

Low-Power, Low Offset, Four Comparators

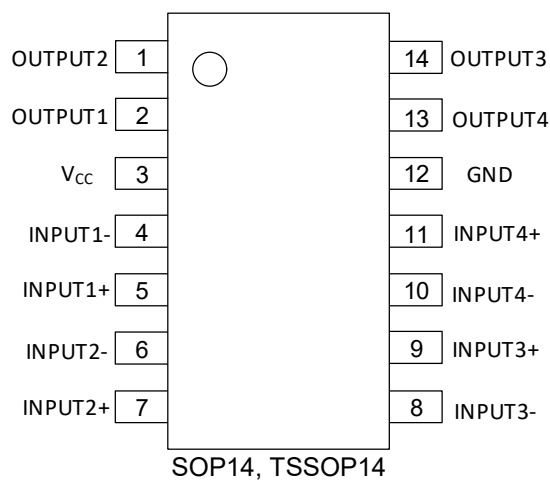
FEATURES

- **Low Power Consumption: 0.9mA (TYP)**
- **Single Supply Voltage Range: 2V to 36V**
- **Dual Supplies Voltage Range: $\pm 1V$ to $\pm 18V$**
- **Low Input Offset Voltage: 2.0mV (TYP)**
- **Open Collector Output**
- **Low Input Bias Current: 25nA (TYP)**
- **Low Input Offset Current: $\pm 5.0nA$ (TYP)**
- **Input Common-Mode Voltage Range to 0V**
- **Differential Input Voltage Range Equals to the Power Supply Voltage**
- **Low Output Saturation Voltage: 200mV at 4mA**
- **Operating Temperature Range: $-40^{\circ}C$ to $+125^{\circ}C$**

APPLICATIONS

- **Zero-Crossing Detectors**
- **RC Timers**
- **IR Receivers**
- **Threshold Detectors and Phase Discriminators**
- **Rotary Position Encoders**

PIN CONFIGURATION



PRODUCT DESCRIPTION

The TS339 is a four-channel high precision voltage comparator with a typical 2mV offset voltage. The device can be operated over a wide range of supply voltages. It can be used with a single supply or a dual supply as long as the difference between the two supplies is from 2V to 36V.

The device has a special feature that allows the input common-mode voltage to be set to negative power rail.

TS339 has an open-collector output buffer. This allows the output to be pulled to any voltage rail up to 36V, regardless of the supply voltage. Such open collector output stage makes the device compatible with transistor-transistor logic (TTL) as well as capable of driving a minimal 16mA current load such as lamps and relays.

ORDERING INFORMATION

Model	Part Number	Eco Plan	Package	CMP	Container, Pack Qty
TS339	TS339SOP14R	RoHS	SOP14	4	Reel,2500
TS339	TS339TSSOP14R	RoHS	TSSOP14	4	Reel,3000

ABSOLUTE MAXIMUM RATINGS

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

Parameter	Min	Max	Unit
Supply Voltage		40	V
Input Terminal Voltage	-0.3	40	V
Differential Input Voltage		40	V
Input Current		50	mA
Junction Temperature		150	°C
Storage Temperature Range	-65	150	°C
Lead Temperature (Soldering, 10s)		260	°C

- (1) Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Parameter	Min	Max	Unit
Supply Voltage Range	2	36	V
Operating Temperature Range	-40	+125	°C

ESD CAUTION



ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjects to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

ELECTRICAL CHARACTERISTICS

Boldface limits apply over the specified temperature range, $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$.

