

# SGM2268

# 0.4Ω Ultra Low ON-Resistance, Dual, SPDT Analog Switch

## GENERAL DESCRIPTION

The SGM2268 is a dual single-pole/double-throw (SPDT) analog switch that designed to operate from a single +1.8V to +4.2V power supply. Targeted applications include battery powered equipment that benefit from ultra low ON-resistance (0.4Ω) and fast switching speeds.

SGM2268 features guaranteed on-resistance matching (0.04Ω TYP) between switches and guaranteed on-resistance flatness over the signal range (0.08Ω TYP), as well as high Off-Isolation and low crosstalk. This ensures excellent linearity and low distortion when switching audio signals.

The SGM2268 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.

SGM2268 is available in Pb-free WQFN-10 package.

## APPLICATIONS

- Portable Instrumentation
- Battery-Operated Equipment
- Computer Peripherals
- Speaker and Earphone Switching
- Medical Equipment
- Audio and Video Switching

## FUNCTION TABLE

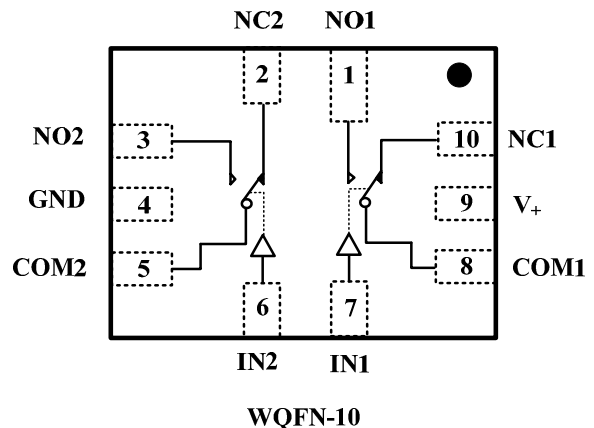
LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

Switches Shown For Logic "0" Input

## FEATURES

- Voltage Operation : +1.8V to +4.2V
- Ultra Low On-Resistance: 0.4Ω (TYP) at +4.2V
- On-Resistance Matching : 0.04Ω (TYP)
- On-Resistance Flatness: 0.08Ω (TYP)
- -3 dB Bandwidth: 40MHz
- High Off-Isolation: -78dB at 100KHz
- Low Crosstalk: -103dB at 100KHz
- Rail-to-Rail Input and Output Operation
- TTL/CMOS Compatible
- Break-Before-Make Switching
- Extended Industrial Temperature Range:  
-40°C to +85°C
- Lead (Pb) Free WQFN-10 Package

