SGM4727
9Ω, 500MHz Bandwidth, Dual, SPDT Analog Switch

GENERAL DESCRIPTION

The SGM4727 is a dual, bidirectional, single-pole/ double-throw (SPDT) CMOS analog switch designed to operate from a single +1.8V to +5.5V power 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

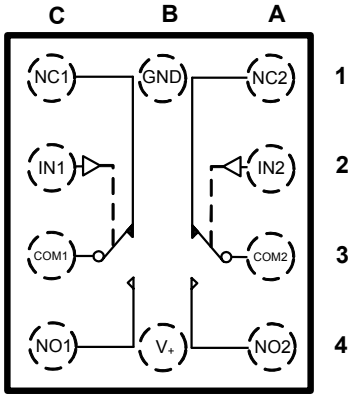
Portable Instrumentation
Battery-Operated Equipment
Computer Peripherals
Cell Phones
PDAs
MP3s

FEATURES

- **Voltage Operation: 1.8V to 5.5V**
- **On-Resistance: 9Ω (TYP) at 5.0V**
- **High Bandwidth: 500MHz**
- **Fast Switching Times**
  - **t_{ON} 26ns**
  - **t_{OFF} 20ns**
- **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℃ to +85℃**
- **Chip-Scale Package**

PIN CONFIGURATION (TOP VIEW)

SGM4727YG



CSP-10

FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

Switches Shown For Logic “0” Input.

ORDERING INFORMATION

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

ABSOLUTE MAXIMUM RATINGS

V_+, IN to GND.....-0.3V to 6V
Analog, Digital voltage range (1)..... -0.3V to (V_+) + 0.3V
Continuous Current NO, NC, or COM.....±30mA
Peak Current NO, NC, or COM.....±50mA
Operating Temperature Range.....-40℃ to +85℃
Junction Temperature.....150℃
Storage Temperature.....- 65℃ to +150℃
Lead Temperature (soldering, 10s).....260℃
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+ 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	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 terminals may be an input or output.

ELECTRICAL CHARACTERISTICS

(V_+ = +4.5V to +5.5V, V_{IH} = +2.0V, V_{IL} = +0.6V, T_A = - 40℃ to +85℃. Typical values are at V_+ = +5.0V, T_A = + 25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			-40℃ to +85℃	0		V_+	V
On-Resistance	R_{ON}	V_+ = 4.5V, V_{NO} or V_{NC} = 3.5V, I_{COM} = -10mA, Test Circuit 1		+25℃		9	14	Ω
				-40℃ to +85℃			16	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 4.5V, V_{NO} or V_{NC} = 3.5V, I_{COM} = -10mA, Test Circuit 1		+25℃		0.3	0.6	Ω
				-40℃ to +85℃			0.8	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 4.5V, V_{NO} or V_{NC} = 1.0V, 2.0V, 3.5V, I_{COM} = -10mA, Test Circuit 1		+25℃		2	2.6	Ω
				-40℃ to +85℃			3	Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 5.5V, V_{NO} or V_{NC} = 1.0V, 4.5V, V_{COM} = 4.5V, 1.0V		-40℃ to +85℃			1	μA
Channel ON Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_+ = 5.5V, V_{COM} = 1.0V, 4.5V, V_{NO} or V_{NC} = 1.0V, 4.5V, or floating		-40℃ to +85℃			1	μA
DIGITAL INPUTS								
Input High Voltage	V_{INH}			-40℃ to +85℃	1.5			V
Input Low Voltage	V_{INL}			-40℃ to +85℃			0.6	V
Input Leakage Current	I_{IN}	V_+ = 5.5V, V_{IN} = 0V or 5.5V		-40℃ to +85℃			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 3.0V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2		+25℃		26		ns
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC} = 3.0V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2		+25℃		20		ns
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 3		+25℃		4		ns
Skew	t_{SKEW}	R_S = 39Ω, C_L = 50pF, Test Circuit 4		+25℃		5.8		ns
Off Isolation	O_{ISO}	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 5	f = 10MHz	+25℃		-66		dB
			f = 1MHz	+25℃		-86		dB
Channel-to-Channel Crosstalk	X_{TALK}	R_L = 50Ω, C_L = 5pF, Test Circuit 6	f = 10MHz	+25℃		-105		dB
			f = 1MHz	+25℃		-103		dB
–3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 7		+25℃		500		MHz
Source OFF Capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	f = 1MHz		+25℃		5.5		pF
Channel ON Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$	f = 1MHz		+25℃		9		pF
POWER REQUIREMENTS								
Power Supply Range	V_+			- 40℃ to +85℃	1.8		5.5	V
Power Supply Current	I_+	V_+ = 5.5V, V_{IN} = 0V or V_+		- 40℃ to +85℃			5	μA

