

Low ON-Resistance, Low Voltage, SPDT Analog Switch

FEATURES

- **-3dB Bandwidth: 120MHz**
- **High Speed, Typically 29ns**
- **Supply Range: +1.8V to +5.5V**
- **Low ON-State Resistance, 3.0Ω(TYP)**
- **Break-Before-Make Switching**
- **Rail-to-Rail Operation**
- **TTL/CMOS Compatible**
- **MicroSIZE PACKAGE: SOT363(SC70-6)**
- **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**

FUNCTION TABLE

| LOGIC | NO | NC |
|-------|-----|-----|
| 0 | OFF | ON |
| 1 | ON | OFF |

PIN DESCRIPTION

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

DESCRIPTION

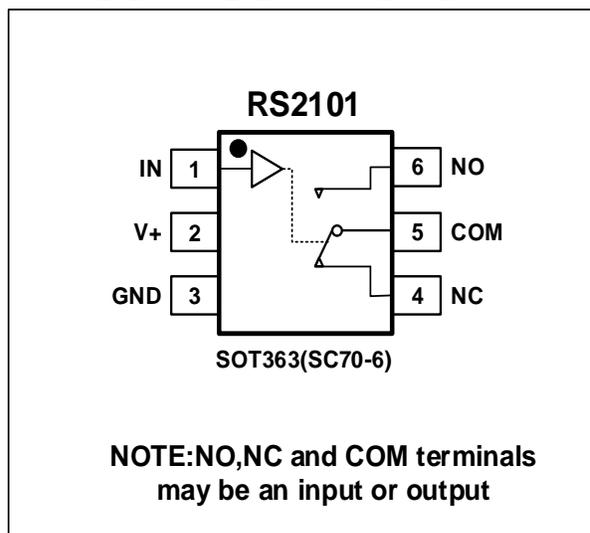
The RS2101 is a low on-resistance, single-pole double-throw (SPDT) analog switch that is designed to operate from 1.8 V to 5.5 V.

The RS2101 device can handle both analog and digital signals. It features fast switching speeds ($t_{ON} = 29ns$, $t_{OFF} = 17ns$) and low on-resistance (3.0Ω TYP).

These features make this device suitable for a wide variety of portable applications including cell phones, audio devices, and instrumentation.

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

PIN CONFIGURATIONS



SPECIFICATIONS

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 ⁽²⁾ | -0.3 | 6.0 | |
| | Analog, Digital Voltage Range | -0.3 | (V ₊)+0.3 | |
| | Continuous Current NO, NC, or COM | -300 | +300 | mA |
| I _{PEAK} | Peak Current NO, NC, or COM | -500 | +500 | |
| T _J | Junction Temperature | | 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.

ESD Ratings

| | | VALUE | UNIT |
|--------------------|-------------------------|------------------------|-------|
| V _(ESD) | Electrostatic discharge | Human-body model (HBM) | ±3000 |
| | | Machine Model (MM) | ±200 |

Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted) ⁽³⁾

| SYMBOL | PARAMETER | MIN | MAX | UNIT |
|-----------------|-----------------------|-----|------|------|
| V _{CC} | Supply Voltage | 1.8 | 5.5 | V |
| T _A | Operating temperature | -40 | +125 | °C |

Thermal Information

| THERMAL METRIC | | RS2101 | UNIT |
|------------------|--|----------------|------|
| | | 6 PINS | |
| | | SOT363(SC70-6) | |
| R _{θJA} | Junction-to-ambient thermal resistance | 250 | °C/W |

PACKAGE/ORDERING INFORMATION

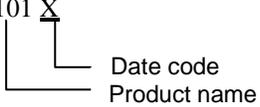
| PRODUCT | ORDERING NUMBER | TEMPERATURE RANGE | PACKAGE LEAD | PACKAGE MARKING ^(1/2) | PACKAGE OPTION |
|---------|-----------------|-------------------|--------------------|----------------------------------|--------------------|
| RS2101 | RS2101XC6 | -40°C~125°C | SOT363 (SC70-6) | 2101 <u>X</u> | 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

