

Temperatur analog

MCU sei Dank

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Komponenten:

Temperatursensor LM335

Der Temperatursensor LM335 gibt bei 0°C eine Spannung von 2.73V ab. Er hat eine Empfindlichkeit von 10mV/K.

Spannungsreferenz TL431

Die einstellbare Zenerdiode TL431 kann mit einem externen Spannungsteiler auf einen Wert zwischen 2,5V und 30V eingestellt werden.

Rail to Rail In/Out OPAMP 6681

CMOS OPAMP für den Betrieb an kleinen Spannungen mit 'Rail to Rail' Charakteristik für Ein- und Ausgänge.

AD-Wandler Eingang des 68HC12

Der AD-Wandler des HC12 hat einen Eingangswiderstand in der Größenordnung von 100kOhm. Mit dem Ausgang eines CMOS OPAMP's kann dieser Eingang somit optimal betrieben werden.

Ziele:

Mit einem Operationsverstärker soll der Temperatursensor LM335 so angepasst werden, dass der AD-Wandler der MCU optimal angesteuert wird. Mit dem Sensor sollen Temperaturen von 0°C bis 50°C gemessen und auf dem LCD angezeigt werden können. Folgende Spannungen sollen am AD-Eingang der MCU anliegen:

0°C -> 0V
50°C -> 5V

Die Speisung der OPAMP-Schaltung erfolgt ab der 5V-Spannung der MCU.



Die Entwicklung der Schaltung muss unbedingt professionell dokumentiert werden. Halten Sie Ihren Arbeitsablauf in einem Arbeitsjournal fest.

Ihre Aufgabe:

- ◆ *Unterlagen studieren*
- ◆ *Schaltung dimensionieren*
- ◆ *Schema zeichnen*
- ◆ *Schaltung aufbauen*
- ◆ *Schaltung ausmessen (Messprotokoll)*
- ◆ *Softwarestruktur erstellen*
- ◆ *uP-Programm in Assembler codieren*
- ◆ *Systemtest durchführen (Testprotokoll)*
- ◆ *Dokumentation erstellen*



LMC6681 Single/LMC6682 Dual/LMC6684 Quad Low Voltage, Rail-To-Rail Input and Output CMOS Amplifier with Powerdown

General Description

The LMC6681/2/4 is a high performance operational amplifier which can operate over a wide range of supply voltages, with guaranteed specifications at 1.8V, 2.2V, 3V, 5V, and 10V.

The LMC6681/2/4 provides an input common-mode voltage range that exceeds both supplies. The rail-to-rail output swing of the amplifier assures maximum dynamic signal range. This rail-to-rail performance of the amplifier, combined with its high open-loop voltage gain makes it unique among CMOS rail-to-rail amplifiers. The LMC6681/2/4 is an excellent choice for circuits where the common-mode voltage range is a concern.

The LMC6681/2/4 has a powerdown mode which can be controlled externally. In this powerdown mode, the supply current decreases from 700 μA per amplifier to less than 1 μA per amplifier. The LMC6684 has two powerdown options. Each of the powerdown pins disables two amplifiers.

The LMC6681/2/4 has been designed specifically to improve system performance in low voltage applications. The amplifier's 80 fA input current, 0.5 mV offset voltage, and 82 dB CMRR maintain accuracy in battery-powered systems.

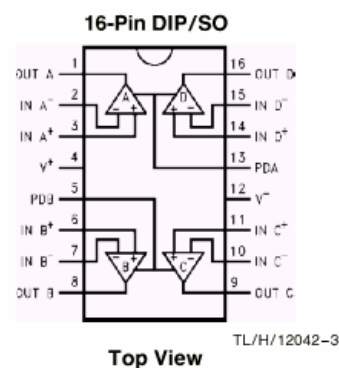
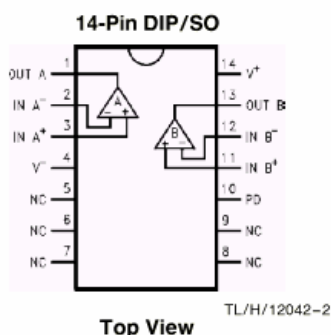
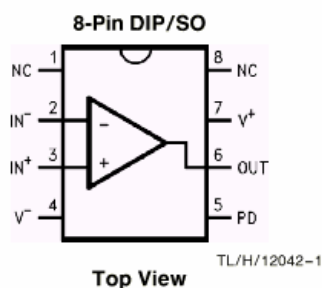
Features (Typical unless otherwise noted)

