Low Noise, Low Temperature Drift, Precise Voltage Reference

Features

- Low Temperature Drift: 5 ppm/°C max (B Grade)
- High Accuracy: ±0.05% max
- Low Noise (0.1 Hz to 10 Hz): 7.0 μV$_{P-P}$, 1.25 V Output Voltage
- Wide Supply Range: up to 15 V
- Quiescent Current: 715 μA; 16 μA Shutdown Mode
- Wide Temperature Range: -40 °C to +125 °C

Application

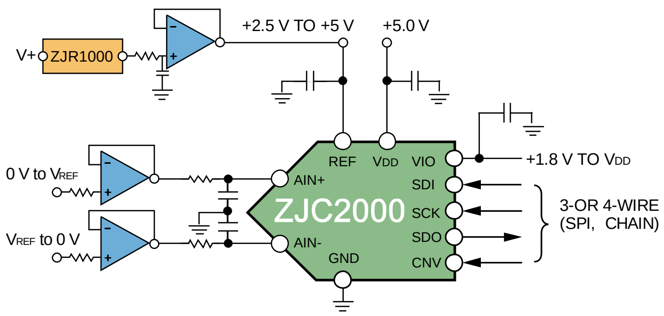
- Precision Data Acquisition
- Precision Instruments
- Industrial Control
- Optical Communication
- Smart Grid

General Description

The ZJR1000 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 ZJR1000 is guaranteed in a wide temperature range from -40 °C to +125°C. Because of the low dropout feature of ZJR1000, 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. ZJR1000 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 ±0.05%. This simplifies or even skip the system initial calibration for most applications. ZJR1000 provides 8-pin SOIC and MSOP packages, and are compatible with industry standard products.

Typical Application

ZJR1000 Used as ADC Voltge Reference



Typical Characteristics

ZJR1000-9 Output Voltge vs. Temperature

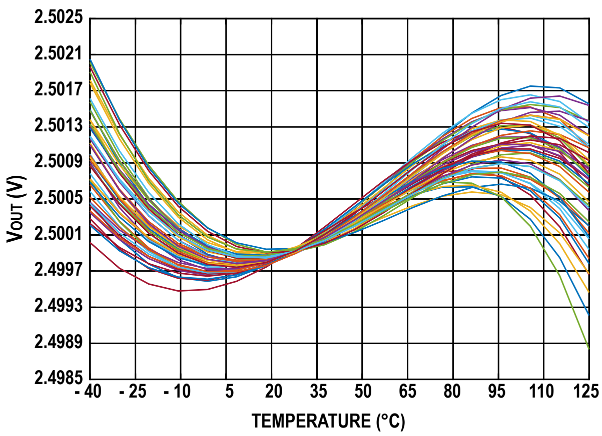


Table of contents

Version (Release C) [1]

Revision History

April 2024 ——Release C

Long-Term Stability updating at page 7

Add Figure 19 at page 10

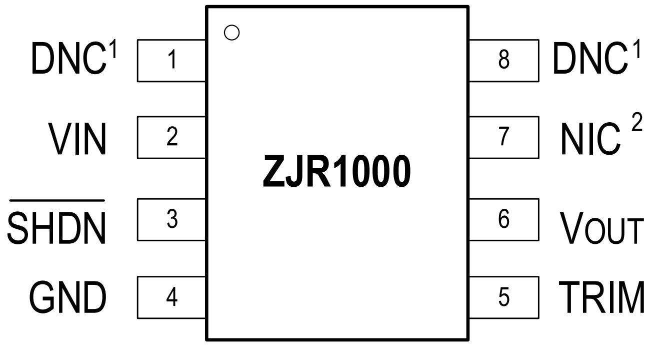
August 2023 —— Release B

Format updating

December 2022 ——Release A

[1] Information furnished by ZJW Microelectronics is believed to be accurate and reliable. However, no responsibility is assumed by ZJW Microelectronics for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of ZJW Microelectronics. Trademarks and registered trademarks are the property of their respective owners.

Pin Configurations and Function Descriptions



Note: 1 DNC = Do Not Connect； 2 NIC = No Internal Connection

Figure 1. ZJR1000 Pin Configuration (8-lead SOIC and MSOP)

Mnemonic	Pin No.	I/O	Description
DNC	1,8	--	Do not connect. There are actual connections in DNC pins, but they are reserved for factory testing purposes. Users should not connect anything to DNC pins; otherwise, the device may not function properly.
VIN	2	I	Input voltage
$\overline{SHDN}$	3	I	Shutdown Input. This active low input powers down the device to 16 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	I	Ground Pin = 0 V.
TRIM	5	o	Trim Terminal. It can be used to adjust the output voltage over ± 0.5 % range without affecting the temperature coefficient.
V_{OUT}	6	o	Output voltage
NIC	7	--	No Internal Connection. NIC has no internal connection.

Absolute Maximum Ratings [1]

Parameter	Rating
Supply Voltage	15 V
Input Voltage	-0.2 V to 15 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]	3.5 kV

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 VIN = 2.5 V to 15.0 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}	ZJR1000-1			1.25		V
		ZJR1000-2			2.048		V
		ZJR1000-9			2.5		V
		ZJR1000-3			3.0		V
		ZJR1000-4			4.096		V
		ZJR1000-5			5.0		V
Initial Accuracy				-0.05		+0.05	%
Temperature Coefficient		- 40 °C to + 125 °C					
B Grade			●		3.6	5	ppm/°C
A Grade			●		5	8	ppm/°C
Voltage Noise		0.1 Hz to 10 Hz			6		ppm_p-p
Voltage Noise Density	e_{ni}	ZJR1000-1, 1 kHz			76		nV/√Hz
		ZJR1000-2, 1 kHz			138		nV/√Hz
		ZJR1000-9, 1 kHz			178		nV/√Hz
		ZJR1000-3, 1 kHz			240		nV/√Hz
		ZJR1000-4, 1 kHz			385		nV/√Hz
		ZJR1000-5, 1 kHz			495		nV/√Hz
Line Regulation		VIN = (V_{OUT} + 0.3) V to 15 V	●		1	5	ppm/V
Load Regulation		- 5 mA < I_{LOAD} < 5 mA	●		1	20	ppm/mA
Supply Voltage	VIN	I_{LOAD} = 5 mA, Output Voltage Error ≤ 0.1%					
		ZJR1000-1&2	●	2.5		15	V
		Others	●	V_{OUT} + 0.3		15	V
Quiescent Current	I_{SY}	No Load			715		μA
			●	580	765	950	μA

