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 ($\overline{\text{OE}}$) 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 different from page numbers in the current version.

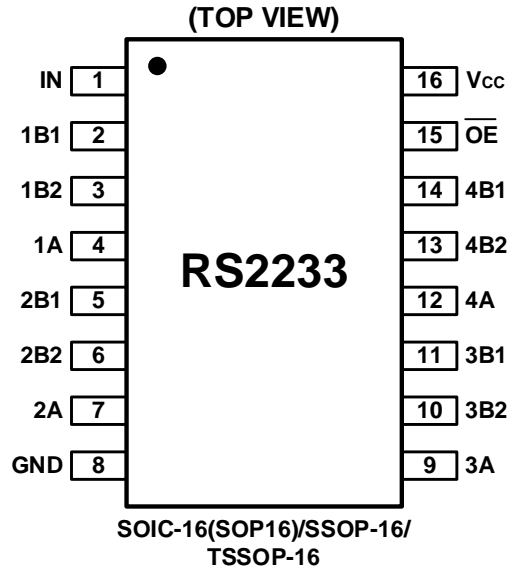| Version	Change Date	Change Item
A.1	2021/08/06	Initial version completed
A.2	2021/12/09	(1) Change the Minimum operating voltage to 1.8V (2) Add the Junction temperature

Pin Configuration and Function

| 1A | 4 | | | 2 | 1B1 |
| | | | | 3 | 1B2 |
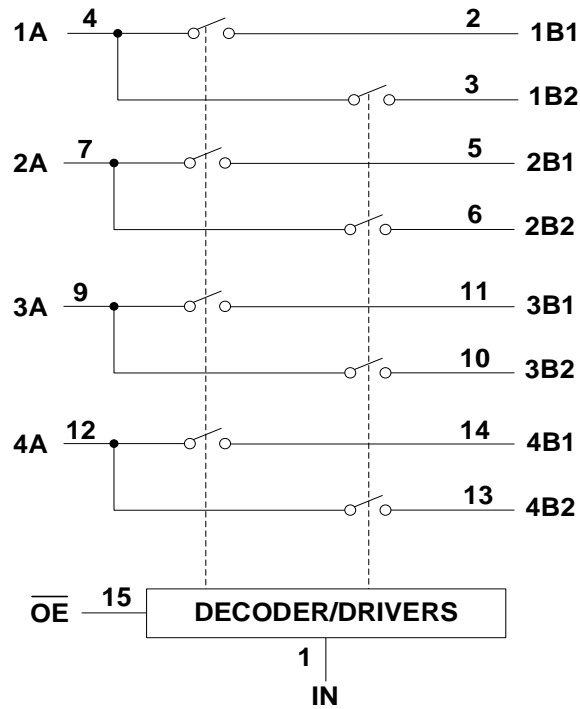
FUNCTION TABLE

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

(TOP VIEW)

```
        IN   1 ●            16  Vcc
        1B1  2              15  OE
        1B2  3              14  4B1
        1A   4    RS2233    13  4B2
        2B1  5              12  4A
        2B2  6              11  3B1
        2A   7              10  3B2
        GND  8               9  3A
```

SOIC-16(SOP16)/SSOP-16/TSSOP-16

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.
Vcc	16	Power Supply.

SPECIFICATIONS

Absolute Maximum Ratings [(1)]

Over operating free-air temperature range (unless otherwise noted) [(1)]

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CC}	Supply Voltage		-0.3	6	V
V_{IN}	Input Voltage (All inputs)		-0.3	V_{CC}+0.3	
I_{IK}	Input clamp current	$V_{IO} < 0$		-50	mA
T_J	Junction temperature			150	°C
T_{stg}	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
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM)	±6000	V
		Machine Model (MM)	±400	V

Recommended Operating Conditions

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

SYMBOL	PARAMETER	MIN	MAX	UNIT
V_{CC}	Supply Voltage	1.8	5.5	V
T_A	Operating temperature	-40	+85	°C

Thermal Information

THERMAL METRIC		RS2233			UNIT
		16 PINS			
		SOIC-16(SOP-16)	SSOP-16	TSSOP-16	
$R_{\Theta JA}$	Junction-to-ambient thermal resistance	76	118.7	111.3	°C/W
$R_{\Theta JC(top)}$	Junction-to-case(top) thermal resistance	42.1	66.4	45.3	°C/W
$R_{\Theta JB}$	Junction-to-board thermal resistance	34.8	62.2	56.9	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	26.9	20.9	5.4	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	34.7	61.7	56.3	°C/W
$R_{\Theta JC(bot)}$	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 [1]	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 +5.5 V, FULL= -40°C to +85°C, Typical values are at T_A = +25°C. (unless otherwise noted)

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

Parameter Measurement Information
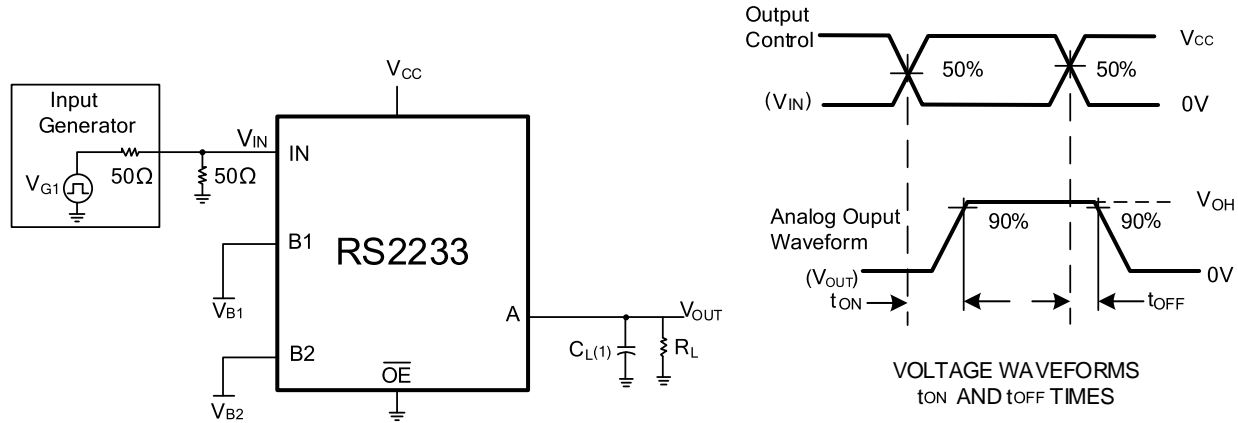
Test	V_{CC}	R_L	C_L	V_{B1}	V_{B2}
t_{ON}	5V±0.5V	75Ω	20pF	GND	3V
	5V±0.5V	75Ω	20pF	3V	GND
t_{OFF}	5V±0.5V	75Ω	20pF	GND	3V
	5V±0.5V	75Ω	20pF	3V	GND

NOTES:
1.CL 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.

Test Circuit 1. Test Circuit for Voltage Waveform and Switch Time
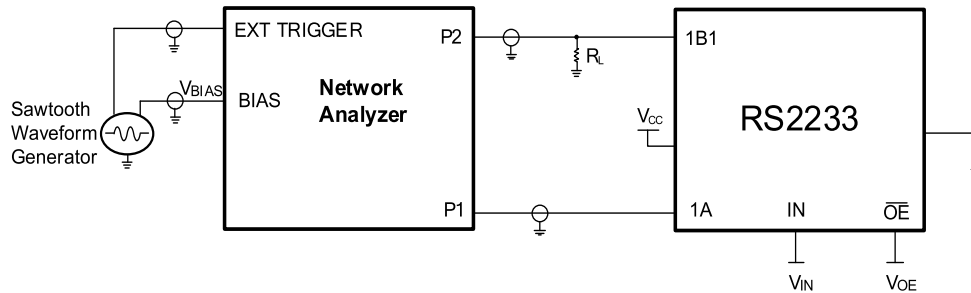
NOTES: Differential gain and phase are measured at the output of the ON channel. For example, when V_{IN} = 0, V_{OE} = 0, and 1A is the input, the output is measured at 1B1.
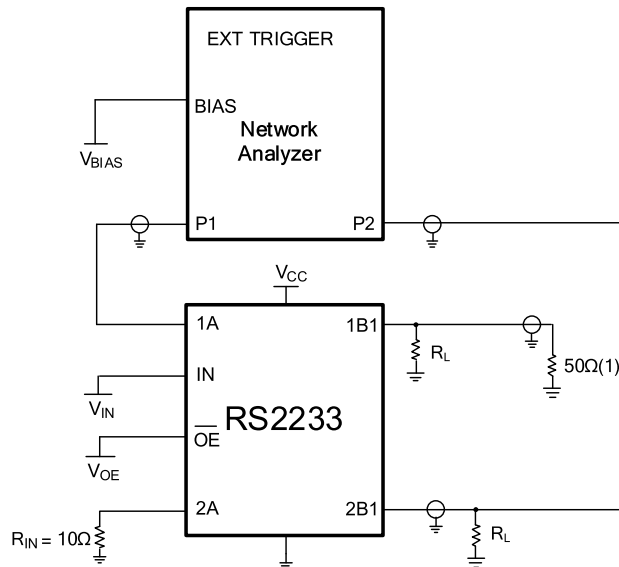
Test Circuit 2. Test Circuit for Differential Gain/Phase Measurement

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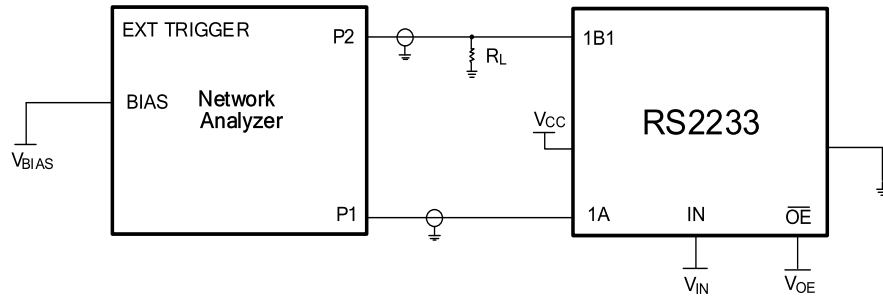
NOTES: Frequency response is measured at the output of the ON channel. For example, when $V_{IN} = 0$, $V_{EN} = 0$, and 1A is the input, the output is measured at 1B1. All unused analog I/O ports are left open.

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

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

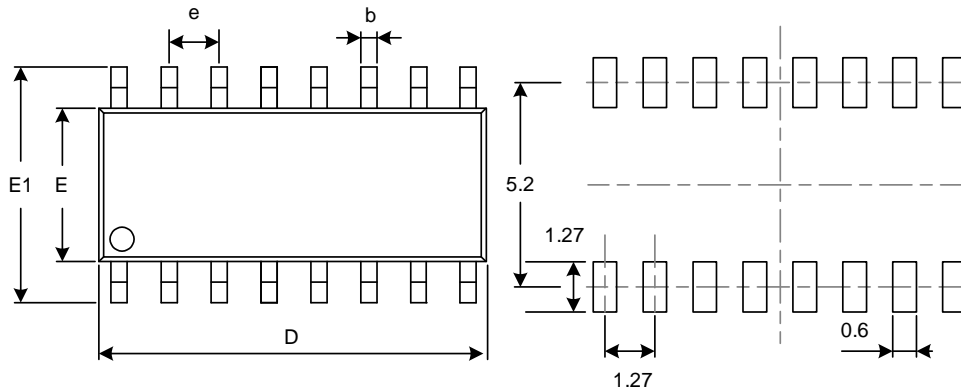**Test Circuit 4. Test Circuit for Crosstalk (X$_{TALK}$)**
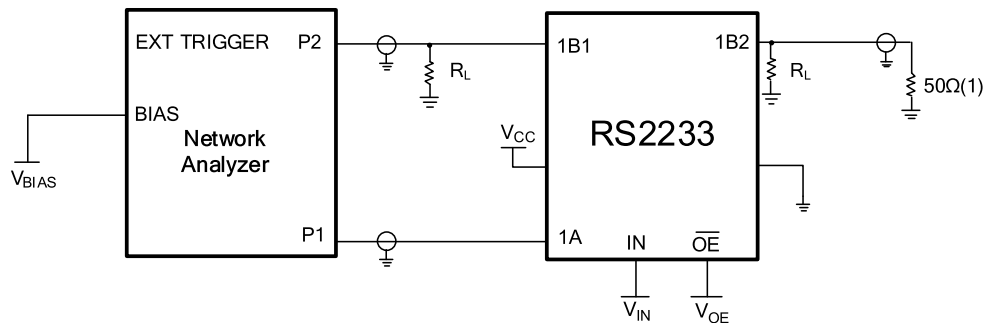
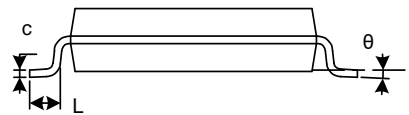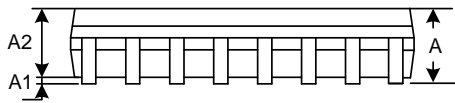NOTE: 1. A 50Ω termination resistor is needed for the network analyzer.

