

## DESCRIPTION

The 3157 is an advanced CMOS analog switch fabricated with silicon gate CMOS technology. It achieves very low propagation delay while maintaining CMOS low power dissipation.

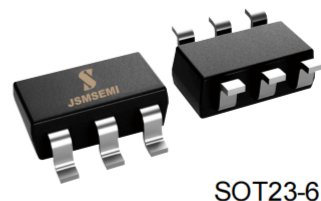
Analog and digital voltages that may vary across the full power-supply range (from  $V_{CC}$  to GND).

The Select pin has over voltage protection that allows voltages above  $V_{CC}$ , up to 7.0 V to be present on the pin without damage or disruption of operation of the part, regardless of the operating voltage.

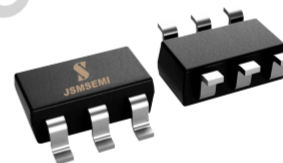
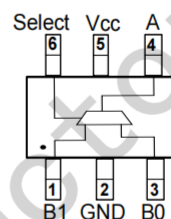
## FEATURES

- Low power dissipation
- High speed
- Standard CMOS logic levels
- High bandwidth, improved linearity
- Switches Standard NTSC/PAL Video, Audio, SPDIF and HDTV
- be used for Clock Switching, Data Mux'ing, etc.
- Low  $R_{DS(on)}$
- Break Before Make Circuitry, Prevents Inadvertent Shorts
- Operating temperature  $-55^{\circ}\text{C} \sim +125^{\circ}\text{C}$
- package : SC70-6, SOT23-6

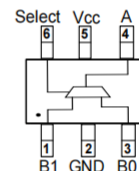
## PIN CONFIGURATION (Top View)



SOT23-6



SC70-6



## ORDER INFORMATION

| Model         | Package | Ordering Number     | Packing Option      |
|---------------|---------|---------------------|---------------------|
| SN74LVC1G3157 | SC70-6  | SN74LVC1G3157DCKRW  | Tape and Reel, 3000 |
|               | SOT23-6 | SN74LVC1G3157DBVRM6 | Tape and Reel, 3000 |

## PIN DESCRIPTIONS

| Pin                                | I/O | Pin Function       |
|------------------------------------|-----|--------------------|
| A, B <sub>0</sub> , B <sub>1</sub> | I/O | Data port          |
| Select                             | I   | Controlling choice |
| V <sub>CC</sub>                    | /   | Power supply port  |
| GND                                | /   | Ground             |

## FUNCTIONS DESCRIPTION

| Select input port | Function                      |
|-------------------|-------------------------------|
| L                 | B <sub>0</sub> Connected to A |
| H                 | B <sub>1</sub> Connected to A |

## ABSOLUTE MAXIMUM RATINGS

| Characteristic                                    | Symbol                            | Value                       | Unit |
|---------------------------------------------------|-----------------------------------|-----------------------------|------|
| Supply Voltage                                    | V <sub>CC</sub>                   | -0.5 ~ +7.0                 | V    |
| DC Switch Voltage <sup>(1)</sup>                  | V <sub>S</sub>                    | -0.5 ~ V <sub>CC</sub> +0.5 | V    |
| DC Input Voltage <sup>(1)</sup>                   | V <sub>IN</sub>                   | -0.5 ~ +7.0                 | V    |
| DC Input Diode Current @ V <sub>IN</sub> < 0 V    | I <sub>IK</sub>                   | -50                         | mA   |
| DC Output Current                                 | I <sub>out</sub>                  | 128                         | mA   |
| DC V <sub>CC</sub> or Ground Current              | I <sub>CC</sub> /I <sub>GND</sub> | 100                         | mA   |
| Storage Temperature Range                         | T <sub>stg</sub>                  | -65 ~ +150                  | °C   |
| Junction Temperature Under Bias                   | T <sub>J</sub>                    | 150                         | °C   |
| Junction Lead Temperature (Soldering, 10 Seconds) | T <sub>L</sub>                    | 260                         | °C   |
| Power Dissipation @ +85°C                         | P <sub>D</sub>                    | 180                         | mW   |

### NOTE:

Stresses beyond those listed under “ABSOLUTE MAXIMUM RATINGS” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

1. The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

## CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. QCSEMI recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. 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.

QCSEMI reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact sales office to get the latest datasheet.

