

# SGM4727

# 9Ω, 500MHz Bandwidth, Dual, SPDT Analog Switch

## GENERAL DESCRIPTION

The SGM4727 is a dual, bidirectional, single-pole/double-throw (SPDT) CMOS analog switches designed to operate from a single +1.8V to +5.5V supply. It features high-bandwidth (500MHz) and low ON-resistance (9Ω typ), Targeted applications for audio switching.

SGM4727 features guaranteed on-resistance matching (0.3Ω TYP) between switches and guaranteed on-resistance flatness over the signal range (2.5Ω TYP). This ensures excellent linearity and low distortion when switching audio signals.

The SGM4727 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.

SGM4727 is available in a CSP-10 package.

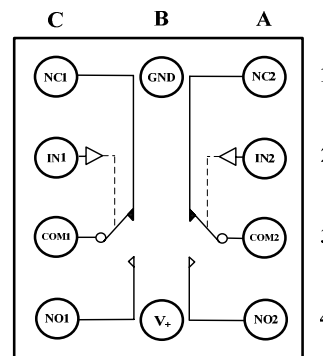
## APPLICATIONS

Portable Instrumentation  
Battery-Operated Equipment  
Computer Peripherals  
Cell Phones  
PDAs  
MP3s

## FEATURES

- Voltage Operation : 1.8 V to 5.5 V
- On-Resistance: 9Ω (typ) at 5.0V
- High Bandwidth: 500 MHz
- Fast Switching Time
  - TON 26 ns
  - TOFF 20 ns
- High Off-Isolation: 66dB at 10MHz
- Low Crosstalk: 105dB at 10MHz
- Rail-to-Rail Operation
- TTL/CMOS Compatible
- Break-Before-Make Switching
- Extended Industrial Temperature Range:
  - 40°C to 85°C
- Chip-Scale Package

## PIN CONFIGURATIONS (TOP VIEW)



## FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

Switches Shown For Logic "0" Input



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REV.A

# ELECTRICAL CHARACTERISTICS

( $V_+ = +2.7V$  to  $+3.6V$ ,  $V_{IH} = +1.4V$ ,  $V_{IL} = +0.5V$ ,  $T_A = -40^\circ C$  to  $+85^\circ C$ , Typical values are at  $V_+ = 3.0V$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TPY	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	$V_{NO}, V_{NC}, V_{COM}$		-40°C to +85°C	0		$V_+$	V
On-Resistance	$R_{ON}$	$V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1.5V,$ $I_{COM} = -10$ mA, Test Circuit 1	+25°C		14	25	$\Omega$
			-40°C to +85°C			28	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1.5V,$ $I_{COM} = -10$ mA, Test Circuit 1	+25°C		0.3	0.6	$\Omega$
