

Ultra-Low ON-Resistance, Low Voltage, 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**
- **Micro Size Packages: SC70-6**

2 APPLICATIONS

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

3 DESCRIPTIONS

The RES4157ISR is a single -pole double-throw (SPDT) analog switch that is designed to operate from 1.8 V to 5.5 V.

The RES4157ISR 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)
RES4157ISR	SC70-6	2.10mm×1.25mm

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

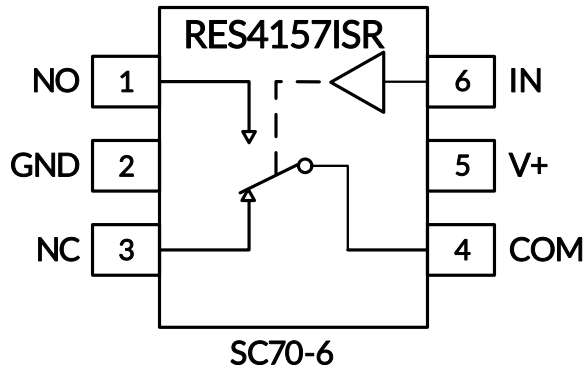
5 PACKAGE/ORDERING INFORMATION ⁽¹⁾

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING ⁽²⁾	MSL ⁽³⁾	PACKAGE OPTION
RES4157	RES4157ISR	-40°C ~125°C	SC70-6 ⁽⁴⁾	RES4157ISR	MSL3	Tape and Reel, 3000

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.
- (4) Equivalent to SOT363.

6 PIN CONFIGURATIONS



6.1 Pin Description

PIN	RES4157ISR	FUNCTION
	SC70-6	
1	NO	Normally-Open Terminal
2	GND	Ground
3	NC	Normally-Closed Terminal
4	COM	Common Terminal
5	V+	Power Supply
6	IN	Digital Control Pin

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		-0.3	6	V
V _{IN}	Input Voltage (All inputs)		-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 ⁽²⁾	SC70-6		265	°C/W
T _J	Junction Temperature ⁽³⁾		-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 package thermal impedance is calculated in accordance with JEDEC-51.

(3) The maximum power dissipation is a function of T_{J(MAX)}, R_{θJA}, and T_A. The maximum allowable power dissipation at any ambient temperature is P_D = (T_{J(MAX)} - T_A) / R_{θJA}. 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)	±100	



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 _{CC}	Supply Voltage	1.8	5.5	V
T _A	Operating temperature	-40	+125	°C

7.4 Electrical Characteristics

$V_+ = 5.0\text{ V}$, $T_A = -40^\circ\text{C}$ 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}	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$, $I_{COM} = -10\text{mA}$, 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}	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$, $I_{COM} = -10\text{mA}$, 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	$R_{FLAT(ON)}$	$0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$, $I_{COM} = -10\text{mA}$, 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	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{NO} \text{ or } V_{NC} = 0.3\text{V}$, $V_+/2$ $V_{COM} = V_+/2$, 0.3V See Figure 5	1.8 to 5.5V	FULL			1	μA
NC, NO, COM ON Leakage Current	$I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_{NO} \text{ or } V_{NC} = 0.3\text{V}$, Open $V_{COM} = \text{Open}$, 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}	$V_{IN} = V_{IO} \text{ or } 0$	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)

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

PARAMETER	SYMBOL	CONDITIONS	V_+	T_A	MIN	TYP	MAX	UNIT
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	$V_{COM} = V_+$, $R_L = 300\Omega$, $C_L = 35\text{pF}$, See Figure 8	5V	$+25^\circ\text{C}$		50		ns
			3.3V			50		
Turn-Off Time	t_{OFF}	$V_{COM} = V_+$, $R_L = 300\Omega$, $C_L = 35\text{pF}$, See Figure 8	5V	$+25^\circ\text{C}$		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 9	5V	$+25^\circ\text{C}$		10		ns
			3.3V			11		
Off Isolation	O_{ISO}	$R_L = 50\Omega$, Switch OFF, See Figure 11	$f = 100\text{KHz}$	$+25^\circ\text{C}$		-68		dB
			$f = 10\text{KHz}$	$+25^\circ\text{C}$		-86		dB
-3dB Bandwidth	BW	Switch ON, $R_L = 50\Omega$ See Figure 10		$+25^\circ\text{C}$		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		$+25^\circ\text{C}$		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		$+25^\circ\text{C}$		350		pF
POWER REQUIREMENTS								
Power Supply Range	V_+			FULL	1.8		5.5	V
Power Supply Current	I_+	$V_{IN} = \text{GND or } V_+$	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.

