SGM331A
Quad, Wide-Bandwidth, 1.2V Self-Biased SPDT Video Analog Switch

GENERAL DESCRIPTION

The SGM331A is a quad, bidirectional, internal 1.2V self-biased, 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 SGM331A offers a high-performance, low-cost solution to switch between video sources. It is specified -40℃ to +85℃ temperature range. The SGM331A is available in Green SOP16, TSSOP16 and SSOP16 packages.

APPLICATIONS

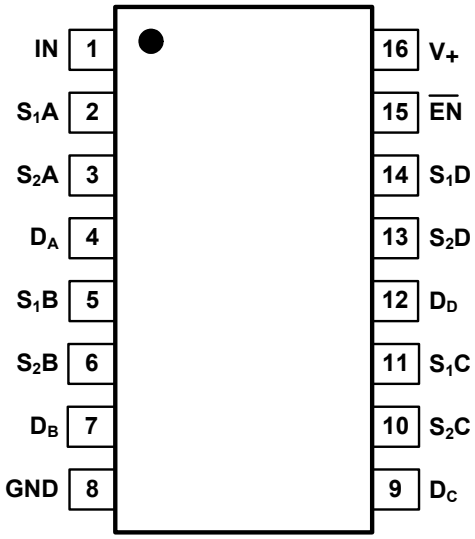
Personal Video Recorders
Terrestrial Set-Top Boxes
Hard Disk Recorders
DVD Players
Game Consoles
Digital VCRs
Desktop Video Editors
Audio and Video Switching

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**
- **Internal 1.2V self-biased**
- **Low Power Consumption**
- **TTL/CMOS Compatible**
- **Micro Size Packages**
  - **SOP16**
  - **TSSOP16**
  - **SSOP16**

PIN CONFIGURATIONS (TOP VIEW)

SGM331A



SOP16/SSOP16/TSSOP16

PACKAGE/ORDERING INFORMATION

ORDERING NUMBER	PIN- PACKAGE	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	PACKAGE OPTION
SGM331A-YS16G/TR	SOP16	-40℃ to +85℃	SGM331A-YS16	Tape and Reel, 2500
SGM331A-YQS16G/TR	SSOP16 (QSOP16)	-40℃ to +85℃	SGM331A-YQS16	Tape and Reel, 3000
SGM331A-YTS16G/TR	TSSOP16	-40℃ to +85℃	SGM331A-YTS16	Tape and Reel, 3000

ABSOLUTE MAXIMUM RATINGS

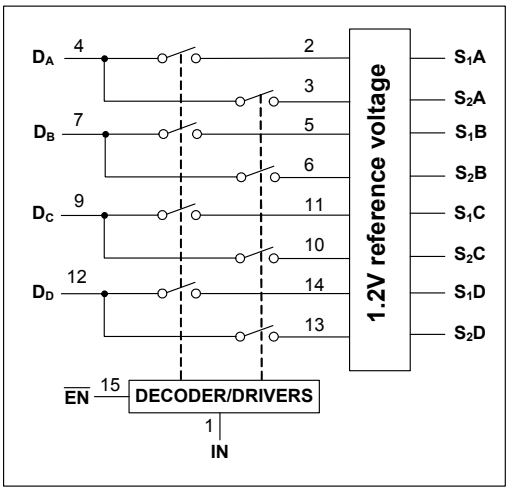
Supply Voltage to Ground Potential (Inputs & V_+ only) ..... -0.3V to 6V
Supply Voltage to Ground Potential (Ouputs & D only) ..... -0.3V to 6V
DC Input Voltage ..... -0.3V to 6V
Operating Temperature Range..... -40°C to +85°C
Junction Temperature.....150°C
Storage Temperature.....-65°C to +150°C
Package Thermal Resistance @ T_A = 25℃
SOP16, θ_{JA}..... 82℃/W
TSSOP16, θ_{JA}..... 100℃/W
SSOP16, θ_{JA}.....103℃/W
Lead Temperature (soldering, 10s) .....260°C
ESD Susceptibility
HBM.....8000V
MM.....400V

NOTE
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.

