High Precision 10V Voltage Reference

1 FEATURES

- **Low Temperature Drift: 20ppm/°C Maximum**
- **High Accuracy: 0.05% Maximum**
- **Low Noise: 54μV_{PP}**
- **Low I_Q: 1.1mA Typical**
- **Operating Temperature Range: -40°C to +125°C**
- **High Output Current: ±15 mA**
- **Micro Size Packages: SOP8**

2 APPLICATIONS

- **Precision Data Acquisition Systems**
- **Semiconductor Test Equipment**
- **Medical Instrumentation**
- **Industrial Process Controls**
- **Pressure and Temperature Transmitters**
- **Lab and Field Instrumentation**

3 DESCRIPTIONS

The RSR581 is a temperature compensated, monolithic, band gap voltage reference that provides a precise 10 V output from an unregulated input level ranging from 10.1 V to 36 V. High accuracy (0.05 %) and excellent temperature drift (20 ppm/°C) and are achieved using proprietary design techniques with 1.1mA quiescent current. The RSR581 is capable of both sinking and sourcing current, and have excellent line and load regulation.

These features, combined with low noise, make the RSR581 ideal for use in high-precision data acquisition systems. The RSR581 is recommended for use as a reference for 8-, 10- or 12-bit digital-to-analog converters (DACs) that require an external precision reference. The device is also ideal for all types of analog-to-digital converters (ADCs) up to 14-bit accuracy.

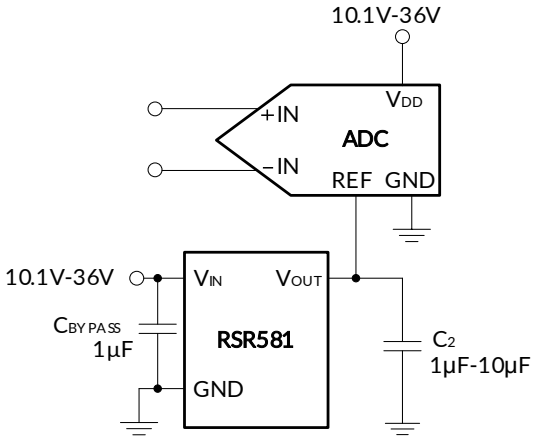
The RSR581 is available in Green SOP8 packages. It operates over an ambient temperature range of -40°C to +125°C.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE(NOM)
RSR581	SOP8	4.90mm x 3.90mm

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

4 TYPICAL APPLICATION



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5 REVISION HISTORY

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

VERSION	Change Date	Change Item
A.0	2024/05/22	Preliminary version completed

6 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING (2)	MSL (3)	PACKAGE OPTION
RSR581	RSR581XK	-40°C ~+125°C	SOP8	RSR581	MSL1	Tape and Reel, 4000

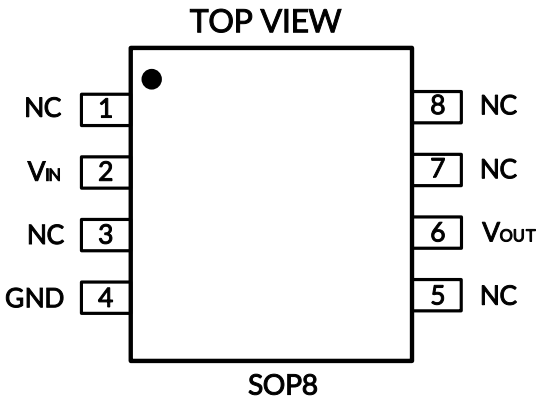
NOTE:

(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.

7 PIN CONFIGURATION AND FUNCTIONS



PIN DESCRIPTION

NAME	PIN	I/O (1)	DESCRIPTION
	SOP8		
NC (2)	1,3,5,7,8	-	No internal connection
V_{IN}	2	I	Input supply voltage
GND	4	G	Ground
V_{OUT}	6	O	Reference voltage output

(1) I = Input, O = Output, G= Ground.
(2) NC = No internal connection.

