

4.5Ω Low Voltage Dual SPDT Analog Switch

1 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**

2 APPLICATIONS

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

3 DESCRIPTIONS

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	UQFN1.4X1.8-10	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.

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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.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
C.5	2024/05/27	1. Add MSL on Page 6@RevC.4.1 2. Add Package thermal impedance on Page 5@RevC.4.1 3. Update PACKAGE note

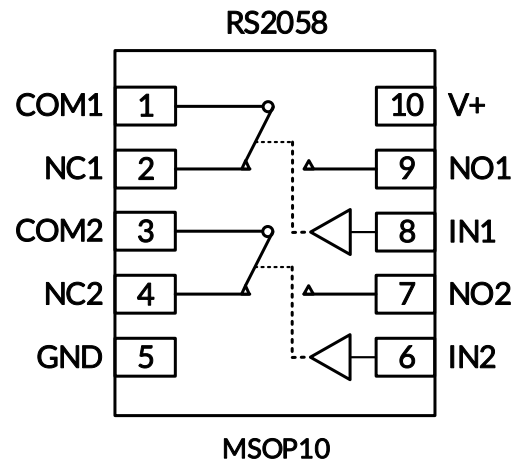
5 PACKAGE/ORDERING INFORMATION ⁽¹⁾

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING ⁽²⁾	MSL ⁽³⁾	PACKAGE OPTION
RS2058	RS2058XN	-40°C ~125°C	MSOP10	RS2058	MSL3	Tape and Reel, 4000
RS2058	RS2058XUTQK10	-40°C ~125°C	UQFN1.4X1.8-10	2058	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 (TOP VIEW)



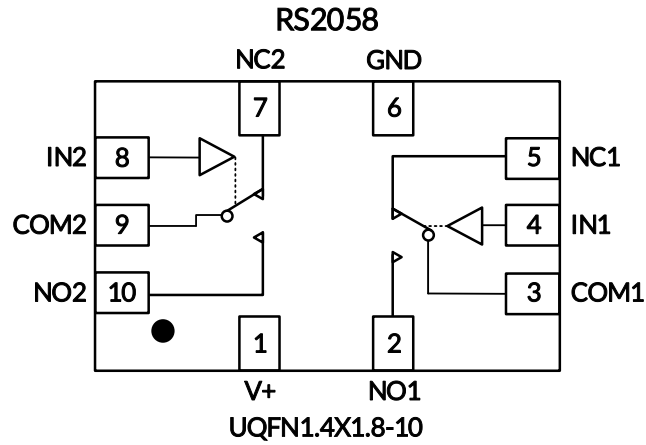
6.1 Pin Description

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

6.2 Function Table

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

PIN CONFIGURATIONS (TOP VIEW)



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

7 SPECIFICATIONS

7.1 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 ⁽²⁾	-0.3	6.0		
	Analog, Digital Voltage Range	-0.3	(V ₊)+0.3		
	Continuous Current NO, NC, or COM	-300	+300	mA	
I _{PEAK}	Peak Current NO, NC, or COM	-500	+500		
θ _{JA}	Package thermal impedance ⁽³⁾	MSOP10		200	°C/W
		UQFN1.4X1.8-10		115	
T _J	Junction Temperature ⁽⁴⁾	-40	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.

(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_{J(MAX)}, R_{θJA}, and T_A. The maximum allowable power dissipation at any ambient temperature is P_D = (T_{J(MAX)} - T_A) / R_{θJA}. 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 _(ESD)	Electrostatic discharge	Human-Body Model (HBM)	±1000	V
		Machine Model (MM)	±100	V



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 _{CC}	Supply Voltage	1.8	5.5	V
T _A	Operating temperature	-40	+125	°C

7.4 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 ⁽²⁾	TYP ⁽³⁾	MAX ⁽²⁾	UNIT
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 4	5V	+25°C	4.5	8	Ω	
				FULL		8.5	Ω	
			3.3V	+25°C	7	10	Ω	
				FULL		10.5	Ω	
On-Resistance Match Between Channels	ΔR_{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	Ω	
				FULL		0.4	Ω	
			3.3V	+25°C	0.15	0.3	Ω	
				FULL		0.4	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 4	5V	+25°C	2	3	Ω	
				FULL		3.3	Ω	
			3.3V	+25°C	3	4	Ω	
				FULL		4.3	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 5	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 6	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.

