

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

## 1 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 UQFN1.4X1.8-10 Package**

## 2 APPLICATIONS

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

## 3 DESCRIPTIONS

The RS2118H 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.

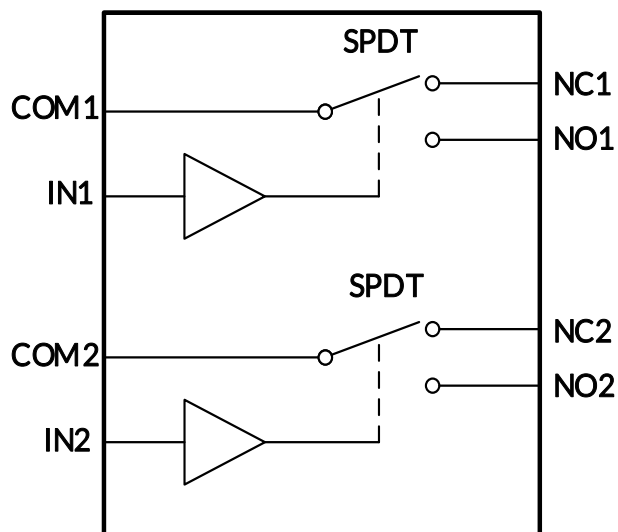
The break-before-make feature prevents signal distortion during the transferring of a signal from one path to another. Low ON-state resistance, excellent channel-to-channel ON-state resistance matching, and minimal total harmonic distortion (THD) performance are ideal for audio applications. This device is available packaged in UQFN1.4X1.8-10.

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

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS2118H	UQFN1.4X1.8-10	1.80mm×1.40mm

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

## 4 Functional Block Diagram



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## 5 Revision History

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

Version	Change Date	Change Item
A.1	2023/09/05	Initial version completed
A.2	2024/01/26	1. Added MSL on Page 4@RevA.1 2. Update ELECTRICAL CHARACTERISTICS on Page 8@RevA.1
A.2.1	2024/03/11	Modify packaging naming

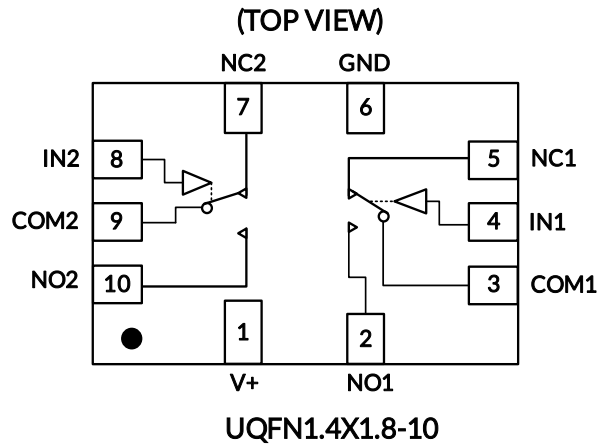
**6 PACKAGE/ORDERING INFORMATION <sup>(1)</sup>**

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING <sup>(2)</sup>	MSL <sup>(3)</sup>	PACKAGE OPTION
RS2118H	RS2118HYUTQK10	-40°C ~+85°C	UQFN1.4X1.8-10	2118	MSL3	Tape and Reel,4000

## NOTE:

- (1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.
- (2) 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.
- (3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

## 7 PIN CONFIGURATIONS



### 7.1 PIN DESCRIPTION

NAME	PIN	FUNCTION
	UQFN1.4X1.8-10	
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.

### 7.2 FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

NOTE: Switches shown for logic "0" input.

## 8 SPECIFICATIONS

### 8.1 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		
θ <sub>JA</sub>	Package thermal impedance <sup>(3)</sup>	UQFN1.4X1.8-10		115	°C/W
T <sub>J</sub>	Junction Temperature <sup>(4)</sup>		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.

(3) The package thermal impedance is calculated in accordance with JESD-51.

(4) The maximum power dissipation is a function of T<sub>J(MAX)</sub>, R<sub>θJA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any ambient temperature is P<sub>D</sub> = (T<sub>J(MAX)</sub> - T<sub>A</sub>) / R<sub>θJA</sub>. All numbers apply for packages soldered directly onto a PCB.

### 8.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

		VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human-body model (HBM), MIL-STD-883K METHOD 3015.9	±2000
		Charged-device model (CDM), ANSI/ESDA/JEDEC JS-002-2018	±1000
		Machine Model (MM), JESD22-A115C (2010)	±200



#### ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 8.3 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

## 8.4 ELECTRICAL CHARACTERISTICS

V+ = 5.0 V, T<sub>A</sub> = -40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	V+	T <sub>A</sub>	MIN <sup>(2)</sup>	TYP <sup>(3)</sup>	MAX <sup>(2)</sup>	UNIT
<b>ANALOG SWITCH</b>								
Analog Signal Range	V <sub>NO</sub> , V <sub>NC</sub> , V <sub>COM</sub>	2.5V ≤ V+ ≤ 3.5V		FULL	-2.0		V+	V
		3.5V ≤ V+ ≤ 5.5V			(V+)-5.5		V+	
On-Resistance	R <sub>ON</sub>	0 ≤ (V <sub>NO</sub> or V <sub>NC</sub> ) ≤ V+, I <sub>COM</sub> = -10mA, Switch ON, See Figure 2	5V	+25°C		0.8	1.1	Ω
				FULL			1.3	Ω
			3.3V	+25°C		1.3	1.8	Ω
				FULL			2	Ω
On-Resistance Match Between Channels	ΔR <sub>ON</sub>	0 ≤ (V <sub>NO</sub> or V <sub>NC</sub> ) ≤ V+, I <sub>COM</sub> = -10mA, Switch ON, See Figure 2	5V	+25°C		0.15	0.25	Ω
				FULL			0.3	Ω
			3.3V	+25°C		0.15	0.25	Ω
				FULL			0.3	Ω
On-Resistance Flatness	R <sub>FLAT(ON)</sub>	0 ≤ (V <sub>NO</sub> or V <sub>NC</sub> ) ≤ V+, I <sub>COM</sub> = -10mA, Switch ON, See Figure 2	5V	+25°C		0.15	0.25	Ω
				FULL			0.3	Ω
			3.3V	+25°C		0.5	0.6	Ω
				FULL			0.7	Ω
NC, NO OFF Leakage Current	I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 0V, V+ V <sub>COM</sub> = V+, 0V See Figure 3	5V	FULL			±1	uA
		V <sub>NO</sub> or V <sub>NC</sub> = -2V, V+ V <sub>COM</sub> = V+, -2V See Figure 3	3.3V	FULL			±1.5	uA
NC, NO, COM ON Leakage Current	I <sub>NC(ON)</sub> , I <sub>NO(ON)</sub> , I <sub>COM(ON)</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 0V, V+ V <sub>COM</sub> = V+, 0V or floating See Figure 4	5V	FULL			±1	uA
		V <sub>NO</sub> or V <sub>NC</sub> = -2V, V+ V <sub>COM</sub> = V+, -2V or floating See Figure 4	3.3V	FULL			±1.5	uA
<b>DIGITAL CONTROL INPUTS <sup>(1)</sup></b>								
Input High Voltage	V <sub>INH</sub>		5V	FULL	1.5			V
			3.3V	FULL	1.3			V
Input Low Voltage	V <sub>INL</sub>		5V	FULL			0.5	V
			3.3V	FULL			0.4	V
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>IO</sub> or 0	2.5V to 5.5V	FULL			±1	uA

(1) All unused digital inputs of the device must be held at V<sub>IO</sub> or GND to ensure proper device operation.

(2) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.

(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

**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> = 50Ω, C <sub>L</sub> = 35pF, See Figure 6	5V	+25°C		33		ns
			3.3V			40		
		V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, See Figure 6	5V			15		
			3.3V			25		
Turn-Off Time	t <sub>OFF</sub>	V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, See Figure 6	5V	+25°C		54		ns
			3.3V			67		
		V <sub>COM</sub> = V <sub>+</sub> , R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, See Figure 6	5V			10		
			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> = 50Ω, C <sub>L</sub> = 35pF, See Figure 7	5V	+25°C		15		ns
			3.3V			17		
		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 7	5V			5		
			3.3V			10		
Charge Injection	Q	V <sub>G</sub> =GND, R <sub>G</sub> =0Ω, C <sub>L</sub> =1.0nF, See Figure 11.	5V	+25°C		55		pC
			3.3V	+25°C		35		
Off Isolation	O <sub>ISO</sub>	R <sub>L</sub> = 50Ω, Switch OFF, See Figure 9	f = 100kHz	+25°C		-70		dB
			f = 1MHz	+25°C		-50		dB
-3dB Bandwidth	BW	Switch ON, R <sub>L</sub> = 50Ω See Figure 8		+25°C		80		MHz
Channel-to-Channel Crosstalk	X <sub>TALK</sub>	R <sub>L</sub> = 50Ω, See Figure 10	f = 100kHz	+25°C		-72		dB
			f = 1MHz	+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 5		+25°C		30		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 5		+25°C		60		pF
Total Harmonic Distortion	THD	V <sub>NC</sub> or V <sub>NO</sub> = 2V <sub>PP</sub> , R <sub>L</sub> =600Ω, f = 20Hz to 20kHz, See Figure 12	3.3V	+25°C		0.03		%
		V <sub>NC</sub> or V <sub>NO</sub> = 2V <sub>PP</sub> , R <sub>L</sub> =32Ω, f = 20Hz to 20kHz, See Figure 12		+25°C		0.1		%
		V <sub>NC</sub> or V <sub>NO</sub> = 1V <sub>PP</sub> , R <sub>L</sub> =32Ω, f = 20Hz to 20kHz, See Figure 12		+25°C		0.035		%
		V <sub>NC</sub> or V <sub>NO</sub> = 0.5V <sub>PP</sub> , R <sub>L</sub> =32Ω, f = 20Hz to 20kHz, See Figure 12		+25°C		0.027		%
<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



