



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 $+85^{\circ}\text{C}$ temperature range. The SGM330A is available in Green SOIC-16, TSSOP-16 and SSOP-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

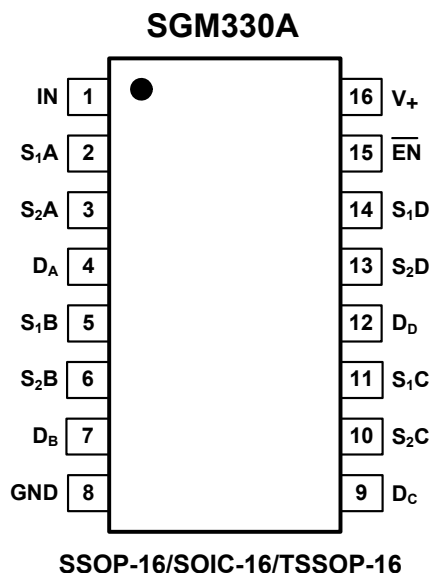
- **Wide Bandwidth: 500MHz**
- **Low On-Resistance: 12Ω (TYP)**
- **Low Crosstalk: -60dB at 10MHz (TYP)**
- **Single Power Operation: +5V**
- **Fast Switching Time**
- **Rail-to-Rail Operation**
- **Typical Power Consumption ($I_{CC} = 0.1\mu\text{A}$)**
- **TTL/CMOS Compatible**
- **Micro Size Packages**

SOIC-16

TSSOP-16

SSOP-16

PIN CONFIGURATIONS (TOP VIEW)



PACKAGE/ORDERING INFORMATION

ORDERING NUMBER	PIN- PACKAGE	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	PACKAGE OPTION
SGM330A-YS/TR	SOIC-16	-40°C to +85°C	SGM330A-YS	Tape and Reel, 2500
SGM330A-YQS/TR	SSOP-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₊ 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 Range.....-65°C to +150°C
Package Thermal Resistance @ T_A = 25°C
SOIC-16, θ_{JA}..... 82°C/W
TSSOP-16, θ_{JA}..... 100°C/W
SSOP-16, θ_{JA}.....103°C/W
Lead Temperature (Soldering, 10s)260°C
ESD Susceptibility
HBM.....8000V
MM.....400V

NOTE:

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.

PIN DESCRIPTION

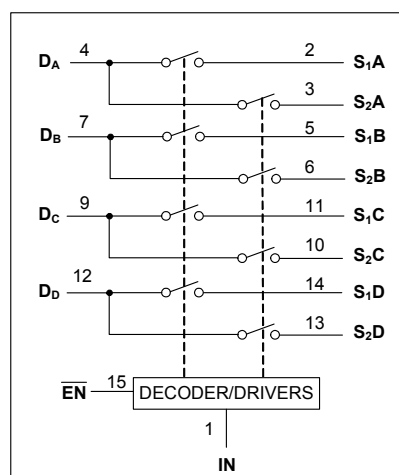
NAME	FUNCTION
S ₁ A, S ₁ B, S ₁ C, S ₁ D S ₂ A, S ₂ B, S ₂ C, S ₂ D	Analog Video I/O.
IN	Select Input.
EN	Switch-Enable Input.
D _A , D _B , D _C , D _D	Analog Video I/O.
GND	Ground.
V ₊	Power Supply.

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.

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.

