

## 4.5Ω Low Voltage SPDT Analog Switch

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

### DESCRIPTION

The RS2057 is a single-pole double-throw (SPDT) analog switch that is designed to operate from 1.8 V to 5.5 V.

The RS2057 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.

### APPLICATIONS

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

**Device Information (1)**

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS2057	SOT23-6	2.92mm×1.60mm
	SOT363(SC70-6)	2.10mm×1.25mm

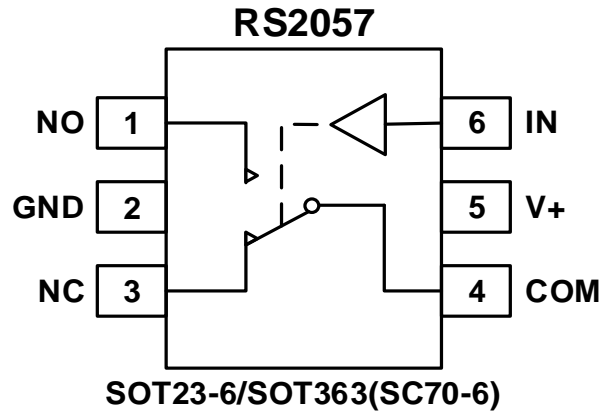
(1) For all available packages, see the orderable addendum at the end of the data sheet.

## Revision History

Note: Page numbers for previous revisions may differ from page numbers in the current version.

VERSION	Change Date	Change Item
C.3	2021/11/26	Added the TAPE AND REEL INFORMATION

## Pin Configuration



NOTE: NO, NC and COM terminals may be an input or output

## PIN DESCRIPTION

NAME	PIN	FUNCTION
	SOT23-6/SOT363(SC70-6)	
NO	1	Normally-Open Terminal
GND	2	Ground
NC	3	Normally-Closed Terminal
COM	4	Common Terminal
V+	5	Power Supply
IN	6	Digital Control Pin

## FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

## SPECIFICATIONS

### Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

SYMBOL	PARAMETER	MIN	MAX	UNIT
V <sub>+</sub>	Supply Voltage	-0.3	6.0	V
V <sub>IN</sub>	Input Voltage	-0.3	6.0	
	Analog, Digital Voltage Range <sup>(2)</sup>	-0.3	(V <sub>+</sub> )+0.3	
	Continuous Current NO, NC, or COM	-300	+300	mA
I <sub>PEAK</sub>	Peak Current NO, NC, or COM	-500	+500	
T <sub>J</sub>	Junction Temperature		150	°C
T <sub>stg</sub>	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.

### ESD Ratings

			VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human-body model (HBM)	±1000	V
		Machine Model (MM)	±100	V

### Recommended Operating Conditions

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

SYMBOL	PARAMETER	MIN	MAX	UNIT
V <sub>CC</sub>	Supply Voltage	1.8	5.5	V
T <sub>A</sub>	Operating temperature	-40	+125	°C

### Thermal Information

THERMAL METRIC		RS2057		UNIT
		6 PINS		
		SOT23-6	SOT363(SC70-6)	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	187.3	214.7	°C/W
R <sub>θJC(top)</sub>	Junction-to-case(top) thermal resistance	126.5	127.1	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	32.6	60.0	°C/W
Ψ <sub>JT</sub>	Junction-to-top characterization parameter	24.1	33.4	°C/W
Ψ <sub>JB</sub>	Junction-to-board characterization parameter	32.1	59.8	°C/W
R <sub>θJC(bot)</sub>	Junction-to-case(bottom) thermal resistance	N/A	N/A	°C/W
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	187.3	214.7	°C/W

**PACKAGE/ORDERING INFORMATION**

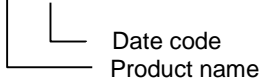
PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING <sup>(1/2)</sup>	PACKAGE OPTION
RS2057	RS2057XC6	-40°C~125°C	SOT363(SC70-6)	2057 <u>X</u>	Tape and Reel,3000
	RS2057XH	-40°C~125°C	SOT23-6	2057	Tape and Reel,3000

NOTE:

