



# SGM3001/SGM3002

## Low On-Resistance, Low Voltage, SPDT Analog Switch

### GENERAL DESCRIPTION

The SGM3001 (single) and SGM3002 (dual) are bidirectional SPDT (single-pole/double-throw), TTL/CMOS compatible analog switches. They both operate from a 1.8V to 5.5V single power supply.

The SGM3001 and SGM3002 feature low on-resistance, low voltage and fast switching times. The high performances make them very suitable for multiple applications, such as portable equipment, audio and video signal routing, etc. In addition, the SGM3002 can be used as a dual 2-to-1 multiplexer because it has two normally open and two normally close switches. Low power consumption is also one of the important reasons that make it a good choice.

The single version SGM3001 is available in a Green SC70-6 package. The dual version SGM3002 is available in a Green MSOP-10 package. They both operate over an ambient temperature range of -40°C to +125°C.

### FEATURES

- **Single Supply Voltage Range: 1.8V to 5.5V**
- **-3dB Bandwidth: 120MHz**
- **Low On-Resistance: 2.5Ω (TYP)**
- **Low On-Resistance Flatness**
- **Low Crosstalk: -35dB (TYP) at 10MHz (SGM3002)**
- **Fast Switching Times:**
  - t<sub>ON</sub>: 11ns**
  - t<sub>OFF</sub>: 30ns (SGM3001)**
  - t<sub>OFF</sub>: 8ns (SGM3002)**
- **Off-Isolation: -45dB at 10MHz**
- **Low Power Consumption**
- **Rail-to-Rail Input and Output Operation**
- **TTL/CMOS Compatible**
- **-40°C to +125°C Operating Temperature Range**
- **SGM3001: Available in a Green SC70-6 Package**
- **SGM3002: Available in a Green MSOP-10 Package**

### APPLICATIONS

Cellular Phones  
Portable Equipment  
Medical Equipment  
Sample-and-Hold Circuits  
Personal Digital Assistants  
Battery-Powered Systems  
Audio and Video Signal Routing

**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM3001	SC70-6	-40°C to +125°C	SGM3001XC6/TR	3001	Tape and Reel, 3000
SGM3002	MSOP-10	-40°C to +125°C	SGM3002XMS/TR	SGM3002 XMS XXXXX	Tape and Reel, 3000

NOTE: XXXXX = Date Code and Vendor Code.

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

**ABSOLUTE MAXIMUM RATINGS**

V<sub>+</sub> to GND ..... -0.3V to 6V  
 Analog, Digital Voltage Range <sup>(1)</sup> ..... -0.3V to (V<sub>+</sub>) + 0.3V  
 Continuous Current NO, NC, or COM ..... ±150mA  
 Peak Current NO, NC, or COM ..... ±250mA  
 Package Thermal Resistance @ T<sub>A</sub> = +25°C  
 SC70-6, θ<sub>JA</sub> ..... 333°C/W  
 MSOP-10, θ<sub>JA</sub> ..... 205°C/W  
 Junction Temperature ..... +150°C  
 Storage Temperature Range ..... -65°C to +150°C  
 Lead Temperature (Soldering, 10s) ..... +260°C  
 ESD Susceptibility  
 HBM ..... 2000V  
 MM ..... 400V

**RECOMMENDED OPERATING CONDITIONS**

Operating Temperature Range ..... -40°C to +125°C

NOTE:

