



# SGM330A

## Quad, Wide-Bandwidth SPDT Video Analog Switch

### GENERAL DESCRIPTION

The SGM330A is a quad, bidirectional, single-pole/double-throw (SPDT) CMOS video analog switch (Mux/DeMux) designed to operate at a single +5V supply. This 2-channel multiplexer/demultiplexer is recommended for both RGB and composite video switching applications. The video switch can be driven from a current output RAMDAC or voltage output composite video source.

Wide bandwidth (500MHz), low on-resistance (12Ω), and low crosstalk make it suitable for high-frequency and other applications. Also this device has exceptionally high current capability which is far greater than most analog switches offered today.

The SGM330A offers a high-performance, low-cost solution to switch between video sources. It is specified -40°C to +85°C temperature range. The SGM330A is available in Green SO-16, TSSOP-16 and QSOP-16 packages.

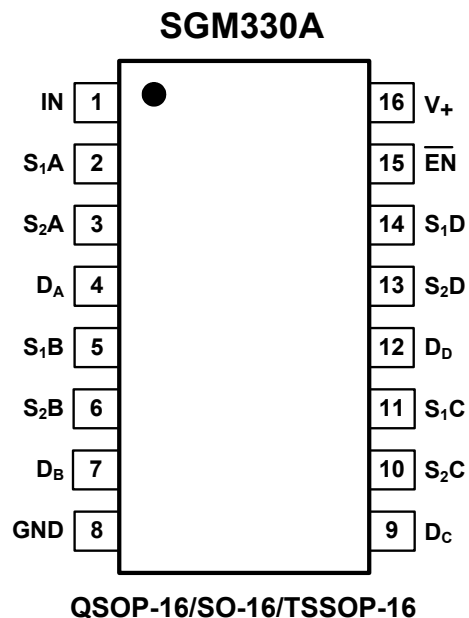
### APPLICATIONS

- Personal Video Recorders
- Terrestrial Set-Top Boxes
- Hard Disk Recorders
- DVD Players
- Game Consoles
- Digital VCRs
- Desktop Video Editors
- Audio and Video Switching

### FEATURES

- **Wide Bandwidth: 500MHz**
- **Low On-Resistance: 12Ω (TYP)**
- **Low Crosstalk: -60dB at 10MHz (TYP)**
- **Single Power Operation: +5V**
- **Fast Switching Time**
- **Rail-to-Rail Operation**
- **Typical Power Consumption (I<sub>CC</sub> = 0.1μA)**
- **TTL/CMOS Compatible**
- **Micro Size Packages**
  - SO-16
  - TSSOP-16
  - QSOP-16

### PIN CONFIGURATIONS (TOP VIEW)



**PACKAGE/ORDERING INFORMATION**

ORDERING NUMBER	PIN- PACKAGE	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	PACKAGE OPTION
SGM330A-YS/TR	SO-16	-40°C to +85°C	SGM330A-YS	Tape and Reel, 2500
SGM330A-YQS/TR	QSOP-16	-40°C to +85°C	SGM330A-YQS	Tape and Reel, 3000
SGM330A-YTS/TR	TSSOP-16	-40°C to +85°C	SGM330A-YTS	Tape and Reel, 3000

**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage to Ground Potential (Inputs & V<sub>+</sub> only)  
..... -0.3V to 6V  
Supply Voltage to Ground Potential (Outputs & D only)  
..... -0.3V to 6V  
DC Input Voltage ..... -0.3V to 6V  
Operating Temperature Range..... -40°C to +85°C  
Junction Temperature..... 150°C  
Storage Temperature..... -65°C to +150°C  
Package Thermal Resistance @ T<sub>A</sub> = 25°C  
SO-16, θ<sub>JA</sub>..... 82°C/W  
TSSOP-16, θ<sub>JA</sub>..... 100°C/W  
QSOP-16, θ<sub>JA</sub>..... 103°C/W  
Lead Temperature ( soldering, 10s ) .....260°C  
ESD Susceptibility  
HBM.....8000V  
MM.....400V