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



PIN DESCRIPTION

NAME	FUNCTION
S_1A, S_1B, S_1C, S_1D S_2A, S_2B, S_2C, S_2D	Analog video I/O
IN	Select input
$\overline{EN}$	Switch-enable input
D_A, D_B, D_C, D_D	Analog video I/O
GND	Ground
V_+	Power supply

FUNCTION TABLE

$\overline{EN}$	IN	ON Switch
0	0	S_1A, S_1B, S_1C, S_1D
0	1	S_2A, S_2B, S_2C, S_2D
1	X	Disabled

ELECTRICAL CHARACTERISTICS

(At V_+ = +5V, T_A = +25℃. unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC CHARACTERISTICS						
On-Resistance	R_{ON}	0V ≤ V_{S1} or V_{S2} ≤ V_+, I_D = 13mA		12	18	Ω
Internal Self-Biased voltage	V_{BIAS}	V_{EN} = 0V, V_{IN} = 0V/V_+		1.2		V
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_+			±1	μA
Input Low Current	I_{IL}	V_+ = 5.5V, V_{IN} and V_{EN} = 0V			±1	μA
Analog Output Leakage Current	I_O	V_+ = 5.5V, V_{S1} or V_{S2} = 0.3V/1.2V, V_D = 1.2V/0.3V			±1.5	μA
Clamp Diode Voltage	V_{IK}	I_{IN} = -18mA		-1		V
DYNAMIC CHARACTERISTICS						
Turn-On Time	T_{ON}	R_L = 75Ω, C_L = 20pF (Figure 1)		25		ns
Turn-Off Time	T_{OFF}	R_L = 75Ω, C_L = 20pF (Figure 1)		13		ns
Off Isolation	O_{IRR}	R_L = 150Ω, f = 10MHz (Figure 5)		-50		dB
Channel-to-Channel Crosstalk	X_{TALK}	R_{IN} = 10Ω, R_L = 150Ω, f = 10MHz (Figure 4)		-60		dB
–3dB Bandwidth	BW	R_L = 150Ω (Figure 3)		500		MHz
Input/Enable Capacitance	C_{IN}	f = 1MHz		4		pF
Differential Gain	D_G	R_L = 150Ω, f = 3.58MHz (Figure 2)		0.55		%
Differential Phase	D_P	R_L = 150Ω, f = 3.58MHz (Figure 2)		0.03		°
POWER REQUIREMENTS						
Power Supply Current	I_{CC}	V_+ = +5.5V, V_{IN} and V_{EN} = 5V		0.5	20	μA
		V_+ = +5.5V, V_{IN} and V_{EN} = 0V		2.6		mA
Supply Current per Input @ TTL HIGH	Δ_{ICC}	V_+ = +5.5V, V_{IN} or V_{EN} = 3.4V			300	μA

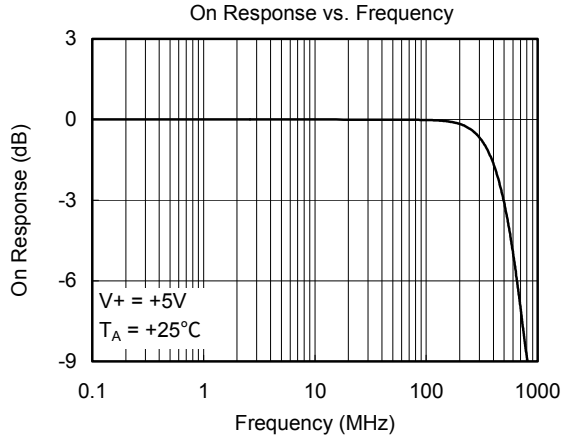
Specifications subject to changes without notice.

