RS151 8-Line To 1-Line Data Selectors/Multiplexers

1 FEATURES

- **Operating Voltage Range: 1.65V to 5.5V**
- **Low power consumption: 8μA MAX I$_{CC}$**
- **Inputs Accept Voltage to 5.5V**
- **Output Drive: ±6mA at V$_{CC}$=4.5V**
- **Operating Temperature Range: -40°C to +125°C**
- **PACKAGES: SOIC-16(SOP16) and TSSOP-16**

2 APPLICATIONS

- **Boolean-function generators**
- **Parallel-to-serial converters**
- **Data source selectors**

3 DESCRIPTIONS

The RS151, a data selector/multiplexer provides full binary decoding to select one of eight data sources.

The RS151 is consist of one enable input $\overline{G}$, three binary address inputs (A0, A1 and A2), eight data inputs (D0 to D7) and two outputs (Y and W). The strobe ($\overline{G}$) input must be at a low logic level to enable the inputs. A high level at the strobe terminal forces the standard output (Y) low and the inverted output (W) high.

The RS151 is available in Green SOIC-16(SOP16) and TSSOP-16 packages. It operates over an ambient temperature range of -40°C to +125°C.

Device Information [1]

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS151	SOIC-16(SOP16)	9.90mm×3.90mm
	TSSOP-16	5.00mm×4.40mm

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

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4 Revision History

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

Version	Change Date	Change Item
A.1	2023/09/01	Initial version completed

5 PACKAGE/ORDERING INFORMATION [1]

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING [2]	MSL[3]	PACKAGE OPTION
RS151	RS151XS16	-40°C ~+125°C	SOIC-16(SOP16)	RS151	MSL3	Tape and Reel,4000
	RS151XTSS16	-40°C ~+125°C	TSSOP-16	RS151	MSL3	Tape and Reel,4000

NOTE:
(1)   This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.
(2)   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.
(3)   MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

6 PIN CONFIGURATIONS

TOP VIEW

```
        ┌───────────────┐
D3 │ 1  ●            16 │ Vcc
D2 │ 2                15 │ D4
D1 │ 3                14 │ D5
D0 │ 4                13 │ D6
 Y │ 5                12 │ D7
 W │ 6                11 │ A
 G̅ │ 7                10 │ B
GND│ 8                 9 │ C
        └───────────────┘
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SOIC-16(SOP16)/TSSOP-16

PIN DESCRIPTION

PIN SOIC-16(SOP16)/TSSOP-16	NAME	I/O TYPE [1]	FUNCTION
1	D3	I	Data input
2	D2	I	Data input
3	D1	I	Data input
4	D0	I	Data input
5	Y	O	Output
6	W	O	Output
7	$\overline{G}$	I	Enable input (active LOW)
8	GND	-	Ground
9	C	I	Address input
10	B	I	Address input
11	A	I	Address input
12	D7	I	Data input
13	D6	I	Data input
14	D5	I	Data input
15	D4	I	Data input
16	V_{CC}	-	Power Supply

(1) I=Input, O=Output.

7 SPECIFICATIONS

7.1 Absolute Maximum Ratings [1]

over operating free-air temperature range (unless otherwise noted) [1] [2]

			MIN	MAX	UNIT
V_{CC}	Supply voltage range		-0.5	7	V
I_{IK}	Input clamp current [2]	$V_I < 0$ or $V_I > V_{CC}$		±20	mA
I_{OK}	Output clamp current [2]	$V_O < 0$ or $V_O > V_{CC}$		±20	mA
I_O	Continuous output current	$V_O = 0$ to V_{CC}		±35	mA
	Continuous current through V_{CC} or GND			±70	mA
θ_{JA}	Package thermal impedance [3]	SOIC-16(SOP16)		150	°C/W
		TSSOP-16		45	
T_J	Junction temperature [4]			150	°C
T_{stg}	Storage temperature		-65	150	°C

(1) 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 under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

(3) The package thermal impedance is calculated in accordance with JESD-51.

(4) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

7.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	Human-body model (HBM), MIL-STD-883K METHOD 3015.9	±2000	V
	Charged-device model (CDM), ANSI/ESDA/JEDEC JS-002-2018	±1000	V
	Machine Model (MM), JESD22-A115C (2010)	±200	V

ESD SENSITIVITY CAUTION

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.

7.3 Recommended Operating Conditions

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Supply voltage	V_{CC}		1.65	5.5	V
High-level input voltage	V_{IH}	V_{CC}=2V	1.5		V
		V_{CC}=4.5V	3.15		
		V_{CC}=5.5V	3.85		
Low-level input voltage	V_{IL}	V_{CC}=2V		0.5	V
		V_{CC}=4.5V		1.35	
		V_{CC}=5.5V		1.65	
Input voltage	V_I		0	V_{CC}	V
Output voltage	V_O		0	V_{CC}	V
Input transition rise and fall time	t_t	V_{CC}=2V		1000	ns
		V_{CC}=4.5V		500	
		V_{CC}=5.5V		400	
Operating temperature	T_A		-40	125	°C

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

7.4 ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range (TYP values are at T_A = +25°C, unless otherwise noted.) [1]

PARAMETER	TEST CONDITIONS	V_{CC}	TEMP	MIN[2]	TYP[3]	MAX[2]	UNIT
V_{OH}	I_{OH} = − 20µA	1.65V to 5.5V	Full	V_{CC}-0.1			V
	I_{OH} = − 6mA	4.5V		4.0			
	I_{OH} = − 7.8mA	5.5V		5.0			
V_{OL}	I_{OL} = 20µA	1.65V to 5.5V	Full			0.1	V
	I_{OL} = 6mA	4.5V				0.35	
	I_{OL} = 7.8mA	5.5V				0.45	
I_I	V_I = V_{CC} or GND	0V to 5.5V	+25°C		±0.1	±1	uA
			Full			±2	
I_{CC}	V_I = V_{CC} or GND, I_O = 0	1.65V to 5.5V	+25°C		±0.1	1	uA
			Full			8	
C_i		1.65V to 5.5V		3		12	pF

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

(2) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.

(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

7.5 Switching Characteristics

over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Parameter Measurement Information) [1]

PARAMETER	FROM (INPUT)	TO (OUTPUT)	Vcc	MIN [2]	TYP [3]	MAX [2]	UNIT
t_{pd}	A, B, or C	Y or W	2V		27		ns
			4.5V		10		
			5.5V		9		
	Any D	Y or W	2V		26		ns
			4.5V		10		
			5.5V		9		
	$\overline{G}$	Y or W	2V		25		ns
			4.5V		10		
			5.5V		9		
t_t		Y or W	2V		15		ns
			4.5V		6		
			5.5V		6		

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.
(2) This parameter is ensured by design and/or characterization and is not tested in production.
(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

Switching Characteristics

over recommended operating free-air temperature range, C_L= 150 pF (unless otherwise noted) (see Parameter Measurement Information) [1]

PARAMETER	FROM (INPUT)	TO (OUTPUT)	Vcc	MIN [2]	TYP [3]	MAX [2]	UNIT
t_{pd}	A, B, or C	Y or W	2V		35		ns
			4.5V		13		
			5.5V		12		
	Any D	Y or W	2V		34		ns
			4.5V		13		
			5.5V		12		
	$\overline{G}$	Y or W	2V		32		ns
			4.5V		13		
			5.5V		12		
t_t		Y or W	2V		28		ns
			4.5V		12		
			5.5V		10		

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.
(2) This parameter is ensured by design and/or characterization and is not tested in production.
(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

7.6 Operating Characteristics

over recommended operating free-air temperature range, (TYP values are at T_A = +25°C, unless otherwise noted)
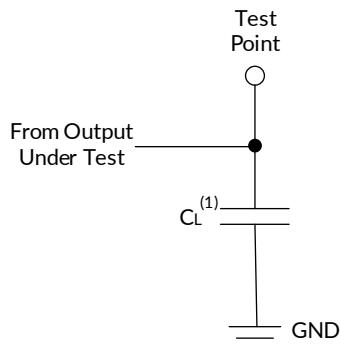
PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{PD}	Power dissipation capacitance	No load	20	pF

8 Parameter Measurement Information

Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_t < 6 ns.
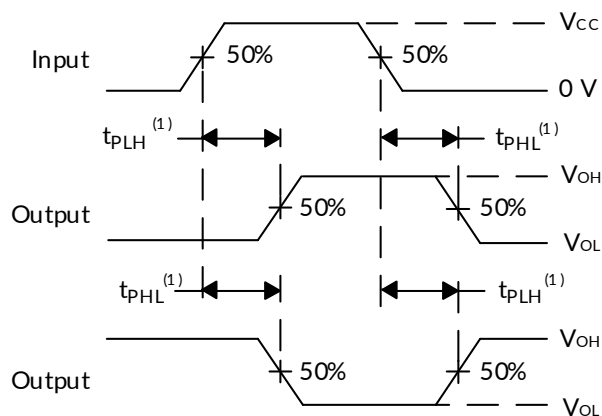
For clock inputs, f_{max} is measured when the input duty cycle is 50%.

The outputs are measured one at a time with one input transition per measurement.
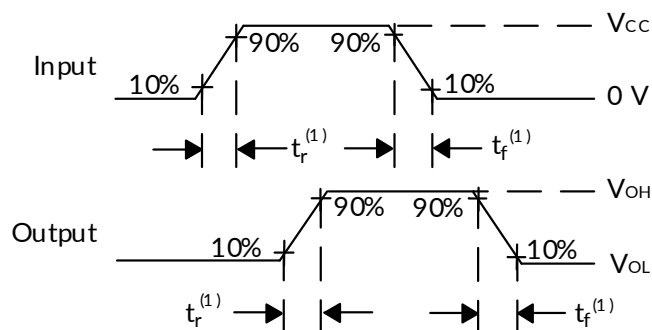

(1) C_L includes probe and test-fixture capacitance.

