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 switch 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} = 21ns, t_{OFF} = 9ns).

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

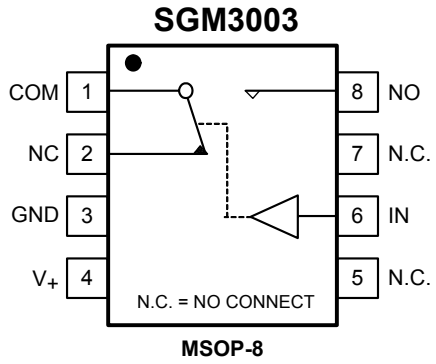
Battery powered, Handheld, and Portable Equipment
- Cellular/mobile Phones
- Laptops, Notebooks, Palmtops

Communication Systems
Sample-and-Hold Circuits
Audio Signal Routing
Audio and Video Switching
Portable Test and Measurement
Medical Equipment

FEATURES

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

PIN CONFIGURATION (TOP VIEW)



MSOP-8

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℃
MSOP-8, θ_{JA}.....216℃/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.

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.

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 terminals may be an input or output.

ELECTRICAL CHARACTERISTICS

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

PARAMETER	SYMBOL	CONDITIONS	SGM3003			
			+25℃	-40℃ to +125℃	UNITS	MIN/ MAX
ANALOG SWITCH						
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			0	V	MIN
				V_+	V	MAX
On-Resistance	R_{ON}	0 ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = −10mA, Test Circuit 1	0.5		Ω	TYP
			0.9	1.1	Ω	MAX
On-Resistance Flatness	$R_{FLAT(ON)}$	0 ≤ V_{NO} or V_{NC} ≤ V+, I_{COM} = −10mA, Test Circuit 1	0.13		Ω	TYP
			0.2	0.4	Ω	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		nA	TYP
			±10	±1000	nA	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		nA	TYP
			±10	±1000	nA	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		μA	TYP
			±0.1	±1	μA	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 = 0Ω, 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, f = 100kHz	-55		dB	TYP
		R_L = 50Ω, C_L = 5pF, Test Circuit 7, f = 10kHz	-75		dB	TYP
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, V_{COM} = $3.5V_{P-P}$, R_L = 600Ω, C_L = 50pF	0.065		%	TYP
–3dB Bandwidth	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 changes without notice.

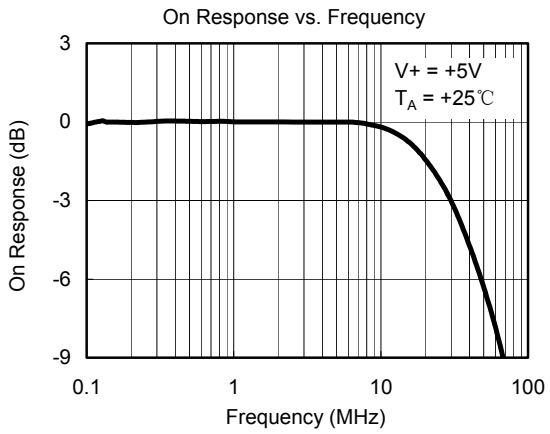
ELECTRICAL CHARACTERISTICS

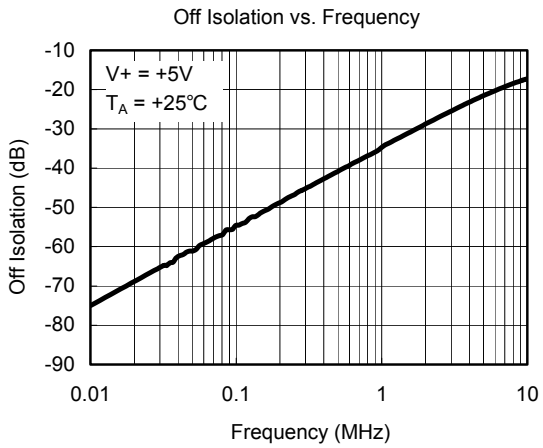
(V_+ = +3V ± 10%, GND = 0V, T_A = -40°C to +125°C. Typical values are at T_A = + 25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM3003			
			+25℃	- 40℃ to +125℃	UNITS	MIN/ MAX
ANALOG SWITCH						
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			0	V	MIN
				V_+	V	MAX
On-Resistance	R_{ON}	0 ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = −10mA, Test Circuit 1	0.6		Ω	TYP
			1.0	1.3	Ω	MAX
On-Resistance Flatness	$R_{FLAT(ON)}$	0 ≤ V_{NO} or V_{NC} ≤ V+, I_{COM} = −10mA, Test Circuit 1	0.18		Ω	TYP
			0.3	0.4	Ω	MAX
LEAKAGE CURRENTS						
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NO} or V_{NC} = 3V/1V, V_{COM} = 1V/3V, V_+ = +3.3V, Test Circuit 2	±5		nA	TYP
			±11	±1000	nA	MAX
Channel ON Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_{NO} or V_{NC} = V_{COM} = 1V or 3V, V_+ = +3.3V , Test Circuit 3	±5		nA	TYP
			±11	±1000	nA	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		μA	TYP
			±0.1	±1	μA	MAX
DYNAMIC CHARACTERISTICS						
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 2V, R_L = 300Ω, C_L = 35pF, Test Circuit 4	32		ns	TYP
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC} = 2V, R_L = 300Ω, C_L = 35pF, Test Circuit 4	20		ns	TYP
Charge Injection	Q	C_L = 1.0nF, V_G = 0V, R_G = 0Ω, Test Circuit 5	10		pC	TYP
Break-Before-Make Time Delay	t_D	V_{NO1} or V_{NC1} = V_{NO2} or V_{NC2} = 2V, R_L = 300Ω, C_L = 35pF, Test Circuit 6	12		ns	TYP
Off Isolation	O_{ISO}	R_L = 50Ω, C_L = 5pF, Test Circuit 7, f = 100kHz	-55		dB	TYP
		R_L = 50Ω, C_L = 5pF, Test Circuit 7, f = 10kHz	-75		dB	TYP
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, V_{COM} = $2V_{P-P}$, R_L = 600Ω, C_L = 50pF	0.06		%	TYP
–3dB Bandwidth	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_+ = +3.3V, V_{IN} = 0V or 3V	0.001		μA	TYP
				1	μA	MAX