PARAMETER DEFINITIONS

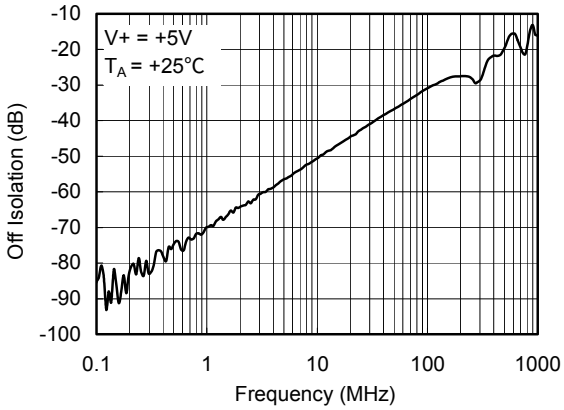
PARAMETER	DESCRIPTION
R_{ON}	Resistance between source and drain with switch in the ON state
I_O	Output leakage current measured at S1, S2, and D with the switch OFF
V_{IN}	Digital voltage at the IN pin that selects between S1 and S2 analog inputs
V_I	Voltage applied to the D or S1, S2 pins when D or S1, S2 is the switch input
V_{EN}	A voltage that ENABLES the chip
C_{IN}	Capacitance at the digital inputs
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} = 20LOG 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

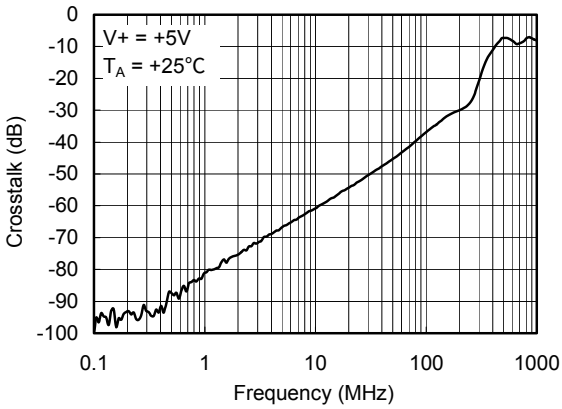
On Response vs. Frequency



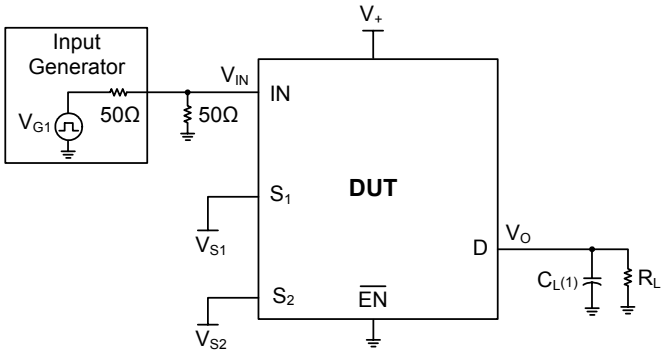
Off Isolation vs. Frequency



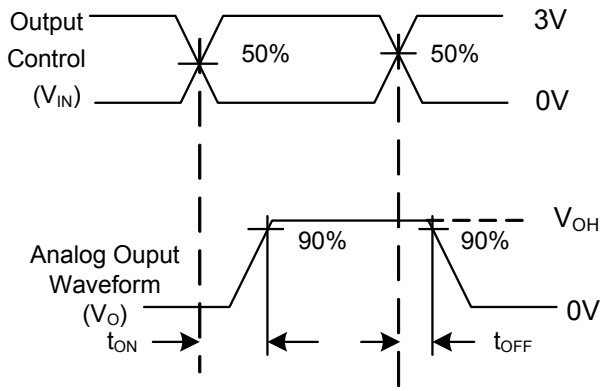
Crosstalk vs. Frequency



TEST CIRCUITS



Test	V_+	R_L	C_L	V_{S1}	V_{S2}
T_{ON}	5V±0.5V	75Ω	20pF	GND	3V
	5V±0.5V	75Ω	20pF	3V	GND
T_{OFF}	5V±0.5V	75Ω	20pF	GND	3V
	5V±0.5V	75Ω	20pF	3V	GND



VOLTAGE WAVEFORMS
T_{ON} AND T_{OFF} TIMES

NOTES:
1. C_L includes probe and jig capacitance.
2. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz, Z_O = 50Ω, t_r ≤ 2.5ns, t_f ≤ 2.5ns.
3. 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.)

