Low Noise, Low Power, Low Temperature Drift, 40 V Precise Voltage Reference

Features

- Low Temperature Drift: 3 ppm/°C max
- High Accuracy: ±0.05% max
- Multiple Output Voltage: 2.048 V, 2.5 V, 3 V, 3.3 V, 4.096 V, 5 V, 10 V
- Low Noise: 0.1 Hz to 10 Hz, 2.1 ppm_{P-P}
- Strong driving capability: 20 mA
- Wide Supply Range: 2.8 V or V_{OUT}+0.3 V to 40 V
- Low Quiescent Current: 160 μA
- Wide Temperature Range: -40 °C to +125 °C

Application

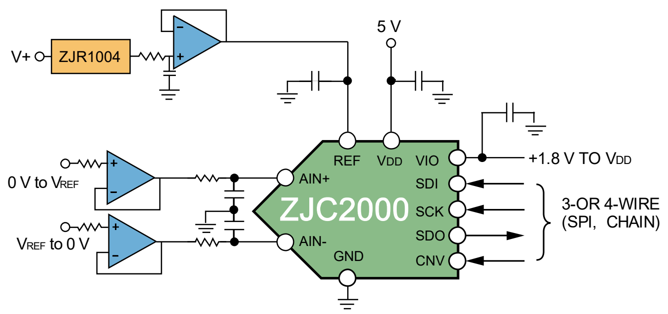
- Precision Data Acquisition
- Precision Instruments
- Industrial Control
- Optical Communication
- Smart Grid

General Description

The ZJR1004 are a series of precision voltage references providing a variety of output voltages with very low temperature coefficient and low noise. It is ideal for applications such as precision instruments and test equipment that require high resolution (>14bit) data acquisition. The performance of ZJR1004 is guaranteed in a wide temperature range from -40 °C to +125 °C. Because of the low dropout feature of ZJR1004, the lowest supply voltage just 2.8 V or 300 mV higher than the output voltage. The maximum supply can be as high as 40 V, which simplifies the design of system power supply. ZJR1004 is a bandgap voltage reference, featuring outstanding temperature coefficient <3 ppm/°C and the initial accuracy <±0.05%. This simplifies or sometimes eliminates the system calibration for most applications. ZJR1004 provides 8-pin SOIC and MSOP packages, and are compatible with industry standard products.

Typical Application

ZJR1004 as ADC Voltge Reference



Typical Characteristics

ZJR1004-5 Output Voltge vs.Temperature (200 units)

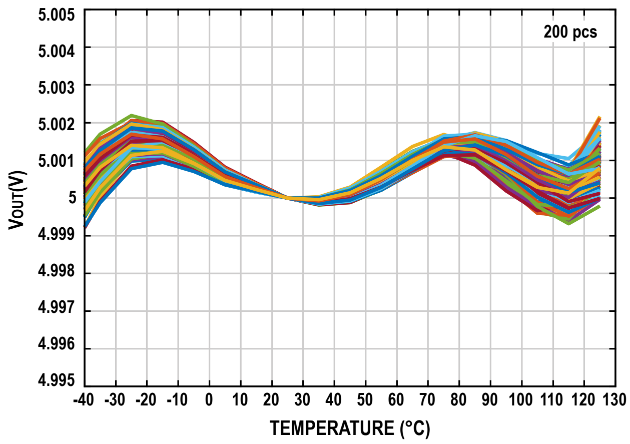


Table of contents

Version (Release D)[1]

Revision History

Oct 2024 ——Release D

Updated Outline Dimensions, Product Order Model and Related Parts

August 2024 —— Release C

Added ZJR1004-2/3/8/4/0 C grade parts

July 2024—— Release B

Added ZJR1004-5/9 C grade parts

Updated Ordering Guide, Product Order Model and Related Parts

May 2024—— Release A

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Pin Configurations and Function Descriptions

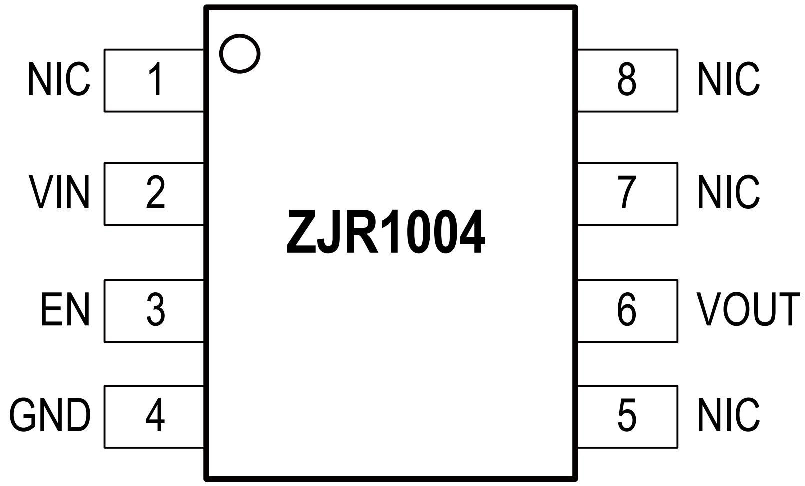

Figure 1. ZJR1004 Pin Configuration (8-lead SOIC and MSOP)

Mnemonic	Pin No.	I/O[1]	Description
NIC	1,5,7,8	--	No Internal Connection
VIN	2	AI	Input voltage
EN	3	AI	EN Input. This active low input powers down the device to 9 μA. If left open, an internal pull-up resistor puts the part in normal operation. It is recommended to tie this pin high externally for best performance during normal operation.
GND	4	AI	Ground Pin=0 V.
VOUT	6	AO	Output voltage

[1] AI: Analog Input; AO: Analog Output.

Absolute Maximum Ratings [1]

Parameter	Rating
Supply Voltage	40 V
Input Voltage	-0.2 V to 40 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) [3]	
Human Body Model (HBM) [4]	4.5 kV
Charge Device Model (CDM) [5]	2 kV

Thermal Resistance [6]

Package Type	θ_{JA}	θ_{JC}	Unit
8-lead SOIC	158	43	°C/W
8-lead MSOP	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.
3 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.
4 ANSI/ESDA/JEDEC JS-001 Compliant
5 ANSI/ESDA/JEDEC JS-002 Complaint
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 operating temperature range, otherwise specifications are at VIN=2.8 V to 40 V, I_{LOAD}=0, C_L=0.1 μF, T_A=25 °C, unless otherwise noted.

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_{OUT}	ZJR1004-2			2.048		V
		ZJR1004-9			2.5		V
		ZJR1004-3			3		V
		ZJR1004-8			3.3		V
		ZJR1004-4			4.096		V
		ZJR1004-5			5		V
		ZJR1004-0			10		V
Initial Accuracy				-0.05		+0.05	%
Temperature Coefficient							
C Grade			●		2.5	3	ppm/°C
B Grade			●		2.8	5	ppm/°C
B Grade, Temperature Grade E		0 °C to +75 °C			3	5	ppm/°C
A Grade			●		3	8	ppm/°C
Voltage Noise		0.1 Hz to 10 Hz			2.1		ppm$_{P-P}$
Voltage Noise Density	e_n	ZJR1004-2, 1 kHz			167		nV/$\sqrt{Hz}$
		ZJR1004-9, 1 kHz			185		nV/$\sqrt{Hz}$
		ZJR1004-3, 1 kHz			225		nV/$\sqrt{Hz}$
		ZJR1004-8, 1 kHz			233		nV/$\sqrt{Hz}$
		ZJR1004-4, 1 kHz			348		nV/$\sqrt{Hz}$
		ZJR1004-5, 1 kHz			380		nV/$\sqrt{Hz}$
		ZJR1004-0, 1 kHz			774		nV/$\sqrt{Hz}$
Line Regulation		ZJR1004-2: VIN=2.8 V~40 V Others: VIN=V_{OUT}+0.3 V~40 V	●		0.1	3	ppm/V
Load Regulation		-10 mA<I_{LOAD}<10 mA	 ●		0.8	20 35	ppm/mA
Supply Voltage	V_{IN}	I_{LOAD}=5 mA, Output Voltage Error≤0.1%					
		ZJR1004-2	●	2.8		40	V
		Others	●	V_{OUT}+0.3		40	V

[1]Each parameter can be found in the Terminology section of this data sheet.

