# Low Power Compact Precision Voltage Reference

## Features

- Excellent Specified Drift Performance
  -40 °C to +125 °C: 15 ppm/°C max
- High Accuracy: 0.1% max
- VIN = 5.5 V max
- Low Dropout: 5 mV
- High Output Current: 20 mA
- Low $I_Q$: 130 µA
- Tiny 3-Pin SOT23 Package

## Applications

- Temperature and Pressure Transmitters
- Portable, Battery-Powered Equipment
- Data Acquisition Systems
- Medical Equipment
- Power Inverters

## General Description

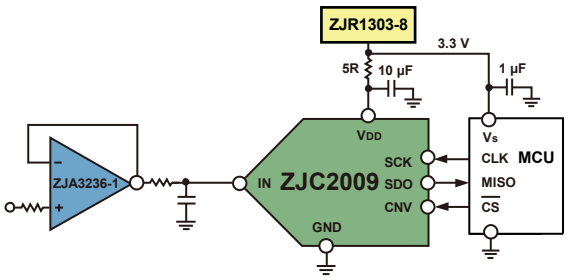
The ZJR1303 is a precision, low-power, low-dropout voltage, compact reference family available in a tiny 3-pin SOT23 package. The ZJR1303 offers excellent temperature drift and initial accuracy while operating at a quiescent current of 130 µA.

The low power consumption and the relatively high precision make the ZJR1303 very attractive for loop-powered industrial applications such as pressure and temperature transmitter applications. The ZJR1303 requires a load capacitor valued between 0.1 µF and 20 µF for stability. The ZJR1303 is specified over the extended industrial temperature range of -40 °C to +125 °C.

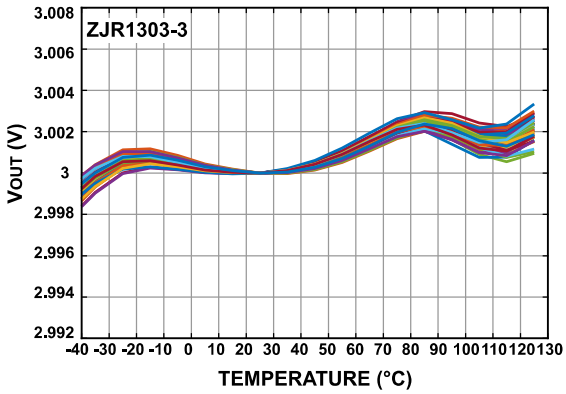
The ZJR1303 operates with supplies within 5 mV of output voltage under zero-load conditions. Engineers can use the low dropout, small size, and low power consumption of the ZJR1303 in portable and battery-powered applications.

| Model | Output Voltage (V) |
|---|---|
| ZJR1303-2 | 2.048 |
| ZJR1303-9 | 2.5 |
| ZJR1303-3 | 3 |
| ZJR1303-8 | 3.3 |

## Typical Application




## Typical Characteristics



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## Version (Preliminary Datasheet)[1]

### Revision History

**Apr. 2025 — Preliminary Datasheet**

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## Pin Configurations and Function

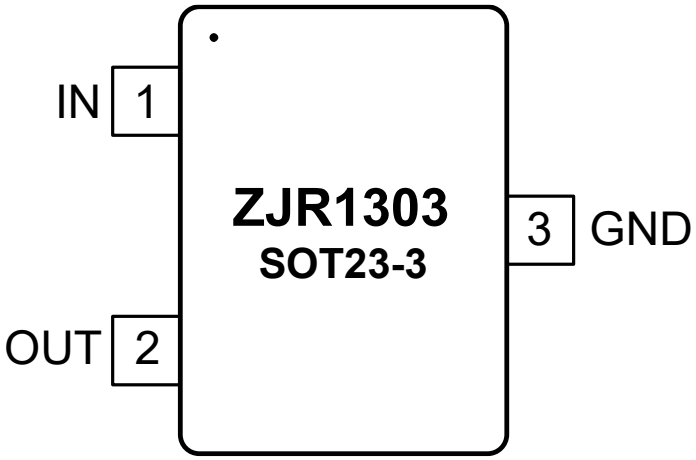


Figure 1. ZJR1303 Pin Configuration (3-lead SOT23)

| Mnemonic | Pin No. | I/O[1] | Description |
|---|---|---|---|
| IN | 1 | AI | Input supply voltage. |
| OUT | 2 | AO | Reference output voltage. |
| GND | 3 | -- | Ground. |

