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

FEATURES

- **-3dB Bandwidth: 30MHz**
- **High Speed, Typically 50ns**
- **Supply Range: +1.8V to +5.5V**
- **Low ON-State Resistance, 0.5Ω(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 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 (0.5Ω TYP).

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

PIN CONFIGURATIONS

MSOP-10

TDFN-3x3-10L

FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

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
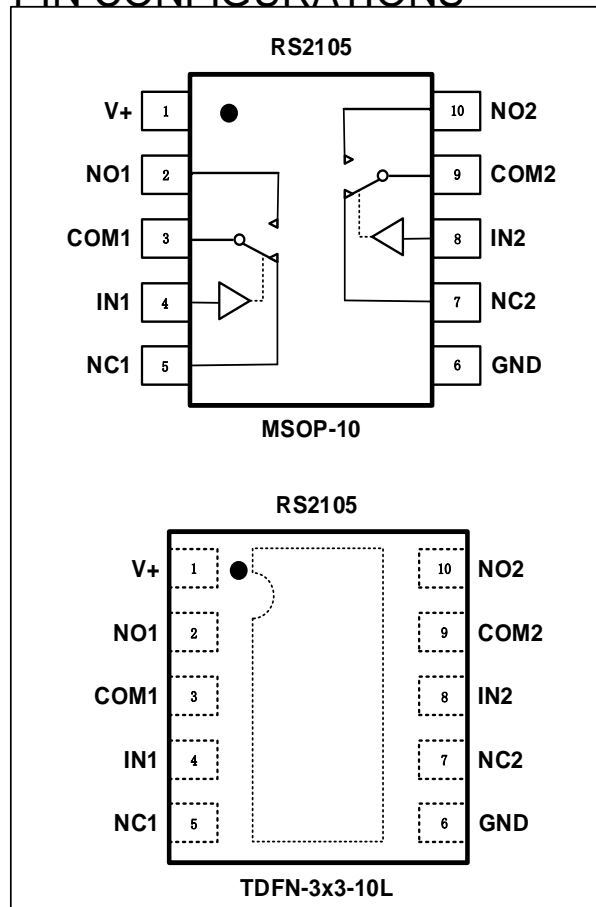
ABSOLUTE MAXIMUM RATINGS [1]

V+, IN to GND...-0.3V to 7.0V

Analog, Digital Voltage Range [2] ….......– 0.3 to (V+) + 0.3V

Continuous Current NO, NC, or COM……......…..... ±500mA

Peak Current NO, NC, or COM……......…..…..... ±800mA

Storage Temperature ……….…………… −65°C to +150°C

Operating Temperature ……….………..… −40°C to +125°C

Junction Temperature...150°C

Package Thermal Resistance @ T_A = +25°C

SOT23-5, SOT23-6………………….………………200°C/W

MSOP-10, SOIC-8 ,TSSOP-8…………..………..... 150°C/W

SOIC-14, TSSOP-14………….……………………100°C/W

Lead Temperature (Soldering, 10s) …………….........260°C
ESD Susceptibility

HBM …..1000V

MM ………………………......…………………….………100V

(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 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.

PACKAGE/ORDERING INFORMATION

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING	PACKAGE OPTION
RS2105	RS2105XN	-40℃~125℃	MSOP-10	RS2105	Tape and Reel,3000
	RS2105XTDC10	-40℃~125℃	TDFN-3x3-10L	RS2105	Tape and Reel,3000

ELECTRICAL CHARACTERISTICS

V+ = 5.0 V, T_A= –40°C to 125°C (unless otherwise noted)

| PARAMETER	SYMBOL	CONDITIONS	V+	T_A	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			FULL	0		V+	V
On-Resistance	R_{ON}	$0 \leqslant$ (V_{NO} or V_{NC}) $\leqslant$V+, I_{COM} = -10mA, Switch ON, See Figure 1	5V	+25°C		0.5	0.9	Ω
				FULL			1.1	Ω
			3.3V	+25°C		0.8	1.3	Ω
				FULL			1.5	Ω
On-Resistance Match Between Channels	ΔR_{ON}	$0 \leqslant$ (V_{NO} or V_{NC}) $\leqslant$V+, I_{COM} = -10mA, Switch ON, See Figure 1	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	$R_{FLAT(ON)}$	$0 \leqslant$ (V_{NO} or V_{NC}) $\leqslant$V+, I_{COM} = -10mA, Switch ON, See Figure 1	5V	+25°C		0.09	0.15	Ω
				FULL			0.2	Ω
			3.3V	+25°C		0.24	0.3	Ω
				FULL			0.4	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 2	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 2	1.8 to 5.5V	FULL			1	µA
DIGITAL CONTROL INPUTS[1]								
Input High Voltage	V_{INH}		5V	FULL	2.4			V
			3.3V	FULL	2.0			V
Input Low Voltage	V_{INL}		5V	FULL			0.8	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.

