

4.5Ω Low Voltage SPDT Analog Switch

1 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**
- **ESD Protection Exceeds JESD 22**
 - 1000-V Human-Body Model
 - 100-V Machine Model (A115)
 - 1000-V Charged-Device Model (JS-002)
- **Micro SIZE PACKAGES: SC70-6, SOT23-6**

2 APPLICATIONS

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

3 DESCRIPTIONS

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.

Device Information (1)

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

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

4 Block Diagram

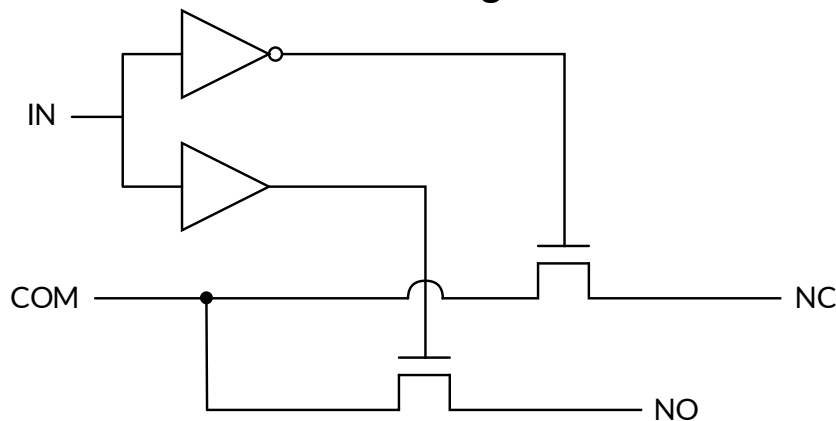


Table of Contents

1 FEATURES	1
2 APPLICATIONS	1
3 DESCRIPTIONS	1
4 Block Diagram	1
5 Revision History	3
6 PACKAGE/ORDERING INFORMATION ⁽¹⁾	4
7 Pin Configuration	5
8 SPECIFICATIONS	6
8.1 Absolute Maximum Ratings	6
8.2 ESD Ratings	6
8.3 Recommended Operating Conditions	6
8.4 ELECTRICAL CHARACTERISTICS	7
8.5 TYPICAL CHARACTERISTICS	9
9 Parameter Measurement Information	10
10 PACKAGE OUTLINE DIMENSIONS	14
11 TAPE AND REEL INFORMATION	16

5 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
C.4	2024/01/19	<ol style="list-style-type: none">1. Update FEATURES on Page 1@RevC.32. Update PACKAGE MARKING on Page 5@RevC.33. Update Package thermal impedance and ESD Ratings on Page 4@RevC.34. Add MSL on Page 5@RevC.35. Added Block Diagram
C.4.1	2024/03/08	Modify packaging naming

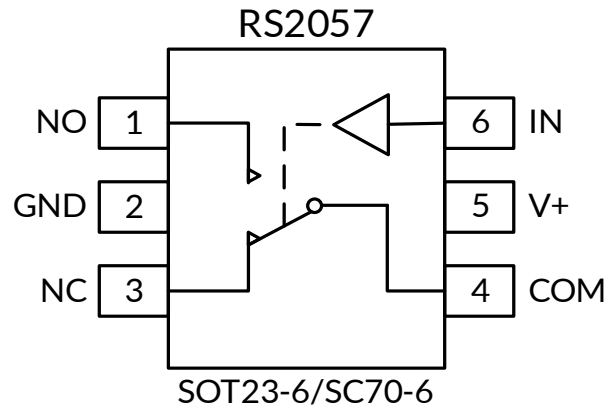
6 PACKAGE/ORDERING INFORMATION ⁽¹⁾

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING ⁽²⁾	MSL ⁽³⁾	PACKAGE OPTION
RS2057	RS2057XC6	-40°C~125°C	SC70-6 ⁽⁴⁾	2057	MSL3	Tape and Reel,3000
	RS2057XH	-40°C~125°C	SOT23-6	2057	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.

7 Pin Configuration



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

PIN DESCRIPTION

NAME	PIN	FUNCTION
	SOT23-6/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

8 SPECIFICATIONS

8.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

SYMBOL	PARAMETER	MIN	MAX	UNIT	
V ₊	Supply Voltage	-0.3	6.0	V	
V _{IN}	Input Voltage	-0.3	6.0		
	Analog, Digital Voltage Range ⁽²⁾	-0.3	(V ₊)+0.3		
	Continuous Current NO, NC, or COM	-300	+300	mA	
I _{PEAK}	Peak Current NO, NC, or COM	-500	+500		
θ _{JA}	Package thermal impedance ⁽³⁾	SOT23-6		235	°C/W
		SC70-6		270	
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) 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.

