



# SGM4684

## Chip Scale Packaging, Low-Voltage 0.4Ω, Dual, SPDT Analog Switch

### GENERAL DESCRIPTION

The SGM4684 is a dual, SPDT (single-pole/double-throw) CMOS analog switch. It operates from a 1.8V to 5.5V single power supply.

The SGM4684 features ultra-low on-resistance, low voltage and fast switching times. The high performances make it very suitable for multiple applications, such as portable equipment, audio and video signal routing, etc. In addition, the SGM4684 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 SGM4684 is available in a Green WLCSP-2.0×1.5-10B package. It operates over an ambient temperature range of -40°C to +125°C.

### FEATURES

- **Single Supply Voltage Range: 1.8V to 5.5V**
- **Ultra Low On-Resistance: 0.4Ω (TYP) at 5V**
- **Low On-Resistance Flatness: 0.1Ω (TYP)**
- **Low On-Resistance Matching: 0.04Ω (TYP)**
- **-3dB Bandwidth: 13MHz**
- **Fast Switching Times at  $V_+ = 5V$ :**
  - $t_{ON}$ : 25ns
  - $t_{OFF}$ : 28ns
- **High Off-Isolation: -70dB at 100kHz**
- **Low Crosstalk: -100dB at 100kHz**
- **Low Power Consumption**
- **Break-Before-Make Switching**
- **TTL/CMOS Compatible**
- **Rail-to-Rail Input and Output Operation**
- **-40°C to +125°C Operating Temperature Range**
- **Available in a Green WLCSP-2.0×1.5-10B Package**

### APPLICATIONS

Cellular Phones  
Medical Equipment  
Computer Peripherals  
Portable Equipment  
Sample-and-Hold Circuits  
Battery-Powered Systems  
Audio and Video Signal Routing

**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM4684	WLCSP-2.0x1.5-10B	-40°C to +125°C	SGM4684XG/TR	XXXXX 4684XG	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 ..... ±300mA  
 Peak Current NO, NC, or COM ..... ±500mA  
 Junction Temperature ..... +150°C  
 Storage Temperature Range ..... -65°C to +150°C  
 Lead Temperature (Soldering, 10s) ..... +260°C  
 ESD Susceptibility  
 HBM ..... 2000V  
 MM ..... 400V

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.

**RECOMMENDED OPERATING CONDITIONS**

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

**OVERSTRESS CAUTION**

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

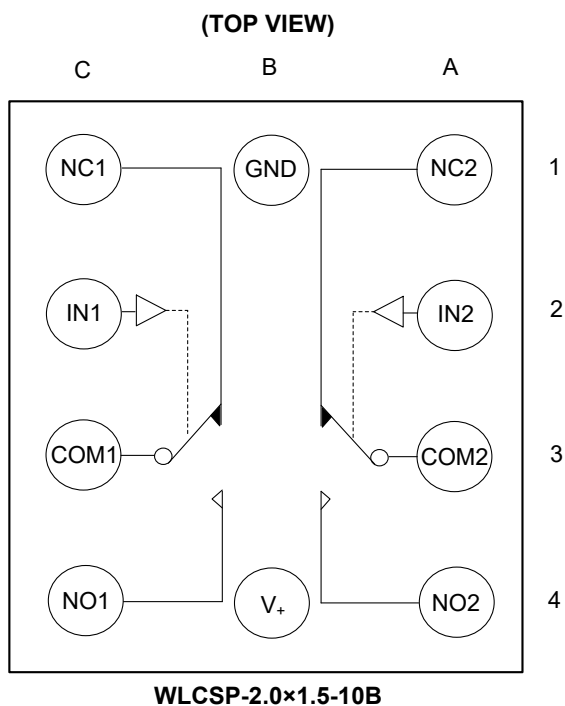
**ESD SENSITIVITY CAUTION**

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, specification or other related things if necessary without notice at any time.

