

Precision Voltage References

FEATURES

- Trimmed Output $\pm 0.3\%$
- Low Drift— $5\text{ppm}/^\circ\text{C}$ Typ
- Low Noise— $3\text{ppm}_{(\text{P-P})}$
- High Line Rejection
- Temperature Output—REF-02
- Low Supply Current 1.4mA Max

APPLICATIONS

- A/D and D/A Converters
- Precision Regulators
- Constant Current Sources
- V/F Converters
- Bridge Excitation

DESCRIPTION

The REF-01/REF-02 are precision 10V and 5V bandgap references which provide stable output voltages over a wide range of operating conditions. Output voltage is accurate to $\pm 0.3\%$ with a low $5\text{ppm}/^\circ\text{C}$ typical temperature coefficient. The REF-01 and REF-02 are excellent choices for applications where low drift, moderate accuracy, low power consumption and low cost are considerations.

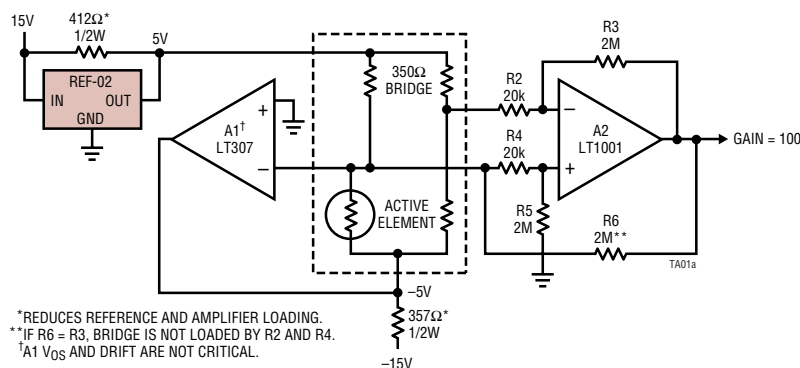
The REF-02 includes a temperature output pin which provides a linear voltage proportional to absolute temperature.

For lower drift and higher accuracy references, please see the LT1019 and LT1021 data sheets.

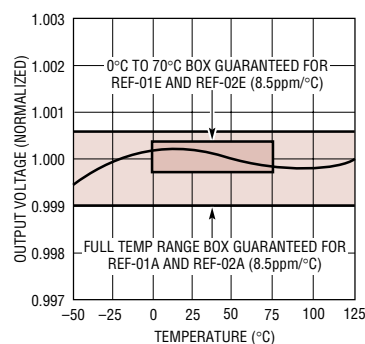
 LTC and LT are registered trademarks of Linear Technology Corporation.

TYPICAL APPLICATION

Ultra Linear Strain Gauge Amplifier



Output Voltage Temperature Drift



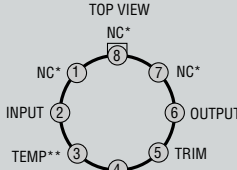
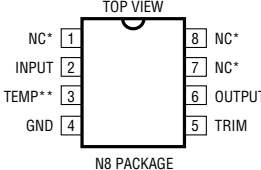
REF-01/REF-02

ABSOLUTE MAXIMUM RATINGS (Note 1)

REF-01/REF-02 A, E, H	40V
REF-01C/REF-02C	30V
Power Dissipation	500mW
Output Short-Circuit Duration	
To Ground	Indefinite
To $V_{IN} \leq 16V$	Indefinite
To $V_{IN} > 16V$	Not Allowed

Storage Temperature Range	-65°C to 150°C
Operating Temperature	
REF-01/REF-02, REF-01A/REF-02A ...	-55°C to 125°C
REF-01E/REF-02E, REF-01H/REF-02H,	
REF-01C/REF-02C, REF-01D/REF-02D	0°C to 70°C
Lead Temperature (Soldering, 10 sec)	300°C