ELECTRICAL CHARACTERISTICS (continued)

V+ = 5.0 V, TEMP= –40°C to 125°C (unless otherwise noted))

PARAMETER	SYMBOL	CONDITIONS		V+	TEMP	MIN	TYP	MAX	UNITS
DYNAMIC CHARACTERISTICS									
Turn-On Time	t_{ON}	V_{COM} = V+, R_L = 300Ω, C_L = 35pF, See Figure 5		5V	+25°C		50		ns
				3.3V			50		
Turn-Off Time	t_{OFF}	V_{COM} = V+, R_L = 300Ω, C_L = 35pF, See Figure 5		5V	+25°C		15		ns
				3.3V			17		
Break-Before-Make Time Delay	t_{BBM}	V_{NO1} = V_{NC1} = V_{NO2} = V_{NC2} = 3V, R_L = 300Ω, C_L = 35pF,See Figure 6		5V	+25°C		10		ns
				3.3V			11		
Off Isolation	O_{ISO}	R_L = 50Ω, Switch OFF, See Figure 8	f = 100KHz		+25°C		-68		dB
			f = 10KHz		+25°C		-86		dB
-3dB Bandwidth	BW	Switch ON, R_L = 50Ω See Figure 7			+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 4			+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 4			+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

TYPICAL CHARACTERISTICS

BANDWIDTH

BANDWIDTH
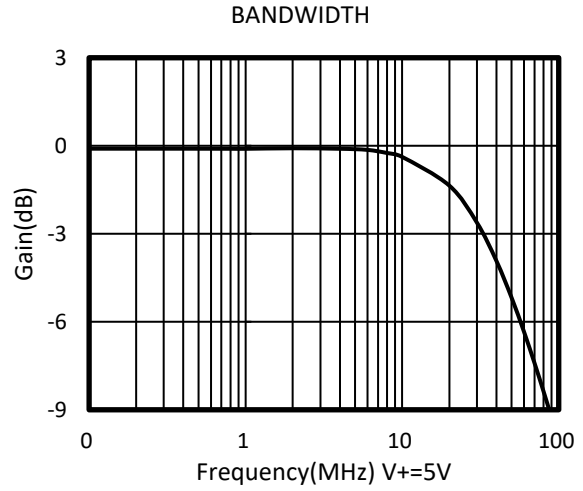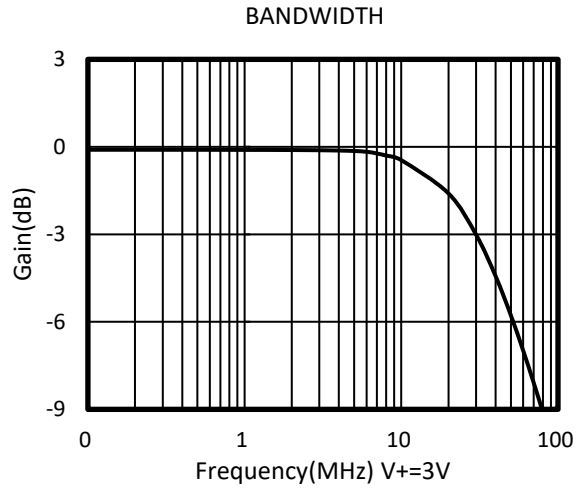
Typical ron as a Function of Input Voltage (VI) for VI = 0 to V+