2101 X



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 | TYP | MAX | UNITS |
|---|--|--|----------------|----------------|-----|-----|-------|---------------|
| 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 1 | 5V | +25°C | | 3.0 | 4.0 | Ω |
| | | | | FULL | | | 5.0 | Ω |
| | | | 3.3V | +25°C | | 5.5 | 7.0 | Ω |
| | | | | FULL | | | 7.5 | 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 1 | 5V | +25°C | | 0.1 | 0.8 | Ω |
| | | | | FULL | | | 0.9 | Ω |
| | | | 3.3V | +25°C | | 0.1 | 0.8 | Ω |
| | | | | FULL | | | 0.9 | 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 1 | 5V | +25°C | | 0.7 | 0.85 | Ω |
| | | | | FULL | | | 0.95 | Ω |
| | | | 3.3V | +25°C | | 2.5 | 3.0 | Ω |
| | | | | FULL | | | 3.2 | 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 2 | 1.8 to 5.5V | FULL | | | 1 | μA |
| NC,NO,COM ON Leakage Current | $I_{NC(ON)}, I_{NO(ON)},$ $I_{COM(ON)}$ | $V_{NO} \text{ or } V_{NC} = 0.3\text{V}$, 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 | 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 |

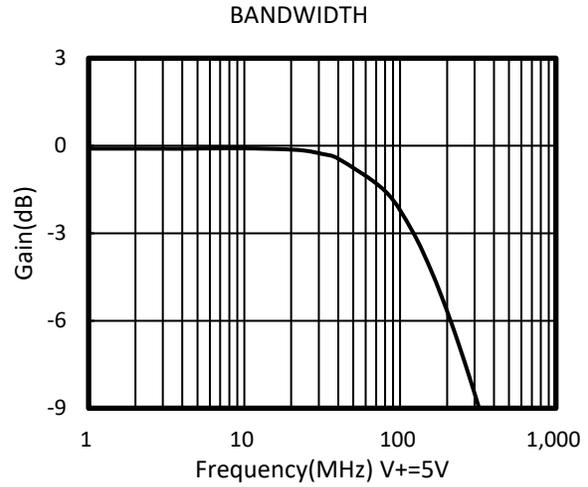
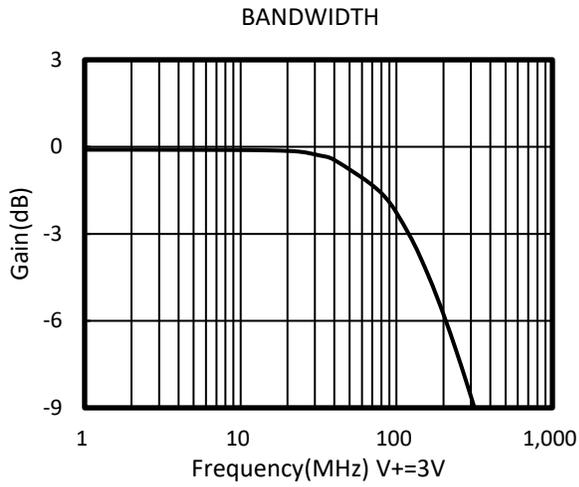
(1) All unused digital inputs of the device must be held at V_{IO} or GND to ensure proper device operation.