## PIN CONFIGURATION (TOP VIEW)



# ELECTRICAL CHARACTERISTICS

(V<sub>+</sub> = +4.2V, GND = 0V, V<sub>IH</sub> = +1.6V, V<sub>IL</sub> = +0.6V, T<sub>A</sub> = - 40°C to + 85°C. Typical values are at V<sub>+</sub> = +4.2V, T<sub>A</sub> = + 25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TPY	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	V <sub>NO</sub> , V <sub>NC</sub> , V <sub>COM</sub>		- 40°C to +85°C	0		V <sub>+</sub>	V
On-Resistance	R <sub>ON</sub>	V <sub>+</sub> = 4.2 V, V <sub>NO</sub> , V <sub>NC</sub> or V <sub>COM</sub> = 1 V, I <sub>COM</sub> = -100 mA, Test Circuit 1	+25°C		0.4	0.65	Ω
			- 40°C to +85°C			0.75	Ω
On-Resistance Match Between Channels	ΔR <sub>ON</sub>	V <sub>+</sub> = 4.2 V, V <sub>NO</sub> , V <sub>NC</sub> or V <sub>COM</sub> = 1 V, I <sub>COM</sub> = -100 mA, Test Circuit 1	+25°C		0.04	0.15	Ω
			- 40°C to +85°C			0.2	Ω
On-Resistance Flatness	R <sub>FLAT(ON)</sub>	V <sub>+</sub> = 4.2 V, V <sub>NO</sub> , V <sub>NC</sub> or V <sub>COM</sub> = 1 V, I <sub>COM</sub> = -100 mA, Test Circuit 1	+25°C		0.08	0.12	Ω
			- 40°C to +85°C			0.2	Ω
Source OFF Leakage current	I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	V <sub>+</sub> = 4.2 V, V <sub>NO</sub> or V <sub>NC</sub> = 3.3 V/ 0.3 V, V <sub>COM</sub> = 0.3 V/ 3.3 V	- 40°C to +85°C			1	μA
Channel ON Leakage current	I <sub>NC(ON)</sub> , I <sub>NO(ON)</sub> , I <sub>COM(ON)</sub>	V <sub>+</sub> = 4.2 V, V <sub>COM</sub> = 0.3 V/ 3.3 V, V <sub>NO</sub> or V <sub>NC</sub> = 0.3 V/ 3.3 V, or floating	- 40°C to +85°C			1	μA
<b>DIGITAL INPUTS</b>							
Input High Voltage	V <sub>IH</sub>		- 40°C to +85°C	1.6			V
Input Low Voltage	V <sub>IL</sub>		- 40°C to +85°C			0.5	V
Input Leakage Current	I <sub>IN</sub>	V <sub>+</sub> = 4.2 V, V <sub>IN</sub> = 0 V or 4.2 V	- 40°C to +85°C			1	μA
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>IN</sub> = 2.1 V to 0 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF, V <sub>NO1</sub> or V <sub>NC1</sub> = V <sub>NO2</sub> or V <sub>NC2</sub> = 2.1 V, Test Circuit2	+25°C		88		ns
Turn-Off Time	t <sub>OFF</sub>	V <sub>IN</sub> = 2.1 V to 0 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF, V <sub>NO1</sub> or V <sub>NC1</sub> = V <sub>NO2</sub> or V <sub>NC2</sub> = 2.1 V, Test Circuit2	+25°C		16		ns
Break-Before-Make Time Delay	t <sub>D</sub>	V <sub>IN</sub> = 2.1 V to 0 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF, V <sub>NO1</sub> or V <sub>NC1</sub> = V <sub>NO2</sub> or V <sub>NC2</sub> = 2.1 V, Test Circuit3	+25°C		6.0		ns
Off Isolation	O <sub>ISO</sub>	V <sub>BIAS</sub> = 2.1 V, V <sub>IN</sub> = 0 dBm, Test Circuit4	100KHz	+25°C		-78	dB
			1MHz	+25°C		-58	dB
Channel-to-Channel Crosstalk	X <sub>TALK</sub>	V <sub>BIAS</sub> = 2.1 V, V <sub>IN</sub> = 0 dBm, Test Circuit5	100KHz	+25°C		-103	dB
			1MHz	+25°C		-90	dB
Bandwidth -3 dB	BW	V <sub>BIAS</sub> = 2.1 V, V <sub>IN</sub> = 0 dBm, Test Circuit6	+25°C		40.0		MHz
Charge Injection Select Input to Common I/O	Q	V <sub>NO1</sub> or V <sub>NC1</sub> = V <sub>NO2</sub> or V <sub>NC2</sub> = 0 V, C <sub>L</sub> = 1.0 nF, Test Circuit7	+25°C		4.0		pC
Channel ON Capacitance	C <sub>ON</sub>		+25°C		106		pF
<b>POWER REQUIREMENTS</b>							
Power Supply Range	V <sub>+</sub>		- 40°C to +85°C	1.8		4.2	V
Power Supply Current	I <sub>+</sub>	V <sub>+</sub> = 4.2 V, V <sub>IN</sub> = 0 V or V <sub>+</sub>	- 40°C to +85°C			1	μA

Specifications subject to change without notice.

