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

Features

- Low Temperature Drift: 5 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, 5V, 10 V
- Low Noise: 0.1 Hz to 10 Hz, 2.1 ppm_{P-P}
- Strong driving capability: typical 20mA, min 17mA
- Wide Supply Range: V_{OUT}+0.3 V to 40 V
- Low Quiescent Current: 160 µA
- Wide Temperature Range: - 40 °C to +125 °C

Application

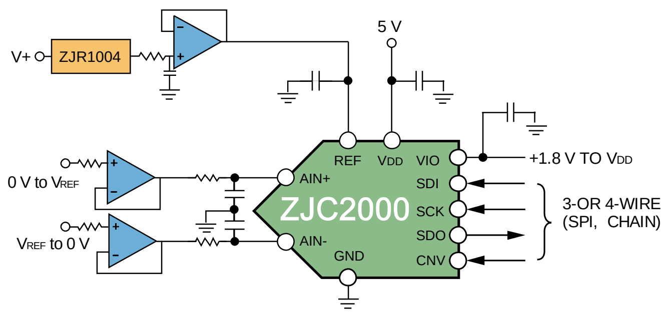
- Precision Data Acquisition
- Precision Instruments
- Industrial Control
- Optical Communication
- Smart Grid

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 (>14 bit) 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 is just 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 <5 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.

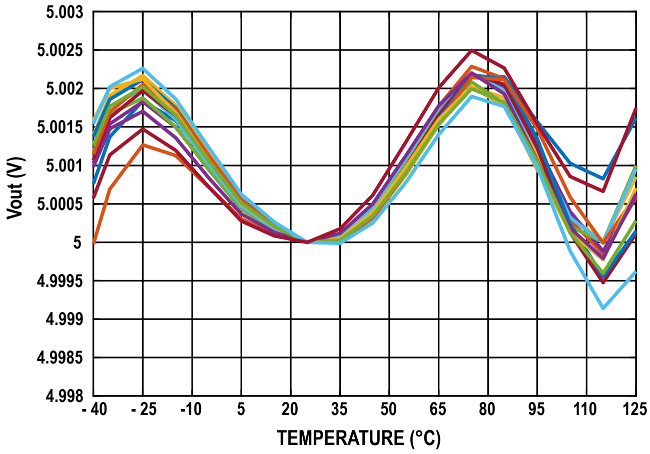
Typical Application

ZJR1004 as ADC Voltge Reference



Typical Characteristics

ZJR1004-5 Output Voltge vs. Temperature (14 units)



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Version (Preliminary Datasheet) [1]

Revision History

January 2024 —— Preliminary Datasheet

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Pin Configurations and Function Descriptions

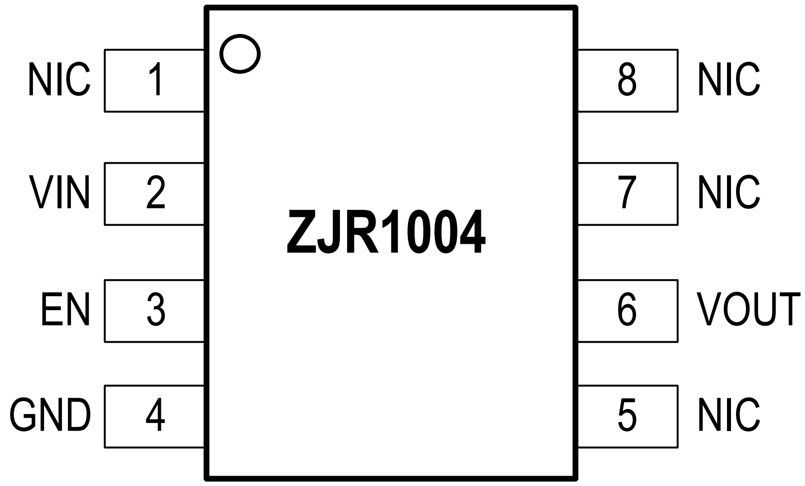

Figure 1. ZJR1004 Pin Configuration (8-lead SOIC and MSOP)

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]	

Thermal Resistance [5]

