

### The Effect of Long-Term Drift on Voltage References

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Long-Term Drift (LTD) in voltage references is a parameter that can be confusing and misleading. It is given as a typical parameter in data sheets, but can cause significant accuracy limitations in system. Unlike tempco and initial accuracy, where a one-time calibration can be used to eliminate these errors, attempts to reduce LTD requires frequent system calibration. This can be both time consuming and expensive. Therefore, it is important to understand the significance of LTD.

Most data sheets specify LTD as ppm/1,000 hours. 1,000 hours is equal to 41.5 days, and in one year there are 8,766 hours. Therefore, if a part is specified to change by 70 ppm/1,000 hours, does this mean that in one year it will change by 613 ppm? No, it does not. This is a common mistake that is made by only reading the data sheet but not understanding what LTD really is.

The following graph shows a typical LTD curve of a typical ADI band gap reference. The output voltage of this part has been recorded every hour for 1,000 hours in a controlled environment with a temperature of 50°C.

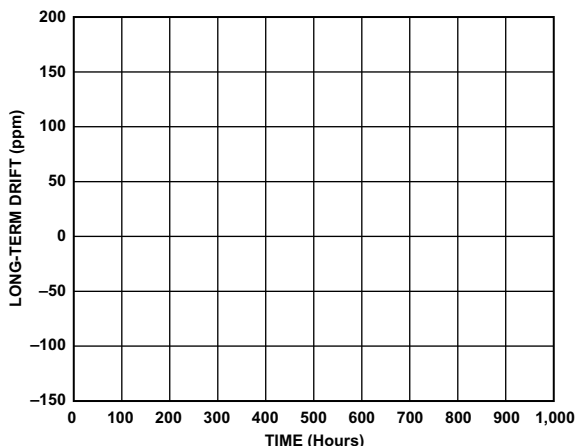


Figure 1. Typical Long-Term Drift Over 1,000 Hours

As the graph shows, in the first 200 hours there is a lot of movement in the part. After this initial movement there is very little change in the  $V_{OUT}$  for the last 800 hours. Over the next 1,000 hours the variation is normally less than one quarter of that in the first 1,000 hours. This trend continues with the change being an approximate cut in four from the previous time period. The changes in output take a “drunken walk” pattern: the changes are random and cannot be predicted, so the output might change positive in the first time period but negative in the second.

- 70 ppm/1,000 hours does not mean the part will change by 613 over one year but will change more in the area of 140 ppm/year
- The changes are random, so if the part starts off in one direction it does not mean it will continue in that direction

#### Ways to Eliminate LTD Effects

- Calibrate the system after 200 hours, thus eliminating the early changes
- Burn in the part for a short period of time to eliminate the early changes

