LT1021
Precision Reference

FEATURES

- **Ultralow Drift: 5ppm/°C Max Slope**
- **Very Low Noise: <1ppm P-P (0.1Hz to 10Hz)**
- **100% Noise Tested**
- Pin Compatible with Most Bandgap Reference Applications, Including Ref 01, Ref 02, LM368, MC1400 and MC1404 with Greatly Improved Stability, Noise and Drift
- Trimmed Output Voltage
- Operates in Series or Shunt Mode
- Output Sinks and Sources in Series Mode
- >100dB Ripple Rejection
- Minimum Input/Output Differential of 1V
- Available in 5-Lead Can, N8 and S8 Packages

APPLICATIONS

- A/D and D/A Converters
- Precision Regulators
- Digital Voltmeters
- Inertial Navigation Systems
- Precision Scales
- Portable Reference Standard

DESCRIPTION

The LT®1021 is a precision reference with ultralow drift and noise, extremely good long term stability and almost total immunity to input voltage variations. The reference output will both source and sink up to 10mA. Three voltages are available: 5V, 7V and 10V. The 7V and 10V units can be used as shunt regulators (two-terminal zeners) with the same precision characteristics as the three-terminal connection. Special care has been taken to minimize thermal regulation effects and temperature induced hysteresis.

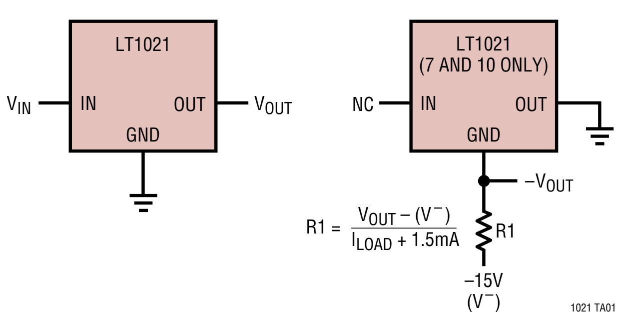
The LT1021 references are based on a buried zener diode structure that eliminates noise and stability problems associated with surface breakdown devices. Further, a subsurface zener exhibits better temperature drift and time stability than even the best bandgap references.

Unique circuit design makes the LT1021 the first IC reference to offer ultralow drift without the use of high power on-chip heaters.

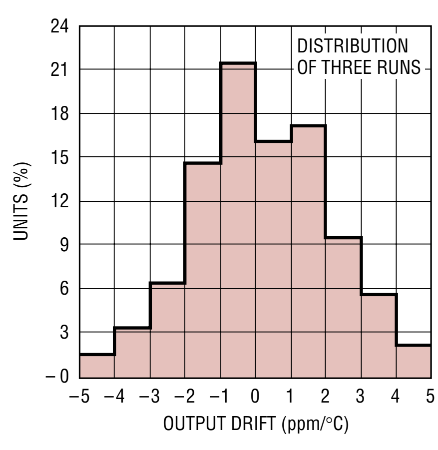
The LT1021-7 uses no resistive divider to set output voltage, and therefore exhibits the best long term stability and temperature hysteresis. The LT1021-5 and LT1021-10 are intended for systems requiring a precise 5V or 10V reference with an initial tolerance as low as ±0.05%.

TYPICAL APPLICATION

Basic Positive and Negative Connections



Typical Distribution of Temperature Drift

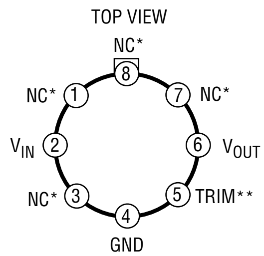


ABSOLUTE MAXIMUM RATINGS (Note 1)

Input Voltage 40V
Input/Output Voltage Differential 35V
Output-to-Ground Voltage (Shunt Mode Current Limit)
LT1021-5 .... 10V
LT1021-7 .... 10V
LT1021-10 .... 16V
Trim Pin-to-Ground Voltage
Positive .... Equal to V_{OUT}
Negative .... – 20V

Output Short-Circuit Duration
V_{IN} = 35V .... 10 sec
$V_{IN} \leq$ 20V .... Indefinite
Operating Temperature Range
Commercial .... 0°C to 70°C
Industrial .... –40°C to 85°C
Military .... –55°C to 125°C
Storage Temperature Range .... –65°C to 150°C
Lead Temperature (Soldering, 10 sec)................ 300°C

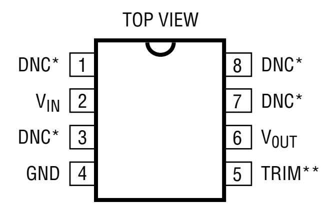
PACKAGE/ORDER INFORMATION



H PACKAGE
8-LEAD TO-5 METAL CAN

*CONNECTED INTERNALLY. DO NOT CONNECT EXTERNAL CIRCUITRY TO THESE PINS.
**NO TRIM PIN ON LT1021-7. DO NOT CONNECT EXTERNAL CIRCUITRY TO PIN 5 ON LT1021-7

T_{JMAX} = 150°C, θ_{JA} = 150°C/W, θ_{JC} = 45°C/W



N8 PACKAGE
8-LEAD PDIP

S8 PACKAGE
8-LEAD PLASTIC SO

*CONNECTED INTERNALLY. DO NOT CONNECT EXTERNAL CIRCUITRY TO THESE PINS.
**NO TRIM PIN ON LT1021-7. DO NOT CONNECT EXTERNAL CIRCUITRY TO PIN 5 ON LT1021-7

T_{JMAX} = 130°C, θ_{JA} = 130°C/W (N)
T_{JMAX} = 130°C, θ_{JA} = 150°C/W (S)

ORDER PART NUMBER		N8 ORDER PART NUMBER
LT1021BCH-5	LT1021DCH-5	LT1021BCN8-5
LT1021BMH-5	LT1021DMH-5	LT1021CCN8-5
LT1021CCH-5	LT1021BCH-7	LT1021CIN8-5
LT1021CMH-5	LT1021BMH-7	LT1021DCN8-5
LT1021BMH-10	LT1021DCH-7	LT1021DIN8-5
	LT1021DMH-7	LT1021BCN8-7
	LT1021BCH-10	LT1021DCN8-7
	LT1021CMH-10	LT1021BCN8-10
	LT1021DCH-10	LT1021CCN8-10
	LT1021DMH-10	LT1021CIN8-10
	OBSOLETE	LT1021DCN8-10
		LT1021DIN8-10

S8 ORDER PART NUMBER	S8 PART MARKING
LT1021DCS8-5	2105
LT1021DCS8-7	2107
LT1021DCS8-10	2110

Order Options Tape and Reel: Add #TR
Lead Free: Add #PBF Lead Free Tape and Reel: Add #TRPBF
Lead Free Part Marking: http://www.linear.com/leadfree/

Consult LTC Marketing for parts specified with wider operating temperature ranges.

ELECTRICAL CHARACTERISTICS

The ● denotes specifications that apply over the full operating temperature range, otherwise specifications are T_A = 25°C. V_{IN} = 10V, I_{OUT} = 0, unless otherwise noted.

PARAMETER	CONDITIONS		LT1021-5 MIN	LT1021-5 TYP	LT1021-5 MAX	UNITS
Output Voltage (Note 2)	LT1021C-5 LT1021B-5/LT1021D-5		4.9975 4.9500	5.000 5.000	5.0025 5.0500	V V
Output Voltage Temperature Coefficient (Note 3)	$T_{MIN} \le T_J \le T_{MAX}$ LT1021B-5 LT1021C-5/LT1021D-5	 ● ●		 2 3	 5 20	 ppm/°C ppm/°C
Line Regulation (Note 4)	$7.2V \le V_{IN} \le 10V$ $10V \le V_{IN} \le 40V$	 ● ●		4 2	12 20 6 10	ppm/V ppm/V ppm/V ppm/V
Load Regulation (Sourcing Current)	$0 \le I_{OUT} \le 10mA$ (Note 4)	 ●		10	20 35	ppm/mA ppm/mA
Load Regulation (Sinking Current)	$0 \le I_{OUT} \le 10mA$ (Note 4)	 ●		60	100 150	ppm/mA ppm/mA
Supply Current		 ●		0.8	1.2 1.5	mA mA
Output Voltage Noise (Note 6)	$0.1Hz \le f \le 10Hz$ $10Hz \le f \le 1kHz$			3.0 2.2	 3.5	μV_{P-P} μV_{RMS}
Long Term Stability of Output Voltage (Note 7)	Δt = 1000Hrs Noncumulative			15		ppm
Temperature Hysteresis of Output	$\Delta T = \pm 25°C$			10		ppm

The ● denotes specifications that apply over the full operating temperature range, otherwise specifications are T_A = 25°C. V_{IN} = 12V, I_{OUT} = 0, unless otherwise noted.

