

# Low ON-Resistance, Low Voltage, Dual, SPDT Analog Switch

## 1 FEATURES

- **-3dB Bandwidth: 120MHz**
- **High Speed, Typically 29ns**
- **Supply Range: +1.8V to +5.5V**
- **Low ON-State Resistance, 3.0Ω(TYP)**
- **Break-Before-Make Switching**
- **Rail-to-Rail Operation**
- **TTL/CMOS Compatible**
- **Extended Industrial Temperature Range: -40°C to +125°C**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114)**
  - **300-V Machine Model (A115)**
  - **1000-V Charged-Device Model (JS-002)**

## 2 APPLICATIONS

- **Wearable Devices**
- **Battery-Operated Equipment**
- **Signal Gating, Chopping, Modulation or Demodulation (Modem)**
- **Portable Computing**
- **Cell Phones**

## 3 DESCRIPTIONS

The RS2102 is a dual, low on-resistance, single-pole double-throw (SPDT) analog switch that is designed to operate from 1.8 V to 5.5 V.

The RS2102 device can handle both analog and digital signals. It features fast switching speeds ( $t_{ON} = 29\text{ns}$ ,  $t_{OFF} = 17\text{ns}$ ) and low on-resistance (3.0Ω TYP).

These features make this device suitable for a wide variety of portable applications including cell phones, audio devices, and instrumentation.

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

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

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS2102	MSOP10	3.00mm×3.00mm

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

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## 4 Revision History

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

VERSION	Change Date	Change Item
C.3	2022/04/21	official version datasheet
C.4	2024/01/25	1. Added the TAPE AND REEL INFORMATION 2. Change Thermal Information on Page 2@RevC.3 3. Update FEATURES, SPECIFICATIONS and ESD Ratings values 4. Add MSL on Page 3@RevC.3
C.4.1	2024/03/07	Modify packaging naming

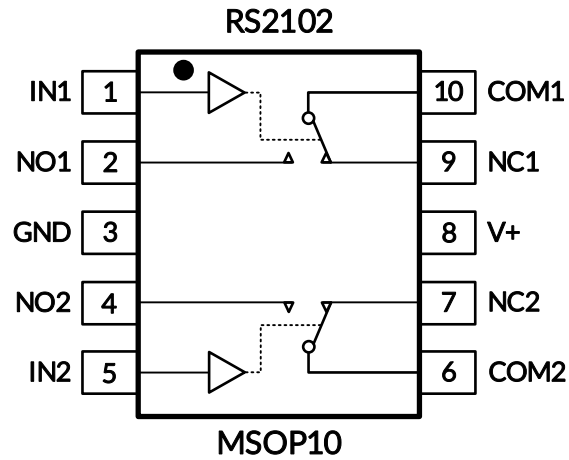
**5 PACKAGE/ORDERING INFORMATION <sup>(1)</sup>**

<b>PRODUCT</b>	<b>ORDERING NUMBER</b>	<b>TEMPERATURE RANGE</b>	<b>PACKAGE LEAD</b>	<b>PACKAGE MARKING <sup>(2)</sup></b>	<b>MSL <sup>(3)</sup></b>	<b>PACKAGE OPTION</b>
RS2102	RS2102XN	-40°C ~125°C	MSOP10	RS2102	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.

## 6 PIN CONFIGURATIONS



### 6.1 PIN DESCRIPTION

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

### 6.2 FUNCTION TABLE

LOGIC	NO1, NO2	NC1, NC2
0	OFF	ON
1	ON	OFF

## 7 SPECIFICATIONS

### 7.1 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 (All inputs)	-0.3	(V <sub>+</sub> )+0.3	
I <sub>IN</sub>	Continuous Current NO, NC, or COM	-500	+500	mA
I <sub>PEAK</sub>	Peak Current NO, NC, or COM	-800	+800	
θ <sub>JA</sub>	Package thermal impedance <sup>(2)</sup>		204	°C/W
T <sub>J</sub>	Junction Temperature <sup>(3)</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) The package thermal impedance is calculated in accordance with JESD-51.

(3) 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  $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$ . All numbers apply for packages soldered directly onto a PCB.

### 7.2 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), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	±2000	V
	Charged-device model (CDM)	±1000	V
	Machine model (MM)	±300	V

(1) JEDEC document JEP155 states that 500 V HBM allows safe manufacturing with a standard ESD control process.



### 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.

### 7.3 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

## 7.4 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 <sup>(2)</sup>	TYP <sup>(3)</sup>	MAX <sup>(2)</sup>	UNIT
<b>ANALOG SWITCH</b>								
Analog Signal Range	$V_{NO}, V_{NC}, V_{COM}$			FULL	0		$V_+$	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		3.0	4.0	$\Omega$
				FULL			5.0	$\Omega$
			3.3V	+25°C		5.5	7.0	$\Omega$
				FULL			7.5	$\Omega$
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		0.1	0.8	$\Omega$
				FULL			0.9	$\Omega$
			3.3V	+25°C		0.1	0.8	$\Omega$
				FULL			0.9	$\Omega$
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		0.7	0.85	$\Omega$
				FULL			0.95	$\Omega$
			3.3V	+25°C		2.5	3.0	$\Omega$
				FULL			3.2	$\Omega$
NC,NO OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NO} \text{ or } V_{NC} = 0.3\text{V}$ , $V_+/2$ $V_{COM} = V_+/2$ , 0.3V See Figure 5	1.8 to 5.5V	FULL			1	$\mu\text{A}$
NC,NO,COM ON Leakage Current	$I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_{NO} \text{ or } V_{NC} = 0.3\text{V}$ , Open $V_{COM} = \text{Open}$ , 0.3V 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	$I_{IN}$	$V_{IN} = V_{IO} \text{ or } 0$	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.

(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  $125^\circ\text{C}$  (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°C		29		ns
			3.3V			33		
Turn-Off Time	$t_{OFF}$	$V_{COM} = V_+$ , $R_L = 300\Omega$ , $C_L = 35\text{pF}$ , See Figure 8	5V	+25°C		17		ns
			3.3V			18		
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°C		10		ns
			3.3V			11		
Off Isolation	$O_{ISO}$	$R_L = 50\Omega$ , Switch OFF, See Figure 11	$f = 10\text{MHz}$	+25°C		-43		dB
			$f = 1\text{MHz}$	+25°C		-67		dB
-3dB Bandwidth	BW	Switch ON, $R_L = 50\Omega$ , See Figure 10		+25°C		120		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°C		15		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°C		50		pF
<b>POWER REQUIREMENTS</b>								
Power Supply Range	$V_+$			FULL	1.8		5.5	V
Power Supply Current	$I_+$	$V_{IN} = \text{GND}$ or $V_+$	5.5V	FULL			1	$\mu\text{A}$



## 7.5 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.

V+ = 5.0 V, T<sub>A</sub> = -40°C to 125°C (unless otherwise noted)

