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 from a single 2.7V to 5.5V power 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℃ to +85℃ temperature range. The SGM330A is available in Green SOIC-16, TSSOP-16 and SSOP-16 packages.

FEATURES

- **Wide Bandwidth: 500MHz**
- **Low On-Resistance: 12Ω (TYP)**
- **Low Crosstalk: -60dB at 10MHz (TYP)**
- **Power Supply Voltage Range: 2.7V to 5.5V**
- **Fast Switching Time**
- **Rail-to-Rail Operation**
- **Typical Power Consumption (I_{CC} = 0.1μA)**
- **TTL/CMOS Compatible**
- **Micro Size Packages**
  - **SOIC-16**
  - **TSSOP-16**
  - **SSOP-16**

APPLICATIONS

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

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM330A	SOIC-16	-40℃ to +85℃	SGM330A-YS/TR	SGM330A-YS XXXXX	Tape and Reel, 2500
	SSOP-16	-40℃ to +85℃	SGM330A-YQS/TR	SGM330A -YQS XXXXX	Tape and Reel, 3000
	TSSOP-16	-40℃ to +85℃	SGM330A-YTS/TR	SGM330A -YTS XXXXX	Tape and Reel, 3000

NOTE: XXXXX = Date Code and Vendor Code.

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

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
Package Thermal Resistance @ T_A = +25℃
SOIC-16, θ_{JA} ..... 82℃/W
TSSOP-16, θ_{JA} ..... 100℃/W
SSOP-16, θ_{JA} ..... 103℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 8000V
MM 400V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range ..... -40℃ to +85℃

OVERSTRESS CAUTION

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

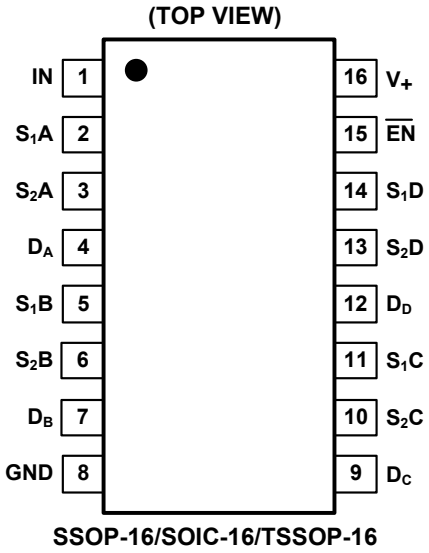
ESD SENSITIVITY CAUTION

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.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time.

PIN CONFIGURATION

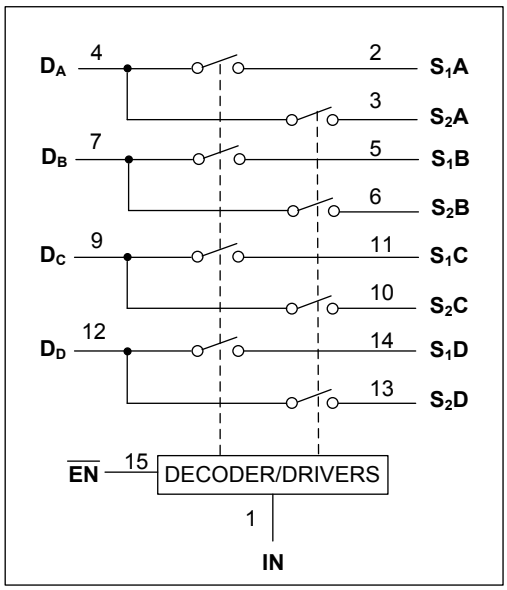


SSOP-16/SOIC-16/TSSOP-16

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	IN	Select Input.
2, 5, 11, 14, 3, 6, 10, 13	S_1A, S_1B, S_1C, S_1D S_2A, S_2B, S_2C, S_2D	Analog Video I/O.
4, 7, 9, 12	D_A, D_B, D_C, D_D	Analog Video I/O.
8	GND	Ground.
15	$\overline{EN}$	Switch-Enable Input.
16	V_+	Power Supply.

FUNCTIONAL BLOCK DIAGRAM



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

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	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} = 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).

