

# SGM5018

# 4.5Ω, High Speed, Low Voltage Quad, SPDT Analog Switch

## GENERAL DESCRIPTION

The SGM5018 is a high-speed, low-voltage, quad single-pole/double-throw (SPDT) CMOS analog switch multiplexer that is designed to operate from a single +1.8V to +5.5V power supply.

SGM5018 features guaranteed on-resistance (4.5Ω TYP), on-resistance matching (3.6Ω MAX) between switches and guaranteed on-resistance flatness over the signal range (3Ω TYP). This ensures excellent linearity and low distortion when switching audio signals. Fast switching speed, coupled with high signal bandwidth (300MHz), also makes the parts suitable for video signal switching. CMOS process ensures ultra low power dissipation, making the parts ideally suited for portable and battery powered instruments.

SGM5018 is available in Pb-free TSSOP-16 package.

## APPLICATIONS

- Battery-Powered Systems
- USB 1.1 Signal Switching Circuits
- Communication Systems
- Portable Instrumentation
- Audio and Video Switching
- Computer Peripherals
- Cell Phones
- PDA's

## FUNCTION TABLE

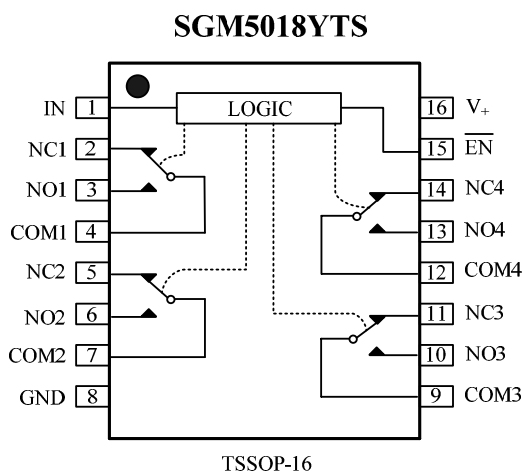
$\overline{EN}$	IN	NO	NC
L	L	OFF	ON
L	H	ON	OFF
H	√	All Switches Open	

√ = Don't Care.

## FEATURES

- Low Voltage Operation : 1.8V to 5.5V
- $R_{ON}$  is Typically 4.5Ω at 5V
- Low On-Resistance Flatness
- -3dB Bandwidth: 300MHz
- Rail-to-Rail Input and Output Operation
- Typical Power Consumption (<0.01 μW)
- TTL/CMOS Compatible
- -40°C to +85°C Operating Temperature Range
- Lead (Pb) Free TSSOP-16 Package

## PIN CONFIGURATION (TOP VIEW)



## ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM5018	TSSOP-16	-40°C to +85°C	SGM5018YTS/TR	SGM5018YTS	Tape and Reel, 3000

## ABSOLUTE MAXIMUM RATINGS

V <sub>+</sub> to GND.....	-0.3V to +6V	Storage Temperature.....	- 65°C to +150°C
Analog, Digital voltage range(1).....	- 0.3V to (V <sub>+</sub> + 0.3V)	Lead Temperature (soldering, 10s).....	+260°C
Continuous Current NO, NC, or COM.....	±200mA	ESD Susceptibility	
Peak Current NO, NC, or COM.....	±350mA	HBM.....	4000V
Operating Temperature Range.....	- 40°C to +85°C	MM.....	400V
Junction Temperature.....	+150°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<sub>x</sub> exceeding V<sub>+</sub> will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

## PIN DESCRIPTION

NAME	TSSOP PIN	FUNCTION
V <sub>+</sub>	16	Power supply
GND	8	Ground
IN	1	Digital control pin to connect the COM terminal to the NO or NC terminals.
$\overline{\text{EN}}$	15	Digital Enable Input. Normally connect to GND. Drive to logic high to set all switches off.
COM <sub>x</sub>	4,7,9,12	Common terminal
NO <sub>x</sub>	3,6,10,13	Normally-open terminal
NC <sub>x</sub>	2,5,11,14	Normally-closed terminal

Note: NO<sub>x</sub>, NC<sub>x</sub> and COM<sub>x</sub> terminal may be an input or output.

