

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

## 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**
- **MicroSIZE PACKAGES: SOT363 (SC70-6), SOT23-6**

## DESCRIPTION

The RS2103 is a single-pole double-throw (SPDT) analog switch that is designed to operate from 1.8 V to 5.5 V.

The RS2103 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.

## APPLICATIONS

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

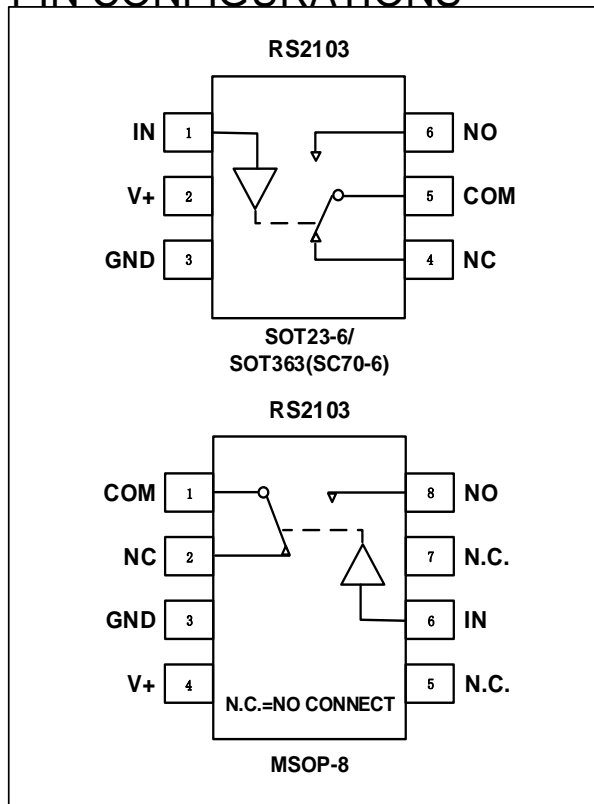
## FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

## PIN DESCRIPTION

NAME	PIN (6)	PIN (8)	FUNCTION
IN	1	6	Digital Control Pin
V+	2	4	Power Supply
GND	3	3	Ground
NC	4	2	Normally-Closed Terminal
COM	5	1	Common Terminal
NO	6	8	Normally-Open Terminal

## PIN CONFIGURATIONS



### ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>

V+, IN to GND.....	-0.3V to 6.0V
Analog, Digital Voltage Range <sup>(2)</sup> .....	- 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 <sub>A</sub> = +25°C	
SOT23-6.....	200°C/W
MSOP-8.....	208°C/W
SOT363(SC70-6).....	250°C/W
Lead Temperature (Soldering, 10s) .....	260°C
ESD Susceptibility	
HBM .....	1000V
MM .....	100V



### 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.

(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.

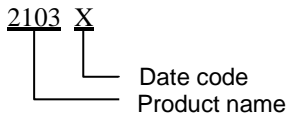
(2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.3V beyond the supply rails should be current-limited to 10mA or less.

### PACKAGE/ORDERING INFORMATION

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING	PACKAGE OPTION
RS2103	RS2103XC6	-40°C ~125°C	SOT363 (SC70-6)	2103X	Tape and Reel,3000
	RS2103XH	-40°C ~125°C	SOT23-6	2103	Tape and Reel,3000
	RS2103XM	-40°C ~125°C	MSOP-8	RS2103	Tape and Reel,3000

NOTE: 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)