# ELECTRICAL CHARACTERISTICS

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

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TPY	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	$V_{NO}, V_{NC}, V_{COM}$		-40°C to +85°C	0		$V_+$	V
On-Resistance	$R_{ON}$	$V_+ = 2.7 V, V_{NO}, V_{NC}$ or $V_{COM} = 1 V,$ $I_{COM} = -100 mA$ , Test Circuit 1	+25°C		0.5	0.7	$\Omega$
			-40°C to +85°C			0.8	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_+ = 2.7 V, V_{NO}, V_{NC}$ or $V_{COM} = 1 V,$ $I_{COM} = -100 mA$ , Test Circuit 1	+25°C		0.03	0.15	$\Omega$
			-40°C to +85°C			0.2	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 2.7 V, V_{NO}, V_{NC}$ or $V_{COM} = 1 V,$ $I_{COM} = -100 mA$ , Test Circuit 1	+25°C		0.1	0.18	$\Omega$
			-40°C to +85°C			0.2	$\Omega$
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	$\mu A$
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	$\mu A$
<b>DIGITAL INPUTS</b>							
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	$I_{IN}$	$V_+ = 2.7 V, V_{IN} = 0 V$ or $2.7 V$	-40°C to +85°C			1	$\mu A$
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	$t_{ON}$	$V_{IN} = 1.5 V$ to $0 V, R_L = 50 \Omega, C_L = 35 pF,$ $V_{NO1}$ or $V_{NC1} = V_{NO2}$ or $V_{NC2} = 1.5 V,$ Test Circuit2	+25°C		100		ns
Turn-Off Time	$t_{OFF}$	$V_{IN} = 1.5 V$ to $0 V, R_L = 50 \Omega, C_L = 35 pF,$ $V_{NO1}$ or $V_{NC1} = V_{NO2}$ or $V_{NC2} = 1.5 V,$ Test Circuit2	+25°C		20		ns
Break-Before-Make Time Delay	$t_d$	$V_{IN} = 1.5 V$ to $0 V, R_L = 50 \Omega, C_L = 35 pF,$ $V_{NO1}$ or $V_{NC1} = V_{NO2}$ or $V_{NC2} = 1.5 V,$ Test Circuit3	+25°C		9.2		ns
Off Isolation	$O_{ISO}$	$V_{BIAS} = 2.1 V, V_{IN} = 0 dBm,$ Test Circuit4	100KHz	+25°C		-78	dB
			1MHz	+25°C		-58	dB
Channel-to-Channel Crosstalk	$X_{TALK}$	$V_{BIAS} = 2.1 V, V_{IN} = 0 dBm,$ Test Circuit5	100KHz	+25°C		-103	dB
			1MHz	+25°C		-90	dB
Bandwidth -3 dB	BW	$V_{BIAS} = 2.1 V, V_{IN} = 0 dBm$ , Test Circuit6	+25°C		40		MHz
Charge Injection Select Input to Common I/O	Q	$V_{NO1}$ or $V_{NC1} = V_{NO2}$ or $V_{NC2} = 0 V, C_L = 1.0nF$ Test Circuit7	+25°C		3.0		pC
Channel ON Capacitance	$C_{ON}$		+25°C		106		pF

Specifications subject to change without notice.

## ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM2268	WQFN-10	- 40°C to +85°C	SGM2268YWQ10/TR	2268	Tape and Reel, 3000

## ABSOLUTE MAXIMUM RATINGS

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V <sub>+</sub> , IN to GND.....	0V to +4.6V	Storage Temperature.....	- 65°C to +150°C
Analog, Digital voltage range(1).....	- 0.3V to (V <sub>+</sub> + 0.3V)	Lead Temperature (soldering, 10s).....	+260°C
Continuous Current NO, NC, or COM.....	±250mA	ESD Susceptibility	
Peak Current NO, NC, or COM.....	±350mA	HBM.....	400V
Operating Temperature Range.....	- 40°C to +85°C	MM.....	400V
Junction Temperature.....	+150°C		

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<sub>+</sub> will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

