

# RS4G32-Q1 Quadruple 2-Input Positive-OR Gate

## 1 FEATURES

- **Qualified for Automotive Applications**
- **AEC-Q100 Qualified with the Grade 1**
- **Operating Voltage Range:1.65V to 5.5V**
- **Low Power Consumption:1μA (Max)**
- **Operating Temperature Range:  
-40°C to +125°C**
- **Inputs Accept Voltage to 5.5V**
- **High Output Drive: ±24mA at V<sub>CC</sub>=3.0V**
- **Micro SIZE PACKAGES: SOP14 and TSSOP14**

## 2 APPLICATIONS

- **Qualified for Automotive Applications**
- **Increase Digital Signal Drive Strength**
- **Automotive Infotainment**
- **Automotive HEV/EV Powertrain**

### LOGIC SYMBOL



## 3 DESCRIPTIONS

The RS4G32-Q1 Quadruple 2-input positive-OR gate is designed for 1.65V to 5.5V V<sub>CC</sub> operation.

The RS4G32-Q1 device performs the Boolean function  $Y=A + B$  or  $Y= \overline{A} \cdot \overline{B}$  in positive logic. The device is fully specified for partial-power-down applications using I<sub>off</sub>. The I<sub>off</sub> circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

The RS4G32-Q1 is available in Green SOP14 and TSSOP14 packages. It operates over an ambient temperature range of -40°C to +125°C.

### Device Information <sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS4G32-Q1	SOP14	8.65mm×3.90mm
	TSSOP14	5.00mm×4.40mm

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

## 4 FUNCTION TABLE

INPUTS		OUTPUT
A	B	Y
H	H	H
L	H	H
H	L	H
L	L	L

Y=A+B

H=High Voltage Level

L=Low Voltage Level

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## 5 Revision History

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

Version	Change Date	Change Item
A.0	2023/12/15	Preliminary version completed
A.0.1	2024/03/06	Modify packaging naming
A.1	2024/03/22	Initial version completed

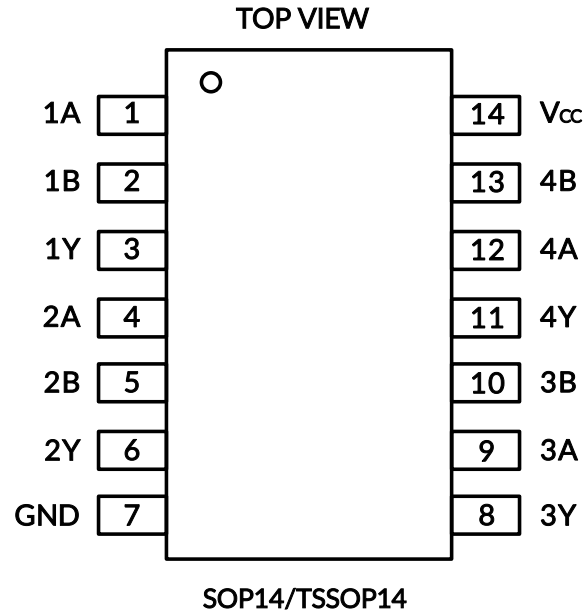
**6 PACKAGE/ORDERING INFORMATION (1)**

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	Lead finish/Ball material <sup>(2)</sup>	MSL Peak Temp <sup>(3)</sup>	PACKAGE MARKING <sup>(4)</sup>	PACKAGE OPTION
RS4G32 -Q1	RS4G32XP -Q1	-40°C ~+125°C	SOP14	Planting Sn	MSL1-260°- Unlimited	RS4G32	Tape and Reel,4000
	RS4G32XQ -Q1	-40°C ~+125°C	TSSOP14	Planting Sn	MSL1-260°- Unlimited	RS4G32	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.
- (4) 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.