(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_{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.

8.2 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), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±1000	V
	Charged-device model (CDM)	±1000	V
	Machine model (MM)	±100	V

(1) JEDEC document JEP155 states that 500 V HBM allows safe manufacturing with a standard ESD control process.



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.

8.3 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

8.4 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}	V _{NO} or V _{NC} = V+/2, I _{COM} = -10mA, Switch ON, See Figure 4	5V	+25°C		4.5	8	Ω
				FULL			8.5	Ω
			3.3V	+25°C		7	10	Ω
				FULL			10.5	Ω
On-Resistance Match Between Channels	ΔR _{ON}	V _{NO} or V _{NC} = V+/2, I _{COM} = -10mA, Switch ON, See Figure 4	5V	+25°C		0.15	0.3	Ω
				FULL			0.4	Ω
			3.3V	+25°C		0.15	0.3	Ω
				FULL			0.4	Ω
On-Resistance Flatness	R _{FLAT(ON)}	0 ≤ (V _{NO} or V _{NC}) ≤ V+/2, I _{COM} = -10mA, Switch ON, See Figure 4	5V	+25°C		2	3	Ω
				FULL			3.3	Ω
			3.3V	+25°C		3	4	Ω
				FULL			4.3	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)

$V_+ = 5.0\text{ V}$, $T_A = -40^\circ\text{C}$ 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°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	$f = 10\text{MHz}$	+25°C		-52		dB
			$f = 1\text{MHz}$	+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
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

8.5 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.

