

# 0.8Ω, Low Ron, Dual SPDT Analog Switch with Negative Rail Capability

## FEATURES

- **Low ON-State Resistance:**0.8Ω (TYP)
- **Supply Range:** +2.5V to +5.5V
- **Negative Signal Swing Capability:** -2V to V<sub>+</sub>
- **Break-Before-Make Switching**
- **Fast Switching Times**
- **1.8V Logic Control**
- **Rail-to-Rail Input and Output Operation**
- **Extended Industrial Temperature Range:** -40°C to +85°C
- **Available in Green QFN-1.4x1.8-10L Package**

## DESCRIPTION

The RS2118 is a bidirectional, 2-channel single-pole double-throw (SPDT) analog switch that is designed to operate from 2.5V to 5.5V. The device features negative signal capability that allows signals below ground to pass through the switch without distortion.

The break-before-make feature prevents signal distortion during the transferring of a signal from one path to another. Low ON-state resistance, excellent channel-to-channel ON-state resistance matching, and minimal total harmonic distortion (THD) performance are ideal for audio applications. This device is available packaged in QFN-1.4x1.8-10L.

## APPLICATIONS

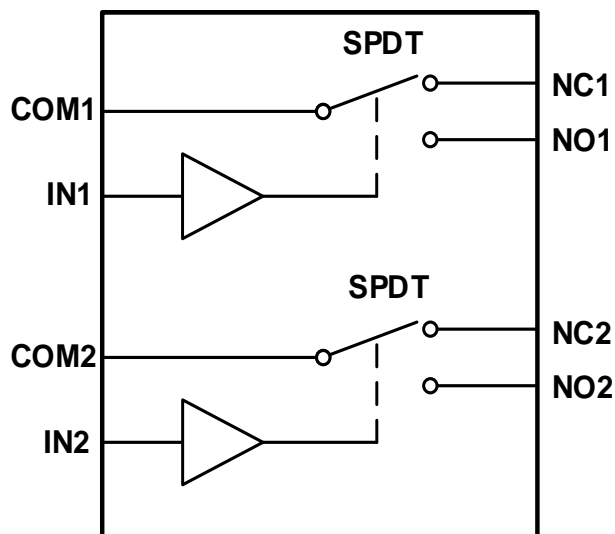
- **Wearable Devices**
- **Battery-Operated Equipment**
- **Portable Instrumentation**
- **Cell Phones**
- **Automation Test Equipment**
- **Relay Replacement**

### Device Information <sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS2118	QFN-1.4x1.8-10L	1.80mmx1.40mm

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

## Functional Block Diagram

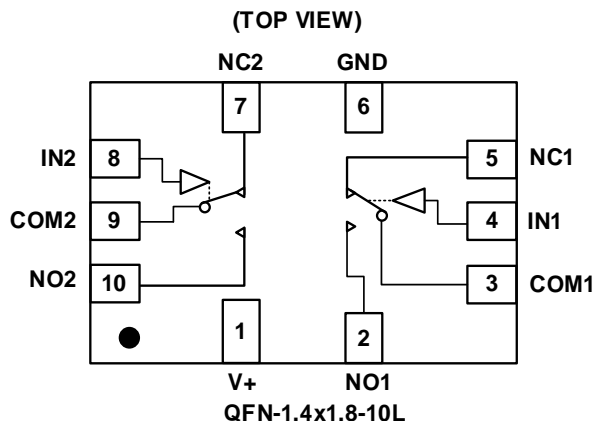


## Revision History

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

Version	Change Date	Change Item
B.2	2021/11/26	Added the TAPE AND REEL INFORMATION

## PIN CONFIGURATIONS



## PIN DESCRIPTION

NAME	PIN	FUNCTION
	QFN-1.4X1.8-10L	
V+	1	Power Supply
NO1, NO2	2,10	Normally-Open Terminal
COM1, COM2	3,9	Common Terminal
IN1, IN2	4,8	Digital Control Pin
NC1, NC2	5,7	Normally-Closed Terminal
GND	6	Ground

NOTE: NOX, NCX and COMX terminals may be an input or output.

## FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

NOTE: Switches shown for logic "0" input.

## 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	-0.3	6.0	
	Analog Voltage Range <sup>(2)</sup>	-2.0	(V <sub>+</sub> )+0.3	
	Digital Voltage Range <sup>(2)</sup>	-0.3	(V <sub>+</sub> )+0.3	
	Continuous Current NO, NC, or COM	-250	+250	mA
I <sub>PEAK</sub>	Peak Current NO, NC, or COM	-350	+350	
T <sub>J</sub>	Junction Temperature		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) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.3V beyond the supply rails should be current-limited to 10mA or less.