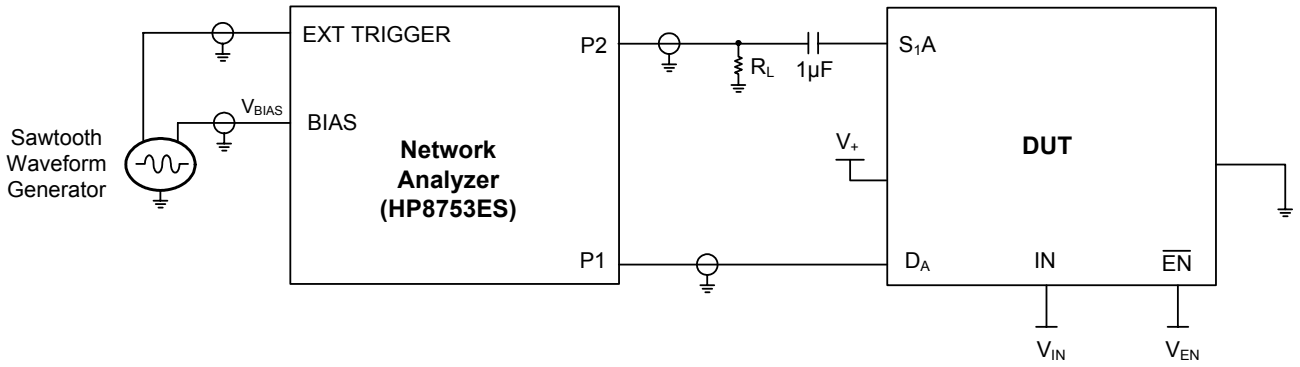


Figure 2. Test Circuit for Differential Gain/Phase Measurement

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.)

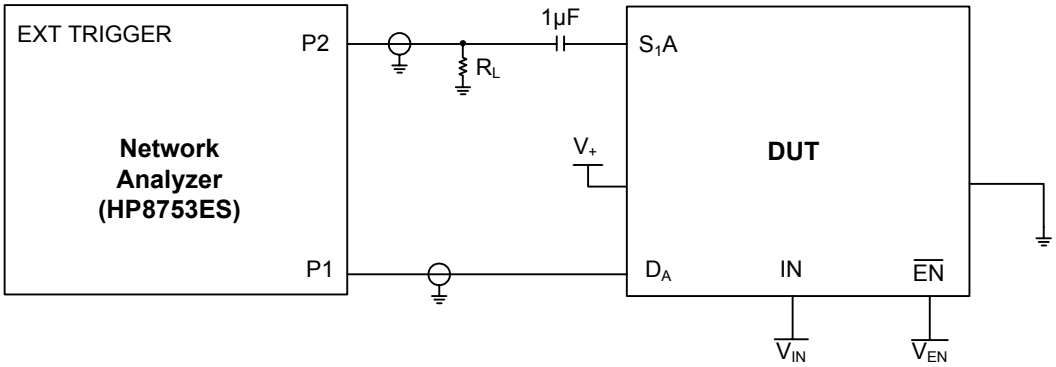


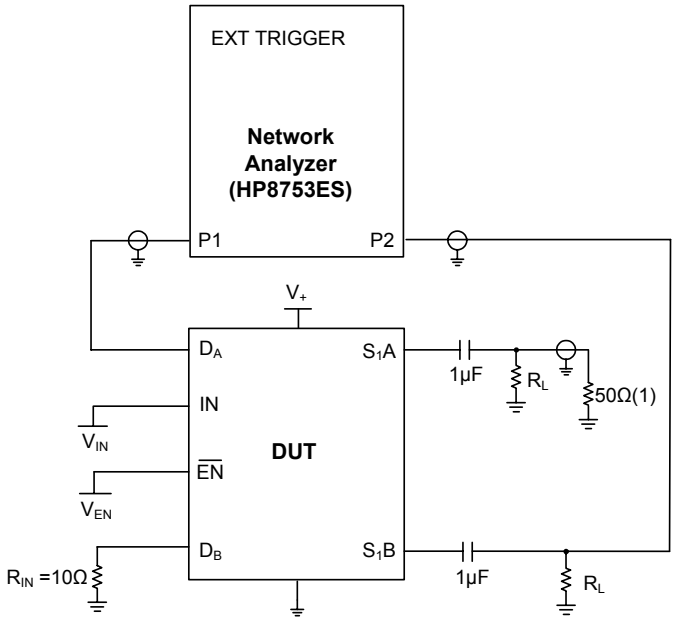
Figure 3. Test Circuit for Frequency Response (BW)

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
ST = 2s
P1 = 0dBM

TEST CIRCUITS (Cont.)