———— V+=5.5V ········· V+=4V ----- V+=3.3V — · — V+=2.5V — — V+=1.8V
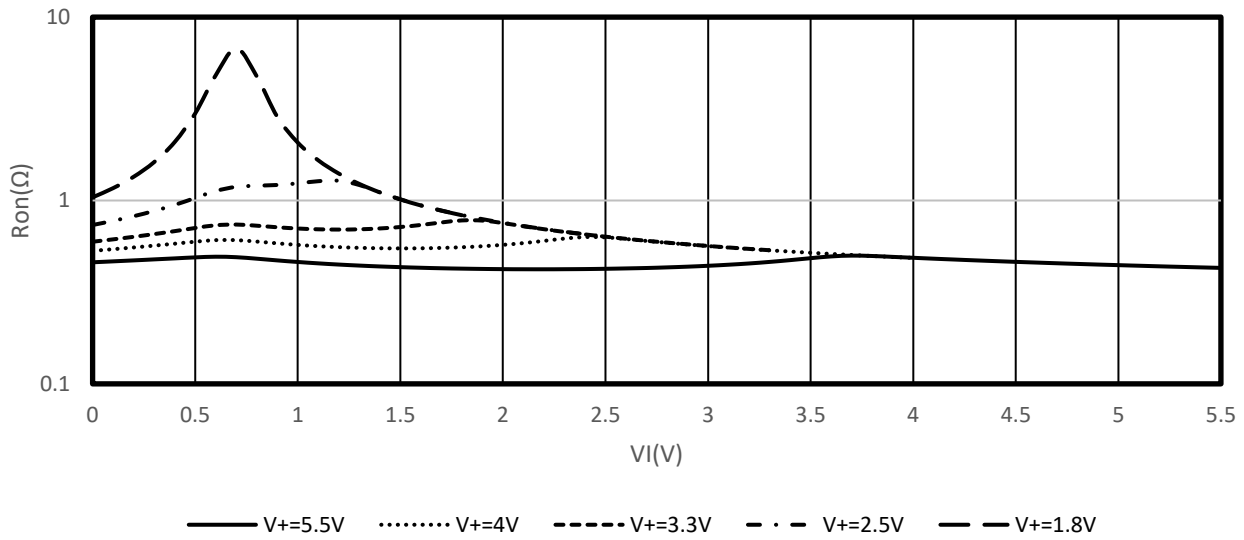
Parameter Measurement Information
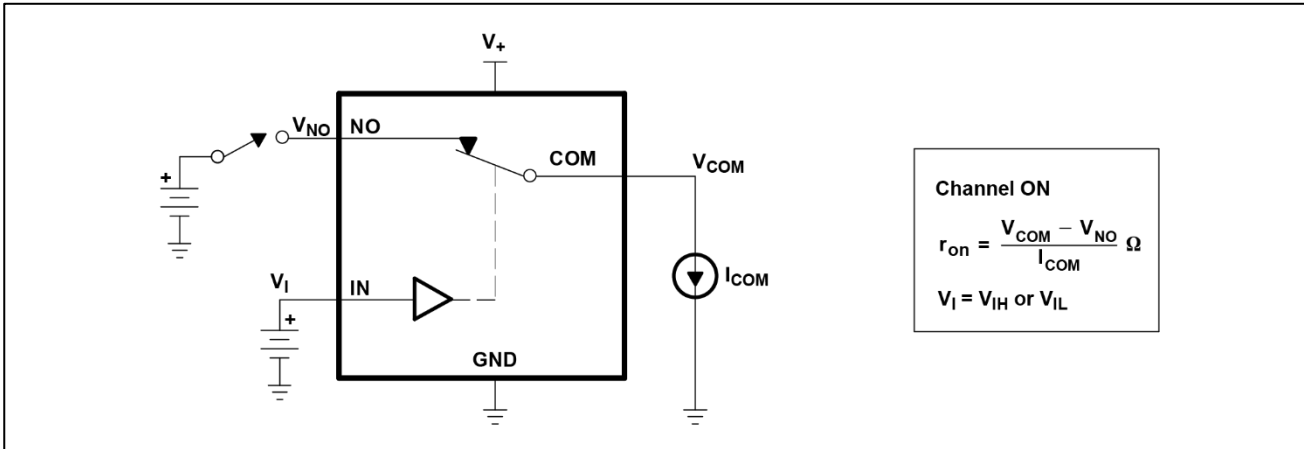
Figure 1.ON-State Resistance (r_{on})

Channel ON

$$r_{on} = \frac{V_{COM} - V_{NO}}{I_{COM}} \, \Omega$$

$V_I = V_{IH}$ or V_{IL}
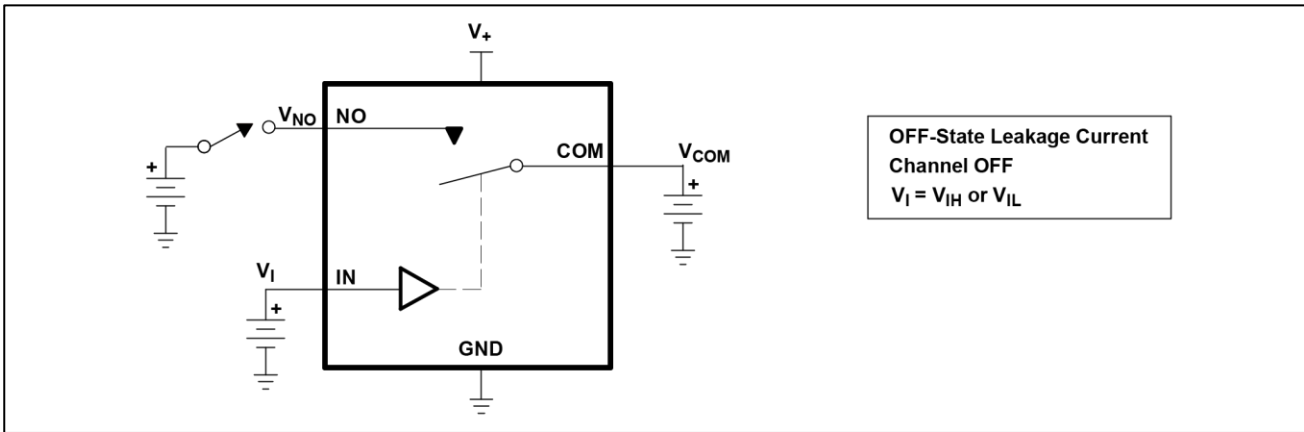
Figure 2.OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NO(OFF)}$)