BLOCK DIAGRAM



FUNCTION TABLE

EN	IN	ON SWITCH
0	0	S ₁ A, S ₁ B, S ₁ C, S ₁ D
0	1	S ₂ A, S ₂ B, S ₂ C, S ₂ D
1	X	Disabled

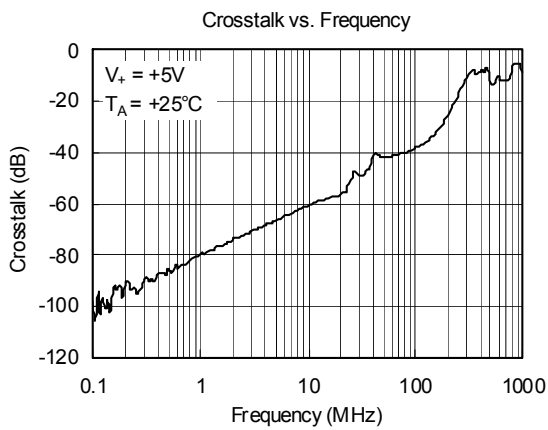
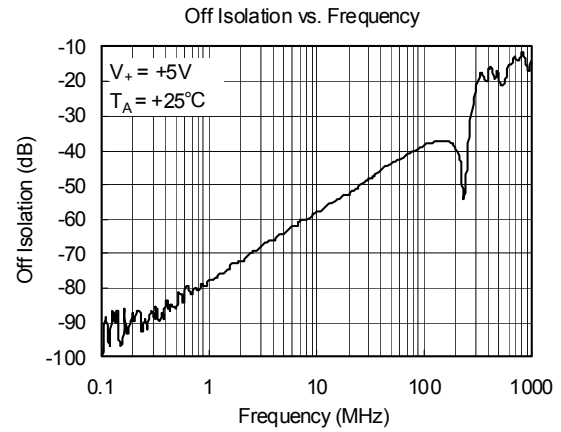
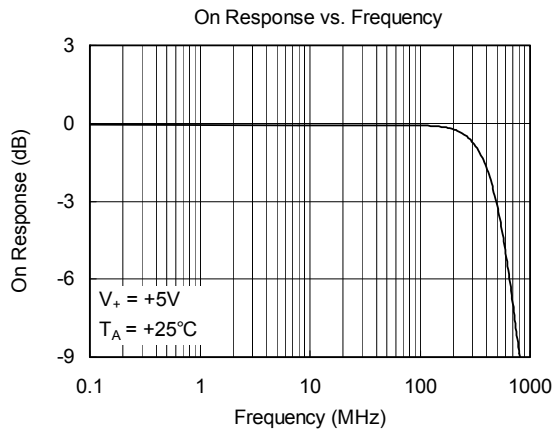
ELECTRICAL CHARACTERISTICS(At $V_+ = +5V$, $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage	V_{IN}		0		V_+	V
DC CHARACTERISTICS						
On-Resistance	R_{ON}	$0V \leq V_{S1} \text{ or } V_{S2} \leq V_+, I_D = 13mA$		12	18	Ω
Input High Voltage	V_{IH}		2			V
Input Low Voltage	V_{IL}				0.6	V
Input High Current	I_{IH}	$V_+ = 5.5V, V_{IN} \text{ and } V_{EN} = V_+$			± 1	μA
Input Low Current	I_{IL}	$V_+ = 5.5V, V_{IN} \text{ and } V_{EN} = 0V$			± 1	μA
Analog Output Leakage Current	I_O	$V_+ = 5.5V, V_{S1} \text{ or } V_{S2} = 3.3V/0.3V, V_D = 0.3V/3.3V$			± 1	μA
Clamp Diode Voltage	V_{IK}	$I_{IN} = -18mA$		-1		V
DYNAMIC CHARACTERISTICS						
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		$^\circ$
POWER REQUIREMENTS						
Power Supply Current	I_{CC}	$V_+ = +5.5V, V_{IN} \text{ and } V_{EN} = 5V/0V$		0.1	20	μA
Supply Current per Input @ TTL HIGH	ΔI_{CC}	$V_+ = +5.5V, V_{IN} \text{ or } V_{EN} = 3.4V$			300	μA

