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

1 FEATURES

- **-3dB Bandwidth: 30MHz**
- **High Speed, Typically 50ns**
- **Supply Range: +1.8V to +5.5V**
- **Low ON-State Resistance, 0.6Ω(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 RS2105 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 RS2105 device can handle both analog and digital signals. It features fast switching speeds (50ns) and low on-resistance (0.6Ω 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)
RS2105	MSOP10	3.00mm×3.00mm
	DFN3X3-10	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 different from page numbers in the current version.

VERSION	Change Date	Change Item
C.3	2022/01/15	Official version datasheet
C.4	2024/03/25	1. Added MSL on Page 3@RevC.3 2. Modify packaging naming 3. Added TAPE AND REEL INFORMATION

5 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING (2)	MSL (3)	PACKAGE OPTION
RS2105	RS2105XN	-40°C ~125°C	MSOP10	RS2105	MSL3	Tape and Reel,4000
	RS2105XTDC10	-40°C ~125°C	DFN3X3-10	RS2105	MSL3	Tape and Reel,5000

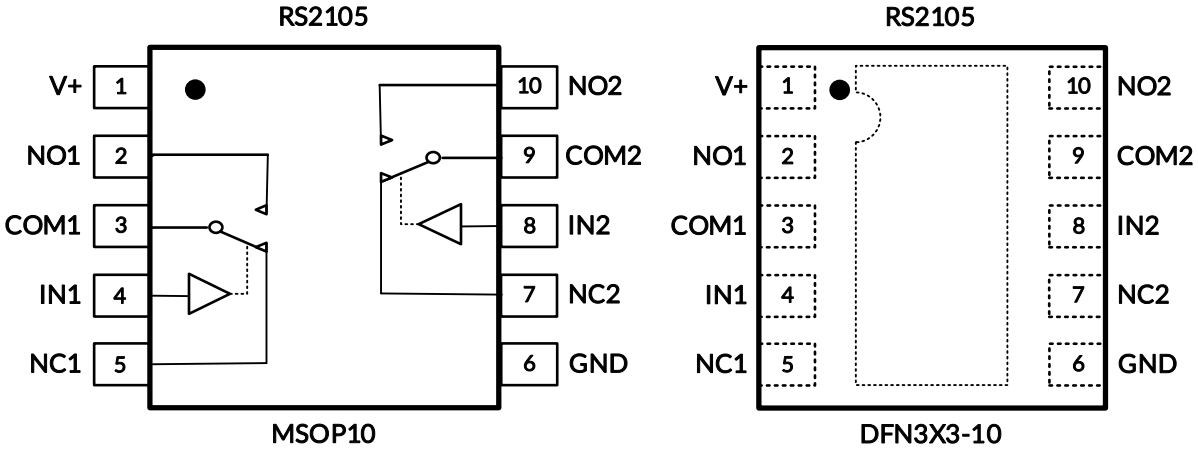
NOTE:

(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 Configuration and Functions (Top View)



6.1 PIN DESCRIPTION

NAME	PIN	FUNCTION
	MSOP10/DFN3X3-10	
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

6.2 Function Table

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

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 (2)		-0.3	6	V
V_{IN}	Control Input voltage (2)		-0.3	$(V_+)+0.3$	
I_{IN}	Continuous Current NO, NC or COM		-500	+500	mA
I_{PEAK}	Peak Current NO, NC, or COM		-800	+800	
θ_{JA}	Package thermal impedance (3)	MSOP10		200	°C/W
		DFN3X3-10		43	
T_J	Junction temperature (4)			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) All voltages are with respect to ground, unless otherwise specified.
(3) The package thermal impedance is calculated in accordance with JESD-51.
(4) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, 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.

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)	±300	

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_+	Supply voltage	1.8	5.5	V
T_A	Operating temperature	-40	+125	°C

7.4 ELECTRICAL CHARACTERISTICS

V+ = 5.0 V, T_A= -40°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}	0 ≤ (V_{NO} or V_{NC}) ≤V+, I_{COM} = -10mA, Switch ON, See Figure 4	5V	+25°C		0.6	1.0	Ω
				FULL			1.2	Ω
			3.3V	+25°C		1.0	1.5	Ω
				FULL			1.7	Ω
On-Resistance Match Between Channels	ΔR_{ON}	0 ≤ (V_{NO} or V_{NC}) ≤V+, I_{COM} = -10mA, Switch ON, See Figure 4	5V	+25°C		0.04	0.1	Ω
				FULL			0.12	Ω
			3.3V	+25°C		0.04	0.1	Ω
				FULL			0.12	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	0 ≤ (V_{NO} or V_{NC}) ≤V+, I_{COM} = -10mA, Switch ON, See Figure 4	5V	+25°C		0.18	0.3	Ω
				FULL			0.4	Ω
			3.3V	+25°C		0.54	0.7	Ω
				FULL			0.8	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	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} = 0.3V, Open V_{COM} = 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)