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

**OVERSTRESS CAUTION**

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

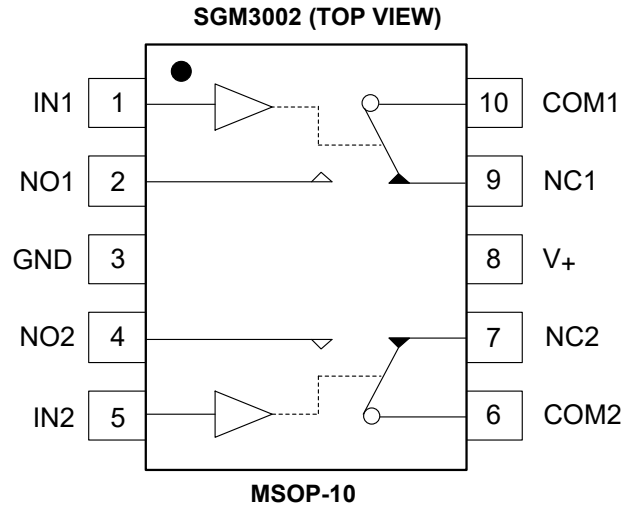
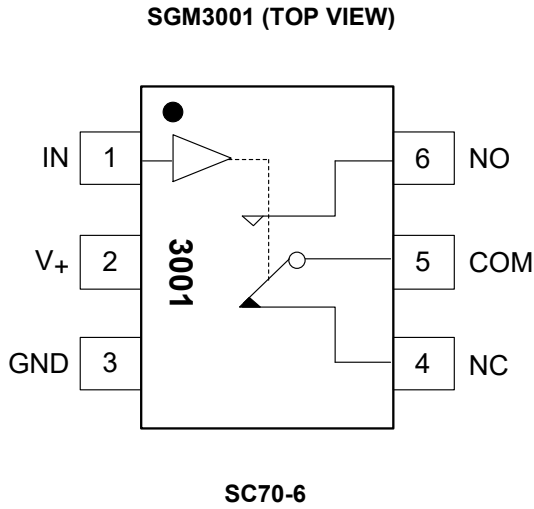
**ESD SENSITIVITY CAUTION**

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.

**DISCLAIMER**

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS



PIN DESCRIPTION

PIN		NAME	FUNCTION
SC70-6	MSOP-10		
1	1, 5	IN (IN1, IN2)	Digital Control Input Pin to Connect the COM Pins to the NO or NC Pins.
2	8	V+	Positive Power Supply Pin.
3	3	GND	Ground.
4	7, 9	NC (NC1, NC2)	Normally Closed Pins.
5	6, 10	COM (COM1, COM2)	Common Pins.
6	2, 4	NO (NO1, NO2)	Normally Open Pins.

