4Ω, 250MHz Bandwidth, Dual-Channel SPDT Analog Switch with Negative Signaling Capability

1 FEATURES

- **-3dB Bandwidth: 250MHz**
- **Supply Range: +2.5V to +5.5V**
- **Negative Signal Swing Capability: -2V to V_+**
- **Break-Before-Make Switching**
- **Fast t_{ON}, t_{OFF} Times**
- **1.8V Logic Control**
- **Extended Industrial Temperature Range: -40°C to +85°C**
- **Small Package Available in Green UQFN1.4X1.8-10 and MSOP10 Package**

2 APPLICATIONS

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

3 DESCRIPTIONS

The RS2117H is a bidirectional, dual-channel single-pole double-throw (SPDT) analog switch that is designed to operate from 2.5V to 5.5V, and the switches can handle negative signal down to -2.0V.

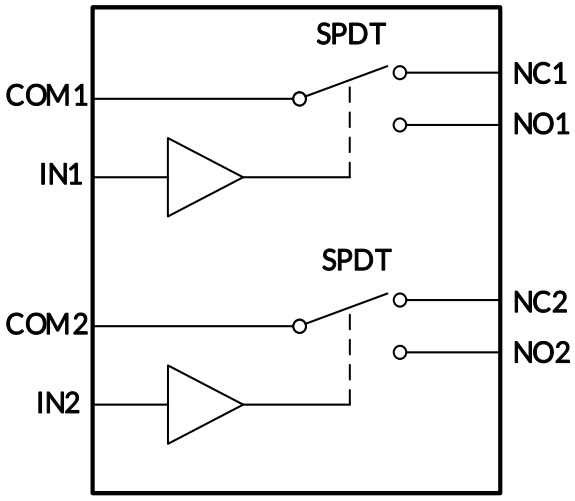
The device also offers a low ON-state resistance of 4Ω, which is matched to within 1 Ω between channels. This device is available packaged in UQFN1.4X1.8-10 and MSOP10.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS2117H	MSOP10	3.00mm×3.00mm
	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 different from page numbers in the current version.

Version	Change Date	Change Item
E.1	2022/08/31	Version updated
E.1.1	2024/03/11	Modify packaging naming

6 PACKAGE/ORDERING INFORMATION (1)

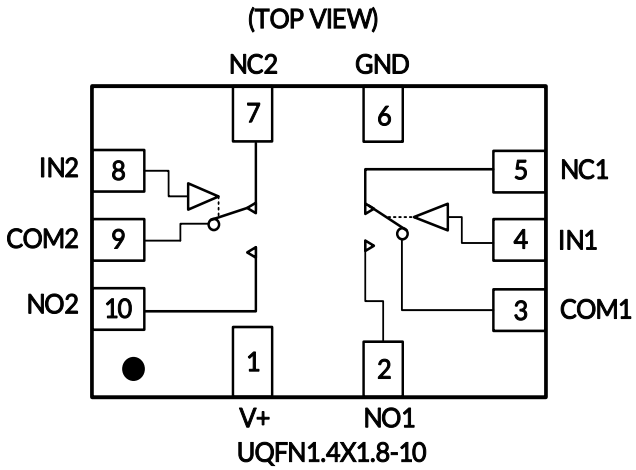
PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING (2)	PACKAGE OPTION
RS2117H	RS2117HYUTQK10	-40°C ~+85°C	UQFN1.4X1.8-10	2117	Tape and Reel,4000
	RS2117HYN	-40°C ~+85°C	MSOP10	RS2117	Tape and Reel,4000

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.

7 PIN CONFIGURATIONS



7.1 PIN DESCRIPTION

NAME	PIN	FUNCTION
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

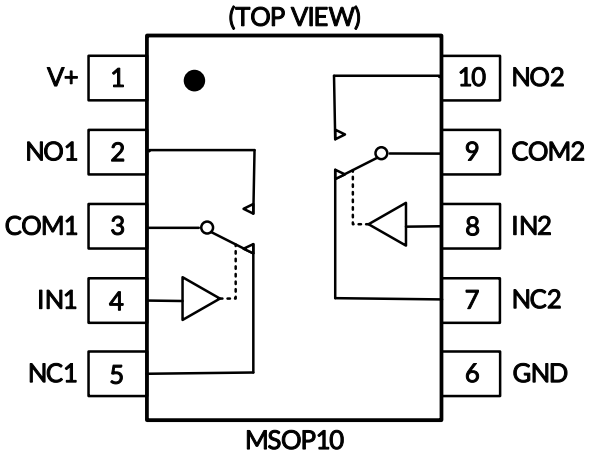
NOTE: NOX, NCX and COMX terminals may be an input or output.

7.2 FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

NOTE: Switches shown for logic “0” input.

PIN CONFIGURATIONS



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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.

8 SPECIFICATIONS

8.1 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	-0.3	6.0	
	Analog Voltage Range	-2.0	(V_+) +0.3	
	Digital Voltage Range	-0.3	(V_+) +0.3	
	Continuous Current NO, NC, or COM	-100	+100	mA
I_{PEAK}	Peak Current NO, NC, or COM	-150	+150	
T_J	Junction Temperature (2)	-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) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. 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.

8.2 ESD Ratings

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

		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±4000	V
	Charged-device model (CDM), per ANSI/ESDA/JEDEC JS-002(2)	±1500	
	Machine Model (MM)	±300	

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

(2) JEDEC document JEP157 states that 250 V CDM 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.

