SGM44599

4Ω, High Speed, Low Voltage Dual, DPDT Analog Switch

GENERAL DESCRIPTION

The SGM44599 is a high-speed, low-voltage, advanced dual-independent double-pole/double-throw (DPDT) CMOS analog switch that is designed to operate from a single +1.8V to +5.5V power supply. It features high-bandwidth (300MHz) and low on-resistance (4Ω TYP), targeted applications for audio switching.

The SGM44599 is configured as a dual double-pole /double-throw (DPDT) device with two logic control inputs that control two multiplexer/demultiplexers each. The configuration can also be used as a dual differential 2-to-1 multiplexer/ demultiplexer.

SGM44599 is available in TQFN-16 (3mm × 3mm) and TQFN-16 (2.5mm × 2.5mm) packages.

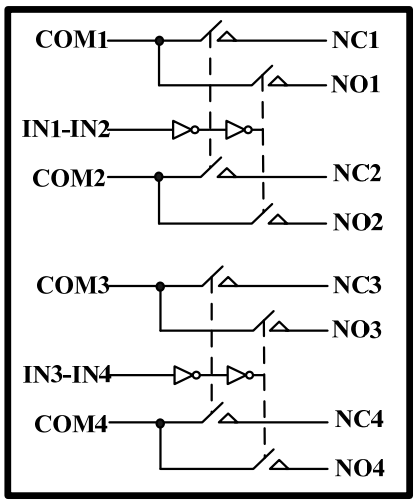
APPLICATIONS

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 5.5V**
- **On-Resistance: 4Ω (TYP)**
- **Low On-Resistance Flatness**
- **-3dB Bandwidth: 300MHz**
- **Rail-to-Rail Input and Output Operation**
- **High Off-Isolation: -75dB at 1MHz**
- **Low Crosstalk: -100dB at 1MHz**
- **Typical Power Consumption (<0.01 μW)**
- **TTL/CMOS Compatible**
- **Lead (Pb) Free TQFN-16 (3mm × 3mm) and TQFN-16 (2.5mm × 2.5mm) Packages**
- **Extended Industrial Temperature Range: -40°C to +85°C**

BLOCK DIAGRAM



ORDERING INFORMATION

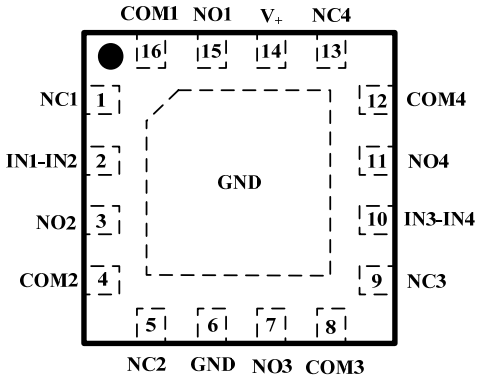
MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM44599	TQFN-16 (2.5mm×2.5mm)	-40°C to +85°C	SGM44599YTQB16/TR	44599	Tape and Reel, 3000
	TQFN-16 (3mm×3mm)	-40°C to +85°C	SGM44599YTQ16/TR	44599	Tape and Reel, 3000

ABSOLUTE MAXIMUM RATINGS

V_+ to GND.....-0.3V to +6V
Analog, Digital voltage range…..... - 0.3V to (V_+ + 0.3V)
Continuous Current NO, NC, or COM .....±150mA
Peak Current NO, NC, or COM .....±200mA
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.....2000V
MM.....200V

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.