PARAMETER	CONDITIONS		LT1021-7 MIN	LT1021-7 TYP	LT1021-7 MAX	UNITS
Output Voltage (Note 2)			6.95	7.00	7.05	V
Output Voltage Temperature Coefficient (Note 3)	$T_{MIN} \le T_J \le T_{MAX}$ LT1021B-7 LT1021D-7	 ● ●		 2 3	 5 20	 ppm/°C ppm/°C
Line Regulation (Note 4)	$8.5V \le V_{IN} \le 12V$ $12V \le V_{IN} \le 40V$	 ● ●		1.0 2.0 0.5 1.0	4 8 2 4	ppm/V ppm/V ppm/V ppm/V
Load Regulation (Sourcing Current)	$0 \le I_{OUT} \le 10mA$ (Note 4)	 ●		12	25 40	ppm/mA ppm/mA
Load Regulation (Shunt Mode)	$1.2mA \le I_{SHUNT} \le 10mA$ (Notes 4, 5)	 ●		50	100 150	ppm/mA ppm/mA
Supply Current (Series Mode)		 ●		0.75	1.2 1.5	mA mA
Minimum Current (Shunt Mode)	V_{IN} is Open	 ●		0.7	1.0 1.2	mA mA
Output Voltage Noise (Note 6)	$0.1Hz \le f \le 10Hz$ $10Hz \le f \le 1kHz$			4.0 2.5	 4.0	μV_{P-P} μV_{RMS}
Long Term Stability of Output Voltage (Note 7)	Δt = 1000Hrs Noncumulative			7		ppm
Temperature Hysteresis of Output	$\Delta T = \pm 25°C$			3		ppm

ELECTRICAL CHARACTERISTICS

The ● denotes specifications that apply over the full operating temperature range, otherwise specifications are $T_A = 25°C$. $V_{IN} = 15V$, $I_{OUT} = 0$, unless otherwise noted.

PARAMETER	CONDITIONS		LT1021-10 MIN	LT1021-10 TYP	LT1021-10 MAX	UNITS
Output Voltage (Note 2)	LT1021C-10		9.995	10.00	10.005	V
	LT1021B-10/LT1021D-10		9.950	10.00	10.050	V
Output Voltage Temperature Coefficient (Note 3)	$T_{MIN} \le T_J \le T_{MAX}$					
	LT1021B-10	●		2	5	ppm/°C
	LT1021C-10/LT1021D-10	●		5	20	ppm/°C
Line Regulation (Note 4)	$11.5V \le V_{IN} \le 14.5V$			1.0	4	ppm/V
		●			6	ppm/V
	$14.5V \le V_{IN} \le 40V$			0.5	2	ppm/V
		●			4	ppm/V
Load Regulation (Sourcing Current)	$0 \le I_{OUT} \le 10mA$			12	25	ppm/mA
	(Note 4)	●			40	ppm/mA
Load Regulation (Shunt Mode)	$1.7mA \le I_{SHUNT} \le 10mA$			50	100	ppm/mA
	(Notes 4, 5)	●			150	ppm/mA
Supply Current (Series Mode)				1.2	1.7	mA
		●			2.0	mA
Minimum Current (Shunt Mode)	V_{IN} is Open			1.1	1.5	mA
		●			1.7	mA
Output Voltage Noise (Note 6)	$0.1Hz \le f \le 10Hz$			6.0		μV_{P-P}
	$10Hz \le f \le 1kHz$			3.5	6	μV_{RMS}
Long Term Stability of Output Voltage (Note 7)	Δt = 1000Hrs Noncumulative			15		ppm
Temperature Hysteresis of Output	$\Delta T = \pm 25°C$			5		ppm

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Note 2: Output voltage is measured immediately after turn-on. Changes due to chip warm-up are typically less than 0.005%.

Note 3: Temperature coefficient is measured by dividing the change in output voltage over the temperature range by the change in temperature. Separate tests are done for hot and cold; T_{MIN} to 25°C and 25°C to T_{MAX}. **Incremental slope is also measured at 25°C.**

Note 4: Line and load regulation are measured on a pulse basis. Output changes due to die temperature change must be taken into account separately. Package thermal resistance is 150°C/W for TO-5 (H), 130°C/W for N and 150°C/W for the SO-8.

Note 5: Shunt mode regulation is measured with the input open. With the input connected, shunt mode current can be reduced to 0mA. Load regulation will remain the same.

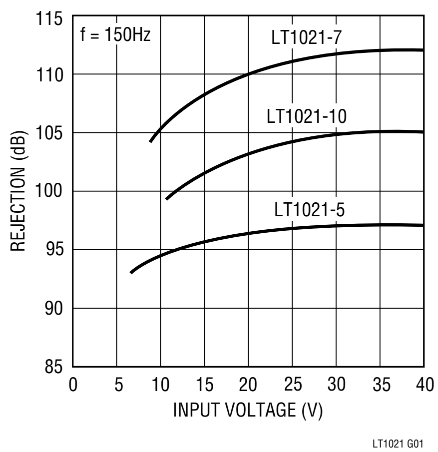
Note 6: RMS noise is measured with a 2-pole highpass filter at 10Hz and a 2-pole lowpass filter at 1kHz. The resulting output is full-wave rectified and then integrated for a fixed period, making the final reading an average as opposed to RMS. Correction factors are used to convert from average to RMS and correct for the non-ideal bandpass of the filters.

Peak-to-peak noise is measured with a single highpass filter at 0.1Hz and a 2-pole lowpass filter at 10Hz. The unit is enclosed in a still-air environment to eliminate thermocouple effects on the leads. Test time is 10 seconds.

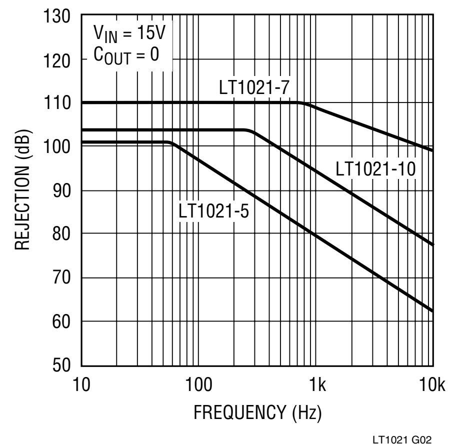
Note 7: Consult factory for units with long term stability data.

TYPICAL PERFORMANCE CHARACTERISTICS

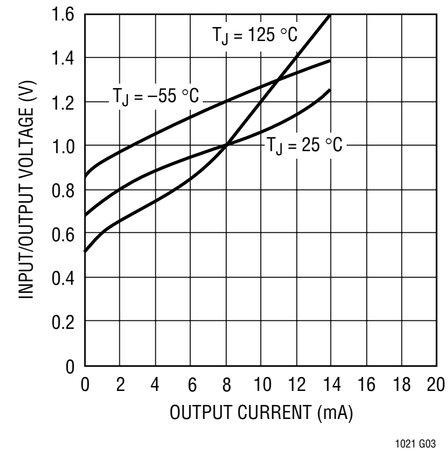
Ripple Rejection



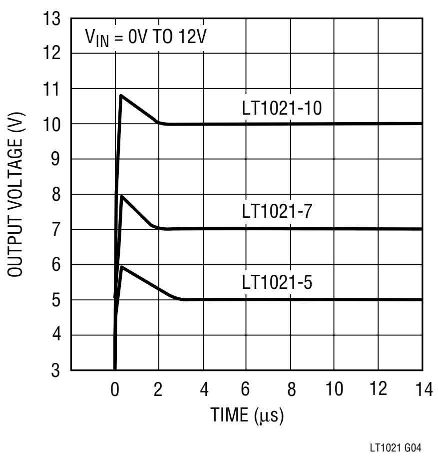
Ripple Rejection



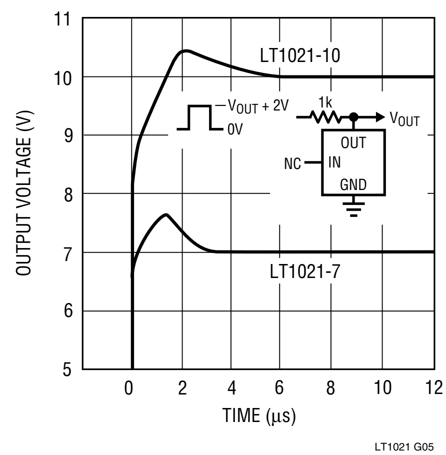
Minimum Input/Output Differential LT1021-7, LT1021-10



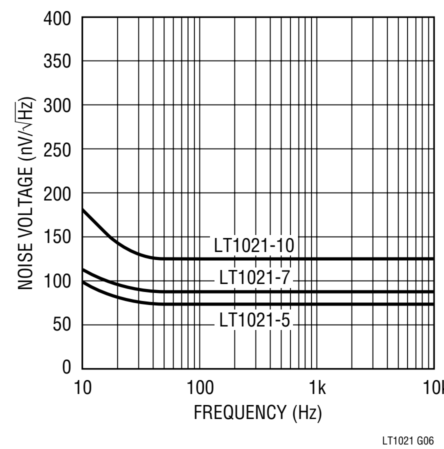
Start-Up (Series Mode)