			-40°C to +85°C			0.8	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1.0V, 1.5V,$ $2.0V, I_{COM} = -10$ mA, Test Circuit 1	+25°C		2.5	8	$\Omega$
			-40°C to +85°C			10	$\Omega$
Source OFF Leakage current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_+ = 3.6V, V_{NO}$ or $V_{NC} = 0.3V, 3.3V,$ $V_{COM} = 0.3V, 3.3V,$	-40°C to +85°C			1	$\mu A$
Channel ON Leakage current	$I_{NC(ON)}, I_{NO(ON)},$ $I_{COM(ON)}$	$V_+ = 3.6V, V_{COM} = 0.3V, 3.3V,$ $V_{NO}$ or $V_{NC} = 0.3V, 3.3V,$ or floating	-40°C to +85°C			1	$\mu A$
<b>DIGITAL INPUTS</b>							
Input High Voltage	$V_{INH}$		-40°C to +85°C	1			V
Input Low Voltage	$V_{INL}$		-40°C to +85°C			0.5	V
Input Leakage Current	$I_{IN}$	$V_+ = +3.6V, V_{IN} = 0$ or $3.6V$	-40°C to +85°C			1	$\mu A$
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	$t_{ON}$	$V_{NO}$ or $V_{NC} = 1.5V,$ $R_L = 300\Omega, C_L = 35pF,$ Test Circuit 2; $V_{IH} = 1.5V, V_{IL} = 0V$	+25°C		23		ns
Turn-Off Time	$t_{OFF}$	$V_{NO}$ or $V_{NC} = 1.5V,$ $R_L = 300\Omega, C_L = 35pF,$ Test Circuit 2; $V_{IH} = 1.5V, V_{IL} = 0V$	+25°C		22		ns
Break-Before-Make Time Delay	$t_d$	$V_{NO1}$ or $V_{NC1} = V_{NO2}$ or $V_{NC2} = 3V,$ $R_L = 300\Omega, C_L = 35pF,$ Test Circuit 3	+25°C		4		ns
Skew	$t_{SKEW}$	$R_S = 39\Omega, C_L = 50pF,$ Test Circuit 4	+25°C		5		ns
Off Isolation	$O_{ISO}$	$R_L = 50\Omega, C_L = 5pF,$ Signal = 0dBm, Test Circuit 5	f = 10MHz	+25°C		-65	dB
			f = 1MHz	+25°C		-86	dB
Channel-to-Channel Crosstalk	$X_{TALK}$	$R_L = 50\Omega, C_L = 5pF,$ Test Circuit 6	f = 10MHz	+25°C		-106	dB
			f = 1MHz	+25°C		-105	dB
Bandwidth -3 dB	BW	Signal = 0dBm, $R_L = 50\Omega, C_L = 5pF,$ Test Circuit 7	+25°C		500		MHz
Source OFF Capacitance	$C_{NC(OFF)}, C_{NO(OFF)}$	f = 1MHz	+25°C		5.5		pF
Channel ON Capacitance	$C_{NC(ON)}, C_{NO(ON)},$ $C_{COM(ON)}$	f = 1MHz	+25°C		9		pF
<b>POWER REQUIREMENTS</b>							
Power Supply Range	$V_+$		-40°C to +85°C	1.8		5.5	V
Power Supply Current	$I_+$	$V_+ = +5.5V, V_{IN} = 0V$ or $V_+$	-40°C to +85°C			5	$\mu A$