PIN CONFIGURATIONS (TOP VIEW)



TQFN-16(3mm × 3mm)
TQFN-16(2.5mm ×2.5mm)

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

PIN DESCRIPTION

NAME	PIN		FUNCTION
	TQFN-16 (3mm×3mm)	TQFN-16 (2.5mm×2.5mm)	
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	16,4, 8, 12		Common terminal
NO_X	15,3, 7, 11		Normally-open terminal
NC_X	1, 5, 9, 13		Normally-closed terminal

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

ELECTRICAL CHARACTERISTICS

(V_+ = +4.5V to +5.5V, GND = 0V, V_{IH} = +1.6V, V_{IL} = +0.5V, T_A = -40°C to +85°C. Typical values are at V_+ = +5.0V, T_A = +25°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_+ = 4.5V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25°C		4	6.2	Ω
				-40°C to +85°C			7.2	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 4.5V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25°C		0.4	2.6	Ω
				-40°C to +85°C			3.1	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 4.5V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25°C		2	3.1	Ω
				-40°C to +85°C			3.6	Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+=5.5V, 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_+ = 5.5V, 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_+ = 5.5V, V_{IN} = 0V or 5.5V		-40°C to +85°C			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{NC} or V_{NO} = 3.0V, R_L = 300Ω, C_L = 35pF, Test Circuit2		+25°C		31.5		ns
Turn-Off Time	t_{OFF}			+25°C		30.0		ns
Break-Before-Make Time Delay	t_D	V_{NC} or V_{NO} = 3.0V, R_L = 300Ω, C_L = 35pF, Test Circuit4		+25°C		11.5		ns
Charge Injection	Q	V_G = GND, R_G = 0Ω, C_L = 1.0nF, Q = C_L x V_{OUT}, Test Circuit3		+25°C		3.5		pC
Off Isolation	O_{ISO}	Signal = 0dBm, R_L = 50Ω, Test Circuit5	1MHz	+25°C		-75		dB
			10MHz	+25°C		-55		
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm,R_L = 50Ω, Test Circuit6	1MHz	+25°C		-100		dB
			10MHz	+25°C		-60		
-3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, Test Circuit7		+25°C		300		MHz
Channel ON Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$			+25°C		43.2		pF
POWER REQUIREMENTS								
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			1	μA

Specifications subject to changes without notice.

ELECTRICAL CHARACTERISTICS

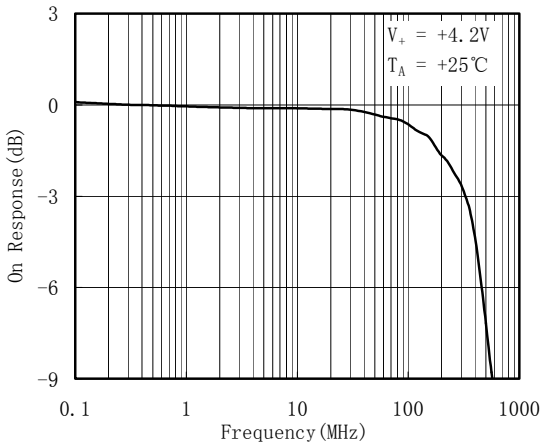
(V_+ = +2.7V to +3.6V, V_{IH} = +1.6V, V_{IL} = +0.4V, T_A = -40°C to +85°C. Typical values are at V_+ = +3.0V, T_A = +25°C, unless otherwise noted.)

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_+ = 2.7V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25°C		10	15	Ω
				-40°C to +85°C			18	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 2.7V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25°C		1	3	Ω
				-40°C to +85°C			4	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 2.7V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100mA, Test Circuit 1		+25°C		6	9	Ω
				-40°C to +85°C			12	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°C to +85°C			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°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_+ = 2.7V, V_{IN} = 0V or 2.7V		-40°C to +85°C			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{NC} or V_{NO} = 1.5V, R_L = 300Ω, C_L = 35pF, Test Circuit2		+25°C		38.0		ns
Turn-Off Time	t_{OFF}			+25°C		44.0		ns
Break-Before-Make Time Delay	t_D	V_{NC} or V_{NO} = 1.5V, R_L = 300Ω, C_L = 35pF, Test Circuit4		+25°C		5.8		ns
Charge Injection	Q	V_G = GND, R_G = 0Ω, C_L = 1.0nF, Q = C_L x V_{OUT}, Test Circuit3		+25°C		2.6		pC
Off Isolation	O_{ISO}	Signal = 0dBm, R_L = 50Ω, Test Circuit5	1MH	+25°C		-75		dB
			10MHz	+25°C		-55		dB
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, R_L = 50Ω, Test Circuit6	1MHz	+25°C		-100		dB
			10MHz	+25°C		-60		dB
-3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, Test Circuit7		+25°C		300		MHz
Channel ON Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$			+25°C		43.2		pF