**NOTE**

1. Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

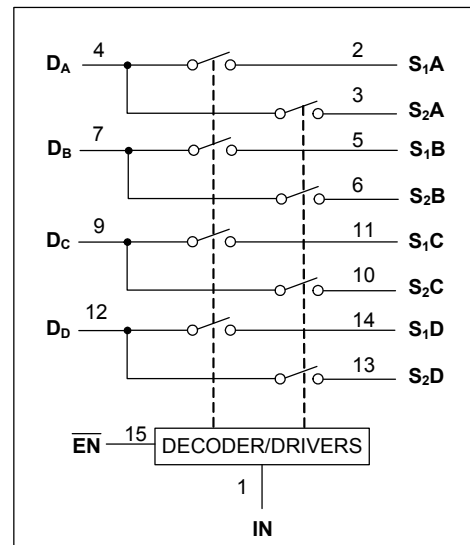
**PIN DESCRIPTION**

NAME	FUNCTION
S <sub>1</sub> A, S <sub>1</sub> B, S <sub>1</sub> C, S <sub>1</sub> D S <sub>2</sub> A, S <sub>2</sub> B, S <sub>2</sub> C, S <sub>2</sub> D	Analog video I/O
IN	Select input
EN	Switch-enable input
D <sub>A</sub> , D <sub>B</sub> , D <sub>C</sub> , D <sub>D</sub>	Analog video I/O
GND	Ground
V <sub>+</sub>	Power supply

**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.

**BLOCK DIAGRAM**



**FUNCTION TABLE**

EN	IN	ON Switch
0	0	S <sub>1</sub> A, S <sub>1</sub> B, S <sub>1</sub> C, S <sub>1</sub> D
0	1	S <sub>2</sub> A, S <sub>2</sub> B, S <sub>2</sub> C, S <sub>2</sub> D
1	X	Disabled

**ELECTRICAL CHARACTERISTICS**(At  $V_+ = +5V$ ,  $T_A = +25^\circ C$ . unless otherwise noted.)

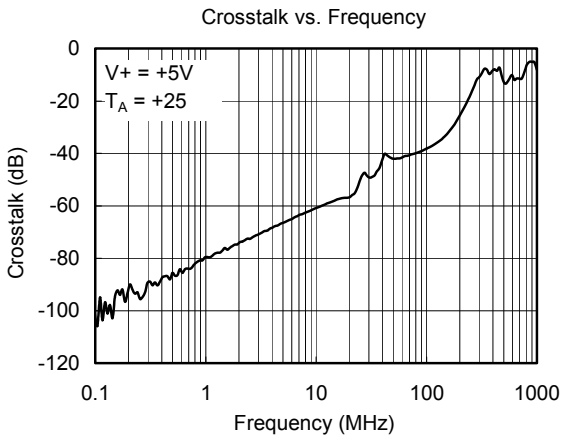
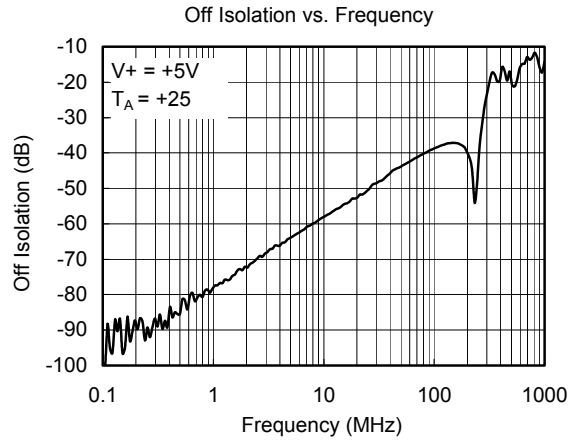
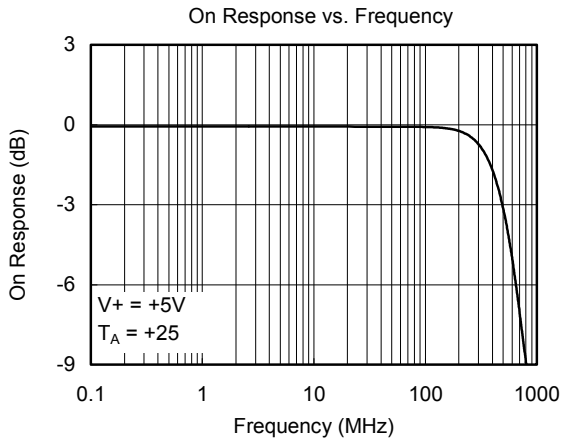
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>DC CHARACTERISTICS</b>						
On-Resistance	$R_{ON}$	$0V \leq V_{S1}$ or $V_{S2} \leq V_+$ , $I_D = 13mA$		12	18	$\Omega$
Input High Voltage	$V_{IH}$		2			V
Input Low Voltage	$V_{IL}$				0.6	V
Input High Current	$I_{IH}$	$V_+ = 5.5V$ , $V_{IN}$ and $V_{EN} = V_+$			$\pm 1$	$\mu A$