8 SPECIFICATIONS

8.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1)(2)

SYMBOL			MIN	MAX	UNIT
V_{IN}	Supply voltage, V+ to V–		-0.2	40	V
	Output short circuit		-25	25	mA
θ_{JA}	Package thermal impedance (3)	SOP8		110	°C/W
T_A	Operating temperature		-40	+125	°C
T_J	Junction temperature (4)		-40	150	
T_{stg}	Storage temperature		-65	150	

(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) All voltages are with respect to the GND pin.
(3) The package thermal impedance is calculated in accordance with JESD-51.
(4) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, 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.

8.2 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-883:2019 method 3015.9	±2000	V
		Charged-Device Model (CDM), ANSI/ESDA/JEDEC JS-002:2022	±1500	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.

8.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted).

SYMBOL	PARAMETER	MIN	MAX	UNIT
V_{IN}	Input voltage	V_{OUT}+0.1	36	V
I_{Load}	Load current	-15	15	mA

8.4 Electrical Characteristics

T_A = 25°C, I_{OUT} = 0 mA, and V_{IN} = V_{OUT}+0.1 V (unless otherwise noted).

PARAMETER			TEST CONDITIONS	MIN (1)	TYP (2)	MAX (1)	UNIT
Output Voltage	V_{OUT}				10		V
Initial Accuracy				-0.05		0.05	%
Output Voltage Noise			f = 0.1Hz to 10Hz		54		μV_{PP}
Output Voltage Temperature Drift (3)	dV_{OUT}/dT		T_A = -40°C to +125°C		13	20	ppm/°C
Long-Term Stability			0 to 1000 hours		TBD		ppm
			1000 to 2000 hours		TBD		
Line Regulation			V_{IN} = (V_{OUT} + 0.1) to 36 V		2	3	ppm/V
			V_{IN} = (V_{OUT} + 0.1) to 36 V T_A = -40°C to +125°C			6	
Load Regulation	dV_{OUT}/dI_{LOAD}		-15 mA < I_{LOAD} < 15mA, V_{IN} = V_{OUT} + 1 V		1	5	ppm/mA
			-15 mA < I_{LOAD} < 15 mA, V_{IN} = V_{OUT} + 1V T_A = -40°C to 125°C (4)			15	
Thermal Hysteresis	dT		First Cycle		TBD		ppm
Short-Circuit Current	I_{SC}	Sourcing			37		mA
		Sinking			25		
Turn on Settling Time			To 0.1% with C_L = 1µF		420		µs
Capacitive Load				1		10	µF
Voltage	V_{IN}		I_{LOAD} = 0, T_A = -40°C to +125°C	V_{OUT}+0.1		36	V
Quiescent Current	I_Q		I_{LOAD} = 0, T_A = 25°C		1.1	1.4	mA
			I_{LOAD} = 0, T_A = -40°C to +125°C			1.5	

(1) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.
(2) 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.
(3) Box Method used to determine temperature drift.
(4) Typical value of load regulation reflects measurements using force and sense contacts.

8.5 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.