**RECOMMENDED OPERATING CONDITIONS<sup>(2)</sup>**

| Characteristic           |                                                         | Symbol    | Min  | Max      | Unit |
|--------------------------|---------------------------------------------------------|-----------|------|----------|------|
| Supply Voltage Operating |                                                         | $V_{CC}$  | 1.65 | 5.5      | V    |
| Select Input Voltage     |                                                         | $V_{IN}$  | 0    | $V_{CC}$ | V    |
| Switch Input Voltage     |                                                         | $V_{IN}$  | 0    | $V_{CC}$ | V    |
| Output Voltage           |                                                         | $V_{OUT}$ | 0    | $V_{CC}$ | V    |
| Operating Temperature    |                                                         | $T_A$     | -55  | +125     | °C   |
| Input Rise and Fall Time | Control Input $V_{CC} = 2.3\text{ V} \sim 3.6\text{ V}$ | tr,tf     | 0    | 10       | ns/V |
|                          | Control Input $V_{CC} = 4.5\text{ V} \sim 5.5\text{ V}$ |           | 0    | 5.0      |      |

Note:

2. Select input must be held HIGH or LOW, it must not float.

## ELECTRICAL CHARACTERISTICS

| Symbol                                                           | Parameter                           | Test Conditions                                                  | V <sub>CC</sub>                                   | T <sub>A</sub> = 25°C                                            |       |                 | T <sub>A</sub> = -40°C ~ +85°C |                 | Unit |
|------------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------|-------|-----------------|--------------------------------|-----------------|------|
|                                                                  |                                     |                                                                  |                                                   | Min                                                              | Typ   | Max             | Min                            | Max             |      |
| DC ELECTRICAL CHARACTERISTICS                                    |                                     |                                                                  |                                                   |                                                                  |       |                 |                                |                 |      |
| V <sub>IH</sub>                                                  | High Level Input Voltage            |                                                                  | 1.65 ~ 1.95                                       |                                                                  |       |                 | 0.75V <sub>CC</sub>            |                 | V    |
|                                                                  |                                     |                                                                  | 2.3 ~ 2.8                                         |                                                                  |       |                 | 1.5                            |                 |      |
|                                                                  |                                     |                                                                  | 3 ~ 4.2                                           |                                                                  |       |                 | 2.4                            |                 |      |
|                                                                  |                                     |                                                                  | 4.5 ~ 5.5                                         |                                                                  |       |                 | 0.6V <sub>CC</sub>             |                 |      |
| V <sub>IL</sub>                                                  | Low Level Input Voltage             |                                                                  | 1.65 ~ 1.95                                       |                                                                  |       |                 | 0.25V <sub>CC</sub>            |                 | V    |
|                                                                  |                                     |                                                                  | 2.3 ~ 2.8                                         |                                                                  |       |                 | 0.4                            |                 |      |
|                                                                  |                                     |                                                                  | 3 ~ 5.5                                           |                                                                  |       |                 | 0.3V <sub>CC</sub>             |                 |      |
| I <sub>IN</sub>                                                  | Input Leakage Current               | 0 < V <sub>IN</sub> < 5.5 V                                      | 0 ~ 5.5                                           |                                                                  | ±0.05 | ±0.1            |                                | ±1              | μA   |
| I <sub>OFF</sub>                                                 | OFF State Leakage Current           | 0 < A, B < V <sub>CC</sub>                                       | 1.65 ~ 5.5                                        |                                                                  | ±0.05 | ±0.1            |                                | ±1              | μA   |
| I <sub>CC</sub>                                                  | Quiescent Supply                    | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>I <sub>OUT</sub> = 0 | 5.5                                               |                                                                  |       | 1.0             |                                | 10              | μA   |
|                                                                  | Analog Signal Range                 |                                                                  | V <sub>CC</sub>                                   | 0                                                                |       | V <sub>CC</sub> | 0                              | V <sub>CC</sub> | V    |
| R <sub>ON</sub>                                                  | Switch On Resistance <sup>(3)</sup> | V <sub>IN</sub> = 0 V,<br>I <sub>O</sub> = 30 mA                 | 4.5                                               |                                                                  | 3.0   |                 |                                | 7.0             | Ω    |
|                                                                  |                                     | V <sub>IN</sub> = 2.4 V,<br>I <sub>O</sub> = -30 mA              |                                                   |                                                                  | 5.0   |                 |                                | 12              | Ω    |
|                                                                  |                                     | V <sub>IN</sub> = 4.5 V,<br>I <sub>O</sub> = -30 mA              |                                                   |                                                                  | 7.0   |                 |                                | 15              | Ω    |
|                                                                  |                                     | V <sub>IN</sub> = 0 V,<br>I <sub>O</sub> = 24 mA                 | 3.0                                               |                                                                  | 4.0   |                 |                                | 9.0             | Ω    |
|                                                                  |                                     | V <sub>IN</sub> = 3 V ,<br>I <sub>O</sub> = -24 mA               |                                                   |                                                                  | 10    |                 |                                | 20              | Ω    |
|                                                                  |                                     | V <sub>IN</sub> = 0 V,<br>I <sub>O</sub> = 8 mA                  | 2.3                                               |                                                                  | 5.0   |                 |                                | 12              | Ω    |
|                                                                  |                                     | V <sub>IN</sub> = 2.3 V,<br>I <sub>O</sub> = -8 mA               |                                                   |                                                                  | 13    |                 |                                | 30              | Ω    |
|                                                                  |                                     | V <sub>IN</sub> =0V, I <sub>O</sub> =4 mA                        | 1.65                                              |                                                                  | 6.5   |                 |                                | 20              | Ω    |
|                                                                  |                                     | V <sub>IN</sub> = 1.65 V,<br>I <sub>O</sub> = -4 mA              |                                                   |                                                                  | 17    |                 |                                | 50              | Ω    |
|                                                                  |                                     | R <sub>RANGE</sub>                                               | On Resistance Over Signal Range <sup>(3)(7)</sup> | I <sub>A</sub> = -30 mA<br>0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub> | 4.5   |                 |                                |                 |      |
| I <sub>A</sub> = -24 mA<br>0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub> | 3                                   |                                                                  |                                                   |                                                                  |       |                 |                                | 50              | Ω    |

**ELECTRICAL CHARACTERISTICS (continued)**

| Symbol                 | Parameter                                                 | Test Conditions                                       | $V_{CC}$ | $T_A = 25^{\circ}\text{C}$ |      |     | $T_A = -40^{\circ}\text{C} \sim +85^{\circ}\text{C}$ |     | Unit     |
|------------------------|-----------------------------------------------------------|-------------------------------------------------------|----------|----------------------------|------|-----|------------------------------------------------------|-----|----------|
|                        |                                                           |                                                       |          | Min                        | Typ  | Max | Min                                                  | Max |          |
| $R_{\text{RANGE}}$     | On Resistance Over Signal Range <sup>(3)(7)</sup>         | $I_A = -8 \text{ mA}$<br>$0 \leq V_{Bn} \leq V_{CC}$  | 2.3      |                            |      |     |                                                      | 100 | $\Omega$ |
|                        |                                                           | $I_A = -4 \text{ mA}$<br>$0 \leq V_{Bn} \leq V_{CC}$  | 1.65     |                            |      |     |                                                      | 300 | $\Omega$ |
| $\Delta R_{\text{ON}}$ | On Resistance Match Between Channels <sup>(3)(4)(5)</sup> | $I_A = -30 \text{ mA}$<br>$V_{Bn} = 3.15$             | 4.5      |                            | 0.15 |     |                                                      |     | $\Omega$ |
|                        |                                                           | $I_A = -24 \text{ mA}$<br>$V_{Bn} = 2.1$              | 3        |                            | 0.2  |     |                                                      |     | $\Omega$ |
|                        |                                                           | $I_A = -8 \text{ mA}$<br>$V_{Bn} = 1.6$               | 2.3      |                            | 0.5  |     |                                                      |     | $\Omega$ |
|                        |                                                           | $I_A = -4 \text{ mA}$<br>$V_{Bn} = 1.15$              | 1.65     |                            | 0.5  |     |                                                      |     | $\Omega$ |
| $R_{\text{FLAT}}$      | On Resistance Flatness <sup>(3)(4)(6)</sup>               | $I_A = -30 \text{ mA}$<br>$0 \leq V_{Bn} \leq V_{CC}$ | 5        |                            | 6.0  |     |                                                      |     | $\Omega$ |
|                        |                                                           | $I_A = -24 \text{ mA}$<br>$0 \leq V_{Bn} \leq V_{CC}$ | 3.3      |                            | 12   |     |                                                      |     | $\Omega$ |
|                        |                                                           | $I_A = -8 \text{ mA}$<br>$0 \leq V_{Bn} \leq V_{CC}$  | 2.5      |                            | 28   |     |                                                      |     | $\Omega$ |
|                        |                                                           | $I_A = -4 \text{ mA}$<br>$0 \leq V_{Bn} \leq V_{CC}$  | 1.8      |                            | 125  |     |                                                      |     | $\Omega$ |

**AC ELECTRICAL CHARACTERISTICS**

|                                      |                                                       |                                                                                                    |             |  |  |      |     |     |    |
|--------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------|--|--|------|-----|-----|----|
| $t_{\text{PHL}}$<br>$t_{\text{PLH}}$ | Propagation Delay Bus to Bus <sup>(8)</sup>           | Figure 1<br>$V_I = \text{OPEN}$                                                                    | 1.65 ~ 1.95 |  |  |      |     |     | nS |
|                                      |                                                       |                                                                                                    | 2.3 ~ 2.7   |  |  |      |     | 1.2 | nS |
|                                      |                                                       |                                                                                                    | 3.0 ~ 3.5   |  |  |      |     | 0.8 | nS |
|                                      |                                                       |                                                                                                    | 4.5 ~ 5.5   |  |  |      |     | 0.3 | nS |
| $t_{\text{PZL}}$<br>$t_{\text{PZH}}$ | Output Enable Time, Turn On Time (A to Bn)            | Figure 1<br>$V_I = 2 \cdot V_{CC}$ for $t_{\text{PZL}}$ , $V_I = 0 \text{ V}$ for $t_{\text{PZH}}$ | 1.65 ~ 1.95 |  |  | 23   | 7.0 | 24  | nS |
|                                      |                                                       |                                                                                                    | 2.3 ~ 2.7   |  |  | 13   | 3.5 | 14  | nS |
|                                      |                                                       |                                                                                                    | 3.0 ~ 3.5   |  |  | 6.9  | 2.5 | 7.6 | nS |
|                                      |                                                       |                                                                                                    | 4.5 ~ 5.5   |  |  | 5.2  | 1.7 | 5.7 | nS |
| $t_{\text{PLZ}}$<br>$t_{\text{PHZ}}$ | Output Disable Time, Turn Off Time (A Port to B Port) | Figure 1<br>$V_I = 2 \cdot V_{CC}$ for $t_{\text{PLZ}}$ , $V_I = 0 \text{ V}$ for $t_{\text{PHZ}}$ | 1.65 ~ 1.95 |  |  | 12.5 | 3.0 | 13  | nS |
|                                      |                                                       |                                                                                                    | 2.3 ~ 2.7   |  |  | 7.0  | 2.0 | 7.5 | nS |
|                                      |                                                       |                                                                                                    | 3.0 ~ 3.5   |  |  | 5.0  | 1.5 | 5.3 | nS |
|                                      |                                                       |                                                                                                    | 4.5 ~ 5.5   |  |  | 3.5  | 0.8 | 3.8 | nS |