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

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Shutdown Current		$\overline{SHDN}$ Tied to GND	●		16	33	µA
Shutdown Pin ($\overline{SHDN}$)		Logic High Input Voltage	●	2		VIN	V
		Logic High Input Current	●		1.5		µA
		Logic Low Input Voltage	●			0.8	V
		Logic Low Input Current	●		1.5	2.5	µA
Output Short Circuit Current	I_{SC}	V_{OUT} = GND or VIN	●	14.5	20		mA
Turn-on Time		0.1% settling, C_L = 0.1 µF			100		µs
Long-Term Stability[2]	LTD	1000 hours, SOIC-8			-35		ppm/1000 hours
		1000 hours, MSOP-8			26		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 = 2.5 V to 15.0 V, I_{LOAD} = 0, C_L = 0.1 μF, T_A =25 °C, unless otherwise noted.

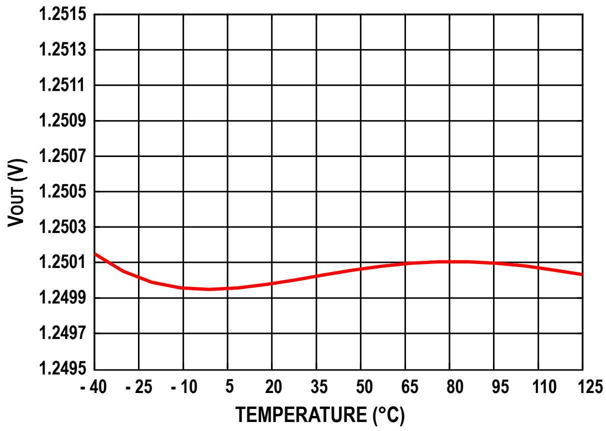


Figure 2. ZJR1000-1 Typical Output Voltage vs. Temperature

