REF3012, REF3020, REF3025, REF3030, REF3033, REF3040

High Precision, Low Drift, CMOS Voltage Reference

The REF30xx family of voltage references provides accurate voltage regulation with a maximum temperature drift of 50 ppm/°C.

The REF30xx can source or sink up to 10 mA of load current. It is supplied in a space−saving SOT−23 package, and for most applications can forgo the use of an output bypass capacitor.

Features

- Reference Voltages: 1.25 V, 2.048 V, 2.5 V, 3.0 V, 3.3 V, 4.096 V
- High Accuracy: ±0.2%
- Low Quiescent Current: 30 μA max
- High Output Current: 10 mA Sourced or Sunk
- Maximum 50 ppm/°C Temperature Drift over the Specified Range of −40°C to +85°C
- SOT−23 3−Lead Package
- This Device is Pb−Free, Halogen Free/BFR Free, and RoHS Compliant

Typical Applications

- Battery Powered Systems
- A/D and D/A Converters
- Precision Regulator Systems
- Power Supplies
- Portable Medical Equipment

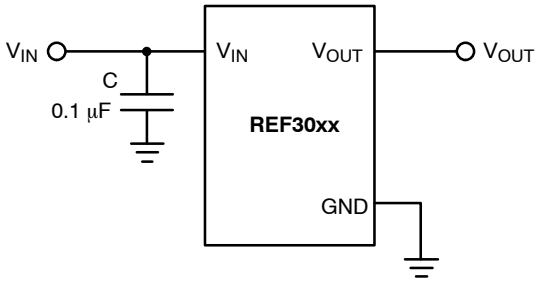
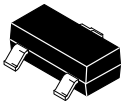


Figure 1. Application Circuit

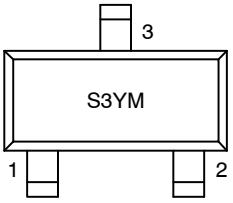
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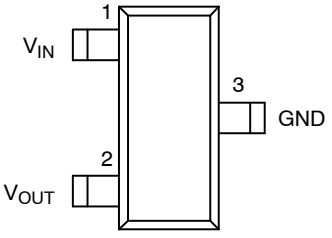
SOT23−3
TB SUFFIX
CASE 527AG

MARKING DIAGRAM



S3 = Specific Device Code
Y = Production Year (Last Digit)
M = Production Month (1 − 9, O, N, D)

PIN CONNECTIONS



(Top View)

PIN FUNCTIONS

Pin No.	Pin Name	Function
1	V_{IN}	Supply Voltage Input
2	V_{OUT}	Output Voltage
3	GND	Ground

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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Table 1. ORDERING INFORMATION

Device	Output Voltage	Marking	Package	Shipping †
REF3012TB−GT3	1.25 V	S3YM	SOT−23	3000 / Tape & Reel
REF3020TB−GT3	2.048 V			
REF3025TB−GT3	2.5 V			
REF3030TB−GT3	3.0 V			
REF3033TB−GT3	3.3 V			
REF3040TB−GT3 (Note 1)	4.096 V			

1. Contact factory for availability of these and other custom voltages.
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Table 2. ABSOLUTE MAXIMUM RATINGS (Note 2)

Rating	Value	Unit
V_{IN}	6.5	V
Storage Temperature Range	−55 to +125	°C
Junction Temperature Range	+150	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.
2. Maximum terminal current is bounded by the maximum current handling of the switches, maximum power dissipation of the package.