8.3 Recommended Operating Conditions

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

SYMBOL	PARAMETER	MIN	MAX	UNIT
V_{CC}	Supply Voltage	2.5	5.5	V
T_A	Operating temperature	-40	+85	°C

8.4 Thermal Information

THERMAL METRIC (1)		RS2117H		UNIT
		10 PINS		
		MSOP10	UQFN1.4X1.8-10	
$R_{\Theta JA}$	Junction-to-ambient thermal resistance	180.7	120	°C/W
$R_{\Theta JC\ (top)}$	Junction-to-case (top) thermal resistance	66.2	46.0	°C/W
$R_{\Theta JB}$	Junction-to-board thermal resistance	103.2	44.5	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	11.2	1.5	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	101.3	44.5	°C/W
$R_{\Theta JC\ (bot)}$	Junction-to-case (bottom) thermal resistance	N/A	31.2	°C/W

(1) Thermal resistance varies with operating conditions.

8.5 ELECTRICAL CHARACTERISTICS

V+= 5.0 V, T_A= -40°C to 85°C (unless otherwise noted).

PARAMETER	SYMBOL	CONDITIONS	V+	T_A	MIN	TYP	MAX	UNIT
ANALOG SWITCH								
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}	2.5V ≤V+≤3.5V		FULL	-2.0		V+	V
		3.5V ≤V+≤ 5.5V			(V+) -5.5		V+	
On-Resistance	R_{ON}	0 ≤ (V_{NO} or V_{NC}) ≤V+, I_{COM}= -10mA, Switch ON, See Figure 4	5.5V	+25°C		2.5	4	Ω
				FULL			4.5	Ω
			3.3V	+25°C		5	6	Ω
				FULL			6.5	Ω
On-Resistance Match Between Channels	ΔR_{ON}	0 ≤ (V_{NO} or V_{NC}) ≤V+, I_{COM}= -10mA, Switch ON, See Figure 4	5.5V	+25°C		0.15	0.5	Ω
				FULL			0.6	Ω
			3.3V	+25°C		0.15	0.5	Ω
				FULL			0.6	Ω
On-Resistance Flatness	$R_{FLAT (ON)}$	0 ≤ (V_{NO} or V_{NC}) ≤V+, I_{COM}= -10mA, Switch ON, See Figure 4	5.5V	+25°C		1	2	Ω
				FULL			2.5	Ω
			3.3V	+25°C		3	5	Ω
				FULL			5.4	Ω
NC, NO OFF Leakage Current	$I_{NC (OFF)}$, $I_{NO (OFF)}$	V_{NO} or V_{NC}= 0.3V, V+/2 V_{COM}= V+/2, 0.3V See Figure 5	2.5V 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}= 0.3V, Open V_{COM}= Open, 0.3V See Figure 6	2.5V 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			0.5	V
			3.3V	FULL			0.4	V
Input Leakage Current	I_{IN}	V_{IN}= V_{IO} or 0	2.5V to 5.5V	FULL			1	μA
POWER REQUIREMENTS								
Power Supply Range	V_+			FULL	2.5		5.5	V
Power Supply Current	I_+	V_{IN}= GND or V_+	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.

ELECTRICAL CHARACTERISTICS (Continued)

$V+$= 5.0 V, T_A= -40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS		V+	TEMP	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		25		ns
				3.3V			30		
Turn-Off Time	t_{OFF}	V_{COM}= V+, R_L= 300Ω, C_L= 35pF, See Figure 8		5V	+25°C		20		ns
				3.3V			25		
Break-Before-Make Time Delay	t_{BBM}	V_{NO1}= V_{NC1}= V_{NO2}= V_{NC2}= V+/2, R_L= 300Ω, C_L= 35pF, See Figure 9		5V	+25°C		5		ns
				3.3V			10		
Charge Injection	Q	V_G= GND, R_G= 0Ω, C_L= 1.0nF, See Figure 13		5V	+25°C		15		pC
				3.3V	+25°C		10		
Off Isolation	O_{ISO}	R_L= 50Ω, Switch OFF, See Figure 11	f=1MHz		+25°C		-50		dB
			f=10MHz		+25°C		-38		dB
-3dB Bandwidth	BW	Switch ON, R_L= 50Ω See Figure 10			+25°C		250		MHz
Channel-to-Channel Crosstalk	X_{TALK}	Signal= 0dBm, R_L= 50Ω, C_L= 5pF, See Figure 12	f=1MHz		+25°C		-72		dB
			f=10MHz		+25°C		-52		dB
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		10		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		25		pF

8.6 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.

