

## 4.5Ω Low Voltage Dual SPDT Analog Switch

### 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

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

### DESCRIPTION

The RS2058 is a dual, single-pole double-throw (SPDT) analog switch that is designed to operate from 1.8 V to 5.5 V.

The RS2058 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)
RS2058	XQFN1.4X1.8-10	1.80mm×1.40mm
	MSOP10	3.00mm×3.00mm

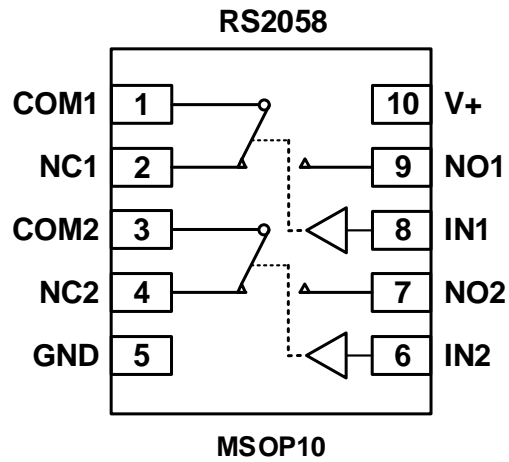
(1) For all available packages, see the orderable addendum at the end of the data sheet.

## 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	2024/03/11	1. Added the TAPE AND REEL INFORMATION 2. Change Thermal Information on Page 3@RevC.4 3. Modify packaging naming

## Pin Configurations (Top View)



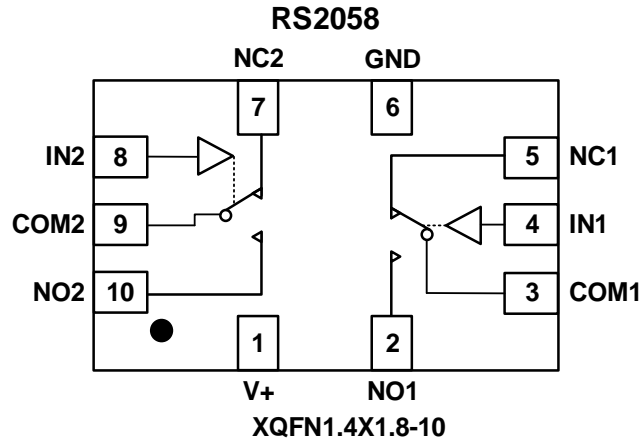
### PIN DESCRIPTION

NAME	PIN	FUNCTION
	MSOP10	
COM1, COM2	1, 3	Common Terminal
NC1, NC2	2, 4	Normally-Closed Terminal
GND	5	Ground
IN2, IN1	6, 8	Digital Control Pin
NO2, NO1	7, 9	Normally-Open Terminal
V+	10	Power Supply

### FUNCTION TABLE

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

### Pin Configurations (Top View)



NAME	PIN	FUNCTION
	XQFN1.4X1.8-10	
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

## 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>+</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) 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)	±1000	V
		Machine Model (MM)	±100	V

### 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

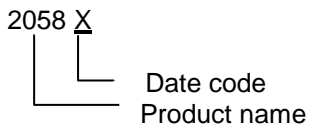
THERMAL METRIC	RS2058		UNIT	
	10 PINS			
	MSOP10	XQFN1.4X1.8-10		
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	169.5	120	°C/W
R <sub>θJC(top)</sub>	Junction-to-case(top) thermal resistance	84.1	46.0	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	113	44.5	°C/W
Ψ <sub>JT</sub>	Junction-to-top characterization parameter	15.8	1.5	°C/W
Ψ <sub>JB</sub>	Junction-to-board characterization parameter	111.6	44.5	°C/W
R <sub>θJC(bot)</sub>	Junction-to-case(bottom) thermal resistance	N/A	31.2	°C/W

**PACKAGE/ORDERING INFORMATION**

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING <sup>(1/2)</sup>	PACKAGE OPTION
RS2058	RS2058XN	-40°C ~125°C	MSOP10	RS2058	Tape and Reel,4000
RS2058	RS2058XUTQK10	-40°C ~125°C	XQFN1.4X1.8-10	2058 <u>X</u>	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.  
 (2) X = Date Code

**MARKING INFORMATION**


## 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 $V_{NC} = 0.3\text{V}$ , $V_+/2$ $V_{COM} = V_+/2$ , 0.3V See Figure 5	1.8 to 5.5V	FULL			1	$\mu\text{A}$
NC,NO,COM ON Leakage Current	$I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_{NO}$ 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	$I_{IN}$	$V_{IN} = V_{IO}$ or 0	1.8 to 5.5V	FULL			1	$\mu\text{A}$

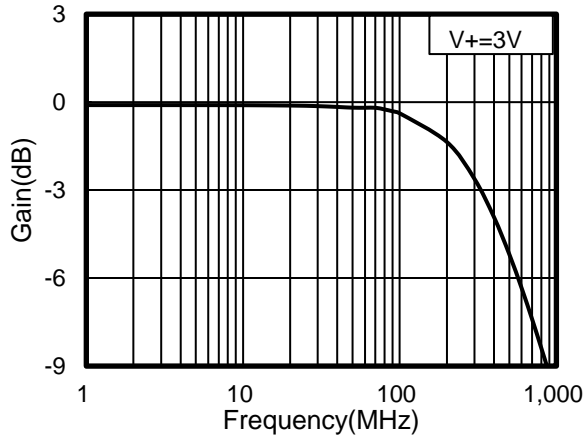
(1) All unused digital inputs of the device must be held at  $V_{IO}$  or GND to ensure proper device operation.

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

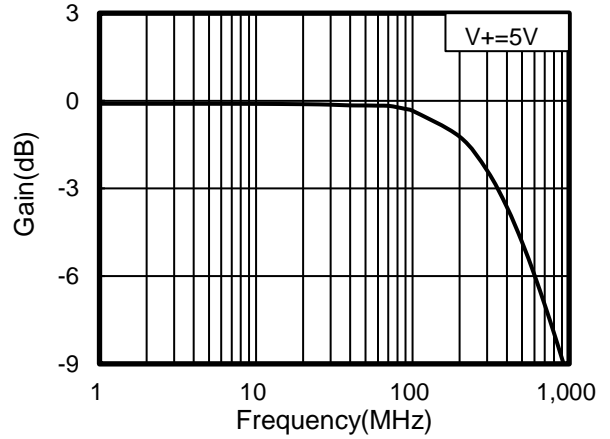
PARAMETER	SYMBOL	CONDITIONS	$V_+$	$T_A$	MIN	TYP	MAX	UNIT
<b>DYNAMIC CHARACTERISTICS</b>								
Turn-On Time	$t_{ON}$	$V_{COM} = V_+$ , $R_L = 300\Omega$ , $C_L = 35\text{pF}$ , See Figure 8	5V	+25°C		30		ns
			3.3V			40		
Turn-Off Time	$t_{OFF}$	$V_{COM} = V_+$ , $R_L = 300\Omega$ , $C_L = 35\text{pF}$ , See Figure 8	5V	+25°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°C		5		ns
			3.3V			8		
Off Isolation	$O_{ISO}$	$R_L = 50\Omega$ , Switch OFF, See Figure 11	$f = 10\text{MHz}$	+25°C		-52		dB
			$f = 1\text{MHz}$	+25°C		-71		dB
-3dB Bandwidth	BW	Switch ON, $R_L = 50\Omega$ See Figure 10		+25°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°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°C		15		pF
<b>POWER REQUIREMENTS</b>								
Power Supply Range	$V_+$			FULL	1.8		5.5	V
Power Supply Current	$I_+$	$V_{IN} = \text{GND}$ or $V_+$	5.5V	FULL			1	uA