Table 3. RECOMMENDED OPERATING CONDITIONS

Rating	Value	Unit
Temperature Range	−40 to +85	°C

Table 4. ELECTRICAL CHARACTERISTICS
(V_{IN} = 3.0 V, I_{OUT} = 0 mA, C_{OUT} = 0.001 μF, −40°C to +85°C unless specified otherwise.)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Output Voltage	REF3012 REF3020 REF3025 REF3030 (V_{IN} = 5.0 V) REF3033 (V_{IN} = 5.0 V) REF3040 (V_{IN} = 5.0 V)	V_{out}	1.2475 2.044 2.495 2.994 3.294 4.088	1.250 2.048 2.500 3.000 3.300 4.096	1.2525 2.052 2.505 3.006 3.306 4.104	V
Output Voltage Accuracy			−0.2		+0.2	%
Output Voltage Noise (Note 3)	f = 0.1 Hz to 10 Hz			50		μVp−p
Line Regulation	2.7 V ≤ V_{IN} ≤ 5.5 V			30	100	μV/V
Output voltage temp Drift	−40°C ≤ T_A ≤ +85°C	dV_{OUT}/dT		20	50	ppm/°C
Long−Term Stability (Note 3)	0−1000 h			50		ppm
Load Regulation	V_{IN} = 3 V 0 mA < I_{LOAD} < 10 mA −10 mA < I_{LOAD} < 0 mA	dV_{OUT}/dI_{LOAD}		 100 150	 250 350	μV/mA
Thermal Hysteresis (Note 3)	ΔT_A = 125°C	dT		100		ppm
Dropout Voltage	VOUT = 2.5 V	$V_{IN} - V_{OUT}$		1	2.5	mV
Short−Circuit Current (Note 3)	T_A = 25°C OUT pin shorted to GND OUT pin shorted to IN	I_{SC}		 50 20	 60 40	mA
Turn On Settling Time	To 0.1% at V_{IN} = 5 V with C_L = 0			2		ms
Power Supply Voltage	I_L = 0	V_S	2.7		5.5	V
Supply Current	I_L = 0	I_Q			30	μA
Temperature Range Specified Range Operating Range Storage Range			 −40 −40 −55		 +85 +85 +125	°C

3. Guaranteed by design.

TYPICAL CHARACTERISTICS

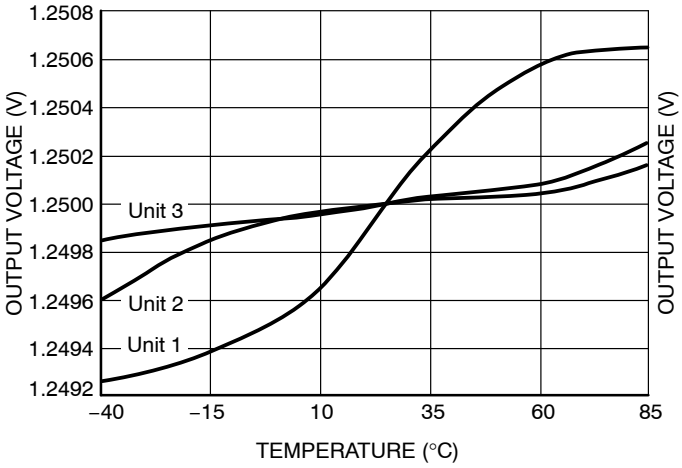


Figure 2. Output Voltage vs. Temperature

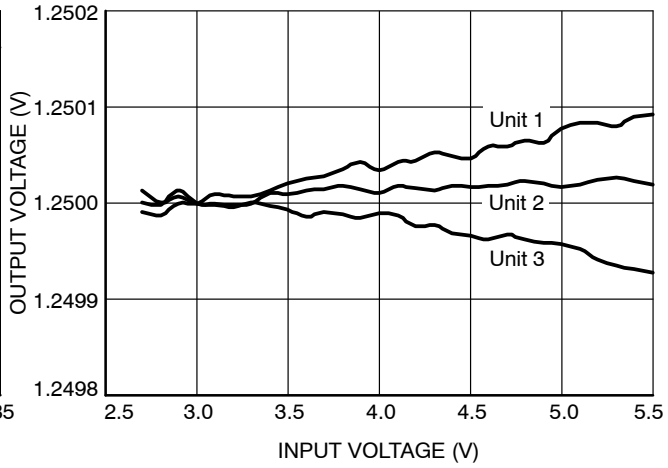


Figure 3. Output Voltage vs. Supply Voltage (No Load)