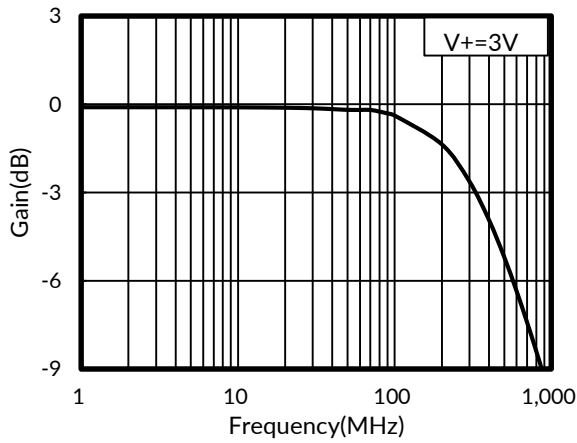


Figure 1. Bandwidth vs Frequency

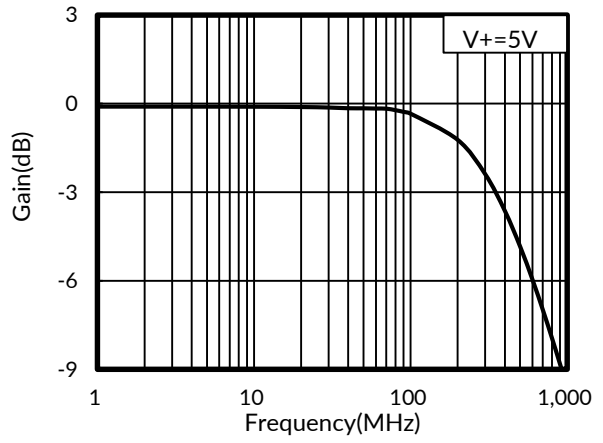


Figure 2. Bandwidth vs Frequency

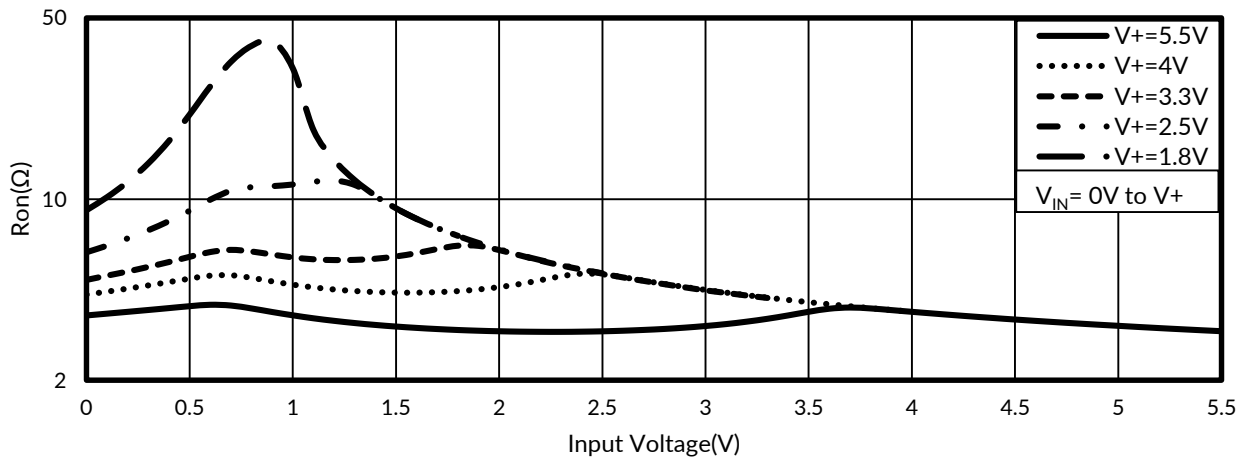


Figure 3. Typical Ron as a Function of Input Voltage

9 Parameter Measurement Information

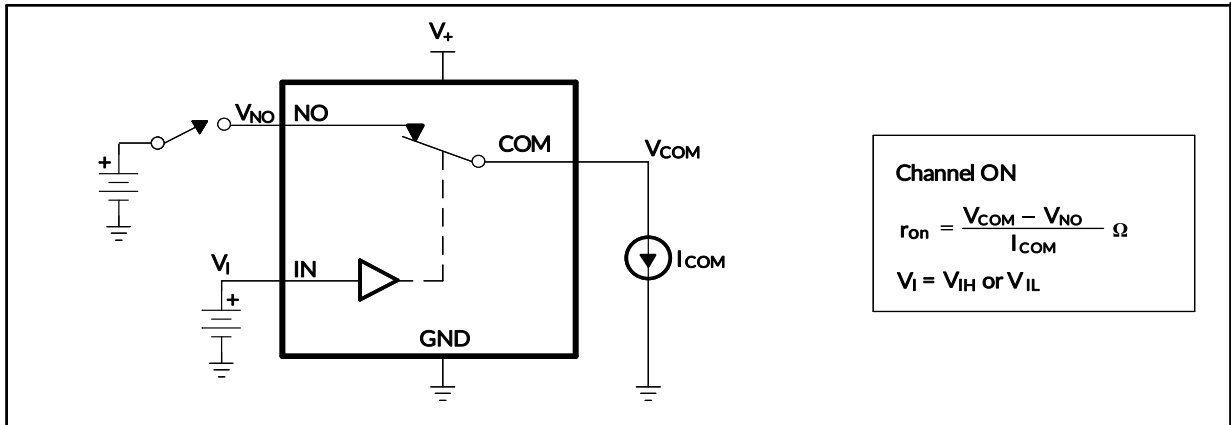


Figure 4. ON-State Resistance (R_{on})

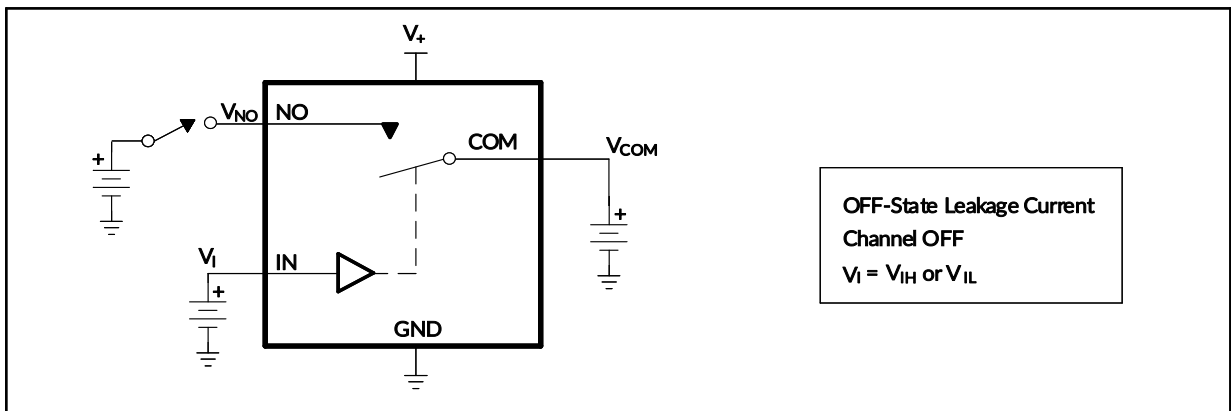


Figure 5. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NO(OFF)}$)