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

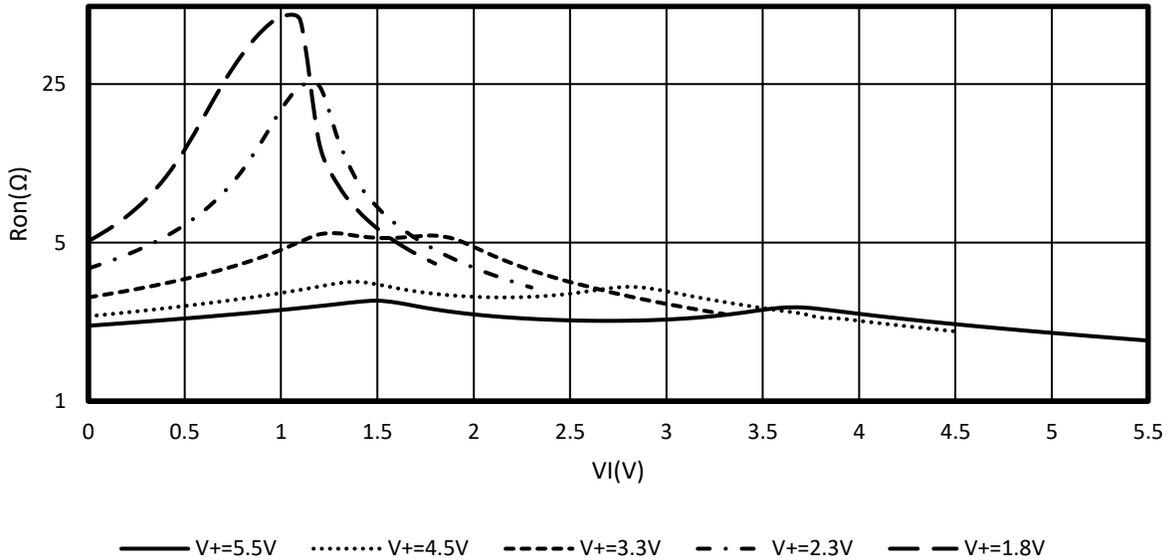
| PARAMETER | SYMBOL | CONDITIONS | V+ | TEMP | MIN | TYP | MAX | UNITS |
|---------------------------------|--|---|-----------|-------|-----|-----|-----|---------------|
| DYNAMIC CHARACTERISTICS | | | | | | | | |
| Turn-On Time | t_{ON} | $V_{COM} = V_+$, $R_L = 300\Omega$, $C_L = 35\text{pF}$, See Figure 5 | 5V | +25°C | | 29 | | ns |
| | | | 3.3V | | | 33 | | |
| Turn-Off Time | t_{OFF} | $V_{COM} = V_+$, $R_L = 300\Omega$, $C_L = 35\text{pF}$, See Figure 5 | 5V | +25°C | | 17 | | ns |
| | | | 3.3V | | | 18 | | |
| 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 = 10MHz | +25°C | | -43 | | dB |
| | | | f = 1MHz | +25°C | | -67 | | dB |
| -3dB Bandwidth | BW | Switch ON, $R_L = 50\Omega$ See Figure 7 | | +25°C | | 120 | | 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 | | 15 | | 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 | | 50 | | 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 |

TYPICAL CHARACTERISTICS

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



Typical r_{on} as a Function of Input Voltage (V_I) for $V_I = 0$ to $V+$



Parameter Measurement Information

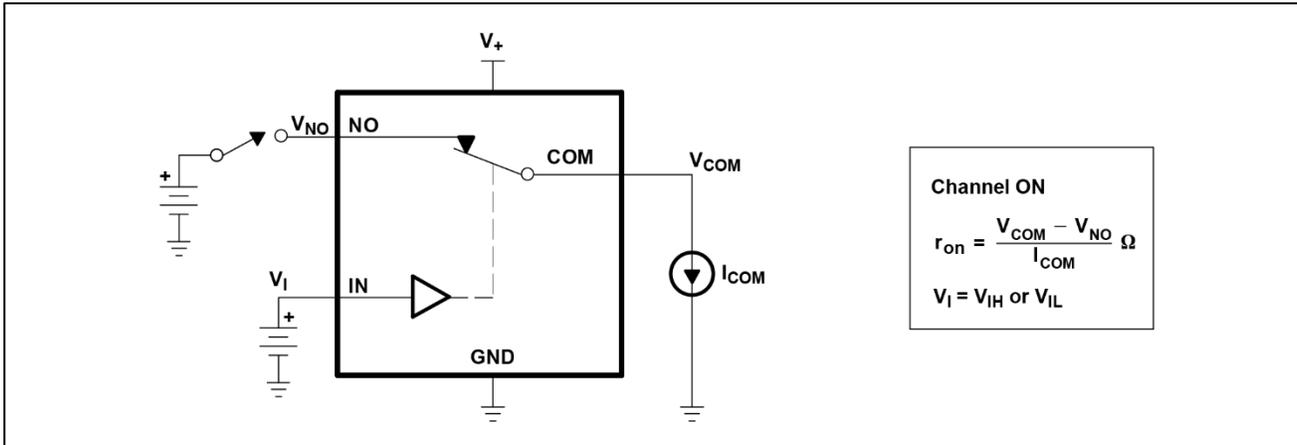


Figure 1.ON-State Resistance (r_{on})

