

# Wide-Bandwidth 4-Channel SPDT Video Analog Switch

## FEATURES

- **Wide Bandwidth: 220MHz**
- **Single Supply Operation +1.8V to +5.5V**
- **Low ON Resistance, 3Ω(TYP)**  
**Low Crosstalk: -58dB at 10MHz (TYP)**
- **Rail-to-Rail Operation**
- **Fast Switching Time**
- **Operating Temperature Range:**  
**-40°C to +85°C**
- **PACKAGES: SOIC-16(SOP16), SSOP-16, TSSOP-16**

## APPLICATIONS

- **Game Consoles**
- **Audio and Video Switching**
- **DVD Players**
- **Personal Video Recorders**
- **Supports defense, aerospace and medical applications**
- **Desktop Video Editors**
- **Hard Disk Recorders**

## DESCRIPTION

The RS2233 is a CMOS analog IC configured as a quad, bidirectional, single-pole/double-throw (SPDT) switches. This CMOS device can operate from 1.8 V to 5.5 V.

The select (IN) input control the data flow. The FET multiplexers/demultiplexers are disabled when the output-enable ( $\overline{OE}$ ) input is high.

The device are digitally-controlled analog switches. It has low on-resistance (3Ω TYP) and low crosstalk (-58dB at 10MHz TYP).

The RS2233 is available in Green SOIC-16(SOP16), SSOP-16, TSSOP-16 packages. It operates over an ambient temperature range of -40°C to +85°C.

### Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS2233	SOIC-16(SOP16)	9.90mm×3.91mm
	SSOP-16	4.90mm×3.90mm
	TSSOP-16	5.00mm×4.40mm

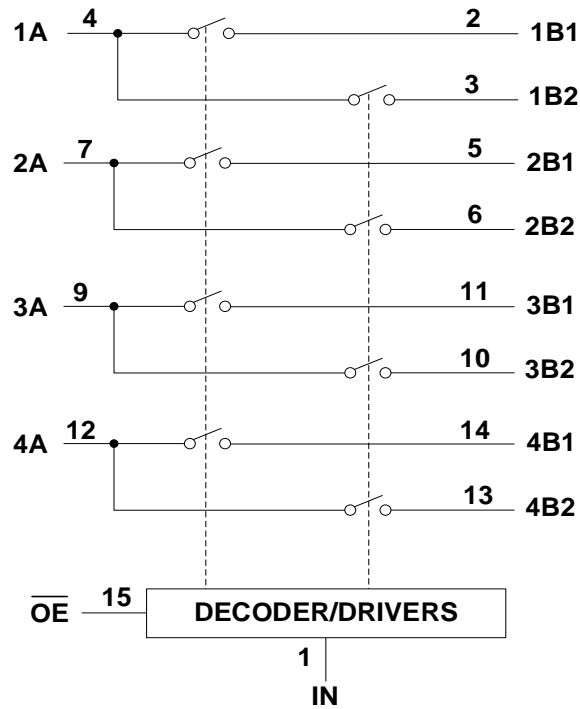
(1) For all available packages, see the orderable addendum at the end of the data sheet.

## Revision History

Note: Page numbers for previous revisions may differ from page numbers in the current version.

Version	Change Date	Change Item
A.1	2021/08/06	Initial version completed
A.2	2021/12/09	(1) Change the Minimum operating voltage to 1.8V (2) Add the Junction temperature

## Pin Configuration and Function



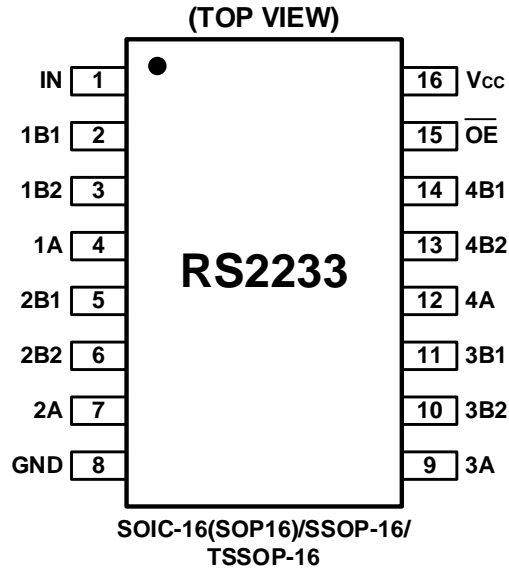
### FUNCTION TABLE

INPUTS		FUNCTION
$\overline{OE}$	IN	
L	L	A port =B1 port
L	H	A port =B2 port
H	X	Disconnect

X=Don't care

NOTE: Input and output pins are identical and inter-changeable. Either may be considered an input or output; signals pass equally well in either direction.