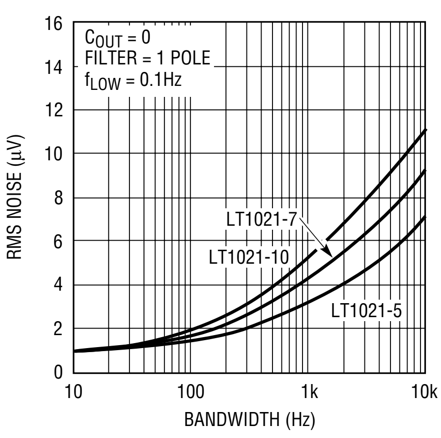
Start-Up (Shunt Mode) LT1021-7, LT1021-10



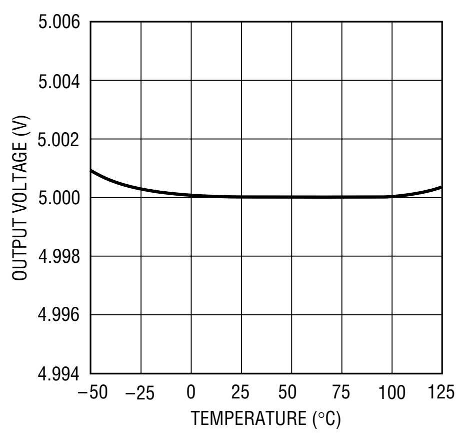
Output Voltage Noise Spectrum



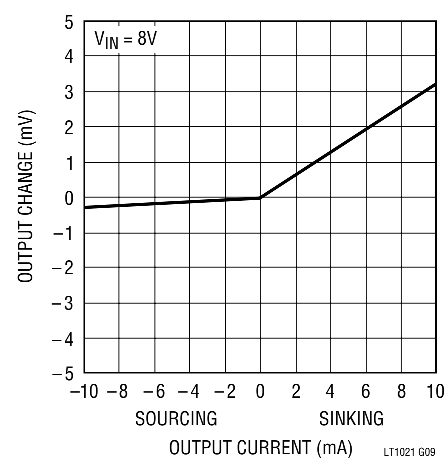
Output Voltage Noise



Output Voltage Temperature Drift LT1021-5

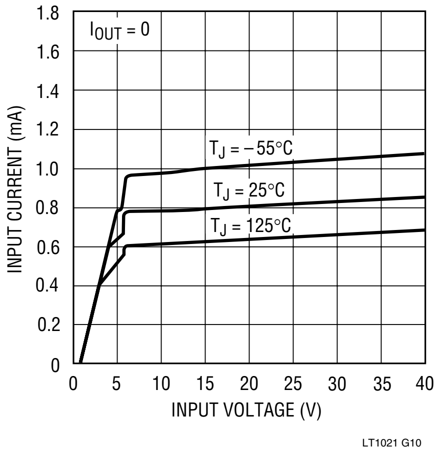


Load Regulation LT1021-5

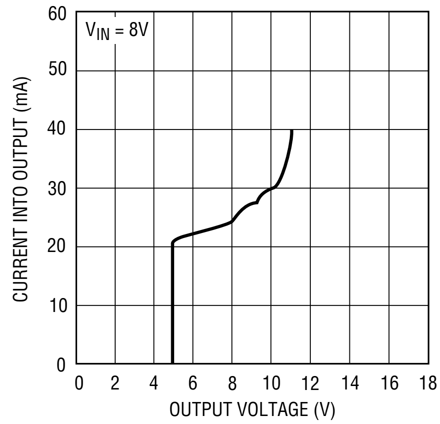


TYPICAL PERFORMANCE CHARACTERISTICS

Quiescent Current LT1021-5



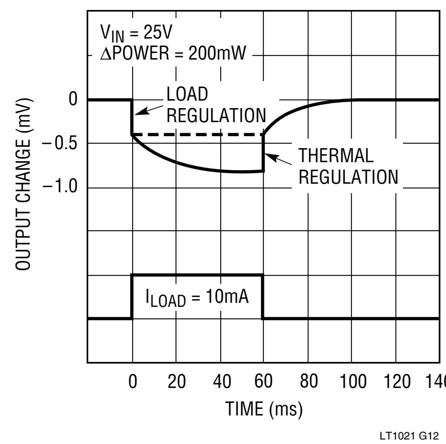
Sink Mode* Current Limit LT1021-5



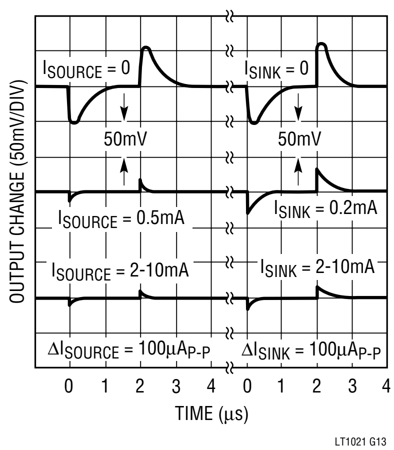
*NOTE THAT AN INPUT VOLTAGE IS REQUIRED FOR 5V UNITS.

LT1021 G11

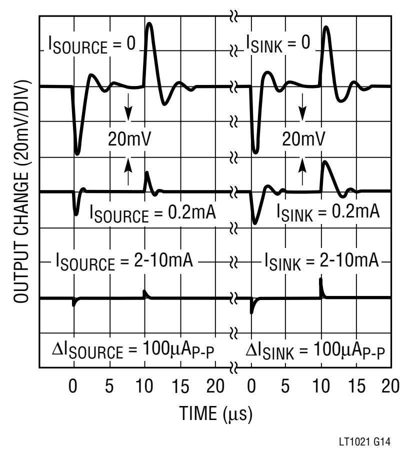
Thermal Regulation LT1021-5



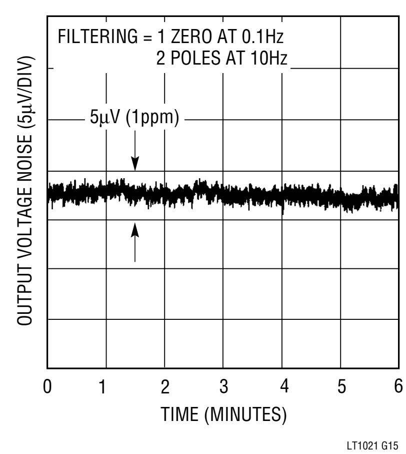
Load Transient Response LT1021-5, C_{LOAD} = 0



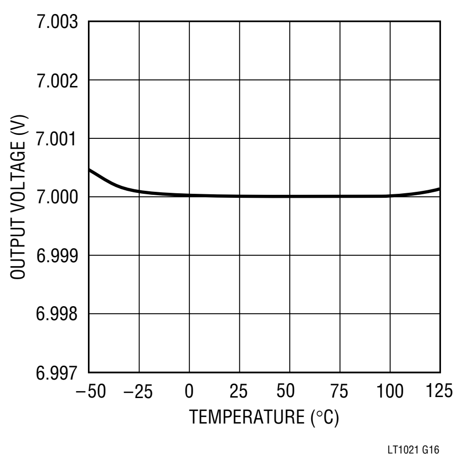
Load Transient Response LT1021-5, C_{LOAD} = 1000pF



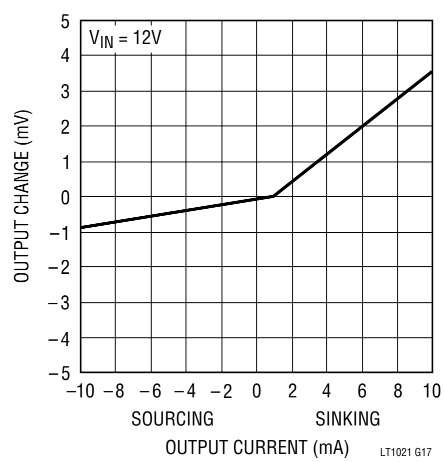
Output Noise 0.1Hz to 10Hz LT1021-5



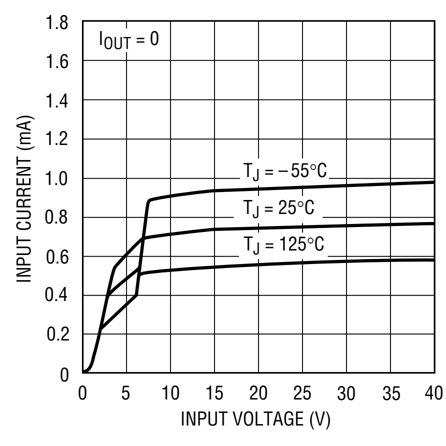
Output Voltage Temperature Drift LT1021-7



