

# SGM4717EP

# 4.5Ω, 300MHz Bandwidth, Dual, SPDT Analog Switch

## GENERAL DESCRIPTION

The SGM4717EP is a dual, bidirectional, single-pole/double-throw (SPDT) CMOS analog switches designed to operate from a single +1.8V to +5.5V supply. It features high-bandwidth (300MHz) and low ON-resistance (4.5Ω typ), Targeted applications for audio switching.

SGM4717EP features guaranteed on-resistance matching (0.3Ω max) between switches and guaranteed on-resistance flatness over the signal range (2.3Ω TYP). This ensures excellent linearity and low distortion when switching audio signals.

The SGM4717EP 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.

SGM4717EP is available in WQFN-10 package.

## FEATURES

- Voltage Operation : 1.8 V to 5.5 V
- On-Resistance: 4.5Ω (typ) at 5.0V
- High Bandwidth: 300 MHz
- Fast Switching Time
  - t<sub>ON</sub> 26 ns
  - t<sub>OFF</sub> 20 ns
- High Off-Isolation: 57dB at 10MHz
- Low Crosstalk: 99dB at 10MHz
- Rail-to-Rail Operation
- TTL/CMOS Compatible
- Break-Before-Make Switching
- Extended Industrial Temperature Range:
  - 40°C to 85°C
- WQFN-10 Packages

## APPLICATIONS

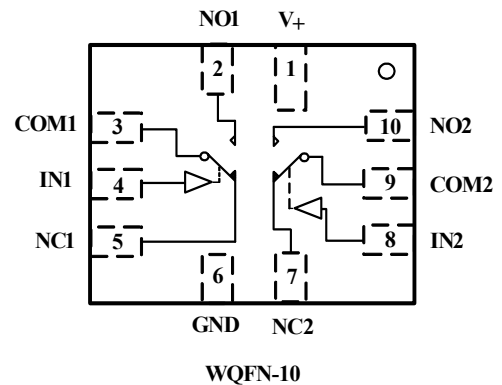
- Portable Instrumentation
- Battery-Operated Equipment
- Computer Peripherals
- Cell Phones
- PDA's
- MP3's

## FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

Switches Shown For Logic "0" Input

## PIN CONFIGURATION (TOP VIEW)



## ELECTRICAL CHARACTERISTICS

( $V_+ = +2.7V$  to  $+3.6V$ ,  $V_{IH} = +1.4V$ ,  $V_{IL} = +0.5V$ ,  $T_A = -40^\circ C$  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	$R_{ON}$	$V_+ = 2.7V$ , $V_{NO}$ or $V_{NC} = 1.5V$ , $I_{COM} = -10mA$ , Test Circuit 1	+25°C		7	10	$\Omega$
			-40°C to +85°C			10.5	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_+ = 2.7V$ , $V_{NO}$ or $V_{NC} = 1.5V$ , $I_{COM} = -10mA$ , Test Circuit 1	+25°C		0.25	0.6	$\Omega$
			-40°C to +85°C			0.8	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 2.7V$ , $V_{NO}$ or $V_{NC} = 1.0V, 1.5V, 2.0V$ , $I_{COM} = -10mA$ , Test Circuit 1	+25°C		3	4	$\Omega$
			-40°C to +85°C			4.3	$\Omega$
Source OFF Leakage current	$I_{N(OFF)}, I_{NO(OFF)}$	$V_+ = 3.6V$ , $V_{NO}$ or $V_{NC} = 0.3V, 3.3V$ , $V_{COM} = 0.3V, 3.3V$ ,	-40°C to +85°C			1	$\mu A$
Channel ON Leakage current	$I_{N(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_+ = 3.6V$ , $V_{COM} = 0.3V, 3.3V$ , $V_{NO}$ or $V_{NC} = 0.3V, 3.3V$ , or floating	-40°C to +85°C			1	$\mu A$
<b>DIGITAL INPUTS</b>							
Input High Voltage	$V_{INH}$		-40°C to +85°C	1			V
Input Low Voltage	$V_{INL}$		-40°C to +85°C			0.5	V
Input Leakage Current	$I_{IN}$	$V_+ = +3.6V$ , $V_{IN} = 0$ or $5.5V$	-40°C to +85°C			1	$\mu A$
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	$t_{ON}$	$V_{NO}$ or $V_{NC} = 1.5V$ , $R_L = 300\Omega$ , $C_L = 35pF$ , Test Circuit 2; $V_{IH} = 1.5V$ , $V_{IL} = 0V$	+25°C		23		ns
Turn-Off Time	$t_{OFF}$	$V_{NO}$ or $V_{NC} = 1.5V$ , $R_L = 300\Omega$ , $C_L = 35pF$ , Test Circuit 2; $V_{IH} = 1.5V$ , $V_{IL} = 0V$	+25°C		22		ns
Break-Before-Make Time Delay	$t_d$	$V_{NO1}$ or $V_{NC1} = V_{NO2}$ or $V_{NC2} = 3V$ , $R_L = 300\Omega$ , $C_L = 35pF$ , Test Circuit 3	+25°C		4		ns
Skew	$t_{SKEW}$	$R_S = 39\Omega$ , $C_L = 50pF$ , Test Circuit 4	+25°C		5		ns
Off Isolation	$O_{ISO}$	$R_L = 50\Omega$ , $C_L = 5pF$ , Signal = 0dBm, Test Circuit 5	f = 10MHz	+25°C		-57	dB
			f = 1MHz	+25°C		-76	dB
Channel-to-Channel Crosstalk	$X_{TALK}$	$R_L = 50\Omega$ , $C_L = 5pF$ , Test Circuit 6	f = 10MHz	+25°C		-98	dB
			f = 1MHz	+25°C		-103	dB
Bandwidth -3 dB	BW	Signal = 0dBm, $R_L = 50\Omega$ , $C_L = 5pF$ , Test Circuit 7	+25°C		300		MHz
<b>POWER REQUIREMENTS</b>							
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			5	$\mu A$

