SGM3699
0.5Ω, Low Voltage Quad, SPDT Analog Switch

GENERAL DESCRIPTION

The SGM3699 is a quad, low on-resistance, low voltage, bidirectional, single-pole/double-throw (SPDT) CMOS analog switch that is designed to operate from a single +1.8V to +4.2V power supply. Targeted applications include battery powered equipment that benefit from low R_{ON} (0.5Ω) and fast switching speeds (t_{ON} = 52ns, t_{OFF} = 25ns).

The SGM3699 consists of four SPDT switches. It is configured as a dual double-pole/double-throw (DPDT) device with two logic control inputs that control two SPDT switches each. The configuration can be used as a dual differential 2-to-1 multiplexer/demultiplexer.

SGM3699 is available in a TQFN-16 and SO-16 packages.

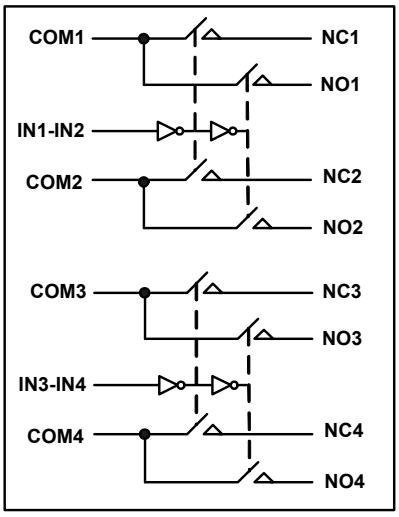
APPLICATIONS

Communication Systems
Cell Phones
Portable Instrumentation
Audio Signal Routing
Audio and Video Switching
PCMCIA Cards
Computer Peripherals
Modems
PDAs

FEATURES

- **Low Voltage Operation: 1.8V to 4.2V**
- **Low On-Resistance: 0.5Ω (TYP)**
- **Low On-Resistance Flatness**
- **–3dB Bandwidth: 70MHz**
- **Fast Switching Times (4.2V)**
  - **t_{ON} 52ns**
  - **t_{OFF} 25ns**
- **Rail-to-Rail Operation**
- **Typical Power Consumption (<0.01μW)**
- **TTL/CMOS Compatible**
- **Lead (Pb) Free TQFN-16 and SO-16 Packages**

BLOCK DIAGRAM



ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM3699	TQFN-16(3mm×3mm)	-40℃ to +85℃	SGM3699YTQ16/TR	3699TQ	Tape and Reel, 3000
	SO-16	-40℃ to +85℃	SGM3699YS16/TR	SGM3699YS16	Tape and Reel, 2500

ABSOLUTE MAXIMUM RATINGS

V_+ to GND.....0V to 4.6V
Analog, Digital voltage range (1)..... -0.3V to (V_+) + 0.3V
Continuous Current NO, NC, or COM .....±200mA
Peak Current NO, NC, or COM .....±350mA
Operating Temperature Range.....-40℃ to +85℃
Junction Temperature.....150℃
Storage Temperature.....-65℃ to +150℃
Lead Temperature (soldering, 10s).....260℃
ESD Susceptibility
HBM.....4000V
MM.....400V

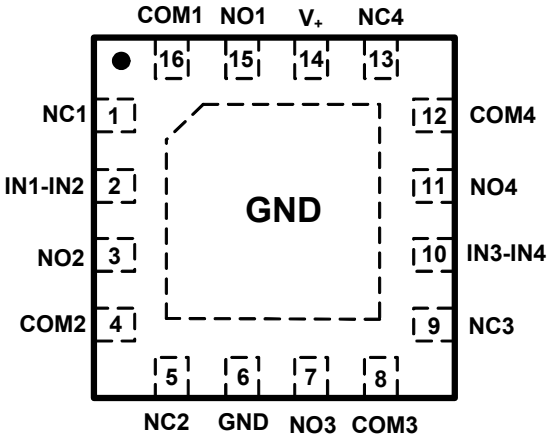
NOTE:
(1) Signals on NC, NO, or COM or IN_X exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

(2) 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.