**PIN CONFIGURATION**



**PIN DESCRIPTION**

PIN	NAME	FUNCTION
B4	V <sub>+</sub>	Positive Power Supply.
B1	GND	Ground
C2, A2	IN1, IN2	Digital Control Input Pins to Connect the COM Pins to the NO or NC Pins.
C3, A3	COM1, COM2	Common Pins.
C4, A4	NO1, NO2	Normally Open Pins.
C1, A1	NC1, NC2	Normally Closed Pins.

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

**FUNCTION TABLE**

LOGIC	NC1, NC2	NO1, NO2
0	ON	OFF
1	OFF	ON

## ELECTRICAL CHARACTERISTICS

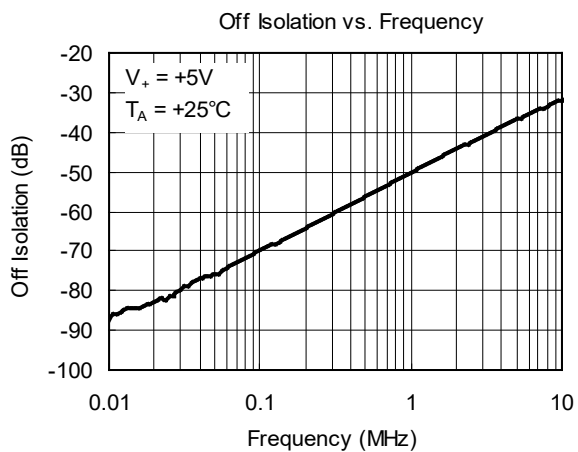
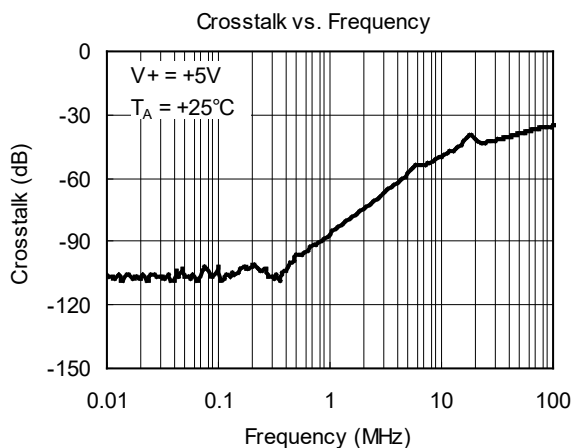
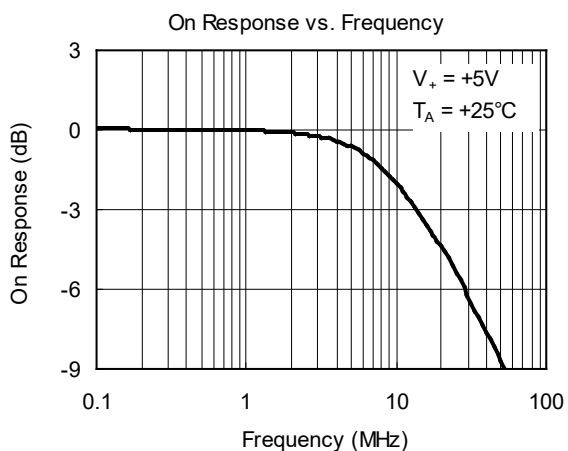
(V<sub>+</sub> = 5V ± 10%, GND = 0V, T<sub>A</sub> = -40°C to +125°C. Typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM4684			
			+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	0.4		Ω	TYP
			0.6	1.1	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	0.04		Ω	TYP
			0.08	0.12	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	0.1		Ω	TYP
			0.15	0.4	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	±4		nA	TYP
			±10	±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	±4		nA	TYP
			±10	±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	25		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	28		ns	TYP
Charge Injection	Q	C <sub>L</sub> = 1nF, 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 = 100kHz	-70	dB	TYP
			f = 10kHz	-85	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	0.07		%	TYP
Channel-to-Channel Crosstalk	X <sub>TALK</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 8	f = 100kHz	-100	dB	TYP
			f = 10kHz	-105	dB	TYP
-3dB Bandwidth	BW	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 9	13		MHz	TYP
Source Off Capacitance	C <sub>NC(OFF)</sub> , C <sub>NO(OFF)</sub>		94		pF	TYP
Channel On Capacitance	C <sub>NC(ON)</sub> , C <sub>NO(ON)</sub> , C <sub>COM(ON)</sub>		450		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