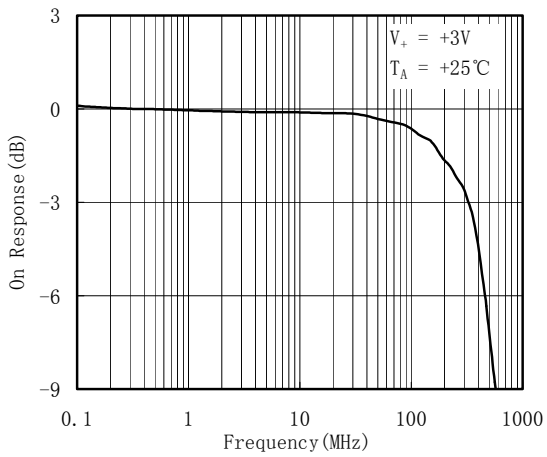
Specifications subject to changes without notice.

TYPICAL PERFORMANCE CHARACTERISTICS

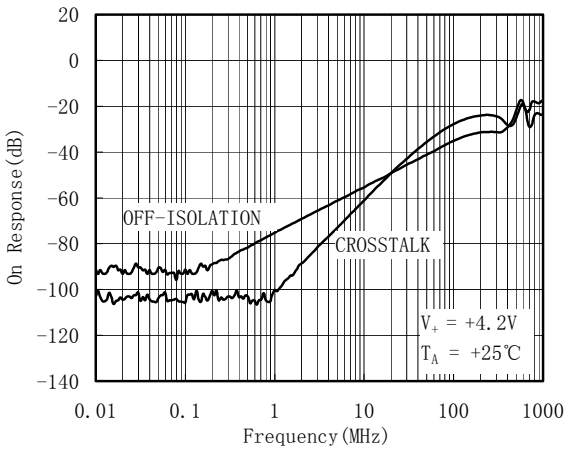
On Response vs. Frequency



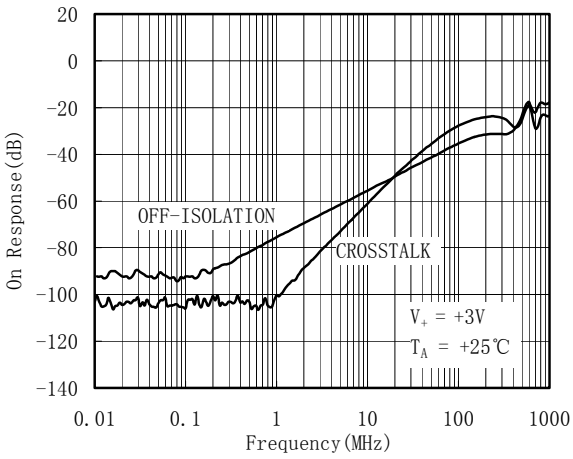
On Response vs. Frequency



