Amphenol Aerospace

CF-020400-438

Thermal Analysis

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Objectives

1. To determine that the critical components on the CF-020400-69 board are within their thermal limits for the following cases:

   a) -40°C at sea level

   b) 85°C at sea level

   At 2 different power levels:

   a) Predicted – Total Power of 29.91 W

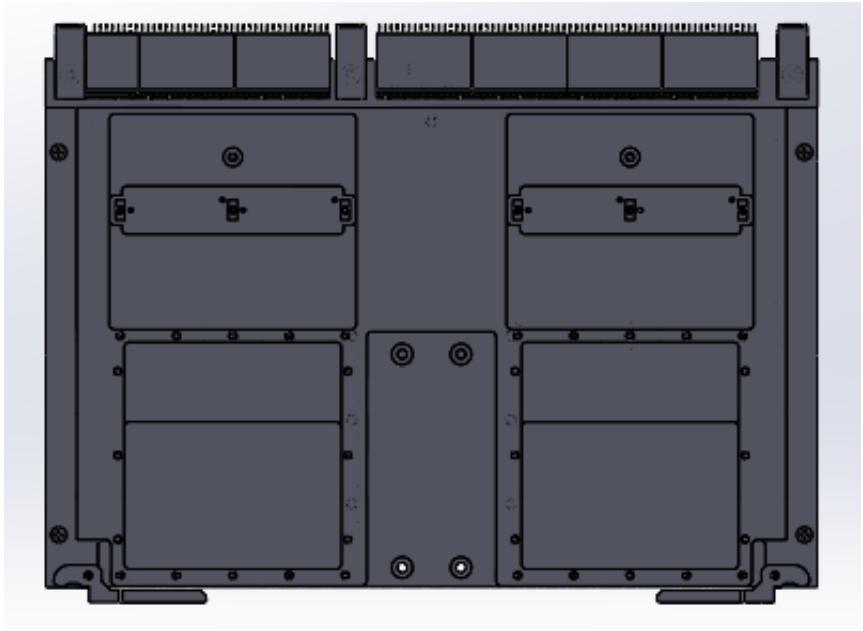
   b) Worst Case – Total Power of 37.21 W

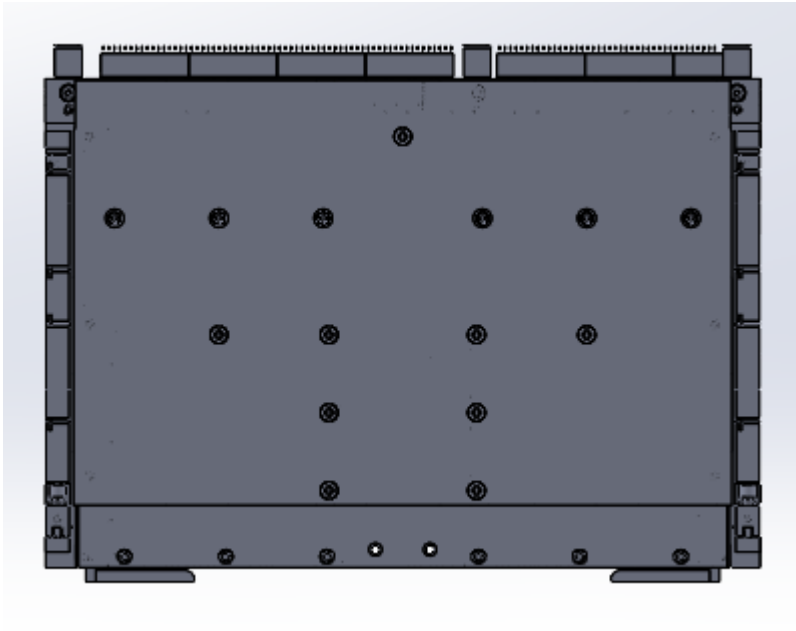
Approach

1. This analysis was done using FloTHERM XT V2021.1 CFD software.
2. The updated thermal model was created from the cf-020400-438m_asm file provided for thermal analysis.
3. The PCB components were obtained from the PDML files provided.
4. It was assumed that no neighboring devices were producing or sinking heat.
5. Gravity has been taken in the vertical direction.
6. The housing and rear cover were assigned Al 6061 T6 as the material.
7. Thermal gap pads have been used for the components : 1.00” , with a thermal conductivity of 10.0 W/m-K.
8. The critical components were modeled as 2-resistor networks with thermal resistance values found on the “Parts Thermal Characteristics.doc”.

Thermal Model Setup

Thermal Model Setup – Overview





Enclosure Material –Al6061 T6 as Rest of Housing & Rear Cover.

Thermal Data

CF-020400-54	Predicted			Worst Case			Thermal Resistance (ºC/W)/Model	
Component	Qty	Per Component	Total	Qty	Per Component	Total	R_{JB}	R_{JC}
BCM84894	2	6.016	12.032	2	7.520	15.04	2.38	1.26
TLK10034	2	4.518	9.036	2	5.648	11.296	7.9	0.2
BCM54140	2	1.517	3.034	2	1.820	3.64	10.29	9.78
LTM4633	2	1.219	2.438	2	1.510	3.02	4.0	5.0
LTM4627	2	1.119	2.238	2	1.399	2.798	6.1	15.0
TPS54821RHLR	2	0.323	0.646	2	0.403	0.806	14.4	64.8
NCP3170ADR2G	2	0.243	0.486	2	0.304	0.608	22.7	37.8
		Total	29.910		Total	37.208		

Note: Thermal resistances from junction to case (R_{JC}) and from junction to board (R_{JB}) and thermal limits were taken from “Parts Thermal Characteristics”.

