

SGM3003

Ultra Low ON-Resistance, Low Voltage, SPDT Analog Switch

GENERAL DESCRIPTION

The SGM3003 is a single, low ON-resistance, low voltage, bidirectional, single-pole/double-throw (SPDT) CMOS analog switches designed to operate from a single +1.8V to +5.5V supply. Targeted applications include battery powered equipment that benefit from low R_{ON} (0.5Ω) and fast switching speeds ($t_{ON} = 21\text{ ns}$, $t_{OFF} = 9\text{ ns}$).

The on resistance profile is very flat over the full analog signal range. This ensures excellent linearity and low distortion when switching audio signals.

SGM3003 has one normally open switch and one normally closed switch. Each switch conducts equally well in both directions when on.

SGM3003 is available in a MSOP-8 package.

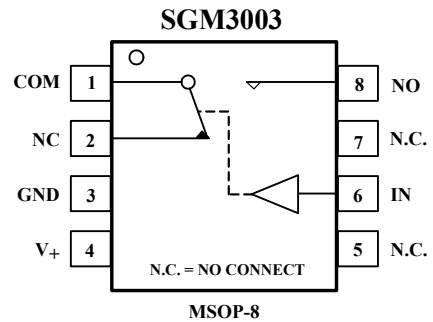
APPLICATIONS

- Battery powered, Handheld, and Portable Equipments
 - Cellular/mobile Phones
 - Laptops, Notebooks, Palmtops
- Communication Systems
- Sample-and-Hold Circuits
- Audio Signal Routing
- Audio and Video Switching
- Portable Test and Measurement
- Medical Equipment

FEATURES

- Low Voltage Operation : 1.8 V to 5.5 V
- Low On-Resistance: 0.5Ω (TYP)
- Low On-Resistance Flatness
- -3 dB Bandwidth: 30 MHz
- Fast Switching Time($V_+ = 5\text{V}$)
 - t_{ON} 21 ns
 - t_{OFF} 9 ns
- Rail-to-Rail Operation
- Typical Power Consumption ($<0.01\ \mu\text{W}$)
- TTL/CMOS Compatible
- Microsize Package

PIN CONFIGURATIONS (TOP VIEW)



FUNCTION TABLE

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

ORDERING INFORMATION

| MODEL | PIN-PACKAGE | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKAGE OPTION |
|---------|-------------|-----------------------------|-----------------|-----------------|---------------------|
| SGM3003 | MSOP-8 | - 40°C to +125°C | SGM3003XMS/TR | SGM3003XMS | Tape and Reel, 3000 |

ABSOLUTE MAXIMUM RATINGS

V₊ to GND.....- 0.3V to +6V
 Analog, Digital voltage range(1)..... - 0.3V to V₊ + 0.3V
 Continuous Current NO, NC, or COM..... ±300mA
 Peak Current NO, NC, or COM ±500mA
 Operating Temperature Range.....- 40°C to +125°C
 Junction Temperature.....+150°C
 Storage Temperature.....- 65°C to +150°C

Package Thermal Resistance @ T_A = 25°C
 MSOP-8, θ_{JA}.....216°C/W
 Lead Temperature (soldering, 10s).....260°C
 ESD Susceptibility
 HBM.....2000V
 MM.....400V

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.

PIN DESCRIPTION

| NAME | PIN | FUNCTION |
|----------------|------|---|
| V ₊ | 4 | Power supply |
| GND | 3 | ground |
| IN | 6 | Digital control pin to connect the COM terminal to the NO or NC terminals |
| COM | 1 | Common terminal |
| NO | 8 | Normally-open terminal |
| NC | 2 | Normally-closed terminal |
| N.C. | 5, 7 | No internal connection |

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

ELECTRICAL CHARACTERISTICS

(V₊ = +5 V ± 10%, GND = 0 V, T_A = - 40°C to +125°C, unless otherwise noted. Typical values are at T_A = + 25°C.)