### ESD Ratings

		VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human-body model (HBM)	±2000
		Machine Model (MM)	±200

### Recommended Operating Conditions

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

SYMBOL	PARAMETER	MIN	MAX	UNIT
V <sub>CC</sub>	Supply Voltage	2.5	5.5	V
T <sub>A</sub>	Operating temperature	-40	+85	°C

### Thermal Information

THERMAL METRIC		RS2118	UNIT
		10 PINS	
		QFN-1.4x1.8-10L	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	120	°C/W
R <sub>θJC(top)</sub>	Junction-to-case(top) thermal resistance	46.0	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	44.5	°C/W
Ψ <sub>JT</sub>	Junction-to-top characterization parameter	1.5	°C/W
Ψ <sub>JB</sub>	Junction-to-board characterization parameter	44.5	°C/W
R <sub>θJC(bot)</sub>	Junction-to-case(bottom) thermal resistance	31.2	°C/W



## ELECTRICAL CHARACTERISTICS

$V_+ = 5.0\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	V+	T <sub>A</sub>	MIN	TYP	MAX	UNIT
<b>ANALOG SWITCH</b>								
Analog Signal Range	$V_{NO}, V_{NC}, V_{COM}$	$2.5\text{V} \leq V_+ \leq 3.5\text{V}$		FULL	-2.0		$V_+$	V
		$3.5\text{V} \leq V_+ \leq 5.5\text{V}$			$(V_+) - 5.5$	$V_+$		
On-Resistance	$R_{ON}$	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$ , $I_{COM} = -10\text{mA}$ , Switch ON, See Figure 4	5V	+25°C		0.8	1.1	$\Omega$
				FULL			1.3	$\Omega$
			3.3V	+25°C		1.3	1.8	$\Omega$
				FULL			2	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$ , $I_{COM} = -10\text{mA}$ , Switch ON, See Figure 4	5V	+25°C		0.15	0.25	$\Omega$
				FULL			0.3	$\Omega$
			3.3V	+25°C		0.15	0.25	$\Omega$
				FULL			0.3	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$ , $I_{COM} = -10\text{mA}$ , Switch ON, See Figure 4	5V	+25°C		0.15	0.25	$\Omega$
				FULL			0.3	$\Omega$
			3.3V	+25°C		0.4	0.6	$\Omega$
				FULL			0.7	$\Omega$
NC, NO OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NO} \text{ or } V_{NC} = 0.3\text{V}$ , $V_+/2$ , $V_{COM} = V_+/2$ , $0.3\text{V}$ See Figure 5	2.5V to 5.5V	FULL			1	$\mu\text{A}$
NC, NO, COM ON Leakage Current	$I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_{NO} \text{ or } V_{NC} = 0.3\text{V}$ , Open $V_{COM} = \text{Open}$ , $0.3\text{V}$ See Figure 6	2.5V 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			0.5	V
			3.3V	FULL			0.4	V
Input Leakage Current	$I_{IN}$	$V_{IN} = V_{IO} \text{ or } 0$	2.5V 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  $85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	V+	T <sub>A</sub>	MIN	TYP	MAX	UNIT
<b>DYNAMIC CHARACTERISTICS</b>								
Turn-On Time	t <sub>ON</sub>	V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, See Figure 8	5V	+25°C		15		ns
			3.3V			25		
Turn-Off Time	t <sub>OFF</sub>	V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, See Figure 8	5V	+25°C		10		ns
			3.3V			15		
Break-Before-Make Time Delay	t <sub>BBM</sub>	V <sub>NO1</sub> = V <sub>NC1</sub> = V <sub>NO2</sub> = V <sub>NC2</sub> = V <sub>+</sub> /2, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, See Figure 9	5V	+25°C		5		ns
			3.3V			10		
Charge Injection	Q	V <sub>G</sub> =GND, R <sub>G</sub> =0Ω, C <sub>L</sub> =1.0nF, See Figure 13.	5V	+25°C		80		pC
			3.3V	+25°C		74		
Off Isolation	O <sub>ISO</sub>	R <sub>L</sub> = 50Ω, Switch OFF, See Figure 11	f = 1MHz	+25°C		-70		dB
			f = 10MHz	+25°C		-50		dB
-3dB Bandwidth	BW	Switch ON, R <sub>L</sub> = 50Ω See Figure 10		+25°C		80		MHz
Channel-to-Channel Crosstalk	X <sub>TALK</sub>	Signal=0dBm, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, See Figure 12	f = 1MHz	+25°C		-72		dB
			f = 10MHz	+25°C		-52		dB
NC, NO OFF Capacitance	C <sub>NC(OFF)</sub> , C <sub>NO(OFF)</sub>	V <sub>NC</sub> or V <sub>NO</sub> =V <sub>+</sub> /2 or GND, Switch OFF See Figure 7		+25°C		40		pF
NC, NO, COM ON Capacitance	C <sub>NC(ON)</sub> , C <sub>NO(ON)</sub> , C <sub>COM(ON)</sub>	V <sub>NC</sub> or V <sub>NO</sub> =V <sub>+</sub> /2 or GND, Switch ON See Figure 7		+25°C		85		pF
<b>POWER REQUIREMENTS</b>								
Power Supply Range	V <sub>+</sub>			FULL	2.5		5.5	V
Power Supply Current	I <sub>+</sub>	V <sub>IN</sub> = GND or V <sub>+</sub>	5.5V	FULL			1	uA

