



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 low on-resistance (0.5Ω) and fast switching speeds ($t_{ON} = 17ns$, $t_{OFF} = 27.5ns$).

The SGM5223 has excellent on-resistance matching (0.18ΩMAX) 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.

The SGM5223 is available in Green TQFN-1.8×1.4-10L package.

FEATURES

- **Supply Voltage Range: 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**
- **Available in Green TQFN-1.8×1.4-10L Package**

APPLICATIONS

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

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM5223	TQFN-1.8×1.4-10L	-40°C to +85°C	SGM5223YWQ10/TR	5223	Tape and Reel, 3000

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₊, IN to GND.....0V to 4.6V
 Analog, Digital Voltage Range ⁽¹⁾.....-0.3V to (V₊) + 0.3V
 Continuous Current NO, NC, or COM.....±250mA
 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

NOTE:

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.

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.

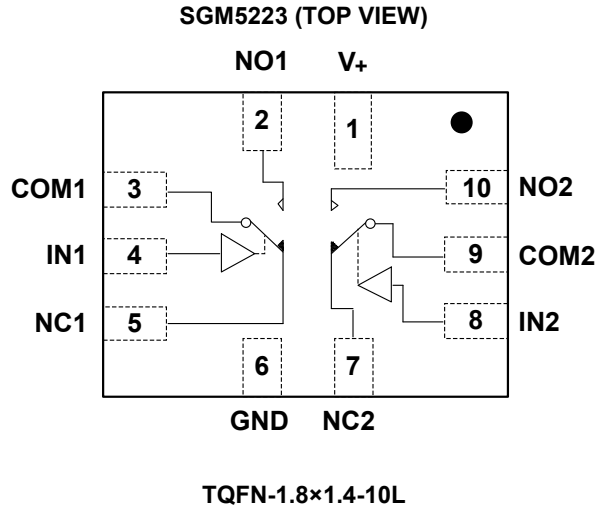
ESD SENSITIVITY CAUTION

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	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.

FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

NOTE: Switches shown for logic “0” input.