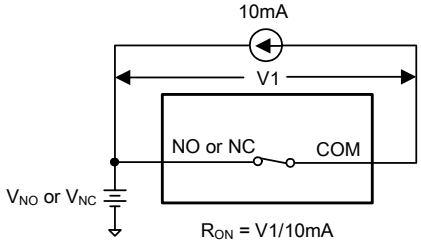
Specifications subject to changes without notice.

TYPICAL PERFORMANCE CHARACTERISTICS

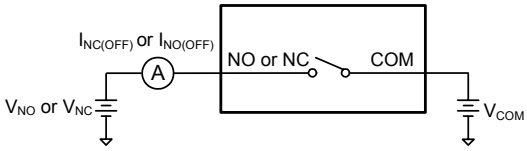




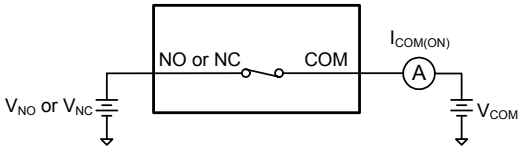
TEST CIRCUITS



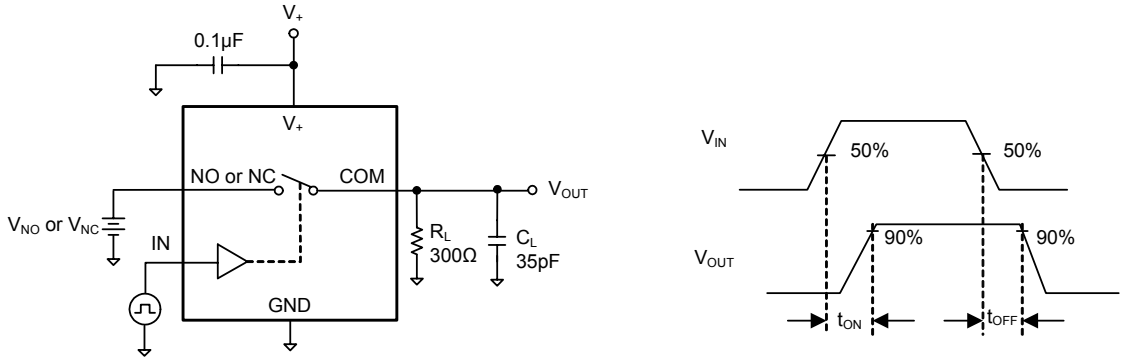
Test Circuit 1. On Resistance



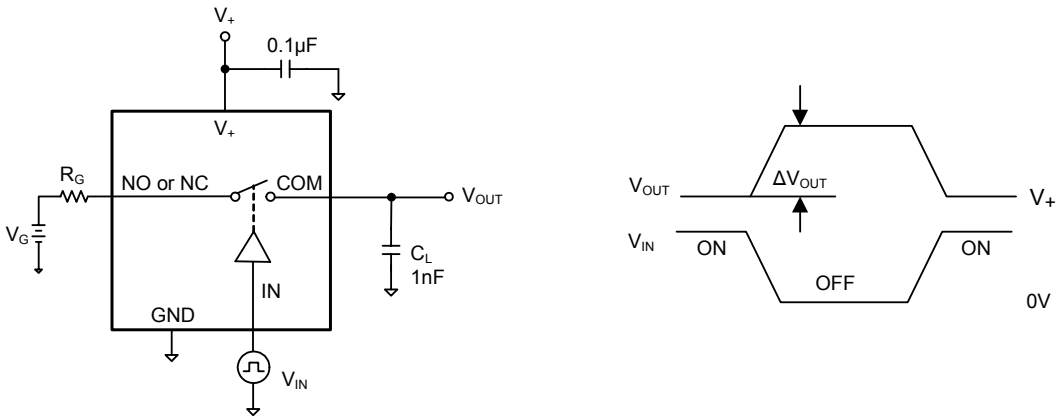
Test Circuit 2. Off Leakage



Test Circuit 3. On Leakage

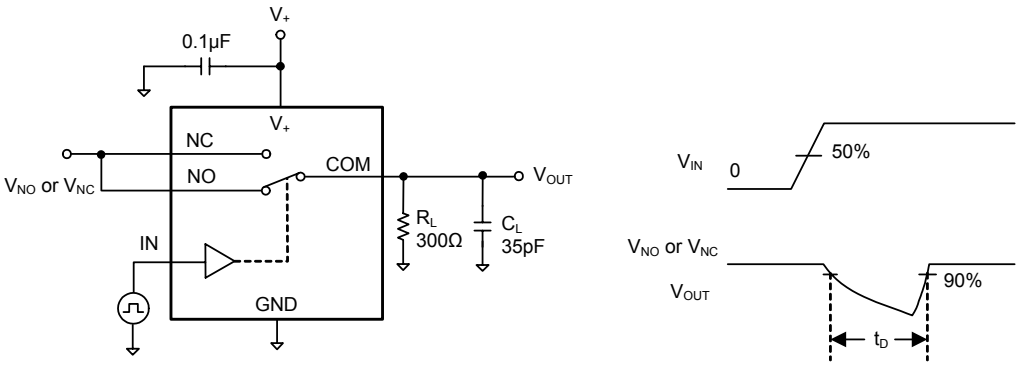