### TYPICAL CHARACTERISTICS

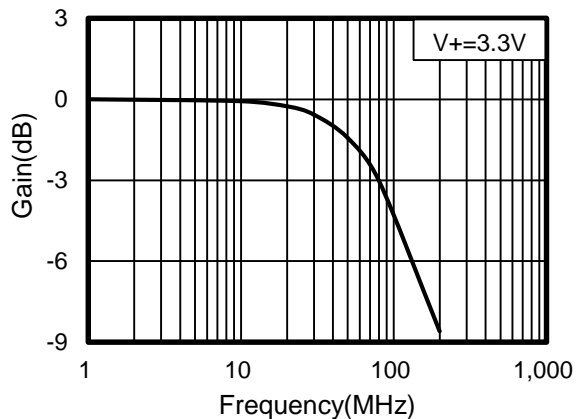


Figure 1. Bandwidth vs Frequency

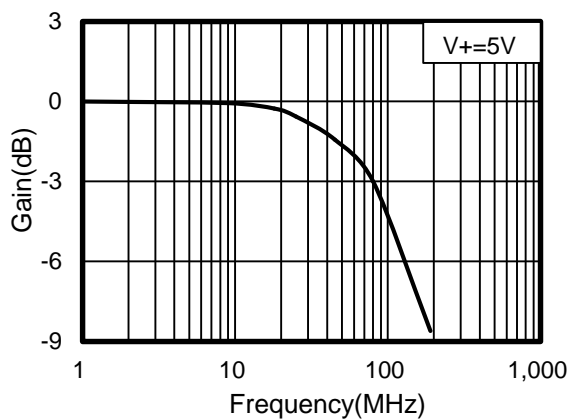


Figure 2. Bandwidth vs Frequency

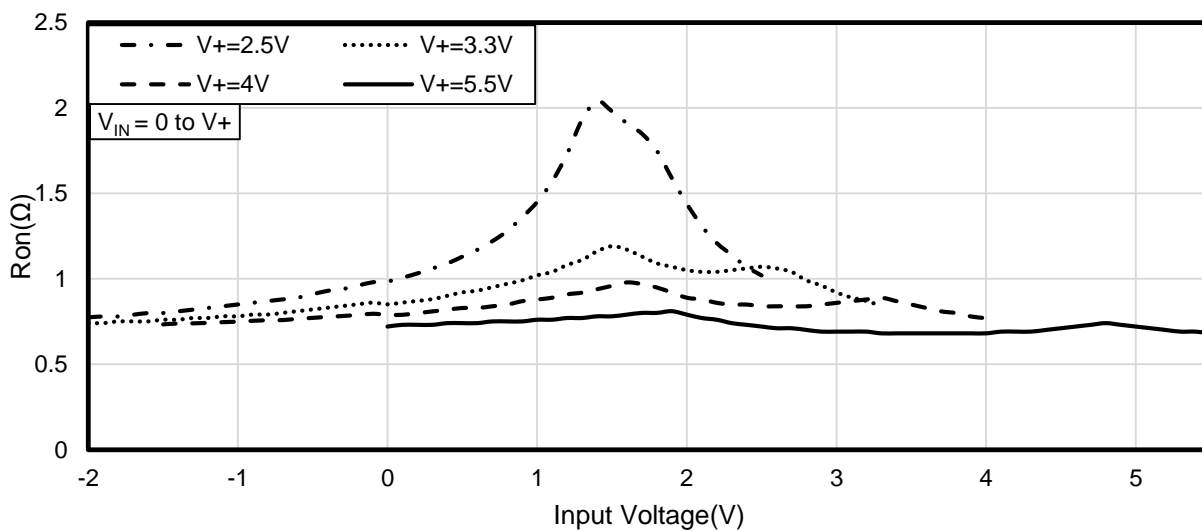


Figure 3. Typical Ron as a Function of Input Voltage



Parameter Measurement Information

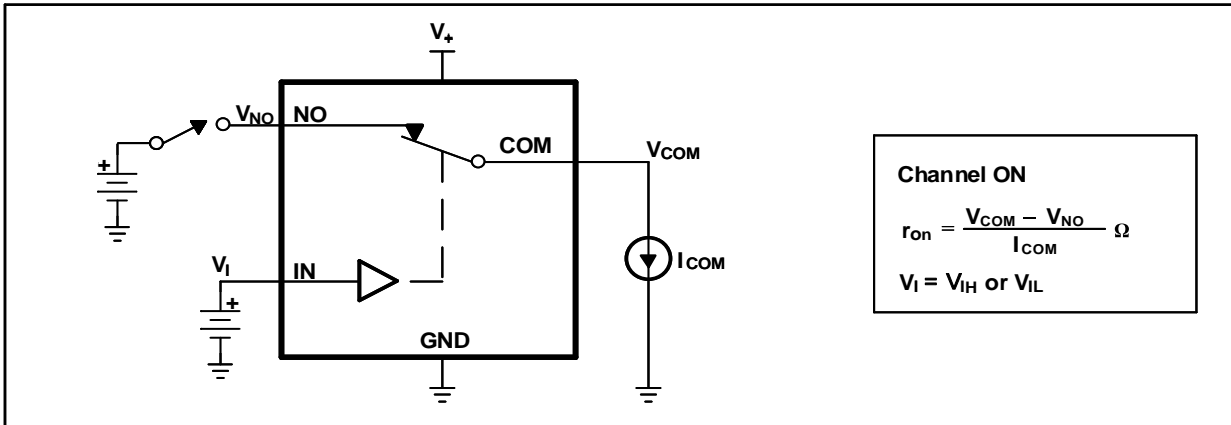


Figure 4. ON-State Resistance ( $R_{on}$ )

