

Low Noise, Low Power Precision Voltage Reference

Features

- Low noise (0.1 Hz to 10 Hz): $6.0 \mu\text{V}_{\text{P-P}}$, 2.5 ppm_{peak-peak}
- Low temperature coefficient: 5 ppm/°C max
- Initial accuracy: $\pm 0.05\%$ max
- Quiescent current: 130 μA
Shutdown current: 3 μA
- Supply voltage: $V_{\text{OUT}} + 0.3 \text{ V}$ to 5.5 V
- Line regulation: 10 ppm/V max
- Load regulation: 10 ppm/mA max
- High output drive capability: 16 mA min
- Packages: SOIC-8/MSOP-8
- Wide temperature range: $-40 \text{ }^\circ\text{C}$ to $+125 \text{ }^\circ\text{C}$
- Pin compatible with industry standard products and ZJR1000 pins

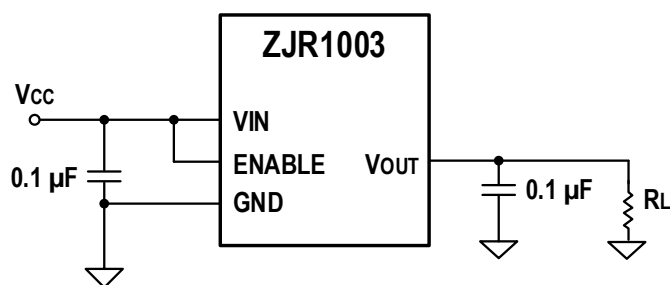
Applications

- Industrial control
- Precision data acquisition
- Optical Communication
- Precision instrument
- Smart grid
- Medical equipment
- Portable Devices

General Description

The ZJR1003 are a series of precision voltage references providing a variety of output voltages with very low temperature coefficient and low noise. This is ideal for applications such as precision instruments and test equipment requiring high resolution (higher than 14 bits) data acquisition. The performance of ZJR1003 is guaranteed in a wide temperature range from $-40 \text{ }^\circ\text{C}$ to $+125 \text{ }^\circ\text{C}$. Because of the low dropout feature of ZJR1003, the lowest supply voltage is just 300 mV higher than the output voltage. Meanwhile its maximum supply voltage can reach 15 V, which can simplify the power supply design of the system. ZJR1003 is a bandgap voltage reference, with its optimized design and trimming, the temperature coefficient is better than 5 ppm/°C, and the initial accuracy is better than $\pm 0.05\%$. This simplifies or even skip the system initial calibration for most applications. ZJR1003 provides 8-pin SOIC and MSOP packages, and are compatible with industry standard products.

Typical Application



Typical Characteristics

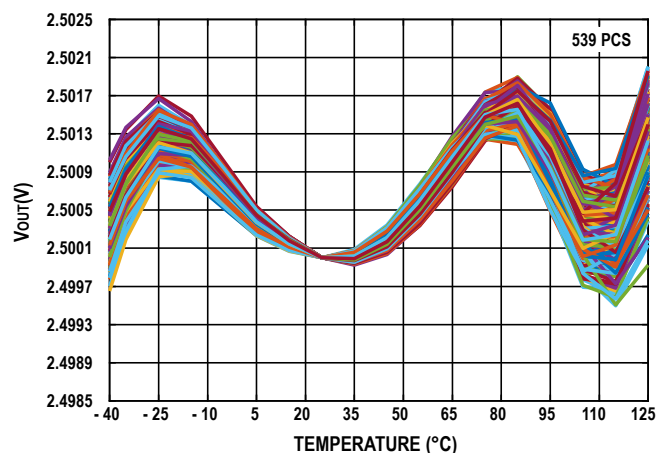


Table of contents

Features	1	Applications.....	15
Applications	1	ZJR1003 Basic Connections	15
General Description	1	Power on and Shutdown Mode	15
Typical Application	1	Supply Voltage	15
Typical Characteristics.....	1	Noise Performance.....	16
Table of contents	2	Power Dissipation.....	16
Version (Release C)	3	Product Applications.....	17
Revision History	3	Voltage Reference Noise to ADC Resolution	17
Pin Configurations and Function Descriptions.....	5	Generating a Negative Output Precision Voltage Reference.....	17
Absolute Maximum Ratings	6	ZJR1003 Used in High-Precision Data Acquisition Systems	18
Thermal Resistance	6	Layout Guidelines	19
Specifications	7	Layout Example.....	19
Typical Performance Characteristics	8	Outline Dimensions.....	20
Terminology	12	Ordering Guide.....	21
Temperature Coefficient.....	12	Orderable Device Explanation	22
Long-term Stability	12	Related Parts	23
Thermal Hysteresis	12		
Line Regulation.....	12		
Load Regulation.....	13		
Theory of Operation.....	14		

Version (Release C)¹

Revision History

April 2024 — Release C

Long-Term Stability updating at page 6

Add Figure 20, Figure 21 at page 10

July 2023 - Release B

Add Figure 23

June 2023 - Release A

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Pin Configurations and Function Descriptions

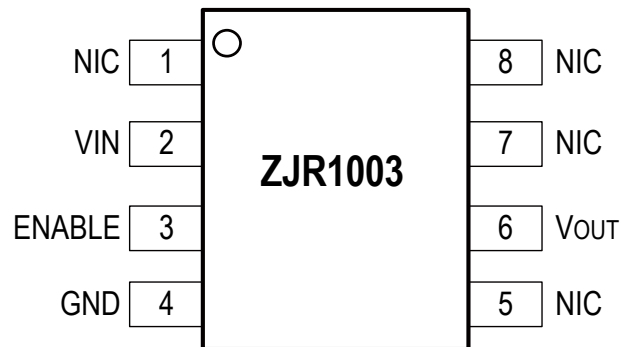


Figure 1. ZJR1003 Pin Configuration (8-lead SOIC and MSOP)

Mnemonic	Pin No.	Description
NIC	1,5,7,8	No Internal Connection. NIC has no internal connection.
VIN	2	Input voltage
ENABLE	3	Enable. Drive high to enable the device. Drive low to disable the device.
GND	4	Ground
V _{OUT}	6	Voltage output, connected to load.

Absolute Maximum Ratings ¹

Parameter	Rating
Input Voltage	-0.2 V to 6 V
Output Short-Circuit Current to GND	±30 mA
Operating Temperature Range	-40 °C to +125 °C
Storage Temperature Range	-65 °C to +150 °C
Junction Temperature Range	-65 °C to +150 °C
Maximum Reflow Temperature ²	260 °C
Lead Temperature (Soldering, 10 sec)	300 °C
Electrostatic Discharge (ESD) ¹	
Human Body Model (HBM) ²	8 kV
Charging Device Model (CDM) ³	1 kV

Thermal Resistance ⁶

Package Type	θ_{JA}	θ_{JC}	Unit
SOIC-8	158	43	°C/W
MSOP-8	190	44	°C/W

¹ These ratings apply at 25 °C, unless otherwise noted. 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 IPC/JEDECJ–STD-020 Compliant.

¹ Charged devices and circuit boards can discharge without detection.

Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

² ANSI/ESDA/JEDEC JS-001 Compliant.

³ ANSI / ESDA / JEDEC JS-002 Compliant

⁶ θ_{JA} addresses the conditions for soldering devices onto circuit boards to achieve surface mount packaging.

Specifications ¹

The “•” denotes the specification which apply over the full specified temperature range, unless otherwise specified, $V_{IN} = V_{OUT} + 0.3\text{ V}$, $I_{LOAD} = 0$, $C_L = 0.1\ \mu\text{F}$, $T_A = 25\ ^\circ\text{C}$.