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

FUNCTION TABLE

LOGIC	NO, NO1, NO2	NC, NC1, NC2
0	OFF	ON
1	ON	OFF

## ELECTRICAL CHARACTERISTICS

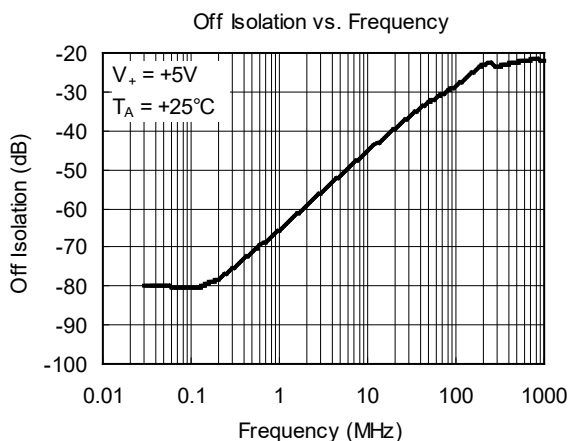
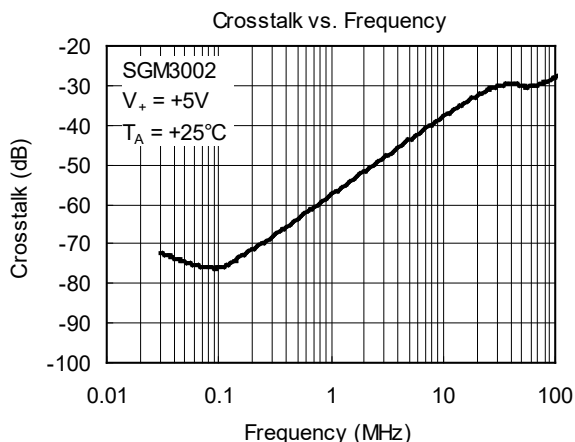
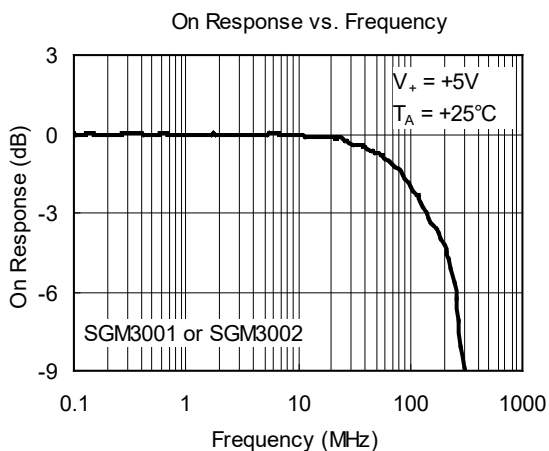
(V<sub>+</sub> = 5V ± 10%, GND = 0V, Full = -40°C to +125°C. Typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM3001/SGM3002			
			+25°C	-40°C to +125°C	UNITS	MIN/MAX
<b>Analog Switch</b>						
Analog Signal Range	V <sub>NO</sub> , V <sub>NC</sub> , V <sub>COM</sub>			0	V	MIN
				V <sub>+</sub>	V	MAX
On-Resistance	R <sub>ON</sub>	0 ≤ V <sub>NO</sub> or V <sub>NC</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = -10mA, Test Circuit 1	2.5		Ω	TYP
			3.7	4.5	Ω	MAX
On-Resistance Match between Channels	ΔR <sub>ON</sub>	0 ≤ V <sub>NO</sub> or V <sub>NC</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = -10mA, Test Circuit 1	0.1		Ω	TYP
			0.8	0.9	Ω	MAX
On-Resistance Flatness	R <sub>FLAT(ON)</sub>	0 ≤ V <sub>NO</sub> or V <sub>NC</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = -10mA, Test Circuit 1	0.75		Ω	TYP
			0.85	0.9	Ω	MAX
<b>Leakage Currents</b>						
Source Off Leakage Current	I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 4.5V/1V, V <sub>COM</sub> = 1V/4.5V, V <sub>+</sub> = 5.5V, Test Circuit 2	±5		nA	TYP
			±11	±1000	nA	MAX
Channel On Leakage Current	I <sub>NC(ON)</sub> , I <sub>NO(ON)</sub> , I <sub>COM(ON)</sub>	V <sub>NO</sub> or V <sub>NC</sub> = V <sub>COM</sub> = 1V or 4.5V, V <sub>+</sub> = 5.5V, Test Circuit 3	±5		nA	TYP
			±11	±1000	nA	MAX
<b>Digital Inputs</b>						
Input High Voltage	V <sub>INH</sub>			2.4	V	MIN
Input Low Voltage	V <sub>INL</sub>			0.8	V	MAX
Input Current	I <sub>INL</sub> or I <sub>INH</sub>	V <sub>IN</sub> = V <sub>INH</sub> or V <sub>INL</sub>	±0.01		μA	TYP
			±0.1	±1	μA	MAX
<b>Dynamic Characteristics</b>						
Turn-On Time	t <sub>ON</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 3V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Test Circuit 4	11		ns	TYP
Turn-Off Time	t <sub>OFF</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 3V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Test Circuit 4	30		ns	TYP
			8		ns	TYP
Charge Injection	Q	C <sub>L</sub> = 1.0nF, V <sub>S</sub> = 0V, R <sub>S</sub> = 0Ω, Test Circuit 5	3		pC	TYP
Break-Before-Make Time Delay	t <sub>D</sub>	V <sub>NO1</sub> or V <sub>NC1</sub> = V <sub>NO2</sub> or V <sub>NC2</sub> = 3V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Test Circuit 6	10		ns	TYP
Off Isolation	O <sub>ISO</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 7	f = 10MHz	-45	dB	TYP
			f = 1MHz	-65	dB	TYP
Channel-to-Channel Crosstalk (SGM3002 Only)	X <sub>TALK</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 8	f = 10MHz	-35	dB	TYP
			f = 1MHz	-55	dB	TYP
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, V <sub>COM</sub> = 3.5V <sub>P-P</sub> , R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50pF	0.006		%	TYP
-3dB Bandwidth	BW	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 9	120		MHz	TYP
Source Off Capacitance	C <sub>NC(OFF)</sub> , C <sub>NO(OFF)</sub>		14		pF	TYP
Channel On Capacitance	C <sub>NC(ON)</sub> , C <sub>NO(ON)</sub> , C <sub>COM(ON)</sub>		53		pF	TYP
<b>Power Requirements</b>						
Power Supply Current	I <sub>+</sub>	V <sub>+</sub> = 5.5V, V <sub>IN</sub> = 0V or 5V	0.001		μA	TYP
				1	μA	MAX

