Low Drift, Low Power Instrumentation Amplifier

1 FEATURES

- **Fixed Gain: 10**
- **Low Offset Voltage: ±70μV (TYP)**
- **High CMRR: 110dB (TYP)**
- **Low Input Bias Current: 0.5nA (TYP)**
- **Supply Range: ±2.3 V to ±16 V**
- **Input Voltage: (V-)+0.6V to (V+)-1.5V**
- **Low Quiescent Current: 3.4mA**
- **Operating Temperature: -40°C to +125°C**
- **Micro Size Packages: SOP8**

2 APPLICATIONS

- **Weigh Scales**
- **Transducer Interface and Data Acquisition Systems**
- **Industrial Process Controls**
- **Battery-Powered and Portable Equipment**

3 DESCRIPTIONS

The RS631B device is a low-power, precision instrumentation amplifier offering excellent accuracy. The versatile 3-operational amplifier design, small size, and low power make it ideal for a wide range of portable applications.

Provides multiple fixed gain configurations.

The RS631B device provides very low offset voltage (±70μV), and high common-mode rejection (110dB). It operates with power supplies as low as 4.6V (±2.3V) and quiescent current is only 3.4mA, making it ideal for battery operated systems. Using autocalibration techniques to ensure excellent precision over the extended industrial temperature range.

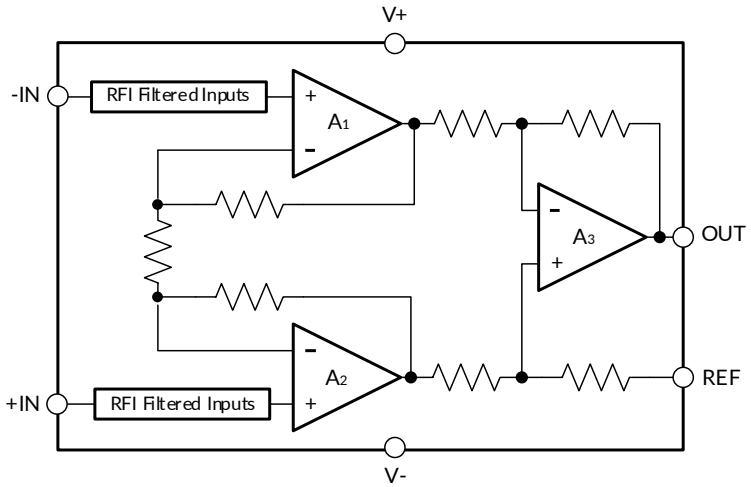
The RS631B device is available in SOP8 packages. It operates over an ambient temperature range of −40°C to +125°C.

Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS631B	SOP8	4.90mm×3.90mm

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

Simplified Schematic



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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	2024/04/12	Initial version completed

5 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING (2)	MSL(3)	PACKAGE OPTION
RS631B	RS631BXK-G	-40°C ~125°C	SOP8	RS631B	MSL1	Tape and Reel, 4000

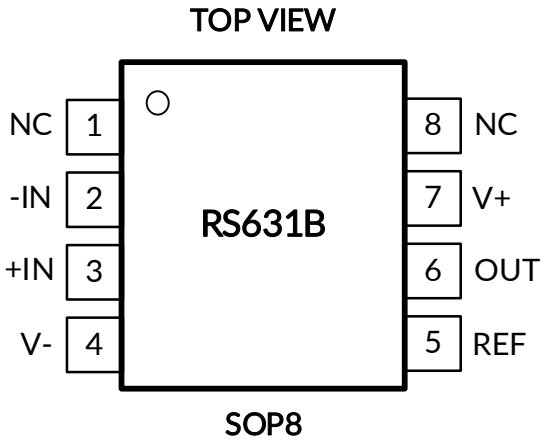
NOTE:

(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 Configuration and Functions



Pin Description

PIN	NAME	I/O (1)	DESCRIPTION
SOP8			
1	NC (2)	-	No internal connection (can be left floating)
2	-IN	I	Inverting input
3	+IN	I	Noninverting input
4	V-	-	Negative (lowest) power supply
5	REF	I	Reference input
6	OUT	O	Output
7	V+	-	Positive (highest) power supply
8	NC (2)	-	No internal connection (can be left floating)

(1) I = Input, O = Output.
(2) There is no internal connection. Typically, GND is the recommended connection to a heat spreading plane.