Specifications subject to change without notice.

# ELECTRICAL CHARACTERISTICS

(V<sub>+</sub> = +4.5V to +5.5V, V<sub>IH</sub> = +2.0 V, V<sub>IL</sub> = +0.6V, T<sub>A</sub> = - 40°C to +85°C, Typical values are at V<sub>+</sub> = 5.0V, T<sub>A</sub> = + 25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TPY	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	V <sub>NO</sub> , V <sub>NC</sub> , V <sub>COM</sub>		- 40°C to +85°C	0		V <sub>+</sub>	V
On-Resistance	R <sub>ON</sub>	V <sub>+</sub> = 4.5V, V <sub>NO</sub> or V <sub>NC</sub> = 3.5V, I <sub>COM</sub> = -10 mA, Test Circuit 1	+25°C		9	14	Ω
			- 40°C to +85°C			16	Ω
On-Resistance Match Between Channels	ΔR <sub>ON</sub>	V <sub>+</sub> = 4.5V, V <sub>NO</sub> or V <sub>NC</sub> = 3.5V, I <sub>COM</sub> = -10 mA, Test Circuit 1	+25°C		0.3	0.6	Ω
			- 40°C to +85°C			0.8	Ω
On-Resistance Flatness	R <sub>FLAT(ON)</sub>	V <sub>+</sub> = 4.5V, V <sub>NO</sub> or V <sub>NC</sub> = 1.0V, 2.0V, 3.5V, I <sub>COM</sub> = -10 mA, Test Circuit 1	+25°C		2	2.6	Ω
			- 40°C to +85°C			3	Ω
Source OFF Leakage current	I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	V <sub>+</sub> = 5.5V, V <sub>NO</sub> or V <sub>NC</sub> = 1.0V, 4.5V, V <sub>COM</sub> = 1.0V, 4.5V,	- 40°C to +85°C			1	μA
Channel ON Leakage current	I <sub>NC(ON)</sub> , I <sub>NO(ON)</sub> , I <sub>COM(ON)</sub>	V <sub>+</sub> = 5.5V, V <sub>COM</sub> = 1.0V, 4.5V, V <sub>NO</sub> or V <sub>NC</sub> = 1.0V, 4.5V, or floating	- 40°C to +85°C			1	μA
<b>DIGITAL INPUTS</b>							
Input High Voltage	V <sub>INH</sub>		- 40°C to +85°C	1.5			V
Input Low Voltage	V <sub>INL</sub>		- 40°C to +85°C			0.6	V
Input Leakage Current	I <sub>IN</sub>	V <sub>+</sub> = +5.5V, V <sub>IN</sub> = 0 or 5.5V	- 40°C to +85°C			1	μA
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 3.0V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Test Circuit 2; V <sub>IH</sub> = 1.5V, V <sub>IL</sub> = 0V	+25°C		26		ns
Turn-Off Time	t <sub>OFF</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 3.0V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Test Circuit 2; V <sub>IH</sub> = 1.5V, V <sub>IL</sub> = 0V	+25°C		20		ns
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 3	+25°C		4		ns
Skew	t <sub>SKEW</sub>	R <sub>S</sub> = 39Ω, C <sub>L</sub> = 50pF, Test Circuit 4	+25°C		5.8		ns
Off Isolation	O <sub>ISO</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Signal = 0dBm, Test Circuit 5	f = 10MHz	+25°C		-66	dB
			f = 1MHz	+25°C		-86	dB
Channel-to-Channel Crosstalk	X <sub>TALK</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 6	f = 10MHz	+25°C		-105	dB
			f = 1MHz	+25°C		-103	dB
Bandwidth -3 dB	BW	Signal = 0dBm, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 7	+25°C		500		MHz
Source OFF Capacitance	C <sub>NC(OFF)</sub> , C <sub>NO(OFF)</sub>	f = 1MHz	+25°C		5.5		pF
Channel ON Capacitance	C <sub>NC(ON)</sub> , C <sub>NO(ON)</sub> , C <sub>COM(ON)</sub>	f = 1MHz	+25°C		9		pF
<b>POWER REQUIREMENTS</b>							
Power Supply Range	V <sub>+</sub>		- 40°C to +85°C	1.8		5.5	V
Power Supply Current	I <sub>+</sub>	V <sub>+</sub> = +5.5V, V <sub>IN</sub> = 0V or V <sub>+</sub>	- 40°C to +85°C			5	μA

Specifications subject to change without notice.

## ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM4727	CSP-10	- 40°C to +85°C	SGM4727YG/TR	4727YG	Tape and Reel, 3000

