SGM3717

4Ω, 400MHz Bandwidth, Dual, SPDT Negative Signal Handling Analog Switch

GENERAL DESCRIPTION

The SGM3717 is a dual, bidirectional, single-pole/ double-throw (SPDT) CMOS analog switch designed to operate from a single +2.5V to +5.0V supply. It features high bandwidth (400MHz) and low on-resistance (4Ω TYP), and the switches can handle negative signal down to -2.0V.

SGM3717 features a guaranteed on-resistance matching of 0.15Ω (TYP) between switches and a guaranteed on-resistance flatness of 1.5Ω (TYP) over the signal range. This ensures excellent linearity and low distortion when switching audio signals.

The SGM3717 is a committed dual single-pole/ double-throw (SPDT) switch that consists of two normally open (NO) and two normally closed (NC) switches. This configuration can be used as a dual 2-to-1 multiplexer.

SGM3717 is available in UTQFN-1.8×1.4-10L package.

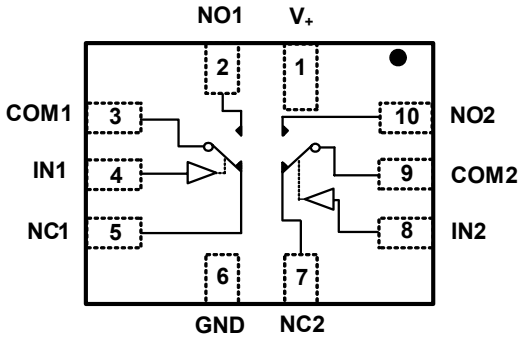
APPLICATIONS

Portable Instrumentation
Battery-Operated Equipment
Computer Peripherals
Cell Phones
PDAs
MP3s

FEATURES

- **Supply Range: +2.5V to +5.0V**
- **Negative Signal Swing Capability: -2.0V to V_+**
- **On-Resistance: 4Ω (TYP) at +5.0V**
- **High Bandwidth: 400MHz**
- **Fast Switching Times**
  - **t_{ON} = 15ns (TYP)**
  - **t_{OFF} = 11ns (TYP)**
- **High Off-Isolation: -49dB at 10MHz**
- **Low Crosstalk: -52dB at 10MHz**
- **1.8V Logic Control**
- **Break-Before-Make Switching**
- **Extended Industrial Temperature Range: -40℃ to +85℃**
- **Small Package: UTQFN-1.8×1.4-10L**

PIN CONFIGURATION (TOP VIEW)



UTQFN-1.8×1.4-10L

ORDERING INFORMATION

MODEL	ORDERING NUMBER	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	PACKAGE OPTION
SGM3717	SGM3717YUWQ10G	UTQFN-1.8×1.4-10L	-40℃ to +85℃	A3XX	Tape and Reel, 3000

ORDER NUMBER

SGM3717 Y X G / TR

- **Tape and Reel**
- **Green product**
- **Package Type**
  - UWQ10 UTQFN-1.8×1.4-10L
- **Operating Temperature Range**
  - Y -40℃ to +85℃

MARKING INFORMATION

A3 X X

- Date code - month ("A" = Jan, "B" = Feb. ⋯ "L" = Dec.)
- Date code - year ("A" = 2010, "B" = 2011 ⋯)
- Chip I.D.

For example: A3BA (2011, January)

ABSOLUTE MAXIMUM RATINGS

V_+, IN to GND.....-0.3V to +6V
Analog, Digital Voltage Range (1)..... (V_+) - 6.0V to (V_+) + 0.3V
Continuous Current NO, NC, or COM.....±50mA
Peak Current NO, NC, or COM .....±80mA
Operating Temperature Range.....-40℃ to +85℃
Junction Temperature.....150℃
Storage Temperature.....-65℃ to +150℃
Lead Temperature (soldering, 10s).....260℃

ESD Susceptibility
HBM.....6000V
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.
(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.