## PIN CONFIGURATIONS



## PIN DESCRIPTION

NAME	PIN	FUNCTION
	SOIC-16(SOP16)/SSOP-16/TSSOP-16	
IN	1	Select Input.
1B1	2	Analog Video I/O.
1B2	3	Analog Video I/O.
1A	4	Analog Video I/O.
2B1	5	Analog Video I/O.
2B2	6	Analog Video I/O.
2A	7	Analog Video I/O.
GND	8	Ground.
3A	9	Analog Video I/O.
3B2	10	Analog Video I/O.
3B1	11	Analog Video I/O.
4A	12	Analog Video I/O.
4B2	13	Analog Video I/O.
4B1	14	Analog Video I/O.
$\overline{OE}$	15	Switch-Enable Input.
V <sub>cc</sub>	16	Power Supply.

## SPECIFICATIONS

### Absolute Maximum Ratings <sup>(1)</sup>

Over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

SYMBOL	PARAMETER	MIN	MAX	UNIT
V <sub>CC</sub>	Supply Voltage	-0.3	6	V
V <sub>IN</sub>	Input Voltage (All inputs)	-0.3	V <sub>CC</sub> +0.3	
I <sub>IK</sub>	Input clamp current		-50	mA
T <sub>J</sub>	Junction temperature		150	°C
T <sub>stg</sub>	Storage temperature	-65	+150	°C

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

### ESD Ratings

		VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human-body model (HBM)	±6000
		Machine Model (MM)	±400

### Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNIT
V <sub>CC</sub>	Supply Voltage	1.8	5.5	V
T <sub>A</sub>	Operating temperature	-40	+85	°C

### Thermal Information

THERMAL METRIC		RS2233			UNIT
		16 PINS			
		SOIC-16(SOP-16)	SSOP-16	TSSOP-16	
R <sub>EJA</sub>	Junction-to-ambient thermal resistance	76	118.7	111.3	°C/W
R <sub>EJC(top)</sub>	Junction-to-case(top) thermal resistance	42.1	66.4	45.3	°C/W
R <sub>EJB</sub>	Junction-to-board thermal resistance	34.8	62.2	56.9	°C/W
Ψ <sub>JT</sub>	Junction-to-top characterization parameter	26.9	20.9	5.4	°C/W
Ψ <sub>JB</sub>	Junction-to-board characterization parameter	34.7	61.7	56.3	°C/W
R <sub>EJC(bot)</sub>	Junction-to-case(bottom) thermal resistance	N/A	N/A	N/A	°C/W

**PACKAGE/ORDERING INFORMATION**

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING <sup>(1)</sup>	PACKAGE OPTION
RS2233	RS2233YS16	-40°C~+85°C	SOIC-16(SOP16)	RS2233	Tape and Reel,4000
	RS2233YSS16	-40°C~+85°C	SSOP-16	RS2233	Tape and Reel,4000
	RS2233YTSS16	-40°C~+85°C	TSSOP-16	RS2233	Tape and Reel,4000