PACKAGE/ORDER INFORMATION

TOP VIEW  NC* 1 8 NC* INPUT 2 7 NC* TEMP** 3 6 OUTPUT 4 5 TRIM GND (CASE) H PACKAGE 8-LEAD TO-5 METAL CAN $T_{JMAX} = 150^{\circ}C$, $\theta_{JA} = 150^{\circ}C/W$, $\theta_{JC} = 45^{\circ}C/W$ * INTERNALLY CONNECTED. DO NOT CONNECT EXTERNALLY. ** DO NOT CONNECT ON REF-01	ORDER PART NUMBER <table><tr><td>REF01AH</td><td>REF02AH</td></tr><tr><td>REF01H</td><td>REF02H</td></tr><tr><td>REF01EH</td><td>REF02EH</td></tr><tr><td>REF01HH</td><td>REF02HH</td></tr><tr><td>REF01CH</td><td>REF02CH</td></tr><tr><td></td><td>REF02DH</td></tr></table>	REF01AH	REF02AH	REF01H	REF02H	REF01EH	REF02EH	REF01HH	REF02HH	REF01CH	REF02CH		REF02DH	TOP VIEW  NC* 1 8 NC* INPUT 2 7 NC* TEMP** 3 6 OUTPUT 4 5 TRIM N8 PACKAGE 8-LEAD PDIP $T_{JMAX} = 100^{\circ}C$, $\theta_{JA} = 130^{\circ}C/W$ * INTERNALLY CONNECTED. DO NOT CONNECT EXTERNALLY. ** DO NOT CONNECT ON REF-01	ORDER PART NUMBER <table><tr><td>REF01EN8</td><td>REF02EN8</td></tr><tr><td>REF01HN8</td><td>REF02HN8</td></tr><tr><td>REF01CN8</td><td>REF02CN8</td></tr><tr><td></td><td>REF02DN8</td></tr></table>	REF01EN8	REF02EN8	REF01HN8	REF02HN8	REF01CN8	REF02CN8		REF02DN8
REF01AH	REF02AH																						
REF01H	REF02H																						
REF01EH	REF02EH																						
REF01HH	REF02HH																						
REF01CH	REF02CH																						
	REF02DH																						
REF01EN8	REF02EN8																						
REF01HN8	REF02HN8																						
REF01CN8	REF02CN8																						
	REF02DN8																						
OBSOLETE PACKAGE Consider the N Package for Alternate Source		OBSOLETE PACKAGE Consider the N Package for Alternate Source	<table><tr><td>REF01EJ8</td><td>REF02EJ8</td></tr><tr><td>REF01HJ8</td><td>REF02HJ8</td></tr><tr><td>REF01CJ8</td><td>REF02CJ8</td></tr><tr><td></td><td>REF02DJ8</td></tr></table>	REF01EJ8	REF02EJ8	REF01HJ8	REF02HJ8	REF01CJ8	REF02CJ8		REF02DJ8												
REF01EJ8	REF02EJ8																						
REF01HJ8	REF02HJ8																						
REF01CJ8	REF02CJ8																						
	REF02DJ8																						

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

ELECTRICAL CHARACTERISTICS $V_{IN} = 15V$, $T_A = 25^{\circ}C$ unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		REF-01A/E, REF-02A/E			REF-01H, REF-02H			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
V _O	Output Voltage	I _L = 0mA	REF-01	9.97	10	10.03	9.95	10	10.05	V
			REF-02	4.985	5	5.015	4.975	5	5.025	V
	Output Adjustment Range	R _P = 10kΩ	REF-01	±3	5, −27		±3	5, −27		%
			REF-02	±3	5, −13		±3	5, −13		%
e _{nP-P}	Output Voltage Noise	0.1Hz to 10Hz (Note 7)	REF-01	20			20			μV _{P-P}
			REF-02	10			10			μV _{P-P}
V _{IN}	Input Voltage Range		REF-01	12		40	12		40	V
			REF-02	7		40	7		40	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation (Note 2)	(V _{OUT} + 3V) ≤ V _{IN} ≤ 33V		0.0001		0.010	0.0001		0.010	%/V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation (Note 2)	I _L = 0mA to 10mA	REF-01	0.0005		0.008	0.0005		0.010	%/mA
			REF-02	0.0010		0.010	0.001		0.010	%/mA
I _Q	Quiescent Supply Current	No Load		0.65		1.4	0.65		1.4	mA
I _{OUT}	Load Current Sink Current			10	20		10	20		mA
				−0.3	−20		−0.3	−20		mA
I _{SC}	Short-Circuit Current	V _O = 0V		25			25			mA
V _T	Temperature Voltage Output	(Note 3)	REF-02 Only	620			620			mV