At $T_A = +25^{\circ}\text{C}$, $V_{CC} = 5\text{V}$, $\text{GND} = 0\text{V}$ (unless otherwise noted)

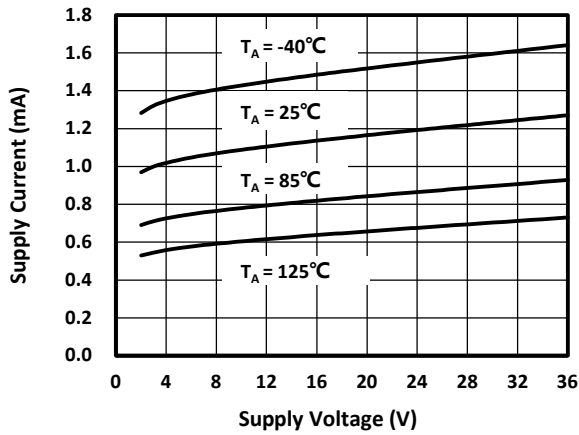
Parameter	Operating Conditions		Min	Typ	Max	Unit
V_S Power Supply Voltage			2		36	V
I_S Supply Current	$R_{PU} = \infty$	$V_{CC} = 5\text{V}$		0.9	2.0 3.0	mA mA
		$V_{CC} = 30\text{V}$		1.2	2.5 3.5	mA mA
Input Characteristics						
V_{OS} Input Offset Voltage	$V_{CC} = 5\text{V to } 30\text{V}$, $V_O = 1.4\text{V}$, $R_S = 0\Omega$ $T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$ $T_A = -40^{\circ}\text{C to } +125^{\circ}\text{C}$			2	5 7 15	mV
I_B Input Bias Current	I_{IN+} or I_{IN-} with Output in Linear Range $T_A = -40^{\circ}\text{C to } +125^{\circ}\text{C}$			25	250 400	nA nA
I_{OS} Input Offset Current	$I_{IN+} - I_{IN-}$ $T_A = -40^{\circ}\text{C to } +125^{\circ}\text{C}$			5.0	50 200	nA nA
G_V Voltage Gain	$V_{CC} = 15\text{V}$, $R_{PU} \geq 15\text{k}\Omega$, $V_O = 1\text{V to } 11\text{V}$		50	200		V/mV
V_{CM} Input Common Mode Voltage Range ⁽²⁾	$V_{CC} = 30\text{V}$ $T_A = -40^{\circ}\text{C to } +125^{\circ}\text{C}$		0		$V_{CC} - 1.5$ $V_{CC} - 2$	V
Output Characteristics						
V_{OL} Saturation Voltage	$V_{IN-} = 1\text{V}$, $V_{IN+} = 0\text{V}$, $I_{OUT} = -4\text{mA}$ $T_A = -40^{\circ}\text{C to } +125^{\circ}\text{C}$			200	400 500	mV mV
I_{OSC} Output Sink Current	$V_{IN-} = 1\text{V}$, $V_{IN+} = 0\text{V}$, $V_O = 1.5\text{V}$		6.0	16		mA
I_{IK} Output Leakage Current	$V_{IN-} = 0\text{V}$, $V_{IN+} = 1\text{V}$	$V_O = 5\text{V}$		0.1		nA
		$V_O = 30\text{V}$, $T_A = -40^{\circ}\text{C to } +125^{\circ}\text{C}$			1	μA
Dynamic Performance						
Large Signal Response Time	$V_{IN} = \text{TTL Logic Swing}$, $V_{REF} = 1.4\text{V}$ $V_{PU} = 5\text{V}$, $R_{PU} = 5.1\text{k}\Omega$			200		ns
Response Time	$V_{PU} = 5\text{V}$, $R_{PU} = 5.1\text{k}\Omega$			1.3		μs
Temperature Range						
Specified Range			-40		+125	$^{\circ}\text{C}$
	Storage Range		-65		+150	$^{\circ}\text{C}$
θ_{JA}	TSSOP14			110		$^{\circ}\text{C/W}$
	SOP14			89		$^{\circ}\text{C/W}$

(2) The input common-mode voltage of either input signal voltage should not be allowed to go negatively by more than 0.3V (at $+25^{\circ}\text{C}$). The upper end of the common-mode voltage range is $V_{CC} - 1.5\text{V}$ (at $+25^{\circ}\text{C}$), but either or both inputs can go to $+36\text{V}$ without damages, independent of the magnitude of the VCC.