Specifications subject to change without notice.

## ELECTRICAL CHARACTERISTICS

( $V_+ = +4.5V$  to  $+5.5V$ ,  $V_{IH} = +2.0V$ ,  $V_{IL} = +0.8V$ ,  $T_A = -40^\circ C$  to  $+85^\circ C$ , Typical values are at  $V_+ = 5.0V$ ,  $T_A = +25^\circ C$ , 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	$R_{ON}$	$V_+ = 4.5V$ , $V_{NO}$ or $V_{NC} = 3.5V$ , $I_{COM} = -10mA$ , Test Circuit 1	+25°C		4.5	8	$\Omega$
			-40°C to +85°C			8.5	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_+ = 4.5V$ , $V_{NO}$ or $V_{NC} = 3.5V$ , $I_{COM} = -10mA$ , Test Circuit 1	+25°C		0.15	0.3	$\Omega$
			-40°C to +85°C			0.8	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 4.5V$ , $V_{NO}$ or $V_{NC} = 1.0V, 2.0V,$ $3.5V$ , $I_{COM} = -10mA$ , Test Circuit 1	+25°C		2.3	3.3	$\Omega$
			-40°C to +85°C			3.7	$\Omega$
Source OFF Leakage current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_+ = 5.5V$ , $V_{NO}$ or $V_{NC} = 1.0V, 4.5V$ , $V_{COM} = 1.0V, 4.5V$ ,	-40°C to +85°C			1	$\mu A$
Channel ON Leakage current	$I_{NC(ON)}, I_{NO(ON)},$ $I_{COM(ON)}$	$V_+ = 5.5V$ , $V_{COM} = 1.0V, 4.5V$ , $V_{NO}$ or $V_{NC} = 1.0V, 4.5V$ , 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			0.6	V
Input Leakage Current	$I_{IN}$	$V_+ = +5.5V$ , $V_{IN} = 0$ or $5.5V$	-40°C to +85°C			1	$\mu A$
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	$t_{ON}$	$V_{NO}$ or $V_{NC} = 3.0V$ , $R_L = 300\Omega$ , $C_L = 35pF$ , Test Circuit 2; $V_{IH} = 1.5V$ , $V_{IL} = 0V$	+25°C		26		ns
Turn-Off Time	$t_{OFF}$	$V_{NO}$ or $V_{NC} = 3.0V$ , $R_L = 300\Omega$ , $C_L = 35pF$ , Test Circuit 2; $V_{IH} = 1.5V$ , $V_{IL} = 0V$	+25°C		20		ns
Break-Before-Make Time Delay	$t_d$	$V_{NO1}$ or $V_{NC1} = V_{NO2}$ or $V_{NC2} = 3V$ , $R_L = 300\Omega$ , $C_L = 35pF$ , Test Circuit 3	+25°C		4		ns
Skew	$t_{SKEW}$	$R_S = 39\Omega$ , $C_L = 50pF$ , Test Circuit 4	+25°C		5.8		ns
Off Isolation	$O_{ISO}$	$R_L = 50\Omega$ , $C_L = 5pF$ , Signal = 0dBm, Test Circuit 5	$f = 10MHz$	+25°C		-57	dB
			$f = 1MHz$	+25°C		-76	dB
Channel-to-Channel Crosstalk	$X_{TALK}$	$R_L = 50\Omega$ , $C_L = 5pF$ , Test Circuit 6	$f = 10MHz$	+25°C		-99	dB
			$f = 1MHz$	+25°C		-110	dB
Total Harmonic Distortion	THD	$V_{COM} = 2V_{P-P}$ , $R_L = 50\Omega$ , $C_L = 5pF$	+25°C				%
Bandwidth -3 dB	BW	Signal = 0dBm, $R_L = 50\Omega$ , $C_L = 5pF$ , Test Circuit 7	+25°C		300		MHz
<b>POWER REQUIREMENTS</b>							
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			5	$\mu A$