- (1) 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.
- (2) X = Date Code

**MARKING INFORMATION**

2057 X



## ELECTRICAL CHARACTERISTICS

$V_+ = 5.0\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	$V_+$	$T_A$	MIN	TYP	MAX	UNIT
<b>ANALOG SWITCH</b>								
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	$\Omega$
				FULL			8.5	$\Omega$
			3.3V	+25°C		7	10	$\Omega$
				FULL			10.5	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_{NO}$ or $V_{NC} = V_+/2$ , $I_{COM} = -10\text{mA}$ , Switch ON, See Figure 4	5V	+25°C		0.15	0.3	$\Omega$
				FULL			0.4	$\Omega$
			3.3V	+25°C		0.15	0.3	$\Omega$
				FULL			0.4	$\Omega$
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	$\Omega$
				FULL			3.3	$\Omega$
			3.3V	+25°C		3	4	$\Omega$
				FULL			4.3	$\Omega$
NC,NO OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NO}$ or $V_{NC} = 0.3\text{V}$ , $V_+/2$ $V_{COM} = V_+/2$ , $0.3\text{V}$ See Figure 5	1.8 to 5.5V	FULL			1	$\mu\text{A}$
NC,NO,COM ON Leakage Current	$I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_{NO}$ or $V_{NC} = 0.3\text{V}$ , Open $V_{COM} = \text{Open}$ , $0.3\text{V}$ See Figure 6	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	$I_{IN}$	$V_{IN} = V_{IO}$ or 0	1.8 to 5.5V	FULL			1	$\mu\text{A}$

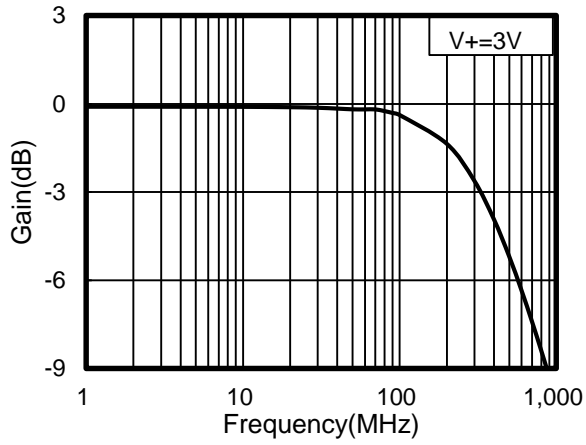
(1) All unused digital inputs of the device must be held at  $V_{IO}$  or GND to ensure proper device operation.

## ELECTRICAL CHARACTERISTICS (continued)

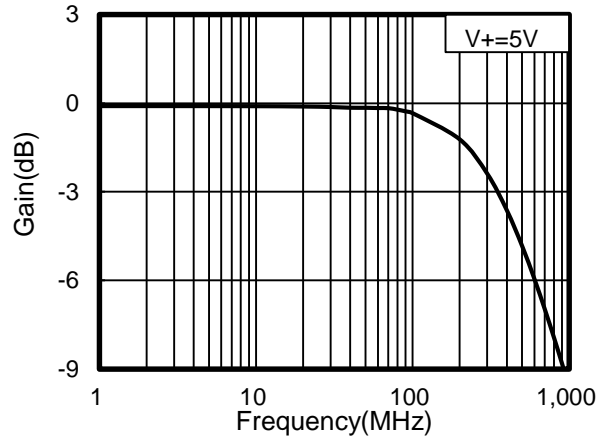
$V_+ = 5.0\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	$V_+$	$T_A$	MIN	TYP	MAX	UNIT
<b>DYNAMIC CHARACTERISTICS</b>								
Turn-On Time	$t_{ON}$	$V_{COM} = V_+$ , $R_L = 300\Omega$ , $C_L = 35\text{pF}$ , See Figure 8	5V	+25°C		30		ns
			3.3V			40		
Turn-Off Time	$t_{OFF}$	$V_{COM} = V_+$ , $R_L = 300\Omega$ , $C_L = 35\text{pF}$ , See Figure 8	5V	+25°C		25		ns
			3.3V			30		
Break-Before-Make Time Delay	$t_{BBM}$	$V_{NO1} = V_{NC1} = V_{NO2} = V_{NC2} = 3\text{V}$ , $R_L = 300\Omega$ , $C_L = 35\text{pF}$ , See Figure 9	5V	+25°C		5		ns
			3.3V			8		
Off Isolation	$O_{ISO}$	$R_L = 50\Omega$ , Switch OFF, See Figure 11		+25°C		-52		dB
				+25°C		-71		dB
-3dB Bandwidth	BW	Switch ON, $R_L = 50\Omega$ , 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
<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	$\mu\text{A}$

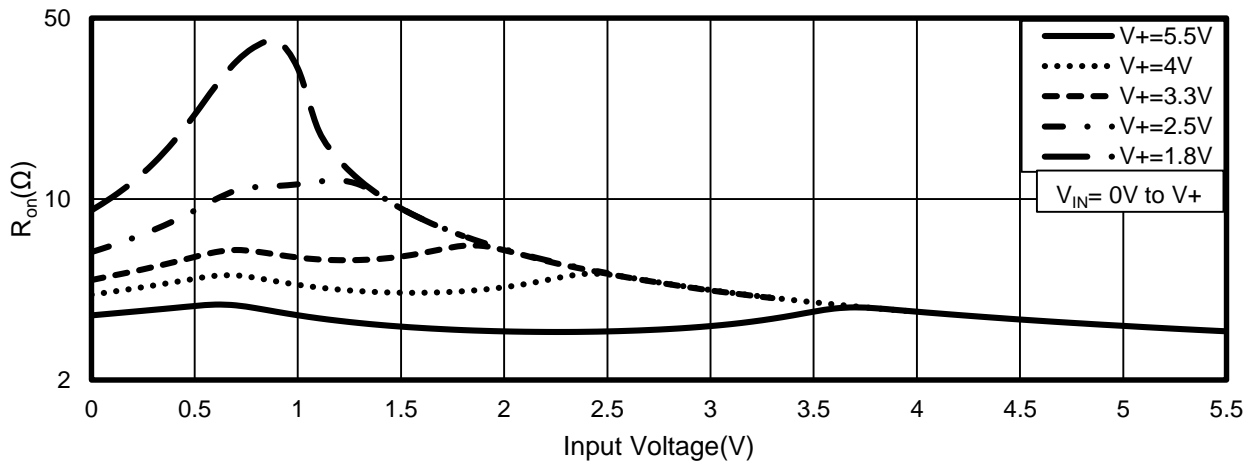
**TYPICAL CHARACTERISTICS**



**Figure 1. Bandwidth vs Frequency**



**Figure 2. Bandwidth vs Frequency**



**Figure 3. Typical Ron as a Function of Input Voltage**



### Parameter Measurement Information

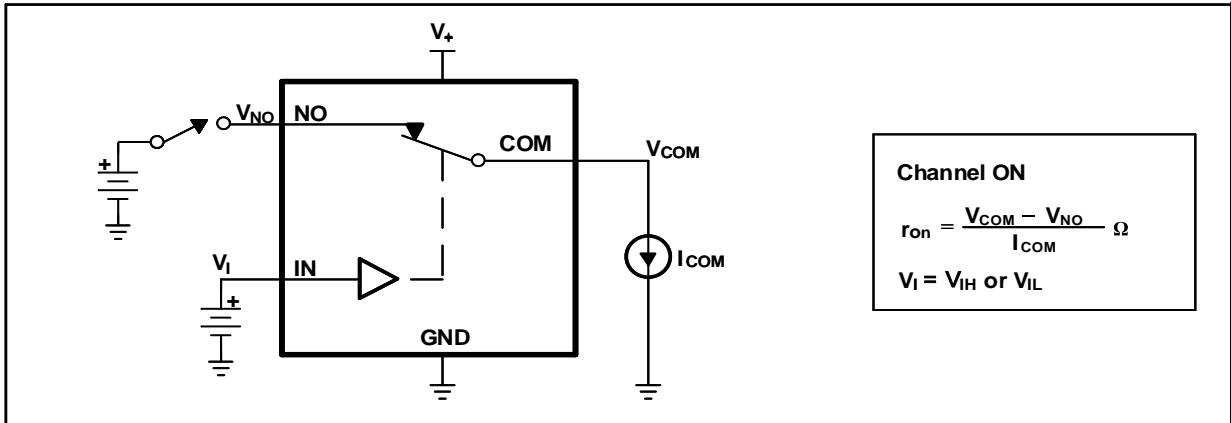


Figure 4. ON-State Resistance ( $R_{on}$ )

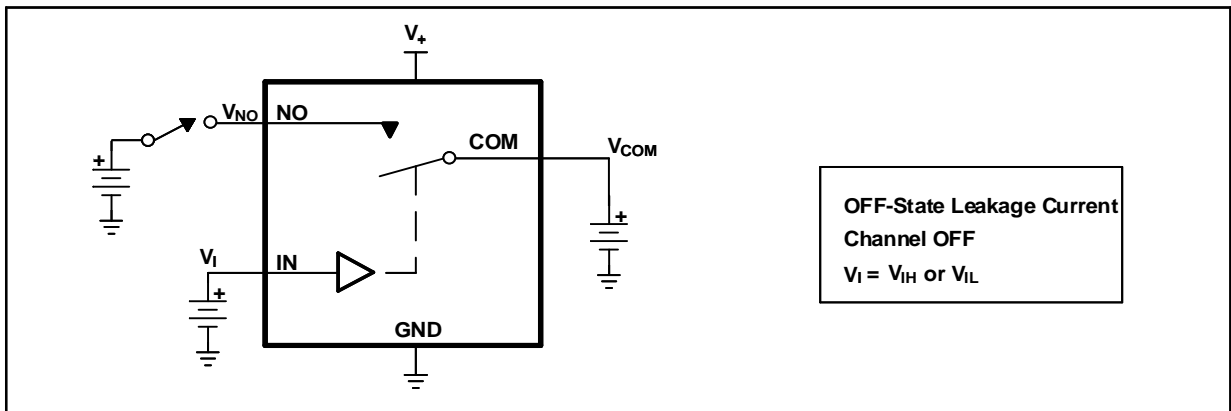


Figure 5. OFF-State Leakage Current ( $I_{COM (OFF)}$ ,  $I_{NO (OFF)}$ )

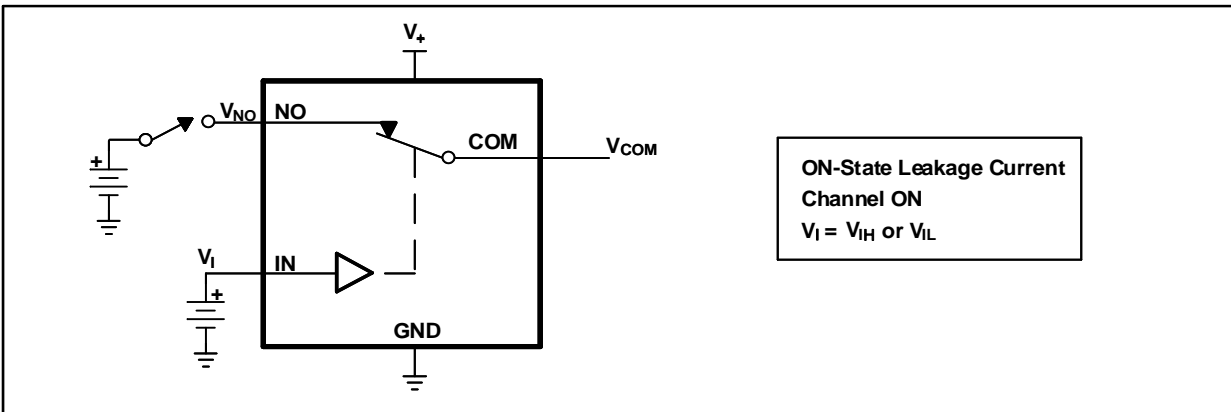


Figure 6. ON-State Leakage Current ( $I_{COM (ON)}$ ,  $I_{NO (ON)}$ )

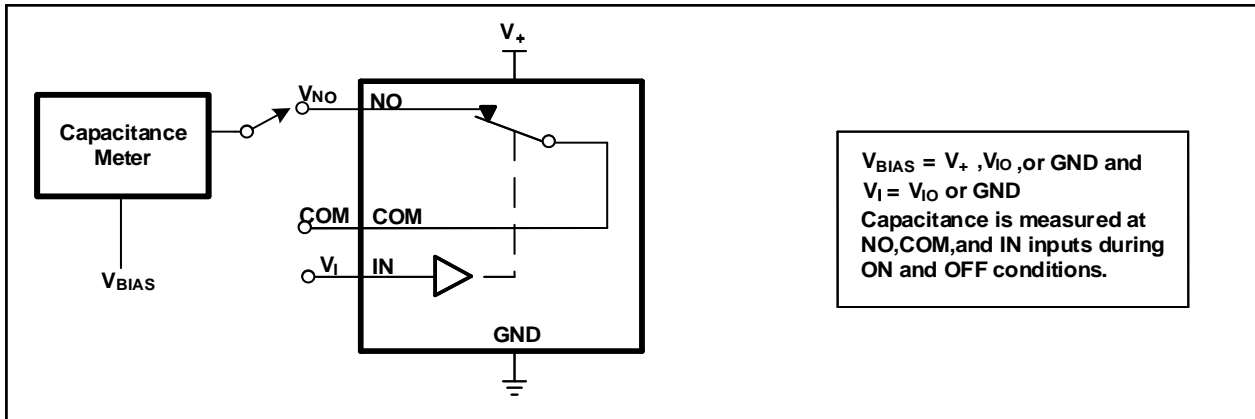


Figure 7. Capacitance ( $C_I$ ,  $C_{COM(OFF)}$ ,  $C_{COM(ON)}$ ,  $C_{NO(OFF)}$ ,  $C_{NO(ON)}$ )