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] 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 V_{IN} = 2.5 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							
B Grade			●		2.8	5	ppm/°C
A Grade			●		3	8	ppm/°C
B Grade, Temperature Grade E		0 °C to +75 °C			3	5	ppm/°C
Voltage Noise		0.1 Hz to 10 Hz			2.1		ppm_{P-P}
Voltage Noise Density	e_{ni}	ZJR1004-2, 1 kHz					nV/√Hz
		ZJR1004-9, 1 kHz					nV/√Hz
		ZJR1004-3, 1 kHz					nV/√Hz
		ZJR1004-8, 1 kHz					nV/√Hz
		ZJR1004-4, 1 kHz					nV/√Hz
		ZJR1004-5, 1 kHz			380		nV/√Hz
		ZJR1004-0, 1 kHz					nV/√Hz
Line Regulation		ZJR1004-2: V_{IN}=2.5 V~40 V Others: V_{IN}=V_{OUT} + 0.3 V~40 V	●		0.1	5	ppm/V
Load Regulation		- 10 mA < I_{LOAD} < 10 mA	●		0.8	20	ppm/mA
Supply Voltage	V_{IN}	I_{LOAD} = 5 mA, Output Voltage Error ≤ 0.1 %					
		ZJR1004-2	●	2.5		40	V
		Others	●	V_{OUT} +0.3		40	V
Quiescent Current	I_{SY}	No Load	●		160		µA
Shutdown Current		EN Tied to GND	●		9		µA

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

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Shutdown Pin (EN)		Logic High Input Voltage	●	2		V_{IN}	V
		Logic High Input Current	●				μA
		Logic Low Input Voltage	●			0.8	V
		Logic Low Input Current	●		0.22		μA
Output Short Circuit Current	I_{SC}	V_{OUT} = GND or V_{IN}	●	17	20		mA
Turn-on Time		0.1 % settling, C_L = 0.1 μF			200		μs
Long-Term Stability [2]	LTD	1000 hours, SOIC-8					ppm/1000 hours
		1000 hours, MSOP-8					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 V_{IN} = 2.5 V to 40 V, I_{LOAD} = 0, C_L = 0.1 µF, T_A =25 °C, unless otherwise noted.

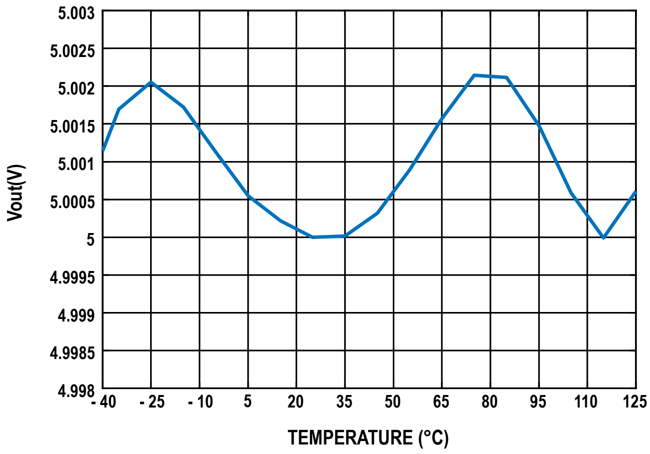

Figure 2. ZJR1004-5 Output Voltage vs. Temperature (B Grade)

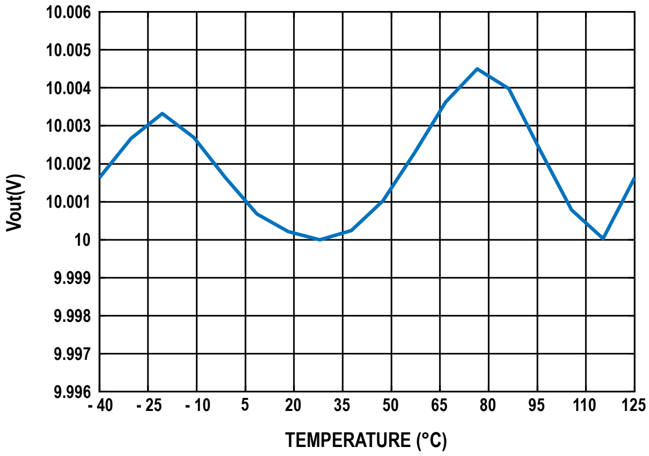

Figure 3. ZJR1004-0 Output Voltage vs. Temperature (B Grade)