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.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

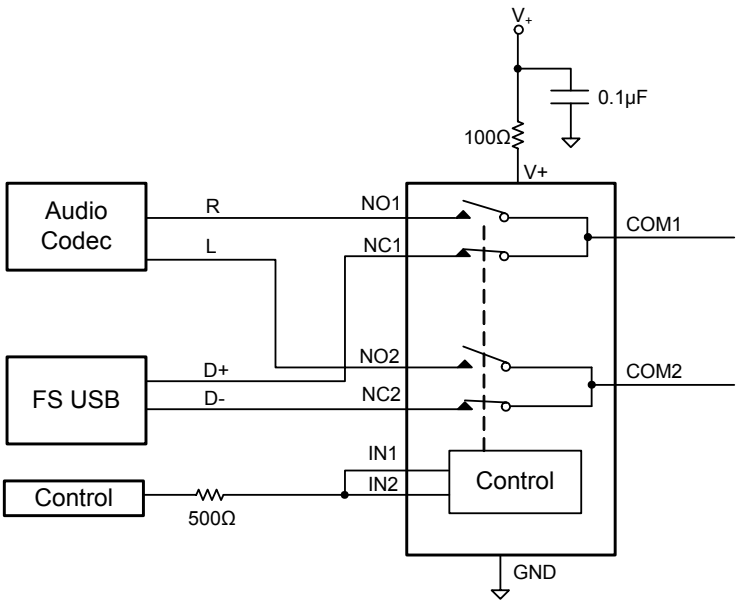
Switches Shown For Logic “0” Input.

PIN DESCRIPTION

NAME	FUNCTION
V_+	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 terminals may be an input or output.

APPLICATION DIAGRAM



ELECTRICAL CHARACTERISTICS

(V_+ = +4.5V to +5.0V, typical values are at V_+ = +5.0V, T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}	2.5V ≤ V_+ ≤ 3.5V		-2.0		V_+	V
		3.5V ≤ V_+ ≤ 5.0V		(V_+) - 5.5		V_+	
On-Resistance	R_{ON}	V_+ = 4.5V, V_{NO} or V_{NC} = 3.5V, I_{COM} = -10mA, Test Circuit 1			4		Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 4.5V, V_{NO} or V_{NC} = 3.5V, I_{COM} = -10mA, Test Circuit 1			0.15		Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 4.5V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -10mA, Test Circuit 1			1.5		Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 5.0V, V_{NO} or V_{NC} = 1.0V, 4.5V, V_{COM} = 4.5V, 1.0V			0.1		μA
Channel ON Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_+ = 5.0V, V_{COM} = 1.0V, 4.5V, V_{NO} or V_{NC} = 1.0V, 4.5V, or floating			0.1		μA
Power Off Leakage Current	$I_{Power\ Off}$	V_+ = 0V, V_{NO} or V_{NC} = 0V, V_{COM} = 5V			0.5		μA
DIGITAL INPUTS							
Input High Voltage	V_{INH}			1.8			V
Input Low Voltage	V_{INL}					0.4	V
Input Leakage Current	I_{IN}	V_+ = 5.0V, V_{IN} = 0V or 5.0V			0.1		μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 3.0V, V_{IH} = 1.8V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2			15		ns
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC} = 3.0V, V_{IH} = 1.8V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2			11		ns
Break-Before-Make Time Delay	t_D	V_{NO1} or V_{NC1} = V_{NO2} or V_{NC2} = 3.0V, R_L = 300Ω, C_L = 35pF, Test Circuit 3			6		ns
Skew	t_{SKEW}	R_S = 39Ω, C_L = 50pF, Test Circuit 4			1		ns
Off Isolation	O_{ISO}	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 5	f = 1MHz		-70		dB
			f = 10MHz		-49		dB
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 6	f = 1MHz		-72		dB
			f = 10MHz		-52		dB
-3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 7			400		MHz
Charge Injection	Q	V_G = GND, R_G = 0Ω, C_L = 1.0nF, Test Circuit 8			16		pC
Switch ON Capacitance	C_{ON}				24		pF
Switch OFF Capacitance	C_{OFF}				9		pF
POWER REQUIREMENTS							
Power Supply Current	I_+	V_+ = 5.0V, V_{IN} = 0V or V_+			0.1		μA