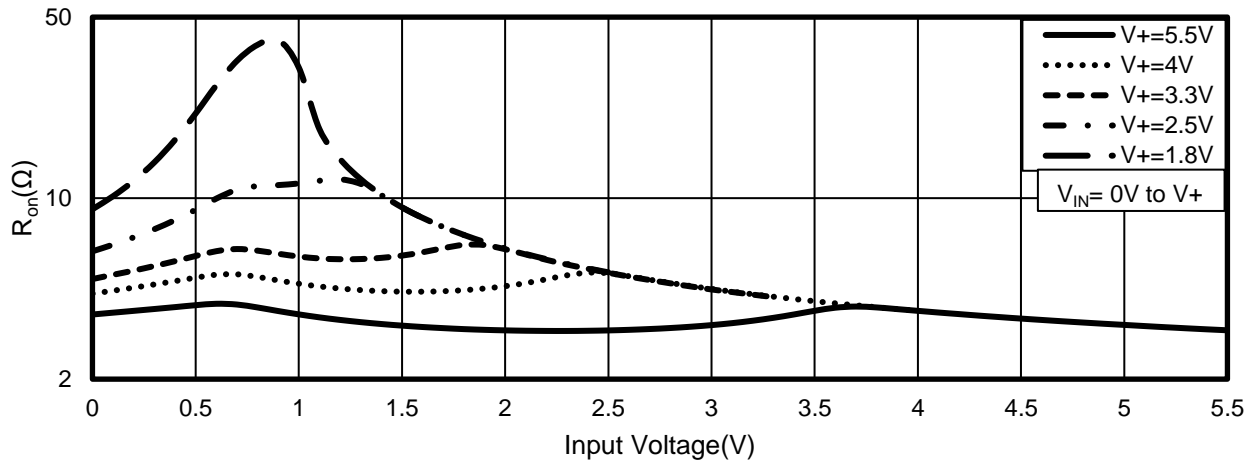
**TYPICAL CHARACTERISTICS**



**Figure 1. Bandwidth vs Frequency**



**Figure 2. Bandwidth vs Frequency**



**Figure 3. Typical Ron as a Function of Input Voltage**

### Parameter Measurement Information

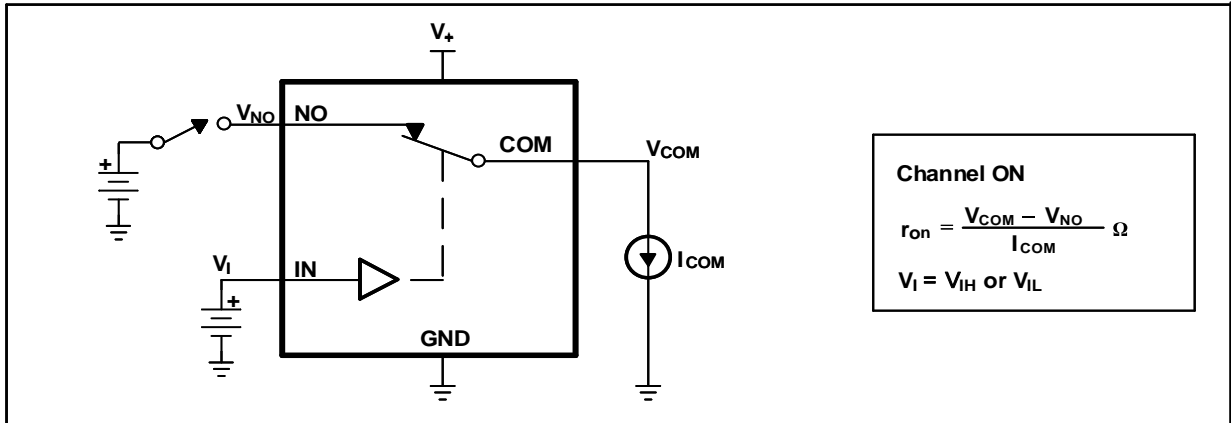


Figure 4. ON-State Resistance ( $R_{on}$ )

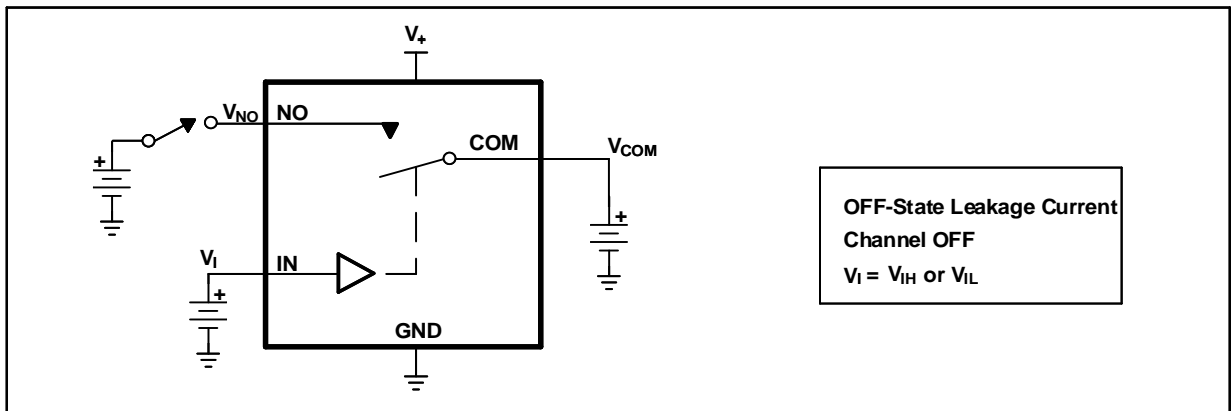


Figure 5. OFF-State Leakage Current ( $I_{COM(OFF)}$ ,  $I_{NO(OFF)}$ )