Thermal Analysis

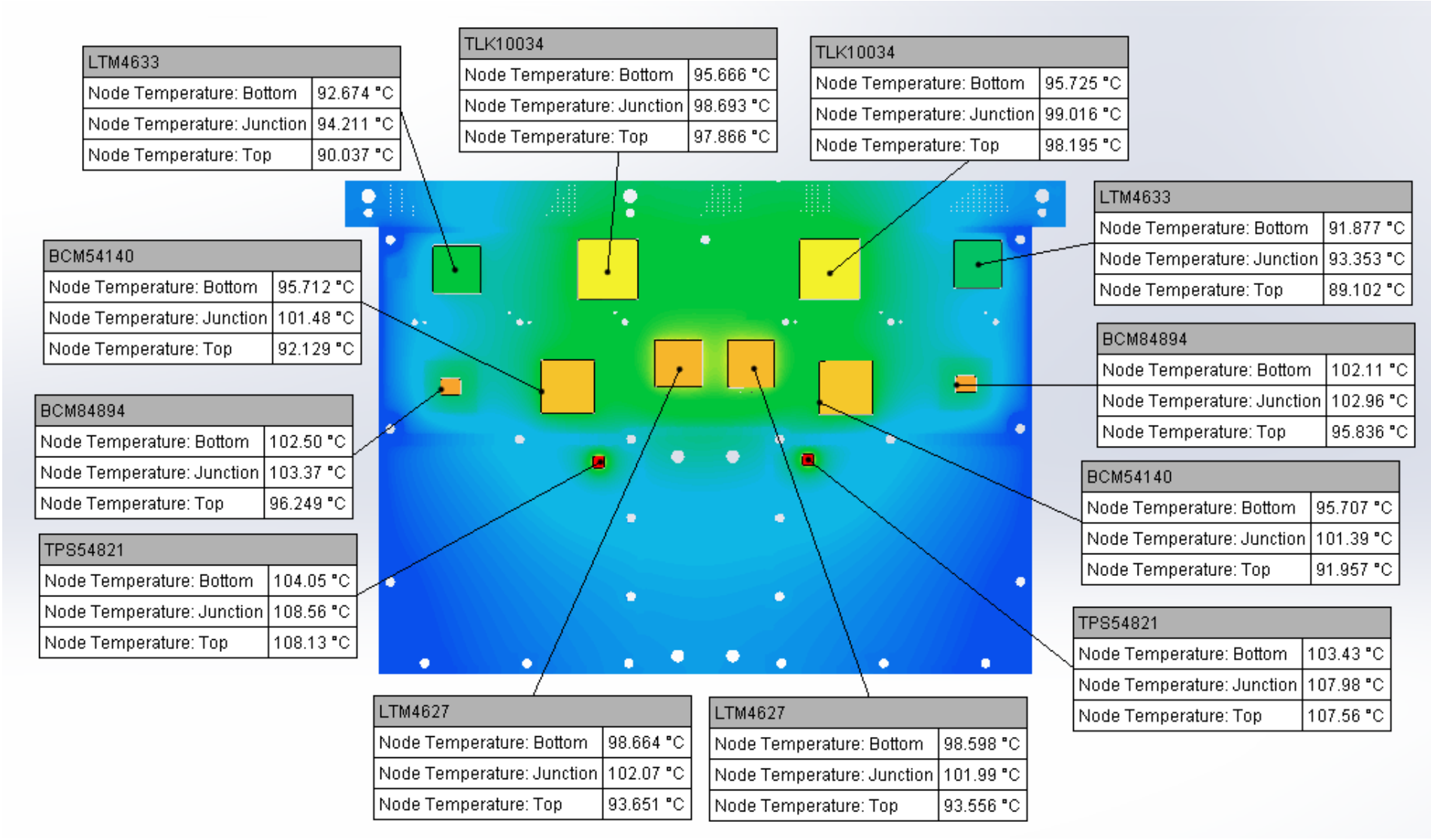
Results Summary – Comparison between Temperature Cases

Al 6061 T6 Housing & Al 6061 T6 Rear Cover															
Parameters				Sim 1			Sim 3			Sim 2			Sim 4		
Power Scenario				Predicted			Predicted			Worst Case			Worst Case		
Cooling Rail Temperature °C				85			-40			85			-40		
Ambient Temp., °C				85			-40			85			-40		
Elevation, ft				0			0			0			0		
RESULTS															
Component	**Min. Limit, °C**	**Max. Limit, °C**	**Limit Type**	**Power, W**	**Result, °C**	**Margin, °C**	**Power W**	**Result, °C**	**Margin from Negative Temp, °C**	**Power, W**	**Result, °C**	**Margin °C**	**Power, W**	**Result, °C**	**Margin from Negative Temp, Margin, °C**
BCM84894	-40	110	junction	6.016	103.4	6.6	6.016	-21.6	18.4	7.520	107.3	2.7	7.520	-17.2	22.8
TLK10034	-40	105	Junction	4.518	99.0	6.0	4.518	-25.2	14.8	5.648	102.5	2.5	5.648	-21.8	18.2
BCM54140	-40	125	junction	1.517	101.5	23.5	1.517	-22.6	17.4	1.820	105.0	20.0	1.820	-19.1	20.9
LTM4633	-55	125	junction	1.219	94.2	30.8	1.219	-30.6	24.4	1.510	96.4	28.6	1.510	-29.0	26.0
LTM4627	-40	125	junction	1.119	102.1	22.9	1.119	-20.8	19.2	1.399	106.2	18.8	1.399	-17.5	22.5
TPS54821RHLR	-40	125	junction	0.323	108.5	16.5	0.323	-13.0	27.0	0.403	114.3	10.7	0.403	-10.3	29.7
NCP3170ADR2G	-40	125	junction	0.243	107.5	17.5	0.243	-13.5	26.5	0.304	113.1	11.9	0.304	-10.8	29.2