Specifications subject to change without notice.

## ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM4717EP	WQFN-10	- 40°C to +85°C	SGM4717EP-YWQ10/TR	4717E	Tape and Reel, 3000

## ABSOLUTE MAXIMUM RATINGS

V <sub>+</sub> , IN to GND.....	- 0.3V to +6V	Junction Temperature.....	+150°C
Analog, Digital voltage range(1).....	- 0.3V to (V <sub>+</sub> + 0.3V)	Storage Temperature.....	- 65°C to +150°C
Continuous Current NO, NC, or COM.....	±200mA	Lead Temperature (soldering, 10s).....	+260°C
Peak Current NO, NC, or COM.....	±300mA	ESD (HBM).....	2000V
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.

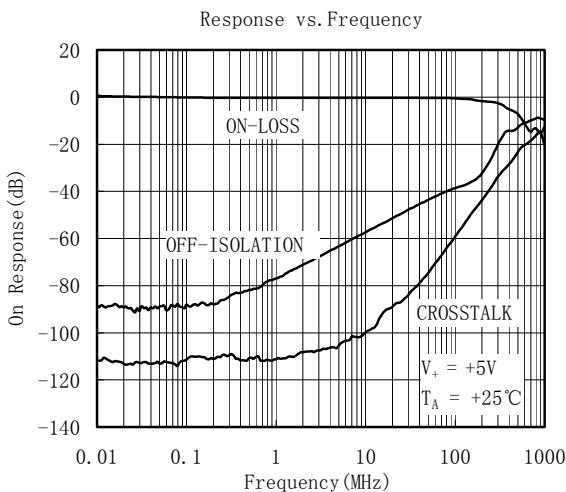
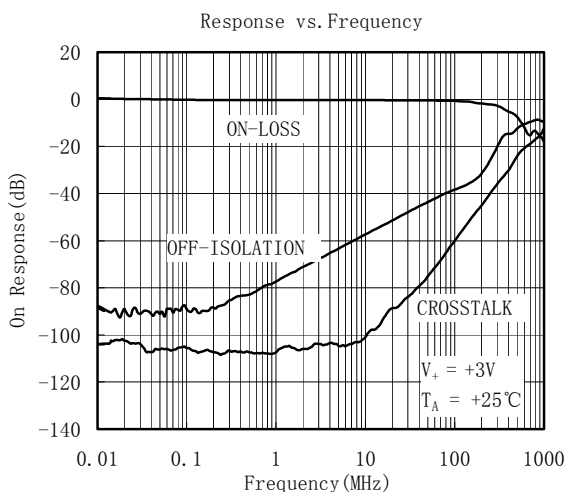
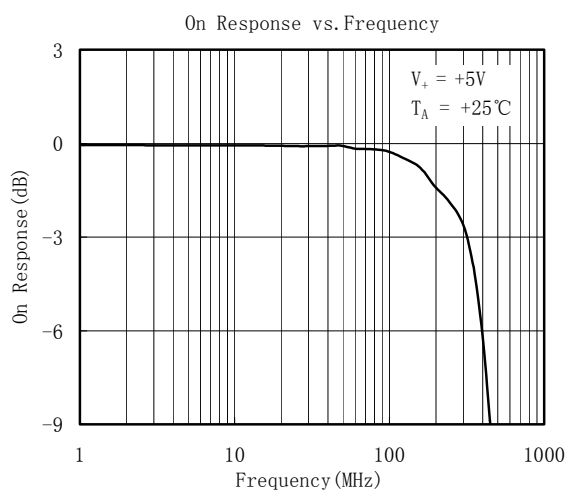
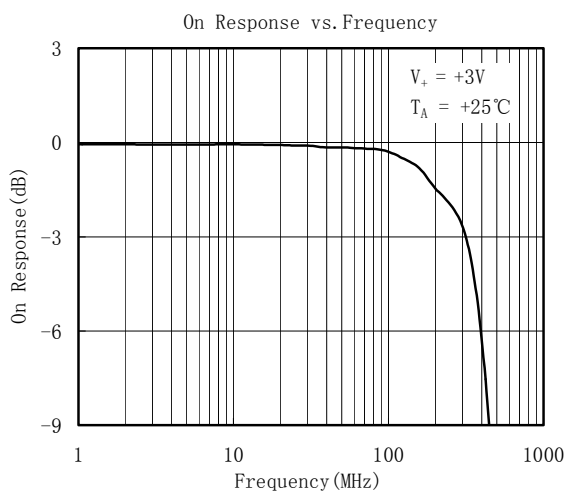
(1) Signals on NC, NO, or COM or IN exceeding V<sub>+</sub> will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