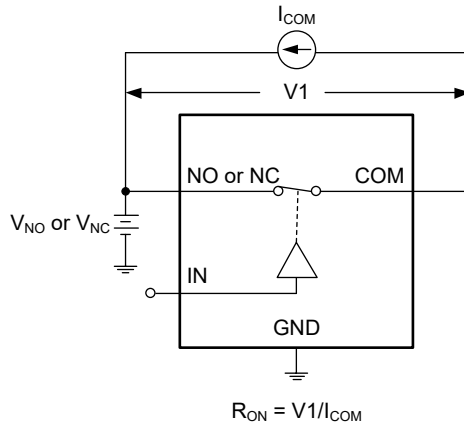
**ELECTRICAL CHARACTERISTICS (continued)**(V<sub>+</sub> = 3V ± 10%, GND = 0V, T<sub>A</sub> = -40°C to +125°C. Typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM4684			
			+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	0.6		Ω	TYP
			1.0	1.3	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	0.05		Ω	TYP
			0.1	0.13	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	0.25		Ω	TYP
			0.3	0.4	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	±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 3V, V <sub>+</sub> = 3.3V, Test Circuit 3	±5		nA	TYP
			±11	±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	30		ns	TYP
Turn-Off Time	t <sub>OFF</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 2V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Test Circuit 4	32		ns	TYP
Charge Injection	Q	C <sub>L</sub> = 1nF, V <sub>S</sub> = 0V, R <sub>S</sub> = 0Ω, Test Circuit 5	5		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 = 100kHz	-70	dB	TYP
			f = 10kHz	-85	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	0.065		%	TYP
Channel-to-Channel Crosstalk	X <sub>TALK</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 8	f = 100kHz	-100	dB	TYP
			f = 10kHz	-105	dB	TYP
-3dB Bandwidth	BW	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 9	13		MHz	TYP
Source Off Capacitance	C <sub>NC(OFF)</sub> , C <sub>NO(OFF)</sub>		94		pF	TYP
Channel On Capacitance	C <sub>NC(ON)</sub> , C <sub>NO(ON)</sub> , C <sub>COM(ON)</sub>		450		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