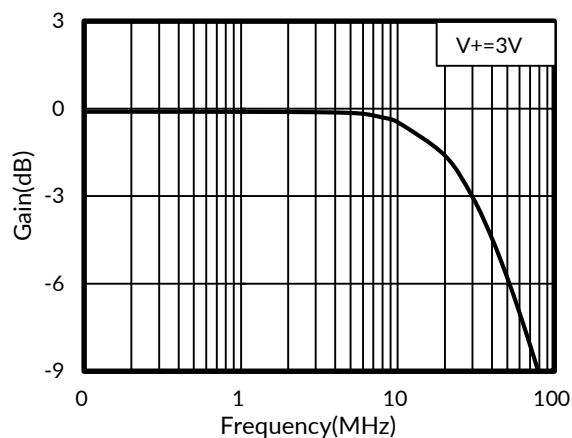


Figure 1. Bandwidth vs Frequency

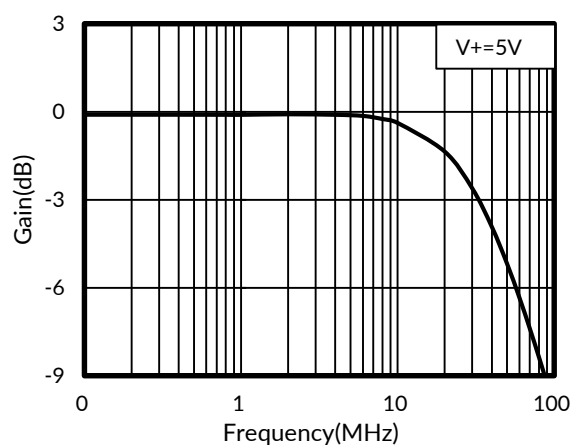


Figure 2. Bandwidth vs Frequency

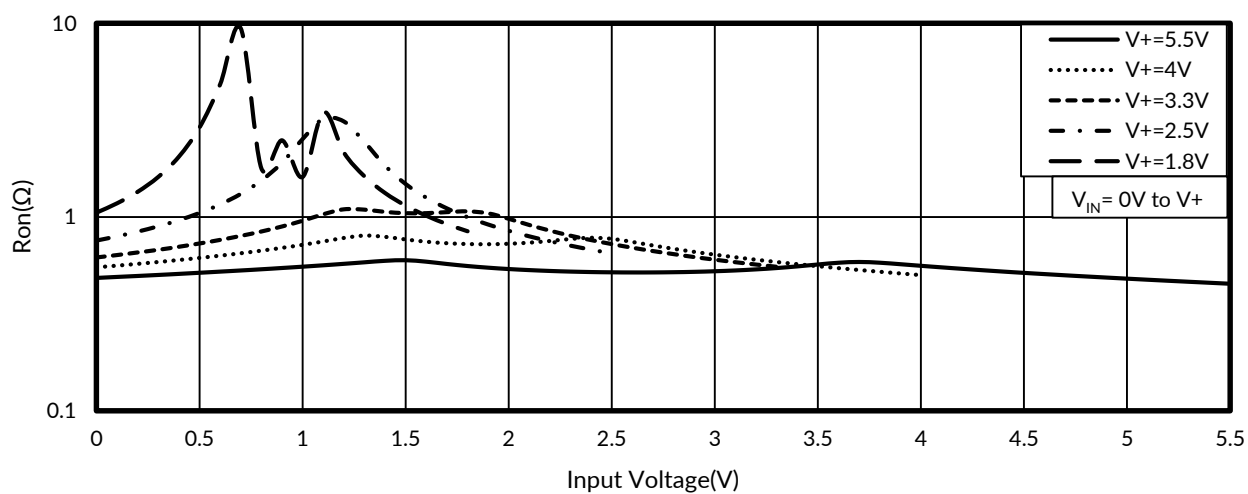


Figure 3. Typical R_{on} as a Function of Input Voltage