# ELECTRICAL CHARACTERISTICS

( $V_+ = +4.5V$  to  $+5.5V$ ,  $GND = 0V$ ,  $V_{IH} = +1.6V$ ,  $V_{IL} = +0.5V$ ,  $T_A = -40^\circ C$  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 $V_{NC} = 1.2V,$ $I_{COM} = -100mA$ , Test Circuit 1	+25°C		4.5	7	$\Omega$
			-40°C to +85°C			8	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_+ = 4.5V, V_{NO}$ or $V_{NC} = 1.2V,$ $I_{COM} = -100mA$ , Test Circuit 1	+25°C		0.8	3.6	$\Omega$
			-40°C to +85°C			4.2	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 4.5V, V_{NO}$ or $V_{NC} = 1.2V,$ $I_{COM} = -100mA$ , Test Circuit 1	+25°C		3	3.7	$\Omega$
			-40°C to +85°C			4.5	$\Omega$
Source OFF Leakage current	$I_{N(OFF)}, I_{O(OFF)}$	$V_+ = 5.5V, V_{NO}$ or $V_{NC} = 3.3V/0.3V,$ $V_{COM} = 0.3V/3.3V$	-40°C to +85°C			1	$\mu A$
Channel ON Leakage current	$I_{N(ON)}, I_{O(ON)},$ $I_{COM(ON)}$	$V_+ = 5.5V, V_{COM} = 0.3V/3.3V,$ $V_{NO}$ 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	1.6			V
Input Low Voltage	$V_{INL}$		-40°C to +85°C			0.5	V
Input Leakage Current	$I_{IN}$	$V_+ = 5.5V, V_{IN} = 0V$ or $5.5V$	-40°C to +85°C			1	$\mu A$
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	$t_{ON}$	$V_{COM} = 2V, C_L = 35pF,$ $R_L = 300\Omega$ , Test Circuit2	+25°C		40		ns
Turn-Off Time	$t_{OFF}$		+25°C		30		ns
Break-Before-Make Time Delay	$t_D$	$V_{NO}$ or $V_{NC} = 3V, R_L = 300\Omega,$ $C_L = 35pF$ , Test Circuit 4	+25°C		18		ns
Off Isolation	$O_{ISO}$	$R_L = 50\Omega, f = 10MHz,$ $V_{BIAS} = 350mV,$ $V_{IN} = 0dBm$ , Test Circuit5	1MHz	+25°C		-70	dB
			10MHz	+25°C		-50	dB
Channel-to-Channel Crosstalk	$X_{TALK}$	$R_L = 50\Omega, f = 10MHz,$ $V_{BIAS} = 350mV,$ $V_{IN} = 0dBm$ , Test Circuit6	1MHz	+25°C		-90	dB
			10MHz	+25°C		-60	dB
Bandwidth -3 dB	$BW$	$R_L = 50\Omega, V_{IN} = 0dBm,$ $V_{BIAS} = 350mV$ , Test Circuit7	+25°C		300		MHz
Charge Injection Select Input to Common I/O	$Q$	$V_{IN} = GND, R_G = 0\Omega,$ $Q = C_L \times V_{OUT}, C_L = 1nF$ , Test Circuit3	+25°C		20		pC
Channel ON Capacitance	$C_{ON}$		+25°C		42		pF
<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			1	$\mu A$

Specifications subject to changes without notice.

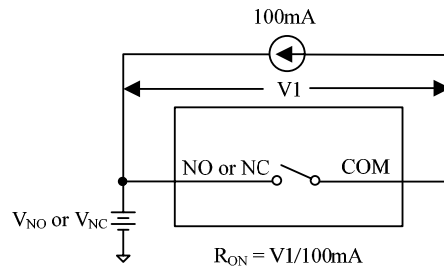
# ELECTRICAL CHARACTERISTICS

( $V_+ = +2.7V$  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.)

