



# SGM3699

## 0.5Ω, Low Voltage Quad, SPDT Analog Switch

### GENERAL DESCRIPTION

The SGM3699 is a bidirectional, quad, SPDT (single-pole/double-throw), TTL/CMOS compatible analog switch. It operates from a 1.8V to 4.35V single power supply.

The SGM3699 features 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 SGM3699 can be used as a dual 2-to-1 multiplexer/demultiplexer because it has two logic control inputs. Low power consumption is also one of the important reasons that make it a good choice.

The SGM3699 is available in Green TQFN-3×3-16L package. It operates over an ambient temperature range of -40°C to +85°C.

### FEATURES

- **Single Supply Voltage Range: 1.8V to 4.35V**
- **-3dB Bandwidth: 70MHz**
- **Fast Switching Times ( $V_+ = 4.2V$ ):**
  - $t_{ON}$ : 52ns
  - $t_{OFF}$ : 25ns
- **Low On-Resistance: 0.5Ω (TYP)**
- **Low On-Resistance Flatness**
- **Low Power Consumption**
- **High Off-Isolation: -75dB at 1MHz**
- **Low Crosstalk: -100dB at 1MHz**
- **TTL/CMOS Compatible**
- **Rail-to-Rail Input and Output Operation**
- **-40°C to +85°C Operating Temperature Range**
- **Available in Green TQFN-3×3-16L Package**

### APPLICATIONS

Cellular Phones  
Portable Equipment  
Medical Equipment  
Sample-and-Hold Circuits  
Personal Digital Assistants  
Battery-Powered Systems  
Audio and Video Signal Routing

**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM3699	TQFN-3×3-16L	-40°C to +85°C	SGM3699YTQ16/TR	3699TQ XXXXX	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 .....0V to 4.6V  
 Analog, Digital Voltage Range <sup>(1)</sup> .....-0.3V to (V<sub>+</sub>) + 0.3V  
 Continuous Current NO, NC, or COM..... ±200mA  
 Peak Current NO, NC, or COM..... ±350mA  
 Junction Temperature.....+150°C  
 Storage Temperature Range .....-65°C to +150°C  
 Lead Temperature (Soldering, 10s).....+260°C  
 ESD Susceptibility  
 HBM..... 4000V  
 MM..... 400V

NOTE:

1. Signals on NC, NO, or COM or IN<sub>x</sub> 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 +85°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.

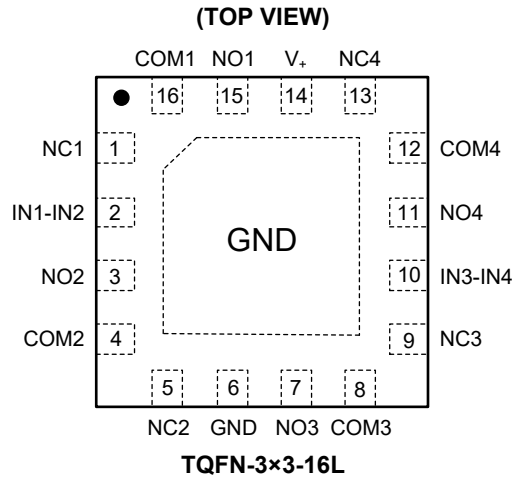
**ESD SENSITIVITY CAUTION**

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
1, 5, 9, 13	NC <sub>x</sub>	Normally Closed Pins.
2, 10	IN <sub>x</sub>	Digital Control Input Pin to Connect the COM Pins to the NO or NC Pins.
3, 7, 11, 15	NO <sub>x</sub>	Normally Open Pins
4, 8, 12, 16	COM <sub>x</sub>	Common Pins.
6	GND	Ground.
14	V <sub>+</sub>	Positive Power Supply.
Exposed Pad	GND	Exposed Pad. Connect exposed pad to GND or left floating.