OFF-State Leakage Current
Channel OFF
$V_I = V_{IH}$ or V_{IL}
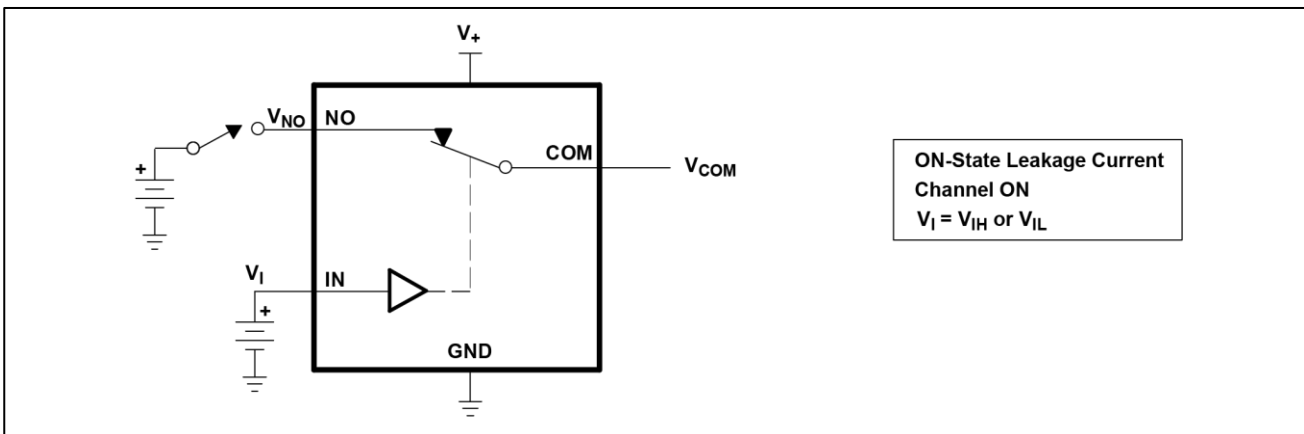
Figure 3.ON-State Leakage Current ($I_{COM(ON)}$, $I_{NO(ON)}$)