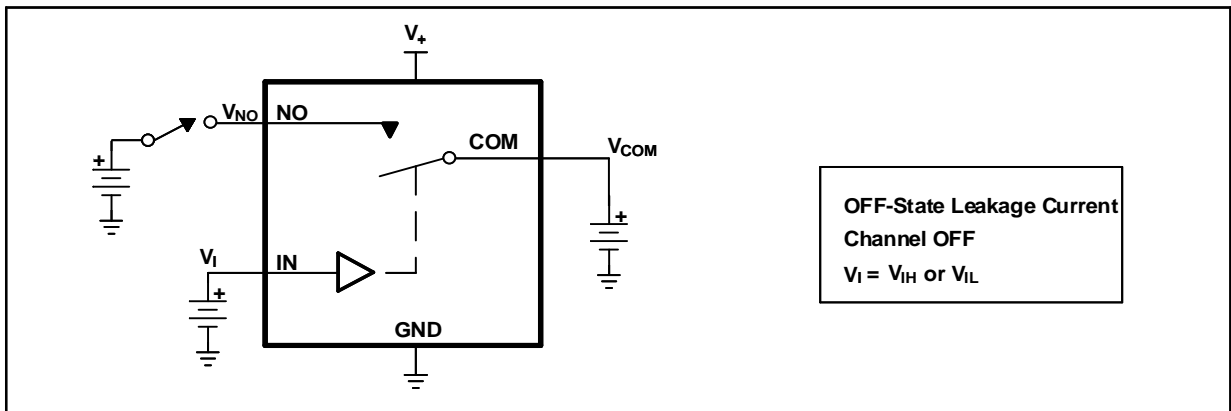


Figure 5. OFF-State Leakage Current ( $I_{COM (OFF)}$ ,  $I_{NO (OFF)}$ )

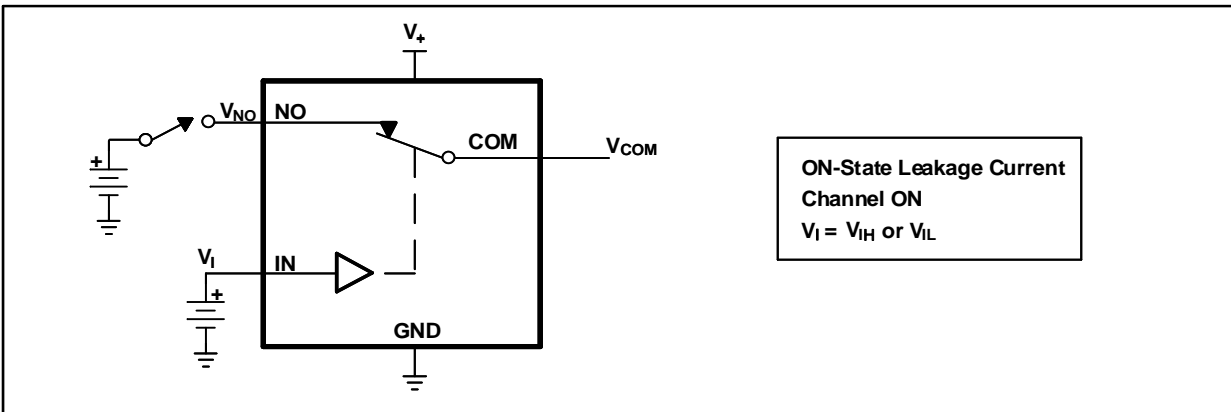


Figure 6. ON-State Leakage Current ( $I_{COM (ON)}$ ,  $I_{NO (ON)}$ )

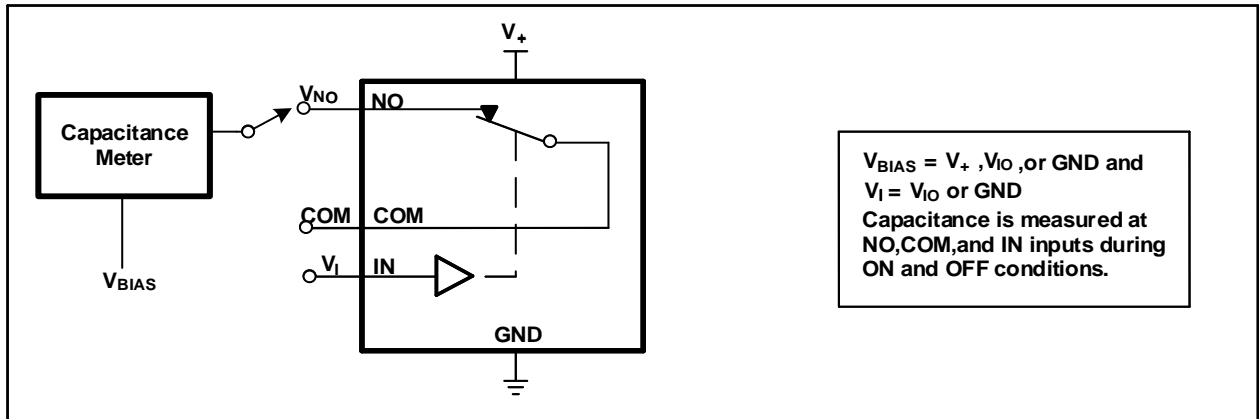


Figure 7. Capacitance ( $C_I$ ,  $C_{COM (OFF)}$ ,  $C_{COM (ON)}$ ,  $C_{NO (OFF)}$ ,  $C_{NO (ON)}$ )