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Supply Current	I_{SY}	No Load	●		160	200	μA
		SHUTDOWN (EN=GND)	●		10	20	μA
Shutdown Pin (EN)		Logic High Input Voltage	●	2			V
		Logic High Input Current	●	-1		1	μA
		Logic Low Input Voltage	●			0.8	V
		Logic Low Input Current	●	-1		1	μA
Output Short Circuit Current	I_{SC}	V_{OUT}=GND or VIN	●	14	20		mA
Turn-on Time		0.1% settling, C_L=0.1 μF			200		μs
Long-Term Stability[2]	LTD	1000 hours, SOIC-8			15		ppm/1000 hours
		1000 hours, MSOP-8			10		ppm/1000 hours
Output Voltage Hysteresis		SOIC-8			50		ppm
		MSOP-8			50		ppm
Temperature Range		Specified Temperature Range		-40		125	°C
		Operating Temperature Range		-55		125	°C

2 Data collected using devices soldered onto the test board.

Typical Performance Characteristics

At VIN=2.8 V to 40 V, I_{LOAD}=0, C_L=0.1 μF, T_A=25 °C, unless otherwise noted.

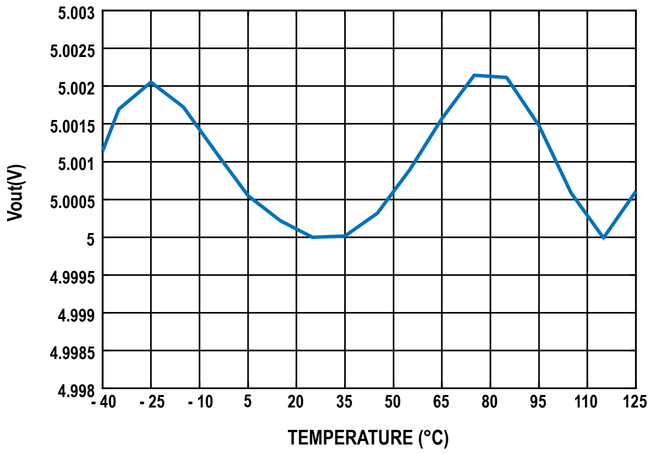

Figure 2. ZJR1004-5 Output Voltage vs. Temperature (B Grade)

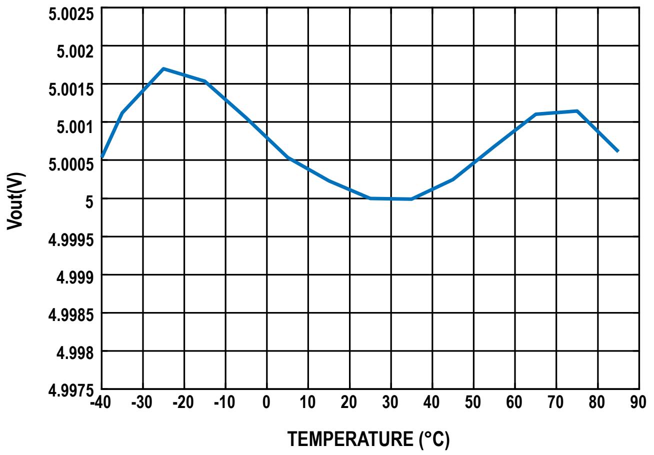

Figure 3. ZJR1004-5 Output Voltage vs. Temperature (E Grade)