8 PARAMETER MEASUREMENT INFORMATION

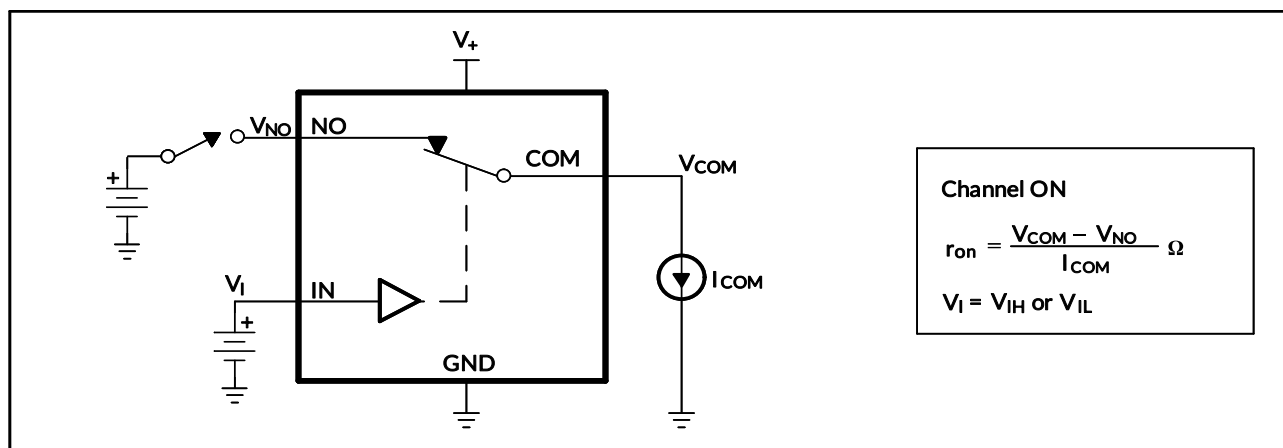


Figure 4. ON-State Resistance (R_{on})

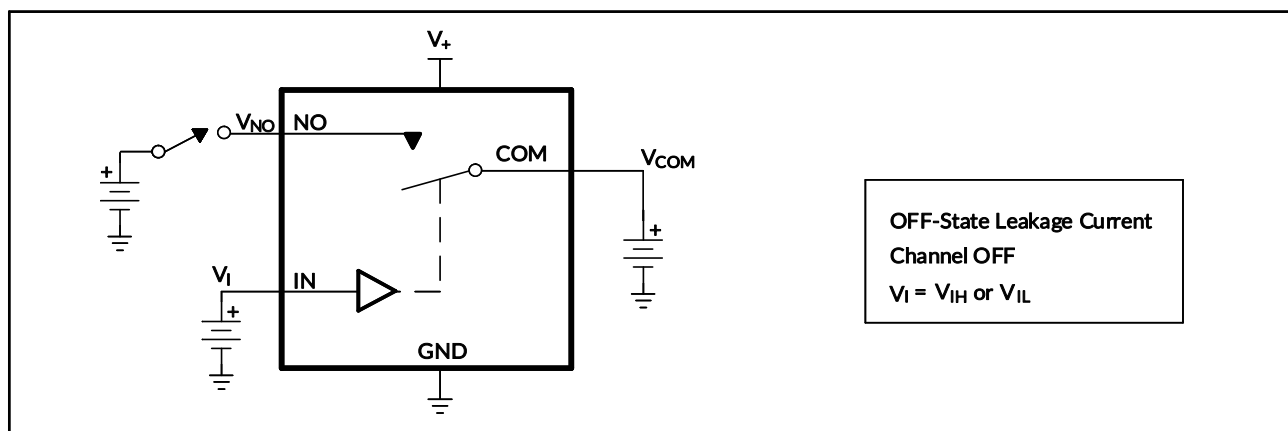


Figure 5. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NO(OFF)}$)