Figure 1. Load Circuit for Push-Pull Outputs

(1) The greater between t_{PLH} and t_{PHL} is the same as t_{pd}.

Figure 2. Voltage Waveforms, Propagation Delays for Standard CMOS Inputs

(1) The greater between t_r and t_f is the same as t_t.
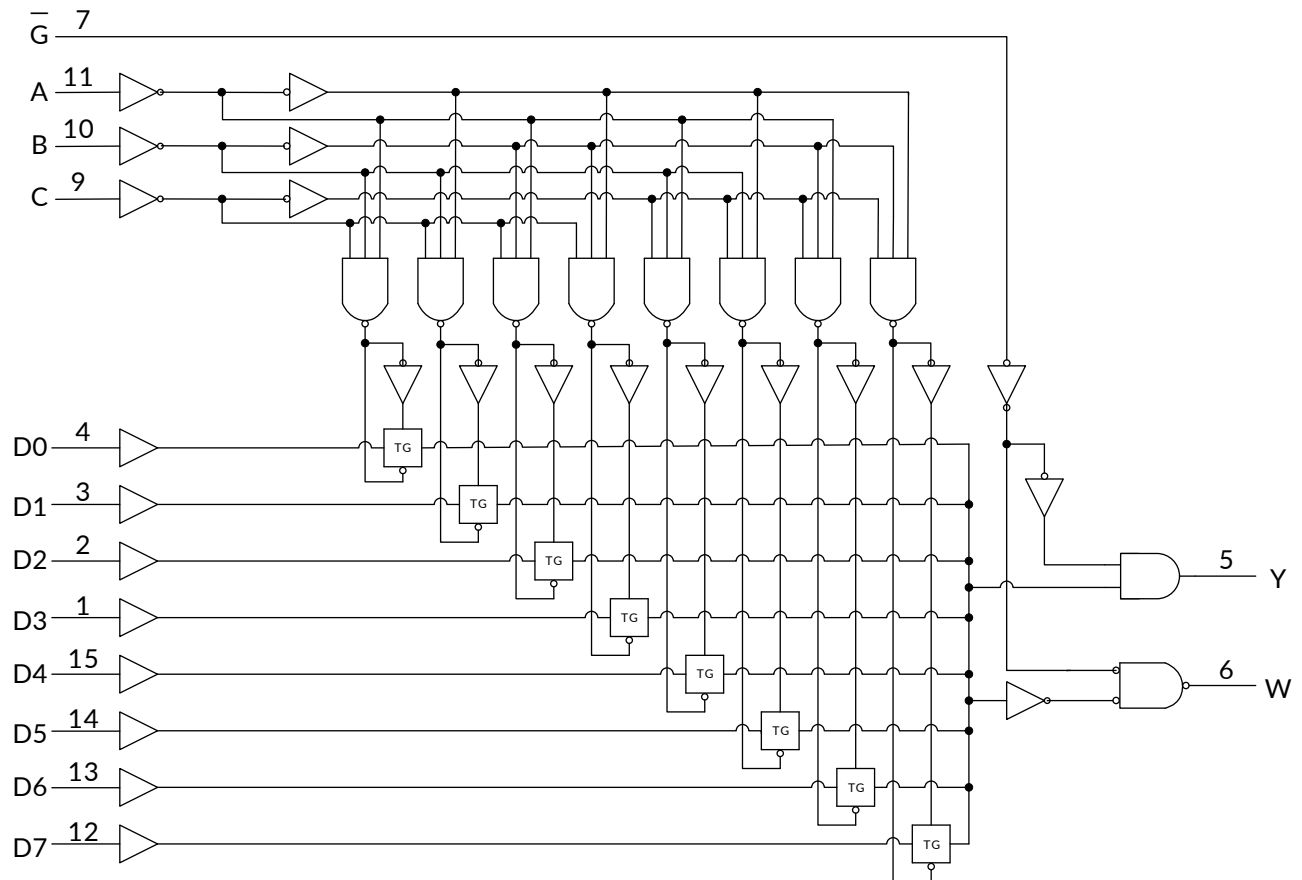
Figure 3. Voltage Waveforms, Input and Output Transition Times for Standard CMOS Inputs

9 Detailed Description

9.1 Overview

This data selector/multiplexer provides full binary decoding to select one of eight data sources. The strobe ($\overline{G}$) input must be at a low logic level to enable the inputs. A high level at the strobe terminal forces the standard output (Y) low and the inverted output (W) high.

9.2 Functional Block Diagram

9.3 Device Functional Modes

Device Function Table

ENABLE INPUT	SELECT INPUTS			OUTPUTS	
$\overline{G}$	C	B	A	Y	W
H	X	X	X	L	H
L	L	L	L	D0	$\overline{D0}$
L	L	L	H	D1	$\overline{D1}$
L	L	H	L	D2	$\overline{D2}$
L	L	H	H	D3	$\overline{D3}$
L	H	L	L	D4	$\overline{D4}$
L	H	L	H	D5	$\overline{D5}$
L	H	H	L	D6	$\overline{D6}$
L	H	H	H	D7	$\overline{D7}$

H: High Voltage Level
L: Low Voltage Level
D0, D1 . . . D7 = the level of the respective D input.

10 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the Recommended Operating Conditions. Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. A 0.1μF capacitor is recommended for this device. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 0.1μF and 1μF capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.
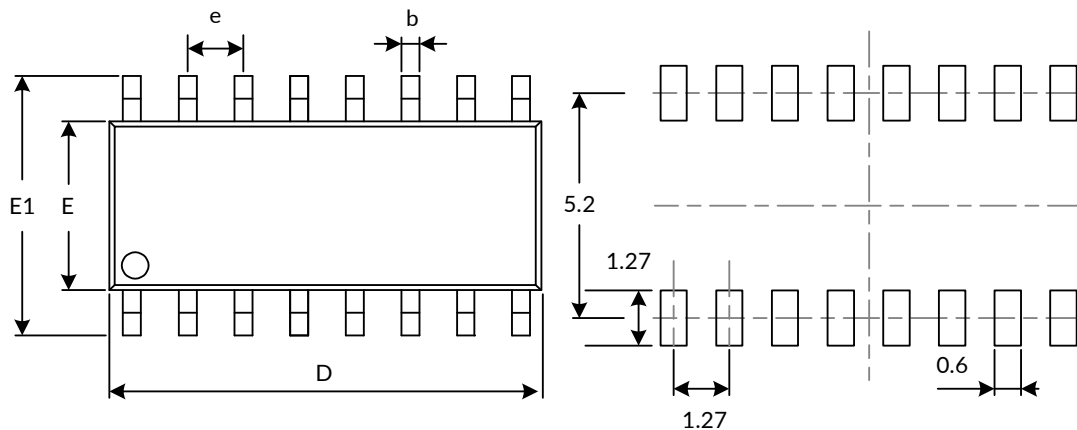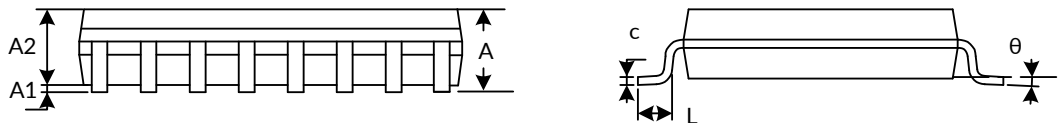
11 Layout