ARAMETER	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		50		ns
				3.3V			50		
Turn-Off Time	t_{OFF}	V_{COM} = V+, R_L = 300Ω, C_L = 35pF, See Figure 8		5V	+25°C		15		ns
				3.3V			17		
Break before make time	t_{BBM}	V_{NO1}=V_{NC1}=V_{NO2}=V_{NC2}=3V, R_L=300Ω, C_L=35pF, See Figure 9		5V	+25°C		10		ns
				3.3V			11		
Off Isolation	O_{ISO}	R_L = 50Ω, Switch OFF, See Figure 11	f= 100KHz		+25°C		-68		dB
			f= 10KHz		+25°C		-86		dB
-3dB Bandwidth	BW	Switch ON, R_L = 50Ω, See Figure 10			+25°C		30		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		80		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		350		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.

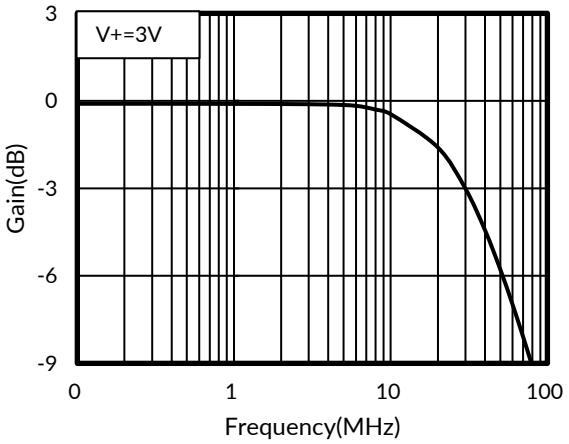


Figure 1. Bandwidth

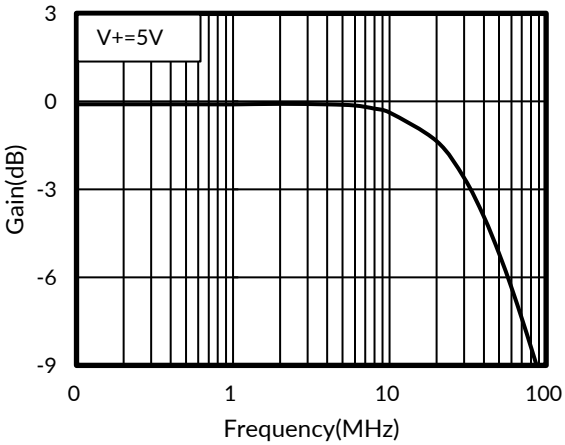


Figure 2. Bandwidth

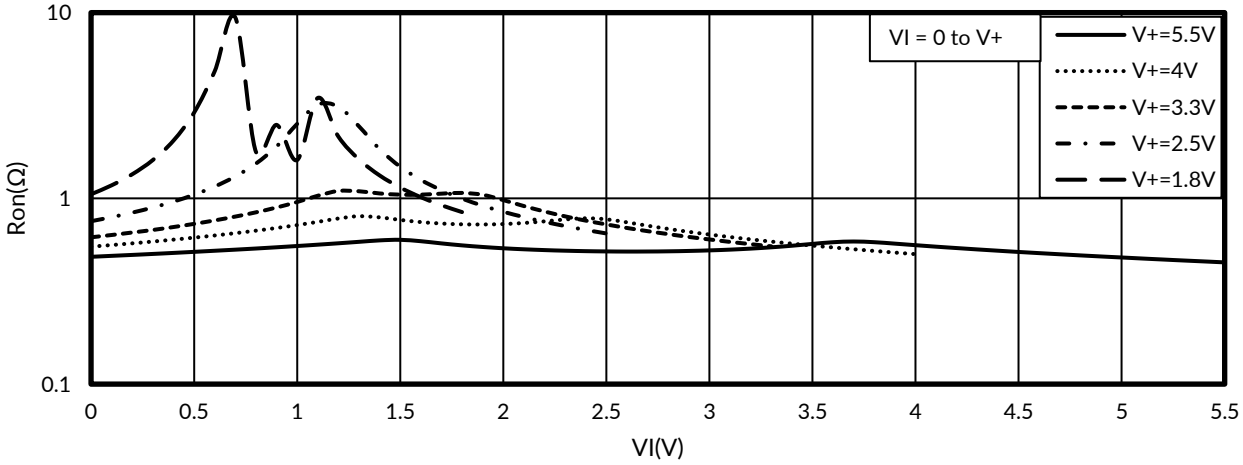


Figure 3. Typical r_{on} as a Function of Input Voltage

8 Parameter Measurement Information

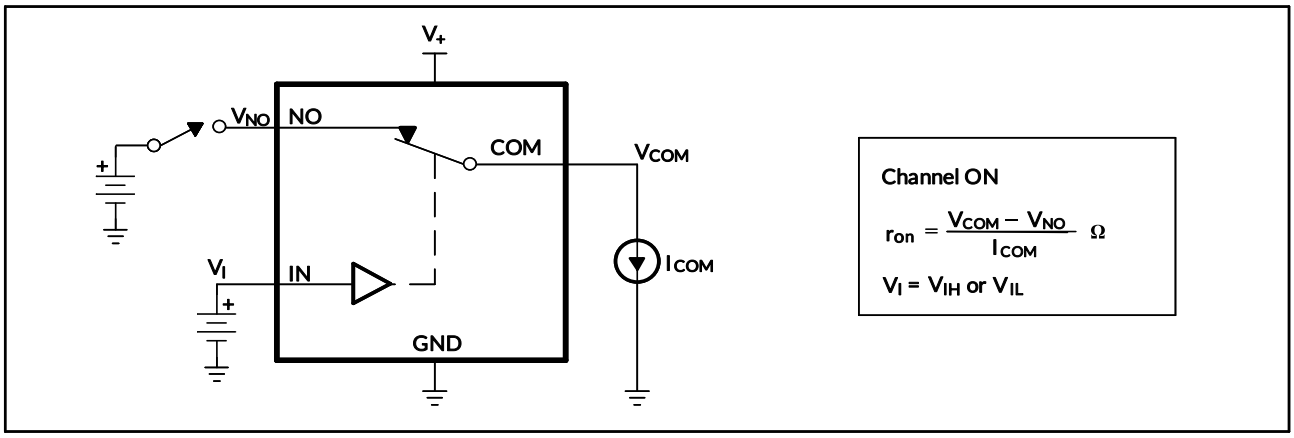


Figure 4. ON-State Resistance (r_{on})

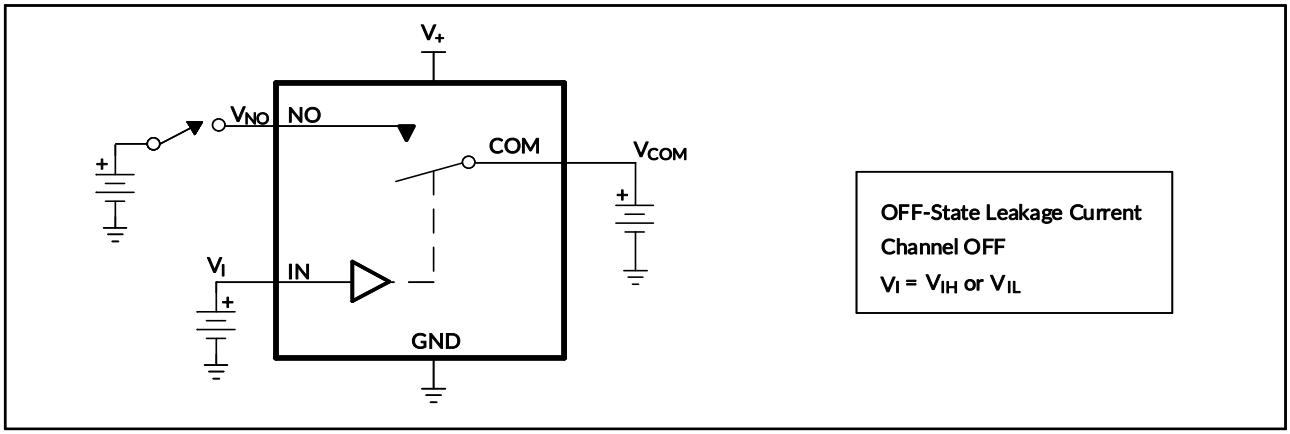


Figure 5. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NO(OFF)}$)