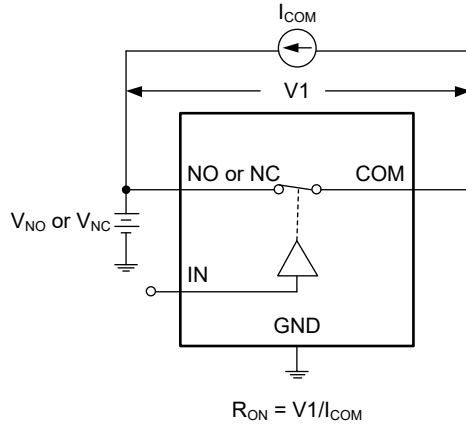
**ELECTRICAL CHARACTERISTICS (continued)**(V<sub>+</sub> = 3V ± 10%, GND = 0V, Full = -40°C to +125°C. Typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM3001/SGM3002			
			+25°C	-40°C to +125°C	UNITS	MIN/MAX
<b>Analog Switch</b>						
Analog Signal Range	V <sub>NO</sub> , V <sub>NC</sub> , V <sub>COM</sub>			0	V	MIN
				V <sub>+</sub>	V	MAX
On-Resistance	R <sub>ON</sub>	0 ≤ V <sub>NO</sub> or V <sub>NC</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = -10mA, Test Circuit 1	2.9	3	Ω	TYP
			4.4	6	Ω	MAX
On-Resistance Match between Channels	ΔR <sub>ON</sub>	0 ≤ V <sub>NO</sub> or V <sub>NC</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = -10mA, Test Circuit 1	0.1		Ω	TYP
			0.8	0.9	Ω	MAX
On-Resistance Flatness	R <sub>FLAT(ON)</sub>	0 ≤ V <sub>NO</sub> or V <sub>NC</sub> ≤ V <sub>+</sub> , I <sub>COM</sub> = -10mA, Test Circuit 1	0.9		Ω	TYP
			1	1.2	Ω	MAX
<b>Leakage Currents</b>						
Source Off Leakage Current	I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 3V/1V, V <sub>COM</sub> = 1V/3V, V <sub>+</sub> = 3.3V, Test Circuit 2	±7		nA	TYP
			±13	±1000	nA	MAX
Channel On Leakage Current	I <sub>NC(ON)</sub> , I <sub>NO(ON)</sub> , I <sub>COM(ON)</sub>	V <sub>NO</sub> or V <sub>NC</sub> = V <sub>COM</sub> = 1V or 3V, V <sub>+</sub> = 3.3V, Test Circuit 3	±7		nA	TYP
			±13	1000	nA	MAX
<b>Digital Inputs</b>						
Input High Voltage	V <sub>INH</sub>			2.0	V	MIN
Input Low Voltage	V <sub>INL</sub>			0.4	V	MAX
Input Current	I <sub>INL</sub> or I <sub>INH</sub>	V <sub>IN</sub> = V <sub>INH</sub> or V <sub>INL</sub>	±0.01		μA	TYP
			±0.1	±1	μA	MAX
<b>Dynamic Characteristics</b>						
Turn-On Time	t <sub>ON</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 2V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Test Circuit 4	12		ns	TYP
Turn-Off Time	SGM3001	V <sub>NO</sub> or V <sub>NC</sub> = 2V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Test Circuit 4	31		ns	TYP
	SGM3002		9		ns	TYP
Charge Injection	Q	C <sub>L</sub> = 1.0nF, V <sub>S</sub> = 0V, R <sub>S</sub> = 0Ω, Test Circuit 5	3		pC	TYP
Break-Before-Make Time Delay	t <sub>D</sub>	V <sub>NO1</sub> or V <sub>NC1</sub> = V <sub>NO2</sub> or V <sub>NC2</sub> = 2V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Test Circuit 6	11		ns	TYP
Off Isolation	O <sub>ISO</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 7	f = 10MHz	-45	dB	TYP
			f = 1MHz	-65	dB	TYP
Channel-to-Channel Crosstalk (SGM3002 Only)	X <sub>TALK</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 8	f = 10MHz	-35	dB	TYP
			f = 1MHz	-55	dB	TYP
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, V <sub>COM</sub> = 2V <sub>P-P</sub> , R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50pF	0.005		%	TYP
-3dB Bandwidth	BW	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 9	120		MHz	TYP
Source Off Capacitance	C <sub>NC(OFF)</sub> , C <sub>NO(OFF)</sub>		14		pF	TYP
Channel On Capacitance	C <sub>NC(ON)</sub> , C <sub>NO(ON)</sub> , C <sub>COM(ON)</sub>		53		pF	TYP
<b>Power Requirements</b>						
Power Supply Current	I <sub>+</sub>	V <sub>+</sub> = 3.3V, V <sub>IN</sub> = 0V or 3V	0.001		μA	TYP
				1	μA	MAX