ELECTRICAL CHARACTERISTICS $V_{IN} = 15V$, $T_A = 25^\circ C$ unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	REF-01C, REF-02C			REF-02D			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
V_O	Output Voltage	$I_L = 0mA$	9.9	10	10.1				V
		REF-01 REF-02	4.95	5	5.05	4.9	5	5.1	V
	Output Adjustment Range	$R_P = 10k\Omega$		5, -27					%
		REF-01 REF-02	± 2.7	5, -13		± 2	5, -13		%
e_{nP-P}	Output Voltage Noise	0.1Hz to 10Hz (Note 7)		30 12			12		μV_{P-P} μV_{P-P}
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation (Note 2)	$(V_{OUT} + 3V) \leq V_{IN} \leq 33V$		0.0001	0.015		0.0001	0.04	%/V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation (Note 2)	$I_L = 0mA$ to 8mA $I_L = 0mA$ to 4mA		0.0005	0.015		0.001	0.04	%/mA %/mA
I_Q	Quiescent Supply Current	No Load		0.65	1.6		0.65	2	mA
I_{OUT}	Load Current Sink Current		8 -0.2	20 20		8 -0.2	20 20		mA mA
I_{SC}	Short-Circuit Current	$V_O = 0V$		25			25		mA
V_T	Temperature Voltage Output	(Note 3) REF-02 Only		620			620		mV

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ C$.
 $V_{IN} = 15V$, $-55^\circ C \leq T_A \leq \pm 125^\circ C$ for REF-01A/REF-02A and REF-01/REF-02, $0^\circ C \leq T_A \leq 70^\circ C$ for REF-01E/REF-02E and REF-01H/REF-02H, $I_L = 0mA$ unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		REF-01A/E, REF-02A/E			REF-01H/REF-02H			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
$\frac{\Delta V}{\Delta T}$	Output Voltage Change with Temperature (Notes 4, 5)	$0^\circ C \leq T_A \leq 70^\circ C$ $-55^\circ C \leq T_A \leq 125^\circ C$	● ●		0.02 0.09	0.06 0.15		0.035 0.144	0.17 0.45	% %
TC	Output Voltage Temperature Coefficient	(Note 6)	●		5	8.5		8	25	ppm/ $^\circ C$
	Change in V_O Temperature Coefficient with Output Adjustment	$R_P = 10k\Omega$	●		0.5			0.5		ppm/%
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	$0^\circ C \leq T_A \leq 70^\circ C$	●		0.0001	0.012		0.0001	0.012	%/V
	$(V_{OUT} + 3V) \leq V_{IN} \leq 33V$ (Note 2)	$-55^\circ C \leq T_A \leq 125^\circ C$	●		0.0001	0.015		0.0001	0.015	%/V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	$0^\circ C \leq T_A \leq 70^\circ C$	●		0.002	0.010		0.002	0.012	%/mA
	$(I_L = 0mA$ to 8mA) (Note 2)	$-55^\circ C \leq T_A \leq 125^\circ C$	●		0.002	0.012		0.002	0.015	%/mA
	Temperature Voltage Output Temperature Coefficient	(Note 3) REF-02	●		2.1			2.1		mV/ $^\circ C$