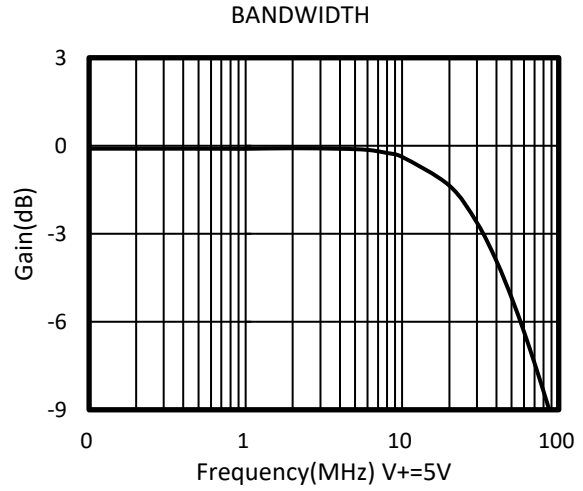
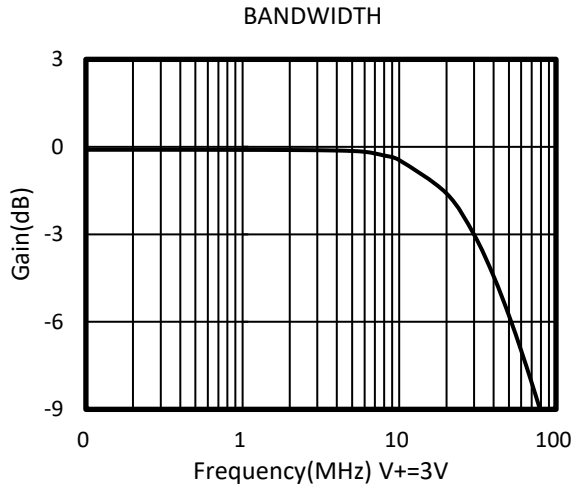
PARAMETER	SYMBOL	CONDITIONS	V+	T <sub>A</sub>	MIN	TYP	MAX	UNITS
<b>ANALOG SWITCH</b>								
Analog Signal Range	$V_{NO}, V_{NC}, V_{COM}$			FULL	0		V+	V
On-Resistance	$R_{ON}$	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V+$ , $I_{COM} = -10\text{mA}$ , Switch ON, See Figure 1	5V	+25°C		0.6	1.0	$\Omega$
				FULL			1.2	$\Omega$
			3.3V	+25°C		1.0	1.5	$\Omega$
				FULL			1.7	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V+$ , $I_{COM} = -10\text{mA}$ , Switch ON, See Figure 1	5V	+25°C		0.04	0.1	$\Omega$
				FULL			0.12	$\Omega$
			3.3V	+25°C		0.04	0.1	$\Omega$
				FULL			0.12	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V+$ , $I_{COM} = -10\text{mA}$ , Switch ON, See Figure 1	5V	+25°C		0.18	0.3	$\Omega$
				FULL			0.4	$\Omega$
			3.3V	+25°C		0.54	0.7	$\Omega$
				FULL			0.8	$\Omega$
NC,NO OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NO} \text{ or } V_{NC} = 0.3\text{V}$ , $V+/2$ $V_{COM} = V+/2$ , $0.3\text{V}$ See Figure 2	1.8 to 5.5V	FULL			1	$\mu\text{A}$
NC,NO,COM ON Leakage Current	$I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_{NO} \text{ or } V_{NC} = 0.3\text{V}$ , Open $V_{COM} = \text{Open}$ , $0.3\text{V}$ See Figure 2	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	$I_{IN}$	$V_{IN} = V_{IO} \text{ or } 0$	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.

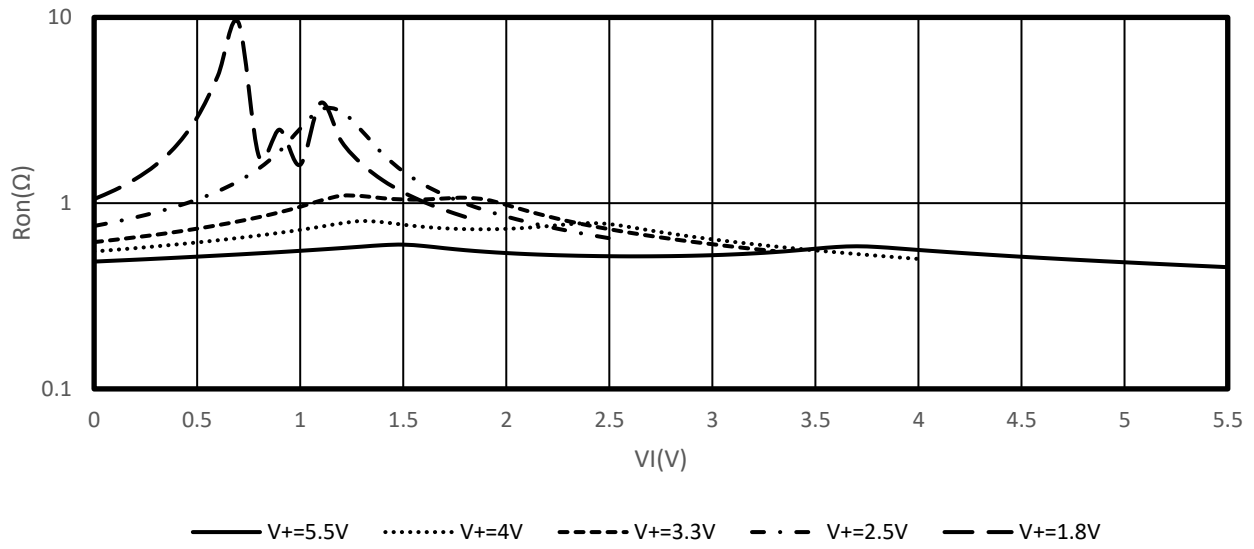
**ELECTRICAL CHARACTERISTICS (continued)**
 $V_+ = 5.0\text{ V}$ , TEMP=  $-40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)

