

RS2G139 Dual 2-Line to 4-Line Decoders/Demultiplexers

1 FEATURES

- **Operating Voltage Range: 2V to 5.5V**
- **Low Power Consumption: 160 μ A (Max)**
- **Operating Temperature Range: -40°C to +125°C**
- **Inputs Accept Voltage to 5.5V**
- **PACKAGES: SOP16 and TSSOP16**

2 APPLICATIONS

- **LED Displays**
- **Servers**
- **White Goods**
- **Power Infrastructure**
- **Factory Automation**

3 DESCRIPTIONS

The RS2G139, a dual 2-to-4-line decoder is designed for 2V to 5.5V.

Each decoder is consisting of two select inputs (nA and nB), one enable input $n\bar{G}$ and four outputs (nY0 to nY3). The active-low enable ($n\bar{G}$) input can be used as a data line in demultiplexing applications.

The RS2G139 is available in Green SOP16 and TSSOP16 packages. It operates over an ambient temperature range of -40°C to +125°C.

Device Information ⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS2G139	SOP16	9.90mm×3.90mm
	TSSOP16	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 differ from page numbers in the current version.

Version	Change Date	Change Item
A.1	2023/08/28	Initial version completed
A.1.1	2024/02/29	Modify packaging naming

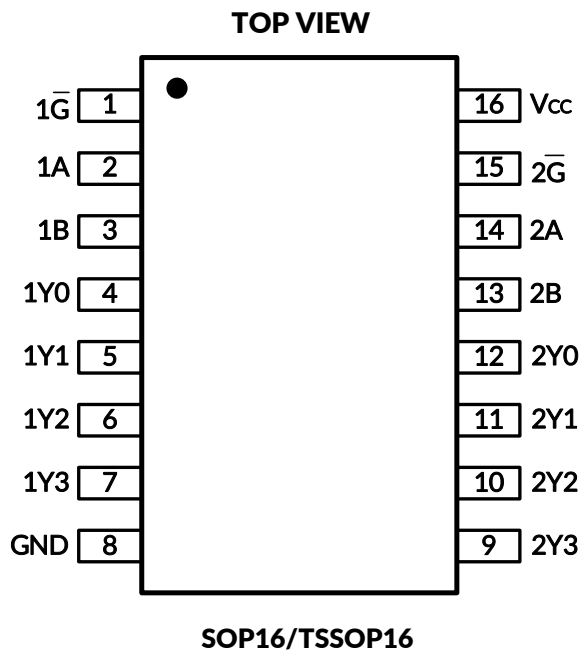
5 PACKAGE/ORDERING INFORMATION ⁽¹⁾

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING ⁽²⁾	MSL ⁽³⁾	PACKAGE OPTION
RS2G139	RS2G139XS16-G	-40°C ~+125°C	SOP16	RS2G139	MSL1	Tape and Reel,4000
	RS2G139XTSS16-G	-40°C ~+125°C	TSSOP16	RS2G139	MSL1	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



PIN DESCRIPTION

PIN	NAME	I/O TYPE ⁽¹⁾	FUNCTION
SOP16/TSSOP16			
1	1 \bar{G}	I	Enable input (active LOW)
2	1A	I	Address input
3	1B	I	Address input
4	1Y0	I	Output
5	1Y1	I	Output
6	1Y2	I	Output
7	1Y3	O	Output
8	GND	-	Ground
9	2Y3	O	Output
10	2Y2	O	Output
11	2Y1	O	Output
12	2Y0	O	Output
13	2B	O	Address input
14	2A	O	Address input
15	2 \bar{G}	O	Enable input (active LOW)
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 diode current	For V _I < 0.5V or V _I > V _{CC} + 0.5V		±20 mA
I _{OK}	Output clamp diode current	For V _O < 0.5V or V _O > V _{CC} + 0.5V		±20 mA
I _O	Output source or sink current per output pin	For V _O > 0.5V or V _O < V _{CC} + 0.5V		±25 mA
	Continuous current through V _{CC} or GND		±50	mA
θ _{JA}	Package thermal impedance ⁽³⁾	SOP16		150
		TSSOP16		45
T _J	Junction temperature ⁽⁴⁾	-65	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_{θJA}, and T_A. The maximum allowable power dissipation at any ambient temperature is P_D = (T_{J(MAX)} - T_A) / R_{θJA}. 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}		2	5.5	V
Input voltage	V_I		0	V_{CC}	V
Output voltage	V_O		0	V_{CC}	V
Input 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