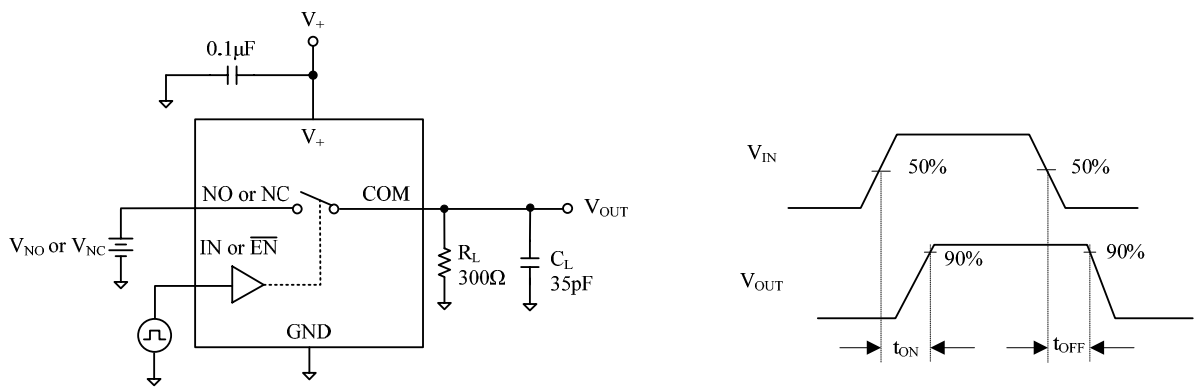
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TPY	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	$V_{NO}, V_{NC}, V_{COM}$		$-40^\circ C$ to $+85^\circ C$	0		$V_+$	V
On-Resistance	$R_{ON}$	$V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1.2V,$ $I_{COM} = -100mA$ , Test Circuit 1	$+25^\circ C$		11	15.5	$\Omega$
			$-40^\circ C$ to $+85^\circ C$			18.5	$\Omega$
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1.2V,$ $I_{COM} = -100mA$ , Test Circuit 1	$+25^\circ C$		1.6	4	$\Omega$
			$-40^\circ C$ to $+85^\circ C$			4.6	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1.2V,$ $I_{COM} = -100mA$ , Test Circuit 1	$+25^\circ C$		7	9.4	$\Omega$
			$-40^\circ C$ to $+85^\circ C$			13	$\Omega$
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	$\mu A$
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	$\mu A$
<b>DIGITAL INPUTS</b>							
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	$I_{IN}$	$V_+ = 5.5V, V_{IN} = 0V$ or $3.6V$	$-40^\circ C$ to $+85^\circ C$			1	$\mu A$
<b>DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	$t_{ON}$	$V_{COM} = 2V, C_L = 35pF,$	$+25^\circ C$		48		ns
Turn-Off Time	$t_{OFF}$	$R_L = 300\Omega$ , Test Circuit2	$+25^\circ C$		45		ns
Break-Before-Make Time Delay	$t_d$	$V_{NO}$ or $V_{NC} = 2V, R_L = 300\Omega,$ $C_L = 35pF$ , Test Circuit 4	$+25^\circ C$		20		ns
Off Isolation	$O_{ISO}$	$R_L = 50\Omega, f = 10MHz,$ $V_{BIAS} = 350mV,$ $V_{IN} = 0dBm$ , Test Circuit5	1MHz	$+25^\circ C$		-70	dB
			10MHz	$+25^\circ C$		-50	dB
Channel-to-Channel Crosstalk	$X_{TALK}$	$R_L = 50\Omega, f = 10MHz,$ $V_{BIAS} = 350mV,$ $V_{IN} = 0dBm$ , Test Circuit6	1MHz	$+25^\circ C$		-90	dB
			10MHz	$+25^\circ C$		-60	dB
Bandwidth -3 dB	BW	$R_L = 50\Omega, V_{IN} = 0dBm,$ $V_{BIAS} = 350mV$ , Test Circuit7	$+25^\circ C$		300		MHz
Charge Injection Select Input to Common I/O	Q	$V_{IN} = GND, R_G = 0\Omega,$ $Q = C_L \times V_{OUT}, C_L = 1nF$ , Test Circuit3	$+25^\circ C$		20		pC
Channel ON Capacitance	$C_{ON}$		$+25^\circ C$		42		pF

Specifications subject to changes without notice.