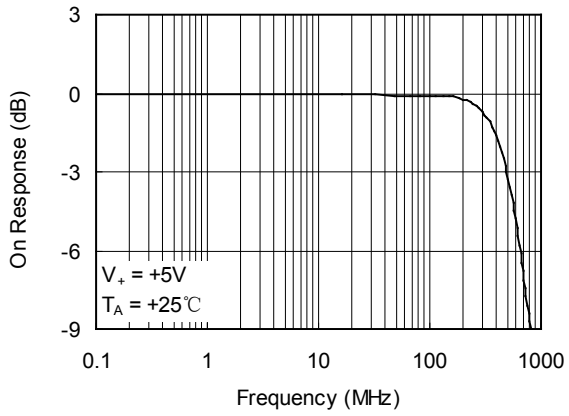
ELECTRICAL CHARACTERISTICS

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

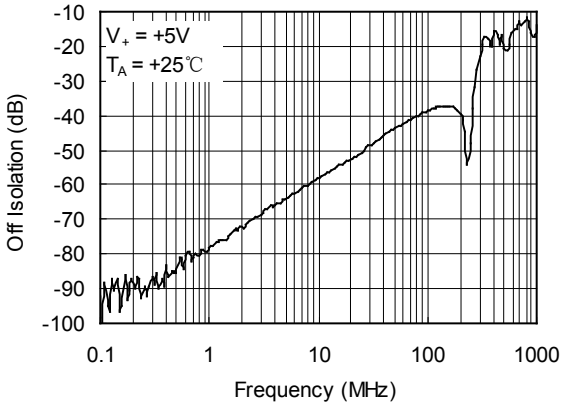
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage	V_{IN}		0		V_+	V
DC CHARACTERISTICS						
On-Resistance	R_{ON}	0V ≤ V_{S1} or V_{S2} ≤ V_+, I_D = 13mA		12	18	Ω
Input High Voltage	V_{IH}		2			V
Input Low Voltage	V_{IL}				0.6	V
Input High Current	I_{IH}	V_+ = 5.5V, V_{IN} and V_{EN} = V_+			±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} = 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 = 75Ω, C_L = 20pF, See Figure 1		25		ns
Turn-Off Time	t_{OFF}	R_L = 75Ω, C_L = 20pF, See Figure 1		13		ns
Off Isolation	O_{IRR}	R_L = 150Ω, f = 10MHz, See Figure 5		-58		dB
Channel-to-Channel Crosstalk	X_{TALK}	R_{IN} = 10Ω, R_L = 150Ω, f = 10MHz, See Figure 4		-60		dB
-3dB Bandwidth	BW	R_L = 150Ω, See 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 = 150Ω, f = 3.58MHz, See Figure 2		0.5		%
Differential Phase	D_P	R_L = 150Ω, f = 3.58MHz, See Figure 2		0.03		°
POWER REQUIREMENTS						
Power Supply Range	V_+		2.7		5.5	V
Power Supply Current	I_{CC}	V_+ = +5.5V, V_{IN} and V_{EN} = 5V/0V		0.1	20	μA
Supply Current per Input @ TTL HIGH	Δ_{ICC}	V_+ = +5.5V, V_{IN} or V_{EN} = 3.4V			300	μA