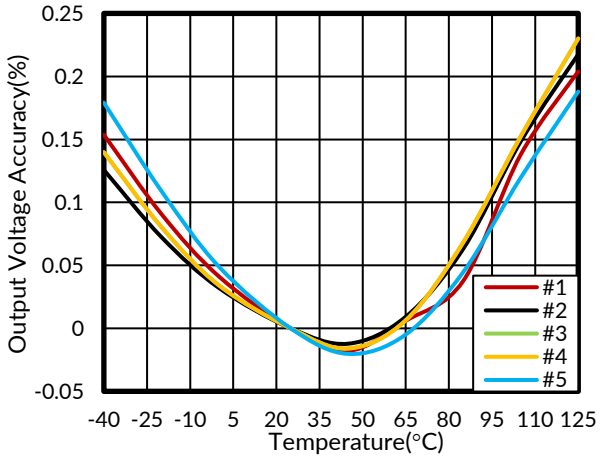


Figure 1. Output Voltage Accuracy vs Temperature

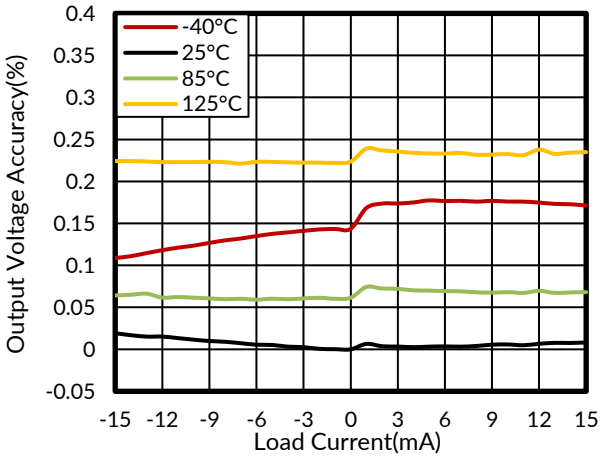


Figure 2. Output Voltage vs Load Current

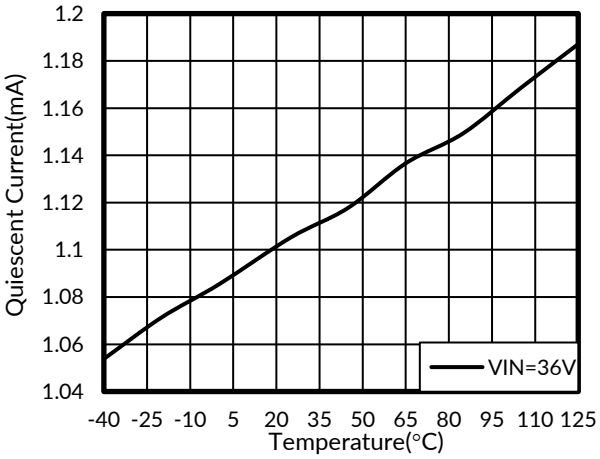


Figure 3. Quiescent Current vs Temperature

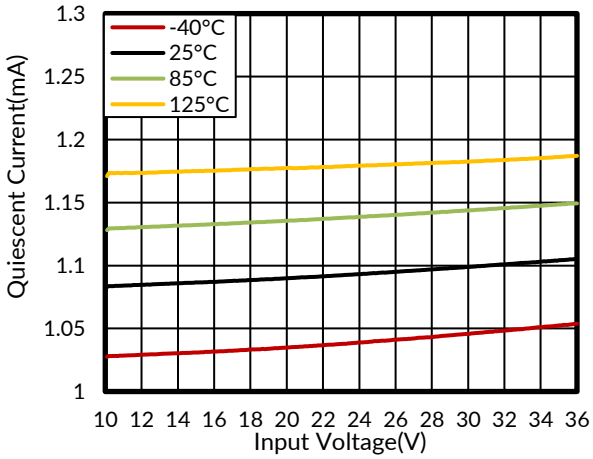


Figure 4. Quiescent Current vs Input Voltage

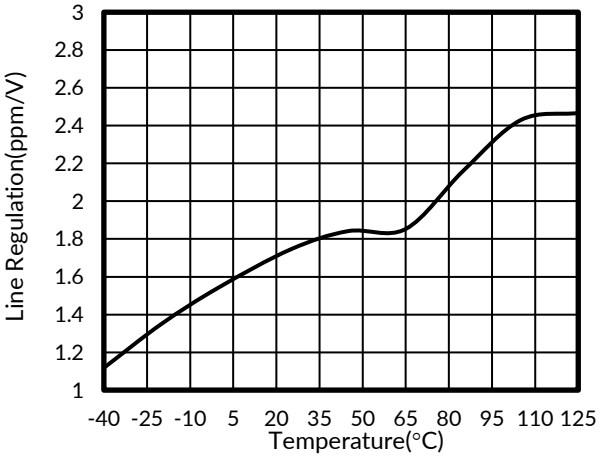


Figure 5. Line Regulation vs Temperature

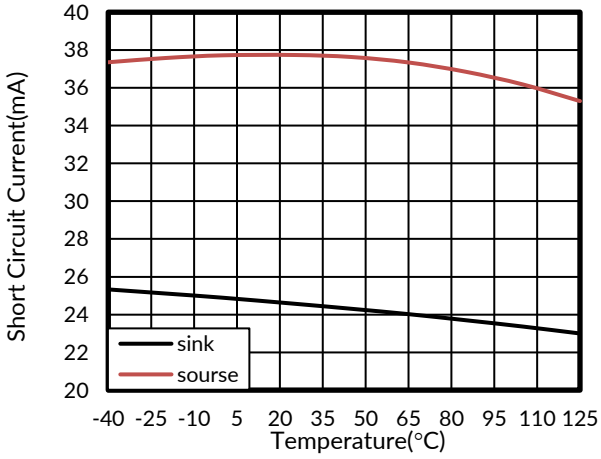


Figure 6. Short Circuit Current vs Temperature

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.