| PARAMETER | SYMBOL | CONDITIONS | SGM3003 | | | |
|--------------------------------|--|--|---------------|---------------------|----------|------------|
| | | | +25°C | - 40°C to +125°C | UNITS | MIN/MAX |
| ANALOG SWITCH | | | | | | |
| Analogue Signal Range | V _{NO} , V _{NC} , V _{COM} | | | 0 V ₊ | V V | MIN MAX |
| On-Resistance | R _{ON} | 0 ≤ V _{NO} or V _{NC} ≤ V ₊ , I _{COM} = -10 mA, Test Circuit 1 | 0.5 0.9 | | Ω Ω | TYP MAX |
| On-Resistance Flatness | R _{FLAT(ON)} | 0 ≤ V _{NO} or V _{NC} ≤ V ₊ , I _{COM} = -10 mA, Test Circuit 1 | 0.13 0.2 | | Ω Ω | TYP MAX |
| LEAKAGE CURRENTS | | | | | | |
| Source OFF Leakage current | I _{NC(OFF)} , I _{NO(OFF)} | V _{NO} or V _{NC} = 4.5V/1V, V _{COM} = 1V/4.5V, V ₊ = +5.5V, Test Circuit 2 | ±4 ±10 | | nA nA | TYP MAX |
| Channel ON Leakage current | I _{NC(ON)} , I _{NO(ON)} , I _{COM(ON)} | V _{NO} or V _{NC} = V _{COM} = 1V or 4.5V, V ₊ = +5.5V, Test Circuit 3 | ±4 ±10 | | nA nA | TYP MAX |
| DIGITAL INPUTS | | | | | | |
| Input High Voltage | V _{INH} | | | 2.4 | V | MIN |
| Input Low Voltage | V _{INL} | | | 0.8 | V | MAX |
| Input Current | I _{INL} or I _{INH} | V _{IN} = V _{INH} or V _{INL} | ±0.01 ±0.1 | | μA μA | TYP MAX |
| DYNAMIC CHARACTERISTICS | | | | | | |
| Turn-On Time | t _{ON} | V _{NO} or V _{NC} = 3V, R _L = 300Ω, C _L = 35pF, Test Circuit 4 | 21 | | ns | TYP |
| Turn-Off Time | t _{OFF} | V _{NO} or V _{NC} = 3V, R _L = 300Ω, C _L = 35pF, Test Circuit 4 | 9 | | ns | TYP |
| Charge Injection, | Q | C _L = 1.0nF, V _G = 0V, R _G = 0, Test Circuit 5 | 5 | | pC | TYP |
| Break-Before-Make Time Delay | t _d | V _{NO1} or V _{NC1} = V _{NO2} or V _{NC2} = 3V, R _L = 300Ω, C _L = 35pF, Test Circuit 6 | 10 | | ns | TYP |
| Off Isolation | O _{ISO} | R _L = 50Ω, C _L = 5pF, Test Circuit 7 | -55 -75 | | dB dB | TYP TYP |
| Total Harmonic Distortion | THD | f = 20Hz to 20KHz, V _{COM} = 3.5V _{P-P} , R _L = 600Ω, C _L = 50pF | 0.065 | | % | TYP |
| Bandwidth -3 dB | BW | R _L = 50Ω, C _L = 5pF, Test Circuit 8 | 30 | | MHz | TYP |
| Source OFF Capacitance | C _{NC(OFF)} , C _{NO(OFF)} | | 82 | | pF | TYP |
| Channel ON Capacitance | C _{NC(ON)} , C _{NO(ON)} , C _{COM(ON)} | | 380 | | pF | TYP |
| POWER REQUIREMENTS | | | | | | |
| Power Supply Current | I ₊ | V ₊ = +5.5V, V _{IN} = 0V or 5V | 0.001 | | μA | TYP |
| | | | | 1 | μA | MAX |

Specifications subject to change without notice.