7 SPECIFICATIONS

7.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
Voltage	Supply Voltage			34	V
	Analog input voltage (2)		(V-)-0.3	(V+)+0.3	
Current	Signal input pin (2)		-10	10	mA
	Signal output pin (3)		-10	10	mA
	Output short-circuit (4)		Continuous		
θ_{JA}	Package thermal impedance (5)	SOP8		110	°C/W
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 0.3V beyond the supply rails shouid be current-limited to 10 mA or less.
(3) Output terminals are diode-clamped to the power-supply rails. Output signals that can swing more than 0.3V beyond the supply rails should be current-limited to ±10mA 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)	±1500	

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	Single-supply	4.6		32	V
	Dual-supply	±2.3		±16	
Specified temperature		-40		125	°C

7.4 ELECTRICAL CHARACTERISTICS

Gain=10, V_S=±15V, T_A=25°C (unless otherwise noted.) (1)

MODEL	CONDITIONS	RS631B			UNIT
		MIN(2)	TYP(3)	MAX(2)	
GAIN					
Gain Error	V_{OUT} = ±10 V		0.21	0.6	%
Nonlinearity, V_{OUT} = −10 V to +10 V			30		ppm of FS
Gain vs Temperature			18		ppm/°C
TOTAL VOLTAGE OFFSET					
Offset (RTI) (4)	V_S = ±16 V	-150	±70	150	µV
Average TC			10		µV/°C
Offset Referred to the Input vs Supply (PSR)	V_S = ±2.3 V to ±16 V	95	115		dB
Total NOISE					
Voltage Noise (RTI)	0.1 Hz to 10 Hz		1.45		µVp-p
INPUT CURRENT					
Input Bias Current (5)(6)	V_S = ±15 V	-3	0.5	3	nA
Over Temperature (5)		-5		5	nA
Input Offset Current (5)		-1		1	nA
Over Temperature (5)		-1.5		1.5	nA
INPUT					
Input Impedance					
Differential			10||2		GΩ||pF
Common-Mode			10||2		GΩ||pF
Common-Mode Rejection Ratio	(V-)+0.6V < V_{CM} <(V+)-1.5V	90	110		dB
OUTPUT					
Output Swing	R_L = 10kΩ, V_S = ±2.3V to ±5V	$-V_S$ + 0.15		$+V_S$ − 0.15	V
	R_L = 10kΩ, V_S = ±5V to ±15V	$-V_S$ + 0.35		$+V_S$ − 0.35	V
Short Current Circuit (7)(8)		±70	±80		mA
DYNAMIC RESPONSE					
Small Signal,−3 dB Bandwidth			900		kHz
Slew Rate (9)			1.1		V/µs
Settling Time	10 V Step		20		µs
REFERENCE INPUT					
R_{IN}			20		kΩ
Voltage Range		$-V_S$		$+V_S$	V
POWER SUPPLY					
Operating Range		±2.3		±16	V
Quiescent Current	V_S = ±2.3 V to ±16 V		3.4	4.5	mA
TEMPERATURE RANGE					
For Specified Performance		-40		125	°C

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) RTI = Referred-to-input.
(5) This parameter is ensured by design and/or characterization and is not tested in production.
(6) Positive current corresponds to current flowing into the device.
(7) 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.
(8) Short circuit test is a momentary test.
(9) Number specified is the slower of positive and negative slew rates.

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.

