UT32M0R500 PCS Temperature Performance

APPLICATION NOTE

1.0 Introduction

This application note is to provide characterization information on the UT32M0R500's Precision Current Source (PCS) output current over the temperature range of the part. This appnote DOES NOT guarantee any performance outside the specifications listed in the device's Datasheet or SMD.

2.0 Data and Calculated Linear Regressions

The data used for this appnote covers the majority of historically tested material. The data shows that the PCS output current is within the targeted specification of ±1.5% at room temperature and within ±5% across the full temperature range specification. Below is a summary statistics table of the PCS measurements at three temperatures.

Temperature (°C)	Mean Output Current (mA)	Standard Deviation of Output Current (mA)	Min. Data (mA)	Max. Data (mA)	Delta (=Max. Data – Min. Data) (mA)	Number of Data Points
-55	1.006	0.004308	0.990	1.026	0.036	4054
25	0.997	0.002890	0.985	1.011	0.026	7480
105	0.979	0.003749	0.962	1.039	0.077	3732

Note that while there is a low standard deviation across all three temperatures, individual parts will occasionally be more than three standard deviations (3σ) from the mean at cold and hot temperature.

Using this data, four different Linear Regression equations were calculated, two to describe the change in the Mean Output Current and two to describe the change in the Standard Deviation at a given temperature.

2.1 Mean Output Current Linear Regressions

The below two linear regressions display the change in the mean output current between room-cold and room-hot temperatures.

Room-Cold Linear Regression:

$$Output\ Current\ (mA) = \left(-\frac{0.000125mA}{°C}\right) * Temperature(°C) + 0.999813mA$$

Room-Hot Linear Regression:

$$Output\ Current\ (mA) = \left(-\frac{0.00023mA}{°C}\right) * Temperature(°C) + 1.002625mA$$

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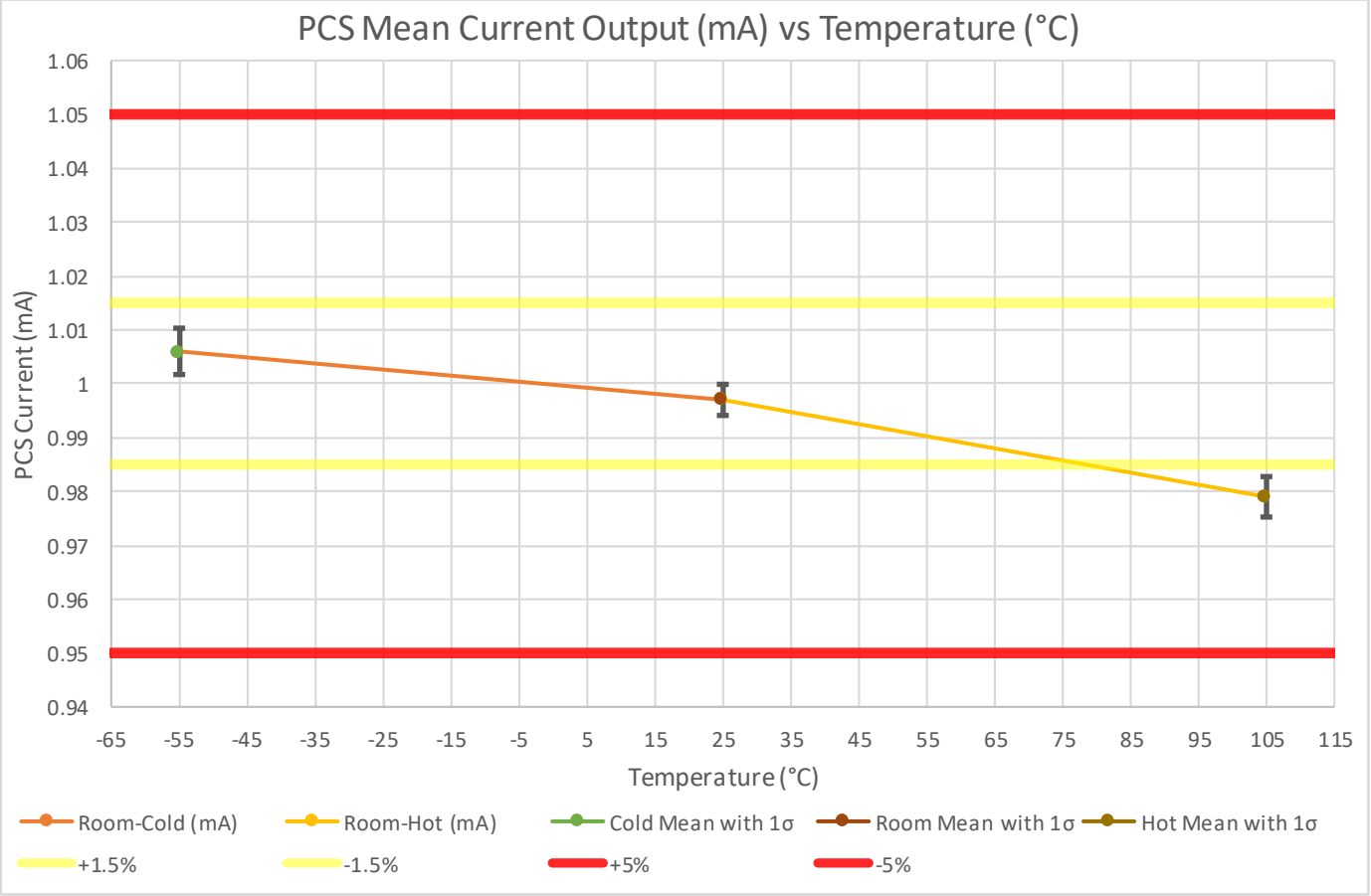
2.2 Mean Output Current Graph

The below graph gives users a visual representation of the Mean Current Output over temperature. The graph includes the two linear regressions from above, 1σ error bars on cold, room, and hot mean data points, and the ±1.5%@room and ±5%@full temperature range specification limits.