ELECTRICAL CHARACTERISTICS

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

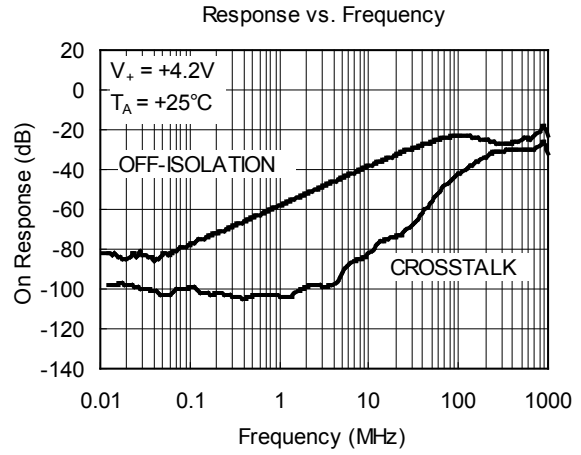
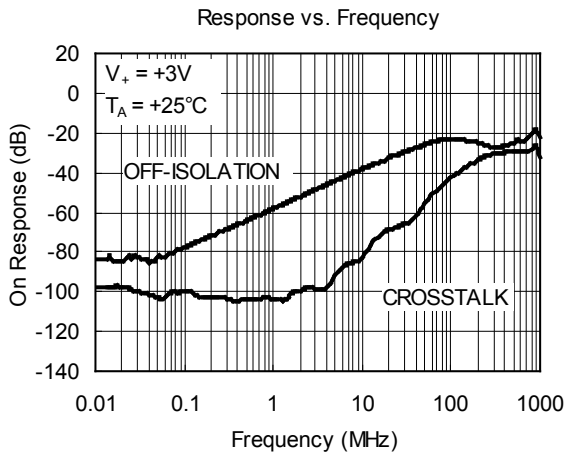
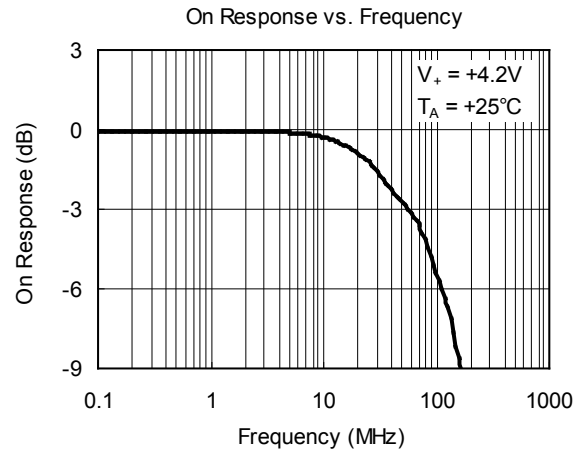
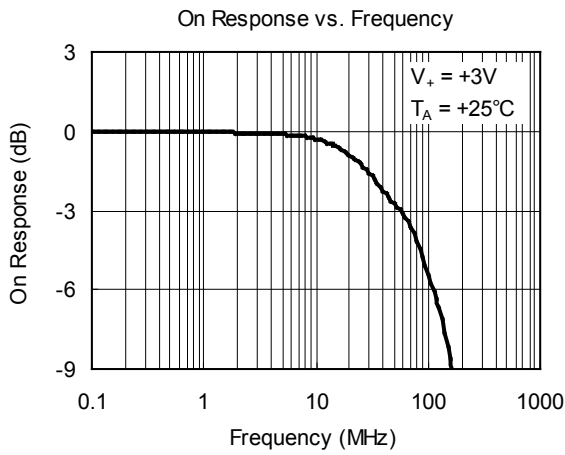
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		Full	0		V_+	V
On-Resistance	R_{ON}	$V_+ = 4.2V, V_{NO}$ or $V_{NC} = 1V, I_{COM} = -100mA$, Test Circuit 1	+25°C		0.5	0.75	Ω
			Full			0.85	Ω
On-Resistance Match Between Channels	ΔR_{ON}	$V_+ = 4.2V, V_{NO}$ or $V_{NC} = 1V, I_{COM} = -100mA$, Test Circuit 1	+25°C		0.11	0.18	Ω
			Full		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°C		0.1	0.22	Ω
			Full			0.26	Ω
Source Off Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_+ = 4.2V, V_{NO}$ or $V_{NC} = 3.3V/0.3V, V_{COM} = 0.3V/3.3V$	Full			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	Full			1	μA
DIGITAL INPUTS							
Input High Voltage	V_{INH}		Full	1.6			V
Input Low Voltage	V_{INL}		Full			0.5	V
Input Leakage Current	I_{IN}	$V_+ = 4.2V, V_{IN} = 0V$ or $4.2V$	Full			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	$V_{IH} = 3V, V_{IL} = 0V$, Test Circuit 2	+25°C		17.0		ns
Turn-Off Time	t_{OFF}	$V_{IH} = 3V, V_{IL} = 0V$, Test Circuit 2	+25°C		27.5		ns
Break-Before-Make Time Delay	t_D	$V_{IH} = 3V, V_{IL} = 0V$, Test Circuit 3	+25°C		5.0		ns
Off Isolation	O_{ISO}	$V_{BIAS} = 2.1V$, Signal = 0dBm, $V_{IH} = 3V, V_{IL} = 0V$, Test Circuit 4	100kHz	+25°C		-78	dB
			1MHz	+25°C		-58	dB
Channel-to-Channel Crosstalk	X_{TALK}	$V_{BIAS} = 2.1V$, Signal = 0dBm, $V_{IH} = 3V, V_{IL} = 0V$, Test Circuit 5	100kHz	+25°C		-100	dB
			1MHz	+25°C		-104	dB
-3dB Bandwidth	BW	$V_{BIAS} = 2.1V$, Signal = 0dBm, $V_{IH} = 3V, V_{IL} = 0V$, Test Circuit 6	+25°C		55		MHz
Channel On Capacitance	C_{ON}		+25°C		95		pF
Charge Injection Select Input to Common I/O	Q	$V_G = GND, R_S = 0\Omega, C_L = 1nF, Q = C_L \times V_{OUT}, V_{IH} = 3V, V_{IL} = 0V$, Test Circuit 7	+25°C		13		pC
POWER REQUIREMENTS							
Power Supply Range	V_+		Full	1.8		4.2	V
Power Supply Current	I_+	$V_+ = 4.2V, V_{IN} = 0V$ or V_+	Full			1	μA