### 8.5 TYPICAL CHARACTERISTICS

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

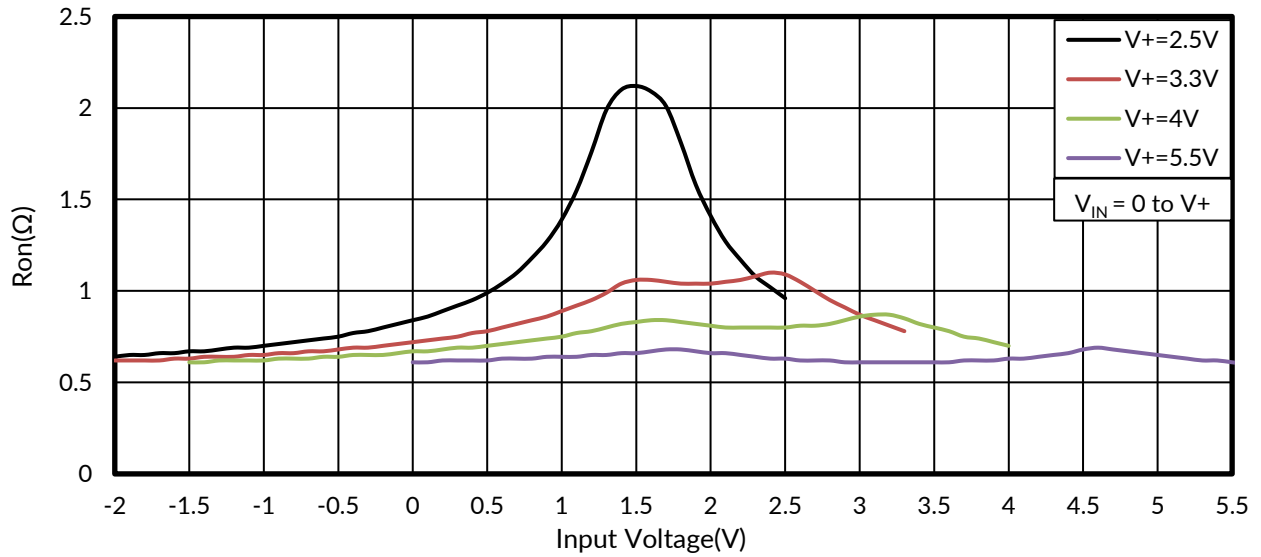
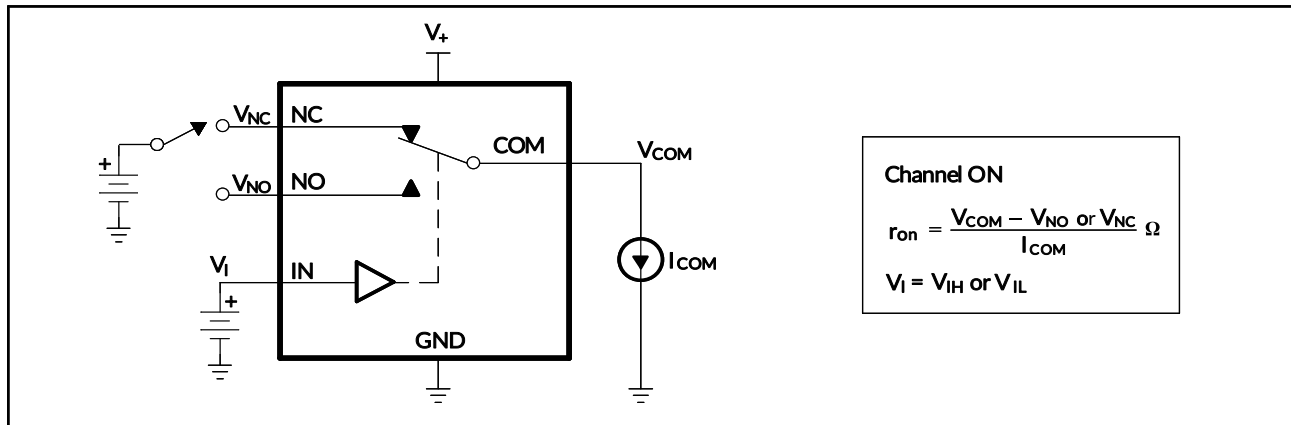
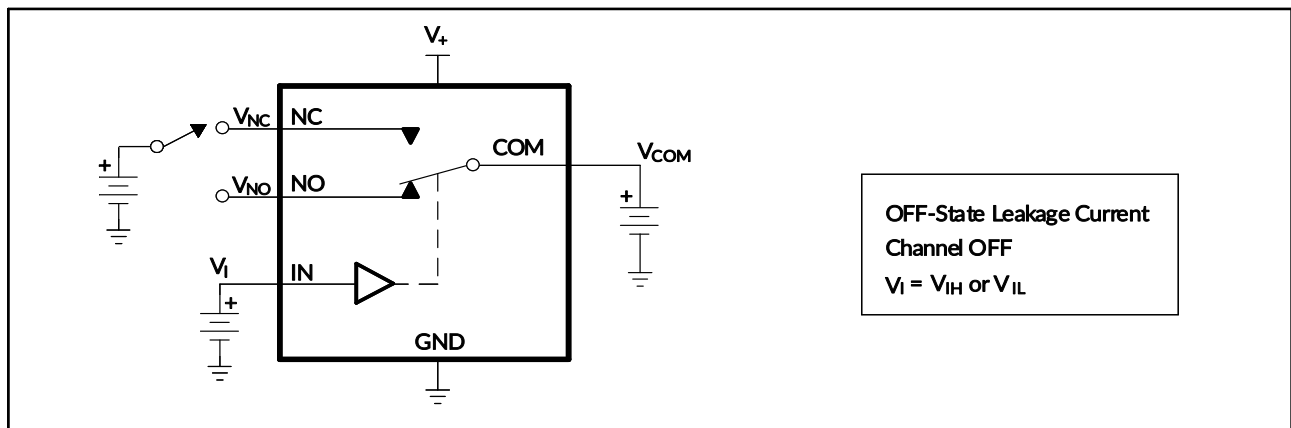