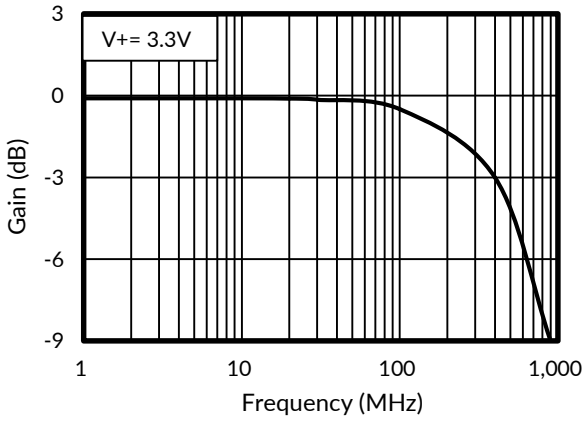


Figure 1. Bandwidth vs Frequency

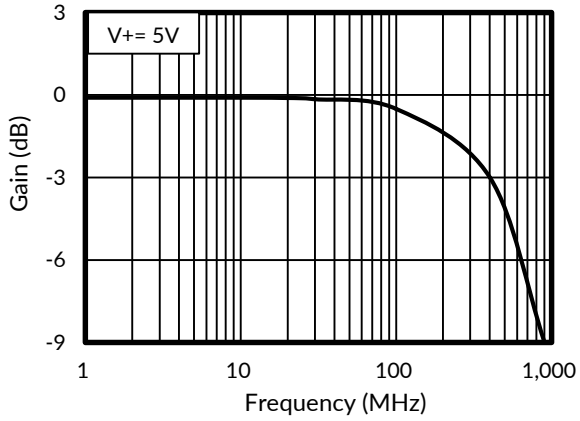


Figure 2. Bandwidth vs Frequency

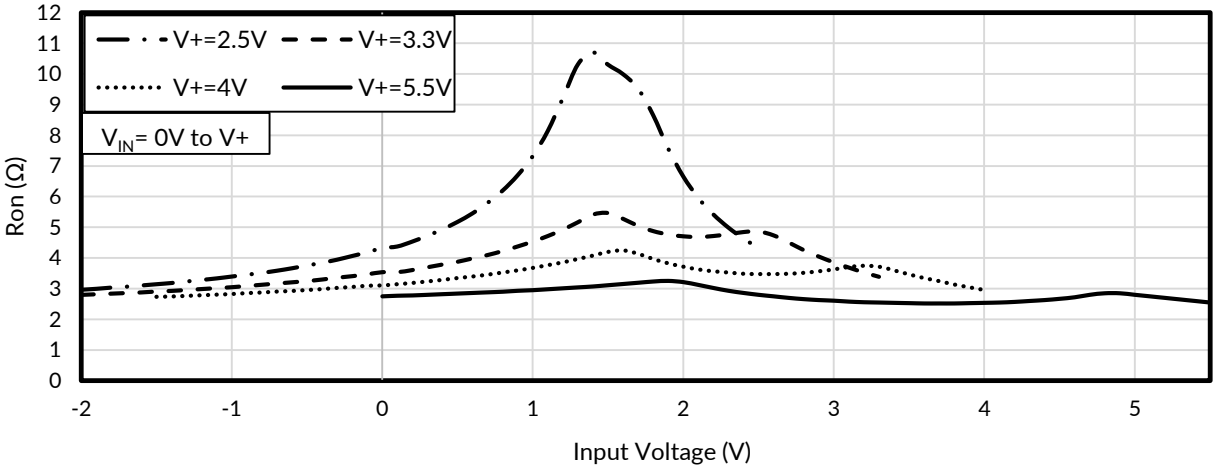


Figure 3. Typical Ron as a Function of Input Voltage

9 Parameter Measurement Information

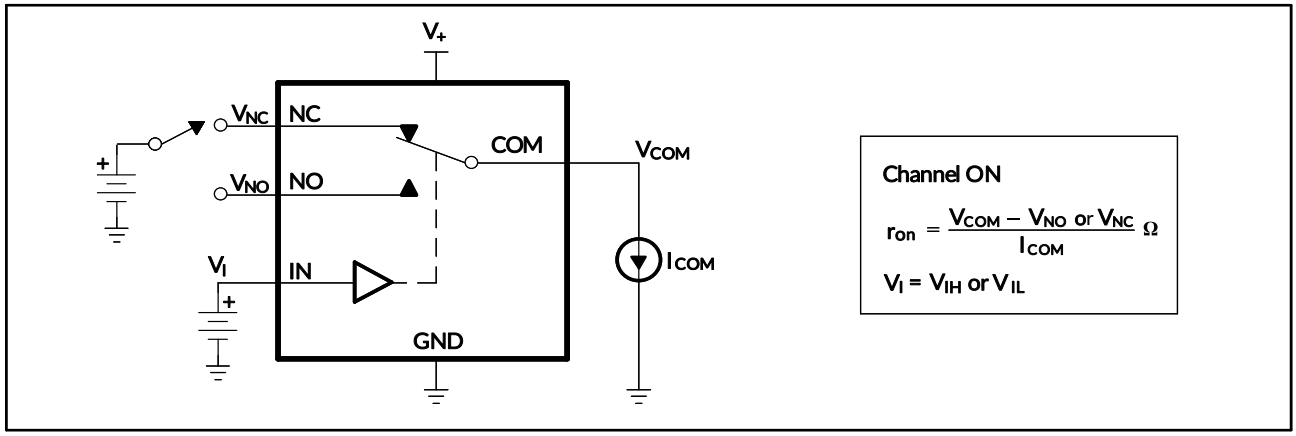


Figure 4. ON-State Resistance (r_{on})