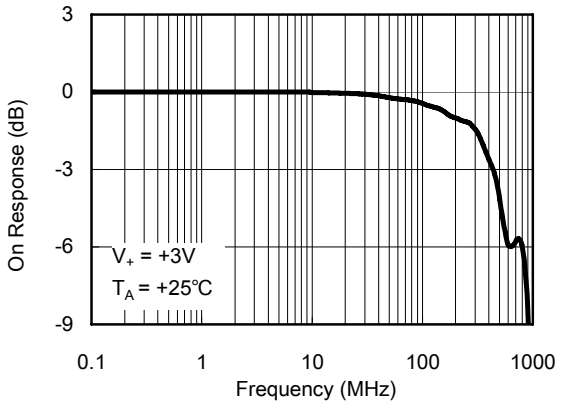
ELECTRICAL CHARACTERISTICS

(V_+ = +2.7V to +3.6V, typical values are at V_+ = +3.0V, T_A = +25℃, unless otherwise noted.)

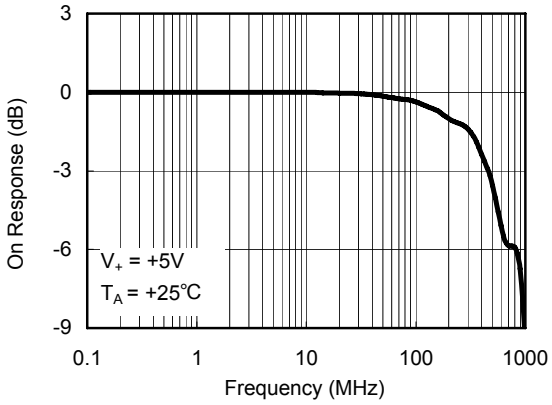
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}	2.5V ≤ V_+ ≤ 3.5V		-2.0		V_+	V
		3.5V ≤ V_+ ≤ 5.0V		(V_+) - 5.5		V_+	
On-Resistance	R_{ON}	V_+ = 2.7V, V_{NO} or V_{NC} = 1.5V, I_{COM} = -10mA, Test Circuit 1			6		Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 2.7V, V_{NO} or V_{NC} = 1.5V, I_{COM} = -10mA, Test Circuit 1			0.25		Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 2.7V, 0V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -10mA, Test Circuit 1			3		Ω
Source OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 3.6V, V_{NO} or V_{NC} = 0.3V, 3.3V, V_{COM} = 3.3V, 0.3V			0.1		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			0.1		μA
Power Off Leakage Current	$I_{Power\ Off}$	V_+ = 0V, V_{NO} or V_{NC} = 0V, V_{COM} = 3V			0.5		μA
DIGITAL INPUTS							
Input High Voltage	V_{INH}			1.8			V
Input Low Voltage	V_{INL}					0.4	V
Input Leakage Current	I_{IN}	V_+ = 3.6V, V_{IN} = 0V or 3.6V			0.1		μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 1.5V, V_{IH} = 1.8V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2			24		ns
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC} = 1.5V, V_{IH} = 1.8V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2			15		ns
Break-Before-Make Time Delay	t_D	V_{NO1} or V_{NC1} = V_{NO2} or V_{NC2} = 1.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 3			10		ns
Skew	t_{SKEW}	R_S = 39Ω, C_L = 50pF, Test Circuit 4			1		ns
Off Isolation	O_{ISO}	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 5	f = 1MHz		-70		dB
			f = 10MHz		-49		dB
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 6	f = 1MHz		-72		dB
			f = 10MHz		-52		dB
-3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 7			400		MHz
Charge Injection	Q	V_G = GND, R_G = 0Ω, C_L = 1.0nF Test Circuit 8			10		pC
Switch ON Capacitance	C_{ON}				24		pF
Switch OFF Capacitance	C_{OFF}				9		pF
Total Harmonic Distortion	THD	V_+ = 3.3V, $V_{NC/NO}$ = 2.0V_{PP}, f = 20Hz to 20kHz, Test Circuit 9	R_L = 600Ω		0.025		%
		V_+ = 3.3V, $V_{NC/NO}$ = 1.0V_{PP}, f = 20Hz to 20kHz, Test Circuit 9	R_L = 32Ω		0.35		
POWER REQUIREMENTS							
Power Supply Current	I_+	V_+ = 3.6V, V_{IN} = 0V or V_+			0.1		μA