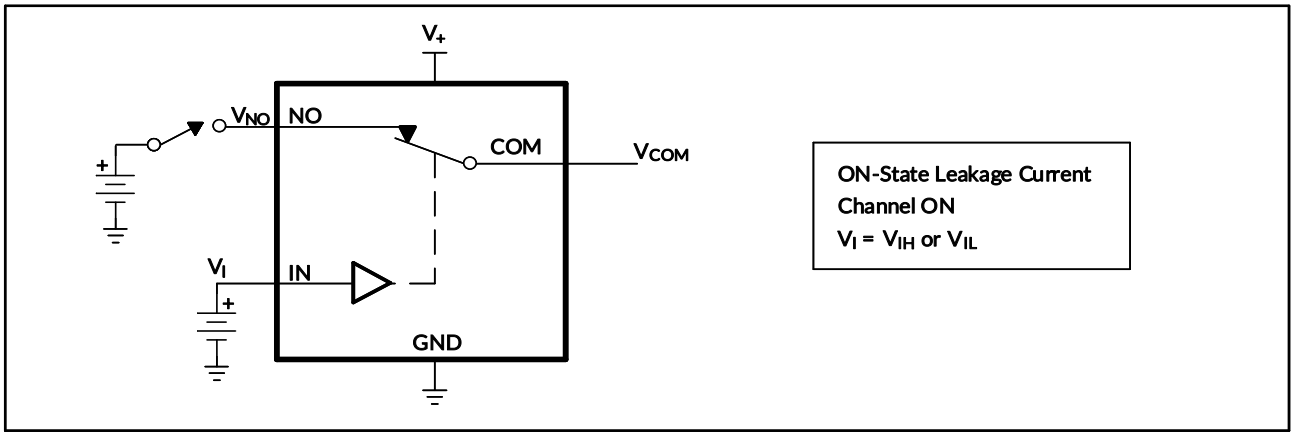


Figure 6. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NO(ON)}$)

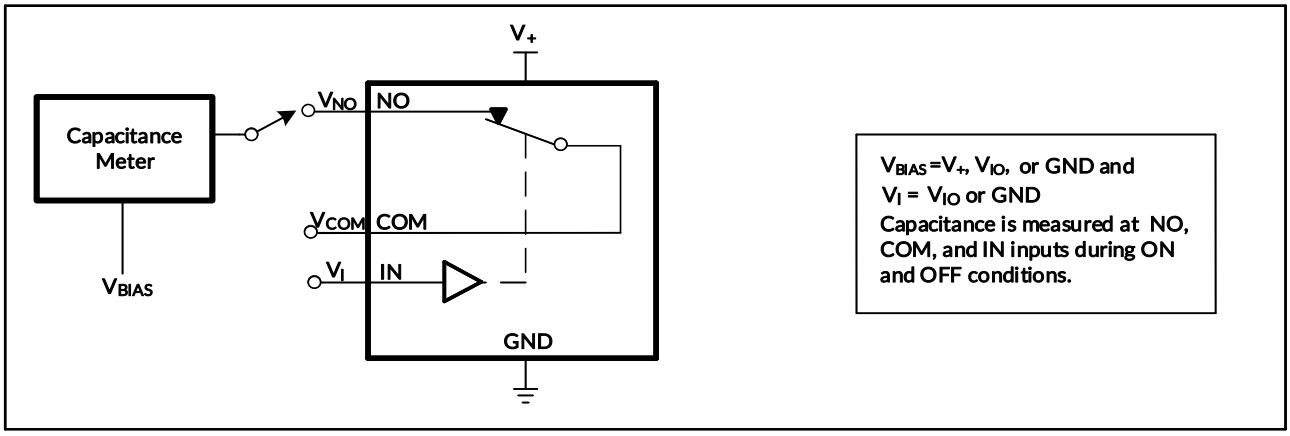
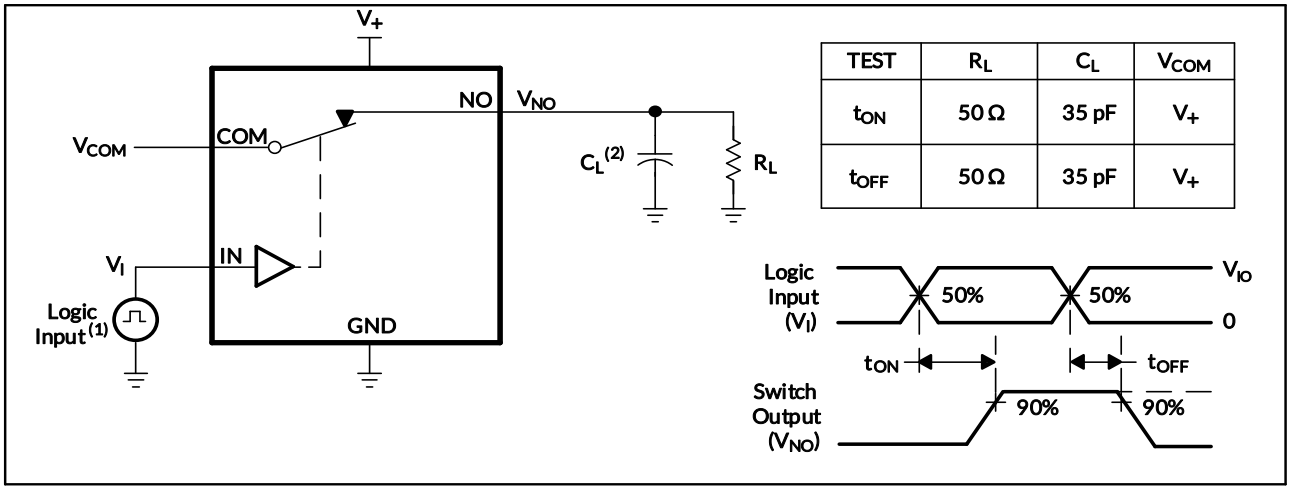