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

## Absolute Maximum Ratings [1]

| Parameter | Rating |
|---|---|
| Total Voltage (Across Any 2 Pins) | ±5.5 V |
| Operating Temperature Range | -40 °C to 125 °C |
| Storage Temperature Range | -65 °C to 150 °C |
| Junction Temperature Range | -65 °C to 150 °C |
| Lead Temperature, Soldering (10 sec) | 300 °C |
| ESD Rating (ESD) [2] | |
| Human Body Model (HBM) [3] | 8 kV |
| Charge Device Model (CDM) [4] | 1 kV |

## Thermal Resistance [5]

| Package Type | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|---|---|---|---|
| 3-lead SOT23 | 230 | 146 | °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] 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.

[3] ANSI/ESDA/JEDEC JS-001 Compliant

[4] ANSI/ESDA/JEDEC JS-002 Complaint

[5] $\theta_{JA}$ addresses the conditions for soldering devices onto circuit boards to achieve surface mount packaging.

## Specifications

The ● denotes the specification which apply over the full operating temperature range, otherwise specifications are at $T_A$ = 25 °C, VIN = 2.8 V to 5.5 V, $I_{LOAD}$ = 0 mA, $C_L$ = 0.1 µF, unless otherwise noted.

| Parameter | Symbol | Conditions | | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}$ | ZJR1303-2 | | | 2.048 | | V |
| | | ZJR1303-9 | | | 2.5 | | V |
| | | ZJR1303-3 | | | 3 | | V |
| | | ZJR1303-8 | | | 3.3 | | V |
| Initial Accuracy | | | | -0.1 | | +0.1 | % |
| Temperature Coefficient | $TC_{VOUT}$ | | ● | | | 15 | ppm/°C |
| Voltage Noise | | 0.1 Hz to 10 Hz | | | 2.5 | | $ppm_{P-P}$ |
| Voltage Noise Density | $e_n$ | ZJR1303-2, 1 kHz | | | 167 | | $nV/\sqrt{Hz}$ |
| | | ZJR1303-9, 1 kHz | | | 200 | | $nV/\sqrt{Hz}$ |
| | | ZJR1303-3, 1 kHz | | | 250 | | $nV/\sqrt{Hz}$ |
| | | ZJR1303-8, 1 kHz | | | 268 | | $nV/\sqrt{Hz}$ |
| Line Regulation | | ZJR1303-2: VIN = 2.8 V ~ 5.5 V<br>Others: VIN = $V_{OUT}$ + 0.3 V ~ 5.5 V | <br>● | | 2<br>5 | 10 | µV/V |
| Load Regulation | | -10 mA < $I_{LOAD}$ < 10 mA | ● | | 1.5<br>5 | 10 | µV/mA |
| Supply Voltage | VIN | ZJR1303-2 [1] | | 2.8 | | 5.5 | V |
| | | Others [1] | | $V_{OUT}$ + 0.3 | | 5.5 | V |
| Dropout Voltage | VIN-$V_{OUT}$ | $I_{LOAD}$ = 0 [2]<br>$I_{LOAD}$ = 5 mA [2] | ●<br>● | | 5<br>50 | | mV |
| Supply Current | $I_{SY}$ | | ● | | 130 | | µA |
| Short Circuit Current | $I_{SC}$ | $V_{OUT}$ = GND or VIN | | 16 | 20 | | mA |
| Temperature Range | | Specified | | -40 | | 125 | °C |

[1] Specified for performance.
[2] Functional, not Specified for performance (Tc, etc).

## Typical Performance Characteristics

At VIN = 5 V, $T_A$ = 25 °C, unless otherwise noted.