TYPICAL PERFORMANCE CHARACTERISTICS

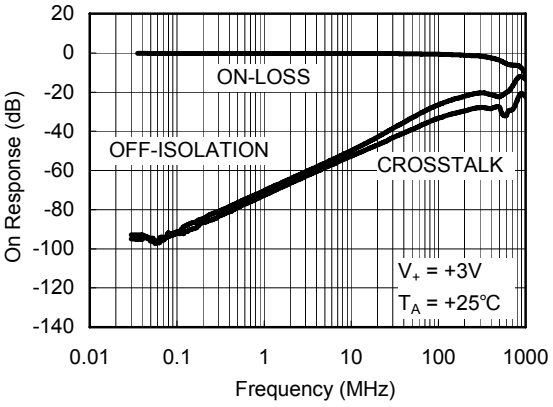
On Response vs. Frequency



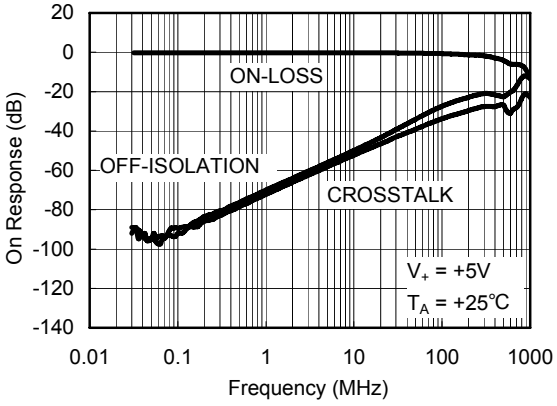
On Response vs. Frequency



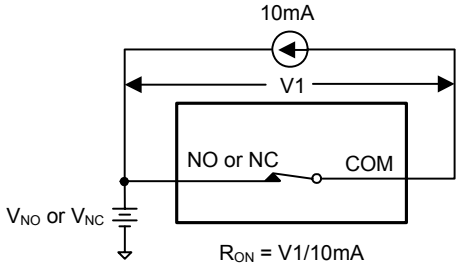
Response vs. Frequency