## NOTE:

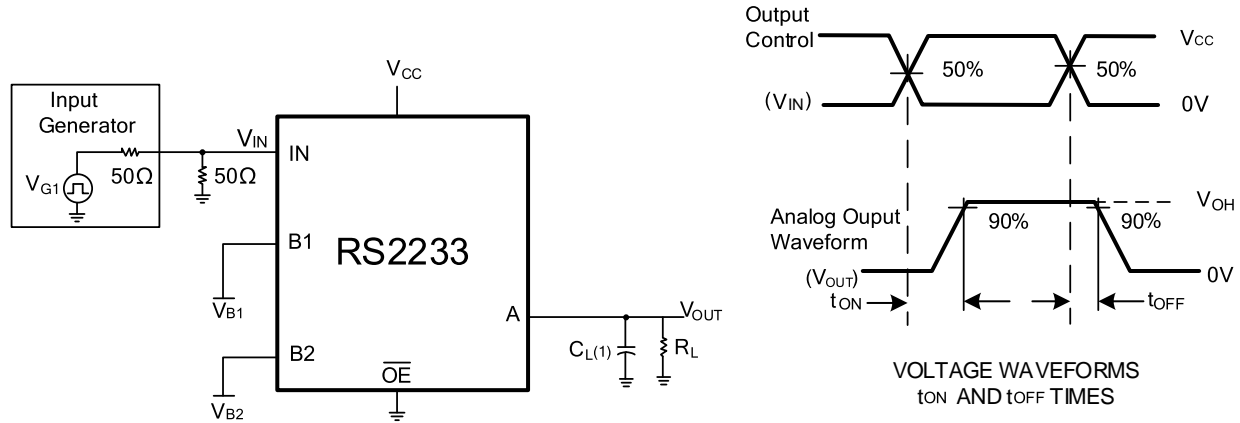
- (1) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

## ELECTRICAL CHARACTERISTICS

$V_{CC} = +1.8V$  to  $+5.5V$ , FULL =  $-40^{\circ}C$  to  $+85^{\circ}C$ , Typical values are at  $T_A = +25^{\circ}C$ . (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	$V_{CC}$	$T_A$	MIN	TYP	MAX	UNITS
<b>DC CHARACTERISTICS</b>								
On-Resistance	$R_{ON}$	$I_A = 13mA$	5.5V	FULL		3		$\Omega$
High-level control input Voltage	$V_{IH}$		1.8V	FULL	1.1			V
			2.5V to 5.5V	FULL	2			
Low-level control input Voltage	$V_{IL}$		1.8V	FULL			0.4	V
			2.5V to 5.5V	FULL			0.5	
Input High Current	$I_{IH}$	$V_{IN}$ and $V_{OE} = V_{CC}$	5.5V	$+25^{\circ}C$			$\pm 1$	$\mu A$
Input Low Current	$I_{IL}$	$V_{IN}$ and $V_{OE} = 0V$	5.5V	$+25^{\circ}C$			$\pm 1$	$\mu A$
Analog Output Leakage Current	$I_O$	$V_{B1}$ or $V_{B2} = 3.3V/0.3V$ $V_A = 0.3V/3.3V$	5.5V	$+25^{\circ}C$			$\pm 1$	$\mu A$
Clamp Diode Voltage	$V_{IK}$	$I_I = -18mA$	5.5V	$+25^{\circ}C$		-0.9		V
<b>DYNAMIC CHARACTERISTICS</b>								
Turn-On Time	$t_{ON}$	$R_L = 75\Omega$ , $C_L = 20pF$ , Test Circuit 1	5.5V	$+25^{\circ}C$		30		ns
Turn-Off Time	$t_{OFF}$	$R_L = 75\Omega$ , $C_L = 20pF$ , Test Circuit 1	5.5V	$+25^{\circ}C$		13		ns
-3dB Bandwidth	BW	$R_L = 150\Omega$ , Test Circuit 3	5.5V	$+25^{\circ}C$		220		MHz
Channel-to-Channel Crosstalk	$X_{TALK}$	$R_{IN} = 10\Omega$ , $R_L = 150\Omega$ , $f = 10MHz$ , Test Circuit 4	5.5V	$+25^{\circ}C$		-54		dB
Off Isolation	$O_{IRR}$	$R_L = 150\Omega$ , $f = 10MHz$ , Test Circuit 5	5.5V	$+25^{\circ}C$		-58		dB
Input/Enable Capacitance	$C_{IN}$	$f = 1MHz$ , Test Circuit 5	5.5V	$+25^{\circ}C$		4		pF
Switch OFF Capacitance	$C_{OFF}$	$f = 1MHz$ , Test Circuit 5	5.5V	$+25^{\circ}C$		5		pF
Switch ON Capacitance	$C_{ON}$	$f = 1MHz$ , Test Circuit 5	5.5V	$+25^{\circ}C$		8		pF
Differential Gain	$D_G$	$R_L = 150\Omega$ , $f = 3.58MHz$ , Test Circuit 2	5.5V	$+25^{\circ}C$		0.5		%
Differential Phase	$D_P$	$R_L = 150\Omega$ , $f = 3.58MHz$ , Test Circuit 2	5.5V	$+25^{\circ}C$		0.03		$^{\circ}$
<b>POWER REQUIREMENTS</b>								
Power Supply Range	$V_{CC}$			FULL	1.8		5.5	V
Power Supply Current	$I_{CC}$	$V_{IN}$ and $V_{OE} = 5V/0V$	5.5V	$+25^{\circ}C$		0.1	1	$\mu A$
Supply Current per Input @ TTL HIGH	$\Delta I_{CC}$	$V_{IN}$ or $V_{OE} = 3.4V$	5.5V	$+25^{\circ}C$			300	$\mu A$

