# SGM4157YC
# SPDT 0.8Ω Analog Switch

## GENERAL DESCRIPTION

The SGM4157YC is a single low on-resistance (0.8Ω), fast single-pole double-throw (SPDT) CMOS switch. It is designed for low operating voltage, high current switching of speaker output for cell phone applications. The SGM4157YC can handle a balanced microphone/ speaker/ring tone generator in a monophone mode. The device contains a break−before−make (BBM) feature.

The control input, IN, tolerates input drive signals up to 5.5V, independent of supply voltage.

SGM4157YC is available in SC70-6 package.

## APPLICATIONS

Portable Instrumentation
Battery-Operated Equipment
Computer Peripherals
Cell Phones
PDAs
MP3s

## FUNCTION TABLE

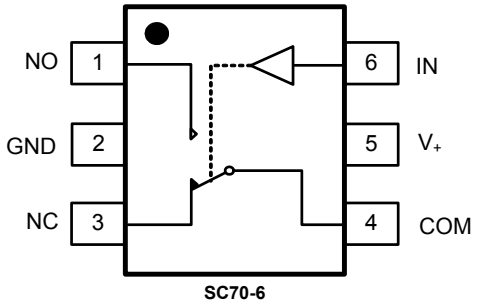
| LOGIC | NO | NC |
|---|---|---|
| 0 | OFF | ON |
| 1 | ON | OFF |

Switches Shown For Logic “0” Input

## FEATURES

- **Voltage Operation: 1.8V to 5.5V**
- **On-Resistance: 0.8Ω (TYP)**
- **-3dB Bandwidth: 90MHz**
- **High Off-Isolation: -45dB at 10MHz**
- **Rail-to-Rail Operation**
- **Low Static Power**
- **TTL/CMOS Compatible**
- **Break-Before-Make Switching**
- **Extended Industrial Temperature Range:**
  **-40℃ to +85℃**
- **Microsize Package**

## PIN CONFIGURATION (TOP VIEW)



SC70-6

## PIN DESCRIPTION

| NAME | PIN | FUNCTION |
|---|---|---|
| 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 to connect the COM terminal to the NO or NC terminals |

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

# PACKAGE/ORDERING INFORMATION

| MODEL | PIN-PACKAGE | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKAGE OPTION |
|---|---|---|---|---|---|
| SGM4157YC | SC70-6 | -40℃ to +85℃ | SGM4157YC6/TR | S4BXX | Tape and Reel, 3000 |

NOTE: SC70-6 package is same as SOT-363 package.

**MARKING INFORMATION**

**SYY X X**

Date code - Month ("A" = Jan. "B" = Feb. ⋯ "L" = Dec.)
Date code - Year ("9" = 2009, "A" = 2010 ⋯)
Chip I.D.

For example: S4B9A (2009, January)

# ABSOLUTE MAXIMUM RATINGS

$V_+$, IN to GND ..... -0.3V to 6V
Voltage Range of NC, NO, and COM Pins (1)
..... -0.5V to ($V_+$) + 0.5V
Continuous Current NO, NC, or COM .....± 200mA
Peak Current NO, NC, or COM .....± 350mA
Operating Temperature Range .....-40℃ to +85℃
Junction Temperature .....150℃
Storage Temperature ..... -65℃ to +150℃
Lead Temperature (soldering, 10s) ..... 260℃
ESD Susceptibility
HBM ..... 8000V
MM ..... 400V

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) Signals on NC, NO, or COM or IN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

# CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO 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.

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

# ELECTRICAL CHARACTERISTICS

($V_+$ = 4.5V to 5.5V, GND = 0V, Typical values are at $T_A$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| **ANALOG SWITCH** | | | | | | | | |
| Analog Signal Range | $V_{NO}$, $V_{NC}$, $V_{COM}$ | | | +25℃ | 0 | | $V_+$ | V |
| On-Resistance | $R_{ON}$ | $V_+$ = 4.5V, $V_{NO}$ or $V_{NC}$ = $V_+$/2, $I_{COM}$ = -100mA, Test Circuit 1 | | +25℃ | | 0.8 | | Ω |
| On-Resistance Match Between Channels | $\Delta R_{ON}$ | $V_+$ = 4.5V, 0V ≤ $V_{NO}$ or $V_{NC}$ ≤ $V_+$, $I_{COM}$ = -100mA, Test Circuit 1 | | +25℃ | | 0.02 | | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $V_+$ = 4.5V, 0V ≤ $V_{NO}$ or $V_{NC}$ ≤ $V_+$, $I_{COM}$ = -100mA, Test Circuit 1 | | +25℃ | | 0.25 | | Ω |
| Source OFF Leakage Current | $I_{NC(OFF)}$, $I_{NO(OFF)}$ | $V_+$ = 5.5 V, $V_{NO}$ or $V_{NC}$ = 4.5V / 1V, $V_{COM}$ = 1V / 4.5V | | +25℃ | | 0.1 | | μA |
| Channel ON Leakage Current | $I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$ | $V_+$ = 5.5V, $V_{COM}$ = 1V / 4.5V, $V_{NO}$ or $V_{NC}$ = floating | | +25℃ | | 0.1 | | μA |
| **DIGITAL INPUTS** | | | | | | | | |
| Input High Voltage | $V_{INH}$ | $V_+$ = 4.5V | | +25℃ | 1.6 | | | V |
| Input Low Voltage | $V_{INL}$ | $V_+$ = 4.5V | | +25℃ | | | 0.6 | V |
| Input Leakage Current | $I_{IN}$ | $V_+$ = 4.5V, $V_{IN}$ = 0V or $V_+$ | | +25℃ | | 0.1 | | μA |
| **DYNAMIC CHARACTERISTICS** | | | | | | | | |
| Turn-On Time (1) | $t_{ON}$ | $V_+$ = 4.5V, $V_{NO}$ or $V_{NC}$ = 3.0V, $R_L$ = 300Ω, $C_L$ = 35pF, Test Circuit 2 | | +25℃ | | 56 | 90 | ns |
| Turn-Off Time (1) | $t_{OFF}$ | $V_+$ = 4.5V, $V_{NO}$ or $V_{NC}$ = 3.0V, $R_L$ = 300Ω, $C_L$ = 35pF, Test Circuit 2 | | +25℃ | | 32 | 55 | ns |
| Break-Before-Make Time Delay | $t_D$ | $V_+$ = 4.5V, $V_{NO}$ or $V_{NC}$ = 3.0V, $R_L$ = 300Ω, $C_L$ = 35pF, Test Circuit 3 | | +25℃ | | 28 | | ns |
| Skew | $t_{SKEW}$ | $R_S$ = 39Ω, $C_L$ = 50pF, Test Circuit 4 | | +25℃ | | 7 | | ns |
| Off Isolation | $O_{ISO}$ | $V_+$ = 4.5V, $R_L$ = 50Ω, Signal = 0dBm, Test Circuit 5 | 10MHz | +25℃ | | -45 | | dB |
| | | | 1MHz | +25℃ | | -65 | | dB |
| –3dB Bandwidth | BW | $V_+$ = 4.5V, Signal = 0dBm, $R_L$ = 50Ω, Test Circuit 6 | | +25℃ | | 90 | | MHz |
| Channel ON Capacitance | $C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$ | $V_+$ = 4.5V, f = 1MHz | | +25℃ | | 40 | | pF |
| Channel OFF Capacitance | $C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{COM(OFF)}$ | $V_+$ = 4.5V, f = 1MHz | | +25℃ | | 8.5 | | pF |
| **POWER REQUIREMENTS** | | | | | | | | |
| Power Supply Range | $V_+$ | | | +25℃ | 1.8 | | 5.5 | V |
| Power Supply Current | $I_+$ | $V_+$ = 5.5V, $V_{IN}$ = 0V or $V_+$ | | +25℃ | | 0.1 | | μA |

NOTE1: Maximum value is guaranteed by design.

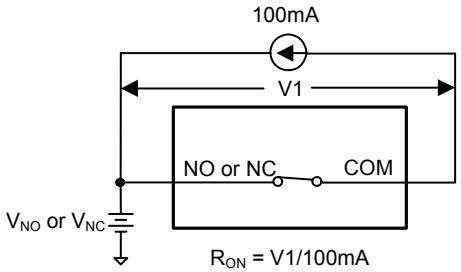
# ELECTRICAL CHARACTERISTICS

($V_+$ = 2.7V to 3.6V, GND = 0V, Typical values are at $T_A$ = +25℃, unless otherwise noted.)