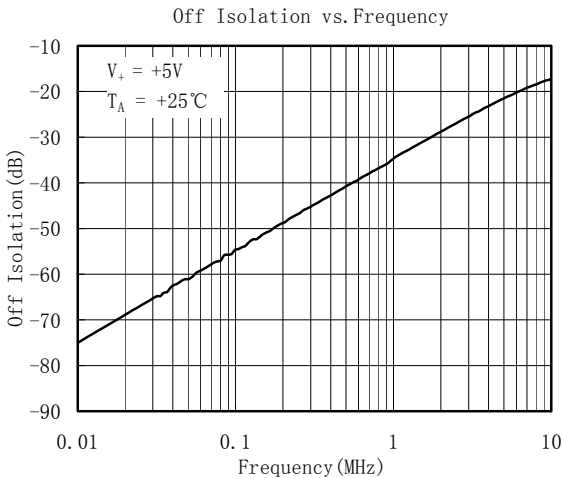
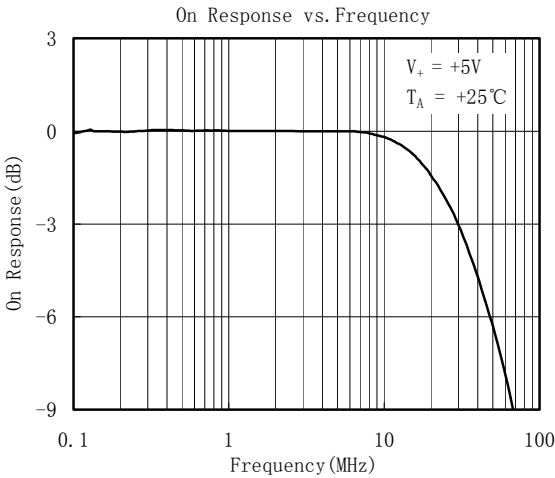
ELECTRICAL CHARACTERISTICS

($V_+ = +3\text{ V} \pm 10\%$, $\text{GND} = 0\text{ V}$, $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, unless otherwise noted. Typical values are at $T_A = +25^\circ\text{C}$.)