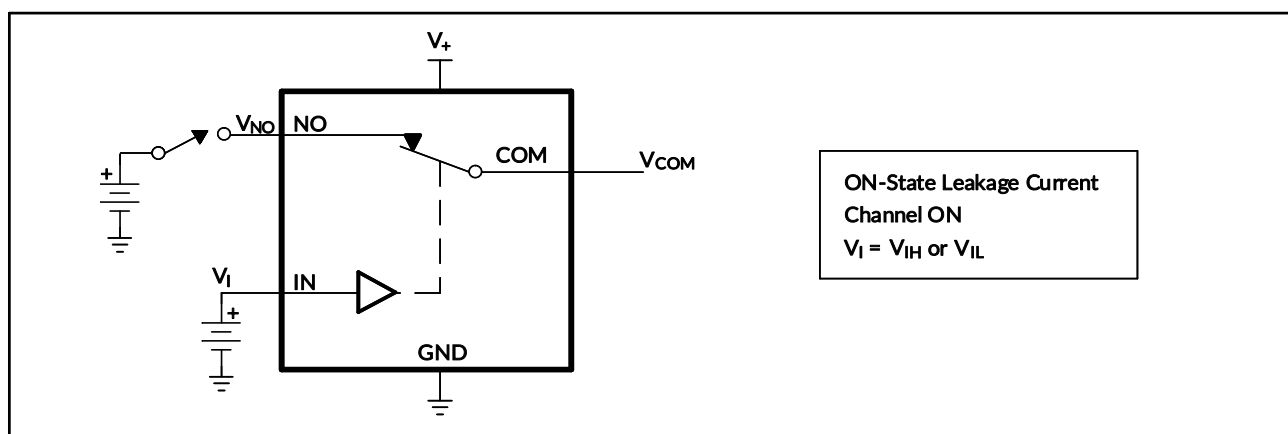


Figure 6. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NO(ON)}$)

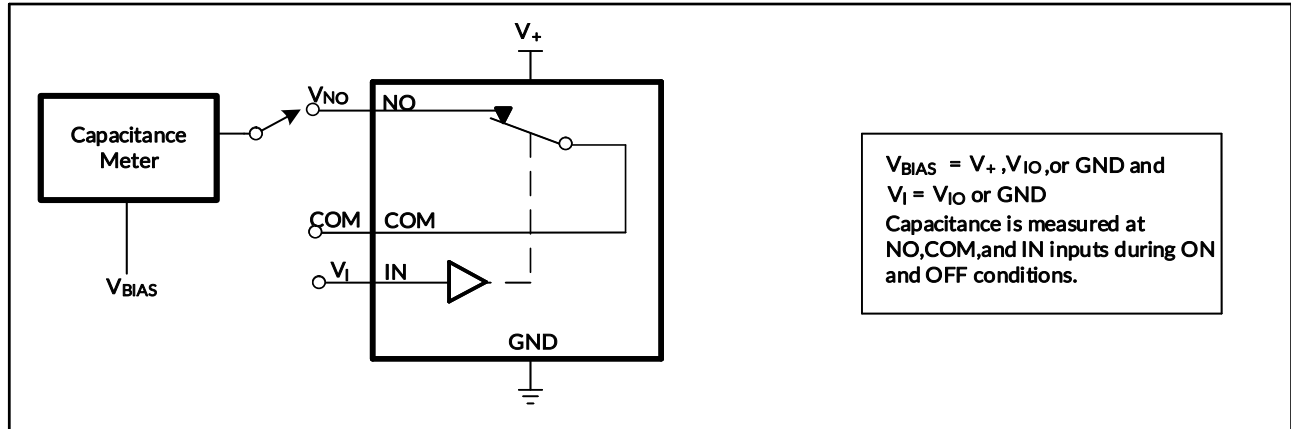


Figure 7. Capacitance (C_I , $C_{COM(ON)}$, $C_{COM(OFF)}$, $C_{NO(ON)}$, $C_{NO(OFF)}$)