Parameter	Symbol	Conditions/Package	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	ZJR1003-9		2.5		V
		ZJR1003-3		3		V
		ZJR1003-4		4.096		V
		ZJR1003-5		5		V
Initial Accuracy			-0.05		+0.05	%
Temperature Coefficient	TCV_{OUT}					
B Grade					5	ppm/ $^\circ\text{C}$
A Grade		•			8	ppm/ $^\circ\text{C}$
Voltage Noise	e_n p-p	0.1 Hz to 10 Hz		2.5		ppm_peak-to-peak
Voltage Noise Density	e_n	f = 1 kHz				
		ZJR1003-9		200		nV/ $\sqrt{\text{Hz}}$
		ZJR1003-3		250		nV/ $\sqrt{\text{Hz}}$
		ZJR1003-4		320		nV/ $\sqrt{\text{Hz}}$
		ZJR1003-5		308		nV/ $\sqrt{\text{Hz}}$
Voltage Regulation						
				2	10	ppm/V
			•	5		ppm/V
Load Regulation		$-10\ \text{mA} < I_{LOAD} < 10\ \text{mA}$	•	1.5	10	ppm/mA
				6		
Supply Voltage		$I_{LOAD} = 5\ \text{mA}$, output voltage error $< 0.1\ \%$	$V_{OUT} + 0.3$		5.5	
Supply Current			•	130		μA
Shutdown Current			•	3		μA
Dropout Voltage		$I_{LOAD} = 0$	•	5		mV
		$I_{LOAD} = 5\ \text{mA}$	•	50		mV
Enable Pin (ENABLE)		Input Current	•	-1	1	μA
		Logic High Voltage	•	2		V
		Logic Low Voltage	•		0.8	V
Short-Circuit Current		$V_{OUT} = \text{GND} / V_{IN}$		16	20	mA
Ripple Rejection Ratio		Frequency = 60 Hz		-95		dB
Turn-on Settling Time		Stable to 0.1 %, $C_L = 0.1\ \mu\text{F}$		220		μs
Long-Term Stability		1000 hours, SOIC-8		16		ppm/1000 hours
		1000 hours, MSOP-8		55		ppm/1000 hours
Temperature Range		Specified Temperature Range		-40	125	$^\circ\text{C}$
		Operating Temperature Range		-55	125	$^\circ\text{C}$

¹ Each parameter is explained in the terminology section of this data sheet.

Typical Performance Characteristics

Unless otherwise stated, $V_{IN} = V_{OUT} + 0.3\text{ V}$, $I_{LOAD} = 0$, $C_L = 0.1\ \mu\text{F}$, $T_A = 25\ ^\circ\text{C}$.

