SGM4782
0.5Ω, High Speed, Low Voltage Analog Switch/Multiplexer

GENERAL DESCRIPTION

The SGM4782 is high-speed, low-voltage, low on-resistance, CMOS analog multiplexer/switch that configured as two 4-channel multiplexers. It operates 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} = 20ns, t_{OFF} = 20ns).

The SGM4782 can handle rail-to-rail analog signals and is available in TQFN-16 (3mm×3mm) and TSSOP-16 packages.

APPLICATIONS

Communication Systems
Cell Phones
Portable Instrumentation
Audio Signal Routing
Audio and Video Switching
Computer Peripherals
Low-Voltage Data-Acquisition Systems

FUNCTION TABLE

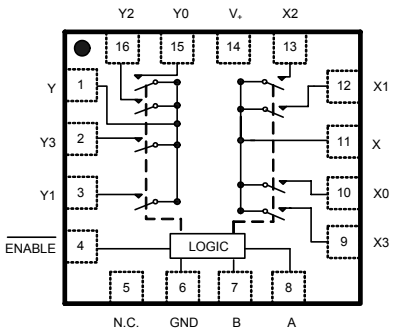
Control Inputs			ON Switches	
ENABLE	Select B	Select A		
L	L	L	X-X0	Y-Y0
L	L	H	X-X1	Y-Y1
L	H	L	X-X2	Y-Y2
L	H	H	X-X3	Y-Y3
H	√	√	All Switches Open	

√ = Don't Care.

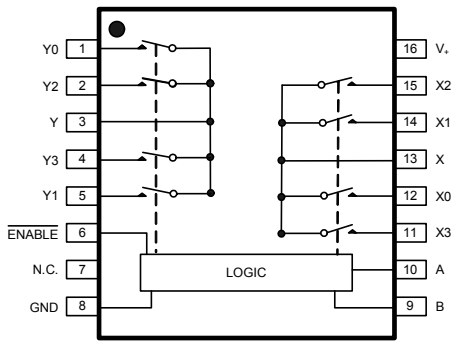
FEATURES

- **Voltage Operation: 1.8V to 4.2V**
- **Low On-Resistance: 0.5Ω (TYP) at 4.2V**
- **Low On-Resistance Flatness**
- **–3dB Bandwidth: 30MHz**
- **Fast Switching Times (+4.2V)**
  - **t_{ON} 20ns**
  - **t_{OFF} 20ns**
- **Low Crosstalk: -108dB at 1MHz**
- **Typical Power Consumption (<0.01μW)**
- **TTL/CMOS Compatible**
- **Rail-to-Rail Input and Output Operation**
- **Break-Before-Make Switching**
- **Extended Industrial Temperature Range:**
  - **-40°C to +85°C**
- **Lead (Pb) Free TQFN-16 and TSSOP-16 packages**

PIN CONFIGURATIONS (TOP VIEW)



TQFN-16 (3mm×3mm)



TSSOP-16

ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM4782	TQFN-16 (3mm×3mm)	-40°C to +85°C	SGM4782YTQ16/TR	4782TQ	Tape and Reel, 3000
	TSSOP-16	-40°C to +85°C	SGM4782YTS/TR	SGM4782YTS	Tape and Reel, 3000

ABSOLUTE MAXIMUM RATINGS

V_+ to GND.....0V to 4.6V
Analog, Digital voltage range..... -0.3V to (V_+) + 0.3V
Continuous Current X_, Y_, X or Y .....±250mA
Peak Current X_, Y_, X or Y .....±400mA
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.

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.

PIN DESCRIPTION

PIN		NAME	FUNCTION
TSSOP-16	TQFN-16		
1,5,2,4	15,3,16,2	Y0-Y3	Analog Switch Y Inputs Y0-Y3.
3	1	Y	Analog Switch Y Output.
6	4	$\overline{\text{ENABLE}}$	Digital Enable Input. Normally connect to GND. Drive to logic high to set all switches off.
7	5	N.C.	Not internally connected.
8	6	GND	Ground.
9	7	B	Digital Address B Input.
10	8	A	Digital Address A Input.
12,14,15,11	10,12,13,9	X0-X3	Analog Switch X Inputs X0-X3.
13	11	X	Analog Switch X Output.
16	14	V_+	Positive Analog and Digital Supply Voltage Input.
—	Exposed Pad	GND	Exposed pad should be soldered to PCB board and connected to GND.

