

## Low-Drift, Low-Power, Small-Footprint Series

### Voltage Reference

#### Features and Benefits

- Voltage options: 1.25V, 1.5V, 1.8V, 2.048V, 2.5V, 3.0V, 3.3V, 4.096V
- Initial accuracy:  $\pm 0.1\%$  (maximum)
- Low temperature coefficient: 20 ppm/°C (maximum)
- Output 1/f noise at 0.1 to 10 Hz: 15  $\mu\text{V}_{\text{PP}}/\text{V}$
- Supply voltage: 2.7 to 5.5 V
- Power consumption: < 500  $\mu\text{A}$
- Startup time: <400us
- Operating temperature: -40 to 125 °C
- Output Current:  $\pm 5\text{mA}$



#### Ordering Information

| DEVICE            | Package Type | MARKING    | Packing | Packing Qty  |
|-------------------|--------------|------------|---------|--------------|
| REF3312AIM3/TR-HG | SOT-23       | 3APWR,R33A | REEL    | 3000pcs/reel |
| REF3315AIM3/TR-HG | SOT-23       | 3GPWR      | REEL    | 3000pcs/reel |
| REF3318AIM3/TR-HG | SOT-23       | R33B       | REEL    | 3000pcs/reel |
| REF3320AIM3/TR-HG | SOT-23       | 3BPWR,R33C | REEL    | 3000pcs/reel |
| REF3325AIM3/TR-HG | SOT-23       | 3CPWR,R33D | REEL    | 3000pcs/reel |
| REF3330AIM3/TR-HG | SOT-23       | 3DPWR,R33E | REEL    | 3000pcs/reel |
| REF3333AIM3/TR-HG | SOT-23       | 3EPWR,R33F | REEL    | 3000pcs/reel |
| REF3340AIM3/TR-HG | SOT-23       | 3FPWR      | REEL    | 3000pcs/reel |

## General Description

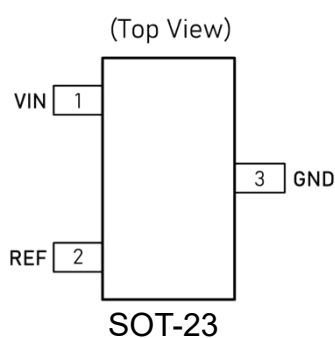
The REF33xx series devices are low temperature drift (20ppm/°C maximum), low-power, high-precision CMOS voltage reference, featuring  $\pm 0.1\%$  initial accuracy, low operating current with power consumption less than 500 $\mu$ A. This device also offers very low output noise of 15  $\mu$ V<sub>PP</sub>/V, which enables its ability to maintain high signal integrity with high-resolution data converters in noise critical systems.

Packaged in the same SOT-23 package, REF33xx offers enhanced specifications and pin-to-pin replacement for REF33xx and LM4132. Stability and system reliability are further improved by the low output-voltage hysteresis of the device and low long-term output voltage drift. REF33xx is specified for the wide temperature range of -40 to +125 °C.

## Applications

- Data acquisition (DAQ)
- PLC analog I/O modules
- Field transmitters
- Motor drive control module
- Battery test equipment
- LCR meters

## Pin Configuration



## Pin Description

| Pin. Name | Pin Description                                                |
|-----------|----------------------------------------------------------------|
| VIN       | Power supply voltage                                           |
| GND       | Ground.                                                        |
| REF       | Reference voltage outputs , an external capacitor is required. |

## Limiting Value

In accordance with the Absolute Maximum Rating System (IEC 60134)

| Parameter                                          | Value       | Unit |
|----------------------------------------------------|-------------|------|
| Operating Ambient Temperature Range <sup>(1)</sup> | -40 to 125  | °C   |
| Storage Temperature Range                          | -50 to 125  | °C   |
| Lead Temperature (Soldering, 10 seconds)           | 260         | °C   |
| Input Voltage Range                                | -0.3 to 5.5 | V    |
| ESD protection                                     | 3000        | V    |

Note: Stress greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions outside those indicated in the operational sections of this specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability

(1) Operating temperature range: -40°C to +125°C. This product is designed for industrial grade applications. For automotive grade versions compliant with AEC-Q100, please conduct internal screening per the standard or contact our sales team for availability.