TYPICAL PERFORMANCE CHARACTERISTICS

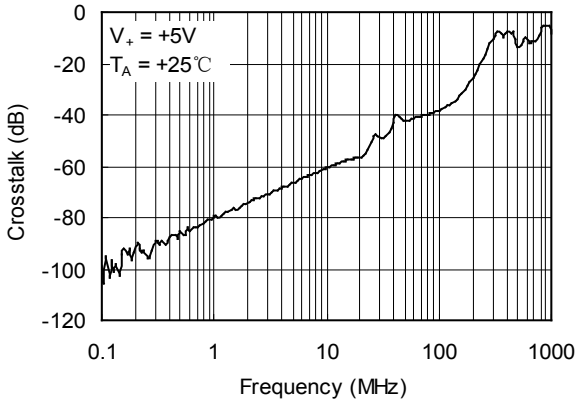
On Response vs. Frequency



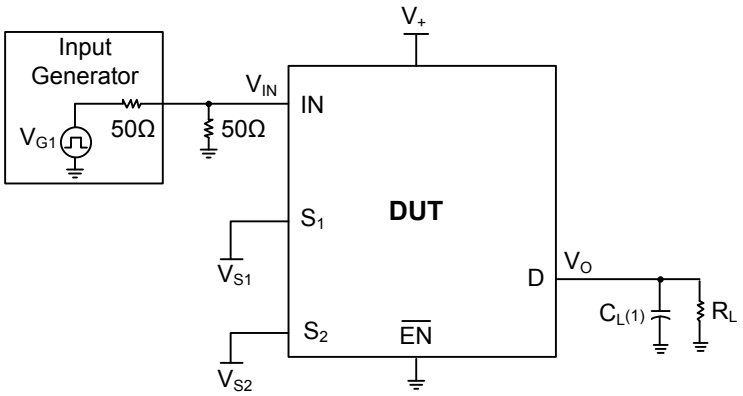
Off Isolation vs. Frequency



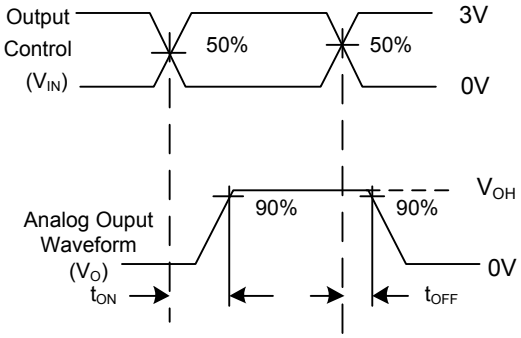
Crosstalk vs. Frequency



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 (continued)

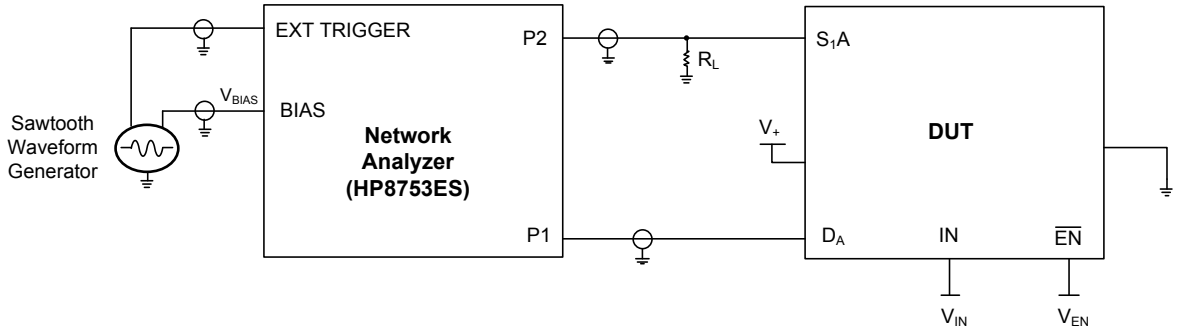


Figure 2. Test Circuit for Differential Gain/Phase Measurement

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.