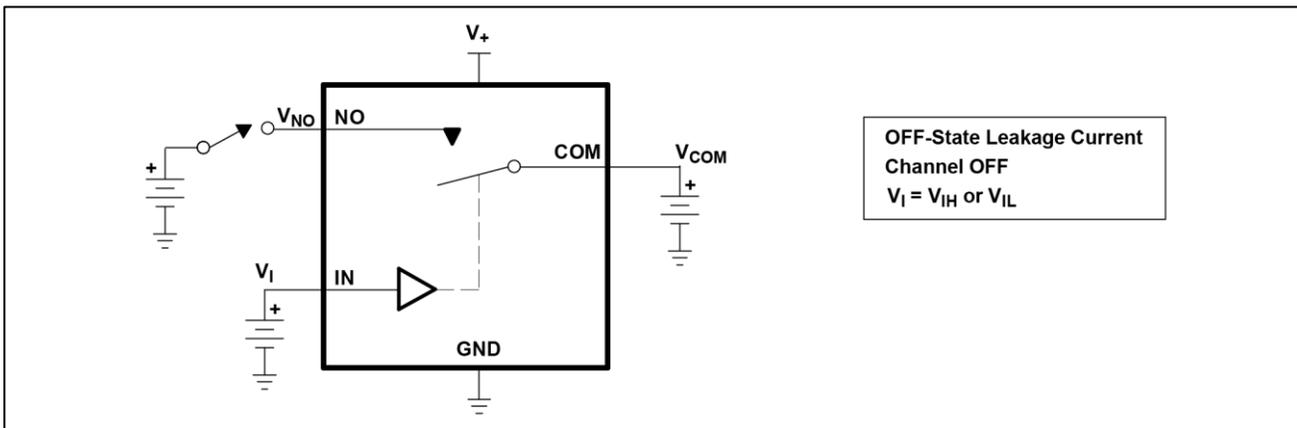


Figure 2.OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NO(OFF)}$)

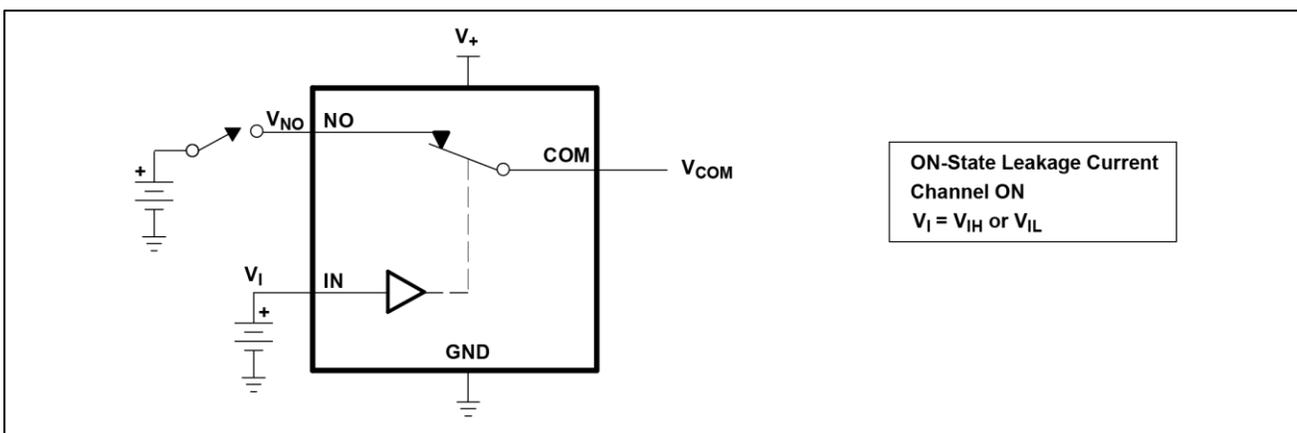


Figure 3.ON-State Leakage Current ($I_{COM(ON)}$, $I_{NO(ON)}$)