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

TYPICAL CHARACTERISTICS



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



### Parameter Measurement Information

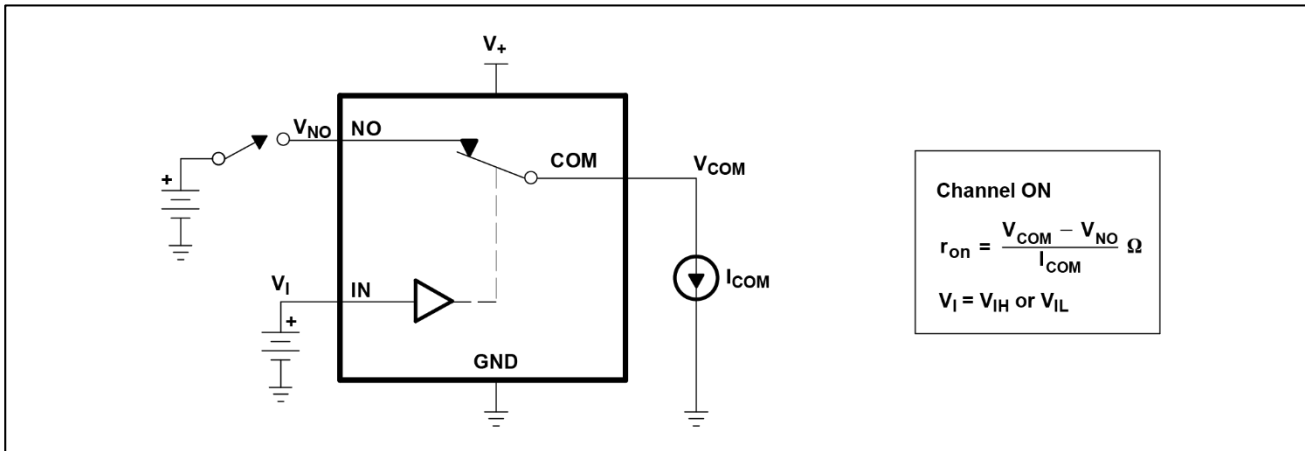


Figure 1.ON-State Resistance ( $r_{on}$ )

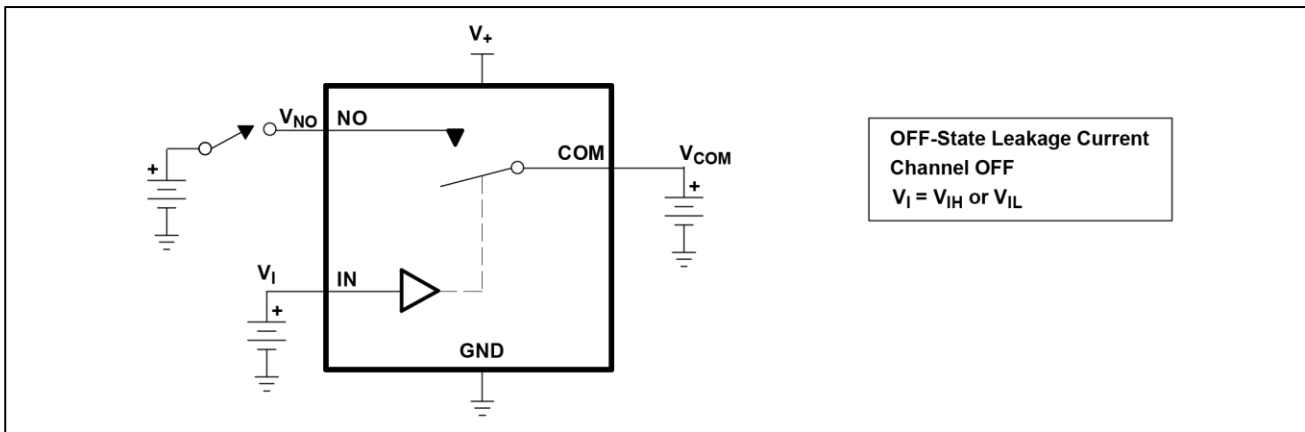


Figure 2.OFF-State Leakage Current ( $I_{COM(OFF)}$ ,  $I_{NO(OFF)}$ )