ELECTRICAL CHARACTERISTICS (continued)

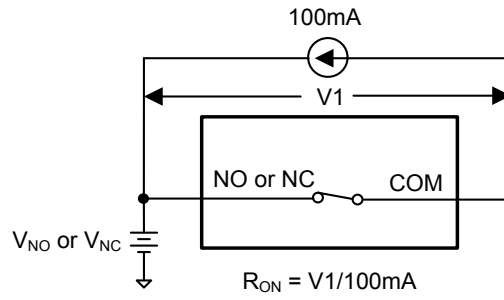
(V₊ = 2.7V to 3.6V, V_{IH} = 1.6V, V_{IL} = 0.4V, Full = -40°C to +85°C. Typical values are at V₊ = 3V, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
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°C		0.6	0.9	Ω
			Full			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°C		0.15	0.22	Ω
			Full		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°C		0.1	0.22	Ω
			Full		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	Full			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	Full			1	μA
DIGITAL INPUTS							
Input High Voltage	V _{IH}		Full	1.5			V
Input Low Voltage	V _{IL}		Full			0.4	V
Input Leakage Current	I _{IN}	V ₊ = 2.7V, V _{IN} = 0V or 2.7V	Full			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t _{ON}	V _{IH} = 1.5V, V _{IL} = 0V, Test Circuit 2	+25°C		22		ns
Turn-Off Time	t _{OFF}	V _{IH} = 1.5V, V _{IL} = 0V, Test Circuit 2	+25°C		34		ns
Break-Before-Make Time Delay	t _D	V _{IH} = 1.5V, V _{IL} = 0V, Test Circuit 3	+25°C		15.5		ns
Off Isolation	O _{ISO}	V _{BIAS} = 1.5V, Signal = 0dBm, V _{IH} = 1.5V, V _{IL} = 0V, Test Circuit 4	100kHz	+25°C		-78	dB
			1MHz	+25°C		-58	dB
Channel-to-Channel Crosstalk	X _{TALK}	V _{BIAS} = 1.5V, Signal = 0dBm, V _{IH} = 1.5V, V _{IL} = 0V, Test Circuit 5	100kHz	+25°C		-100	dB
			1MHz	+25°C		-104	dB
-3dB Bandwidth	BW	V _{BIAS} = 1.5V, Signal = 0dBm, V _{IH} = 1.5V, V _{IL} = 0V, Test Circuit 6	+25°C		55		MHz
Charge Injection Select Input to Common I/O	Q	V _G = GND, R _S = 0Ω, C _L = 1nF, Q = C _L × V _{OUT} , V _{IH} = 1.5V, V _{IL} = 0V, Test Circuit 7	+25°C		8.5		pC
Channel On Capacitance	C _{ON}		+25°C		95		pF