(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 V, T_A = -40°C to 125°C (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	V ₊	T _A	MIN	TYP	MAX	UNIT
DYNAMIC CHARACTERISTICS								
Turn-On Time	t _{ON}	V _{COM} = V ₊ , R _L = 300Ω, C _L = 35pF, See Figure 8	5V	+25°C		30		ns
			3.3V			40		
Turn-Off Time	t _{OFF}	V _{COM} = V ₊ , R _L = 300Ω, C _L = 35pF, 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} = 3V, R _L = 300Ω, C _L = 35pF, See Figure 9	5V	+25°C		5		ns
			3.3V			8		
Off Isolation	O _{ISO}	R _L = 50Ω, Switch OFF, See Figure 11		+25°C		-52		dB
				+25°C		-71		dB
-3dB Bandwidth	BW	Switch ON, R _L = 50Ω, 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
POWER REQUIREMENTS								
Power Supply Range	V ₊			FULL	1.8		5.5	V
Power Supply Current	I ₊	V _{IN} = GND or V ₊	5.5V	FULL			1	μA

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.

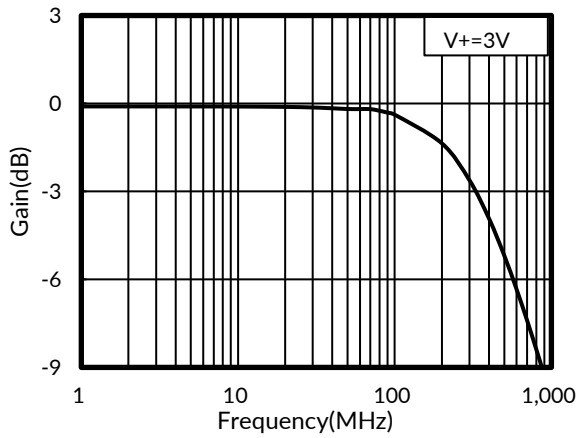


Figure 1. Bandwidth vs Frequency

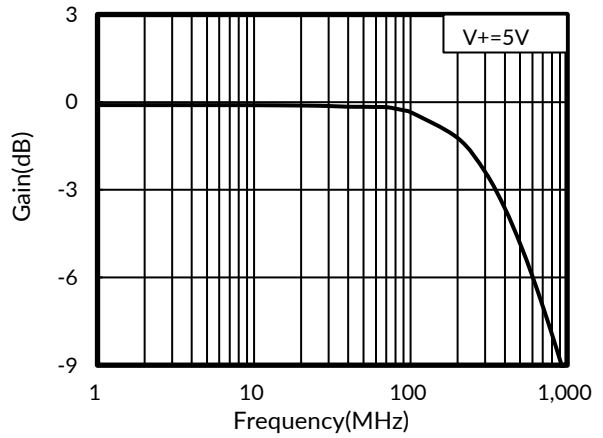


Figure 2. Bandwidth vs Frequency

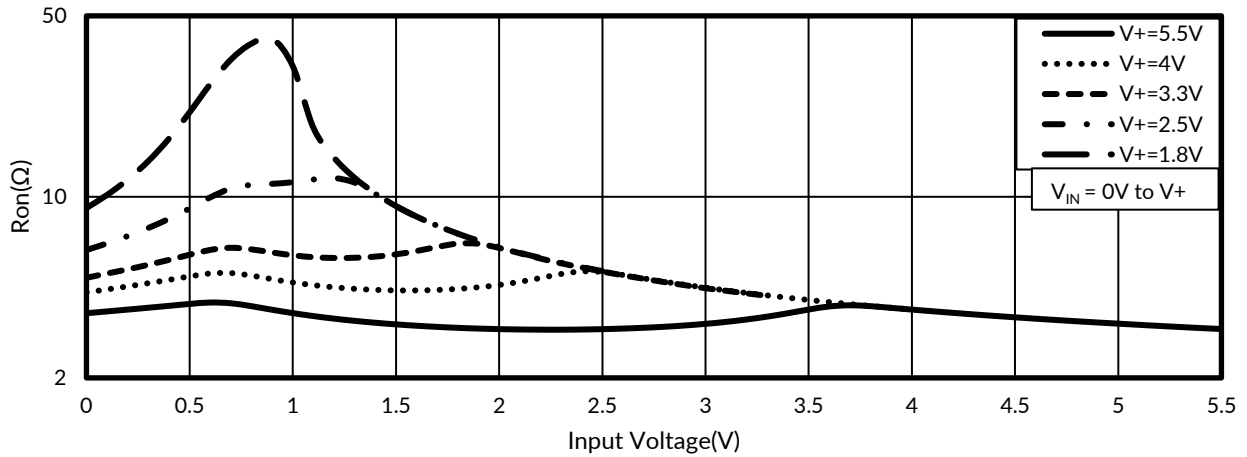


Figure 3. Typical Ron as a Function of Input Voltage

8 PARAMETER MEASUREMENT INFORMATION

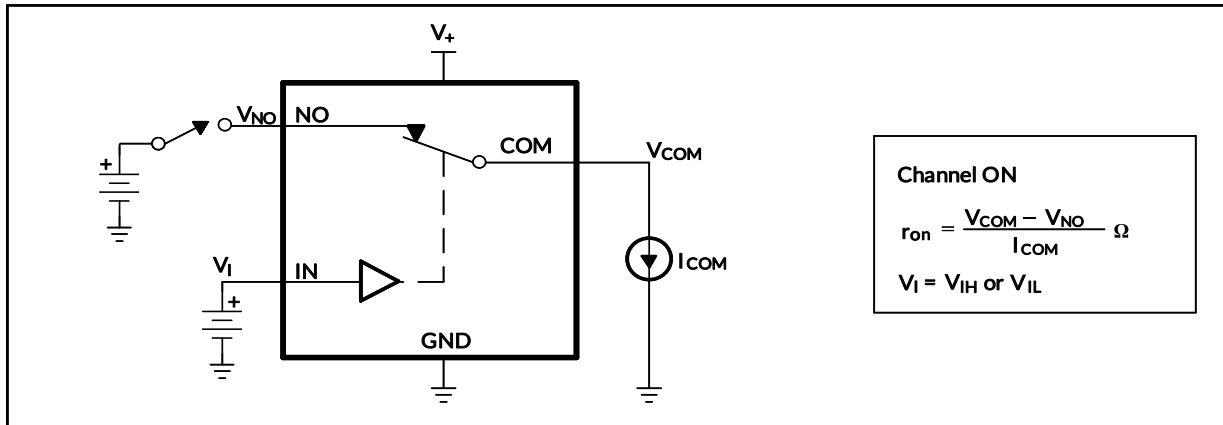


Figure 4. ON-State Resistance (R_{on})

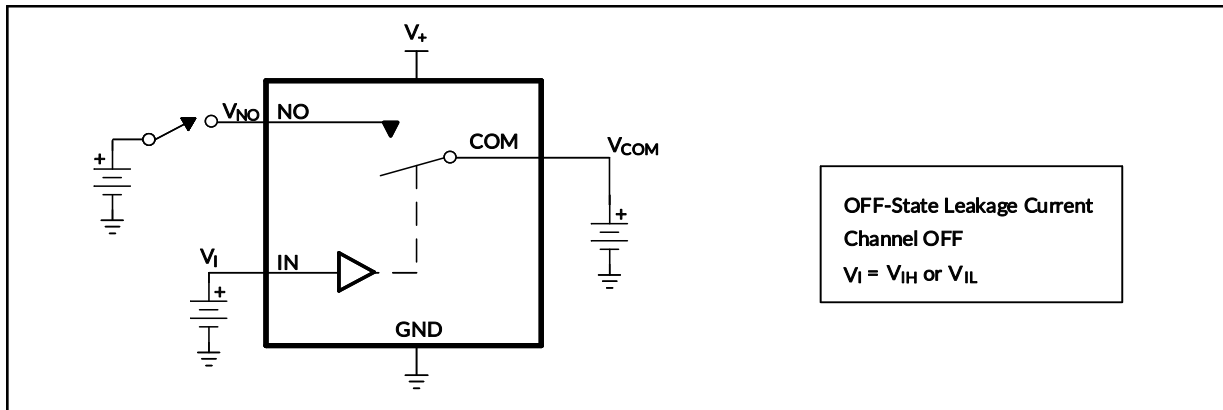


Figure 5. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NO(OFF)}$)

