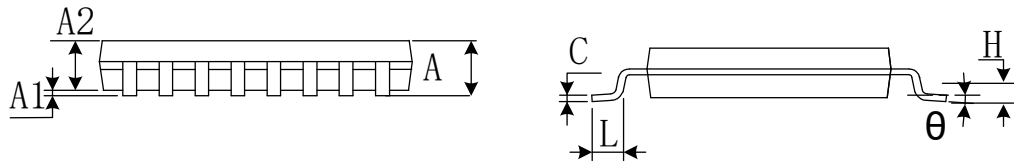
SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

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

TSSOP-16


RECOMMENDED LAND PATTERN (Unit: mm)


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650(BSC)		0.026(BSC)	
L	0.500	0.700	0.02	0.028
H	0.25TYP		0.01TYP	
θ	1°	7°	1°	7°