85 C Ambient, Vertical, 85C Cooling Rails
Al 6061 T6 Housing & Al 6061 T6 Rear Cover
Predicted Power

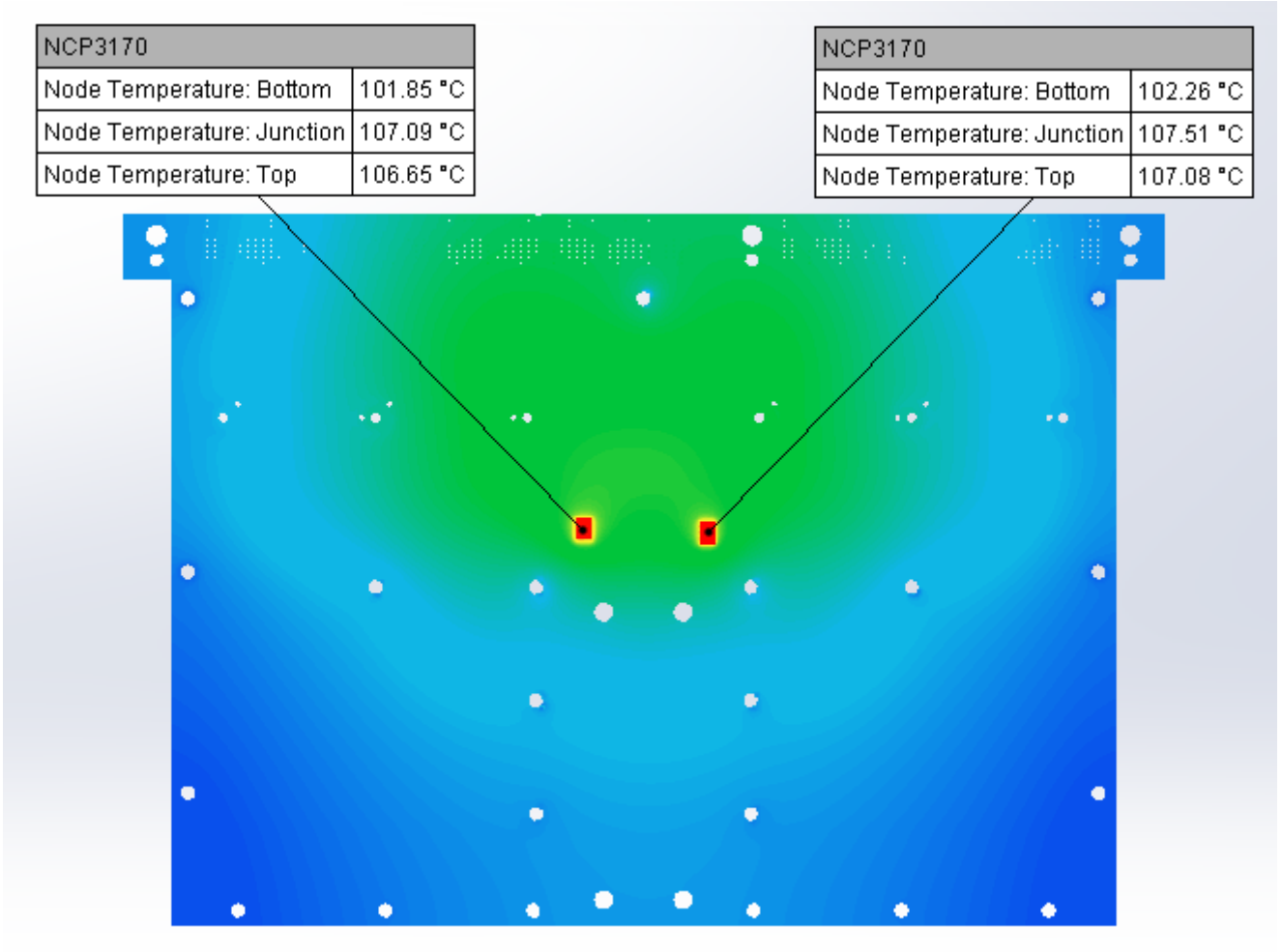
PCB Top Components Temperature Plot

85°C , sea level



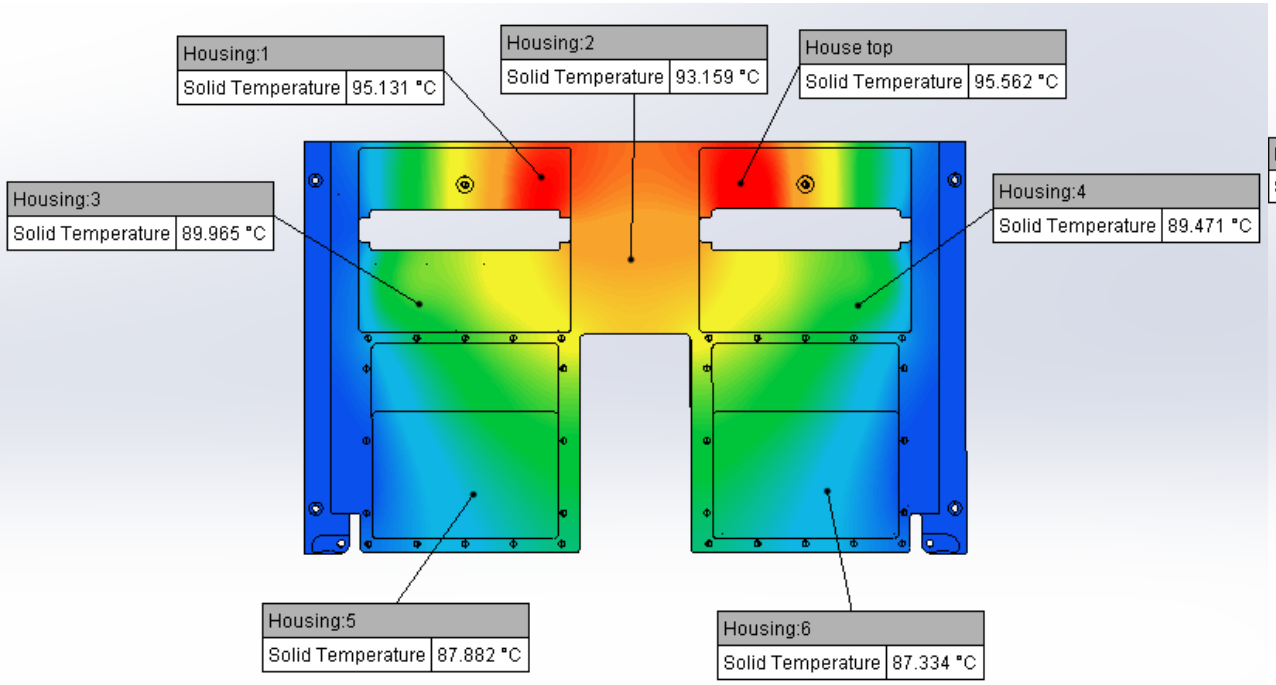