Input Low Current	$I_{IL}$	$V_+ = 5.5V$ , $V_{IN}$ and $V_{EN} = 0V$			$\pm 1$	$\mu A$
Analog Output Leakage Current	$I_O$	$V_+ = 5.5V$ , $V_{S1}$ or $V_{S2} = 3.3V/0.3V$ , $V_D = 0.3V/3.3V$			$\pm 1$	$\mu A$
Clamp Diode Voltage	$V_{IK}$	$I_{IN} = -18mA$		-1		V
<b>DYNAMIC CHARACTERISTICS</b>						
Turn-On Time	$T_{ON}$	$R_L = 75\Omega$ , $C_L = 20pF$ ( Figure 1)		25		ns
Turn-Off Time	$T_{OFF}$	$R_L = 75\Omega$ , $C_L = 20pF$ ( Figure 1)		13		ns
Off Isolation	$O_{IRR}$	$R_L = 150\Omega$ , $f = 10MHz$ ( Figure 5)		-58		dB
Channel-to-Channel Crosstalk	$X_{TALK}$	$R_{IN} = 10\Omega$ , $R_L = 150\Omega$ , $f = 10MHz$ ( Figure 4)		-60		dB
-3dB Bandwidth	BW	$R_L = 150\Omega$ ( Figure 3)		500		MHz
Input/Enable Capacitance	$C_{IN}$	$f = 1MHz$		4		pF
Switch OFF Capacitance	$C_{OFF}$	$f = 1MHz$		4		pF
Switch ON Capacitance	$C_{ON}$	$f = 1MHz$		8		pF
Differential Gain	$D_G$	$R_L = 150\Omega$ , $f = 3.58MHz$ ( Figure 2)		0.5		%
Differential Phase	$D_P$	$R_L = 150\Omega$ , $f = 3.58MHz$ ( Figure 2)		0.03		$^\circ$
<b>POWER REQUIREMENTS</b>						
Power Supply Current	$I_{CC}$	$V_+ = +5.5V$ , $V_{IN}$ and $V_{EN} = 5V/0V$		0.1	20	$\mu A$
Supply Current per Input @ TTL HIGH	$\Delta I_{CC}$	$V_+ = +5.5V$ , $V_{IN}$ or $V_{EN} = 3.4V$			300	$\mu A$