ELECTRICAL CHARACTERISTICS

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

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	$V_{X\_}$, $V_{Y\_}$, V_X, V_Y			-40°C to +85°C	0		V_+	V
On-Resistance	R_{ON}	V_+ = 4.2V, $I_{X\_}$, $I_{Y\_}$ = -100mA, V_X, V_Y = 1V, Test Circuit 1		+25°C		0.5	0.7	Ω
				-40°C to +85°C			0.8	
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 4.2V, $I_{X\_}$, $I_{Y\_}$ = -100mA, V_X, V_Y = 1V, Test Circuit 1		+25°C		0.05	0.2	Ω
				-40°C to +85°C			0.24	
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 4.2V, $I_{X\_}$, $I_{Y\_}$ = -100mA, V_X, V_Y = 1V, 2.5V, Test Circuit 1		+25°C		0.1	0.2	Ω
				-40°C to +85°C			0.24	
Source OFF Leakage Current	$I_{X\_(OFF)}$, $I_{Y\_(OFF)}$	V_+ = 4.2V, $V_{X\_}$, $V_{Y\_}$ = 3.3V , 0.3V, V_X, V_Y = 0.3V, 3.3V		-40°C to +85°C			1	μA
Channel ON Leakage Current	$I_{X\_(ON)}$, $I_{Y\_(ON)}$, $I_{X(ON)}$, $I_{Y(ON)}$	V_+ = 4.2V, V_X , V_Y = 0.3V, 3.3V, $V_{X\_}$, $V_{Y\_}$ = 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_A, V_B = V_{ENABLE} = 0V or 4.2V		-40°C to +85°C			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{IN} = 1.5V to 0.5V, V_X or V_Y = 2.1V, R_L= 50 Ω, C_L = 35pF, Test Circuit 2		+25°C		20		ns
Turn-Off Time	t_{OFF}			+25°C		20		
Address Transition Time	t_{TRANS}	V_{IN} = 4.2V to 0V, V_X or V_Y = 2.1V, R_L = 50Ω, C_L = 35pF, Test Circuit 3		+25°C		30		ns
Break-Before-Make Time Delay	t_D	V_{IN} = 4.2V to 0V, V_X or V_Y = 2.1V, R_L = 50Ω, C_L = 35pF, Test Circuit 4		+25°C		20		ns
Charge Injection	Q	C_L = 1nF, Test Circuit 5		+25°C		-18		pC
Off Isolation	O_{ISO}	Signal = 0dBm, V_{BIAS} = 2.1V, R_L = 50Ω, C_L = 35pF, Test Circuit 6	100kHz	+25°C		-75		dB
			1MHz	+25°C		-55		
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, V_{BIAS} = 2.1V, R_L = 50Ω, C_L = 35pF, Test Circuit 6	100kHz	+25°C		-106		dB
			1MHz	+25°C		-108		
–3dB Bandwidth	BW	Signal = 0dBm, V_{BIAS} = 2.1V, R_L = 50 Ω, Test Circuit 6		+25°C		30		MHz
Channel ON Capacitance	$C_{X\_(ON)}$, $C_{Y\_(ON)}$, $C_{X(ON)}$, $C_{Y(ON)}$			+25°C		146		pF
POWER REQUIREMENTS								
Power Supply Range	V_+			-40°C to +85°C	1.8		4.2	V
Power Supply Current	I_+	V_+ = 4.2 V, V_A, V_B, V_{ENABLE} = 4.2 V or 0 V		-40°C to +85°C			1	μA

Specifications subject to change without notice.