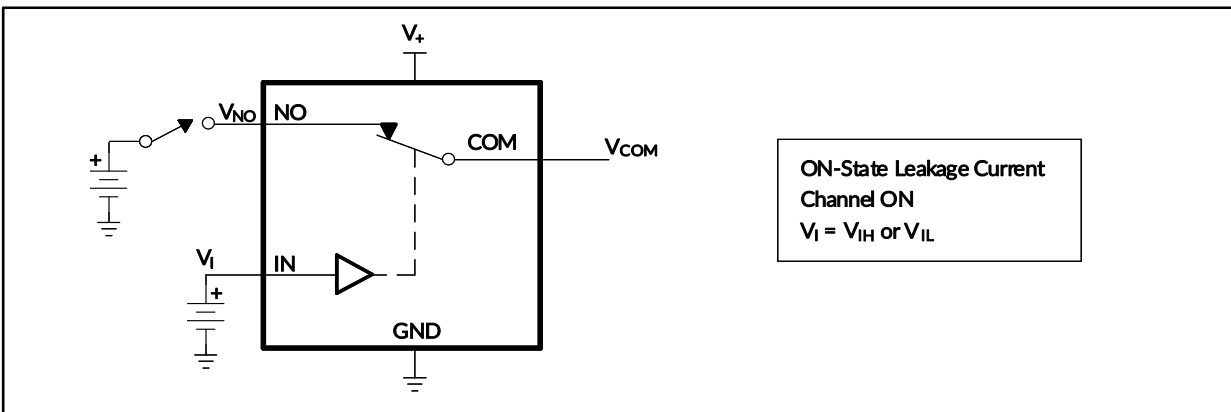


Figure 6. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NO(ON)}$)

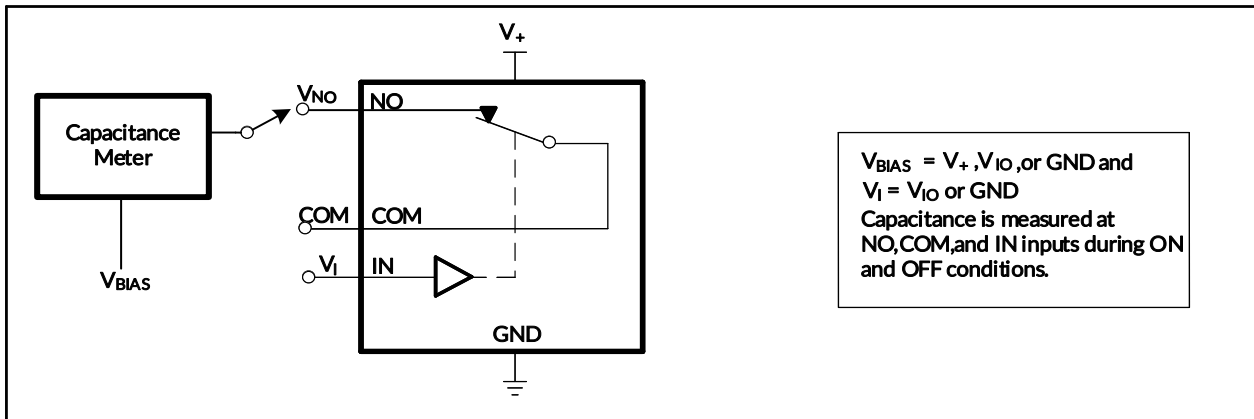


Figure 7. Capacitance (C_I , $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)

