

Micropower Low Dropout Reference

May 1998

FEATURES

- 200mV Max Dropout at 10mA Output Current
- 4 μ A Typical Quiescent Current
- 0.15% Max Initial Accuracy
- No Output Capacitor Required
- Output Sources 10mA, Sinks 2mA
- 40ppm/ $^{\circ}$ C Max Drift Over Commercial Temp Range
- Load Regulation Over Temperature
0.1mV/mA, Source up to 10mA
1.75mV/mA, Sink up to 2mA
- 2.7V to 12.6V Supply Voltage Range

APPLICATIONS

- Battery Powered Systems
- Hand-Held Instruments
- Precision Power Supply
- A/D and D/A Converters

DESCRIPTION

The LTC[®]1258-2.5 is a micropower bandgap reference that combines high accuracy and low drift with very low supply current and small package size. The combination of ultralow quiescent current and low dropout voltage of only 200mV max makes it ideal for battery powered equipment.

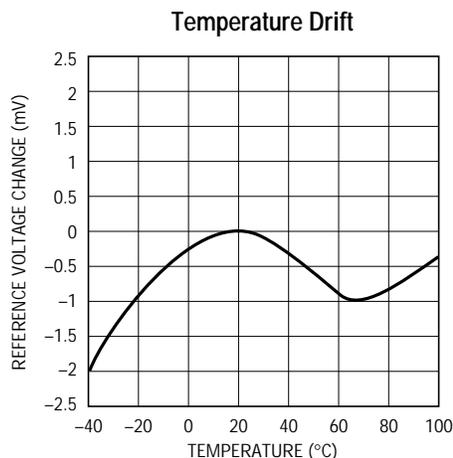
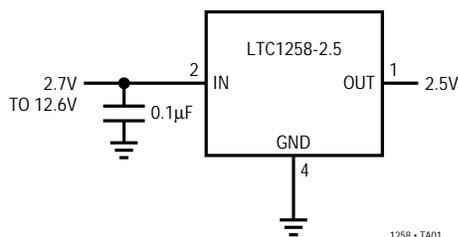
This reference uses curvature compensation to obtain low temperature coefficient and trimmed thin-film resistors to achieve high output accuracy. The reference can supply up to 10mA and sink up to 2mA, making it ideal for precision regulator applications. The LTC1258-2.5 is stable without an output bypass capacitor, but also is stable with capacitance up to 1 μ F. This feature is important in critical applications where PC board space is a premium and fast settling is demanded.

Series references provide power dissipation advantages over shunt references. In addition to supply current, shunt references must also idle the entire load current to operate.

The LTC1258-2.5 is available in the 8-pin SO package.

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TYPICAL APPLICATION



LTC1258-2.5

ABSOLUTE MAXIMUM RATINGS

Supply Voltage	13V
Input Voltages	-0.3V to 13V
Output Voltages	-0.3V to 13V
Output Short Circuit Duration	Indefinite
Operating Temperature Range	0°C to 70°C
Storage Temperature Range (Note 1)	-65°C to 150°C
Lead Temperature (Soldering, 10 sec)	300°C

PACKAGE/ORDER INFORMATION

<p>TOP VIEW</p> <p>S8 PACKAGE 8-LEAD PLASTIC SO</p> <p>$T_{JMAX} = 125^{\circ}\text{C}$, $\theta_{JA} = 190^{\circ}\text{C/W}$</p> <p>*CONNECTED INTERNALLY. DO NOT CONNECT EXTERNAL CIRCUITRY TO THESE PINS.</p>	ORDER PART NUMBER
	LTC1258CS8-2.5
	S8 PART MARKING
	12582

Consult factory for Industrial and Military grade parts.

ELECTRICAL CHARACTERISTICS $V_{IN} = 2.7\text{V}$, $I_{OUT} = 0\text{mA}$, $T_A = 25^{\circ}\text{C}$ unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS	
V_{IN}	Input Voltage Range	●	2.7		12.6	V	
I_{IN}	Input Current	●		4	6.5 8.5	μA μA	
V_{OUT}	Output Voltage (Note 2)		2.4963	2.5	2.5037	V	
e_n	Output Voltage Noise (Note 3)	$0.1\text{Hz} \leq f \leq 10\text{Hz}$		20		$\mu\text{Vp-p}$	
TC	Output Voltage Temp Coefficient (Note 4)	$T_{MIN} \leq T_J \leq T_{MAX}$	●	15	40	ppm/ $^{\circ}\text{C}$	
V_{OUT}/V_{IN}	Line Regulation	$V_{IN} = 2.7\text{V}$ to 12.6V	●	100	200	$\mu\text{V/V}$	
V_{OUT}/I_{OUT}	Load Regulation (Note 5)	Sourcing 0mA to 10mA	●	0.1	0.2 0.3	mV/mA mV/mA	
		Sinking 0mA to 2mA	●	1.75	3.5 5	mV/mA mV/mA	
I_{SC}	Short Circuit Output Current	V_{OUT} Shorted to GND		20	40	60	mA
		V_{OUT} Shorted to V_{IN}		2	4	10	mA
ΔV_{DO}	Dropout Voltage (Note 6)	$I_{OUT} = 0$, $\Delta V_{OUT} \leq 0.1\%$	●		100	mV	
		$I_{OUT} = 10\text{mA}$, $\Delta V_{OUT} \leq 0.1\%$	●		200	mV	
V_{HYST}	Output Hysteresis (Note 7)	$\Delta T = -40^{\circ}\text{C}$ to 85°C		200		ppm	
		$\Delta T = 0^{\circ}\text{C}$ to 70°C		50		ppm	

The ● denotes specifications which apply over the operating temperature range.