Figure 1. Typical Ron as a Function of Input Voltage

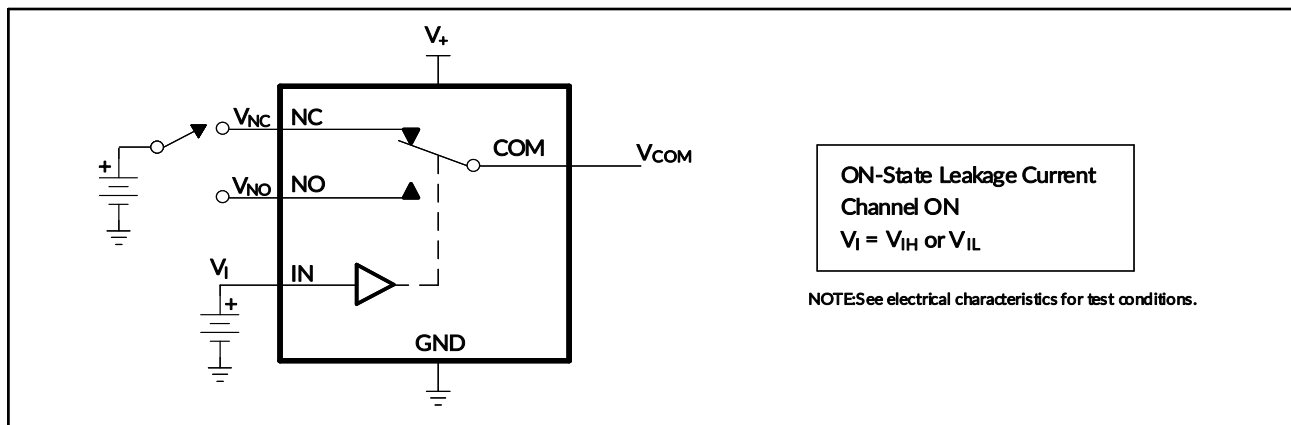
## 9 Parameter Measurement Information



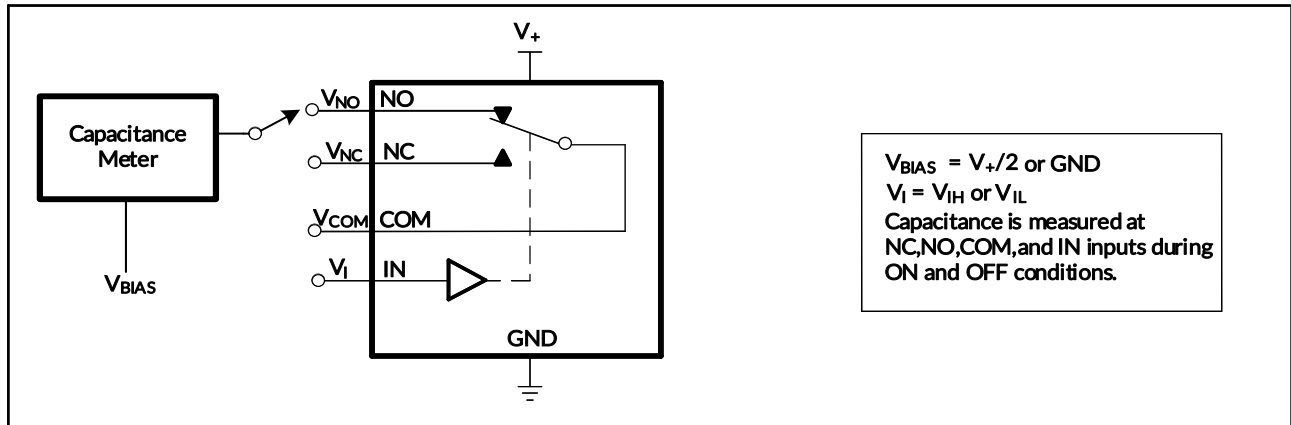
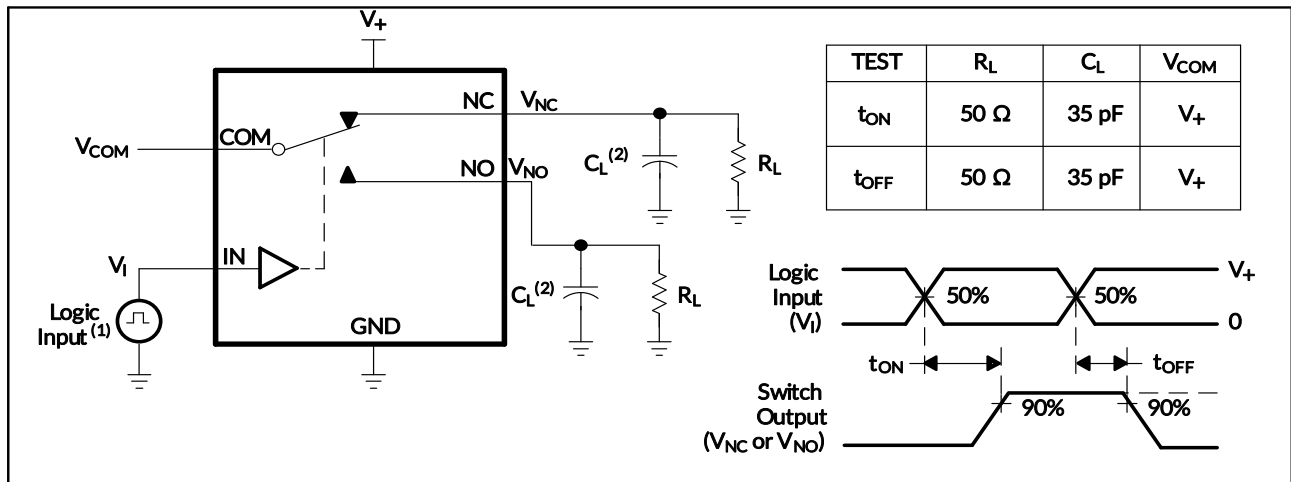
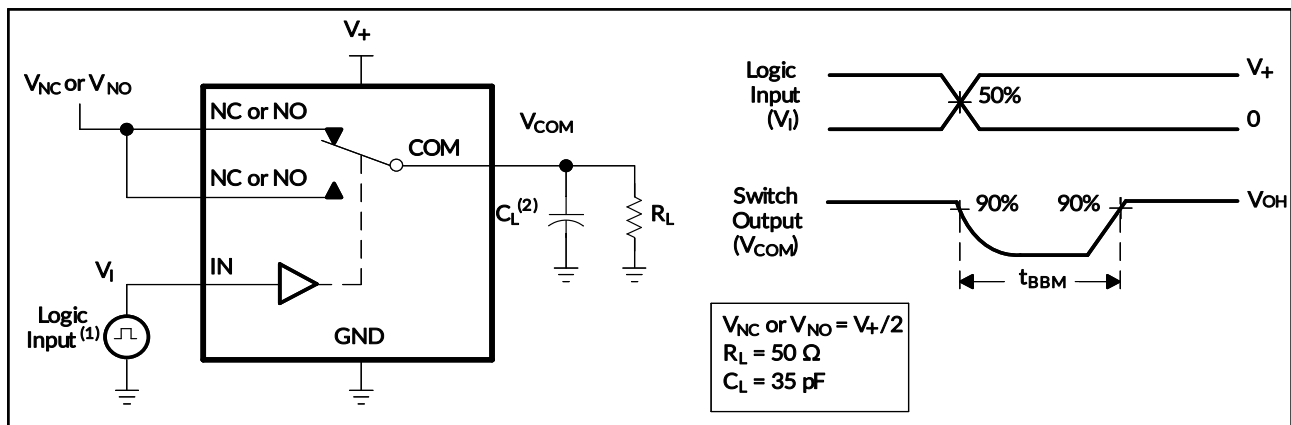
**Figure 2. ON-State Resistance ( $R_{on}$ )**



**Figure 3. OFF-State Leakage Current ( $I_{NC(OFF)}$ ,  $I_{NO(OFF)}$ )**



**Figure 