11.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices inputs must not ever be left floating. In many cases, functions or parts of functions of digital logic devices are unused; for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such unused input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a logic high or logic low voltage, as defined by the input voltage specifications, to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally, the inputs are tied to GND or V_{CC}, whichever makes more sense for the logic function or is more convenient.
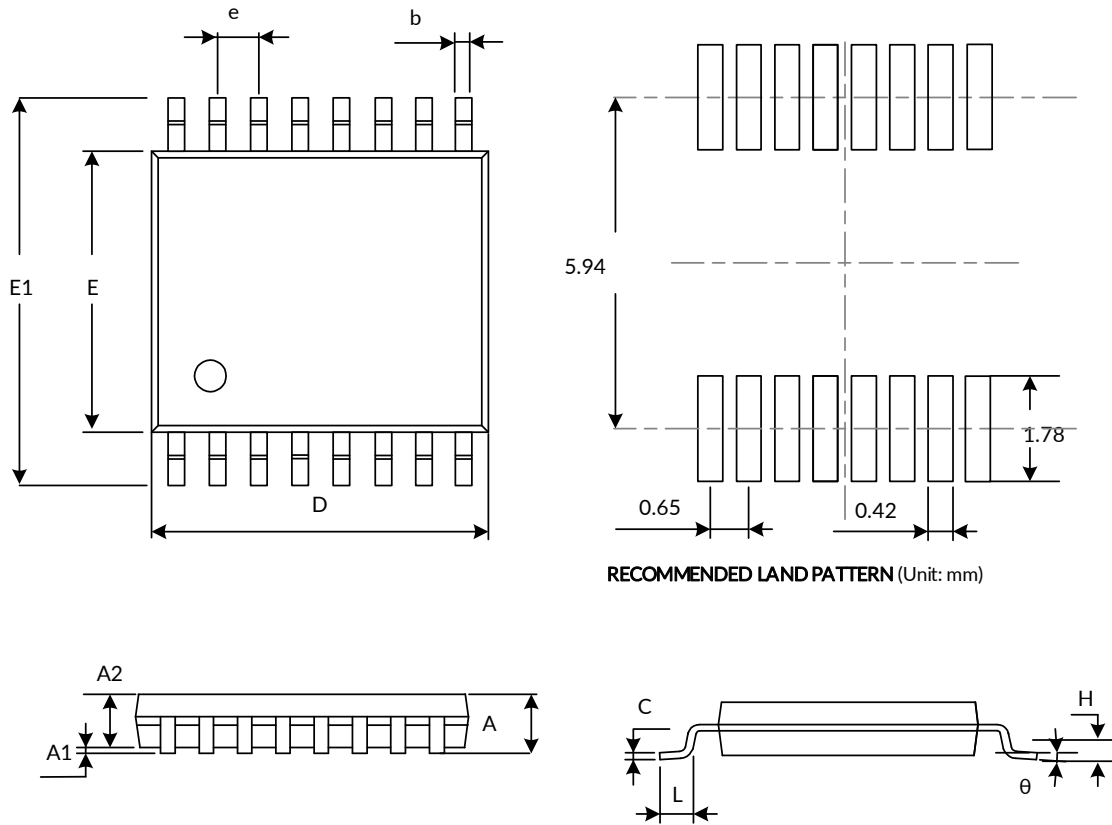
12 PACKAGE OUTLINE DIMENSIONS
SOIC-16(SOP16) [3]

RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A [1]		1.750		0.069
A1	0.100	0.225	0.004	0.009
A2	1.300	1.500	0.051	0.059
b	0.390	0.470	0.015	0.019
c	0.200	0.240	0.008	0.009
D [1]	9.800	10.000	0.386	0.394
E [1]	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC) [2]		0.050(BSC) [2]	
L	0.500	0.800	0.020	0.031
θ	0°	8°	0°	8°

NOTE:
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

TSSOP-16 [3]

RECOMMENDED LAND PATTERN (Unit: mm)

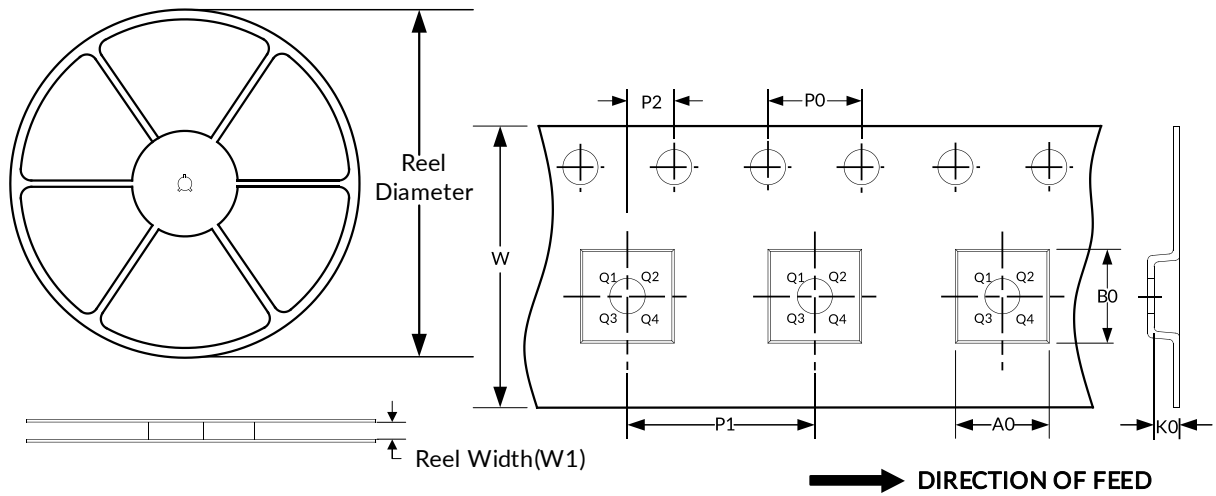| Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A [1]		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D [1]	4.860	5.100	0.191	0.201
E [1]	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650(BSC) [2]		0.026(BSC) [2]	
L	0.500	0.700	0.02	0.028
H	0.25TYP		0.01TYP	
θ	1°	7°	1°	7°

NOTE:
    1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
    2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
    3. This drawing is subject to change without notice.

13 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
SOIC-16(SOP16)	13"	16.4	6.50	10.30	2.10	4.0	8.0	2.0	16.0	Q1
TSSOP-16	13"	12.4	6.90	5.60	1.20	4.0	8.0	2.0	12.0	Q1

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.

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