**ELECTRICAL CHARACTERISTICS (continued)**

| Symbol              | Parameter                                                 | Test Conditions                                                                              | V <sub>CC</sub> | T <sub>A</sub> = 25°C |       |     | T <sub>A</sub> = -40°C ~ +85°C |     | Unit |
|---------------------|-----------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------|-----------------------|-------|-----|--------------------------------|-----|------|
|                     |                                                           |                                                                                              |                 | Min                   | Typ   | Max | Min                            | Max |      |
| t <sub>B-M</sub>    | Break Before Make Time <sup>(7)</sup>                     | Figure 2 ,<br>C <sub>L</sub> = 50 pF ,<br>R <sub>L</sub> = 600 Ω                             | 1.65 ~ 1.95     |                       |       |     | 0.5                            |     | nS   |
|                     |                                                           |                                                                                              | 2.3 ~ 2.7       |                       |       |     | 0.5                            |     | nS   |
|                     |                                                           |                                                                                              | 3.0 ~ 3.5       |                       |       |     | 0.5                            |     | nS   |
|                     |                                                           |                                                                                              | 4.5 ~ 5.5       |                       |       |     | 0.5                            |     | nS   |
| Q                   | Charge Injection <sup>(7)</sup>                           | Figure 3,<br>C <sub>L</sub> = 0.1 nF ,<br>V <sub>GEN</sub> = 0 V ,<br>R <sub>GEN</sub> = 0 Ω | 5.0             |                       | 7.0   |     |                                |     | pC   |
|                     |                                                           |                                                                                              | 3.3             |                       | 3.0   |     |                                |     | pC   |
| OIRR                | Off Isolation <sup>(9)</sup>                              | Figure 4,<br>R <sub>L</sub> = 50 Ω ,<br>f = 10MHz                                            | 1.65 ~ 5.5      |                       | -57   |     |                                |     | dB   |
| Xtalk               | Crosstalk                                                 | Figure 5,<br>R <sub>L</sub> = 50 Ω ,<br>f = 10MHz                                            | 1.65 ~ 5.5      |                       | -54   |     |                                |     | dB   |
| BW                  | -3 dB Bandwidth                                           | Figure 8,<br>R <sub>L</sub> = 50 Ω                                                           | 1.65 ~ 5.5      |                       | 350M  |     |                                |     | Hz   |
| THD                 | Total Harmonic Distortion <sup>(7)</sup>                  | R <sub>L</sub> = 600 Ω ,<br>0.5V <sub>P-P</sub><br>f = 600 Hz ~ 20 kHz                       | 5.0             |                       | 0.011 |     |                                |     | %    |
| C <sub>IN</sub>     | Select Pin Input Capacitance <sup>(10)</sup>              |                                                                                              | 0               |                       | 2.3   |     |                                |     | pF   |
| C <sub>IO-B</sub>   | B Port Off Capacitance <sup>(10)</sup>                    | Figure 6                                                                                     | 5.0             |                       | 5.0   |     |                                |     | pF   |
| C <sub>IOA-ON</sub> | A Port Capacitance when Switch is Enabled <sup>(10)</sup> | Figure 7                                                                                     | 5.0             |                       | 15.5  |     |                                |     | pF   |

Note:

3. Measured by the voltage drop between A and B pins at the indicated current through the switch. On Resistance is determined by the lower of the voltages on the two (A or B Ports).
4. Parameter is characterized but not tested in production.
5.  $\Delta R_{ON} = R_{ON \text{ max}} - R_{ON \text{ min}}$  measured at identical  $V_{CC}$ , temperature and voltage levels.
6. Flatness is defined as the difference between the maximum and minimum value of On Resistance over the specified range of conditions.
7. Guaranteed by Design.
8. This parameter is guaranteed by design but not tested. The bus switch contributes no propagation delay other than the RC delay of the On Resistance of the switch and the 50 pF load capacitance, when driven by an ideal voltage source (zero output impedance).
9. Off Isolation =  $20 \log_{10} [V_A/V_{Bn}]$ .
10.  $T_A = +25^\circ\text{C}$ ,  $f = 1 \text{ MHz}$ , Capacitance is characterized but not tested in production.