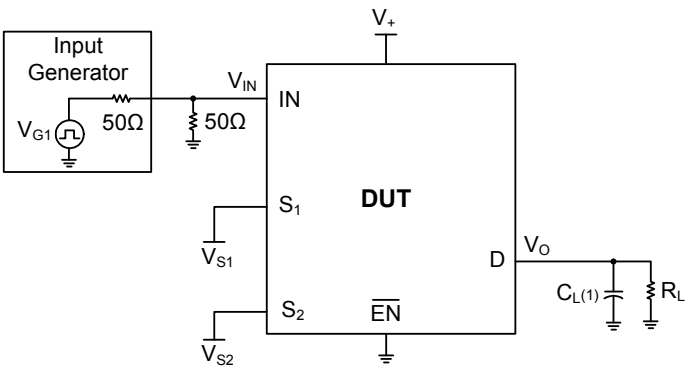
PARAMETER DEFINITIONS

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.
$I_{IH} (I_{IL})$	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	Frequency 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).

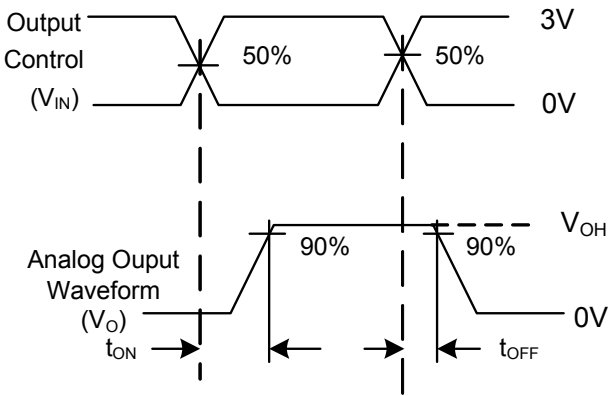
TYPICAL PERFORMANCE CHARACTERISTICS



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.)

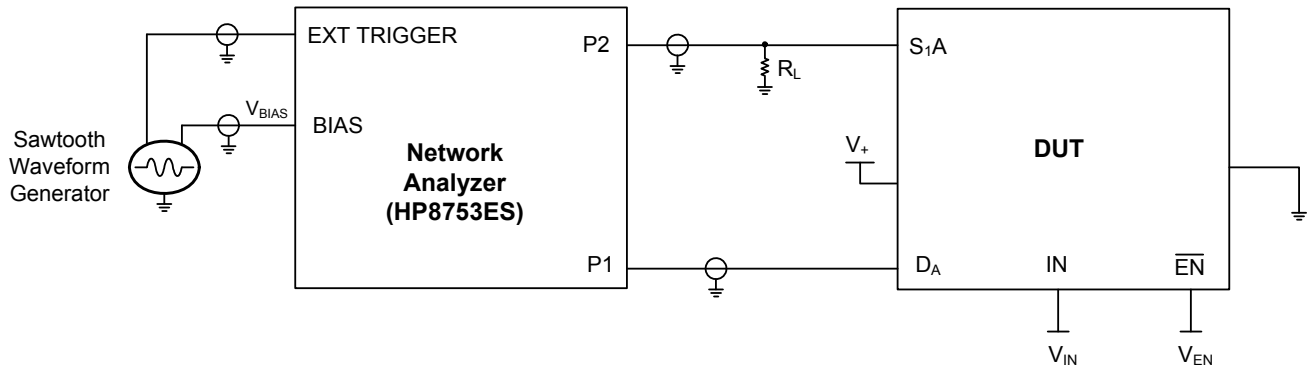


Figure 2. Test Circuit for Differential Gain/Phase Measurement

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.)