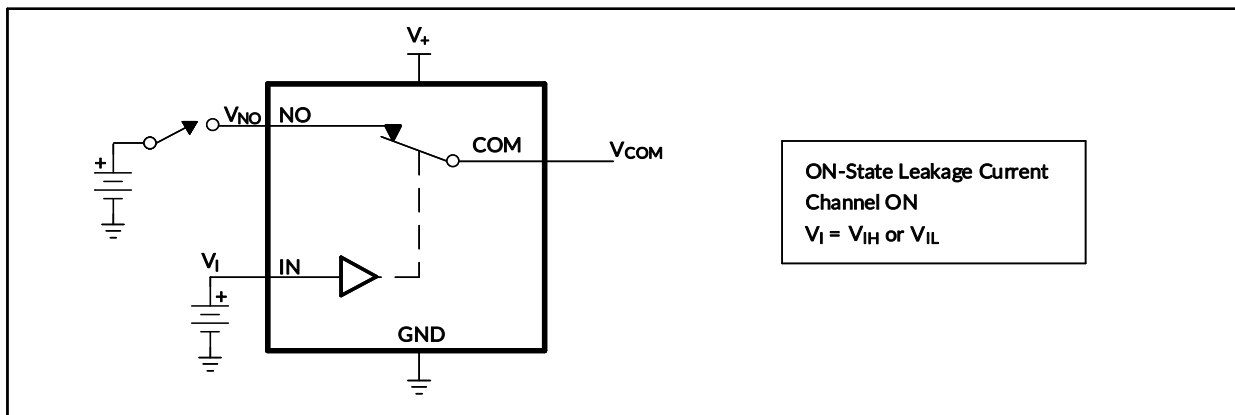


Figure 6. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NO(ON)}$)

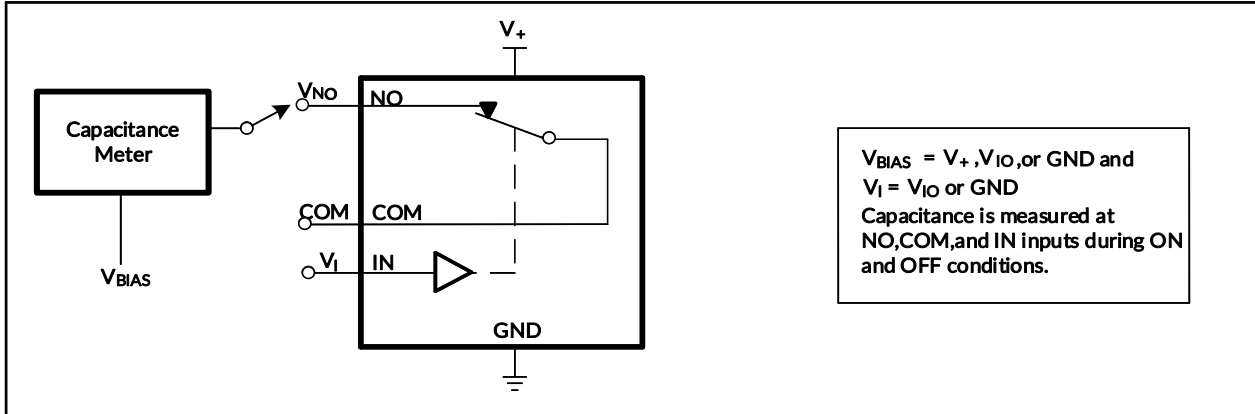


Figure 7. Capacitance (C_I , $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)