Load Regulation LT1021-7, LT1021-10

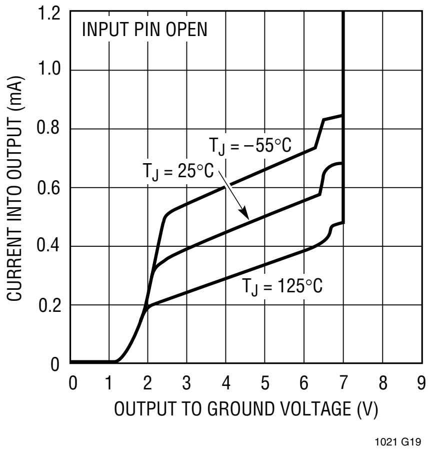


Quiescent Current LT1021-7

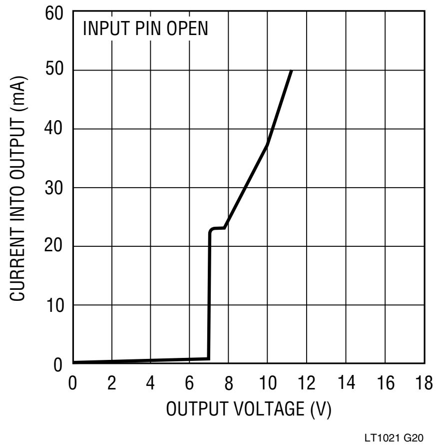


TYPICAL PERFORMANCE CHARACTERISTICS

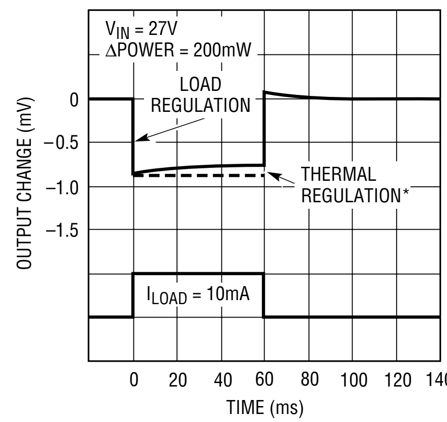
Shunt Characteristics LT1021-7



Shunt Mode Current Limit LT1021-7



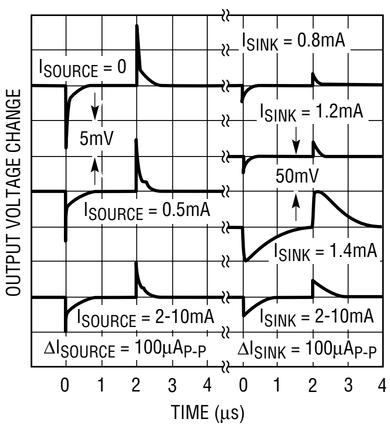
Thermal Regulation LT1021-7



*INDEPENDENT OF TEMPERATURE COEFFICIENT

LT1021 G21

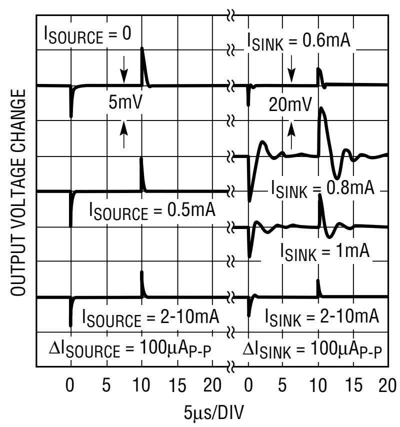
Load Transient Response LT1021-7, C_{LOAD} = 0



NOTE VERTICAL SCALE CHANGE
BETWEEN SOURCING AND SINKING

LT1021 G22

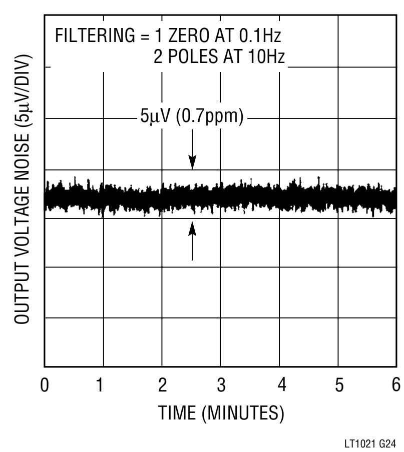
Load Transient Response LT1021-7, C_{LOAD} = 1000pF



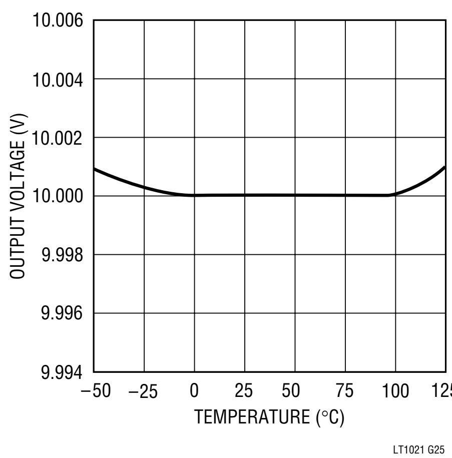
NOTE VERTICAL SCALE CHANGE
BETWEEN SOURCING AND SINKING

LT1021 G23

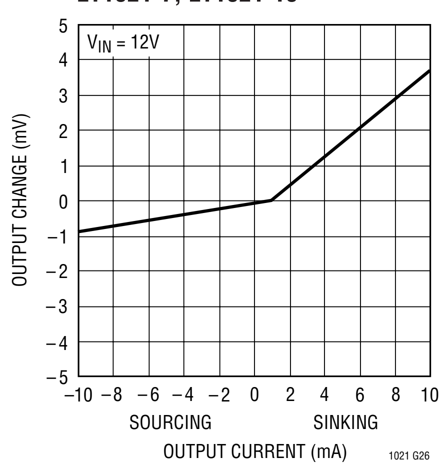
Output Noise 0.1Hz to 10Hz LT1021-7



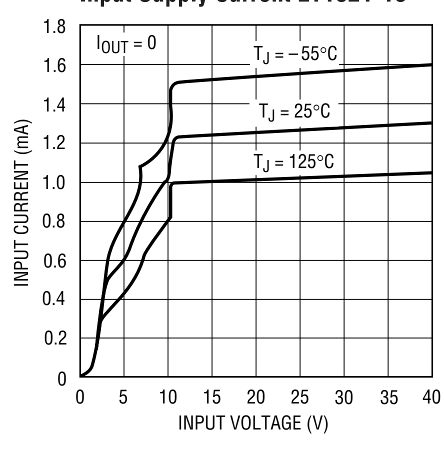
Output Voltage Temperature Drift LT1021-10



Load Regulation LT1021-7, LT1021-10

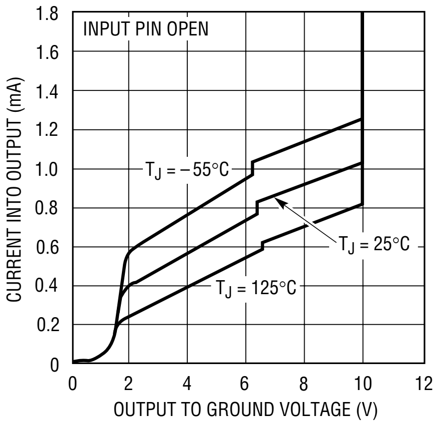


Input Supply Current LT1021-10

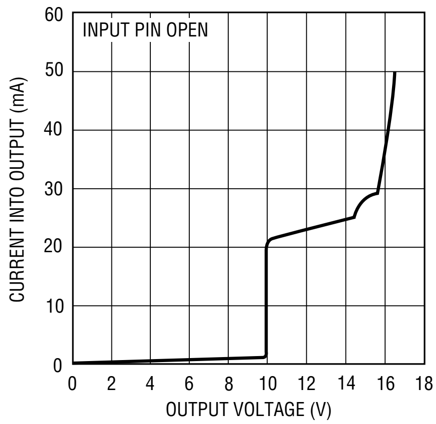


TYPICAL PERFORMANCE CHARACTERISTICS

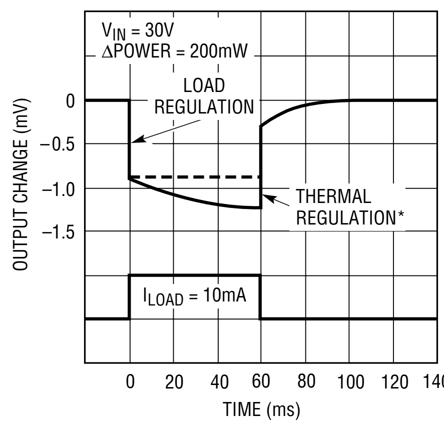
Shunt Characteristics LT1021-10



Shunt Mode Current Limit LT1021-10



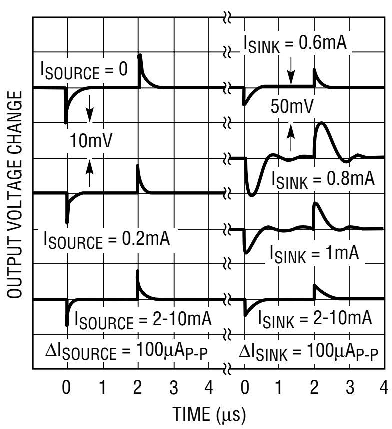
Thermal Regulation LT1021-10



*INDEPENDENT OF TEMPERATURE COEFFICIENT

1021 G30

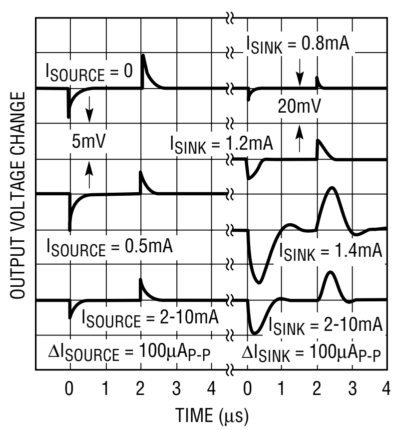
Load Transient Response LT1021-10, $C_{LOAD} = 0$