2.3 Standard Deviation Linear Regressions

The below two linear regressions display the change in the standard deviation of output currents between room-cold and room-hot temperatures.

Room-Cold Linear Regression:

$$Output\ Current\ (mA) = \left(-\frac{0.0000773mA}{°C}\right) * Temperature(°C) + 0.003333mA$$

Room-Hot Linear Regression:

$$Output\ Current\ (mA) = \left(-\frac{0.00001074mA}{°C}\right) * Temperature(°C) + 0.002621mA$$

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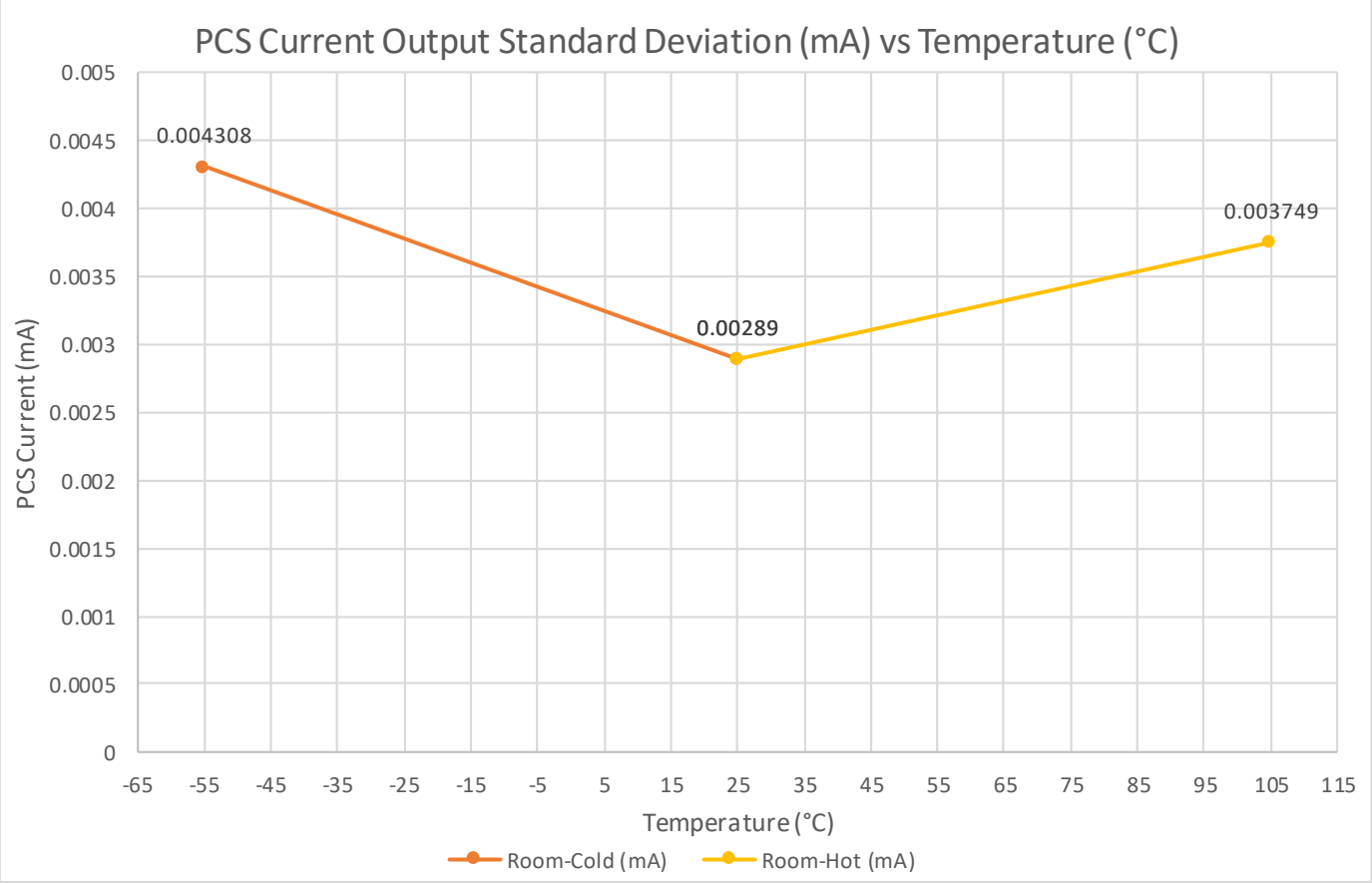
2.4 Standard Deviation Graph

The below graph gives users a visual representation of the change in Standard Deviations over temperature. The graph shows linear regressions calculated between room-cold and room-hot data.



3.0 Conclusion

The characterization data for the UT32M0R500's Precision Current Source peripheral shows how the output current is typically affected by the full temperature range of the part, as well as low standard deviation values at cold, room, and hot temperatures. This appnote DOES NOT guarantee any performance outside the specifications listed in the device's Datasheet or SMD.

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4.0 Revision History

Date	Rev. #	Author	Change Description
02/23/2021	0.0.1	OW	Initial Draft
02/25/2021	1.0.0	OW	Initial Release

The following United States (U.S.) Department of Commerce statement shall be applicable if these commodities, technology, or software are exported from the U.S.: These commodities, technology, or software were exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited.