SGM4684

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

GENERAL DESCRIPTION

The SGM4684 is a dual, 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} (0.4Ω) and fast switching speeds (t_{ON} = 25 ns, t_{OFF} = 28 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.

The SGM4684 is a committed dual single-pole/double -throw (SPDT) that consist of two normally open (NO) and two normally close (NC) switches. This configuration can be used as a dual 2-to-1 multiplexer.

SGM4684 is available in a 10-ball Chip Scale Packaging (CSP)

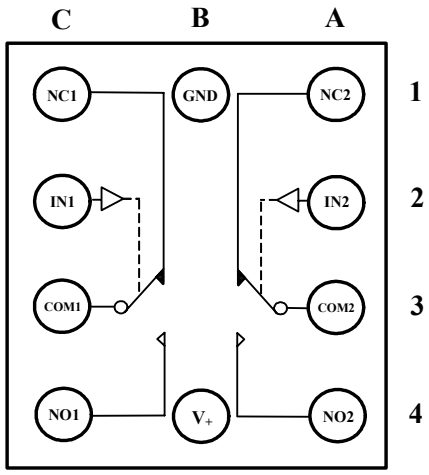
APPLICATIONS

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. 4Ω(TYP)**
- **Low On-Resistance Flatness**
- **–3 dB Bandwidth: 30 MHz**
- **Fast Switching Time**
  t_{ON} 25 ns
  t_{OFF} 28 ns
- **Rail-to-Rail Operation**
- **Typical Power Consumption (<0.01 μW)**
- **TTL/CMOS Compatible**
- **Chip Scale Packaging**

PIN CONFIGURATIONS/BLOCK DIAGRAM (top view) CSP



FUNCTION TABLE

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

ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM4684	**CSP-10**	**- 40°C to +125°C**	**SGM4684XG**	**4684XG**	**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
Lead Temperature (soldering, 10s).....+300°C
ESD.....2000V

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	FUNCTION
V_+	Power supply
GND	ground
IN1, IN2	Digital control pin to connect the COM terminal to the NO or NC terminals
COM1, COM2	Common terminal
NO1, NO2	Normally-open terminal
NC1, NC2	Normally-closed terminal

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	SGM4684			
			+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} = −10 mA, Test Circuit 1	0.4		Ω	TYP
			0.6	1.1	Ω	MAX
On-Resistance Match Between Channels	ΔR_{ON}	0 ≤ V_{NO} or V_{NC} ≤ V+, I_{COM} = −10 mA, Test Circuit 1	0.04		Ω	TYP
			0.08	0.12	Ω	MAX
On-Resistance Flatness	$R_{FLAT(ON)}$	0 ≤ V_{NO} or V_{NC} ≤ V+, I_{COM} = −10 mA, Test Circuit 1	0.1		Ω	TYP
			0.15	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_{INH}	±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	25		ns	TYP
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC} = 3V, R_L = 300Ω, C_L = 35pF, Test Circuit 4	28		ns	TYP
Charge Injection,	Q	C_L = 1.0nF, V_G = 0V, R_G = 0, Test Circuit 5	3		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	-75		dB	TYP
		f = 10KHz	-85		dB	TYP
Total Harmonic Distortion	THD	f = 20Hz to 20KHz, V_{COM} = 3.5V_{P-P}, R_L = 600Ω, C_L = 50pF	0.07		%	TYP
Channel-to-Channel Crosstalk	X_{TALK}	R_L = 50Ω, C_L = 5pF, Test Circuit 8 f = 100KHz	-100		dB	TYP
		f = 10KHz	-105		dB	TYP
Bandwidth –3 dB	BW	R_L = 50Ω, C_L = 5pF, Test Circuit 9	30		MHz	TYP
Source OFF Capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$		94		pF	TYP
Channel ON Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$		450		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

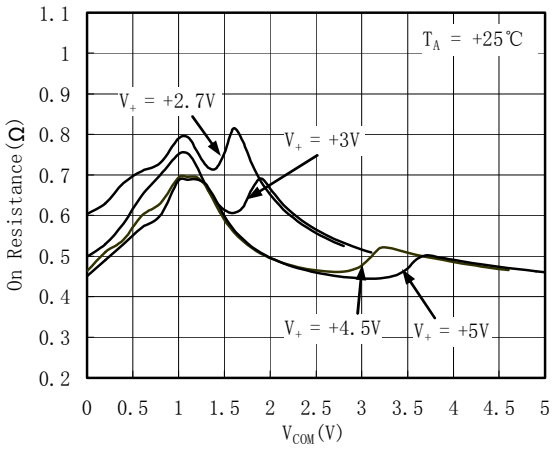
(V_+ = +3 V ± 10%, GND = 0 V, T_A = - 40°C to +125°C, unless otherwise noted. Typical values are at T_A = + 25°C.)

