14MHz, Precision, Rail-to-Rail I/O CMOS Operational Amplifier

1 FEATURES

- **HIGH GAIN BANDWIDTH:14MHz**
- **RAIL-TO-RAIL INPUT AND OUTPUT ±0.8mV Max Vos**
- **INPUT VOLTAGE RANGE: -0.1V to +5.6V with Vs = 5.5V**
- **SUPPLY RANGE: +2.7V to +5.5V**
- **SPECIFIED UP TO +125°C**

2 APPLICATIONS

- **SENSORS**
- **PHOTODIODE AMPLIFICATION**
- **ACTIVE FILTERS**
- **TEST EQUIPMENT**
- **DRIVING A/D CONVERTERS**

3 DESCRIPTIONS

The RS82XP families of products offer low voltage operation and rail-to-rail input and output, as well as excellent speed/power consumption ratio, providing an excellent bandwidth (14MHz) and slew rate of 10V/us. The op-amps are unity gain stable and feature an ultra-low input bias current.

The RS82XP has lower offset, which is guaranteed not upper than ±0.8mV at 25°C with V_S=5V, V_{CM}=V_S/2.

The devices are ideal for sensor interfaces, active filters and portable applications. The RS82XP families of operational amplifiers are specified at the full temperature range of -40°C to +125°C under single or dual power supplies of 2.7V to 5.5V.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE(NOM)
RS821P	SOT23-5	2.90mm×1.60mm
RS822P	SOP8	4.90mm×3.90mm
	MSOP8	3.00mm×3.00mm
RS824P	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.

Table of Contents

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	2022/04/08	Initial version completed
A.2	2023/09/22	Update ELECTRICAL CHARACTERISTICS on Page 10 in RevA.1
A.2.1	2024/03/01	Modify packaging naming
B.1	2025/04/28	1. Version Upgrade 2. Add MSL

5 PACKAGE/ORDERING INFORMATION [1]

Orderable Device	Package Type	Pin	Channel	Op Temp(°C)	Device Marking [2]	MSL [3]	Package Qty
RS821PXF	SOT23-5	5	1	-40°C ~125°C	821P	MSL3	Tape and Reel,3000
RS822PXK	SOP8	8	2	-40°C ~125°C	RS822P	MSL3	Tape and Reel,4000
RS822PXM	MSOP8	8	2	-40°C ~125°C	RS822P	MSL3	Tape and Reel,4000
RS824PXP	SOP14	14	4	-40°C ~125°C	RS824P	MSL3	Tape and Reel,4000
RS824PXQ	TSSOP14	14	4	-40°C ~125°C	RS824P	MSL3	Tape and Reel,4000

NOTE:

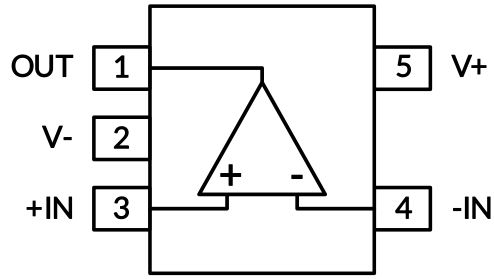
(1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.

(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) RUNIC classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F, Please align with RUNIC if your end application is quite critical to the preconditioning setting or if you have special requirement.

6 PIN CONFIGURATION AND FUNCTIONS (TOP VIEW)

RS821P



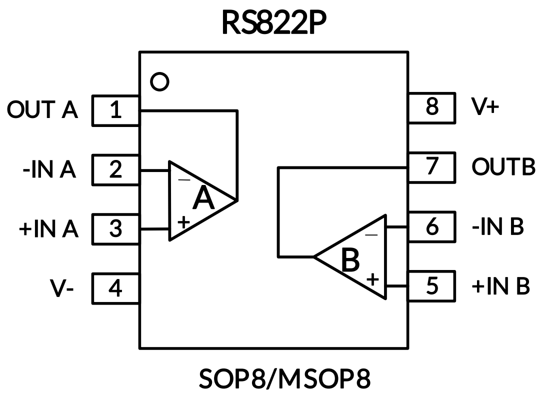
SOT23-5

Pin Description

NAME	PIN RS821P SOT23-5	I/O (1)	DESCRIPTION
-IN	4	I	Negative (inverting) input
+IN	3	I	Positive (noninverting) input
OUT	1	O	Output
V-	2	-	Negative (lowest) power supply
V+	5	-	Positive (highest) power supply

(1) I = Input, O = Output.

PIN CONFIGURATION AND FUNCTIONS (TOP VIEW)



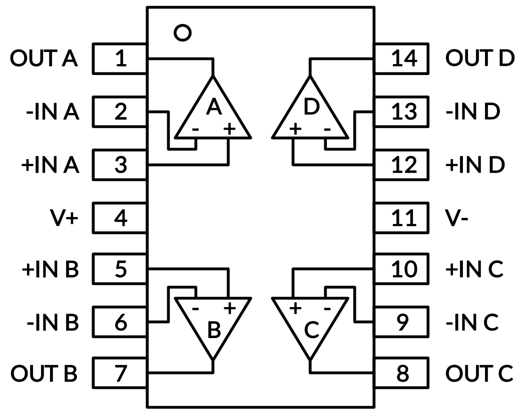
Pin Description

NAME	PIN RS822P SOP8/MSOP8	I/O (1)	DESCRIPTION
-INA	2	I	Inverting input, channel A
+INA	3	I	Noninverting input, channel A
-INB	6	I	Inverting input, channel B
+INB	5	I	Noninverting input, channel B
OUTA	1	O	Output, channel A
OUTB	7	O	Output, channel B
V-	4	-	Negative (lowest) power supply
V+	8	-	Positive (highest) power supply

(1) I = Input, O = Output.

PIN CONFIGURATION AND FUNCTIONS (TOP VIEW)

RS824P



SOP14,TSSOP14

Pin Description

NAME	PIN	I/O (1)	DESCRIPTION
	SOP14/TSSOP14		
-INA	2	I	Inverting input, channel A
+INA	3	I	Noninverting input, channel A
-INB	6	I	Inverting input, channel B
+INB	5	I	Noninverting input, channel B
-INC	9	I	Inverting input, channel C
+INC	10	I	Noninverting input, channel C
-IND	13	I	Inverting input, channel D
+IND	12	I	Noninverting input, channel D
OUTA	1	O	Output, channel A
OUTB	7	O	Output, channel B
OUTC	8	O	Output, channel C
OUTD	14	O	Output, channel D
V-	11	-	Negative (lowest) power supply
V+	4	-	Positive (highest) power supply

(1) I = Input, O = Output.