Test Circuit 4. Switching Times

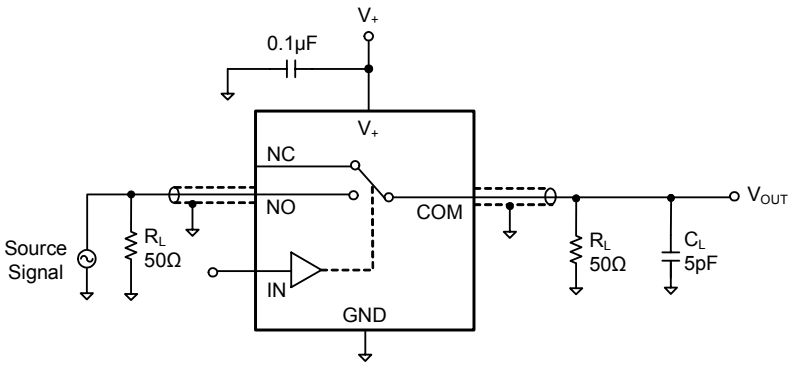


Test Circuit 5. Charge Injection

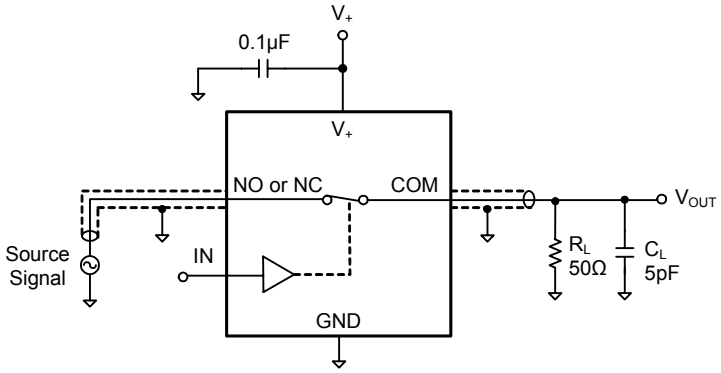
TEST CIRCUITS (Cont.)



Test Circuit 6. Break-Before-Make Time Delay, t_D



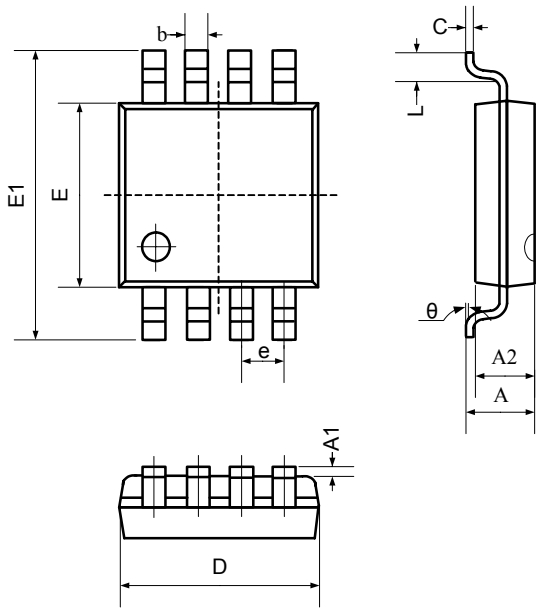
Test Circuit 7. Off Isolation



Test Circuit 8. -3dB Bandwidth

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°

12/2008 REV. C. 1