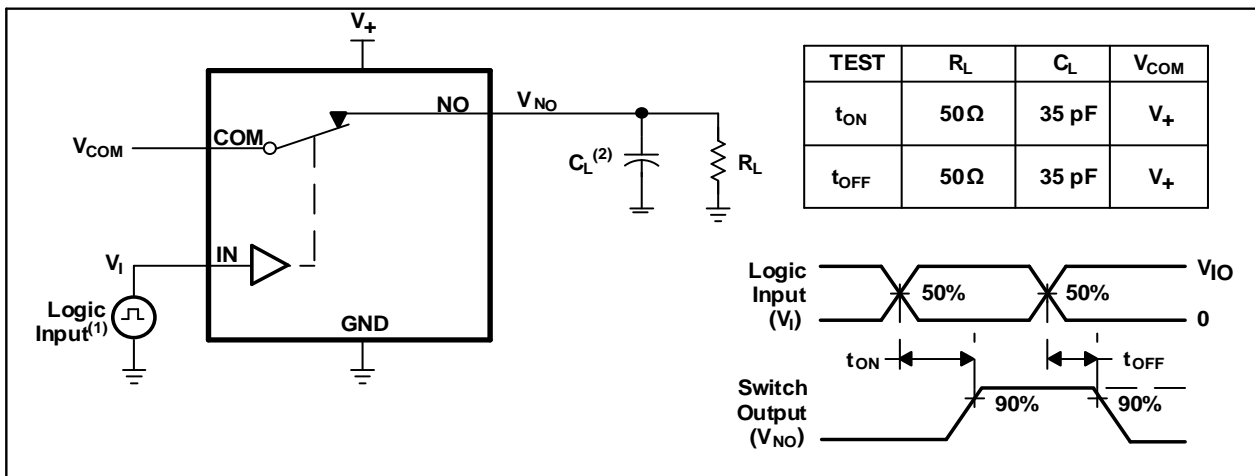


Figure 8. Turn-On ( $t_{ON}$ ) and Turn-Off Time ( $t_{OFF}$ )

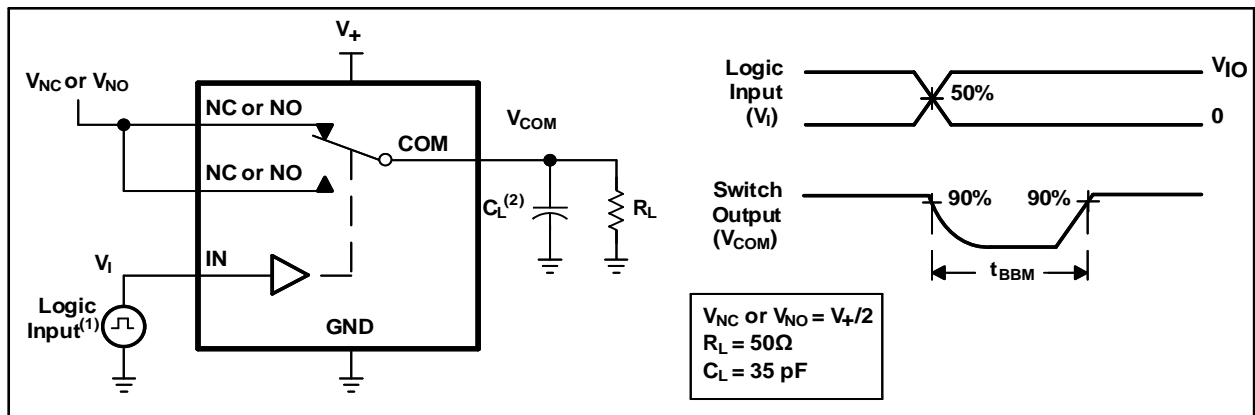


Figure 9. Break-Before-Make Time ( $t_{BBM}$ )