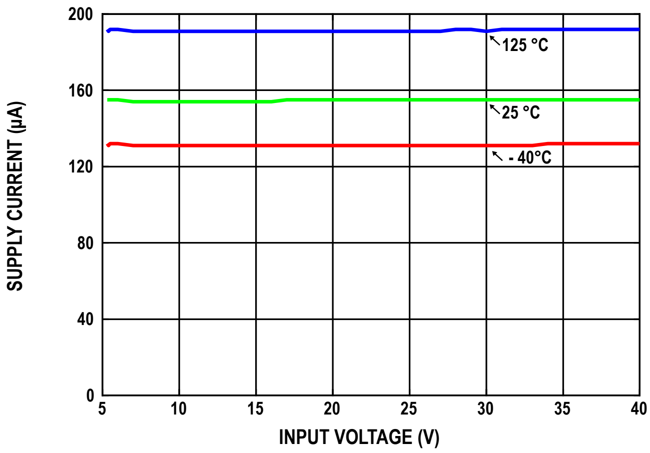

Figure 4. Supply Current vs. Input Voltage

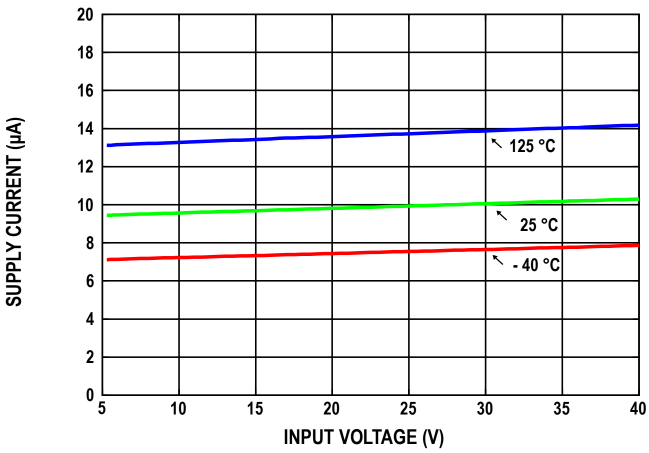

Figure 5. Supply Current vs. Input Voltage in SHUTDOWN mode

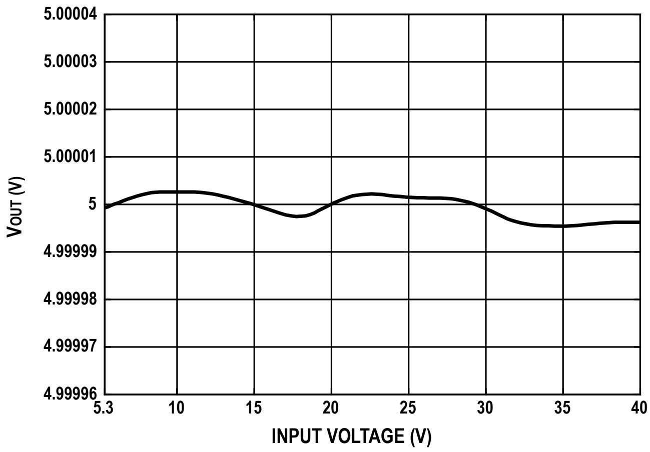

Figure 6. ZJR1004-5 Line Regulation

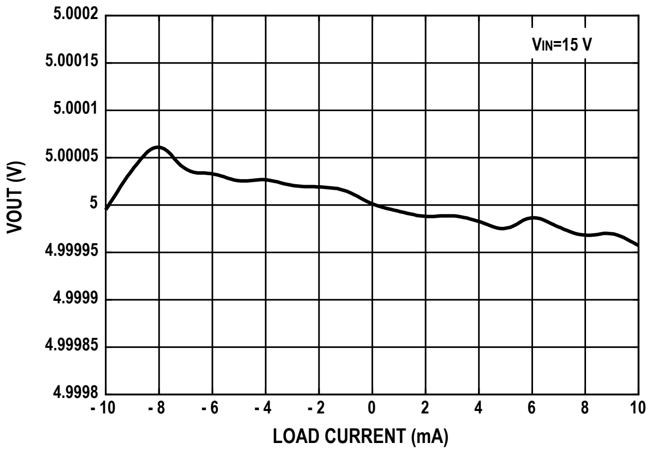

Figure 7. ZJR1004-5 Load Regulation

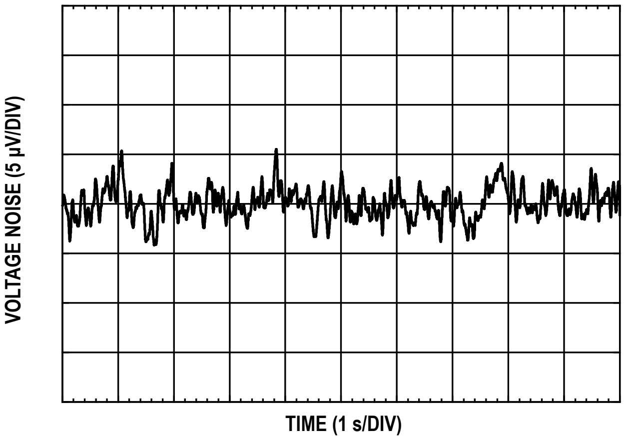

Figure 8. ZJR1004-5 0.1~10 Hz Noise

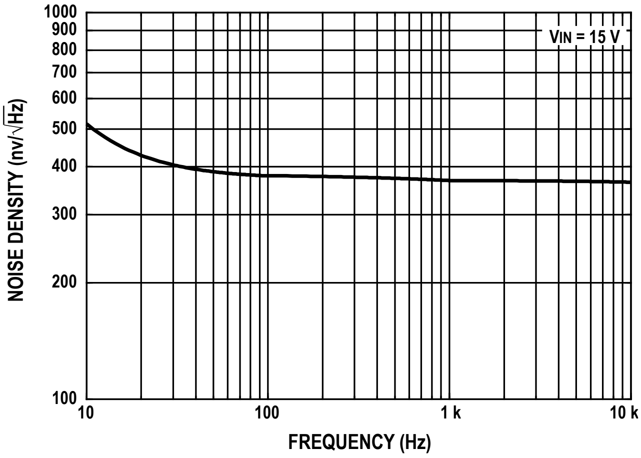

