

SGM5223

0.5Ω Ultra Low ON-Resistance, Dual, SPDT Analog Switch

GENERAL DESCRIPTION

The SGM5223 is a dual single-pole/double-throw (SPDT) 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 SGM5223's low on-resistance (0.5Ω) and fast switching speeds ($t_{ON} = 17ns$, $t_{OFF} = 27.5ns$).

SGM5223 has excellent on-resistance matching (0.18 Ω max) between switches and guarantees excellent on-resistance flatness over all signal range (0.1Ω TYP). This ensures excellent linearity and low distortion when switching audio signals.

The SGM5223 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.

SGM5223 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

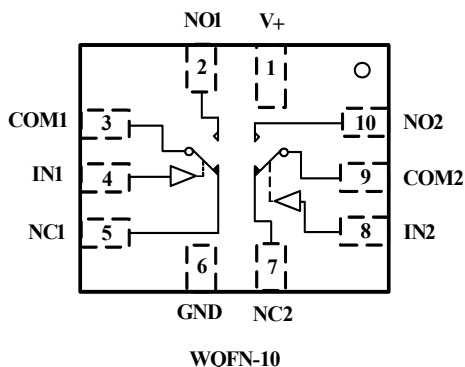
LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

Switches Shown For Logic "0" Input

FEATURES

- Voltage Operation: 1.8V to 4.2V
- Ultra Low On-Resistance: 0.5Ω (TYP) at 4.2V
- Fast Switching Times
 - $t_{ON} 17ns$
 - $t_{OFF} 27.5ns$
- High Off-Isolation: -58dB at 1MHz
- Low Crosstalk: -104dB at 1MHz
- Rail-to-Rail Input and Output Operation
- 1.8V Logic Compatible Control Pin
- Break-Before-Make Switching
- Extended Industrial Temperature Range:
 - 40°C to +85°C
- Lead (Pb) Free WQFN-10 Package

PIN CONFIGURATION (TOP VIEW)



SG Micro Limited
www.sg-micro.com

REV.A. 1

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}		$-40^\circ C$ to $+85^\circ C$	0		V_+	V
On-Resistance	R_{ON}	$V_+ = 4.2V, V_{NO}$ or $V_{NC} = 1V,$ $I_{COM} = -100mA$, Test Circuit 1	$+25^\circ C$		0.5	0.75	Ω
			$-40^\circ C$ to $+85^\circ C$			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	$+25^\circ C$		0.11	0.18	Ω
			$-40^\circ C$ to $+85^\circ C$		0.1	0.23	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 4.2V, V_{NO}, V_{NC}$ or $V_{COM} = 1V, 2.5V,$ $I_{COM} = -100mA$, Test Circuit 1	$+25^\circ C$		0.1	0.22	Ω
			$-40^\circ C$ to $+85^\circ C$			0.26	Ω
Source OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_+ = 4.2V, V_{NO}$ or $V_{NC} = 3.3V/0.3V,$ $V_{COM} = 0.3V/3.3V$	$-40^\circ C$ to $+85^\circ C$			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	$-40^\circ C$ to $+85^\circ C$			1	μA
DIGITAL INPUTS							
Input High Voltage	V_{INH}		$-40^\circ C$ to $+85^\circ C$	1.6			V
Input Low Voltage	V_{INL}		$-40^\circ C$ to $+85^\circ C$			0.5	V
Input Leakage Current	I_{IN}	$V_+ = 4.2V, V_{IN} = 0V$ or $4.2V$	$-40^\circ C$ to $+85^\circ C$			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	$V_{IH} = 3V, V_{IL} = 0V$, Test Circuit2	$+25^\circ C$		17.0		ns
Turn-Off Time	t_{OFF}	$V_{IH} = 3V, V_{IL} = 0V$, Test Circuit2	$+25^\circ C$		27.5		ns
Break-Before-Make Time Delay	t_d	$V_{IH} = 3V, V_{IL} = 0V$, Test Circuit3	$+25^\circ C$		5.0		ns
Off Isolation	O_{ISO}	$V_{BIAS} = 2.1V$, Signal = 0dBm, $V_{IH} = 3V, V_{IL} = 0V$, Test Circuit4	100kHz	$+25^\circ C$		-78	dB
			1MHz	$+25^\circ C$		-58	dB
Channel-to-Channel Crosstalk	X_{TALK}	$V_{BIAS} = 2.1V$, Signal = 0dBm, $V_{IH} = 3V, V_{IL} = 0V$, Test Circuit5	100kHz	$+25^\circ C$		-100	dB
			1MHz	$+25^\circ C$		-104	dB
-3dB Bandwidth	BW	$V_{BIAS} = 2.1V$, Signal = 0dBm, $V_{IH} = 3V, V_{IL} = 0V$, Test Circuit6	$+25^\circ C$		55		MHz
Channel ON Capacitance	C_{ON}		$+25^\circ C$		95		pF
Charge Injection Select Input to Common I/O	Q	$V_G = GND, R_S = 0\Omega, C_L = 1.0nF,$ $V_{IH} = 3V, V_{IL} = 0V, Q = C_L \times V_{OUT}$, Test Circuit7	$+25^\circ C$		13		pC
POWER REQUIREMENTS							
Power Supply Range	V_+		$-40^\circ C$ to $+85^\circ C$	1.8		4.2	V
Power Supply Current	I_+	$V_+ = 4.2V, V_{IN} = 0V$ or V_+	$-40^\circ C$ to $+85^\circ C$			1	μA