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ\text{C}$. $V_{IN} = 15\text{V}$, $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ and $I_L = 0\text{mA}$ unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		REF-01C, REF-02C			REF-02D			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
$\frac{\Delta V}{\Delta T}$	Output Voltage Change with Temperature	(Notes 4, 5)	●			0.45			1.7	%
TC	Output Voltage Temperature Coefficient	(Note 6)	●		8	65		8	250	ppm/ $^\circ\text{C}$
	Change in V_O Temperature Coefficient with Output Adjustment	$R_P = 10\text{k}\Omega$	●		0.5			0.5		ppm/%
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation (Note 2)	$V_{IN} = 8\text{V to } 30\text{V}$	●		0.0001	0.018		0.0001	0.05	%/V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation (Note 2)	$I_L = 0\text{mA to } 5\text{mA}$	●		0.002	0.018		0.002	0.05	%/mA
	Temperature Voltage Output Temperature Coefficient	(Note 3) REF-02	●		2.1			2.1		mV/ $^\circ\text{C}$

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

Note 2: Line and load regulation specifications include the effect of self heating.

Note 3: Limit current in or out of Pin 3 to 50nA and capacitance on Pin 3 to 30pF.

Note 4: ΔV is defined as the absolute difference between the maximum output voltage and the minimum output voltage over the specified temperature range expressed as a percentage of nominal output.

$$\Delta V = \left| \frac{V_{MAX} - V_{MIN}}{V_{OUT}} \right| \cdot 100$$

Note 5: ΔV specification applies trimmed or untrimmed.

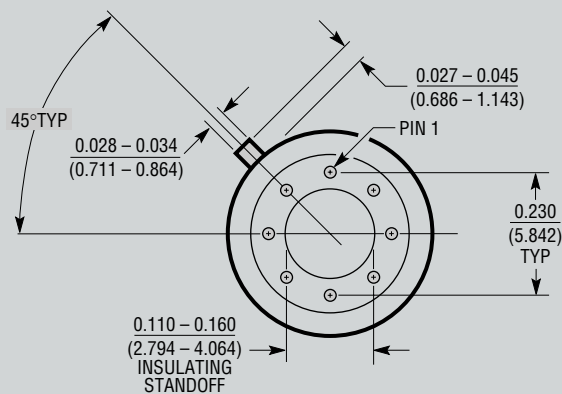
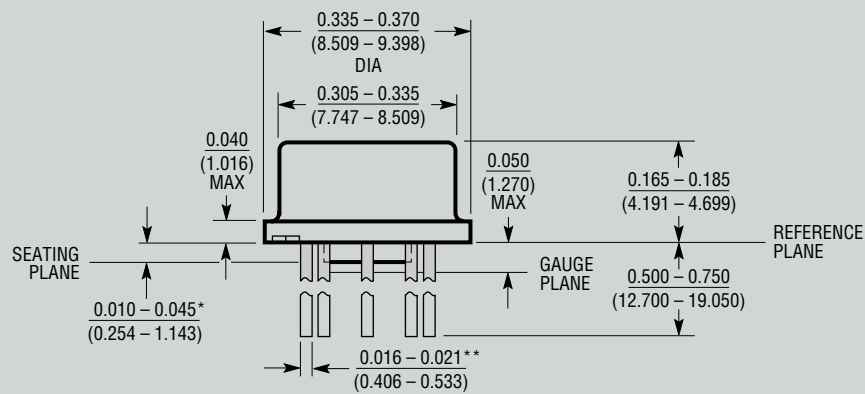
Note 6: TC is defined as ΔV divided by the temperature range, i.e.,

$$TC = \frac{\Delta V}{T_{MAX} - T_{MIN}}$$

Note 7: 0.1Hz to 10Hz noise cannot be 100% tested on modern high speed test equipment, so Linear Technology does not put a guaranteed maximum specification on this parameter for standard units. 100% bench testing of 0.1Hz to 10Hz noise is available on special request. To ensure low output noise, Linear Technology *does* 100% test 10Hz to 1kHz noise. Consult factory for details.