NOTE: NO<sub>x</sub>, NC<sub>x</sub> and COM<sub>x</sub> pins 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<sub>+</sub> = 4.2V, GND = 0V, V<sub>IH</sub> = 1.6V, V<sub>IL</sub> = 0.5V, Full = -40°C to +85°C, typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)

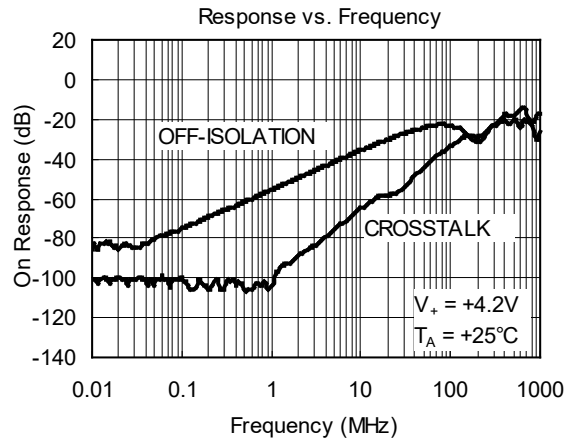
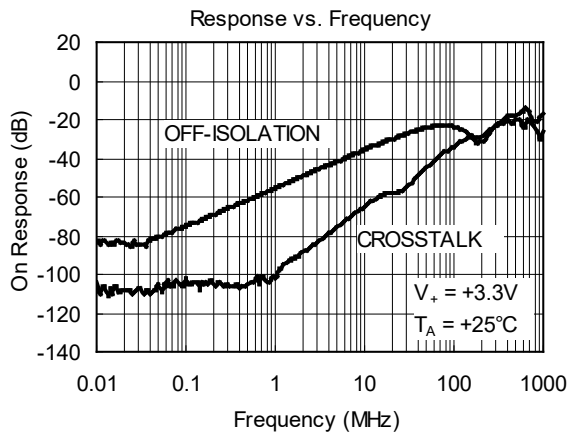
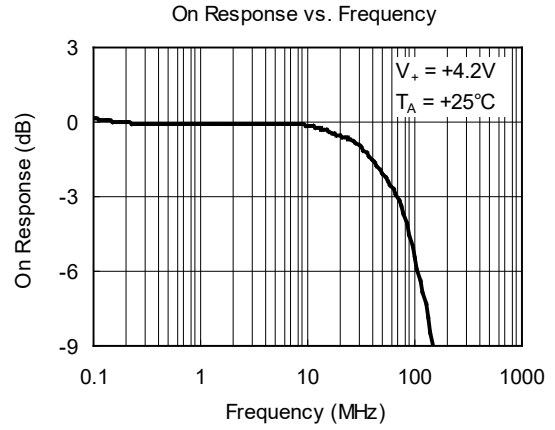
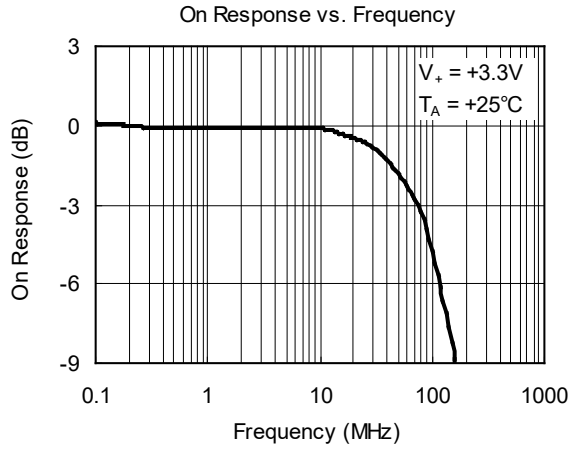
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	V <sub>NO</sub> , V <sub>NC</sub> , V <sub>COM</sub>		Full	0		V <sub>+</sub>	V
On-Resistance	R <sub>ON</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 1V, I <sub>COM</sub> = -100mA, Test Circuit 1	+25°C		0.5	0.85	Ω
			Full			1.2	Ω
On-Resistance Match Between Channels	ΔR <sub>ON</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 1V, I <sub>COM</sub> = -100mA, Test Circuit 1	+25°C		0.1	0.22	Ω
			Full			0.45	Ω
On-Resistance Flatness	R <sub>FLAT(ON)</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 1V, 2.5V, I <sub>COM</sub> = -100mA, Test Circuit 1	+25°C		0.15	0.25	Ω
			Full			0.35	Ω
Source Off Leakage Current	I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 3.3V/0.3V, V <sub>COM</sub> = 0.3V/3.3V	Full			1	μA
Channel On Leakage Current	I <sub>NC(ON)</sub> , I <sub>NO(ON)</sub> , I <sub>COM(ON)</sub>	V <sub>COM</sub> = 0.3V/3.3V, V <sub>NO</sub> or V <sub>NC</sub> = 0.3V/3.3V or floating	Full			1	μA
<b>DIGITAL INPUTS</b>							
Input High Voltage	V <sub>INH</sub>		Full	1.6			V
Input Low Voltage	V <sub>INL</sub>		Full			0.5	V
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = 0V or 4.2V	Full			1	μA
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 2.0V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Test Circuit 2	+25°C		52		ns
Turn-Off Time	t <sub>OFF</sub>		+25°C		25		ns
Charge Injection	Q	C <sub>L</sub> = 1.0nF, V <sub>S</sub> = 0V, R <sub>S</sub> = 0Ω, Test Circuit 3	+25°C		30		pC
Break-Before-Make Time Delay	t <sub>D</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Test Circuit 4	+25°C		8		ns
Off Isolation	O <sub>ISO</sub>	Signal = 0dBm, V <sub>NO</sub> or V <sub>NC</sub> centered between V <sub>+</sub> and GND, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 5	f = 100kHz	+25°C		-75	dB
			f = 1MHz	+25°C		-55	
Channel-to-Channel Crosstalk	X <sub>TALK</sub>	Signal = 0dBm, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 6	f = 1MHz	+25°C		-103	dB
			f = 10MHz	+25°C		-65	
-3dB Bandwidth	BW	Signal = 0dBm, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Test Circuit 7	+25°C		70		MHz
Channel On Capacitance	C <sub>NC(ON)</sub> , C <sub>NO(ON)</sub> , C <sub>COM(ON)</sub>	f = 1MHz	+25°C		80		pF
<b>POWER REQUIREMENTS</b>							
Power Supply Range	V <sub>+</sub>		Full	1.8		4.35	V
Power Supply Current	I <sub>+</sub>	V <sub>IN</sub> = 0V or V <sub>+</sub>	Full			1	μA

**ELECTRICAL CHARACTERISTICS (continued)**

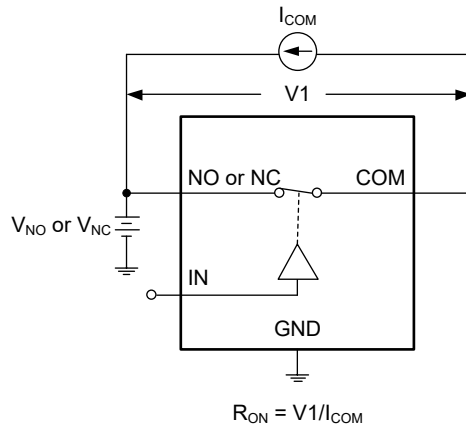
( $V_+ = 2.7V$  to  $3.6V$ ,  $GND = 0V$ ,  $V_{IH} = 1.5V$ ,  $V_{IL} = 0.4V$ , Full =  $-40^\circ C$  to  $+85^\circ C$ , typical values are at  $V_+ = 3.0V$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	$V_{NO}, V_{NC}, V_{COM}$		Full	0		$V_+$	V
On-Resistance	$R_{ON}$	$V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1V,$ $I_{COM} = -100mA$ , Test Circuit 1	$+25^\circ C$		0.6	0.9	$\Omega$
			Full			1.3	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1V,$ $I_{COM} = -100mA$ , Test Circuit 1	$+25^\circ C$		0.15	0.25	$\Omega$
			Full			0.5	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1V, 2.5V,$ $I_{COM} = -100mA$ , Test Circuit 1	$+25^\circ C$		0.15	0.25	$\Omega$
			Full			0.35	$\Omega$
Source Off Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_+ = 3.6V, V_{NO}$ or $V_{NC} = 3.3V/0.3V,$ $V_{COM} = 0.3V/3.3V$	Full			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	Full			1	$\mu A$
<b>DIGITAL INPUTS</b>							
Input High Voltage	$V_{INH}$		Full	1.5			V
Input Low Voltage	$V_{INL}$		Full			0.4	V
Input Leakage Current	$I_{IN}$	$V_+ = 2.7V, V_{IN} = 0V$ or $2.7V$	Full			1	$\mu A$
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	$t_{ON}$	$V_+ = 3.3V, V_{NO}$ or $V_{NC} = 2.0V, R_L = 50\Omega,$ $C_L = 35pF$ , Test Circuit 2	$+25^\circ C$		54		ns
Turn-Off Time	$t_{OFF}$		$+25^\circ C$		38		ns
Charge Injection	Q	$C_L = 1.0nF, V_S = 0V, R_S = 0\Omega$ , Test Circuit 3	$+25^\circ C$		26		pC
Break-Before-Make Time Delay	$t_D$	$V_{NO}$ or $V_{NC} = 1.5V, R_L = 50\Omega, C_L = 35pF,$ Test Circuit 4	$+25^\circ C$		12		ns
Off Isolation	$O_{ISO}$	Signal = 0dBm, $V_{NO}$ or $V_{NC}$ centered between $V_+$ and GND, $R_L = 50\Omega, C_L = 5pF$ , Test Circuit 5	f = 100kHz	$+25^\circ C$		-75	dB
			f = 1MHz	$+25^\circ C$		-55	
Channel-to-Channel Crosstalk	$X_{TALK}$	Signal = 0dBm, $R_L = 50\Omega,$ $C_L = 5pF$ , Test Circuit 6	f = 1MHz	$+25^\circ C$		-103	dB
			f = 10MHz	$+25^\circ C$		-65	
-3dB Bandwidth	BW	Signal = 0dBm, $R_L = 50\Omega, C_L = 5pF,$ Test Circuit 7	$+25^\circ C$		70		MHz
Channel On Capacitance	$C_{NC(ON)}, C_{NO(ON)},$ $C_{COM(ON)}$	f = 1MHz	$+25^\circ C$		80		pF

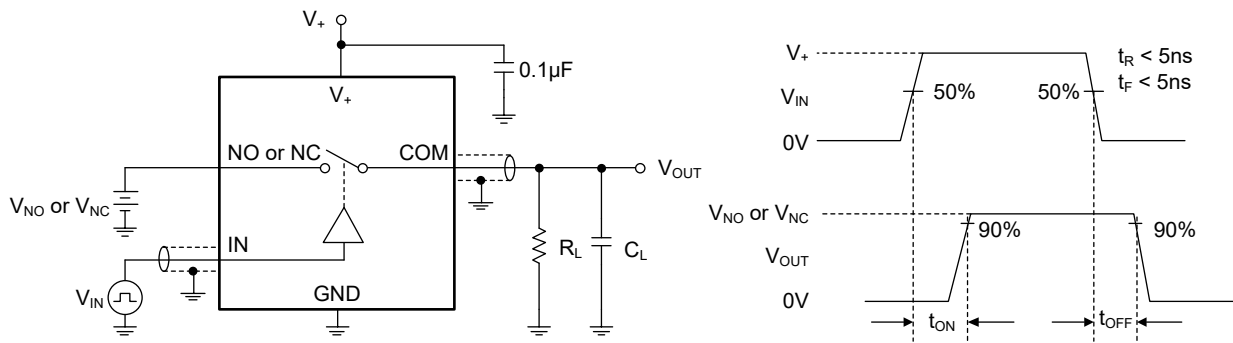
TYPICAL PERFORMANCE CHARACTERISTICS



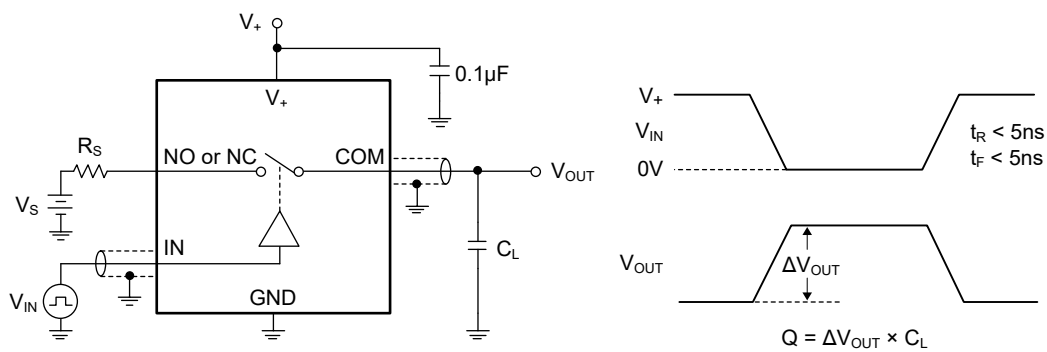
TEST CIRCUITS



Test Circuit 1. On-Resistance

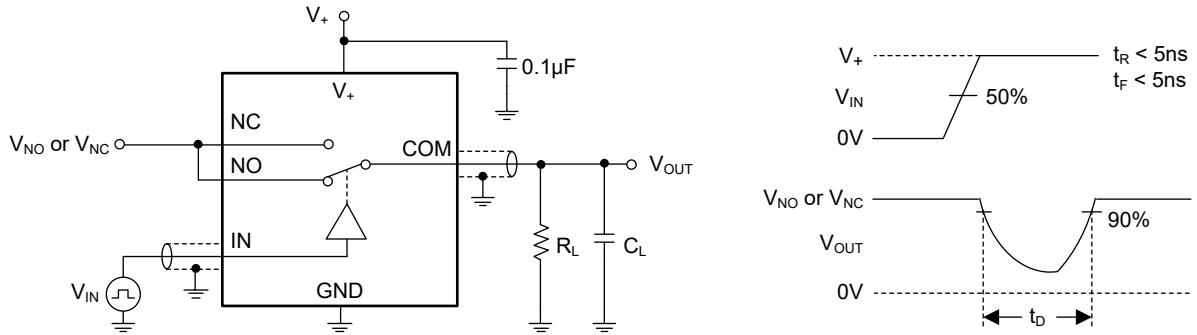


Test Circuit 2. Switching Times

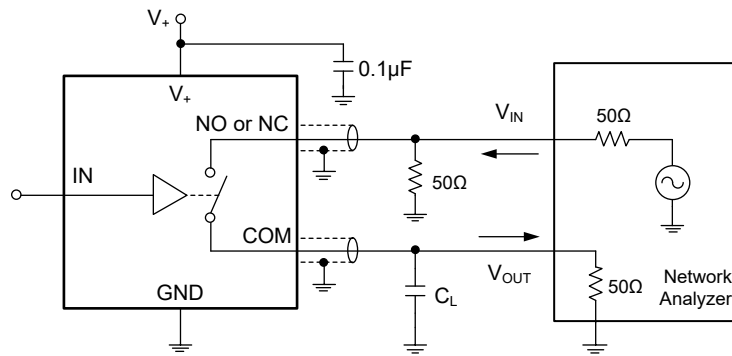


Test Circuit 3. Charge Injection

TEST CIRCUITS (continued)