7 SPECIFICATIONS

7.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
Voltage	Supply, V_S=(V+) - (V-)			7	V
	Signal input pin (2)		(V-)-0.5	(V+) +0.5	
	Signal output pin (3)		(V-)-0.5	(V+) +0.5	
Current	Signal input pin (2)		-10	10	mA
	Signal output pin (3)		-55	55	mA
	Output short-circuit (4)		Continuous		
θ_{JA}	Package thermal impedance (5)	SOT23-5		230	°C/W
		SOP8		110	
		MSOP8		170	
		SOP14		105	
		TSSOP14		90	
Temperature	Operating range, T_A		-40	125	°C
	Junction, T_J (6)		-40	150	
	Storage, T_{stg}		-65	150	

(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.
(2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.5V beyond the supply rails should be current-limited to 10mA or less.
(3) Output terminals are diode-clamped to the power-supply rails. Output signals that can swing more than 0.5V beyond the supply rails should be current-limited to ±55mA or less.
(4) Short-circuit to ground, one amplifier per package.
(5) The package thermal impedance is calculated in accordance with JESD-51.
(6) 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)	±2000	V
		Charged-Device Model (CDM)	±1000	

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

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

		MIN	NOM	MAX	UNIT
Supply voltage，V_S= (V+) - (V-)	Single-supply	2.7		5.5	V
	Dual-supply	±1.35		±2.75	

7.4 ELECTRICAL CHARACTERISTICS

(At T_A = +25°C, V_S=5V, R_L = 10kΩ connected to V_S/2, and V_{OUT} = V_S/2, V_{CM} = V_S/2, Full [9] = -40°C to 125°C, unless otherwise noted.) [1]

PARAMETER		CONDITIONS	T_J	RS821P, RS822P, RS824P			
				MIN[2]	TYP[3]	MAX[2]	UNIT
POWER SUPPLY							
V_S	Operating Voltage Range		25°C	2.7		5.5	V
I_Q	Quiescent Current Per Amplifier	V_S= 5V	25°C		1.6	1.95	mA
			Full			2.1	
PSRR	Power-Supply Rejection Ratio	V_S=2.7V to 5.5V V_{CM}= (V-)+0.5V	25°C	75	88		dB
			Full	70			
INPUT							
Vos	Input Offset Voltage	V_{CM}= V_S/2	25°C	-0.8	±0.25	0.8	mV
V_{OS} T_C	Input Offset Voltage Average Drift	V_{CM}= V_S/2	Full		±2		µV/°C
IB	Input Bias Current [4] [5]	V_{CM}= V_S/2	25°C		±3	±10	pA
			Full			±500	
I_{OS}	Input Offset Current [4]	V_{CM}= V_S/2	25°C		±2.5	±10	pA
			Full			±200	
V_{CM}	Common-Mode Voltage Range	V_S= 5.5V	25°C	(V-)-0.1		(V+)+0.1	V
CMRR	Common-Mode Rejection Ratio	V_S= 5.5V V_{CM}=-0.1V to 4V	25°C	73	88		dB
			Full	65			
		V_S= 5.5V V_{CM}=-0.1V to 5.6V	25°C	60	75		
			Full	54			
OUTPUT							
A_{OL}	Open-Loop Voltage Gain	R_L=2kΩ, Vo=0.15V to 4.85V	25°C	105	129		dB
			Full	90			
		R_L=10kΩ, Vo= 0.05V to 4.95V	25°C	105	129		
			Full	90			
	Output Swing from Rail	V_S=±2.5V, R_L=10kΩ	25°C		10	20	mV
			Full			25	
I_{SC}	Short-Circuit Current [6] [7]		25°C	±100	±150		mA
			Full	±80			
C_{LOAD}	Capacitive load drive		25°C		100		pF
FREQUENCY RESPONSE							
SR	Slew Rate [8]	G= +1, R_L=10kΩ	25°C		10		V/µs
GBP	Gain-Bandwidth Product		25°C		14		MHz
ts	Settling Time,0.01%	V_S=±2.5V, G=+1, C_L=100pF, Step=2V	25°C		0.5		µs
t_{OR}	Overload Recovery Time	V_{IN}·Gain≥V_S, G=11	25°C		0.4		µs
NOISE							
e_np-p	Input Voltage Noise	V_S=±2.5V, f= 0.1Hz to 10Hz	25°C		4		µVpp
e_n	Input Voltage Noise Density [4]	f = 1kHz	25°C		9		nV/$\sqrt{HZ}$

NOTE:

(1) Electrical table values apply only for factory testing conditions at the temperature indicated. Factory testing conditions result in very limited self-heating of the device.

(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) This parameter is ensured by design and/or characterization and is not tested in production.

(5) Positive current corresponds to current flowing into the device.

(6) 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) Short circuit test is a momentary test.

(8) Number specified is the slower of positive and negative slew rates.

(9) Specified by characterization only.

7.5 TYPICAL CHARACTERISTICS

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

At T_A = +25°C, Vs=5V, R_L = 10kΩ connected to Vs/2, V_{OUT} = Vs/2, unless otherwise noted.