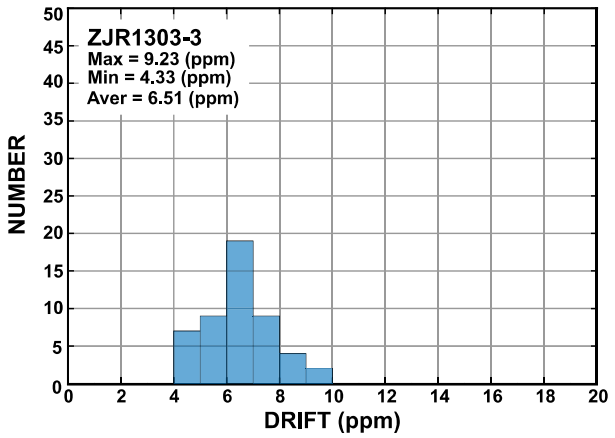


Figure 2. Temperature Drift

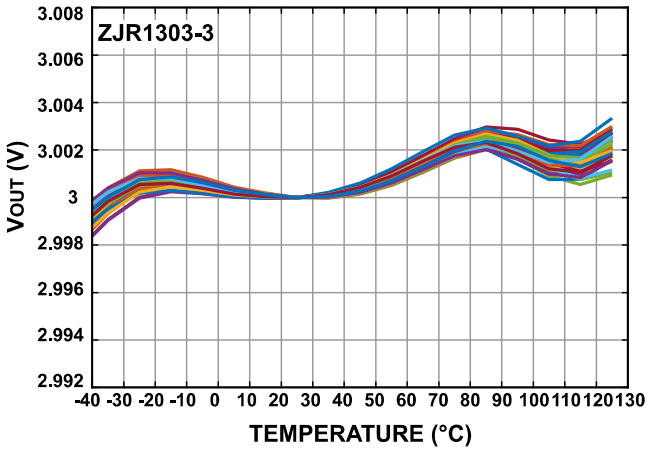


Figure 3. Output Voltage vs Temperature

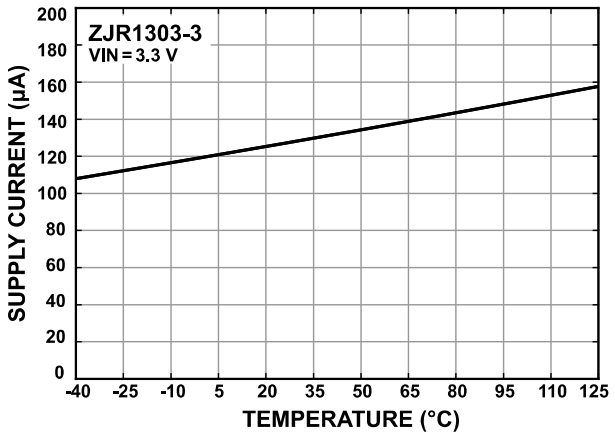


Figure 4. Supply Current vs Temperature

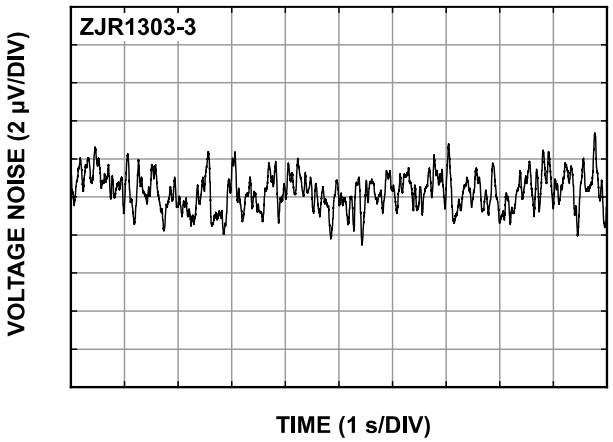


Figure 5. Voltage Noise (0.1 Hz to 10 Hz)