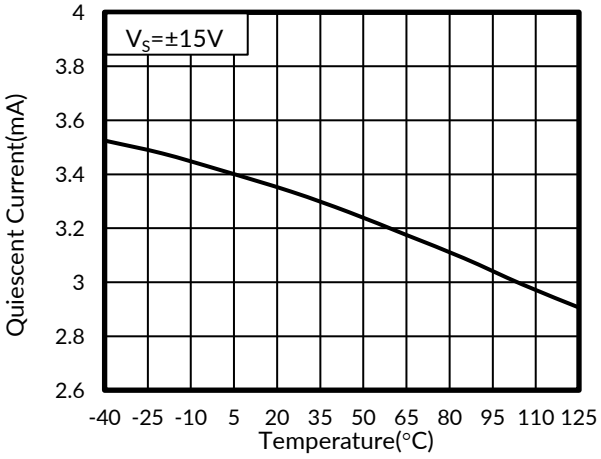


Figure 1. Quiescent Current vs Temperature

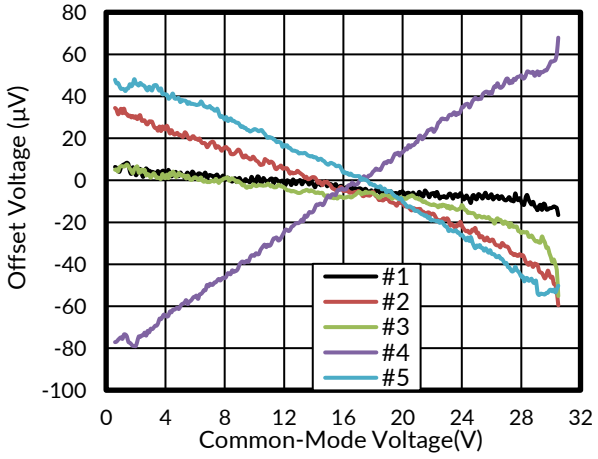


Figure 2. Offset Voltage vs Common-Mode Voltage

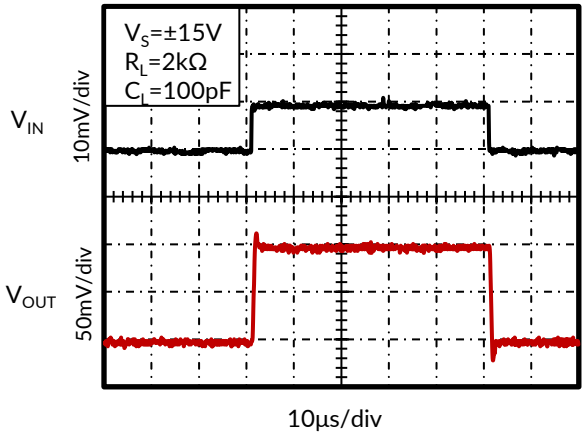


Figure 3. Small Signal Pulse Response

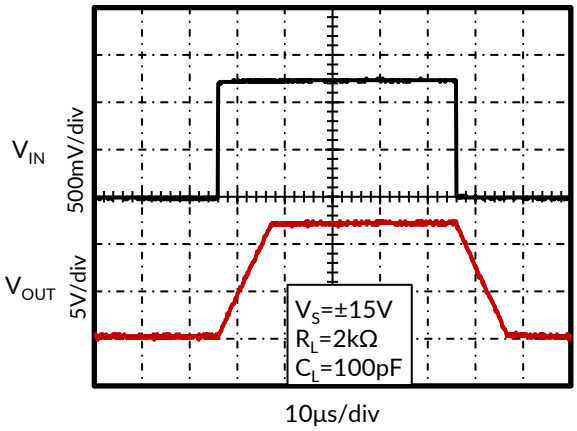


Figure 4. Large Signal Pulse Response

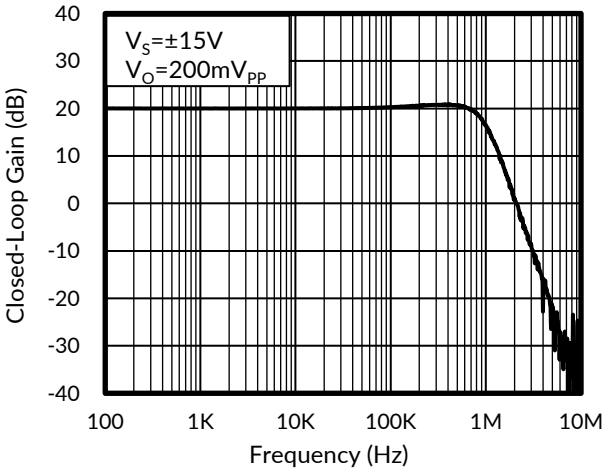


Figure 5. Closed-Loop Gain vs Frequency

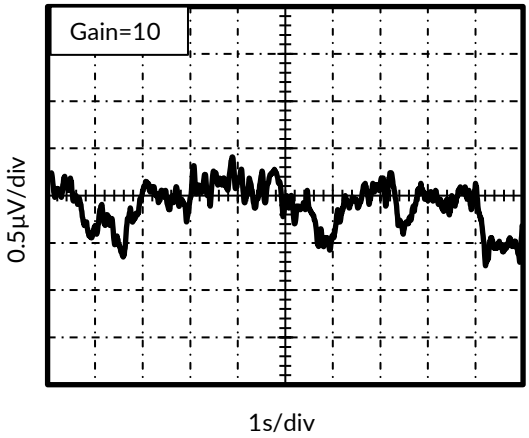


Figure 6. 0.1Hz to 10Hz RTI Voltage Noise

8 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.

8.1 Ground Returns for Input Bias Currents

