

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 ($t_{ON} = 52\text{ ns}$, $t_{OFF} = 25\text{ ns}$).

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 package.

APPLICATIONS

- Communication Systems
- Cell Phones
- Portable Instrumentation
- Audio Signal Routing
- Audio and Video Switching
- PCMCIA Cards
- Computer Peripherals
- Modems
- PDA's

FUNCTION TABLE

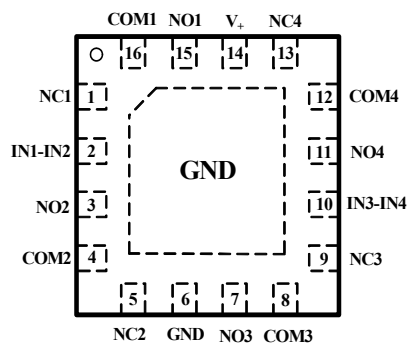
IN1-IN2	Function	
	NC1 and NC2	NO1 and NO2
0	ON	OFF
1	OFF	ON

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

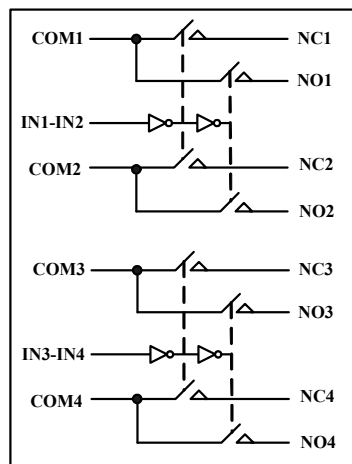
FEATURES

- Low Voltage Operation: 1.8V to 4.2V
- Low On-Resistance: 0.5Ω(TYP)
- Low On-Resistance Flatness
- -3dB Bandwidth: 70MHz
- Fast Switching Time(4.2V)
 - t_{ON} 52ns
 - t_{OFF} 25ns
- Rail-to-Rail Operation
- Typical Power Consumption (<0.01 μW)
- TTL/CMOS Compatible
- Lead (Pb) Free TQFN-16 Package (3.0mm x 3.0mm)

PIN CONFIGURATION (TOP VIEW)



BLOCK DIAGRAM



ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM3699	TQFN-16	- 40°C to +85°C	SGM3699YTQ16/TR	3699TQ	Tape and Reel, 3000

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°C to +85°C
 Junction Temperature.....+150°C

Storage Temperature.....- 65°C to +150°C
 Lead Temperature (soldering, 10s).....260°C
 ESD Susceptibility
 HBM.....4000V
 MM.....400V

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_x exceeding V₊ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

PIN DESCRIPTION

NAME	PIN	FUNCTION
V ₊	14	Power supply
GND	6	Ground
IN _x	2,10	Digital control pin to connect the COM terminal to the NO or NC terminals
COM _x	4, 8, 12, 16	Common terminal
NO _x	3, 7, 11, 15	Normally-open terminal
NC _x	1, 5, 9, 13	Normally-closed terminal

Note: NO_x, NC_x and COM_x terminal may be an input or output.

ELECTRICAL CHARACTERISTICS

($V_+ = +4.2V$, $GND = 0V$, $V_{IH} = +1.6V$, $V_{IL} = +0.6V$, $T_A = -40^\circ C$ to $+85^\circ C$. Typical values are at $V_+ = +4.2V$, $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TPY	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		-40°C to +85°C	0		V_+	V
On-Resistance	R_{ON}	$V_+ = 4.2V, V_{NO}$ or $V_{NC} = 1V,$ $I_{COM} = -100mA$, Test Circuit 1	+25°C		0.5	0.75	Ω
			-40°C to +85°C			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°C		0.05	0.15	Ω
			-40°C to +85°C		0.1	0.2	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 4.2V, V_{NO}$ or $V_{NC} = 1V,$ $I_{COM} = -100mA$, Test Circuit 1	+25°C		0.1	0.22	Ω
			-40°C to +85°C			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°C to +85°C			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°C to +85°C			1	μA
DIGITAL INPUTS							
Input High Voltage	V_{INH}		-40°C to +85°C	1.6			V
Input Low Voltage	V_{INL}		-40°C to +85°C			0.5	V
Input Leakage Current	I_{IN}	$V_+ = 4.2V, V_{IN} = 0$ or $4.2V$	-40°C to +85°C			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	$V_+ = 4.2V, V_{COM} = 2.0V,$	+25°C		52		ns
Turn-Off Time	t_{OFF}	$R_L = 50\Omega, C_L = 35pF$, Test Circuit 2	+25°C		25		ns
Charge Injection,	Q	$C_L = 1.0nF, V_G = 0V, R_G = 0\Omega$ Test Circuit 3	+25°C		30		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°C		8		ns
Off Isolation	O_{ISO}	Signal = 0dBm, V_{NO} or V_{NC} centered between V_+ and GND, $R_L = 50\Omega,$ Test Circuit 5	f = 100kHz,	+25°C		-75	dB
			f = 1MHz,	+25°C		-55	
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, Test Circuit 6	f = 1MHz,	+25°C		-103	dB
			f = 10MHz,	+25°C		-65	
Bandwidth -3 dB	BW	Signal = 0dBm, Test Circuit 7	+25°C		70		MHz
Channel ON Capacitance	$C_{NC(ON)}, C_{NO(ON)},$ $C_{COM(ON)}$	f = 1MHz	+25°C		80		pF
POWER REQUIREMENTS							
Power Supply Range	V_+		-40°C to +85°C	1.8		4.2	V
Power Supply Current	I_+	$V_+ = 4.2V, V_{IN} = 0V$ or V_+	-40°C to +85°C			1	μA