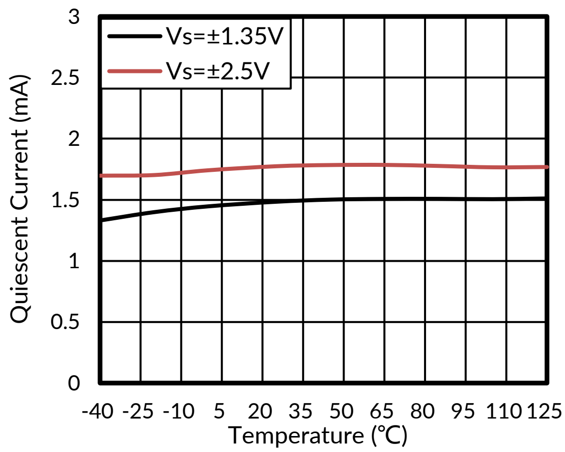


Figure 1. Quiescent Current vs Temperature

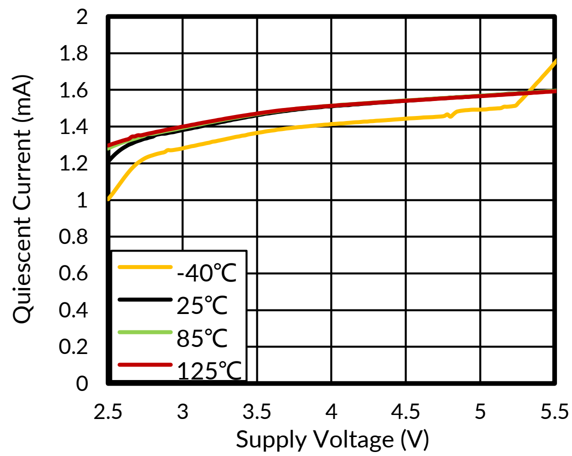


Figure 2. Quiescent Current vs Supply Voltage

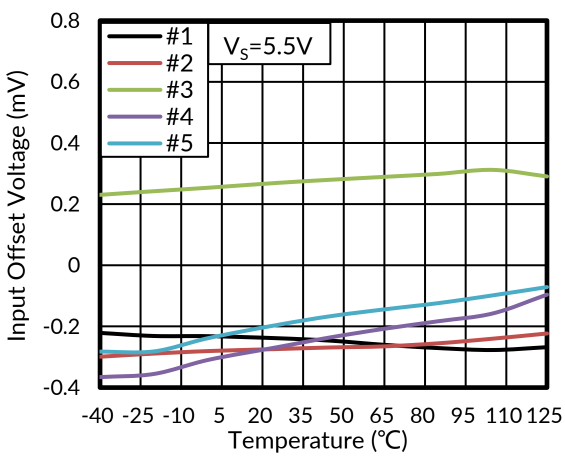


Figure 3. Input Offset Voltage vs Temperature

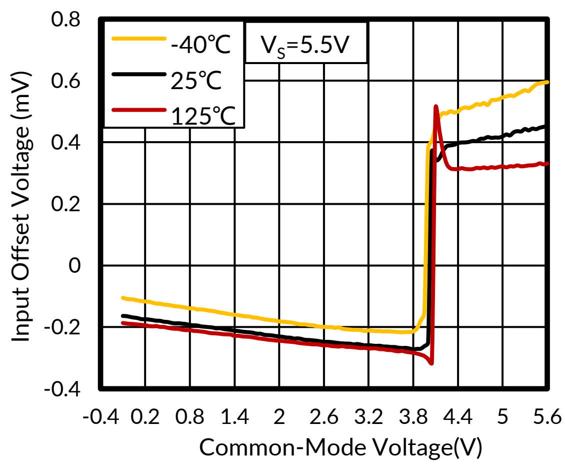


Figure 4. Input Offset Voltage vs Common-Mode Voltage

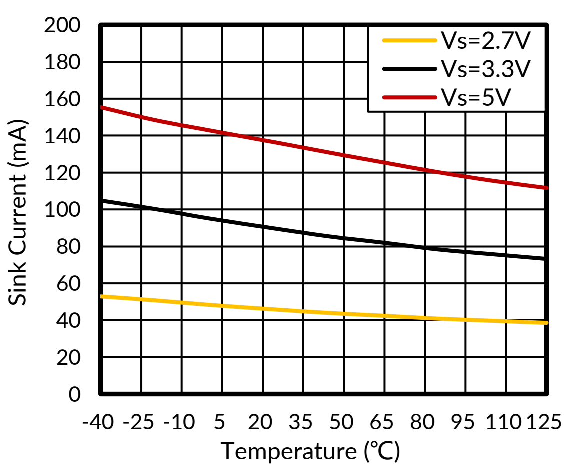


Figure 5. Sink Current vs Temperature

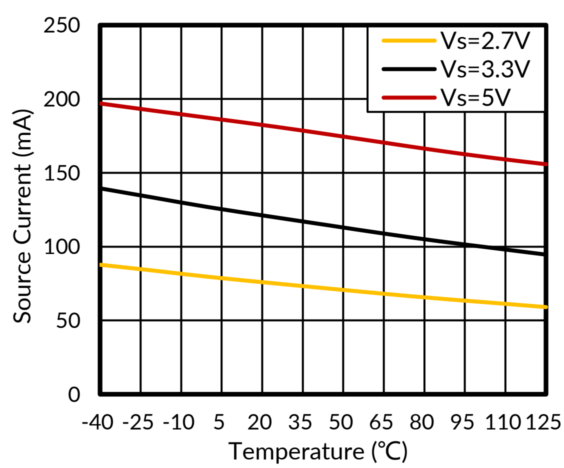


Figure 6. Source Current vs Temperature

TYPICAL CHARACTERISTICS

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.
At T_A = +25°C, Vs=5V, R_L = 10kΩ connected to Vs/2, V_{OUT} = Vs/2, unless otherwise noted.

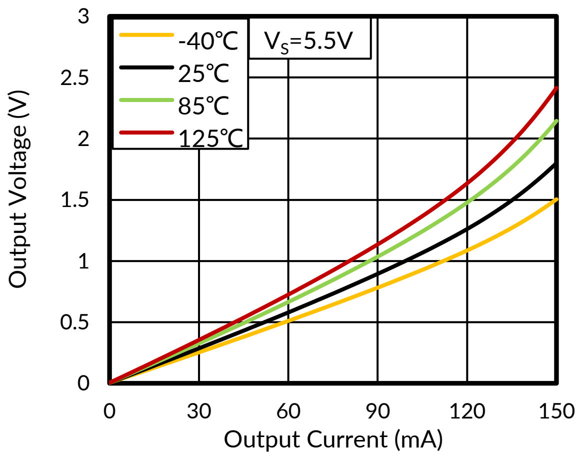


Figure 7. Output Voltage Swing vs Output Current (Sinking)

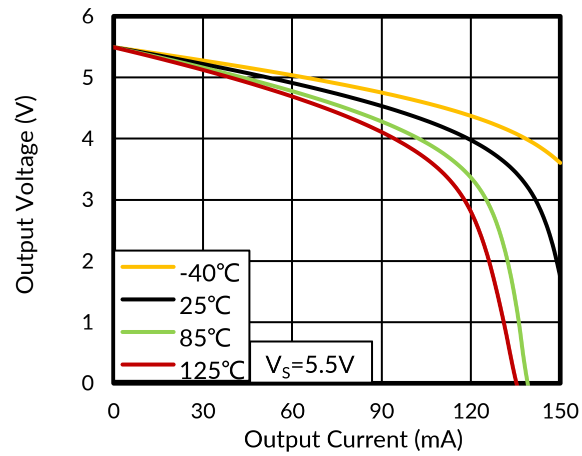


Figure 8. Output Voltage Swing vs Output Current (Sourcing)