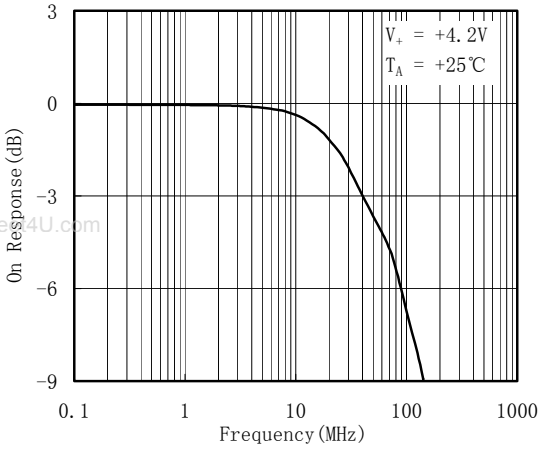
## PIN DESCRIPTION

WQFN-10	NAME	FUNCTION
9	V <sub>+</sub>	Power supply
4	GND	Ground
7,6	IN1, IN2	Digital control pin to connect the COM terminal to the NO or NC terminals
8,5	COM1, COM2	Common terminal
1,3	NO1, NO2	Normally-open terminal
10,2	NC1, NC2	Normally-closed terminal

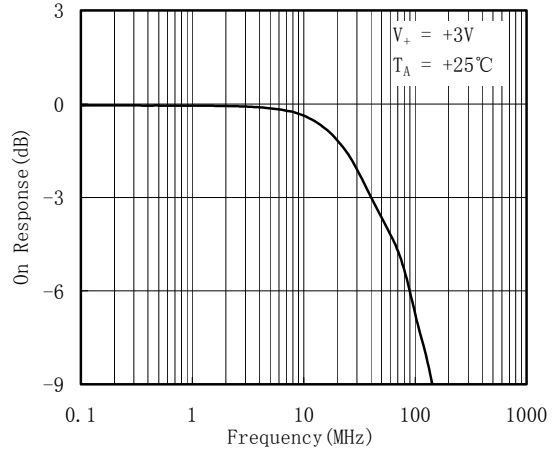
Note: NO, NC and COM terminal may be an input or output.