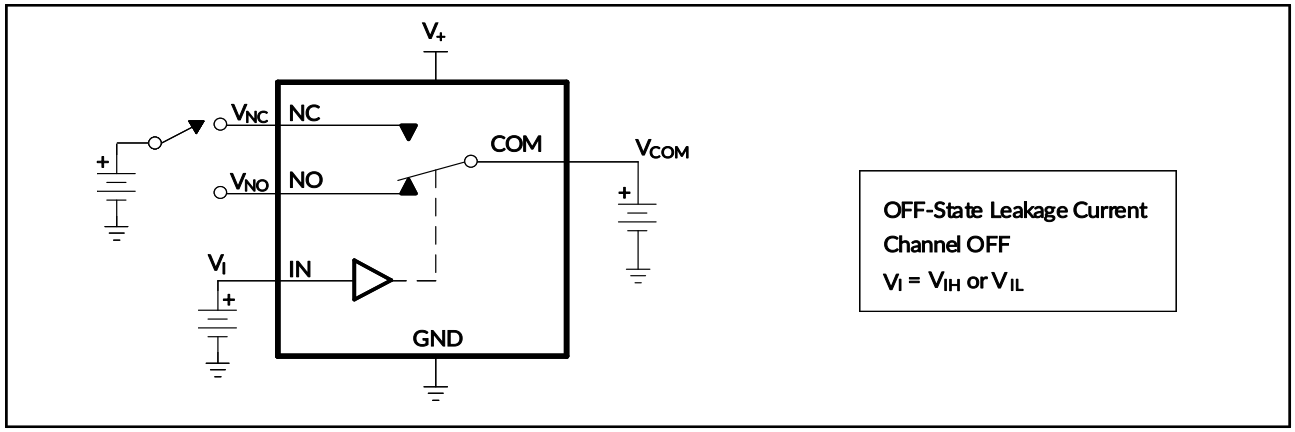


Figure 5.OFF-State Leakage Current ($I_{NC(OFF)}$, $I_{NO(OFF)}$)

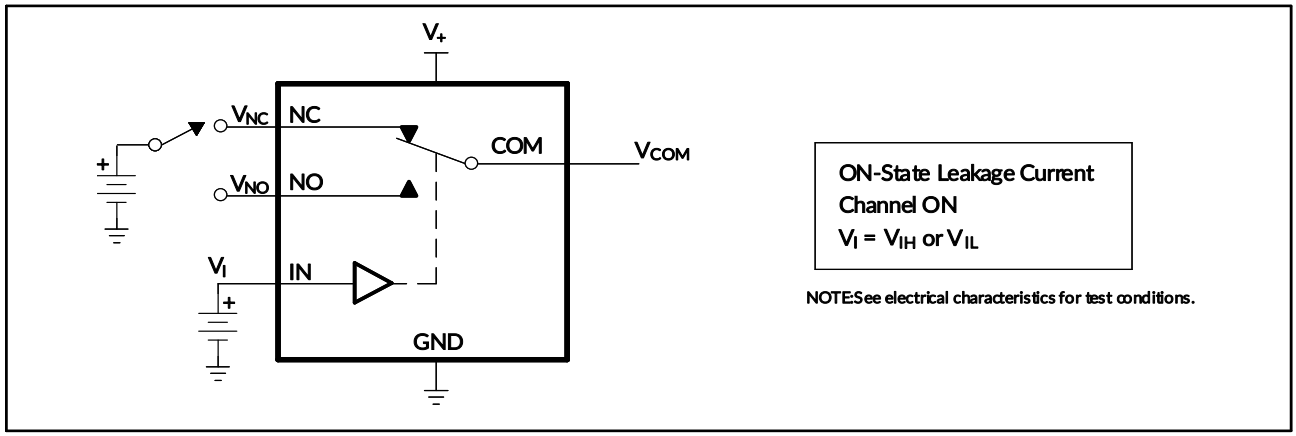


Figure 6. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NC(ON)}$, $I_{NO(ON)}$)

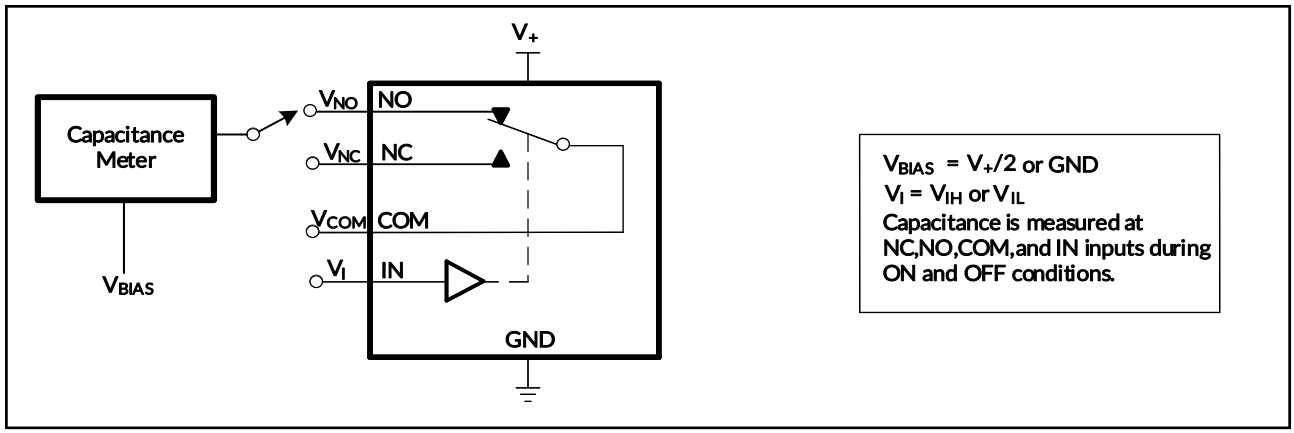
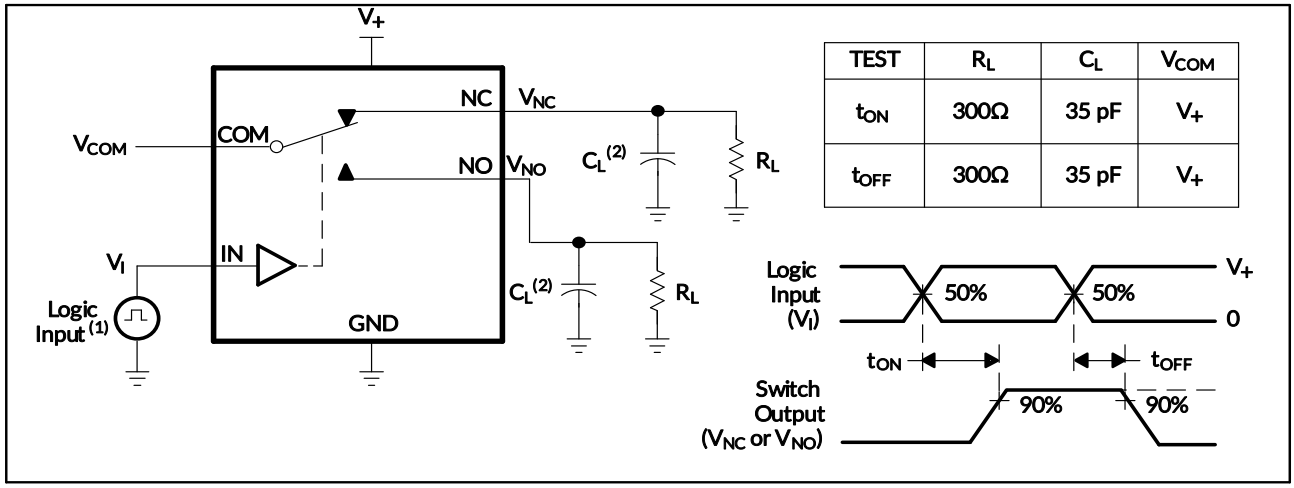