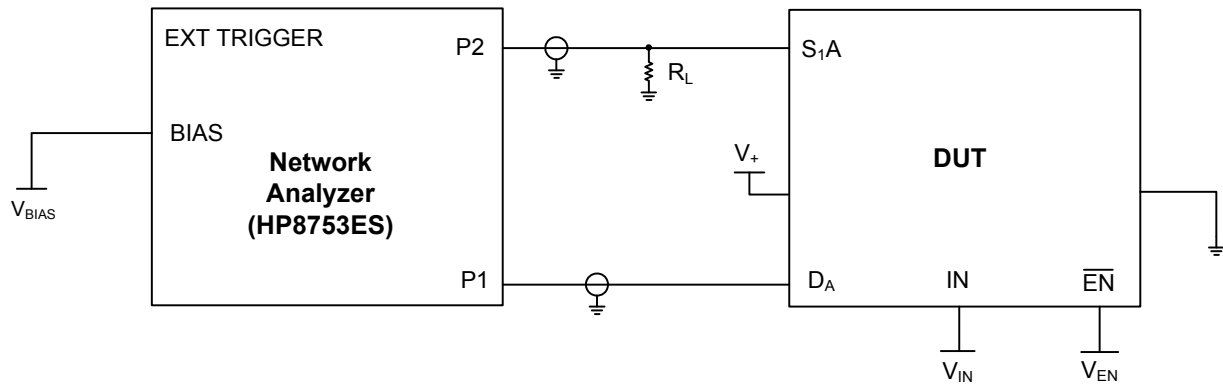


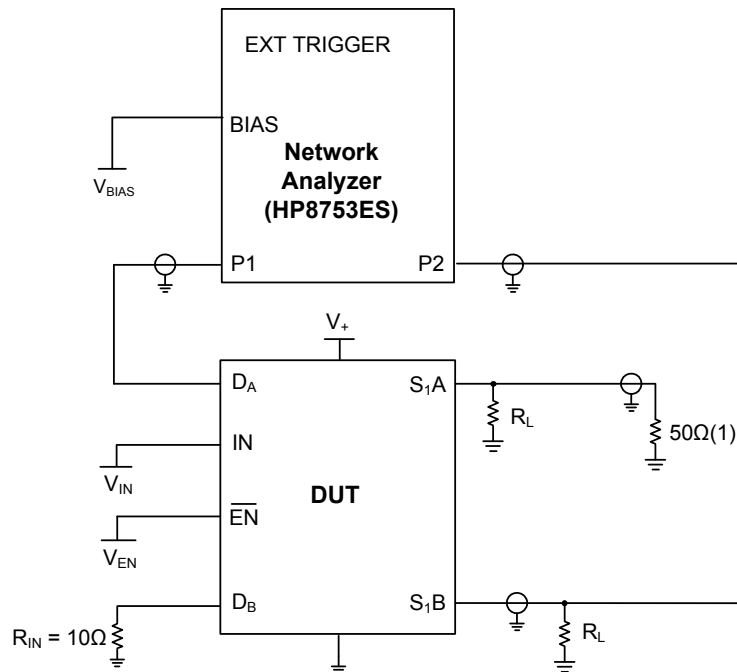
Figure 3. Test Circuit for Frequency Response (BW)

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
 $V_{BIAS} = 1/2 V_+$
 ST = 2s
 P1 = 0dBm

TEST CIRCUITS (Cont.)



NOTE: 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

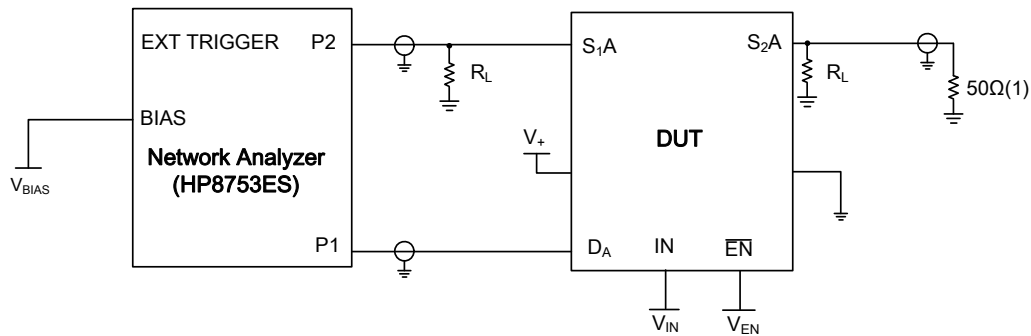
RBW = 3kHz

$V_{BIAS} = 1/2 V_+$

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})