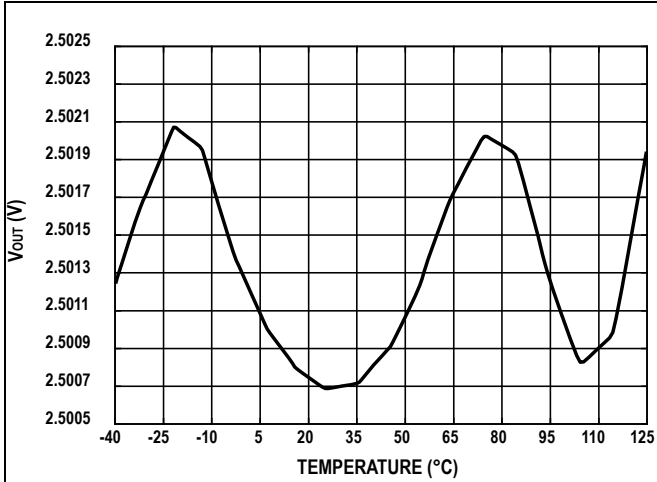


Figure 2. ZJR1003-9 Typical Output Voltage vs. Temperature

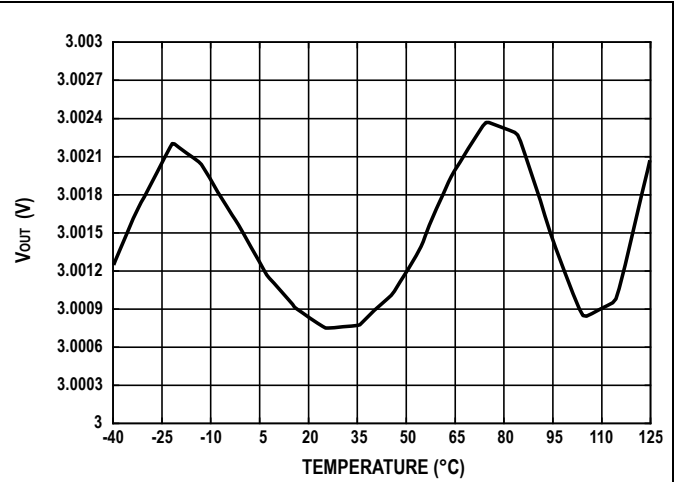


Figure 3. ZJR1003-3 Typical Output Voltage vs. Temperature

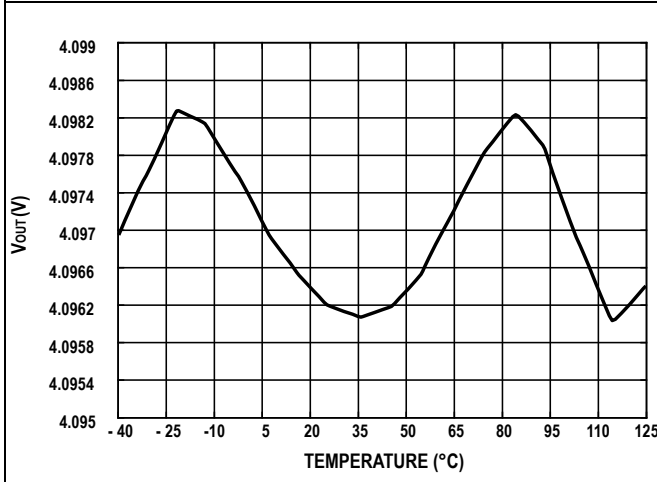


Figure 4. ZJR1003-4 Typical Output Voltage vs. Temperature

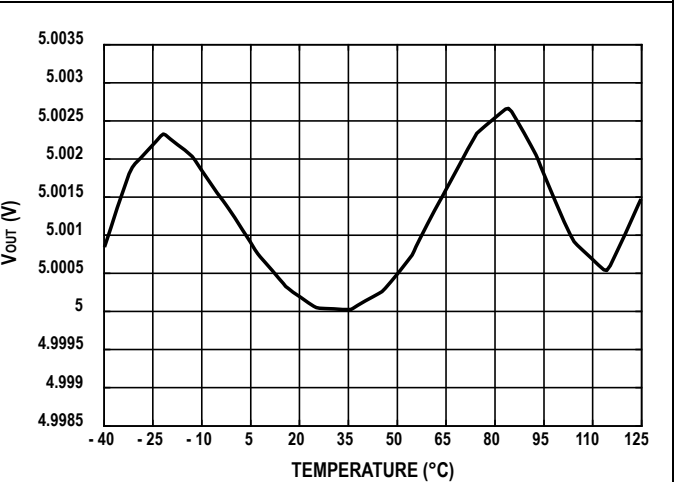


Figure 5. ZJR1003-5 Typical Output Voltage vs. Temperature

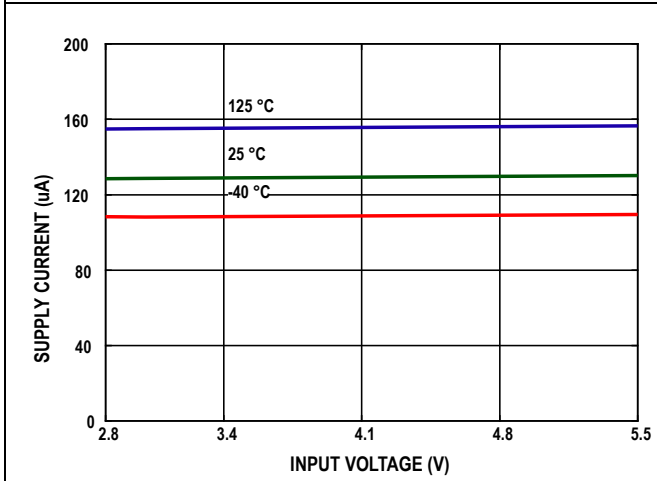


Figure 6. ZJR1003-9 Supply Current vs. Input Voltage

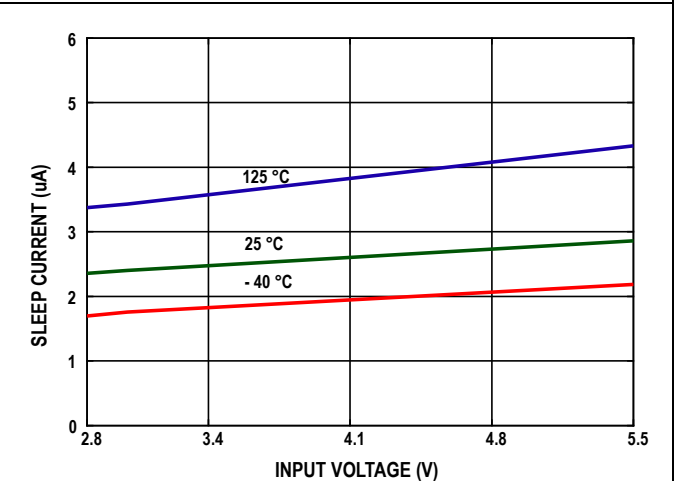


Figure 7. ZJR1003-9 Shutdown Current vs. Input Voltage

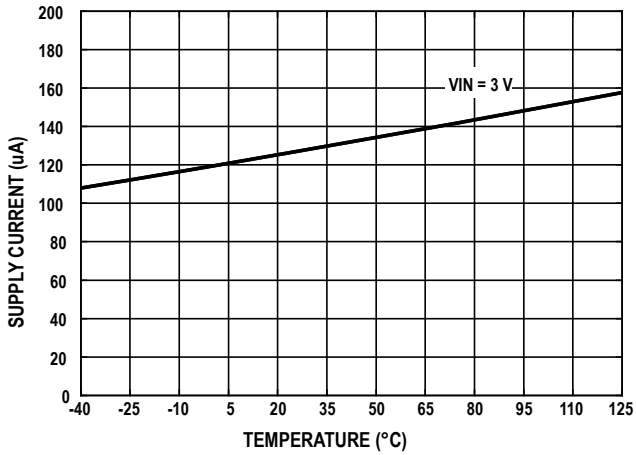


Figure 8. ZJR1003-9 Supply Current vs. Temperature

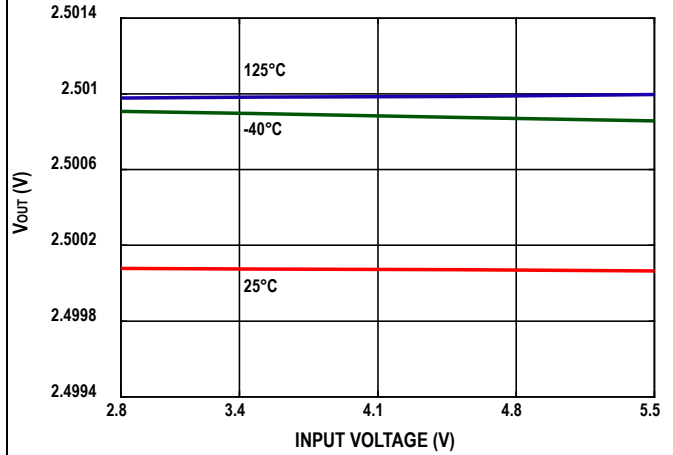


Figure 9. ZJR1003-9 Line Regulation

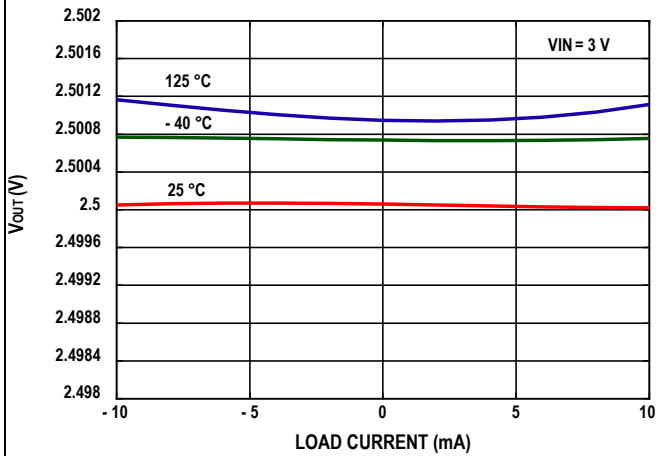


Figure 10. ZJR1003-9 Load Regulation

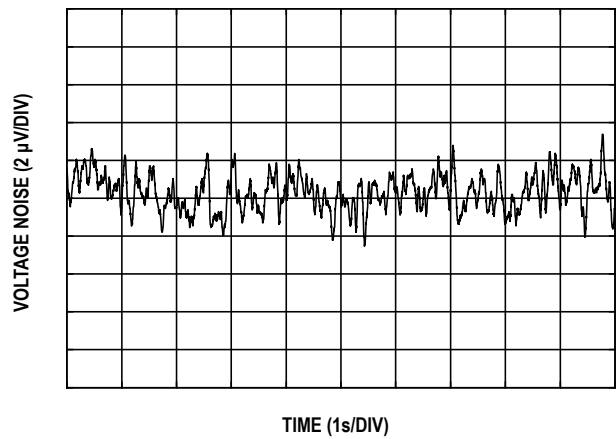


Figure 11. ZJR1003-9 Typical Voltage Noise (0.1 Hz to 10 Hz)

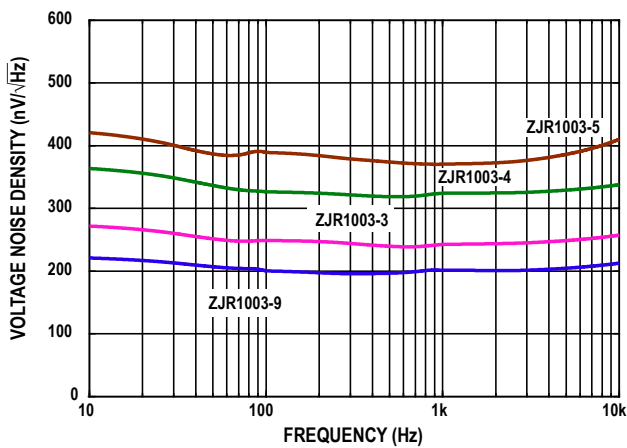


Figure 12. ZJR1003 Noise Density vs. Frequency (10 Hz to 10 kHz)