Figure 7. Capacitance (C_I, $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NC(ON)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)



TEST	R_L	C_L	V_{COM}
t_{ON}	300Ω	35 pF	V+
t_{OFF}	300Ω	35 pF	V+

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

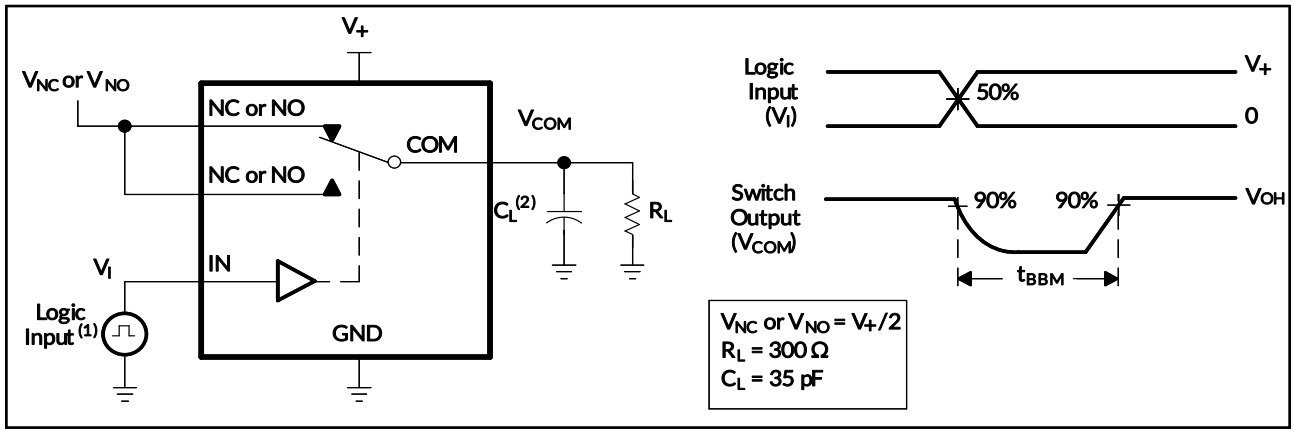


Figure 9. Break-Before-Make Time (t_{BBM})

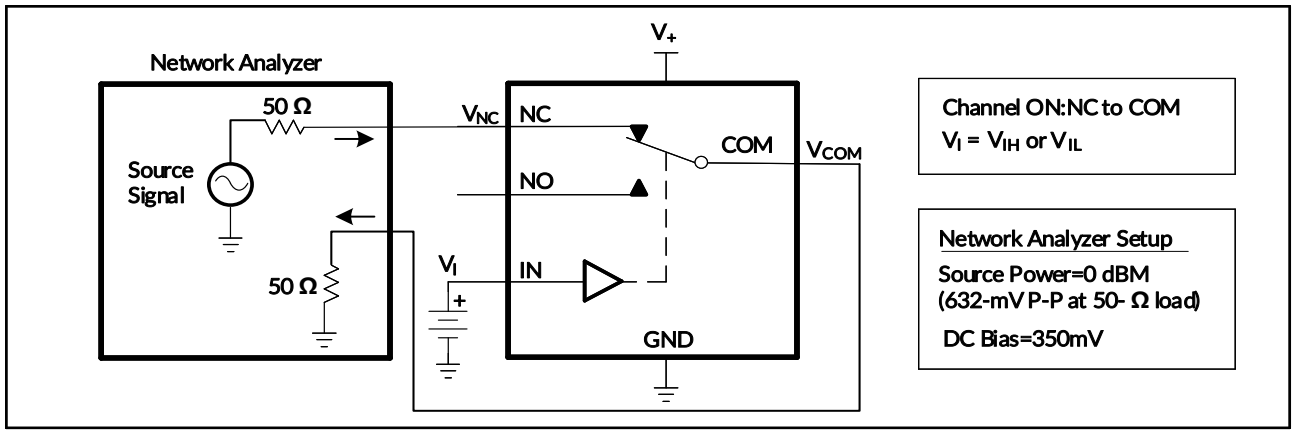


Figure 10. Bandwidth (BW)

