

Application Note:
Prosilica GT Camera Body Temperature

Overview

The improved thermal conductivity of the AVT Prosilica GT camera family allows for camera operation at an increased ambient temperature range from -20°C up to +65°C.

This is achieved in the GT by minimizing the temperature differential between the heat generating internal camera components and the camera body, through a uniquely designed thermal housing.

This document explains the correlation between ambient temperature and camera body temperature.



Figure 1: Prosilica GT thermal housing

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Ambient temperature range is camera model dependent. See Prosilica GT technical manual for more details:

http://www.alliedvisiontec.com/fileadmin/content/PDF/Products/Technical_Manual/GT_Series/GT_TechMan_70-0070.pdf

Free convection cooling

The temperature differential between the camera body (T_B) and the surrounding air temperature (T_A) is defined by Newton's Law of Cooling for free convection:

$$Q = H_C \times A \times (T_B - T_A)$$

Q = Rate of heat. This is equal to camera power consumption, in Watts.

H_C = Convection heat-transfer coefficient of air. This will vary depending on the density and humidity of the air. In general, H_C of air = 5 – 25 W/m²°C. AVT's lab tests measured this at 12.3 W/m²°C.

A = Object's exposed area. Depending on the sensor type, the Prosilica GT comes in a short (86 mm) or long (92 mm) case. $A_{SHORT} = 0.0184 \text{ m}^2$, $A_{LONG} = 0.0194 \text{ m}^2$.

T_B = Camera body temperature. For AVT lab tests, this was measured on the bottom face of the camera— T_B = the hottest point. Testing showed less than 2°C temperature differential between all points on the camera body.

T_A = Ambient temperature, defined as the air temperature surrounding a camera, not influenced by the heat radiating from the camera itself. For AVT lab tests, T_A was measured 60 cm away from the camera body.

Testing methodology

A GT1380 with a measured power consumption of 3.4 W and surface area of 0.0184 m^2 was brought to thermal stability over a period of one hour. Using a thermocouple probe, T_A was measured at 25°C and T_B at 40°C .

$$H_C = \frac{3.4}{(0.0184 \times (40 - 25))} = 12.3 \text{ W}/(\text{m}^2\text{°C})$$

The test was repeated with a GT2300 at 5.4 W with a surface area 0.0194 m^2 for the same result in H_C .

Results

Using Newton's law of cooling, camera body temperature can be calculated at any ambient temperature by applying the appropriate camera area, power consumption, and H_C value.

T_A °C	T_B °C			
	GT1290 - 2.9 W	GT1380 - 3.4 W	GT1600 - 3.3 W	GT2450 - 3.8 W
20	33	35	35	37
25	38	40	40	42
30	43	45	45	47
35	48	50	50	52
40	53	55	55	57
45	58	60	60	62
50	63	65	65	67
55	68	70	70	72
60	73	75	75	77
65	78	80	80	82

Table 1: Prosilica GT "Short" T_B calculations. $A = 0.0184 \text{ m}^2$. $H_C = 12.3 \text{ W}/\text{m}^2\text{°C}$

T_A °C	T_B °C					
	GT1660 - 5.1 W	GT1910 - 5.1 W	GT1920 - 4.9 W	GT2300 - 5.4 W	GT2750 - 5.4 W	GT3300 - 5.6 W
20	41	41	41	43	43	43
25	46	46	46	48	48	48
30	51	51	51	53	53	53
35	56	56	56	58	58	58
40	61	61	61	63	63	63
45	66	66	66	68	68	68
50	71	71	71	73	73	73
55	76	76	76	78	78	78
60	81	81	81	83	83	83
65	86	86	86	88	88	88

Table 2: Prosilica GT "Long" T_B measurements. $A = 0.0194 \text{ m}^2$. $H_C = 12.3 \text{ W}/\text{m}^2\text{°C}$

Further reduction of camera body temperature

In demanding ambient temperature applications, it may be desirable to further reduce T_B , thereby reducing the temperature of the camera's internal components. There are several ways of doing this:

- Increase camera surface area (A). This could be achieved by attaching a heat sink to the camera. Care should be taken to ensure proper thermal bonding between the camera body and a heat sink.
- Reduce ambient temperature (T_A). For example, in an outdoor application with direct sunlight, provide shading using an enclosure.
- Forced convection cooling, via air flow over the camera body.



Figure 2: Prosilica GT in a [Bosch UHO-HBGS-10](#) enclosure with fan

Additional references

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See the GT Technical Manual for additional camera specifications:

http://www.alliedvisiontec.com/fileadmin/content/PDF/Products/Technical_Manual/GT_Series/GT_TechMan_70-0070.pdf

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