Dual Op Amp with On-Chip Fixed 2.5V Reference

Check for Samples: LM433

FEATURES

- **Dual Op Amp Circuitry**
  - **(Typical For V_S = 5V)**
  - **Input Offset Voltage 0.6mV**
  - **Input Offset Current 1nA**
  - **Input Bias Current 3nA**
  - **Common-Mode Input Voltage Range 0V to V_S−1V**
  - **Power Supply Current 150µA**
- **Reference Circuitry**
  - **Reference Voltage 2.5V**
  - **Reference Voltage Deviation (−40°C to 85°C) 4mV**
  - **Sink Current Capability 0.2mA to 10mA**

APPLICATIONS

- **Low Cost Charging Circuitry**
- **Power Supplies and Adapters**

DESCRIPTION

The LM433 integrates two operational amplifiers and one 2.5V reference. The reference is based on the LMV431 adjustable shunt regulator with the output voltage adjusted to a fixed 2.5V. The Op Amps are similar to the LM358 with a common-mode input range that includes ground. Integrating the reference and Op Amps creates a solution for low cost charging applications.

Connection Diagram

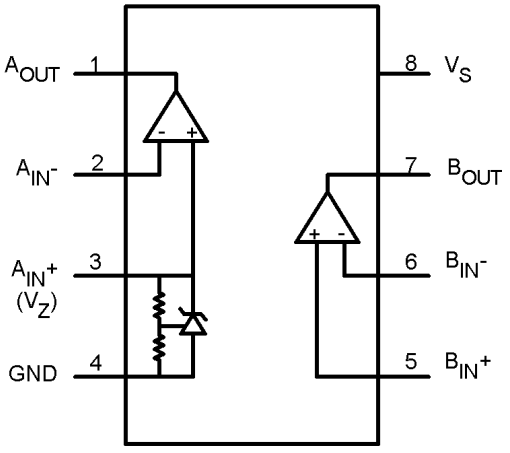

Figure 1. 8-Pin SOIC Top View

Application Circuit

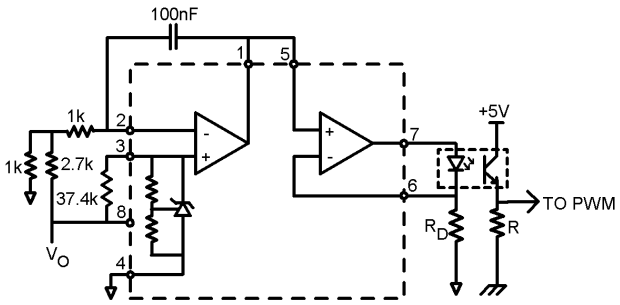

Figure 2. Optocoupler Driver Circuit for Power Supply Isolation

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

ABSOLUTE MAXIMUM RATINGS(1)(2)(3)

	Value	Unit
Suppy Voltage (V_S)	20	V
Storage Temperature	−65 to 150	°C
Junction Temperature (T_J)	150	°C
ESD Human Body Model	2	kV
Input Voltage Range	−0.3 to 20	V

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur.
(2) All voltages are measured with respect to GND = 0 V_{DC}, unless otherwise specified.
(3) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.

OPERATING RATINGS(1)(2)

	Value	Unit
Temperature Range	−40 to 85	°C
Supply Voltage(3)	2.5 to 16	V
Thermal Resistance(θ_{JA})	162	°C/W

(1) Operating Rating indicate conditions for which the device is functional. These rating do not ensure specific performance limits. For ensured specifications and test conditions, see the ELECTRICAL CHARACTERISTICS. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
(2) All voltages are measured with respect to GND = 0 V_{DC}, unless otherwise specified.
(3) Minimum value of operating voltage is for Amplifier B only.

ELECTRICAL CHARACTERISTICS

The following specifications apply for both amplifiers at V_S = 5V, V_{CM} = 2.5V, V_O = 2.5V, R_L = ∞, and T_J = 25°C, unless otherwise noted.

Symbol	Parameter	Conditions	Min (1)	Typ (2)	Max (1)	Units
OP Amp Circuitry						
V_{OS}	Input Offset Voltage	Amplifier B only	−7	2	7	mV
I_{OS}	Input Offset Current	Amplifier B only		1	50	nA
I_B	Input Bias Current	Amplifier B only		3	150	nA
V_{CM}	Common-Mode Input Voltage Range	Amplifier B only, CMRR > 50dB	0		V_S-1	V
I_S	Power Supply Current	Total for both amplifiers		150	500	µA
A_V	Voltage Gain	V_S = 16V, 1V < V_O < 11V, R_L = 10kΩ connected to V_S/2	65	100		dB
V_{OL}	Output Voltage Low			2	50	mV
V_{OH}	Output Voltage High		V_S – 1.5	V_S – 1.3		V
I_{SOURCE}	Output Current Source		20	30		mA
I_{SINK}	Output Current Sink		5	11		mA
Reference Circuitry For Op Amp A The following specifications apply for I_Z = 200µA and T_J = 25°C, unless otherwise noted.						
V_Z	Reference Voltage at IN^+ Terminal		2.425	2.5	2.575	V
V_{ZDEV}	Reference Voltage Deviation at IN^+ Terminal Over Temperature (3)(4)	−40°C ≤ T_J ≤ 85°C		4	65	mV
$I_{Z\ (MIN)}$	Minimum Cathode Current for Regulation at IN^+ (V_Z) Terminal			150	200	µA
r_z	Dynamic Output Impedance (5)	200µA < I_Z < 1mA, Freq = 0Hz		0.2		Ω

(1) Ensured to TI's Average Outgoing Quality Level (AOQL).
(2) Typicals represent the most likely parametic norm.
(3) Reference voltage deviation, V_{ZDEV}, is defined as the maximum variation of the reference input voltage over the full temperature range.
(4) Typical Temperature drift ΔV/ΔT = 12.8ppm/°C
(5) The Dynamic Output Impendance, r_z, is defined as $r_z = \Delta V_Z/\Delta I_Z$.

REVISION HISTORY

Changes from Revision D (April 2013) to Revision E	Page
• Changed layout of National Data Sheet to TI format	3

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