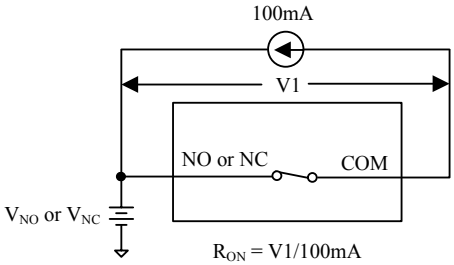
Response vs. Frequency



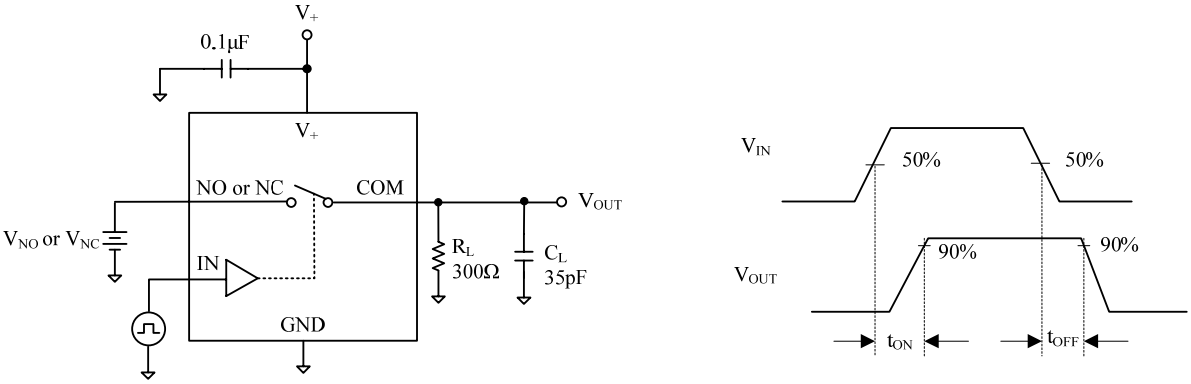
Response vs. Frequency



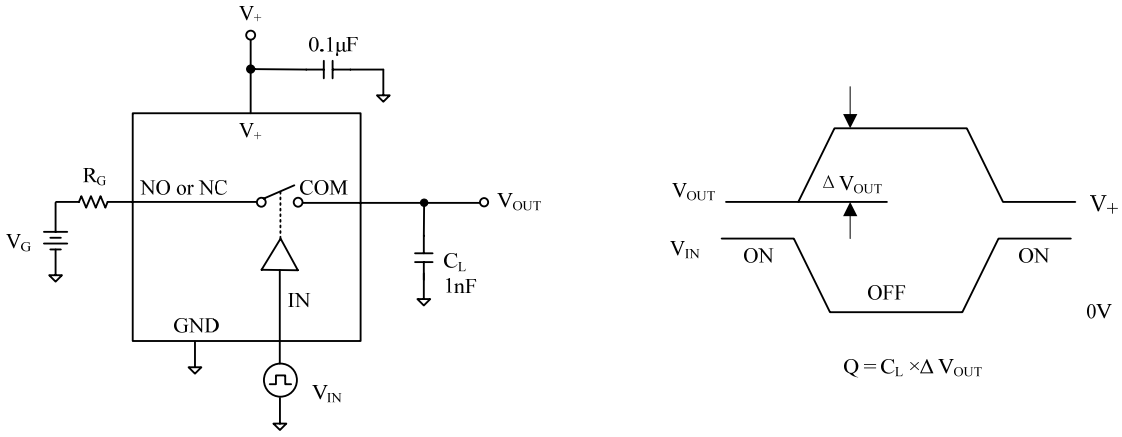
TEST CIRCUITS



Test Circuit 1. On Resistance

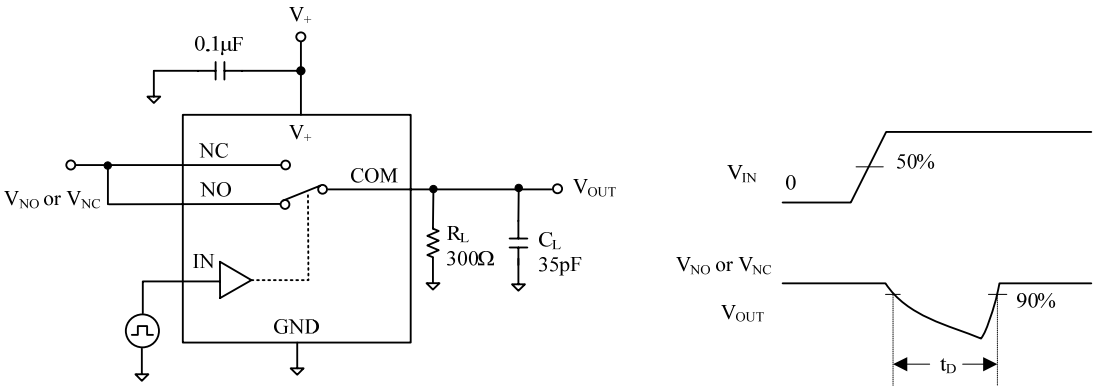