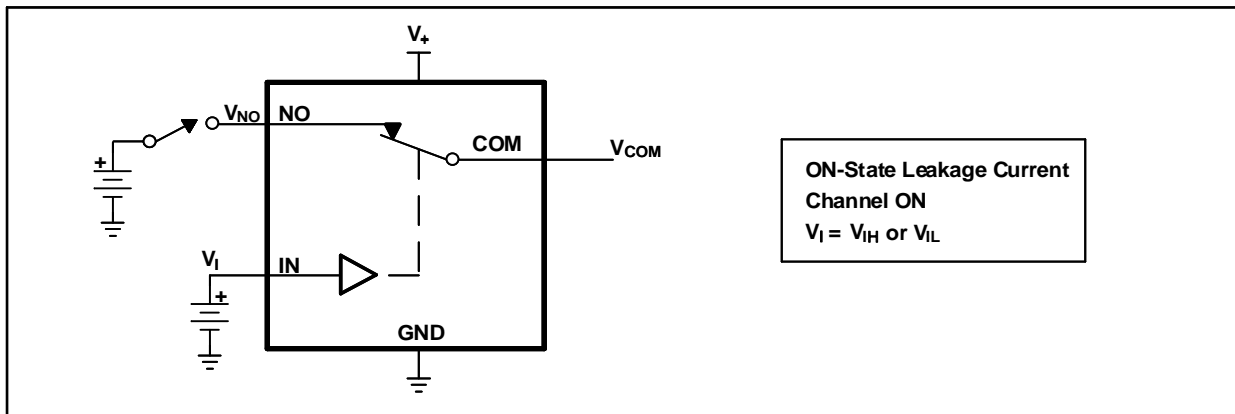


Figure 6. ON-State Leakage Current ( $I_{COM(ON)}$ ,  $I_{NO(ON)}$ )

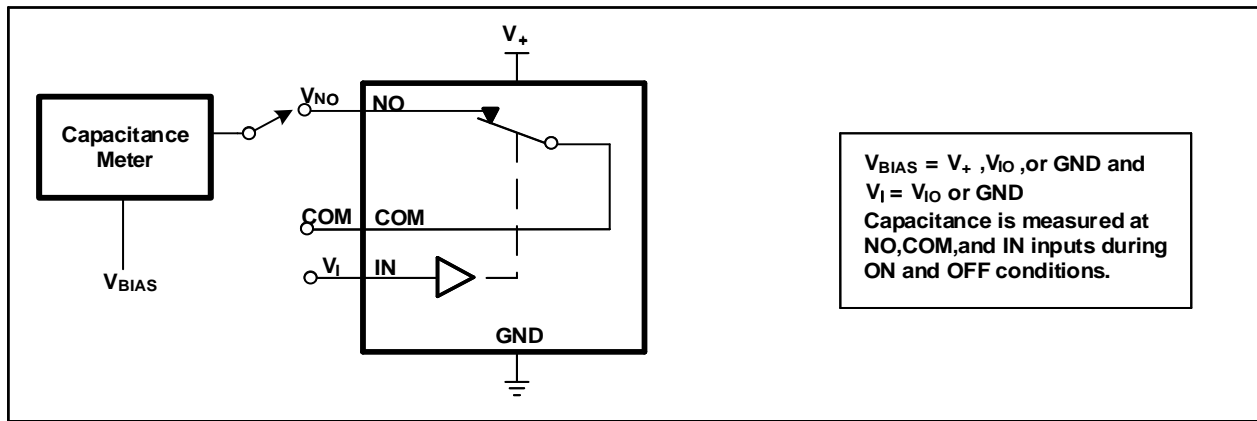


Figure 7. Capacitance ( $C_I$ ,  $C_{COM(OFF)}$ ,  $C_{COM(ON)}$ ,  $C_{NO(OFF)}$ ,  $C_{NO(ON)}$ )