ON-State Leakage Current
Channel ON
$V_I = V_{IH}$ or V_{IL}
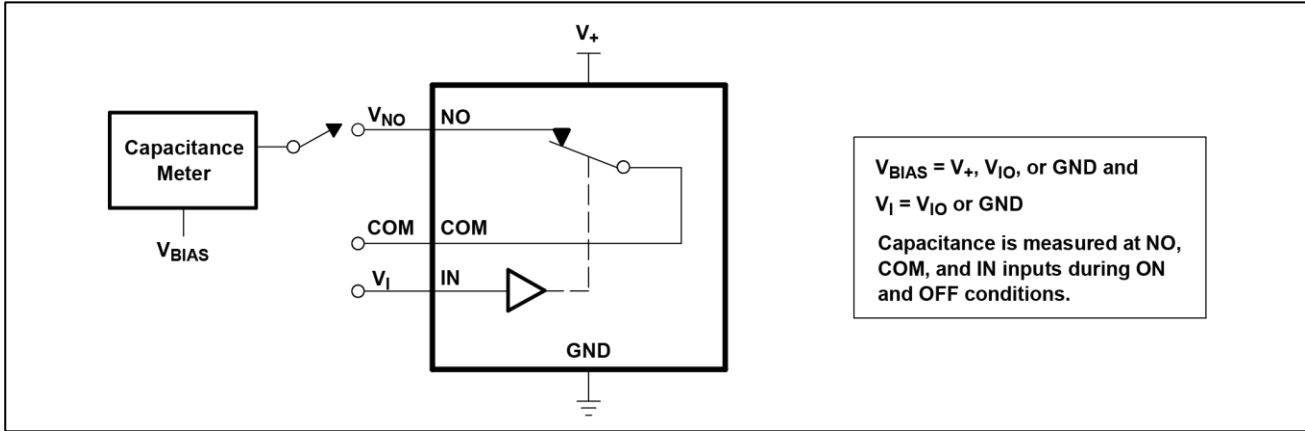
Figure 4.Capacitance (C_I, $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)
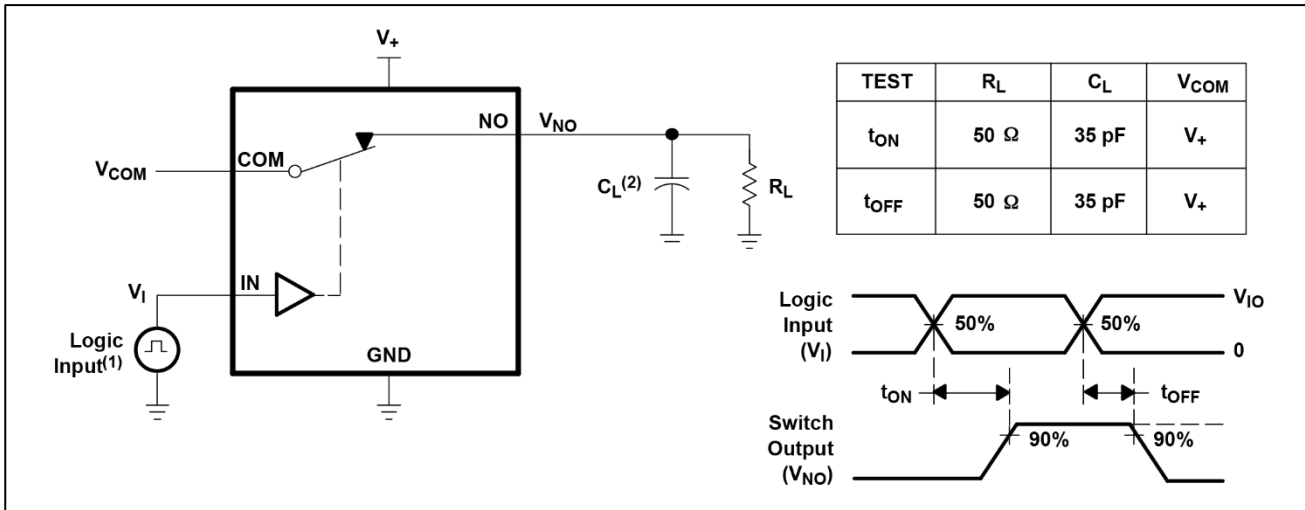
Figure 5.Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})
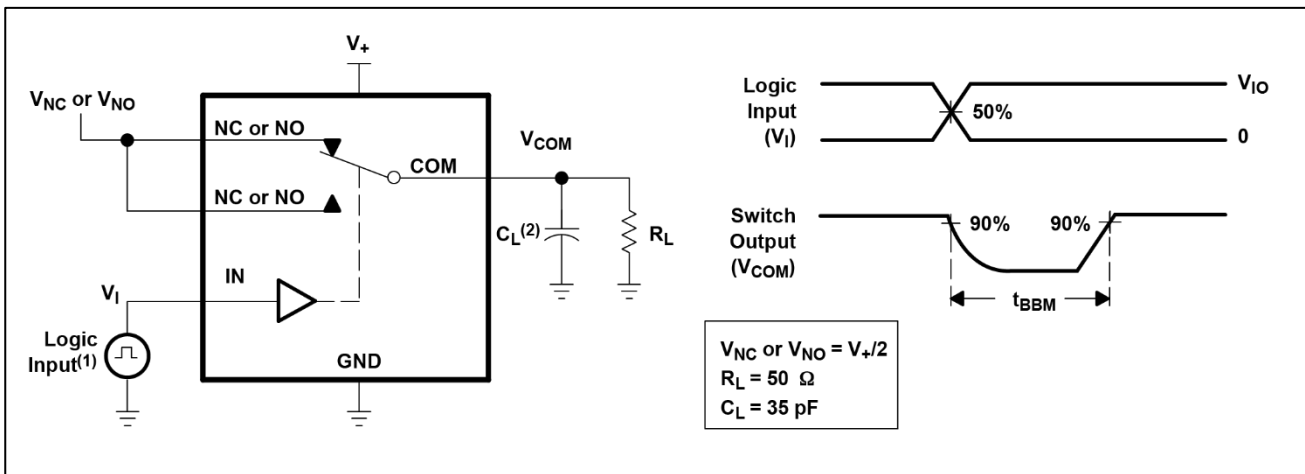
Figure 6.Break-Before-Make Time (t_{BBM})

Figure 7.Bandwidth (BW)