Specifications subject to changes without notice.

ELECTRICAL CHARACTERISTICS

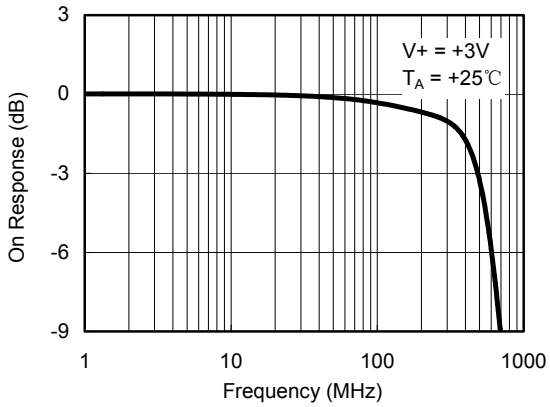
(V_+ = +2.7V to +3.6V, V_{IH} = +1.4V, V_{IL} = +0.5V, T_A = -40℃ to +85℃. Typical values are at V_+ = +3.0V, T_A = + 25℃, unless otherwise noted.)

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

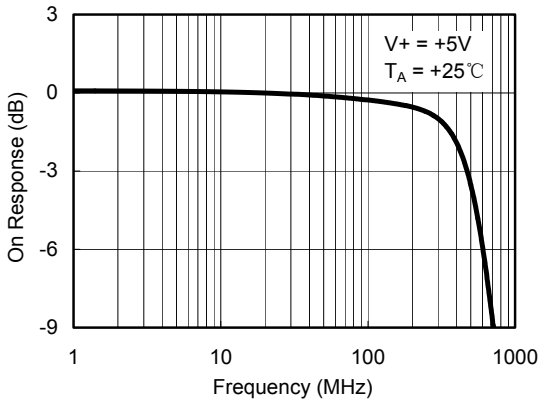
Specifications subject to changes without notice.