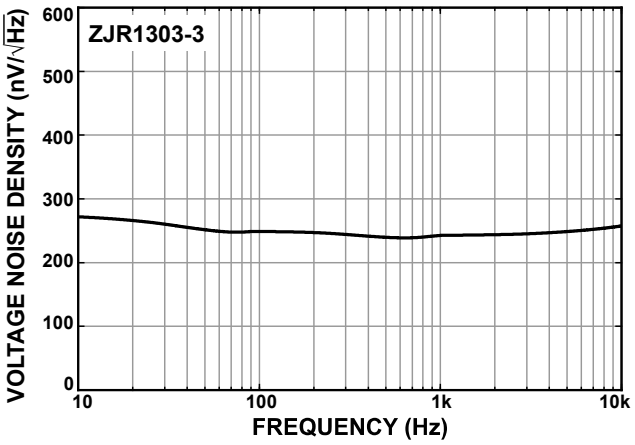


Figure 6. Noise Density vs. Frequency

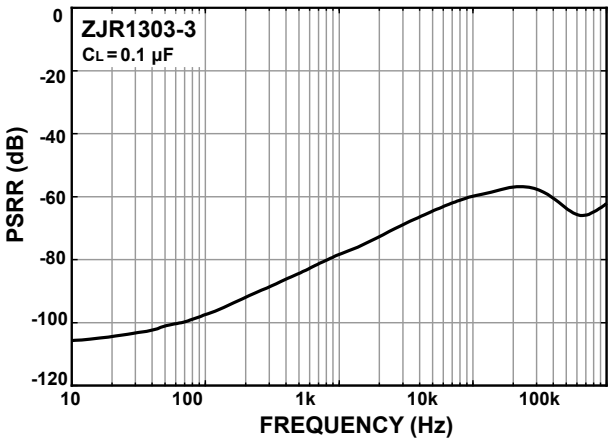


Figure 7. Power Supply Rejection Ratio vs. Frequency

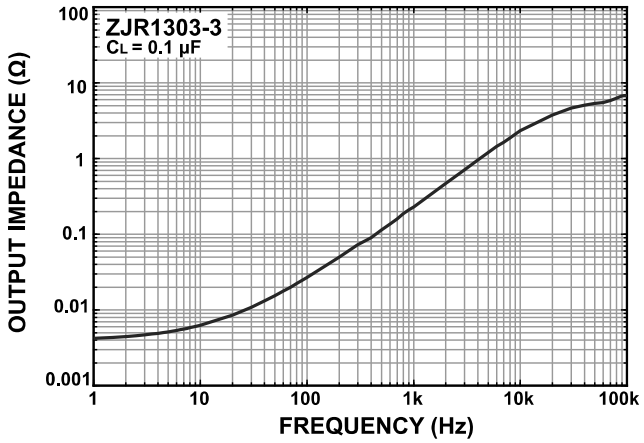


Figure 8. Output Impedance vs. Frequency

## 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.

### Application Information

Figure 9 is the basic connection of ZJR1303. Other than a 0.1 μF capacitor at the output, no further component is needed for nor maloperation. 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. The output capacitance ranges from 0.1 μF to 10 μF. Too big capacitive load can cause output oscillation.