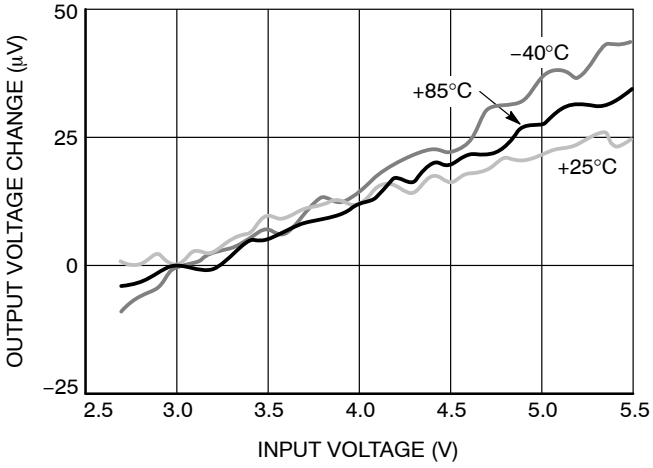


Figure 4. Line Regulation over Temperature

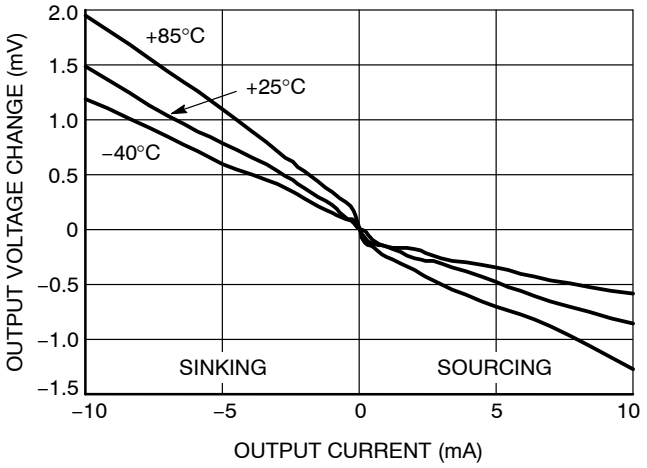


Figure 5. Load Regulation over Temperature

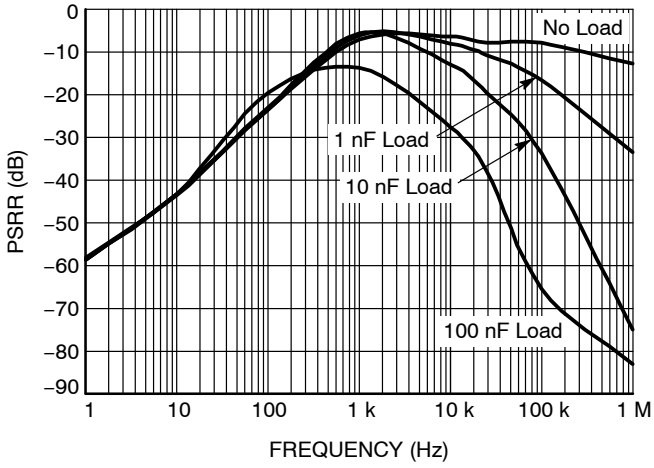


Figure 6. Power−Supply Rejection Ratio vs. Frequency

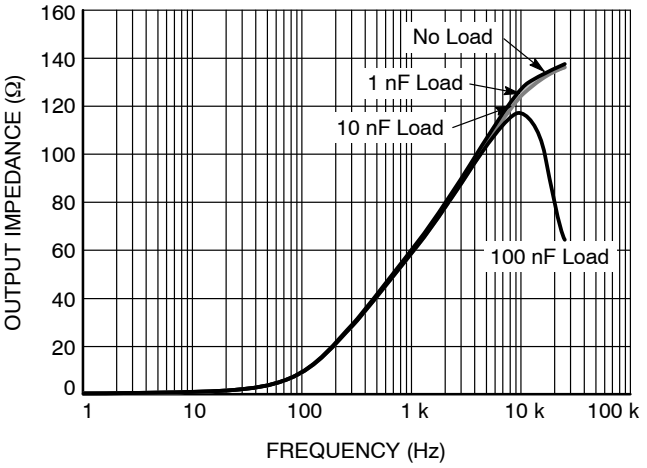


Figure 7. Output Impedance vs. Frequency

TYPICAL CHARACTERISTICS