PARAMETER	SYMBOL	CONDITIONS	SGM4684			
			+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} = −10 mA, Test Circuit 1	0.6		Ω	TYP
			1.0	1.3	Ω	MAX
On-Resistance Match Between Channels	ΔR_{ON}	0 ≤ V_{NO} or V_{NC} ≤ V+, I_{COM} = −10 mA, Test Circuit 1	0.05		Ω	TYP
			0.1	0.13	Ω	MAX
On-Resistance Flatness	$R_{FLAT(ON)}$	0 ≤ V_{NO} or V_{NC} ≤ V+, I_{COM} = −10 mA, Test Circuit 1	0.25		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_{INH}	±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	30		ns	TYP
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC} = 2V, R_L = 300Ω, C_L = 35pF, Test Circuit 4	32		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} = 2V, R_L = 300Ω, C_L = 35pF, Test Circuit 6	11		ns	TYP
Off Isolation	O_{ISO}	R_L = 50Ω, C_L = 5pF, Test Circuit 7, f = 100KHz	-75		dB	TYP
		R_L = 50Ω, C_L = 5pF, Test Circuit 7, f = 10KHz	-85		dB	TYP
Total Harmonic Distortion	THD	f = 20Hz to 20KHz, V_{COM} = $2V_{P-P}$, R_L = 600Ω, C_L = 50pF	0.065		%	TYP
Channel-to-Channel Crosstalk	X_{TALK}	R_L = 50Ω, C_L = 5pF, Test Circuit 8, f = 100KHz	-100		dB	TYP
		R_L = 50Ω, C_L = 5pF, Test Circuit 8, f = 10KHz	-105		dB	TYP
Bandwidth –3 dB	BW	R_L = 50Ω, C_L = 5pF, Test Circuit 9	30		MHz	TYP
Source OFF Capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$		94		pF	TYP
Channel ON Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$		450		pF	TYP
POWER REQUIREMENTS						
Power Supply Current	I_+	V+ = +3.3V, V_{IN} = 0V or 3V	0.001		μA	TYP
				1	μA	MAX

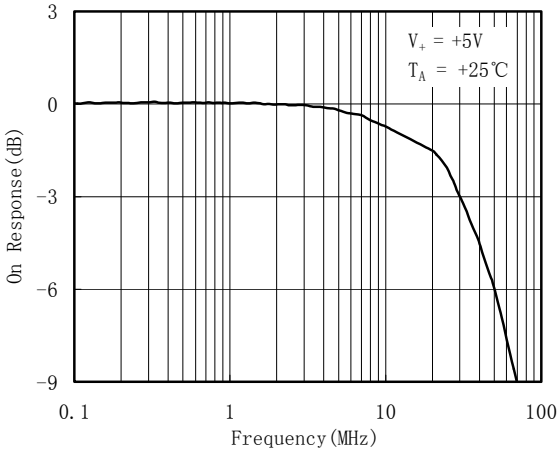
Specifications subject to change without notice.

TYPICAL PERFORMANCE CHARACTERISTICS

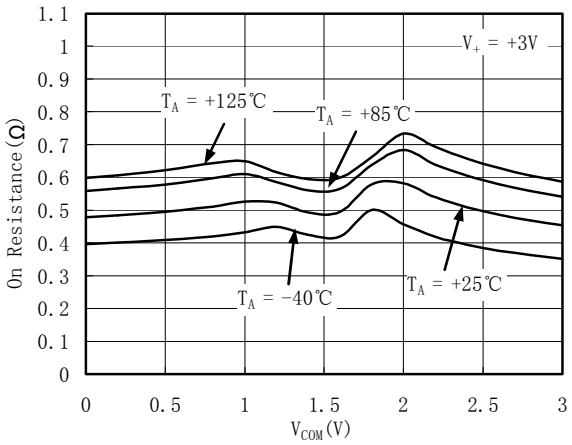
On Resistance vs. Supply Voltage vs. Switch Voltage