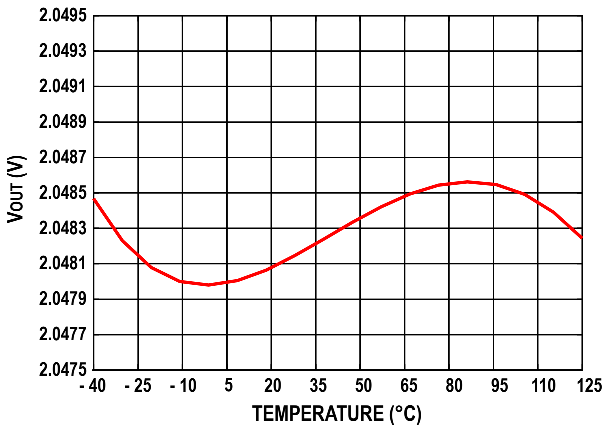


Figure 3. ZJR1000-2 Typical Output Voltage vs. Temperature

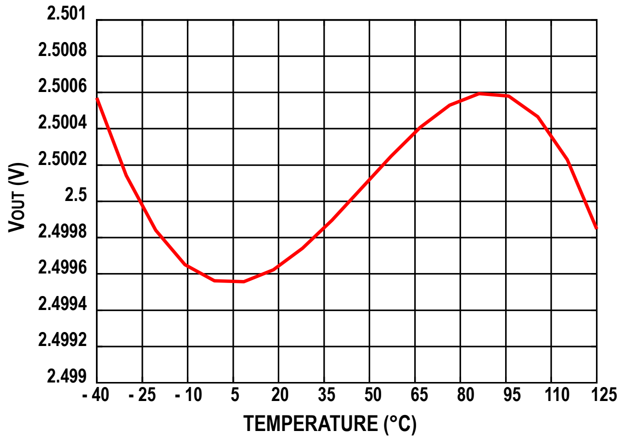


Figure 4. ZJR1000-9 Typical Output Voltage vs. Temperature

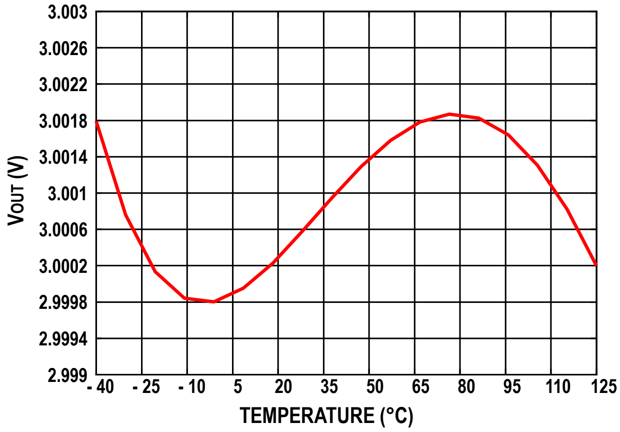


Figure 5. ZJR1000-3 Typical Output Voltage vs. Temperature

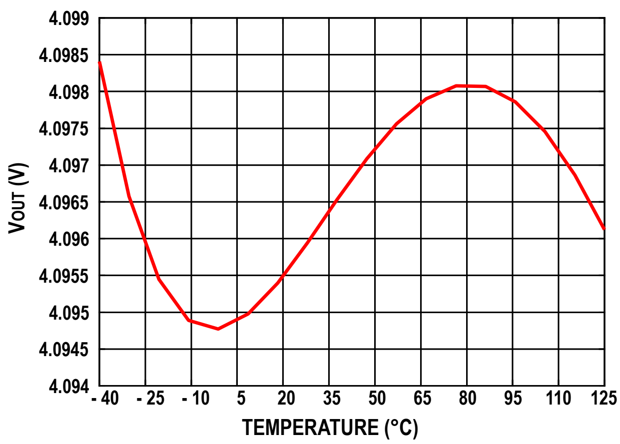


Figure 6. ZJR1000-4 Typical Output Voltage vs. Temperature

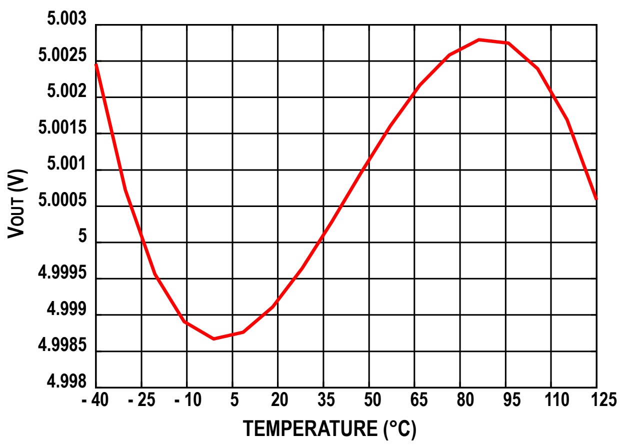


Figure 7. ZJR1000-5 Typical Output Voltage vs. Temperature

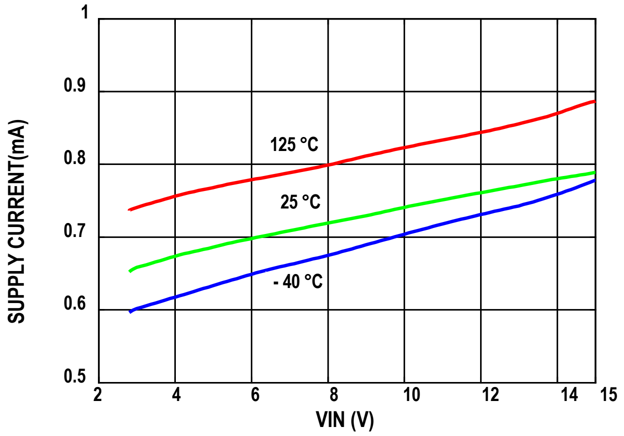


Figure 8. ZJR1000-9 Supply Current vs. Input Voltage

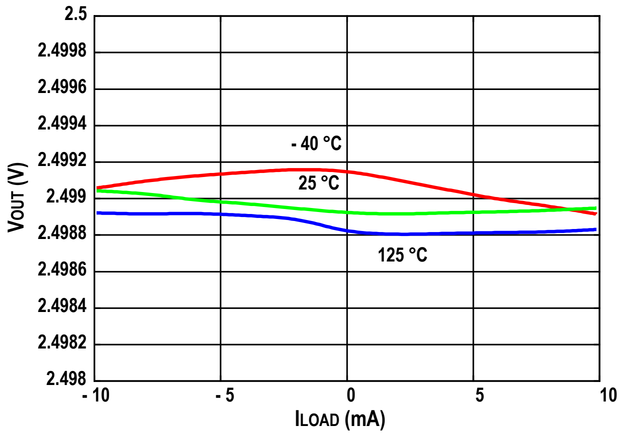


Figure 9. ZJR1000-9 Load Regulation vs. Temperature

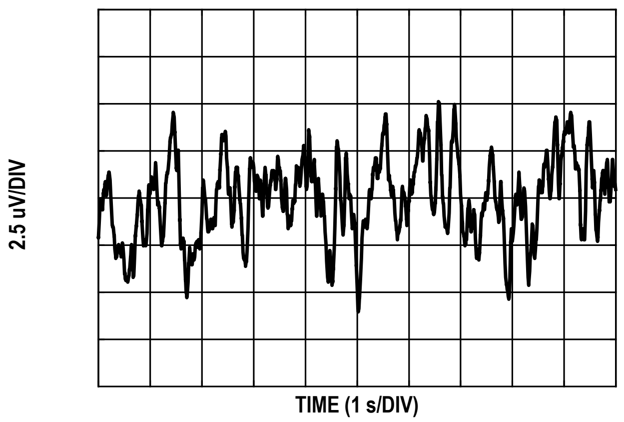


Figure 10. ZJR1000-9 Typical Voltage Noise (0.1 Hz to 10 Hz)