## TEST CIRCUITS

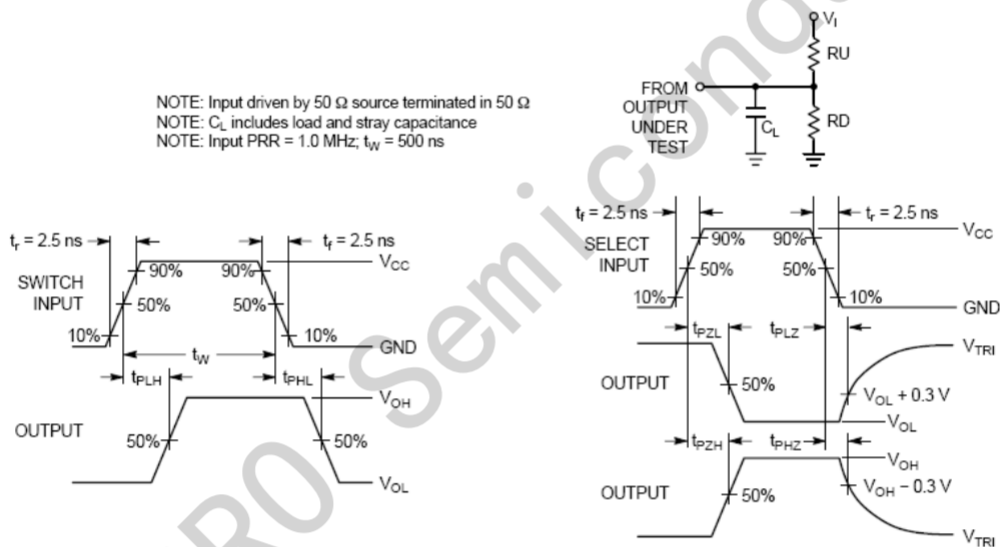


Figure 1. AC Test Circuit ,AC Waveforms

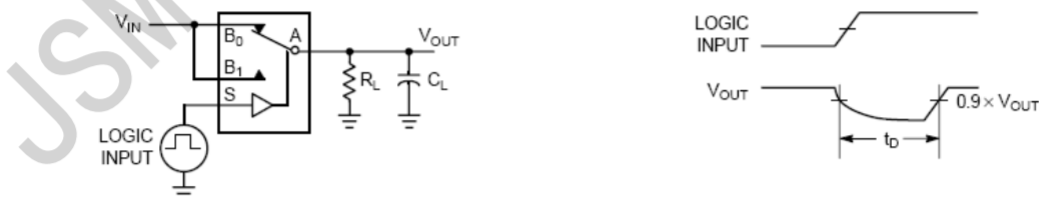


Figure 2. Break Before Make Interval Timing



## TEST CIRCUITS (continued)

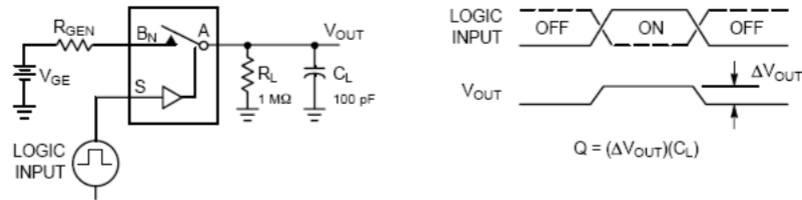


Figure 3. Charge Injection Test

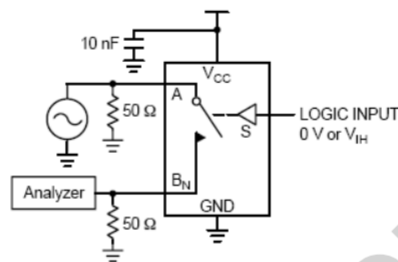


Figure 4. Off Isolation

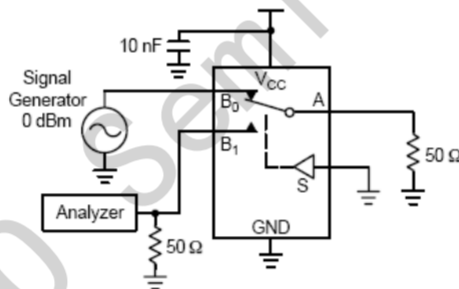