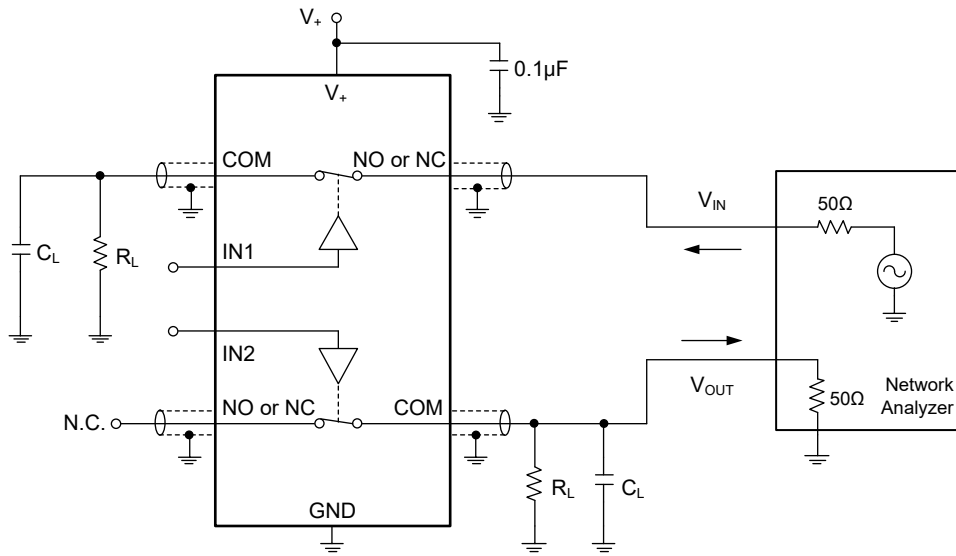
Test Circuit 4. Break-Before-Make Time Delay,  $t_d$



Test Circuit 5. Off Isolation

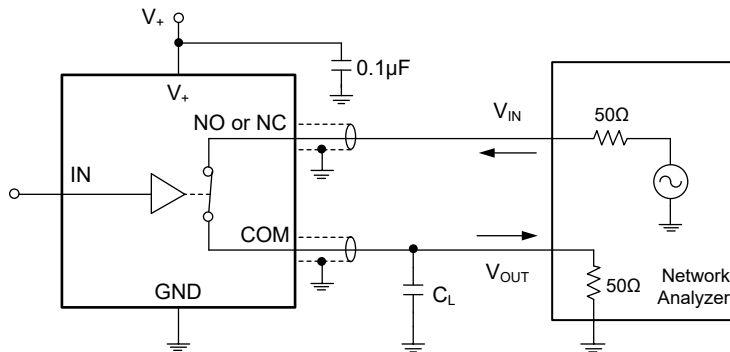


TEST CIRCUITS (continued)



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

Test Circuit 6. Channel-to-Channel Crosstalk

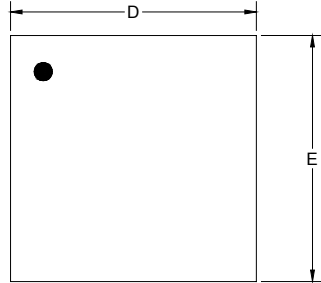


Test Circuit 7. -3dB Bandwidth

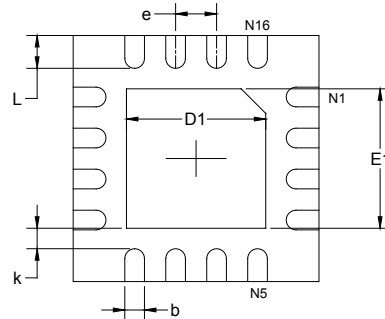
# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

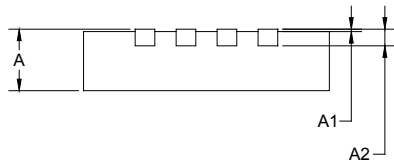
### TQFN-3×3-16L



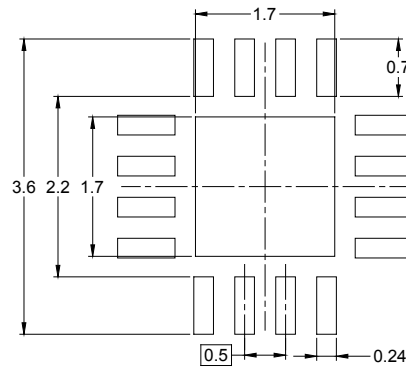
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.900	3.100	0.114	0.122
D1	1.600	1.800	0.063	0.071
E	2.900	3.100	0.114	0.122
E1	1.600	1.800	0.063	0.071
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.500 TYP		0.020 TYP	
L	0.300	0.500	0.012	0.020

# 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
TQFN-3×3-16L	13"	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	Q1

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
13"	386	280	370	5

DD0002