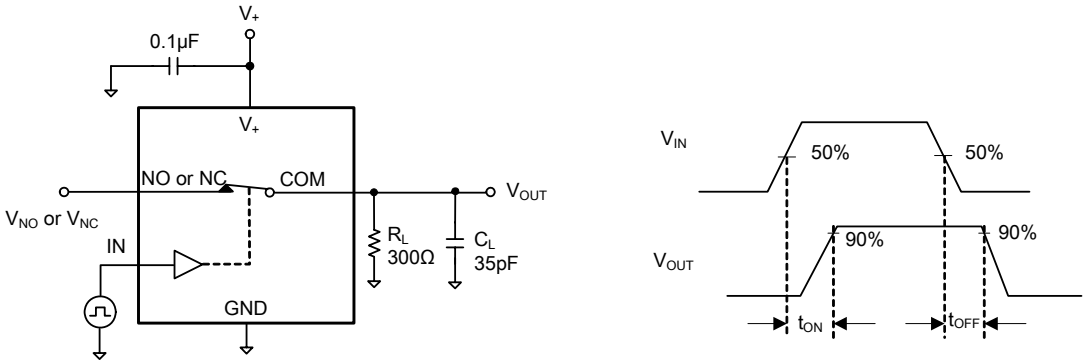
Response vs. Frequency



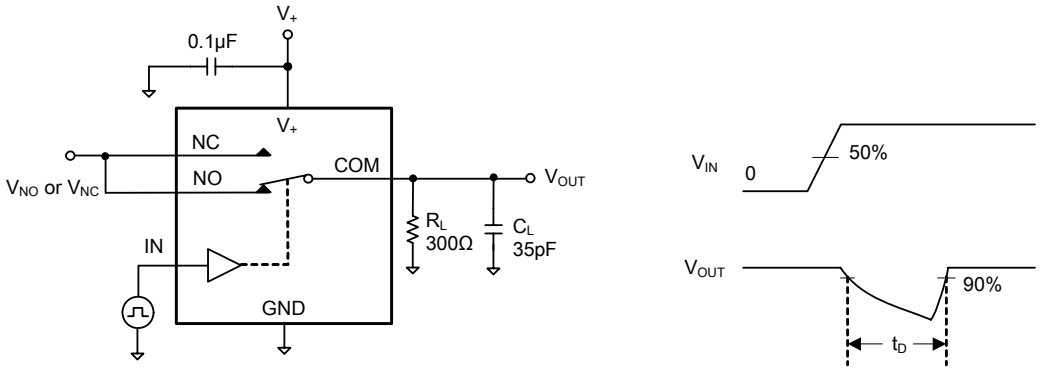
TEST CIRCUITS



Test Circuit 1. On Resistance

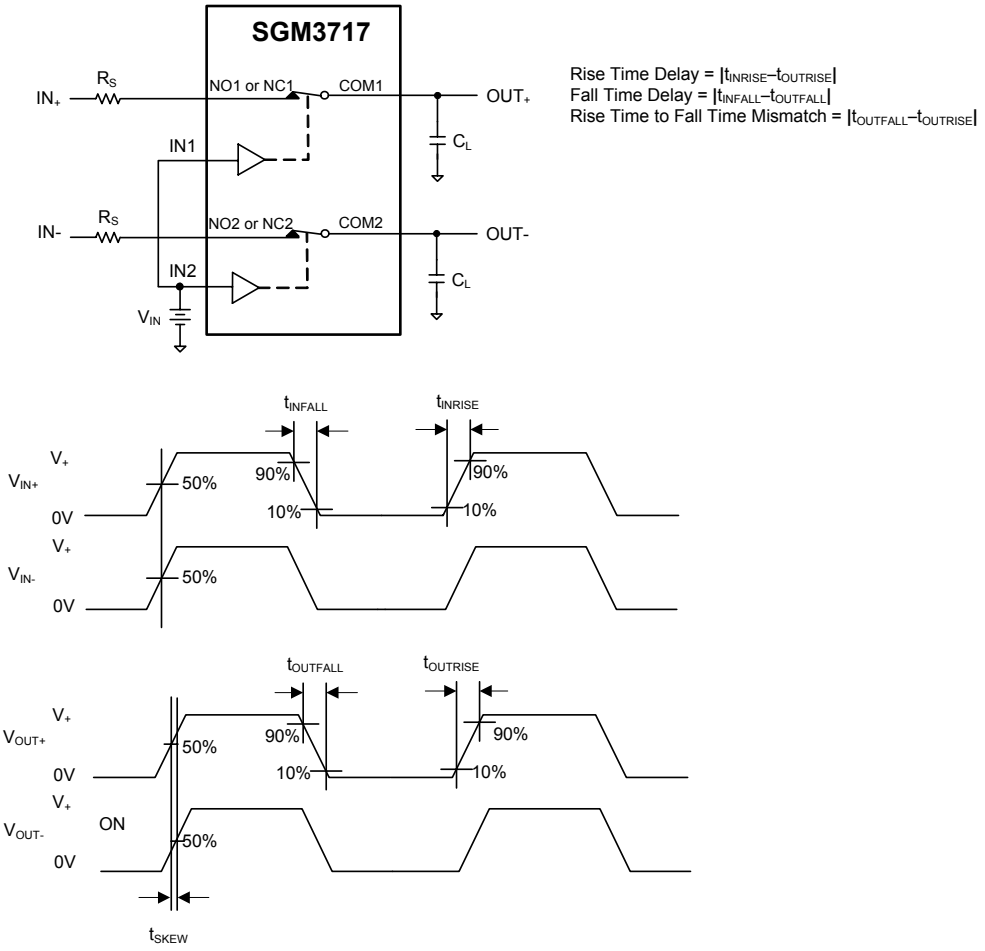


Test Circuit 2. Switching Times

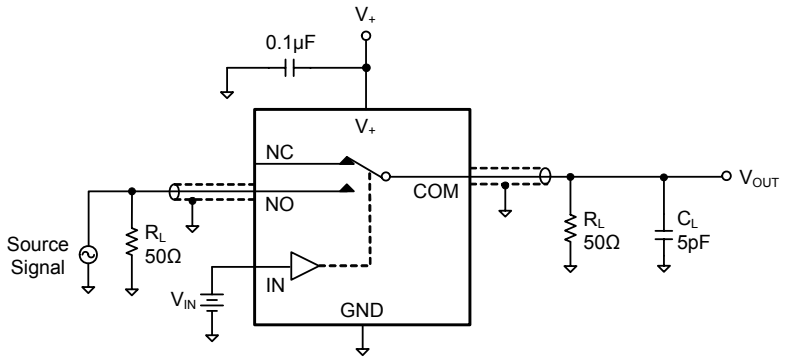