NOTE VERTICAL SCALE CHANGE BETWEEN SOURCING AND SINKING

1021 G31

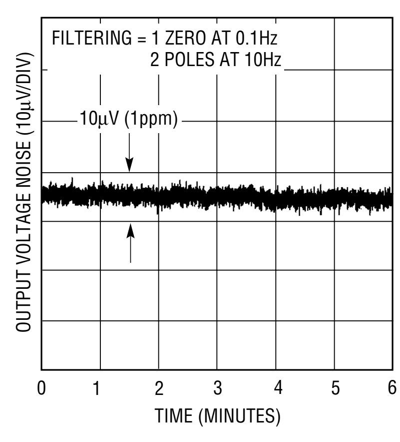
Load Transient Response LT1021-10, $C_{LOAD} = 1000pF$



NOTE VERTICAL SCALE CHANGE BETWEEN SOURCING AND SINKING

1021 G32

Output Noise 0.1Hz to 10Hz LT1021-10

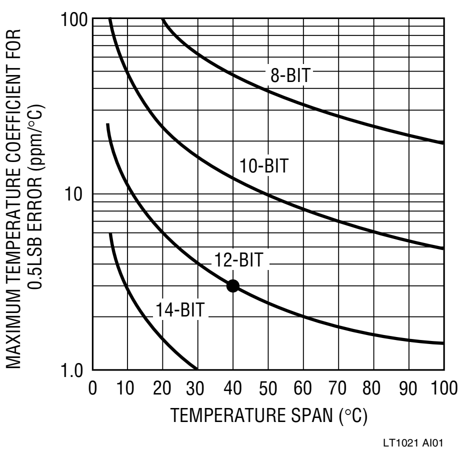


APPLICATIONS INFORMATION

Effect of Reference Drift on System Accuracy

A large portion of the temperature drift error budget in many systems is the system reference voltage. This graph indicates the maximum temperature coefficient allowable if the reference is to contribute no more than 0.5LSB error to the overall system performance. The example shown is a 12-bit system designed to operate over a temperature range from 25°C to 65°C. Assuming the system calibration is performed at 25°C, the temperature span is 40°C. It can be seen from the graph that the temperature coefficient of the reference must be no worse than 3ppm/°C if it is to contribute less than 0.5LSB error. For this reason, the LT1021 family has been optimized for low drift.

Maximum Allowable Reference Drift



Trimming Output Voltage

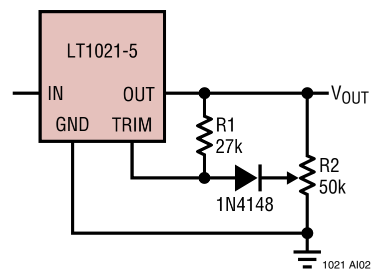
LT1021-10

The LT1021-10 has a trim pin for adjusting output voltage. The impedance of the trim pin is about 12kΩ with a nominal open-circuit voltage of 5V. It is designed to be driven from a source impedance of 3kΩ or less to minimize changes in the LT1021 TC with output trimming. Attenuation between the trim pin and the output is 70:1. This allows ±70mV trim range when the trim pin is tied to the wiper of a potentiometer connected between the output and ground. A 10kΩ potentiometer is recommended, preferably a 20 turn cermet type with stable characteristics over time and temperature.

The LT1021-10 "C" version is pre-trimmed to ±5mV and therefore can utilize a restricted trim range. A 75k resistor in series with a 20kΩ potentiometer will give ±10mV trim range. Effect on the output TC will be only 1ppm/°C for the ±5mV trim needed to set the "C" device to 10.000V.

LT1021-5

The LT1021-5 does have an output voltage trim pin, but the TC of the nominal 4V open-circuit voltage at this pin is about –1.7mV/°C. For the voltage trimming not to affect reference output TC, the external trim voltage must track the voltage on the trim pin. Input impedance of the trim pin is about 100kΩ and attenuation to the output is 13:1. The technique shown below is suggested for trimming the output of the LT1021-5 while maintaining minimum shift in output temperature coefficient. The R1/R2 ratio is chosen to minimize interaction of trimming and TC shifts, so the exact values shown should be used.



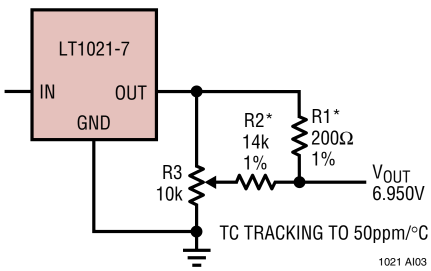
LT1021-7

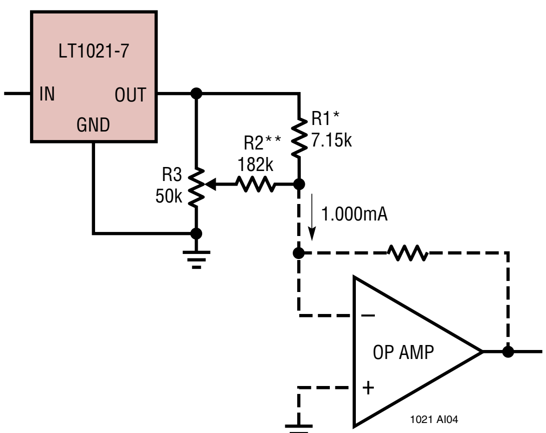
The 7V version of the LT1021 has no trim pin because the internal architecture does not have a point which could be driven conveniently from the output. Trimming must therefore be done externally, as is the case with ordinary reference diodes. Unlike these diodes, however, the output of the LT1021 can be loaded with a trim potentiometer. The following trim techniques are suggested; one for voltage output and one for current output. The voltage output is trimmed for 6.95V. Current output is 1mA, as shown, into a summing junction, but all resistors may be scaled for currents up to 10mA.

Both of these circuits use the trimmers in a true potentiometric mode to reduce the effects of trimmer TC. The voltage output has a 200Ω impedance, so loading must be

APPLICATIONS INFORMATION

minimized. In the current output circuit, R1 determines output current. It should have a TC commensurate with the LT1021 or track closely with the feedback resistor around the op amp.





*RESISTOR TC DETERMINES I_{OUT} TC
**TC ≤ (10 • R1) TC. R2 AND R3 SCALE WITH R1 FOR DIFFERENT OUTPUT CURRENTS

Capacitive Loading and Transient Response

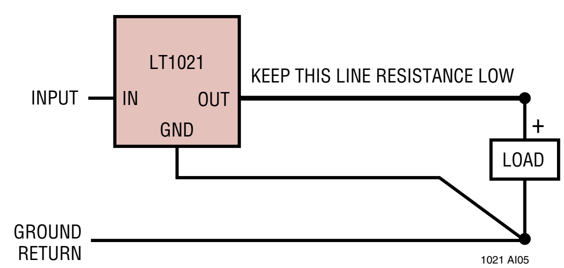
The LT1021 is stable with all capacitive loads, but for optimum settling with load transients, output capacitance should be under 1000pF. The output stage of the reference is class AB with a fairly low idling current. This makes transient response worst-case at light load currents. Because of internal current drain on the output, actual worst-case occurs at I_{LOAD} = 0 on LT1021-5, I_{LOAD} = –0.8mA (sinking) on LT1021-7 and I_{LOAD} = 1.4mA (sinking) on LT1021-10. Significantly better load transient response is obtained by moving slightly away from these points. See Load Transient Response curves for details. In general, best transient response is obtained when the output is sourcing current. In critical applications, a 10µF solid tantalum capacitor with several ohms in series provides optimum output bypass.

Kelvin Connections

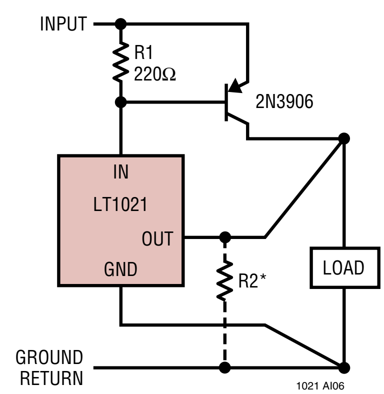
Although the LT1021 does not have true force/sense capability at its outputs, significant improvements in ground loop and line loss problems can be achieved with proper hook-up. In series mode operation, the ground pin of the LT1021 carries only ≈1mA and can be used as a sense line, greatly reducing ground loop and loss problems on the low side of the reference. The high side supplies load current so line resistance must be kept low. Twelve feet of #22 gauge hook-up wire or 1 foot of 0.025 inch printed circuit trace will create 2mV loss at 10mA output current. This is equivalent to 1LSB in a 10V, 12-bit system.