4. ON-State Leakage Current ( $I_{COM(ON)}$ ,  $I_{NC(ON)}$ ,  $I_{NO(ON)}$ )**


**Figure 5. Capacitance ( $C_I$ ,  $C_{COM(ON)}$ ,  $C_{NC(OFF)}$ ,  $C_{NC(ON)}$ ,  $C_{NO(OFF)}$ ,  $C_{NO(ON)}$ )**

**Figure 6. Turn-On ( $t_{ON}$ ) and Turn-Off Time ( $t_{OFF}$ )**

**Figure 7. Break-Before-Make Time ( $t_{BBM}$ )**

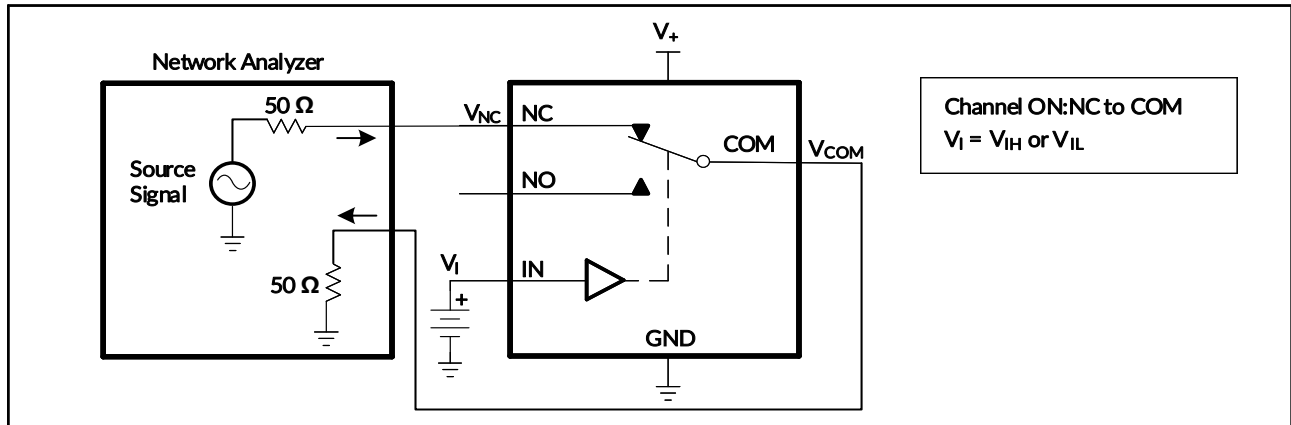


Figure 8. Bandwidth (BW)

