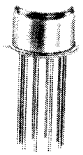
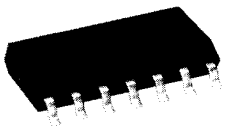
LAS 1000, 1100

150 mA POSITIVE VOLTAGE REGULATORS/ LINEAR CONTROLLERS





FEATURES

- Guaranteed line regulation: 0.008%
- Guaranteed temperature coefficient: 0.015%
- Low noise, band gap reference
- Low reference voltage of 2.5 Volts
- Remote sense capability
- Electronic shutdown

DESCRIPTION

The LAS 1000, 1100 voltage regulators are monolithic integrated circuits designed for use in applications requiring a well regulated positive output voltage. Outstanding features include full power usage up to 150 milliamperes of load variation, internal current limiting, electronic shutdown and thermal shutdown on the chip under most operating conditions. Hermetically sealed TO-96 packages are employed for high reliability and low thermal resistance. A low-noise temperature stable band gap reference is the key design factor insuring excellent temperature regulation of the LAS 1000, 1100. This, coupled to a very low output impedance, insures superior performance and load regulation. A very low reference voltage of 2.5 volts ±5% compared to the 7.0 volts ±5% reference commonly used in similar devices, allows the LAS 1000, 1100 a much greater output voltage range without the use of external components. Both devices offer low standby current drain and high ripple rejection. When additional current capability is required, series NPN or PNP transistors may be added.

ABSOLUTE MAXIMUM RATINGS

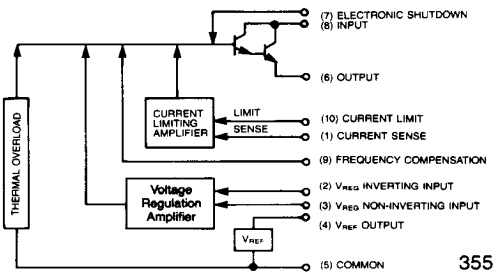
PARAMETER	SYMBOL	MAXIMUM	UNITS
Input Voltage LAS 1000 LAS 1100	V_{IN}	 40(1) 50(1)	Volts
Input/Output Differential LAS 1000 LAS 1100	V_{IN}-V_{OUT}	 38(1) 48(1)	Volts
Power Dissipation @ $T_A \leq 25°C$	P_D	0.8(1),(2)	Watts
Thermal Resistance Junction to Ambient	θ_{JA}	150(3)	°C/Watt
Operating Junction Temperature Range	T_J	0 to 150	°C
Storage Temperature Range	T_{STG}	−65 to 150	°C
Lead Temperature (Soldering, 60 Seconds Time Limit)	T_{LEAD}	300	°C

(1) The maximum input voltage of the LAS 1000, 1100 is limited by the maximum input-output differential, maximum power dissipation, and the maximum current limit-safe operating area, whichever is less.
(2) For operation above 25°C T_{CASE} derate @ 6.7 mW/°C (7.7 mW/°C for LAS1100S).
(3) θ_{JA} = 130°C/Watt (typical) for LAS1100S.

DEVICE SELECTION GUIDE

DEVICE	V_{IN}, VOLTS	V_O, VOLTS
LAS 1000	5 to 40	2.63 to 38
LAS 1100	5 to 50	2.63 to 48
LAS 1100S (Surface Mount Device)	5 to 50	2.63 to 48

BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS

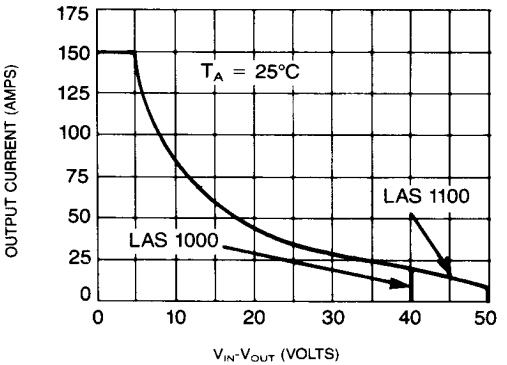
Test conditions are as follows: V_{IN} = 10 Volts, V_O = 5 Volts, I_O = 1 mA, R_{SC} = 0, unless otherwise specified.