Figure 5. Crosstalk

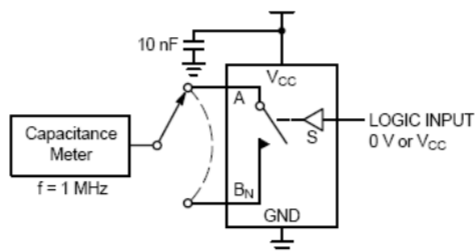


Figure 6. Channel Off Capacitance



## TEST CIRCUITS (continued)

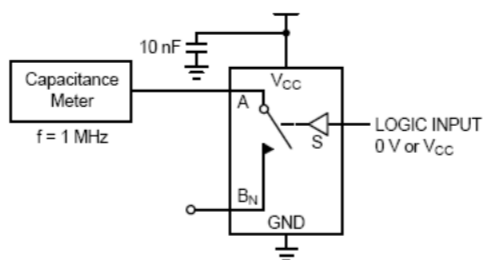


Figure 7. Channel On Capacitance

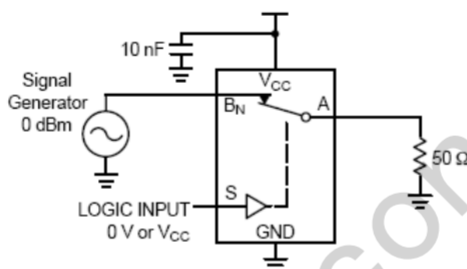
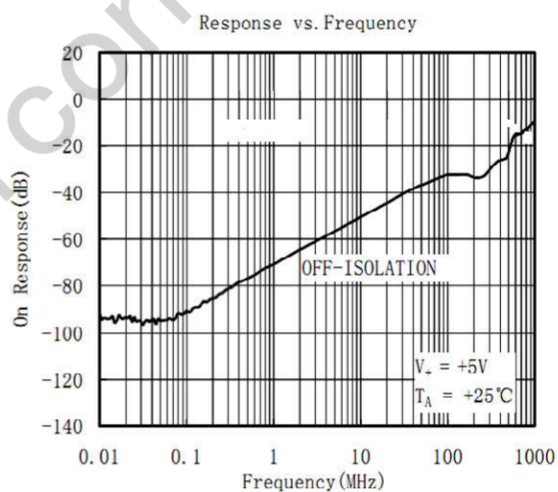
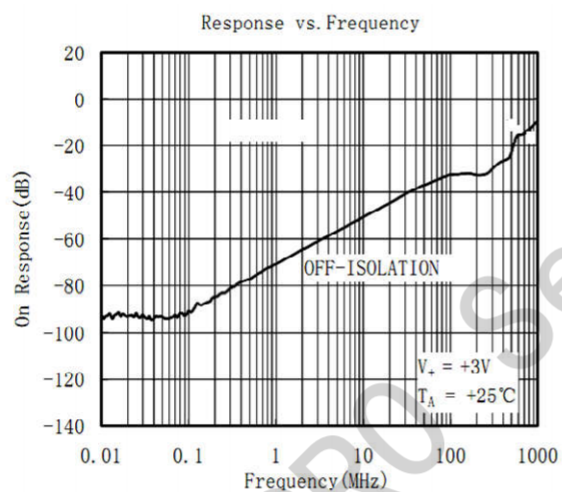
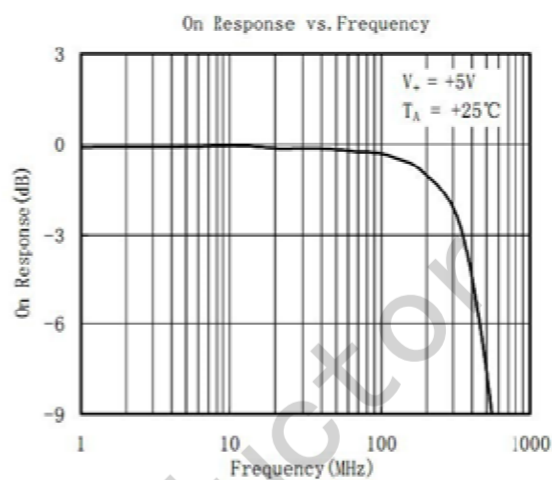
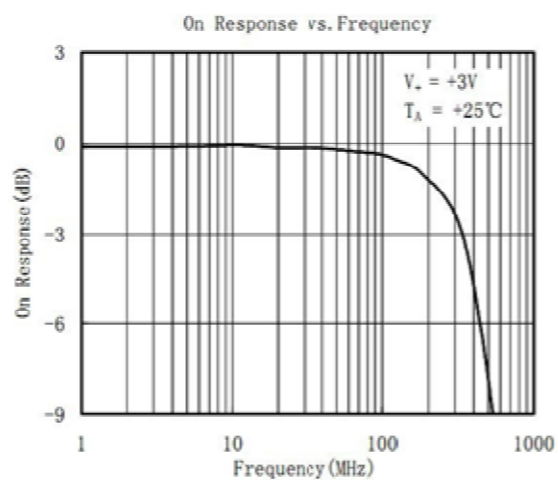