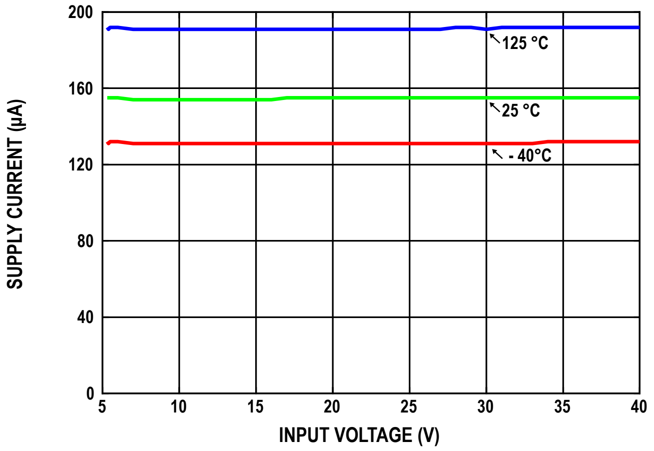

Figure 4. Supply Current vs. Input Voltage

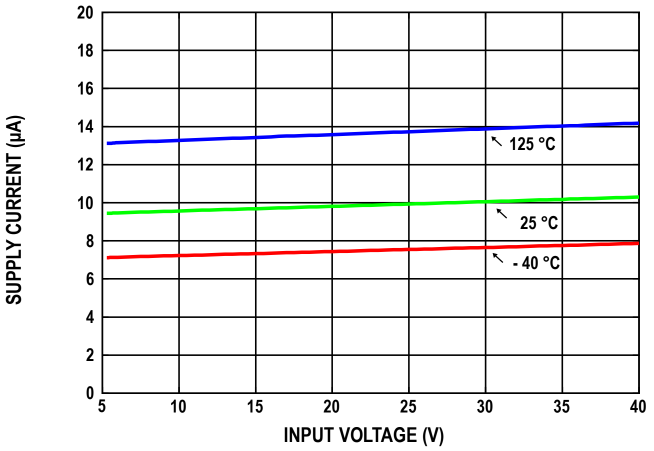

Figure 5. Supply Current vs. Input Voltage in SHUTDOWN mode

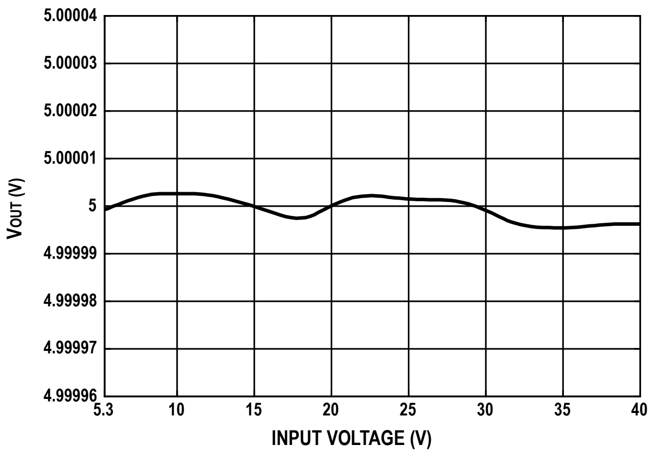

Figure 6. ZJR1004-5 Line Regulation

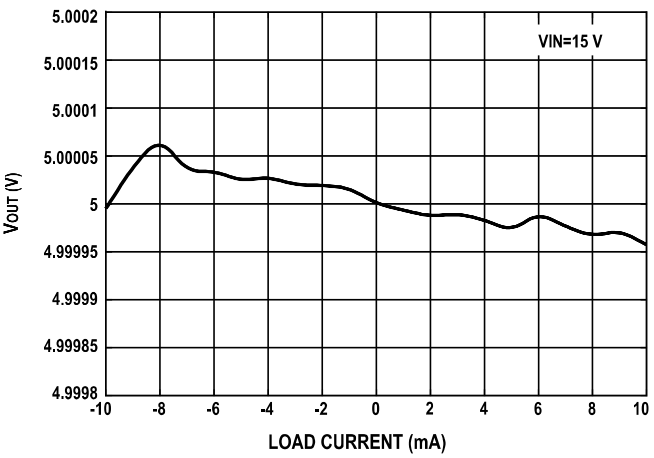

Figure 7. ZJR1004-5 Load Regulation

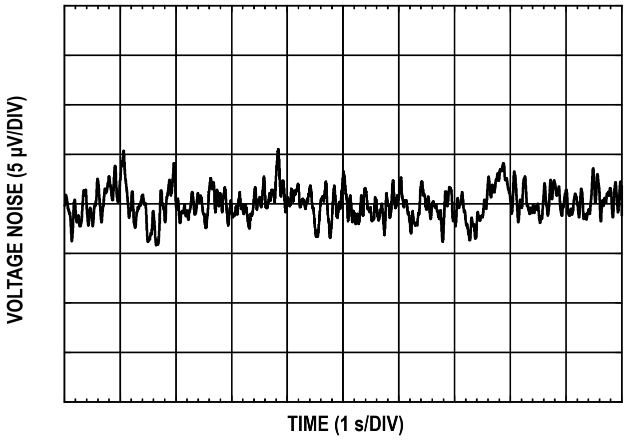

Figure 8. ZJR1004-5 0.1~10 Hz Noise

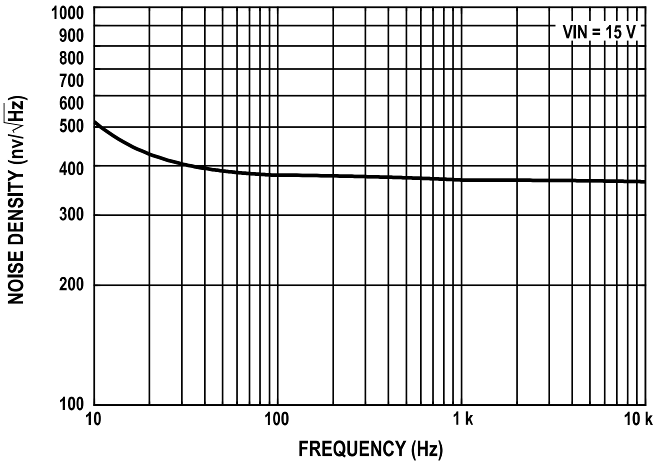

Figure 9. ZJR1004-5 Voltage Noise Density vs. Frequency

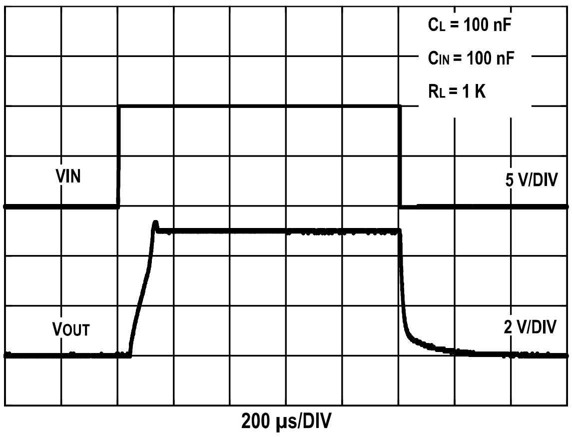

Figure 10. Power-On/Off Response

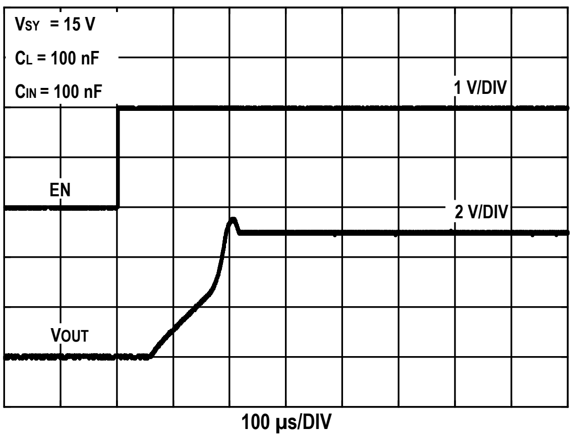

Figure 11. Enable Response

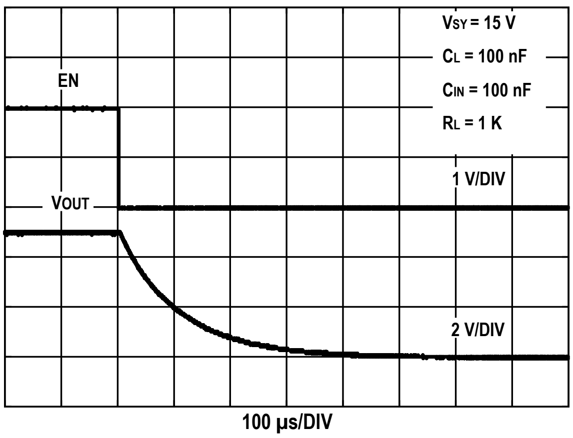

Figure 12. Disable Response

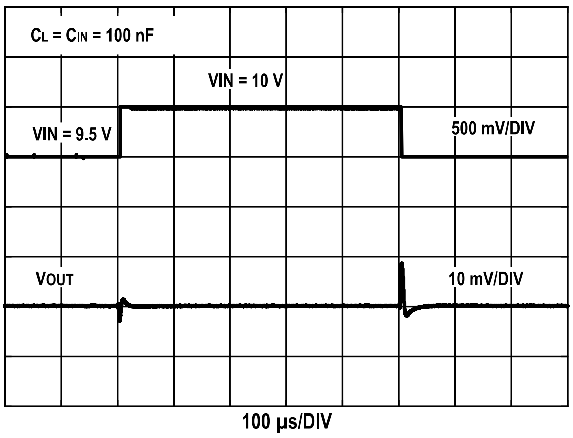

Figure 13. Line Transient Response

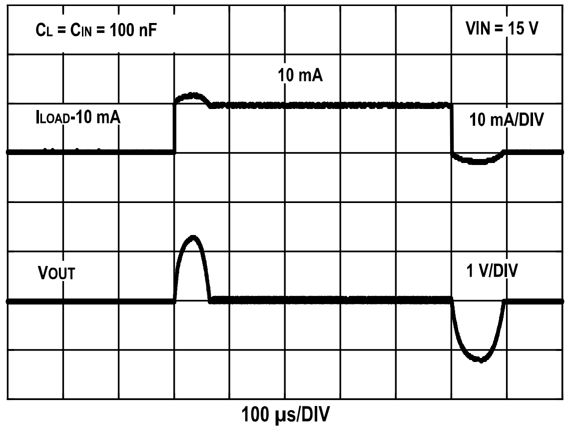

Figure 14. ZJR1004-5 Load Transient Response

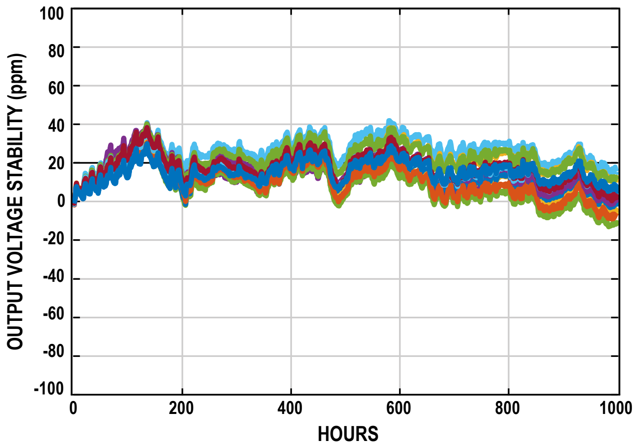

Figure 15. Long-Term Stability (MSOP-8 package)

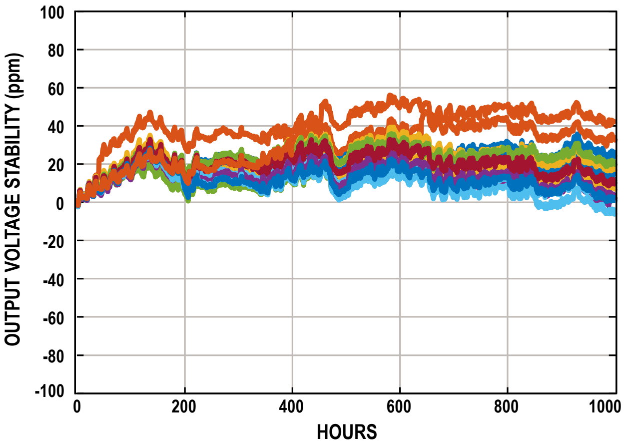

Figure 16. Long-Term Stability (SOIC-8 package)

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

ZJR1004 is a family of low power, low noise and precision voltage reference, which were developed in 40 V BCD process. Figure 17 shows its simplified schematic. The bandgap circuit is the key building block, which was carefully optimized and trimmed in order to deliver the outstanding low temperature co-efficient. The output amplifier provides sufficient driving capability. EN enables or disables the part for normal operation.