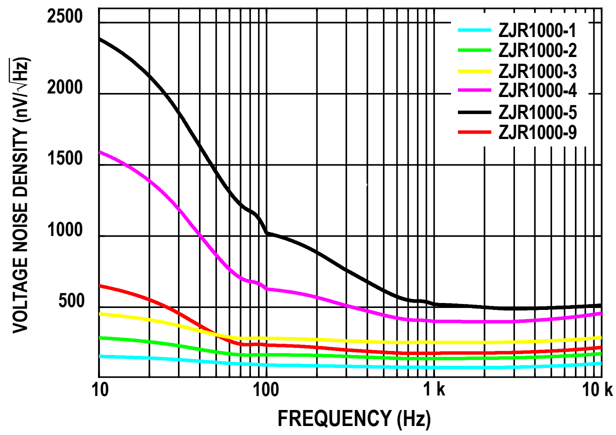


Figure 11. Voltage Noise Density vs. Frequency

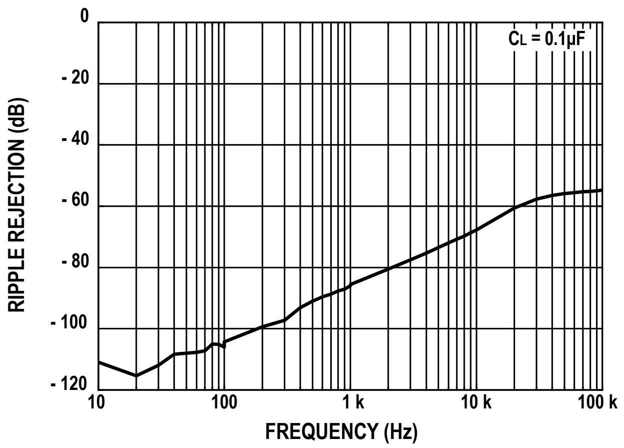


Figure 12. ZJR1000-9 Power Supply Rejection Ratio vs. Frequency

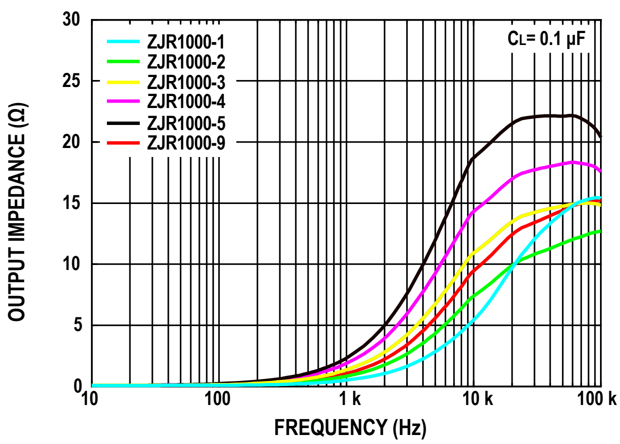


Figure 13. Output Impedance vs. Frequency

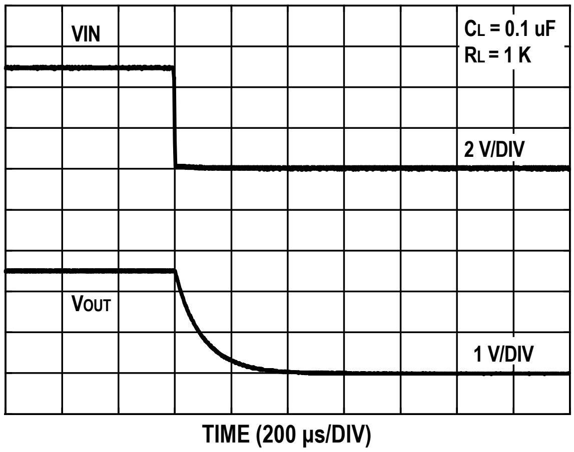


Figure 14. ZJR1000-9 Turn-Off Response

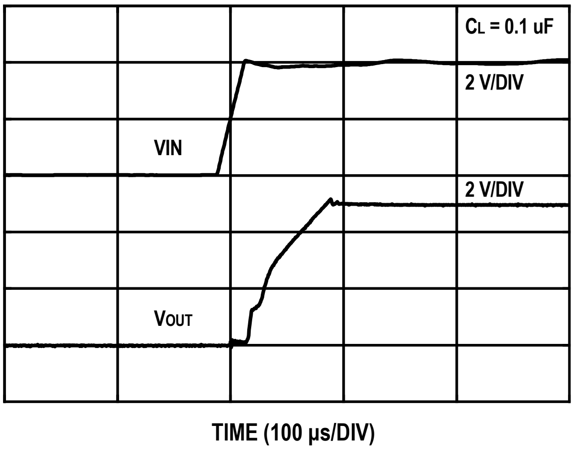


Figure 15. ZJR1000-9 Turn-On Response

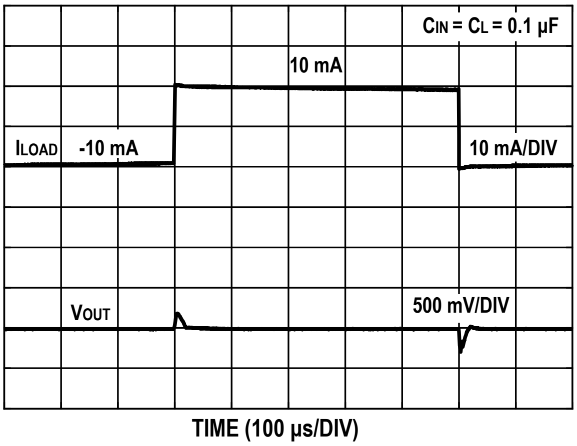


Figure 16. Load Transient Response

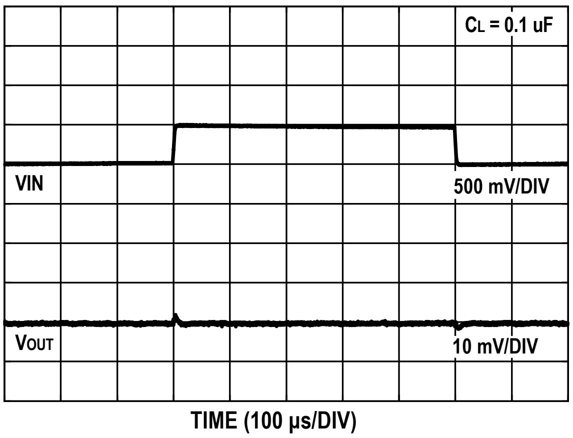


Figure 17. Line Transient Response

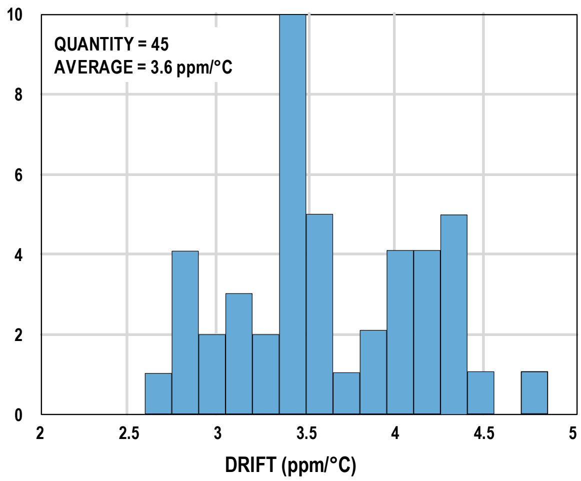


Figure 18. ZJR1000-9 Temperature Coefficient Distribution (MSOP-8 package)