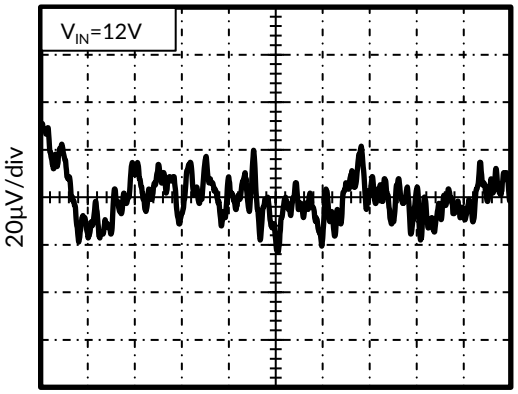


Figure 7. 0.1Hz to 10Hz Noise

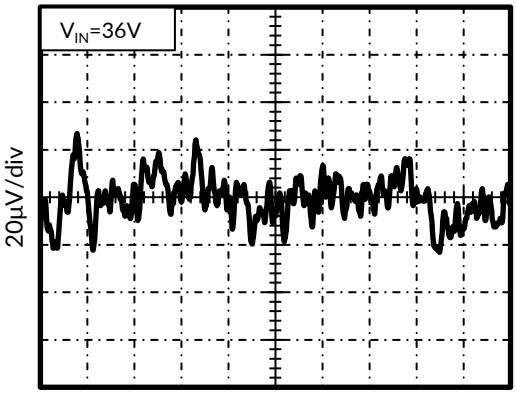


Figure 8. 0.1Hz to 10Hz Noise

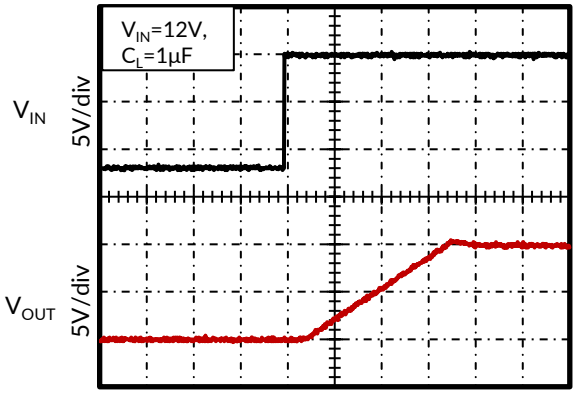


Figure 9. Start-up

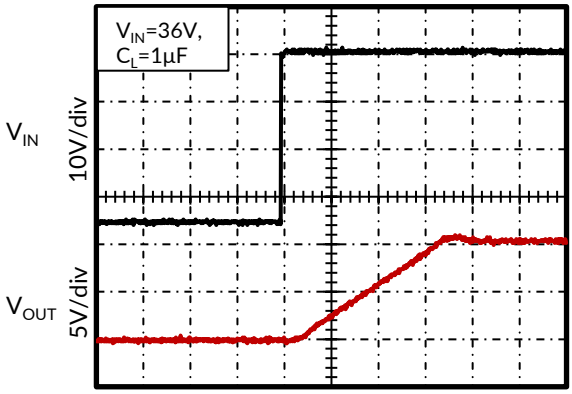


Figure 10. Start-up

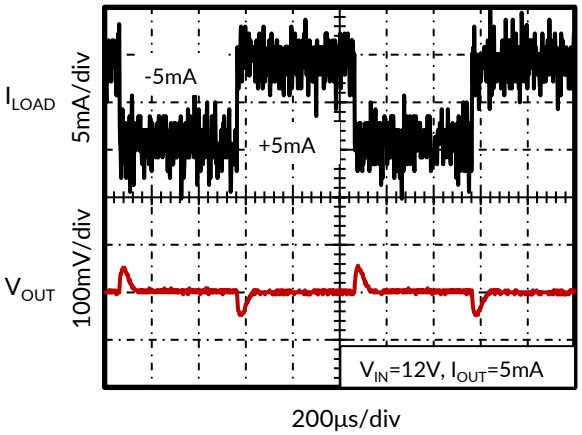


Figure 11. Load Transient

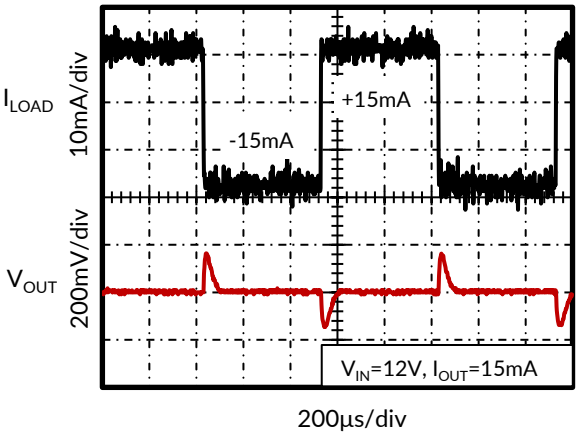


Figure 12. Load Transient

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.