PARAMETER	TEST CONDITIONS ⁽⁴⁾	V_{CC}	Operating free-air temperature (T_A)									UNIT
			25°C			-40°C to 85°C			-40°C to 125°C			
			MIN ₍₂₎	TYP ₍₃₎	MAX ₍₂₎	MIN ₍₂₎	TYP ₍₃₎	MAX ₍₂₎	MIN ₍₂₎	TYP ₍₃₎	MAX ₍₂₎	
V_{IH}		2V	1.5			1.5			1.5			V
		4.5V	3.15			3.15			3.15			
		5.5V	3.85			3.85			3.85			
V_{IL}		2V			0.5			0.5			0.5	V
		4.5V			1.35			1.35			1.35	
		5.5V			1.65			1.65			1.65	
V_{OH}	$I_{OH} = -20\mu A$	2V	1.9			1.9			1.9			V
	$I_{OH} = -20\mu A$	4.5V	4.4			4.4			4.4			
	$I_{OH} = -20\mu A$	5.5V	5.4			5.4			5.4			
	$I_{OH} = -4mA$	4.5V	3.98			3.84			3.7			
	$I_{OH} = -5.2mA$	5.5V	4.95			4.81			4.67			
V_{OL}	$I_{OL} = 20\mu A$	2V			0.1			0.1			0.1	V
	$I_{OL} = 20\mu A$	4.5V			0.1			0.1			0.1	
	$I_{OL} = 20\mu A$	5.5V			0.1			0.1			0.1	
	$I_{OL} = 4mA$	4.5V			0.26			0.33			0.4	
	$I_{OL} = 5.2mA$	5.5V			0.26			0.33			0.4	
I_I	$V_I = V_{CC}$ or GND	5.5V			± 0.1			± 1			± 1	μA
I_{CC}	$V_I = V_{CC}$ or GND	5.5V			8			80			160	μA

(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.

(4) $V_I = V_{IH}$ or V_{IL} , unless otherwise noted.

7.5 Switching Characteristics

Input $t_t = 6\text{ns}$.

PARAMETER		TEST CONDITIONS	V_{CC}	Operating free-air temperature (T_A)									UNIT
				25°C			-40°C to 85°C			-40°C to 125°C			
				MIN (2)	TYP (3)	MAX (2)	MIN (2)	TYP (3)	MAX (2)	MIN (2)	TYP (3)	MAX (2)	
t_{pd}	Address to output	$C_L = 50\text{pF}$	2	51			54			55			ns
			4.5	11	16	18			19				
			5.5	14			16			17			
	Strobe $1\bar{G}, 2\bar{G}$ to output	$C_L = 50\text{pF}$	2	46			49			50			ns
			4.5	14			15			16			
			5.5	12			13			14			
t_t	Output transition time	$C_L = 50\text{pF}$	2	39			41			46			ns
			4.5	14			16			17			
			5.5	12			13			15			
C_{PD}	Power dissipation capacitance (4)	$C_L = 15\text{pF}$	5	67									pF
C_i	Input capacitance			10			10			10			pF

(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.

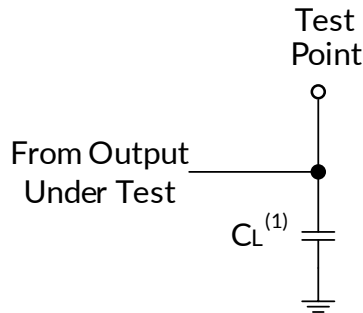
(4) C_{PD} is used to determine the dynamic power consumption, per gate.