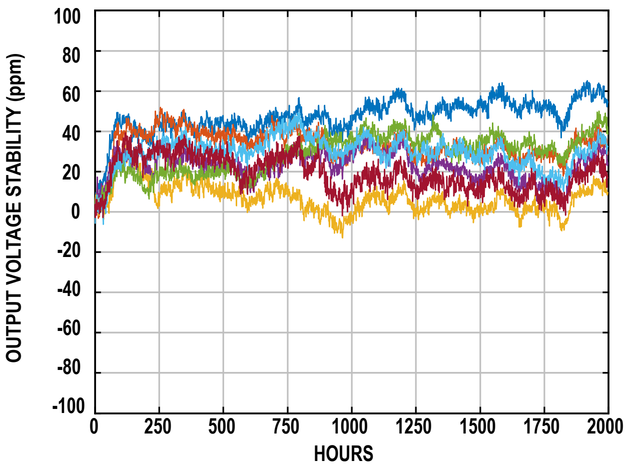


Figure 19. Long-Term Stability (MSOP-8 package)

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

ZJR1000 series of precision voltage references adopt 15 V high-voltage CMOS process. Figure 20 shows ZJR1000's internal blocks. The bandgap reference is the core, which has been carefully designed and can deliver the key performances by proprietary post-package trimming. The output stage provides enough drive capability while keeping high performances. The TRIM terminal can be used to adjust the output voltage over ±0.5% range. This feature allows the system designer to trim system errors out by setting the reference to a voltage other than the nominal. All pins have the internal protection circuit in order to make ZJR1000 a reliable part.

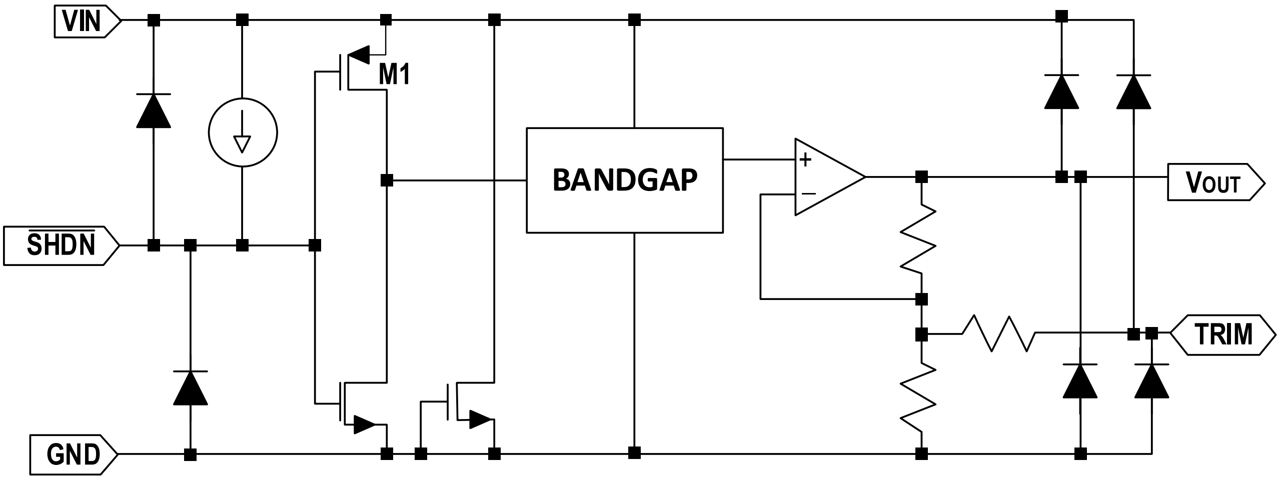


Figure 20. Simplified Schematic of ZJR1000

Applications

ZJR1000 Basic Connections

Voltage references, including ZJR1000, normally require a capacitor at the output between V_{OUT} and GND. Figure 21 is the basic connection of ZJR1000. 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.

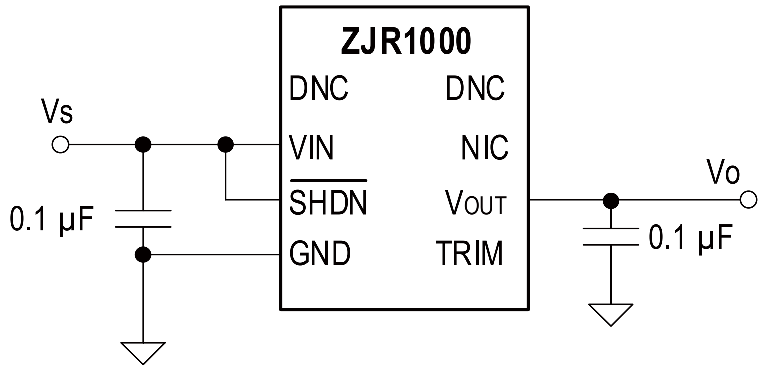


Figure 21. ZJR1000 Basic Connections

Pin 1 and pin 8 are used during ZJR1000's manufacturing, do not connect anything to these pins, otherwise the device may not function properly. Pin 7 has no internal circuitry and can leave float or connect to GND.

Power on and Shutdown mode

Figure 15 shows the turn-on process of ZJR1000. 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, ZJR1000 has shutdown mode. It burns just 16 μA in shutdown mode, the shutdown procedure can be found in Figure 14. Shutdown mode is controlled by pin 3 ($\overline{SHDN}$). The voltage level of this pin is compatible with popular CMOS / TTL digital logic.

There is an internal pull-up resistor tied to this pin. If left unconnected, this pin rises to VIN and the part is enabled. Due to the low internal pull-up current, it is recommended that the $\overline{SHDN}$ pin be pulled high externally for normal operation to prevent accidental shutdown due to system noise or leakage currents.