Test Circuit 3. Break-Before-Make Time Delay (t_D)

TEST CIRCUITS (Cont.)

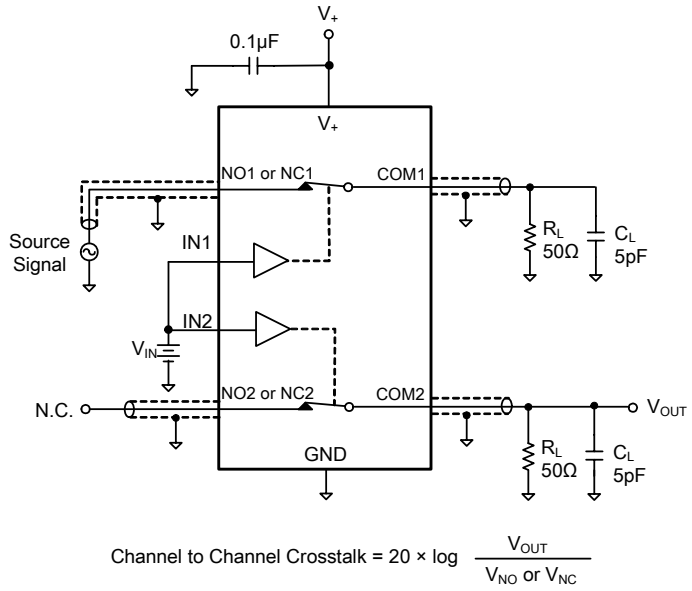


Test Circuit 4. Output Signal Skew (T_{SKEW})

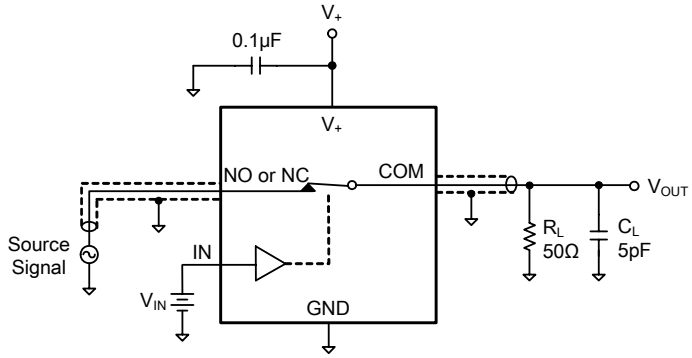


Test Circuit 5. Off Isolation (O_{ISO})