Specifications subject to changes without notice.

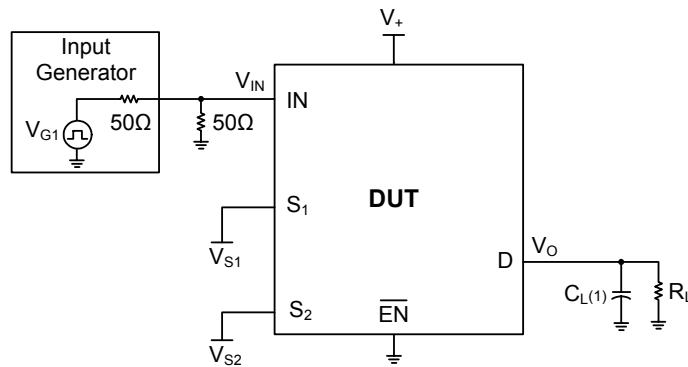
## PARAMETER DEFINITIONS

PARAMETER	DESCRIPTION
$R_{ON}$	Resistance between source and drain with switch in the ON state
$I_O$	Output leakage current measured at S1, S2, and D with the switch OFF
$V_{IN}$	Digital voltage at the IN pin that selects between S1 and S2 analog inputs
$V_I$	Voltage applied to the D or S1, S2 pins when D or S1, S2 is the switch input
$V_{EN}$	A voltage that ENABLES the chip
$C_{IN}$	Capacitance at the digital inputs
$C_{OFF}$	Capacitance at analog I/O (S1, S2, D) with switch OFF
$C_{ON}$	Capacitance at analog I/O (S1, S2, D) with switch ON
$V_{IH}$	Minimum input voltage for logic HIGH
$V_{IL}$	Minimum input voltage for logic LOW
$I_{IH(IIL)}$	Input current of the digital input
$T_{ON}$	Propagation delay measured between 50% of the digital input to 90% of the analog output when switch is turned ON.
$T_{OFF}$	Propagation delay measured between 50% of the digital input to 90% of the analog output when switch is turned OFF.
BW	response of the switch in the ON state measured at 3dB down
$X_{TALK}$	Is an unwanted signal coupled from channel to channel. Measured in -dB. $X_{TALK} = 20\text{LOG } V_{OUT}/V_{IN}$ . This is non-adjacent crosstalk
$D_G$	Magnitude variation between analog input and output pins when the switch is ON and the dc offset of composite-video signal varies at the analog input pin. In the NTSC standard, the frequency of the video signal is 3.58MHz.
$D_P$	Phase variation between analog input and output pins when the switch is ON and the dc offset of composite-video signal varies at the analog input pin. In the NTSC standard, the frequency of the video signal is 3.58MHz.
$O_{IRR}$	Off isolation is the resistance (measured in -dB) between the input and output with the switch off (NO)

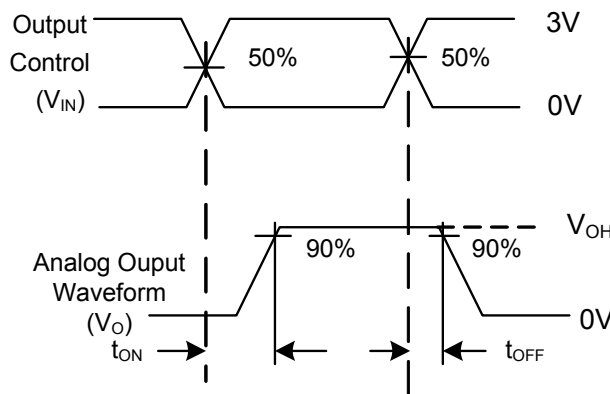
TYPICAL PERFORMANCE CHARACTERISTIC



TEST CIRCUITS



Test	V <sub>+</sub>	R <sub>L</sub>	C <sub>L</sub>	V <sub>S1</sub>	V <sub>S2</sub>
T <sub>ON</sub>	5V±0.5V	75Ω	20pF	GND	3V
	5V±0.5V	75Ω	20pF	3V	GND
T <sub>OFF</sub>	5V±0.5V	75Ω	20pF	GND	3V
	5V±0.5V	75Ω	20pF	3V	GND



VOLTAGE WAVEFORMS  
T<sub>ON</sub> AND T<sub>OFF</sub> TIMES

NOTES:

- C<sub>L</sub> includes probe and jig capacitance.
- All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz, Z<sub>O</sub> = 50Ω, t<sub>r</sub> ≤ 2.5ns, t<sub>f</sub> ≤ 2.5ns.
- The outputs are measured one at a time, with one transition per measurement.

Figure 1. Test Circuit for Voltage Waveform and Switch Time

TEST CIRCUITS (Cont.)

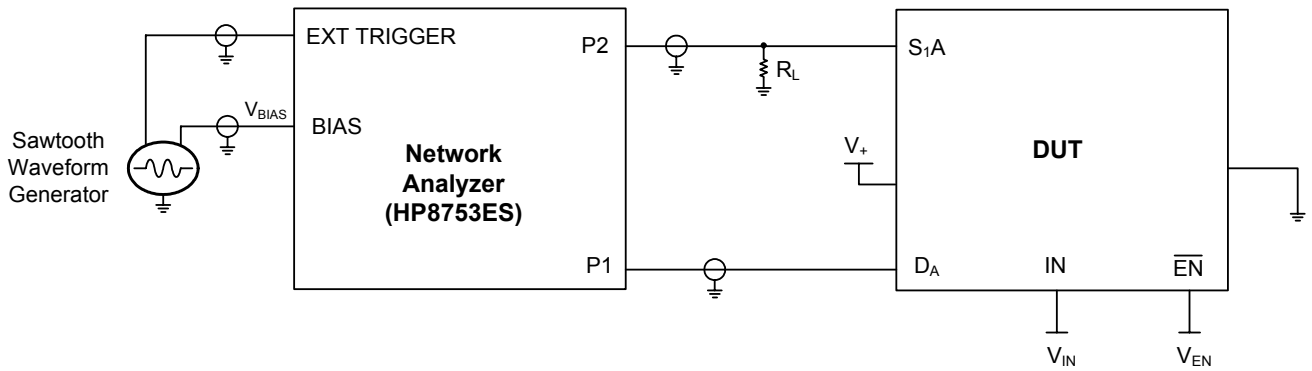


Figure 2. Test Circuit for Differential Gain/Phase Measurement

Differential gain and phase are measured at the output of the ON channel. For example, when  $V_{IN} = 0$ ,  $V_{EN} = 0$ , and  $D_A$  is the input, the output is measured at  $S_{1A}$ .