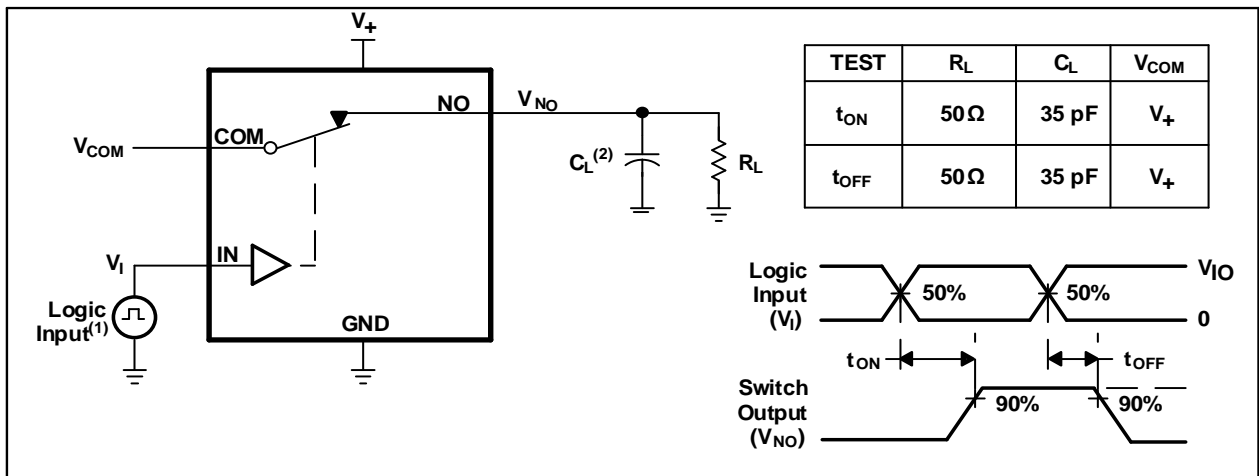


Figure 8. Turn-On ( $t_{ON}$ ) and Turn-Off Time ( $t_{OFF}$ )

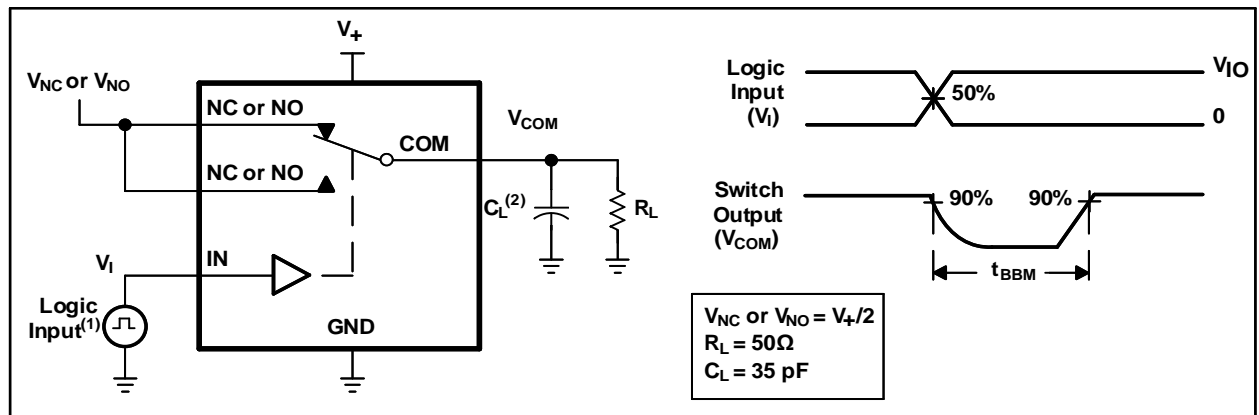


Figure 9. Break-Before-Make Time ( $t_{BBM}$ )

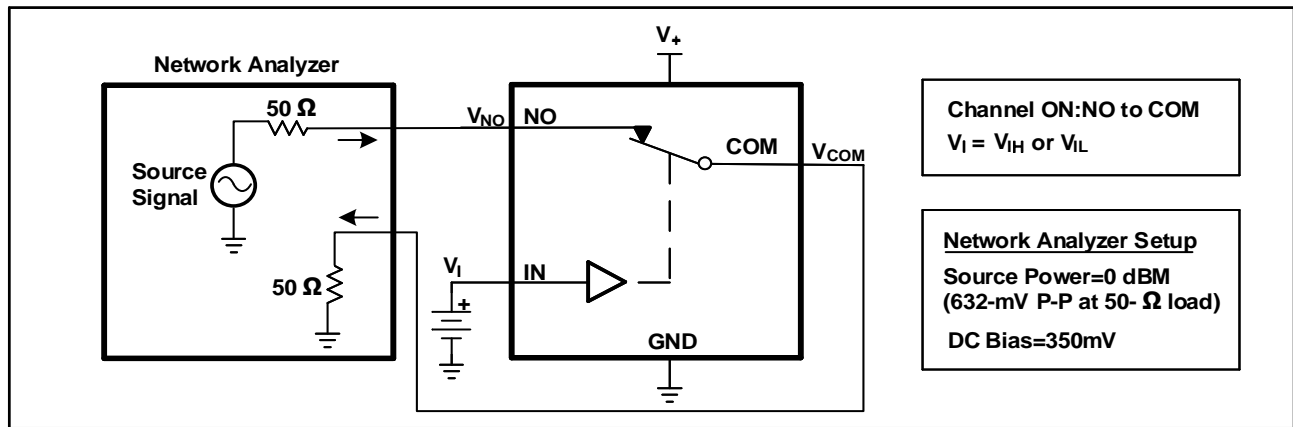


Figure 10. Bandwidth (BW)