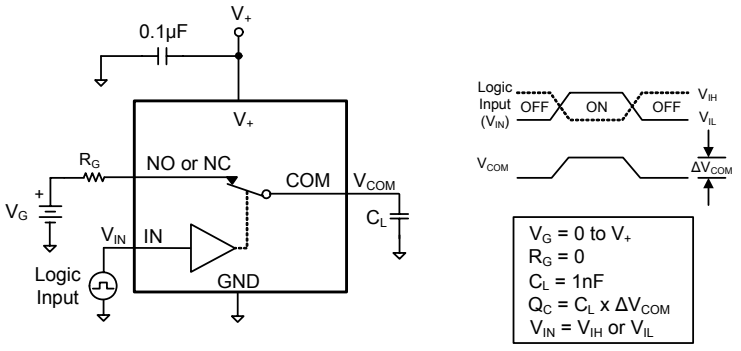
TEST CIRCUITS (Cont.)



Test Circuit 6. Channel-to-Channel Crosstalk (X_{TALK})

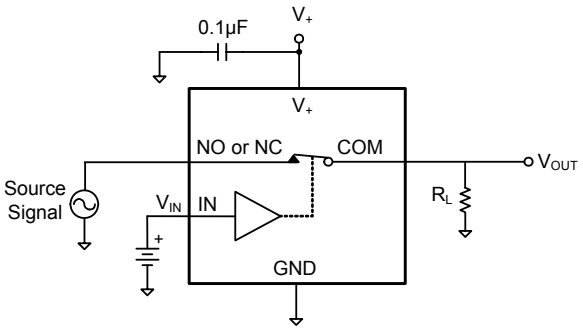


Test Circuit 7. -3dB Bandwidth (BW)



Test Circuit 8. Charge Injection (Q)

TEST CIRCUITS (Cont.)



Test Circuit 9. Total Harmonic Distortion (THD)

APPLICATION

In order to enhance the negative signal swing capability of SGM3717, the circuit in Figure 10 is recommended. R1 and R2 will prevent the device from entering into latch-up state when passing negative signal. For input signals from 0V to -2.5V, V_+ = 3.3V is recommended.

