National Semiconductor

LH7070 Series Precision BCD Buffered Reference
LH7071 Series Precision Binary Buffered Reference

General Description

The LH7070 and LH7071 are precision, three terminal, voltage references consisting of a temperature compensated zener diode driven by a current regulator and a buffer amplifier. The devices provide an accurate reference that is virtually independent of input voltage, load current, temperature and time. The LH7070 has a 10.000V nominal output to provide equal step sizes in BCD applications. The LH7071 has a 10.240V nominal output to provide equal step sizes in binary applications.

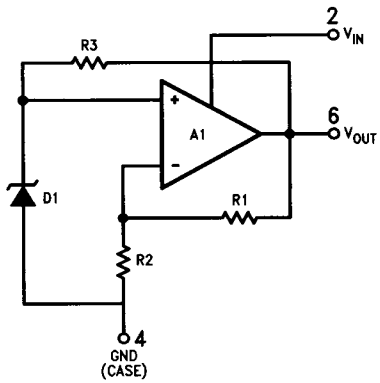
The output voltage is established by trimming ultrastable, low temperature drift, thin film resistors under actual operating circuit conditions. The devices are short-circuit proof in both the current sourcing and sinking directions.

The LH7070 and LH7071 series combine excellent long term stability, ease of application, and low cost, making them ideal choices as reference voltages in precision D to A and A to D systems.

Features

- Accurate output voltage
  - — LH7070 10V ±0.03%
  - — LH7071 10.24V ±0.03%
- Single supply operation 11.4V to 40V
- Low output impedance 0.2Ω
- Excellent line regulation 0.2 mV/V
- Low zener noise 20 μVp-p
- Short circuit proof
- Low standby current 3 mA

Equivalent Schematic



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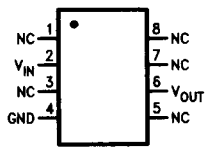
Connection Diagram



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Top View

Order Number LH7070CN or LH7071CN
See NS Package Number N08E

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	40V
Power Dissipation (See Curve)	800 mW
Short Circuit Duration	Continuous
Output Current	±20 mA
Operating Temperature Range	−25°C to +85°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 Sec.)	300°C

Electrical Characteristics (Note 1)

Parameter	Conditions	Min	Typ	Max	Units
Output Voltage	T_A = 25°C				
	LH7070		10.000		V
	LH7071		10.240		V
Output Accuracy	T_A = 25°C				
	LH7070, LH7071		±0.03	±0.1	%
Output Accuracy	T_A = −25°C to +85°C (Note 3)			±0.3	%
Output Voltage Change with Temperature	(Notes 2, 3)			±0.14	%
Line Regulation	13V ≤ V_{IN} ≤ 33V, T_A = 25°C		0.02	0.1	%
Input Voltage Range	R_L = 50 kΩ	11.4		40	V
Load Regulation	0 mA ≤ I_{OUT} ≤ 5 mA		0.01	0.03	%
Quiescent Current	13V ≤ V_{IN} ≤ 33V, I_{OUT} = 0 mA	1	2	3	mA
Change in Quiescent Current	ΔV_{IN} = 20V from 13V to 33V		0.75	1.5	mA
Output Noise Voltage	BW = 0.1 Hz to 10 Hz, T_A = 25°C		20		μV_{p-p}
Ripple Rejection	f = 120 Hz		0.01		$\%/V_{p-p}$
Output Resistance			0.2	0.6	Ω
Long Term Stability	T_A = 25°C (Note 3)			±0.2	%/yr.

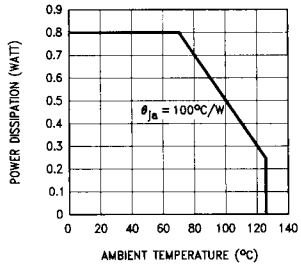
Note 1: Unless otherwise specified, these specifications apply for V_{IN} = 15.0V, R_L = 10 kΩ, and over the temperature range of −25°C ≤ T_A ≤ +85°C.