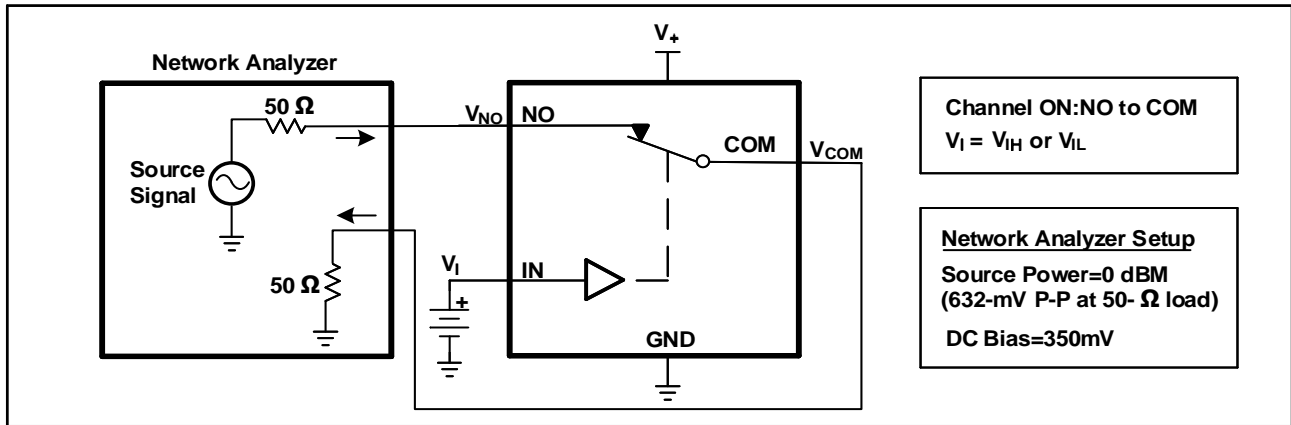


Figure 10. Bandwidth (BW)

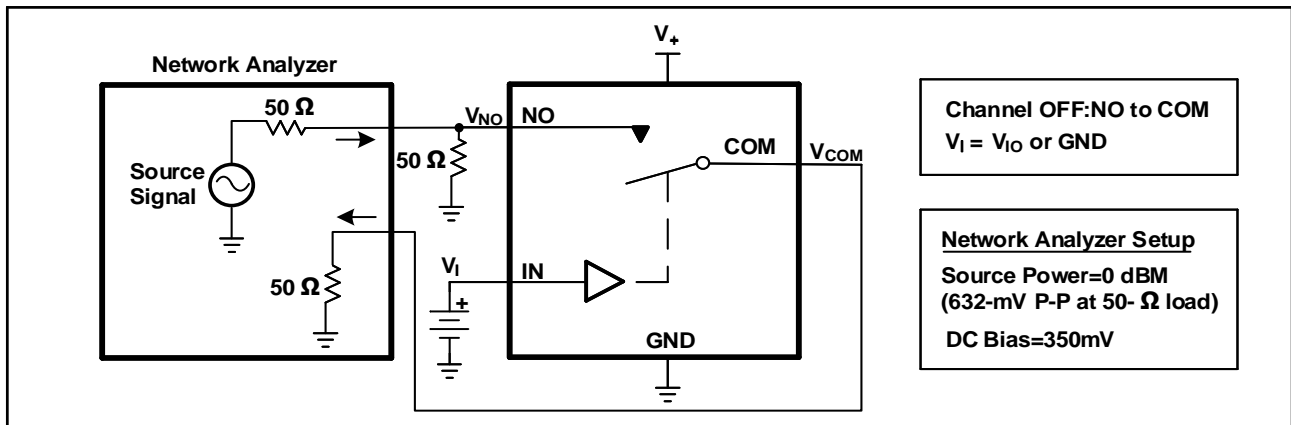


Figure 11. OFF Isolation ( $O_{ISO}$ )

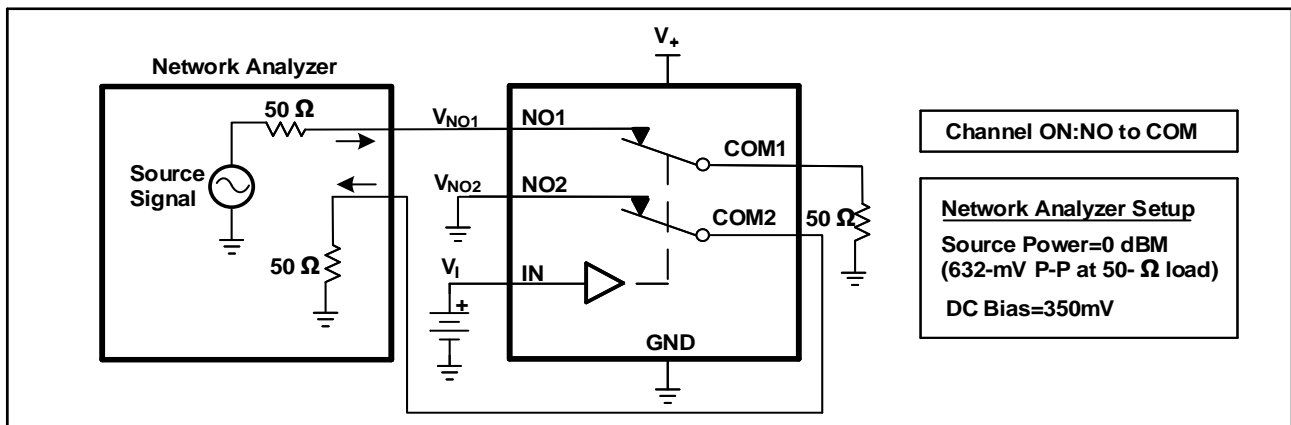


Figure 12. Crosstalk ( $X_{TALK}$ )