Supply Voltage

ZJR1000 has a wide supply voltage range. The lowest supply voltage for ZJR1000-1 and ZJR1000-2 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, ZJR1000's highest supply voltage of 15 V can simplify system power supply design.

It is recommended to power ZJR1000 by linear power supplies, such as LDO, in order to get high performances.

Output Adjustment

The ZJR1000 TRIM terminal can be used to adjust the output voltage over a ±0.5% range. This feature allows the system designer to trim system errors out by setting the reference to a voltage other than the nominal. This is also helpful if the part is used in a system at temperature to trim out any error. Adjustment of the output has a negligible effect on the temperature performance of the device. To avoid degrading temperature coefficients, both the trimming potentiometer and the two resistors need to be low temperature coefficient types, preferably within 100 ppm/°C.

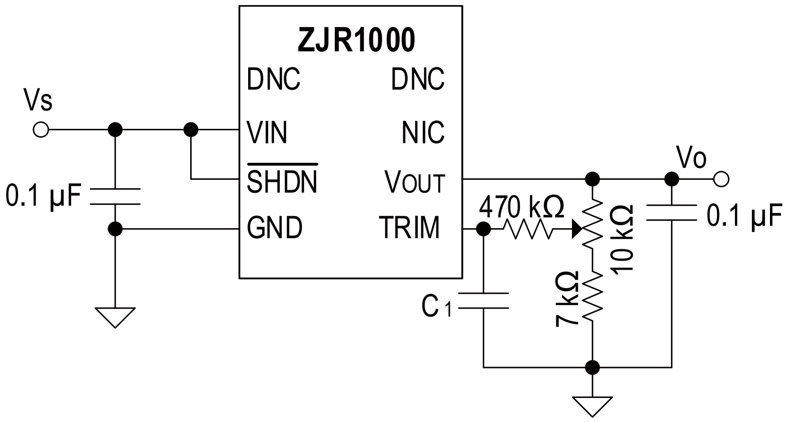


Figure 22. Output TRIM Adjustment

Noise Performance

The noise generated by ZJR1000-9 is typically less than 11 $\mu V_{P\text{-}P}$ over the 0.1 Hz to 10 Hz band as shown in Figure 10. 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

ZJR1000 is a low power dissipation device with a typical supply current of 715 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 ZJR1000 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.

Solder Heat Shift

The materials used in the manufacture of the ZJR1000 have different coefficients of thermal expansion, resulting in stress on the device die when the part is heated. Mechanical and thermal stress on the device can cause the output voltages to shift, degrading the initial accuracy and drift specifications of the product. Reflow soldering is a common cause of this error.

To illustrate this effect, a total of 160 devices, 80 devices each for SOIC and MSOP, were soldered on PCBs (printed-circuit-boards) using lead-free solder paste and the paste manufacturer suggested reflow profile. The PCB is comprised of FR4 material. The board thickness is 1.6 mm and the area is 40 mm × 20 mm, which can be found in Figure 27 and Figure 28. The reference voltage is measured before and after the reflow process under room temperature, the typical shift of accuracy is displayed in Figure 23 and Figure 24. As can be seen, reflow soldering changes the output voltage of ZJR1000: slightly lower after soldering & the degree of shift depends on the package type. Although all tested units exhibit very low shifts, higher shifts are also possible depending on the size, thickness, and material of the printed-circuit-board. An important note is that the histograms display the typical shift for exposure to a single reflow profile. Exposure to multiple reflows, as is common on PCBs with surface-mount components on both sides, causes additional shifts in the output bias voltage. If the PCB is exposed to multiple reflows, then solder the device in the last pass to minimize device exposure to thermal stress.

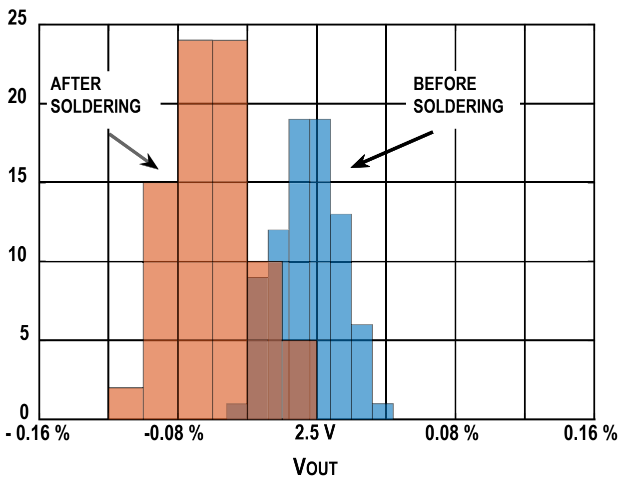


Figure 23. Solder Heat Shift Distribution (%), ZJR1000-9 in 8-lead SOIC

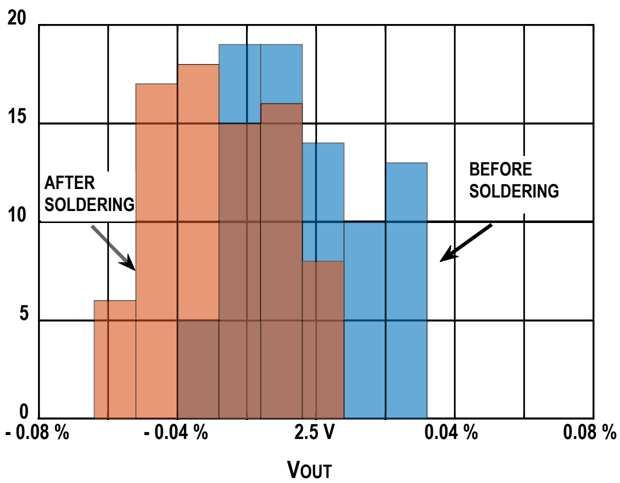


Figure 24. Solder Heat Shift Distribution (%), ZJR1000-9 in 8-lead MSOP

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. ZJR1000 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 25 shows a simple way to get a negative output precision voltage reference by using ZJR1000. Extra resistor R is needed together with the negative power supply. ZJR1000-9 is used to verify the circuit, and the power supplies are ±5 V (Vcc = 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. So 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.