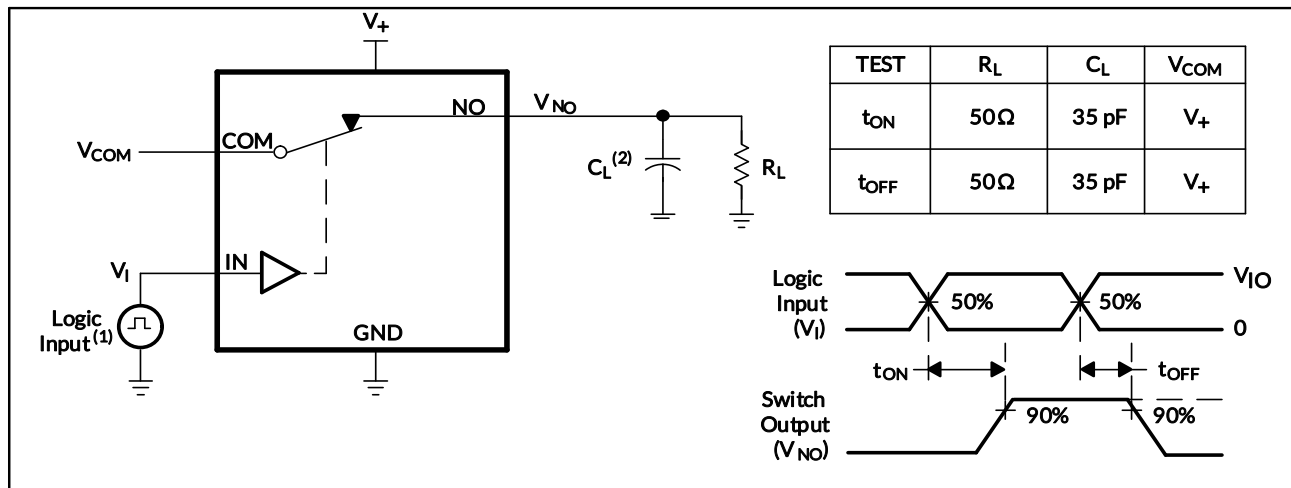


Figure 8. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

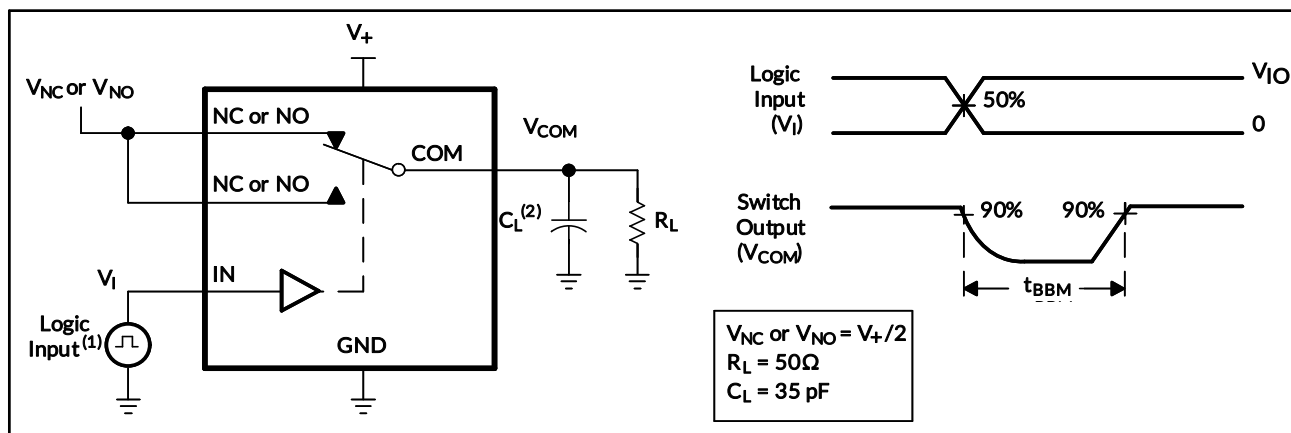


Figure 9. Break-Before-Make Time (t_{BBM})