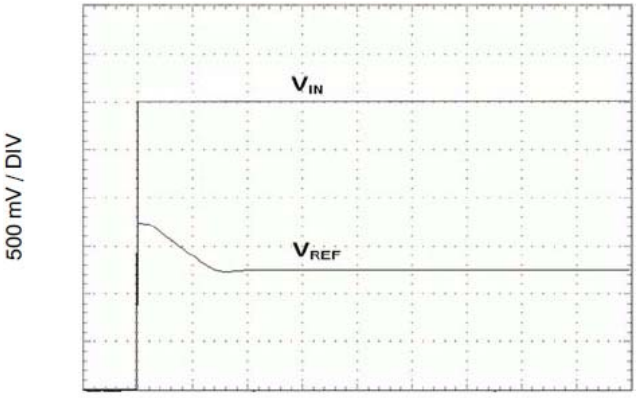


Figure 8. Step Response, C_L = 0, 3 V Startup

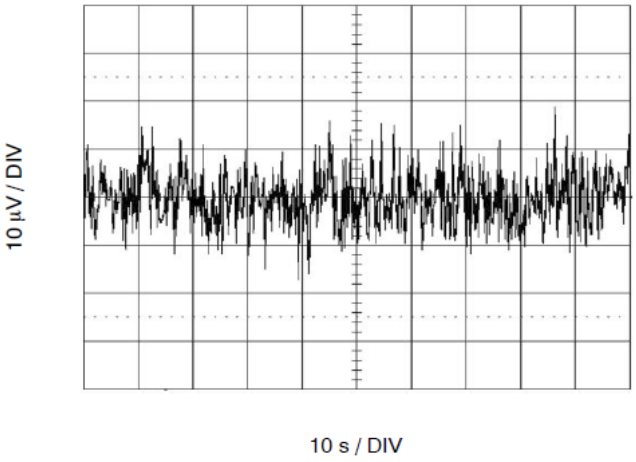


Figure 9. 0.1 Hz to 10 Hz Noise

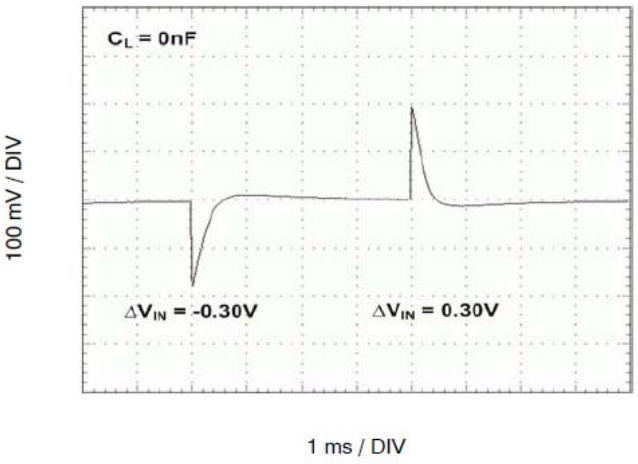


Figure 10. Line Transient Response

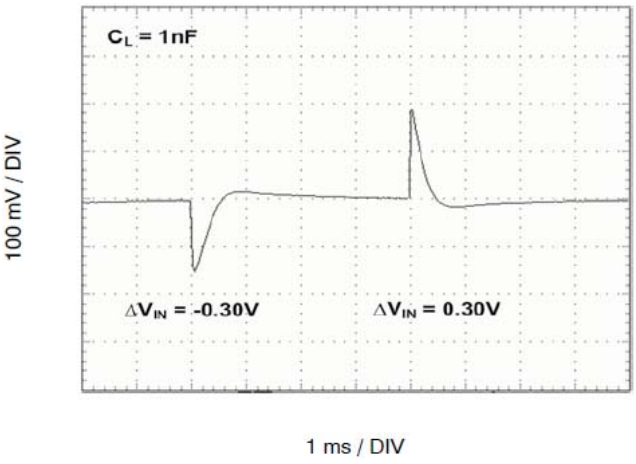


Figure 11. Line Transient Response with Cap. Load

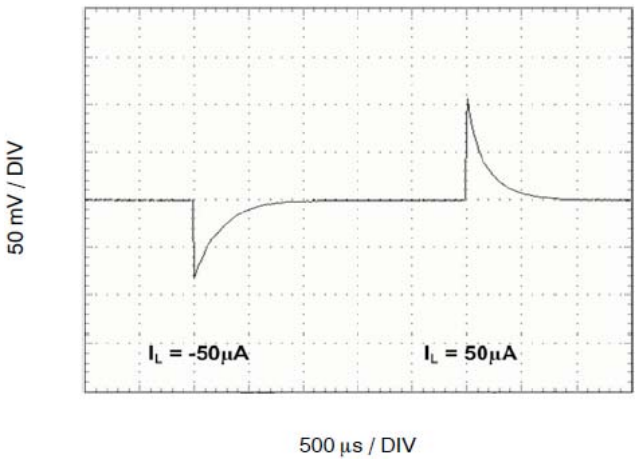


Figure 12. Load Transient (I_L = 50 μA)