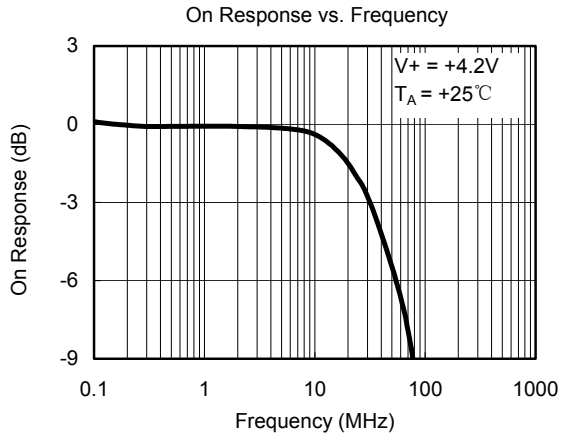
ELECTRICAL CHARACTERISTICS

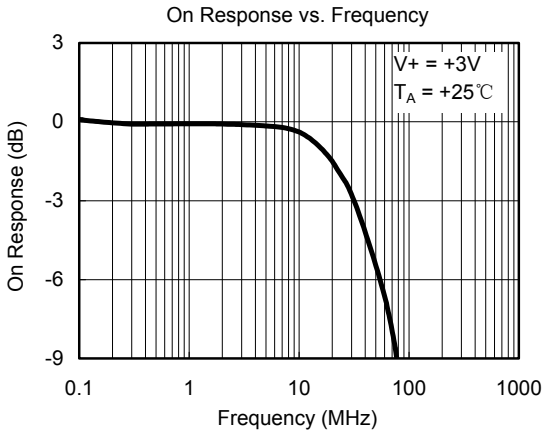
(V_+ = +2.7V to +3.6V, GND = 0 V, V_{IH} = +1.6 V, V_{IL} = +0.4V, T_A = -40°C to +85°C. Typical values are at V_+ = +3.0V, T_A = + 25°C, unless otherwise noted.)

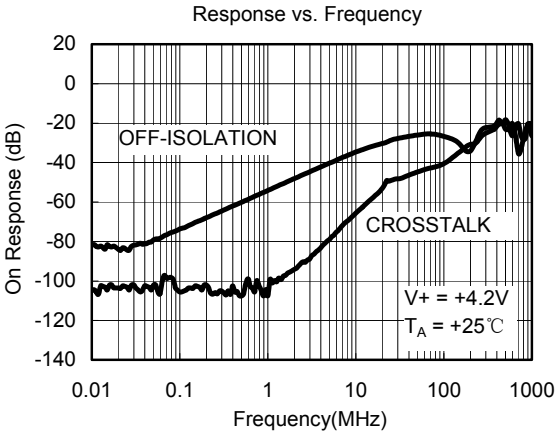
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	$V_{X\_}$, $V_{Y\_}$, V_X, V_Y			-40°C to +85°C	0		V_+	V
On-Resistance	R_{ON}	V_+ = 2.7V, $I_{X\_}$, $I_{Y\_}$ = -100mA, V_X, V_Y = 1V, Test Circuit 1		+25°C		0.6	0.8	Ω
				-40°C to +85°C			0.9	
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 2.7V, $I_{X\_}$, $I_{Y\_}$ = -100mA, V_X, V_Y = 1V, Test Circuit 1		+25°C		0.05	0.2	Ω
				-40°C to +85°C			0.24	
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 2.7V, $I_{X\_}$, $I_{Y\_}$ = -100mA, V_X, V_Y = 1V, 2.5V, Test Circuit 1		+25°C		0.1	0.2	Ω
				-40°C to +85°C			0.24	
Source OFF Leakage Current	$I_{X\_(OFF)}$, $I_{Y\_(OFF)}$	V_+ = 3.6V, $V_{X\_}$, $V_{Y\_}$ = 3.3V, 0.3V, V_X,V_Y = 0.3V, 3.3V		-40°C to +85°C			1	μA
Channel ON Leakage Current	$I_{X\_(ON)}$, $I_{Y\_(ON)}$, $I_{X(ON)}$, $I_{Y(ON)}$	V_+ = 3.6V, V_X, V_Y = 0.3V, 3.3V, $V_{X\_}$, $V_{Y\_}$ = 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_A, V_B = V_{ENABLE} = 0V or 2.7V		-40°C to +85°C			1	μA
DYNAMIC CHARACTERISTICS								
Turn-On Time	t_{ON}	V_{IN} = 1.5V to 0.5V, V_X or V_Y = 1.5V, R_L = 50Ω, C_L = 35pF, Test Circuit 2		+25°C		33		ns
Turn-Off Time	t_{OFF}			+25°C		20		
Address Transition Time	t_{TRANS}	V_{IN} = 1.5V to 0V, V_X or V_Y = 1.5V, R_L = 50 Ω, C_L = 35pF, Test Circuit 3		+25°C		36		ns
Break-Before-Make Time Delay	t_D	V_{IN} = 1.5V to 0V, V_X or V_Y = 1.5V, R_L = 50Ω, C_L = 35pF, Test Circuit 4		+25°C		18		ns
Charge Injection	Q	C_L = 1nF, Test Circuit 5		+25°C		-18		pC
Off Isolation	O_{ISO}	Signal = 0dBm, V_{BIAS} = 1.5V, R_L = 50Ω, C_L = 35pF, Test Circuit 6	100kHz	+25°C		-75		dB
			1MHz	+25°C		-55		
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, V_{BIAS} = 1.5V, R_L = 50Ω, C_L = 35pF, Test Circuit 6	100kHz	+25°C		-106		dB
			1MHz	+25°C		-108		
–3dB Bandwidth	BW	Signal = 0dBm, V_{BIAS} = 1.5V, R_L = 50Ω, Test Circuit 6		+25°C		30		MHz
Channel ON Capacitance	$C_{X\_(ON)}$, $C_{Y\_(ON)}$, $C_{X(ON)}$, $C_{Y(ON)}$			+25°C		146		pF