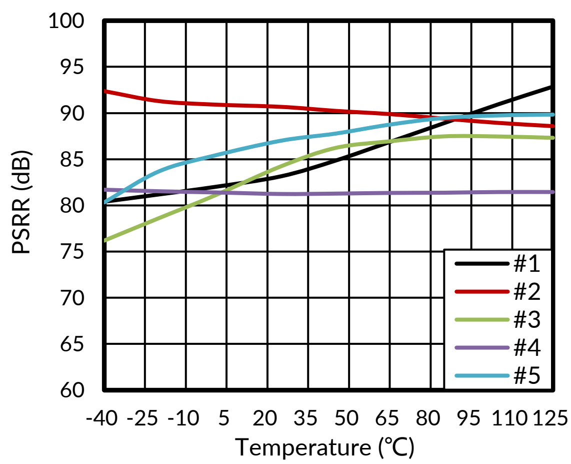


Figure 9. Power-Supply Rejection Ratio vs Temperature

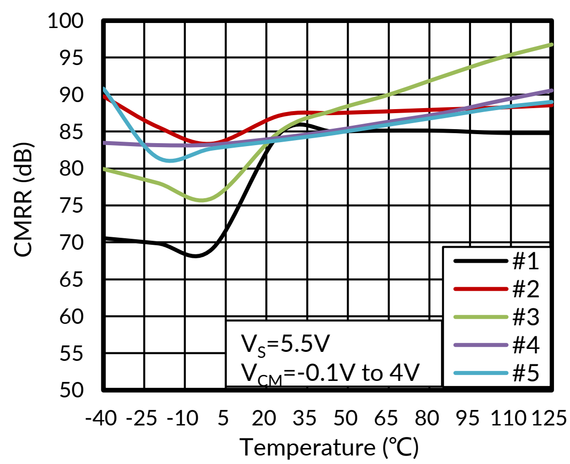


Figure 10. Common-Mode Rejection Ratio vs Temperature

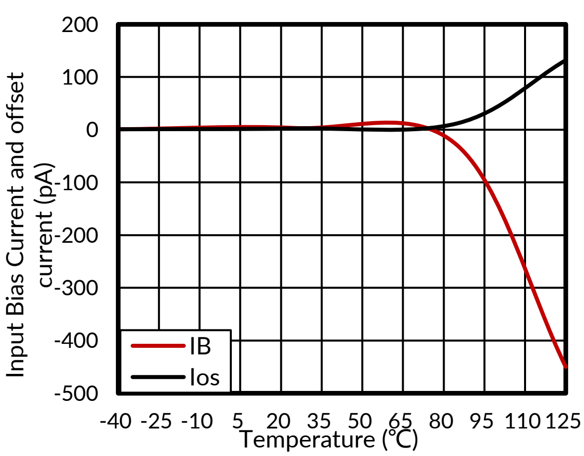


Figure 11. Input Bias Current and offset current vs Temperature

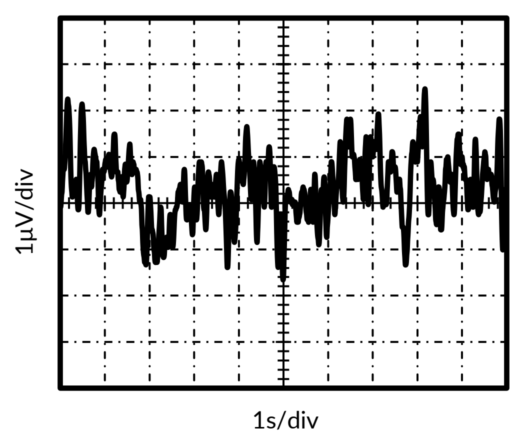


Figure 12. 0.1Hz to 10Hz Input Voltage Noise

TYPICAL CHARACTERISTICS

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

At T_A = +25°C, V_S=5V, R_L = 10kΩ connected to $V_S/2$, V_{OUT} = $V_S/2$, unless otherwise noted.