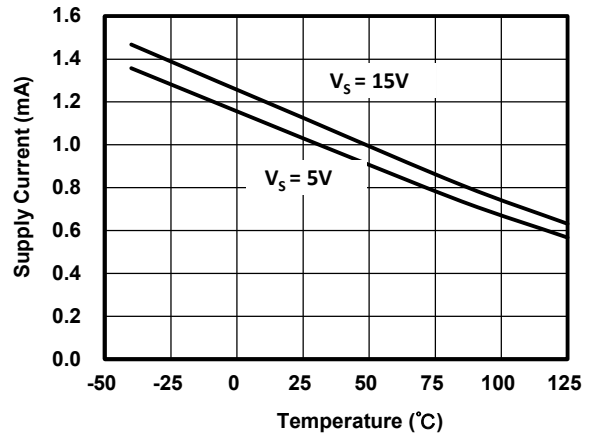
TYPICAL CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_{PU} = 15\text{k}\Omega$ (unless otherwise noted)

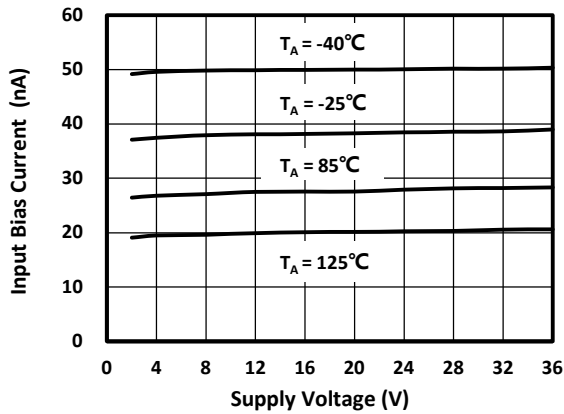
Supply Voltage vs Supply Current



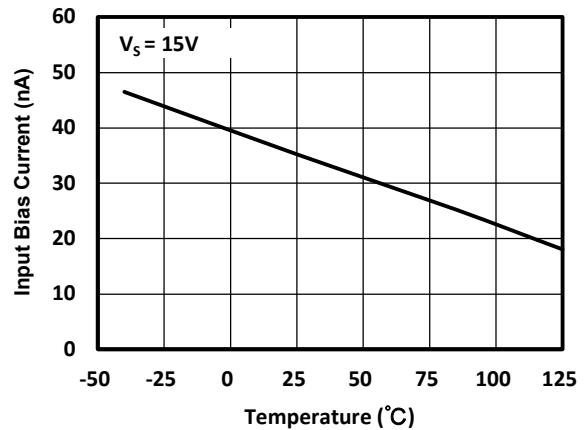
Supply Current vs Temperature



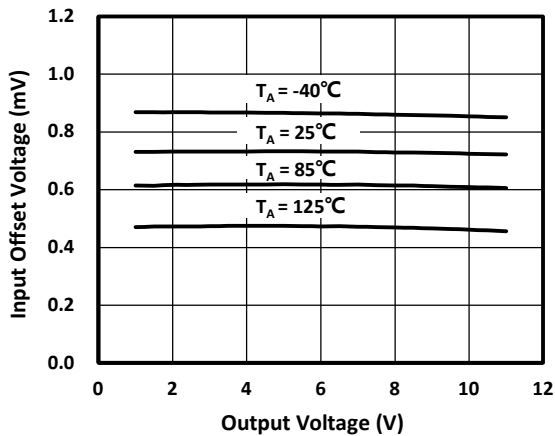