PCB Bottom Components Temperature Plot

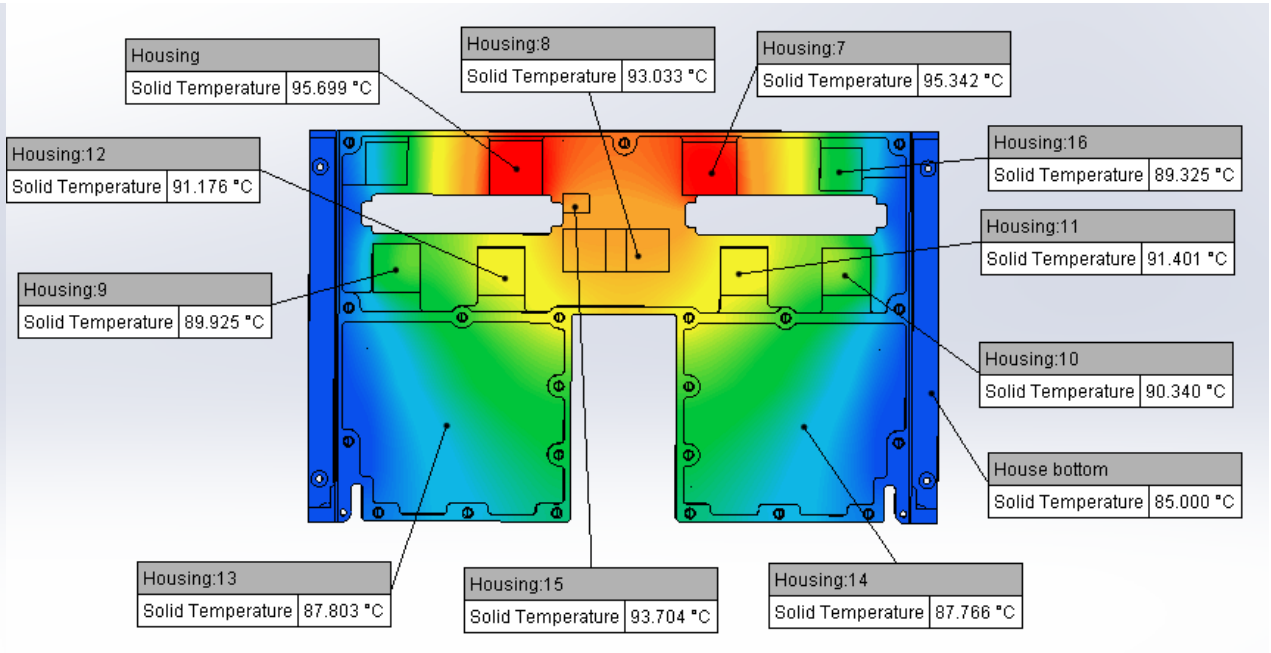
85°C , sea level

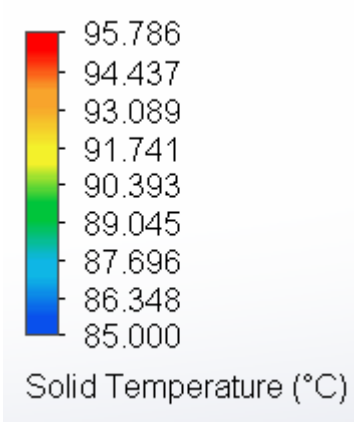


Housing Surface Temperature Plot

85°C , sea level





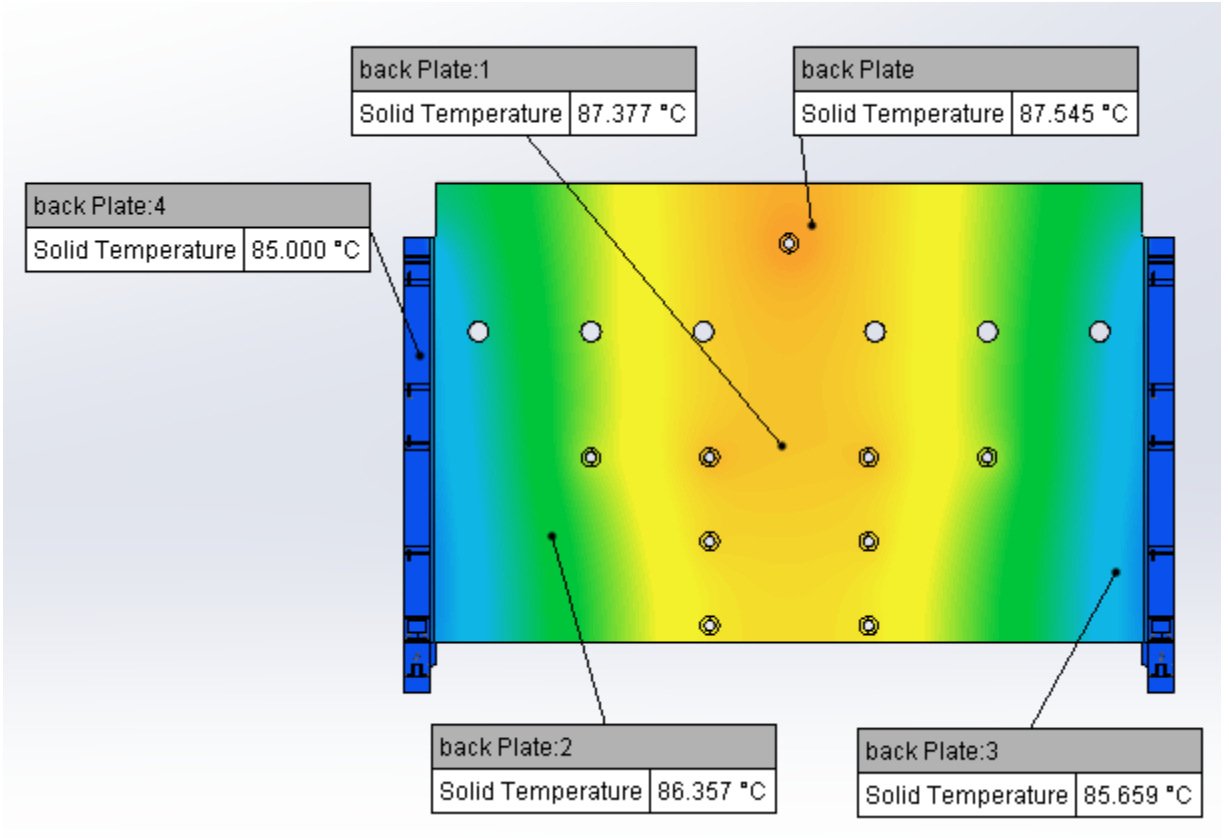