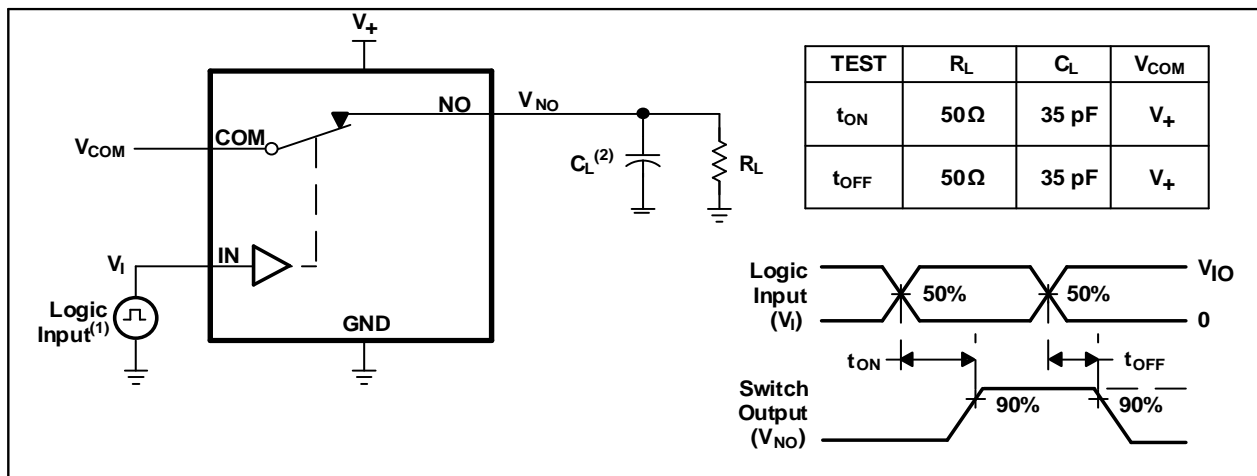


Figure 8. Turn-On ( $t_{ON}$ ) and Turn-Off Time ( $t_{OFF}$ )

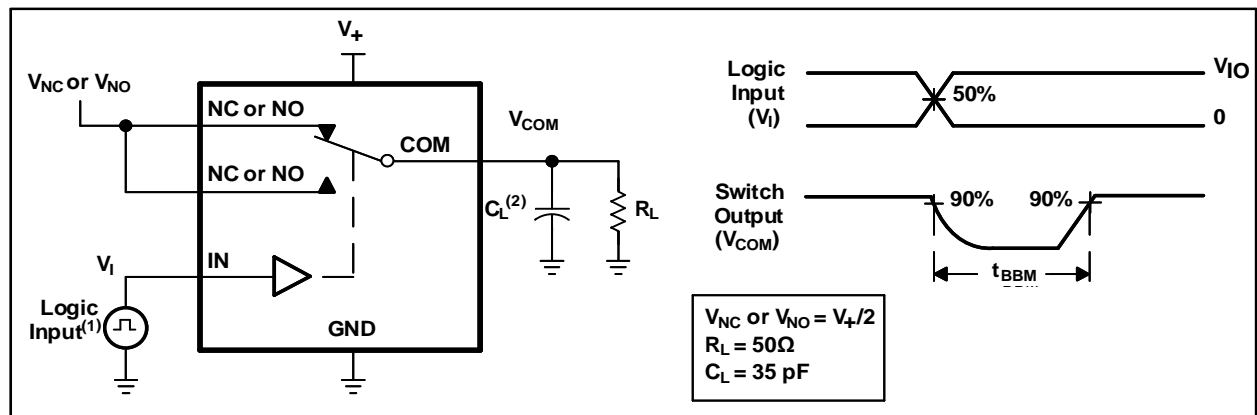


Figure 9. Break-Before-Make Time ( $t_{BBM}$ )

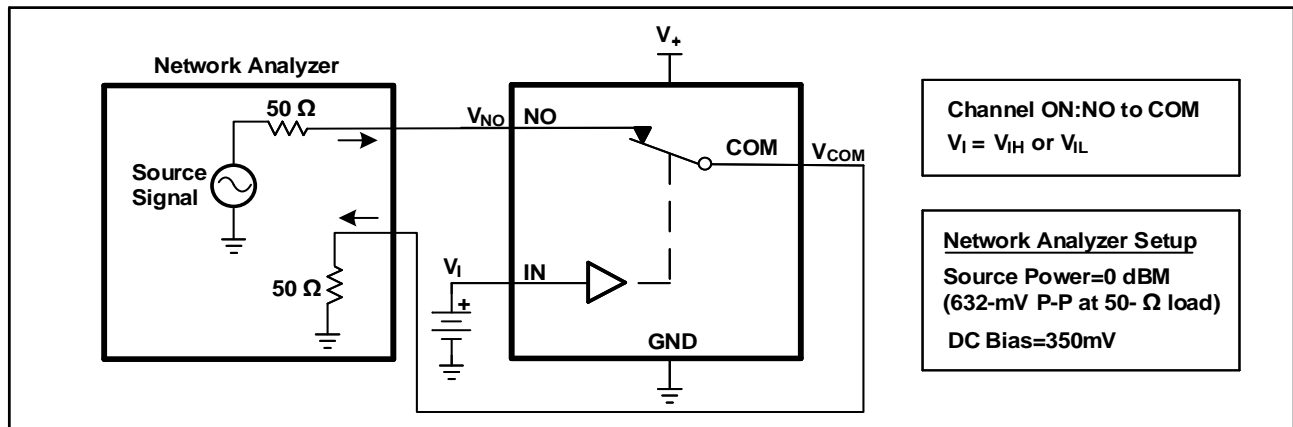


Figure 10. Bandwidth (BW)