Input Bias Current vs Supply Voltage



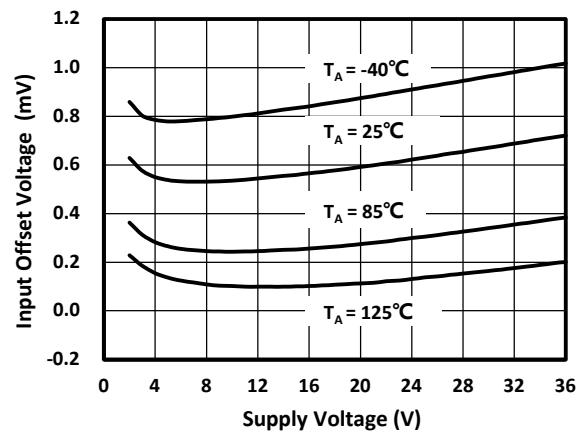
Input Bias Current vs Temperature



Input Offset Voltage vs Output Voltage

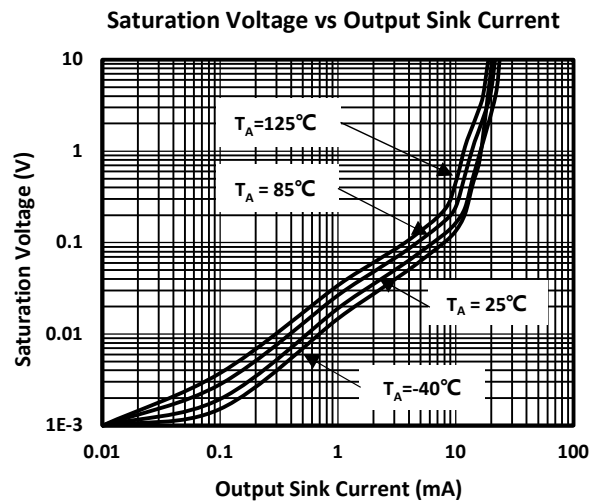
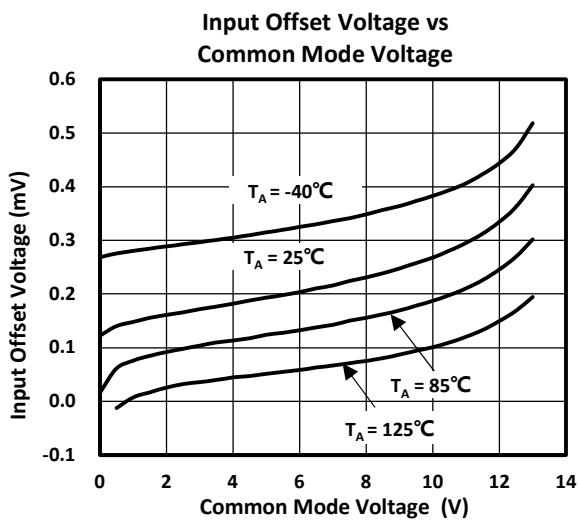
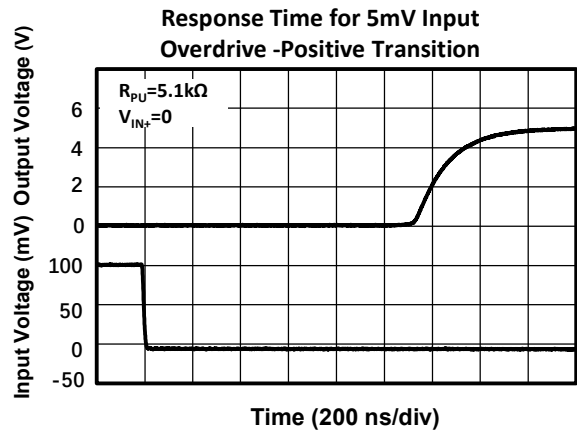
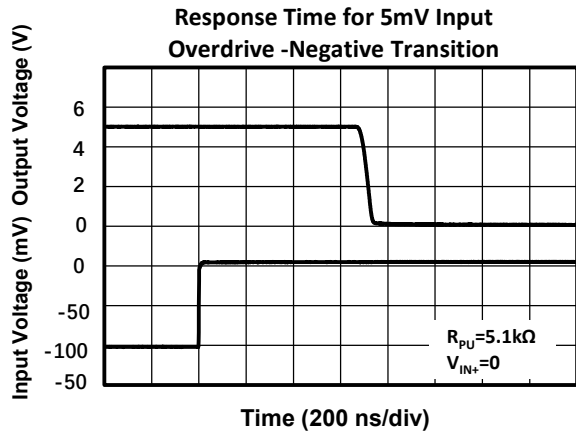