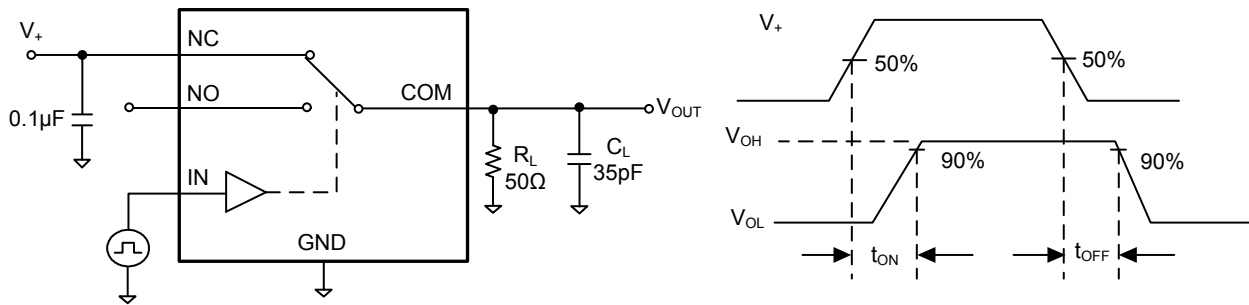
TYPICAL PERFORMANCE CHARACTERISTICS



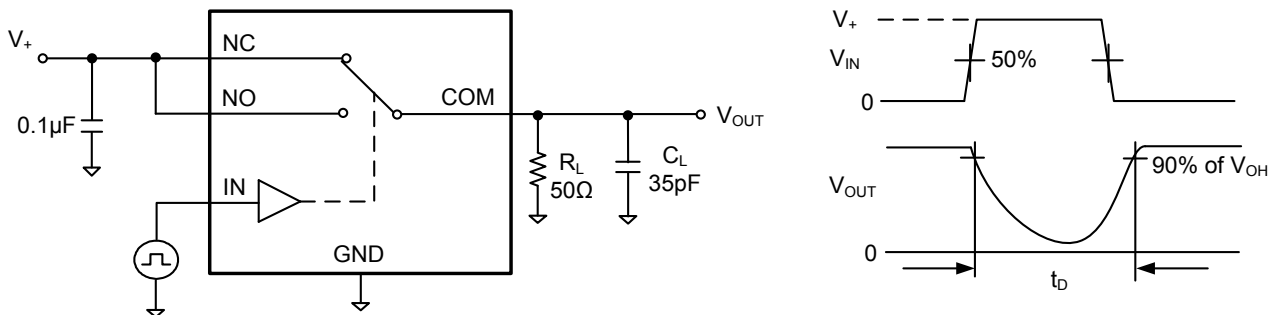
TEST CIRCUITS



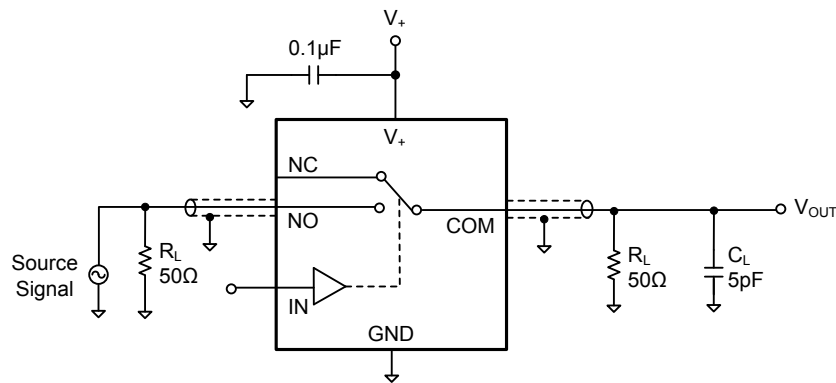
Test Circuit 1. On-Resistance



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

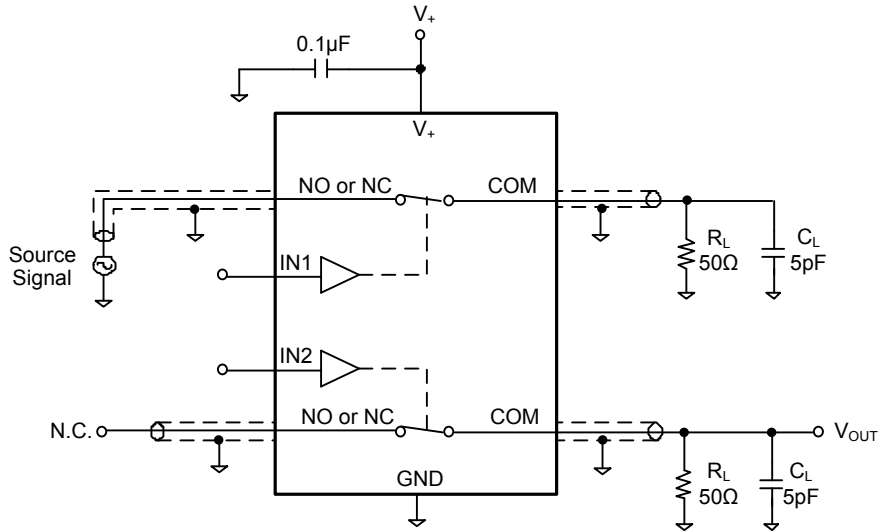


Test Circuit 3. Break-Before-Make Time (t_D)