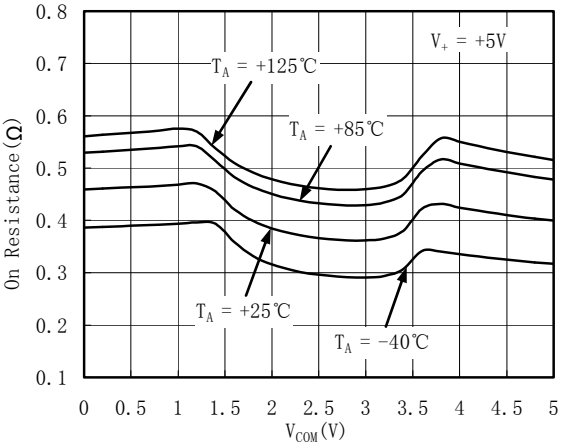
On Response vs. Frequency



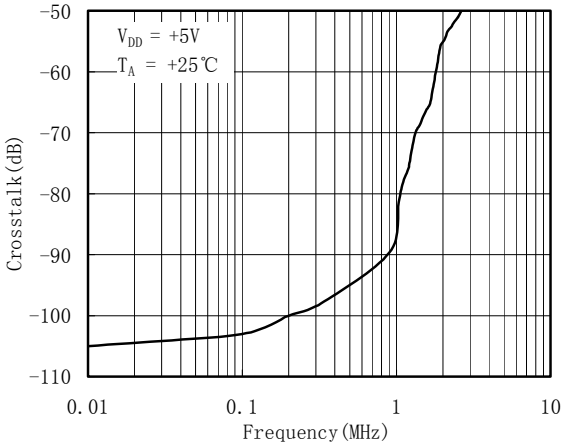
On Resistance vs. Switch Voltage



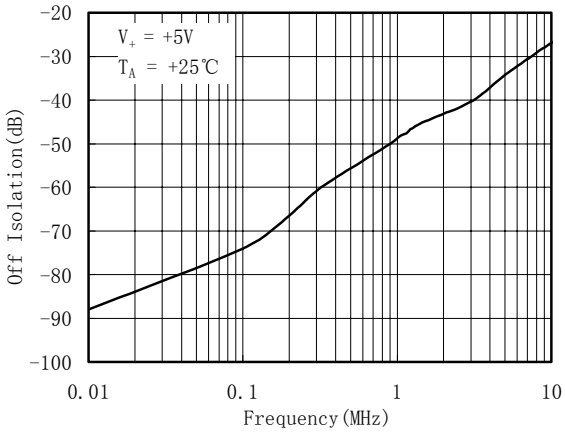
On Resistance vs. Switch Voltage



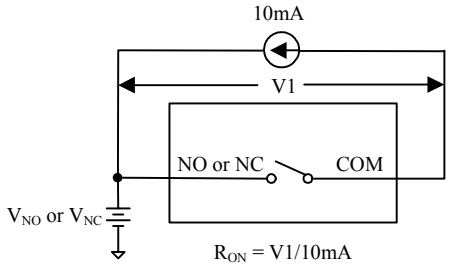
Crosstalk vs. Frequency



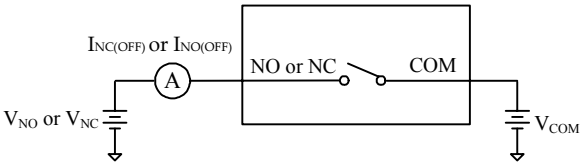
Off Isolation vs. Frequency



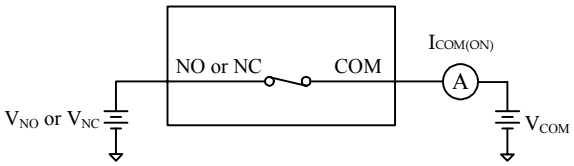
TEST CIRCUITS



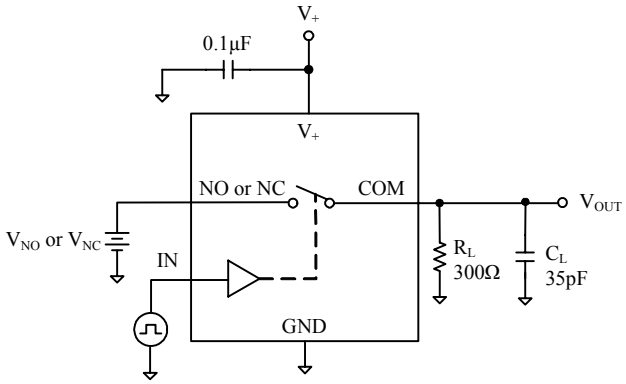
Test Circuit 1. On Resistance