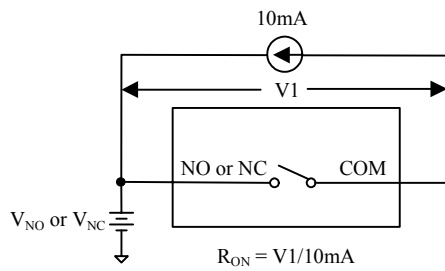
| PARAMETER | SYMBOL | CONDITIONS | SGM3003 | | | |
|--------------------------------|--|---|-------------------------|-----------------|--------------------------------|------------|
| | | | +25°C | -40°C to +125°C | UNITS | MIN/MAX |
| ANALOG SWITCH | | | | | | |
| Analogue Signal Range | V_{NO}, V_{NC}, V_{COM} | | | 0 V_+ | V V | MIN MAX |
| On-Resistance | R_{ON} | $0 \leq V_{NO}$ or $V_{NC} \leq V_+$, $I_{COM} = -10\text{ mA}$, Test Circuit 1 | 0.6 1.0 | | Ω Ω | TYP MAX |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $0 \leq V_{NO}$ or $V_{NC} \leq V_+$, $I_{COM} = -10\text{ mA}$, Test Circuit 1 | 0.18 0.3 | | Ω Ω | TYP MAX |
| LEAKAGE CURRENTS | | | | | | |
| Source OFF Leakage current | $I_{NC(OFF)}, I_{NO(OFF)}$ | V_{NO} or $V_{NC} = 3\text{V}/1\text{V}$, $V_{COM} = 1\text{V}/3\text{V}$, $V_+ = +3.3\text{V}$, Test Circuit 2 | ± 5 ± 11 | | nA nA | TYP MAX |
| Channel ON Leakage current | $I_{NC(ON)}, I_{NO(ON)},$ $I_{COM(ON)}$ | V_{NO} or $V_{NC} = V_{COM} = 1\text{V}$ or 3V , $V_+ = +3.3\text{V}$, Test Circuit 3 | ± 5 ± 11 | | nA nA | TYP MAX |
| DIGITAL INPUTS | | | | | | |
| Input High Voltage | V_{INH} | | | 2.0 | V | MIN |
| Input Low Voltage | V_{INL} | | | 0.4 | V | MAX |
| Input Current | I_{INL} or I_{INH} | $V_{IN} = V_{INH}$ or V_{INL} | ± 0.01 ± 0.1 | | μA μA | TYP MAX |
| DYNAMIC CHARACTERISTICS | | | | | | |
| Turn-On Time | t_{ON} | V_{NO} or $V_{NC} = 2\text{V}$, $R_L = 300\Omega$, $C_L = 35\text{pF}$, Test Circuit 4 | 32 | | ns | TYP |
| Turn-Off Time | t_{OFF} | V_{NO} or $V_{NC} = 2\text{V}$, $R_L = 300\Omega$, $C_L = 35\text{pF}$, Test Circuit 4 | 20 | | ns | TYP |
| Charge Injection, | Q | $C_L = 1.0\text{nF}$, $V_G = 0\text{V}$, $R_G = 0$, Test Circuit 5 | 10 | | pC | TYP |
| Break-Before-Make Time Delay | t_d | V_{NO1} or $V_{NC1} = V_{NO2}$ or $V_{NC2} = 2\text{V}$, $R_L = 300\Omega$, $C_L = 35\text{pF}$, Test Circuit 6 | 12 | | ns | TYP |
| Off Isolation | O_{ISO} | $R_L = 50\Omega$, $C_L = 5\text{pF}$, Test Circuit 7 | -55 -75 | | dB dB | TYP TYP |
| Total Harmonic Distortion | THD | $f = 20\text{Hz}$ to 20kHz , $V_{COM} = 2V_{P-P}$, $R_L = 600\Omega$, $C_L = 50\text{pF}$ | 0.06 | | % | TYP |
| Bandwidth -3 dB | BW | $R_L = 50\Omega$, $C_L = 5\text{pF}$, Test Circuit 8 | 30 | | MHz | TYP |
| Source OFF Capacitance | $C_{NC(OFF)}, C_{NO(OFF)}$ | | 82 | | pF | TYP |
| Channel ON Capacitance | $C_{NC(ON)}, C_{NO(ON)},$ $C_{COM(ON)}$ | | 380 | | pF | TYP |
| POWER REQUIREMENTS | | | | | | |
| Power Supply Current | I_+ | $V_+ = +3.3\text{V}$, $V_{IN} = 0\text{V}$ or 3V | 0.001 | | μA | TYP |
| | | | | 1 | μA | MAX |

Specifications subject to change without notice.

