LT1031M/883 and LH0070/883

Precision 10 Volt Reference

DESCRIPTION

The LT1031M/883 is a precision 10V reference with ultra low 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 and can be used as a shunt regulator (two terminal zener) 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 reference is based on a buried zener diode structure which 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 band-gap references.

Unique circuit design makes the LT1031M/883 the first three terminal IC reference to offer ultra low drift without the use of high power on-chip heaters. Output voltage is pre-trimmed to 0.05% accuracy.

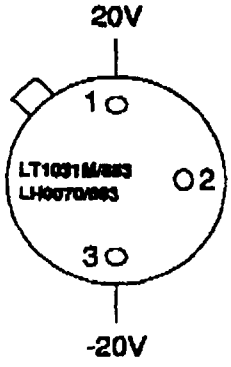
The LT1031M/883 can be used as a plug-replacement for the AD581 and LH0070, with improved electrical and thermal performance.

The device is processed to the requirements of MIL-STD-883 Class B to yield circuits usable in precision military applications.

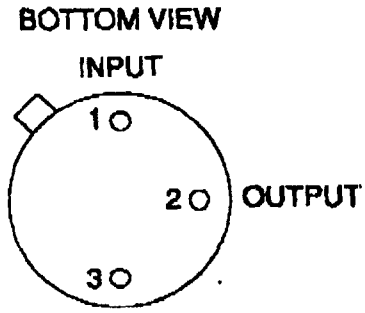
ABSOLUTE MAXIMUM RATINGS

Input Voltage 40V
Input-Output Voltage Differential 35V
Output to Ground Voltage
(Shunt Mode Current Limit) 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 ..... -55°C to 125°C
Storage Temperature Range ..... -65°C to 150°C
Lead Temperature (Soldering, 10 sec.) ..... 300°

BURN-IN CIRCUIT



PACKAGE/ORDER INFORMATION



H PACKAGE
TO-5 METAL CAN

ORDER PART NUMBER
LH0070-0H/883
LH0070-1H/883
LH0070-2H/883
LT1031BMH/883
LT1031CMH/883
LT1031DMH/883
PART MARKING†
LH0070-0H/883C
LH0070-1H/883C
LH0070-2H/883C
LT1031BMH/883C
LT1031CMH/883C
LT1031DMH/883C

† The suffix letter "C" of the part mark indicates compliance per MIL-STD-883, para 1.2.1.1.