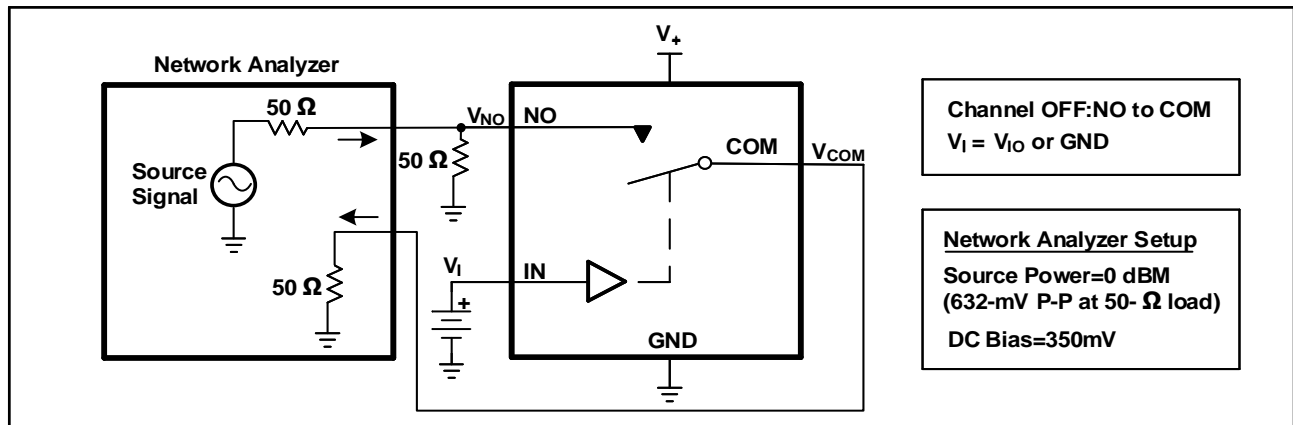


Figure 11. OFF Isolation ( $O_{ISO}$ )

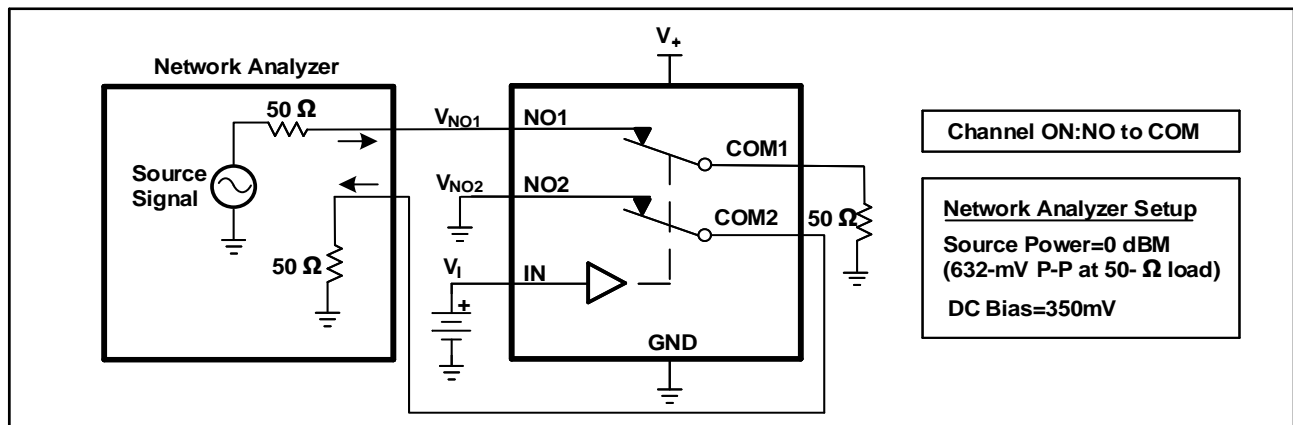


Figure 12. Crosstalk ( $X_{TALK}$ )