Input Offset Voltage vs Supply Voltage

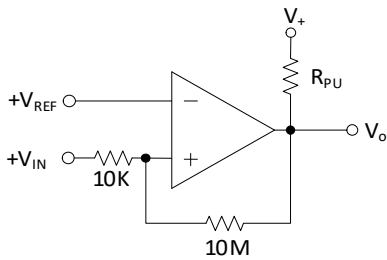


TYPICAL CHARACTERISTICS (CONTINUE)

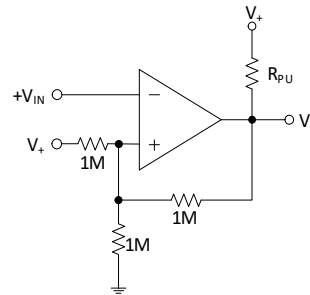
At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_{PU} = 15\text{k}\Omega$ (unless otherwise noted)



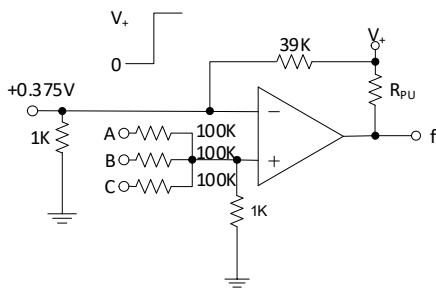
TYPICAL APPLICATION CIRCUIT



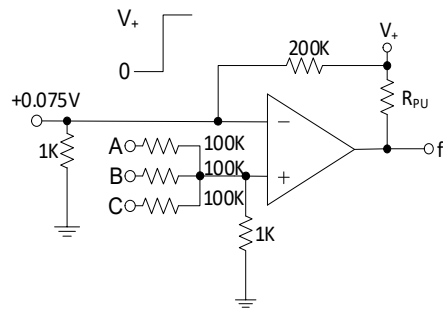
Non-Inverting Comparator with Hysteresis