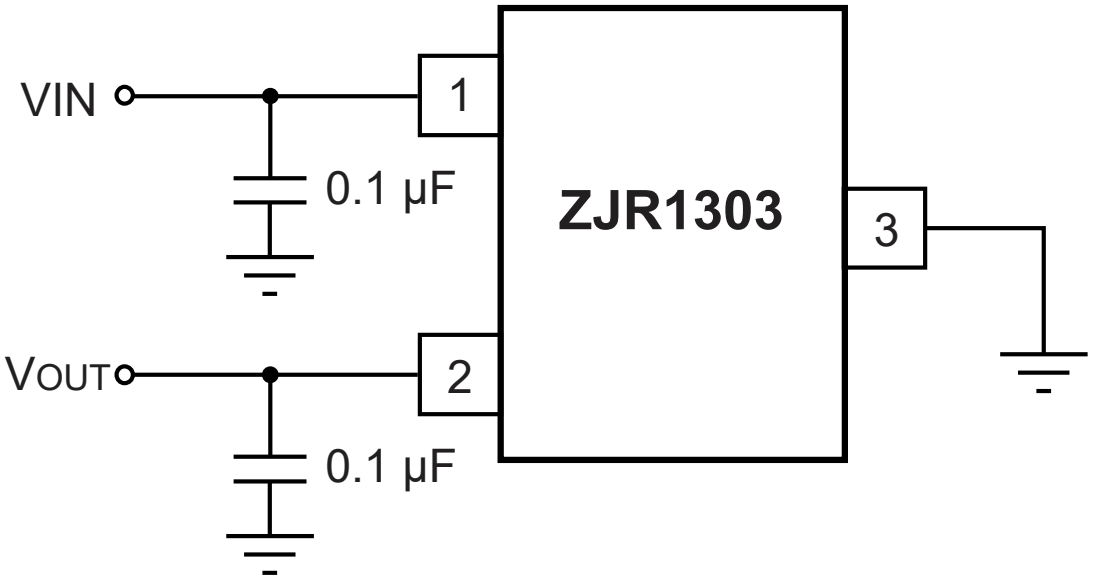


Figure 9. Typical Connections for Operating ZJR1303

## Outline Information

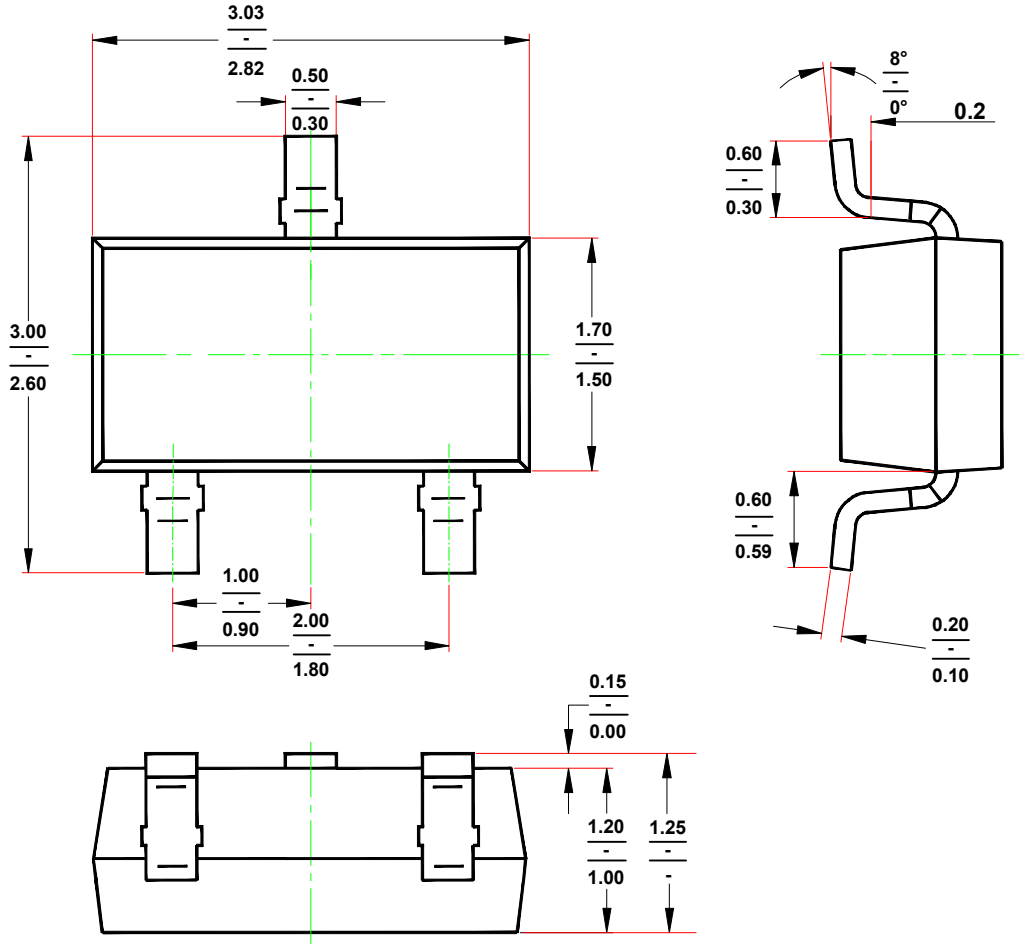


Figure 10. 3-Lead SOT23 Package Dimensions shown in millimeters

## Ordering Guide

| Model | Orderable Device | Output Voltage (V) | Max TempCo (ppm/°C) | Temperature Range (°C) | Package | External Package |
|---|---|---|---|---|---|---|
| ZJR1303-2 | ZJR1303-2AURBR | 2.048 | 15 | -40 to +125 | SOT23-3 | 7”reel |
| ZJR1303-9 | ZJR1303-9AURBR | 2.5 | | | | |
| ZJR1303-3 | ZJR1303-3AURBR | 3 | | | | |
| ZJR1303-8 | ZJR1303-8AURBR | 3.3 | | | | |

## 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, SOT23; T = DFN, QFN; X = SC70; W = WLCSP; Z = TSOT23
- Grade: B grade is better than A grade
- Base: R = Voltage reference; A = Amplifier; C = Data Converter; G = Switches and Multiplexers; M = Others

## Related Parts

| 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 -113 dB |
| ZJC2001/2011 | 16-bit 500 kSPS/250 kSPS SAR ADC | Fully differential input, SINAD 95.3 dB, THD -113 dB |
| ZJC2002/2012<br>ZJC2003/2013 | 16-bit 500 kSPS/250 kSPS SAR ADC | Pseudo-differential unipolar input, SINAD 91.7 dB, THD -105 dB<br>Pseudo-differential bipolar input, SINAD 91.7 dB, THD -105 dB |
| ZJC2004/2014<br>ZJC2005/2015 | 18-bit 400 kSPS/200 kSPS SAR ADC | Pseudo-differential unipolar input, SINAD 94.2 dB, THD -105 dB<br>Pseudo-differential bipolar input, SINAD 94.2 dB, THD -105 dB |