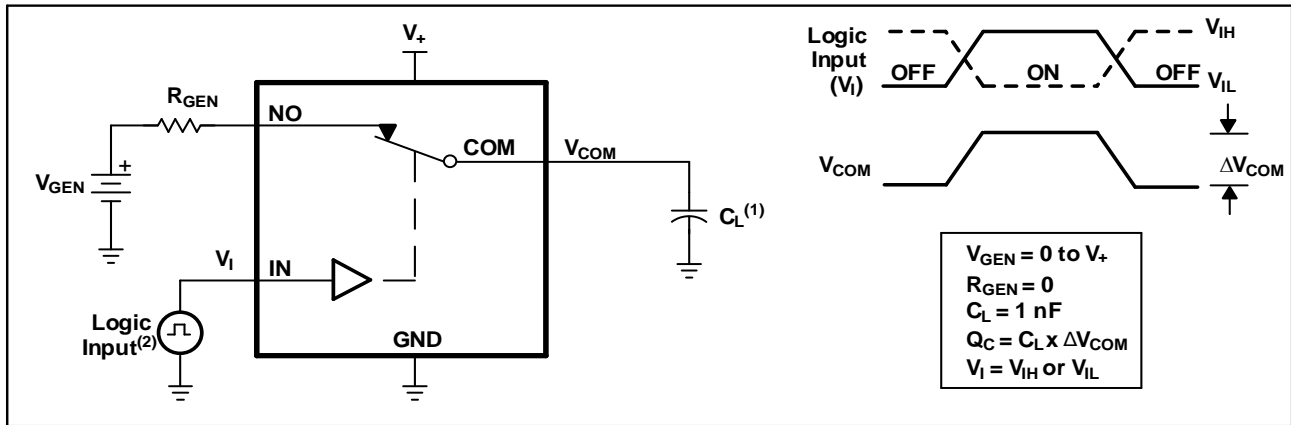


Figure 13. Charge Injection ( $Q_c$ )

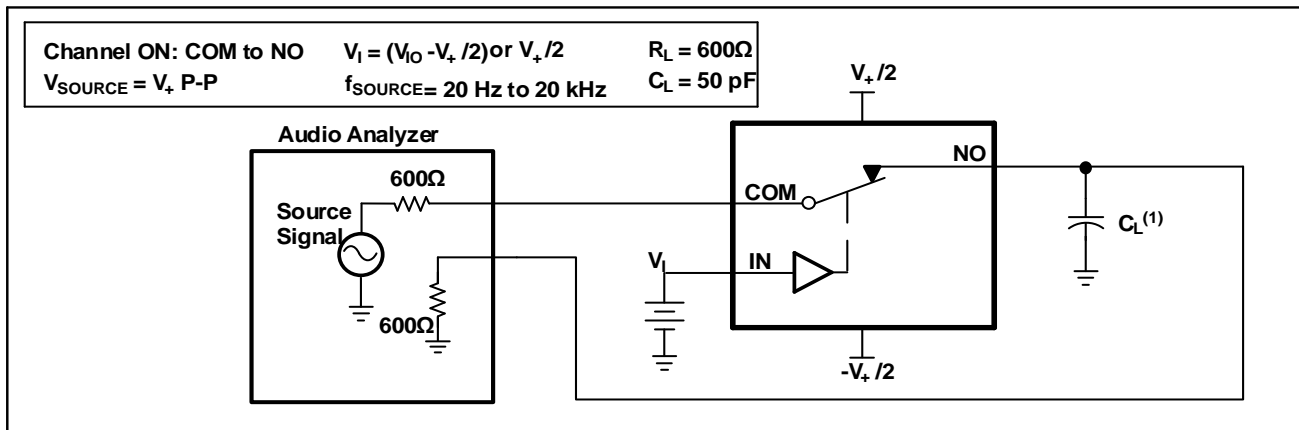
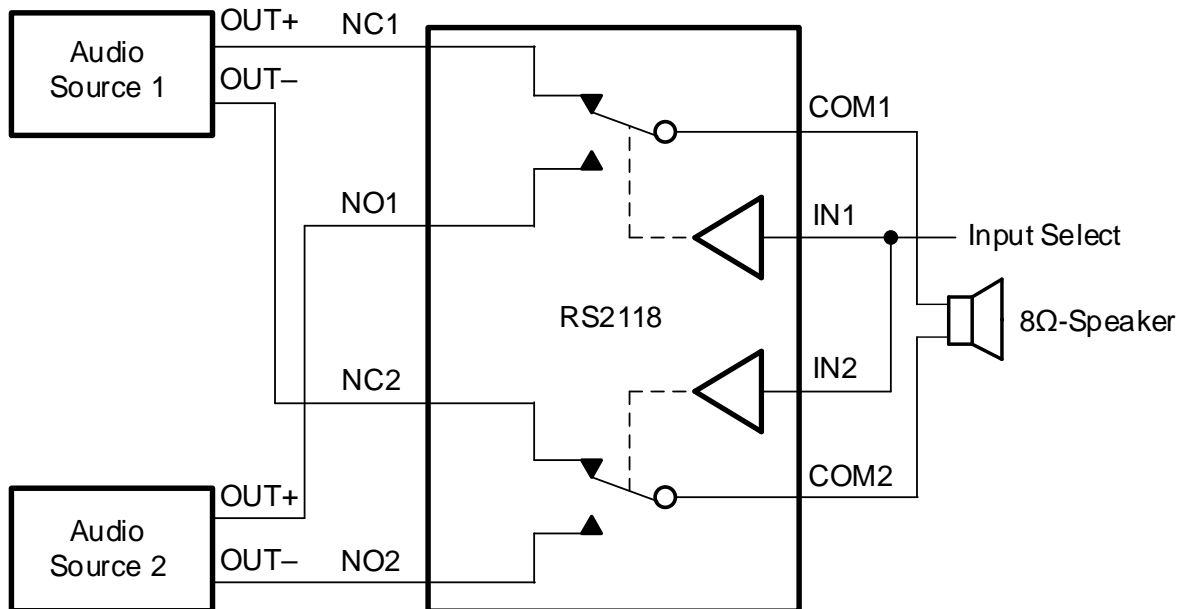