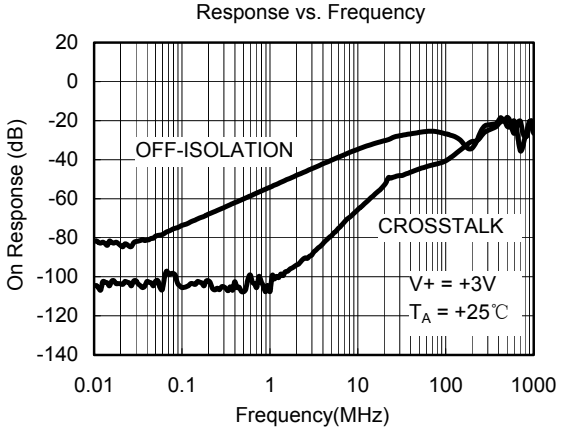
Specifications subject to change without notice.

TYPICAL PERFORMANCE CHARACTERISTICS

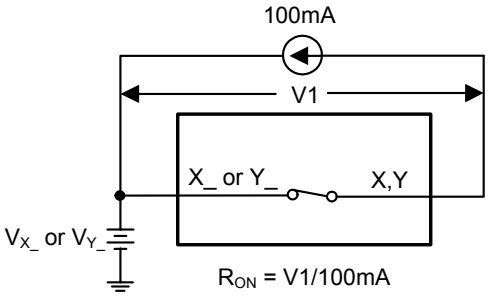




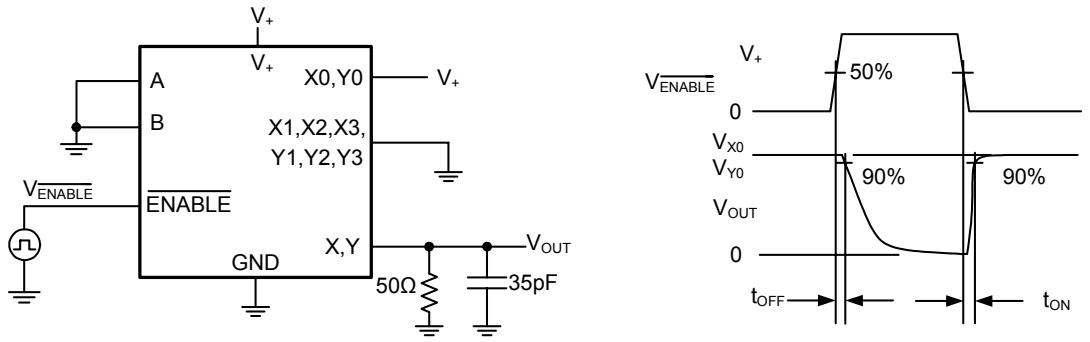




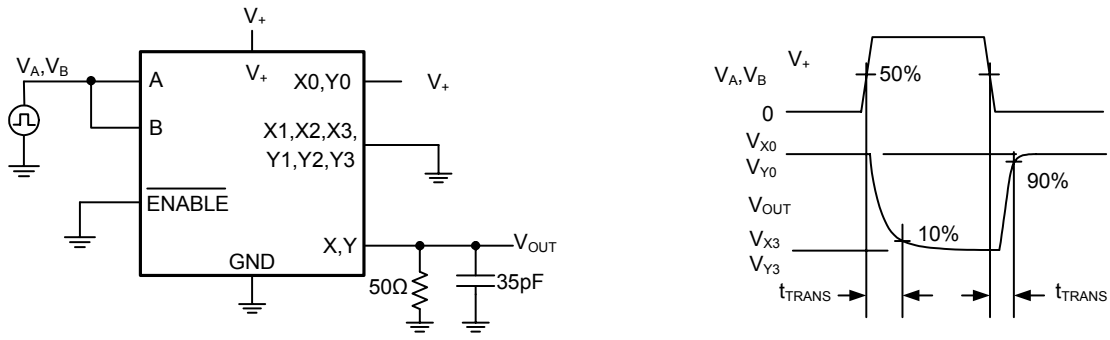