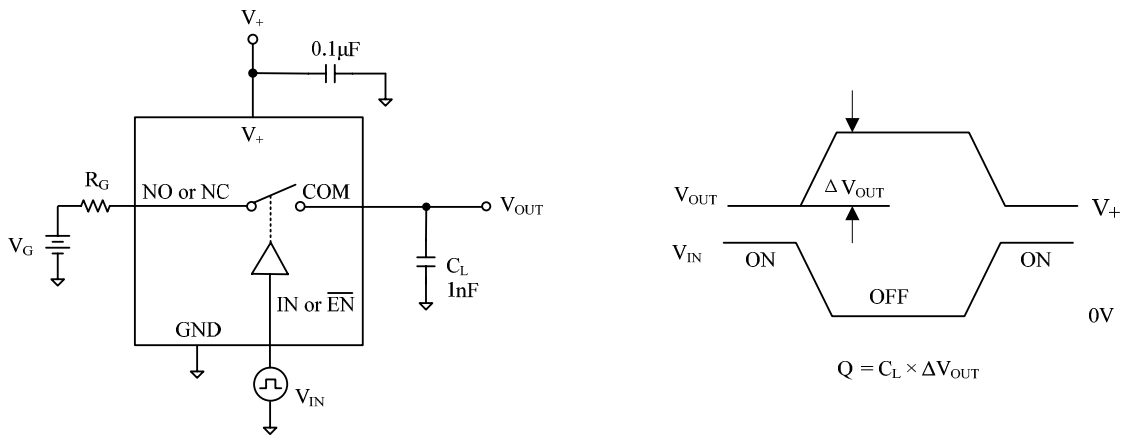
# TEST CIRCUITS



Test Circuit 1. On Resistance

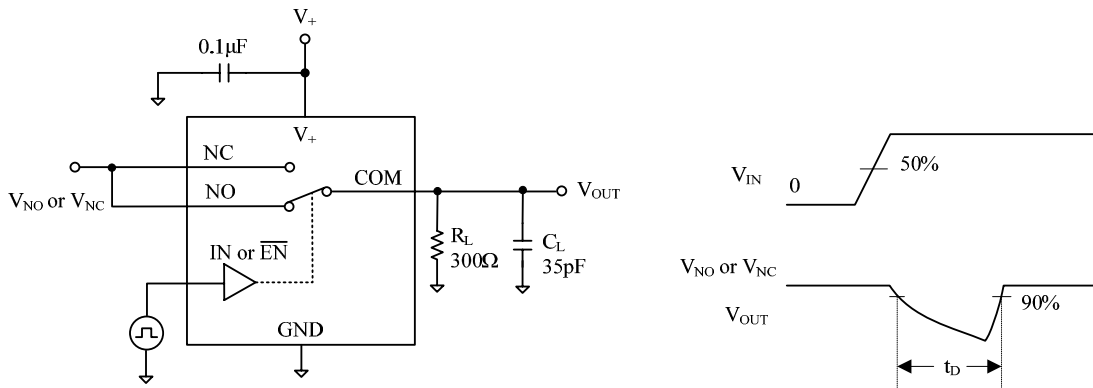


Test Circuit 2. Switching Times

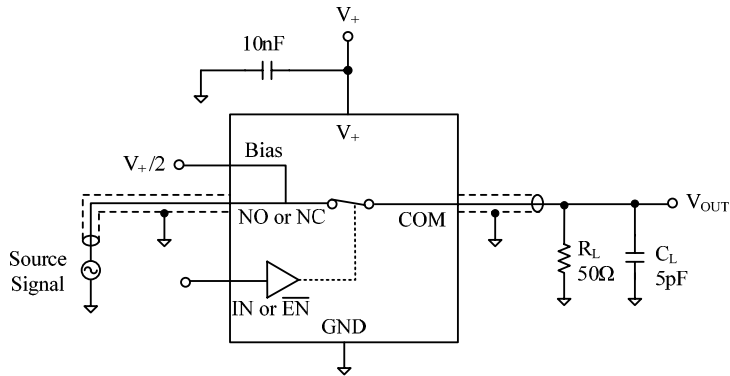


Test Circuit 3. Charge Injection

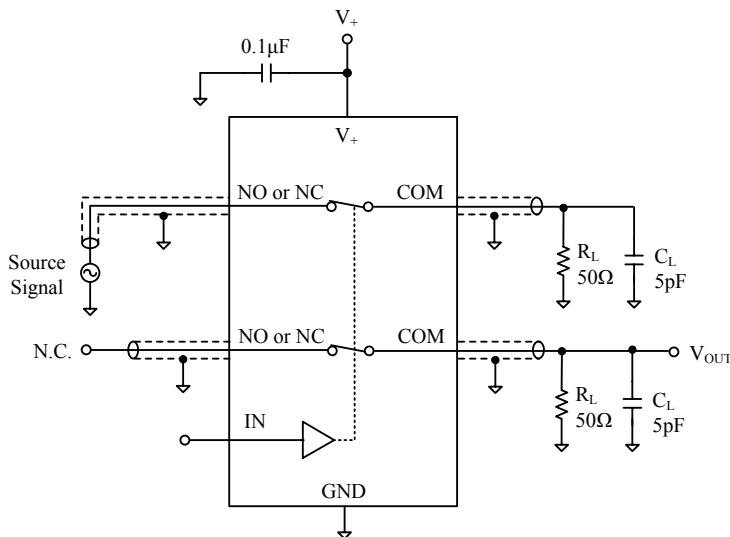