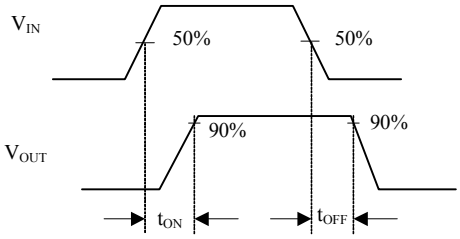


Test Circuit 2: Off Leakage

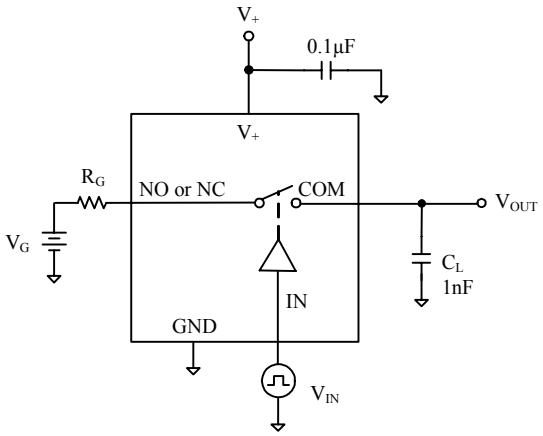


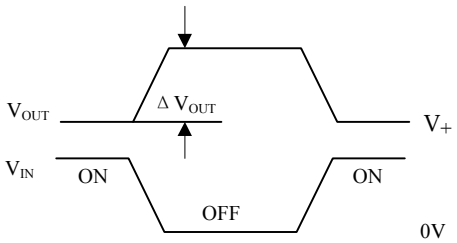
Test Circuit 3: On Leakage





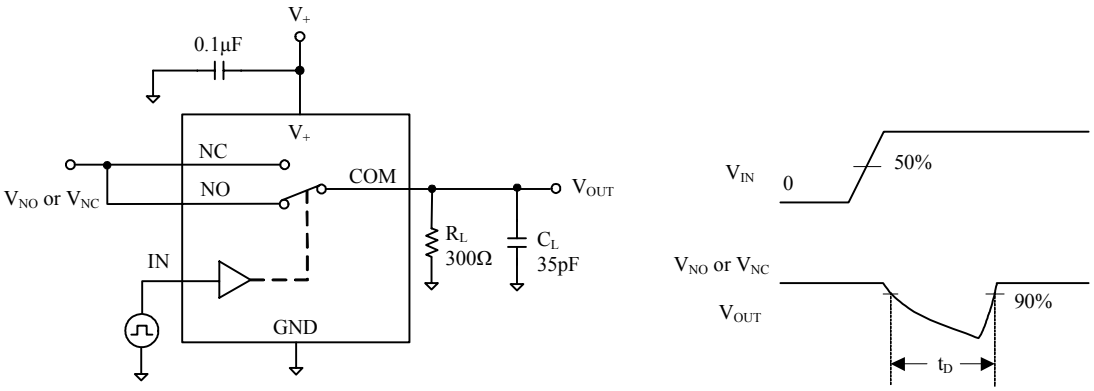
Test Circuit 4: Switching Times



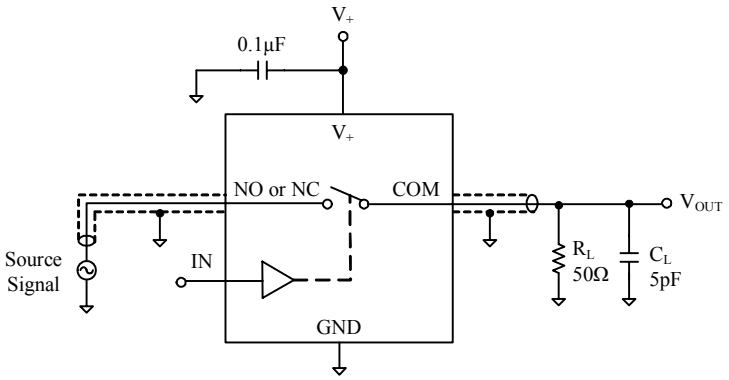


Test Circuit 5: Charge Injection

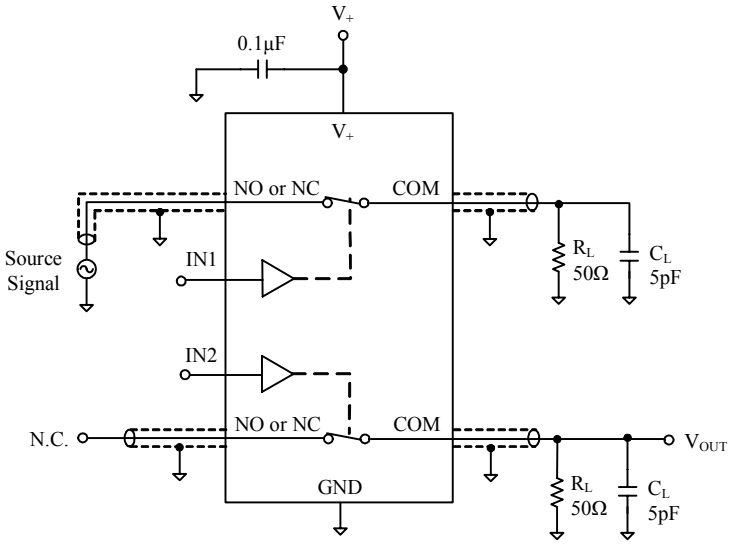
TEST CIRCUITS(Cont.)



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



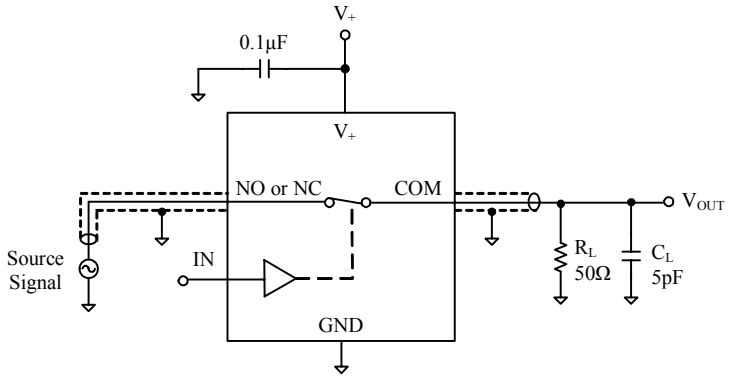