## 7 PIN CONFIGURATIONS



### PIN DESCRIPTION

PIN	NAME	I/O TYPE <sup>(1)</sup>	FUNCTION
SOP14/TSSOP14			
1	1A	I	Channel 1 logic input
2	1B	I	Channel 1 logic input
3	1Y	O	Logic level output1
4	2A	I	Channel 2 logic input
5	2B	I	Channel 2 logic input
6	2Y	O	Logic level output2
7	GND	-	Ground
8	3Y	O	Logic level output3
9	3A	I	Channel 3 logic input
10	3B	I	Channel 3 logic input
11	4Y	O	Logic level output4
12	4A	I	Channel 4 logic input
13	4B	I	Channel 4 logic input
14	Vcc	-	Power Supply

(1) I=input, O=output, P=power.

## 8 Specifications

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

over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup> <sup>(2)</sup>

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage range	-0.5	6.5	V
V <sub>I</sub>	Input voltage range <sup>(2)</sup>	-0.5	6.5	V
V <sub>O</sub>	Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup>	-0.5	6.5	V
V <sub>O</sub>	Voltage range applied to any output in the high or low state <sup>(2)</sup> <sup>(3)</sup>	-0.5	V <sub>CC</sub> +0.5	V
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> <0	-50	mA
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> <0	-50	mA
I <sub>O</sub>	Continuous output current		±50	mA
	Continuous current through V <sub>CC</sub> or GND		±100	mA
θ <sub>JA</sub>	Package thermal impedance <sup>(4)</sup>	SOP14	105	°C/W
		TSSOP14	90	
T <sub>J</sub>	Junction temperature <sup>(5)</sup>	-65	150	°C
T <sub>stg</sub>	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 value of V<sub>CC</sub> is provided in the Recommended Operating Conditions table.

(4) The package thermal impedance is calculated in accordance with JEDEC-51.

(5) The maximum power dissipation is a function of T<sub>J(MAX)</sub>, R<sub>θJA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any ambient temperature is P<sub>D</sub> = (T<sub>J(MAX)</sub> - T<sub>A</sub>) / R<sub>θJA</sub>. All numbers apply for packages soldered directly onto a PCB.

### 8.2 ESD Ratings

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

		VALUE	UNIT	
V <sub>(ESD)</sub>	Electrostatic discharge	Human-Body Model (HBM), per AEC Q100-002 <sup>(1)</sup>	±2000	V
		Charged-Device Model (CDM), per AEC Q100-011	±1000	V
		Latch-Up (LU), per AEC Q100-004	±100	mA

(1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.



#### 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.

## 9 ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range (TYP values are at  $T_A = +25^{\circ}\text{C}$ , Full= $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ , unless otherwise noted.)<sup>(1)</sup>

### 9.1 Recommended Operating Conditions

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Supply voltage	$V_{CC}$	Operating	1.65	5.5	V
		Data retention only	1.5	5.5	
High-level input voltage	$V_{IH}$	$V_{CC}=1.65\text{V to }1.95\text{V}$	$0.65 \times V_{CC}$		V
		$V_{CC}=2.3\text{V to }2.7\text{V}$	1.7		
		$V_{CC}=3\text{V to }3.6\text{V}$	2.3		
		$V_{CC}=4.5\text{V to }5.5\text{V}$	$0.7 \times V_{CC}$		
Low-level input voltage	$V_{IL}$	$V_{CC}=1.65\text{V to }1.95\text{V}$		$0.25 \times V_{CC}$	V
		$V_{CC}=2.3\text{V to }2.7\text{V}$		0.6	
		$V_{CC}=3\text{V to }3.6\text{V}$		0.8	
		$V_{CC}=4.5\text{V to }5.5\text{V}$		$0.3 \times V_{CC}$	
Input voltage	$V_I$		0	5.5	V
Output voltage	$V_O$		0	$V_{CC}$	V
Input transition rise or fall	$t_r, t_f$	$V_{CC}=1.8\text{V} \pm 0.15\text{V}, 2.5\text{V} \pm 0.2\text{V}$		20	ns/V
		$V_{CC}=3.3\text{V} \pm 0.3\text{V}$		10	
		$V_{CC}=5\text{V} \pm 0.5\text{V}$		5	
Operating temperature	$T_A$		-40	125	$^{\circ}\text{C}$