## PIN DESCRIPTION

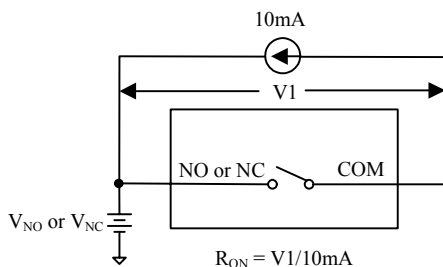
NAME	FUNCTION
V <sub>+</sub>	Power supply
GND	ground
IN1, IN2	Digital control pin to connect the COM terminal to the NO or NC terminals
COM1, COM2	Common terminal
NO1, NO2	Normally-open terminal
NC1, NC2	Normally-closed terminal

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

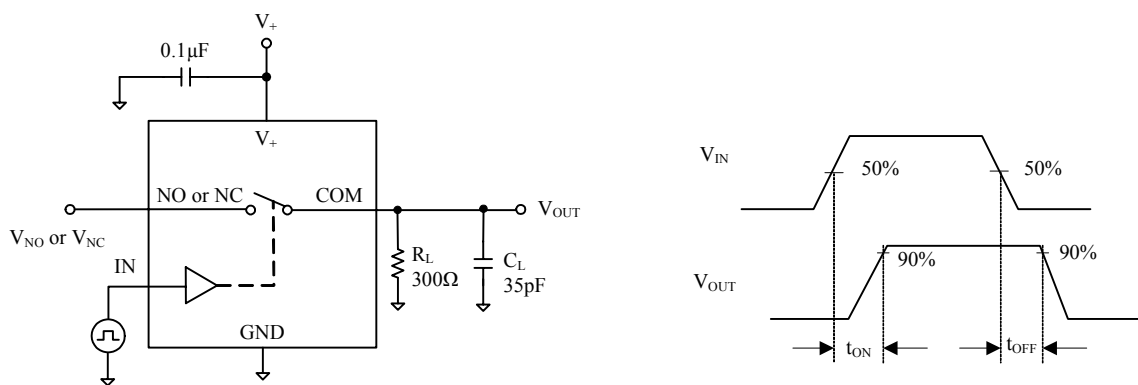
# TYPICAL PERFORMANCE CHARACTERISTICS



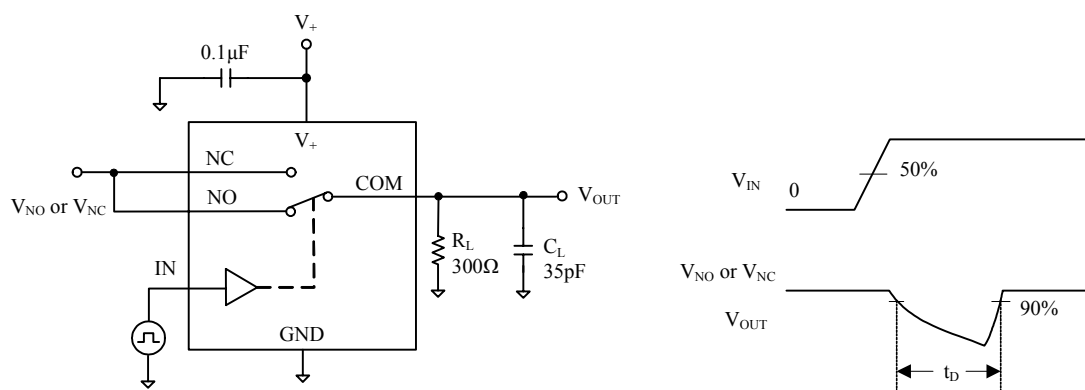
## TEST CIRCUITS



Test Circuit 1. On Resistance

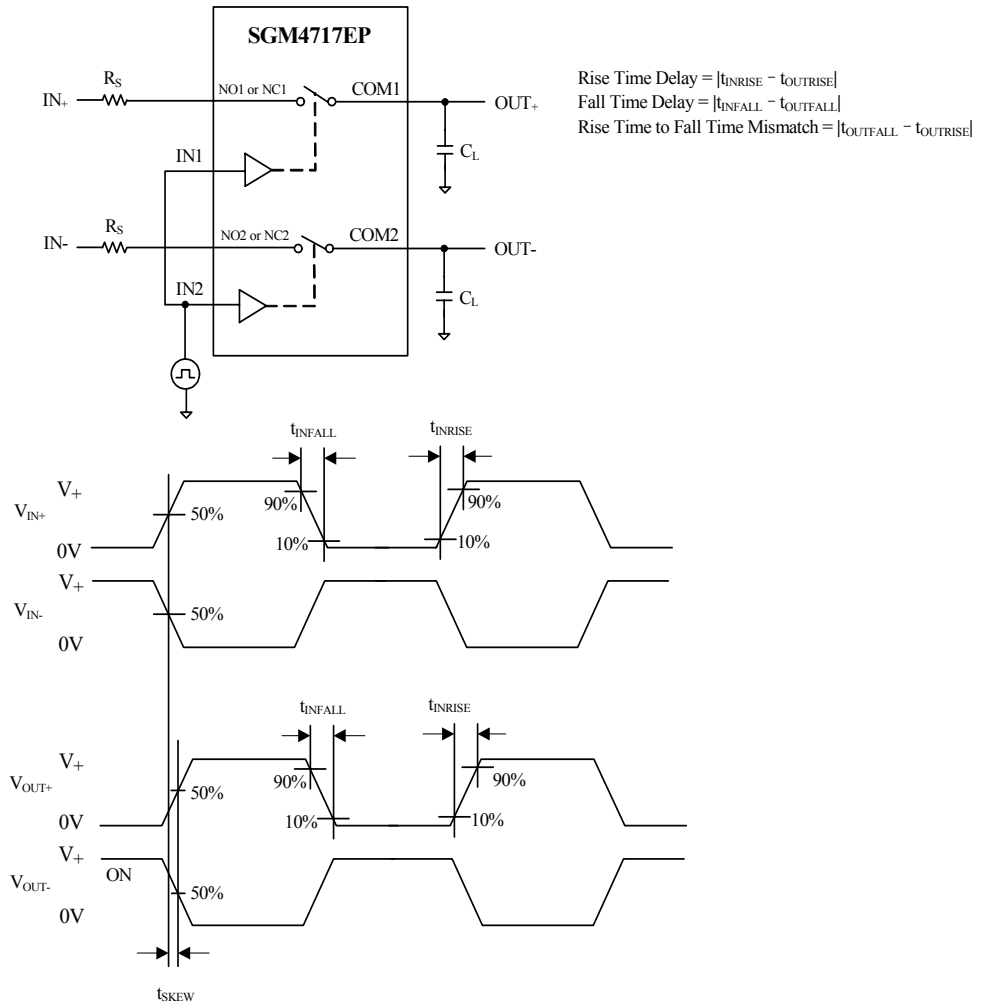


Test Circuit 2. Switching Times

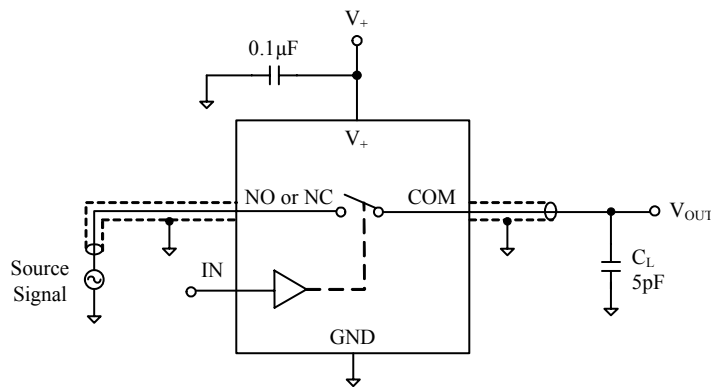


Test Circuit 3. Break-Before-Make Time Delay,  $t_D$