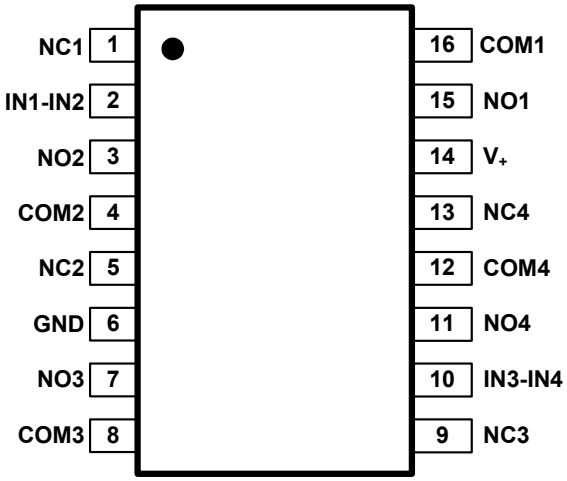
CAUTION

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 CONFIGURATIONS (TOP VIEW)



TQFN-16 (3mm×3mm)



SO-16

PIN DESCRIPTION

NAME	PIN		FUNCTION
	TQFN-16 (3mm×3mm)	SO-16	
V_+	14	14	Power supply
GND	6	6	Ground
IN_X	2,10	2,10	Digital control pin to connect the COM terminal to the NO or NC terminals
COM_X	16, 4, 8, 12	16, 4, 8, 12	Common terminal
NO_X	15, 3, 7, 11	15, 3, 7, 11	Normally-open terminal
NC_X	1, 5, 9, 13	1, 5, 9, 13	Normally-closed terminal

Note: NO_X, NC_X and COM_X terminal may be an input or output.

FUNCTION TABLE

IN1-IN2	FUNCTION	
	NC1 and NC2	NO1 and NO2
0	ON	OFF
1	OFF	ON

IN3-IN4	FUNCTION	
	NC3 and NC4	NO3 and NO4
0	ON	OFF
1	OFF	ON

ELECTRICAL CHARACTERISTICS

(V_+ = +4.2V, GND = 0V, V_{IH} = +1.6V, V_{IL} = +0.6V, T_A = -40℃ to +85℃. Typical values are at V_+ = +4.2V, 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_+ = 4.2V, V_{NO} or V_{NC} = 1V, I_{COM} = -100mA, Test Circuit 1		+25℃		0.5	0.75	Ω
				-40℃ to +85℃			0.85	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 4.2V, V_{NO} or V_{NC} = 1V, I_{COM} = -100mA, Test Circuit 1		+25℃		0.05	0.15	Ω
				-40℃ to +85℃		0.1	0.2	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 4.2V, V_{NO} or V_{NC} = 1V, 2.5V, I_{COM} = -100mA, Test Circuit 1		+25℃		0.1	0.22	Ω
				-40℃ to +85℃			0.26	Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 4.2V, V_{NO} or V_{NC} = 3.3V/ 0.3V, V_{COM} = 0.3V/ 3.3V		-40℃ to +85℃			1	μA
Channel ON Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_+ = 4.2V, 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℃	1.6			V
Input Low Voltage	V_{INL}			-40℃ to +85℃			0.5	V
Input Leakage Current	I_{IN}	V_+ = 4.2V, V_{IN} = 0V or 4.2V		-40℃ to +85℃			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_+ = 4.2V, V_{NO} or V_{NC} = 2.0V, R_L = 50Ω, C_L = 35pF, Test Circuit 2		+25℃		52		ns
Turn-Off Time	t_{OFF}			+25℃		25		ns
Charge Injection	Q	C_L = 1.0nF, V_G = 0V, R_G = 0Ω, Test Circuit 3		+25℃		30		pC
Break-Before-Make Time Delay	t_D	V_{NO} or V_{NC} = 1.5V, R_L = 50Ω, C_L = 35pF, Test Circuit 4		+25℃		8		ns
Off Isolation	O_{ISO}	Signal = 0dBm, V_{NO} or V_{NC} centered between V_+ and GND, R_L = 50Ω, Test Circuit 5	f = 100kHz	+25℃		-75		dB
			f = 1MHz	+25℃		-55		
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, Test Circuit 6	f = 1MHz	+25℃		-103		dB
			f = 10MHz	+25℃		-65		
–3dB Bandwidth	BW	Signal = 0dBm, Test Circuit 7		+25℃		70		MHz
Channel ON Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$	f = 1MHz		+25℃		80		pF
POWER REQUIREMENTS								
Power Supply Range	V_+			-40℃ to +85℃	1.8		4.2	V
Power Supply Current	I_+	V_+ = 4.2V, V_{IN} = 0V or V_+		-40℃ to +85℃			1	μA

Specifications subject to changes without notice.