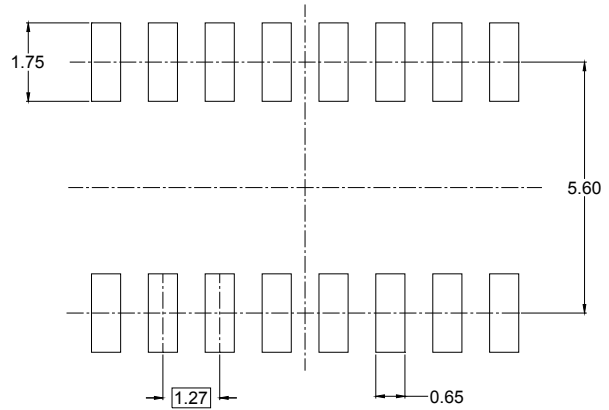
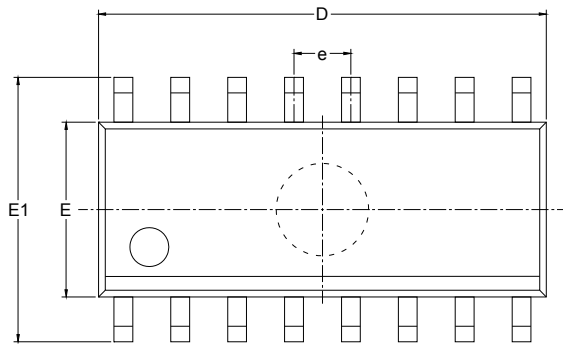
Off isolation is measured at the output of the OFF channel. For example, when $V_{IN} = V_+$, $V_{EN} = 0$, and D_A is the input, the output is measured at S_1A . All unused analog input (D) ports are left open.

HP8753ES Setup

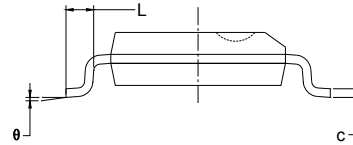
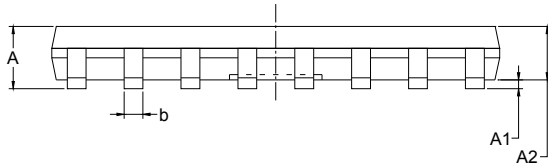
Average = 4
 RBW = 3kHz
 $V_{BIAS} = 1/2 V_+$
 ST = 2s
 P1 = 0dBm