## TEST CIRCUITS (Cont.)

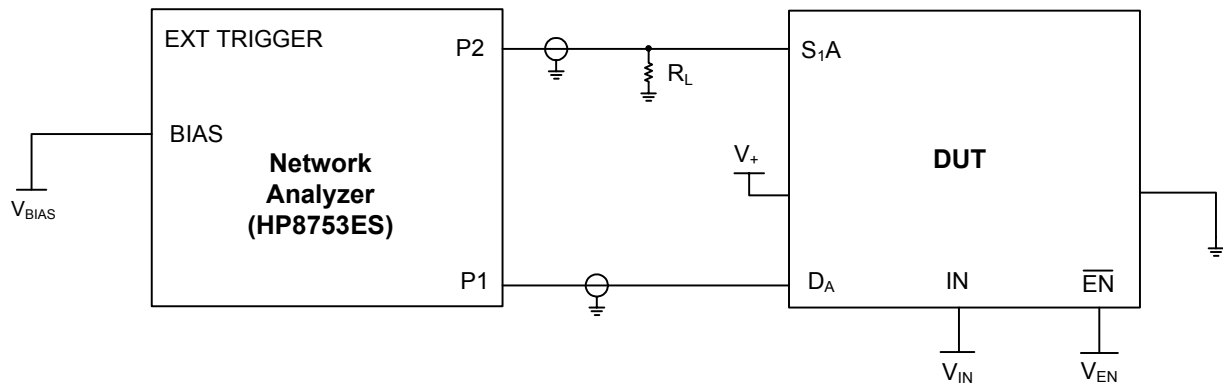


Figure 3. Test Circuit for Frequency Response (BW)

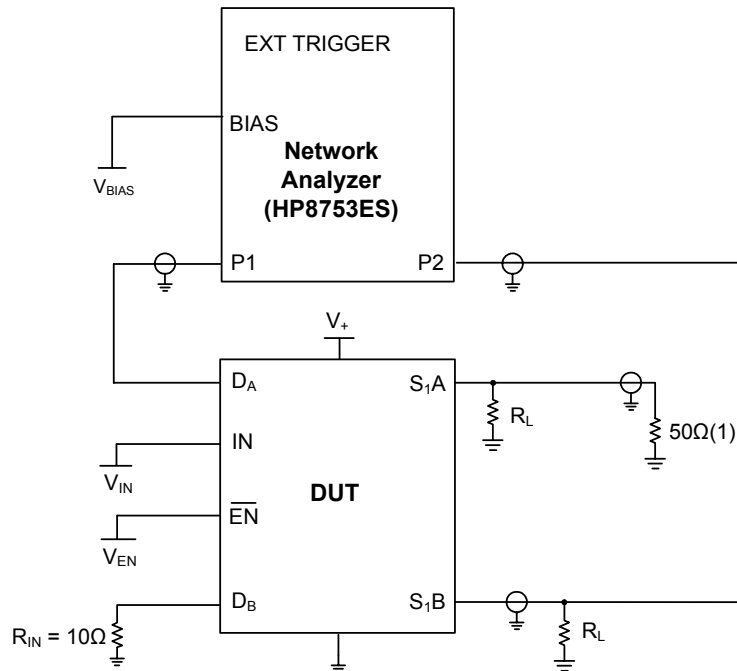
Frequency response is measured at the output of the ON channel. For example, when  $V_{IN} = 0$ ,  $V_{EN} = 0$ , and  $D_A$  is the input, the output is measured at  $S_1A$ . All unused analog I/O ports are left open.

**HP8753ES Setup**

Average = 4  
 RBW = 3Hz  
 $V_{BIAS} = 1/2 V_+$   
 ST = 2s  
 P1 = 0dBm



## TEST CIRCUITS (Cont.)



NOTE: (1) A 50Ω termination resistor is needed for the network analyzer.