Test Circuit 7. Off Isolation



$$\text{Channel To Channel Crosstalk} = -20 \times \log \frac{V_{NO} \text{ or } V_{NC}}{V_{OUT}}$$

Test Circuit 8. Channel-to-Channel Crosstalk

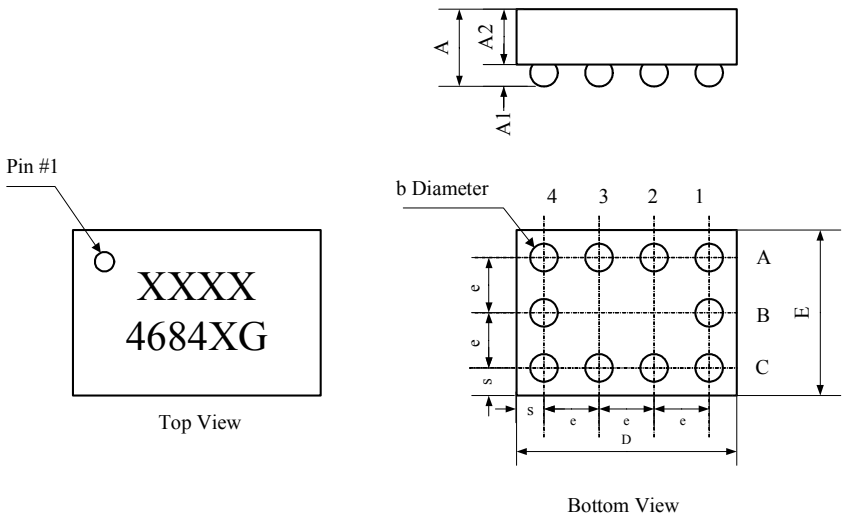
TEST CIRCUITS(Cont.)



Test Circuit 9. Bandwidth

PACKAGE OUTLINE DIMENSIONS

CSP-10



Symbol	Dimensions In Millimeters		
	Min	Nominal	Max
A	0.575	0.615	0.655
A1	0.215	0.235	0.255
A2	0.360	0.380	0.400
b	0.300	0.320	0.340
D	2.015	2.025	2.035
E	1.515	1.525	1.535
e	0.5 BASIC		
S	0.252	0.262	0.272