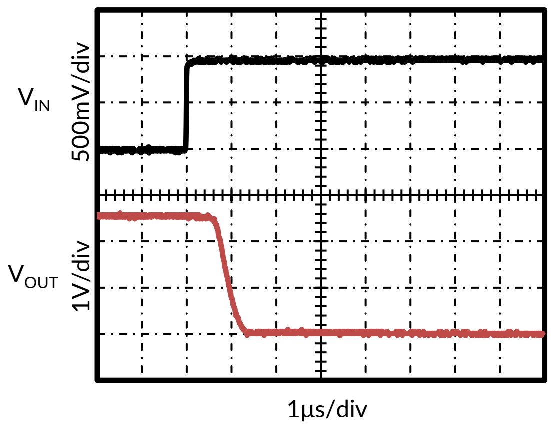


Figure 13. Positive Overvoltage Recovery

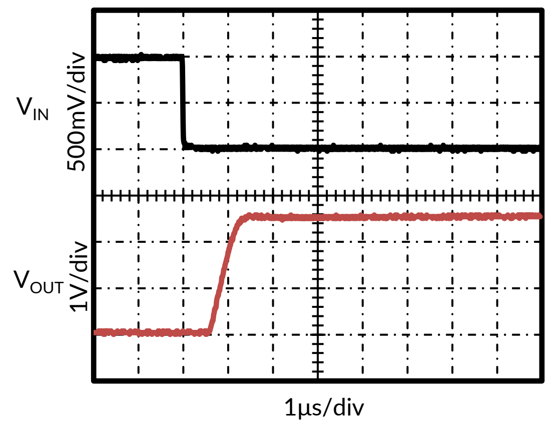


Figure 14. Negative Overvoltage Recovery

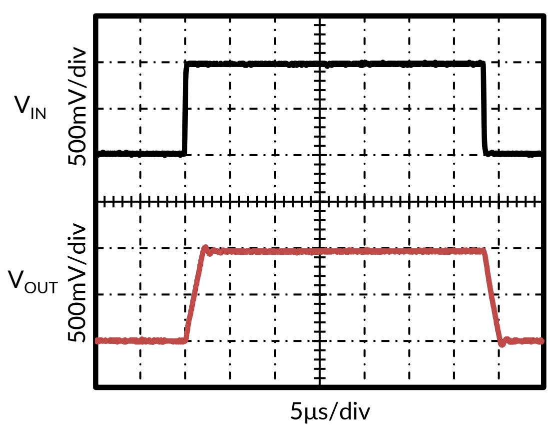


Figure 15. Large-Signal Step Response

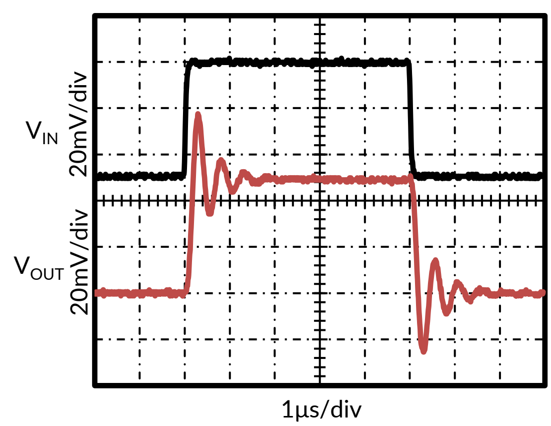


Figure 16. Small-Signal Step Response

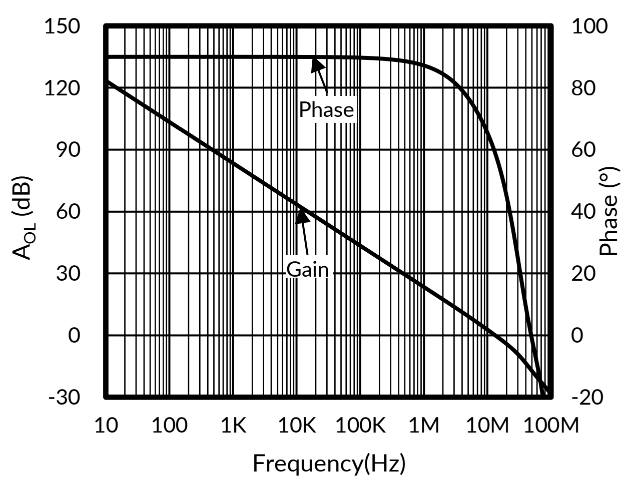


Figure 17. Open−Loop Gain and Phase vs Frequency

8 DETAILED DESCRIPTION

8.1 Overview

The RS82XP devices are unity-gain stable, dual and qual-channel op amps with low noise and distortion. The device consists of a low noise input stage with a folded cascade and a rail-to-rail output stage. This topology exhibits superior noise and distortion performance across a wide range of supply voltages that are not delivered by legacy commodity audio operational amplifiers.

8.2 Phase Reversal Protection

The RS82XP family has internal phase-reversal protection. Many op amps exhibit phase reversal when the input is driven beyond the linear common-mode range. This condition is most often encountered in noninverting circuits when the input is driven beyond the specified common-mode voltage range, causing the output to reverse into the opposite rail. The input of the RS82XP prevents phase reversal with excessive common-mode voltage. Instead, the appropriate rail limits the output voltage. This performance is shown in figure 18.

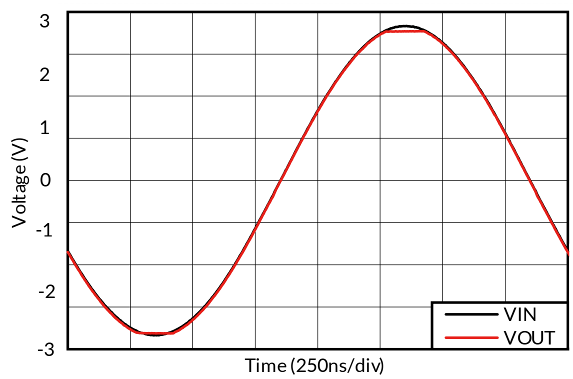


Figure 18. Output Waveform Devoid of Phase Reversal During an Input Overdrive Condition

9 APPLICATION AND IMPLEMENTATION

Information in the following applications sections is not part of the RUNIC component specification, and RUNIC does not warrant its accuracy or completeness. RUNIC's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 APPLICATION NOTE

The RS82XP are high precision, rail-to-rail operational amplifiers that can be run from a single-supply voltage 2.7V to 5.5V (±1.35V to ±2.75V). Supply voltages higher than 7V (absolute maximum) can permanently damage the amplifier. Rail-to-rail input and output swing significantly increases dynamic range, especially in low-supply applications. Good layout practice mandates use of a 0.1uF capacitor place closely across the supply pins.

Typical Applications

9.2 25-kHz Low-pass Filter

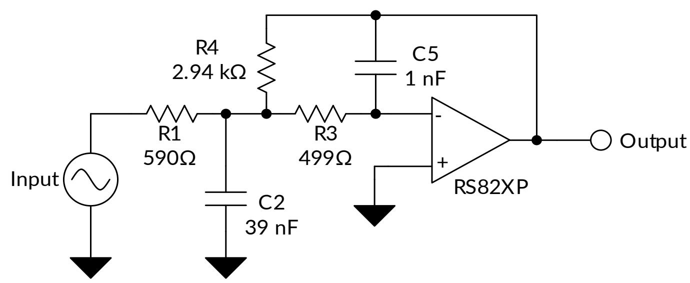


Figure 19. 25-kHz Low-Pass Filter

9.3 Design Requirements

Low-pass filters are commonly employed in signal processing applications to reduce noise and prevent aliasing. The RS82XP devices are ideally suited to construct high-speed, high-precision active filters. Figure 19 shows a second-order, low-pass filter commonly encountered in signal processing applications.