PACKAGE OUTLINE DIMENSIONS

SOIC-16



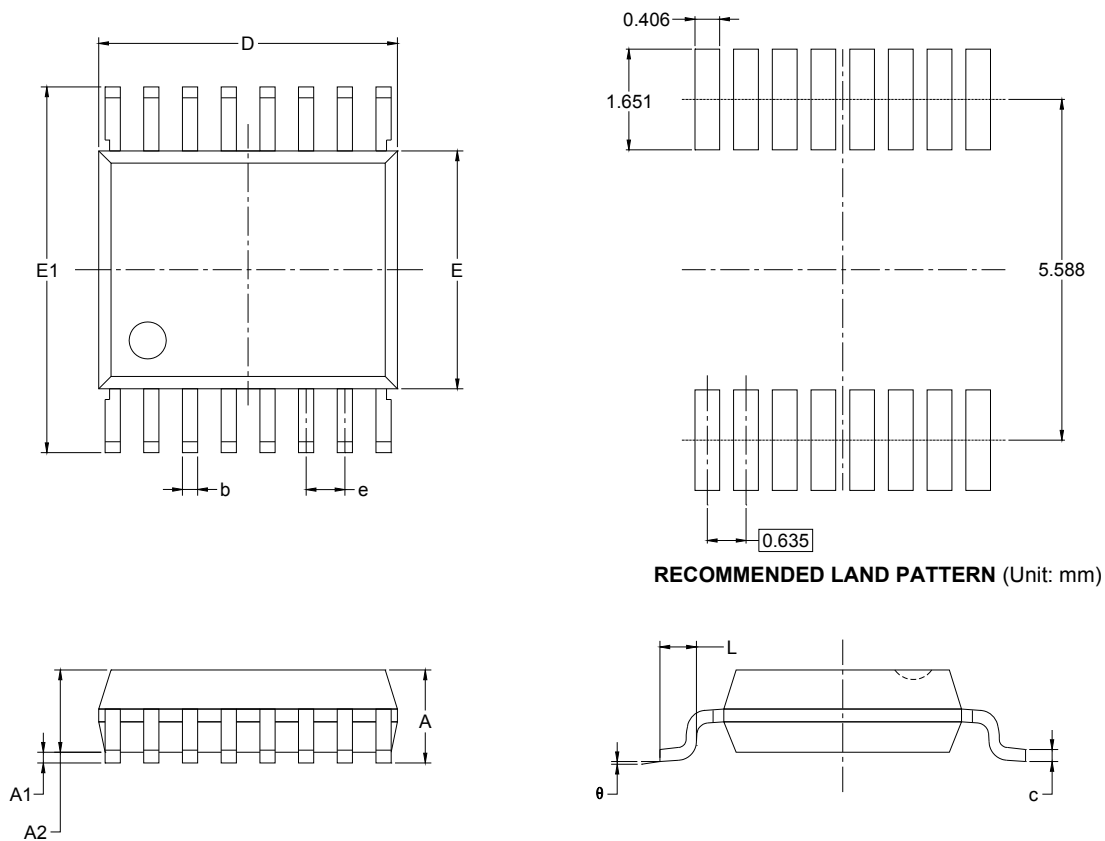
RECOMMENDED LAND PATTERN (Unit: mm)



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

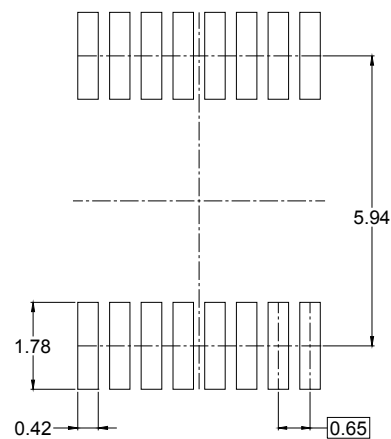
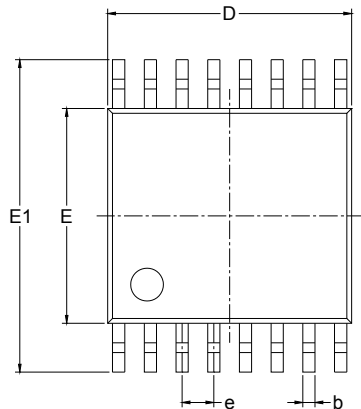
SSOP-16



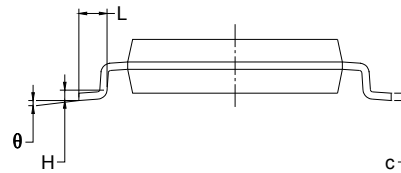
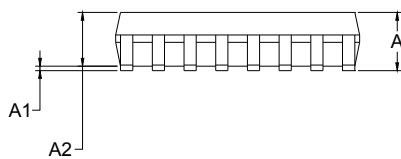
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.200	0.300	0.008	0.012
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	0.635 BSC		0.025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