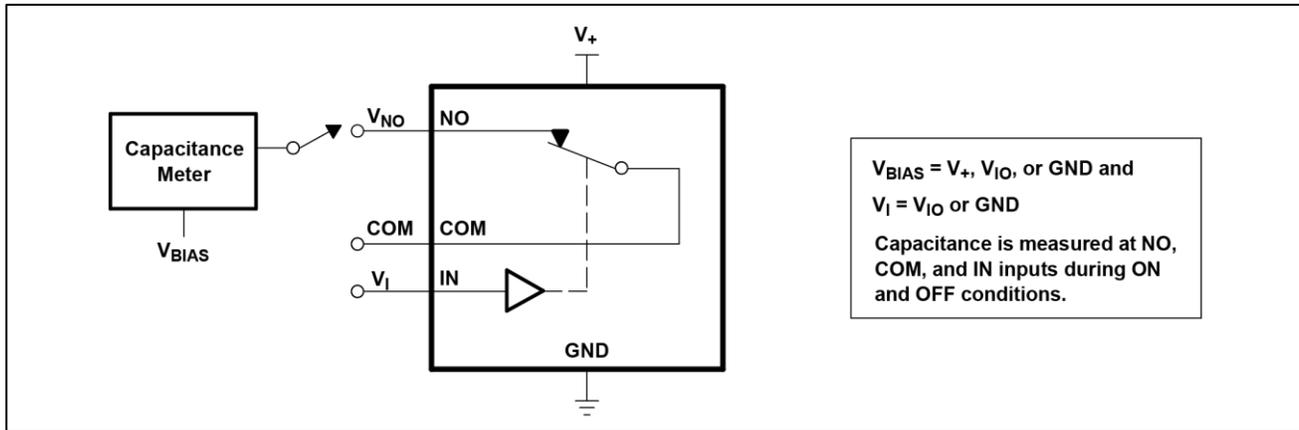


Figure 4. Capacitance (C_I , $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)

