LUMENERA QUICK START GUIDE

Lt16059H Thermal Characterisitics & Requirements

A guide to understanding the thermal characteristics of the high-performance Lt16059H camera and how to obtain the best performance

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OVERVIEW

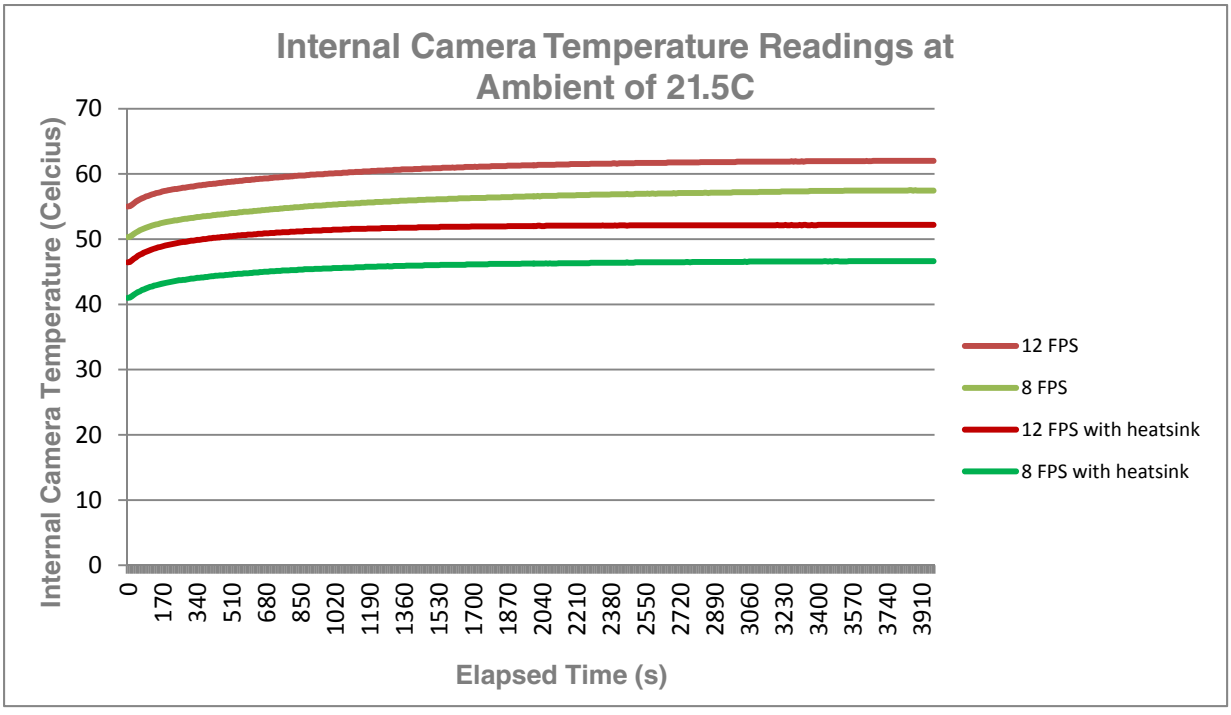
The Lt16059H camera uses the high-performance KAI-16070 CCD sensor combined with amplifiers and other circuitry required to read images off the sensor from 4 taps. This combination of technology, along with FPGAs and other components creates considerable heat within the camera housing. High operating temperatures impact the quality of images, thus the use of active and passive cooling techniques can improve operating and imaging performance of this camera. In deployments with very high ambient temperatures (50°C and above), heat sinking or convection cooling is required to avoid the risk of damage due to thermal overload.

Lumenera's Lt16059H camera design heat sinks the imager to the enclosure to aid in the dissipation of heat. The use of air convection or a heatsink attached to the enclosure will reduce the internal temperature of the camera.
Temperature Measurements