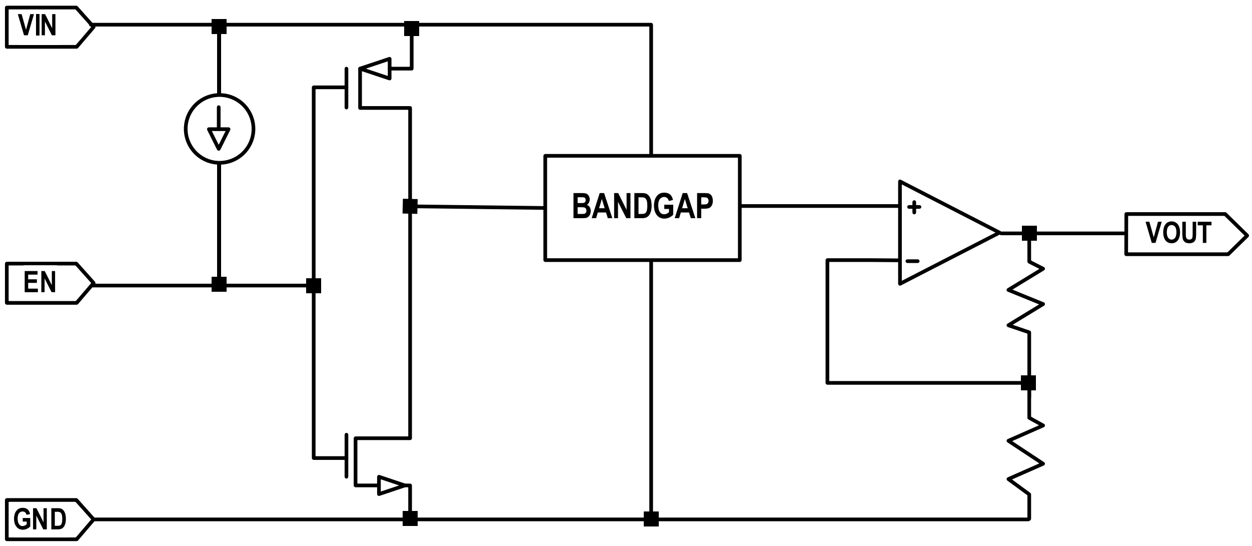

Figure 17. Simplified schematic of ZJR1004

Applications

Typical Configuration

Typical configuration of modern series voltage reference is straight forward. ZJR1004 normally requires a load cap of 0.1 μF~10 μF between V_{OUT} and GND. An input bypass cap of 1 μF is desirable for better power supply rejection as show in Figure 18.

Note the load capacitor ranges from 0.1 μF to 10 μF. Excessive load cap might lead to output settling problem or sometimes oscillation, as well as slower start up. The equivalent series resistance (ESR) of cap is recommended to be less than 1.5 ohm in order to ensure circuit stability. Optimal capacitance value depends on the load condition of the part. For example, if ZJR1004 directly drives SAR ADC, such as ZJC2000, 1 μF or 2.2 μF offers good noise and settling performance.

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 and voltage rating shall be at least as wide as the system requirement.

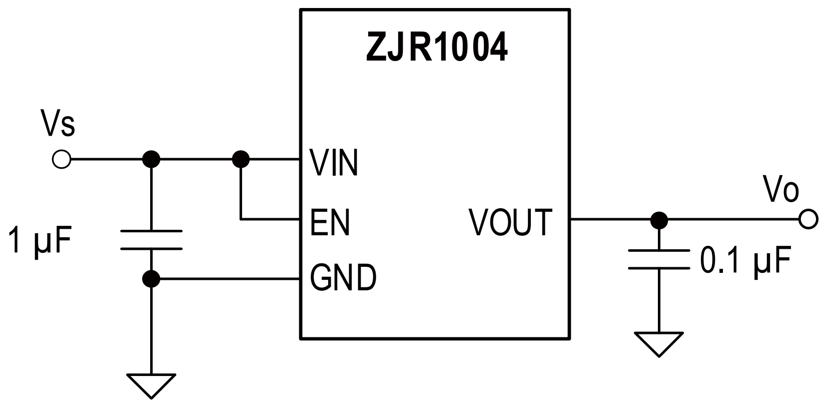

Figure 18. ZJR1004 Typical Configuration

Power on and Shutdown mode

Figure 10 shows the power-on process of ZJR1004. The value of the load capacitor affects the turn-on time. In general, the larger the load cap, the longer the settling time. Settling to higher accuracy sees exponentially longer turn-on time.

For power consumption sensitive applications, ZJR1004 offers useful shut down feature. The part burns just 10 μA in shutdown mode, the shutdown procedure can be found in Figure 11 and Figure 12. Shutdown mode is controlled by pin 3 (EN). The voltage threshold of this pin is around 1.2 V and compatible with CMOS/TTL logic.

There is an internal weak pull-up current 0.22 μA on chip. If the pin is left floating, its voltage rises close to V_{IN} and the part is enabled. Due to the weak pull-up nature, it is recommended that the EN pin be pulled high externally for normal operation to prevent accidental shut down.

Supply Voltage

ZJR1004 has a wide supply voltage range. The lowest supply voltage for ZJR1004-2 is 2.8 V, while in other versions it can be as low as output voltage plus 300 mV. Supply voltage of 10 V higher is widely used in many applications, such as industrial control systems. ZJR1004's highest supply voltage of 40 V might simplify system power supply design.

It is recommended to power ZJR1004 by linear power supplies, such as LDO, in order to ensure high frequency performances.

Noise Performance

The noise generated by ZJR1004-5 is typical 10 μV_{P-P} over the 0.1 Hz to 10 Hz band as shown in Figure 8. The noise measurement employs a band-pass filter with corner frequencies of 0.1 Hz and 10 Hz.

Power Dissipation

ZJR1004 is a low power device with a typical supply current of 160 μA. For high supply voltage and/or 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 (°C)
- T_A=Ambient temperature (°C)
- P_D=Power dissipated (W)
- θ_{JA}=Junction-to-ambient thermal resistance (°C/W)

The ZJR1004 junction temperature must not exceed the absolute maximum rating of 150 °C.

Applications and Implementation

NOTE

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

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. ZJR1004 is able to be used as 16-bit ADC voltage reference.

Resolution (bit)	0.1 Hz to 10 Hz Noise (μV_{P-P})	
	2.5 V Full Scale Voltage	5 V Full Scale Voltage
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

Negative Output Precision Voltage References

In some systems, negative output voltage reference is needed, Figure 19 shows a simple way to get a negative precision voltage reference by using ZJR1004. Extra resistor R is needed together with the negative power supply. ZJR1004-9 is used to verify the circuit, and the power supplies are ±5 V (V_S=5 V, Vee=-5 V). The current of resistor R is (Vee-Vo)/R, and its power dissipation is $(Vee-Vo)^2/R$. In order to obtain highest performance, the user shall minimize on chip heat generation. When the voltage drop on R is high, proper value of R should be picked. Meanwhile, resistor R won't impact the negative voltage reference's temperature coefficient.