Note 2: This specification is the difference in output voltage measured at T_A = 85°C and T_A = 25°C or T_A = 25°C and T_A = −25°C with readings taken after test chamber and device-under-test stabilization at temperature using a suitable precision voltmeter.

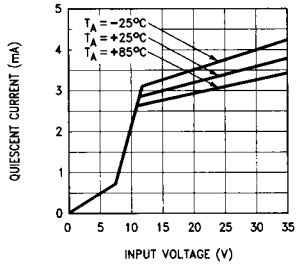
Note 3: This parameter is guaranteed by design and not tested.

Typical Performance Characteristics

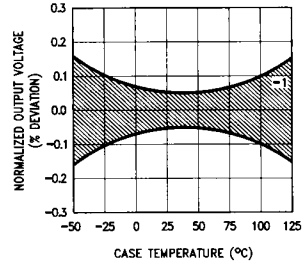
Maximum Power Dissipation



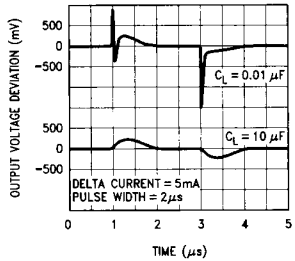
Quiescent Current vs Input Voltage



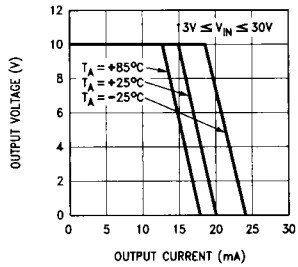
Normalized Output Voltage vs Temperature



Load Transient Response



Output Short Circuit Characteristics



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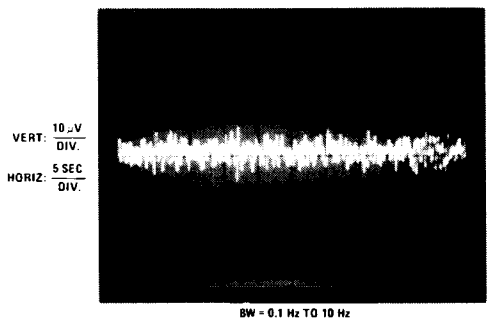
Noise Voltage



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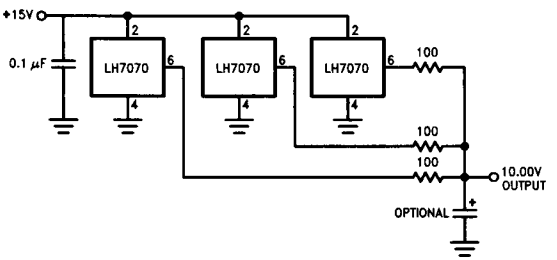
Typical Applications

Statistical Voltage Standard



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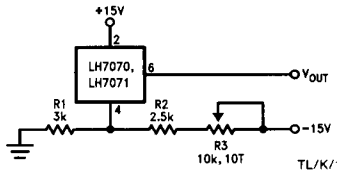
*Output Voltage Fine Adjustment



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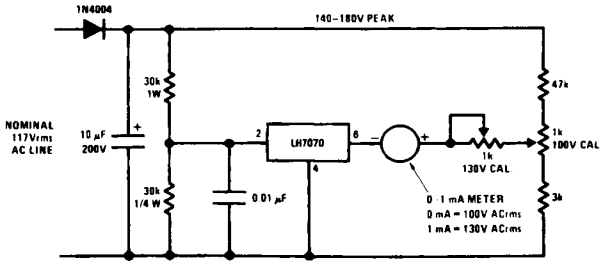
***Note:** The output of the LH7070 and LH7071 may be adjusted to a precise voltage by using the above circuit since the supply current of the device is relatively small and constant with temperature and input voltage. For the circuit shown, supply sensitivities are degraded slightly to 0.01%/V change in V_{OUT} for changes in V_{IN} and V^-.

An additional temperature drift of 0.0001%/°C is added due to the variation of supply current with temperature of the LH7070 and LH7071. Sensitivity to the value of R1, R2 and R3 is less than 0.001%/%.