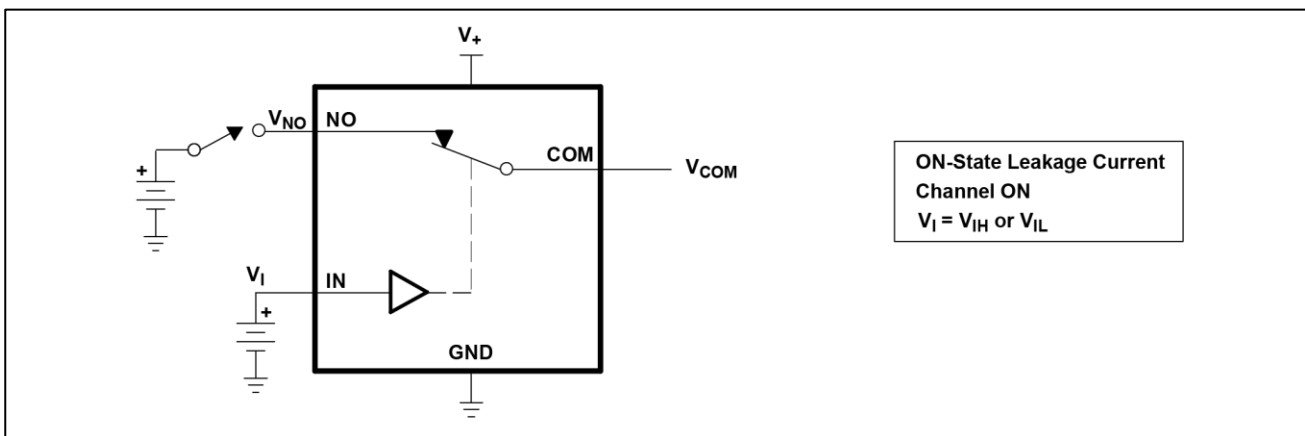


Figure 3.ON-State Leakage Current ( $I_{COM(ON)}$ ,  $I_{NO(ON)}$ )

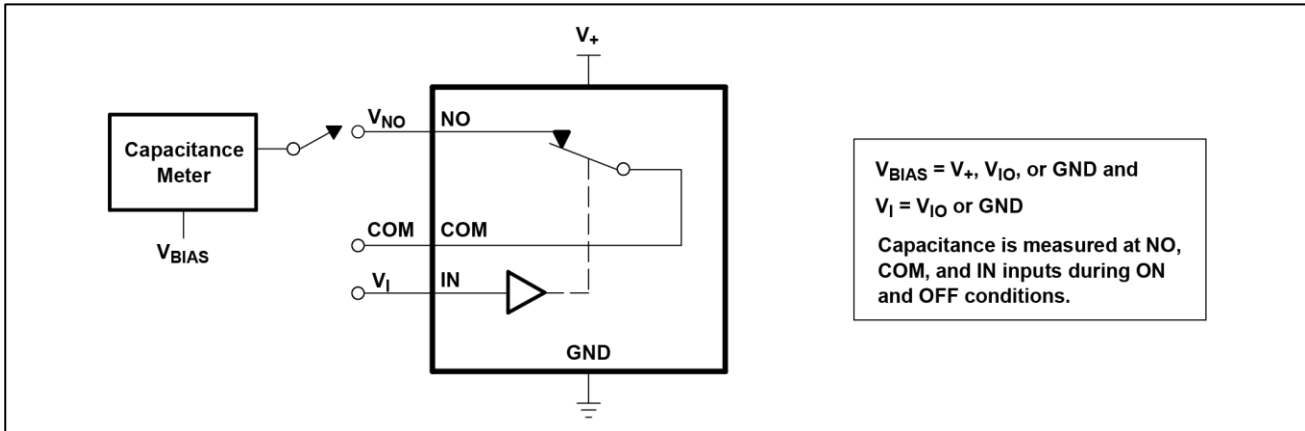


Figure 4. Capacitance ( $C_I$ ,  $C_{COM(OFF)}$ ,  $C_{COM(ON)}$ ,  $C_{NO(OFF)}$ ,  $C_{NO(ON)}$ )