Figure 9. ZJR1004-5 Voltage Noise Density vs. Frequency

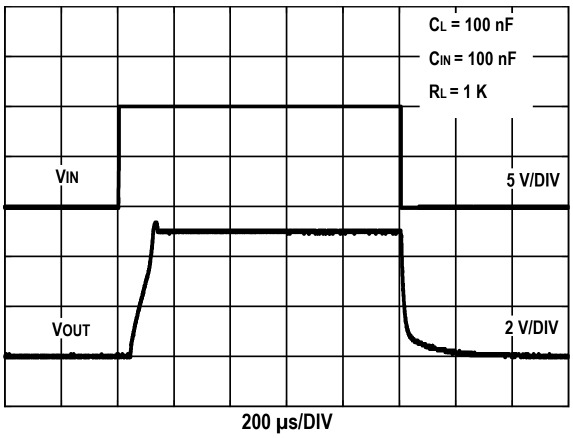

Figure 10. Power-On/Off Response

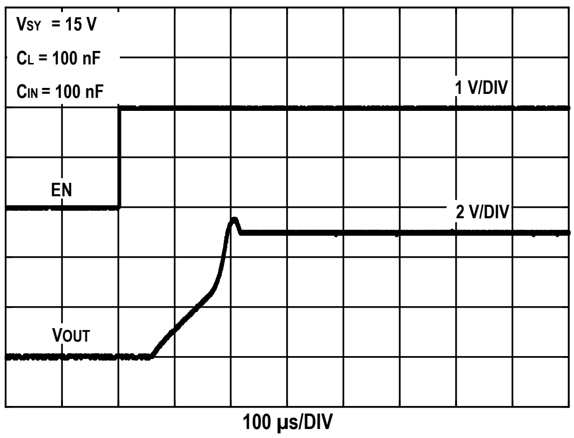

Figure 11. Enable Response

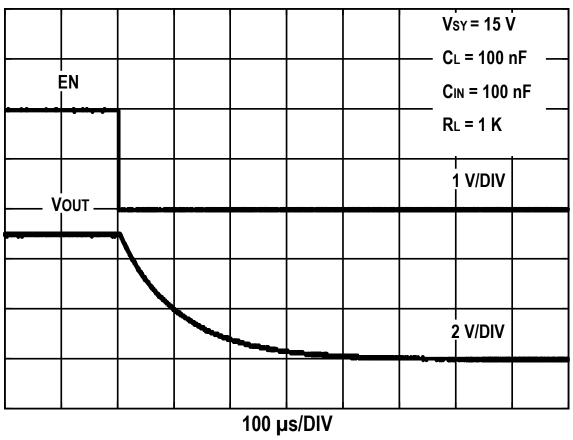

Figure 12. Disable Response

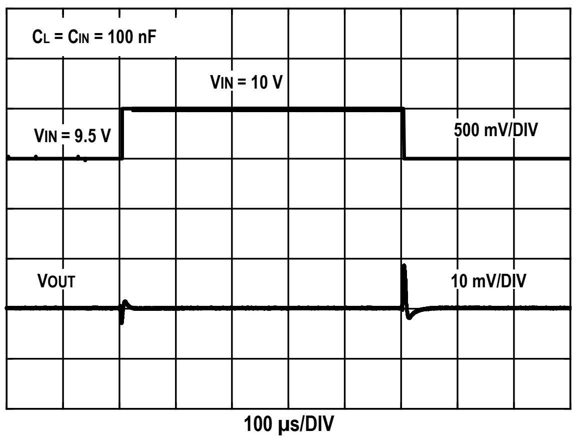

Figure 13. Line Transient Response

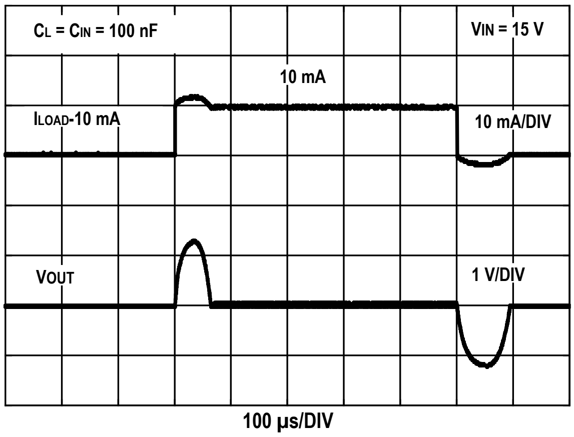

Figure 14. ZJR1004-5 Load Transient Response

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 15 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.