Figure 7. Capacitance (C_I, $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)



TEST	R_L	C_L	V_{COM}
t_{ON}	50 Ω	35 pF	V_+
t_{OFF}	50 Ω	35 pF	V_+

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

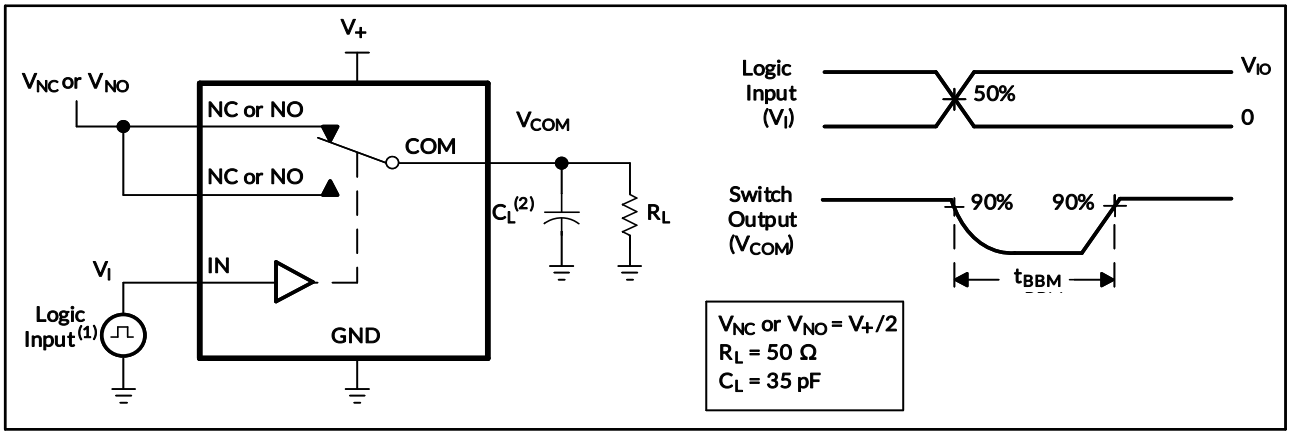


Figure 9. Break-Before-Make Time (t_{BBM})

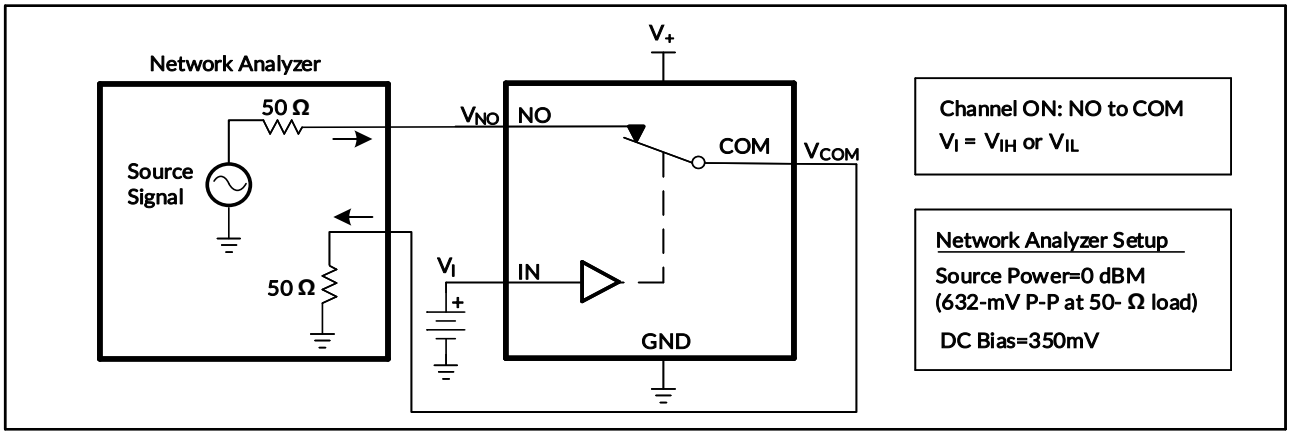


Figure 10. Bandwidth (BW)