## ABSOLUTE MAXIMUM RATINGS

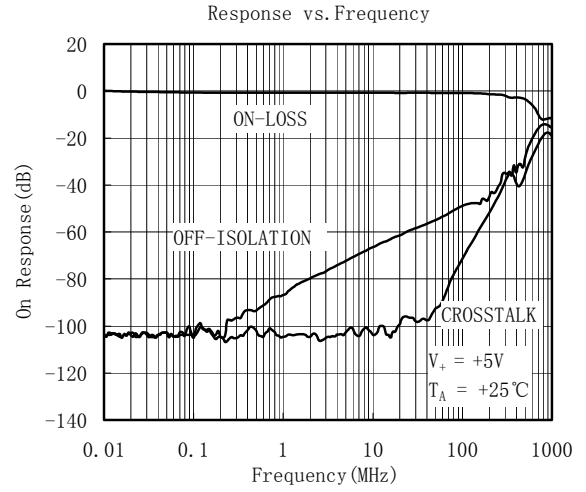
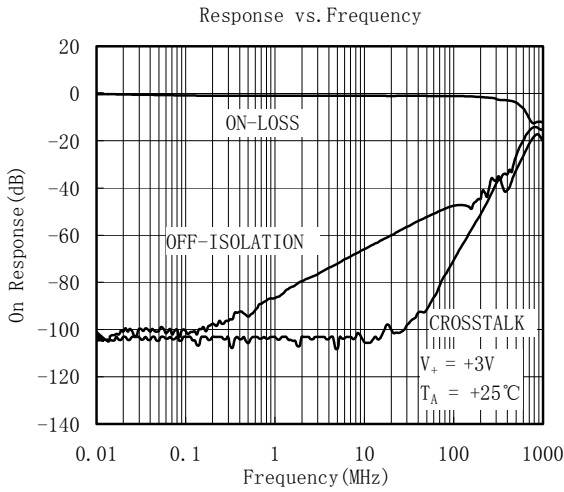
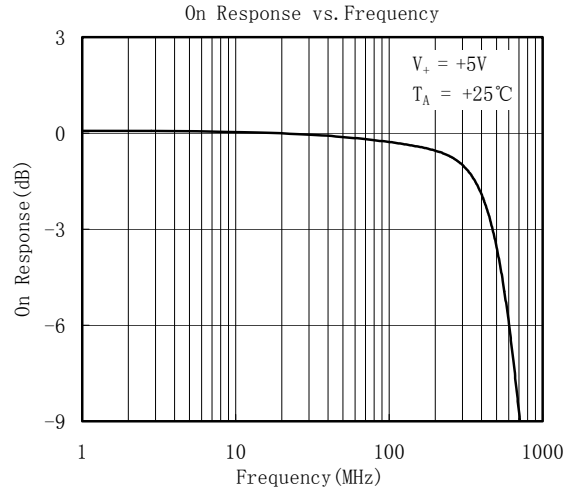
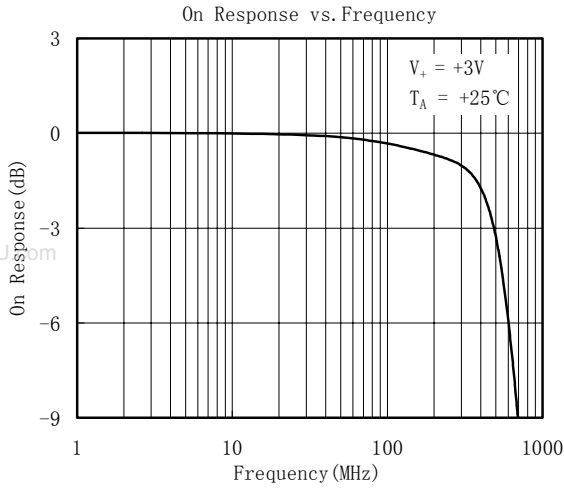
V<sub>+</sub>, IN to GND.....- 0.3V to +6V  
 Analog, Digital voltage range(1)..... - 0.3V to (V<sub>+</sub> + 0.3V)  
 Continuous Current NO, NC, or COM..... ± 120mA  
 Peak Current NO, NC, or COM..... ± 250mA  
 Operating Temperature Range.....- 40°C to +85°C

Junction Temperature.....+150°C  
 Storage Temperature.....- 65°C to +150°C  
 Lead Temperature (soldering, 10s).....+260°C  
 ESD(HBM).....2000V

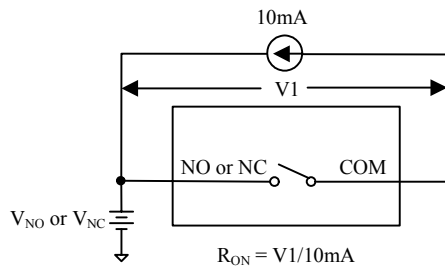
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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

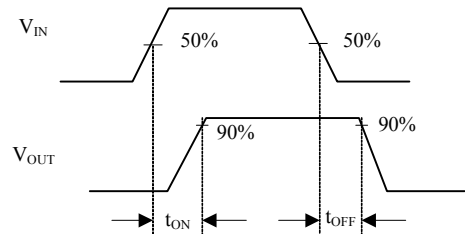
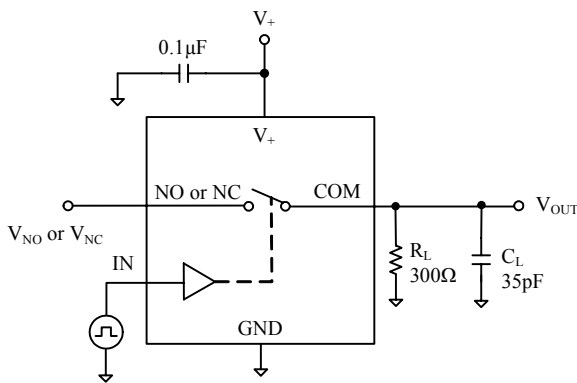
# TYPICAL PERFORMANCE CHARACTERISTICS