TEST CIRCUITS



Test Circuit 1. On Resistance

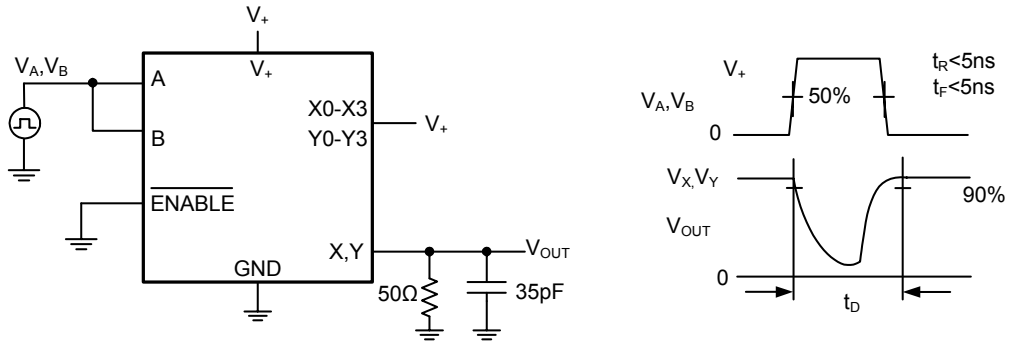


Test Circuit 2. Enable Switching Times (t_{OFF}, t_{ON})

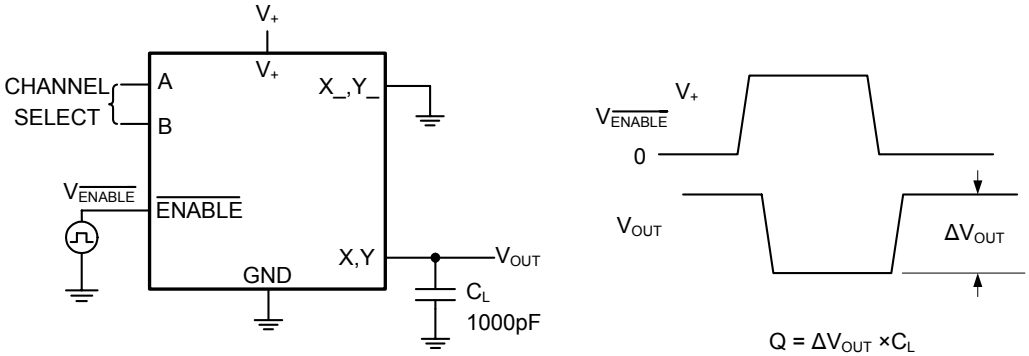


Test Circuit 3. Address Transition Times (t_{TRANS})