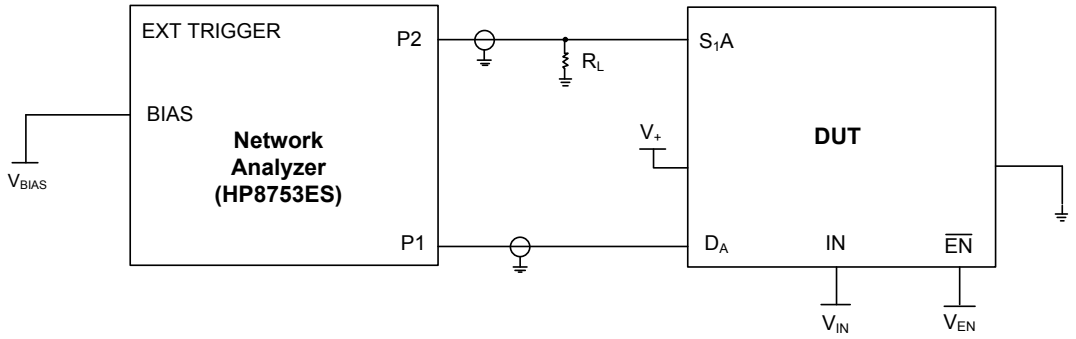


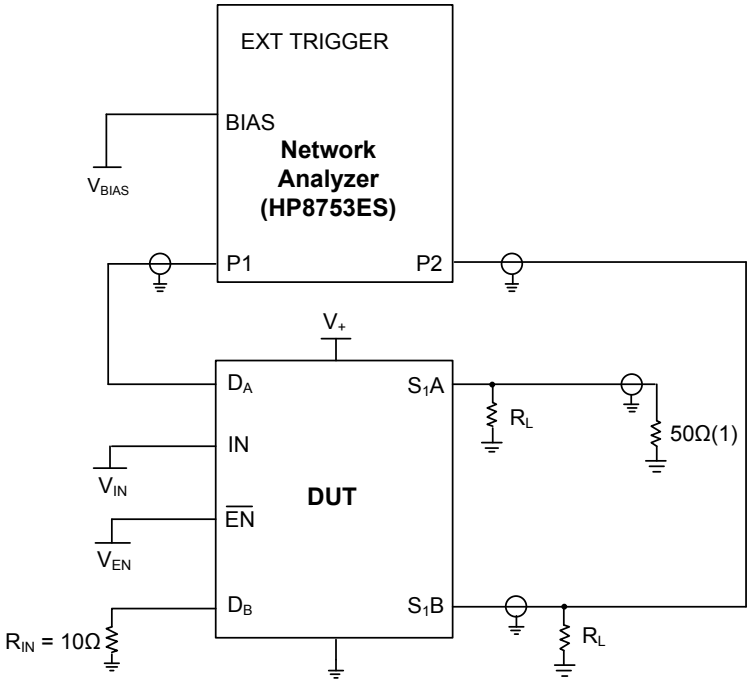
Figure 3. Test Circuit for Frequency Response (BW)

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 (continued)



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

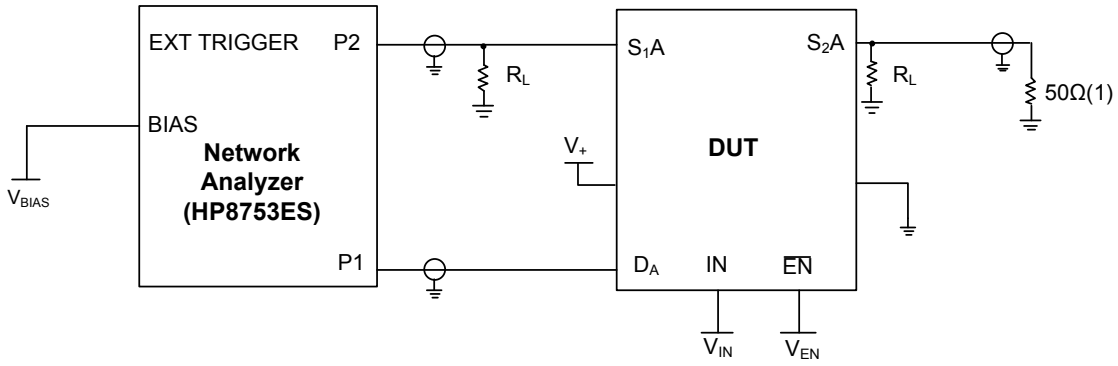
Figure 4. Test Circuit for Crosstalk (X_{TALK})

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 (continued)



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

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

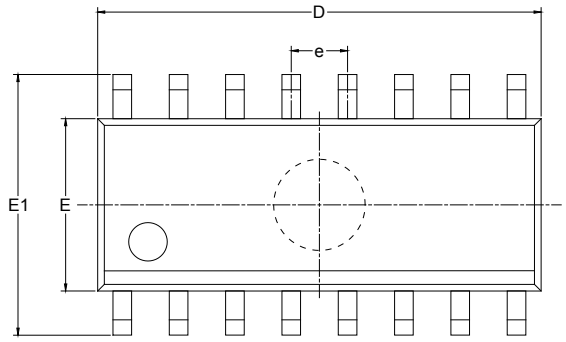
Off isolation is measured at the output of the OFF channel. For example, when V_{IN} = V_+, V_{EN} = 0, and D_A is the input, the output is measured at S_1A. All unused analog input (D) ports are left open.

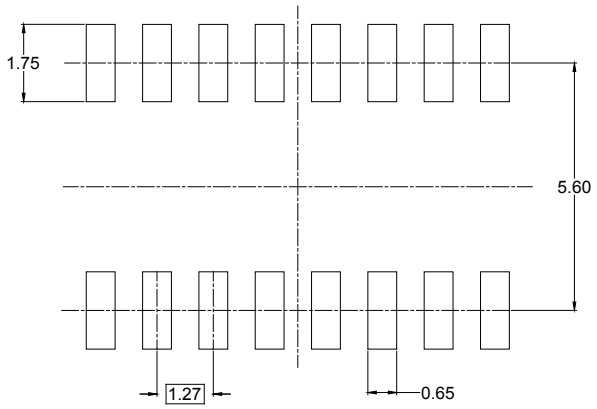
HP8753ES Setup

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

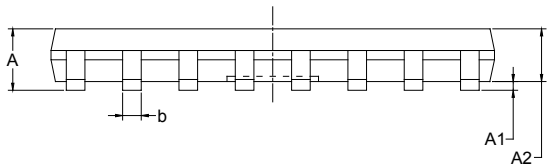
PACKAGE OUTLINE DIMENSIONS

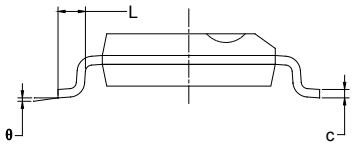
SOIC-16





RECOMMENDED LAND PATTERN (Unit: mm)