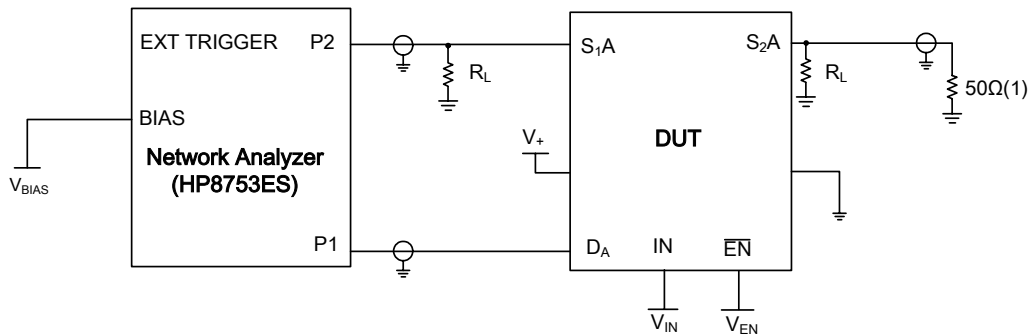
Figure 4. Test Circuit for Crosstalk ( $X_{TALK}$ )

Crosstalk is measured at the output of the nonadjacent ON channel. For example, when  $V_{IN} = 0$ ,  $V_{EN} = 0$ , and  $D_A$  is the input, the output is measured at  $S_{1B}$ .

#### HP8753ES Setup

Average = 4  
 RBW = 3kHz  
 $V_{BIAS} = 1/2 V_+$   
 ST = 2s  
 P1 = 0dBm

## TEST CIRCUITS (Cont.)



NOTE: (1) A 50Ω termination resistor is needed for the network analyzer.

Figure 5. Test Circuit for Off Isolation ( $O_{IRR}$ )

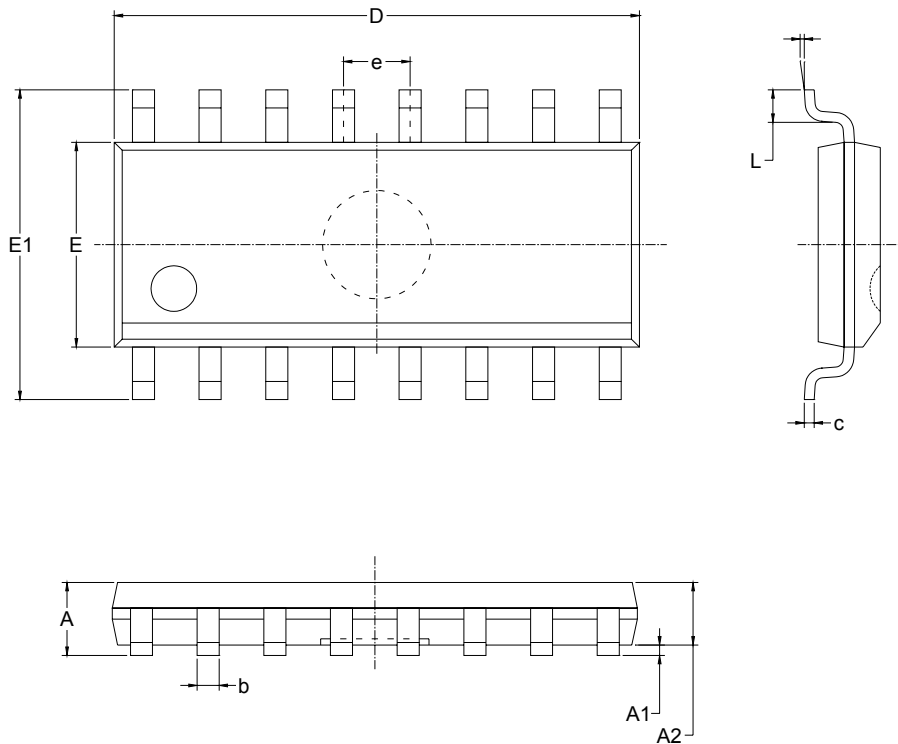
Off isolation is measured at the output of the OFF channel. For example, when  $V_{IN} = V_+$ ,  $V_{EN} = 0$ , and  $D_A$  is the input, the output is measured at  $S_{1A}$ . All unused analog input (D) ports are left open.