- Guaranteed Specs at 1.8V, 2.2V, 3V, 5V, 10V
- Rail-to-Rail Input Common-Mode Voltage Range
- Rail-to-Rail Output Swing (within 10 mV of supply rail, @ $V_S = 3\text{V}$ and $R_L = 10\text{ k}\Omega$)
- Powerdown Mode $I_{S\text{OFF}} \leq 1.5\ \mu\text{A}/\text{Amplifier}$ (Guaranteed at $V_S = 1.8\text{V}, 2.2\text{V}, 3\text{V},$ and 5V)
- Ultra Low Input Current 80 fA
- High Voltage Gain ($V_S = 3\text{V}, R_L = 10\text{ k}\Omega$) 120 dB
- Unity Gain Bandwidth 1.2 MHz

Applications

- Battery Operated Circuits
- Sensor Amplifiers
- Portable Communication Devices
- Medical Instrumentation
- Battery Monitoring Circuits
- Level Detectors, Sample-and-Hold Circuits

Connection Diagrams



Ordering Information

Package	Temperature Range Industrial, -40°C to $+85^{\circ}\text{C}$	NSC Drawing	Transport Media
8-Pin Molded DIP	LMC6681AIN, LMC6681BIN	N08E	Rails
8-Pin Small Outline	LMC6681AIM, LMC6681BIM LMC6681AIMX, LMC6681B1MX	M08A M08A	Rails Tape and Reel
14-Pin Molded DIP	LMC6682AIN, LMC6682BIN	N14A	Rails
14-Pin Small Outline	LMC6682AIM, LMC6682BIM LMC6682AIMX, LMC6682B1MX	M14A M14A	Rails Tape and Reel
16-Pin Molded DIP	LMC6684AIN, LMC6684BIN	N16A	Rails
16-Pin Small Outline	LMC6684AIM, LMC6684BIM LMC6684AIMX, LMC6684B1MX	M16A M16A	Rails Tape and Reel

TL431C, TL431AC, TL431I, TL431AI, TL431M, TL431Y ADJUSTABLE PRECISION SHUNT REGULATORS

SLVS005E – JULY 1978 – REVISED AUGUST 1995

- Equivalent Full-Range Temperature Coefficient . . . 30 ppm/°C
- 0.2-Ω Typical Output Impedance
- Sink-Current Capability . . . 1 mA to 100 mA
- Low Output Noise
- Adjustable Output Voltage . . . $V_{I(\text{ref})}$ to 36 V
- Available in a Wide Range of High-Density Packaging Options:
 - Small Outline (D)
 - TO-226AA (LP)
 - SOT-89 (PK)

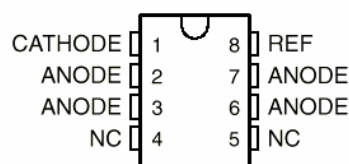
description

The TL431 and TL431A are 3-terminal adjustable shunt regulators with specified thermal stability over applicable automotive, commercial, and military temperature ranges. The output voltage can be set to any value between $V_{I(\text{ref})}$ (approximately 2.5 V) and 36 V with two external resistors (see Figure 16). These devices have a typical output impedance of 0.2 Ω. Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacements for zener diodes in many applications, such as on-board regulation, adjustable power supplies, and switching power supplies.

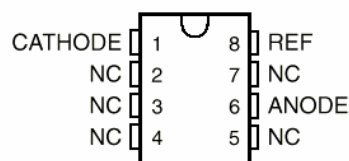
The TL431 is offered in a wide variety of high-density packaging options that includes an SOT-89-type package (suffix PK).

The TL431C and TL431AC are characterized for operation from 0°C to 70°C, and the TL431I and TL431AI are characterized for operation from –40°C to 85°C. The TL431M is characterized for operation over the full military temperature range of –55°C to 125°C.

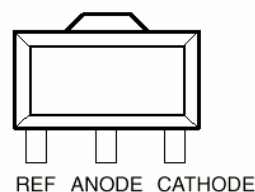
D OR PW PACKAGE
(TOP VIEW)



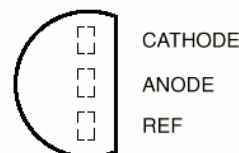
JG OR P PACKAGE
(TOP VIEW)



PK PACKAGE
(TOP VIEW)



LP PACKAGE
(TOP VIEW)



FK PACKAGE
(TOP VIEW)