Specifications subject to changes without notice.

ELECTRICAL CHARACTERISTICS

($V_+ = +2.7V$ to $+3.6V$, $V_{IH} = +1.6V$, $V_{IL} = +0.4V$, $T_A = -40^\circ C$ 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
ANALOG SWITCH							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		$-40^\circ C$ to $+85^\circ C$	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	Ω
			$-40^\circ C$ to $+85^\circ C$			1	Ω
On-Resistance Match Between Channels	ΔR_{ON}	$V_+ = 2.7V$, V_{NO} or $V_{NC} = 1V$, $I_{COM} = -100mA$, Test Circuit 1	$+25^\circ C$		0.15	0.22	Ω
			$-40^\circ C$ to $+85^\circ C$		0.15	0.25	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 2.7V$, V_{NO}, V_{NC} or $V_{COM} = 1V, 2.5V$, $I_{COM} = -100mA$, Test Circuit 1	$+25^\circ C$		0.1	0.22	Ω
			$-40^\circ C$ to $+85^\circ C$		0.1	0.26	Ω
Source OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_+ = 3.6V$, V_{NO} or $V_{NC} = 3.3V / 0.3V$, $V_{COM} = 0.3V / 3.3V$	$-40^\circ C$ to $+85^\circ C$			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	$-40^\circ C$ to $+85^\circ C$			1	μA
DIGITAL INPUTS							
Input High Voltage	V_{INH}		$-40^\circ C$ to $+85^\circ C$	1.5			V
Input Low Voltage	V_{INL}		$-40^\circ C$ to $+85^\circ C$			0.4	V
Input Leakage Current	I_{IN}	$V_+ = 2.7V$, $V_{IN} = 0V$ or $2.7V$	$-40^\circ C$ to $+85^\circ C$			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	$V_{IH} = 1.5V$, $V_{IL} = 0V$, Test Circuit2	$+25^\circ C$		22		ns
Turn-Off Time	t_{OFF}	$V_{IH} = 1.5V$, $V_{IL} = 0V$, Test Circuit2	$+25^\circ C$		34		ns
Break-Before-Make Time Delay	t_D	$V_{IH} = 1.5V$, $V_{IL} = 0V$, Test Circuit3	$+25^\circ C$		15.5		ns
Off Isolation	O_{ISO}	$V_{BIAS} = 1.5V$, Signal = 0dBm, $V_{IH} = 1.5V$, $V_{IL} = 0V$, Test Circuit4	100kHz	$+25^\circ C$		-78	dB
			1MHz	$+25^\circ C$		-58	dB
Channel-to-Channel Crosstalk	X_{TALK}	$V_{BIAS} = 1.5V$, Signal = 0dBm, $V_{IH} = 1.5V$, $V_{IL} = 0V$, Test Circuit5	100kHz	$+25^\circ C$		-100	dB
			1MHz	$+25^\circ C$		-104	dB
-3dB Bandwidth	BW	$V_{BIAS} = 1.5V$, Signal = 0dBm, $V_{IH} = 1.5V$, $V_{IL} = 0V$, Test Circuit6	$+25^\circ C$		55		MHz
Charge Injection Select Input to Common I/O	Q	$V_G = GND$, $R_S = 0\Omega$, $C_L = 1.0nF$, $Q = C_L \times V_{OUT}$, $V_{IH} = 1.5V$, $V_{IL} = 0V$, Test Circuit7	$+25^\circ C$		8.5		pC
Channel ON Capacitance	C_{ON}		$+25^\circ C$		95		pF