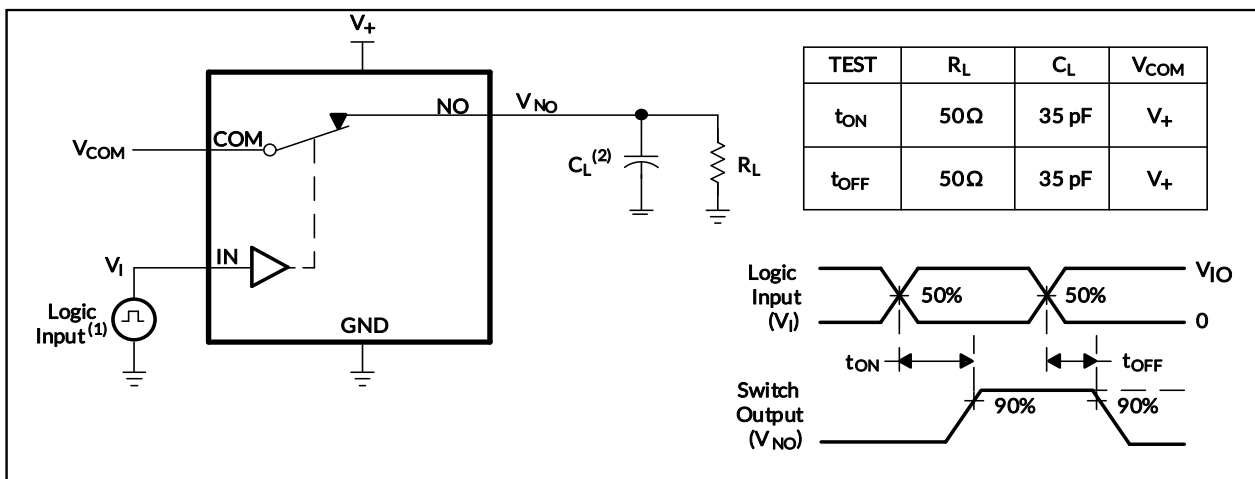


Figure 8. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

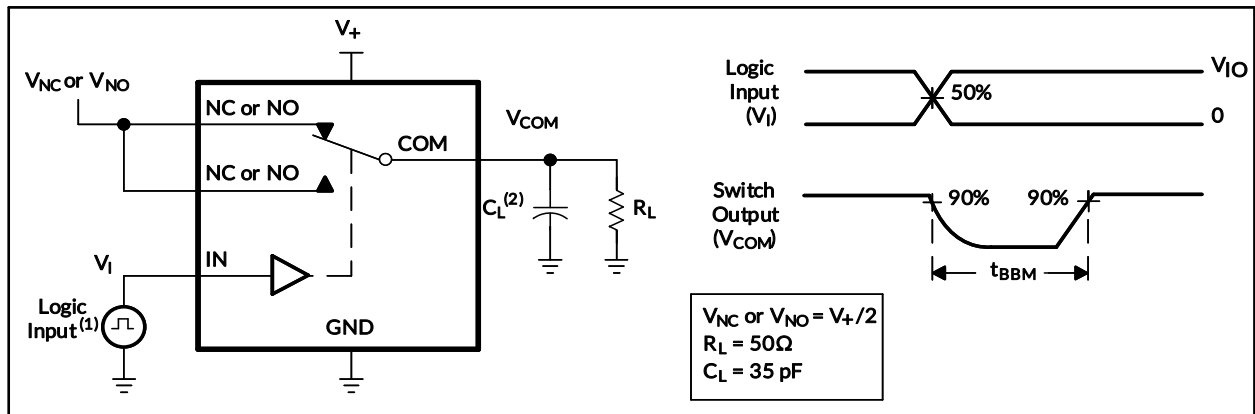


Figure 9. Break-Before-Make Time (t_{BBM})

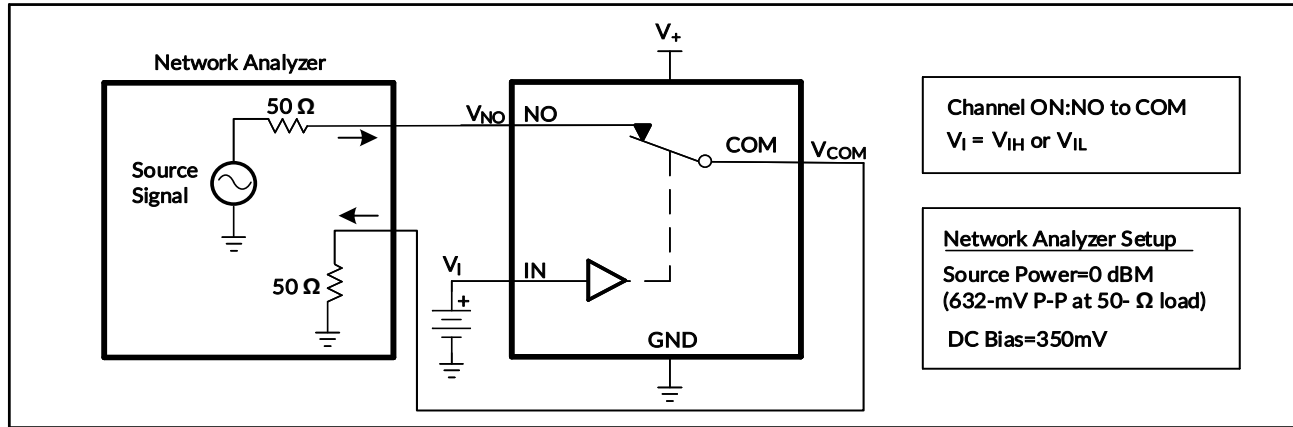


Figure 10. Bandwidth (BW)