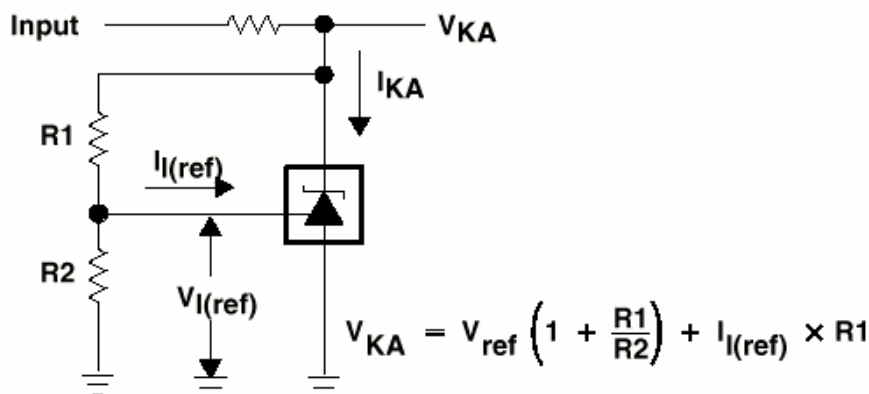


Figure 2. Test Circuit for $V_{KA} > V_{I(\text{ref})}$

LM135/LM235/LM335, LM135A/LM235A/LM335A Precision Temperature Sensors

General Description

The LM135 series are precision, easily-calibrated, integrated circuit temperature sensors. Operating as a 2-terminal zener, the LM135 has a breakdown voltage directly proportional to absolute temperature at +10 mV/°K. With less than 1Ω dynamic impedance the device operates over a current range of 400 μA to 5 mA with virtually no change in performance. When calibrated at 25°C the LM135 has typically less than 1°C error over a 100°C temperature range. Unlike other sensors the LM135 has a linear output.

Applications for the LM135 include almost any type of temperature sensing over a -55°C to +150°C temperature range. The low impedance and linear output make interfacing to readout or control circuitry especially easy.

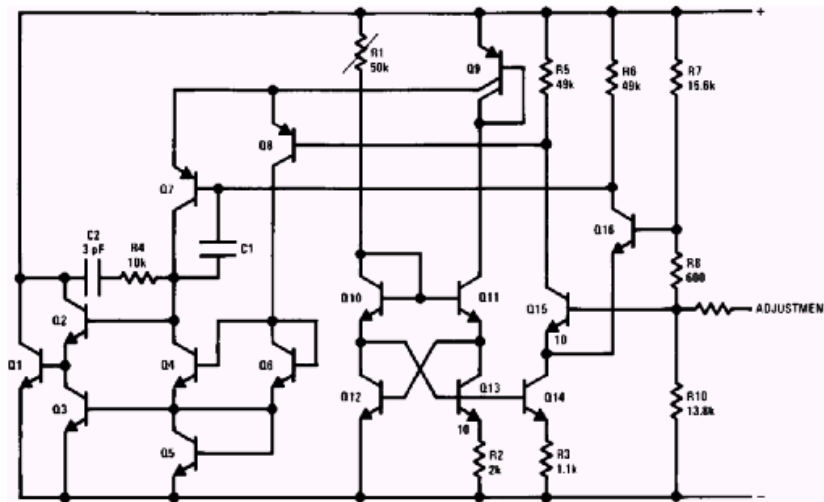
The LM135 operates over a -55°C to +150°C temperature range while the LM235 operates over a -40°C to +125°C

temperature range. The LM335 operates from -40°C to +100°C. The LM135/LM235/LM335 are available packaged in hermetic TO-46 transistor packages while the LM335 is also available in plastic TO-92 packages.

Features

- Directly calibrated in °Kelvin
- 1°C initial accuracy available
- Operates from 400 μA to 5 mA
- Less than 1Ω dynamic impedance
- Easily calibrated
- Wide operating temperature range
- 200°C overrange
- Low cost

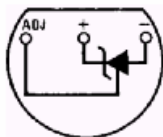
Schematic Diagram



TL/H/5698-1

Connection Diagrams

TO-92 Plastic Package

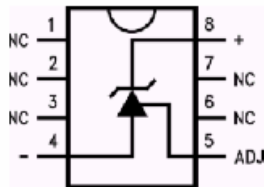


TL/H/5698-8

Bottom View

Order Number LM335Z or LM335AZ
See NS Package Number Z03A

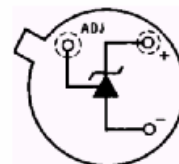
SO-8 Surface Mount Package



TL/H/5698-25

Order Number LM335M or LM335AM
See NS Package Number M08A

TO-46 Metal Can Package*



TL/H/5698-26

Bottom View

*Case is connected to negative pin
Order Number LM135H,
LM135H-MIL, LM235H, LM335H,
LM135AH, LM235AH or LM335AH
See NS Package Number H03H