Specifications subject to changes without notice.

ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM5223	WQFN-10	-40°C to +85°C	SGM5223YWQ10/TR	5223	Tape and Reel, 3000

ABSOLUTE MAXIMUM RATINGS

V ₊ , IN to GND.....	0V to +4.6V	Junction Temperature.....	+150°C
Analog, Digital voltage range(1).....	- 0.3V to (V ₊ + 0.3V)	Storage Temperature.....	- 65°C to +150°C
Continuous Current NO, NC, or COM.....	±250mA	Lead Temperature (soldering, 10s).....	+260°C
Peak Current NO, NC, or COM.....	±350mA	ESD (HBM).....	4000V
Operating Temperature Range.....	-40°C to +85°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₊ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

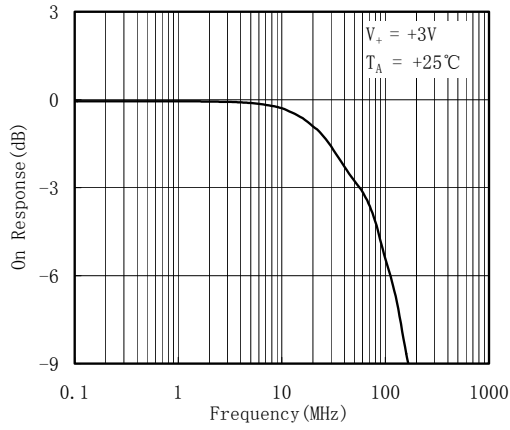
PIN DESCRIPTION

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

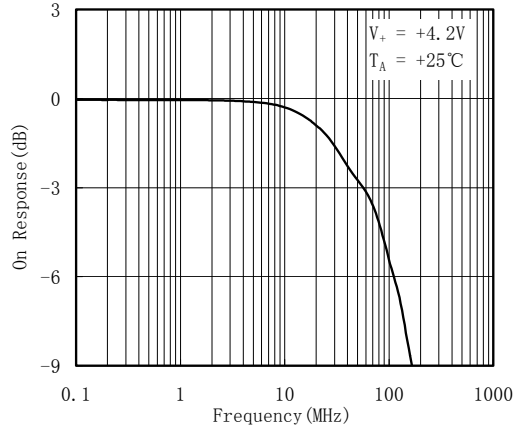
Note: NO, NC and COM terminals may be an input or output.