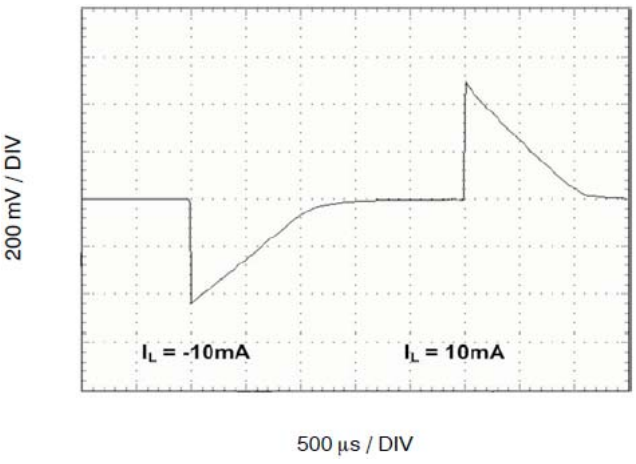


Figure 13. Load Transient (I_L = 10 mA)

APPLICATION INFORMATION

Application Information

A supply bypass capacitor of 0.1 μF is recommended.

In most applications, the REF30xx does not require an output bypass capacitor. For the effects of a capacitive load on device performance, see Figures 8 and 9 in the Typical Characteristics section.

Power Supply

The REF30xx family of references works at supply voltages between 2.7 V and 5.5 V. The maximum dropout voltage in this range is 2.5 mV.

While the power supply voltage rises to the specified level during power−up, the REF30xx will temporarily draw a higher than typical current. It is recommended to use a power supply with a fast rising edge.

Line Regulation

Line regulation is defined as the change in output voltage due to the change in the input voltage. For REF30xx, this change is less than 100 μV/V across the specified supply voltage range.

Thermal Hysteresis

Thermal hysteresis is defined as the change in the output voltage after the device is cycled through the operating temperature range. This change is reported as a fraction of the nominal output voltage, in ppm. The initial output V_{PRE} is measured at 25°C. After the device is cooled to −40°C, heated to +80°C, then cooled back to 25°C, the final output voltage V_{POST} is measured. The thermal hysteresis is equal to

$$T_hHYST = \frac{|V_{PRE} - V_{POST}|}{V_{NOM}} \cdot 10^6(ppm) \quad \text{(eq. 1)}$$

where V_{NOM} is the nominal output voltage.

Temperature Drift

Temperature drift is defined as the change in the output voltage caused by a change in operating temperature. (See Figure 2 in the Typical Characteristics section.) The REF30xx family is designed to exhibit a temperature drift of less than 50 ppm/°C across its entire operating temperature range of −40°C to +85°C.

Noise Performance

The noise generated by the REF30xx family is typically less than 50 μVp−p between frequencies of 0.1 Hz to 10 Hz, as shown in the Typical Characteristic Curves. Output noise can be additionally reduced using a low−pass filter, although care should be taken, as capacitive loads affect the PSRR and the output impedance. (See the Typical Characteristics section.)

Load Regulation

Load regulation is defined as the change in output voltage due to a specified change in load current. The REF30xx family can sink or source up to 10 mA of current, with an output change of less than 250 μV/mA when sourcing, or 350 μV/mA when sinking current.