PACKAGE OUTLINE DIMENSIONS

TSSOP-16



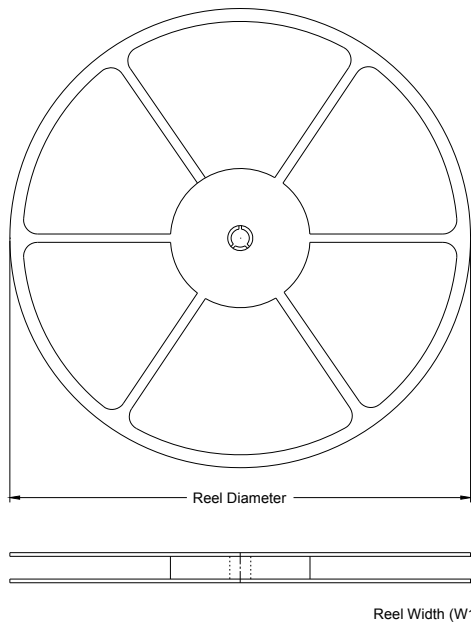
RECOMMENDED LAND PATTERN (Unit: mm)



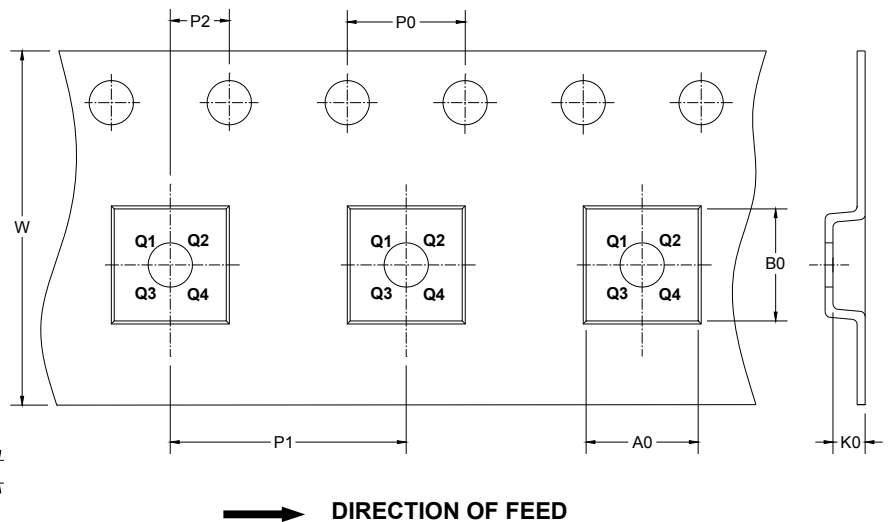
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.900	5.100	0.193	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500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

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS

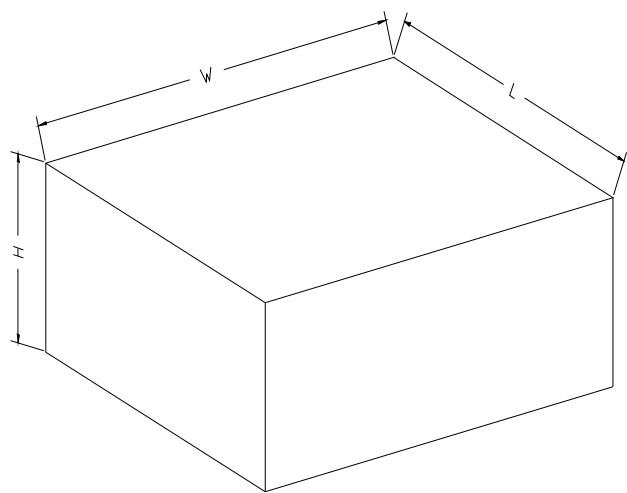


NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOIC-16	13"	16.4	6.5	10.3	2.1	4.0	8.0	2.0	16.0	Q1
SSOP-16	13"	12.4	6.4	5.4	2.1	4.0	8.0	2.0	12.0	Q1
TSSOP-16	13"	12.4	6.9	5.6	1.2	4.0	8.0	2.0	12.0	Q1

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13"	386	280	370	5