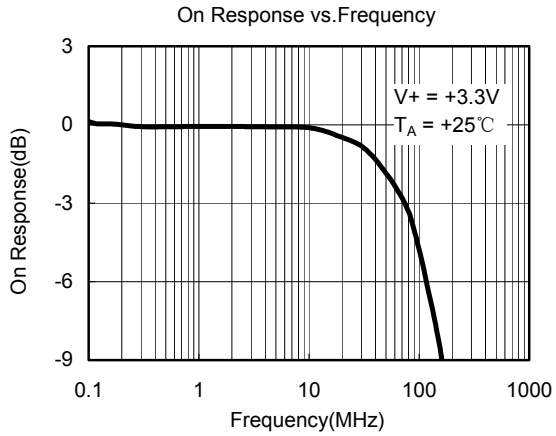
ELECTRICAL CHARACTERISTICS

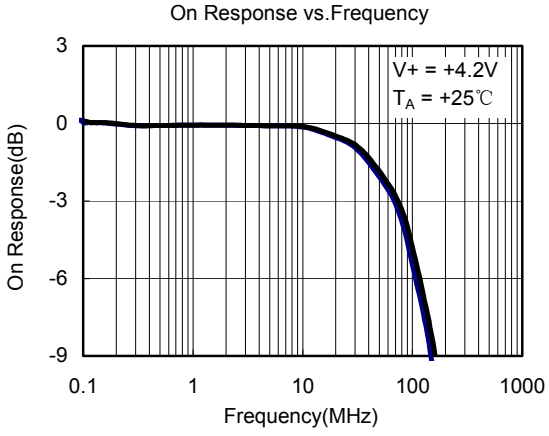
(V_+ = +2.7 to +3.6V, GND = 0V, V_{IH} = +1.6 V, V_{IL} = +0.4V, T_A = -40℃ to +85℃. Typical values are at V_+ = +3.0V, T_A = +25℃, unless otherwise noted.)

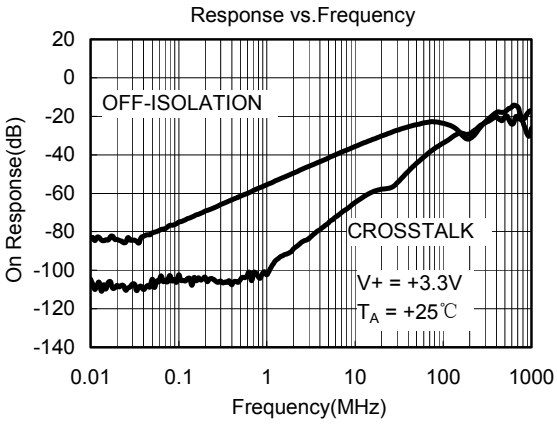
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			-40℃ to +85℃	0		V_+	V
On-Resistance	R_{ON}	V_+ = 2.7V, V_{NO} or V_{NC} = 1V, I_{COM} = -100mA, Test Circuit 1		+25℃		0.6	0.9	Ω
				-40℃ to +85℃			1	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 2.7V, V_{NO} or V_{NC} = 1V, I_{COM} = -100mA, Test Circuit 1		+25℃		0.15	0.2	Ω
				-40℃ to +85℃		0.15	0.24	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 2.7V, V_{NO} or V_{NC} = 1V, 2.5V, I_{COM} = -100mA, Test Circuit 1		+25℃		0.05	0.15	Ω
				-40℃ to +85℃		0.1	0.2	Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 3.6V, V_{NO} or V_{NC} = 3.3V/ 0.3V, V_{COM} = 0.3V/ 3.3V		-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℃	1.5			V
Input Low Voltage	V_{INL}			-40℃ to +85℃			0.4	V
Input Leakage Current	I_{IN}	V_+ = 2.7V, V_{IN} = 0V or 2.7V		-40℃ to +85℃			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_+ = 3.3V, V_{NO} or V_{NC} = 2.0V, R_L = 50Ω, C_L = 35pF, Test Circuit 2		+25℃		54		ns
Turn-Off Time	t_{OFF}			+25℃		38		ns
Charge Injection	Q	C_L = 1.0nF, V_G = 0V, R_G = 0Ω Test Circuit 3		+25℃		26		pC
Break-Before-Make Time Delay	t_D	V_{NO} or V_{NC} = 1.5V, R_L = 50Ω, C_L = 35pF, Test Circuit 4		+25℃		12		ns
Off Isolation	O_{ISO}	Signal = 0dBm, V_{NO} or V_{NC} centered between V_+ and GND, R_L = 50Ω, Test Circuit 5	f = 100kHz	+25℃		-75		dB
			f = 1MHz	+25℃		-55		
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, Test Circuit 6	f = 1MHz	+25℃		-103		dB
			f = 10MHz	+25℃		-65		
–3dB Bandwidth	BW	Signal = 0dBm, Test Circuit 7		+25℃		70		MHz
Channel ON Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$	f = 1MHz		+25℃		80		pF