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

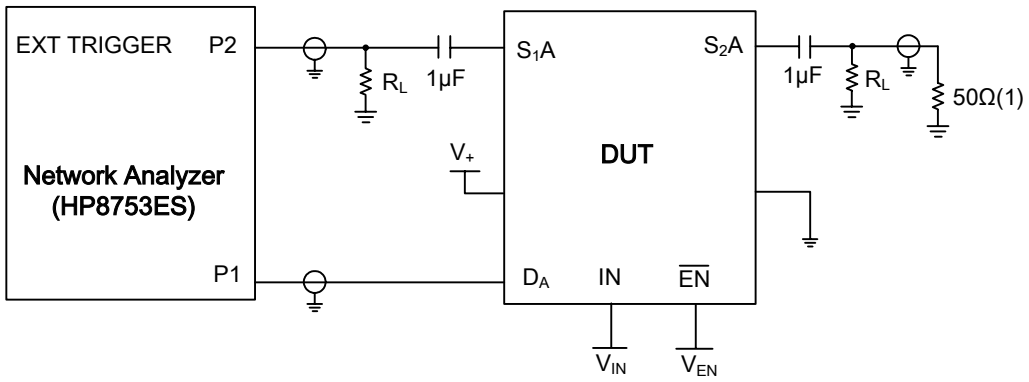
Figure 4. Test Circuit for Crosstalk (X_{TALK})

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
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})

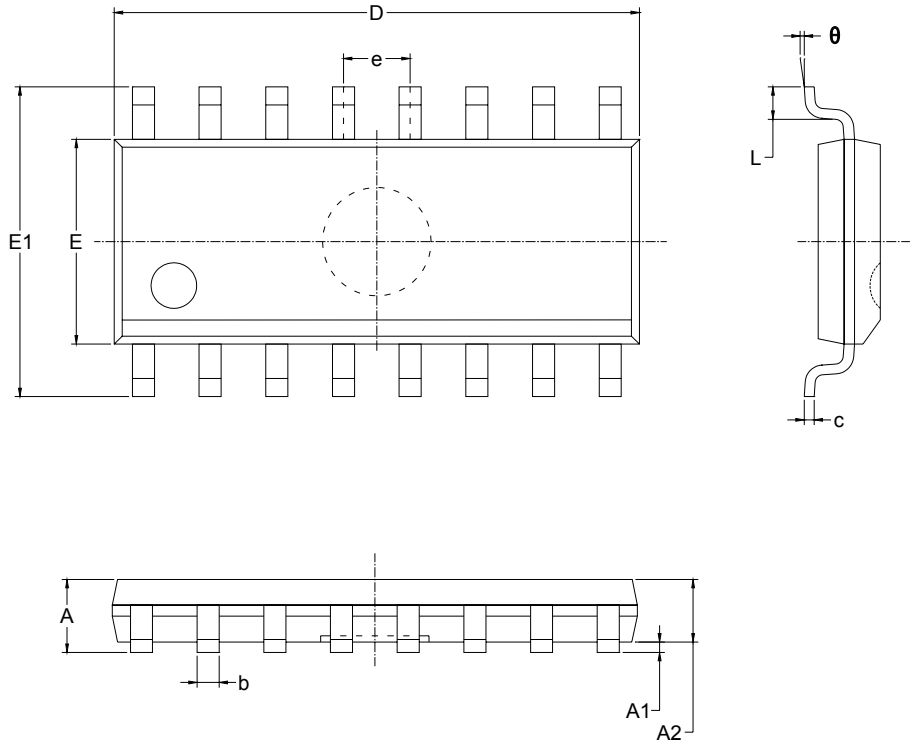
Off isolation is measured at the output of the OFF channel. For example, when V_{IN} = V_+, V_{EN} = 0, and D_A is the input, the output is measured at S_1A. All unused analog input (D) ports are left open.

