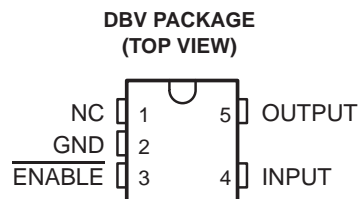


- Low Drift . . . 30 ppm/°C (max)
- ±0.5% Output-Voltage Tolerance
- Low Quiescent Current . . . 180 μA (max)
- Shutdown Feature
- Standby Current . . . –50 μA (max)
- Packaged In Plastic SOT-23 Package



**description**

The TL461 is a precision series voltage reference with a very low temperature drift of 30 ppm/°C, and an output voltage tolerance of 0.5%. The TL461 offers a power-saving advantage over three-terminal precision shunt regulators and voltage references that must conduct the full-load current when operated in the reverse-breakdown region. In addition, the shutdown feature of the device provides low standby current. This device is ideal for use with handheld and battery-operated equipment, switching power supplies, dc-dc converters, A/D and D/A converters, and in low-power precision regulator applications.

The TL461 device is characterized for operation from –40°C to 85°C.

PRODUCT PREVIEW



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



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# TL461 PRECISION SERIES REFERENCE

SLVS263 – NOVEMBER 1999

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Input voltage	30 V
Package thermal impedance, $\theta_{JA}$ (see Note 1)	347°C/W
Operating virtual junction temperature range, $T_J$	0°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C
Storage temperature range, $T_{stg}$	-65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: Package thermal impedance is calculated in accordance with JESD 51.

## recommended operating conditions

		MIN	MAX	UNIT
Input voltage, $V_I$	TL461-33	4.7		V
	TL461-05	6.4		
Output current, $I_O$			20	mA
Operating free-air temperature range, $T_A$		-40	85	°C
Operating virtual-junction temperature range, $T_J$		0	125	°C

PRODUCT PREVIEW

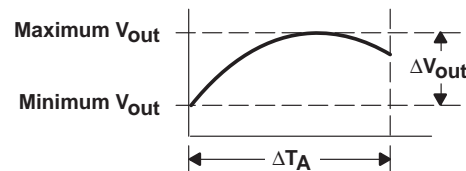


electrical characteristics at 25°C free-air temperature,  $V_{in} = V_{out} + 2.5 V$ ,  $I_{out} = 0$   
(unless otherwise noted)

PARAMETER		TEST CONDITIONS	$T_A$	MIN	TYP	MAX	UNIT
$V_O$	Output voltage	TL461-33	25°C	3.284	3.3	3.317	V
		TL461-05	25°C	4.975	5	5.025	
$\alpha_{V_{out}}$	Output voltage temperature coefficient (see Note 2)	$T_{min} < T_j < T_{max}$	-40°C to 85°C		10	30	ppm/°C
$\Delta V_O$	Line regulation	$7.5 V < V_{in} < 20 V$	25°C		3.1	6.3	mV
			-40°C to 85°C			8.1	
$\Delta V_O$	Load regulation sourcing	$I_{out} = 100 \mu A$	25°C		2.2	3	mV
			-40°C to 85°C			4	
		$I_{out} = 10 mA$	25°C		14	27	
			-40°C to 85°C			35	
		$I_{out} = 20 mA$	25°C		22	40	
			-40°C to 85°C			50	
Dropout voltage		$I_{out} = 10 mA$	-40°C to 85°C			1.4	V
$I_O$	Output current	$V_{out} = GND$	25°C		40		mA
Reverse leakage		$V_{in} = -15 V$	-40°C to 85°C		0.5	10	$\mu A$
Quiescent current			25°C		125	180	$\mu A$
			-40°C to 85°C			225	
Standby current			-40°C to 85°C			50	$\mu A$
$\overline{ENABLE}$ bias current		$\overline{ENABLE} = 0.8 V$ $\overline{ENABLE} = 2 V$	-40°C to 85°C			7	$\mu A$
						0.05	
Output noise voltage (see Note 3)		0.1 Hz < f < 10 Hz 10 Hz < f < 1 kHz	25°C			20	$\mu V_{pp}$
						20	$\mu V_{rms}$
Long-term stability of output voltage (see Note 4)			25°C		70		$\frac{ppm}{\sqrt{kHz}}$

NOTES: 2. Temperature coefficient is measured by dividing the change in output voltage by the specified temperature range.

$$|\alpha_{V_{out}}| \left( \frac{ppm}{^\circ C} \right) = \frac{\left( \frac{\Delta V_{out}}{V_{out \text{ at } 25^\circ C}} \right) \times 10^6}{\Delta T_A}$$



Where:

$\Delta T_A$  is the recommended operating free-air temperature range of the device.

$\alpha_{V_{out}}$  can be positive or negative, depending on whether minimum  $V_{out}$  or maximum  $V_{out}$ , respectively, occurs at the lower temperature.

- Peak-to-peak noise is measured with a single high-pass filter at 0.1 Hz and two-pole low-pass filter at 10 Hz. The unit is enclosed in a still-air environment to eliminate thermocouple effects on the leads. The test time is 10 seconds. RMS noise is measured with a single high-pass filter at 10 Hz and a two-pole low-pass filter at 1 kHz. The resulting output is full-wave rectified, then integrated for a fixed period, making the final reading an average rather than RMS. A correction factor of 1.1 converts from average to RMS. A second correction of 0.88 corrects for the nonideal bandpass of the filters.
- Long-term stability typically has a logarithmic characteristic. Therefore, stability changes after 1000 hours tend to be much smaller than before that time. Total drift in the second thousand hours is normally less than one third of that of the first thousand hours, with a continuing trend toward reduced drift with time. Significant improvement in long-term drift can be realized by preconditioning the device with a 100-hour to 200-hour, 125°C burn-in. Long-term stability also is affected by differential stresses between the device and the board material that are created during board assembly.

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