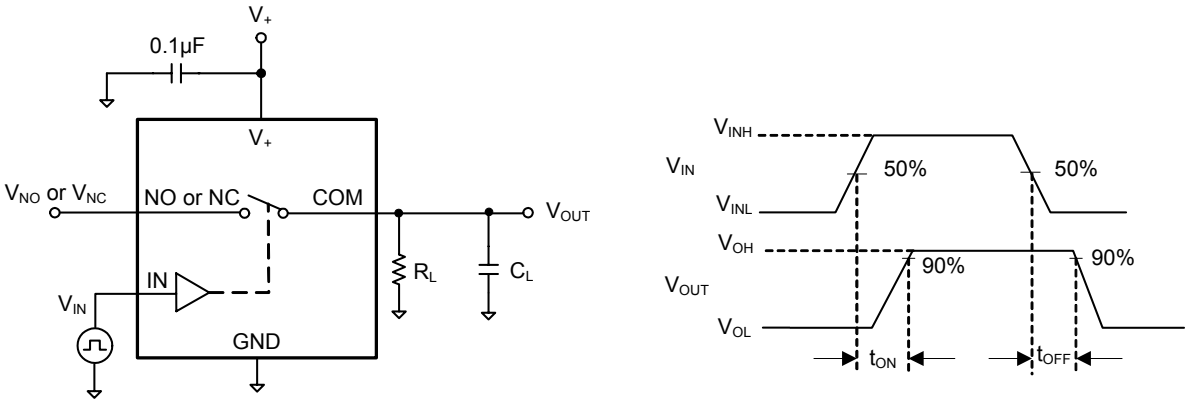
| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| **ANALOG SWITCH** | | | | | | | | |
| Analog Signal Range | $V_{NO}$, $V_{NC}$, $V_{COM}$ | | | +25℃ | 0 | | $V_+$ | V |
| On-Resistance | $R_{ON}$ | $V_+$ = 2.7V, $V_{NO}$ or $V_{NC}$ = $V_+$/2, $I_{COM}$ = -100mA, Test Circuit 1 | | +25℃ | | 1.4 | | Ω |
| On-Resistance Match Between Channels | $\Delta R_{ON}$ | $V_+$ = 2.7V, 0V ≤ $V_{NO}$ or $V_{NC}$ ≤ $V_+$, $I_{COM}$ = -100mA, Test Circuit 1 | | +25℃ | | 0.03 | | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $V_+$ = 2.7V, 0V ≤ $V_{NO}$ or $V_{NC}$ ≤ $V_+$, $I_{COM}$ = -100mA, Test Circuit 1 | | +25℃ | | 0.9 | | Ω |
| Source OFF Leakage Current | $I_{NC(OFF)}$, $I_{NO(OFF)}$ | $V_+$ = 3.6 V, $V_{NO}$ or $V_{NC}$ = 3.3V / 0.3V, $V_{COM}$ = 0.3V / 3.3V | | +25℃ | | 0.1 | | μA |
| Channel ON Leakage Current | $I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$ | $V_+$ = 3.6V, $V_{COM}$ = 0.3V / 3.3V, $V_{NO}$ or $V_{NC}$ = floating | | +25℃ | | 0.1 | | μA |
| **DIGITAL INPUTS** | | | | | | | | |
| Input High Voltage | $V_{INH}$ | $V_+$ = 2.7V | | +25℃ | 1.4 | | | V |
| Input Low Voltage | $V_{INL}$ | $V_+$ = 2.7V | | +25℃ | | | 0.4 | V |
| Input Leakage Current | $I_{IN}$ | $V_+$ = 2.7V, $V_{IN}$ = 0V or $V_+$ | | +25℃ | | 0.1 | | μA |
| **DYNAMIC CHARACTERISTICS** | | | | | | | | |
| Turn-On Time (1) | $t_{ON}$ | $V_+$ = 3V, $V_{NO}$ or $V_{NC}$ = 1.5V, $R_L$ = 300Ω, $C_L$ = 35pF, Test Circuit 2 | | +25℃ | | 88 | 115 | ns |
| Turn-Off Time (1) | $t_{OFF}$ | $V_+$ = 3V, $V_{NO}$ or $V_{NC}$ = 1.5V, $R_L$ = 300Ω, $C_L$ = 35pF, Test Circuit 2 | | +25℃ | | 46 | 70 | ns |
| Break-Before-Make Time Delay | $t_D$ | $V_+$ = 3V, $V_{NO}$ or $V_{NC}$ = 1.5V, $R_L$ = 300Ω, $C_L$ = 35pF, Test Circuit 3 | | +25℃ | | 43 | | ns |
| Skew | $t_{SKEW}$ | $R_S$ = 39Ω, $C_L$ = 50pF, Test Circuit 4 | | +25℃ | | 7 | | ns |
| Off Isolation | $O_{ISO}$ | $V_+$ = 3V, $R_L$ = 50Ω, Signal = 0dBm, Test Circuit 5 | 10MHz | +25℃ | | -45 | | dB |
| | | | 1MHz | +25℃ | | -65 | | dB |
| –3dB Bandwidth | BW | $V_+$ = 3V, Signal = 0dBm, $R_L$ = 50Ω, Test Circuit 6 | | +25℃ | | 90 | | MHz |
| Channel ON Capacitance | $C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$ | $V_+$ = 3V, f = 1MHz | | +25℃ | | 40 | | pF |
| Channel OFF Capacitance | $C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{COM(OFF)}$ | $V_+$ = 3V, f = 1MHz | | +25℃ | | 8.5 | | pF |
| **POWER REQUIREMENTS** | | | | | | | | |
| Power Supply Current | $I_+$ | $V_+$ = 3.6V, $V_{IN}$ = 0V or $V_+$ | | +25℃ | | 0.1 | | μA |