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

## 9.2 DC Characteristics

PARAMETER		TEST CONDITIONS	V <sub>CC</sub>	TEMP	MIN <sup>(2)</sup>	TYP <sup>(3)</sup>	MAX <sup>(2)</sup>	UNIT
V <sub>OH</sub>		I <sub>OH</sub> = -100μA	1.65V to 5.5V	Full	V <sub>CC</sub> -0.1			V
		I <sub>OH</sub> = -4mA	1.65V		1.2			
		I <sub>OH</sub> = -8mA	2.3V		1.9			
		I <sub>OH</sub> = -16mA	3V		2.4			
		I <sub>OH</sub> = -24mA			2.3			
		I <sub>OH</sub> = -32mA	4.5V		3.8			
V <sub>OL</sub>		I <sub>OL</sub> = 100μA	1.65V to 5.5V	Full			0.1	V
		I <sub>OL</sub> = 4mA	1.65V				0.45	
		I <sub>OL</sub> = 8mA	2.3V				0.3	
		I <sub>OL</sub> = 16mA	3V				0.4	
		I <sub>OL</sub> = 24mA					0.55	
		I <sub>OL</sub> = 32mA	4.5V				0.55	
I <sub>i</sub>	A or B inputs	V <sub>i</sub> =5.5V or GND	0V to 5.5V	+25°C		±0.1	±1	μA
				Full			±5	
I <sub>off</sub>		V <sub>i</sub> or V <sub>o</sub> =5.5V	0V	+25°C		±0.1	±1	μA
				Full			±10	
I <sub>CC</sub>		V <sub>i</sub> =5.5V or GND, I <sub>o</sub> =0	1.65V to 5.5V	+25°C		0.1	1	μA
				Full			10	
ΔI <sub>CC</sub>		One input at V <sub>CC</sub> -0.6V, Other inputs at V <sub>CC</sub> or GND	3V to 5.5V	Full			500	μA
C <sub>i</sub> (Input Capacitance)		V <sub>i</sub> =V <sub>CC</sub> or GND	3.3V	+25°C		4		pF

(1) All unused inputs of the device must be held at V<sub>CC</sub> 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.

## 9.3 AC Characteristics

(T<sub>A</sub> = -40°C to +125°C, typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)<sup>(1)</sup>

PARAMETER	SYMBOL	TEST CONDITIONS		TEMP	MIN <sup>(2)</sup>	TYP <sup>(3)</sup>	MAX <sup>(2)</sup>	UNIT
Propagation Delay	t <sub>pd</sub>	V <sub>CC</sub> =1.8V±0.15V	C <sub>L</sub> =30pF, R <sub>L</sub> =1kΩ	Full	9		36	ns
		V <sub>CC</sub> =2.5V±0.2V	C <sub>L</sub> =30pF, R <sub>L</sub> =500Ω	Full	4		16	
		V <sub>CC</sub> =3.3V±0.3V	C <sub>L</sub> =50pF, R <sub>L</sub> =500Ω	Full	3		12.5	
		V <sub>CC</sub> =5V±0.5 V	C <sub>L</sub> =50pF, R <sub>L</sub> =500Ω	Full	2.5		10	
Power dissipation capacitance	C <sub>pd</sub>	V <sub>CC</sub> =1.8V	f=10MHz	+25°C		20		pF
		V <sub>CC</sub> =2.5V				21		
		V <sub>CC</sub> =3.3V				22		
		V <sub>CC</sub> =5V				25		

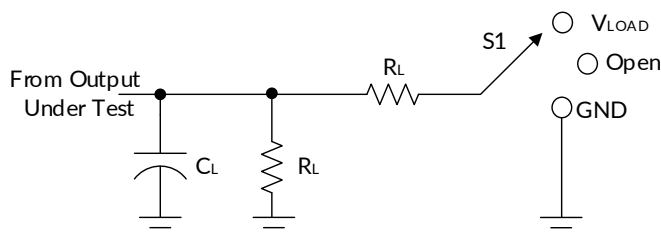
(1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation.

(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.