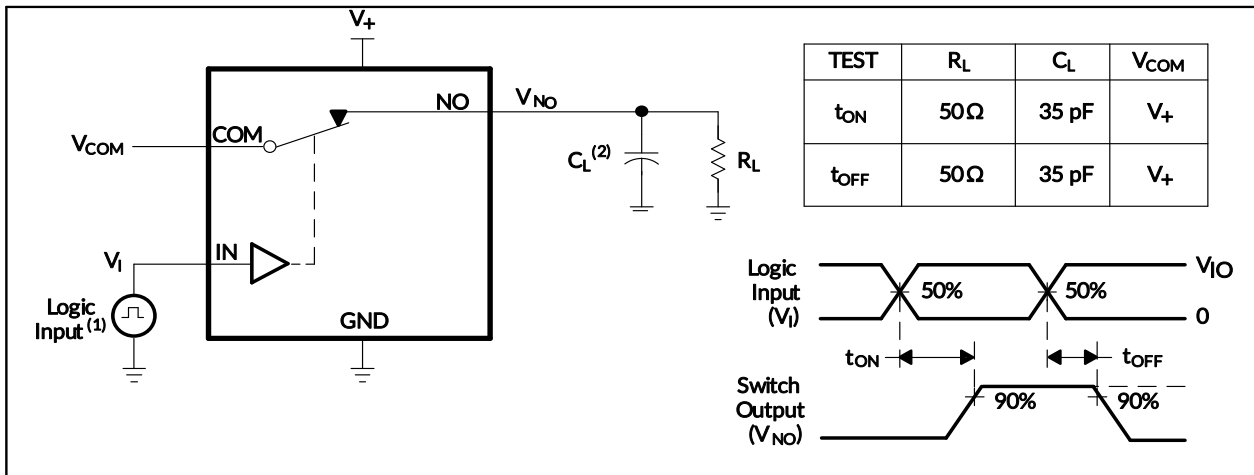


Figure 8. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

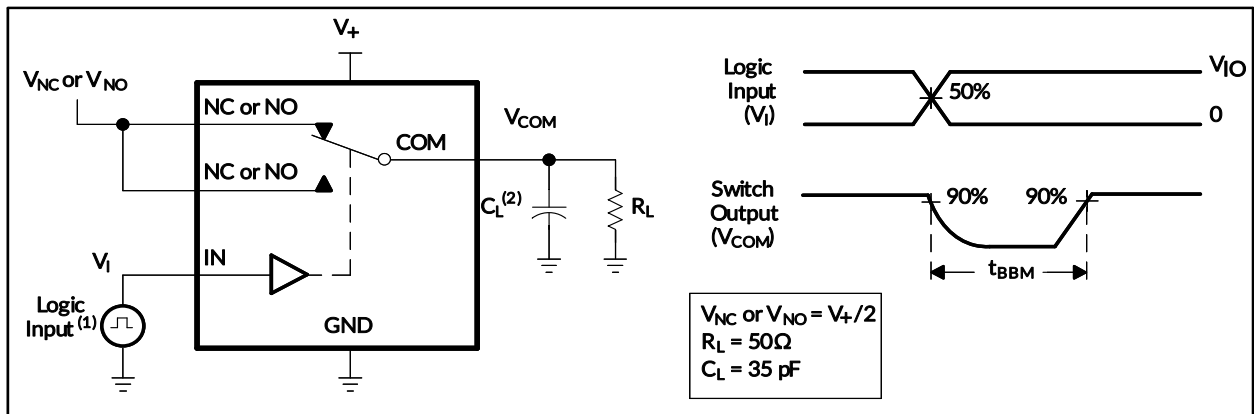
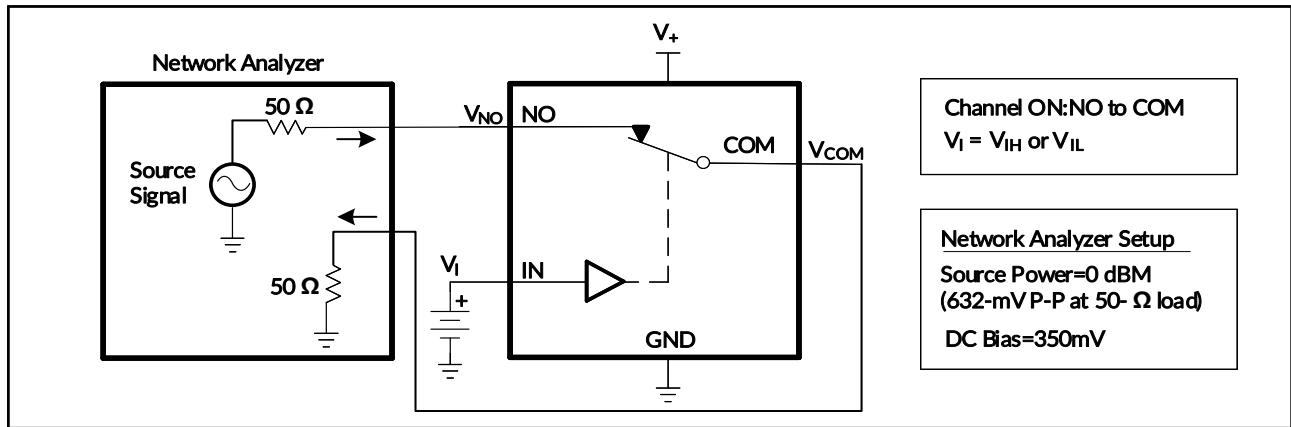