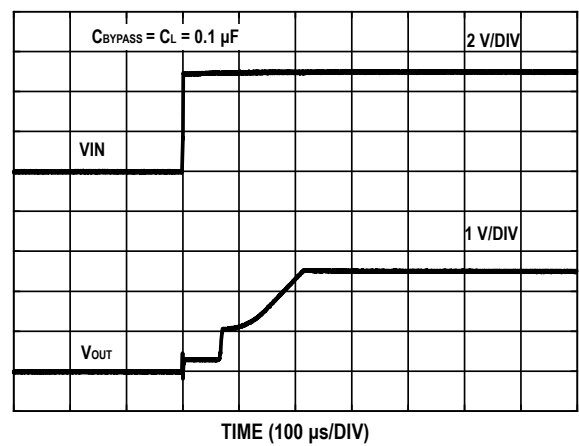


Figure 13. ZJR1003-9 Turn-On Response

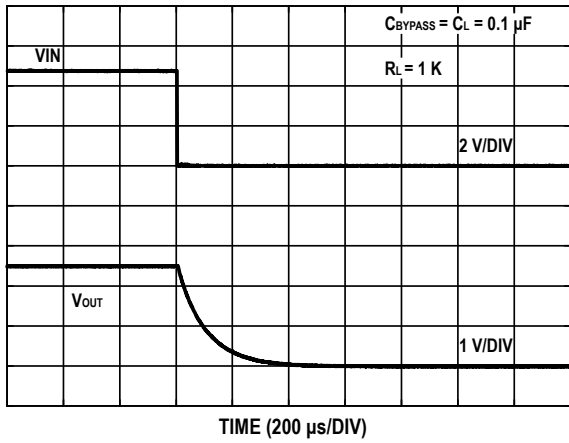


Figure 14. ZJR1003-9 Turn-Off Response

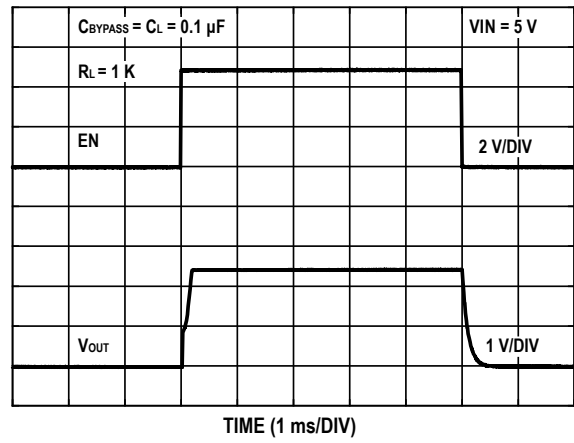


Figure 15. ZJR1003-9 Enable Transient

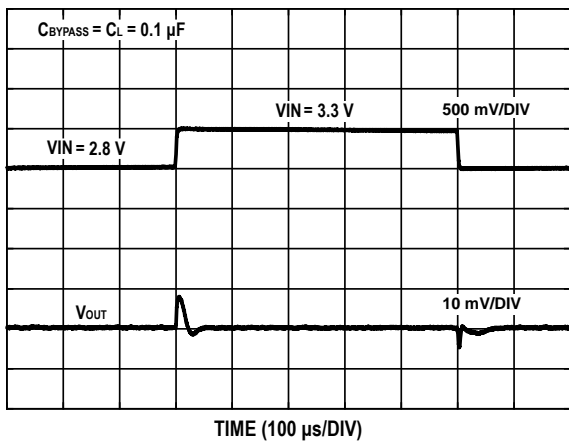


Figure 16. ZJR1003-9 Line Transien

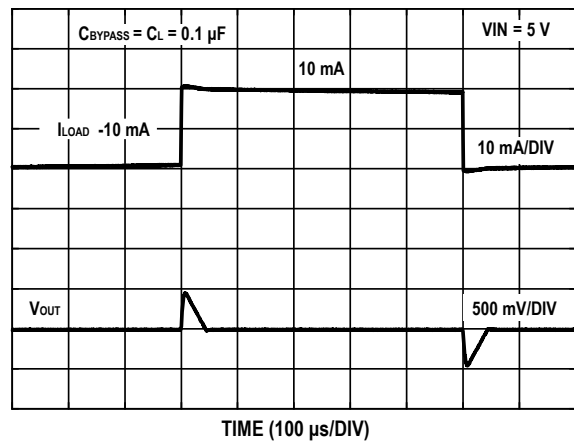


Figure 17. ZJR1003-9 Load Transient

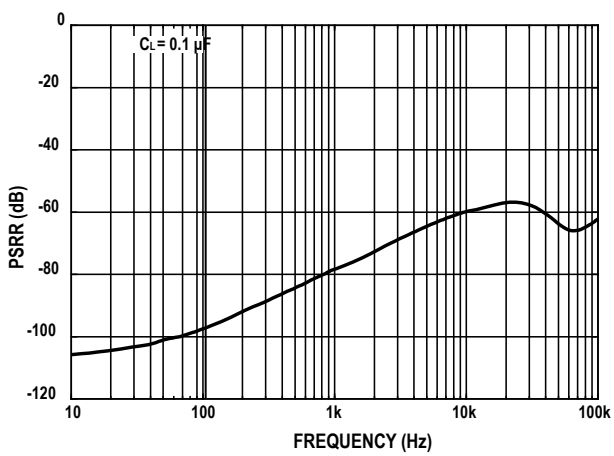


Figure 18. ZJR1003-9 Power Supply Rejection Ratio vs. Frequency

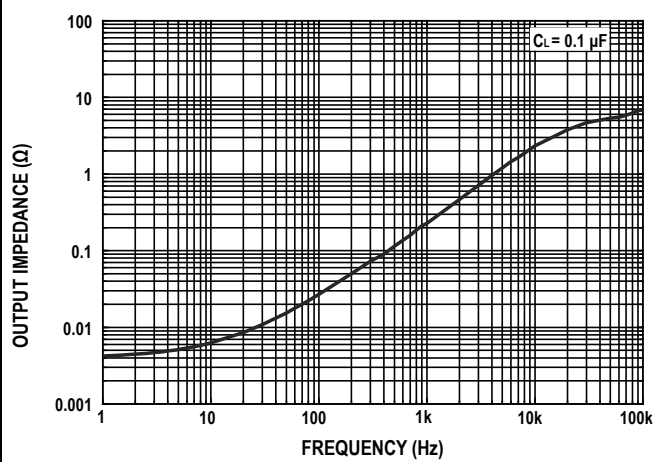
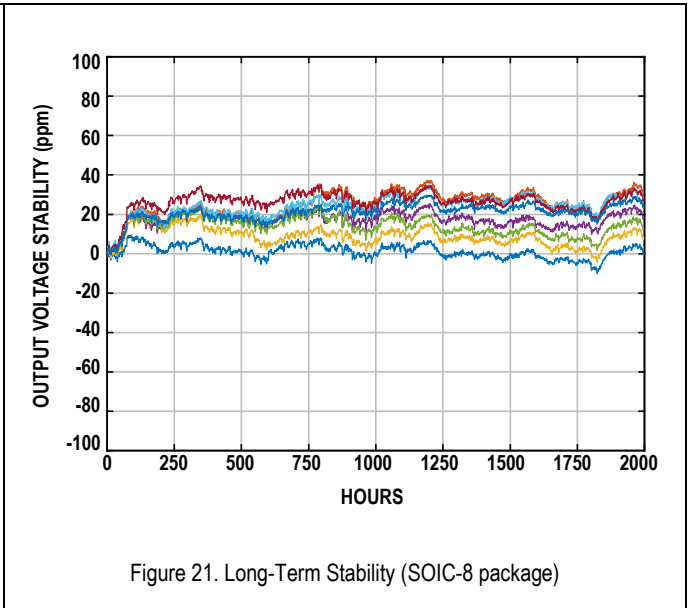
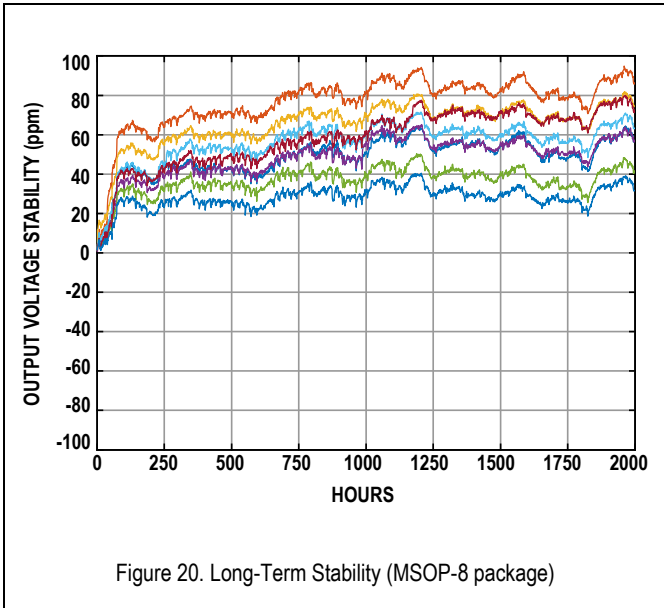


Figure 19. ZJR1003-9 Output Impedance vs. Frequency



Terminology

Temperature Coefficient

The change of output voltage over the operating temperature range is normalized by the output voltage at 25 °C, and expressed in ppm/°C as

$$dV_{OUT}/dT = \frac{V_{OUT(max)} - V_{OUT(min)}}{V_{OUT(25)} \times (T2 - T1)} \times 10^6$$

Where:

$V_{OUT(25)}$: Output voltage at 25 °C.