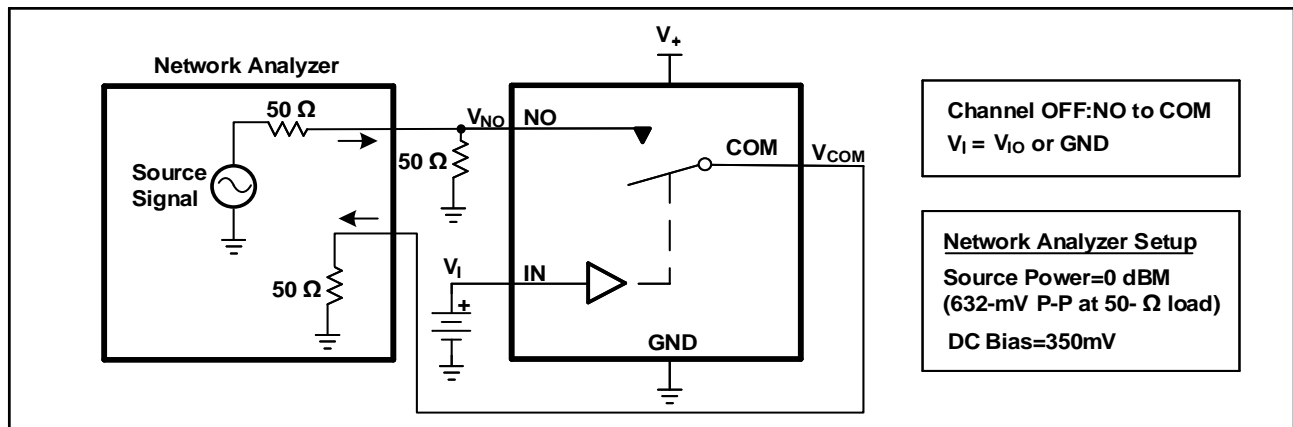


Figure 11. OFF Isolation ( $O_{ISO}$ )

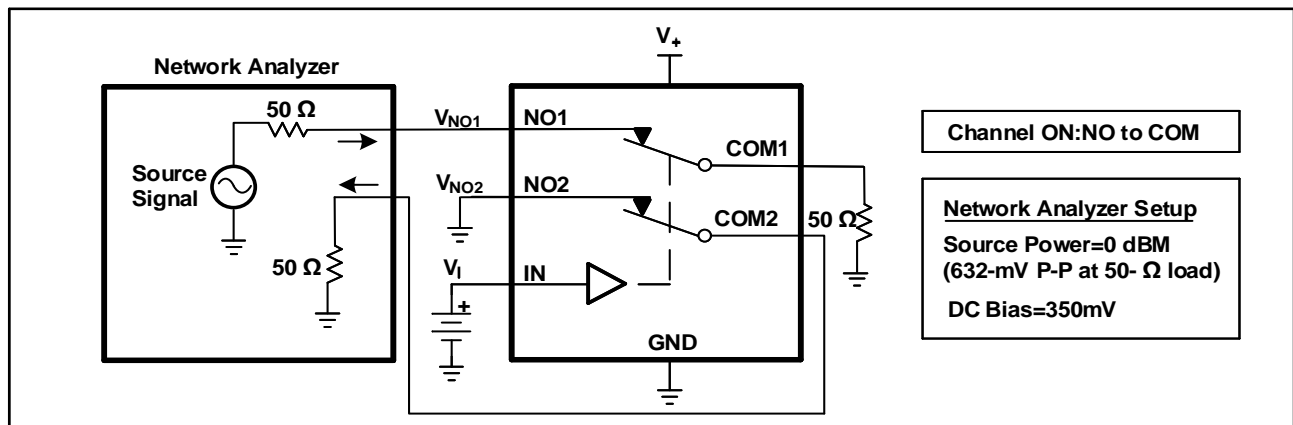


Figure 12. Crosstalk ( $X_{TALK}$ )