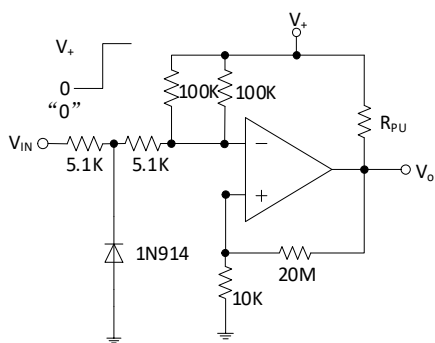
Inverting Comparator with Hysteresis



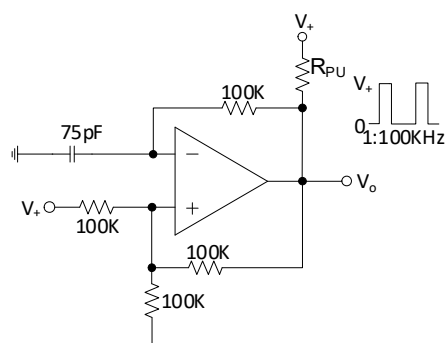
AND Gate



OR Gate



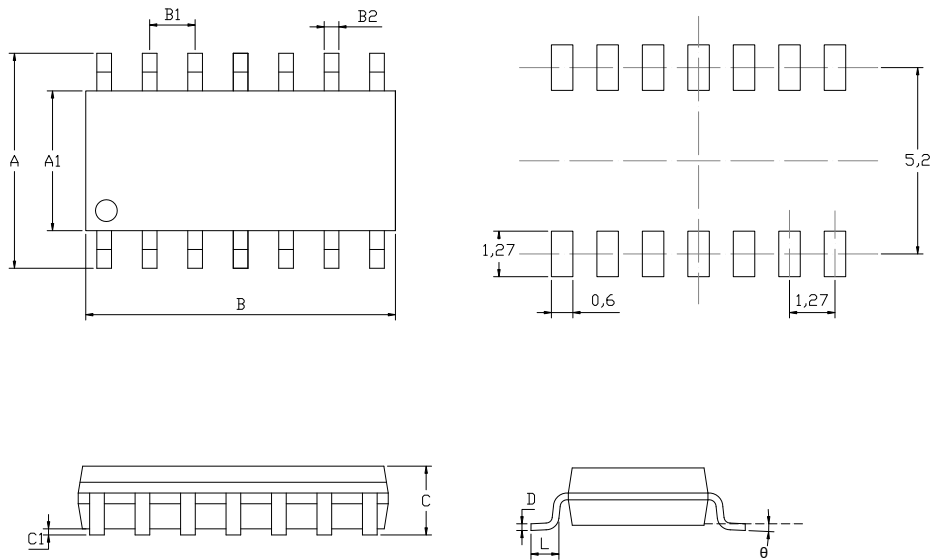
Zero Crossing Detector



Square Wave Oscillator

MECHANICAL DIMENSIONS

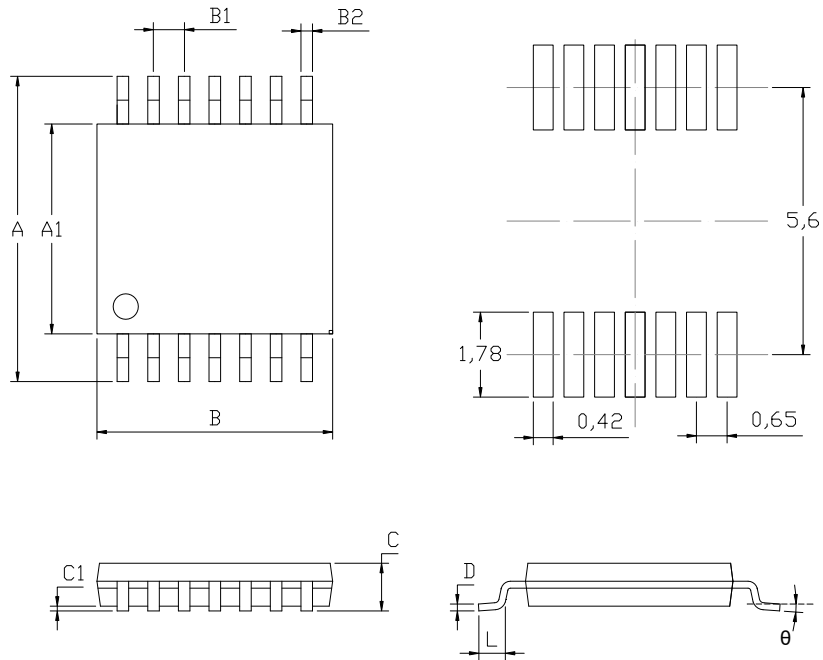
SOP14 PACKAGE MECHANICAL DRAWING



SOP14 PACKAGE MECHANICAL DATA

symbol	dimensions			
	millimeters		inches	
	min	max	min	max
A	5.800	6.200	0.228	0.244
A1	3.800	4.000	0.150	0.157
B	8.450	8.850	0.333	0.348
B1	1.270		0.050	
B2	0.310	0.510	0.012	0.020
C		1.750		0.069
C1	0.100	0.250	0.004	0.010
L	0.400	1.270	0.016	0.050
D	0.100	0.250	0.004	0.010
θ	0°	8°	0°	8°