**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
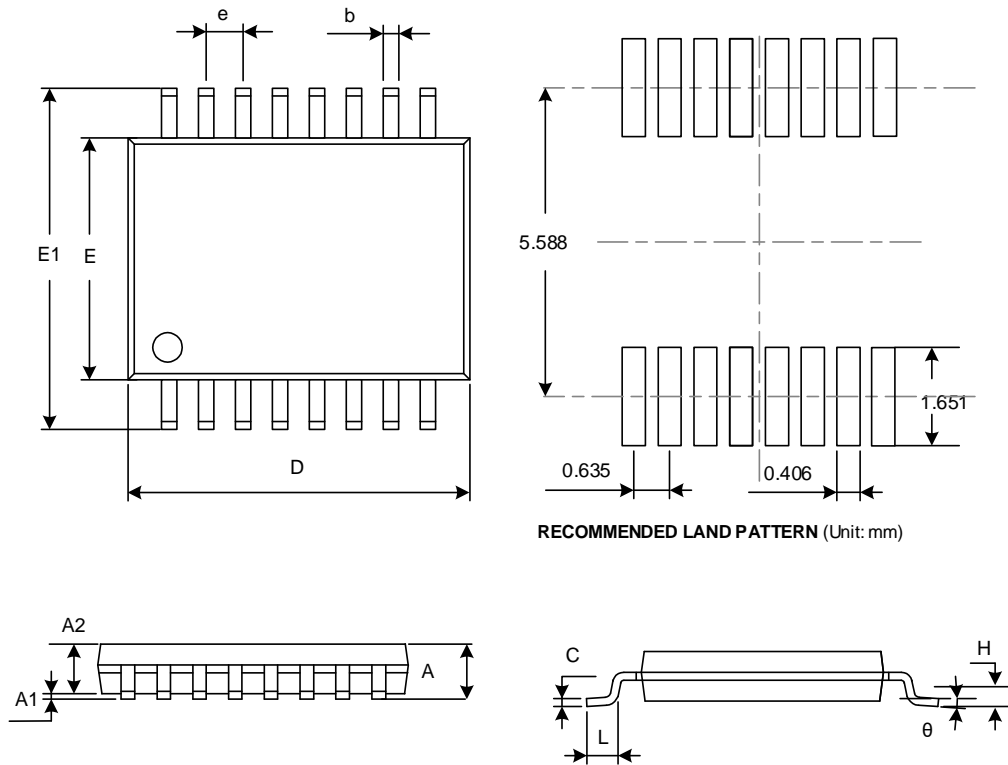
RECOMMENDED LAND PATTERN (Unit: mm)