Test Circuit 2. Switching Times (t_{ON}, t_{OFF})

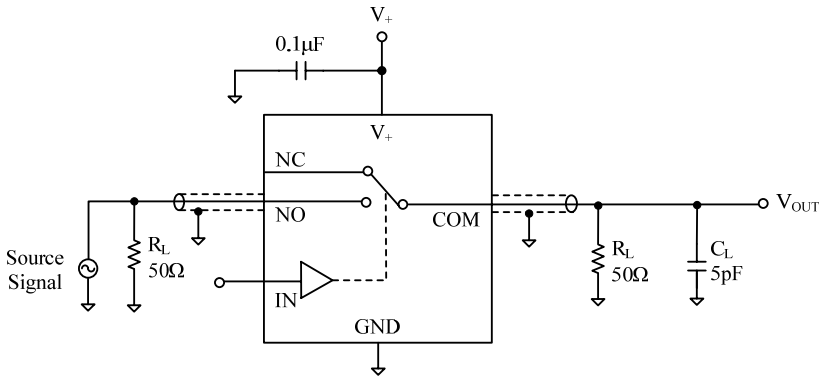


Test Circuit 3. Charge Injection

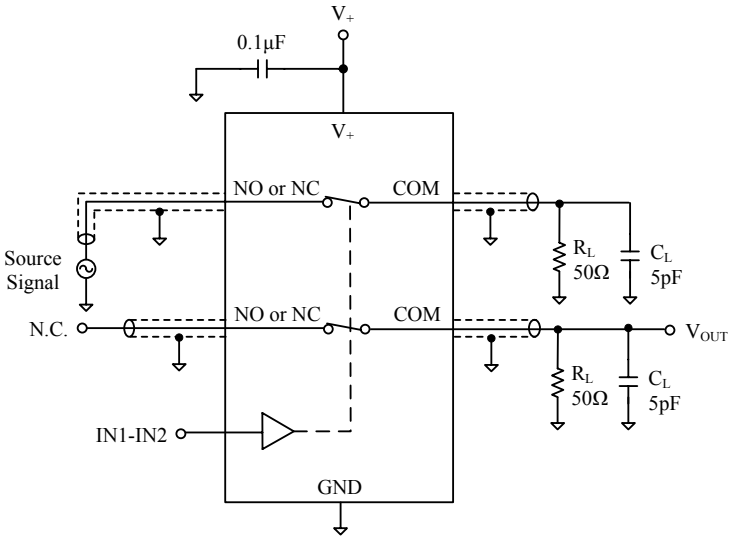
TEST CIRCUITS (Cont.)



Test Circuit 4. Break-Before-Make Time Delay (t_D)