Use the following parameters for this design example:

- Gain = 5 V/V (inverting gain)
- Low-pass cutoff frequency = 25 kHz
- Second-order Chebyshev filter response with 3-dB gain peaking in the passband

9.4 Detailed Design Procedure

The infinite-gain multiple-feedback circuit for a low-pass network function is shown in Figure 19. Use Equation 1 to calculate the voltage transfer function.

$$\frac{Output}{Input}(s) = \frac{-1/R_1R_3C_2C_5}{s^2 + (s/C_2)(1/R_1 + 1/R_3 + 1/R_4) + 1/R_3R_4C_2C_5} \quad (1)$$

This circuit produces a signal inversion. For this circuit, the gain at dc and the low-pass cutoff frequency are calculated by Equation 2:

$$Gain = \frac{R_4}{R_1}$$

$$f_C = \frac{1}{2\pi}\sqrt{(1/R_3R_4C_2C_5)} \quad (2)$$

9.5 Application Curve

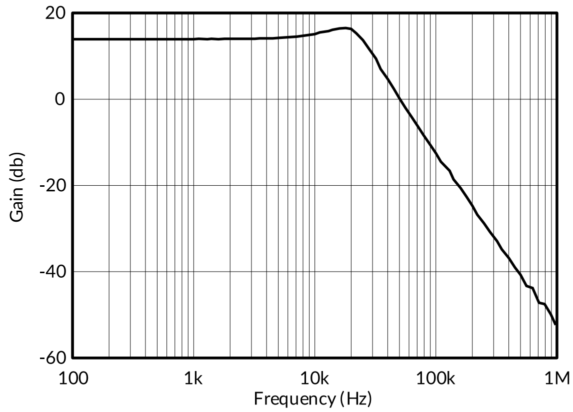


Figure 20. Low-pass filter transfer function

10 LAYOUT

10.1 Layout Guidelines

Attention to good layout practices is always recommended. Keep traces short. When possible, use a PCB ground plane with surface-mount components placed as close to the device pins as possible. Place a 0.1uF capacitor closely across the supply pins.

These guidelines should be applied throughout the analog circuit to improve performance and provide benefits such as reducing the EMI susceptibility.

10.2 Layout Example

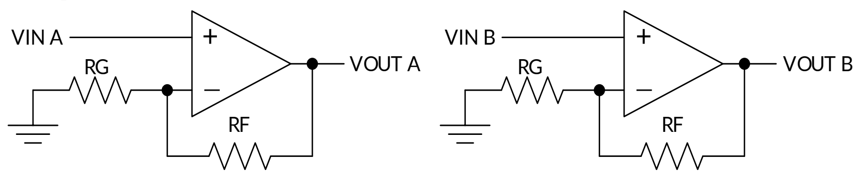


Figure 21. Schematic Representation

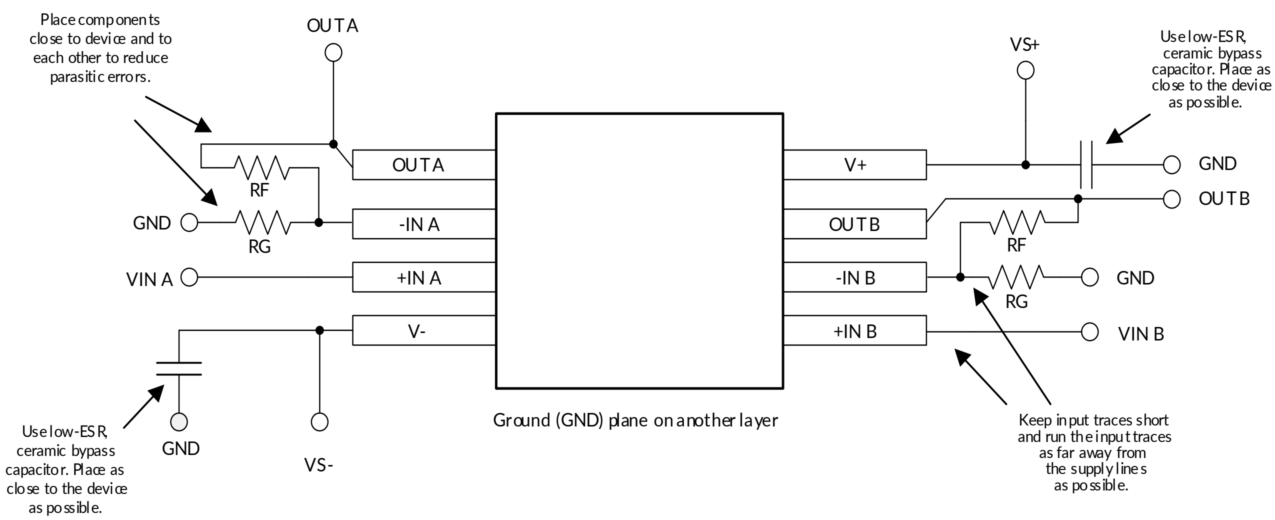
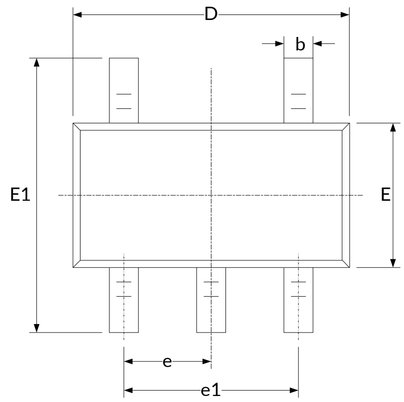


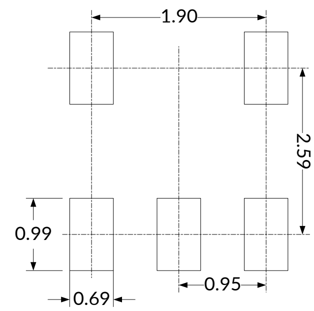
Figure 22. Layout Example

NOTE: Layout Recommendations have been shown for dual op-amp only, follow similar precautions for Single and four.

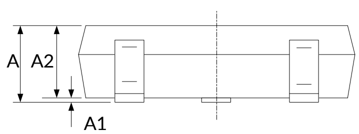
11 PACKAGE OUTLINE DIMENSIONS

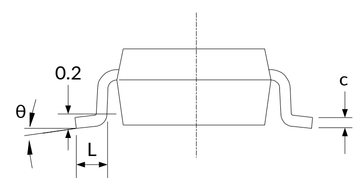
SOT23-5 (3)





RECOMMENDED LAND PATTERN (Unit: mm)