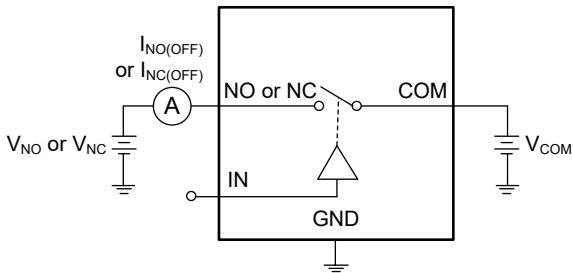
TYPICAL PERFORMANCE CHARACTERISTICS



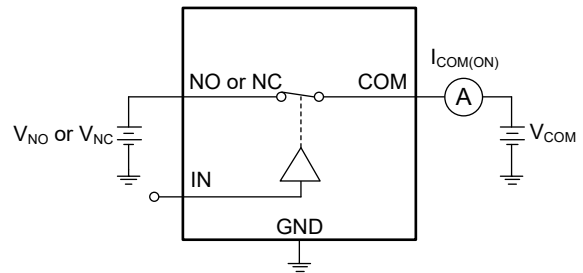
TEST CIRCUITS



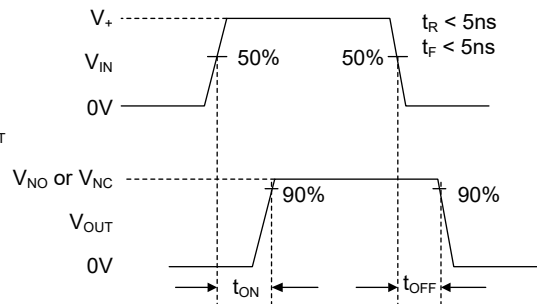
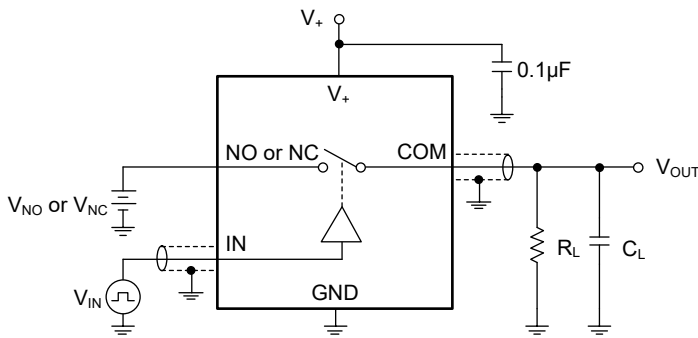
Test Circuit 1. On-Resistance