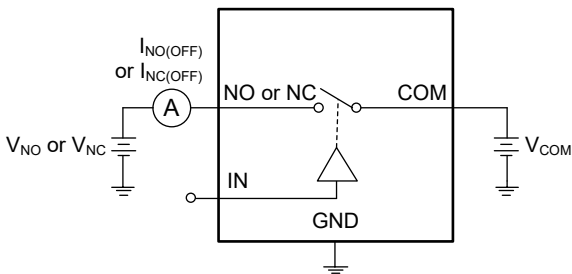
TYPICAL PERFORMANCE CHARACTERISTICS



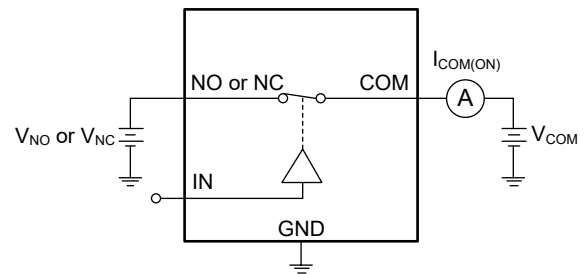
TEST CIRCUITS



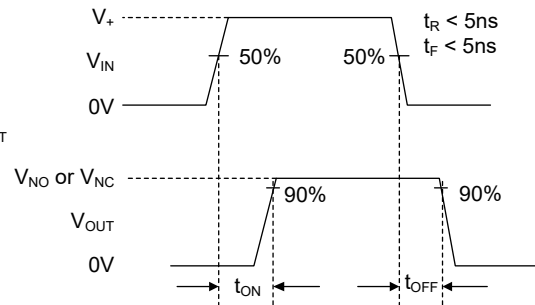
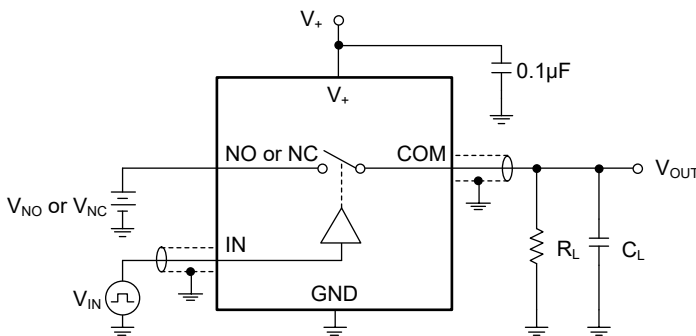
Test Circuit 1. On-Resistance



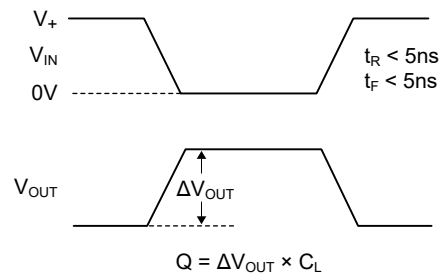
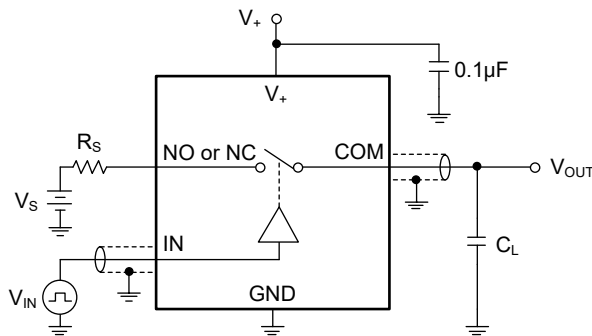
Test Circuit 2. Off Leakage