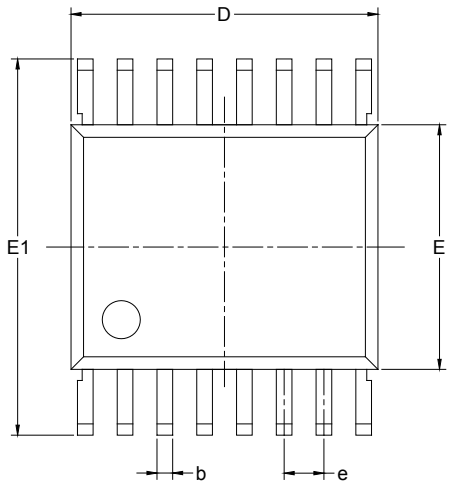


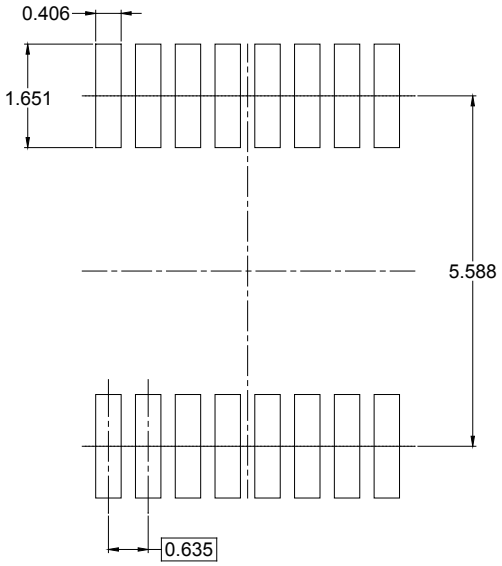


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	9.800	10.200	0.386	0.402
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

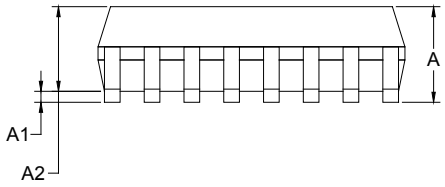
PACKAGE OUTLINE DIMENSIONS

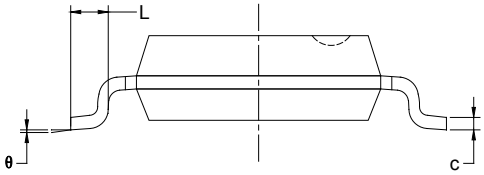
SSOP-16





RECOMMENDED LAND PATTERN (Unit: mm)

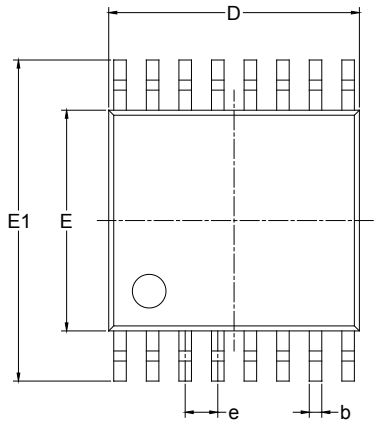


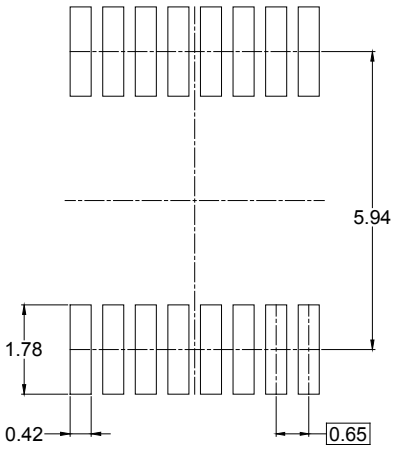


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.200	0.300	0.008	0.012
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	0.635 BSC		0.025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