8 Parameter Measurement Information

Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_t < 6 \text{ ns}$.

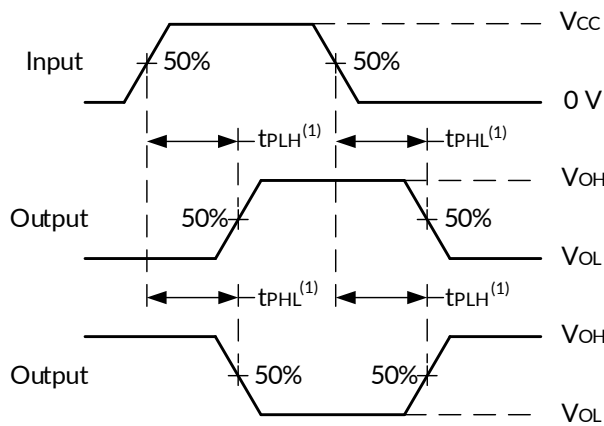
For clock inputs, f_{max} is measured when the input duty cycle is 50%.

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



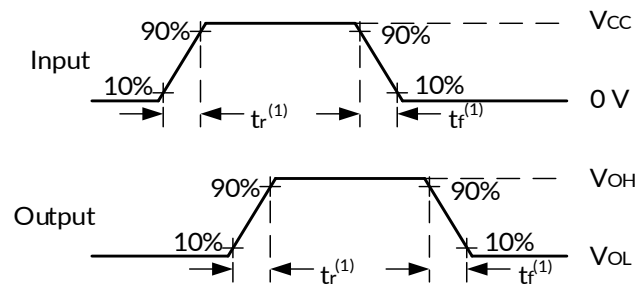
(1) C_L includes probe and test-fixture capacitance.

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

The RS2G139 device decodes the 2-bit input to one of the four outputs. The B input is the most significant bit and the Y outputs are active low. The propagation delays are very short and well matched. Supply voltage from 2V to 5.5V is supported.