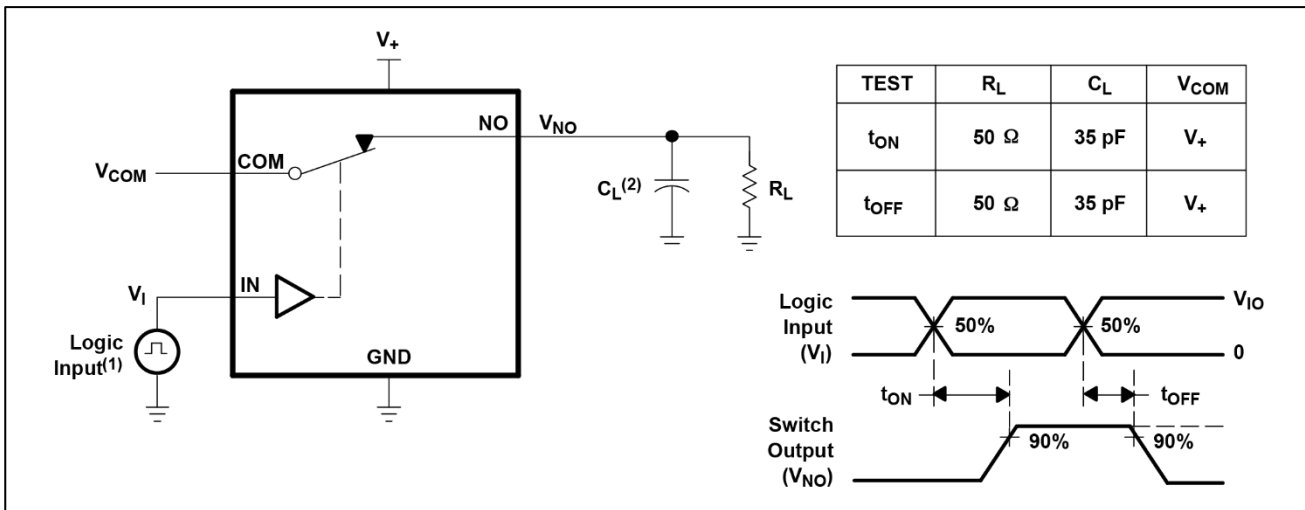


Figure 5. Turn-On ( $t_{ON}$ ) and Turn-Off Time ( $t_{OFF}$ )

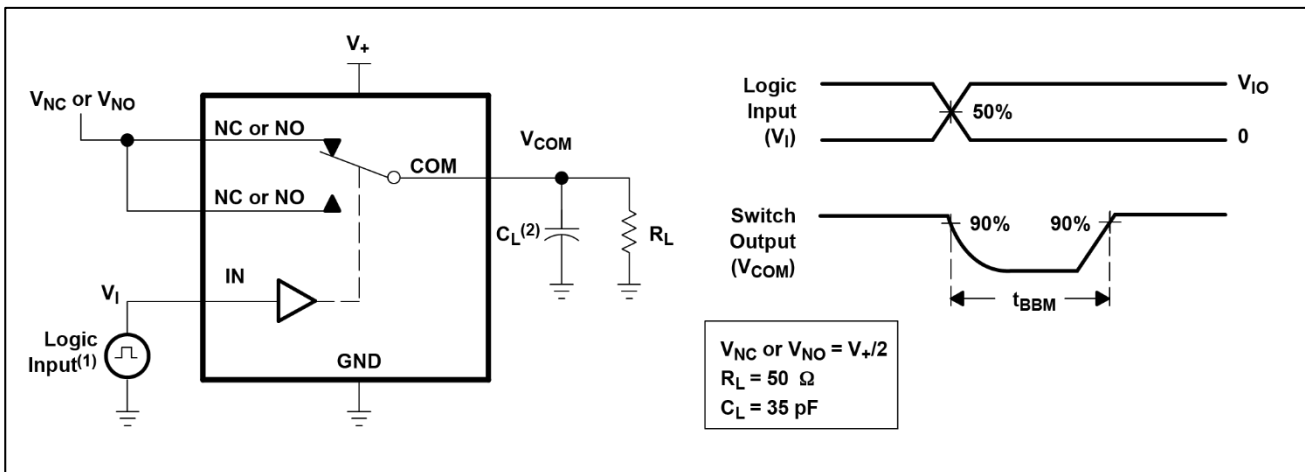


Figure 6. Break-Before-Make Time ( $t_{BBM}$ )

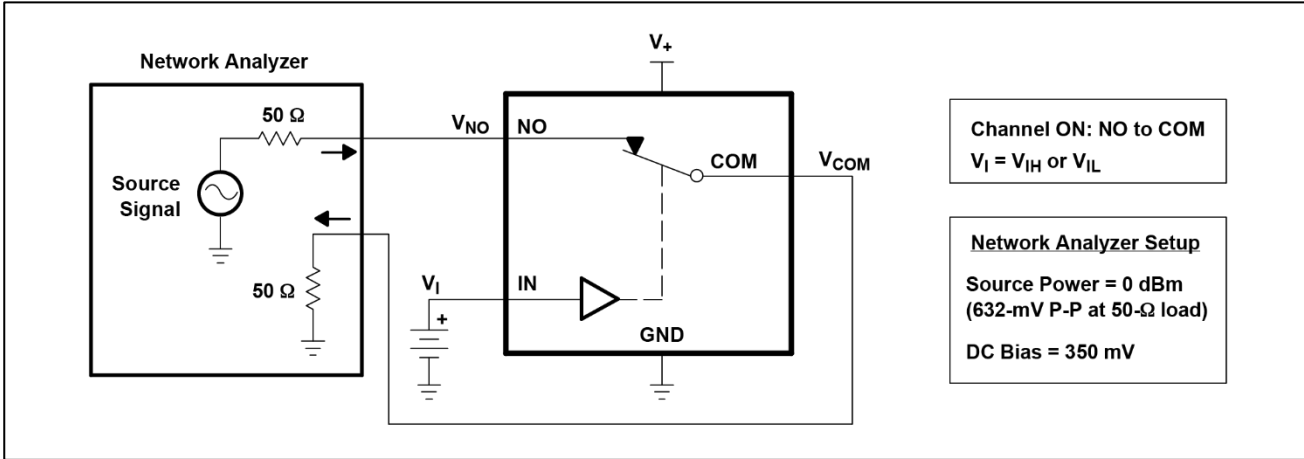


Figure 7. Bandwidth (BW)

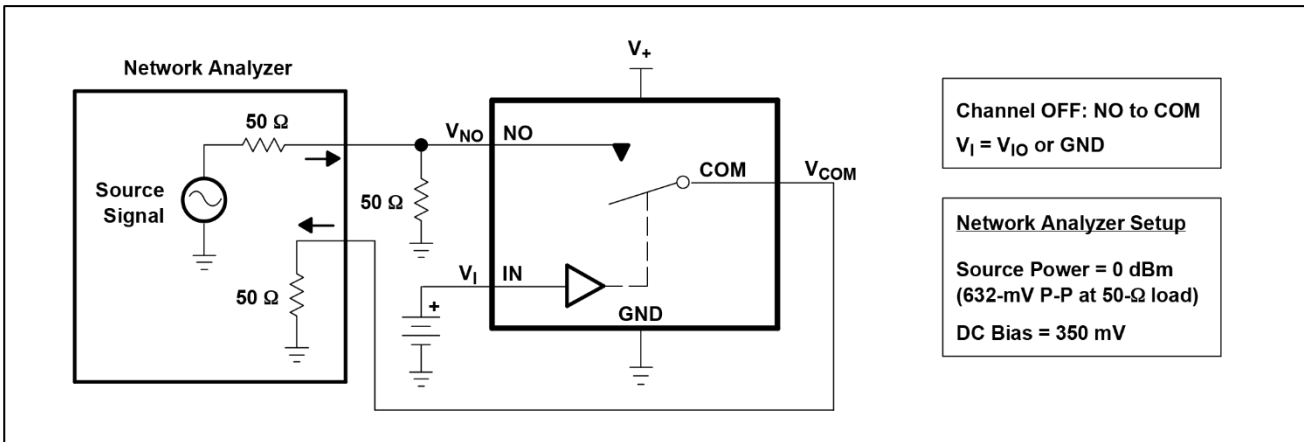


Figure 8. OFF Isolation ( $O_{iso}$ )

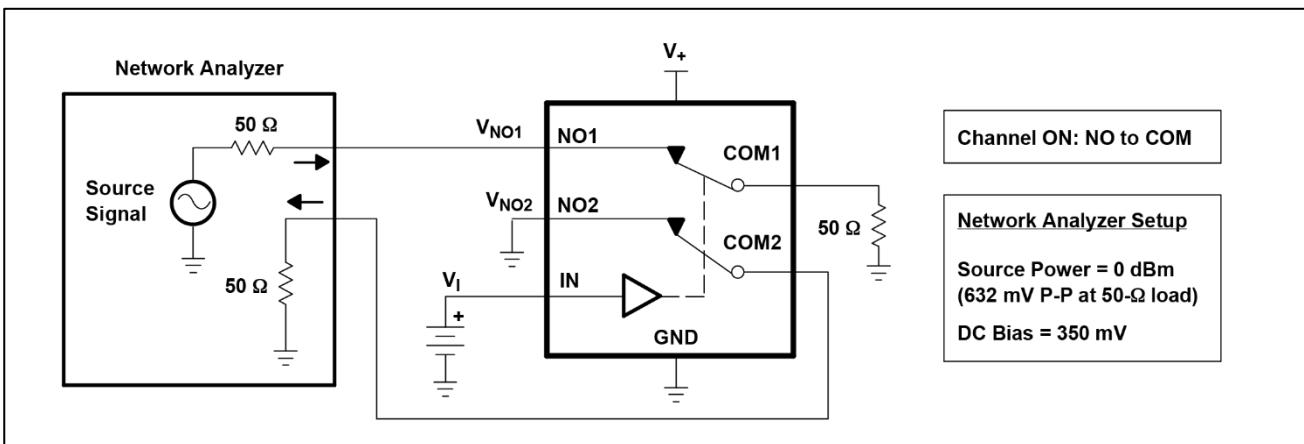
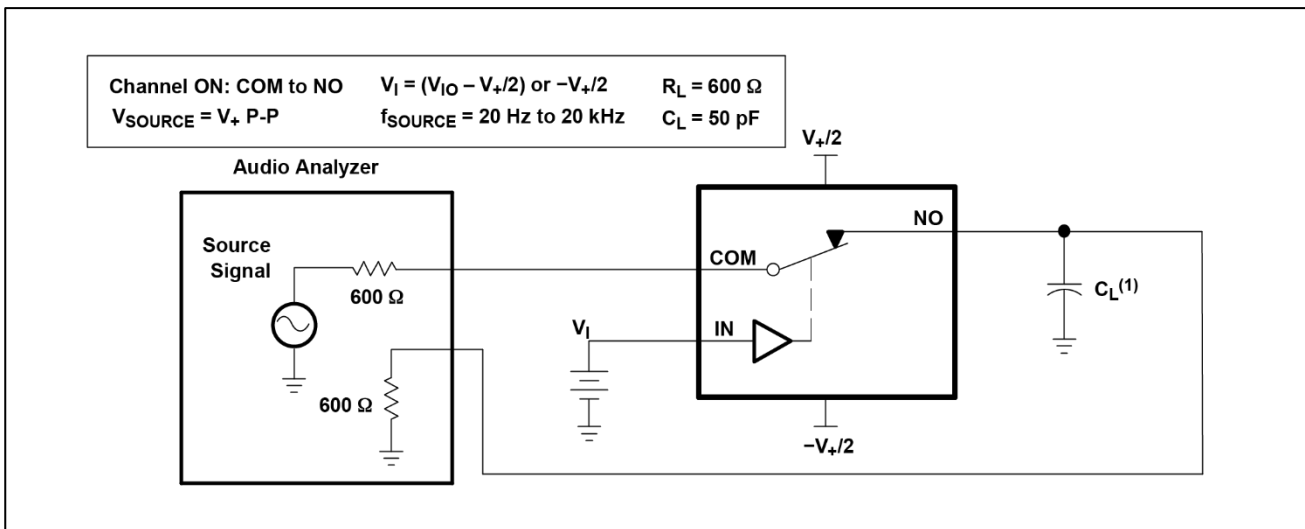
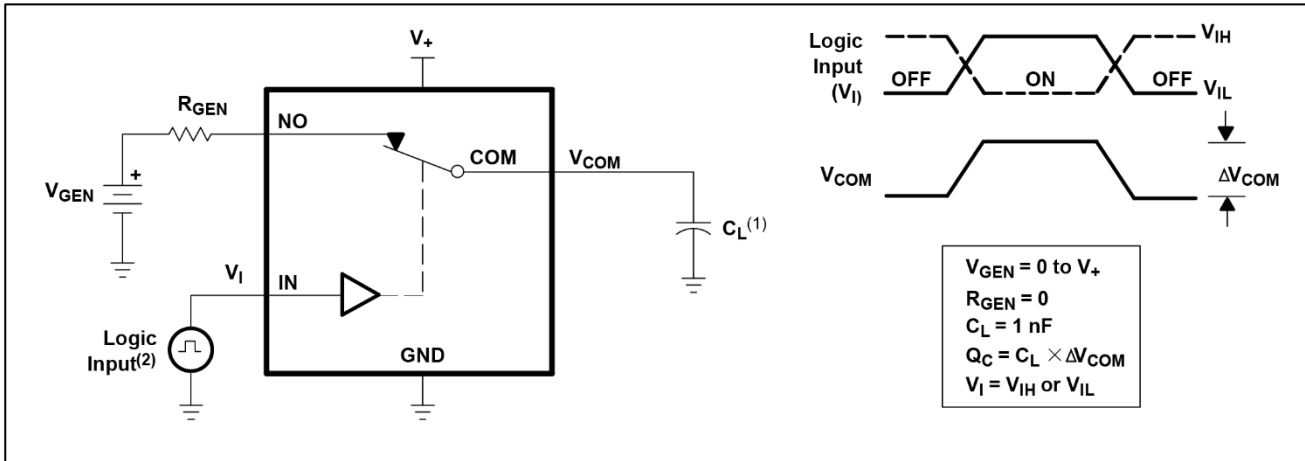


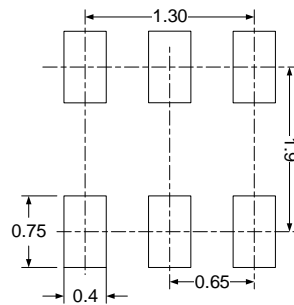
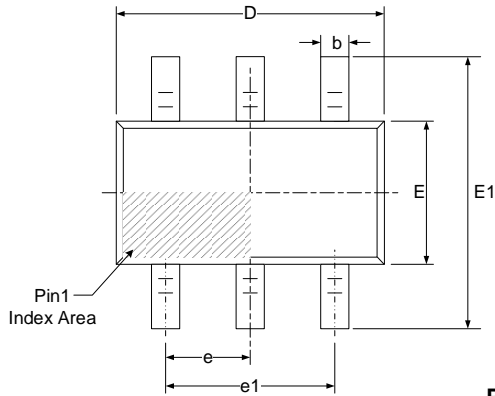
Figure 9. Crosstalk ( $X_{TALK}$ )