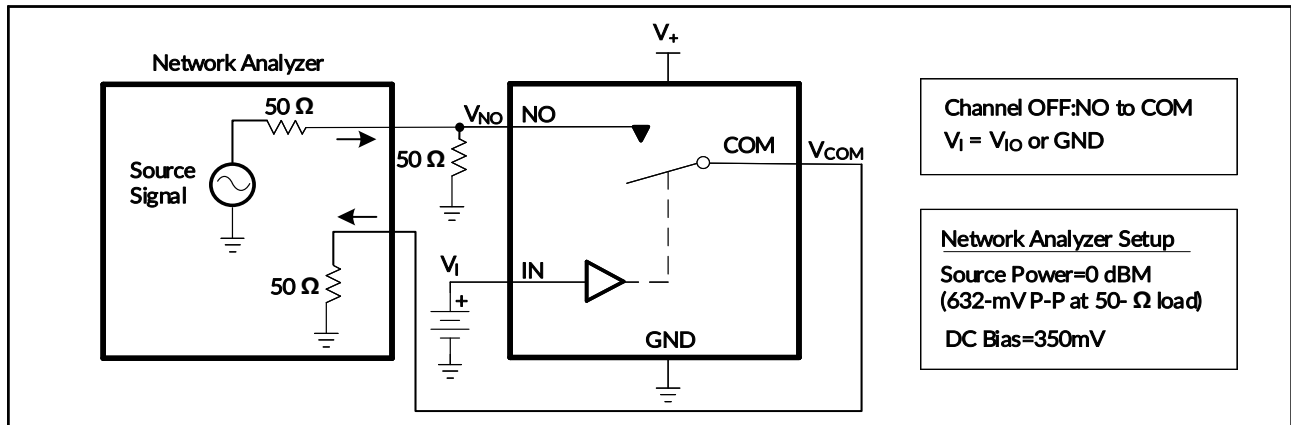
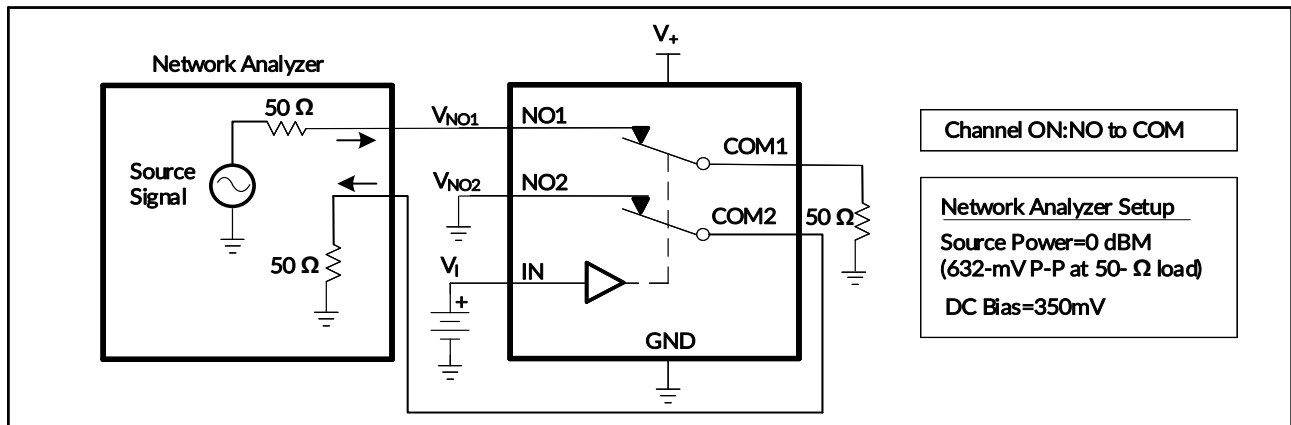


Figure 9. Break-Before-Make Time (t_{BBM})


Figure 10. Bandwidth (BW)

Figure 11. OFF Isolation (O_{Iso})

Figure 12. Crosstalk (X_{TALK})