# TYPICAL PERFORMANCE CHARACTERISTICS

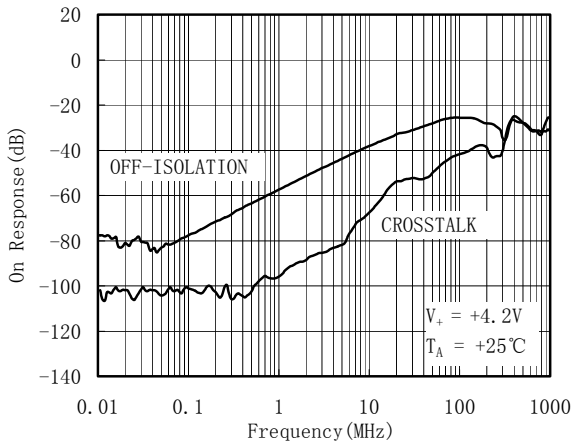
On Response vs. Frequency



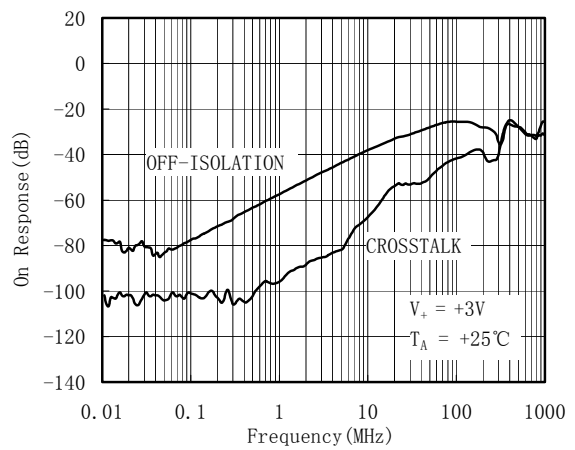
On Response vs. Frequency



Response vs. Frequency

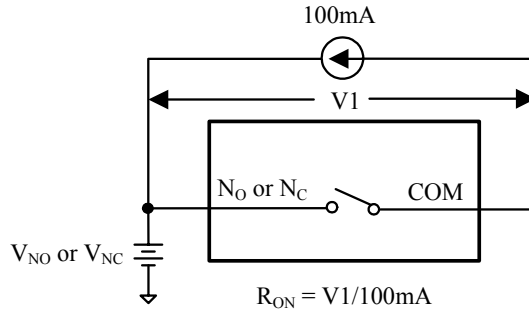


Response vs. Frequency

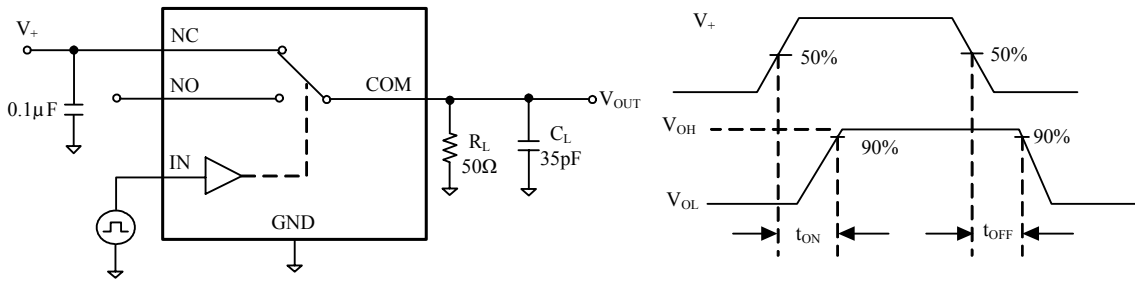


# TEST CIRCUITS

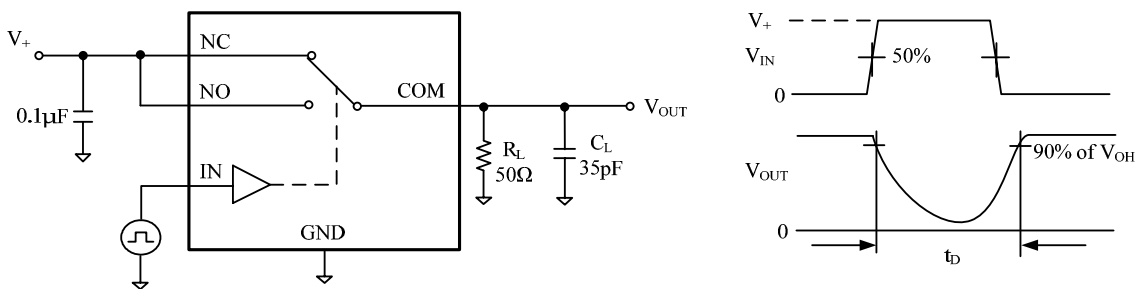
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Test Circuit 1. On Resistance



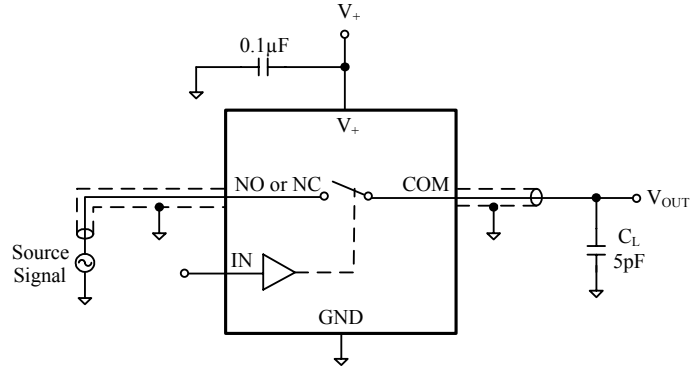
Test Circuit 2. Switching Times ( $t_{ON}$ ,  $t_{OFF}$ )