Top Side

Bottom Side

Rear Cover Temperature Plot

85°C , sea level

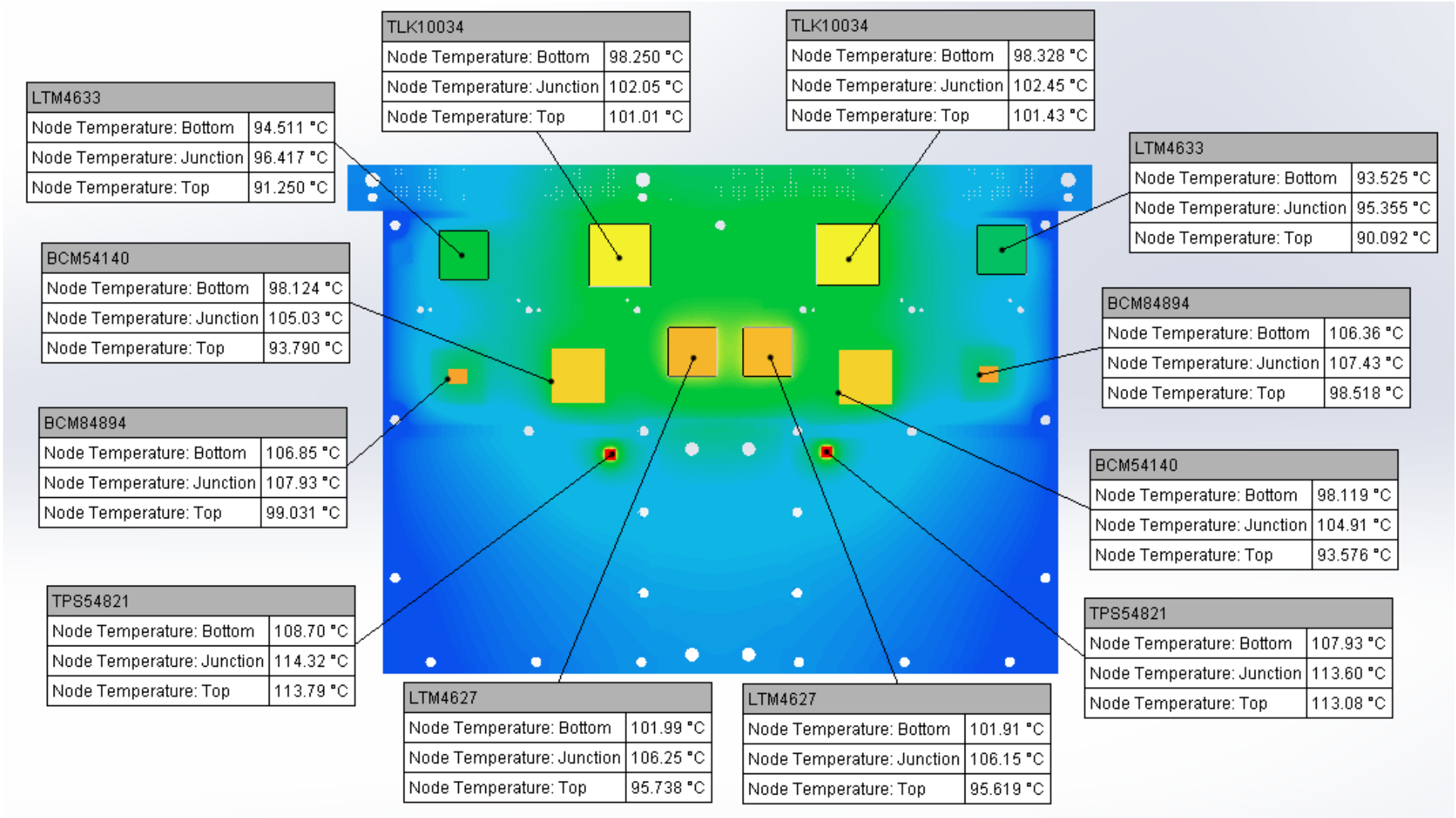


Top Side

85C Ambient, Vertical, 85C Cooling Rails
Al 6061 T6 Housing & Al 6061 T6 Rear Cover
Worst Case Power