Figure 14. Total Harmonic Distortion (THD)

## TYPICAL APPLICATION

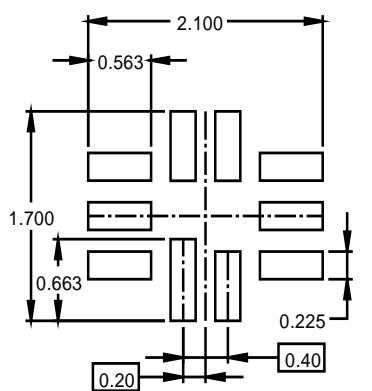
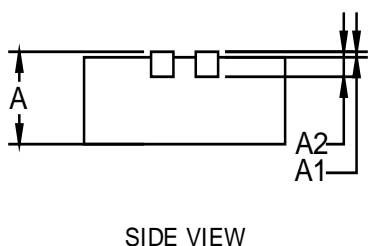
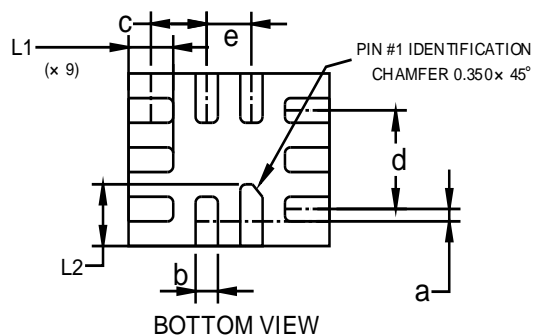
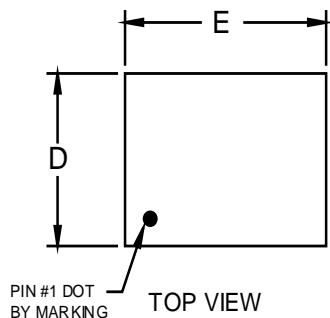
Ensure that the device is powered up with a supply voltage on VCC before a voltage can be applied to the signal paths NC and NO. All unused digital inputs of the device must be held at VCC or GND to ensure proper device operation. Tie the digitally controlled inputs select pins IN1 and IN2 to VCC or GND to avoid unwanted switch states that could result if the logic control pins are left floating.



**Figure 15. Typical Application Schematic**

# PACKAGE OUTLINE DIMENSIONS

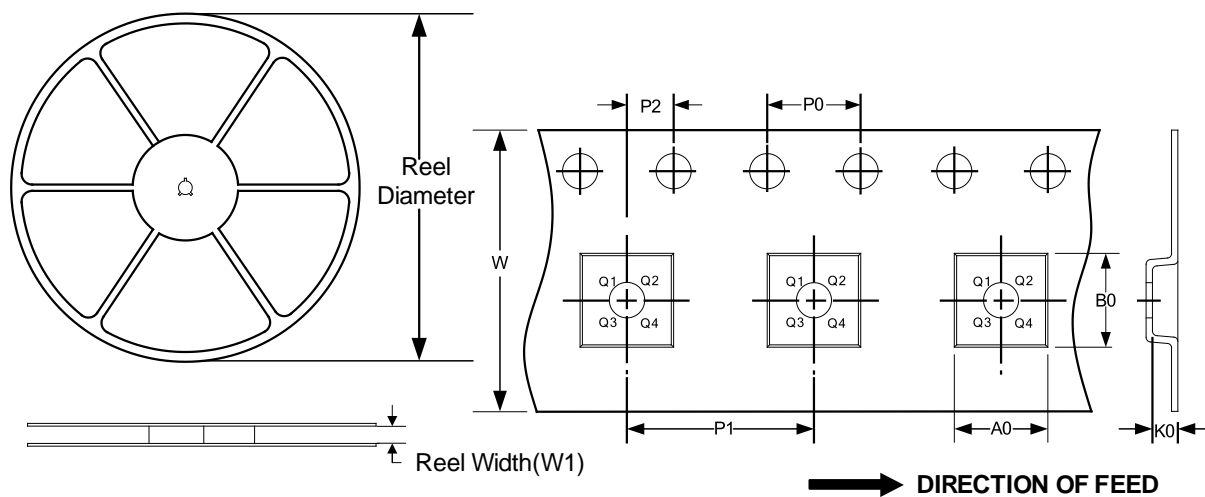
## QFN-1.4x1.8-10L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
a	0.050	0.150	0.002	0.006
b	0.150	0.250	0.006	0.010
c	0.450	0.550	0.018	0.022
d	0.800 REF		0.031 REF	
D	1.350	1.450	0.053	0.057
E	1.750	1.850	0.069	0.073
e	0.400 TYP		0.016 TYP	
L1	0.350	0.450	0.014	0.018
L2	0.450	0.550	0.018	0.022

**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
QFN-1.4x1.8-10L	7"	9.0	1.60	2.00	0.85	4.0	4.0	2.0	8.0	Q1