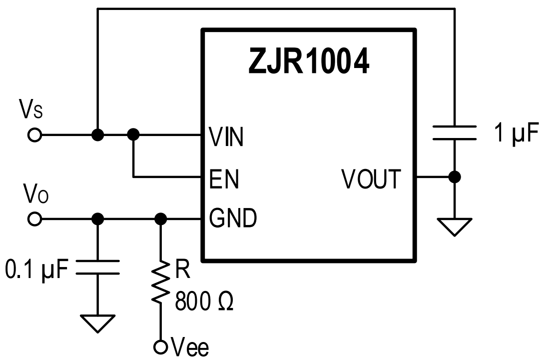

Figure 19. Using ZJR1004 to Generate Negative Output Precision Voltage Reference

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 µF to 10 µF. 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 µF 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 ZJR1004.

Layout Example

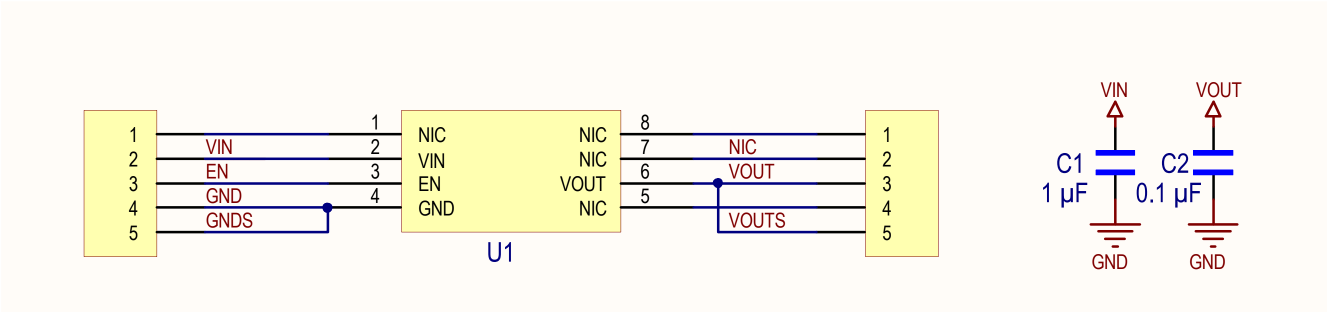

Figure 20. ZJR1004 Evaluation Board Schematic

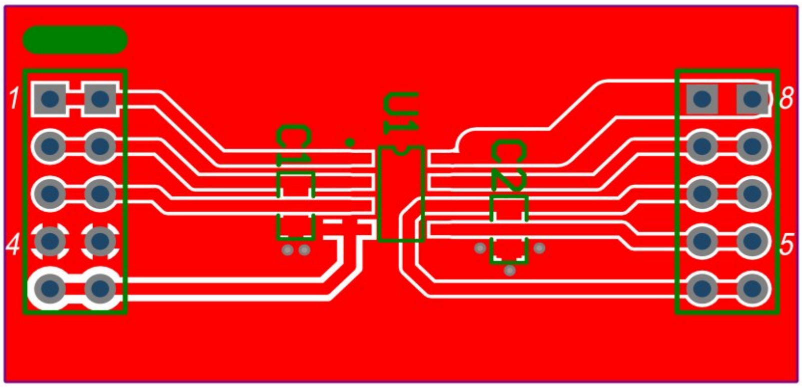

Figure 21. ZJR1004 Evaluation Board Layout (TopLayer)

Figure 22. ZJR1004 Evaluation Board Layout (Bottom Layer)