The following circuits show proper hook-up to minimize errors due to ground loops and line losses. Losses in the output lead can be greatly reduced by adding a PNP boost transistor if load currents are 5mA or higher. R2 can be added to further reduce current in the output sense lead.

Standard Series Mode



Series Mode with Boost Transistor



*OPTIONAL—REDUCES CURRENT IN OUTPUT SENSE LEAD
R2 = 2.4k (LT1021-5), 3k (LT1021-7), 5.6k (LT1021-10)

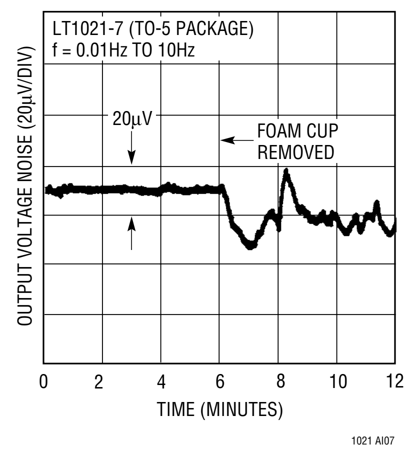
APPLICATIONS INFORMATION

Effects of Air Movement on Low Frequency Noise

The LT1021 has very low noise because of the buried zener used in its design. In the 0.1Hz to 10Hz band, peak-to-peak noise is about 0.5ppm of the DC output. To achieve this low noise, however, care must be taken to shield the reference from ambient air turbulence. Air movement can create noise because of thermoelectric differences between IC package leads (especially kovar lead TO-5) and printed circuit board materials and/or sockets. Power dissipation in the reference, even though it rarely exceeds 20mW, is enough to cause small temperature gradients in the package leads. Variations in thermal resistance, caused by uneven air flow, create differential lead temperatures, thereby causing thermoelectric voltage noise at the output of the reference. The following XY plotter trace dramatically illustrates this effect. The first half of the plot was done with the LT1021 shielded from ambient air with a small foam cup. The cup was then removed for the second half of the trace. Ambient in both cases was a lab environment with no excessive air turbulence from air conditioners, opening/closing doors, etc. Removing the foam cup increases the output noise by almost an order of magnitude in the 0.01Hz to 1Hz band! The kovar leads of the TO-5 (H) package are the primary culprit. Alloy 42 and copper lead frames used on dual-in-line packages are not nearly as sensitive to thermally generated noise because they are intrinsically matched.

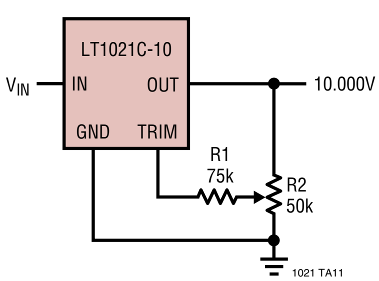
There is nothing magical about foam cups—any enclosure which blocks air flow from the reference will do. Smaller enclosures are better since they do not allow the build-up of internally generated air movement. Naturally, heat generating components external to the reference itself should not be included inside the enclosure.

Noise Induced By Air Turbulence (TO-5 Package)



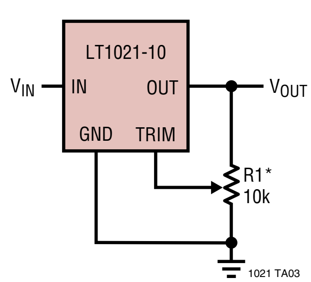
TYPICAL APPLICATIONS

Restricted Trim Range for Improved Resolution, 10V, "C" Version Only



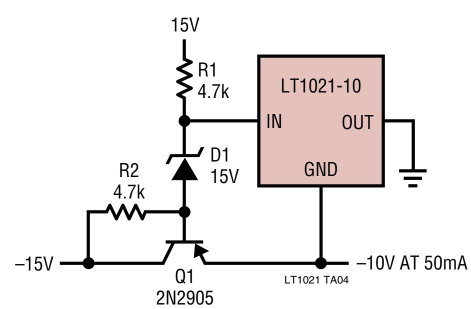
TRIM RANGE ≈ ±10mV

LT1021-10 Full Trim Range (±0.7%)



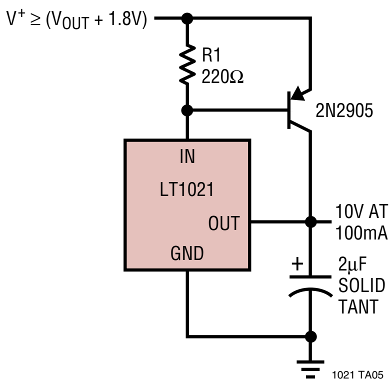
*CAN BE RAISED TO 20k FOR LESS CRITICAL APPLICATIONS

Negative Series Reference

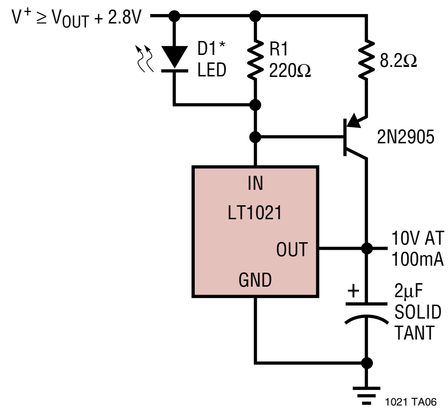


TYPICAL APPLICATIONS

Boosted Output Current with No Current Limit

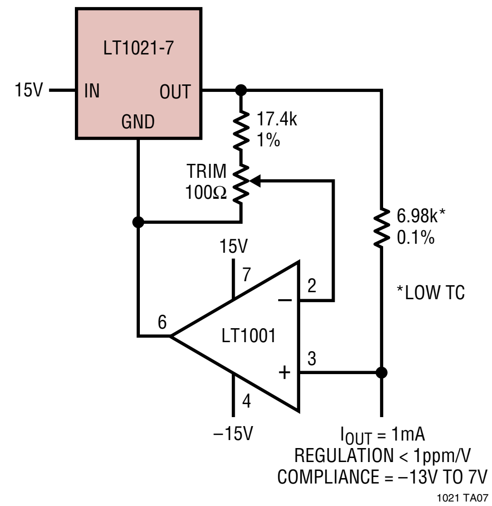


Boosted Output Current with Current Limit

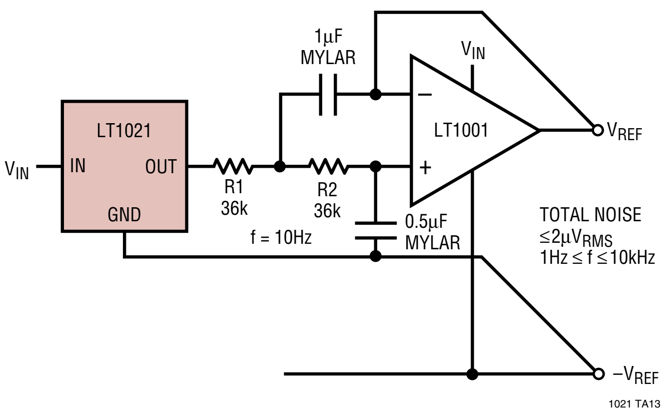


*GLOWS IN CURRENT LIMIT, DO NOT OMIT

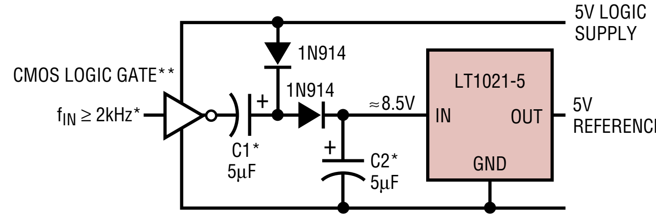
Ultraprecise Current Source



2-Pole Lowpass Filtered Reference



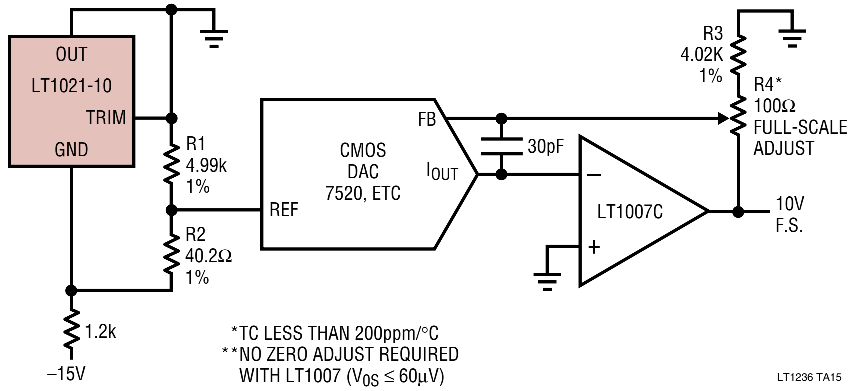
Operating 5V Reference from 5V Supply



*FOR HIGHER FREQUENCIES C1 AND C2 MAY BE DECREASED
**PARALLEL GATES FOR HIGHER REFERENCE CURRENT LOADING

1021 TA16

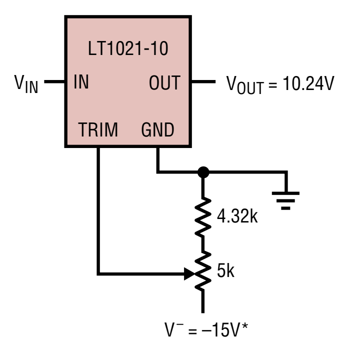
CMOS DAC with Low Drift Full-Scale Trimming**