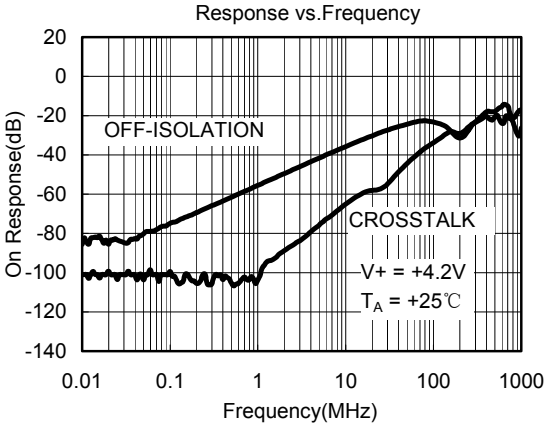
Specifications subject to changes without notice.

TYPICAL PERFORMANCE CHARACTERISTICS

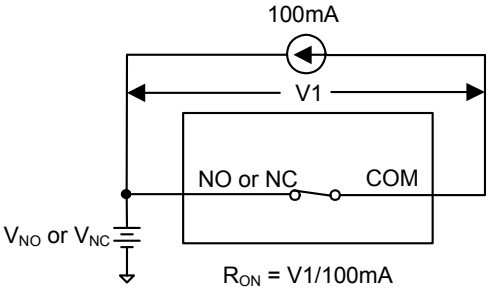




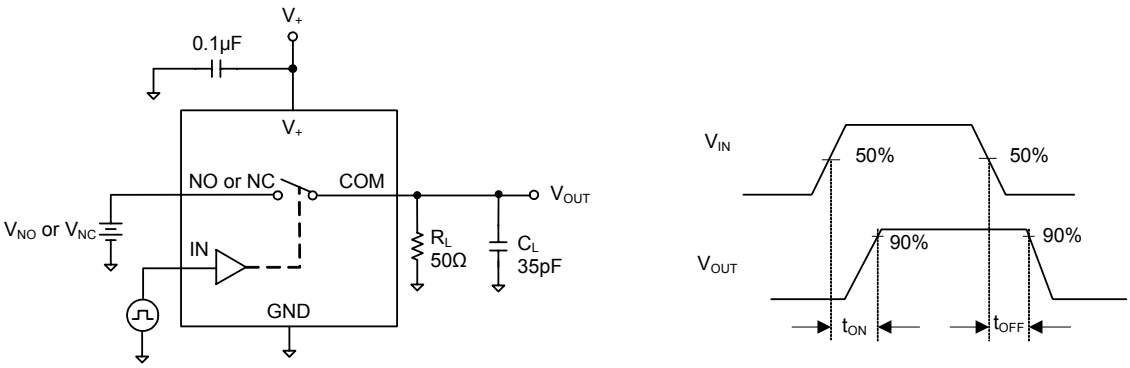




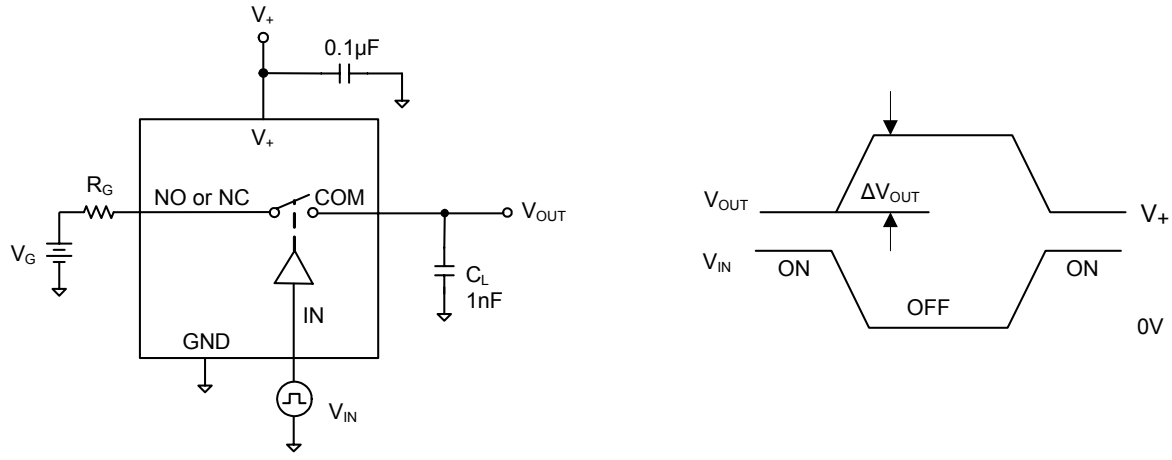