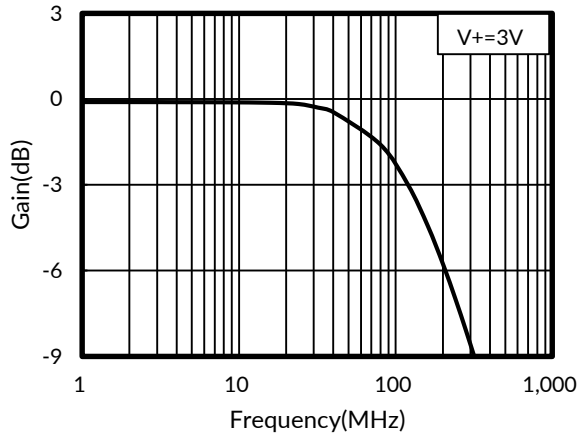


Figure 1. Bandwidth vs Frequency

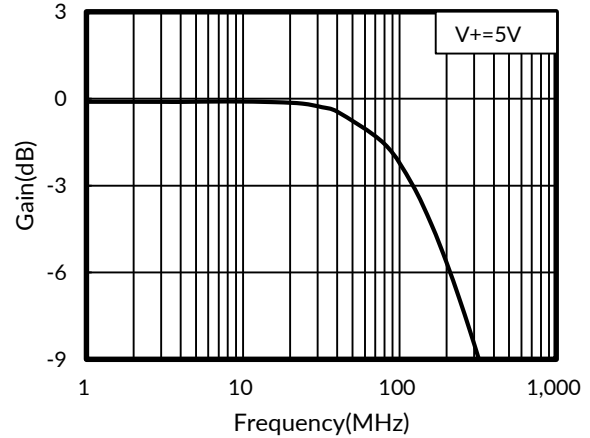


Figure 2. Bandwidth vs Frequency

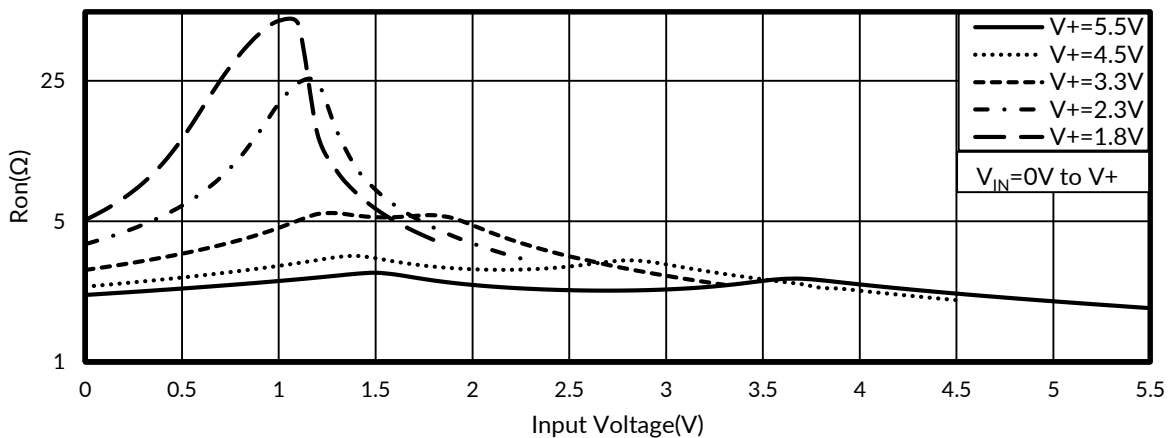


Figure 3. Typical Ron as a Function of Input Voltage

### 8 Parameter Measurement Information

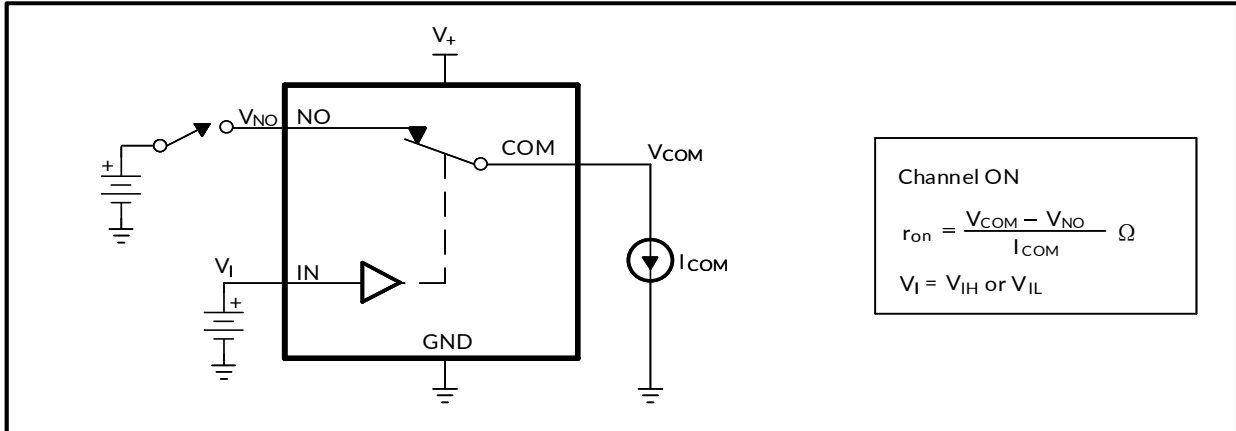


Figure 4. ON-State Resistance ( $r_{on}$ )

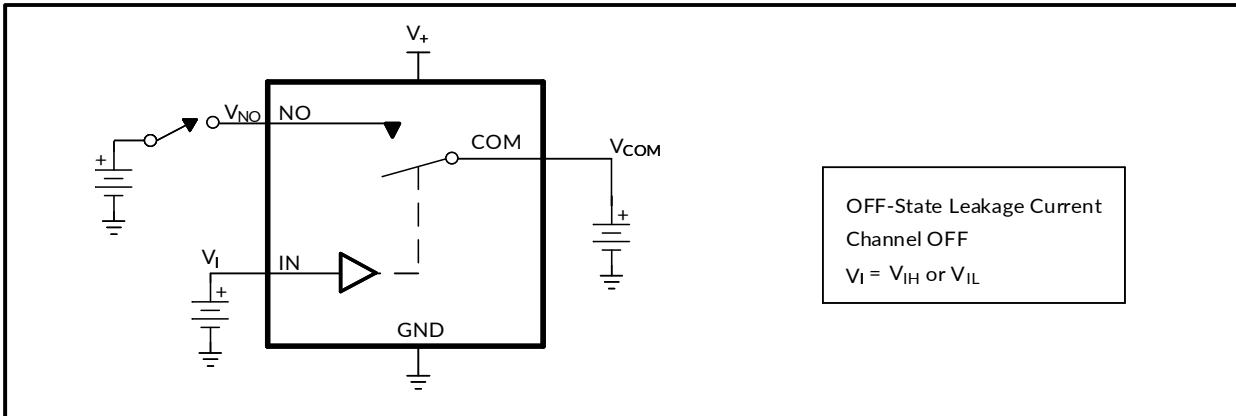


Figure 5. OFF-State Leakage Current ( $I_{COM(OFF)}$ ,  $I_{NO(OFF)}$ )