TYPICAL PERFORMANCE CHARACTERISTICS

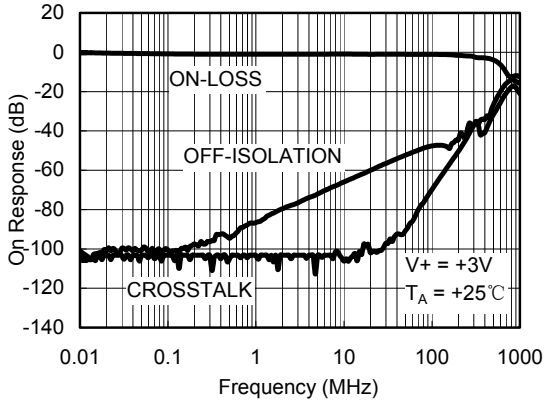
On Response vs. Frequency



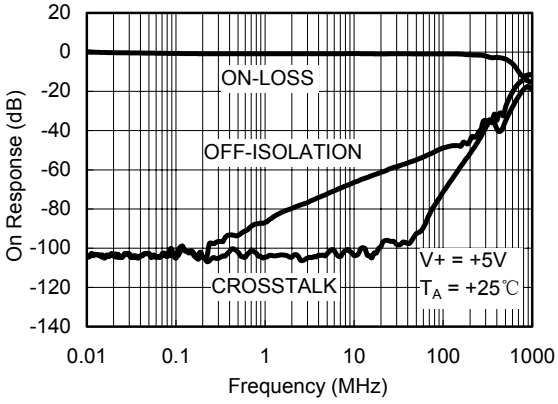
On Response vs. Frequency



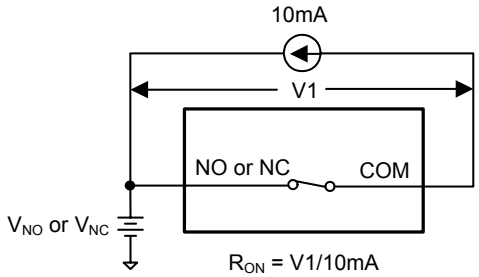
Response vs. Frequency



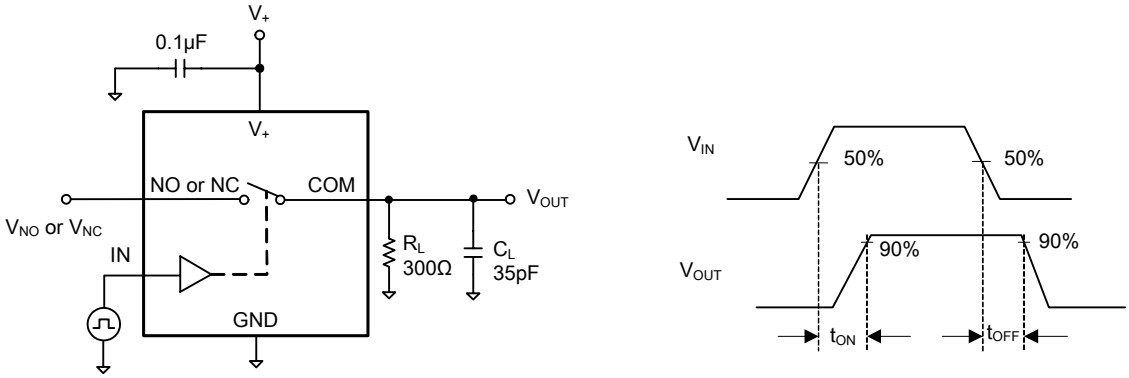