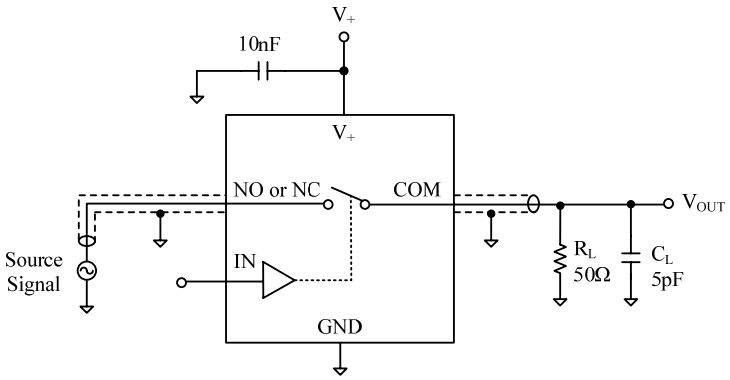
Test Circuit 5. Off Isolation



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

Test Circuit 6. Channel-to-Channel Crosstalk

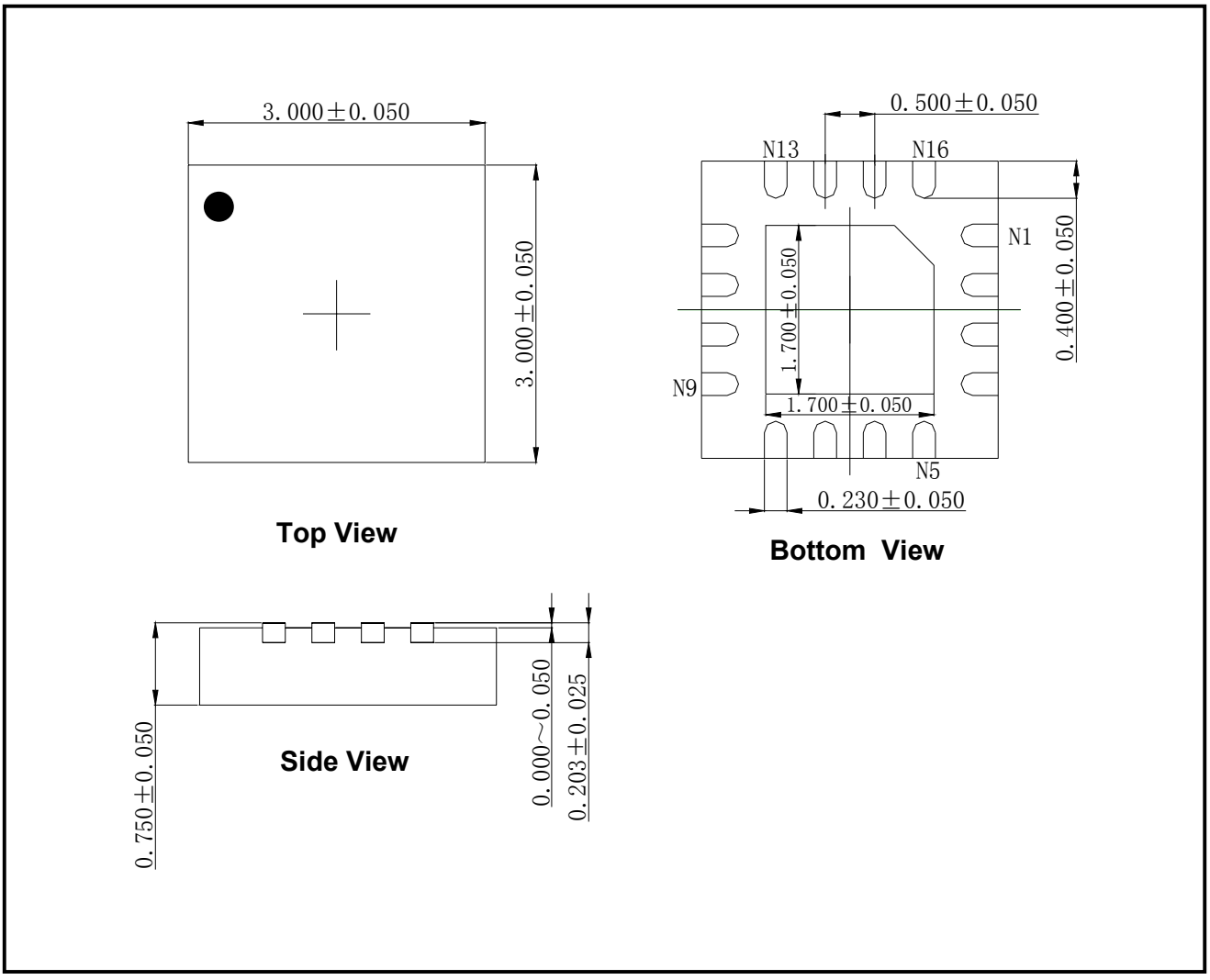
TEST CIRCUITS (Cont.)