NOTE1: Maximum value is guaranteed by design.

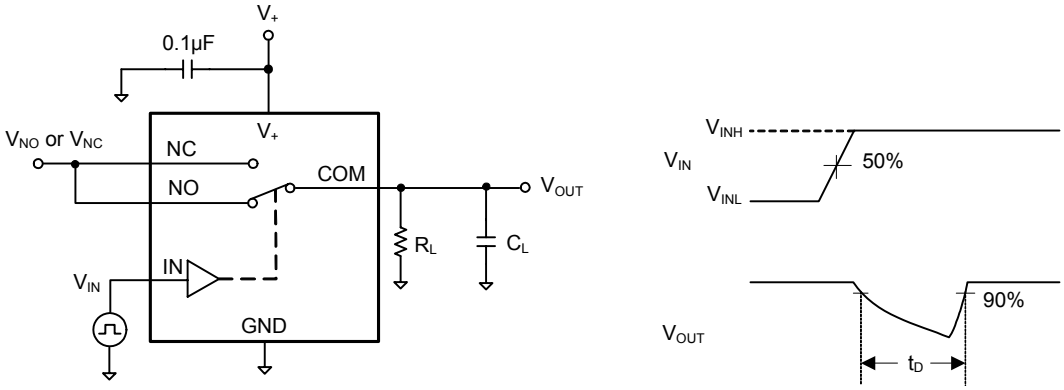
# TEST CIRCUITS




Test Circuit 1. On Resistance

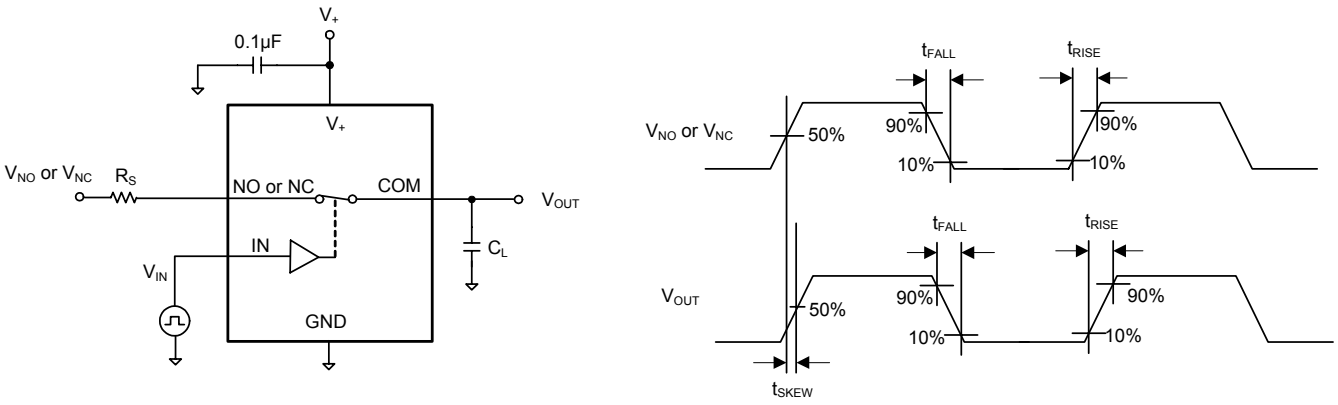



Test Circuit 2. Switching Times

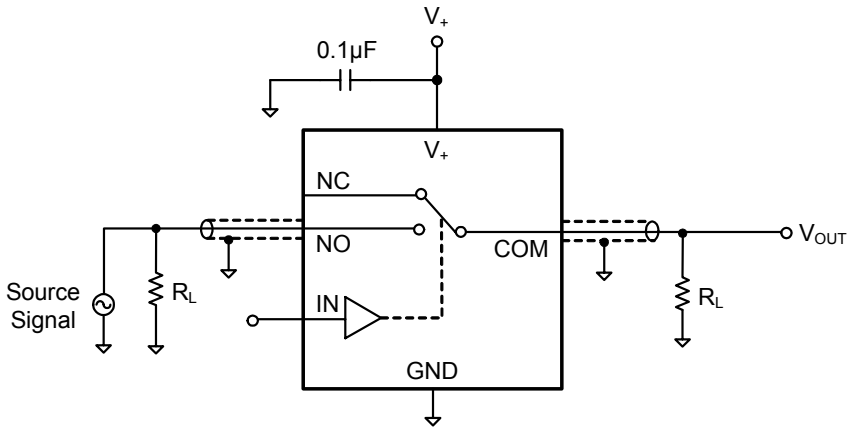



Test Circuit 3. Break-Before-Make Time Delay, $t_D$

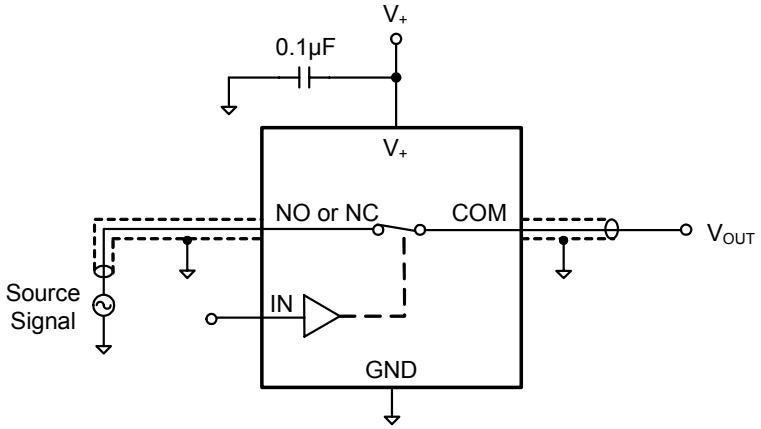
## TEST CIRCUITS (Cont.)




Test Circuit 4. Skew Test