TEMPERATURE MEASUREMENTS

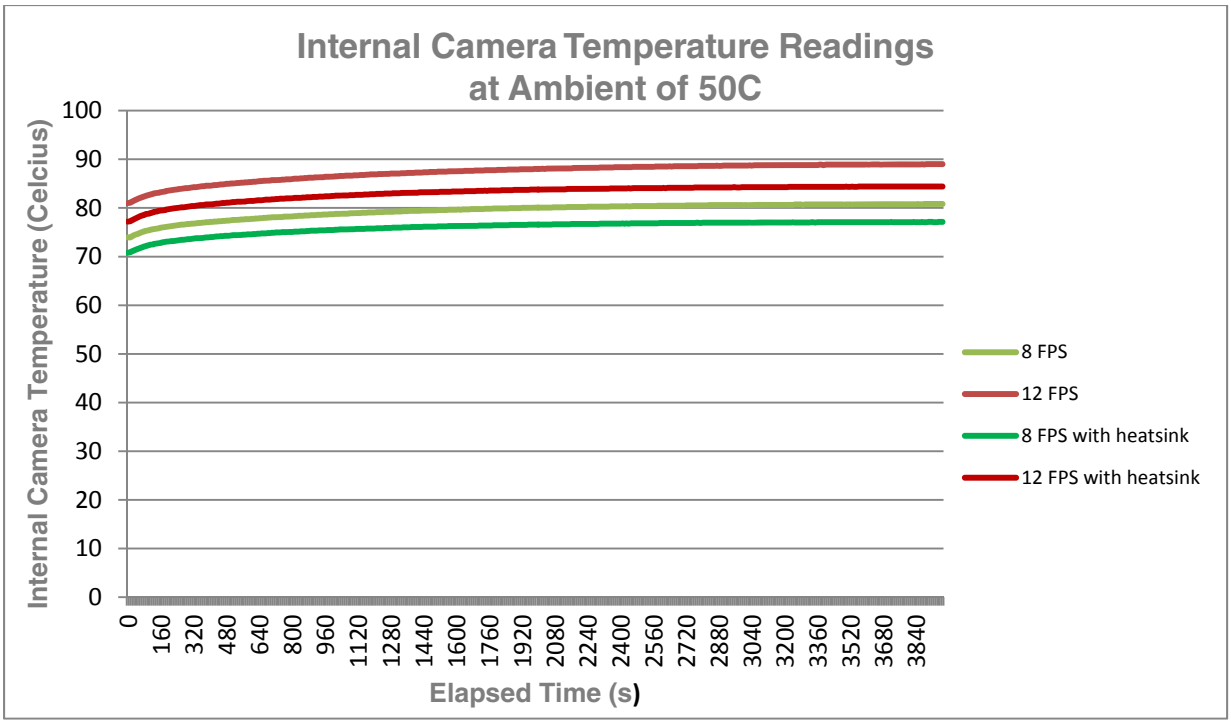
Environment at Room Temperature

Adding a heat sink to the design reduces the internal camera by approximately 10°C over the ramp up period to reach final operating temperature while the camera resides in an environment with an ambient temperature of approximately 21.5°C (see plots in figure 1). Figure 1 shows the temperatures measured inside the camera while operating in the overclocked mode at 12 frames per second (quad-tap mode, clock 0) and 2nd fastest frame rate (quad-tap mode, clock 1). Measurements were taken with the camera body isolated from thermal bridging and then with the camera body bridged with a heavy metal plate acting as a heat sink.



Environment at Maximum Recommended Temperature (50°C)

In figure 2, adding a heat sink to the design reduces the internal camera less than what is observed at room temperature due to the higher ambient temperature. The plots in figure 2 show the temperatures measured inside the camera while operating in the overclocked mode at 12 frames per second (quad-tap mode, clock 0) and 2nd fastest frame rate (quad-tap mode, clock 1). Measurements were taken with the camera body isolated from thermal bridging and then with the camera body bridged with a heavy metal plate acting as a heat sink. When the camera is operating at the fastest frame rate, the delta in temperature measured internally is 4.5°C between the camera with heat sink and without heat sink. When the camera is operating at 8fps, the delta in temperature measured internally is 3.7°C between the camera with heat sink and without heat sink.



RECOMMENDATIONS

As can be seen in the 2 test scenarios, using a heat sink reduces the internal operating temperature of the camera. When the camera is operating in ambient temperature situations, a heat sink is not necessary to comply with warranty conditions as the camera is operating well within normal operating specifications. Adding a heat sink or using air convection will improve imaging performance by reducing noise in images.

When operating the camera in high temperature environments (ie. 50°C / 122°F or more), it is strongly recommended that a heat sink or air flow across the enclosure be used to reduce the operating temperature of the camera. It is extremely important in cases where the camera will be operating at the fastest frame rate. If the camera is integrated into an enclosure as part of a larger system for applications such as ITS or UAV, then thermal regulation is all the more critical as temperatures can be very high at particular times of day and in warmer regions of

the world. Consider using a solid metal coupling to the enclosure if made of metal to aid with heat dissipation. Fans within the system enclosure can also improve the temperature of the camera, even if not venting directly to the exterior of the enclosure.

Enclosed system with venting to exterior

Enclosed system with air circulation inside system

Enclosed system camera thermal coupling to system metal enclosure

Since each application can be unique in how the camera is integrated and the environments deployed, Lumenera's pre-sales and post-sales team can provide suggestions to improve thermal conditions if required.