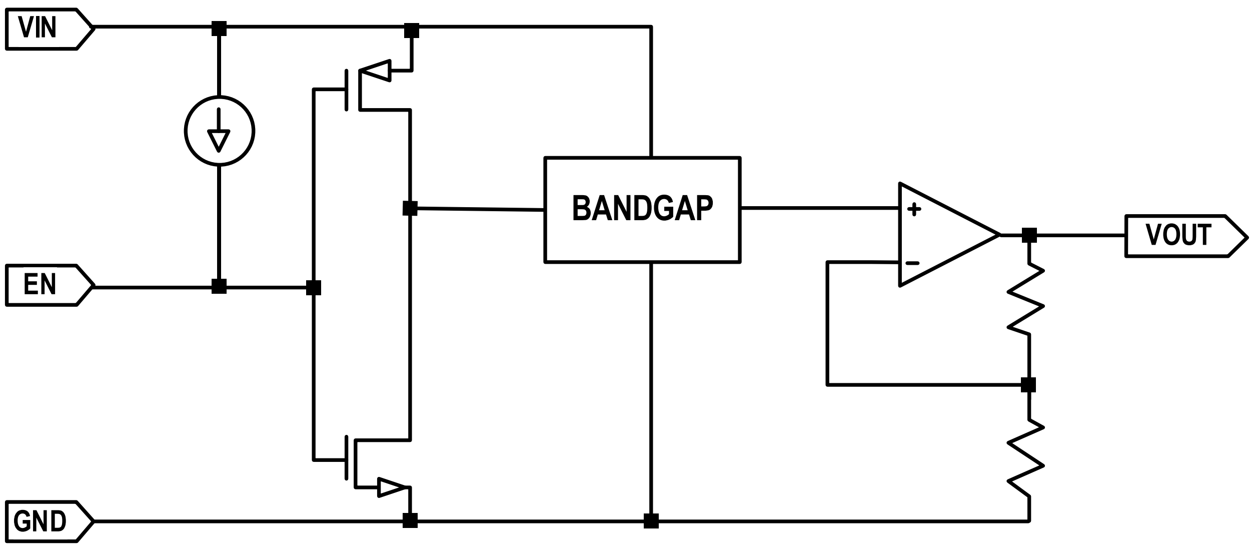

Figure 15. Simplified schematic of ZJR1004

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 16.

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.

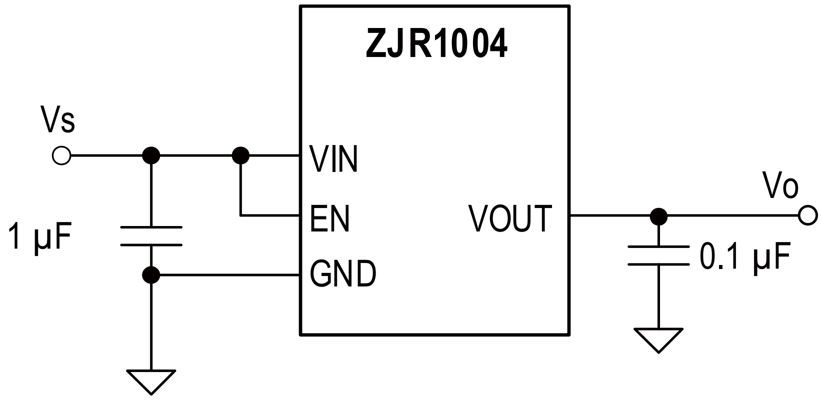

Figure 16. ZJR1004 Typical Configuration

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 shutdown feature. The part burns just 9 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 shutdown.