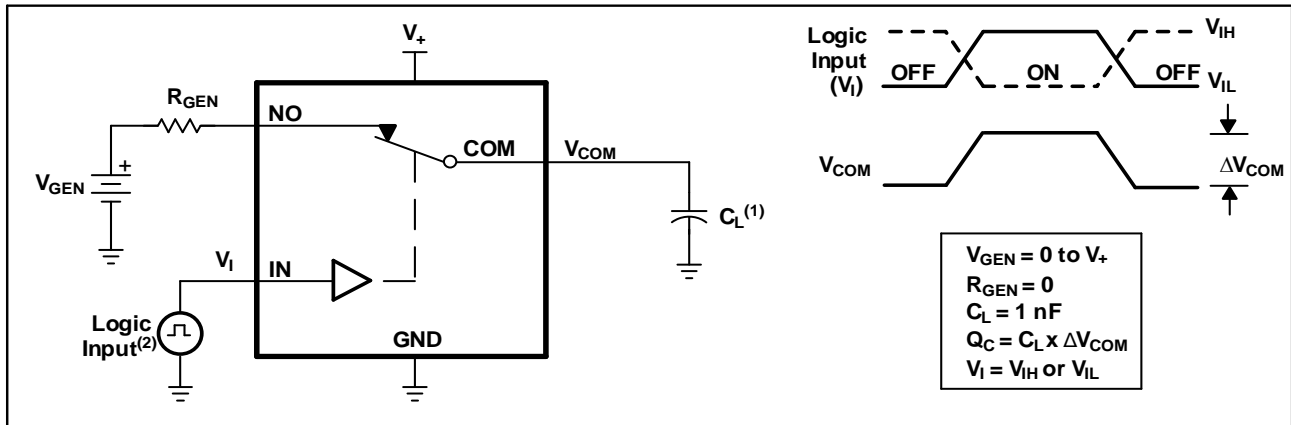


Figure 13. Charge Injection ( $Q_c$ )

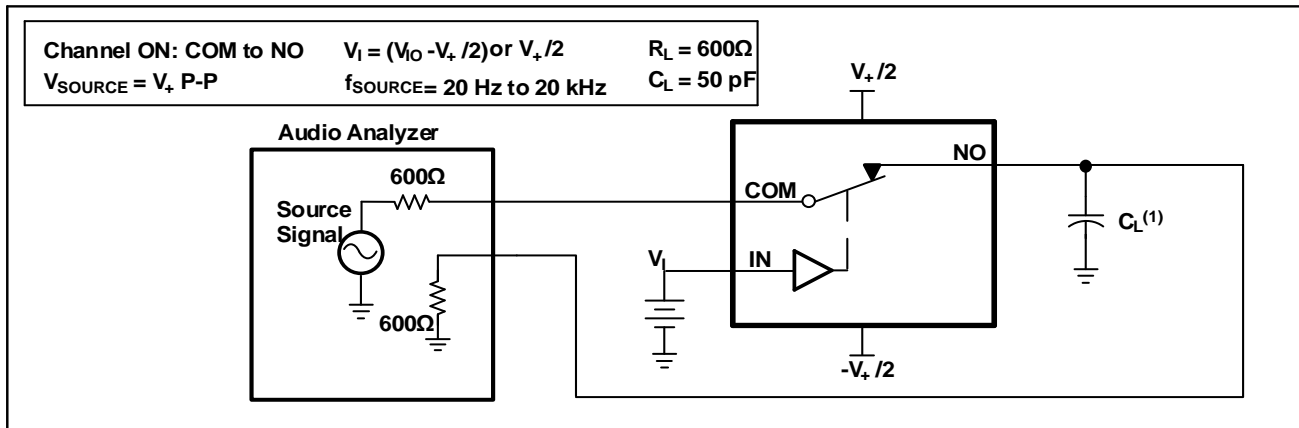
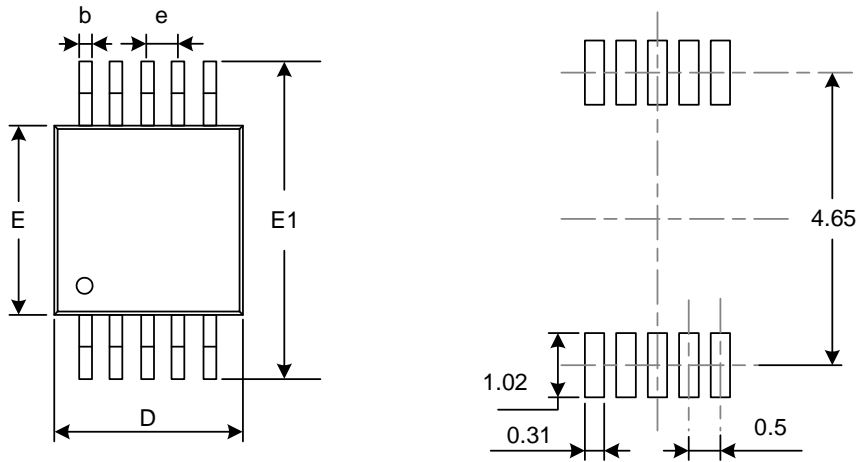
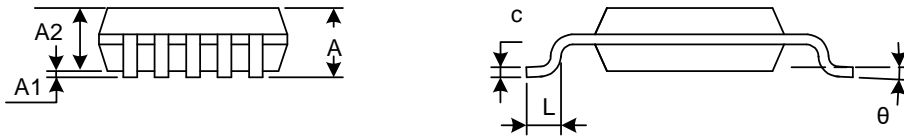