Response vs. Frequency



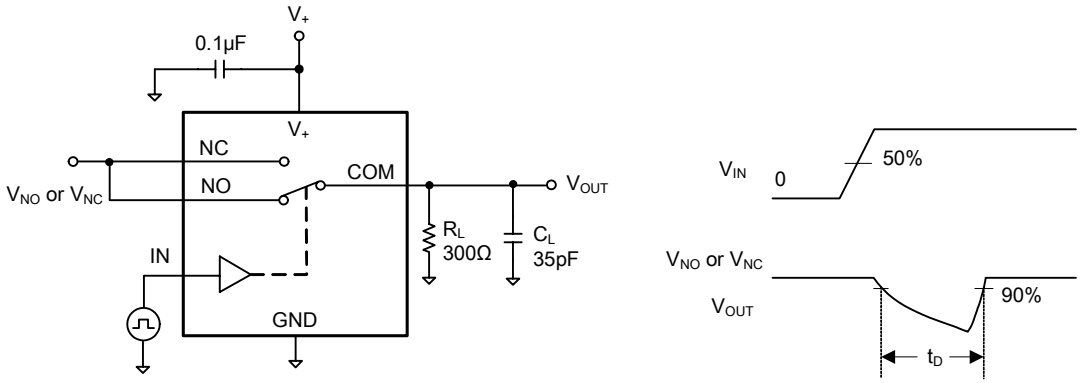
TEST CIRCUITS



Test Circuit 1. On Resistance

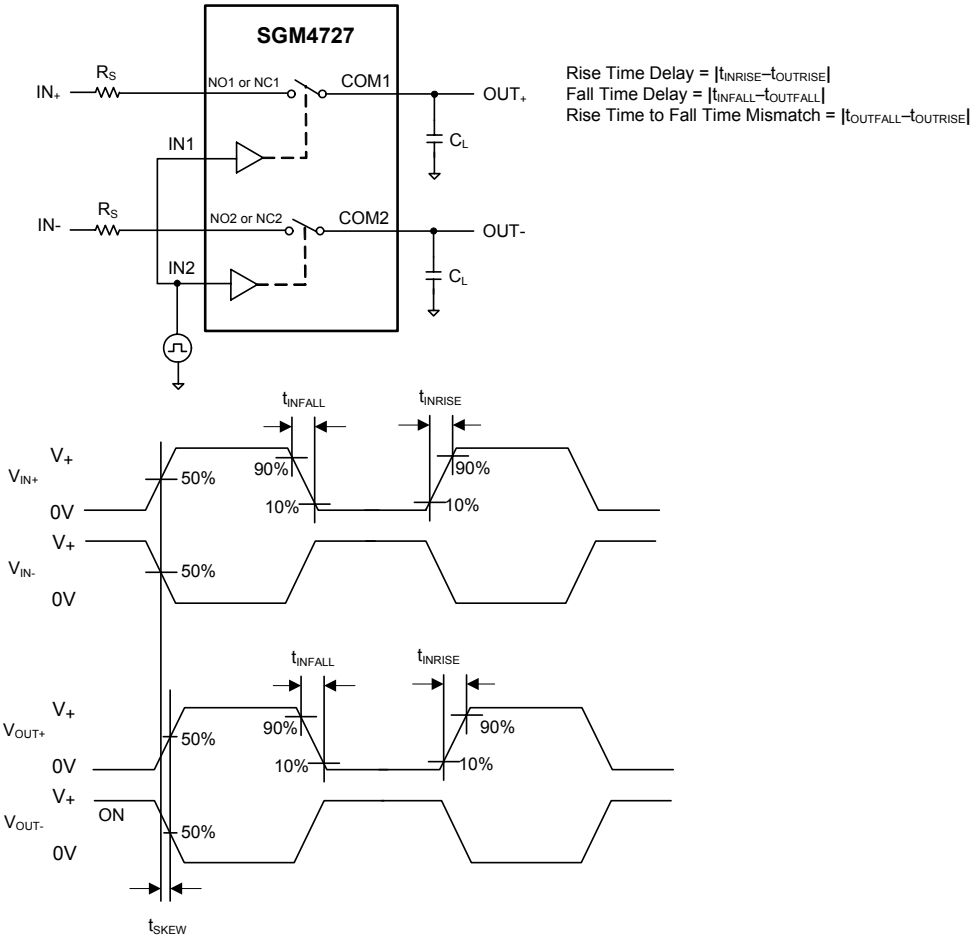


Test Circuit 2. Switching Times

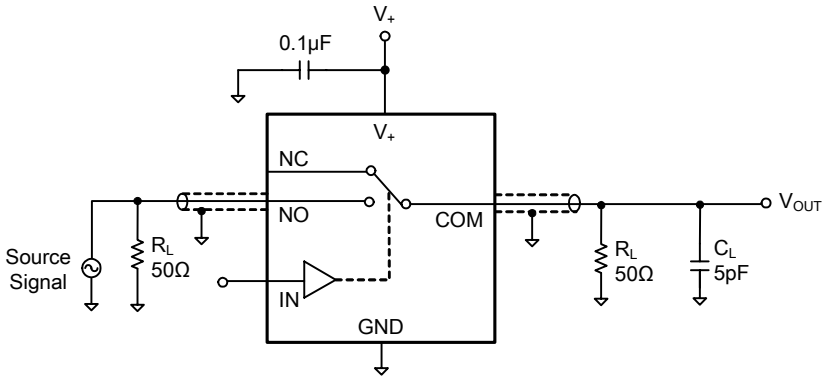


Test Circuit 3. Break-Before-Make Time Delay, t_D

TEST CIRCUITS (Cont.)