Specifications subject to changes without notice.

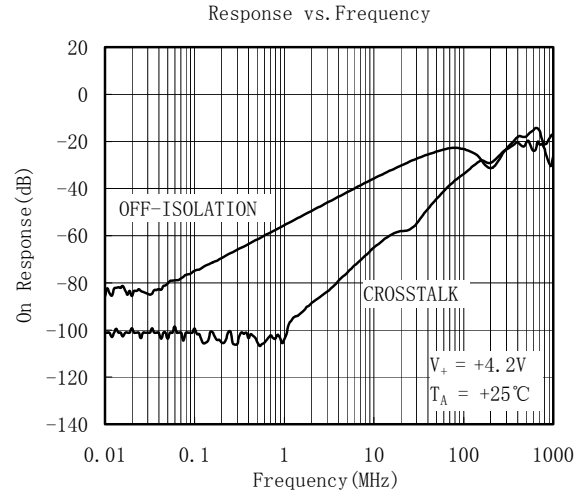
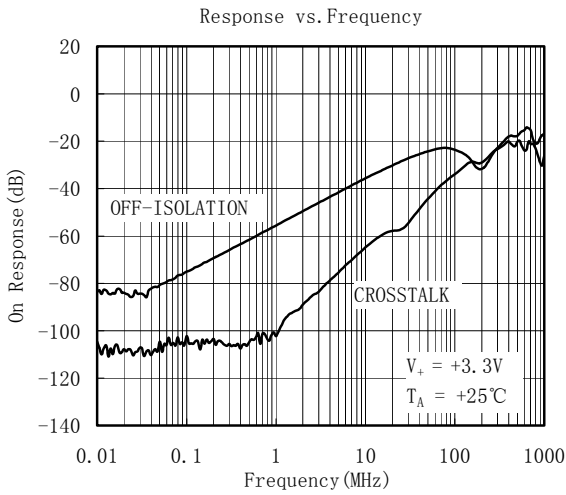
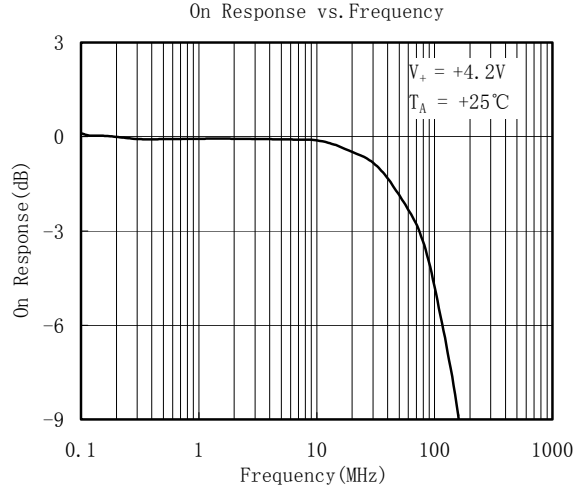
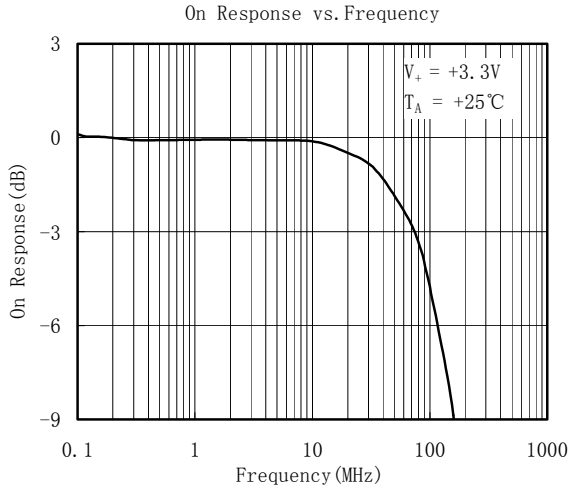
ELECTRICAL CHARACTERISTICS