Test Circuit 2. Off Leakage

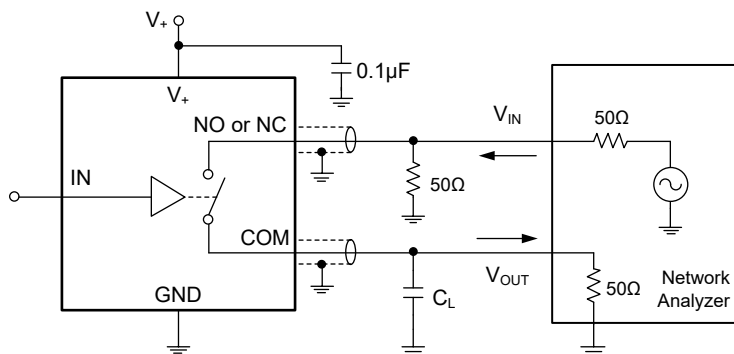
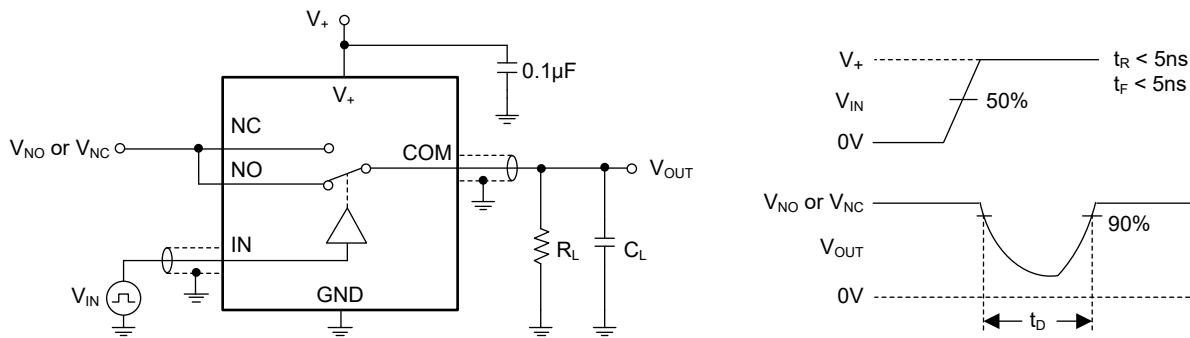
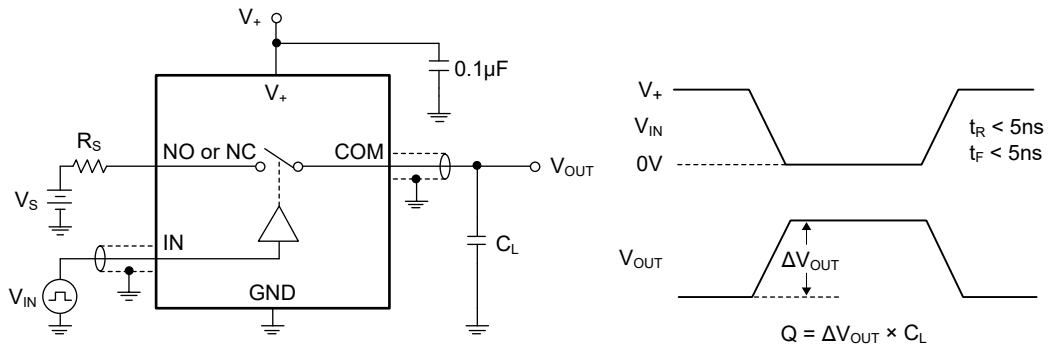