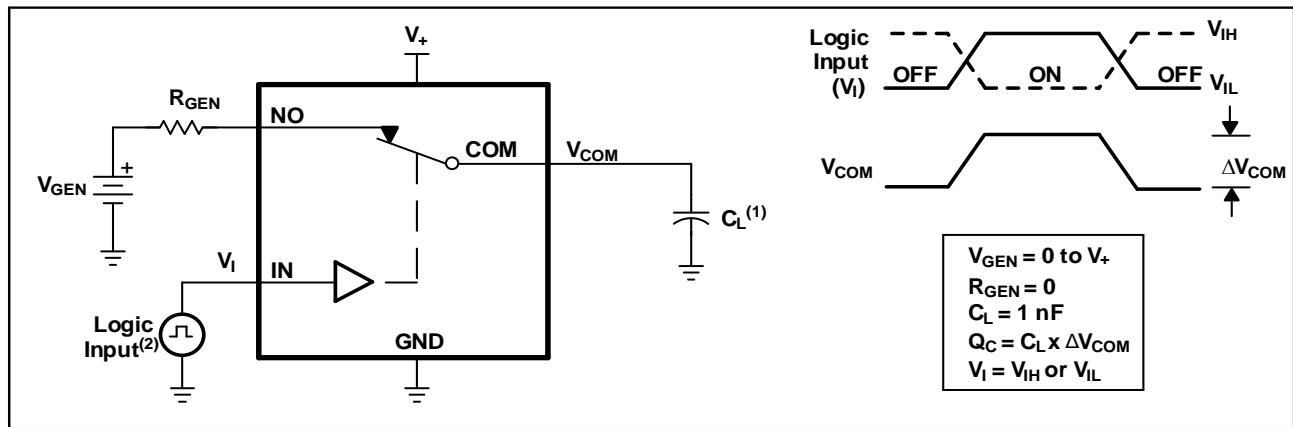


Figure 13. Charge Injection ( $Q_C$ )

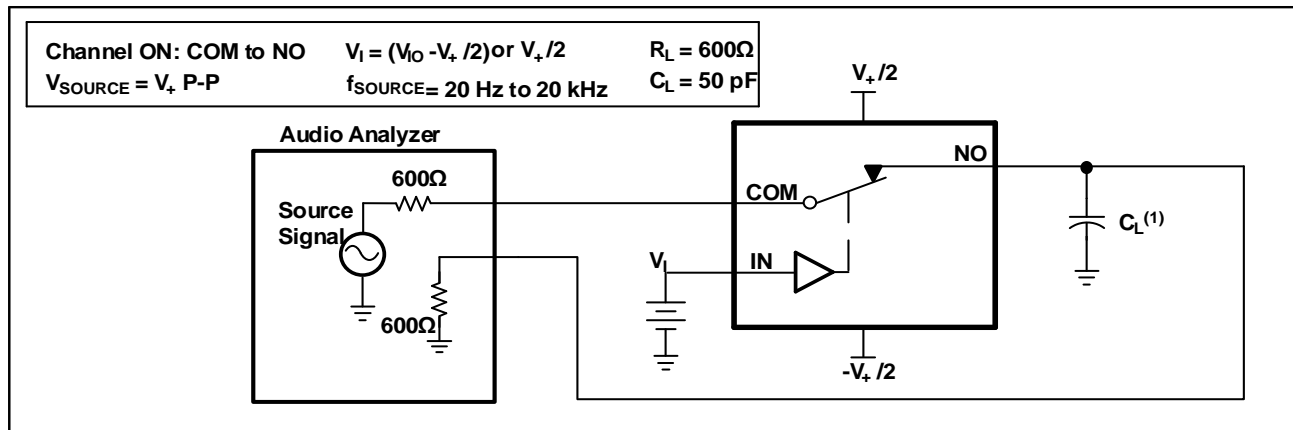
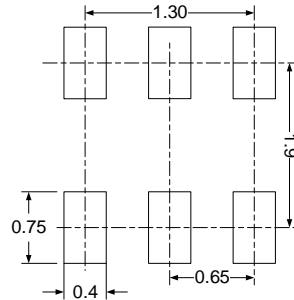
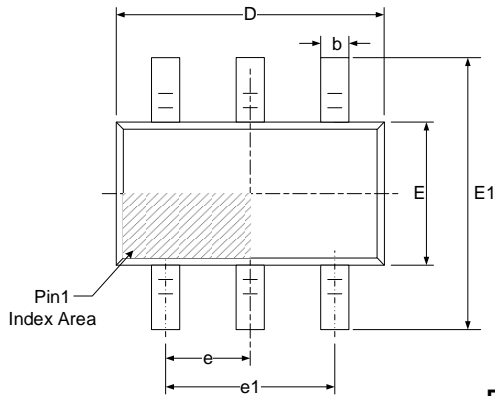
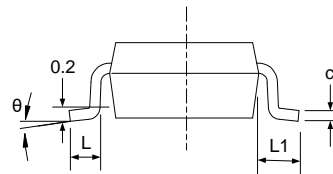
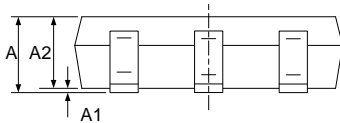