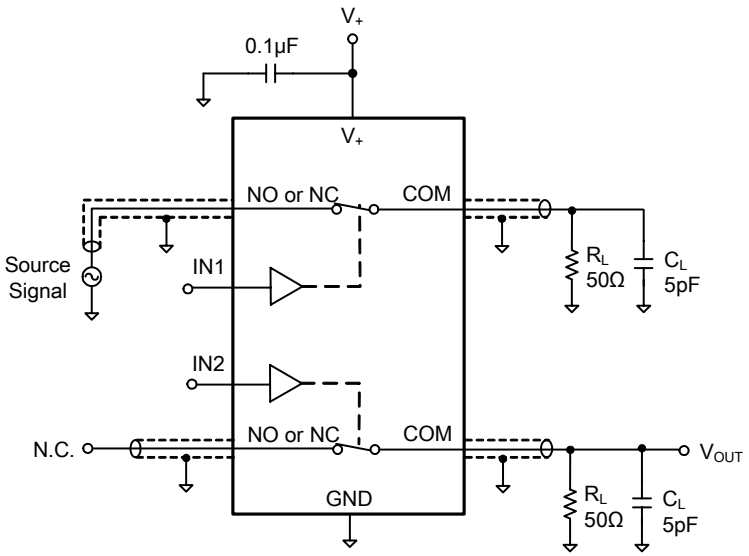


Test Circuit 4. Output Signal Skew



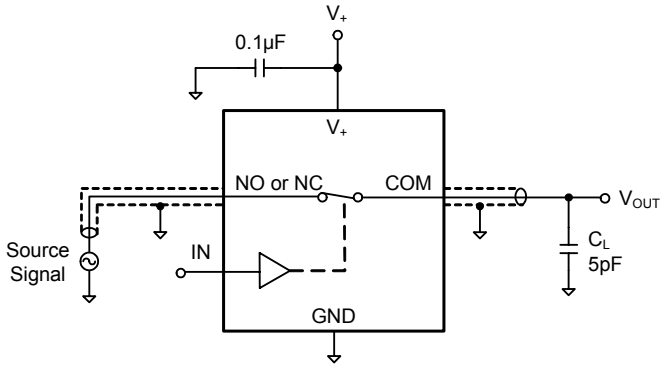
Test Circuit 5. Off Isolation

TEST CIRCUITS (Cont.)



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

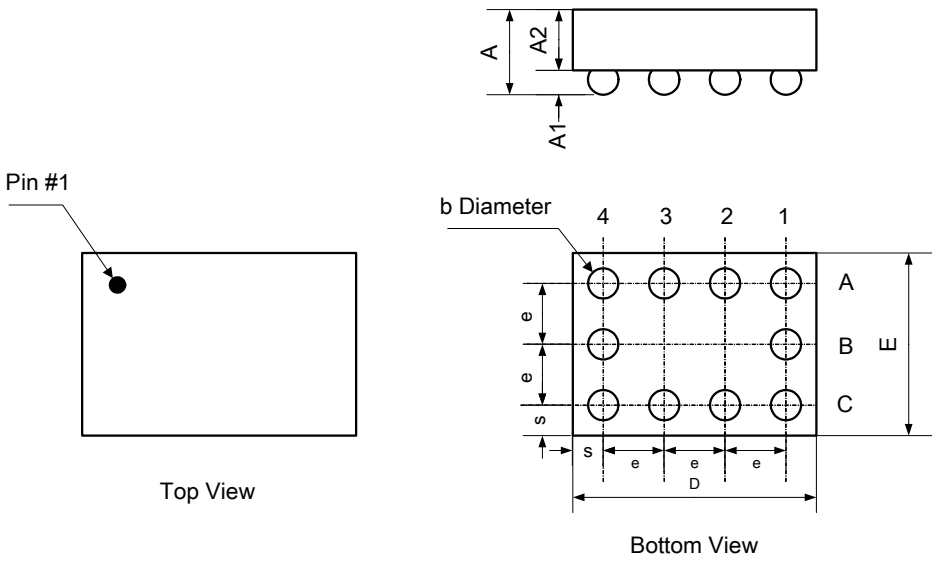
Test Circuit 6. Channel-to-Channel Crosstalk



Test Circuit 7. -3dB 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

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