Test Circuit 3. On Leakage



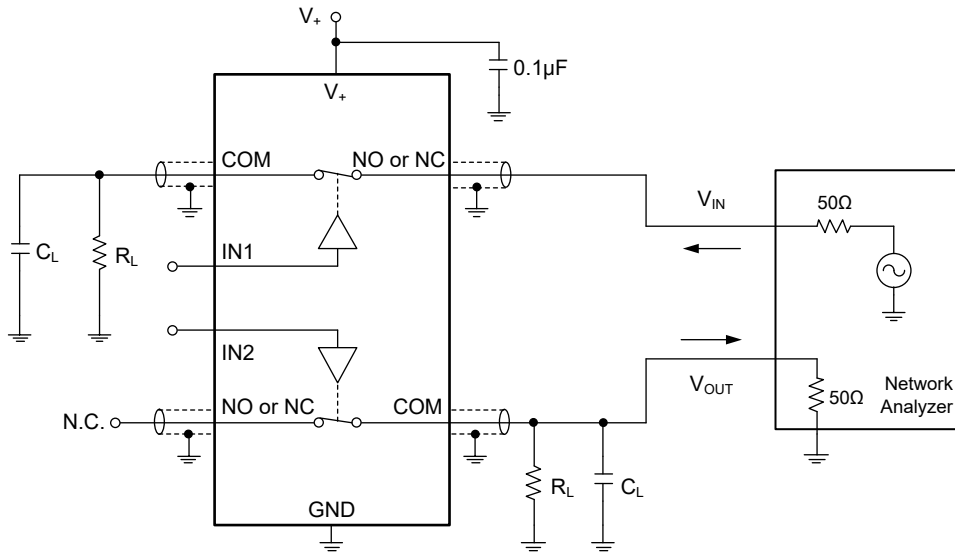
Test Circuit 4. Switching Times

TEST CIRCUITS (continued)



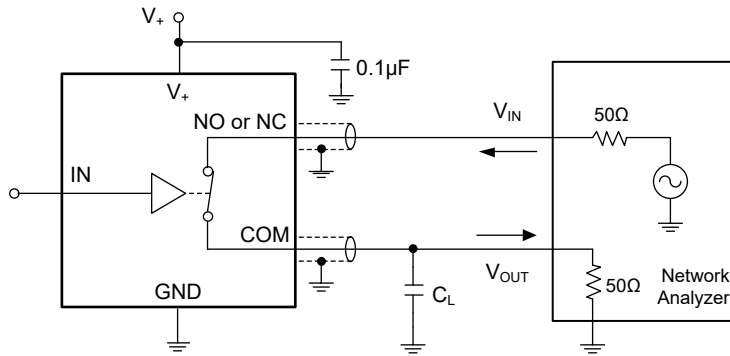


TEST CIRCUITS (continued)



$$\text{Channel-to-Channel Crosstalk} = -20 \log (V_{NO} \text{ or } V_{NC}/V_{OUT})$$

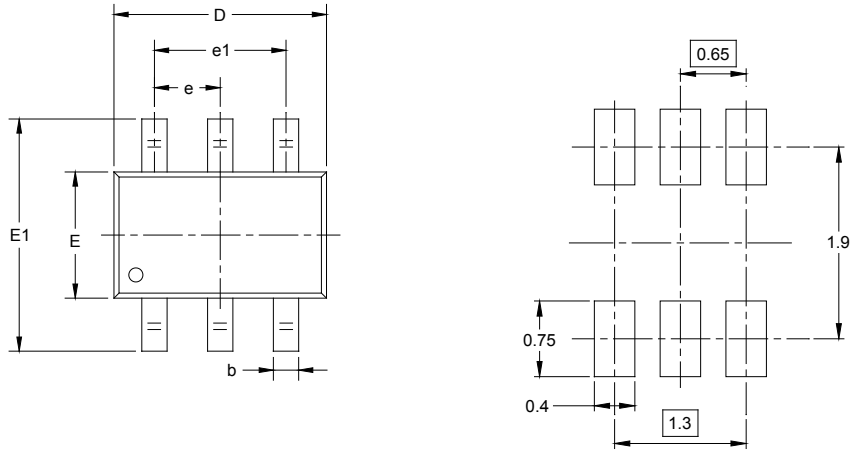
Test Circuit 8. Channel-to-Channel Crosstalk