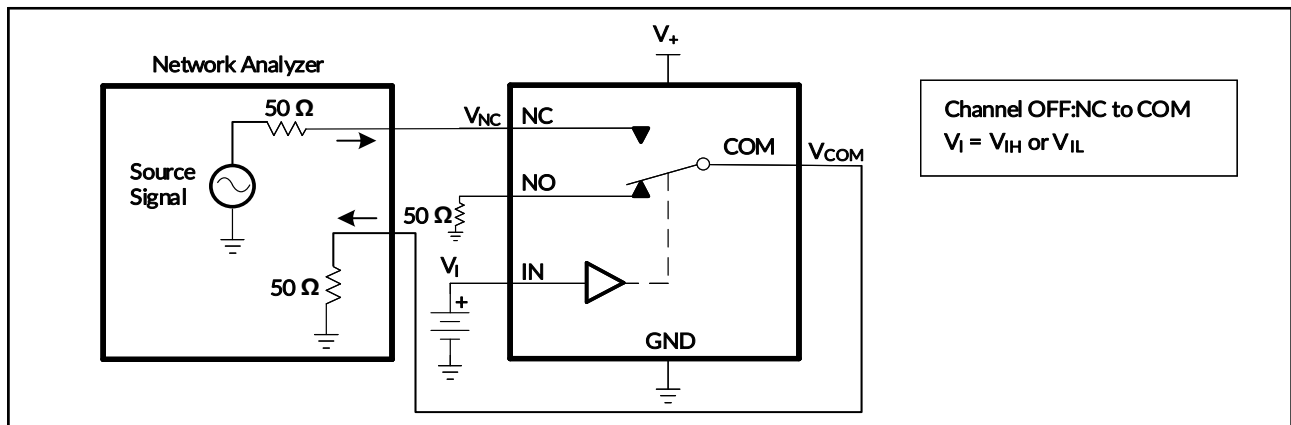


Figure 9. OFF Isolation ( $O_{ISO}$ )

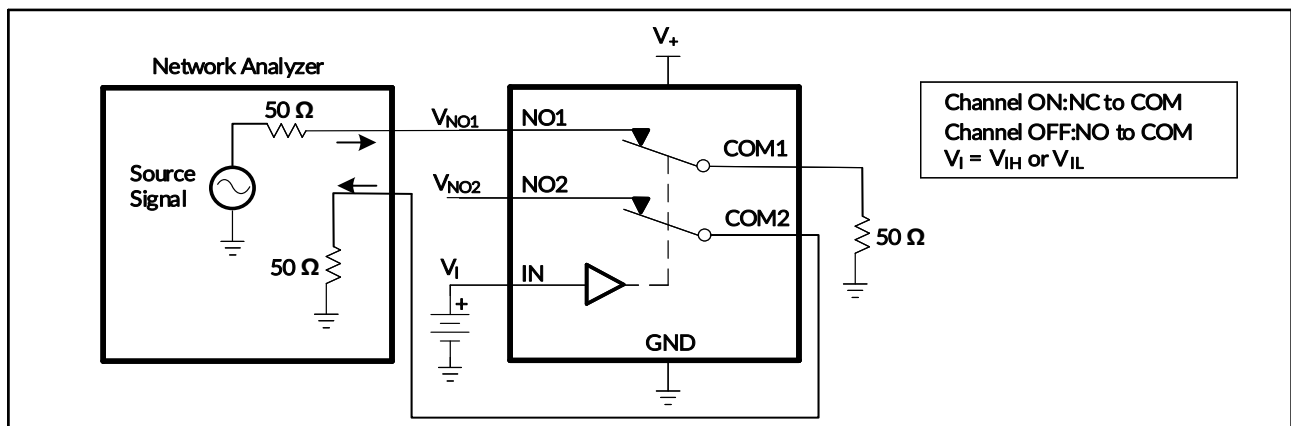
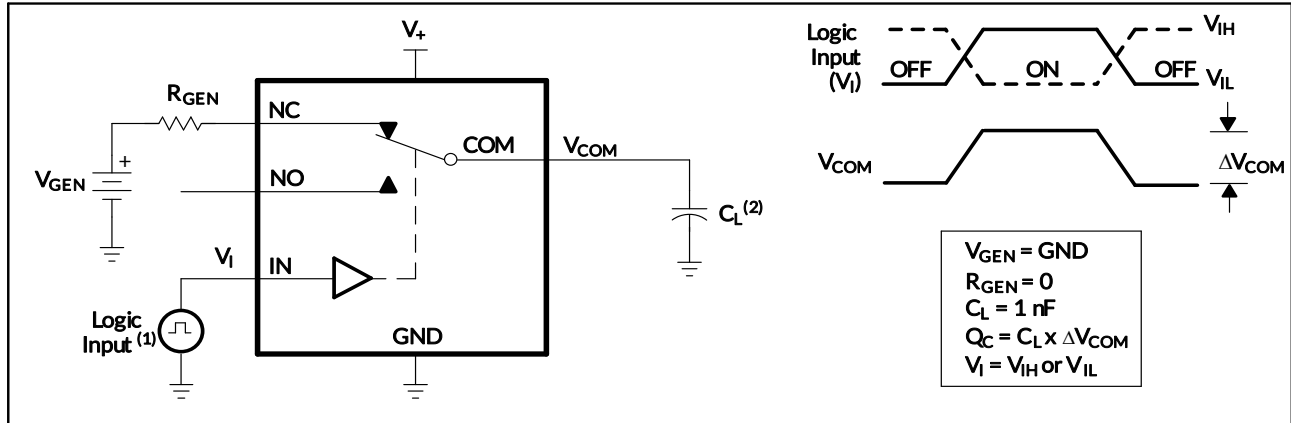
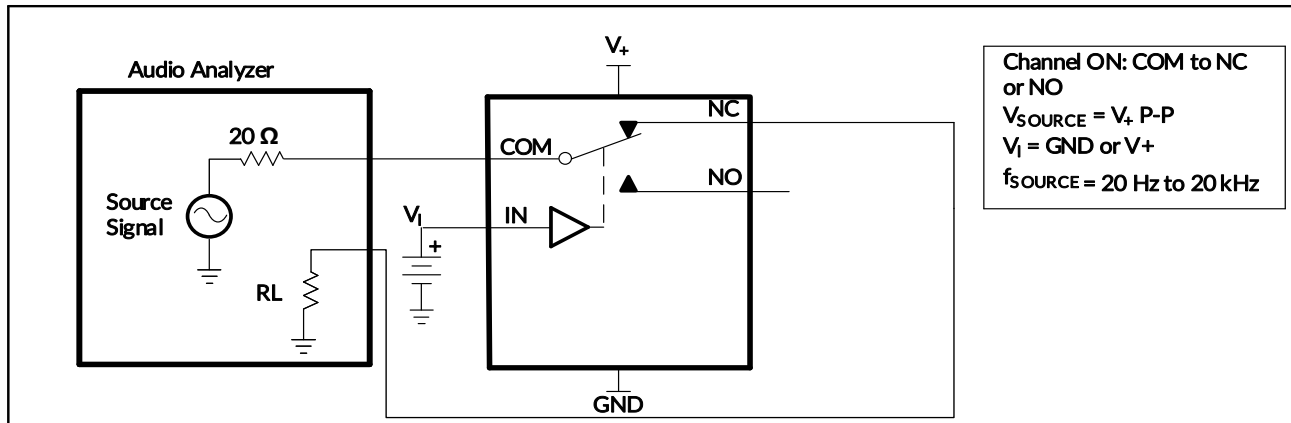