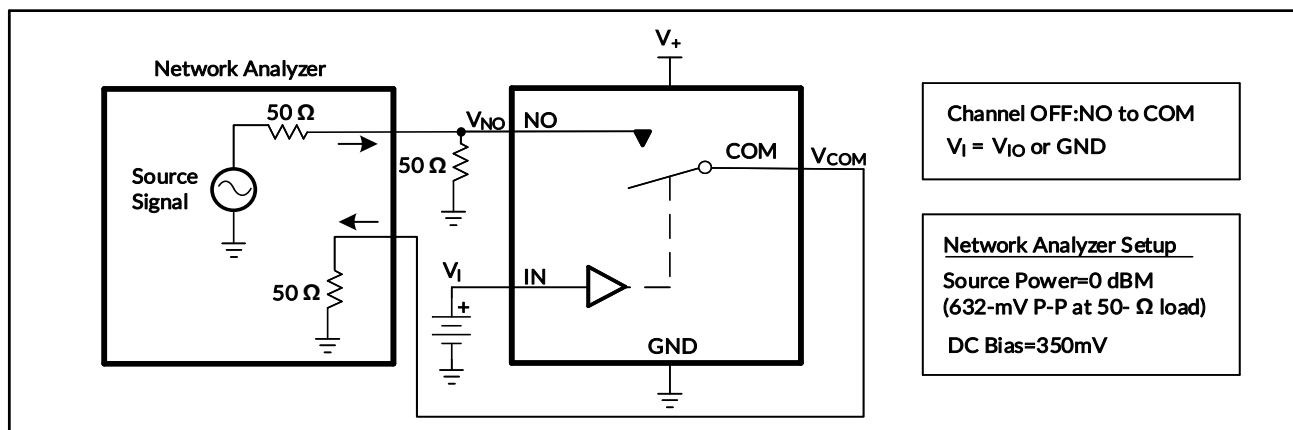


Figure 11. OFF Isolation (O_{Iso})

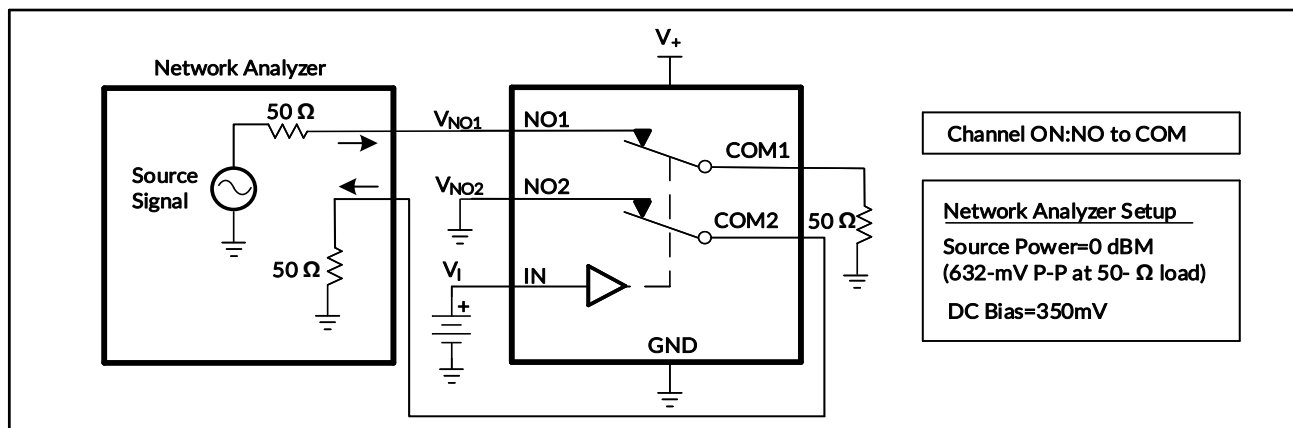


Figure 12. Crosstalk (X_{TALK})

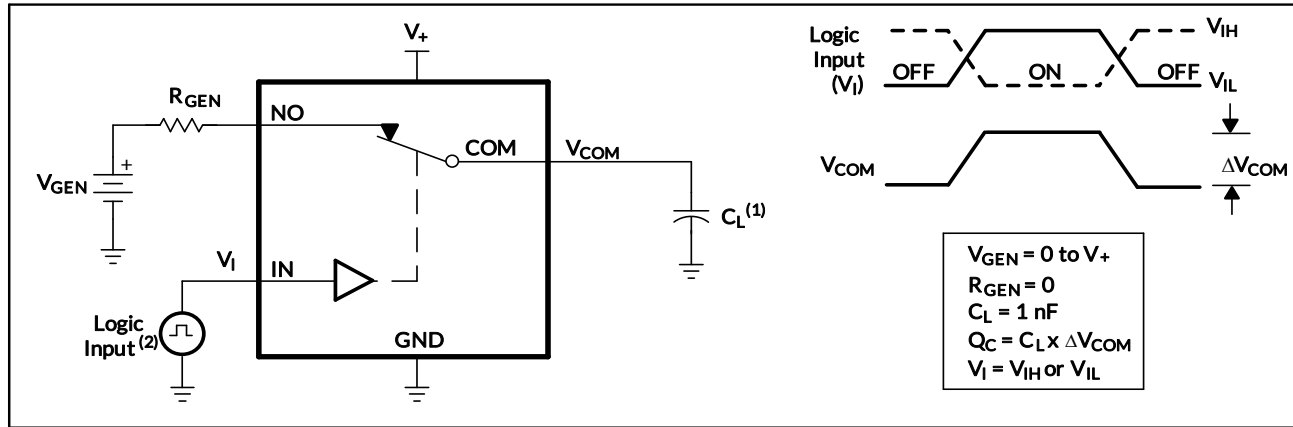


Figure 13. Charge Injection (Q_c)