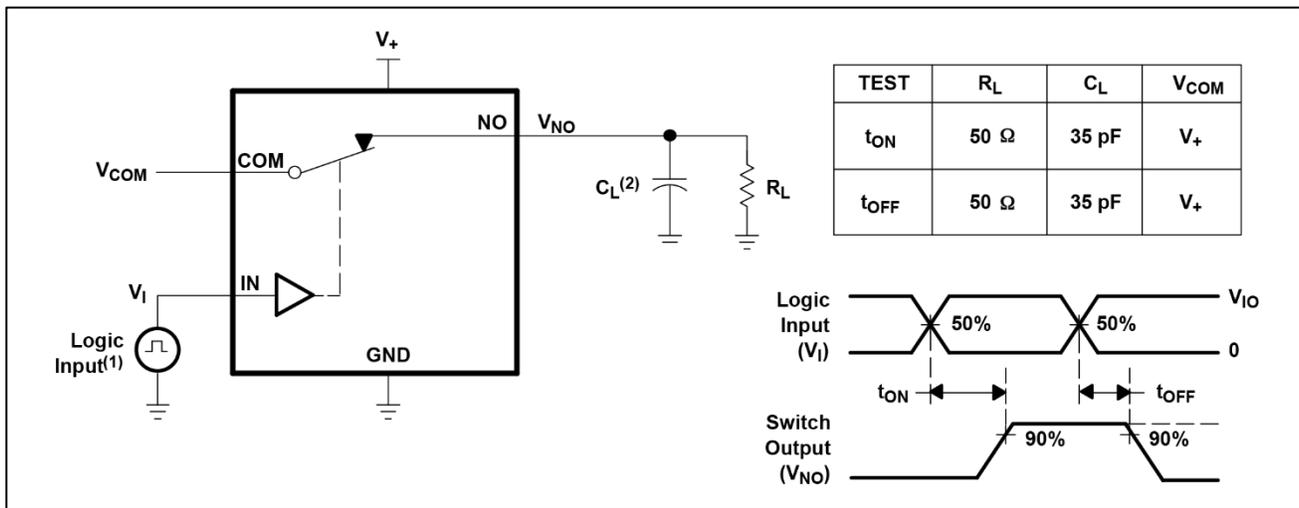


Figure 5. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

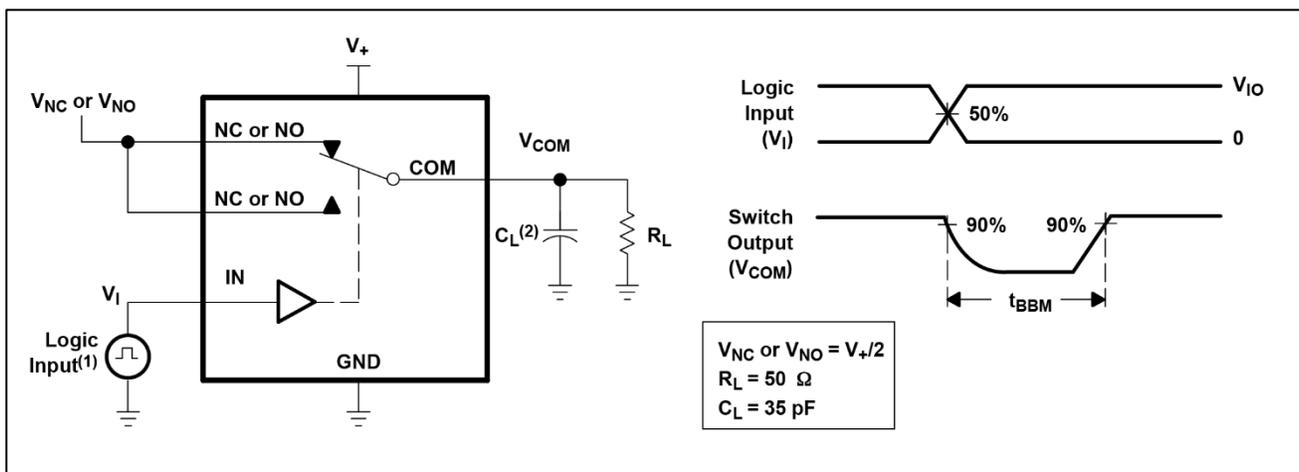


Figure 6. Break-Before-Make Time (t_{BBM})

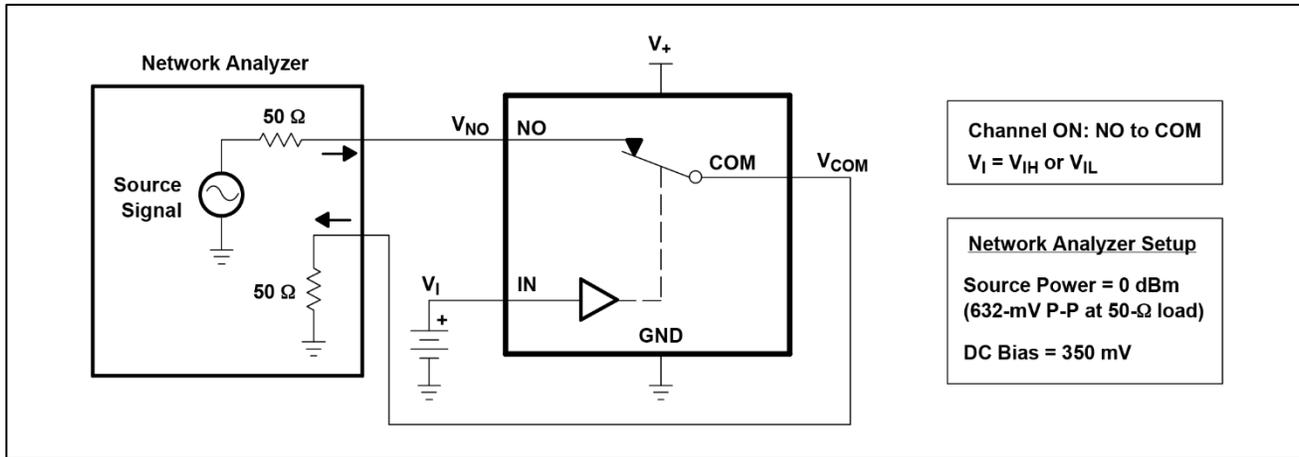


Figure 7. Bandwidth (BW)