LTTCS01036

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TABLE 1: ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	NOTES	T_A = 25°C MIN	TYP	MAX	SUB-GROUP	-55°C ≤ T_A ≤ 125°C MIN	TYP	MAX	SUB-GROUP	UNITS
LT1031/883, V_{IN} = 15V, I_{OUT} = 0, unless otherwise noted.												
V_R	Output Voltage	LT1031B	A	9.995	10.000	10.005	1					V
		LT1031C	A	9.990	10.000	10.010	1					V
		LT1031D	A	9.980	10.000	10.020	1					V
$\frac{\Delta V_R}{\Delta T}$	Output Voltage Temperature Coefficient	$T_{MIN} \le T_J \le T_{MAX}$										
		LT1031B	B						3	5	2,3	ppm/°C
		LT1031C	B						6	15	2,3	ppm/°C
		LT1031D	B						10	25	2,3	ppm/°C
$\frac{\Delta V_R}{\Delta V_{IN}}$	Line Regulation	11.5V ≤ V_{IN} ≤ 14.5V	C		1	4	1			6	2,3	ppm/V
		14.5V ≤ V_{IN} ≤ 40V	C		0.5	2	1			4	2,3	ppm/V
$\frac{\Delta V_R}{\Delta I_o}$	Load Regulation (Sourcing Current)	0 ≤ I_{OUT} ≤ 10mA	C		12	25	1			40	2,3	ppm/mA
$\frac{\Delta V_R}{\Delta I_o}$	Load Regulation (Shunt Mode)	1.7mA ≤ I_{SHUNT} ≤ 10mA	C,D		50	100	1			150	2,3	ppm/mA
I_Q	Series Mode Supply Current				1.2	1.7	1			2.0	2,3	mA
I_{MIN}	Shunt Mode Minimum Current	V_{IN} is Open			1.1	1.5	1			1.7	2,3	mA
	Output Short Circuit Current	11V ≤ V_{IN} ≤ 35V			30							mA
	Minimum Input Voltage	I_{OUT} ≤ 1mA	F		10.8	11.0	1					V
e_n	Output Voltage Noise	0.1Hz ≤ f ≤ 10Hz			6							µVp-p
		0.1Hz ≤ f ≤ 10Hz			11							μV_{rms}
$\frac{\Delta V_R}{\Delta V_{Time}}$	Long Term Stability of Output Voltage	Δt = 1000 Hrs Non-Cumulative			15							ppm
	Temperature Hysteresis of Output	ΔT = 50°C			5							ppm
LH0070/883, V_{IN} = 15V, R_L = 10kΩ, unless otherwise noted.												
V_R	Output Voltage				10.000							V
ΔV_R	Output Accuracy	LH0070-0,1			±0.03	±0.1	1			±0.3	2,3	%
		LH0070-2			±0.02	±0.05	1			±0.3	2,3	%
$\frac{\Delta V_R}{\Delta T}$	Output Voltage Change with Temperature	LH0070-0	E							±0.2	2,3	%
		LH0070-1	E						±0.02	±0.1	2,3	%
		LH0070-2	E						±0.01	±0.04	2,3	%
$\frac{\Delta V_R}{\Delta V_{IN}}$	Line Regulation	13V ≤ V_{IN} ≤ 33V,										
		LH0070-0,1			0.006	0.1	1					%
		LH0070-2			0.006	0.03	1					%
	Input Voltage Range			11.4		40	1	11.4		40	2,3	V
$\frac{\Delta V_R}{\Delta I_o}$	Load Regulation	0mA ≤ I_{OUT} ≤ 5mA			0.1	0.3	1		0.01	0.03	2,3	%
I_Q	Quiescent Current	13 ≤ V_{IN} ≤ 33V			1.2	5	1		1.2	5	2,3	mA
$\frac{\Delta I_Q}{\Delta V_{IN}}$	Change in Quiescent Current	ΔV_{IN} = 20V from 13V to 33V			0.1	1.5	1		0.1	1.5	2,3	mA
e_n	Output Voltage Noise				6							µVp-p
	Ripple Rejection	f = 120Hz			.001				0.001			%/Vp-p
r_O	Output Resistance				0.2	0.6	1		0.2	0.8	2,3	Ω
$\frac{\Delta V_Z}{\Delta Time}$	Long Term Stability	LH0070-0,1	G			±0.2						%/Yr
		LH0070-2	G			±0.05						%/Yr

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TABLE 2: ELECTRICAL TEST REQUIREMENTS

MIL-STD-883 TEST REQUIREMENTS	SUBGROUP
Final Electrical Test Requirements (Method 5004)	1,2,3
Group A Test Requirements (Method 5005)	1,2,3
Group C and D End Point Electrical Parameters (Method 5005)	1,2,3

* PDA applies to subgroup 1. See PDA Test Notes.

PDA Test Notes.

The PDA is specified as 5% based on failures from group A, subgroup 1, tests after cooldown as the final electrical test in accordance with method 5004 of MIL-STD-883 Class B. The verified failures of group A, subgroup 1, after burn-in divided by the total number of devices submitted for burn-in in that lot shall be used to determine the percent for the lot.

Linear Technology Corporation reserves the right to test to tighter limits than those given.

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

Note B: 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°.** For LT1031BMH, the 5ppm/°C to +125°C range is guaranteed to 7ppm/°C.

Note C: 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.

Note D: 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 E: Temperature drift is guaranteed from -25°C to +85°C on LH0070.

Note F: See curve on standard data sheet for guaranteed minimum V_{IN} versus I_{OUT}.

Note G: Guaranteed by design.