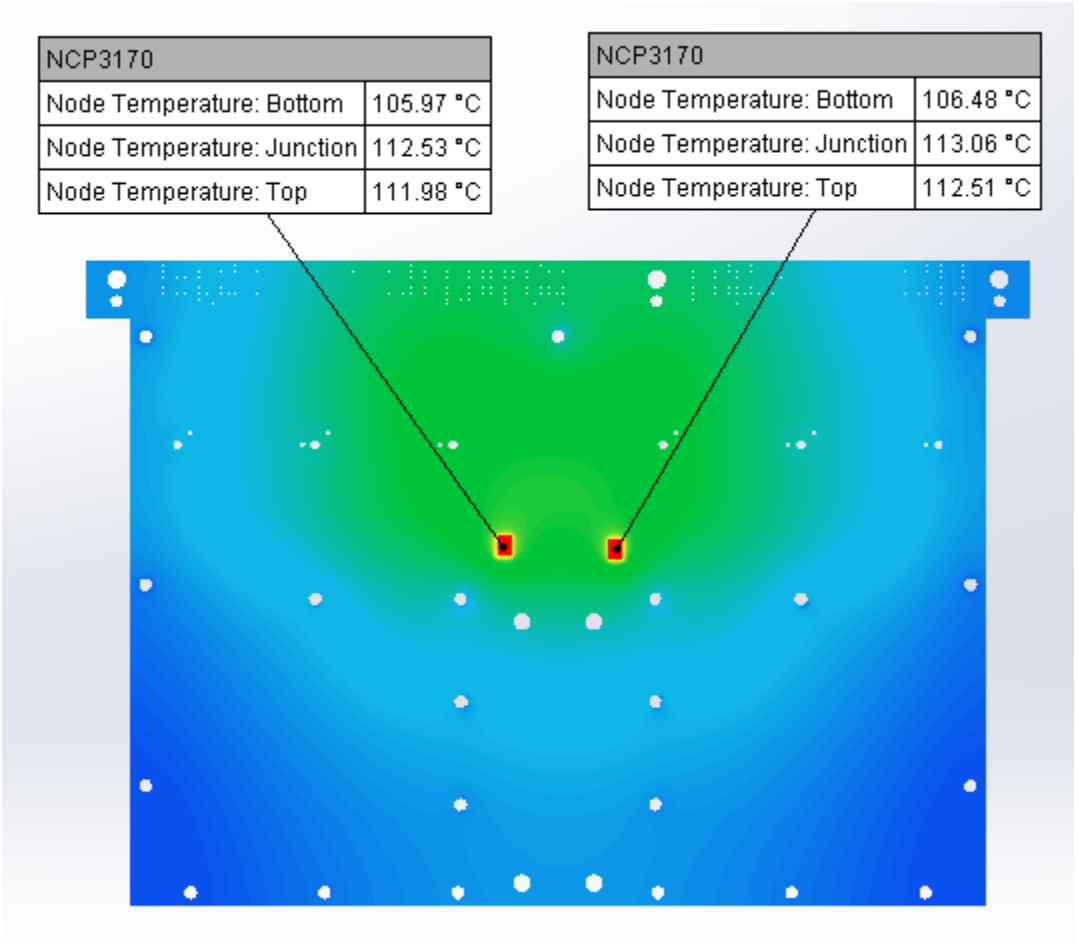
PCB Top Components Temperature Plot

85°C , sea level



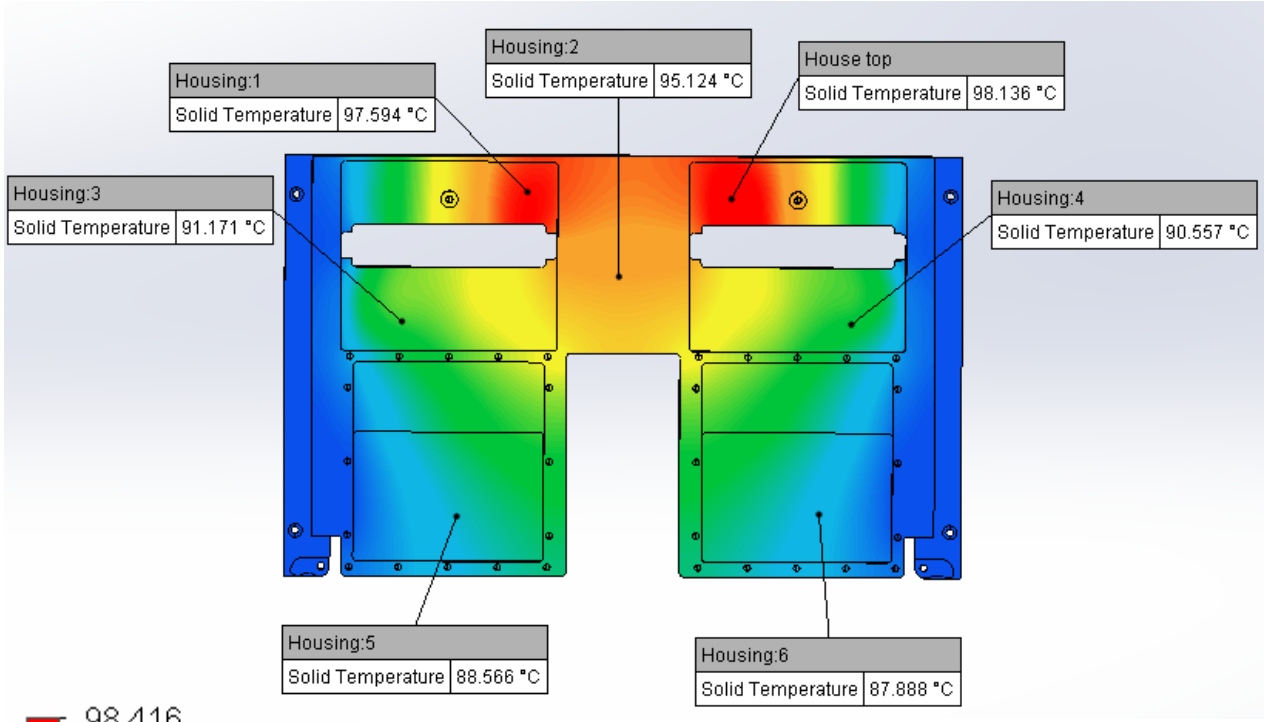
PCB Bottom Components Temperature Plot

85°C , sea level

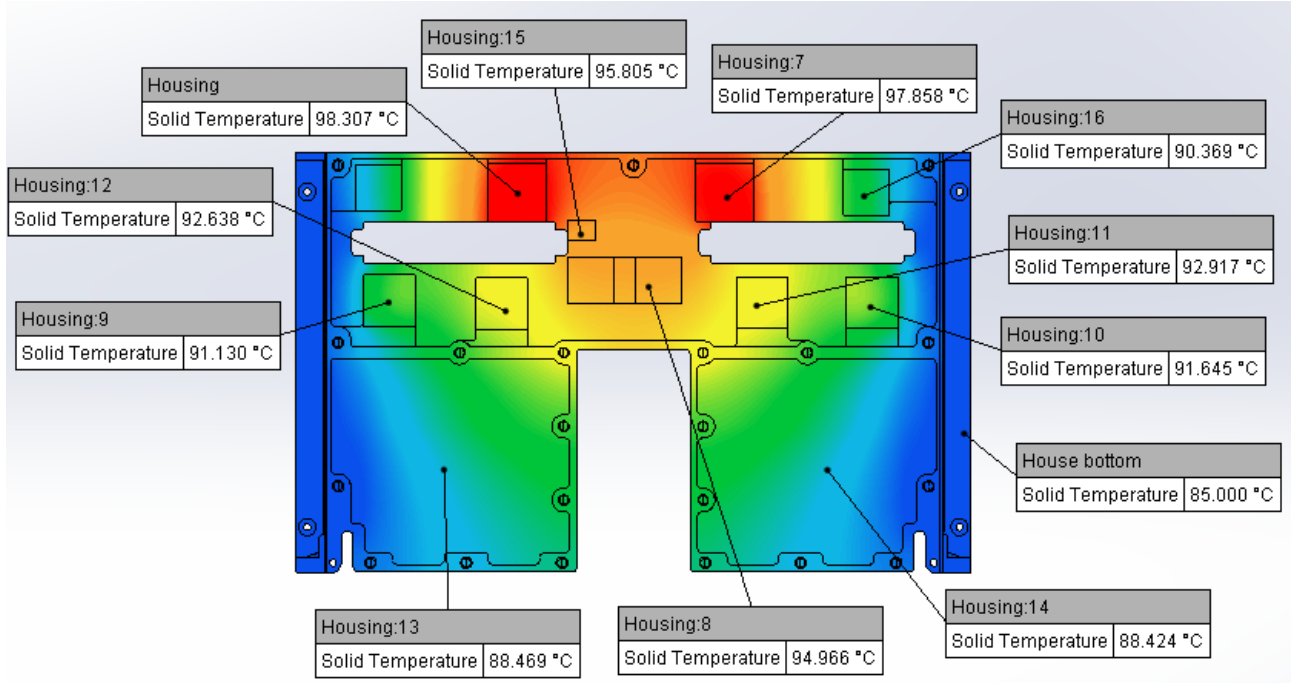


Housing Surface Temperature Plot