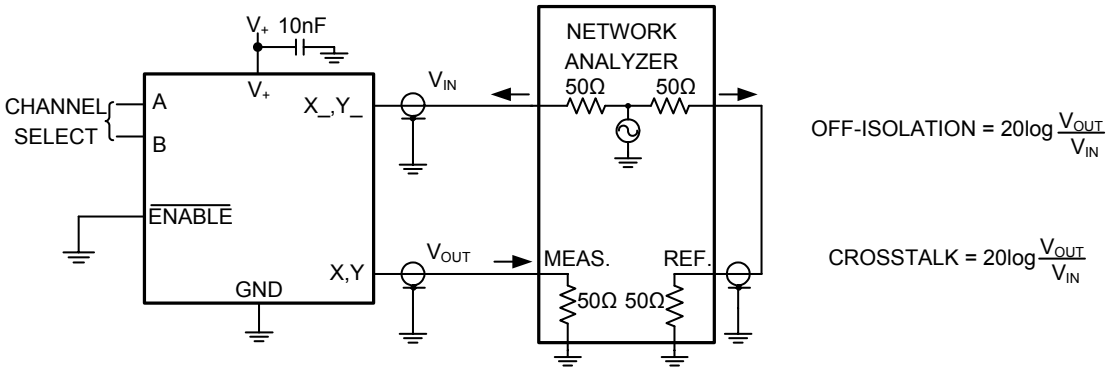
TEST CIRCUITS (Cont.)



Test Circuit 4. Break-Before-Make Interval (t_D)



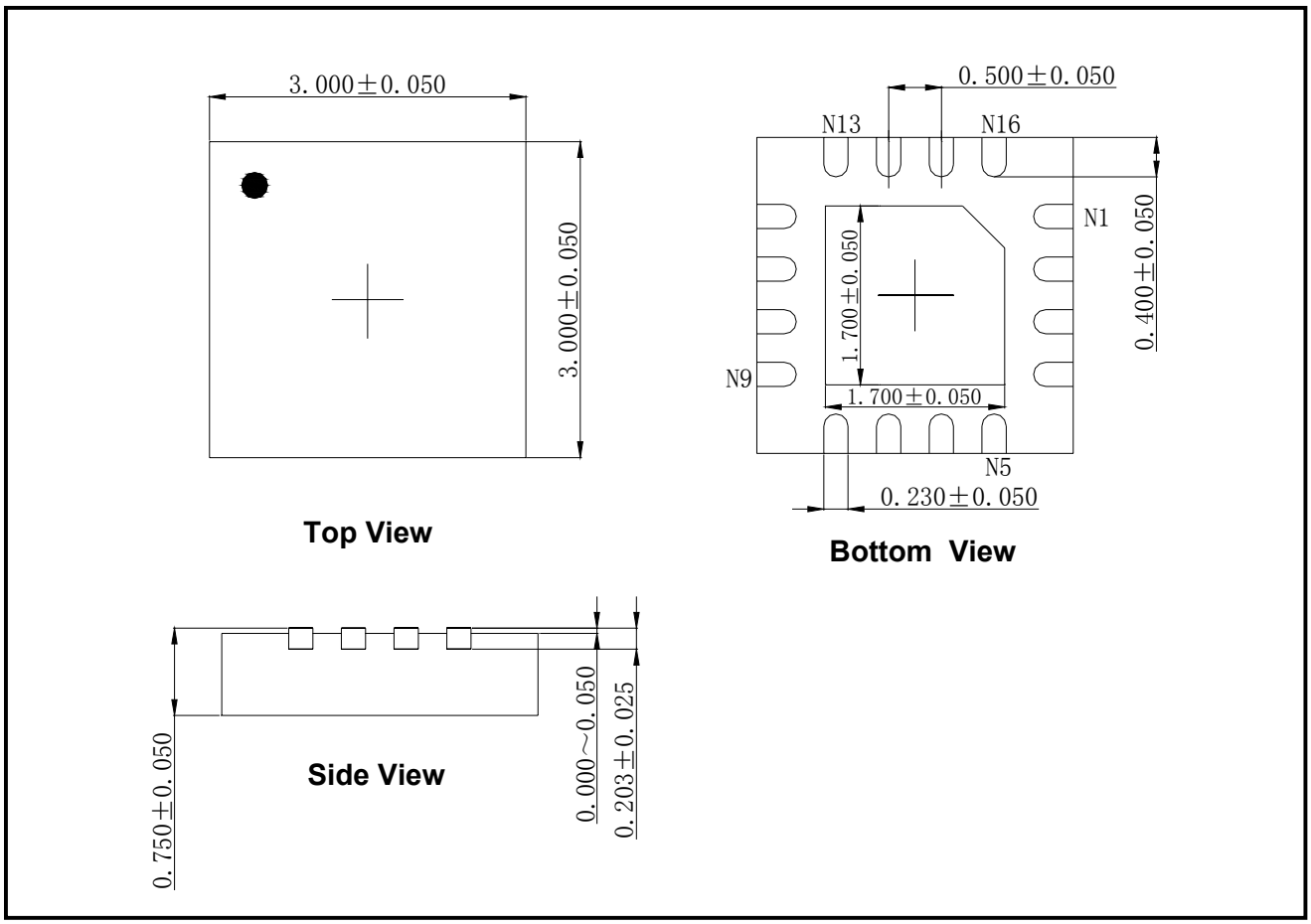
Test Circuit 5. Charge Injection (Q)