Outline Dimensions

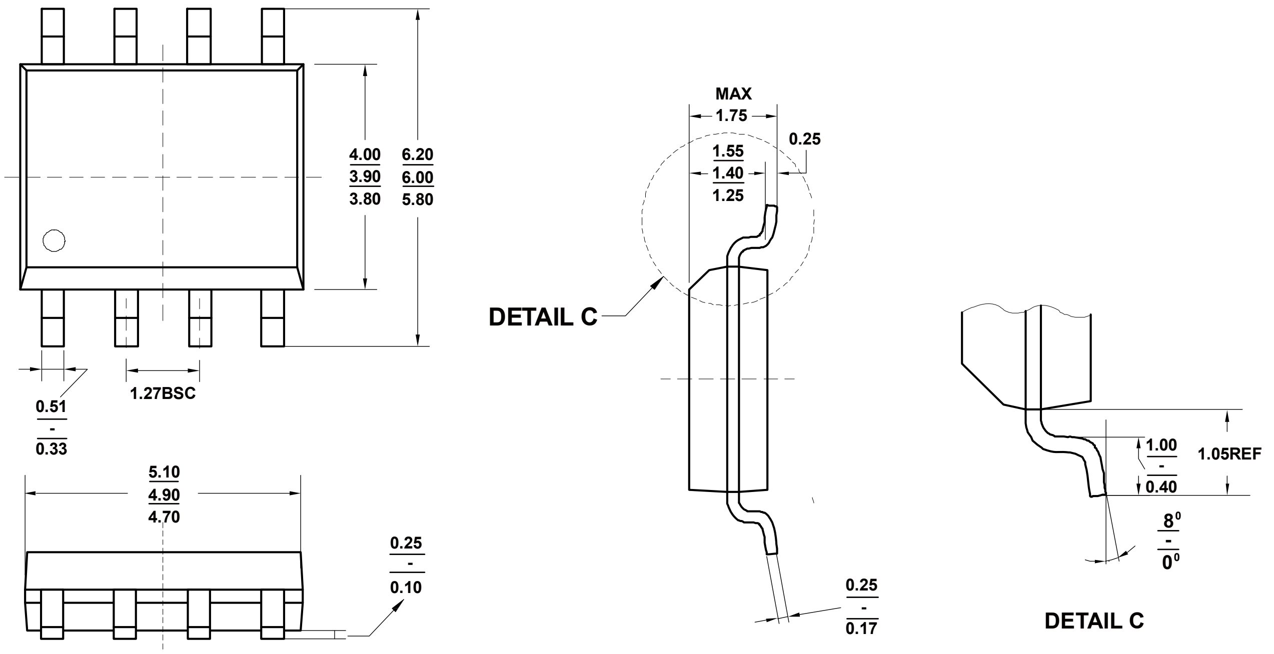

Figure 23. 8-Lead SOIC Package Dimensions shown in millimeters

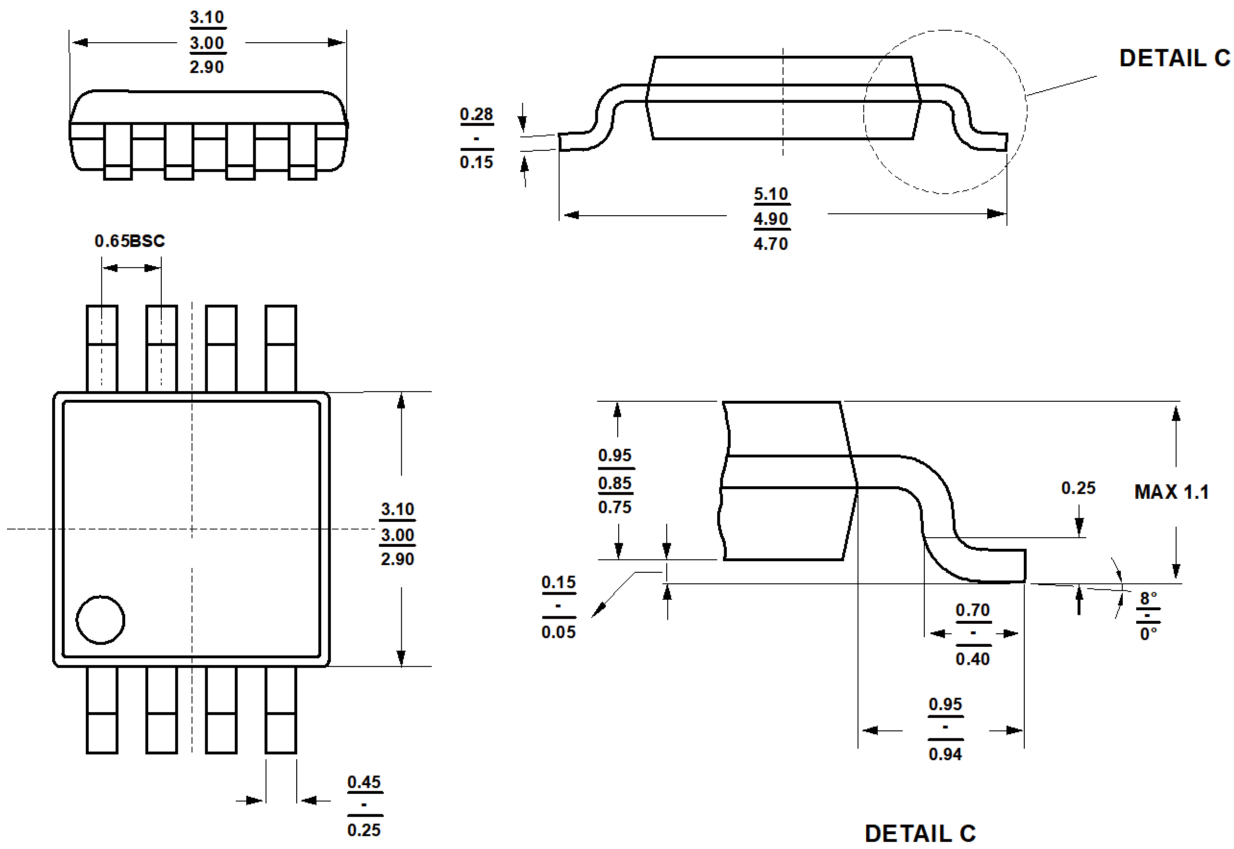

Figure 24. 8-Lead MSOP Package Dimensions shown in millimeters

Ordering Guide

Model	Orderable Device	Status[1]	Temperature Range (°C)	Output Voltage (V)	Max TempCo (ppm/°C)	Package	External Package
ZJR1004-2	ZJR1004-2BSABT	ACTIVE	-40 to +125	2.048	5	SOIC-8	Tube
	ZJR1004-2BSABR					SOIC-8	13” Reel
	ZJR1004-2BUABT					MSOP-8	Tube
	ZJR1004-2BUABR					MSOP-8	13” Reel
	ZJR1004-2ASABT				8	SOIC-8	Tube
	ZJR1004-2ASABR					SOIC-8	13” Reel
	ZJR1004-2AUABT					MSOP-8	Tube
	ZJR1004-2AUABR					MSOP-8	13” Reel
	ZJR1004-2CSABT				3	SOIC-8	Tube
	ZJR1004-2CSABR					SOIC-8	13” Reel
	ZJR1004-2CUABT					MSOP-8	Tube
	ZJR1004-2CUABR					MSOP-8	13” Reel
	ZJR1004-2BSAET		-40 to +85		5	SOIC-8	Tube
	ZJR1004-2BSAER					SOIC-8	13” Reel
	ZJR1004-2BUAET					MSOP-8	Tube
	ZJR1004-2BUAER					MSOP-8	13” Reel
	ZJR1004-2ASAET				8	SOIC-8	Tube
	ZJR1004-2ASAER					SOIC-8	13” Reel
	ZJR1004-2AUAET					MSOP-8	Tube
	ZJR1004-2AUAER					MSOP-8	13” Reel
ZJR1004-9	ZJR1004-9BSABT	ACTIVE	-40 to +125	2.5	5	SOIC-8	Tube
	ZJR1004-9BSABR					SOIC-8	13” Reel
	ZJR1004-9BUABT					MSOP-8	Tube
	ZJR1004-9BUABR					MSOP-8	13” Reel
	ZJR1004-9ASABT				8	SOIC-8	Tube
	ZJR1004-9ASABR					SOIC-8	13” Reel
	ZJR1004-9AUABT					MSOP-8	Tube
	ZJR1004-9AUABR					MSOP-8	13” Reel
	ZJR1004-9CSABT				3	SOIC-8	Tube
	ZJR1004-9CSABR					SOIC-8	13” Reel
	ZJR1004-9CUABT					MSOP-8	Tube
	ZJR1004-9CUABR					MSOP-8	13” Reel
	ZJR1004-9BSAET		-40 to +85		5	SOIC-8	Tube
	ZJR1004-9BSAER					SOIC-8	13” Reel
	ZJR1004-9BUAET					MSOP-8	Tube
	ZJR1004-9BUAER					MSOP-8	13” Reel
	ZJR1004-9ASAET				8	SOIC-8	Tube
	ZJR1004-9ASAER					SOIC-8	13” Reel
	ZJR1004-9AUAET					MSOP-8	Tube
	ZJR1004-9AUAER					MSOP-8	13” Reel

[1] The marketing status values are defined as follows:
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
ACTIVE: Product device recommended for new designs.
NRND: Not recommended for new designs. Device is in production to support existing customers, but ZJW does not recommend using this part in a new design.
LIFEBUY: ZJW has announced that the device will be discontinued, and a lifetime-buy period is in effect.
OBSOLETE: ZJW has discontinued the production of the device.