85°C , sea level



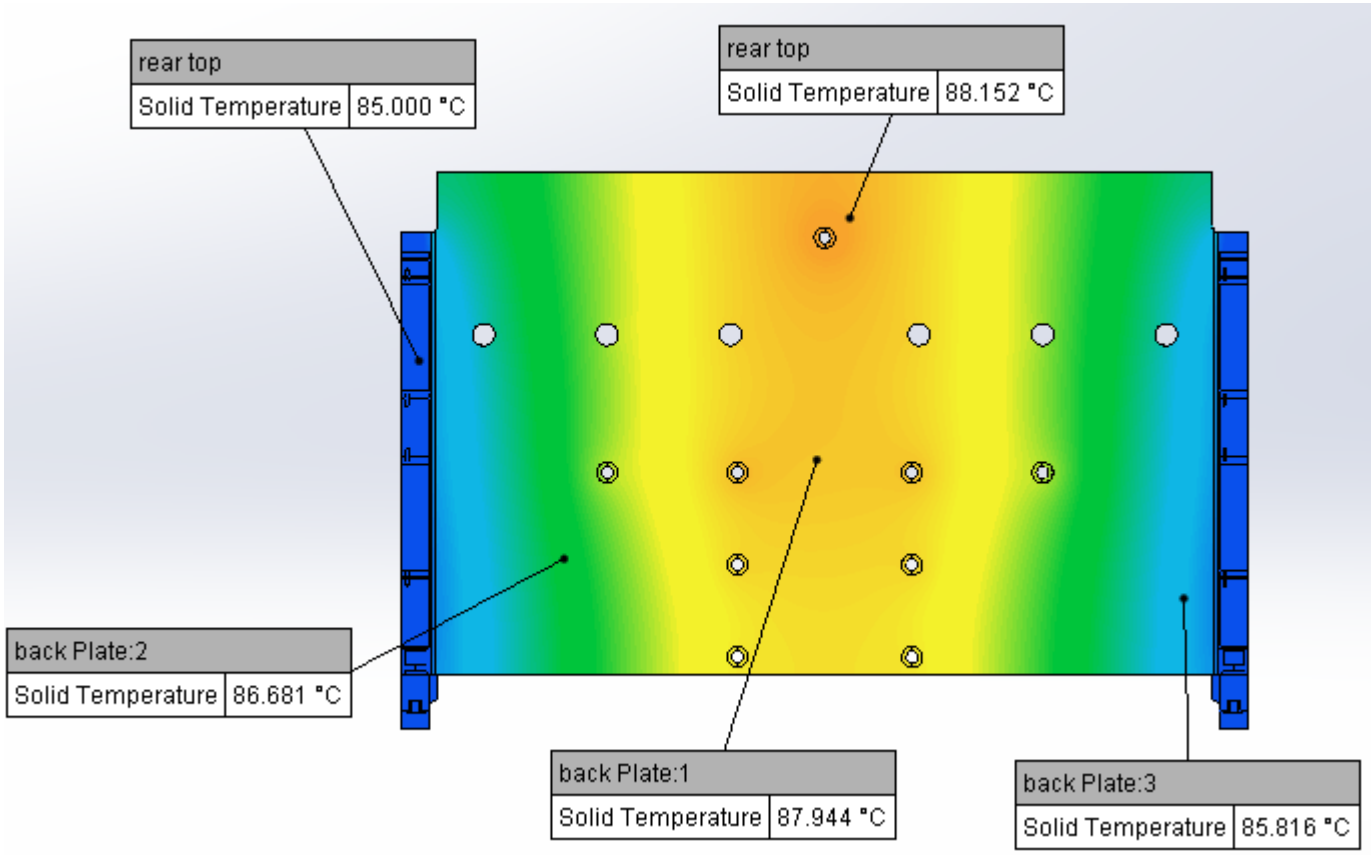
Top Side



Bottom Side

Rear Cover Temperature Plot

85°C , sea level

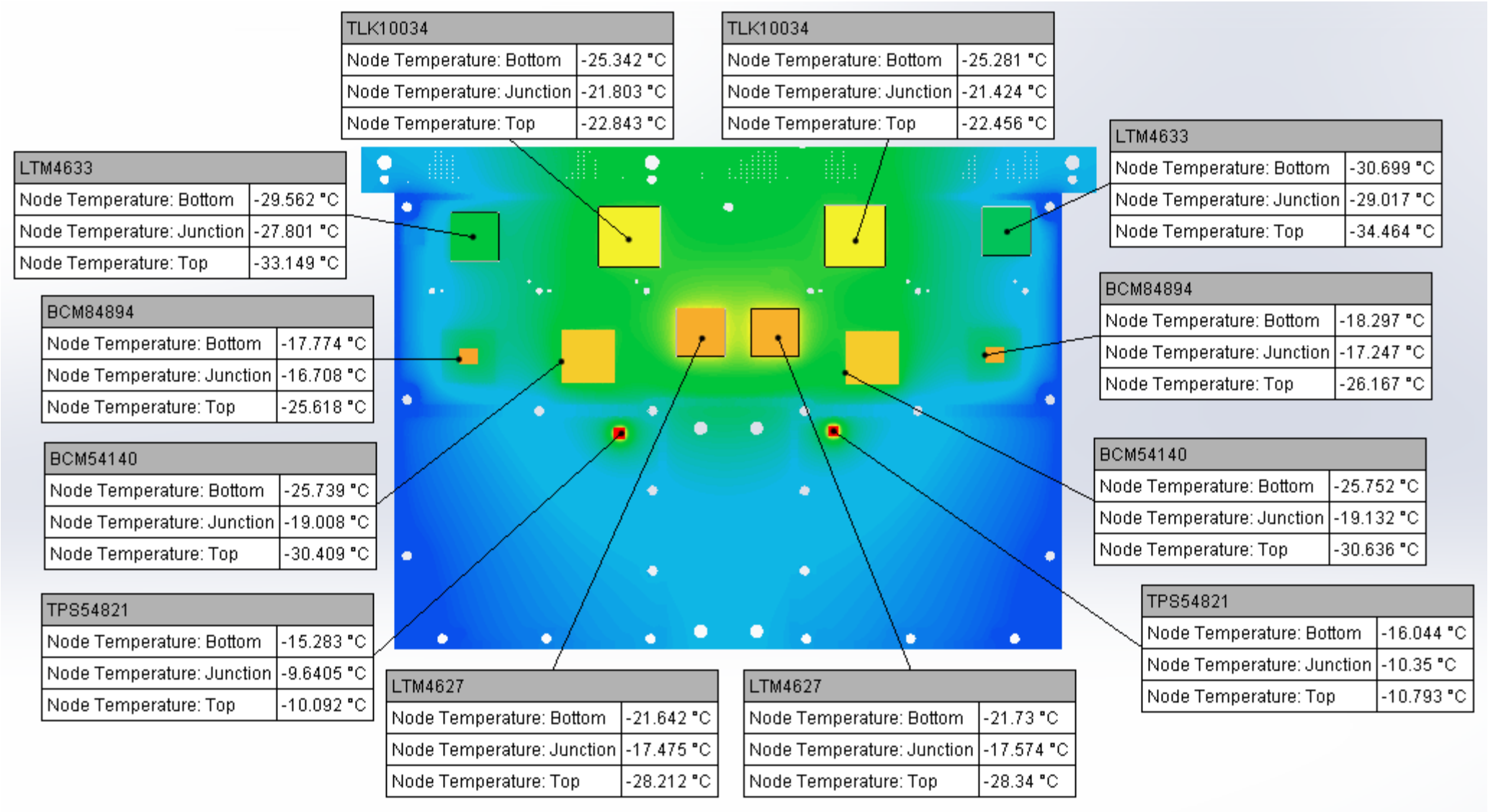


Top Side

-40C Ambient, Vertical, -40C Cooling Rails
Al 6061 T6 Housing & Al 6061 T6 Rear Cover
Worst Case Power