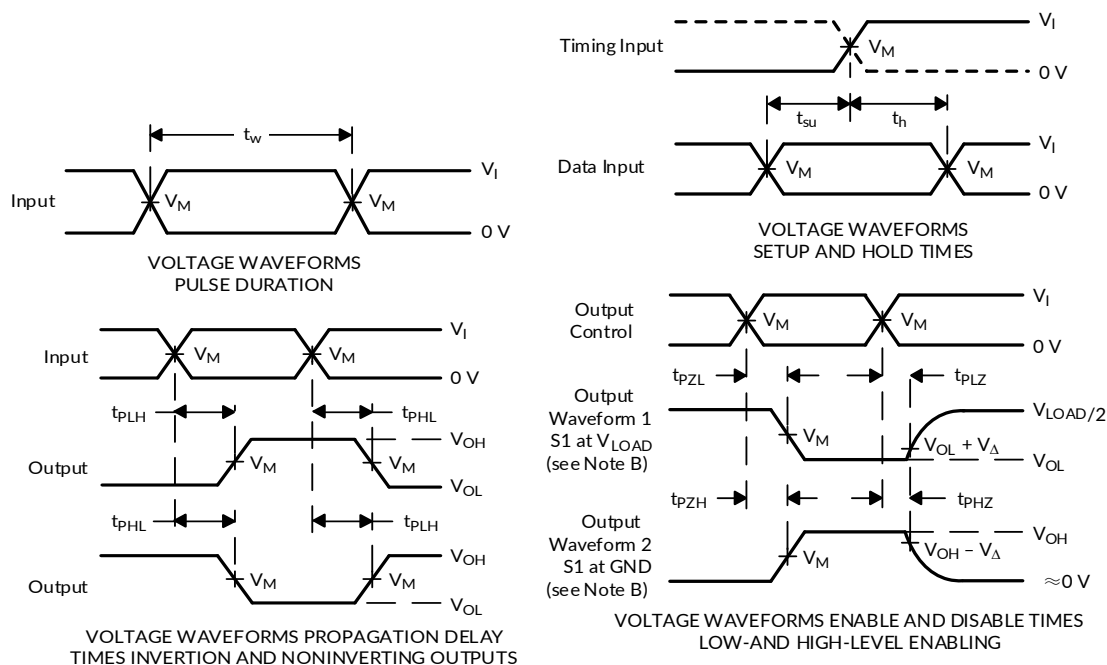


## 10 Parameter Measurement Information



TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$V_{LOAD}$
$t_{PHZ}/t_{PZH}$	GND

$V_{CC}$	INPUTS		$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_{\Delta}$
	$V_I$	$t_r/t_f$					
$1.8V \pm 0.15V$	$V_{CC}$	$\leq 2ns$	$V_{CC}/2$	$2 \times V_{CC}$	30pF	1k $\Omega$	0.15V
$2.5V \pm 0.2V$	$V_{CC}$	$\leq 2ns$	$V_{CC}/2$	$2 \times V_{CC}$	30pF	500 $\Omega$	0.15V
$3.3V \pm 0.3V$	3V	$\leq 2.5ns$	1.5V	6V	50pF	500 $\Omega$	0.3V
$5V \pm 0.5V$	$V_{CC}$	$\leq 2.5ns$	$V_{CC}/2$	$2 \times V_{CC}$	50pF	500 $\Omega$	0.3V