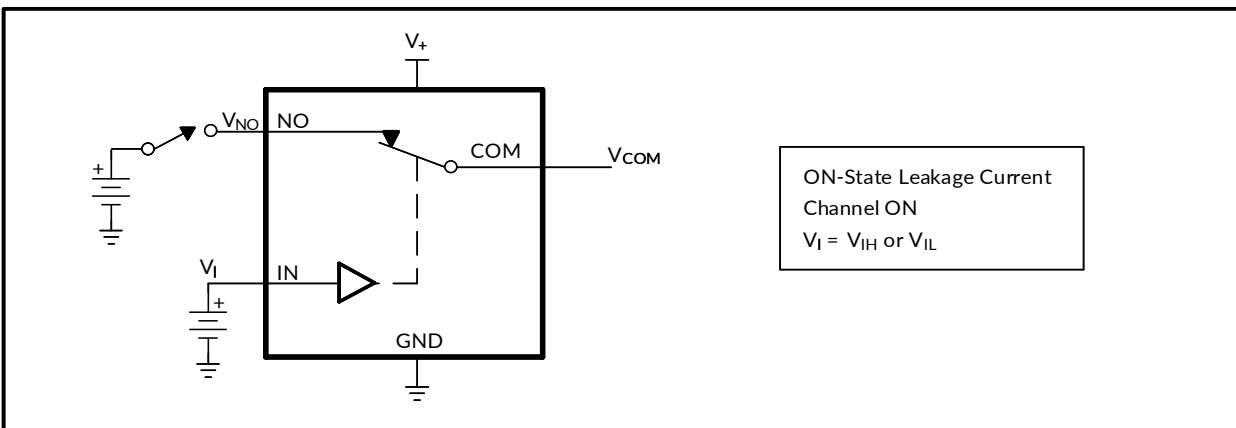
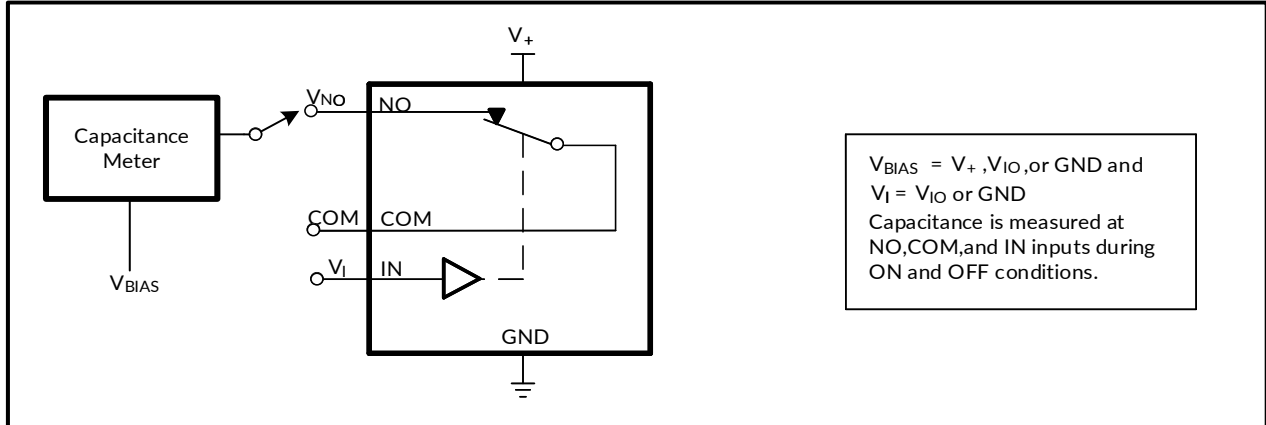
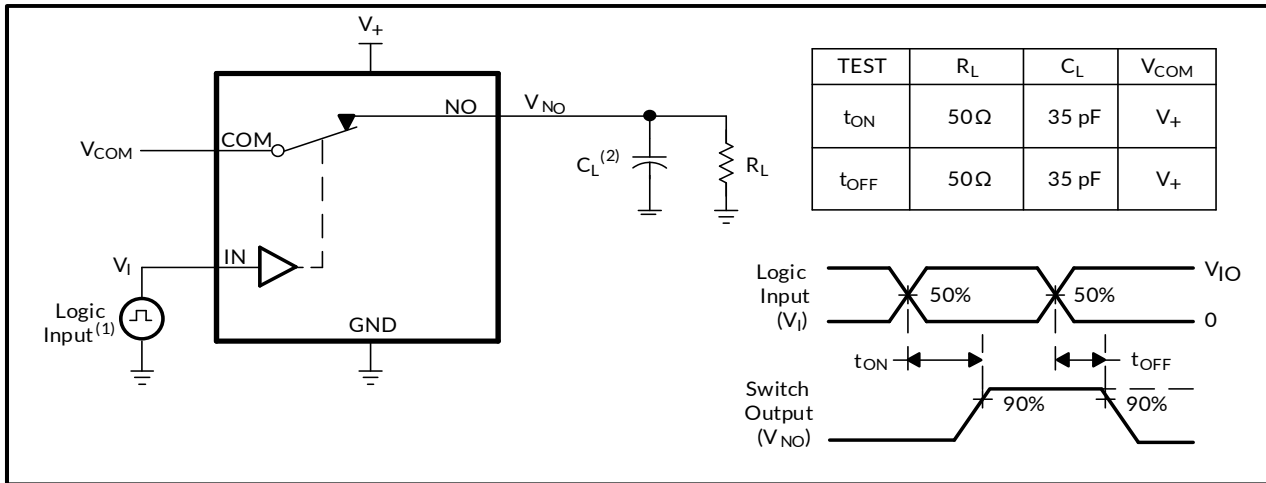