*TC LESS THAN 200ppm/°C
**NO ZERO ADJUST REQUIRED WITH LT1007 ($V_{OS} \le 60\mu V$)

LT1236 TA15

Trimming 10V Units to 10.24V



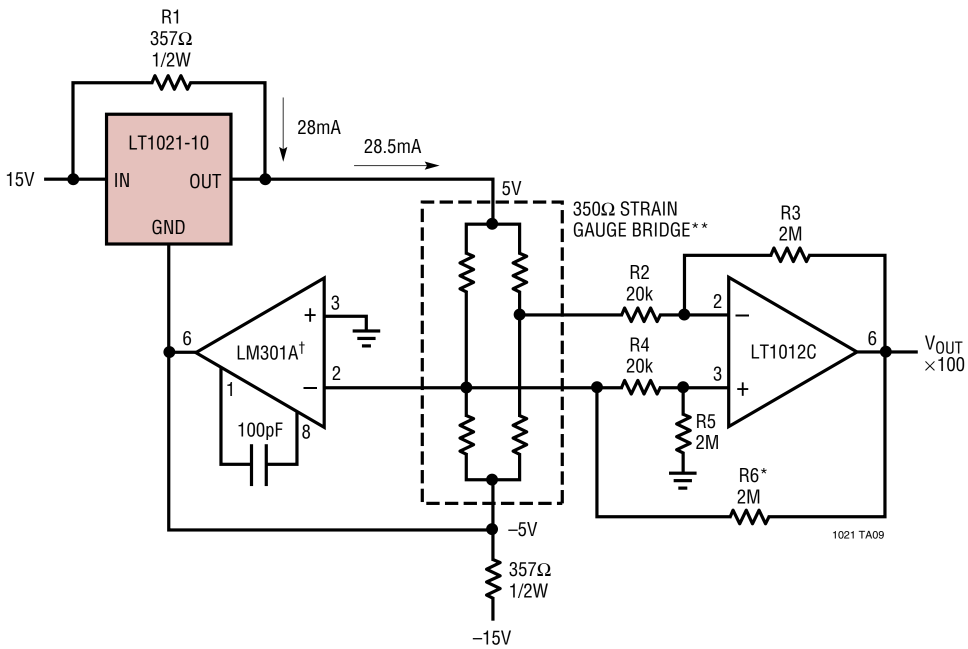
*MUST BE WELL REGULATED

$$\frac{dV_{OUT}}{dV^-} = \frac{15mV}{V}$$

1021 TA12

TYPICAL APPLICATIONS

Strain Gauge Conditioner for 350Ω Bridge

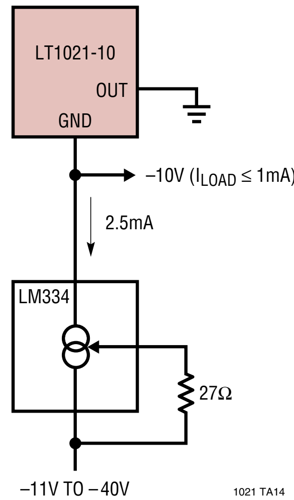


*THIS RESISTOR PROVIDES POSITIVE FEEDBACK TO THE BRIDGE TO ELIMINATE LOADING EFFECT OF THE AMPLIFIER. EFFECTIVE Z_{IN} OF AMPLIFIER STAGE IS ≥1MΩ. IF R2 TO R5 ARE CHANGED, SET R6 = R3

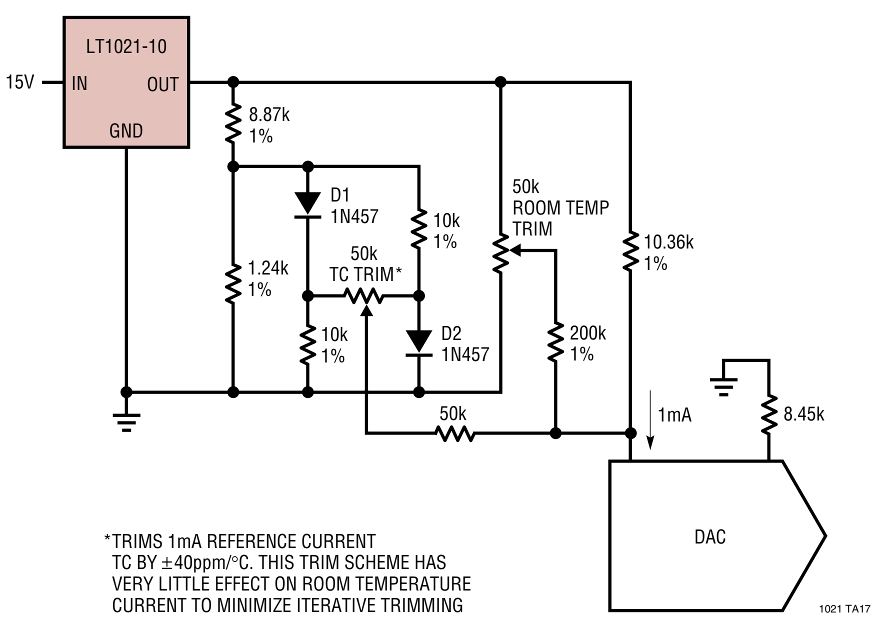
**BRIDGE IS ULTRALINEAR WHEN ALL LEGS ARE ACTIVE, TWO IN COMPRESSION AND TWO IN TENSION, OR WHEN ONE SIDE IS ACTIVE WITH ONE COMPRESSED AND ONE TENSIONED LEG

†OFFSET AND DRIFT OF LM301A ARE VIRTUALLY ELIMINATED BY DIFFERENTIAL CONNECTION OF LT1012C

Negative Shunt Reference Driven by Current Source

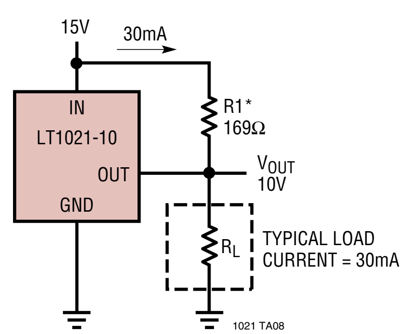


Precision DAC Reference with System TC Trim



*TRIMS 1mA REFERENCE CURRENT TC BY ±40ppm/°C. THIS TRIM SCHEME HAS VERY LITTLE EFFECT ON ROOM TEMPERATURE CURRENT TO MINIMIZE ITERATIVE TRIMMING

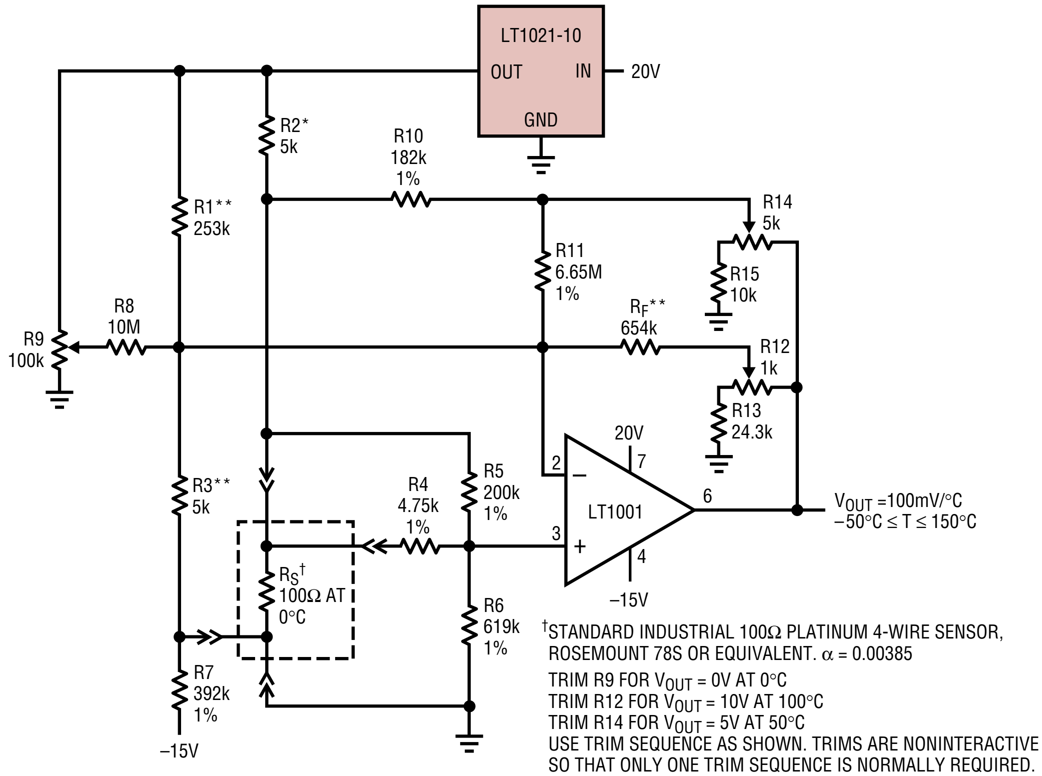
Handling Higher Load Currents



*SELECT R1 TO DELIVER TYPICAL LOAD CURRENT. LT1021 WILL THEN SOURCE OR SINK AS NECESSARY TO MAINTAIN PROPER OUTPUT. DO NOT REMOVE LOAD AS OUTPUT WILL BE DRIVEN UNREGULATED HIGH. LINE REGULATION IS DEGRADED IN THIS APPLICATION