| ZJC2007/2017<br>ZJC2008/2018 | 14-bit 600 kSPS/300 kSPS SAR ADC | Pseudo-differential unipolar input, SINAD 85 dB, THD -105 dB<br>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<br>ZJC2100/1-16 | 18-bit 400 kSPS/200 kSPS 4-ch differential SAR ADC, SINAD 99.3 dB, THD -113 dB<br>16-bit 500 kSPS/250 kSPS 4-ch differential SAR ADC, SINAD 95.3 dB, THD -113 dB | |
| ZJC2102/3-18<br>ZJC2102/3-16<br>ZJC2102/3-14 | 18-bit 400 kSPS/200 kSPS 8-ch pseudo-differential SAR ADC, SINAD 94.2 dB, THD -105 dB<br>16-bit 500 kSPS/250 kSPS 8-ch pseudo-differential SAR ADC, SINAD 91.7 dB, THD -105 dB<br>14-bit 600 kSPS/300 kSPS 8-ch pseudo-differential SAR ADC, SINAD 85 dB, THD -105 dB | |
| ZJC2104/5-18<br>ZJC2104/5-16 | 18-bit 400 kSPS/200 kSPS 4-ch pseudo-differential SAR ADC, SINAD 94.2 dB, THD -105 dB<br>16-bit 500 kSPS/250 kSPS 4-ch pseudo-differential SAR ADC, SINAD 91.7 dB, THD -105 dB | |
| **DAC** | | |
| ZJC2541-18/16/14<br>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<br>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<br>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<br>ZJA3008-2 | OVP ±75 V, 36 V, Low Power, High Precision Op Amp<br>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<br>ZJA3678/9 | Low power, G = 1 Single/Dual 36 V difference amplifier<br>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<br>ZJR1003 | 5.5 V low power voltage reference<br>(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 |
| ZJR1302 | 5.5 V low power compact precision voltage reference | $V_{OUT}$ = 2.048/2.5/3/3.3/4.096 V, 30 ppm/°C max drift -40 °C to 125 °C, 130 µA, SOT23-3 |
| **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 |