Figure 10. Crosstalk ( $X_{TALK}$ )


**Figure 11. Charge Injection ( $Q_c$ )**

**Figure 12. Total Harmonic Distortion (THD)**

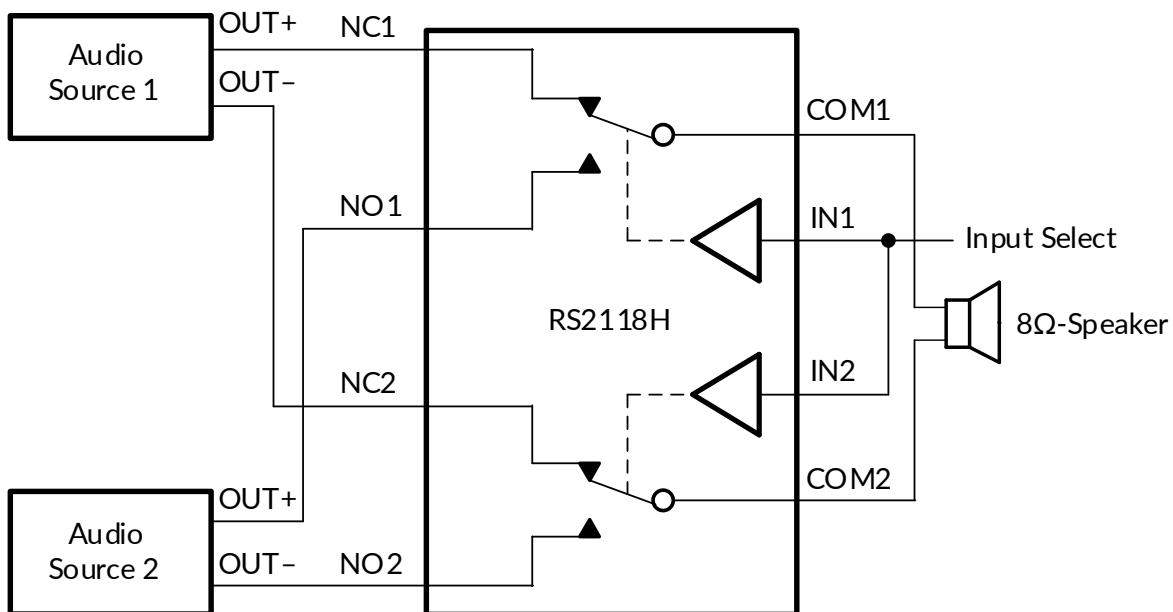
## 10 Application and Implementation

Information in the following applications sections is not part of the Runic component specification, and Runic does not warrant its accuracy or completeness. Runic's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 10.1 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.