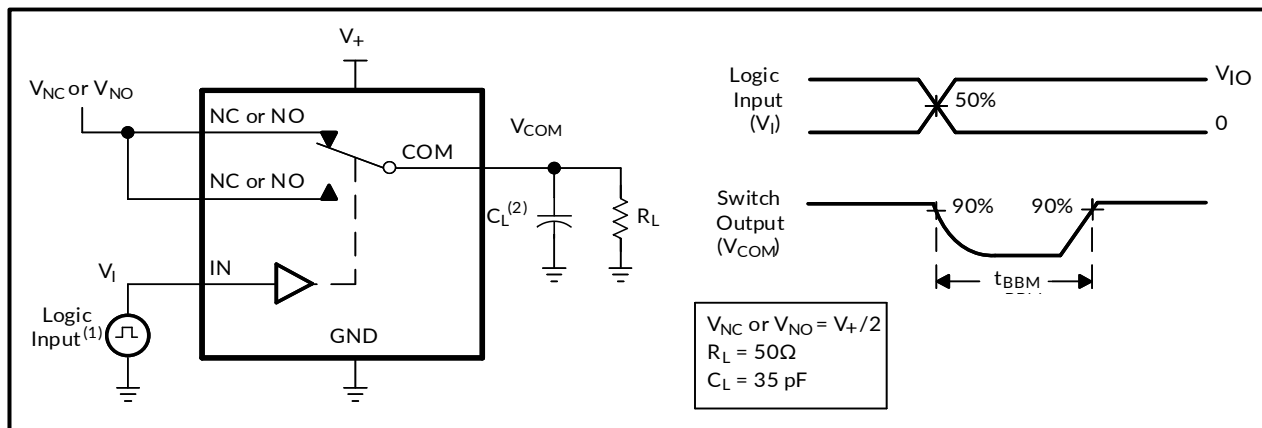
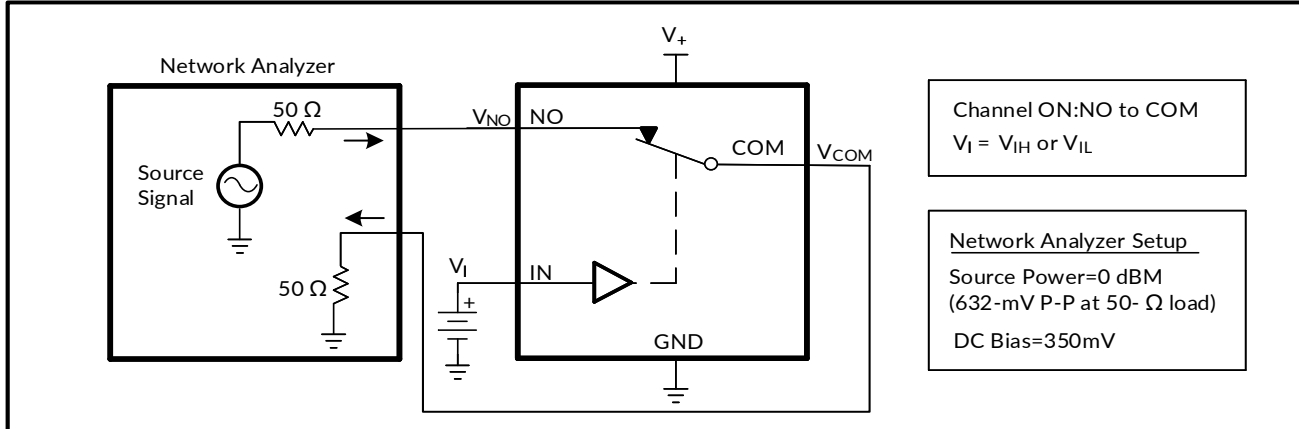
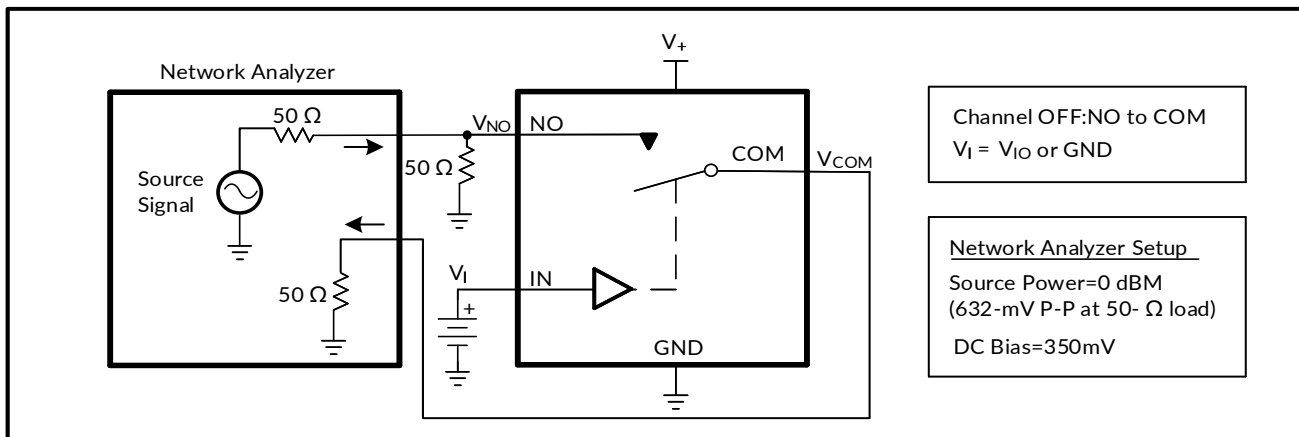