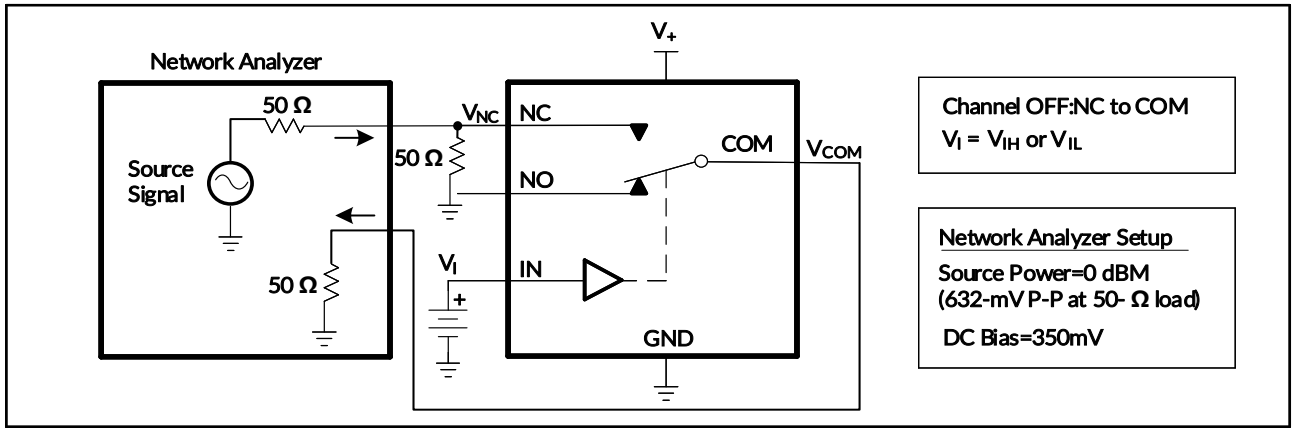


Figure 11. OFF Isolation (O_{ISO})

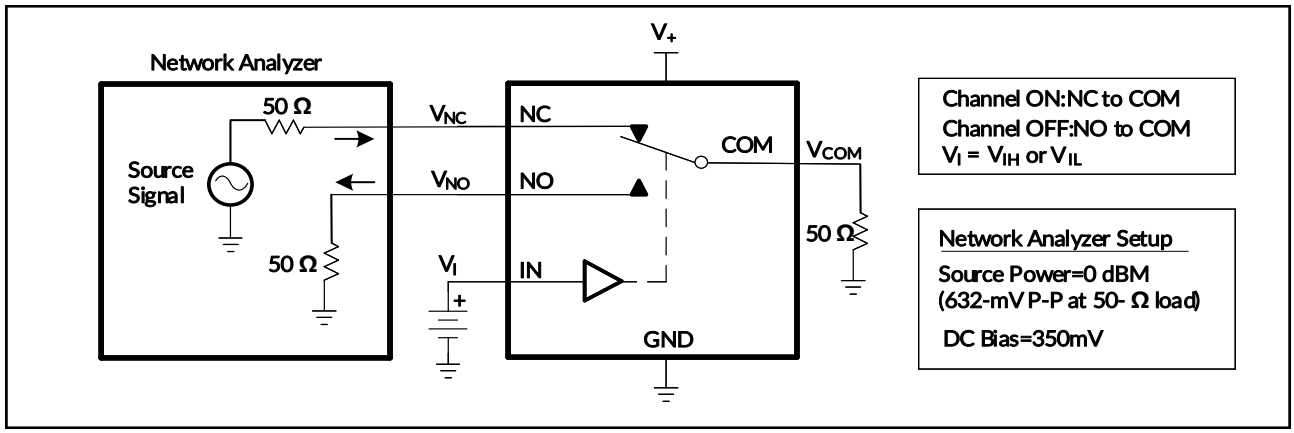


Figure12. Crosstalk (X_{TALK})

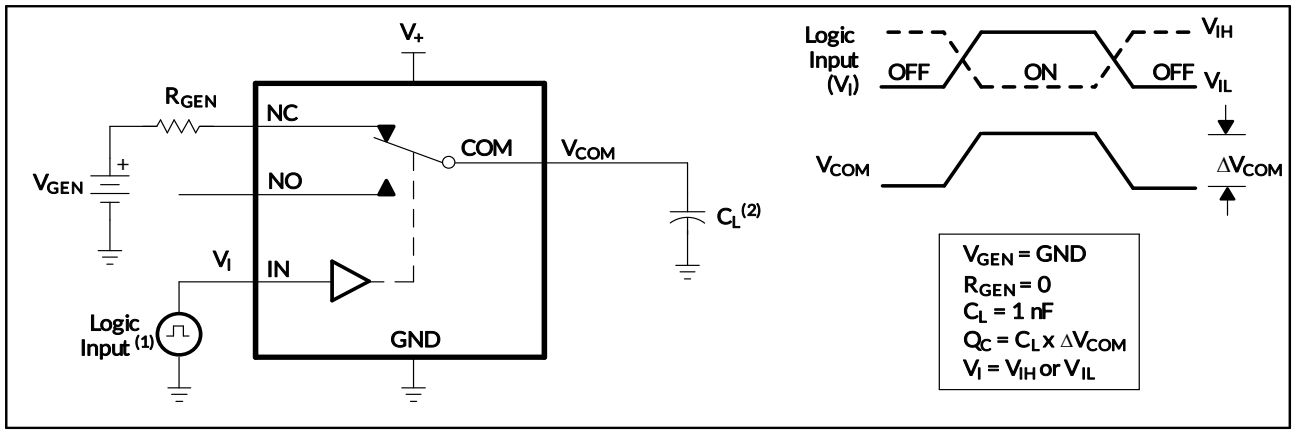


Figure 13. Charge Injection (Q_C)