Test Circuit 6. -3dB Bandwidth, Off-Isolation and Crosstalk

PACKAGE OUTLINE DIMENSIONS

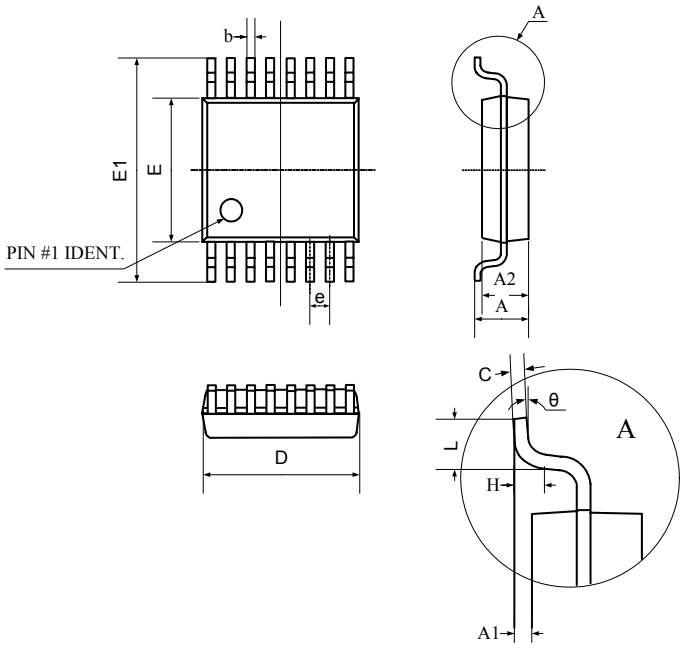
TQFN-16 (3mm × 3mm)



Note: All linear dimensions are in millimeters.

PACKAGE OUTLINE DIMENSIONS

TSSOP-16



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	4.900	5.100	0.193	0.201
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
C	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A		1.100		0.043
A2	0.800	1.000	0.031	0.039
A1	0.020	0.150	0.001	0.006
e	0.65 (BSC)		0.026 (BSC)	
L	0.500	0.700	0.020	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°	7°	1°	7°

05/2009 REV. A. 2