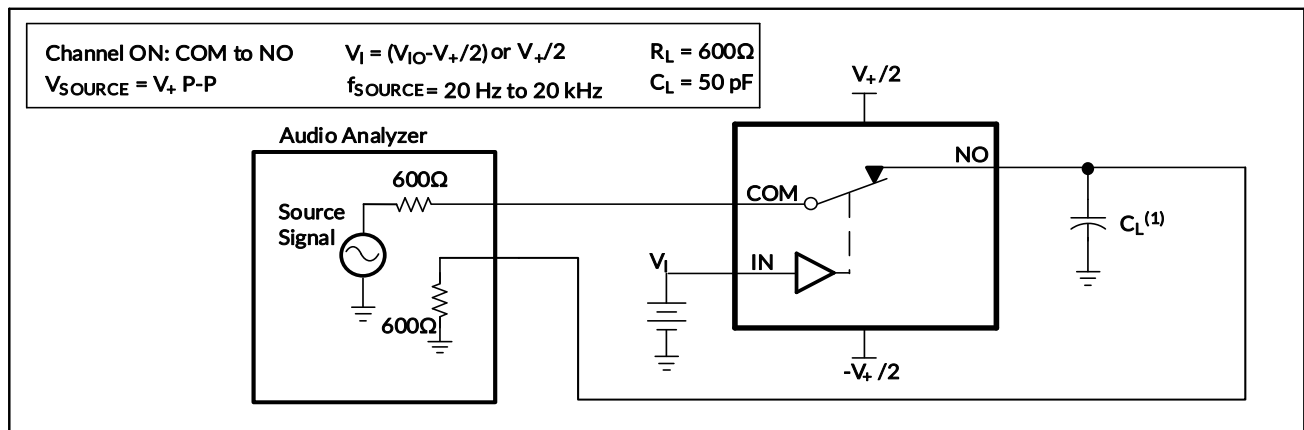
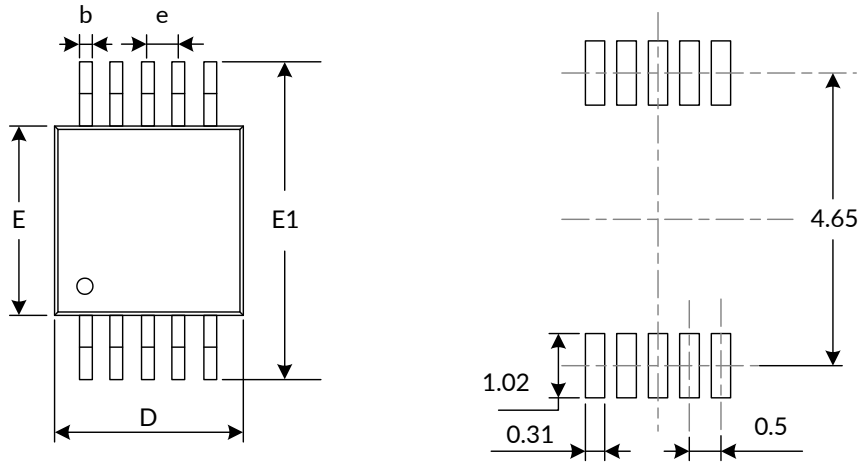
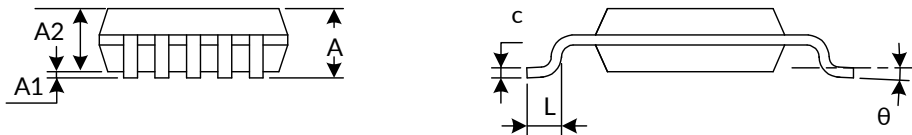


Figure 14. Total Harmonic Distortion (THD)