TYPICAL PERFORMANCE CHARACTERISTICS

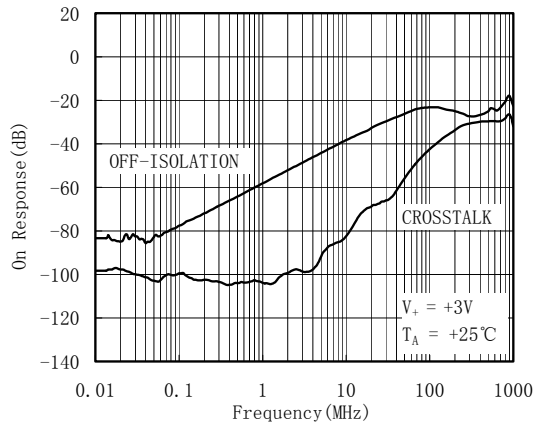
On Response vs. Frequency



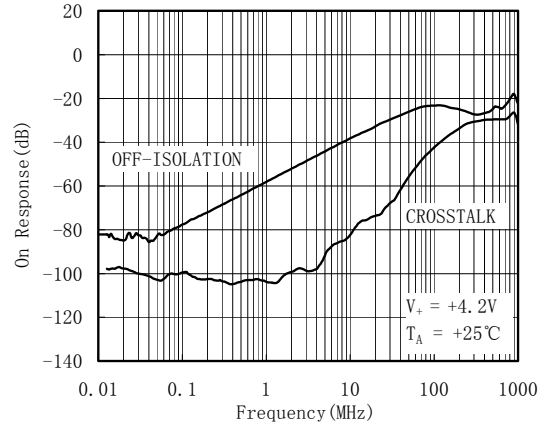
On Response vs. Frequency



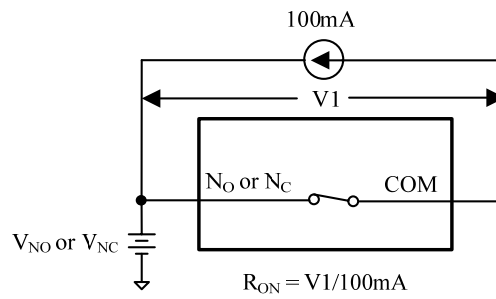
Response vs. Frequency



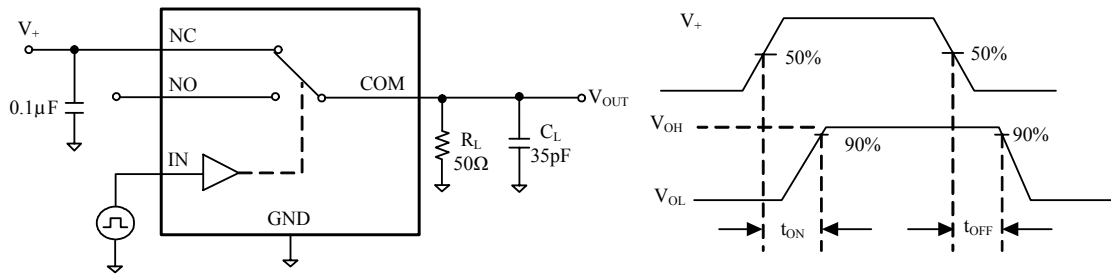
Response vs. Frequency



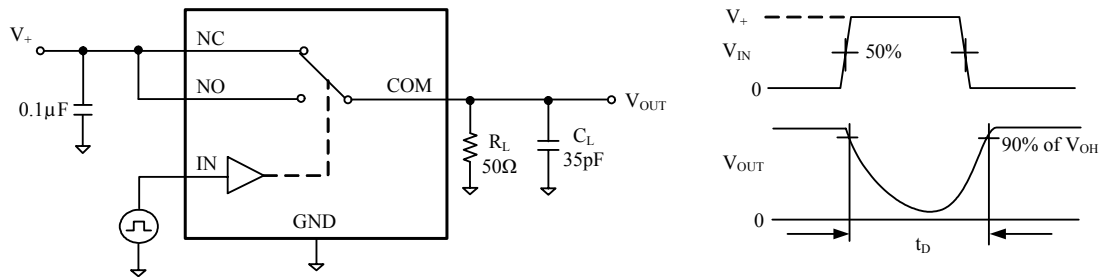
TEST CIRCUITS



Test Circuit 1. On Resistance

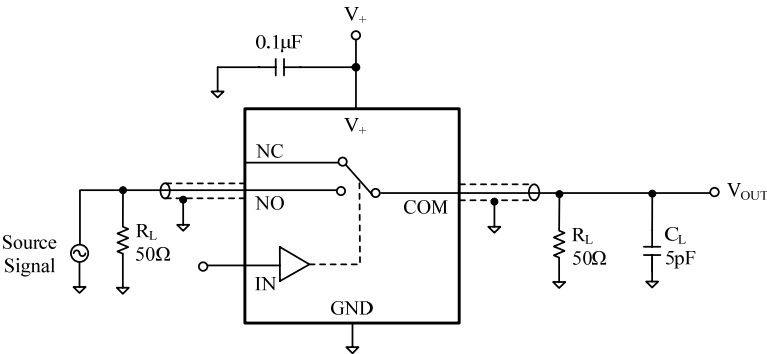


Test Circuit 2. Switching Times (t_{ON} , t_{OFF})