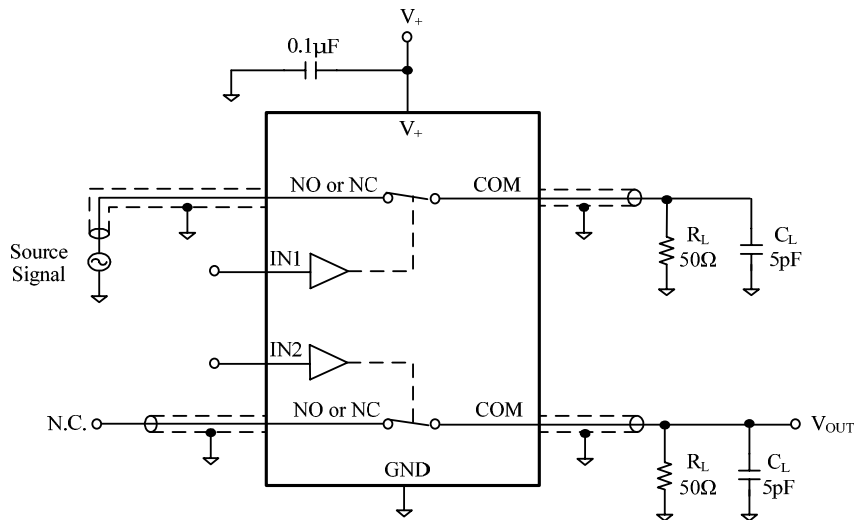
Test Circuit 3. Break-Before-Make Time ( $t_D$ )

# TEST CIRCUITS (Cont.)

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Test Circuit 4. Off Isolation

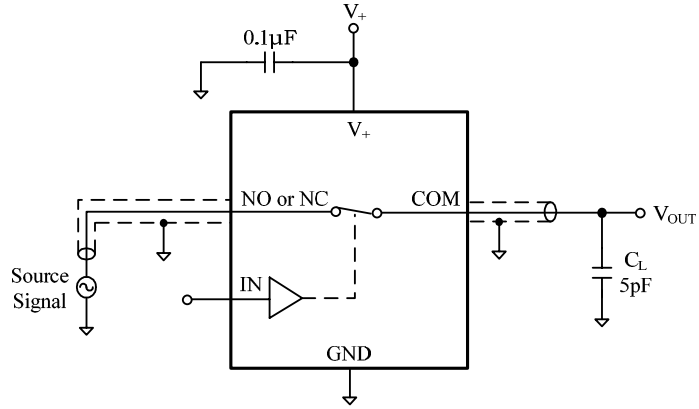


$$\text{Channel To Channel Crosstalk} = -20 \times \log \frac{V_{\text{NO or V}_{\text{NC}}}}{V_{\text{OUT}}}$$

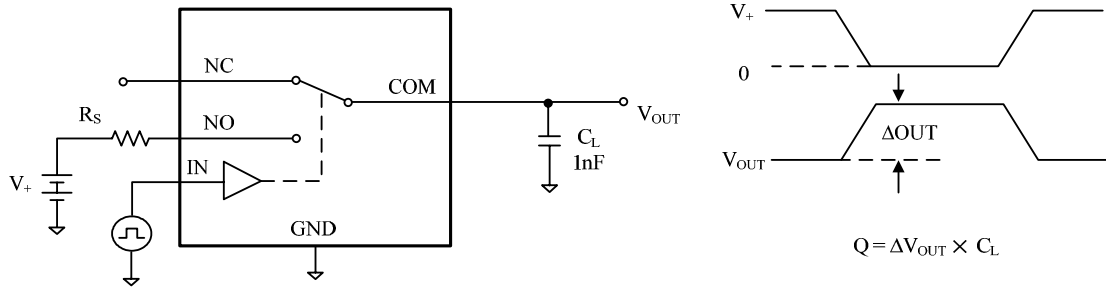
Test Circuit 5. Channel-to-Channel Crosstalk

# TEST CIRCUITS (Cont.)

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Test Circuit 6. Bandwidth -3dB