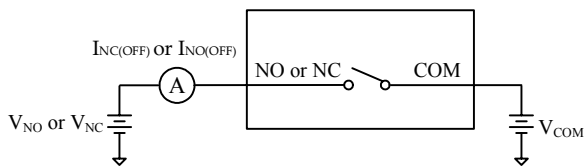
TYPICAL PERFORMANCE CHARACTERISTICS



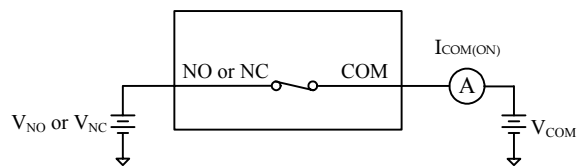
TEST CIRCUITS



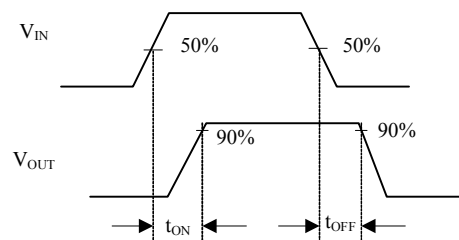
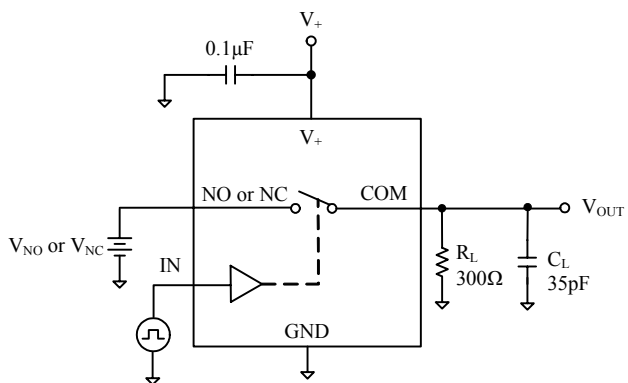
Test Circuit 1. On Resistance



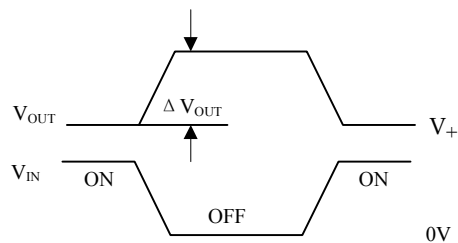
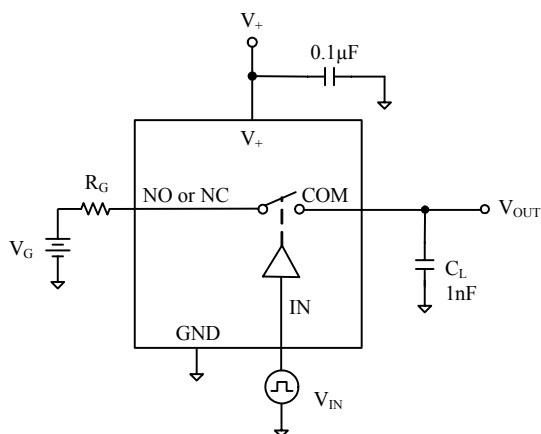
Test Circuit 2: Off Leakage



Test Circuit 3: On Leakage

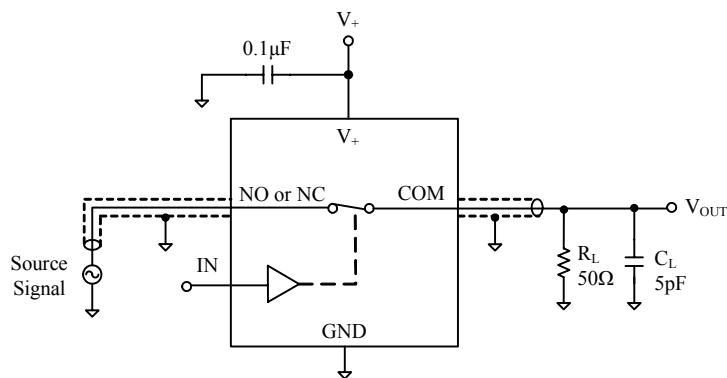
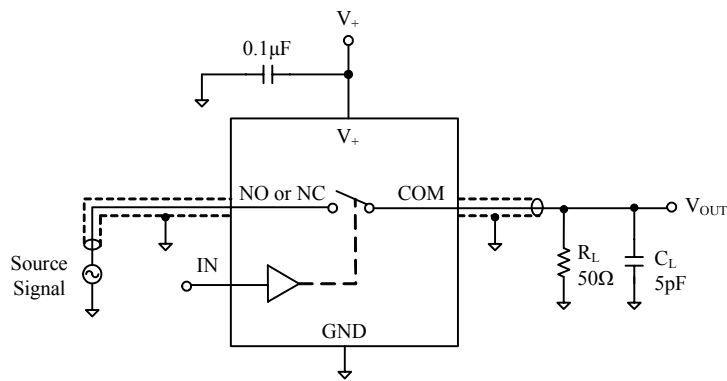
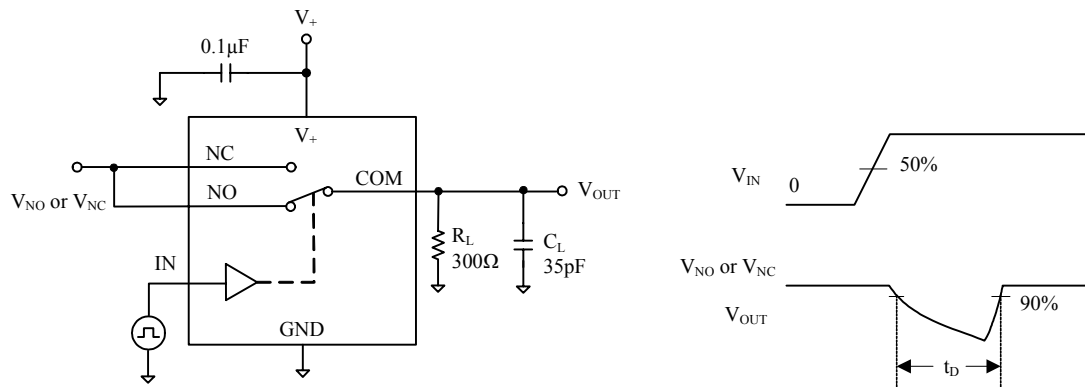