$V_{OUT(min)}$: The lowest output voltage over temperature T1 to T2 range.

$V_{OUT(max)}$: The highest output voltage over temperature range T1 to T2.

For ZJW Micro voltage references, temperature T1 is -40 °C, and T2 is +125 °C.

Long-term Stability

This is the measurement of the change in output voltage of the measured device at 25 °C after 1000 hours (approximately 42 days) of operation at a constant ambient temperature. Generally measured in ppm. Long-term stability is not only affected by variations in the device itself, but also by soldering and board materials. Long-term stability generally exhibits a logarithmic characteristic, therefore the change in the second 1000 hours will be much smaller than the change in the first 1000 hours.

$$LTD = \frac{V_{OUT(t0)} - V_{OUT(t1)}}{V_{OUT(t0)}} \times 10^6$$

where:

$V_{OUT(t0)}$: Output voltage at 25 °C at Time 0.

$V_{OUT(t1)}$: Output voltage at 25 °C at Time 1 after 1000 hours of operation under constant ambient temperature.

Thermal Hysteresis

The change of output voltage after the device is cycled through temperatures from +25 °C to -40 °C to +125 °C and back to +25 °C. This is a typical value from a sample of parts put through such a cycle. It is normally in ppm using the following equation:

$$TH = \frac{V_{OUT(25)} - V_{OUT(TC)}}{V_{OUT(25)}} \times 10^6$$

where:

$V_{OUT(25)}$: Output voltage at 25 °C.

$V_{OUT(TC)}$: Output voltage at 25 °C after the temperature cycle.

Line Regulation

The change in output voltage due to a specified change in input voltage. It includes the effects of self-heating. Line regulation is expressed in either percent per volt, parts per million per volt, or microvolts per volt change in input voltage, such as ppm/V.

Load Regulation

The change in output voltage due to a specified change in load current. It includes the effects of self-heating. Load regulation is expressed in either microvolts per milliampere or parts per million per milliampere, such as ppm/mA.

Theory of Operation

ZJR1003 series of precision voltage reference products is based on state-of-the-art CMOS technology, Figure 22 shows ZJR1003 internal blocks respectively. The bandgap reference is the core, which has been carefully designed and can deliver the key performances by proprietary post-package trimming. All pins have the internal protection circuit in order to make ZJR1003 reliable parts, and their ESD level reaches 8 kV HBM.

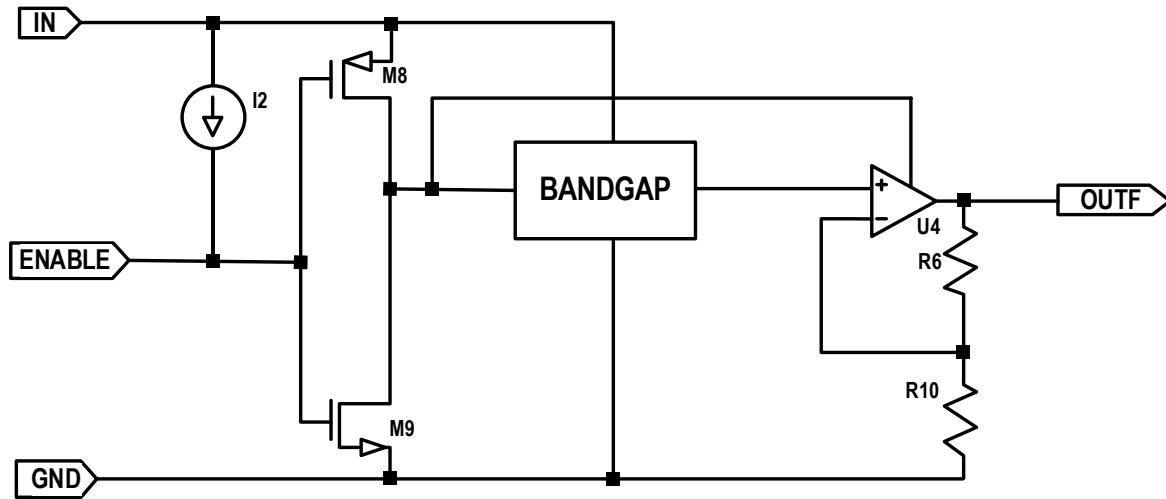


Figure 22. Simplified Schematic of ZJR1003

Applications

ZJR1003 Basic Connections

Voltage references, including ZJR1003, normally require a capacitor at the output between OUTF and GND. Figure 23 is the basic connection of ZJR1003. Other than a 0.1 μF capacitor at the output, no further component is needed for normal operation.

However, in actual system, the power supply may change rapidly. Adding a 1 μF to 10 μF capacitor at the input can help the performances of the voltage reference. An additional 0.1 μF capacitor in parallel can reduce power supply noise further.

The output capacitance ranges from 0.1 μF to 10 μF . Too big capacitive load can cause output oscillation. Capacitor equivalent series resistance (ESR) within 1.5 Ω is recommended to ensure its stability. Meanwhile, larger output capacitor results in longer turn-on time.

Capacitance value depends on the load of the voltage reference, source or sink current et al. New SAR ADC, such as ZJC2000, requires its voltage reference can source and sink current.

It is recommended to use surface-mounted ceramic capacitors (such as X5R, X7R). If an electrolytic capacitor is used at the output, a 0.1 μF ceramic capacitor should be placed in parallel to reduce the overall ESR at the output. In addition, the capacitors' operating temperature range should be wider, or at least the same as the system's temperature range.

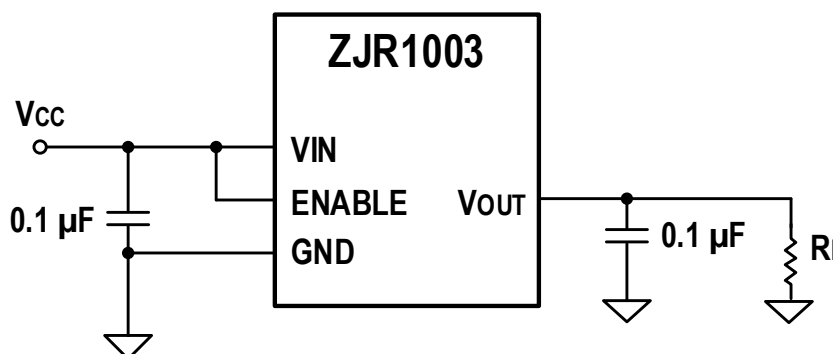


Figure 23. ZJR1003 Basic Connections

Power on and Shutdown Mode

Figure 13 shows the turn-on process of ZJR1003. The value of the load capacitance affects the turn-on time. In general, the larger the load capacitance, the longer the settling time. Settling to higher accuracy sees exponentially longer turn-on time.

For power sensitive high precision applications, ZJR1003 have shutdown mode, which has the supply current of 3 μA across the specified temperature range. Drive pin 3 (ENABLE) low, the part will enter shutdown mode & high will be in normal operation as can be found in Figure 18. Leave pin 3 unconnected (there is a weak internal pull-up circuit) or connect to IN, ZJR1003 will be in normal operation. For applications operating in complex environments, it is recommended to connect a 1 k Ω resistor in series and pull it to pin 2 VIN to enhance system reliability.

Supply Voltage

The supply voltage of ZJR1003 range from 300 mV higher than the output voltage to 5.5 V. It is recommended to power ZJR1003 by linear power supplies, such as LDO, in order to get high performances.

Noise Performance

ZJR1003 have very low output noise. The noise of ZJR1003-9 is typically within 2.5 ppm_peak-to-peak over the 0.1 Hz to 10 Hz band. The noise measurement is made with a band-pass filter made of a high-pass filter with a corner frequency at 0.1 Hz and a low-pass filter with a corner frequency at 10 Hz.