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
θ	0°	8°	0°	8°
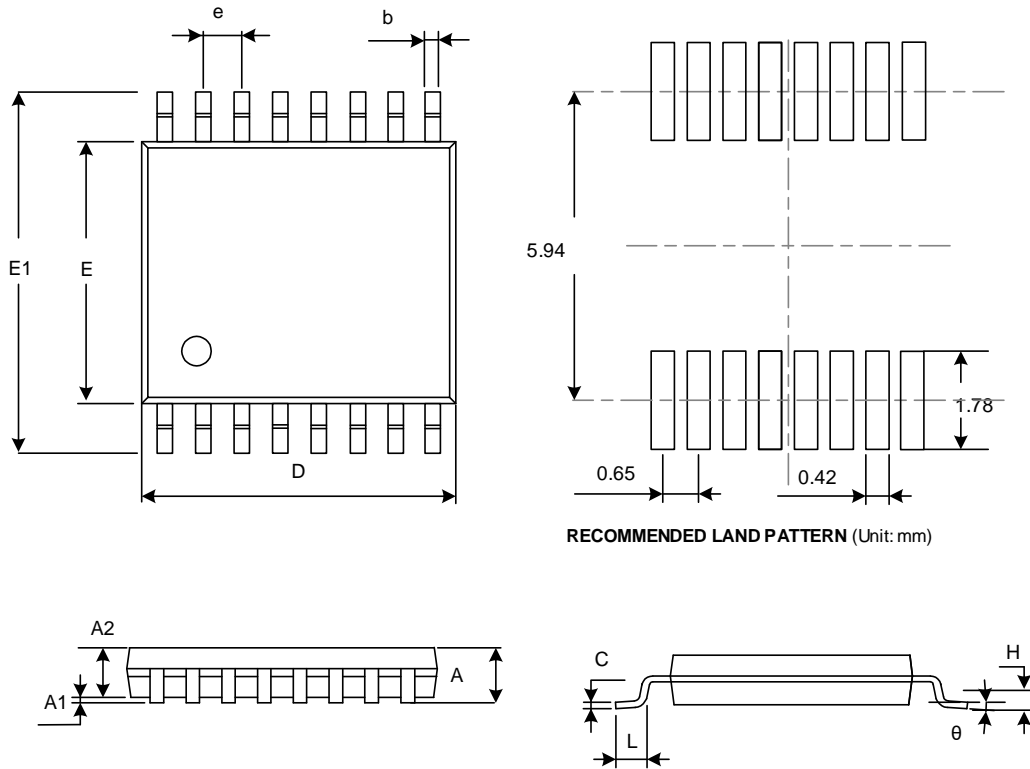
TSSOP-16

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	
θ	1°	7°	1°	7°

TAPE AND REEL INFORMATION
REEL DIMENSIONS TAPE DIMENSION
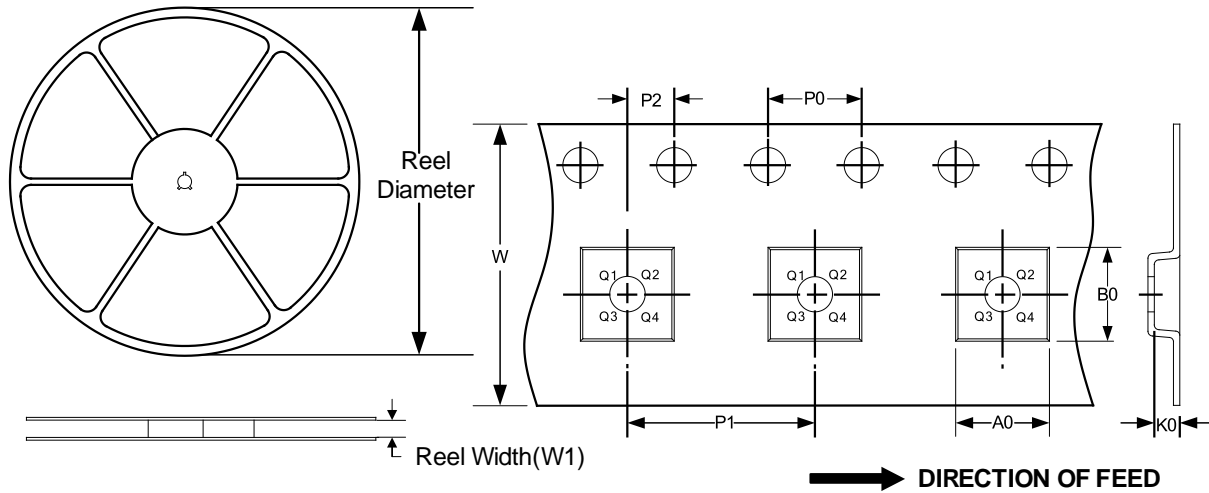
NOTE: The picture is only for reference. Please make the object as the standard.

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