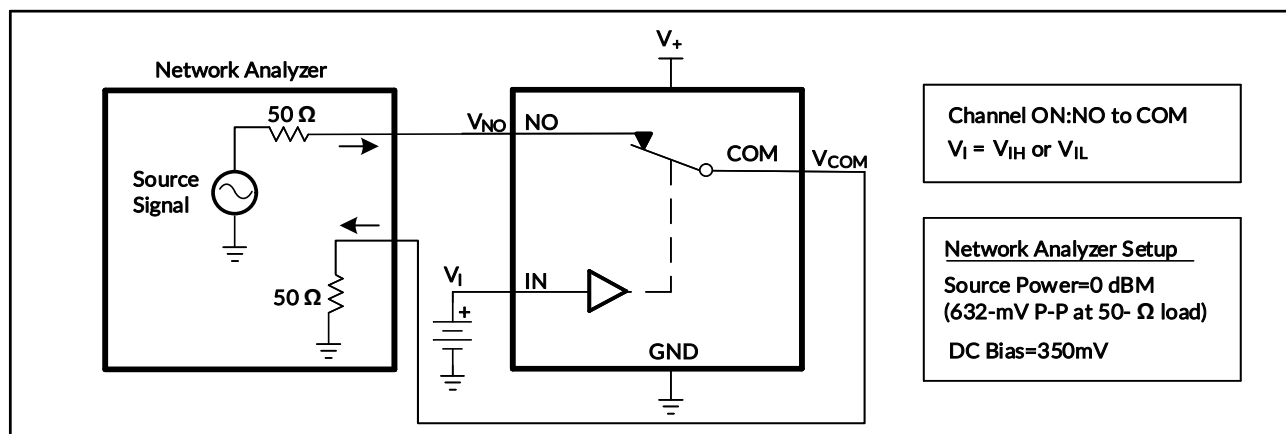


Figure 10. Bandwidth (BW)

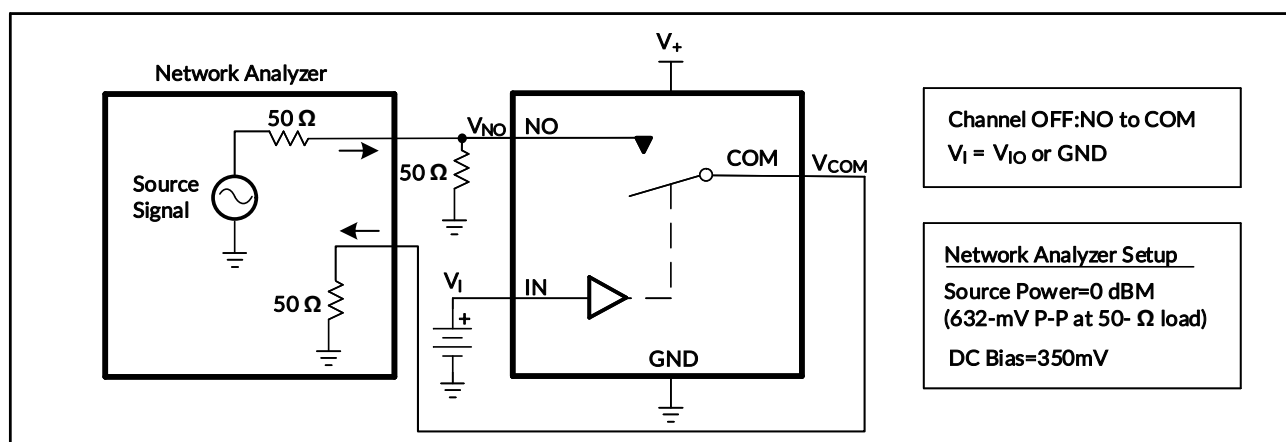


Figure 11. OFF Isolation (O_{Iso})

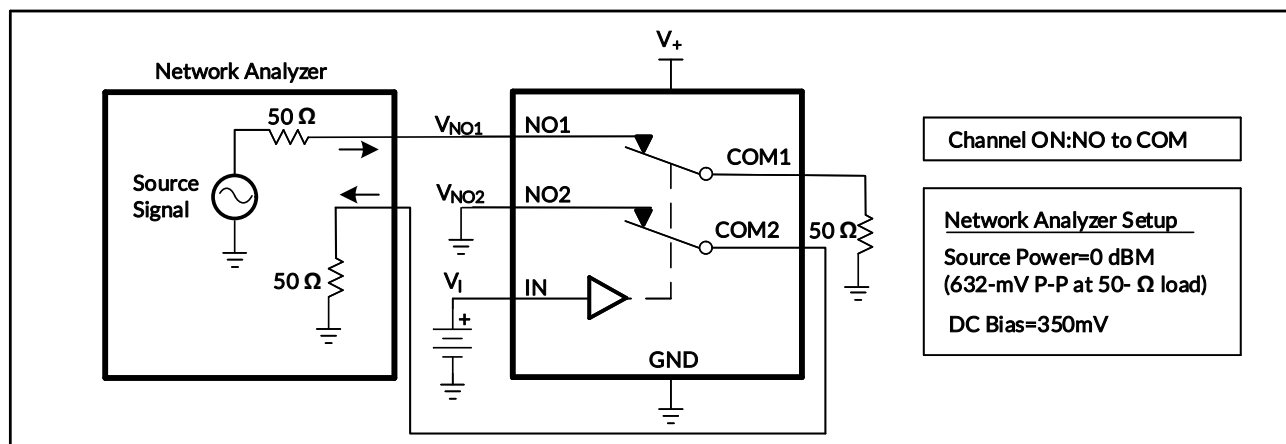


Figure 12. Crosstalk (X_{TALK})