Parameter	Symbol	Test Conditions			Test Limits		Units
		V_{IN}	I_O	T_J	Min	Max	
Output Voltage[1] LAS 1000 LAS 1100	V_O	V_O + 2V	25mA	0-125°C	 2.63 2.63	 38 48	Volts
Input-Output Differential	V_{IN}-V_O		150mA	0-125°C	2.0		Volts
Output Current	I_O					150	mA
Line Regulation[2] LAS 1000 LAS 1100 LAS 1100	REG_{LINE}	 5 to 40 7 to 50 10 to 20	 25mA	0-125°C		 0.020 0.008 0.020	%V_O/V[3]
Load Regulation[2]	$REG_{(LOAD)}$		1 to 25mA 1 to 100mA	0-125°C		0.05 0.15	%V_O
Quiescent Current	I_Q	40[4]		25°C		4.2	mA
Reference Voltage	V_{REF}			25°C	2.375	2.625	Volts
Reference Output Current	I_{REF}			25°C		3	mA
Temperature Coefficient	T_C			0-125°C		0.015	%V_O/°C[5]
Ripple Attenuation[6] LAS 1000 LAS 1100	R_A	10V + 1V_{RMS}		0-125°C	 60 69		dB
Output Noise Voltage[7]	V_N			0-125°C		50	μV_{rms}
Current Limit Sense Voltage[8]	V_S			25°C	0.060	0.110	Volts
Error Amplifier Voltage Gain	A_V			25°C	4000		
Shutdown Voltage Threshold	V_7			25°C	0.55	0.85	Volts
Shutdown Source Current	I_7			25°C	100	300	µA
Current Limit Source Current	I_{10}			25°C	50	130	µA

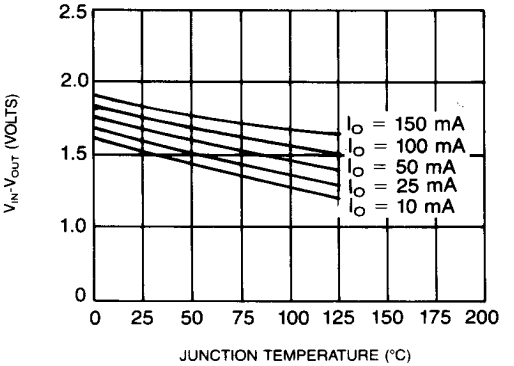
(1) $V_O = V_{REF}(1 + R_1/R_2)$
R_1 = Resistance from output to inverting input
R_2 = Resistance from inverting input to common
(2) Instantaneous measurement; average chip temperature changes must be accounted for separately.
(3) Percentage times V_O per volt change in V_{IN}
(4) V_{IN} = 50 Volts for LAS 1100
(5) Percentage times V_O per °C change in temperature
(6) Ripple attenuation is specified for a 1V_{RMS}, 120 Hz input ripple. Ripple attenuation is a minimum of 60 dB (LAS 1000) or 69 dB (LAS 1100) at a 5V output, and is 1 dB less for each volt increase in the output voltage.
(7) BW = 10 Hz – 100 kHz
(8) R_{SC} = 100 Ω