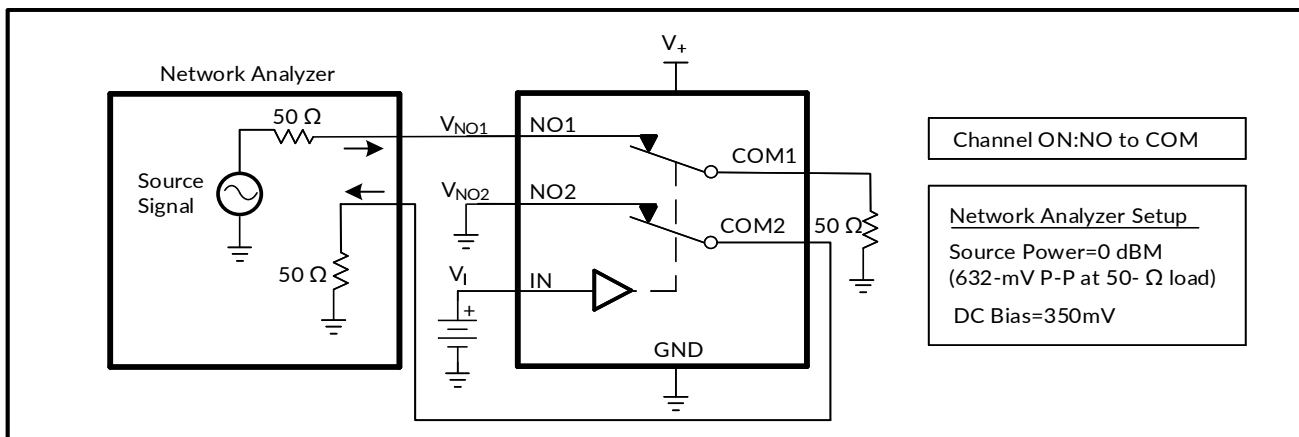
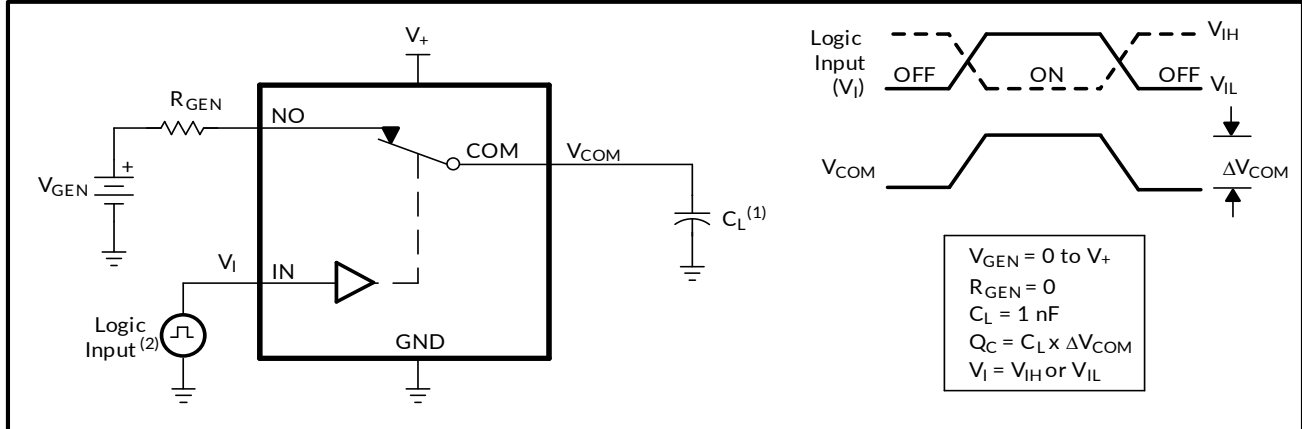
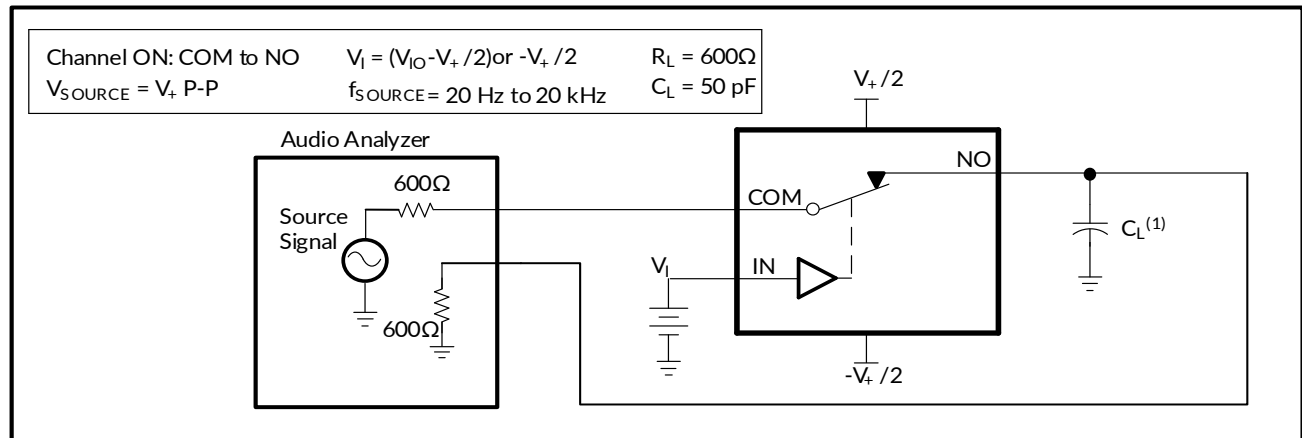