Input bias currents are those currents necessary to bias the input transistors of an amplifier. There must be a direct return path for these currents; therefore when amplifying "floating" input sources such as transformers, or ac-coupled sources, there must be a dc path from each input to ground as shown in Figures 7 through 9.

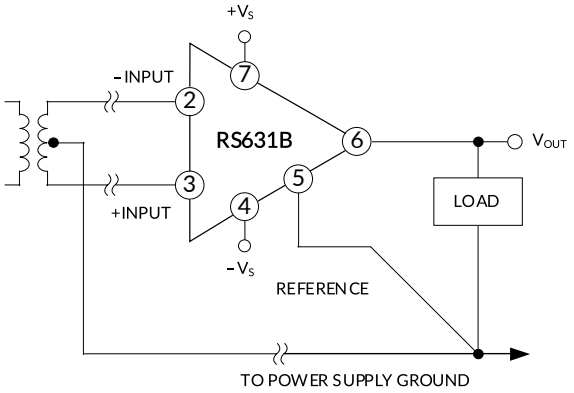


Figure 7. Ground Returns for Bias Currents when Using Transformer Input Coupling

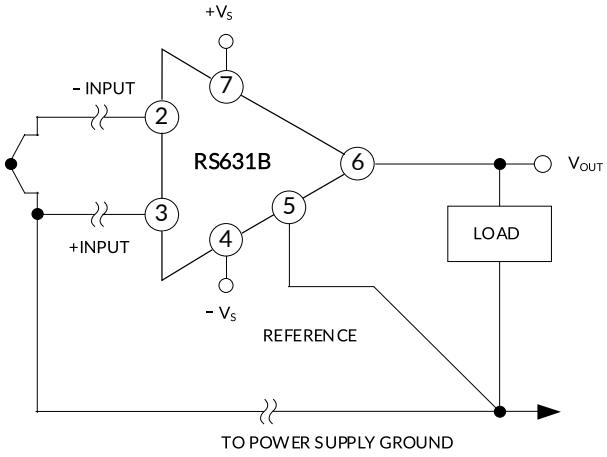


Figure 8. Ground Returns for Bias Currents when Using a Thermocouple Input

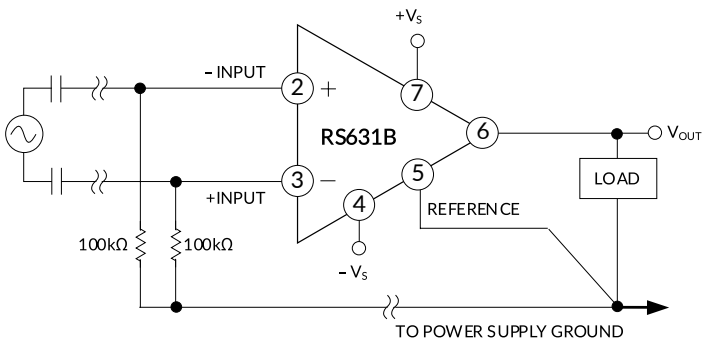
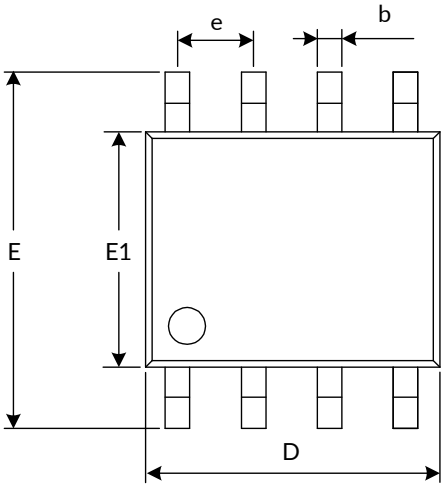
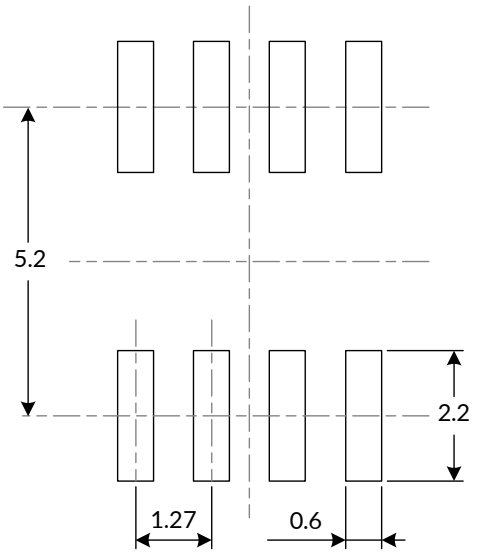