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Power Dissipation

ZJR1003 is low power dissipation devices with a typical supply current of 130 μ A. In case of heavy load, it is necessary to calculate the power dissipation of the device, and take into account the performance changes caused by it. The temperature of the device increases according to the equation below.

$$T_J = P_D \times \theta_{JA} + T_A$$

where:

T_J = Junction temperature ($^{\circ}$ C)

T_A = Ambient temperature ($^{\circ}$ C)

P_D = Power dissipated (W)

θ_{JA} = Junction-to-ambient thermal resistance ($^{\circ}$ C/W)

The junction temperature of ZJR1003 must not exceed the absolute maximum rating of 150 $^{\circ}$ C.

Product Applications

Voltage Reference Noise to ADC Resolution

In general, the voltage reference's 0.1 Hz to 10 Hz noise should be within ADC's 1/2 LSB. With the same resolution, the larger the full-scale voltage, the lower the noise requirement to the voltage reference as can be found in Table 1. ZJR1001 and ZJR1002 are able to be used as 16-bit ADC voltage reference.

Resolution (bit)	0.1 Hz to 10 Hz Noise ($\mu\text{V}_{\text{P-P}}$)	
	2.5 V full scale	5 V full scale
8	4,882.8	9,765.6
10	1,220.7	2,441.4
12	305.2	610.4
14	76.3	152.6
16	19.1	38.1
18	4.8	9.5

Table 1. ADC Resolution vs. Voltage Reference Noise

Generating a Negative Output Precision Voltage Reference

Sometimes a system needs to provide a negative output precision voltage reference. The circuit in Figure 24 can meet this goal. Its advantage is that the circuit uses very few external components, and these external components do not affect the output performance. In verification, we used a ZJR1003-9 with power supplies of $\pm 5\text{ V}$ ($V_{\text{CC}} = 5\text{ V}$, $V_{\text{EE}} = -5\text{ V}$). It's important to note the current and power consumption of the resistor R connected to the pin GND. If its resistance is R, the current flowing through it is $(V_{\text{EE}} - V_{\text{O}})/R$, and the power consumption is $(V_{\text{EE}} - V_{\text{O}})^2 / R$. Especially when the voltage difference ($V_{\text{EE}} - V_{\text{O}}$) is large, select a resistor that can withstand the calculated power consumption. However, this resistor does not affect the temperature coefficient of the negative output precision voltage reference. Figure 25 shows the lab verification results.

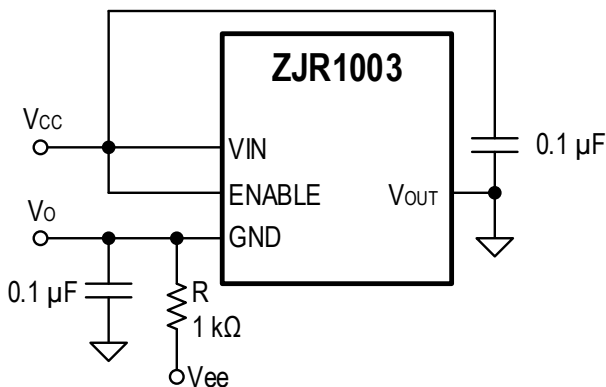


Figure 24. Generating a Negative Output Precision Voltage Reference with ZJR1003

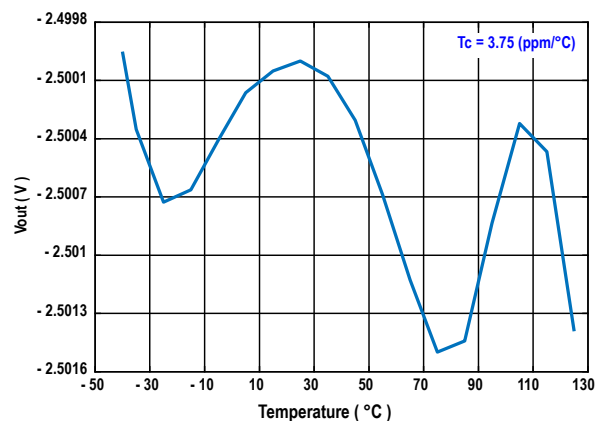


Figure 25. Experimental Results of Figure 22

ZJR1003 Used in High-Precision Data Acquisition Systems

Designing 16-bit and 18-bit programmable data acquisition systems (DAS) with high common-mode rejection (CMRR) is challenging. This requires a high-performance voltage reference to ensure the noise and performance over temperature of the data acquisition system, and in some cases, its long-term stability. ZJW, building on its robust portfolio of high-performance signal chain products, has launched a reference design for a high CMRR, programmable data acquisition system with up to 18-bit accuracy. The low noise and temperature drift of ZJR1003, which is better than 5 ppm/°C, lays the foundation for ensuring the system’s performance. The materials for this reference design are available on zjwmicro.com.

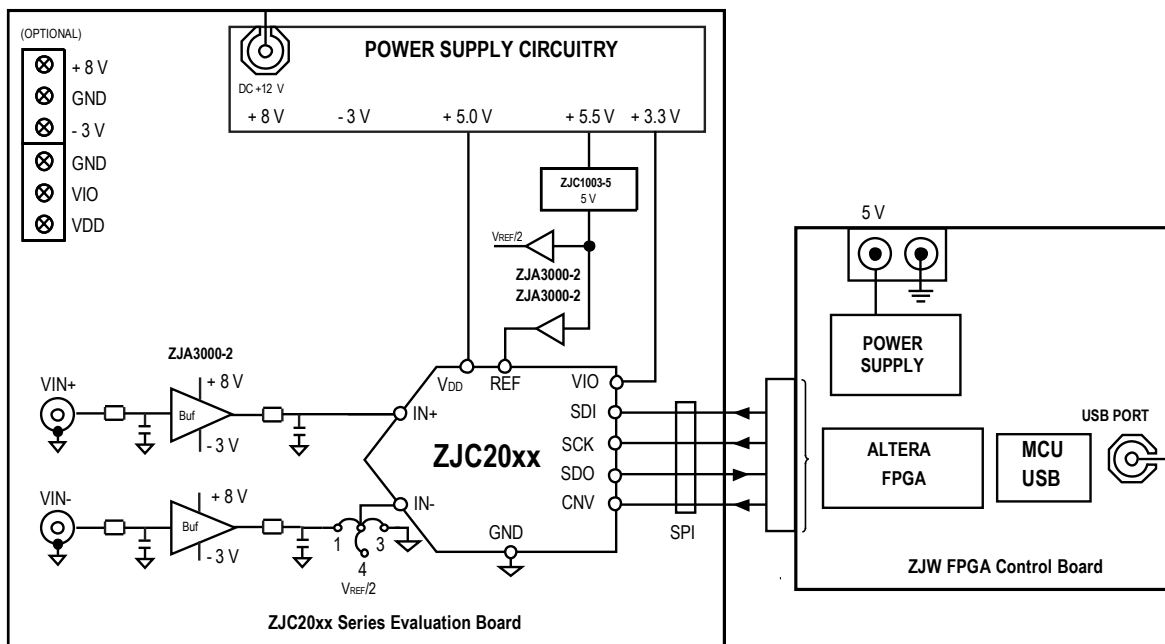


Figure 26. ZJR1003 Used in up to 18-bit Accuracy Precision DAS

Layout Guidelines

- Place the power-supply bypass capacitor as closely as possible to the supply and ground pins. The recommended value of this bypass capacitor is from 1 μ F to 10 μ F. If necessary, additional decoupling capacitance can be added to compensate for noisy or high-impedance power supplies.
- The output must be decoupled with a bigger than 0.1 μ F capacitor. For better noise performance, the recommended ESR on the output capacitor is from 1 Ω to 1.5 Ω . For even lower noise, a larger capacitor in parallel or an RC filter can be added.
- Use large area ground plane if possible. Keep fast-changing or high-frequency interference signals far from ZJR1003.