TEST CIRCUITS



Test Circuit 1. On Resistance

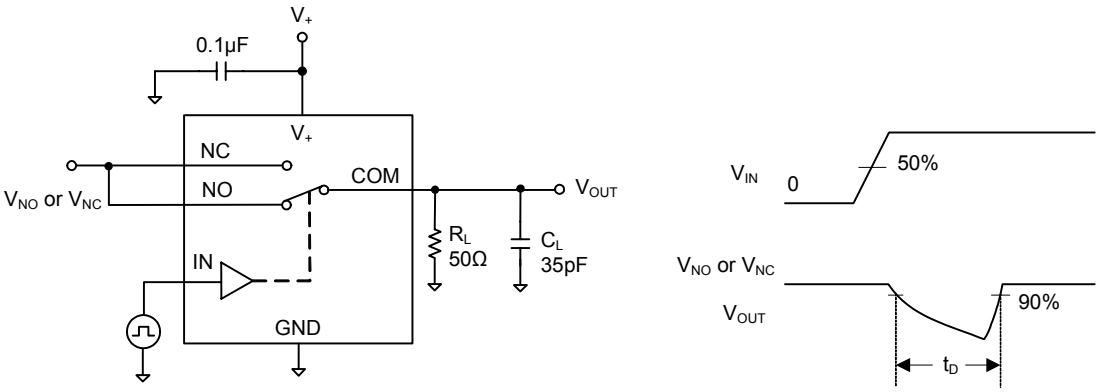


Test Circuit 2. Switching Times

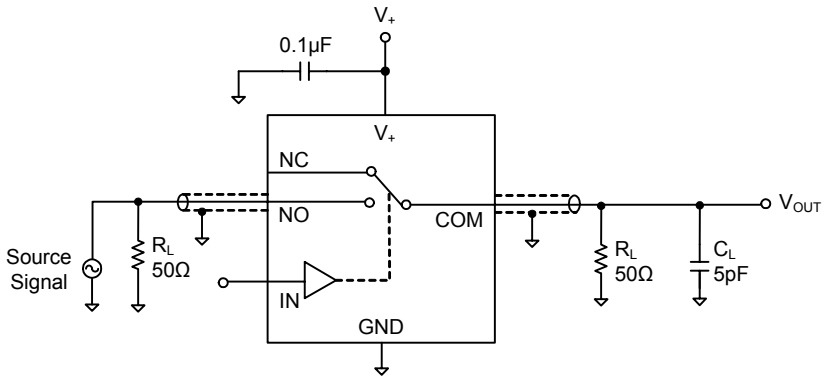


Test Circuit 3. Charge Injection

TEST CIRCUITS (Cont.)