Supply Voltage

ZJR1004 has a wide supply voltage range. The lowest supply voltage for ZJR1004-2 is 2.5 V, while the other versions can work from output voltage plus 300 mV. Because higher than 10 V supply voltage is widely used in many applications, such as industrial control systems, ZJR1004's highest supply voltage of 40 V can simplify system power supply design.

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

Noise Performance

The noise generated by ZJR1004-5 is typically 10 μV_{P-P} over the 0.1 Hz to 10 Hz band as shown in Figure 8. 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.

Power Dissipation

ZJR1004 is a low power dissipation device with a typical supply current of 160 μA. In case of high supply voltage 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 17 shows a simple way to get a negative output 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 on resistor R is (Vee - Vo)/R, and the power dissipation is (Vee - Vo) ^{2}/R. In order to get higher performances negative output voltage reference, lower heat is critical. When the voltage drop on R is high, proper value of R should be picked. Meanwhile, resistor R won't impact the negative output voltage reference's temperature coefficient.

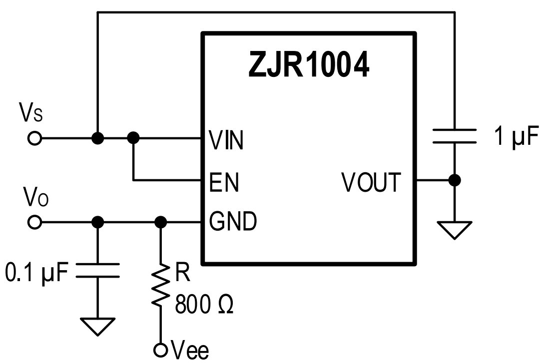

Figure 17. Using ZJR1004 to Generate Negative Output Precision Voltage Reference

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

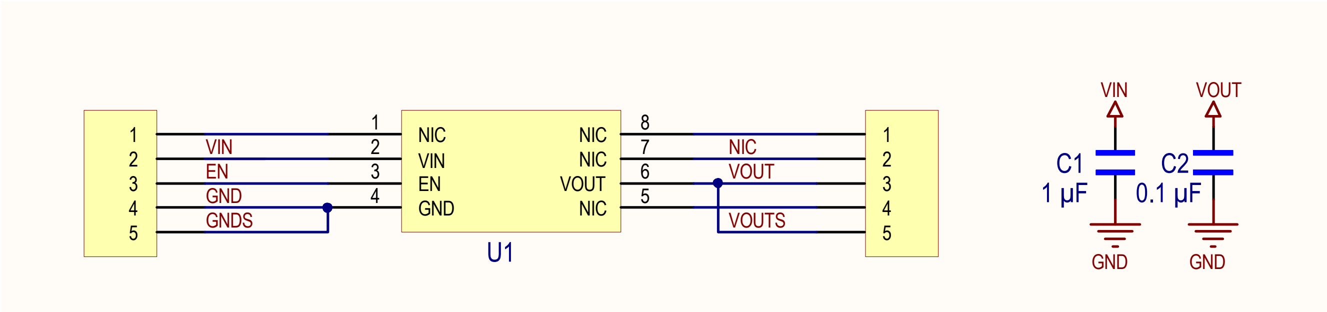

Figure 18. ZJR1004 Evaluation Board Schematic

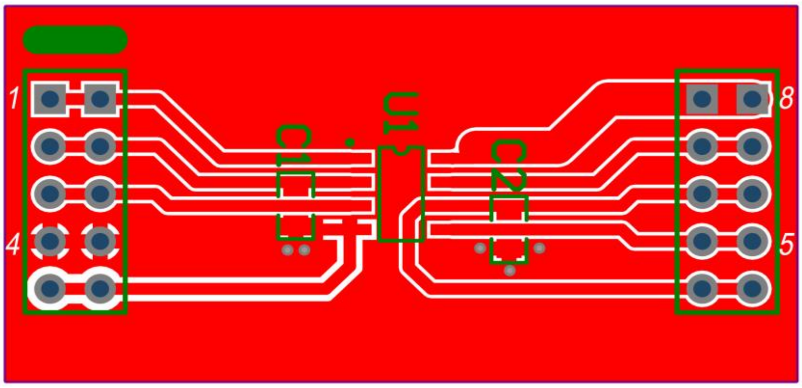

Figure 19. ZJR1004 Evaluation Board Layout (Top Layer)

Figure 20. ZJR1004 Evaluation Board Layout (Bottom Layer)