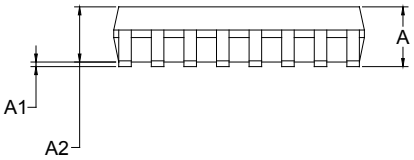
PACKAGE OUTLINE DIMENSIONS

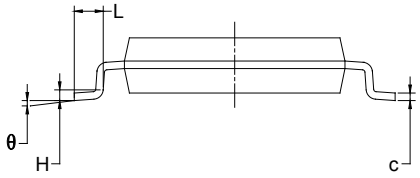
TSSOP-16





RECOMMENDED LAND PATTERN (Unit: mm)

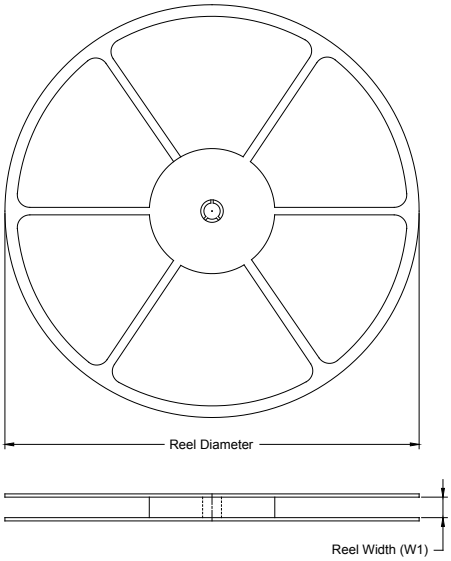




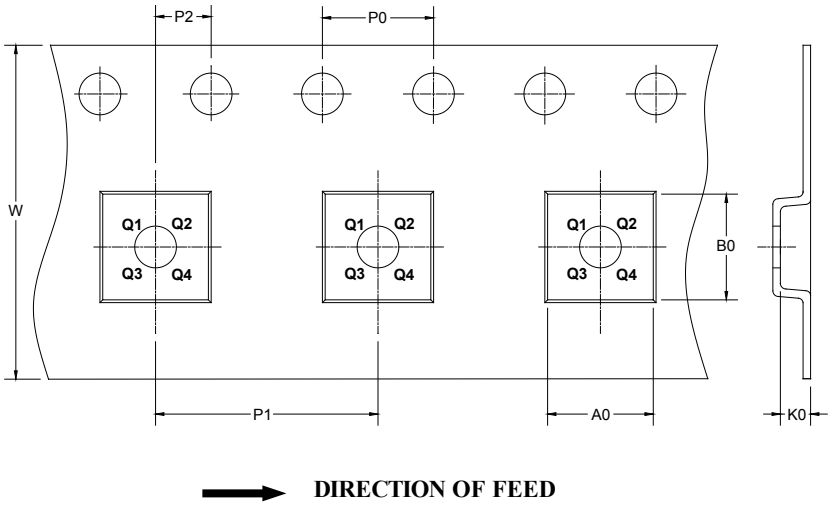
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650 BSC		0.026 BSC	
L	0.500	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



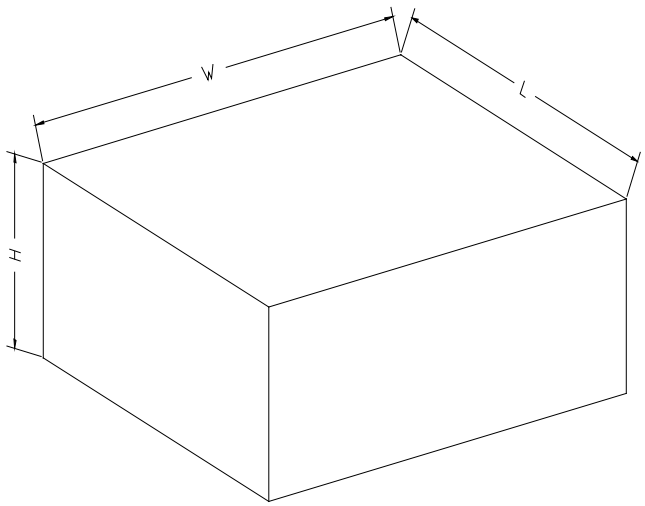
NOTE: The picture is only for reference. Please make the object as the standard.

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	6.50	10.30	2.10	4.0	8.0	2.0	16.0	Q1
SSOP-16	13″	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
TSSOP-16	13″	12.4	6.90	5.60	1.20	4.0	8.0	2.0	12.0	Q1

DD0001

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

DD0002