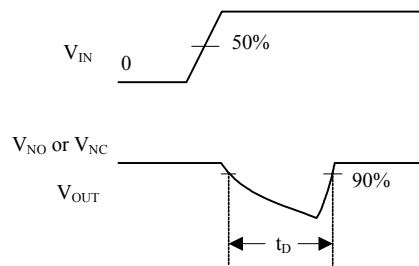
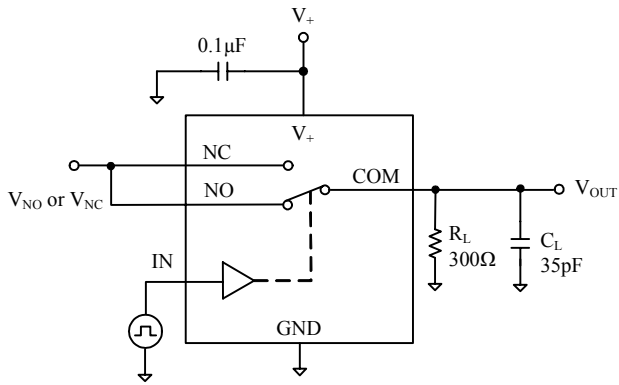
# TEST CIRCUITS



Test Circuit 1. On Resistance

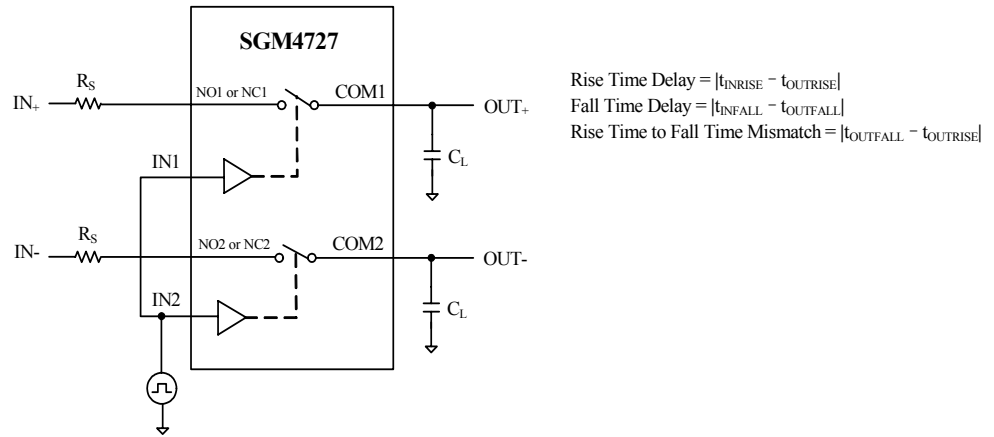


Test Circuit 2. Switching Times

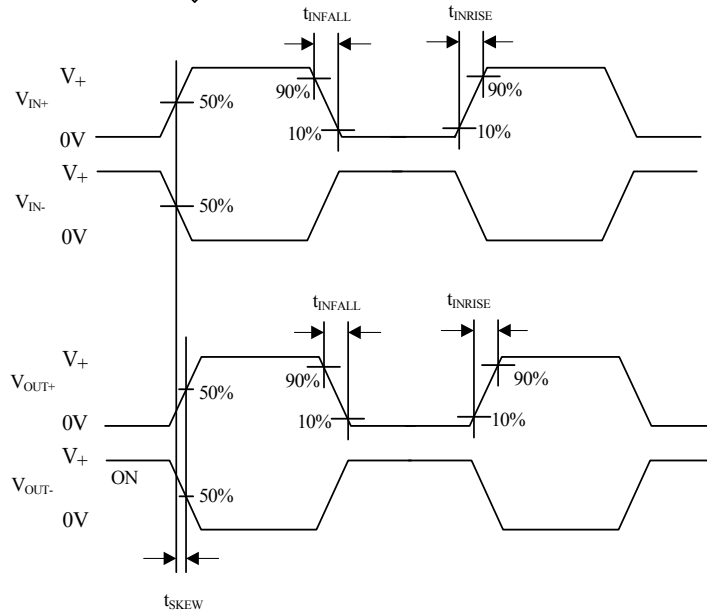


Test Circuit 3. Break-Before-Make Time Delay,  $t_D$