9 PACKAGE OUTLINE DIMENSIONS MSOP10⁽³⁾



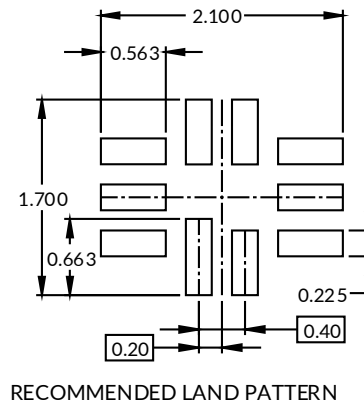
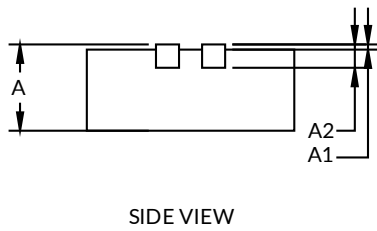
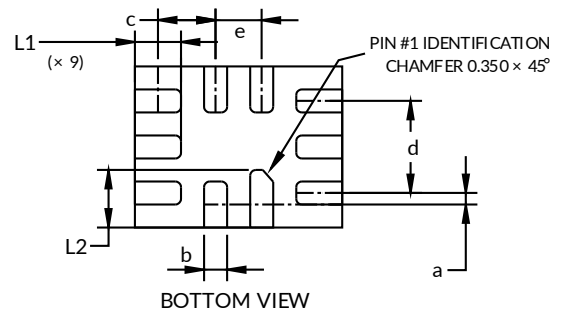
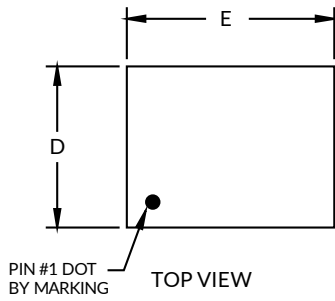
RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A ⁽¹⁾	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 ⁽¹⁾	2.900	3.100	0.114	0.122
e	0.500(BSC) ⁽²⁾		0.020(BSC) ⁽²⁾	
E ⁽¹⁾	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.

UQFN1.4X1.8-10⁽³⁾


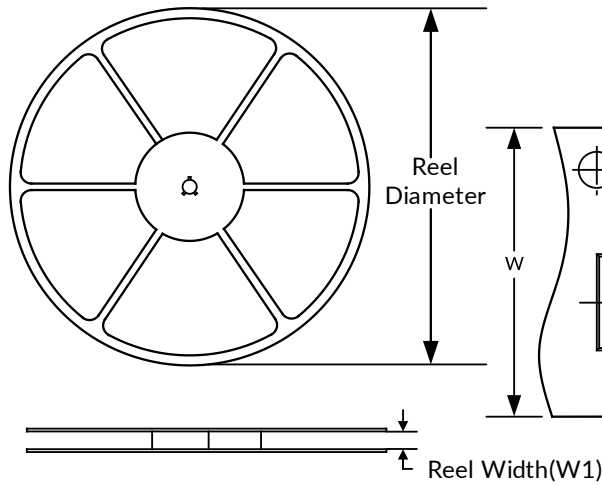
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A ⁽¹⁾	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A2	0.203 REF ⁽²⁾		0.008 REF ⁽²⁾	
a	0.050	0.150	0.002	0.006
b	0.150	0.250	0.006	0.010
c	0.450	0.550	0.018	0.022
d	0.800 REF ⁽²⁾		0.031 REF ⁽²⁾	
D ⁽¹⁾	1.350	1.450	0.053	0.057
E ⁽¹⁾	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

NOTE:

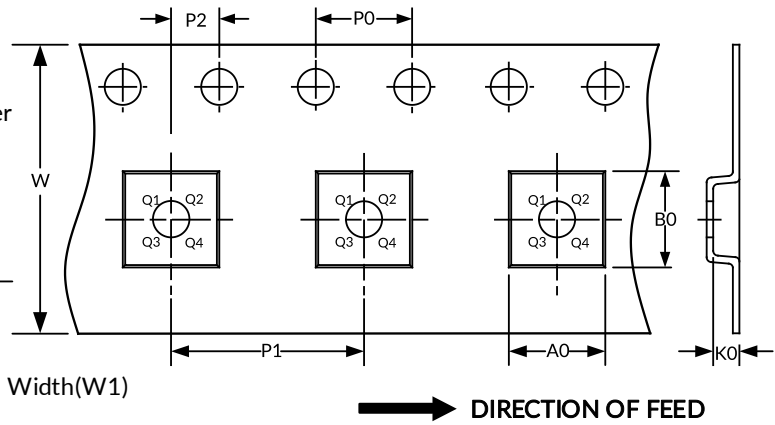
1. Plastic or metal protrusions of 0.075mm maximum per side are not included.
2. REF is the abbreviation for Reference.
3. This drawing is subject to change without notice.

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
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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