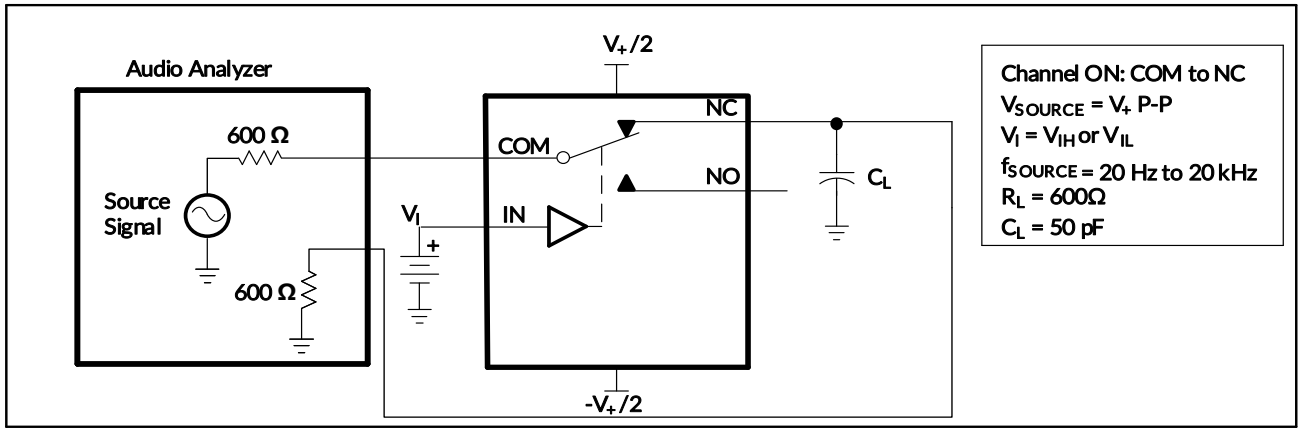


Figure 14. Total Harmonic Distortion (THD)

10 TYPICAL APPLICATION

Analog signals that range over the entire supply voltage V_{CC} to GND can be passed with very little change in ON-state resistance. The switches are bidirectional, so the NO, NC, and COM pins can be used as either inputs or outputs. Pull the digitally controlled input select pin IN to V_{CC} or GND to avoid unwanted switch states that could result if the logic control pin is left floating.

Under the cut-off state of -40°C to 85°C, the voltage difference between the NO, NC shall not be greater than 4.2V, and there will be leakage when it is greater than 4.2V.

10.1 Typical Application

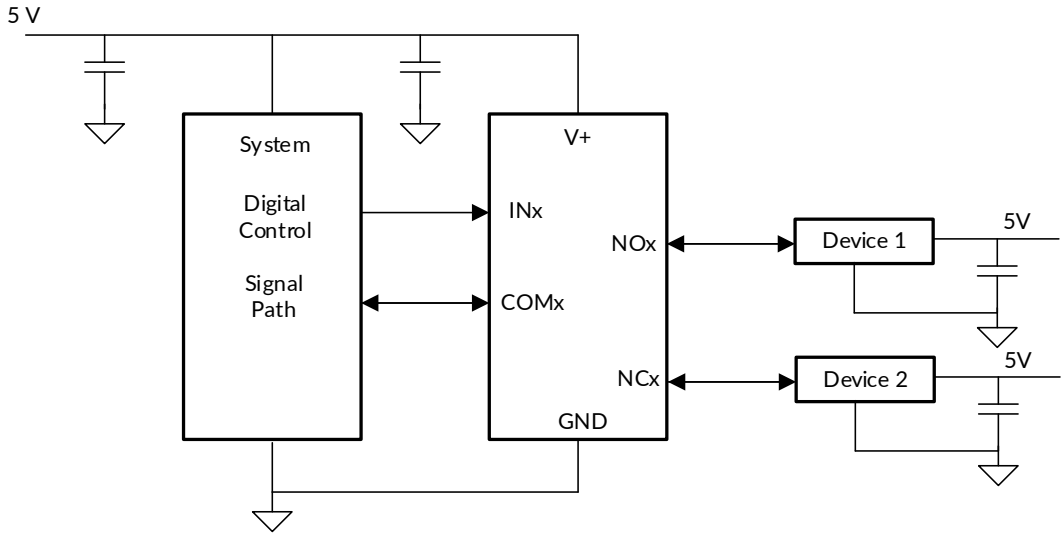
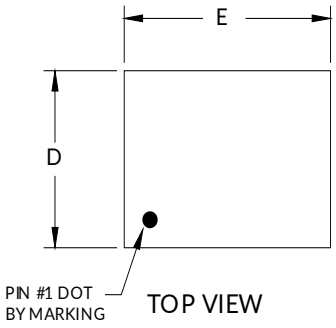