HP8753ES Setup

Average = 4
RBW = 3kHz
ST = 2s
P1 = 0dBM

PACKAGE OUTLINE DIMENSIONS

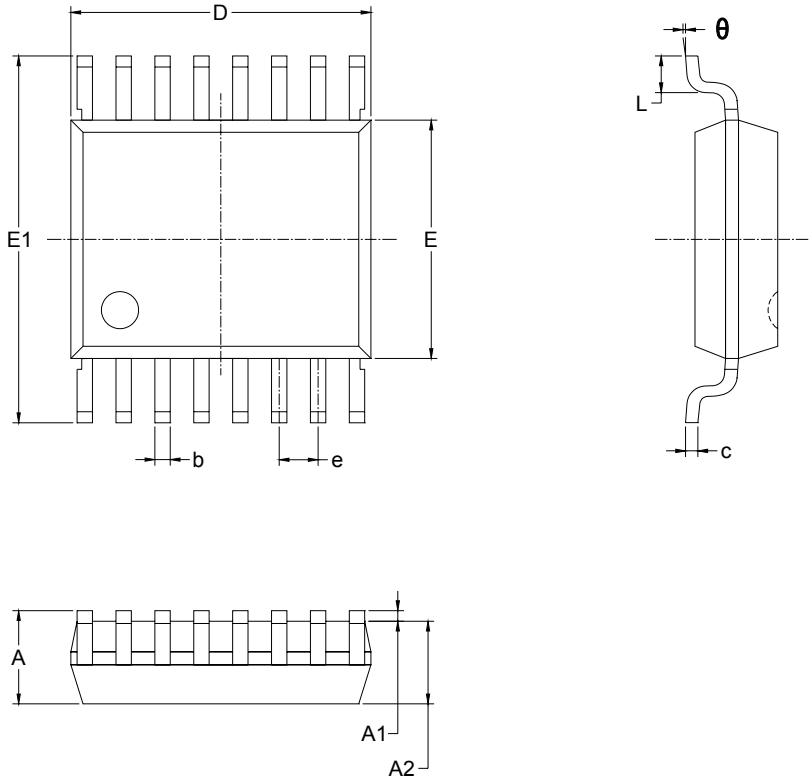
SOP16



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

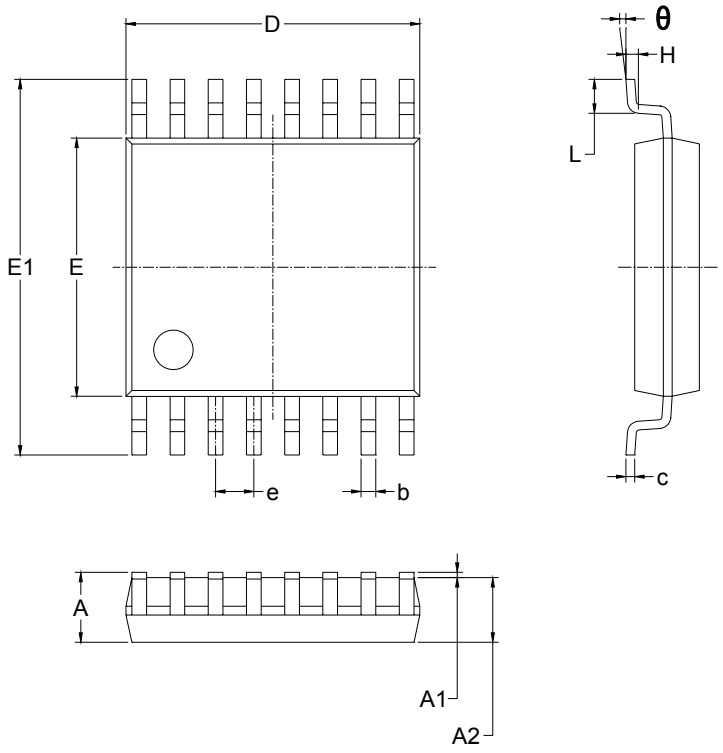
SSOP16 (QSOP16)



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

TSSOP16



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°

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