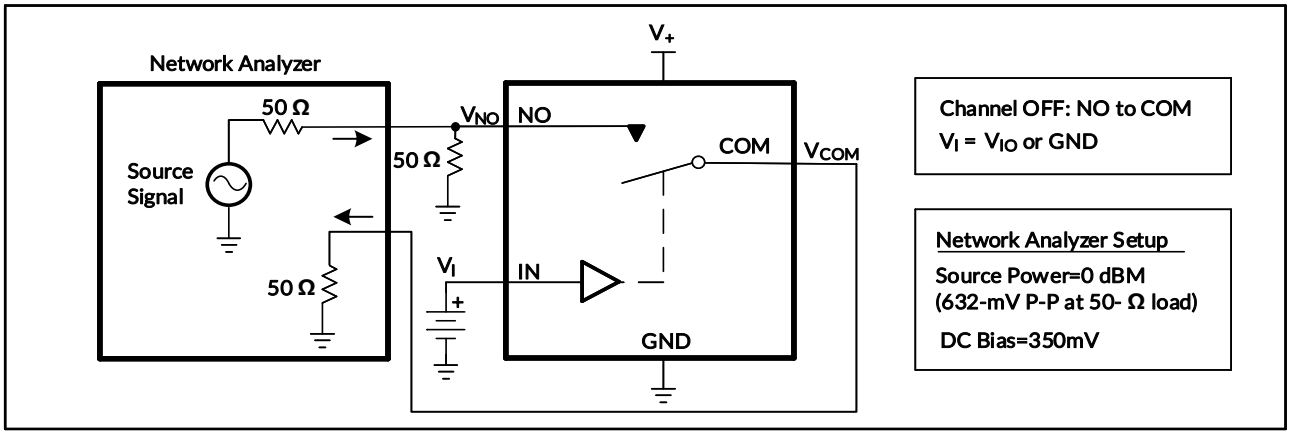


Figure 11. OFF Isolation (O_{ISO})

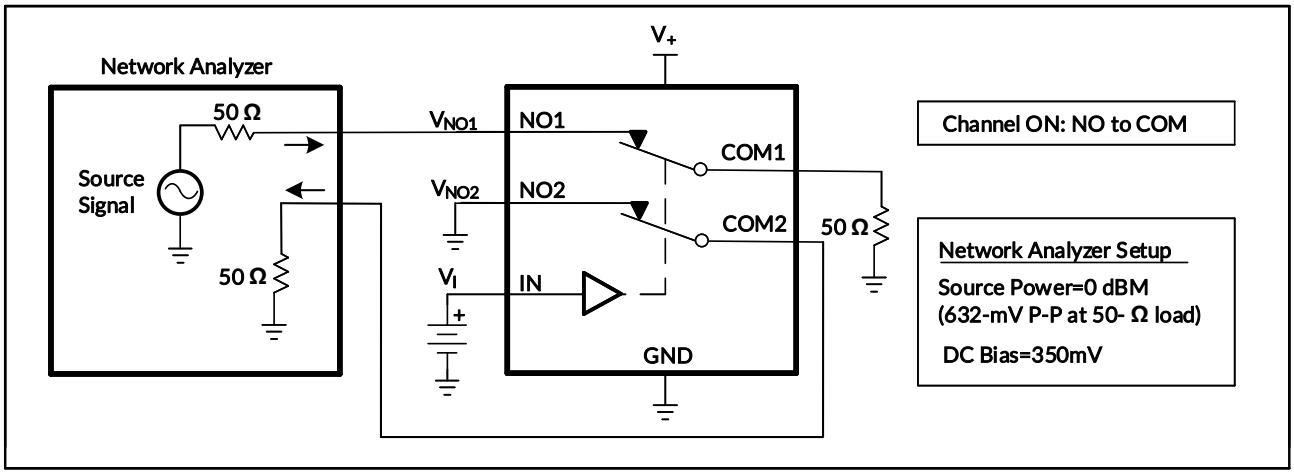


Figure 12. Crosstalk (X_{TALK})

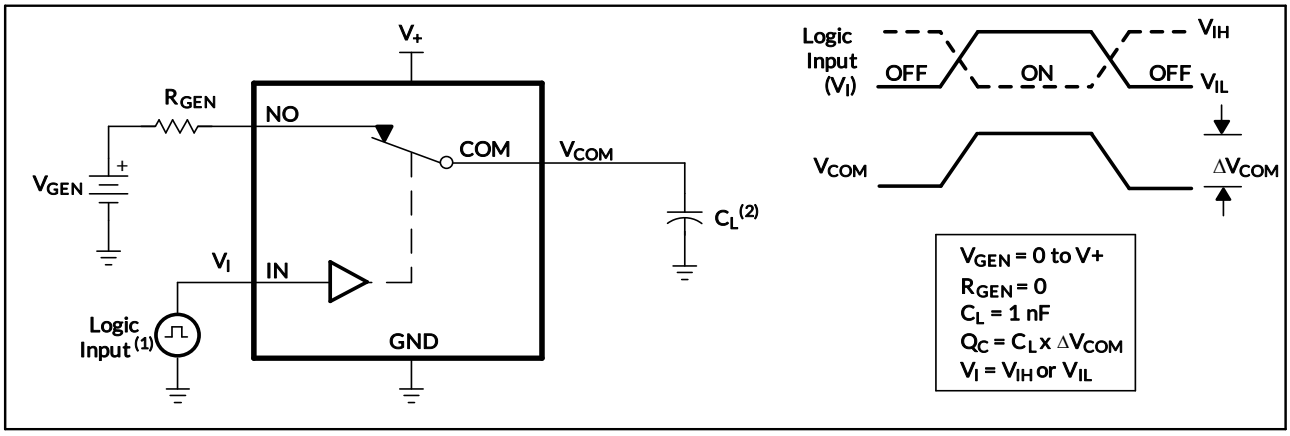


Figure 13. Charge Injection (Q_C)

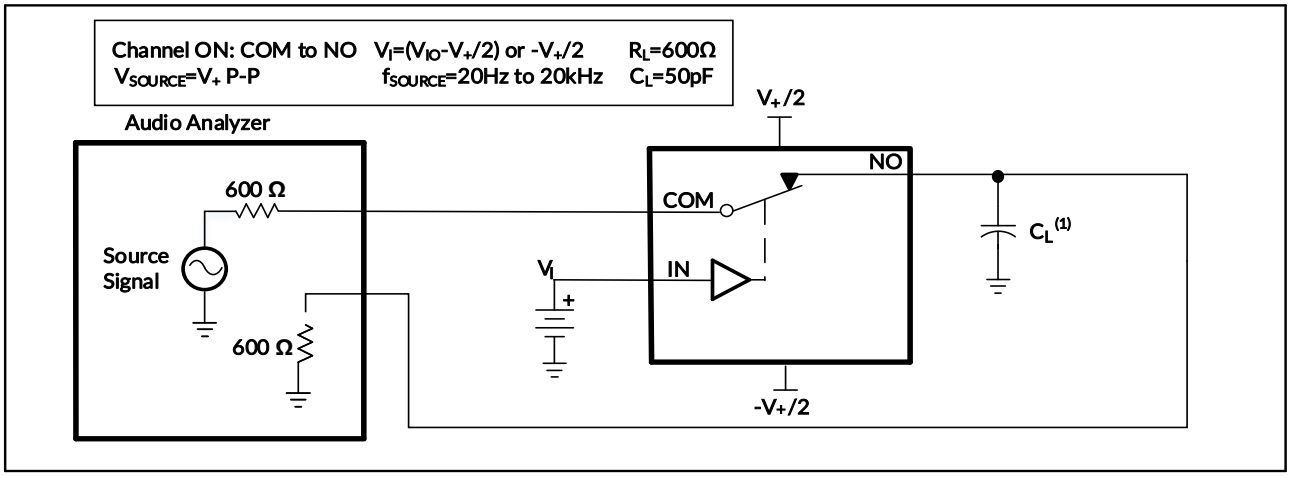
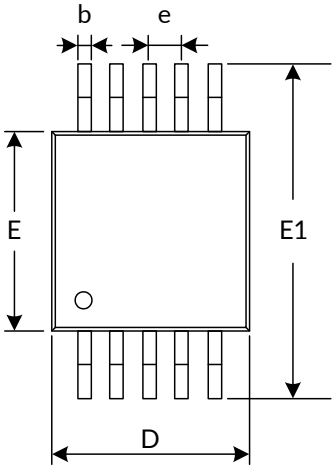
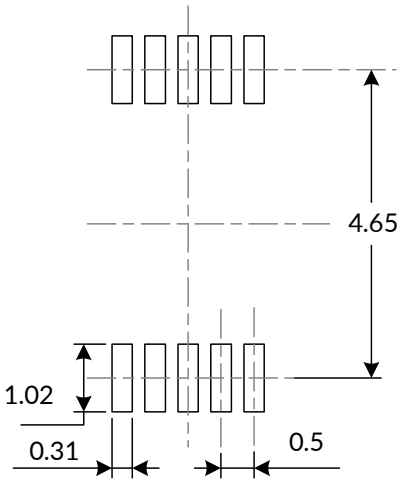


Figure 14. Total Harmonic Distortion (THD)

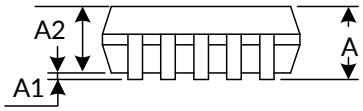
9 PACKAGE OUTLINE DIMENSIONS

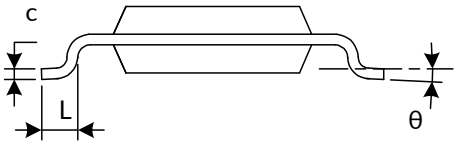
MSOP10 (3)





RECOMMENDED LAND PATTERN (Unit: mm)



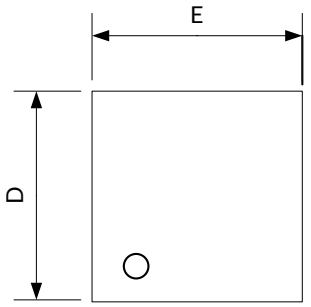


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D (1)	2.900	3.100	0.114	0.122
e	0.50(BSC) (2)		0.020(BSC) (2)	
E (1)	2.900	3.100	0.114	0.122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

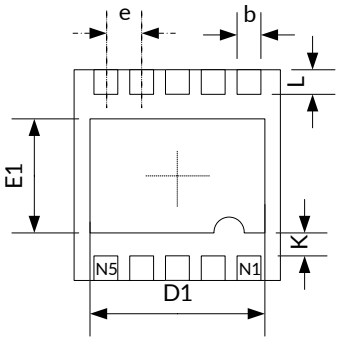
NOTE:

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.

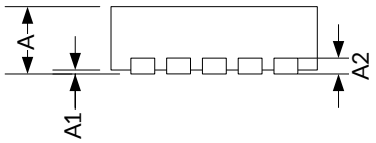
DFN3X3-10 (2)



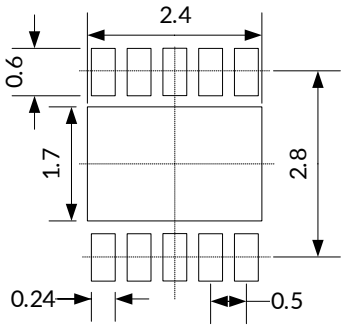
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203		0.008	
b	0.180	0.300	0.007	0.012
D (1)	2.900	3.100	0.114	0.122
D1	2.300	2.600	0.091	0.103
E (1)	2.900	3.100	0.114	0.122
E1	1.500	1.800	0.059	0.071
e	0.500 TYP		0.020 TYP	
k	0.200 MIN		0.008 MIN	
L	0.300	0.500	0.012	0.020

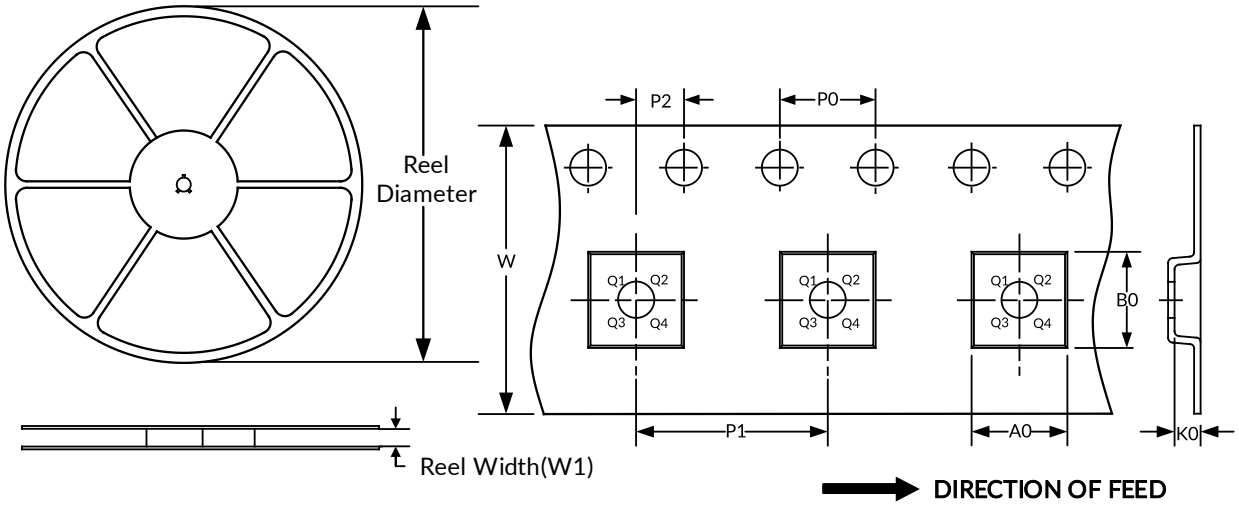
NOTE:

1. Plastic or metal protrusions of 0.075mm maximum per side are not included.
2. 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
DFN3X3-10	13”	12.4	3.35	3.35	1.13	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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