OPERATIONAL DATA

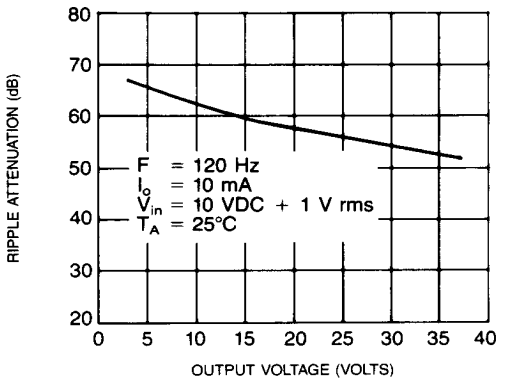
CURRENT LIMIT



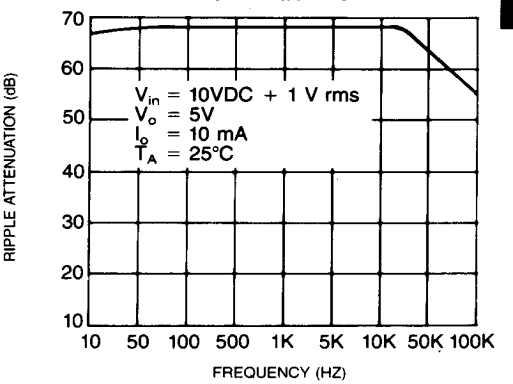
TYPICAL INPUT-OUTPUT DIFFERENTIAL VS JUNCTION TEMPERATURE



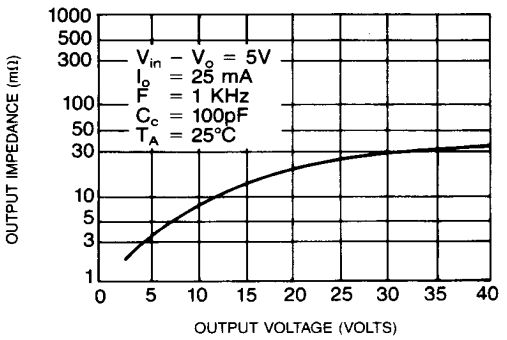
TYPICAL RIPPLE ATTENUATION VS OUTPUT VOLTAGE



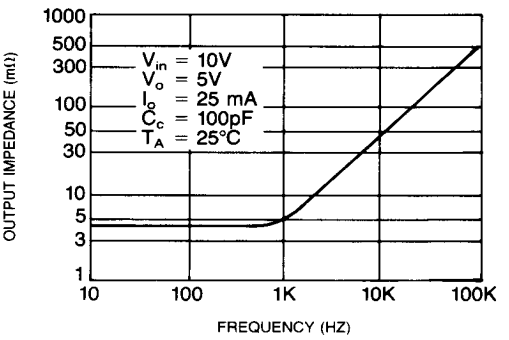
TYPICAL RIPPLE ATTENUATION VS FREQUENCY



TYPICAL OUTPUT IMPEDANCE VS OUTPUT VOLTAGE

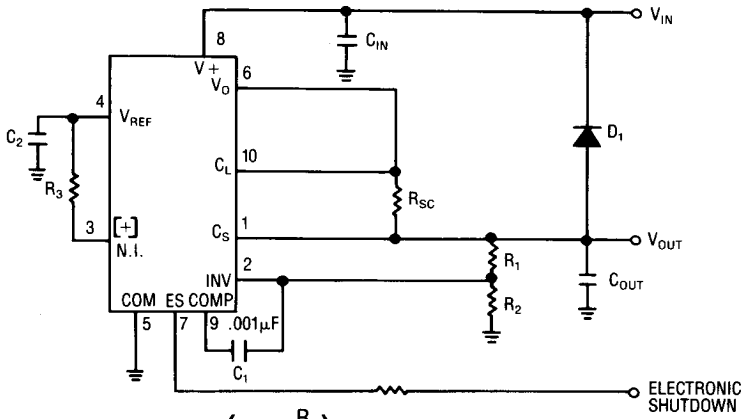


TYPICAL OUTPUT IMPEDANCE VS FREQUENCY



TYPICAL APPLICATIONS

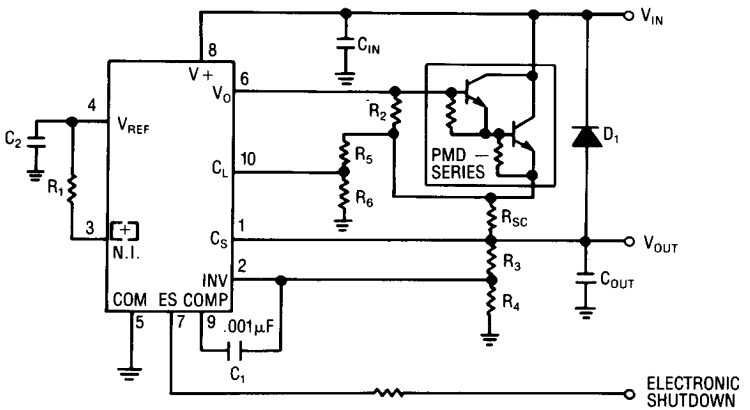
BASIC POSITIVE REGULATOR WITH ELECTRONIC SHUTDOWN[1,2]