## Parameter Measurement Information

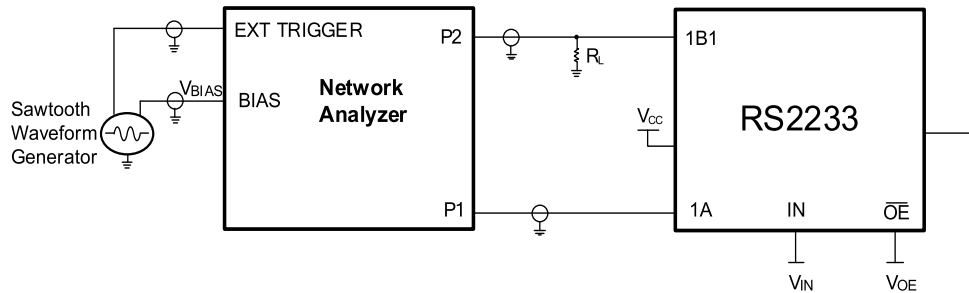


Test	V <sub>CC</sub>	R <sub>L</sub>	C <sub>L</sub>	V <sub>B1</sub>	V <sub>B2</sub>
t <sub>ON</sub>	5V±0.5V	75Ω	20pF	GND	3V
	5V±0.5V	75Ω	20pF	3V	GND
t <sub>OFF</sub>	5V±0.5V	75Ω	20pF	GND	3V
	5V±0.5V	75Ω	20pF	3V	GND

**NOTES:**

1. CL includes probe and jig capacitance.
2. 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.
3. The outputs are measured one at a time, with one transition per measurement.

### Test Circuit 1. Test Circuit for Voltage Waveform and Switch Time

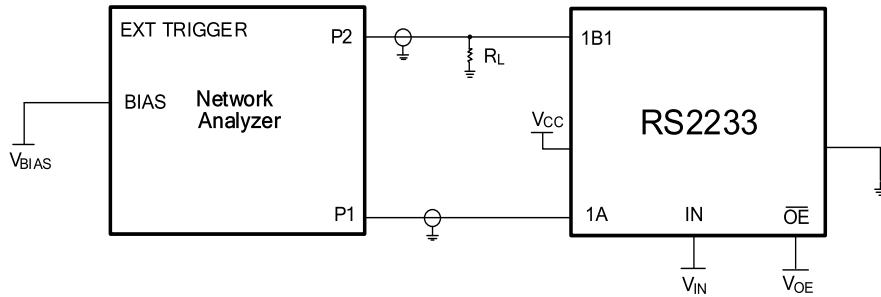


NOTES: Differential gain and phase are measured at the output of the ON channel. For example, when V<sub>IN</sub> = 0, V<sub>OE</sub> = 0, and 1A is the input, the output is measured at 1B1.