Outline Dimensions

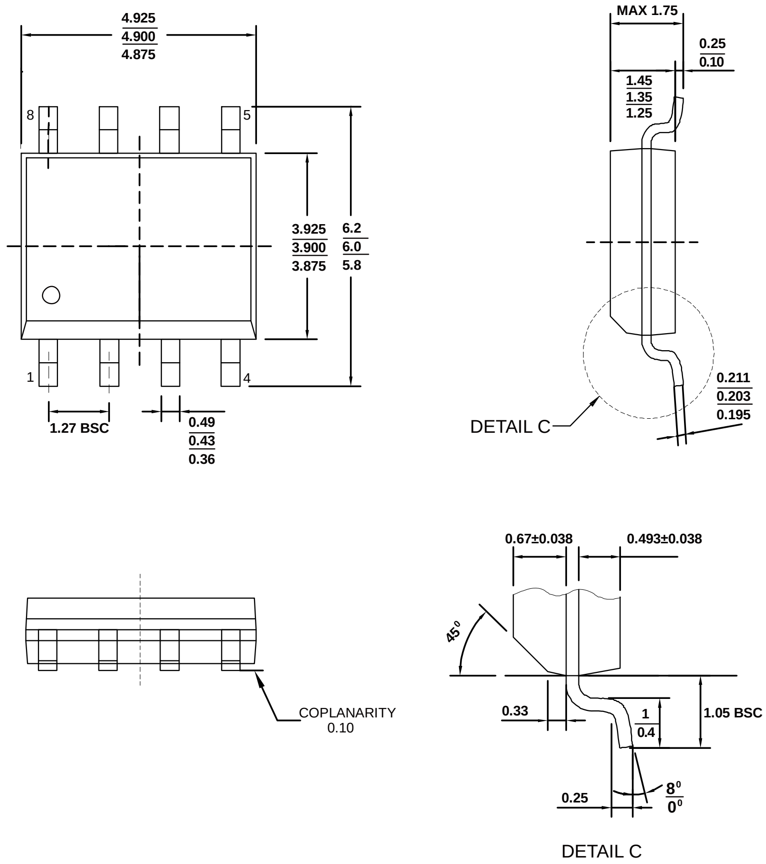

Figure 21. 8-Lead SOIC Package Dimensions shown in millimeters

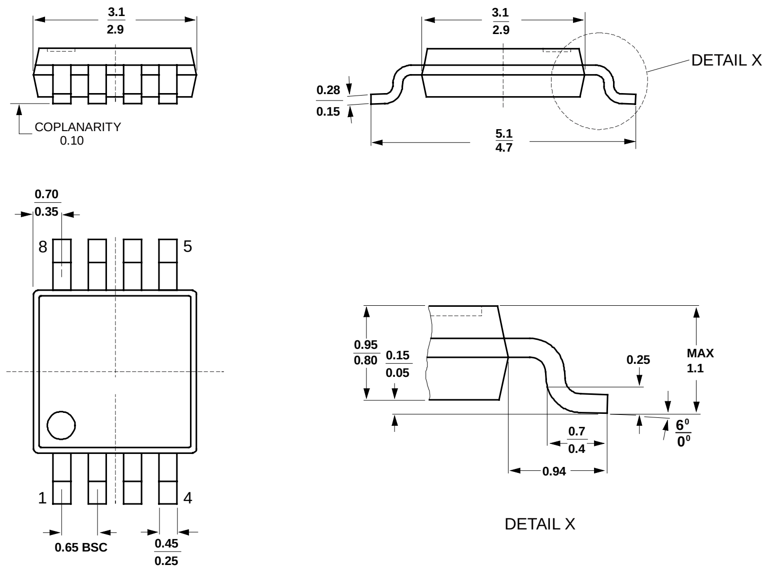

Figure 22. 8-Lead MSOP Package Dimensions shown in millimeters

Ordering Guide

Model	Orderable Device	Temperature Range (°C)	Output Voltage (V)	Max TempCo (ppm/°C)	Package	External Package
ZJR1004-2	ZJR1004-2BSABT	- 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
	ZJR1004-2BSAET	- 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	- 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
	ZJR1004-9BSAET	- 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