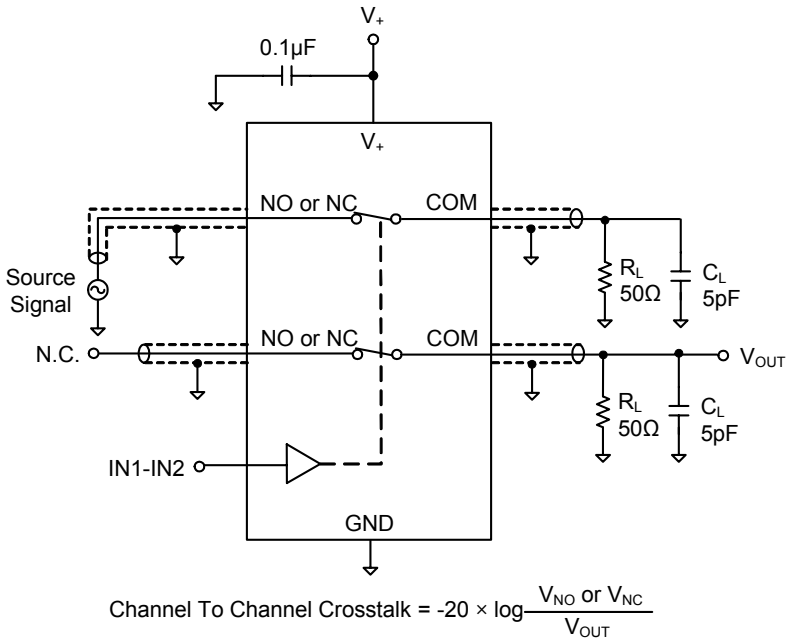


Test Circuit 4. Break-Before-Make Time Delay, t_D

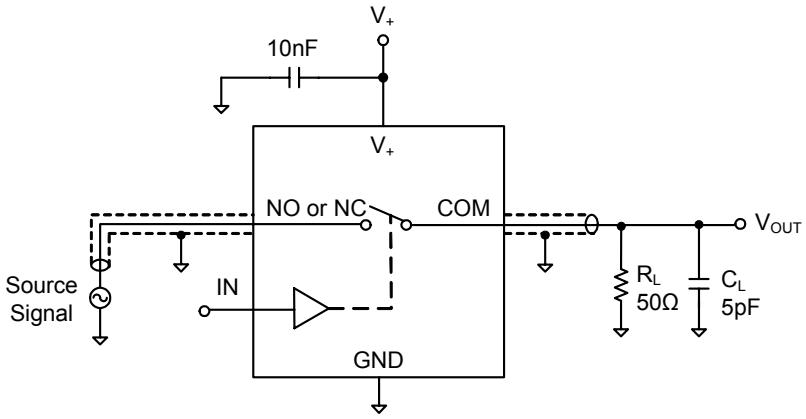


Test Circuit 5. Off Isolation

TEST CIRCUITS (Cont.)