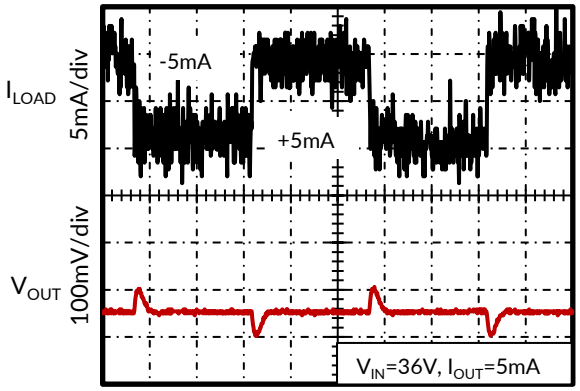


Figure 13. Load Transient

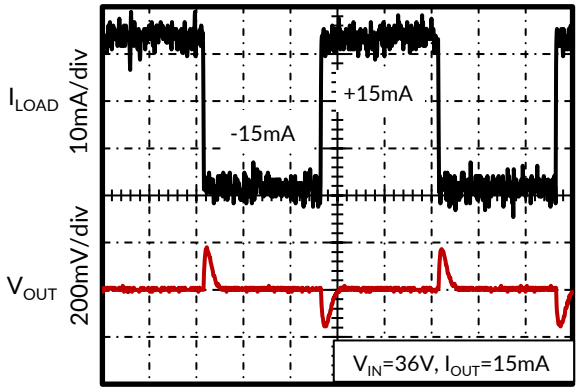


Figure 14. Load Transient

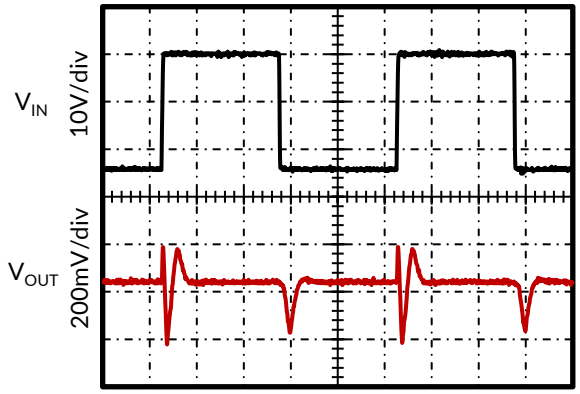
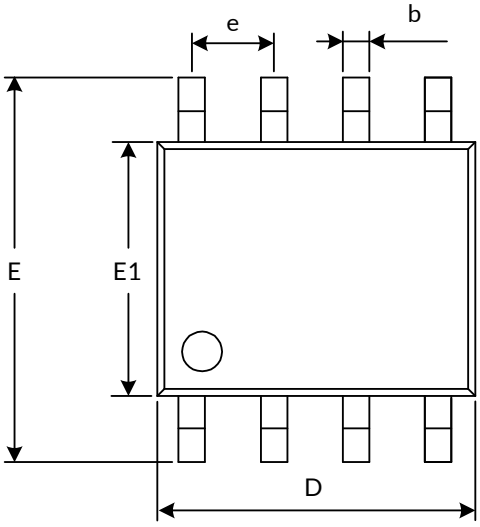
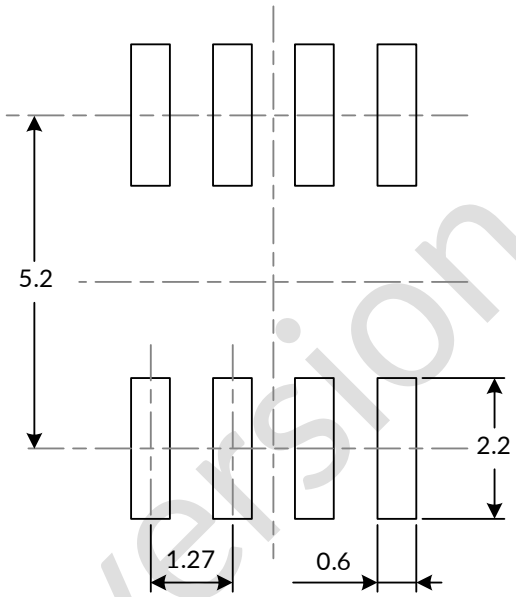


Figure 15. Line Transient

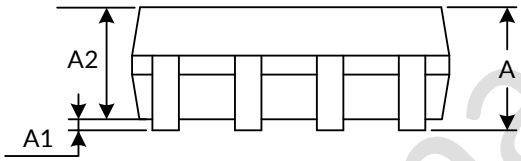