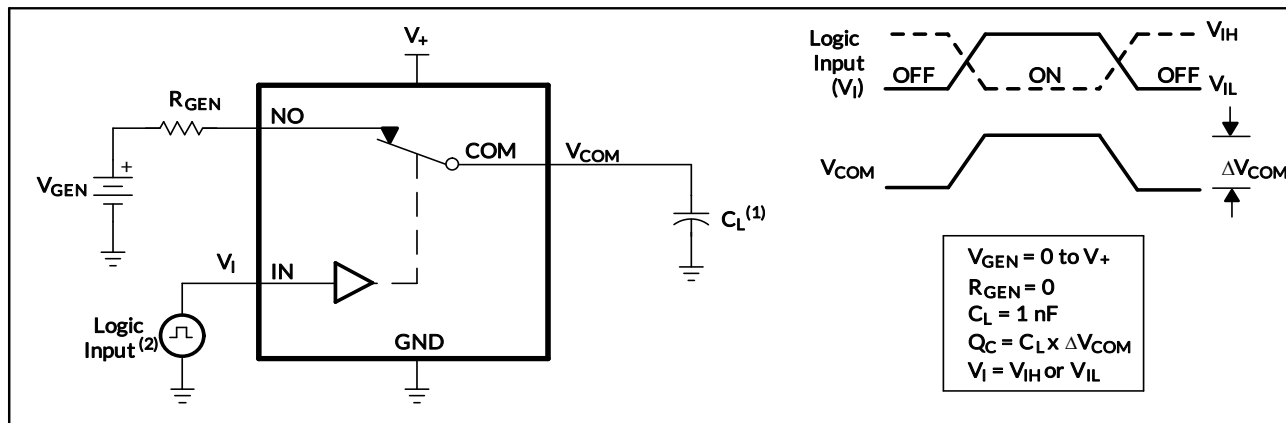


Figure 13. Charge Injection (Q_c)

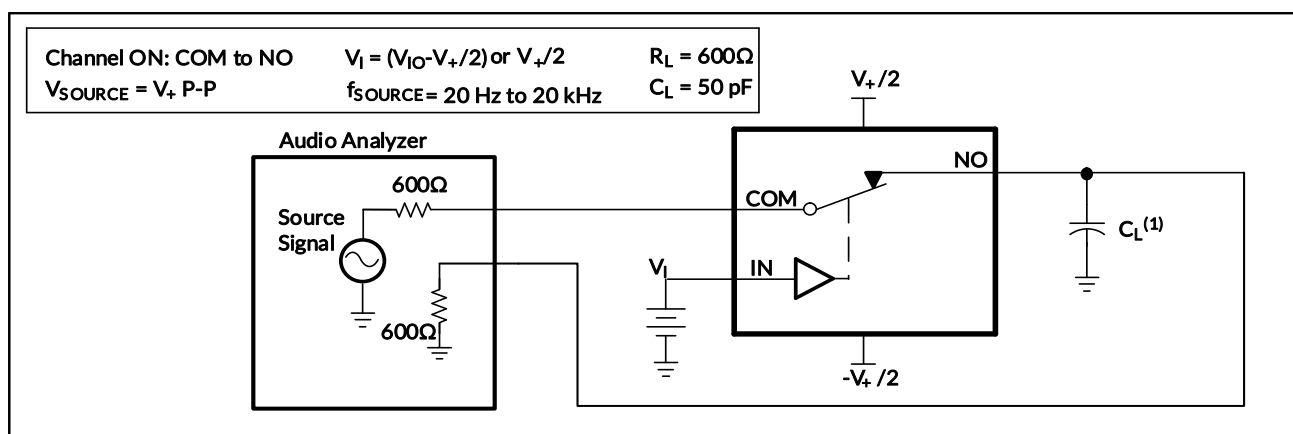
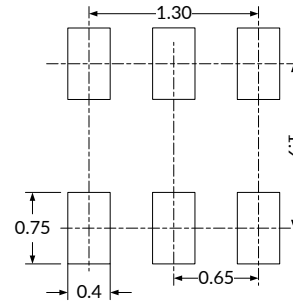
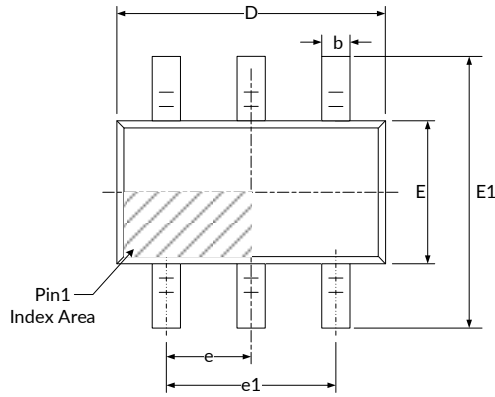