### Test Circuit 2. Test Circuit for Differential Gain/Phase Measurement

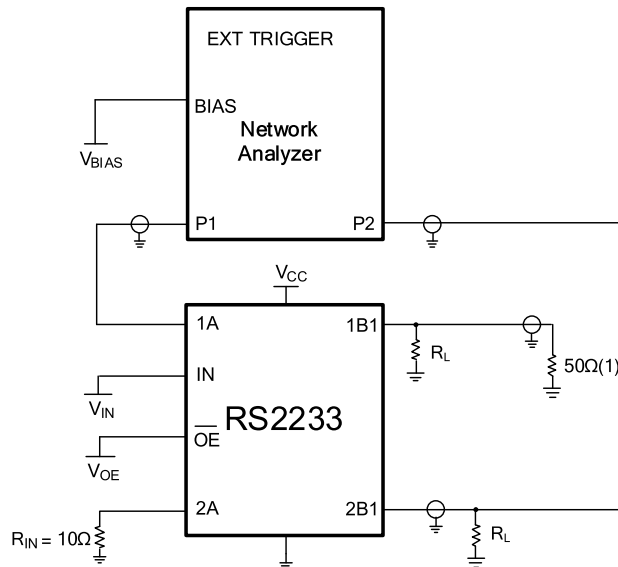


## Parameter Measurement Information



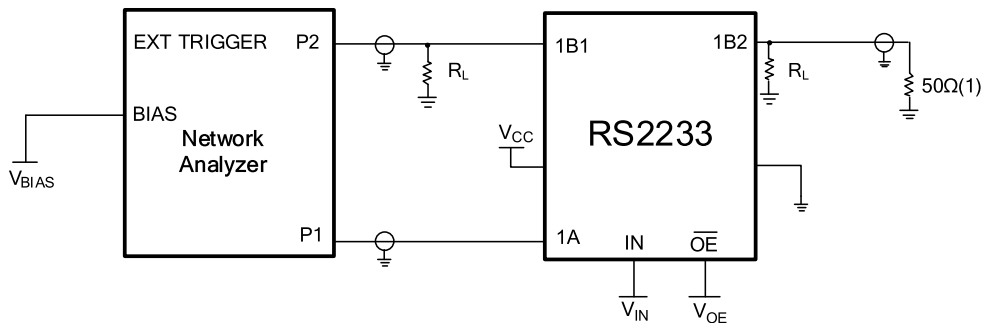
NOTES: Frequency response is measured at the output of the ON channel. For example, when  $V_{IN} = 0$ ,  $V_{EN} = 0$ , and 1A is the input, the output is measured at 1B1. All unused analog I/O ports are left open.

### Test Circuit 3. Test Circuit for Frequency Response (BW)



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

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

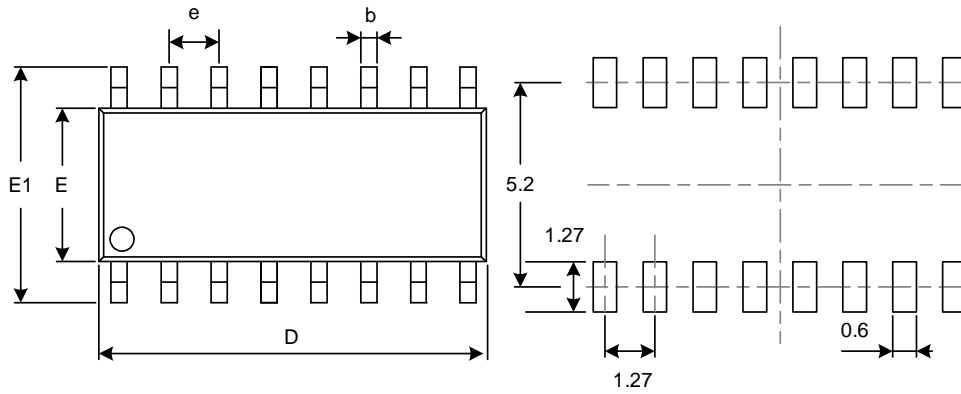


NOTE: 1. A 50Ω termination resistor is needed for the network analyzer.