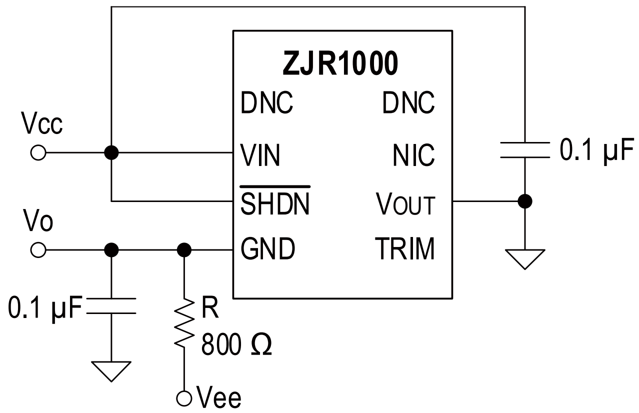


Figure 25. Using ZJR1000 to Generate Negative Output Precision Voltage Reference

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 ZJR1000.

Layout Example

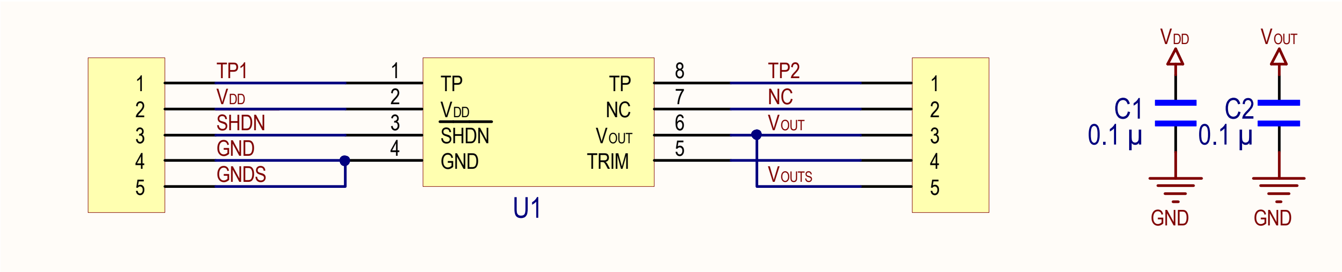


Figure 26. ZJR1000 Evaluation Board Schematic

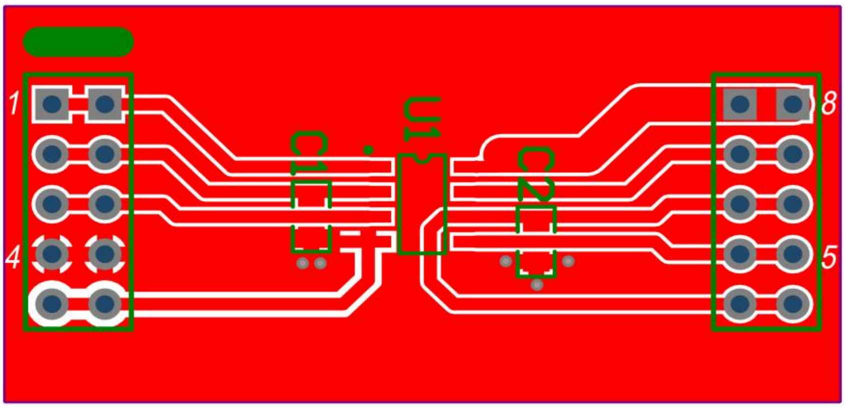


Figure 27. ZJR1000 Evaluation Board Layout (Top Layer)

Figure 28. ZJR1000 Evaluation Board Layout (Bottom Layer)