Test Circuit 7. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

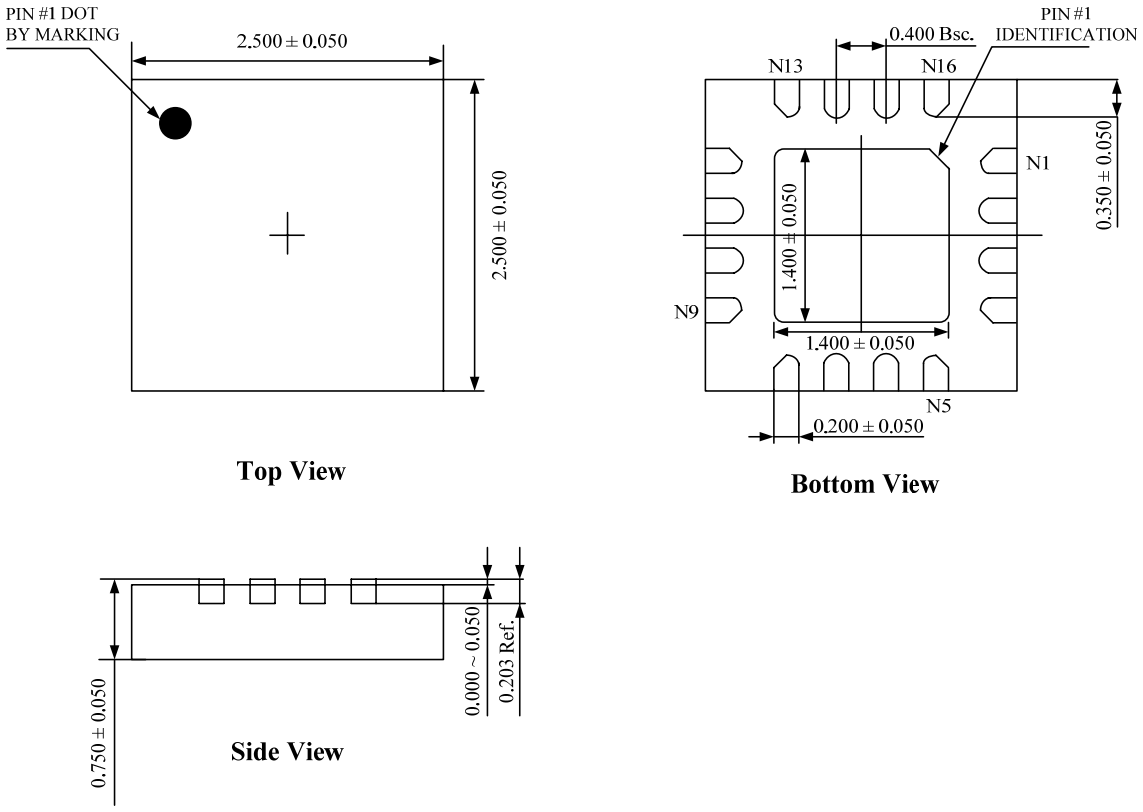
TQFN-16 (3mm × 3mm)



Note: All linear dimensions are in millimeters.

PACKAGE OUTLINE DIMENSIONS

TQFN-16 (2.5mm × 2.5mm)



Note: All linear dimensions are in millimeters.

REVISION HISTORY

Location **Page**

10/2007—Preliminary Datasheet

01/2008— Data Sheet changed from preliminary to REV. A

Adds TQFN-16 (2.5mm × 2.5mm) Package 1,2,10