Layout Example

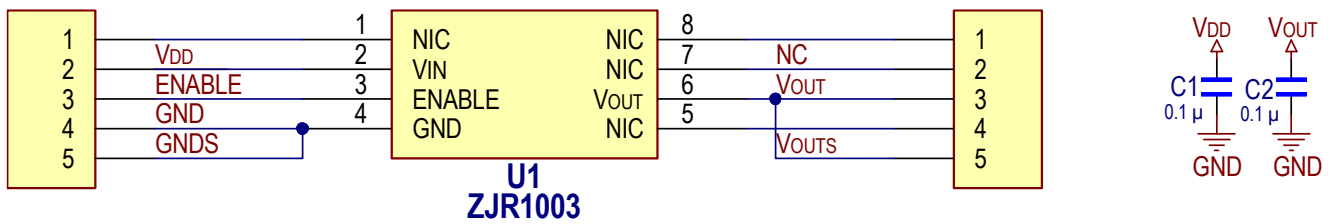


Figure 27. ZJR1003 Evaluation Board Schematic

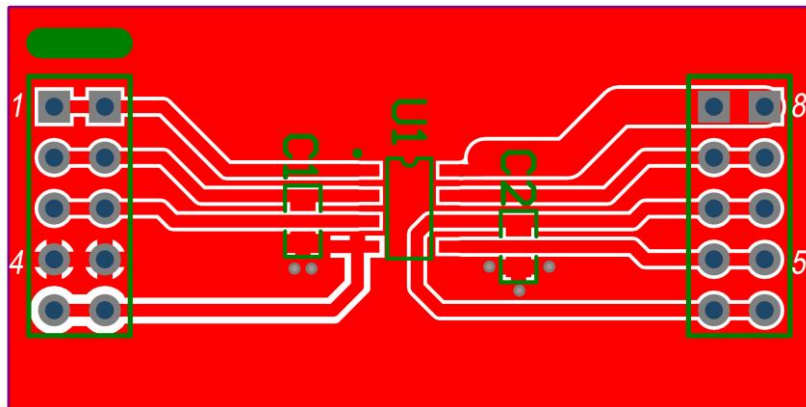


Figure 28. ZJR1003 Evaluation Board Layout (Top Layer)



Figure 29. ZJR1003 Evaluation Board Layout (Bottom Layer)

Outline Dimensions

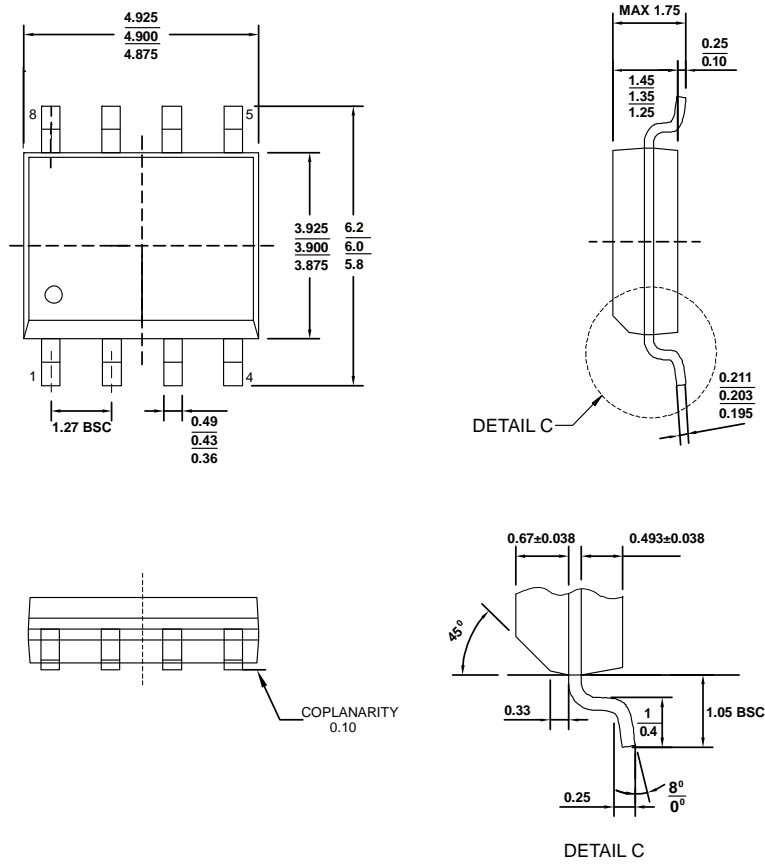


Figure 30. 8-Lead SOIC Package Dimensions shown in millimeters

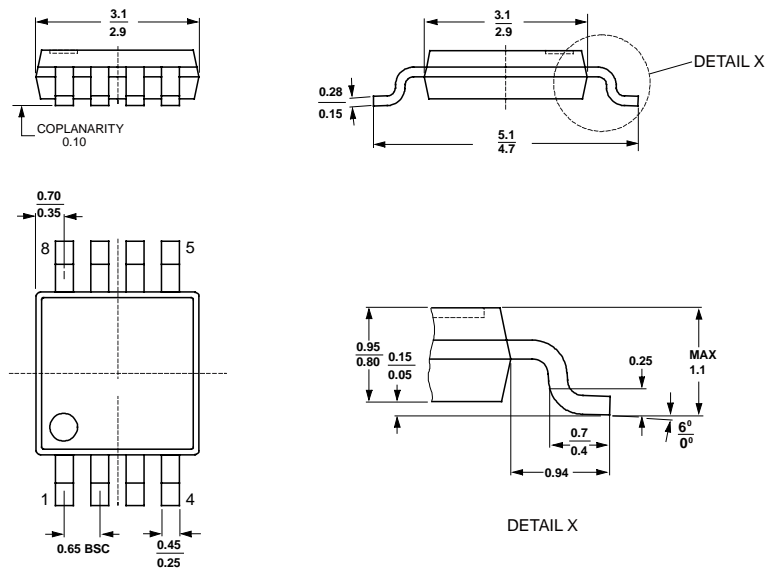


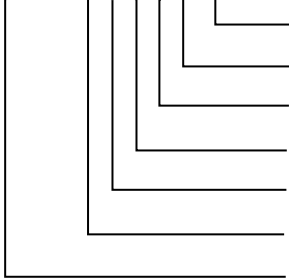
Figure 31. 8-Lead MSOP Package Dimensions shown in millimeters

Ordering Guide

Model	Output Voltage (V)	Package	Orderable Device	Max TempCo (ppm/°C)	Temperature Range (°C)	External Package
ZJR1003-9	2.5	SOIC - 8	ZJR1003-9BSABT	5	- 40 至 + 125	Tube
		SOIC - 8	ZJR1003-9BSABR	5	- 40 至 + 125	13" Reel
		MSOP - 8	ZJR1003-9BUABT	5	- 40 至 + 125	Tube
		MSOP - 8	ZJR1003-9BUABR	5	- 40 至 + 125	13" Reel
		SOIC - 8	ZJR1003-9ASABT	8	- 40 至 + 125	Tube
		SOIC - 8	ZJR1003-9ASABR	8	- 40 至 + 125	13" Reel
		MSOP - 8	ZJR1003-9AUABT	8	- 40 至 + 125	Tube
		MSOP - 8	ZJR1003-9AUABR	8	- 40 至 + 125	13" Reel
ZJR1003-3	3	SOIC - 8	ZJR1003-3BSABT	5	- 40 至 + 125	Tube
		SOIC - 8	ZJR1003-3BSABR	5	- 40 至 + 125	13" Reel
		MSOP - 8	ZJR1003-3BUABT	5	- 40 至 + 125	Tube
		MSOP - 8	ZJR1003-3BUABR	5	- 40 至 + 125	13" Reel
		SOIC - 8	ZJR1003-3ASABT	8	- 40 至 + 125	Tube
		SOIC - 8	ZJR1003-3ASABR	8	- 40 至 + 125	13" Reel
		MSOP - 8	ZJR1003-3AUABT	8	- 40 至 + 125	Tube
		MSOP - 8	ZJR1003-3AUABR	8	- 40 至 + 125	13" Reel
ZJR1003-4	4.096	SOIC - 8	ZJR1003-4BSABT	5	- 40 至 + 125	Tube
		SOIC - 8	ZJR1003-4BSABR	5	- 40 至 + 125	13" Reel
		MSOP - 8	ZJR1003-4BUABT	5	- 40 至 + 125	Tube
		MSOP - 8	ZJR1003-4BUABR	5	- 40 至 + 125	13" Reel
		SOIC - 8	ZJR1003-4ASABT	8	- 40 至 + 125	Tube
		SOIC - 8	ZJR1003-4ASABR	8	- 40 至 + 125	13" Reel
		MSOP - 8	ZJR1003-4AUABT	8	- 40 至 + 125	Tube
		MSOP - 8	ZJR1003-4AUABR	8	- 40 至 + 125	13" Reel
ZJR1003-5	5	SOIC - 8	ZJR1003-5BSABT	5	- 40 至 + 125	Tube
		SOIC - 8	ZJR1003-5BSABR	5	- 40 至 + 125	13" Reel
		MSOP - 8	ZJR1003-5BUABT	5	- 40 至 + 125	Tube
		MSOP - 8	ZJR1003-5BUABR	5	- 40 至 + 125	13" Reel
		SOIC - 8	ZJR1003-5ASABT	8	- 40 至 + 125	Tube
		SOIC - 8	ZJR1003-5ASABR	8	- 40 至 + 125	13" Reel
		MSOP - 8	ZJR1003-5AUABT	8	- 40 至 + 125	Tube
		MSOP - 8	ZJR1003-5AUABR	8	- 40 至 + 125	13" Reel