PACKAGE DESCRIPTION

H Package
8-Lead TO-5 Metal Can (.230 Inch PCD)
 (Reference LTC DWG # 05-08-1321)



* LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND 0.045" BELOW THE REFERENCE PLANE

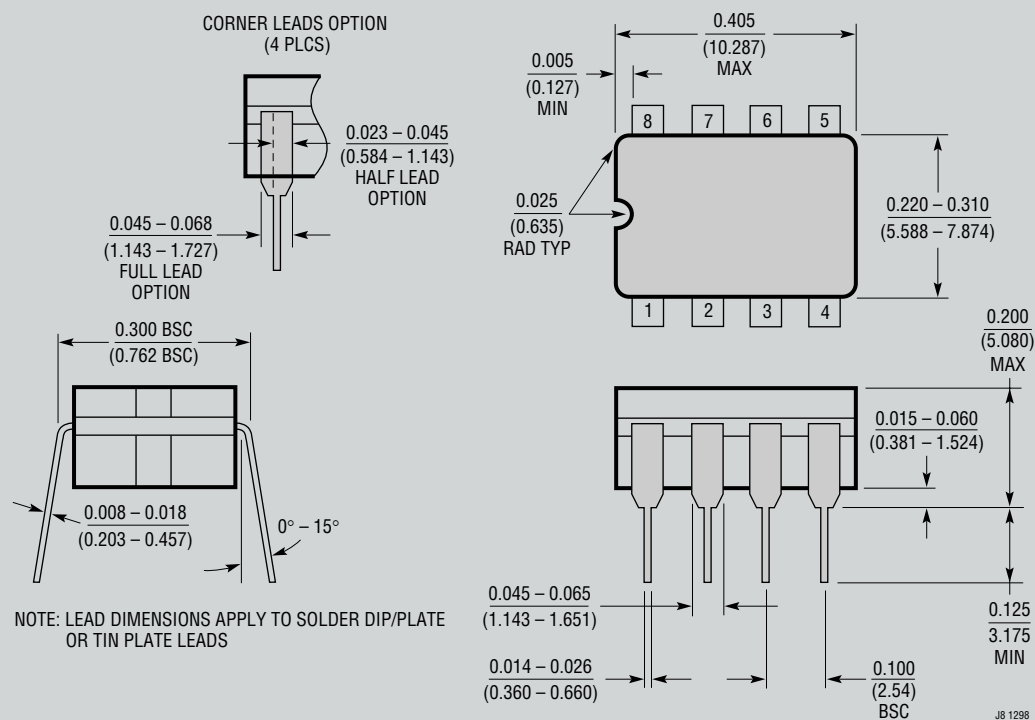
** FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS $0.016 - 0.024$ (0.406 - 0.610)

H8 (TO-5) 0.230 PCD 1197

OBSOLETE PACKAGE

PACKAGE DESCRIPTION

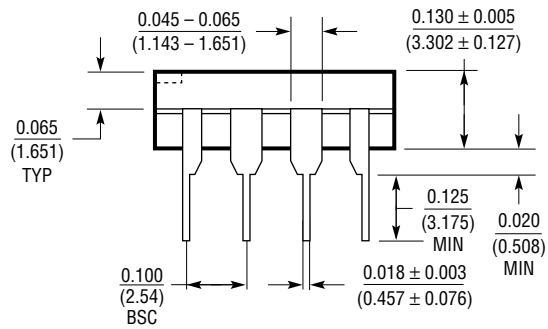
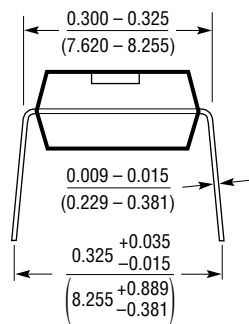
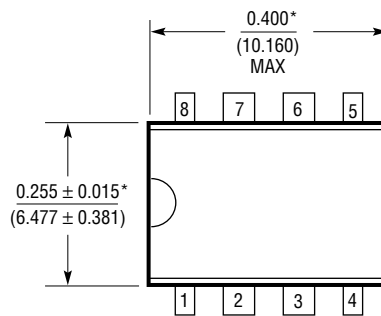
J8 Package
8-Lead Cerdip (Narrow .300 Inch, Hermetic)
(Reference LTC DWG # 05-08-1110)



OBSOLETE PACKAGE

PACKAGE DESCRIPTION

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



*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
 MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 INCH (0.254mm)

N8 1098

RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1019	0.05%, 5ppm/°C Precision Reference	Pin Compatible with the REF-01, REF-02, Improved Specs



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.