#### HP8753ES Setup

Average = 4  
 RBW = 3kHz  
 $V_{BIAS} = 1/2 V_+$   
 ST = 2s  
 P1 = 0dBm

PACKAGE OUTLINE DIMENSIONS

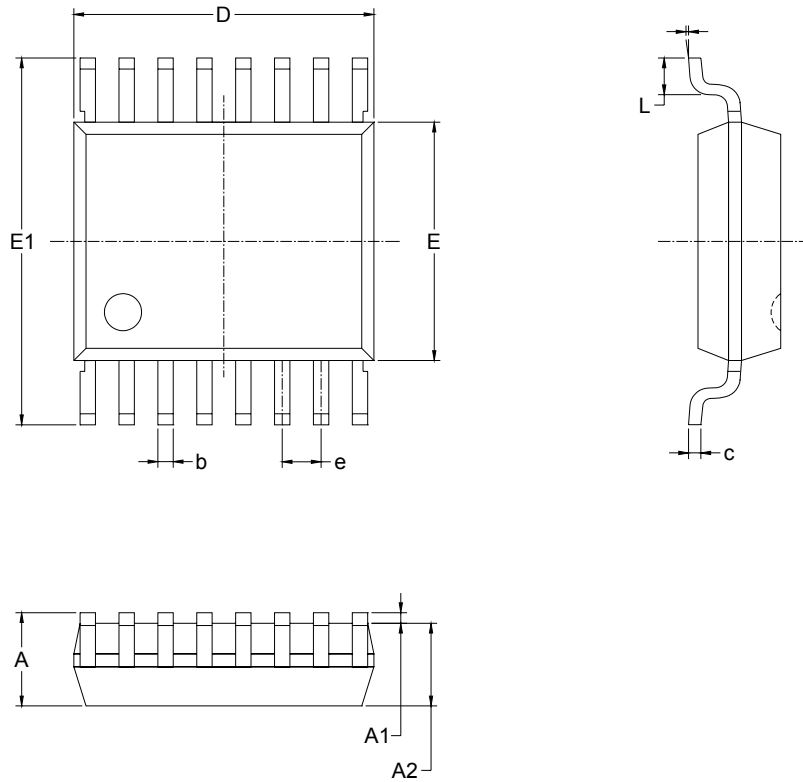
SO-16



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	9.800	10.200	0.386	0.402
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

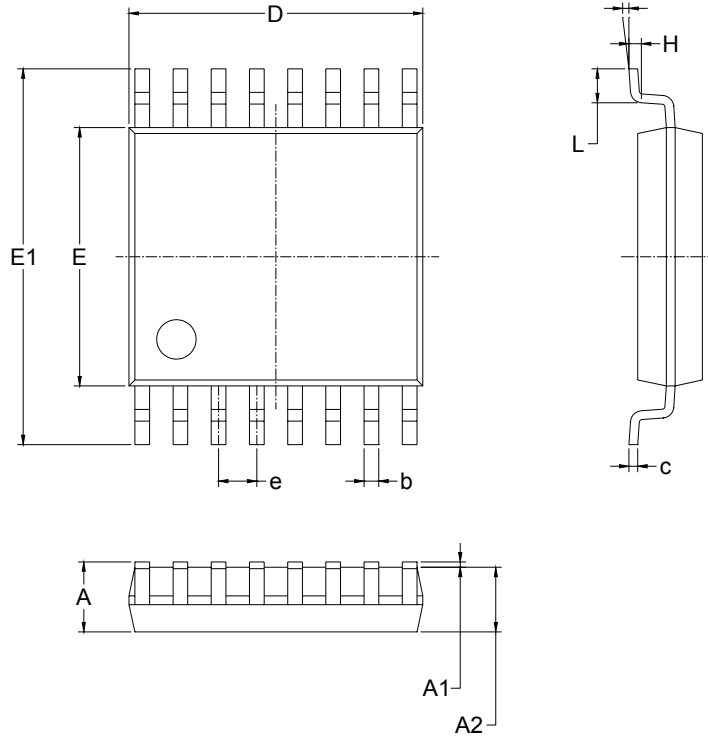
QSOP-16 (SSOP16)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.200	0.300	0.008	0.012
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	0.635 BSC		0.025 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

TSSOP-16



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.900	5.100	0.193	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

04/2010 REV. B

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