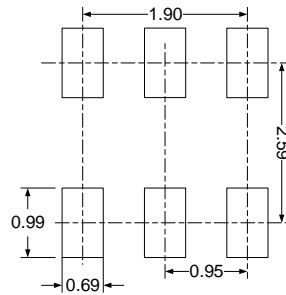
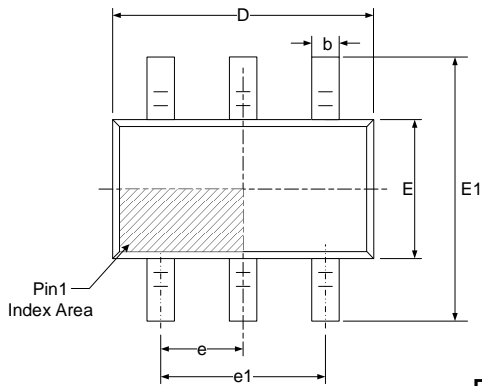
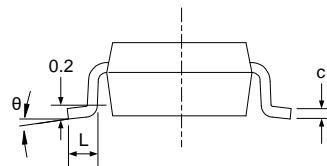
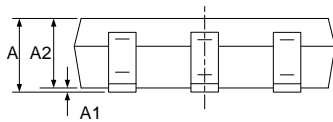
Figure 14. Total Harmonic Distortion (THD)

# PACKAGE OUTLINE DIMENSIONS

## SOT363 (SC70-6)


**RECOMMENDED LAND PATTERN (Unit: mm)**


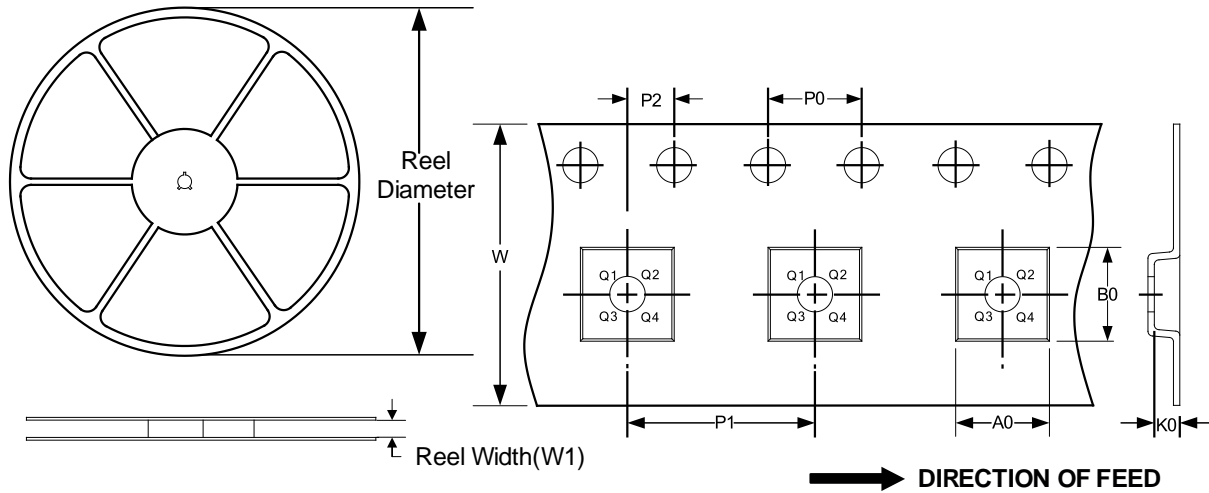
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650(BSC)		0.026(BSC)	
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**

**RECOMMENDED LAND PATTERN (Unit: mm)**


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
$\theta$	0°	8°	0°	8°

**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
SOT363(SC70-6)	7"	9.5	2.40	2.50	1.20	4.0	4.0	2.0	8.0	Q3
SOT23-6	7"	9.5	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3