Channel ON: NO to COM
$V_I = V_{IH}$ or V_{IL}
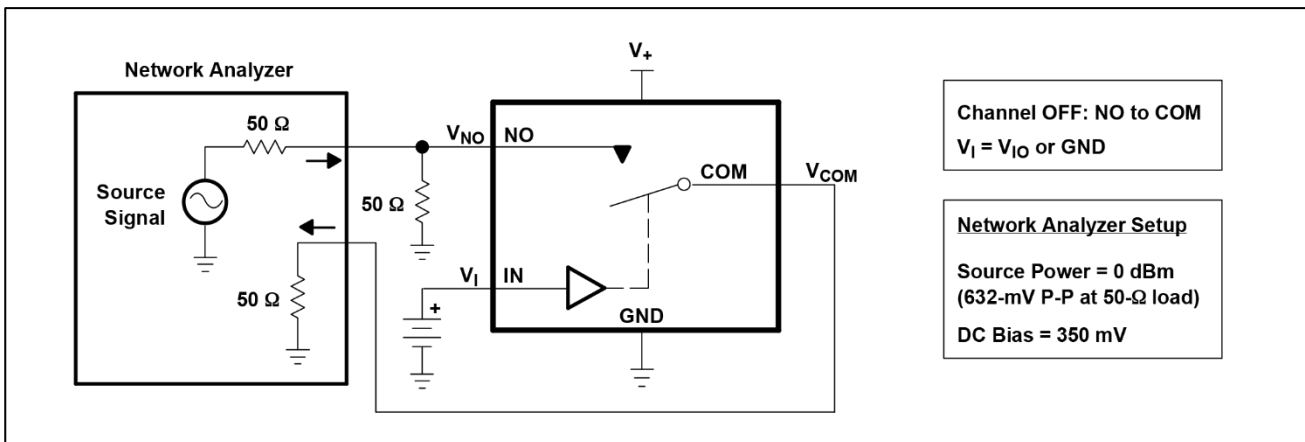
Network Analyzer Setup

Source Power = 0 dBm
(632-mV P-P at 50-Ω load)

DC Bias = 350 mV
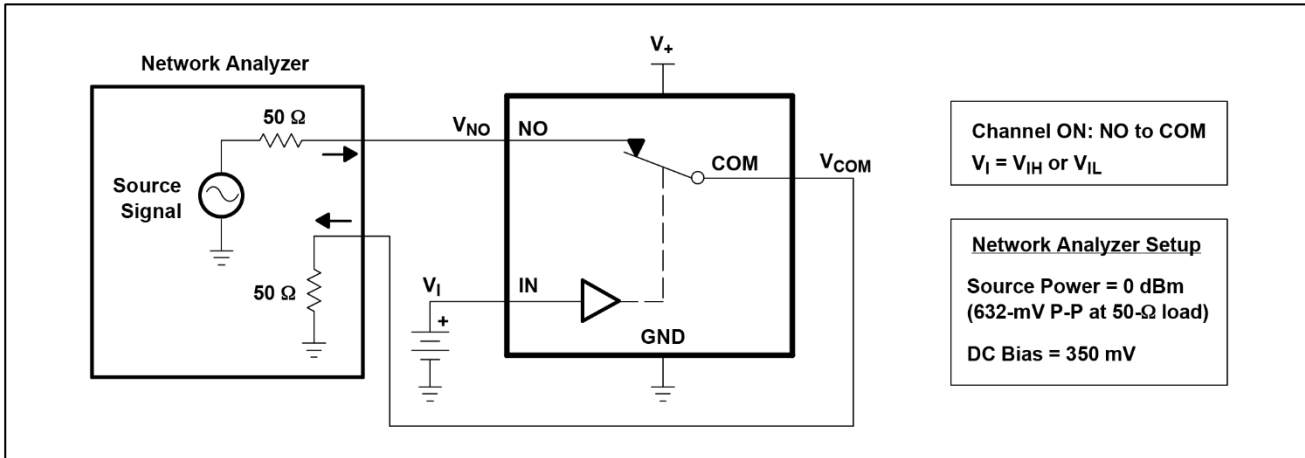
Figure 8.OFF Isolation (O_{ISO})

Channel OFF: NO to COM
$V_I = V_{IO}$ or GND

Network Analyzer Setup

Source Power = 0 dBm
(632-mV P-P at 50-Ω load)