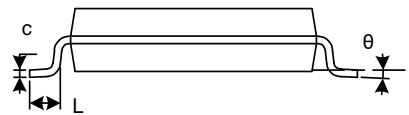
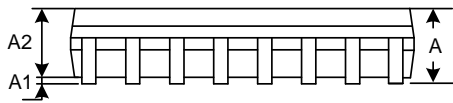
### Test Circuit 5. Test Circuit for Off Isolation ( $O_{IRR}$ )

# PACKAGE OUTLINE DIMENSIONS

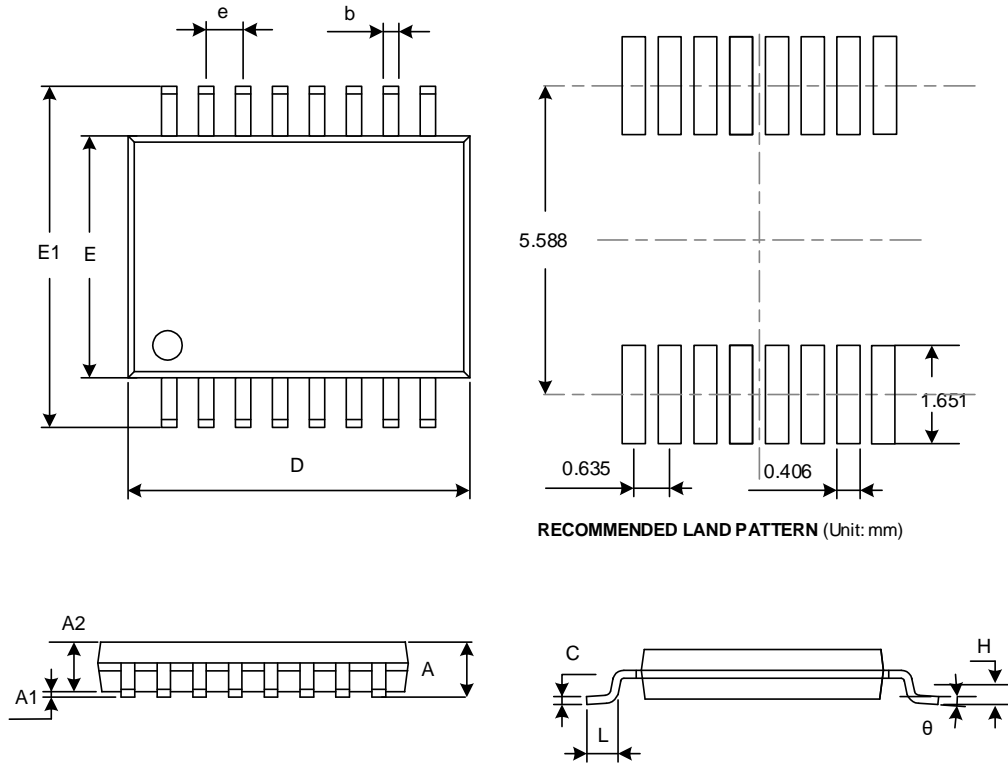
## SOIC-16(SOP16)