Figure 9. Ground Returns for Bias Currents when Using AC Input Coupling

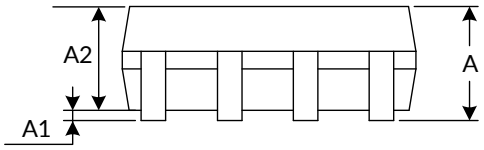
9 PACKAGE OUTLINE DIMENSIONS

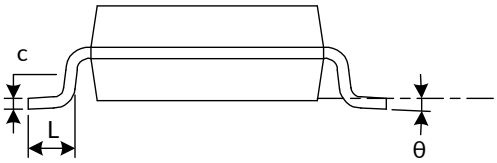
SOP8 (3)





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°

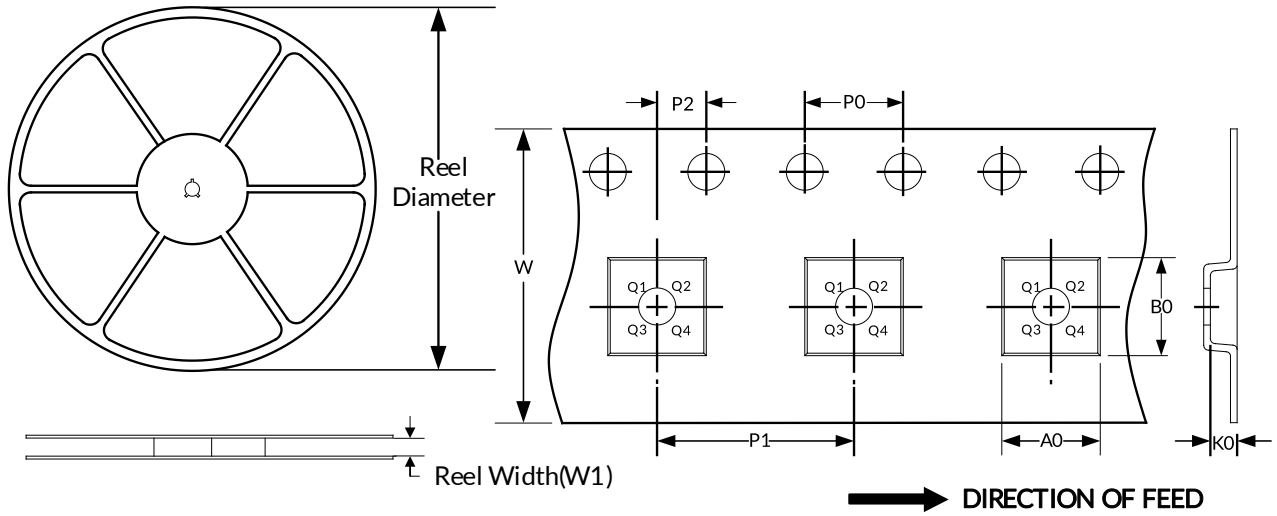
NOTE:

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.

10 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
SOP8	13''	12.4	6.40	5.40	2.10	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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