Model	Orderable Device	Status[1]	Temperature Range (°C)	Output Voltage (V)	Max TempCo (ppm/°C)	Package	External Package
ZJR1004-3	ZJR1004-3BSABT	ACTIVE	-40 to +125	3	5	SOIC-8	Tube
ZJR1004-3	ZJR1004-3BSABR	ACTIVE	-40 to +125	3	5	SOIC-8	13" Reel
ZJR1004-3	ZJR1004-3BUABT	ACTIVE	-40 to +125	3	5	MSOP-8	Tube
ZJR1004-3	ZJR1004-3BUABR	ACTIVE	-40 to +125	3	5	MSOP-8	13" Reel
ZJR1004-3	ZJR1004-3ASABT	ACTIVE	-40 to +125	3	8	SOIC-8	Tube
ZJR1004-3	ZJR1004-3ASABR	ACTIVE	-40 to +125	3	8	SOIC-8	13" Reel
ZJR1004-3	ZJR1004-3AUABT	ACTIVE	-40 to +125	3	8	MSOP-8	Tube
ZJR1004-3	ZJR1004-3AUABR	ACTIVE	-40 to +125	3	8	MSOP-8	13" Reel
ZJR1004-3	ZJR1004-3CSABT	ACTIVE	-40 to +125	3	3	SOIC-8	Tube
ZJR1004-3	ZJR1004-3CSABR	ACTIVE	-40 to +125	3	3	SOIC-8	13" Reel
ZJR1004-3	ZJR1004-3CUABT	ACTIVE	-40 to +125	3	3	MSOP-8	Tube
ZJR1004-3	ZJR1004-3CUABR	ACTIVE	-40 to +125	3	3	MSOP-8	13" Reel
ZJR1004-3	ZJR1004-3BSAET	ACTIVE	-40 to +85	3	5	SOIC-8	Tube
ZJR1004-3	ZJR1004-3BSAER	ACTIVE	-40 to +85	3	5	SOIC-8	13" Reel
ZJR1004-3	ZJR1004-3BUAET	ACTIVE	-40 to +85	3	5	MSOP-8	Tube
ZJR1004-3	ZJR1004-3BUAER	ACTIVE	-40 to +85	3	5	MSOP-8	13" Reel
ZJR1004-3	ZJR1004-3ASAET	ACTIVE	-40 to +85	3	8	SOIC-8	Tube
ZJR1004-3	ZJR1004-3ASAER	ACTIVE	-40 to +85	3	8	SOIC-8	13" Reel
ZJR1004-3	ZJR1004-3AUAET	ACTIVE	-40 to +85	3	8	MSOP-8	Tube
ZJR1004-3	ZJR1004-3AUAER	ACTIVE	-40 to +85	3	8	MSOP-8	13" Reel
ZJR1004-8	ZJR1004-8BSABT	ACTIVE	-40 to +125	3.3	5	SOIC-8	Tube
ZJR1004-8	ZJR1004-8BSABR	ACTIVE	-40 to +125	3.3	5	SOIC-8	13" Reel
ZJR1004-8	ZJR1004-8BUABT	ACTIVE	-40 to +125	3.3	5	MSOP-8	Tube
ZJR1004-8	ZJR1004-8BUABR	ACTIVE	-40 to +125	3.3	5	MSOP-8	13" Reel
ZJR1004-8	ZJR1004-8ASABT	ACTIVE	-40 to +125	3.3	8	SOIC-8	Tube
ZJR1004-8	ZJR1004-8ASABR	ACTIVE	-40 to +125	3.3	8	SOIC-8	13" Reel
ZJR1004-8	ZJR1004-8AUABT	ACTIVE	-40 to +125	3.3	8	MSOP-8	Tube
ZJR1004-8	ZJR1004-8AUABR	ACTIVE	-40 to +125	3.3	8	MSOP-8	13" Reel
ZJR1004-8	ZJR1004-8CSABT	ACTIVE	-40 to +125	3.3	3	SOIC-8	Tube
ZJR1004-8	ZJR1004-8CSABR	ACTIVE	-40 to +125	3.3	3	SOIC-8	13" Reel
ZJR1004-8	ZJR1004-8CUABT	ACTIVE	-40 to +125	3.3	3	MSOP-8	Tube
ZJR1004-8	ZJR1004-8CUABR	ACTIVE	-40 to +125	3.3	3	MSOP-8	13" Reel
ZJR1004-8	ZJR1004-8BSAET	ACTIVE	-40 to +85	3.3	5	SOIC-8	Tube
ZJR1004-8	ZJR1004-8BSAER	ACTIVE	-40 to +85	3.3	5	SOIC-8	13" Reel
ZJR1004-8	ZJR1004-8BUAET	ACTIVE	-40 to +85	3.3	5	MSOP-8	Tube
ZJR1004-8	ZJR1004-8BUAER	ACTIVE	-40 to +85	3.3	5	MSOP-8	13" Reel
ZJR1004-8	ZJR1004-8ASAET	ACTIVE	-40 to +85	3.3	8	SOIC-8	Tube
ZJR1004-8	ZJR1004-8ASAER	ACTIVE	-40 to +85	3.3	8	SOIC-8	13" Reel
ZJR1004-8	ZJR1004-8AUAET	ACTIVE	-40 to +85	3.3	8	MSOP-8	Tube
ZJR1004-8	ZJR1004-8AUAER	ACTIVE	-40 to +85	3.3	8	MSOP-8	13" Reel
ZJR1004-4	ZJR1004-4BSABT	ACTIVE	-40 to +125	4.096	5	SOIC-8	Tube
ZJR1004-4	ZJR1004-4BSABR	ACTIVE	-40 to +125	4.096	5	SOIC-8	13" Reel
ZJR1004-4	ZJR1004-4BUABT	ACTIVE	-40 to +125	4.096	5	MSOP-8	Tube
ZJR1004-4	ZJR1004-4BUABR	ACTIVE	-40 to +125	4.096	5	MSOP-8	13" Reel
ZJR1004-4	ZJR1004-4ASABT	ACTIVE	-40 to +125	4.096	8	SOIC-8	Tube
ZJR1004-4	ZJR1004-4ASABR	ACTIVE	-40 to +125	4.096	8	SOIC-8	13" Reel
ZJR1004-4	ZJR1004-4AUABT	ACTIVE	-40 to +125	4.096	8	MSOP-8	Tube
ZJR1004-4	ZJR1004-4AUABR	ACTIVE	-40 to +125	4.096	8	MSOP-8	13" Reel
ZJR1004-4	ZJR1004-4CSABT	ACTIVE	-40 to +125	4.096	3	SOIC-8	Tube
ZJR1004-4	ZJR1004-4CSABR	ACTIVE	-40 to +125	4.096	3	SOIC-8	13" Reel
ZJR1004-4	ZJR1004-4CUABT	ACTIVE	-40 to +125	4.096	3	MSOP-8	Tube
ZJR1004-4	ZJR1004-4CUABR	ACTIVE	-40 to +125	4.096	3	MSOP-8	13" Reel

Model	Orderable Device	Status[1]	Temperature Range (°C)	Output Voltage (V)	Max TempCo (ppm/°C)	Package	External Package
ZJR1004-4	ZJR1004-4BSAET	ACTIVE	-40 to +85	4.096	5	SOIC-8	Tube
	ZJR1004-4BSAER					SOIC-8	13” Reel
	ZJR1004-4BUAET					MSOP-8	Tube
	ZJR1004-4BUAER					MSOP-8	13” Reel
	ZJR1004-4ASAET				8	SOIC-8	Tube
	ZJR1004-4ASAER					SOIC-8	13” Reel
	ZJR1004-4AUAET					MSOP-8	Tube
	ZJR1004-4AUAER					MSOP-8	13” Reel
ZJR1004-5	ZJR1004-5BSABT	ACTIVE	-40 to +125	5.0	5	SOIC-8	Tube
	ZJR1004-5BSABR					SOIC-8	13” Reel
	ZJR1004-5BUABT					MSOP-8	Tube
	ZJR1004-5BUABR					MSOP-8	13” Reel
	ZJR1004-5ASABT				8	SOIC-8	Tube
	ZJR1004-5ASABR					SOIC-8	13” Reel
	ZJR1004-5AUABT					MSOP-8	Tube
	ZJR1004-5AUABR					MSOP-8	13” Reel
	ZJR1004-5CSABT				3	SOIC-8	Tube
	ZJR1004-5CSABR					SOIC-8	13” Reel
	ZJR1004-5CUABT					MSOP-8	Tube
	ZJR1004-5CUABR					MSOP-8	13” Reel
	ZJR1004-5BSAET		-40 to +85		5	SOIC-8	Tube
	ZJR1004-5BSAER					SOIC-8	13” Reel
	ZJR1004-5BUAET					MSOP-8	Tube
	ZJR1004-5BUAER					MSOP-8	13” Reel
	ZJR1004-5ASAET				8	SOIC-8	Tube
	ZJR1004-5ASAER					SOIC-8	13” Reel
	ZJR1004-5AUAET					MSOP-8	Tube
	ZJR1004-5AUAER					MSOP-8	13” Reel
ZJR1004-0	ZJR1004-0BSABT	ACTIVE	-40 to +125	10.0	5	SOIC-8	Tube
	ZJR1004-0BSABR					SOIC-8	13” Reel
	ZJR1004-0BUABT					MSOP-8	Tube
	ZJR1004-0BUABR					MSOP-8	13” Reel
	ZJR1004-0ASABT				8	SOIC-8	Tube
	ZJR1004-0ASABR					SOIC-8	13” Reel
	ZJR1004-0AUABT					MSOP-8	Tube
	ZJR1004-0AUABR					MSOP-8	13” Reel
	ZJR1004-0CSABT				3	SOIC-8	Tube
	ZJR1004-0CSABR					SOIC-8	13” Reel
	ZJR1004-0CUABT					MSOP-8	Tube
	ZJR1004-0CUABR					MSOP-8	13” Reel
	ZJR1004-0BSAET		-40 to +85		5	SOIC-8	Tube
	ZJR1004-0BSAER					SOIC-8	13” Reel
	ZJR1004-0BUAET					MSOP-8	Tube
	ZJR1004-0BUAER					MSOP-8	13” Reel
	ZJR1004-0ASAET				8	SOIC-8	Tube
	ZJR1004-0ASAER					SOIC-8	13” Reel
	ZJR1004-0AUAET					MSOP-8	Tube
	ZJR1004-0AUAER					MSOP-8	13” Reel