Model	Orderable Device	Temperature Range (°C)	Output Voltage (V)	Max TempCo (ppm/°C)	Package	External Package
ZJR1004-3	ZJR1004-3BSABT	- 40 to +125	3.0	5	SOIC - 8	Tube
	ZJR1004-3BSABR				SOIC - 8	13" Reel
	ZJR1004-3BUABT				MSOP - 8	Tube
	ZJR1004-3BUABR				MSOP - 8	13" Reel
	ZJR1004-3ASABT			8	SOIC - 8	Tube
	ZJR1004-3ASABR				SOIC - 8	13" Reel
	ZJR1004-3AUABT				MSOP - 8	Tube
	ZJR1004-3AUABR				MSOP - 8	13" Reel
	ZJR1004-3BSAET	- 40 to + 85		5	SOIC - 8	Tube
	ZJR1004-3BSAER				SOIC - 8	13" Reel
	ZJR1004-3BUAET				MSOP - 8	Tube
	ZJR1004-3BUAER				MSOP - 8	13" Reel
	ZJR1004-3ASAET			8	SOIC - 8	Tube
	ZJR1004-3ASAER				SOIC - 8	13" Reel
	ZJR1004-3AUAET				MSOP - 8	Tube
	ZJR1004-3AUAER				MSOP - 8	13" Reel
ZJR1004-8	ZJR1004-8BSABT	- 40 to +125	3.3	5	SOIC - 8	Tube
	ZJR1004-8BSABR				SOIC - 8	13" Reel
	ZJR1004-8BUABT				MSOP - 8	Tube
	ZJR1004-8BUABR				MSOP - 8	13" Reel
	ZJR1004-8ASABT			8	SOIC - 8	Tube
	ZJR1004-8ASABR				SOIC - 8	13" Reel
	ZJR1004-8AUABT				MSOP - 8	Tube
	ZJR1004-8AUABR				MSOP - 8	13" Reel
	ZJR1004-8BSAET	- 40 to + 85		5	SOIC - 8	Tube
	ZJR1004-8BSAER				SOIC - 8	13" Reel
	ZJR1004-8BUAET				MSOP - 8	Tube
	ZJR1004-8BUAER				MSOP - 8	13" Reel
	ZJR1004-8ASAET			8	SOIC - 8	Tube
	ZJR1004-8ASAER				SOIC - 8	13" Reel
	ZJR1004-8AUAET				MSOP - 8	Tube
	ZJR1004-8AUAER				MSOP - 8	13" Reel
ZJR1004-4	ZJR1004-4BSABT	- 40 to +125	4.096	5	SOIC - 8	Tube
	ZJR1004-4BSABR				SOIC - 8	13" Reel
	ZJR1004-4BUABT				MSOP - 8	Tube
	ZJR1004-4BUABR				MSOP - 8	13" Reel

Model	Orderable Device	Temperature Range (°C)	Output Voltage (V)	Max TempCo (ppm/°C)	Package	External Package
ZJR1004-4	ZJR1004-4ASABT	- 40 to +125	4.096	8	SOIC - 8	Tube
	ZJR1004-4ASABR				SOIC - 8	13” Reel
	ZJR1004-4AUABT				MSOP - 8	Tube
	ZJR1004-4AUABR				MSOP - 8	13” Reel
	ZJR1004-4BSAET	- 40 to + 85		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	- 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
	ZJR1004-5BSAET	- 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	- 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

Model	Orderable Device	Temperature Range (°C)	Output Voltage (V)	Max TempCo (ppm/°C)	Package	External Package
ZJR1004-0	ZJR1004-0BSAET	- 40 to + 85	10.0	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

Orderable Device Explanation

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: 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 Device

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 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
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/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	Single/Dual/Quad 36 V low bias current precision Op Amps	3 MHz GBW, 35 μV max Vos, 0.5 μV/°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 μV max Vos, 0.5 μV/°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/μS SR, 50 μV max Vos, 1 μV/°C max Vos drift, 2 mA/Amplifier, RRO, 4.5V to 35 V
ZJA3600/1	36 V ultra-high precision in-amp	CMRR 105 dB min (G = 1), 25 pA max Ibias, 25 μV 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 ºC to 125 ºC specified
ZJA3622/8	36 V low cost precision in-amp	CMRR 93 dB min (G = 10), 0.5 nA max Ibias, 125 μV 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 μV max Vosi, 1.2 MHz BW (G = 10), 3.3 mA/Amplifier, ± 2.4 V to ± 18 V, - 40 ºC to 125 ºC specified
ZJA3676/7	Low power, G = 1 Single/Dual 36 V difference amplifier	Input protection to ± 65 V, CMRR 104 dB min, Vos 100 μV max, gain error 15 ppm max, 500 kHz BW, 330 μA, 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/°C max drift - 40 ºC to 125 ºC, ± 0.05 % initial error
ZJR1001 ZJR1002 ZJR1003	5.5V low power voltage reference (ZJR1001 with noise filter option)	V_{OUT} = 2.5/3/4.096/5 V, 5 ppm/°C max drift - 40 ºC to 125 ºC, ± 0.05 % initial error, 130 μA, ZJR1001/2 in SOT23-6, ZJR1003 in SOIC/MS-8
Switches and Multiplexers		
ZJG4438/4439	36V 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