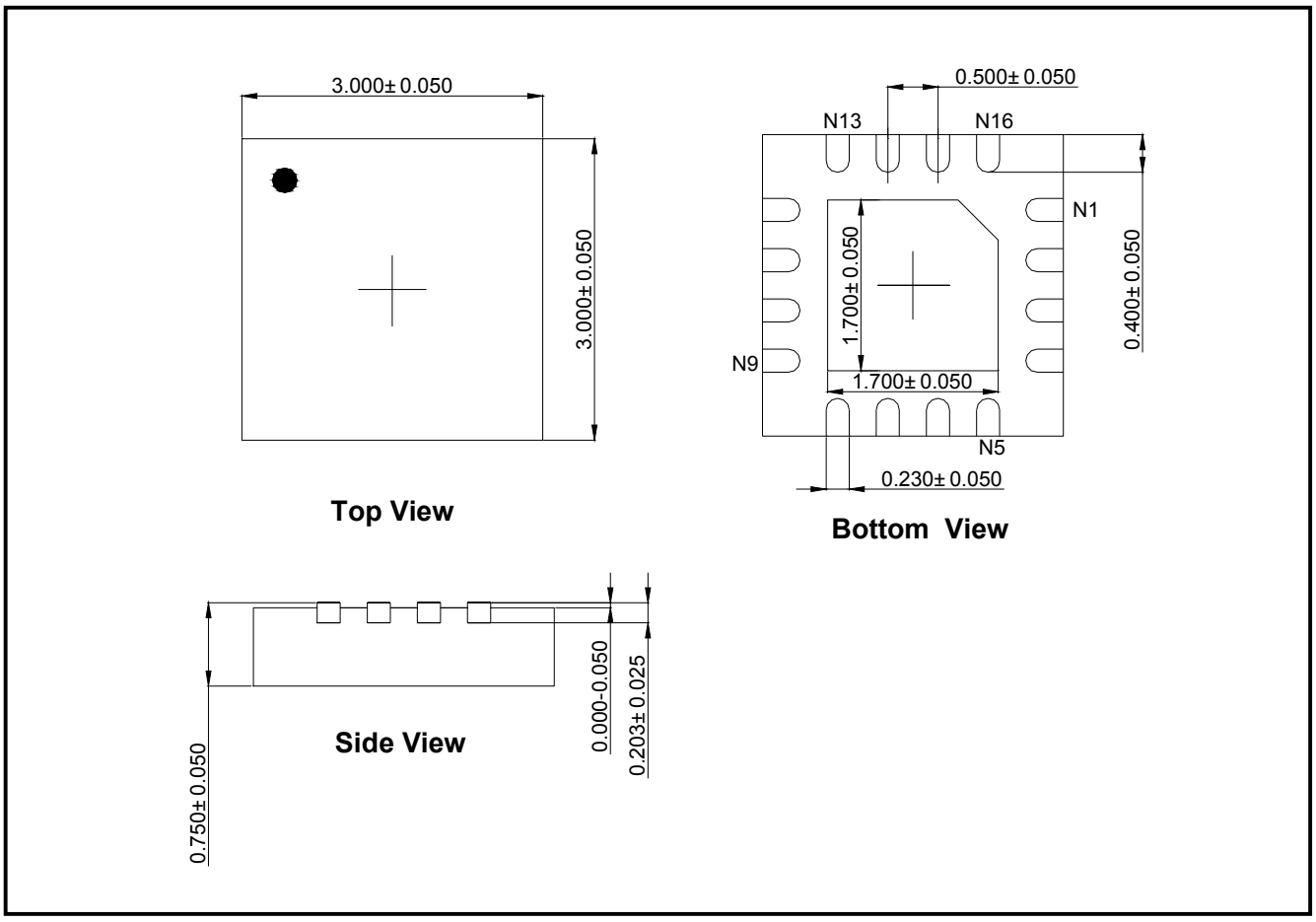
Test Circuit 6. Channel-to-Channel Crosstalk



Test Circuit 7. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

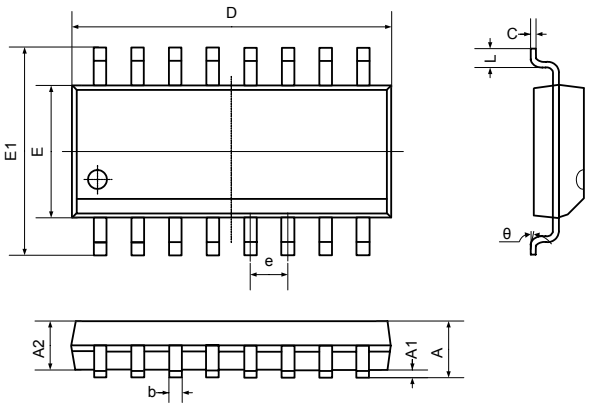
TQFN-16 (3mm × 3mm)



NOTE: All linear dimensions are in millimeters.

PACKAGE OUTLINE DIMENSIONS

SO-16



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
C	0.170	0.250	0.007	0.010
D	9.800	10.20	0.386	0.402
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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