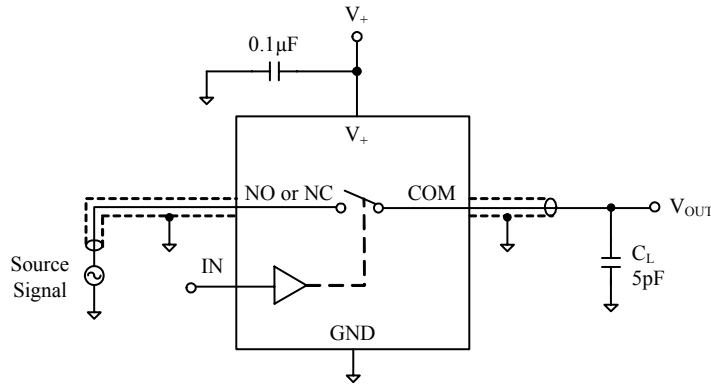
# TEST CIRCUITS (Cont.)



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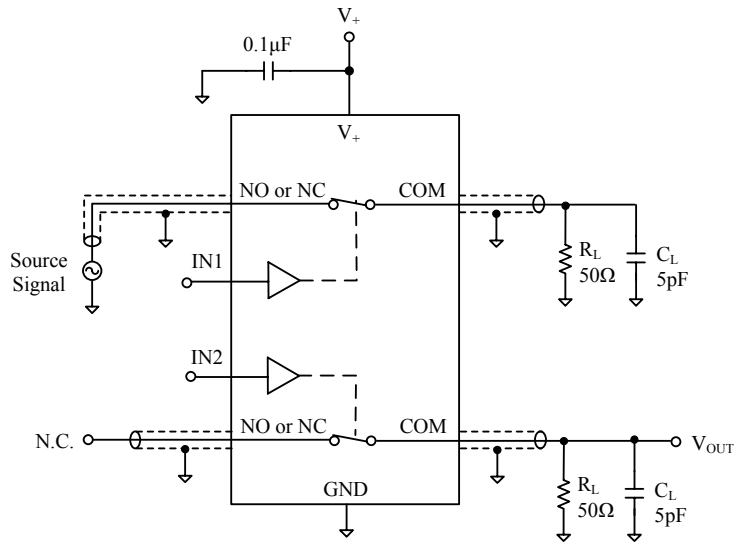
Test Circuit 4. Output Signal Skew



Test Circuit 5. Off Isolation

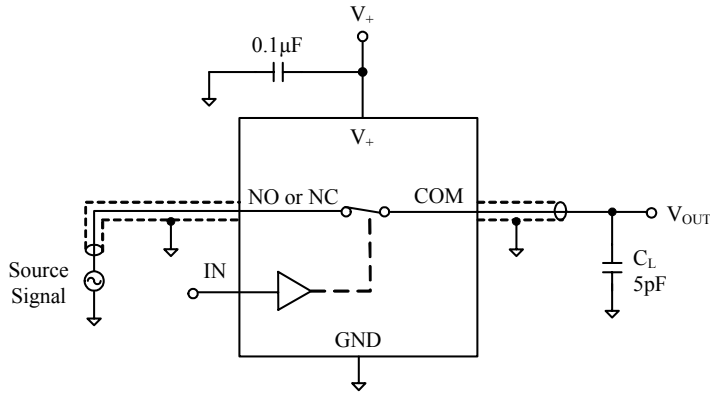
# TEST CIRCUITS (Cont.)