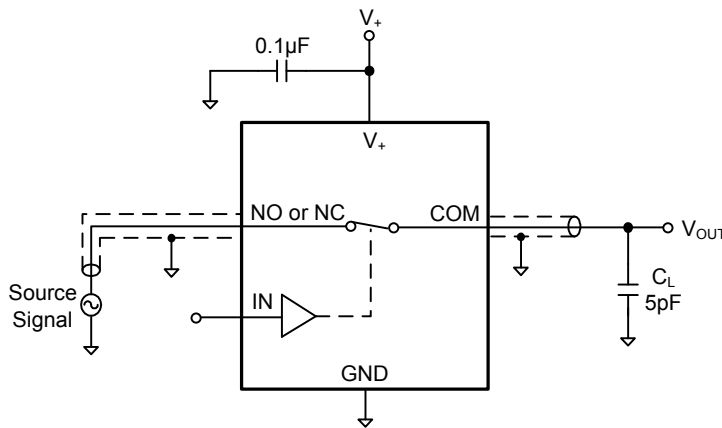
Test Circuit 4. Off Isolation

TEST CIRCUITS (continued)

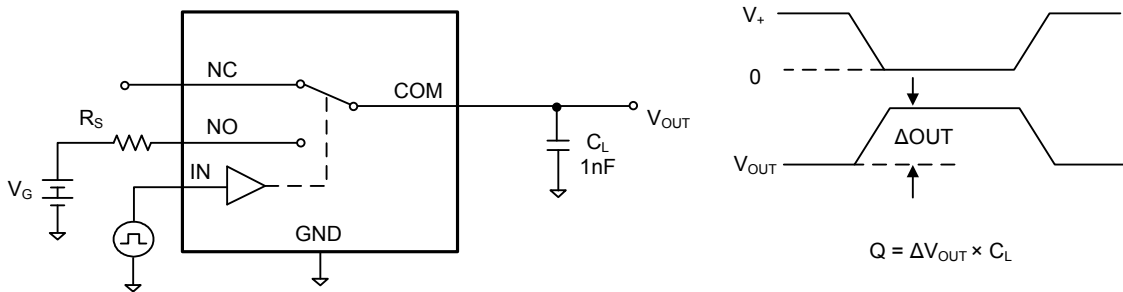


$$\text{Channel-to-Channel Crosstalk} = -20 \times \log \frac{V_{\text{NO or V}_{\text{NC}}}}{V_{\text{OUT}}}$$

Test Circuit 5. Channel-to-Channel Crosstalk



Test Circuit 6. -3dB Bandwidth



Test Circuit 7. Charge Injection (Q)

REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

JANUARY 2013 – REV.A.3 to REV.A.4

Added Recommended Land Pattern Information	9
Added Tape and Reel Information.....	10, 11

MAY 2011 – REV.A.2 to REV.A.3

Updated Package Description	All
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MARCH 2011 – REV.A.1 to REV.A.2

Updated Package Outline Dimensions.....	9
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MAY 2008 – REV.A to REV.A.1