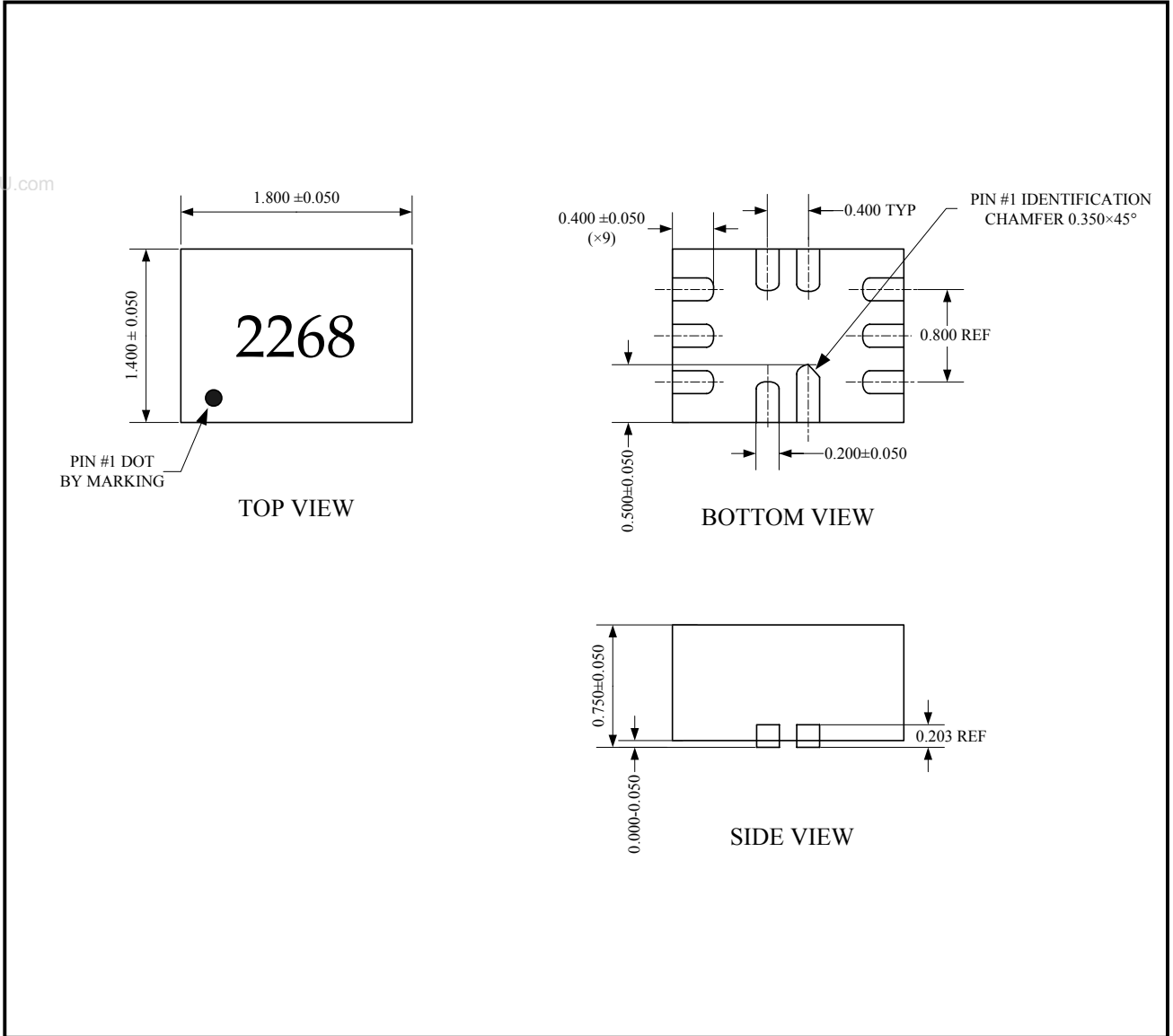


Test Circuit 7. Charge Injection (Q)



# PACKAGE OUTLINE DIMENSIONS

## WQFN-10



Note: All linear dimensions are in millimeters.

## REVISION HISTORY

Location

Page

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10/2007—Preliminary Datasheet

01/2008—Data Sheet REV.A

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