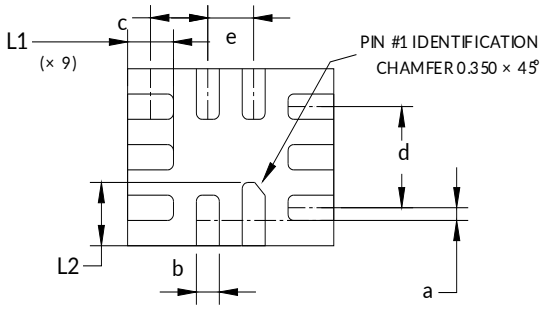
Figure 15. Typical Application Schematic

11 PACKAGE OUTLINE DIMENSIONS

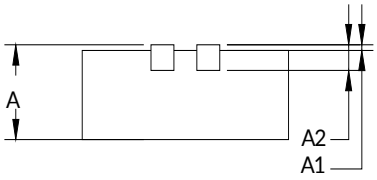
UQFN1.4X1.8-10 (3)



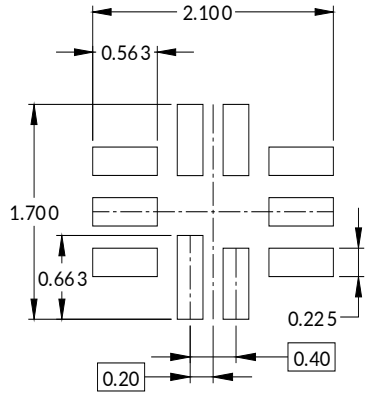
TOP VIEW



BOTTOM VIEW



SIDE VIEW



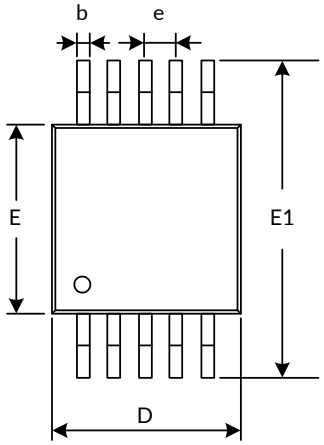
RECOMMENDED LAND PATTERN

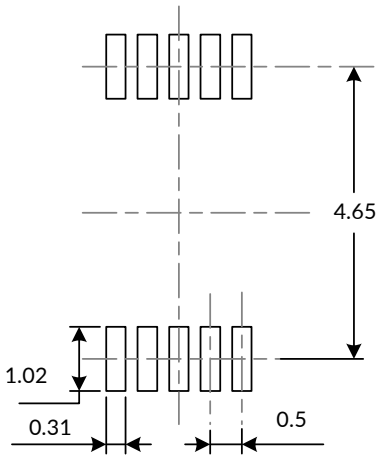
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A2	0.203 REF (2)		0.008 REF (2)	
a	0.050	0.150	0.002	0.006
b	0.150	0.250	0.006	0.010
c	0.450	0.550	0.018	0.022
d	0.800 REF (2)		0.031 REF (2)	
D (1)	1.350	1.450	0.053	0.057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

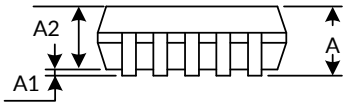
1. Plastic or metal protrusions of 0.075mm maximum per side are not included.
2. REF is the abbreviation for Reference.
3. This drawing is subject to change without notice.

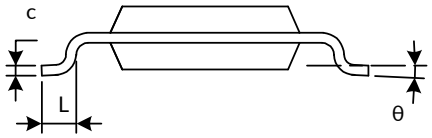
MSOP10 (3)





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	0.50 (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°

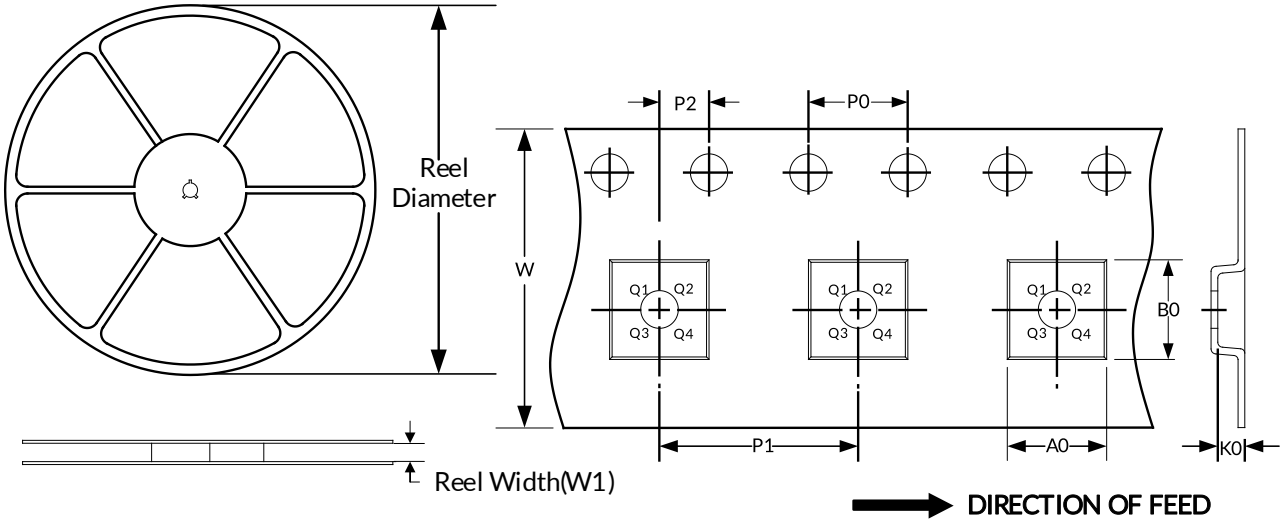
NOTE:

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.

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
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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