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

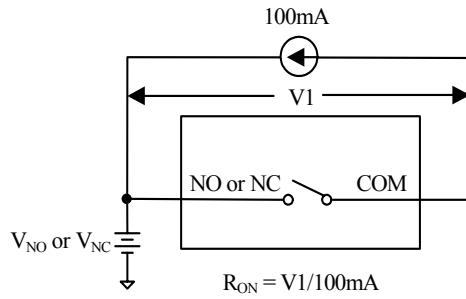
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TPY	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		-40°C to +85°C	0		V_+	V
On-Resistance	R_{ON}	$V_+ = 2.7$ V, V_{NO} or $V_{NC} = 1$ V, $I_{COM} = -100$ mA, Test Circuit 1	+25°C		0.6	0.9	Ω
			-40°C to +85°C			1	Ω
On-Resistance Match Between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

Specifications subject to changes without notice.

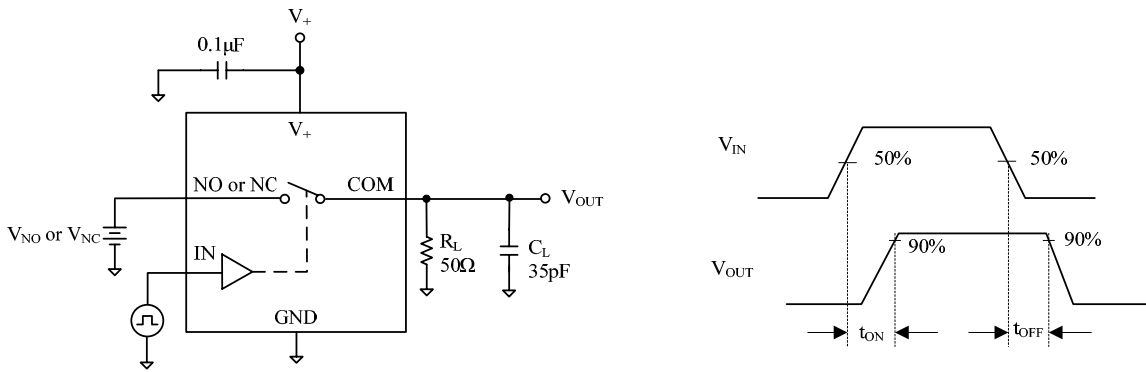
TYPICAL PERFORMANCE CHARACTERISTICS



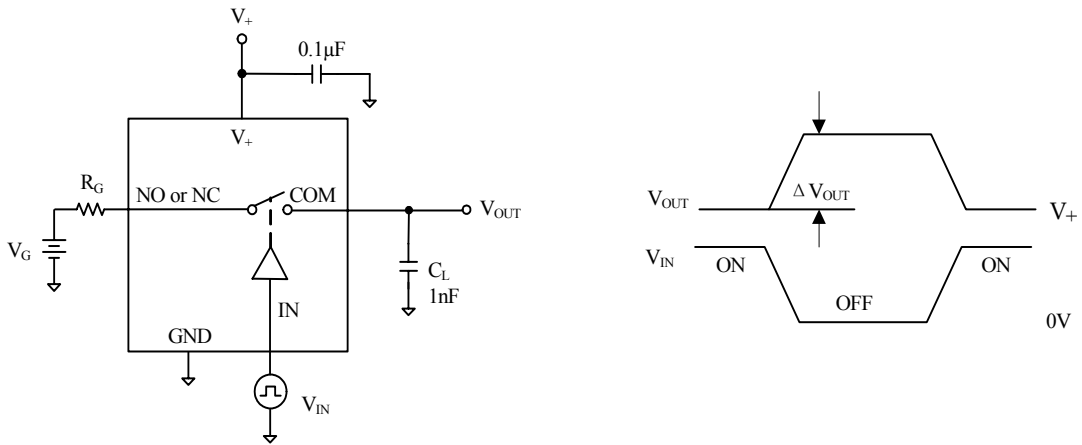
TEST CIRCUITS



Test Circuit 1. On Resistance

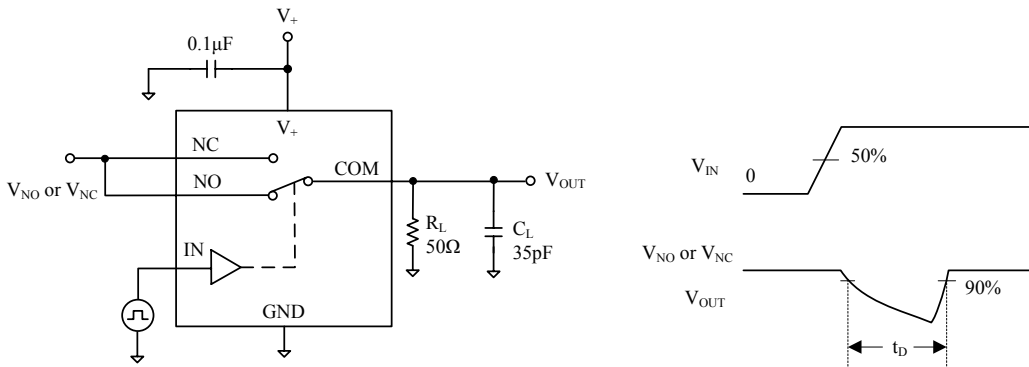


Test Circuit 2. Switching Times

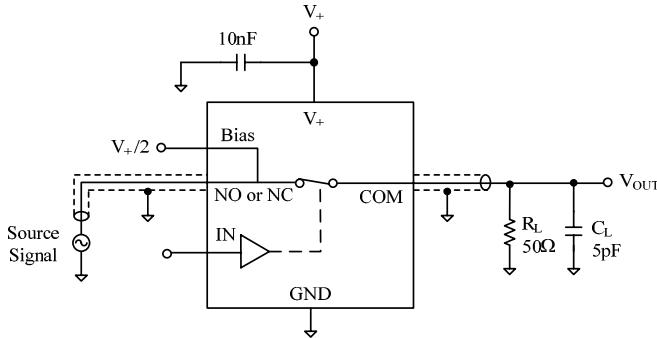


Test Circuit 3. Charge Injection

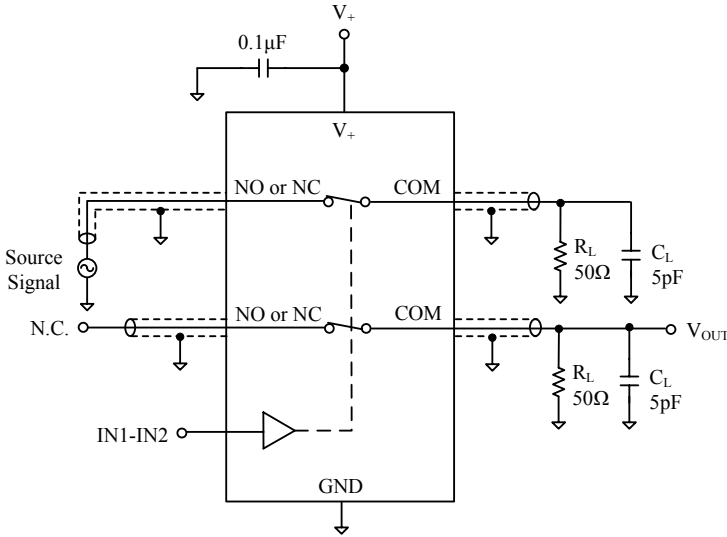
TEST CIRCUITS (Cont.)