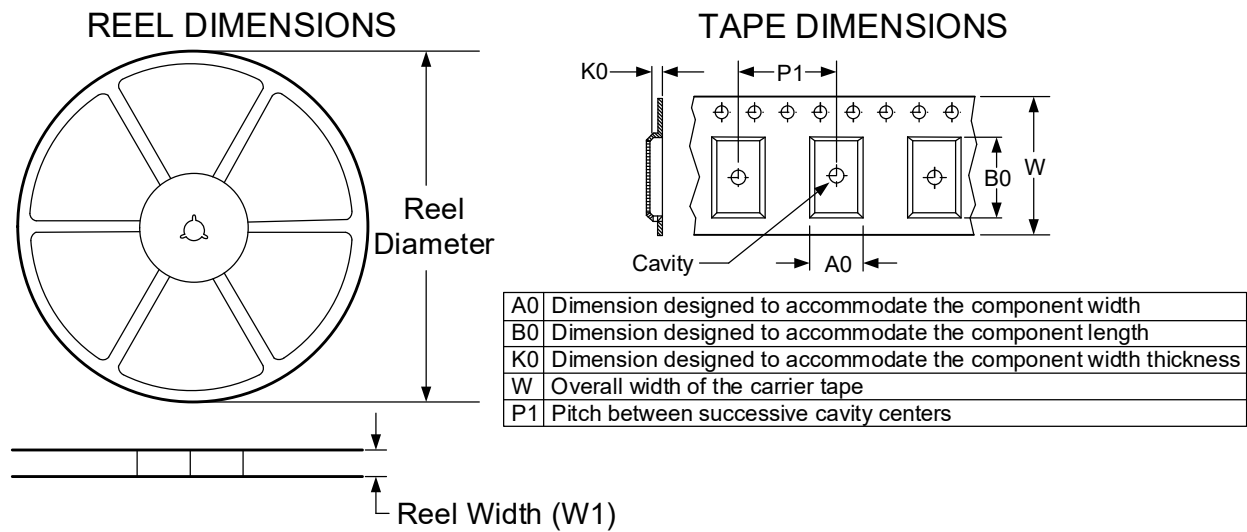
TSSOP14 PACKAGE MECHANICAL DRAWING



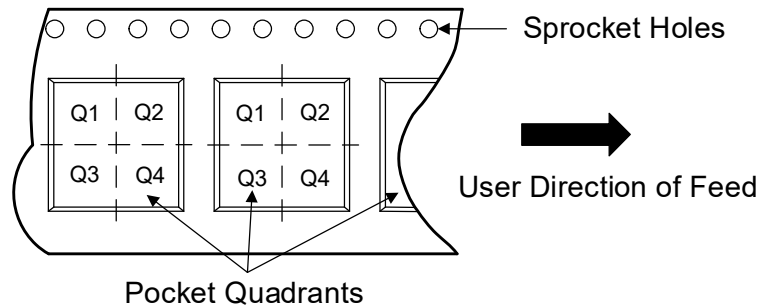
TSSOP14 PACKAGE MECHANICAL DATA

symbol	dimensions			
	millimeters		inches	
	min	max	min	max
A	6.25	6.55	0.246	0.258
A1	4.30	4.50	0.169	0.177
B	4.90	5.10	0.193	0.201
B1	0.65		0.026	
B2	0.19	0.30	0.007	0.012
C		1.20		0.047
C1	0.05	0.15	0.002	0.006
L	0.5	0.7	0.020	0.028
D	0.09	0.20	0.004	0.008
θ	1°	7°	1°	7°

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TS339SOP14R	SOP14	14	2500	330.0	12.4	6.5	9.0	2.1	8.0	16.0	Q1
TS339TSSOP14R	TSSOP14	14	3000	330.0	12.4	6.8	5.4	1.2	8.0	12.0	Q1

REVISION HISTORY

NOTE: Page numbers for previous revisions may be different from that of the current version.

2022/11/29 — REV KY1.0.0A to REV KY1.1.0A

Added TSSOP14 package1,2,3,8,9

CONTACT INFORMATION

Trusignal Microelectronics

Phone: +86 512-65923982

Fax: +86 512-65923995

Email: support@kunyuanic.com; sales@kunyuanic.com