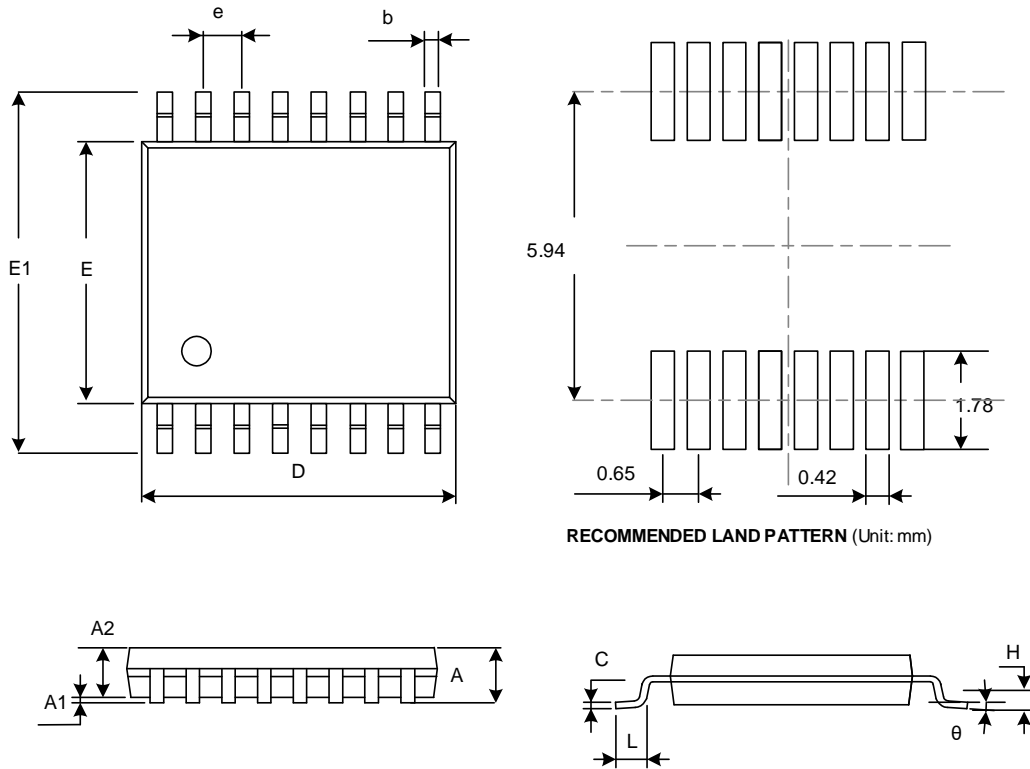
RECOMMENDED LAND PATTERN (Unit: mm)



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	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

**SSOP-16**

**RECOMMENDED LAND PATTERN** (Unit: mm)

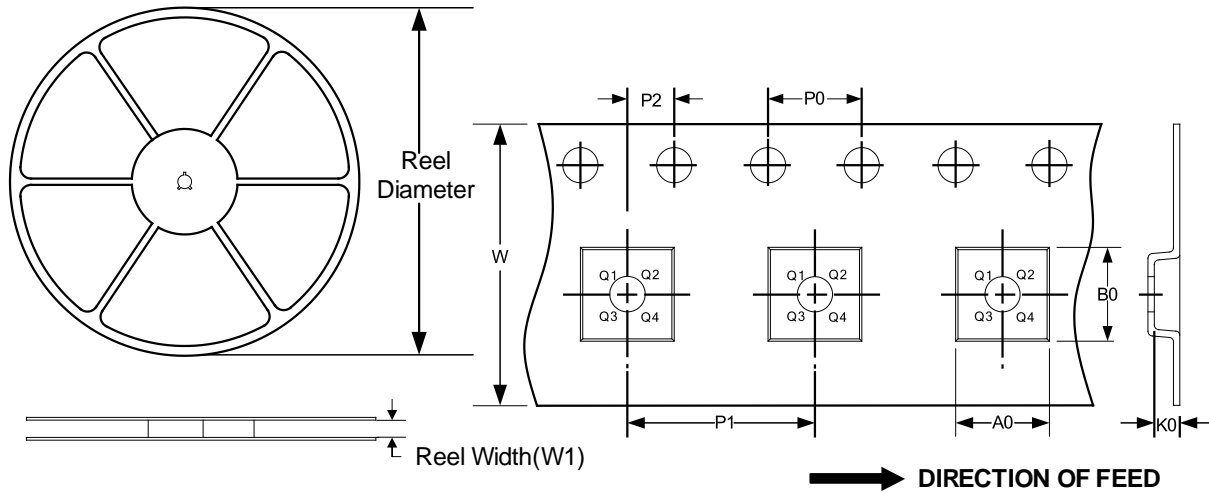
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.200	0.300	0.008	0.012
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	0.635(BSC)		0.025(BSC)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

**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	0.25TYP		0.01TYP	
$\theta$	1°	7°	1°	7°

**TAPE AND REEL INFORMATION**  
**REEL DIMENSIONS**

**TAPE DIMENSION**



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(mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TSSOP-16	13"	12.4	6.90	5.60	1.20	4.0	8.0	2.0	12.0	Q1
SSOP-16	13"	12.4	8.30	6.70	2.10	4.0	8.0	2.0	12.0	Q1
SOIC-16(SOP16)	13"	16.4	6.50	10.30	2.10	4.0	8.0	2.0	16.0	Q1

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