Test Circuit 3. On Leakage

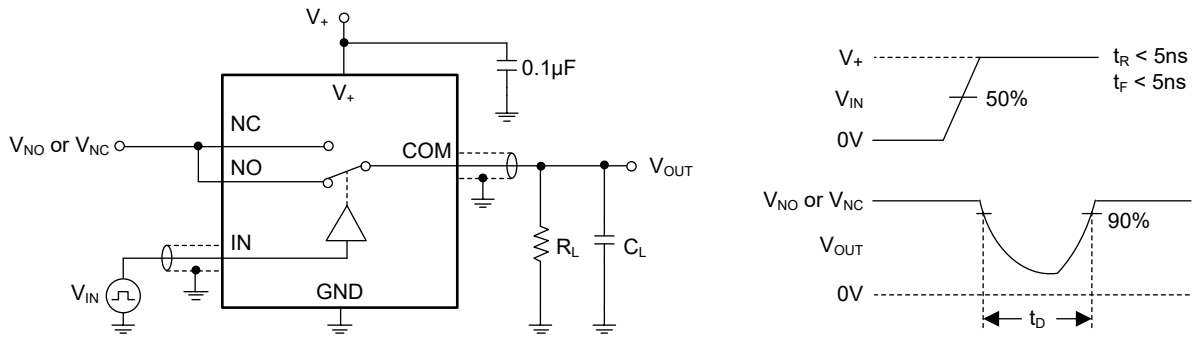


Test Circuit 4. Switching Times

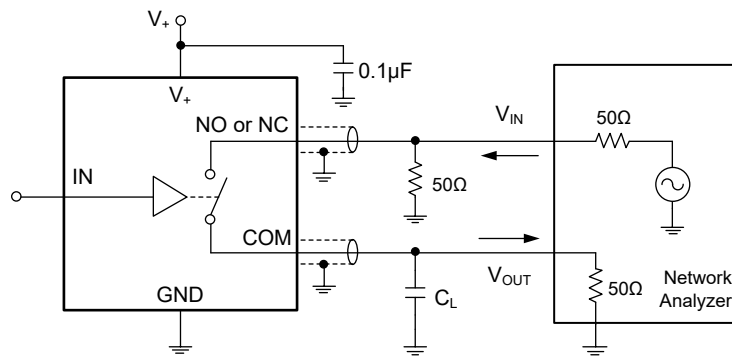


Test Circuit 5. Charge Injection

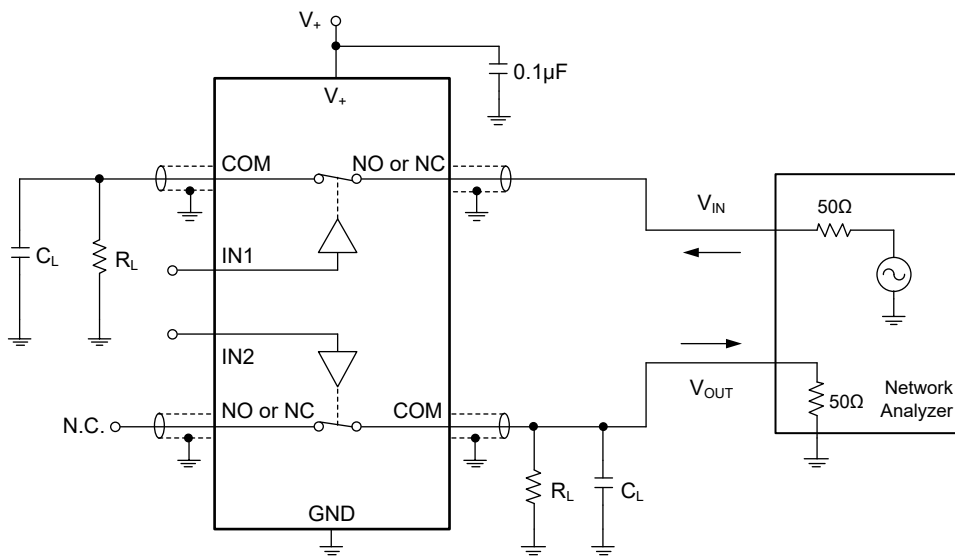
TEST CIRCUITS (continued)



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



Test Circuit 7. Off Isolation

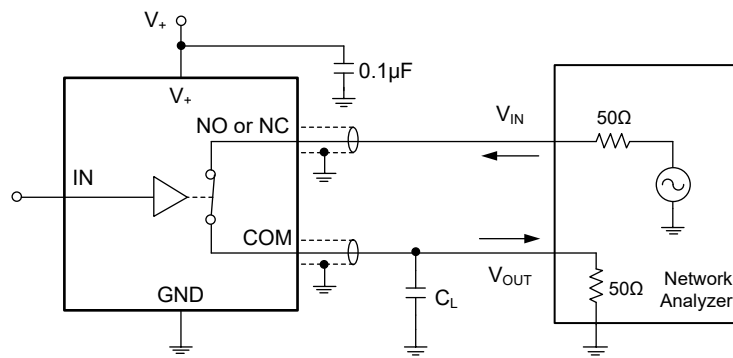


$$\text{Channel-to-Channel Crosstalk} = -20 \log (V_{NO} \text{ or } V_{NC}/V_{OUT})$$