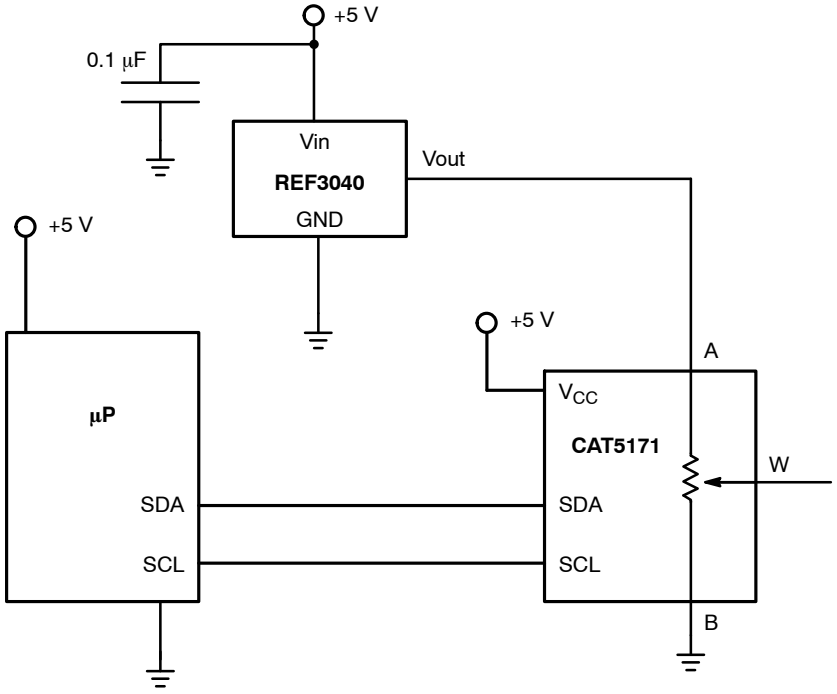


Figure 14. Adjustable Voltage Reference

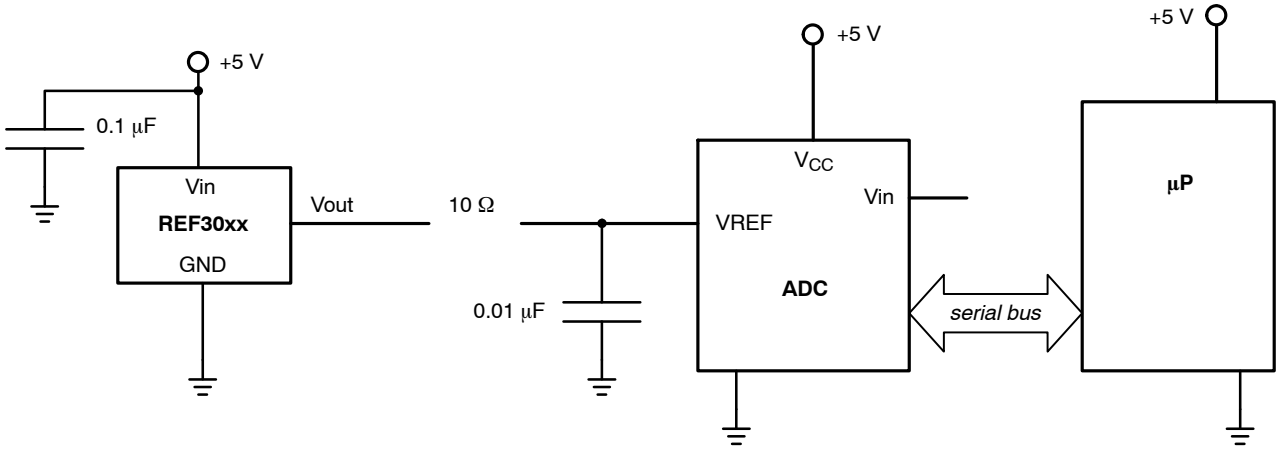
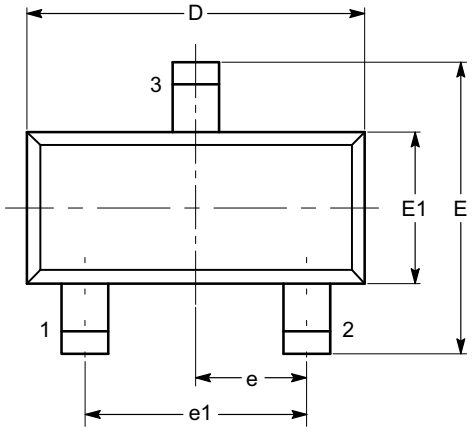


Figure 15. Data Acquisition System using REF30xx Voltage Reference, with Noise Filter

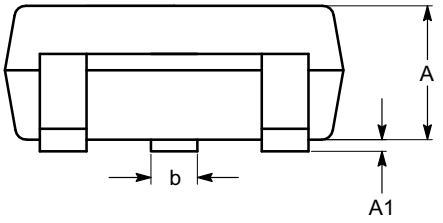
PACKAGE DIMENSIONS

SOT−23, 3 Lead
CASE 527AG−01
ISSUE O

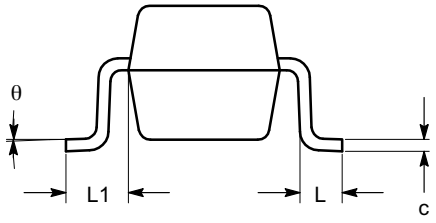


TOP VIEW

SYMBOL	MIN	NOM	MAX
A	0.89		1.12
A1	0.013		0.10
b	0.37		0.50
c	0.085		0.18
D	2.80		3.04
E	2.10		2.64
E1	1.20		1.40
e	0.95 BSC		
e1	1.90 BSC		
L	0.40 REF		
L1	0.54 REF		
θ	0°		8°



SIDE VIEW



END VIEW

Notes:

(1) All dimensions are in millimeters. Angles in degrees.
(2) Complies with JEDEC TO-236.

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