Test Circuit 4: Switching Times



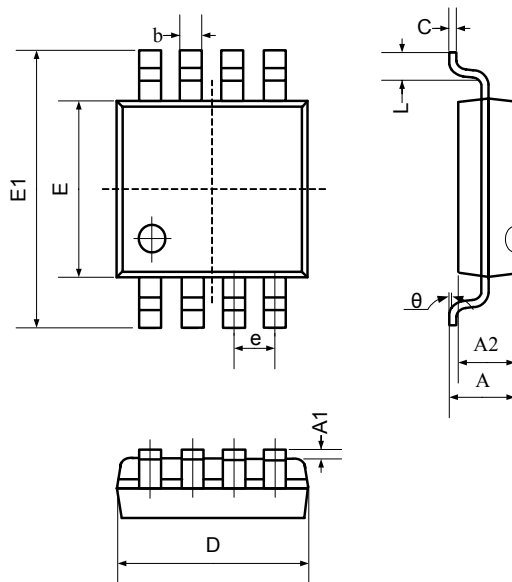
Test Circuit 5: Charge Injection

TEST CIRCUITS(Cont.)



PACKAGE OUTLINE DIMENSIONS

MSOP-8



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------------------------------|-------|-------------------------|-------|
| | Min | Max | Min | Max |
| A | 0.800 | 1.200 | 0.031 | 0.047 |
| A1 | 0.000 | 0.200 | 0.000 | 0.008 |
| A2 | 0.760 | 0.970 | 0.030 | 0.038 |
| b | 0.30 TYP | | 0.012 TYP | |
| c | 0.15 TYP | | 0.006 TYP | |
| D | 2.900 | 3.100 | 0.114 | 0.122 |
| e | 0.65 TYP | | 0.026 TYP | |
| E | 2.900 | 3.100 | 0.114 | 0.122 |
| E1 | 4.700 | 5.100 | 0.185 | 0.201 |
| L | 0.410 | 0.650 | 0.016 | 0.026 |
| θ | 0° | 6° | 0° | 6° |

REVISION HISTORY

| Location | Page |
|--|------|
| 11/06— Data Sheet changed from REV.A to REV.B | |
| Changes to ABSOLUTE MAXIMUM RATINGS | 2 |
| 10/07— Data Sheet changed from REV.B to REV.C | |
| Changes to TYPICAL PERFORMANCE CHARACTERISTICS | 5 |

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