Orderable Device Explanation

ZJXXXXX X X X X Q1



Q1: Automotive Grade

External Package: T = tube; R = reel

Temperature range: A = - 40 °C to 125 °C Automotive Grade 1; B = -40 °C to 125 °C; E = - 40 °C to 85 °C

Number of Pins: T = 6, A = 8; B = 10; D = 14; E = 16; P = 20;

Package type: S = SOIC; U = MSOP, TSSOP, SOT; T = DFN, QFN

Grade: B grade is better than A grade

Base: R = Voltage reference; A = Amplifier; C = Data Converter; G = Switch and Multiplexer

Related Parts

Part Number	Description	Comments
ADC		
ZJC2000/2010	18-bit 400 kSPS/200 kSPS SAR ADC	Fully differential input, SINAD 99.3 dB, THD -113 dB
ZJC2001/2011	16-bit 500 kSPS/250 kSPS SAR ADC	Fully differential input, SINAD 95.3 dB, THD -113 dB
ZJC2002/2012	16-bit 500 kSPS/250 kSPS SAR ADC	Pseudo-differential unipolar input, SINAD 91.7 dB, THD -105 dB
ZJC2003/2013		Pseudo-differential bipolar input, SINAD 91.7 dB, THD -105 dB
ZJC2004/2014	18-bit 400 kSPS/200 kSPS SAR ADC	Pseudo-differential unipolar input, SINAD 94.2 dB, THD -105 dB
ZJC2005/2015		Pseudo-differential bipolar input, SINAD 94.2 dB, THD -105 dB
ZJC2007/2017	14-bit 600 kSPS/300 kSPS SAR ADC	Pseudo-differential unipolar input, SINAD 85 dB, THD -105 dB
ZJC2008/2018		Pseudo-differential bipolar input, SINAD 85 dB, THD -105 dB
ZJC2100/1-18	18-bit 400 kSPS/200 kSPS 4-ch differential SAR ADC, SINAD 99.3 dB, THD -113 dB	
ZJC2100/1-16	16-bit 500 kSPS/250 kSPS 4-ch differential SAR ADC, SINAD 95.3 dB, THD -113 dB	
ZJC2102/3-18	18-bit 400 kSPS/200 kSPS 8-ch pseudo-differential SAR ADC, SINAD 94.2 dB, THD -105 dB	
ZJC2102/3-16	16-bit 500 kSPS/250 kSPS 8-ch pseudo-differential SAR ADC, SINAD 91.7 dB, THD -105 dB	
ZJC2102/3-14	14-bit 600 kSPS/300 kSPS 8-ch pseudo-differential SAR ADC, SINAD 85 dB, THD -105 dB	
ZJC2104/5-18	18-bit 400 kSPS/200 kSPS 4-ch pseudo-differential SAR ADC, SINAD 94.2 dB, THD -105 dB	
ZJC2104/5-16	16-bit 500 kSPS/250 kSPS 4-ch pseudo-differential SAR ADC, SINAD 91.7 dB, THD -105 dB	
DAC		
ZJC2541-18/16/14	18/16/14-bit 1 MSPS single channel DAC with unipolar output	Power on reset to 0 V (ZJC2541) or $V_{REF}/2$ (ZJC2543), 1 nV-S glitch, SOIC-8/MSOP-10/DFN-10 packages
ZJC2543-18/16/14		
ZJC2542-18/16/14	18/16/14-bit 1 MSPS single channel DAC with bipolar output	Power on reset to 0 V (ZJC2542) or $V_{REF}/2$ (ZJC2544), 1 nV-S glitch, SOIC-14/TSSOP-16/QFN-16 packages
ZJC2544-18/16/14		
Amplifier		
ZJA3000-1/2/4	Single/Dual/Quad 36 V low bias current precision Op Amps	3 MHz GBW, 35 μ V max Vos, 0.5 μ V/ $^{\circ}$ C max Vos drift, 25 pA max Ibias, 1 mA/Amplifier, input to V-, RRO, 4.5 V to 36 V
ZJA3001-1/2/4	Single/Dual/Quad 36 V low bias current precision Op Amps	3 MHz GBW, 35 μ V max Vos, 0.5 μ V/ $^{\circ}$ C max Vos drift, 25 pA max Ibias, 1 mA/Amplifier, RRO, 4.5 V to 36 V
ZJA3512-2/4	Dual/Quad 36 V 7 MHz precision JFET Op Amps	7 MHz GBW, 35 V/ μ S SR, 50 μ V max Vos, 1 μ V/ $^{\circ}$ C max Vos drift, 2 mA/Amplifier, RRO, 4.5 V to 35 V
ZJA3600/1	36 V ultra-high precision in-amp	CMRR 105 dB min (G = 1), 25 pA max Ibias, 25 μ V max Vosi, gain error 0.001 % max (G = 1), 625 kHz BW (G = 10), 3.3 mA/Amplifier, ± 2.4 V to ± 18 V, -40 $^{\circ}$ C to 125 $^{\circ}$ C specified
ZJA3622/8	36 V low cost precision in-amp	CMRR 93 dB min (G = 10), 0.5 nA max Ibias, 125 μ V max Vosi, 625 kHz BW (G = 10), 3.3 mA/Amplifier, ± 2.4 V to ± 18 V
ZJA3611, ZJA3609	36 V ultra-high precision wider bandwidth precision in-amp (min gain of 10)	CMRR 120 dB min (G = 10), 25 pA max Ibias, 25 μ V max Vosi, 1.2 MHz BW (G = 10), 3.3 mA/Amplifier, ± 2.4 V to ± 18 V, -40 $^{\circ}$ C to 125 $^{\circ}$ C specified
ZJA3676/7	Low power, G = 1 Single/Dual 36 V difference amplifier	Input protection to ± 65 V, CMRR 104 dB min, Vos 100 μ V max, gain error 15 ppm max, 500 kHz BW, 330 μ A, 2.7 to 36 V
Voltage Reference		
ZJR1000	15 V supply precision voltage reference	$V_{OUT} = 1.25/2.048/2.5/3/4.096/5$ V, 5 ppm/ $^{\circ}$ C max drift -40 $^{\circ}$ C to 125 $^{\circ}$ C, ± 0.05 % initial error
ZJR1001	5.5 V low power voltage reference (ZJR1001 with noise filter option)	$V_{OUT} = 2.5/3/4.096/5$ V, 5 ppm/ $^{\circ}$ C max drift -40 $^{\circ}$ C to 125 $^{\circ}$ C, ± 0.05 % initial error, 130 μ A, ZJR1001/2 in SOT23-6, ZJR1003 in SOIC/MS-8
ZJR1002		
ZJR1003		
Switches and Multiplexers		
ZJG4438/4439	36 V fault protection 8:1/dual 4:1 multiplexer	Protection to ± 50 V power on & off, latch-up immune, Ron 270 Ω , 14.8 pC charge injection, t_{ON} 166 nS, 10 V to 36 V