Outline Dimensions

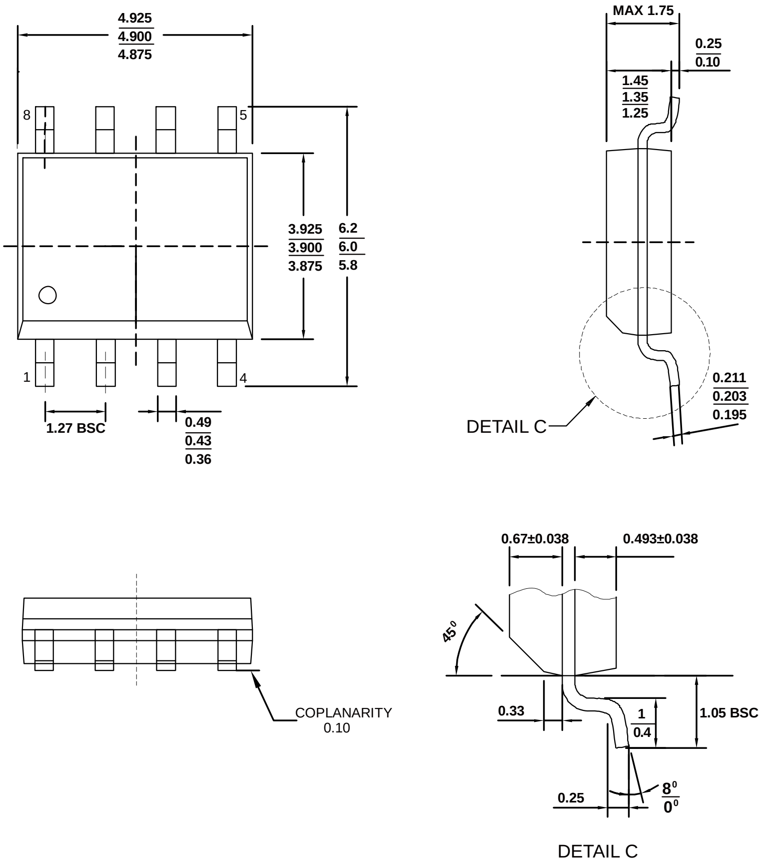


Figure 29. 8-Lead SOIC Package Dimensions shown in millimeters

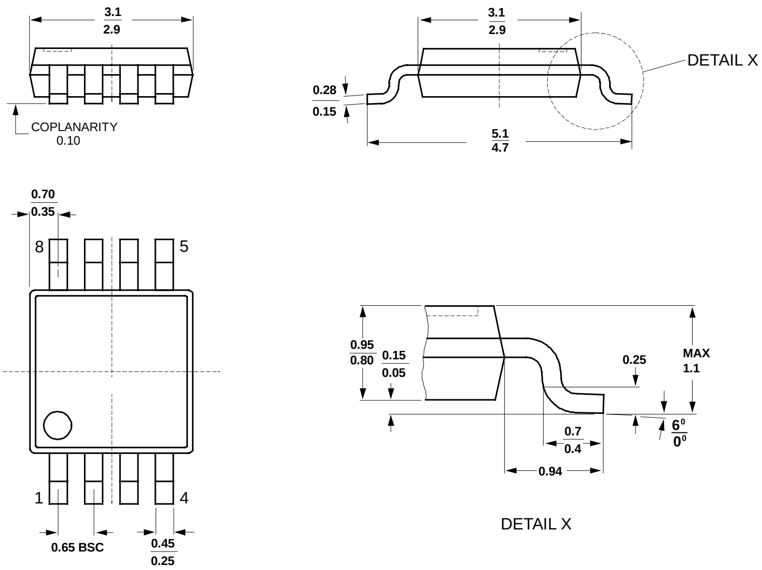


Figure 30. 8-Lead MSOP Package Dimensions shown in millimeters

Ordering Guide

Model	Package	Orderable Device	Output Voltage (V)	Max TempCo (ppm/°C)	Temperature Range (°C)	External Package
ZJR1000-1	SOIC - 8	ZJR1000-1CSABT	1.25	3	- 40 to +125	Tube
	SOIC - 8	ZJR1000-1CSABR		3	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-1CUABT		3	- 40 to +125	Tube
	MSOP - 8	ZJR1000-1CUABR		3	- 40 to +125	13” Reel
	SOIC - 8	ZJR1000-1BSABT		5	- 40 to +125	Tube
	SOIC - 8	ZJR1000-1BSABR		5	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-1BUABT		5	- 40 to +125	Tube
	MSOP - 8	ZJR1000-1BUABR		5	- 40 to +125	13” Reel
	SOIC - 8	ZJR1000-1ASABT		8	- 40 to +125	Tube
	SOIC - 8	ZJR1000-1ASABR		8	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-1AUABT		8	- 40 to +125	Tube
	MSOP - 8	ZJR1000-1AUABR		8	- 40 to +125	13” Reel
ZJR1000-2	SOIC - 8	ZJR1000-2BSABT	2.048	5	- 40 to +125	Tube
	SOIC - 8	ZJR1000-2BSABR		5	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-2BUABT		5	- 40 to +125	Tube
	MSOP - 8	ZJR1000-2BUABR		5	- 40 to +125	13” Reel
	SOIC - 8	ZJR1000-2ASABT		8	- 40 to +125	Tube
	SOIC - 8	ZJR1000-2ASABR		8	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-2AUABT		8	- 40 to +125	Tube
	MSOP - 8	ZJR1000-2AUABR		8	- 40 to +125	13” Reel
ZJR1000-9	SOIC - 8	ZJR1000-9BSABT	2.5	5	- 40 to +125	Tube
	SOIC - 8	ZJR1000-9BSABR		5	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-9BUABT		5	- 40 to +125	Tube
	MSOP - 8	ZJR1000-9BUABR		5	- 40 to +125	13” Reel
	SOIC - 8	ZJR1000-9ASABT		8	- 40 to +125	Tube
	SOIC - 8	ZJR1000-9ASABR		8	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-9AUABT		8	- 40 to +125	Tube
	MSOP - 8	ZJR1000-9AUABR		8	- 40 to +125	13” Reel

Model	Package	Orderable Device	Output Voltage (V)	Max TempCo (ppm/°C)	Temperature Range (°C)	External Package
ZJR1000-3	SOIC - 8	ZJR1000-3BSABT	3	5	- 40 to +125	Tube
	SOIC - 8	ZJR1000-3BSABR		5	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-3BUABT		5	- 40 to +125	Tube
	MSOP - 8	ZJR1000-3BUABR		5	- 40 to +125	13” Reel
	SOIC - 8	ZJR1000-3ASABT		8	- 40 to +125	Tube
	SOIC - 8	ZJR1000-3ASABR		8	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-3AUABT		8	- 40 to +125	Tube
	MSOP - 8	ZJR1000-3AUABR		8	- 40 to +125	13” Reel
ZJR1000-4	SOIC - 8	ZJR1000-4BSABT	4.096	5	- 40 to +125	Tube
	SOIC - 8	ZJR1000-4BSABR		5	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-4BUABT		5	- 40 to +125	Tube
	MSOP - 8	ZJR1000-4BUABR		5	- 40 to +125	13” Reel
	SOIC - 8	ZJR1000-4ASABT		8	- 40 to +125	Tube
	SOIC - 8	ZJR1000-4ASABR		8	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-4AUABT		8	- 40 to +125	Tube
	MSOP - 8	ZJR1000-4AUABR		8	- 40 to +125	13” Reel
ZJR1000-5	SOIC - 8	ZJR1000-5BSABT	5	5	- 40 to +125	Tube
	SOIC - 8	ZJR1000-5BSABR		5	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-5BUABT		5	- 40 to +125	Tube
	MSOP - 8	ZJR1000-5BUABR		5	- 40 to +125	13” Reel
	SOIC - 8	ZJR1000-5ASABT		8	- 40 to +125	Tube
	SOIC - 8	ZJR1000-5ASABR		8	- 40 to +125	13” Reel
	MSOP - 8	ZJR1000-5AUABT		8	- 40 to +125	Tube
	MSOP - 8	ZJR1000-5AUABR		8	- 40 to +125	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 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 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