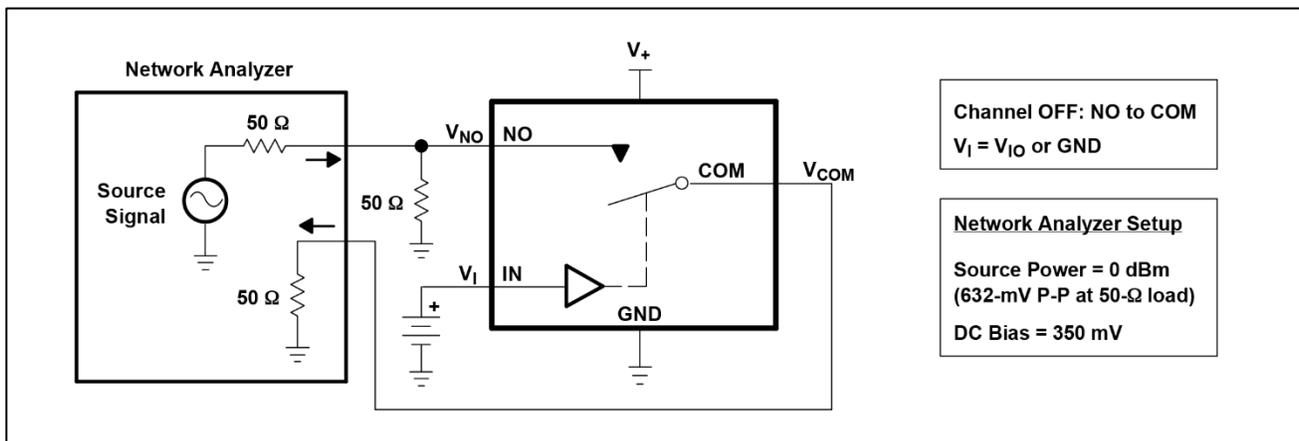


Figure 8. OFF Isolation (O_{iso})

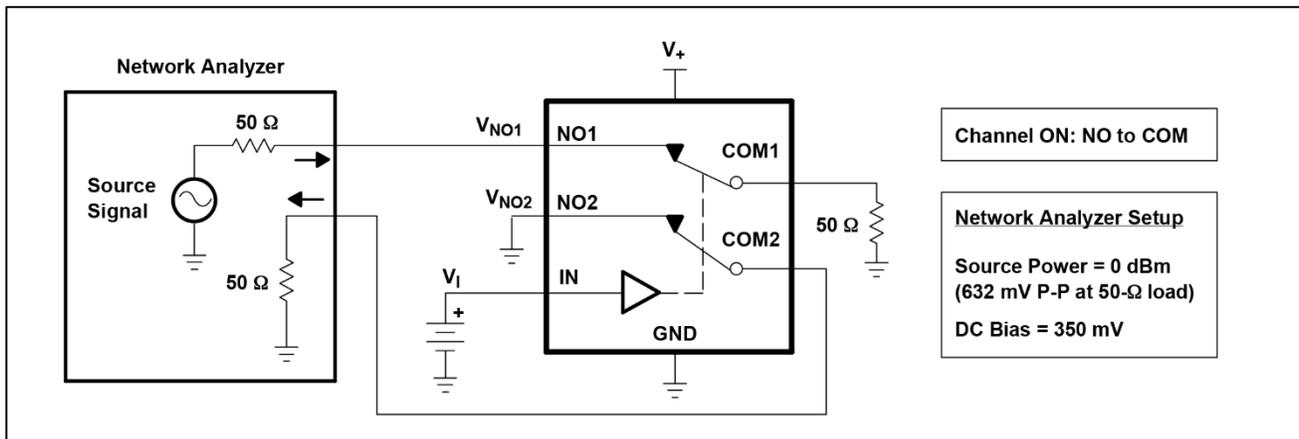


Figure 9. Crosstalk (X_{TALK})