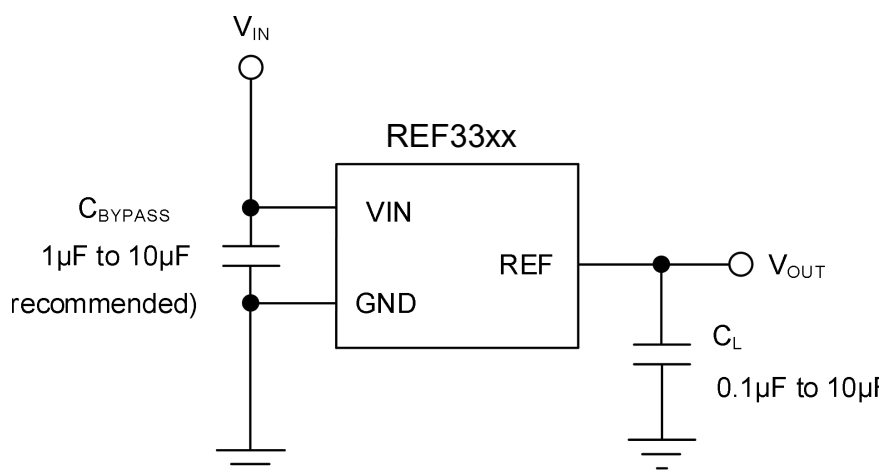
## Recommended Operating Conditions

| Symbol          | Parameter            | Min.                  | Typ. | Max. | Unit |
|-----------------|----------------------|-----------------------|------|------|------|
| V <sub>IN</sub> | Supply input voltage | V <sub>OUT</sub> +0.2 |      | 5.5  | V    |
| I <sub>CC</sub> | Output current range | -5                    |      | 5    | mA   |

## Electrical Characteristics

| Symbol                           | Parameter               | Description                | Min. | Typ.  | Max. | Unit           |
|----------------------------------|-------------------------|----------------------------|------|-------|------|----------------|
| $V_{IN}$                         | Power supply voltage    |                            | 2.7  | 5     | 5.5  | V              |
| $I_{CC}$                         | Power consumption       | $V_{CC} = 5.0V$ , no load. |      | 300   | 500  | $\mu A$        |
| $V_{OUT}$                        | Output voltage          | REF3312                    |      | 1.25  |      | V              |
|                                  |                         | REF3315                    |      | 1.5   |      | V              |
|                                  |                         | REF3318                    |      | 1.8   |      | V              |
|                                  |                         | REF3320                    |      | 2.048 |      | V              |
|                                  |                         | REF3325                    |      | 2.5   |      | V              |
|                                  |                         | REF3330                    |      | 3.0   |      | V              |
|                                  |                         | REF3333                    |      | 3.3   |      | V              |
|                                  |                         | REF3340                    |      | 4.096 |      | V              |
| $\Delta V_{OUT}$                 | Output voltage accuracy |                            | -0.1 |       | 0.1  | %              |
| $V_{noise}$                      | Output Noise            | 0.1Hz~10Hz                 |      | 15    |      | $\mu V_{pp}/V$ |
| $T_C$                            | Temperature coefficient | -40 to 125 °C              |      |       | 20   | ppm/°C         |
| $V_{IN}-V_{OUT}$                 | Dropout Voltage         |                            |      | 200   |      | mV             |
| $\Delta V_{OUT} / \Delta V_{IN}$ | Line Regulation         |                            |      |       | 100  | ppm/V          |
| $\Delta V_{OUT} / \Delta I_L$    | Load Regulation         |                            |      |       | 50   | ppm/mA         |
| $dT$                             | Thermal hysteresis      |                            |      | 80    |      | ppm            |
|                                  | Long-term stability     | 0h to 1000h at 25 °C       |      | 200   |      | ppm            |
| $I_{sc}$                         | Short-circuit current   | Sourcing and sinking       |      | 50    |      | mA             |
|                                  | Capacitive load         |                            | 0.1  |       | 10   | $\mu F$        |
|                                  | Turn-on setting time    |                            |      |       | 400  | $\mu s$        |