9 PACKAGE OUTLINE DIMENSIONS

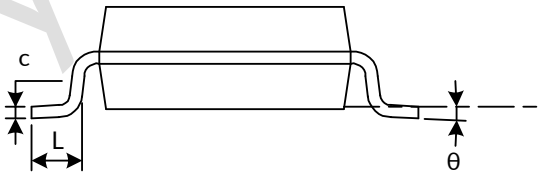
SOP8 (3)





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°

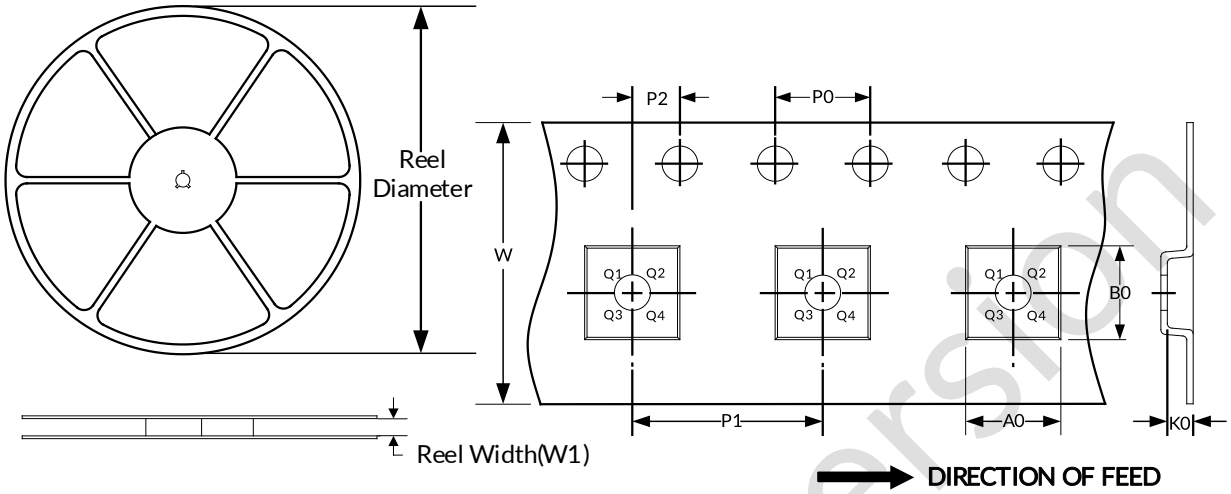
NOTE:

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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