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



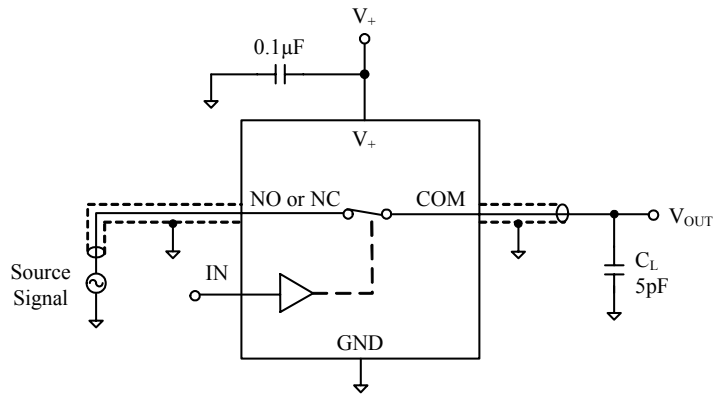
Test Circuit 5. Off Isolation



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

Test Circuit 6. Channel-to-Channel Crosstalk

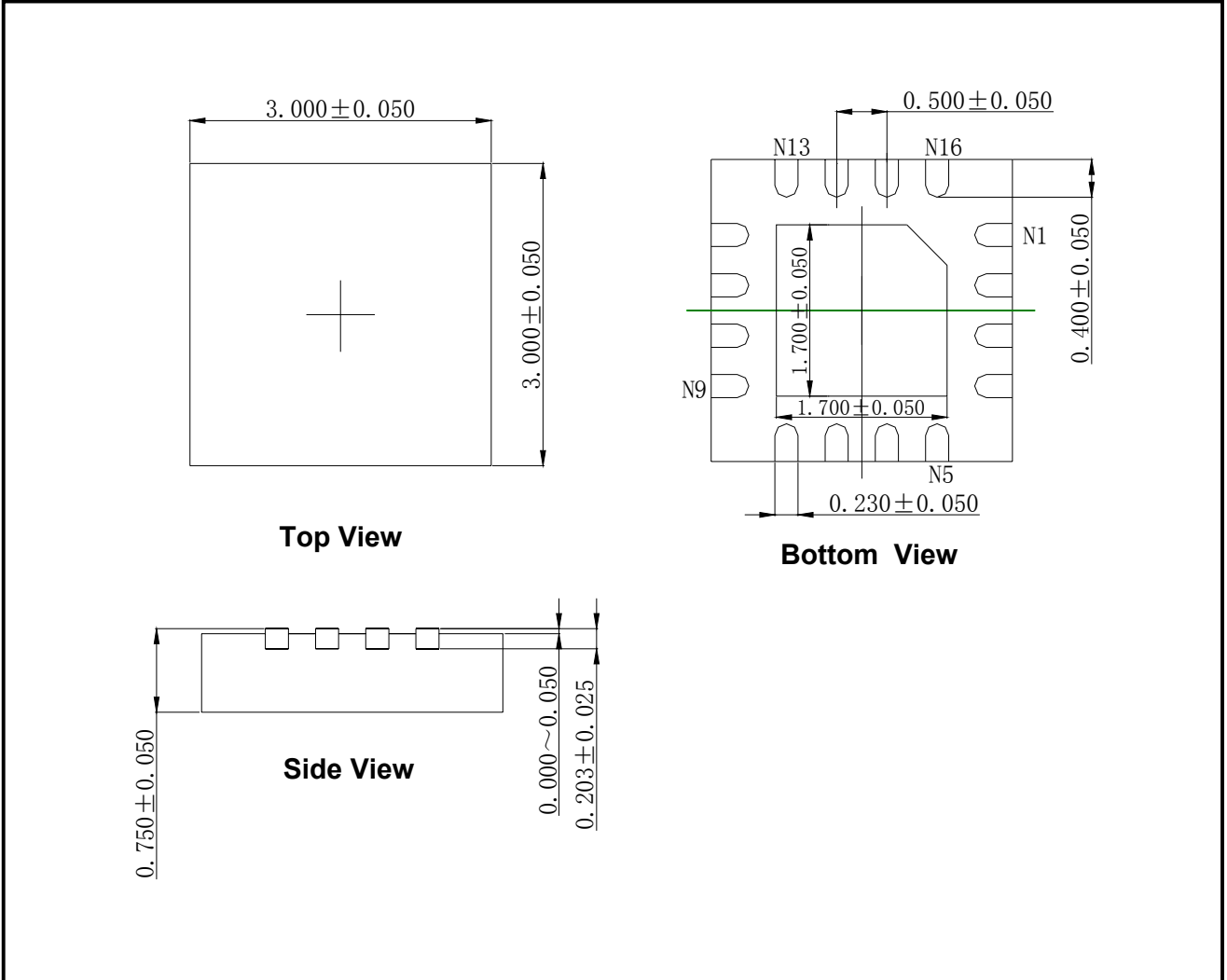
TEST CIRCUITS (Cont.)



Test Circuit 7. Bandwidth

PACKAGE OUTLINE DIMENSIONS

TQFN-16



Note: All linear dimensions are in millimeters.

REVISION HISTORY

Location	Page
10/07— Data Sheet changed from Preliminary Data sheet to REV.A	
Changes to ELECTRICAL CHARACTERISTICS about Source OFF Leakage current	3, 4
10/07— Data Sheet changed from REV.A to REV.B	
Changes to TYPICAL PERFORMANCE CHARACTERISTICS	5

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