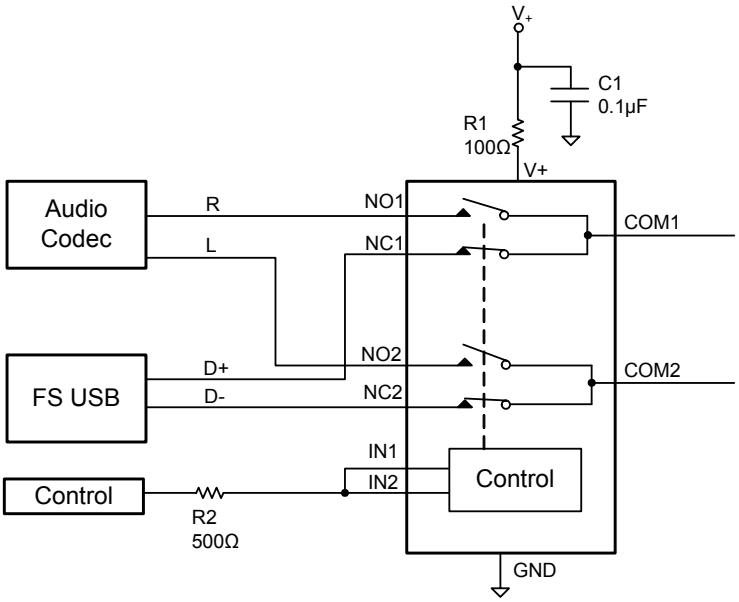
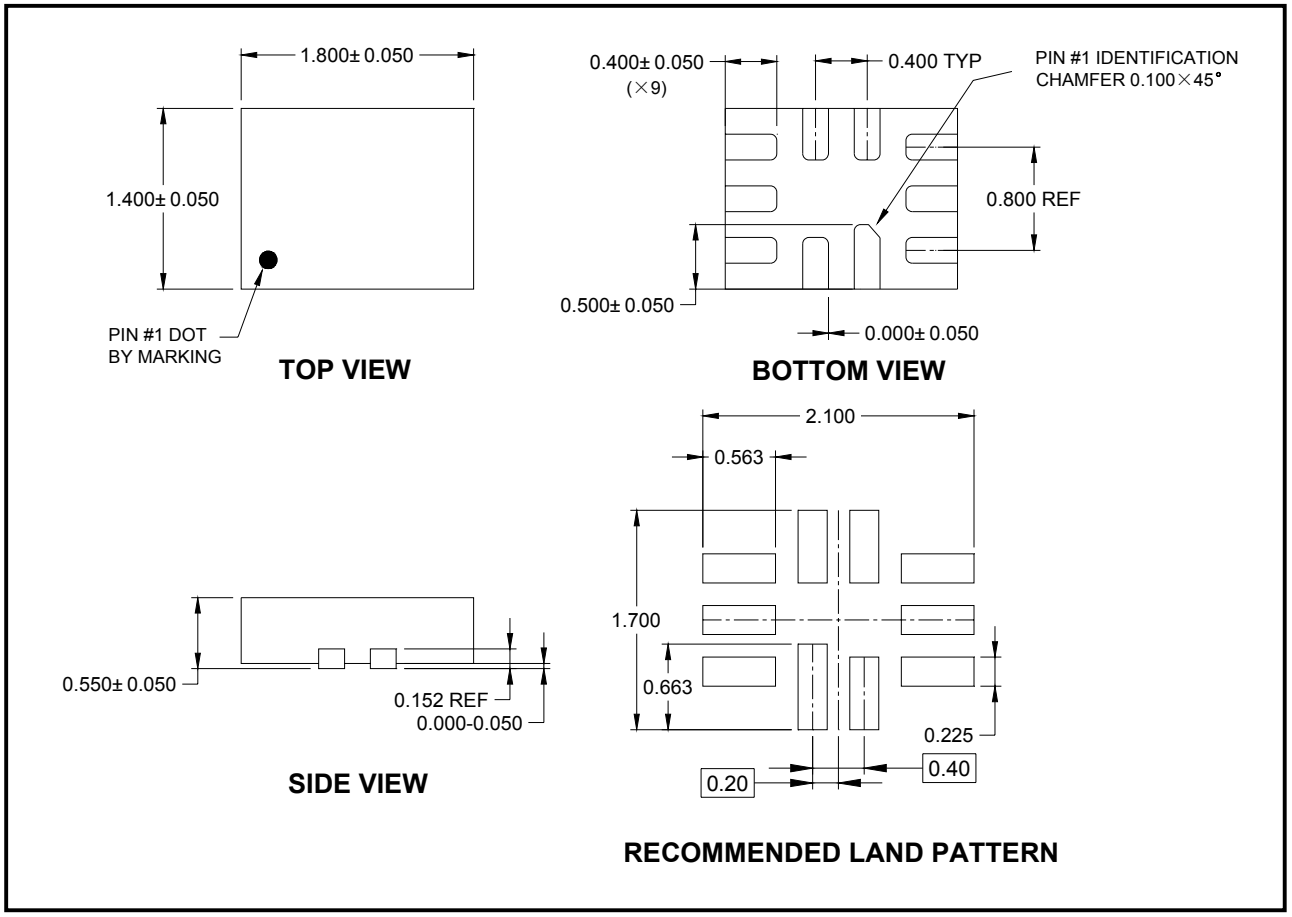


Figure 10. Typical Application Circuit

PACKAGE OUTLINE DIMENSIONS

UTQFN-1.8×1.4-10L



NOTE: All linear dimensions are in millimeters.