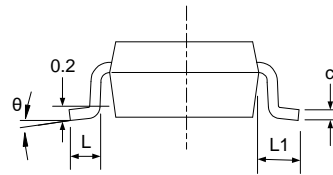
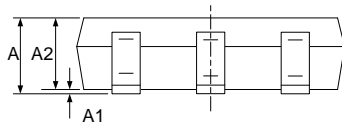


# PACKAGE OUTLINE DIMENSIONS

## SOT363 (SC70-6)

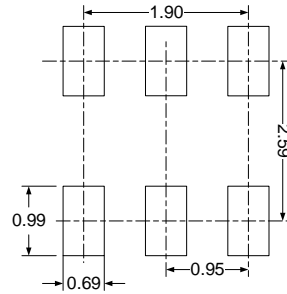
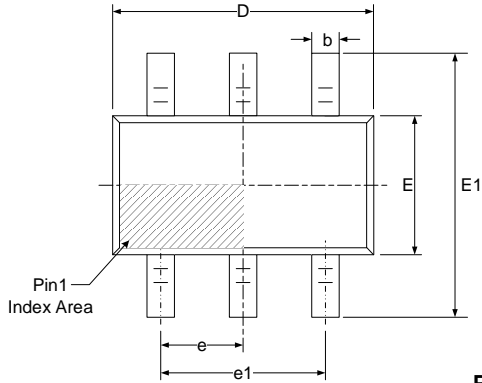


RECOMMENDED LAND PATTERN (Unit: mm)

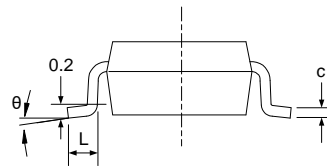
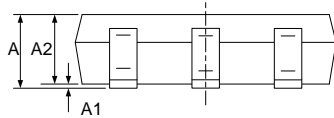


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650(BSC)		0.026(BSC)	
e1	1.300(BSC)		0.051(BSC)	
L	0.260	0.460	0.010	0.018
L1	0.525		0.021	
θ	0°	8°	0°	8°

# SOT23-6

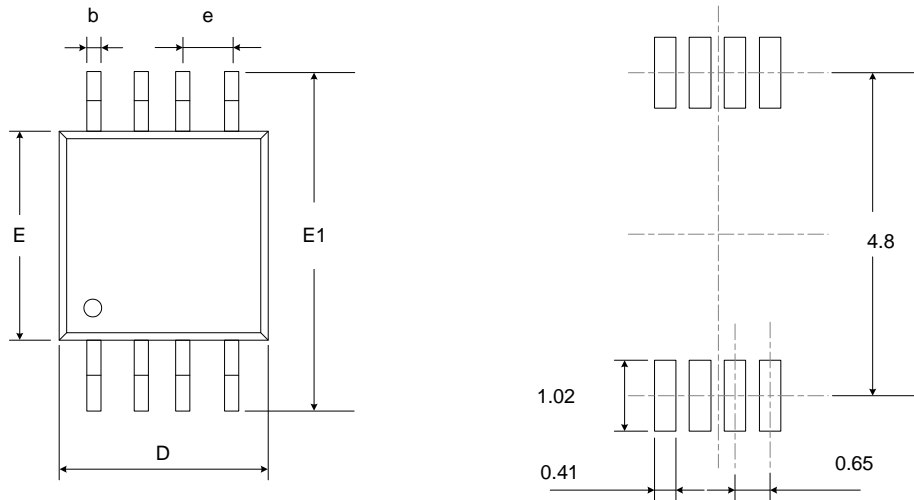


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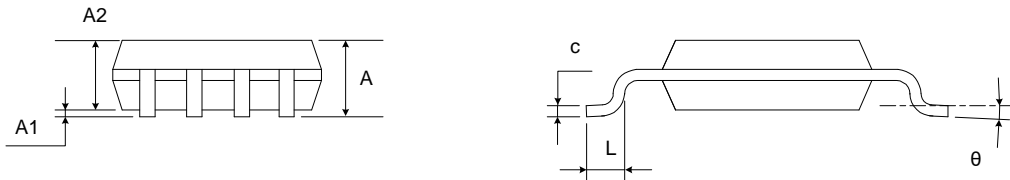


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

# MSOP-8



**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	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.650(BSC)		0.026(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°

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