Test Circuit 8. Channel-to-Channel Crosstalk



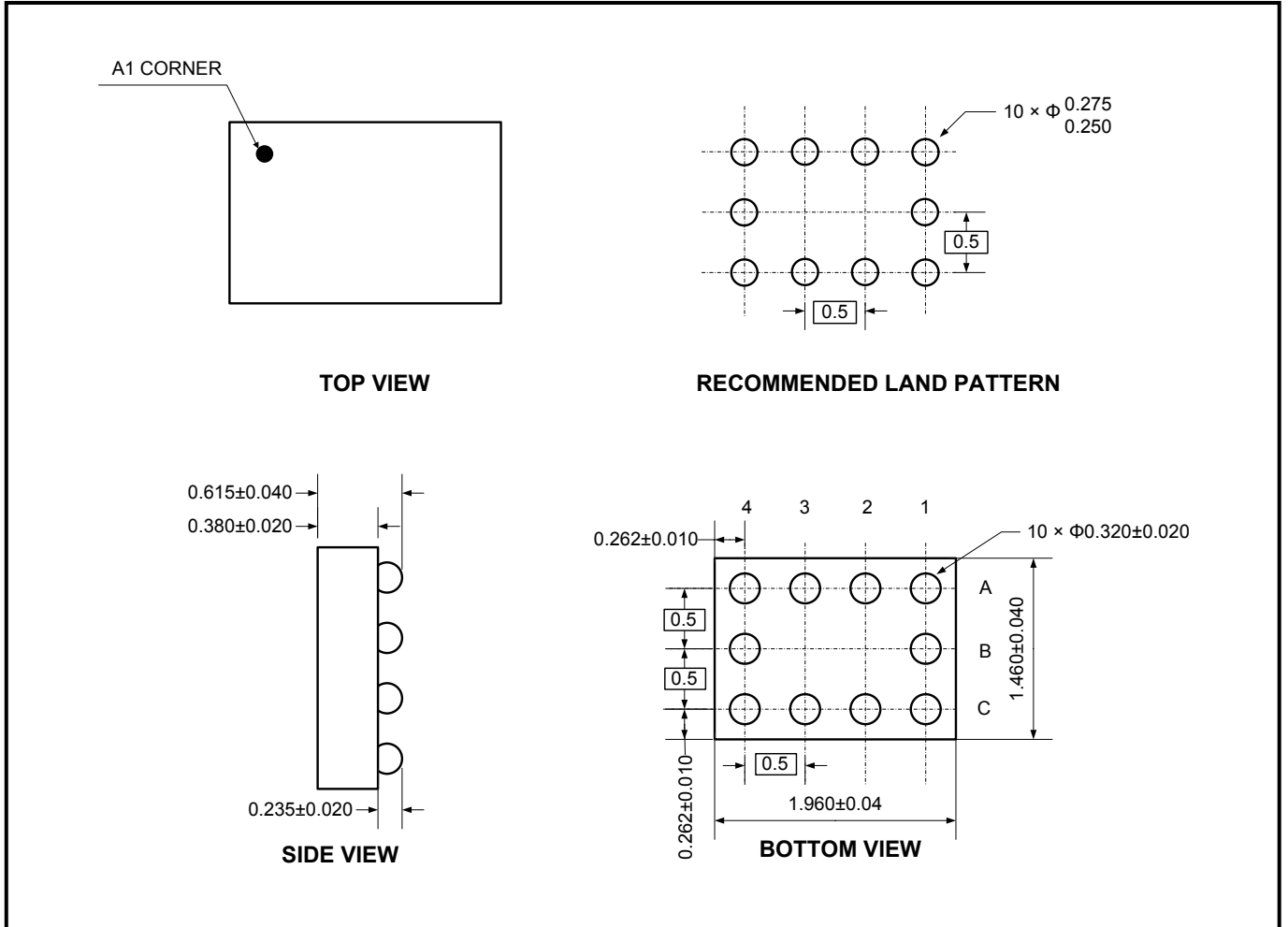
TEST CIRCUITS (continued)



Test Circuit 9. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

WLCSP-2.0x1.5-10B



NOTE: All linear dimensions are in millimeters.

# PACKAGE INFORMATION

## 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
WLCSP-2.0×1.5-10B	7"	9.2	1.70	2.20	0.90	4.0	4.0	2.0	8.0	Q2

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

DD0002