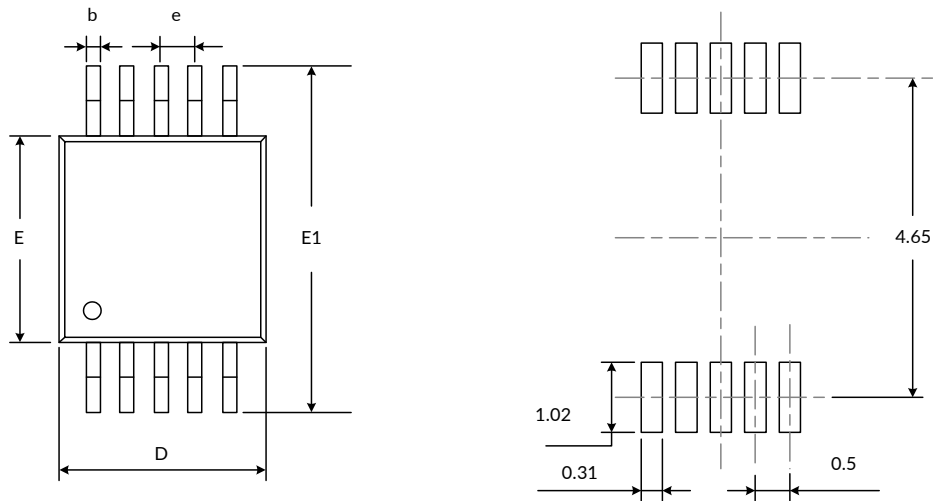
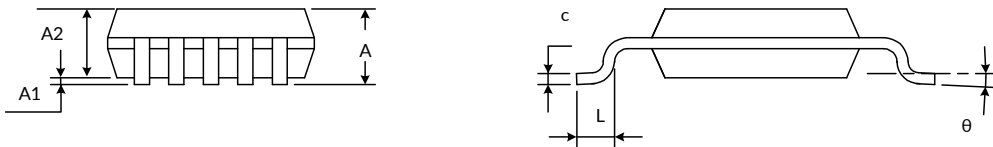
Figure 6. ON-State Leakage Current ( $I_{COM(ON)}$ ,  $I_{NO(ON)}$ )