Product Order Model

ZJXXXXX X 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: R=3; K=5; T=6, A=8; B=10; D=14; E=16; P=20
- Package type: S=SOIC; U=MSOP, TSSOP, SOT (3 to 6 pins); T=DFN, QFN; K=SOT (8 pins)
- Grade: B grade is better than A grade
- Base: R=Voltage reference; A=Amplifier; C=Data Converter; G=Switches and Multiplexers, M=Others

Related Device

Part Number	Description	Comments
ADC		
ZJC2020	20-bit 350 kSPS SAR ADC	Fully differential input, SINAD 101.4 dB, THD -118 dB
ZJC2000/2010	18-bit 400 kSPS/200 kSPS SAR ADC	Fully differential input, SINAD 99.3 dB, THD -113dB
ZJC2001/2011	16-bit 500 kSPS/250 kSPS SAR ADC	Fully differential input, SINAD 95.3 dB, THD -113 dB
ZJC2002/2012 ZJC2003/2013	16-bit 500 kSPS/250 kSPS SAR ADC	Pseudo-differential unipolar input, SINAD 91. 7 dB, THD -105 dB Pseudo-differential bipolar input, SINAD 91.7 dB, THD -105 dB
ZJC2004/2014 ZJC2005/2015	18-bit 400 kSPS/200 kSPS SAR ADC	Pseudo-differential unipolar input, SINAD 94.2 dB, THD -105 dB Pseudo-differential bipolar input, SINAD 94.2 dB, THD -105 dB
ZJC2007/2017 ZJC2008/2018	14-bit 600 kSPS/300 kSPS SAR ADC	Pseudo-differential unipolar input, SINAD 85 dB, THD -105 dB Pseudo-differential bipolar input, SINAD 85 dB, THD -105 dB
ZJC2009	Small size, 12-bit 1 MSPS SAR ADC	Single-ended input, SOT23-6, 2.3 V to 5 V, SINAD 73 dB, THD -89 dB
ZJC2100/1-18 ZJC2100/1-16	18-bit 400 kSPS/200 kSPS 4-ch differential SAR ADC, SINAD 99.3 dB, THD -113 dB 16-bit 500 kSPS/250 kSPS 4-ch differential SAR ADC, SINAD 95.3 dB, THD -113 dB	
ZJC2102/3-18 ZJC2102/3-16 ZJC2102/3-14	18-bit 400 kSPS/200 kSPS 8-ch pseudo-differential SAR ADC, SINAD 94.2 dB, THD -105 dB 16-bit 500 kSPS/250 kSPS 8-ch pseudo-differential SAR ADC, SINAD 91.7 dB, THD -105 dB 14-bit 600 kSPS/300 kSPS 8-ch pseudo-differential SAR ADC, SINAD 85 dB, THD -105 dB	
ZJC2104/5-18 ZJC2104/5-16	18-bit 400 kSPS/200 kSPS 4-ch pseudo-differential SAR ADC, SINAD 94.2 dB, THD -105 dB 16-bit 500 kSPS/250 kSPS 4-ch pseudo-differential SAR ADC, SINAD 91.7 dB, THD -105 dB	
DAC		
ZJC2541-18/16/14 ZJC2543-18/16/14	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-10/8, DFN-10 packages
ZJC2542-18/16/14 ZJC2544-18/16/14	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
Amplifier		
ZJA3000-1/2/4 ZJA3001-1/2/4	Single/Dual/Quad 36 V low bias current precision Op Amps	3 MHz, 35 μV max Vos, 0.5 μV/°C max TCVos, 25 pA max Ibias, 1 mA/ch, input to V- (ZJA3000 only), RRO, 4.5 V to 36 V
ZJA3018-2 ZJA3008-2	OVP ±75 V, 36 V, Low Power, High Precision Op Amp 36 V, Low Power, High Precision Op Amp	1.3 MHz, 10 μV max Vos, 0.5 μV/°C max TCVos, 25 pA max Ibias, 0.5 mA/ch, OVP±75 V (ZJA3018 only), RRO, 4.5 V to 36 V
ZJA3512-2	Dual 36 V 7 MHz precision JFET Op Amps	7 MHz, 35 V/μS, 50 μV max Vos, 1 μV/°C max TCVos, 2 mA/ch, RRO, 9 V to 36 V
ZJA3216/06/02-1/2	Precision 24/11.6/5.3 MHz CMOS RRIO Op Amps	24/11.6/5.3 MHz, RRIO, 30 μV max Vos, 1 μV/°C max TCVos, 0.6 pA Ib, 2.7 V to 5.5 V
ZJA3600/1	36 V ultra-high precision in-amp	CMRR 105 dB min (G=1), 25 pA max Ib, 25 μV max Vosi, ±2.4 V to ±18 V, -40°C to 125°C
ZJA3611, ZJA3609	36 V precision wider bandwidth precision in-amp (G≥10)	CMRR 120 dB min (G=10), 25 pA max Ibias, 25 μV max Vosi, 1.2 MHz BW (G=10)
ZJA3676/7 ZJA3678/9	Low power, G=1 Single/Dual 36 V difference amplifier Low power, G=0.5/2 Single/Dual 36 V difference amplifier	Input protection to ±65 V, CMRR 104 dB min (G=1), Vos 100 μV max, gain error 15 ppm max, 500 kHz BW (G=1), 330 μA/channel, 2.7 V to 36 V
ZJA3669	High Common-Mode Voltage Difference Amplifier	±270 V CMV, 2.5 kV ESD, 96 dB min CMRR, 450 kHz BW, 4 V to 36 V, SOIC-8
ZJA3100	15 V precision fully differential amplifier	145 MHz, 447 V/μS, 50 nS to 16-bit, 50 μV max Vos, 4.6 mA Iq, SOIC/MSOP-8, QFN-16
ZJA3236/26/22-2	Low-cost 22/10/5 MHz CMOS RRIO Op Amps	22/11/5 MHz, RRIO, 2 mV max Vos, 6 μV/°C max TCVos, 0.6 pA Ib, 2.7 V to 5.5 V
ZJA3622/8	36 V low-cost precision in-amp	0.5 nA max Ibias, 125 μV max Vosi, 625 kHz BW (G=10), 3.3 mA Iq, ±2.4 V to ±18 V
Voltage Reference		
ZJR1004	40 V supply precision voltage reference	V_{OUT}=2.048/2.5/3/3.3/4.096/5/10 V, 5 ppm/°C max drift -40°C to 125°C
ZJR1001/2 ZJR1003	5.5 V low power voltage reference (ZJR1001 with noise filter option)	V_{OUT}=2.048/2.5/3/3.3/4.096/5 V, 5 ppm/°C max drift -40°C to 125°C, ±0.05% initial error, 130 μA, ZJR1001/2 in SOT23-6, ZJR1003 in SOIC/MSOP-8
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, t_{ON} 166 nS
ZJG4428/4429	36 V 8:1/dual 4:1 multiplexer	Latch-up immune, Ron 270 Ω,14.8 pC charge injection, t_{ON} 166 nS
Quad Matching Resistor		
ZJM5400	±75 V precision match resistors	Mismatch<100 ppm, 10k:10k:10k:10k, 100k:100k:100k:100k, 100k:10k:10k:100k, 1k:1k:1k:1k, 1M:1M:1M:1M, 5k:1k:1k:5k, 5k:1.25k:1.25k:5k, 9k:1k:1k:9k, ESD: 3.5 kV