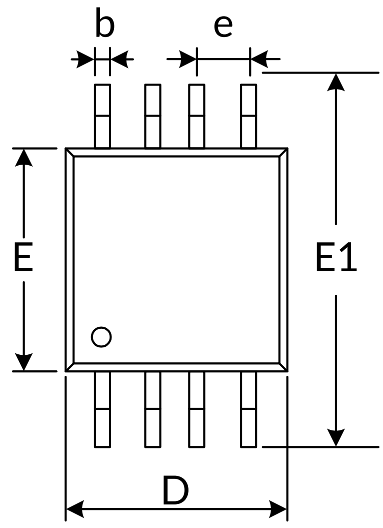


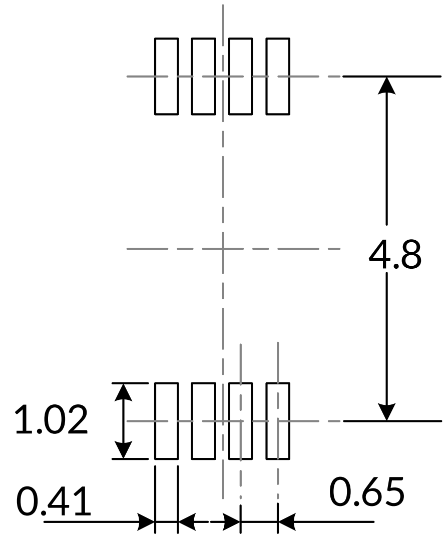
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D (1)	2.820	3.020	0.111	0.119
E (1)	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC) (2)		0.037(BSC) (2)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

NOTE:

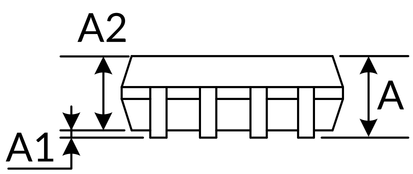
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

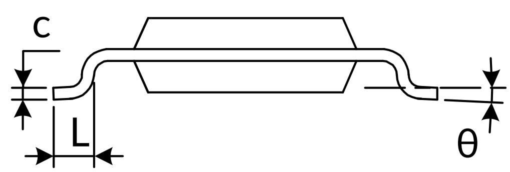
MSOP8 [3]





RECOMMENDED LAND PATTERN (Unit: mm)



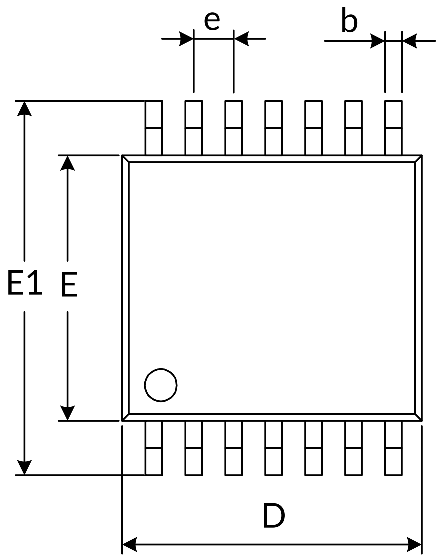


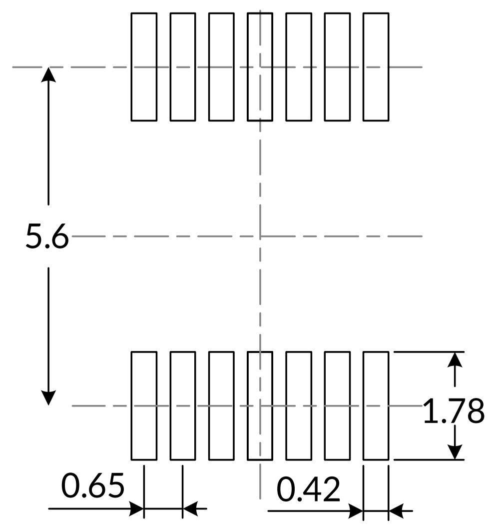
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A [1]	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D [1]	2.900	3.100	0.114	0.122
e	0.650(BSC) [2]		0.026(BSC) [2]	
E [1]	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

NOTE:

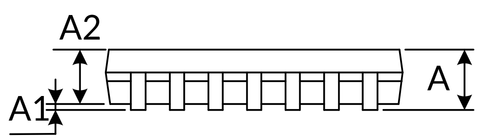
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

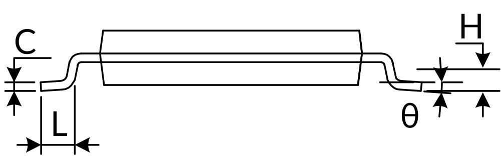
TSSOP14 (3)





RECOMMENDED LAND PATTERN (Unit: mm)

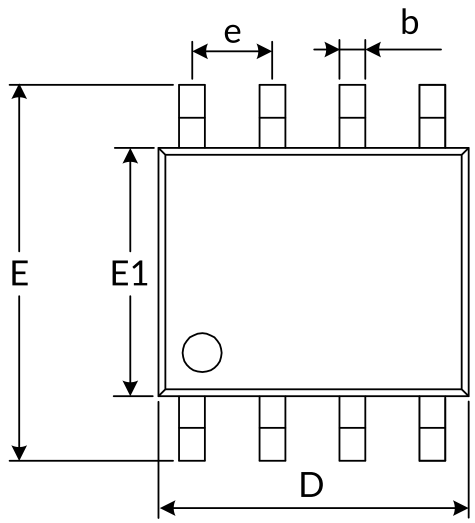


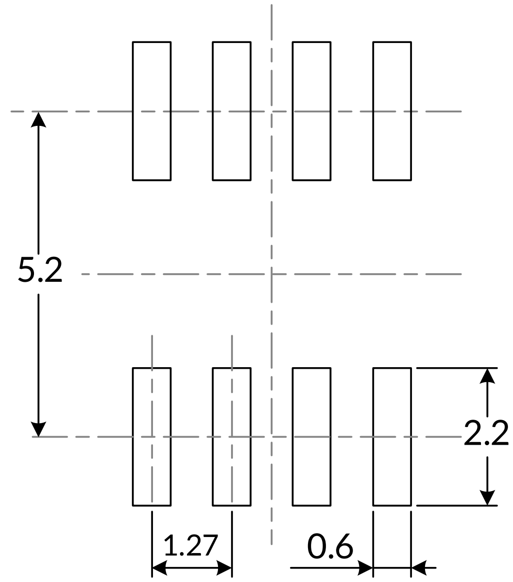


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D (1)	4.860	5.100	0.191	0.201
E (1)	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650(BSC) (2)		0.026(BSC) (2)	
L	0.500	0.700	0.020	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°	7°	1°	7°

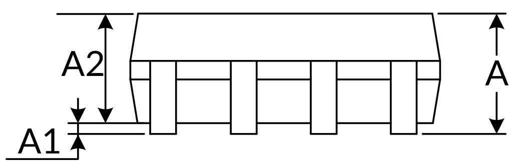
NOTE:
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