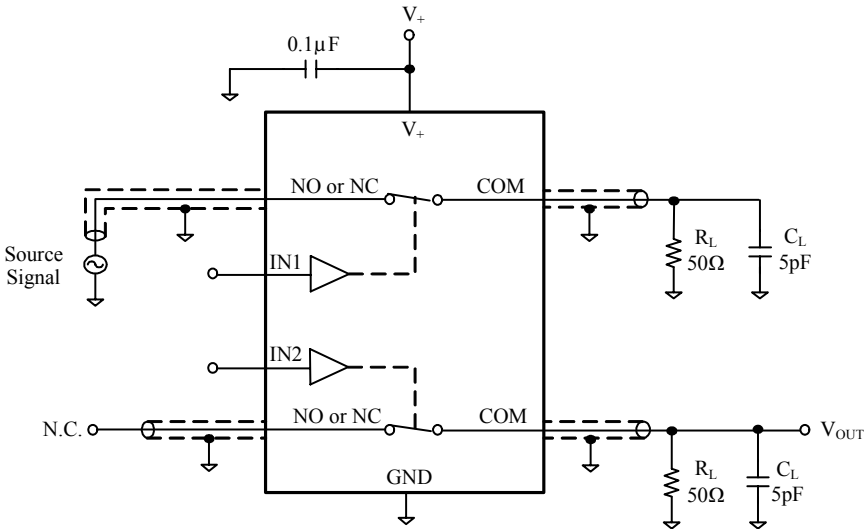


Test Circuit 3. Break-Before-Make Time (t_d)

TEST CIRCUITS (Cont.)



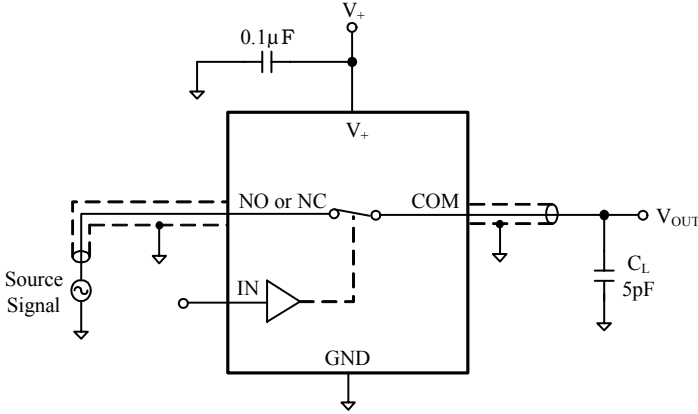
Test Circuit 4. Off Isolation



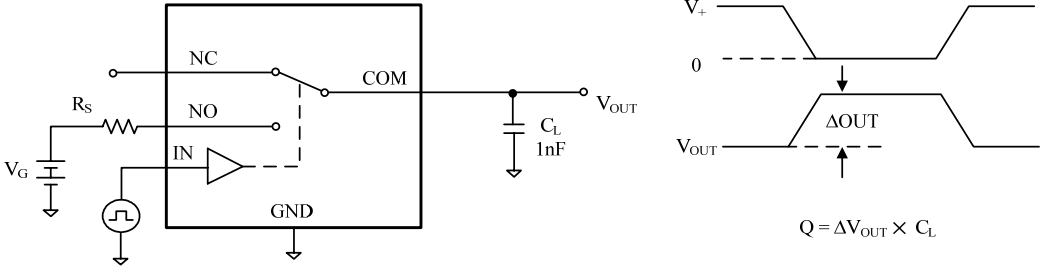
$$\text{Channel To Channel Crosstalk} = -20 \times \log \frac{V_{\text{NO or V}_{\text{NC}}}}{V_{\text{OUT}}}$$

Test Circuit 5. Channel-to-Channel Crosstalk

TEST CIRCUITS (Cont.)