Note 1: If the part is stored outside of the specified operating temperature range, the output may shift due to hysteresis.

Note 2: ESD (Electrostatic Discharge) sensitive device. Extensive use of ESD protection devices are used internal to the LTC1258-2.5, however, high electrostatic discharge can damage or degrade the device. Use proper ESD handling precautions.

Note 3: Peak-to-peak noise is measured with a single highpass filter at 0.1Hz and 2-pole lowpass filter at 10Hz.

Note 4: Temperature coefficient is measured by dividing the change in output voltage by the specified operating temperature range.

Note 5: Load regulation is measured on a pulse basis from no load to the specified load current. Output changes due to die temperature change must be taken into account separately.

Note 6: Dropout voltage is $(V_{IN} - V_{OUT})$ when V_{OUT} falls to 0.1% below its nominal value at $V_{IN} = V_{OUT} + 0.5\text{V}$.

Note 7: Hysteresis in output voltage is created by package stress that differs depending on whether the IC was previously at a higher or lower temperature. Output voltage is always measured at 25°C, but the IC is cycled to 85°C or -40°C before successive measurements. Hysteresis is roughly proportional to the square of the temperature change. Hysteresis is not normally a problem for operational temperature excursions where the instrument might be stored at high or low temperature.

PIN FUNCTIONS

OUT (Pin 1): Reference Output. The output can source up to 10mA and sink up to 2mA. Stable with output bypass capacitor ranges from 0 μ F to 1 μ F.

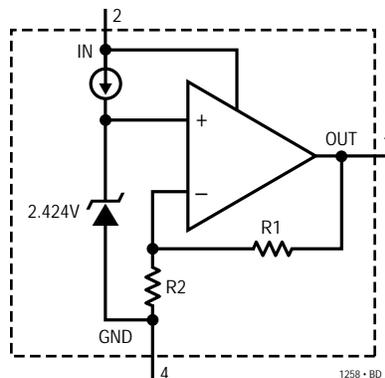
IN (Pin 2): Positive Supply. Bypass with a 0.1 μ F capacitor is recommended if the output loading changes.

$$(V_{OUT} + 0.2V) \leq V_{IN} \leq 12.6V.$$

GND (Pin 4): Negative Supply or Ground Connection.

NC (Pins 3, 5, 6, 7, 8): No Connection. Connected internally for post package trim. These pins should be left unconnected.

BLOCK DIAGRAM



APPLICATIONS INFORMATION

Longer Battery Life

Series references have an advantage over shunt style references. To operate, shunt references require a resistor between the power supply and the output. This resistor must be chosen to supply the maximum current that is demanded by the circuit being regulated. When the circuit being controlled is not operating at this maximum current, the shunt reference must always sink this current, resulting in high power dissipation and short battery life.

The LTC1258-2.5 series low dropout reference does not require a current setting resistor and can operate with any supply voltage from $(V_{OUT} + 0.2V)$ to 12.6V. When the circuitry being regulated does not demand current, the LTC1258-2.5 reduces its dissipation and battery life is extended. If the reference is not delivering load current it dissipates only 12 μ W on a 3V supply, yet the same connection can deliver 10mA of load current when demanded.

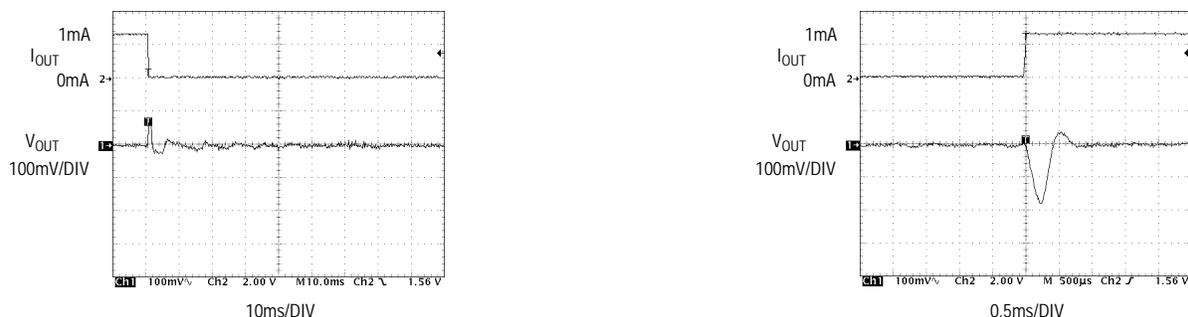


Figure 1. Reference Output Load Transient Response