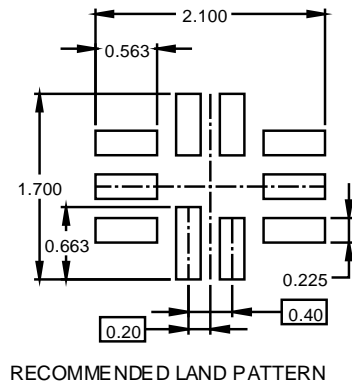
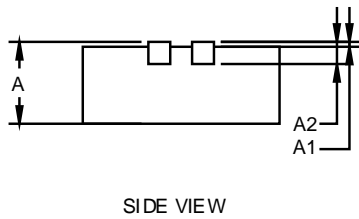
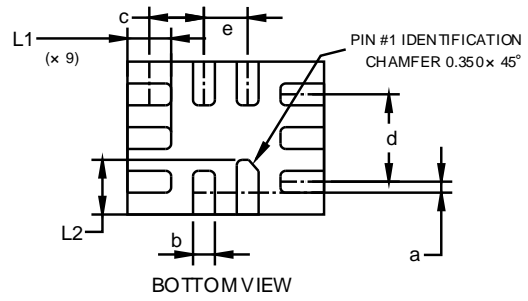
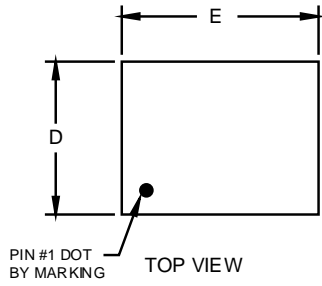
Figure 14. Total Harmonic Distortion (THD)

# PACKAGE OUTLINE DIMENSIONS

## MSOP10


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


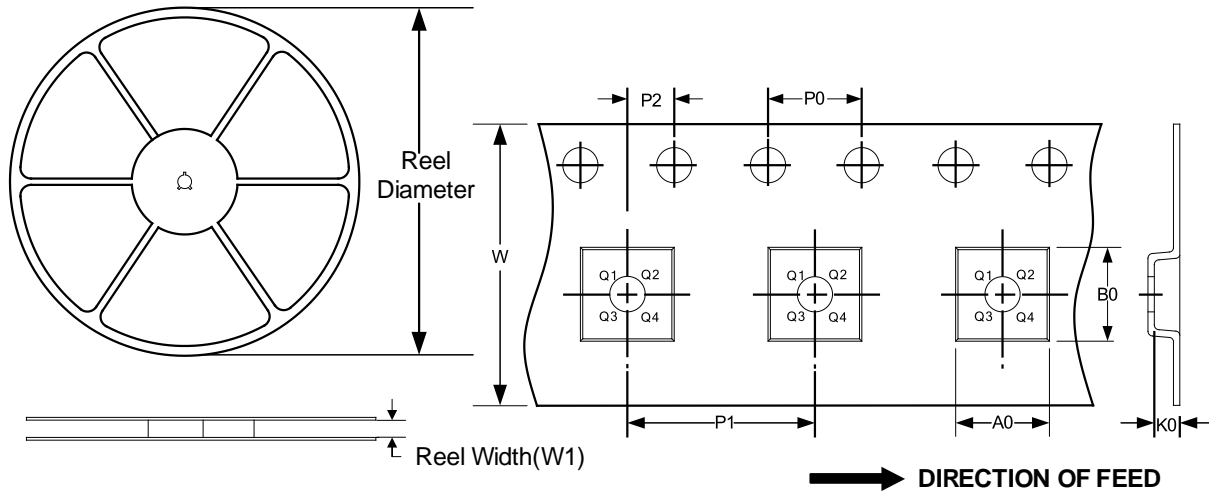
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.50(BSC)		0.020(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187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

**XQFN1.4X1.8-10**


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
MSOP10	13"	12.4	5.20	3.30	1.20	4.0	8.0	2.0	12.0	Q1
XQFN1.4X1.8-10	7"	9.0	1.60	2.00	0.85	4.0	4.0	2.0	8.0	Q1