# TEST CIRCUITS (Cont.)



Test Circuit 4. Break-Before-Make Time Delay,  $t_d$



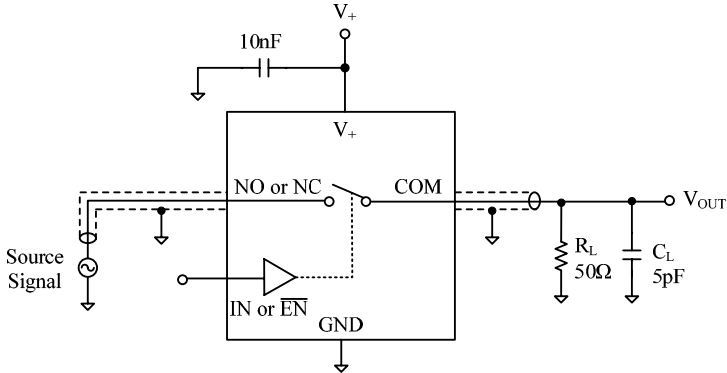
Test Circuit 5. Off Isolation



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

Test Circuit 6. Channel-to-Channel Crosstalk

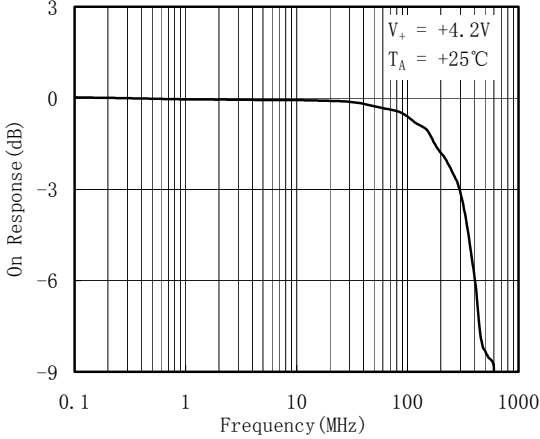
# TEST CIRCUITS (Cont.)