DC Bias = 350 mV
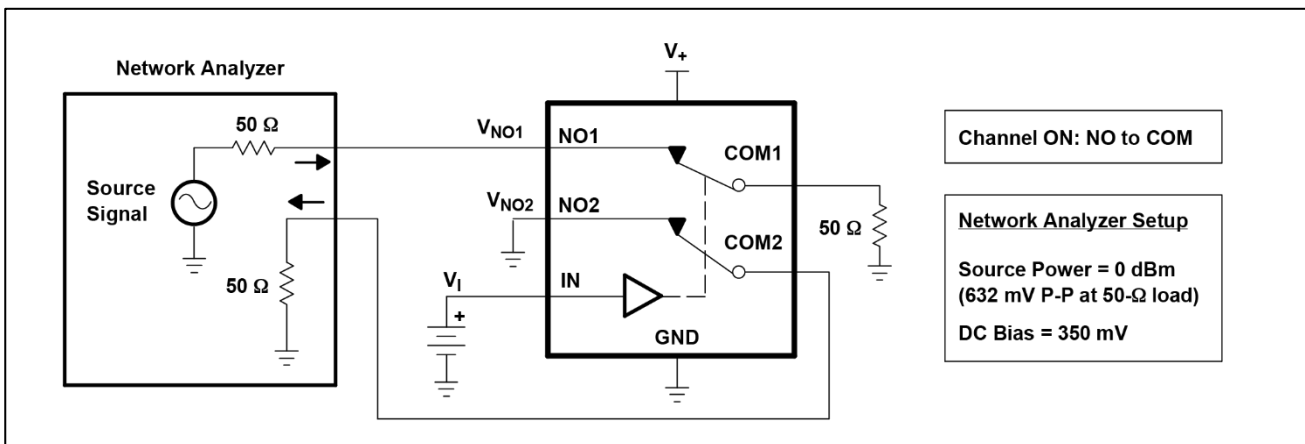
Figure 9.Crosstalk (X_{TALK})

Channel ON: NO to COM

Network Analyzer Setup

Source Power = 0 dBm
(632 mV P-P at 50-Ω load)

DC Bias = 350 mV

Figure 10.Charge Injection (Q$_C$)