$$V_O = V_{REF}\left(1 + \frac{R_1}{R_2}\right) \qquad R_3 \text{ will minimize drift}$$

$$I_L = \frac{V_S}{R_{SC}} \qquad R_3 = \frac{R_1\,R_2}{R_1 + R_2}$$

BASIC POSITIVE REGULATOR WITH ELECTRONIC SHUTDOWN FOR HIGH CURRENT APPLICATIONS[1,2]



$$V_O = V_{REF}\left(1 + \frac{R_3}{R_4}\right) \qquad R_1 = \frac{R_3\,R_4}{R_3 + R_4}$$

V_S = Sense Voltage

I_K = Maximum output current (Knee current)

$I_{10} \cong 130\ \mu A$

I_{SC} = Short circuit current

$$I_{SC} = \frac{V_S}{R_{SC}}\left(1 + \frac{R_5}{R_6}\right) - I_{10}\left(\frac{R_5}{R_{SC}}\right) \qquad I_K = I_{SC} + \frac{V_O}{R_{SC}}\left(\frac{R_5}{R_6}\right), \text{ where } \frac{R_5\,R_6}{R_5 + R_6} < \frac{V_S}{I_{10}}$$

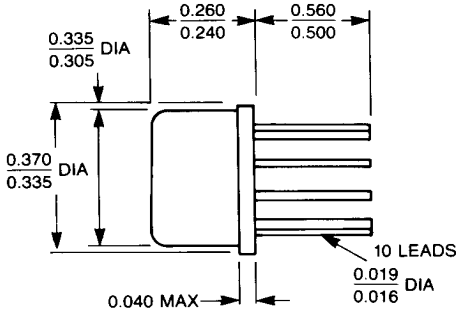
R_1 will minimize drift

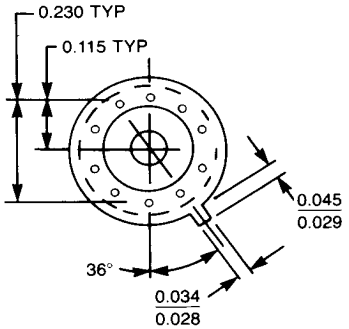
(1) Clamp pin #7 to 1V max.

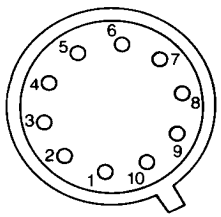
(2) To disable electronic shutdown, connect pin #7 to pin #5.

DEVICE OUTLINE

LAS 1000, 1100



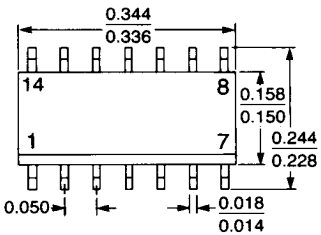


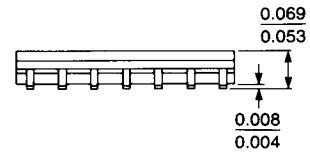


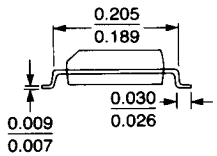
Bottom View

1	Current Sense
2	V_{REG} Inverting Input
3	V_{REG} Non-Inverting Input
4	V_{REF} Output
5	Common
6	Output
7	Electronic Shutdown
8	Input
9	Frequency Compensation
10	Current Limit

LAS 1100S







1	N/C
2	Current Limit
3	Current Sense
4	V_{REG} Inverting Input
5	V_{REG} Non-Inverting Input
6	V_{REF}
7	Common
8	N/C
9	N/C
10	Output
11	Electronic Shutdown
12	Input
13	Frequency Compensation
14	N/C

NOTE: All dimensions are in inches.