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

Test Circuit 6. Channel-to-Channel Crosstalk

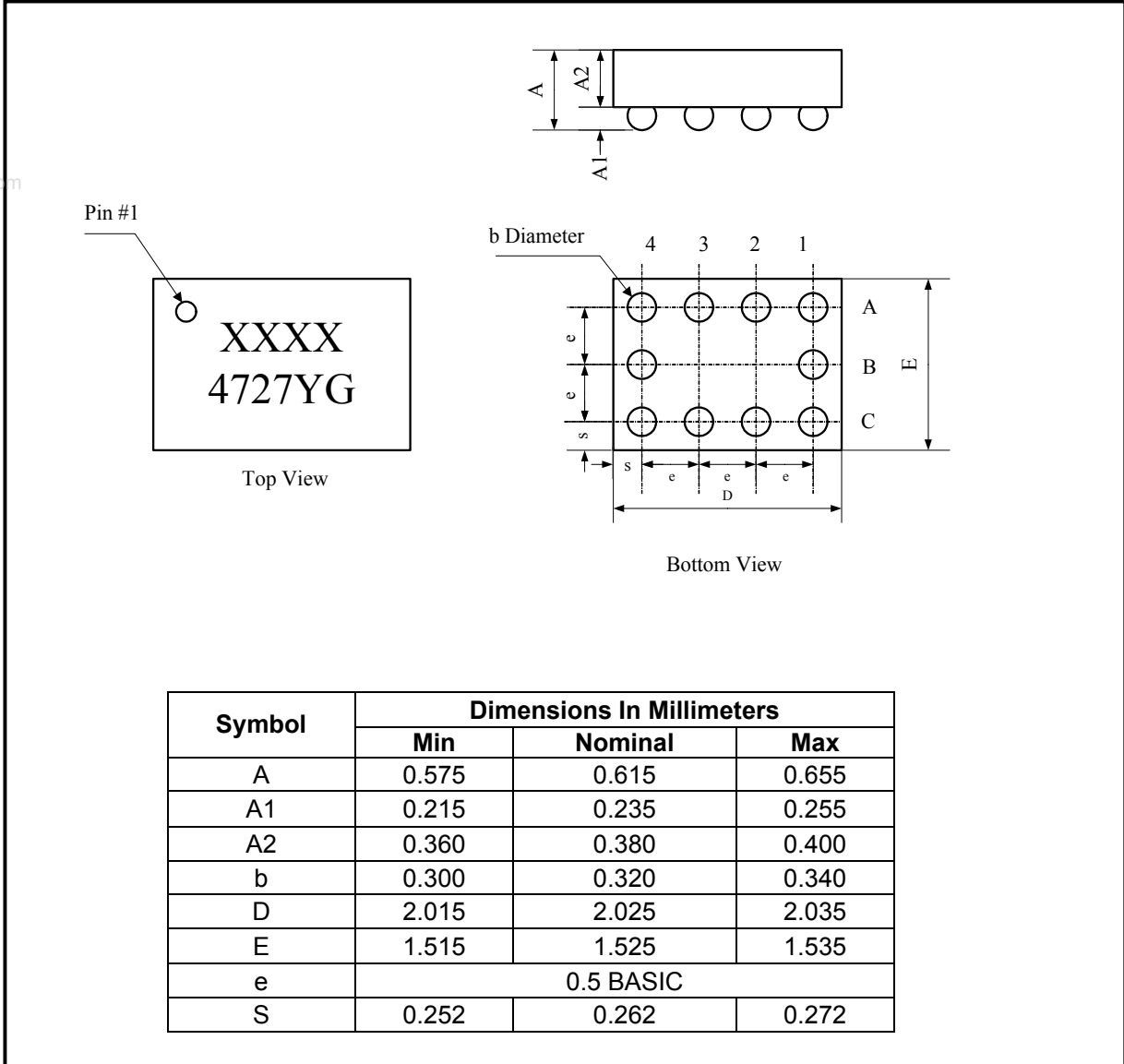


Test Circuit 7. Bandwidth



# PACKAGE OUTLINE DIMENSIONS

## CSP-10



## REVISION HISTORY

Location	Page
<b>10/07— Data Sheet changed from Preliminary Data sheet to REV.A</b>	
Changes to TYPICAL PERFORMANCE CHARACTERISTICS .....	5

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