9.2 Functional Block Diagram

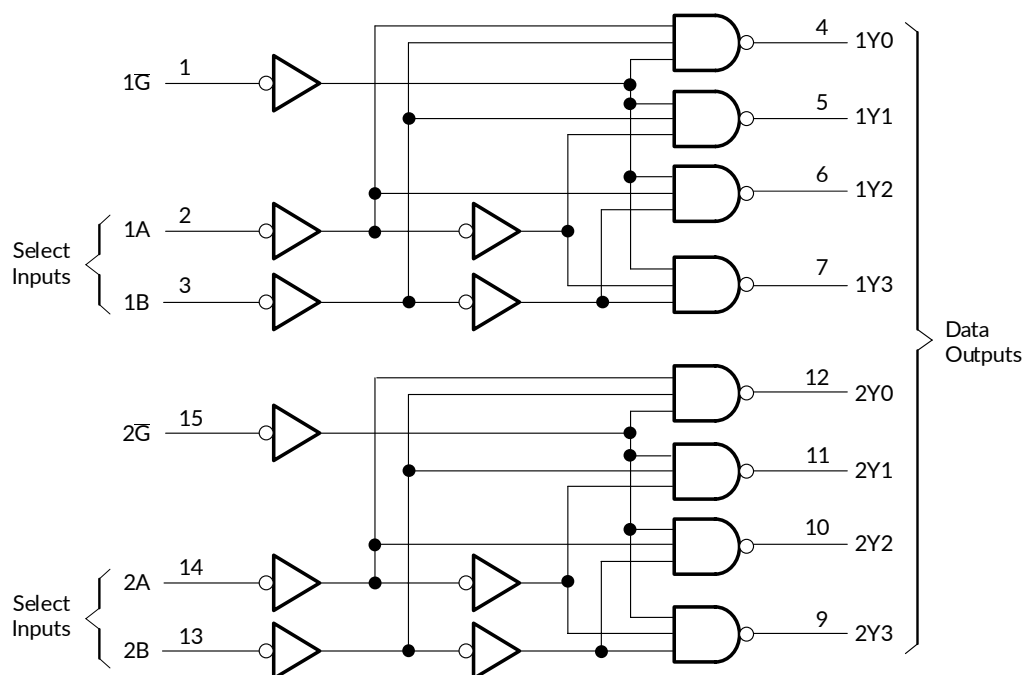


Figure 4. Functional Block Diagram

9.3 Device Functional Modes

Device Function Table

ENABLE INPUT	SELECT INPUTS		OUTPUTS			
\bar{G}	B	A	Y3	Y2	Y1	Y0
L	L	L	H	H	H	L
L	L	H	H	H	L	H
L	H	L	H	L	H	H
L	H	H	L	H	H	H
H	X	X	H	H	H	H

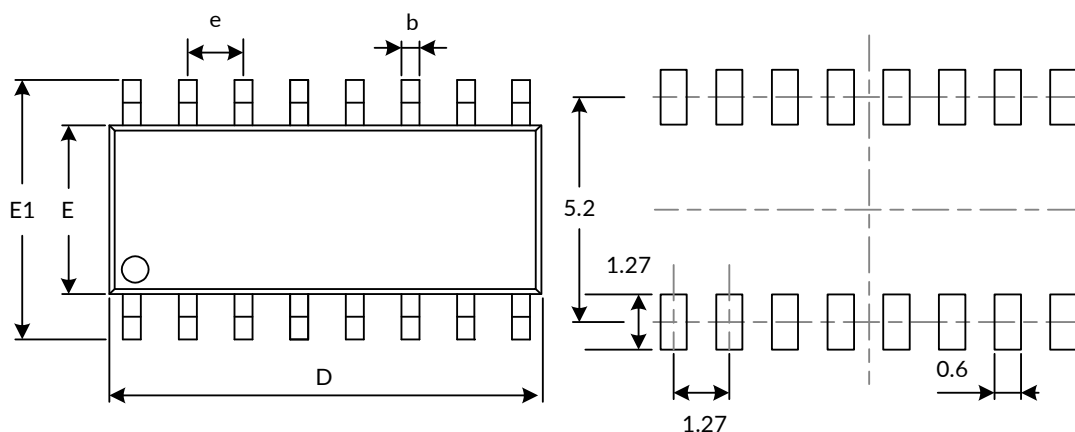
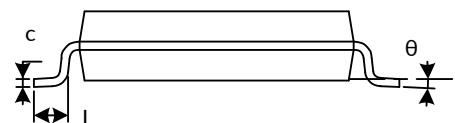
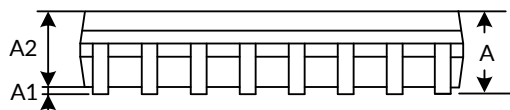
H: High Voltage Level