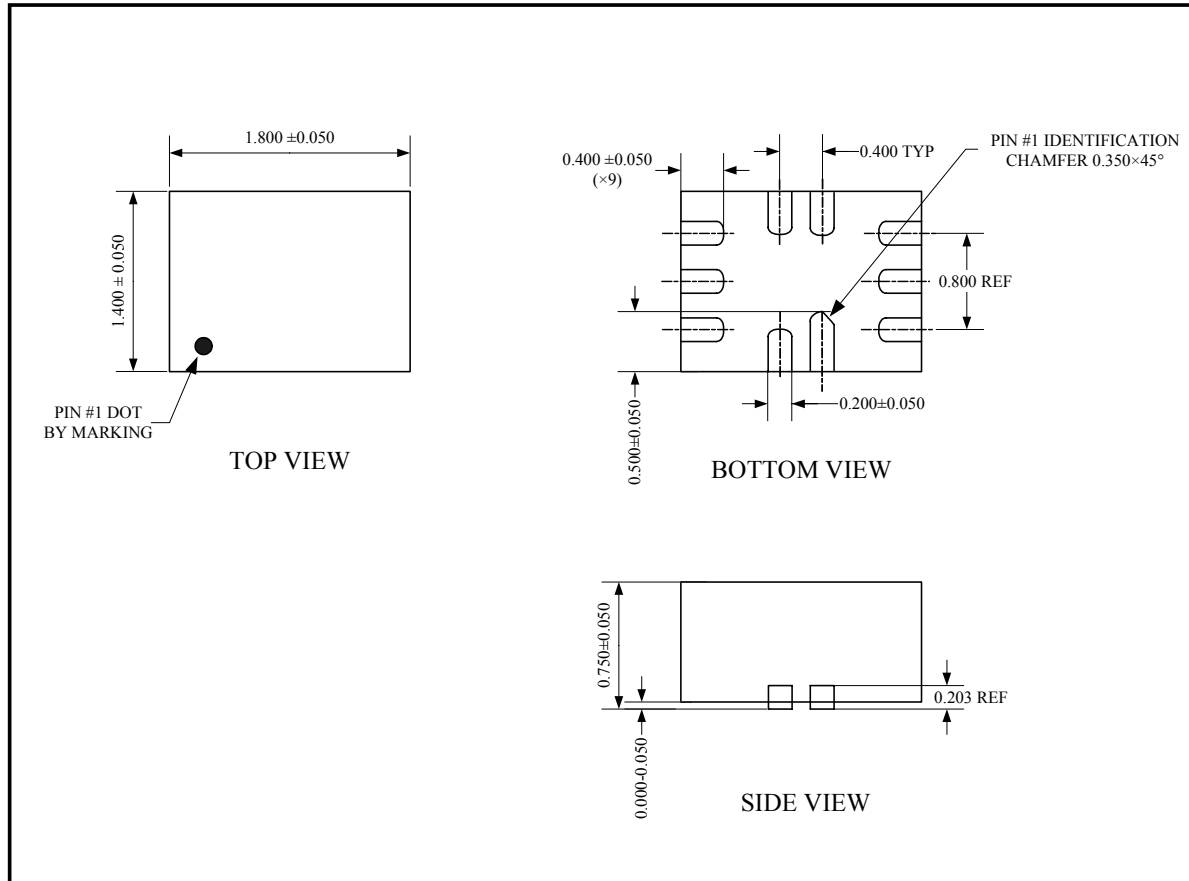
Test Circuit 6. -3dB Bandwidth



Test Circuit 7. Charge Injection (Q)

PACKAGE OUTLINE DIMENSIONS

WQFN-10



Note: All linear dimensions are in millimeters.

REVISION HISTORY

Location	Page
10/2007— Data Sheet REV.A	
05/2008— Data Sheet changed from REV.A to REV.A.1	
Changes to ELECTRICAL CHARACTERISTICS	2, 3
Changes to TEST CIRCUITS	6, 7, 8

SGMICRO

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