## Typical Application



## Layout

### Layout Guidelines

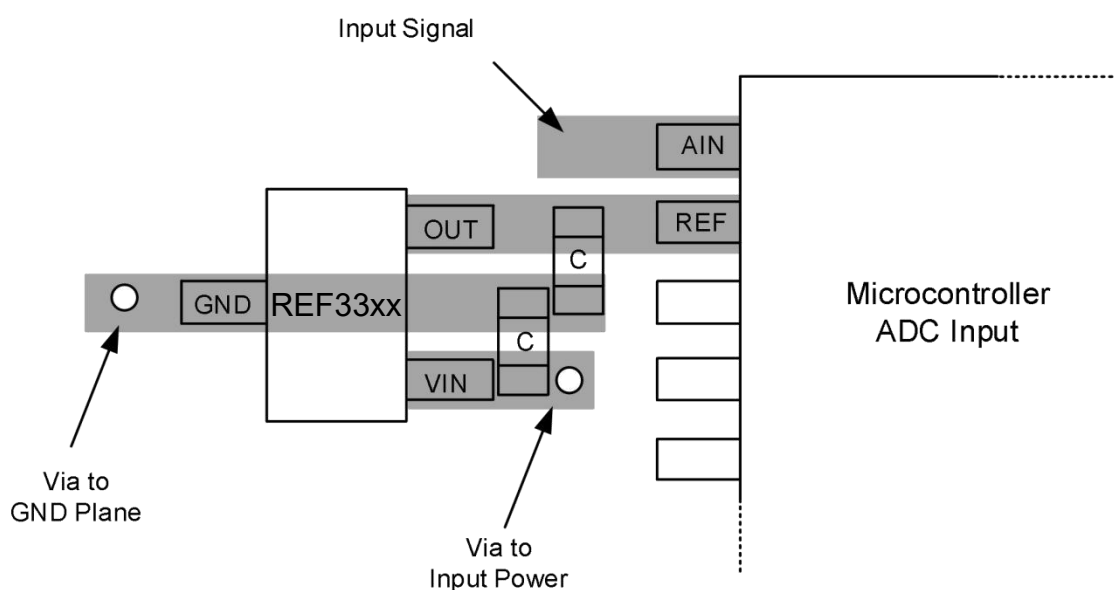
For optimal performance of this design, please follow standard printed circuit board (PCB) layout guidelines, including proper decoupling close to the integrated circuits and adequate power and ground connections with large copper pours.

As shown below an example of a PCB layout for a data acquisition system using the REF33xx.

Some key considerations are:

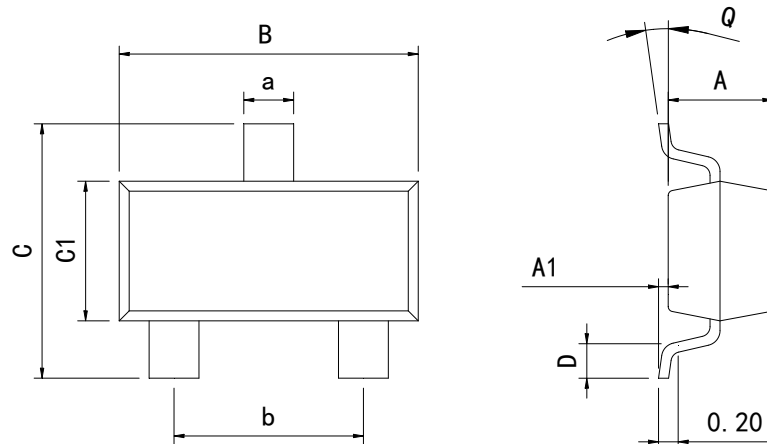
- Connect a low-ESR, 1 $\mu$ F ceramic capacitor at the IN pin for bypass, and a 0.1 $\mu$ F to 10 $\mu$ F ceramic capacitor at the OUT pin for stability of the REF33xx.
- Decouple other active devices in the system per the device specifications.
- Use a solid ground plane helps distribute heat and reduces EMI noise pickup.
- Place the external components as close to the device as possible. This configuration prevents parasitic errors (such as the Seebeck effect) from occurring.
- Minimize trace length between the reference and bias connections to the ADC to reduce noise pickup.
- Do not run sensitive analog traces in parallel with digital traces. Avoid crossing digital and analog traces if possible, and only make perpendicular crossings when absolutely necessary.

### Layout Example



## Physical Dimensions

SOT-23



| Dimensions In Millimeters(SOT-23) |      |      |      |      |      |      |    |      |          |
|-----------------------------------|------|------|------|------|------|------|----|------|----------|
| Symbol:                           | A    | A1   | B    | C    | C1   | D    | Q  | a    | b        |
| Min:                              | 0.90 | 0.00 | 2.80 | 2.25 | 1.20 | 0.13 | 0° | 0.30 | 1.90 BSC |
| Max:                              | 1.05 | 0.15 | 3.00 | 2.55 | 1.40 | 0.41 | 8° | 0.50 |          |

## Revision History

| REVISION<br>NUMBER | DATE   | REVISION              | PAGE |
|--------------------|--------|-----------------------|------|
| V1.0               | 2017-1 | New                   | 1-8  |
| V1.1               | 2026-4 | Document Reformatting | 1-8  |

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