TYPICAL APPLICATIONS

Ultralinear Platinum Temperature Sensor*



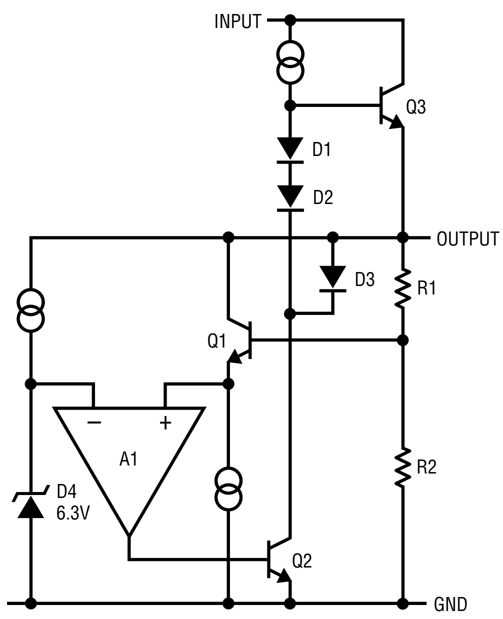
†STANDARD INDUSTRIAL 100Ω PLATINUM 4-WIRE SENSOR, ROSEMOUNT 78S OR EQUIVALENT. α = 0.00385

TRIM R9 FOR V_{OUT} = 0V AT 0°C
TRIM R12 FOR V_{OUT} = 10V AT 100°C
TRIM R14 FOR V_{OUT} = 5V AT 50°C
USE TRIM SEQUENCE AS SHOWN. TRIMS ARE NONINTERACTIVE SO THAT ONLY ONE TRIM SEQUENCE IS NORMALLY REQUIRED.

*FEEDBACK LINEARIZES OUTPUT TO ±0.005°C FROM –50°C TO 150°C

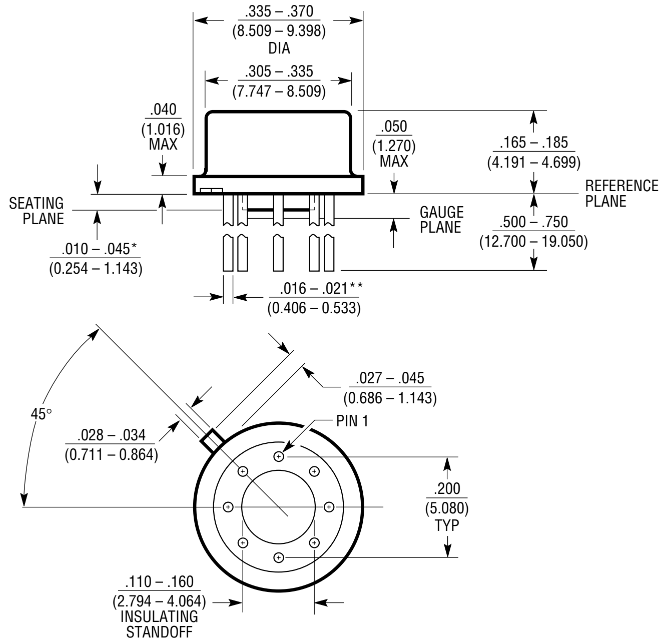
**WIREWOUND RESISTORS WITH LOW TC

EQUIVALENT SCHEMATIC



PACKAGE DESCRIPTION

H Package
8-Lead TO-5 Metal Can (.200 Inch PCD)
(Reference LTC DWG # 05-08-1320)

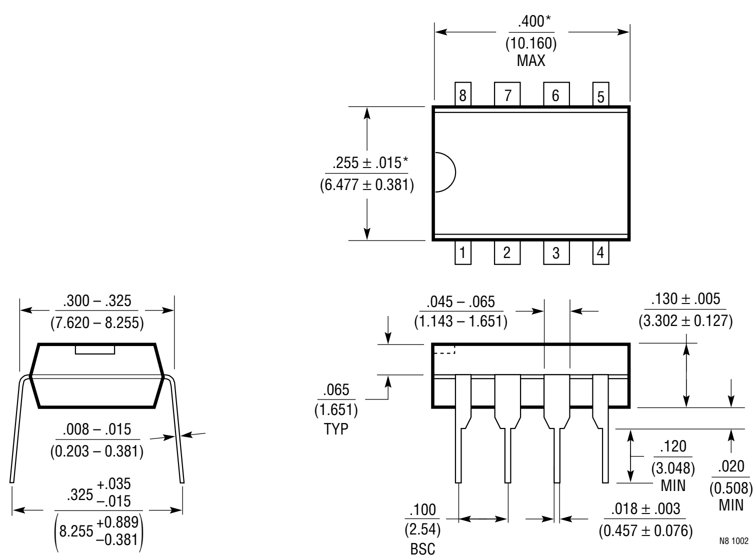


*LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND THE SEATING PLANE

**FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS $\frac{.016 – .024}{(0.406 – 0.610)}$

H8(TO-5) 0.200 PCD 0204

N8 Package
8-Lead PDIP (Narrow .300 Inch)
(Reference LTC DWG # 05-08-1510)

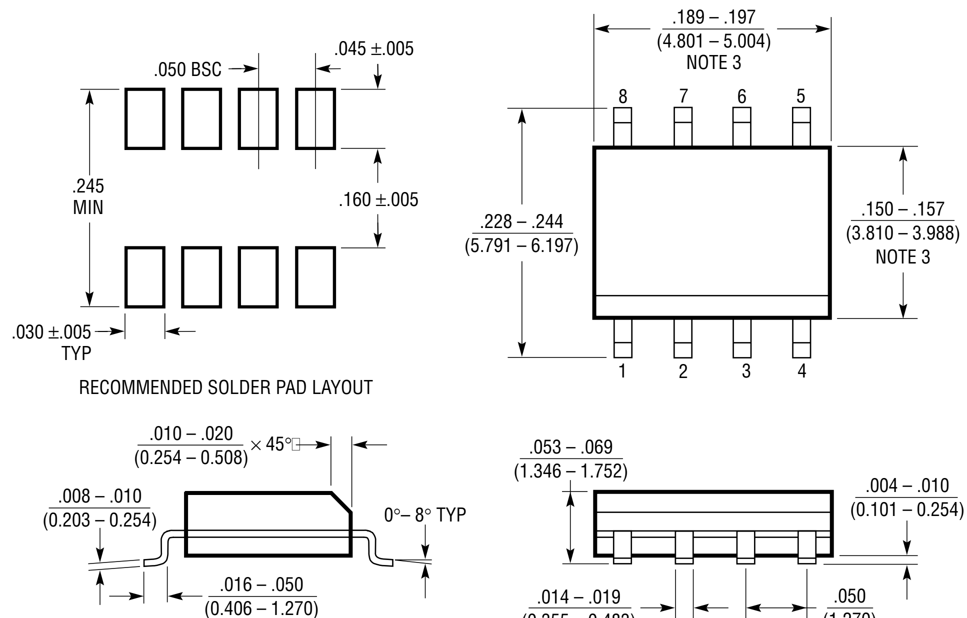


NOTE:
1. DIMENSIONS ARE $\frac{\text{INCHES}}{\text{MILLIMETERS}}$

*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

PACKAGE DESCRIPTION

S8 Package
8-Lead Plastic Small Outline (Narrow .150 Inch)
(Reference LTC DWG # 05-08-1610)



NOTE:
1. DIMENSIONS IN $\frac{\text{INCHES}}{\text{(MILLIMETERS)}}$
2. DRAWING NOT TO SCALE
3. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)

SO8 0303

RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1019	Precision Bandgap Reference	0.05%, 5ppm/°C
LT1027	Precision 5V Reference	0.02%, 2ppm/°C
LT1236	Precision Reference	SO-8, 5V and 10V, 0.05%, 5ppm/°C
LTC®1258	Micropower Reference	200mV Dropout, MSOP
LT1389	Nanopower Shunt Reference	800nA Operating Current
LT1460	Micropower Reference	SOT-23, 2.5V, 5V, 10V
LT1634	Micropower Shunt Reference	0.05%, 10ppm/°C, MSOP

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