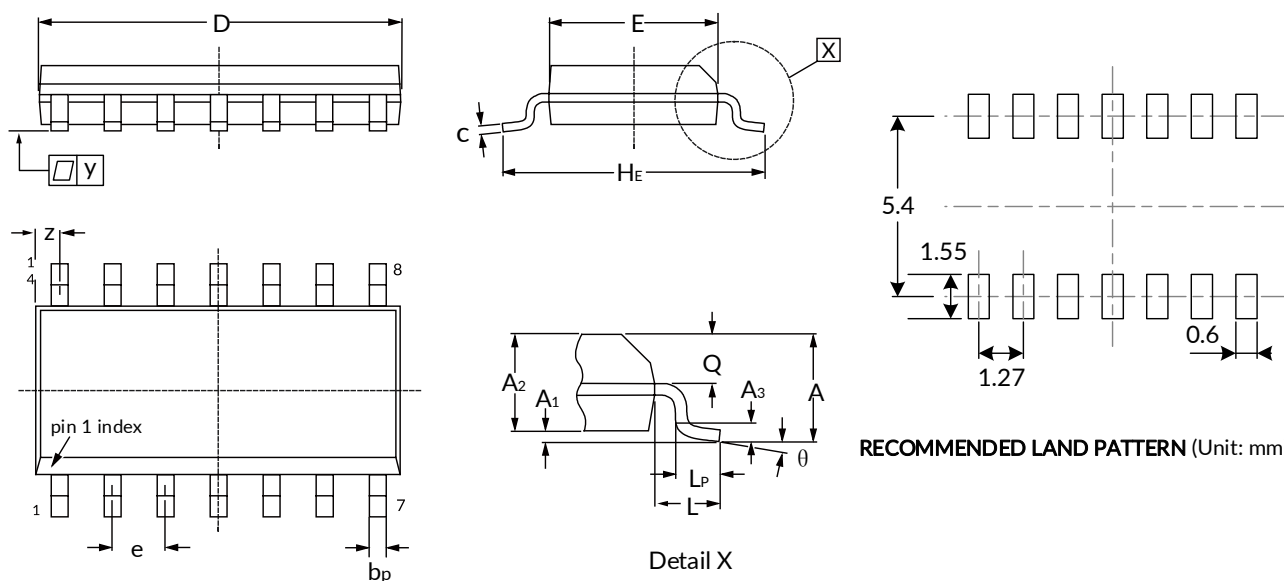


- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
  - C. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_o = 50 \Omega$ .
  - D. The outputs are measured one at a time, with one transition per measurement.
  - E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - H. All parameters and waveforms are not applicable to all devices.

**Figure 1. Load Circuit and Voltage Waveforms**

# 11 PACKAGE OUTLINE DIMENSIONS

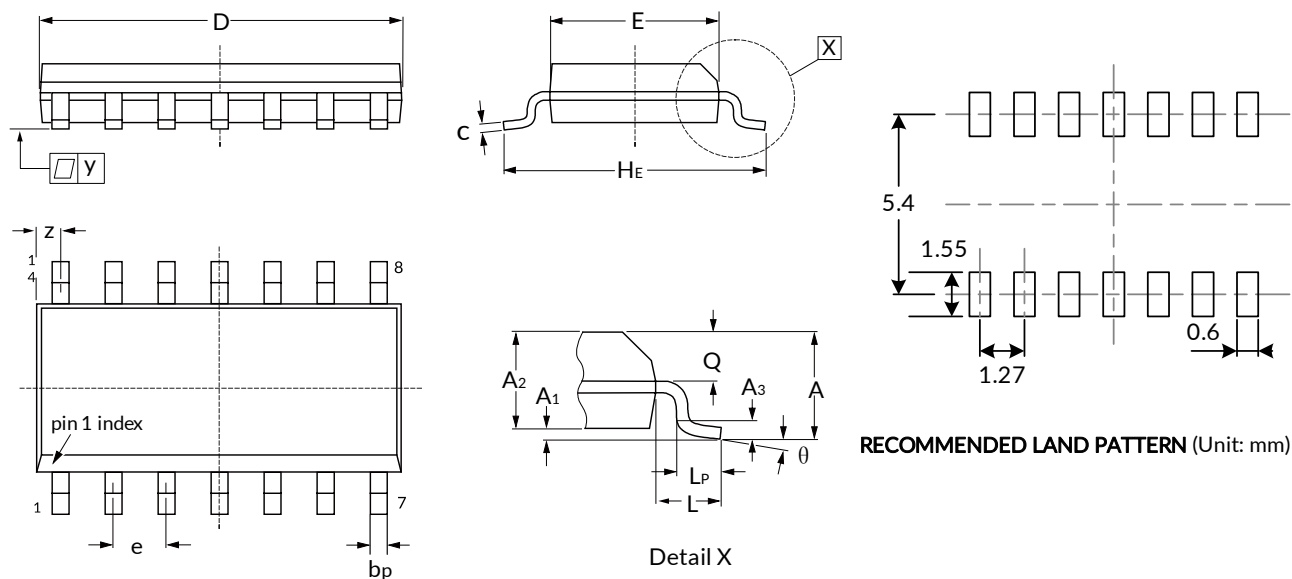
## SOP14 (2)