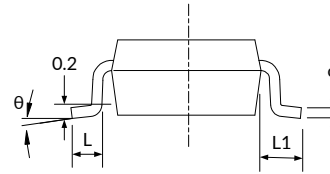
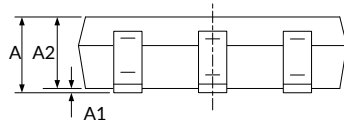
Figure 14. Total Harmonic Distortion (THD)

9 PACKAGE OUTLINE DIMENSIONS

SC70-6⁽³⁾



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A ⁽¹⁾	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 ⁽¹⁾	2.000	2.200	0.079	0.087
E ⁽¹⁾	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650(BSC) ⁽²⁾		0.026(BSC) ⁽²⁾	
e1	1.300(BSC) ⁽²⁾		0.051(BSC) ⁽²⁾	
L	0.260	0.460	0.010	0.018
L1	0.525		0.021	
θ	0°	8°	0°	8°

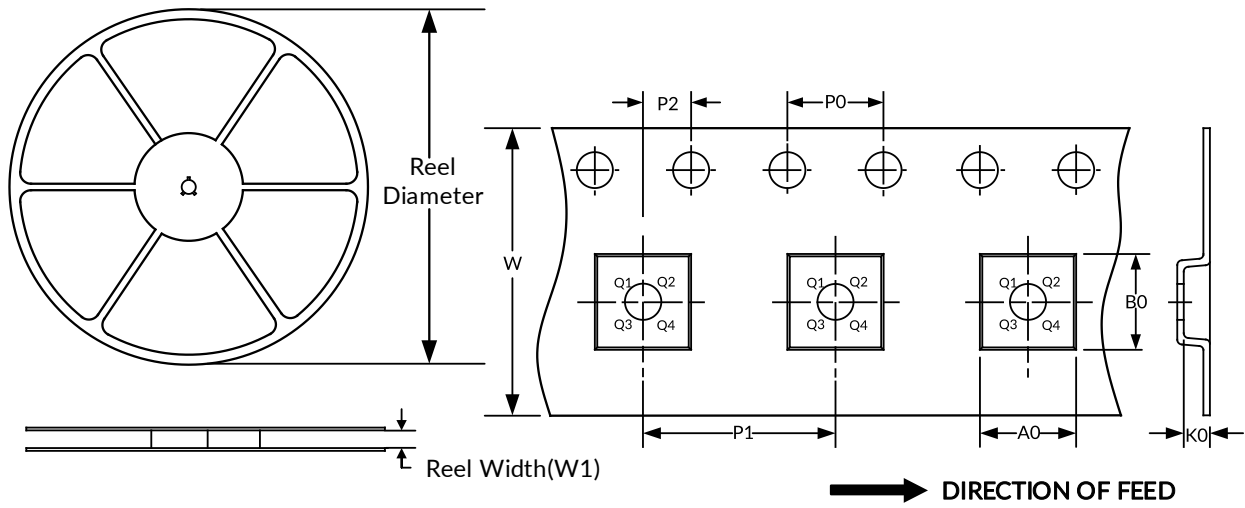
NOTE:

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.

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
SC70-6	7"	9.5	2.40	2.50	1.20	4.0	4.0	2.0	8.0	Q3

NOTE:

1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.