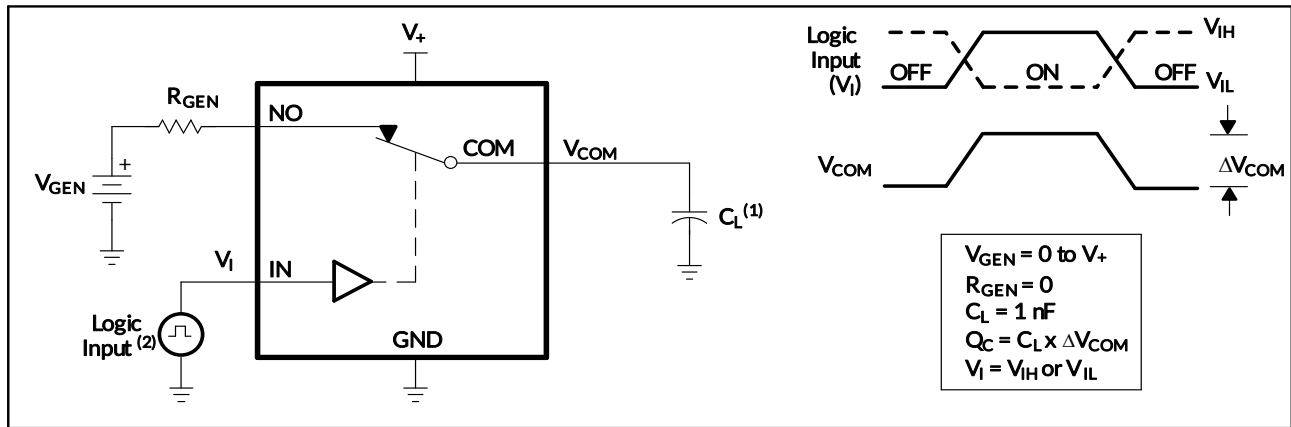


Figure 13. Charge Injection (Q_c)

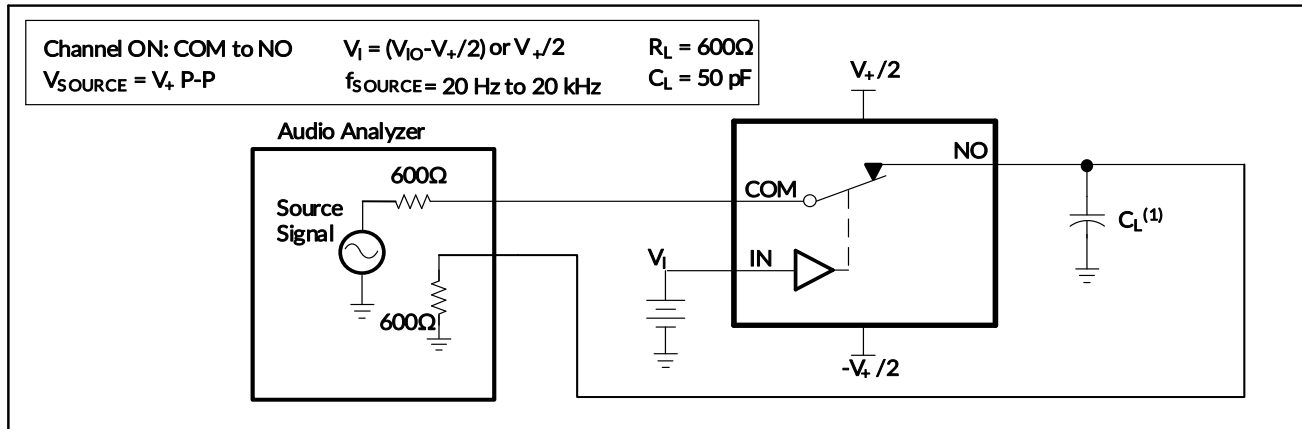
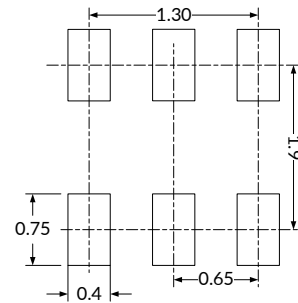
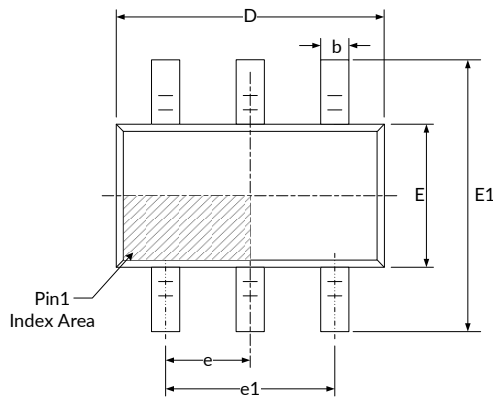
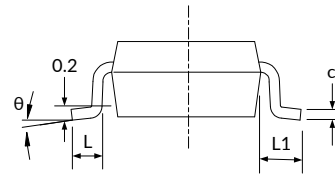
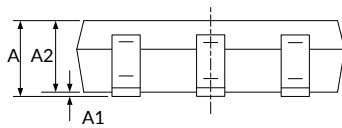