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

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A <sup>(1)</sup>		1.750		0.069
A <sub>1</sub>	0.100	0.250	0.004	0.010
A <sub>2</sub>	1.250	1.450	0.049	0.057
A <sub>3</sub>	0.25		0.010	
b <sub>p</sub>	0.360	0.490	0.014	0.019
c	0.190	0.250	0.007	0.010
D <sup>(1)</sup>	8.550	8.750	0.340	0.350
E <sup>(1)</sup>	3.800	4.000	0.150	0.160
H <sub>E</sub>	5.800	6.200	0.228	0.244
e	1.270		0.050	
L	1.05		0.041	
L <sub>p</sub>	0.400	1.000	0.016	0.039
Q	0.600	0.700	0.024	0.028
Z	0.300	0.700	0.012	0.028
y	0.1		0.004	
θ	0°	8°	0°	8°

**NOTE:**

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. This drawing is subject to change without notice.

**TSSOP14 (2)**


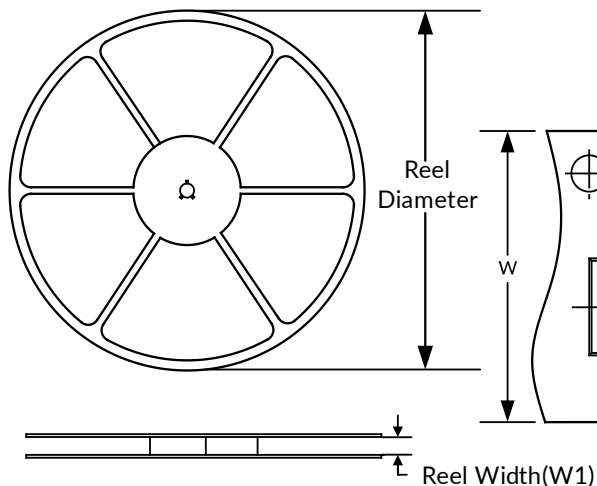
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A <sup>(1)</sup>		1.100		0.043
A <sub>1</sub>	0.050	0.150	0.002	0.006
A <sub>2</sub>	0.800	0.950	0.031	0.037
A <sub>3</sub>	0.25		0.010	
b <sub>p</sub>	0.190	0.300	0.007	0.012
c	0.100	0.200	0.004	0.008
D <sup>(1)</sup>	4.900	5.100	0.193	0.201
E <sup>(1)</sup>	4.300	4.500	0.169	0.177
H <sub>E</sub>	6.200	6.600	0.244	0.260
e	0.650		0.026	
L	1		0.039	
L <sub>p</sub>	0.500	0.750	0.020	0.030
Q	0.300	0.400	0.012	0.016
Z	0.380	0.720	0.015	0.028
y	0.1		0.004	
$\theta$	0°	8°	0°	8°

**NOTE:**

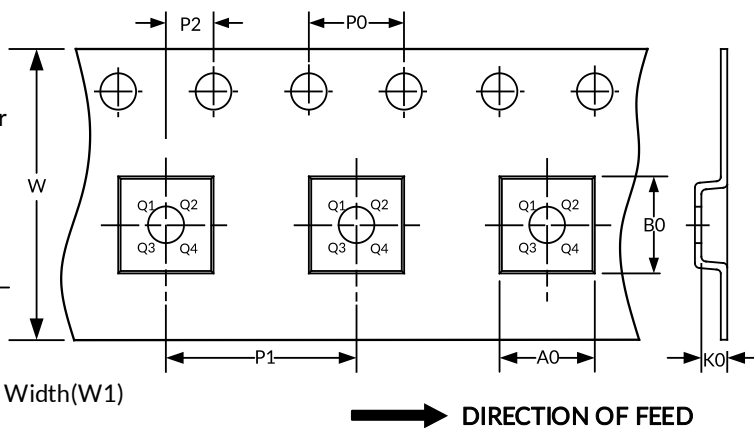
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. This drawing is subject to change without notice.

## 12 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
SOP14	13"	16.4	6.60	9.30	2.10	4.0	8.0	2.0	16.0	Q1
TSSOP14	13"	12.4	6.95	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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