## TEST CIRCUITS (Cont.)

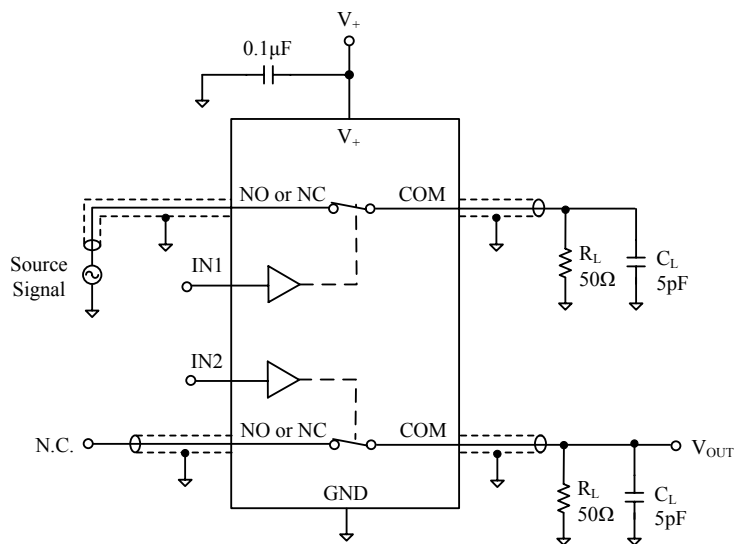


Test Circuit 4. Output Signal Skew



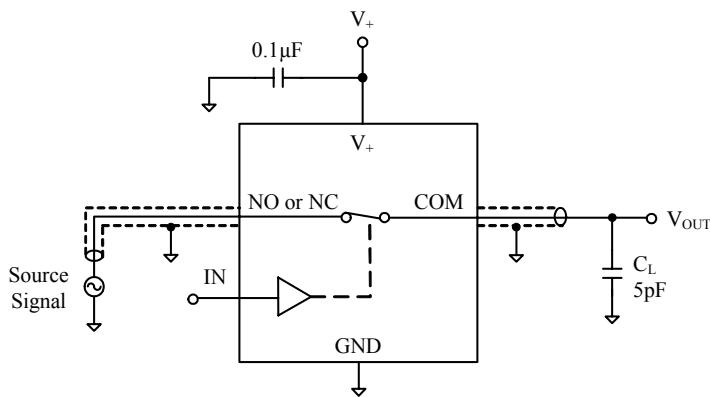
Test Circuit 5. Off Isolation

## TEST CIRCUITS (Cont.)



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

Test Circuit 6. Channel-to-Channel Crosstalk

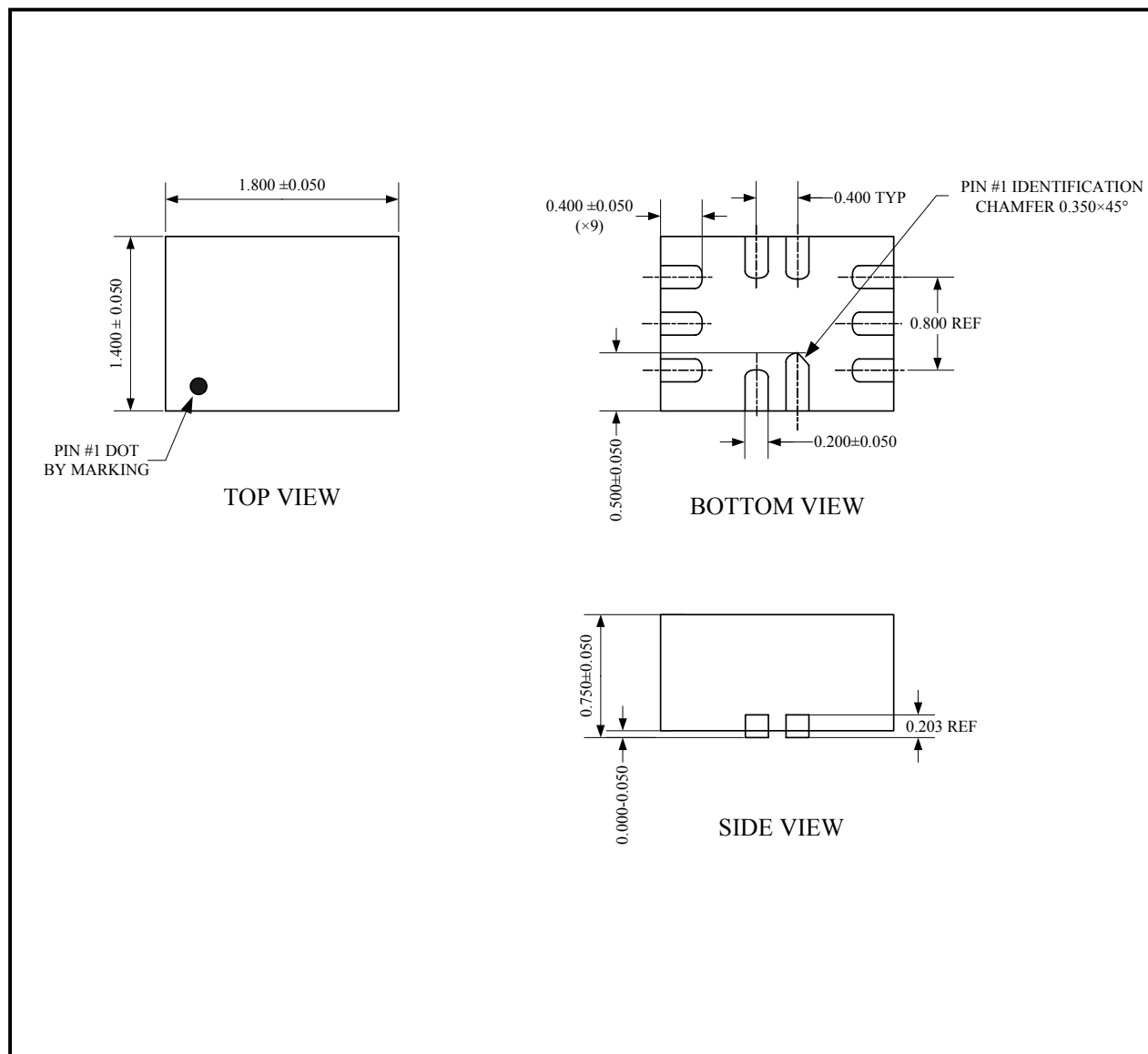


Test Circuit 7. Bandwidth



## PACKAGE OUTLINE DIMENSIONS

### WQFN-10



Note: All linear dimensions are in millimeters.

## REVISION HISTORY

Location	Page
<b>10/07— Data Sheet changed from REV.A to REV.B</b>	
Changes to TYPICAL PERFORMANCE CHARACTERISTICS .....	5

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