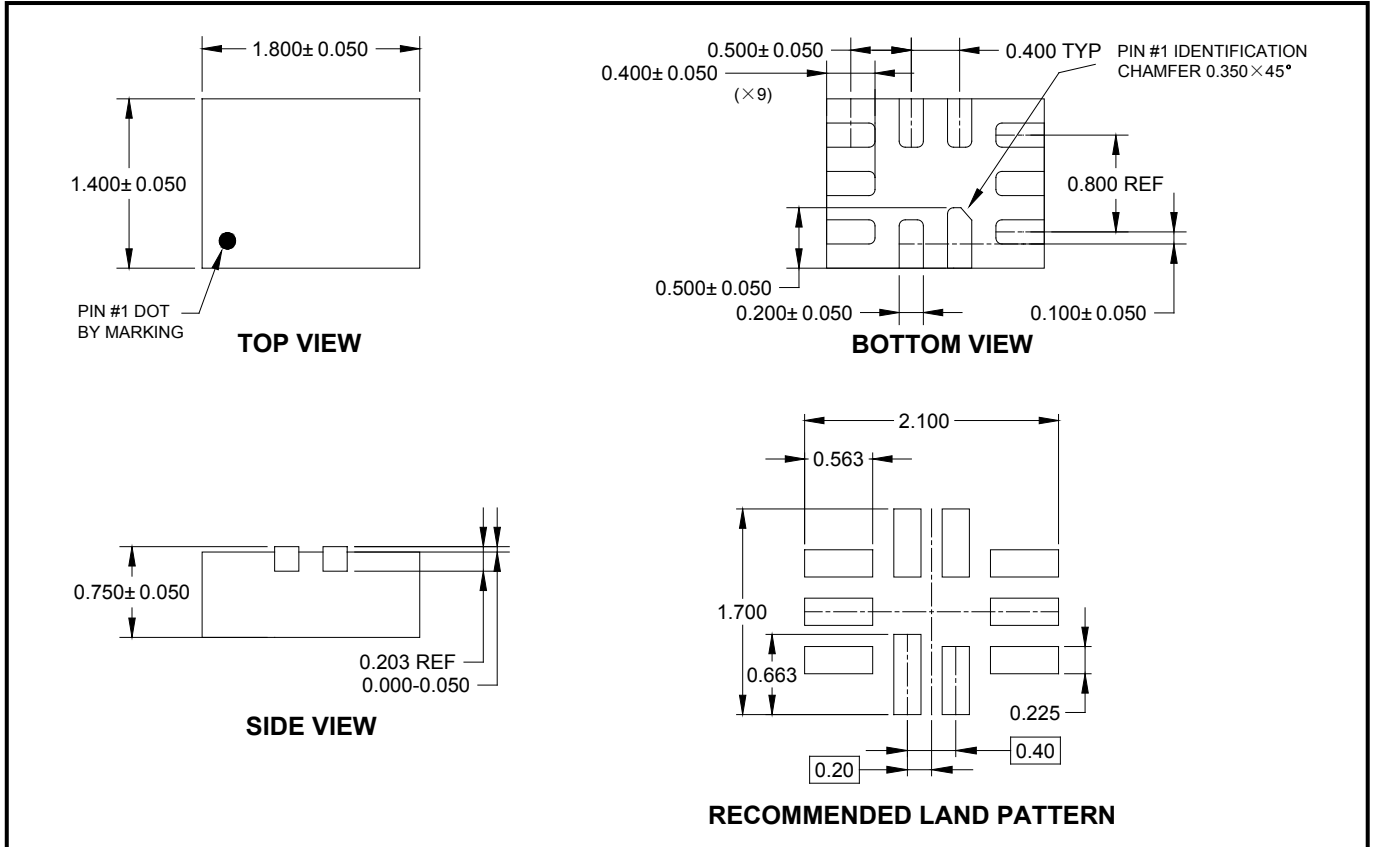
Updated Electrical Characteristics section.....	2, 3
Updated Test Circuits section	6, 7, 8

Changes from Original (OCTOBER 2007) to REV.A

Changed from product preview to production data.....	All
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PACKAGE OUTLINE DIMENSIONS

TQFN-1.8×1.4-10L



NOTE: All linear dimensions are in millimeters.

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-1.8×1.4-10L	7"	9.0	1.75	2.10	1.00	4.0	4.0	2.0	8.0	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
7" (Option)	368	227	224	8
7"	442	410	224	18

DD0002