L: Low Voltage Level

X: Don't care

10 PACKAGE OUTLINE DIMENSIONS

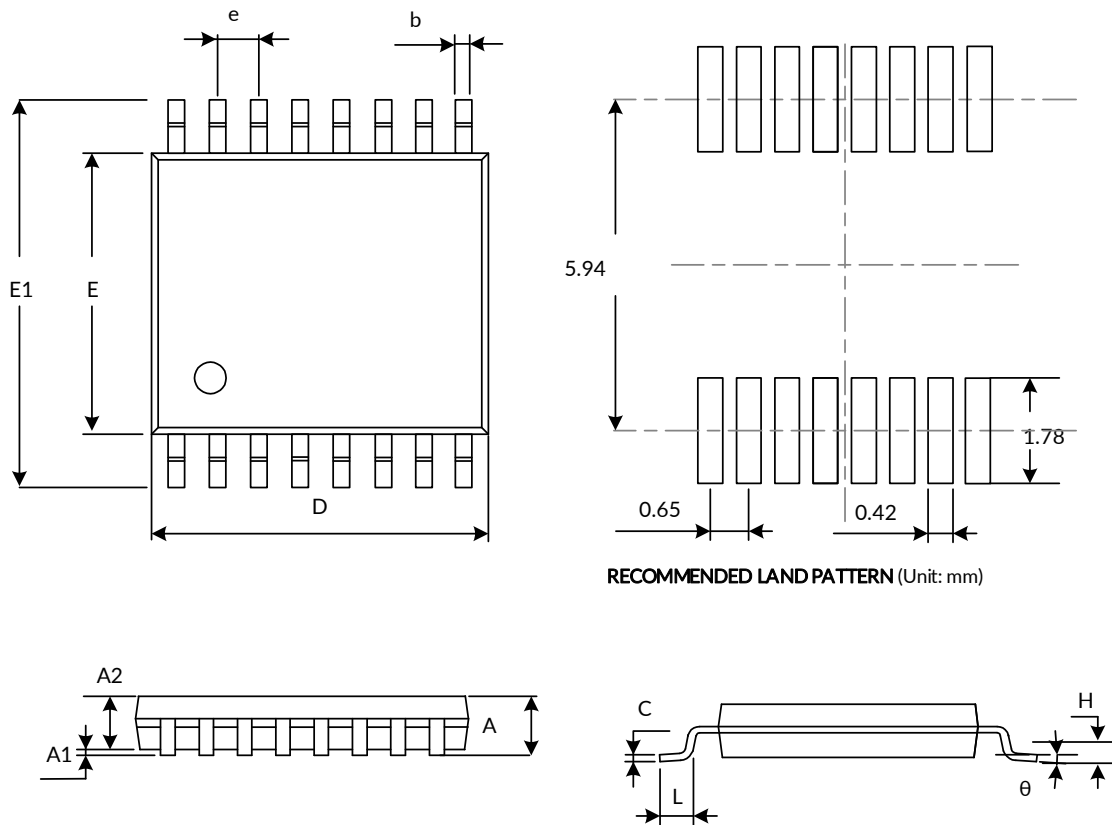
SOP16⁽³⁾


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.

TSSOP16 (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°

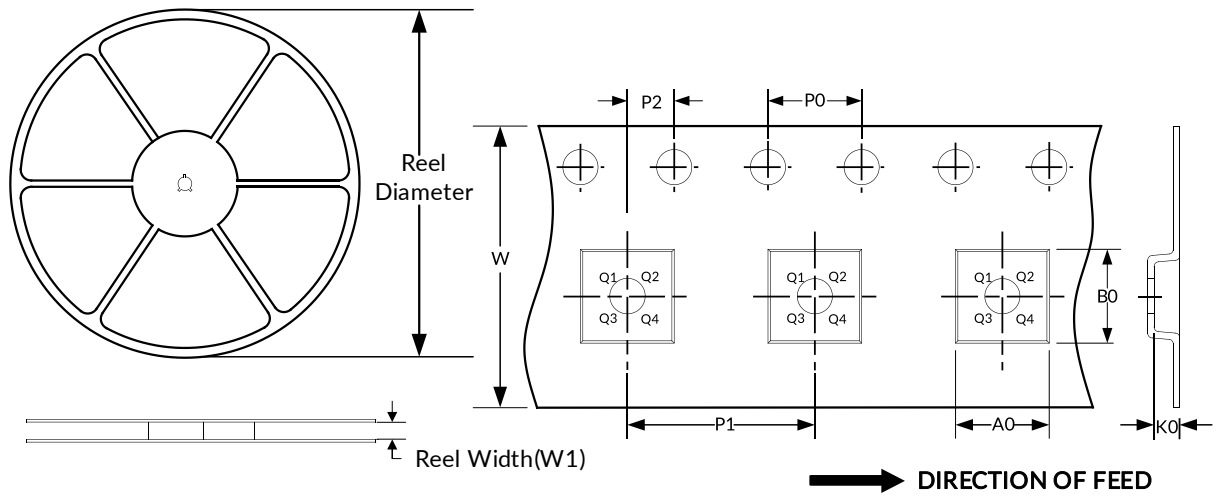
NOTE:

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.

11 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
SOP16	13"	16.4	6.50	10.30	2.10	4.0	8.0	2.0	16.0	Q1
TSSOP16	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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