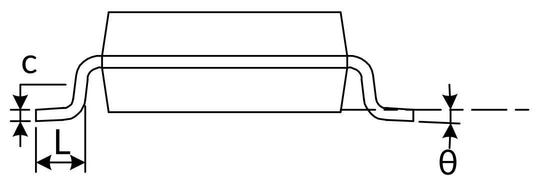
SOP8 (3)





RECOMMENDED LAND PATTERN (Unit: mm)



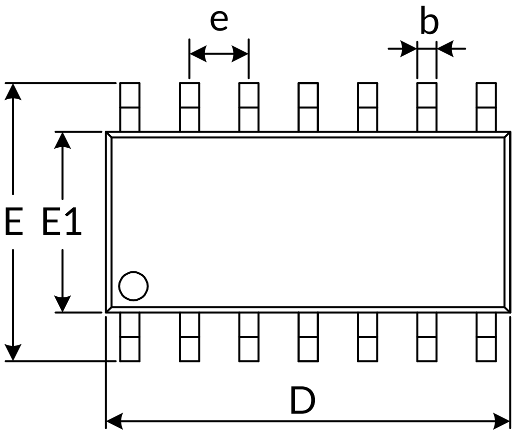


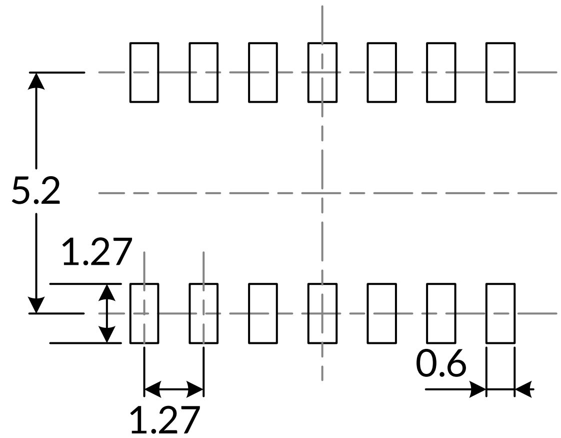
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D (1)	4.800	5.000	0.189	0.197
e	1.270(BSC) (2)		0.050(BSC) (2)	
E	5.800	6.200	0.228	0.244
E1 (1)	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

NOTE:

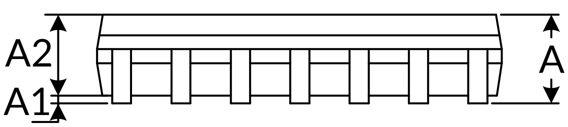
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

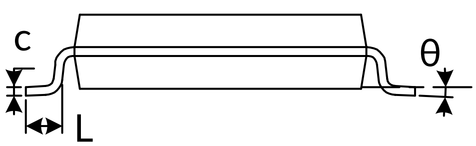
SOP14 (3)





RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A (1)	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	0.310	0.510	0.012	0.020
c	0.100	0.250	0.004	0.010
D (1)	8.450	8.850	0.333	0.348
e	1.270(BSC) (2)		0.050(BSC) (2)	
E	5.800	6.200	0.228	0.244
E1 (1)	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

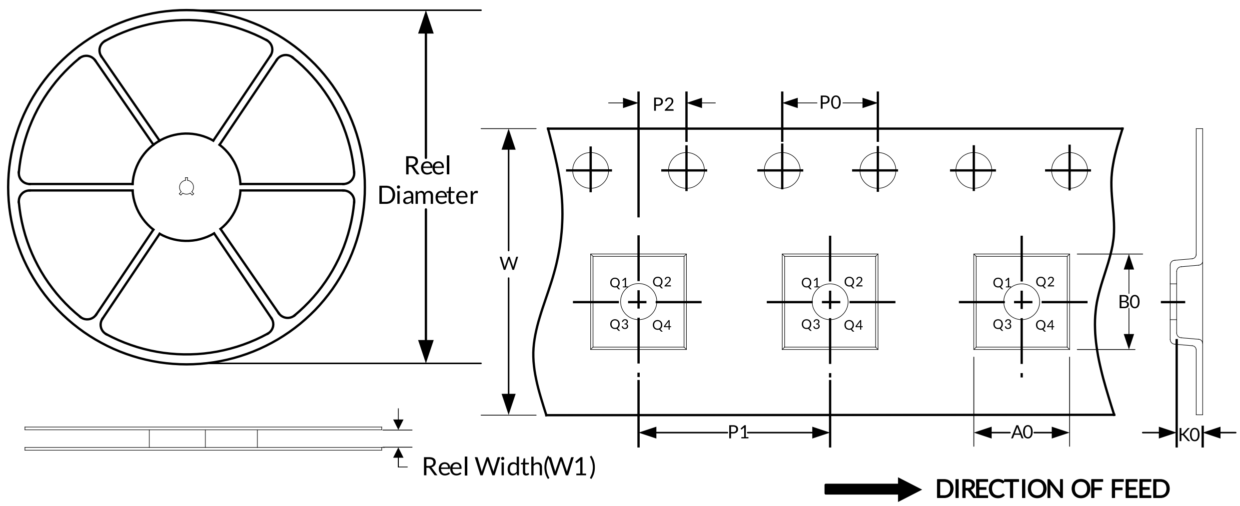
NOTE:

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.

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
SOT23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SOP8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
MSOP8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1
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.

IMPORTANT NOTICE AND DISCLAIMER

Jiangsu RUNIC Technology Co., Ltd. will accurately and reliably provide technical and reliability data (including data sheets), design resources (including reference designs), application or other design advice, WEB tools, safety information and other resources, without warranty of any defect, and will not make any express or implied warranty, including but not limited to the warranty of merchantability Implied warranty that it is suitable for a specific purpose or does not infringe the intellectual property rights of any third party.

These resources are intended for skilled developers designing with RUNIC products You will be solely responsible for: (1) Selecting the appropriate products for your application; (2) Designing, validating and testing your application; (3) Ensuring your application meets applicable standards and any other safety, security or other requirements; (4) RUNIC and the RUNIC logo are registered trademarks of RUNIC INCORPORATED. All trademarks are the property of their respective owners; (5) For change details, review the revision history included in any revised document. The resources are subject to change without notice. Our company will not be liable for the use of this product and the infringement of patents or third-party intellectual property rights due to its use.