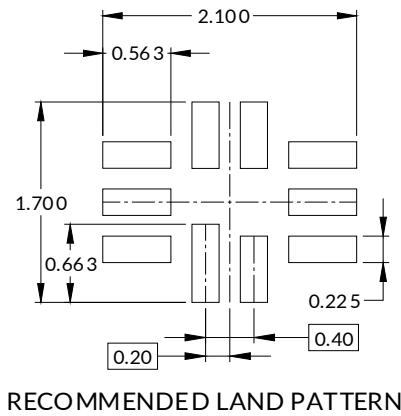
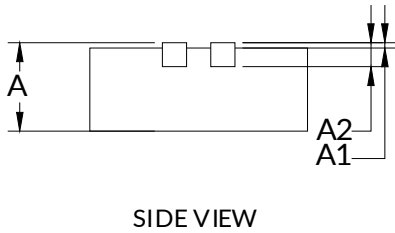
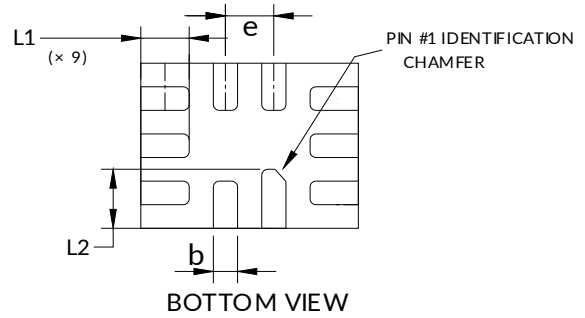
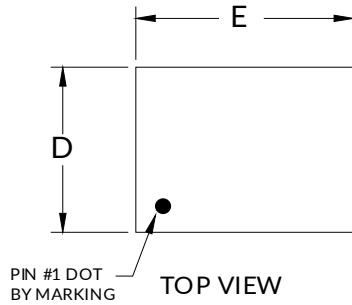
### 10.2 Typical Application



**Figure 13. Typical Application Schematic**

# 11 PACKAGE OUTLINE DIMENSIONS

## UQFN1.4X1.8-10<sup>(4)</sup>



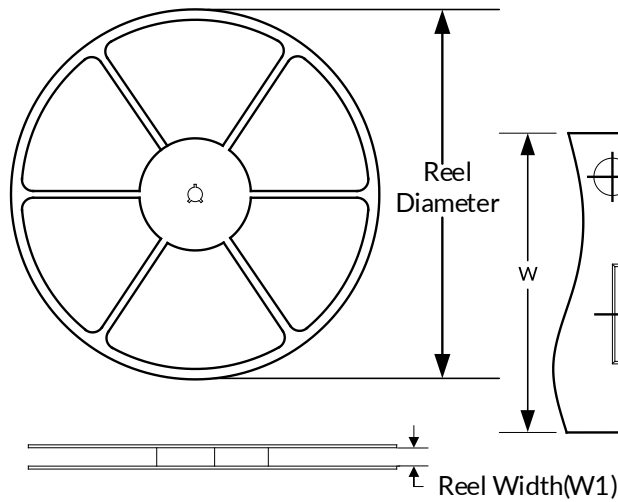
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A <sup>(1)</sup>	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A2	0.150 REF <sup>(2)</sup>		0.006 REF <sup>(2)</sup>	
b	0.150	0.250	0.006	0.010
D <sup>(1)</sup>	1.350	1.450	0.053	0.057
E <sup>(1)</sup>	1.750	1.850	0.069	0.073
e	0.400 BSC <sup>(3)</sup>		0.016 BSC <sup>(3)</sup>	
L1	0.300	0.500	0.012	0.020
L2	0.400	0.600	0.016	0.024

**NOTE:**

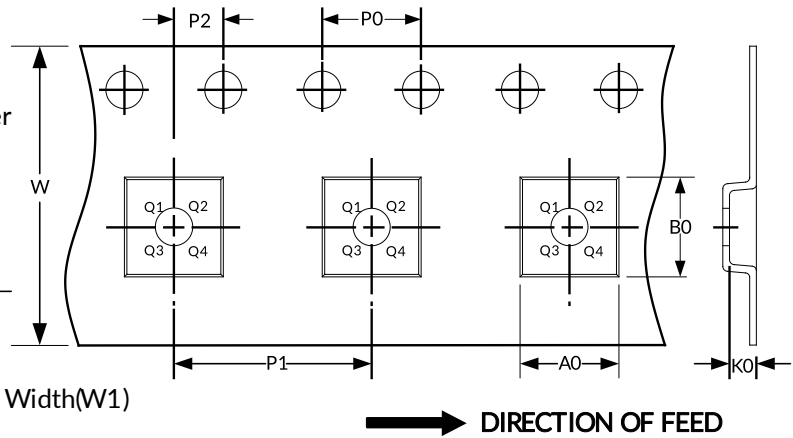
1. Plastic or metal protrusions of 0.075mm maximum per side are not included.
2. REF is the abbreviation for Reference.
3. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
4. This drawing is subject to change without notice.

## 12 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
UQFN1.4X1.8-10	7"	9.0	1.60	2.00	0.85	4.0	4.0	2.0	8.0	Q1

NOTE:

1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.



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