Expanded Scale AC Voltmeter



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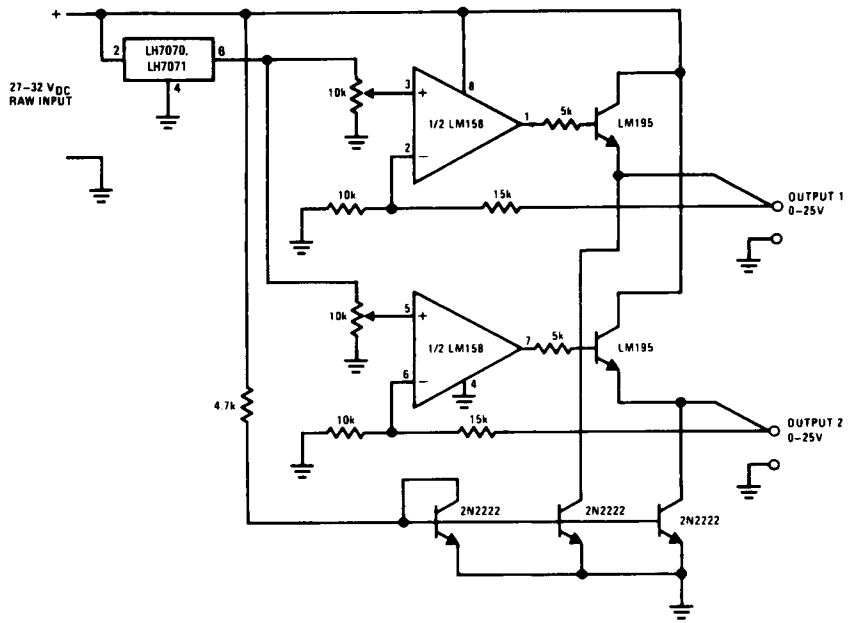
Dual Output Bench Power Supply



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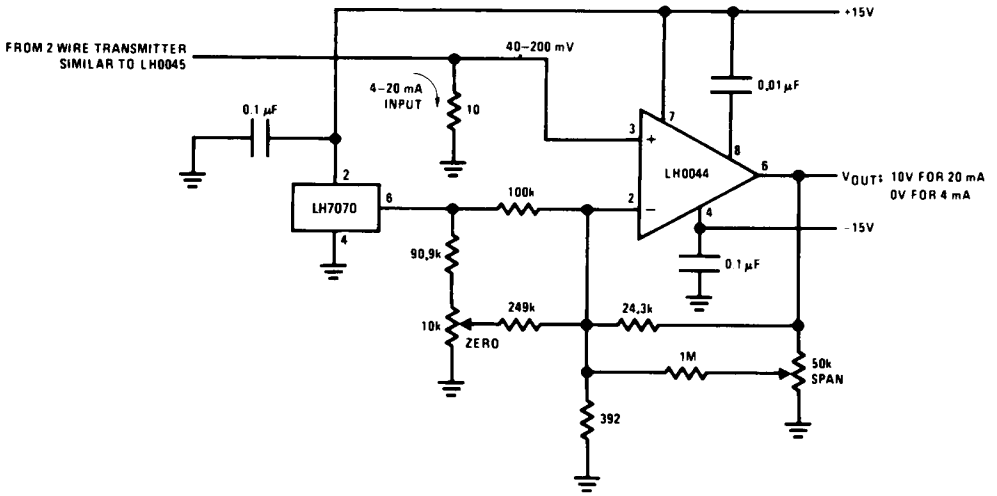
Typical Applications (Continued)

Precision Process Control Interface



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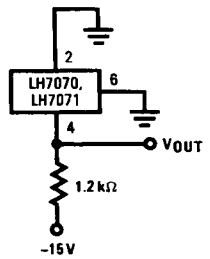
Negative 10V Reference



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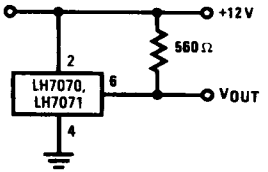
Current Boost for Low Input Voltages



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