Figure11.Total Harmonic Distortion (THD)
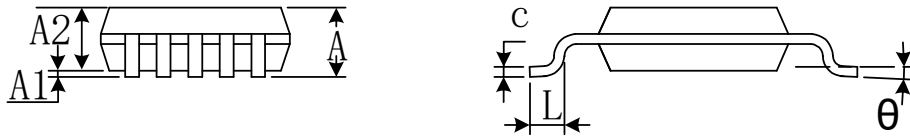
9   www.run-ic.com
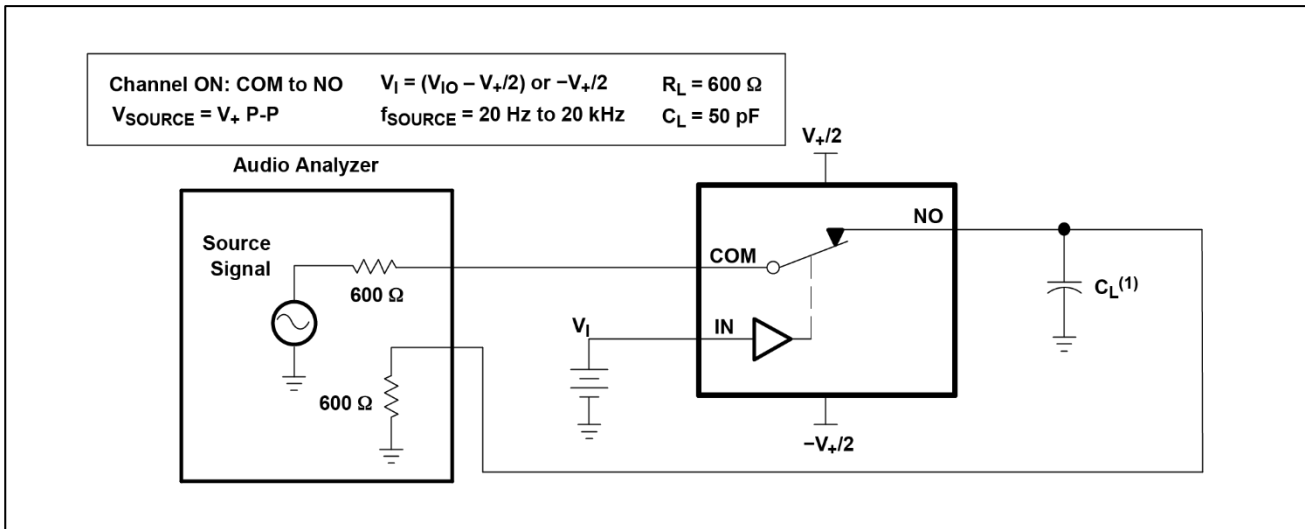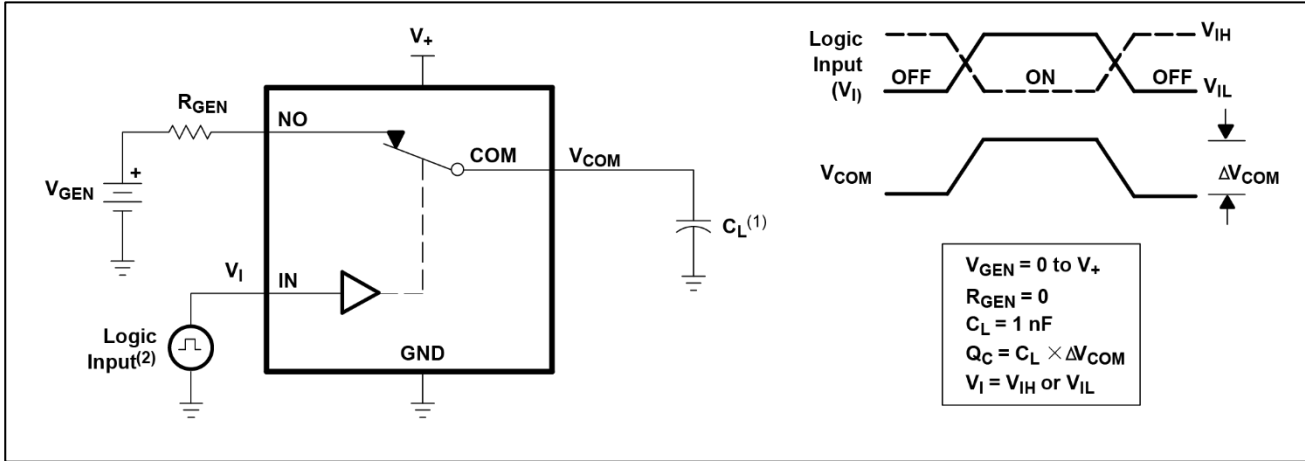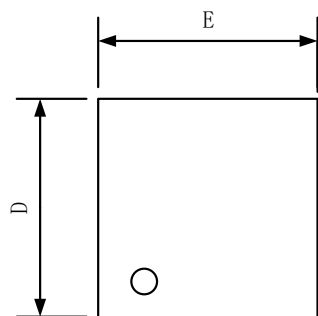
PACKAGE OUTLINE DIMENSIONS
MSOP-10
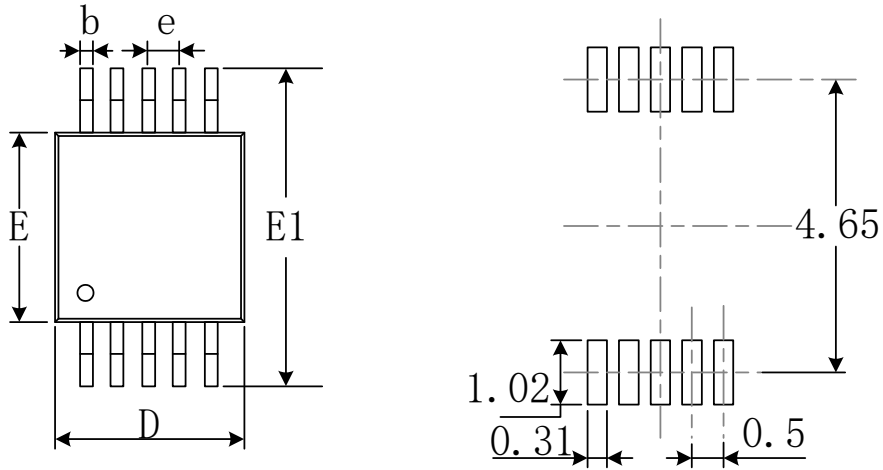
RECOMMENDED LAND PATTERN (Unit: mm)

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°

TDFN-3x3-10L

TOP VIEW
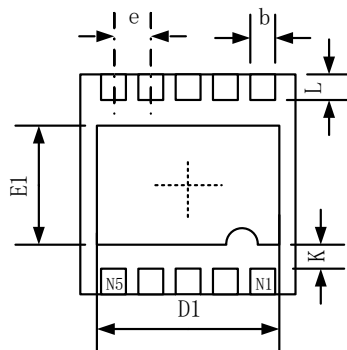
BOTTOM VIEW
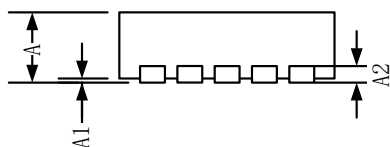
SIDE VIEW
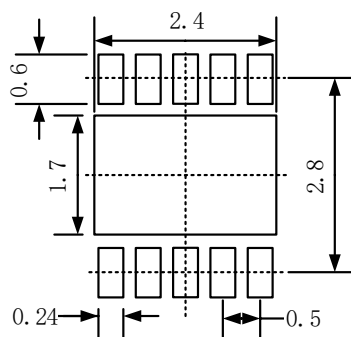
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A	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	2.900	3.100	0.114	0.122
D1	2.300	2.600	0.091	0.103
E	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