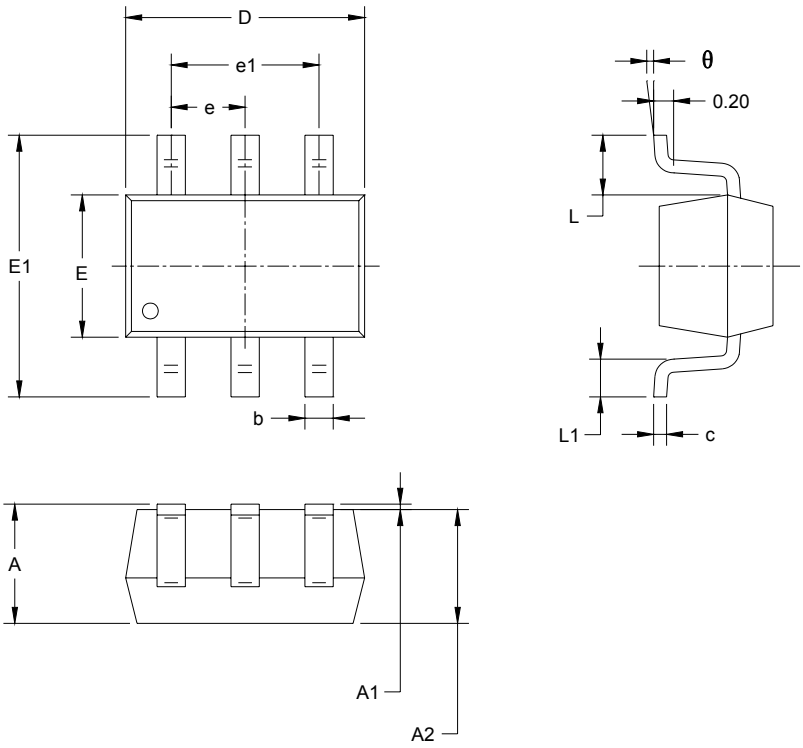

Test Circuit 5. Off Isolation




Test Circuit 6. -3dB Bandwidth

# PACKAGE OUTLINE DIMENSIONS

## SC70-6 / SOT-363




| 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 | 0.65 TYP | | 0.026 TYP | |
| e1 | 1.300 BSC | | 0.051 BSC | |
| L | 0.525 REF | | 0.021 REF | |
| L1 | 0.260 | 0.460 | 0.010 | 0.018 |
| θ | 0° | 8° | 0° | 8° |