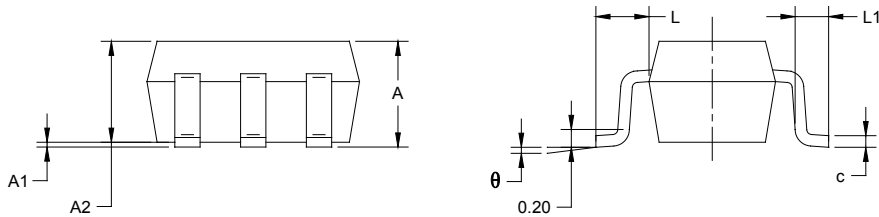
Test Circuit 9. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

SC70-6



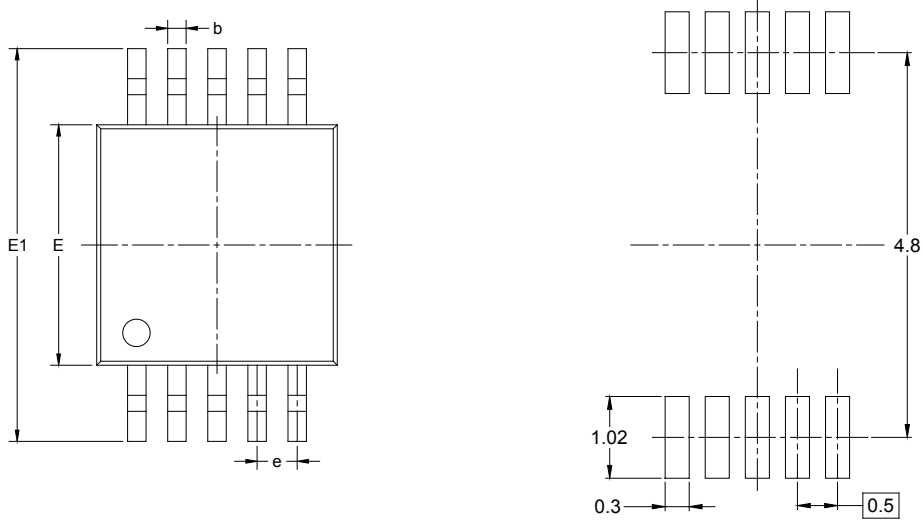
RECOMMENDED LAND PATTERN (Unit: mm)



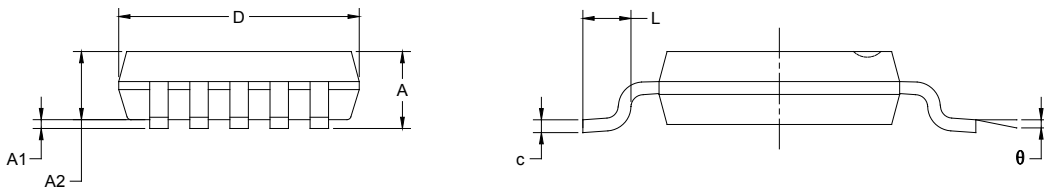
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026 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°

PACKAGE OUTLINE DIMENSIONS

MSOP-10



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.500 BSC		0.020 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

### KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SC70-6	7"	9.5	2.40	2.50	1.20	4.0	4.0	2.0	8.0	Q3
MSOP-10	13"	12.4	5.20	3.30	1.20	4.0	8.0	2.0	12.0	Q1

DD0001

# PACKAGE INFORMATION

## CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7" (Option)	368	227	224	8
7"	442	410	224	18
13"	386	280	370	5

DD0002