**Parameter Measurement Information (continued)**

**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 ( $t_{BBM}$ )**

**Parameter Measurement Information (continued)**

**Figure 10. Bandwidth (BW)**

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

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

**Parameter Measurement Information (continued)**

**Figure 13. Charge Injection ( $Q_C$ )**

**Figure 14. Total Harmonic Distortion (THD)**

## 9 PACKAGE OUTLINE DIMENSIONS MSOP10<sup>(3)</sup>


**RECOMMENDED LAND PATTERN (Unit: mm)**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A <sup>(1)</sup>	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D <sup>(1)</sup>	2.900	3.100	0.114	0.122
e	0.50(BSC) <sup>(2)</sup>		0.020(BSC) <sup>(2)</sup>	
E <sup>(1)</sup>	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

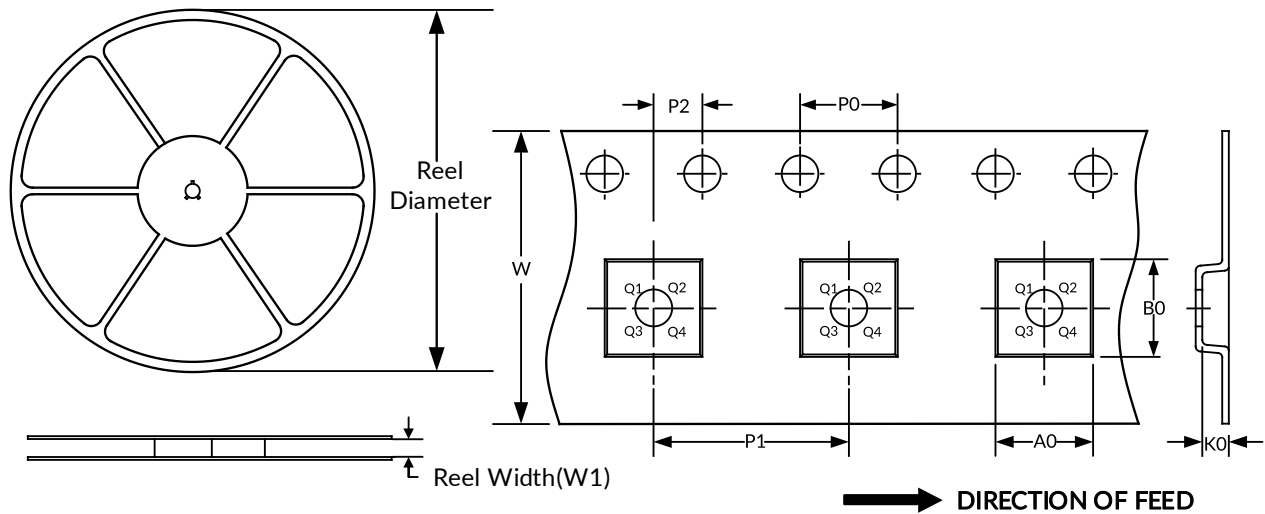
**NOTE:**

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

# 10 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
MSOP10	13"	12.4	5.20	3.30	1.20	4.0	8.0	2.0	12.0	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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