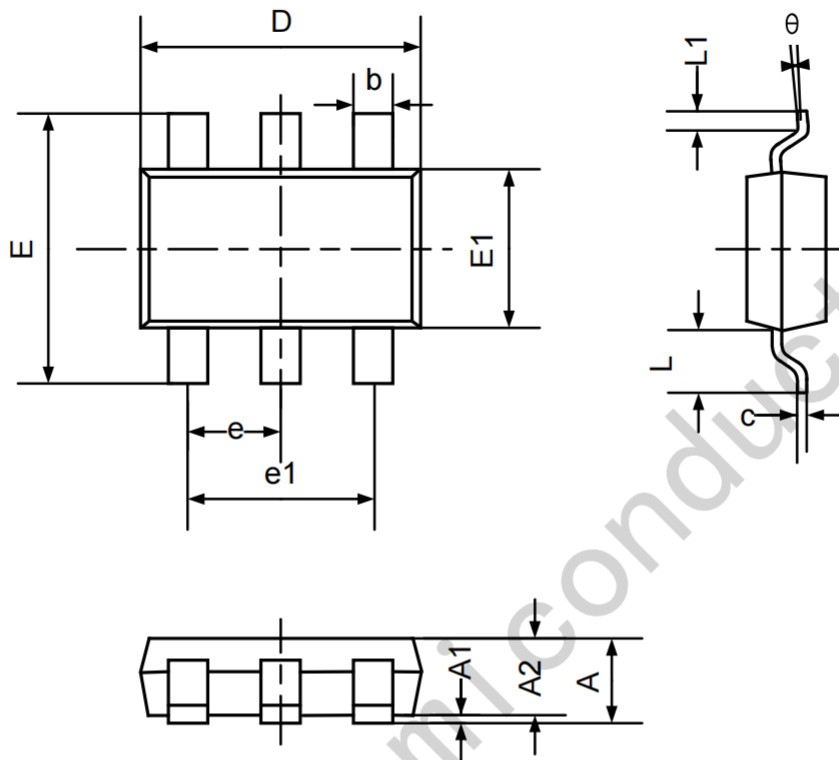
Figure 8. Bandwidth

## TYPICAL PERFORMANCE CHARACTERISTICS



## PACKAGE OUTLINE

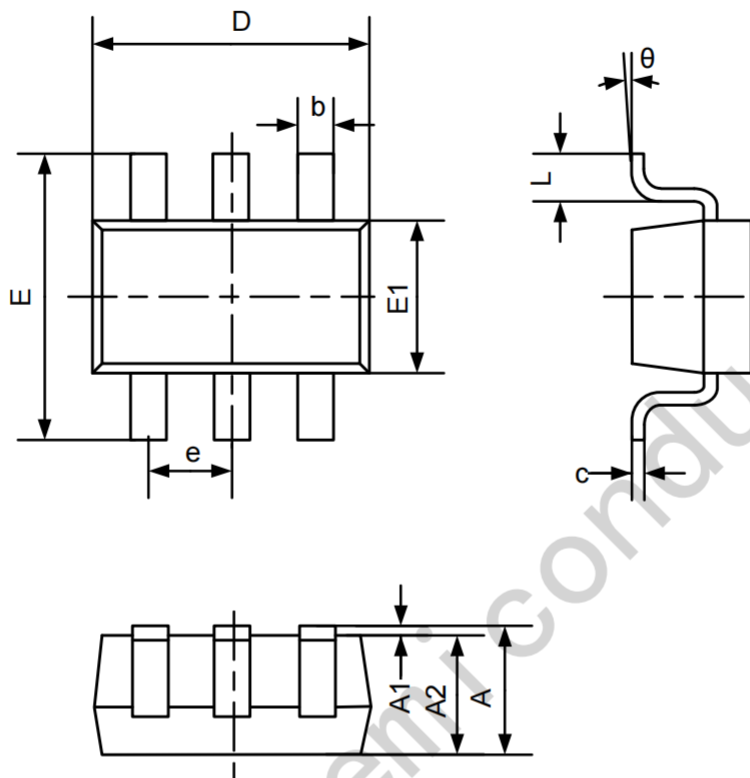
### SC70-6



| Symbol | Dimensions in Millimeters |      |
|--------|---------------------------|------|
|        | Min                       | Max  |
| A      | 0.85                      | 1.05 |
| A1     | 0.00                      | 0.10 |
| A2     | 0.80                      | 1.00 |
| b      | 0.15                      | 0.35 |
| c      | 0.08                      | 0.22 |
| D      | 2.02                      | 2.12 |
| E      | 2.20                      | 2.40 |
| E1     | 1.25                      | 1.35 |
| e      | 0.65BSC                   |      |
| e1     | 1.30BSC                   |      |
| L      | 0.50REF                   |      |
| L1     | 0.28                      | 0.38 |
| θ      | 0°                        | 8°   |

## PACKAGE OUTLINE

SOT23-6



| Symbol | Dimensions in Millimeters |       |       |
|--------|---------------------------|-------|-------|
|        | Min                       | Nom   | Max   |
| A      |                           |       | 1.240 |
| A1     | 0.010                     | 0.050 | 0.090 |
| A2     | 1.050                     | 1.100 | 1.150 |
| b      | 0.300                     | 0.350 | 0.400 |
| c      | 0.117                     |       | 0.157 |
| D      | 2.870                     | 2.920 | 2.970 |
| E      | 2.720                     | 2.800 | 2.880 |
| E1     | 1.550                     | 1.600 | 1.650 |
| e      | 0.950BSC                  |       |       |
| e1     | 1.900BSC                  |       |       |
| L      | 0.320                     | 0.400 | 0.480 |
| θ      | 0°                        |       | 5°    |