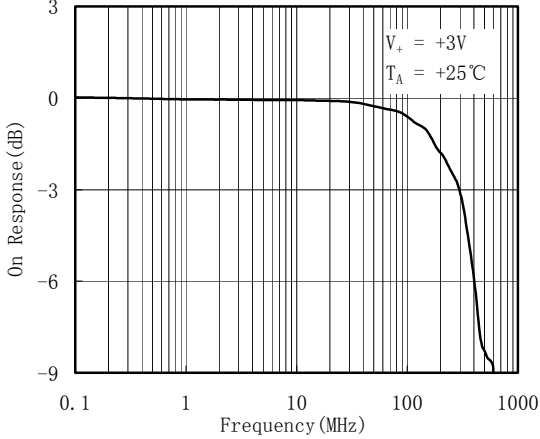
Test Circuit 7. Bandwidth -3dB

# TYPICAL PERFORMANCE CHARACTERISTICS

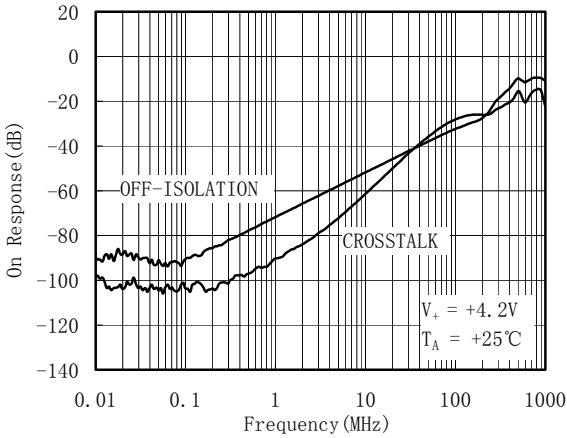
On Response vs. Frequency



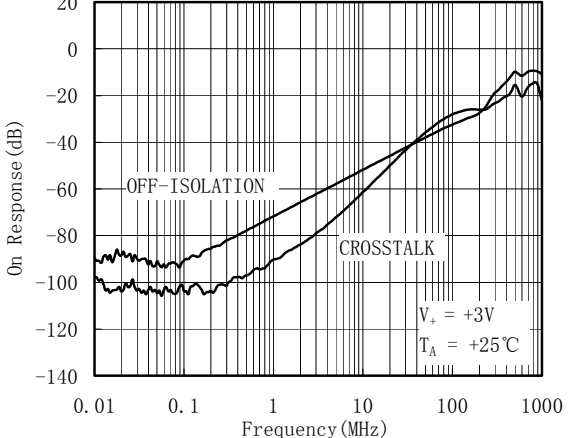
On Response vs. Frequency



Response vs. Frequency



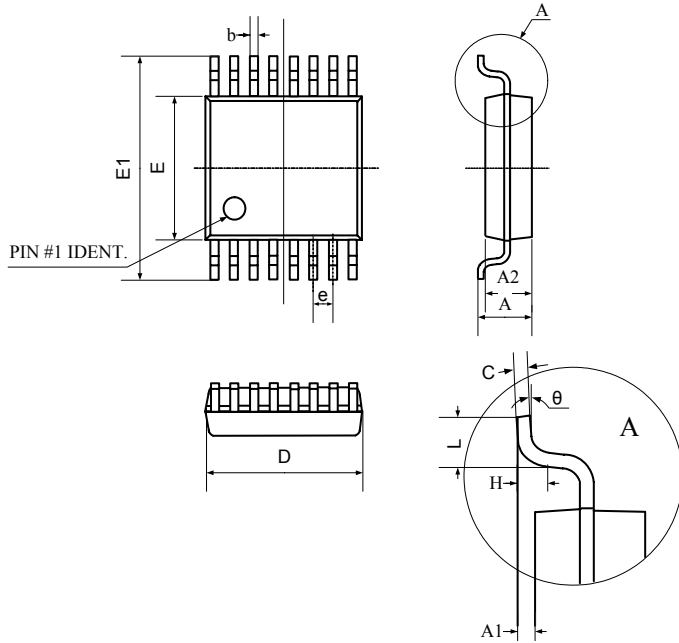
Response vs. Frequency





# 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)	
$\theta$	1° - 7°		1° - 7°	

## REVISION HISTORY

Location

Page

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11/2007—Preliminary Datasheet

01/2008—Data Sheet REV.A

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