Figure 14. Total Harmonic Distortion (THD)

10 PACKAGE OUTLINE DIMENSIONS

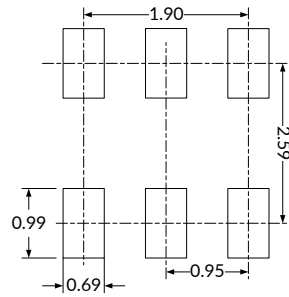
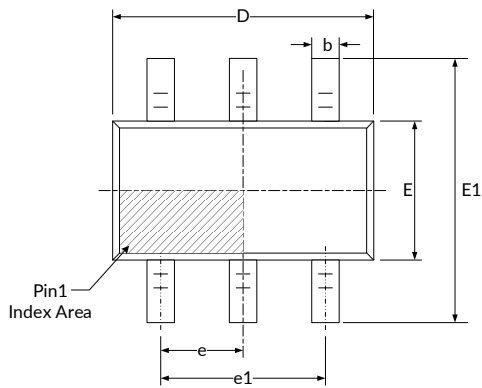
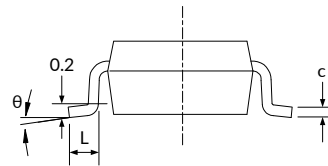
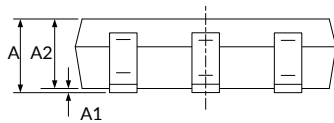
SC70-6⁽³⁾


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.

SOT23-6⁽³⁾

RECOMMENDED LAND PATTERN (Unit: mm)


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A ⁽¹⁾	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 ⁽¹⁾	2.820	3.020	0.111	0.119
E ⁽¹⁾	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC) ⁽²⁾		0.037(BSC) ⁽²⁾	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

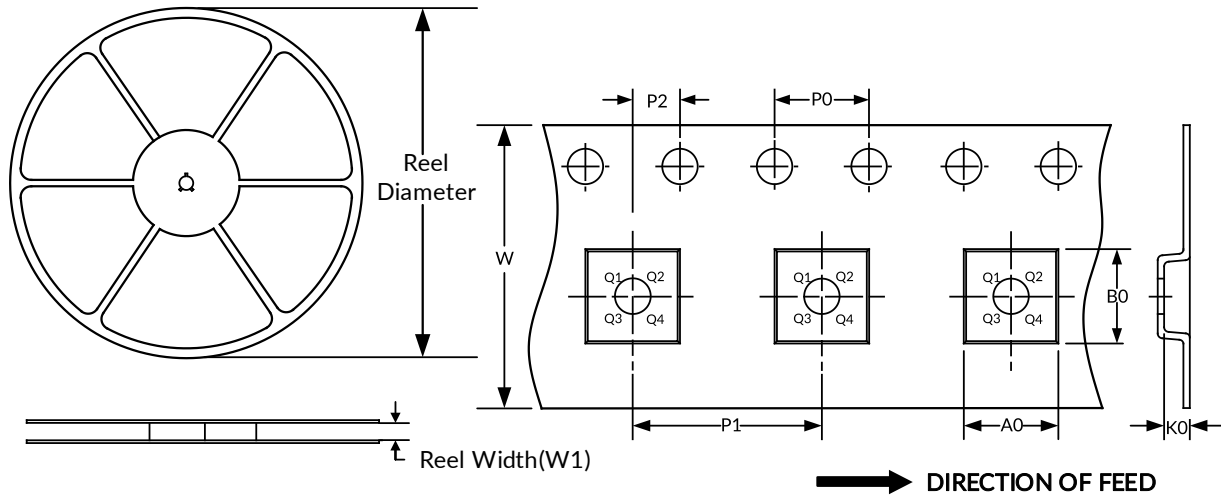
NOTE:

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.

11 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
SOT23-6	7"	9.5	3.17	3.23	1.37	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.

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