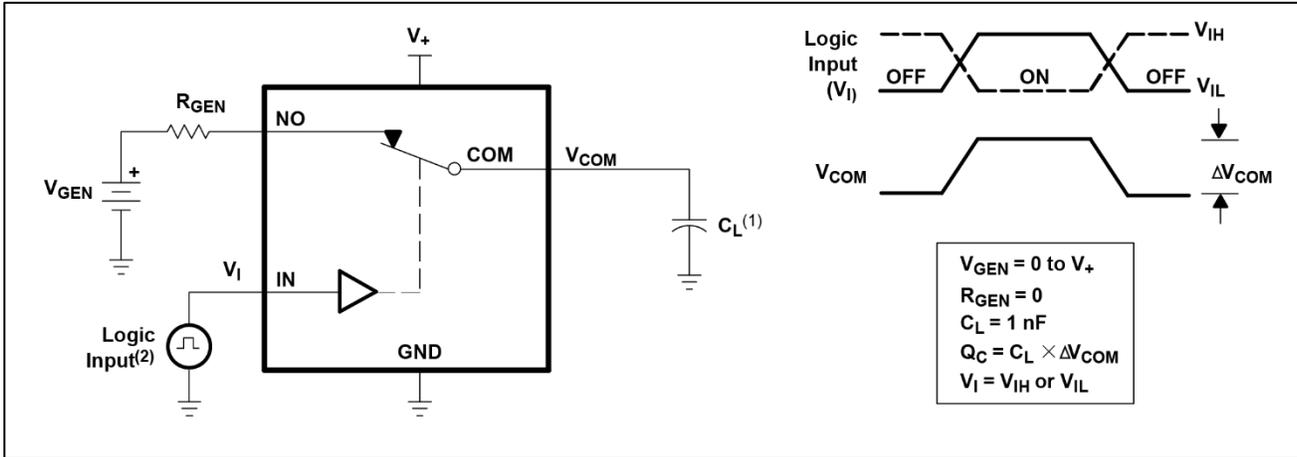


Figure 10. Charge Injection (Q_c)

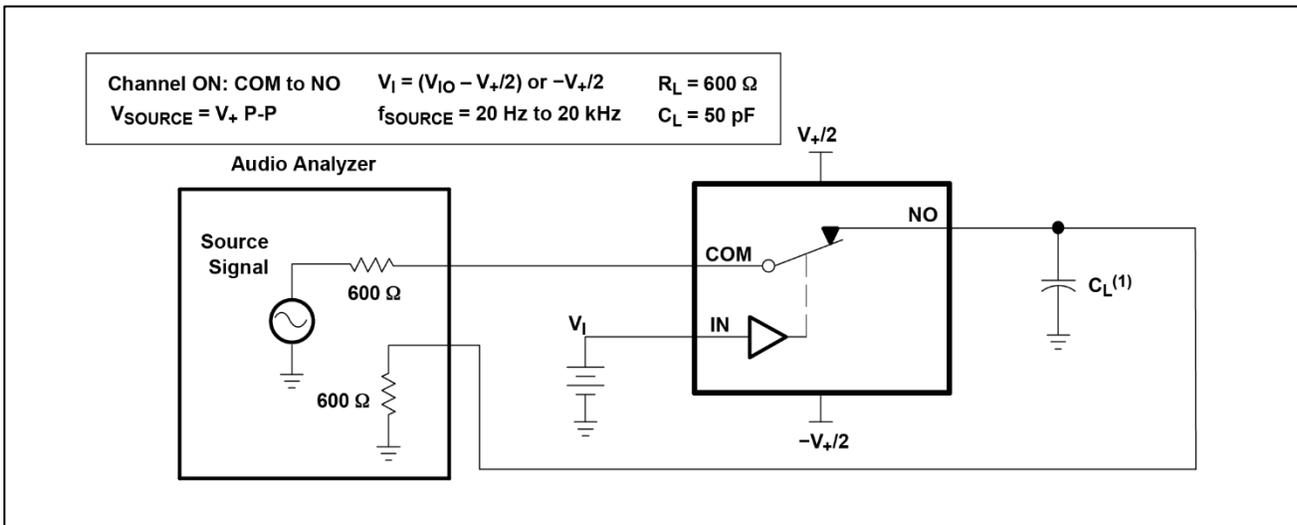
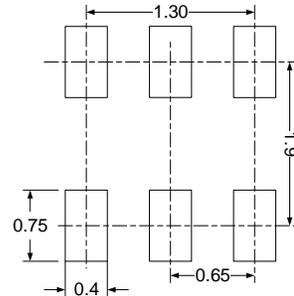
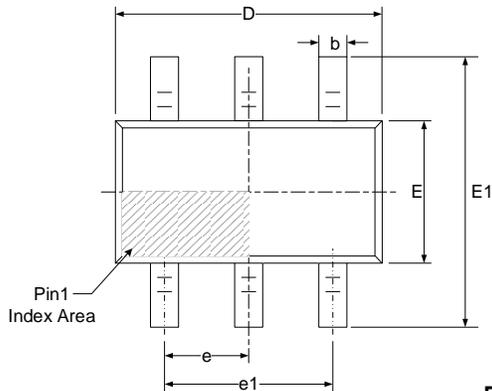
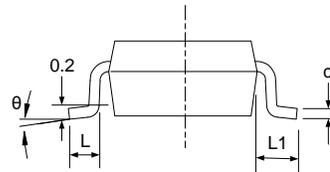
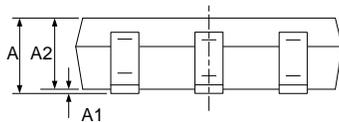


Figure 11. Total Harmonic Distortion (THD)

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° |