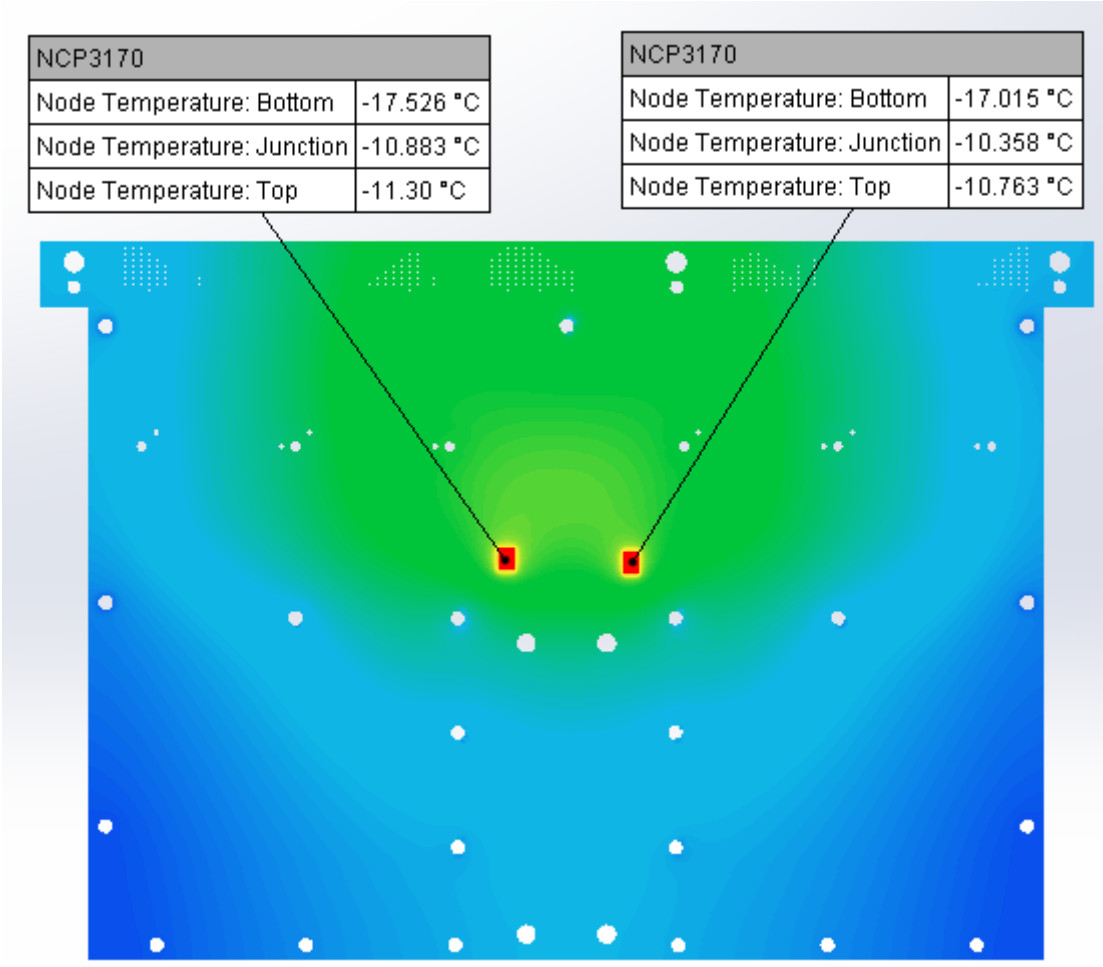
PCB Top Components Temperature Plot

-40°C , sea level



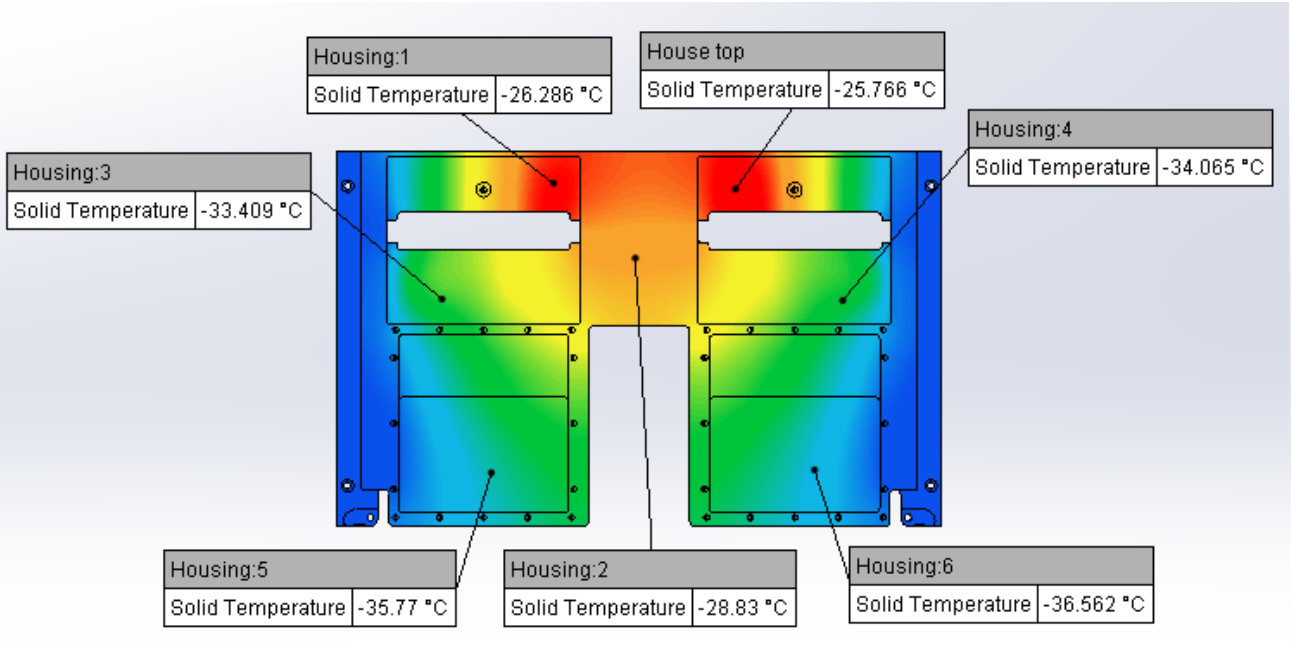
PCB Bottom Components Temperature Plot

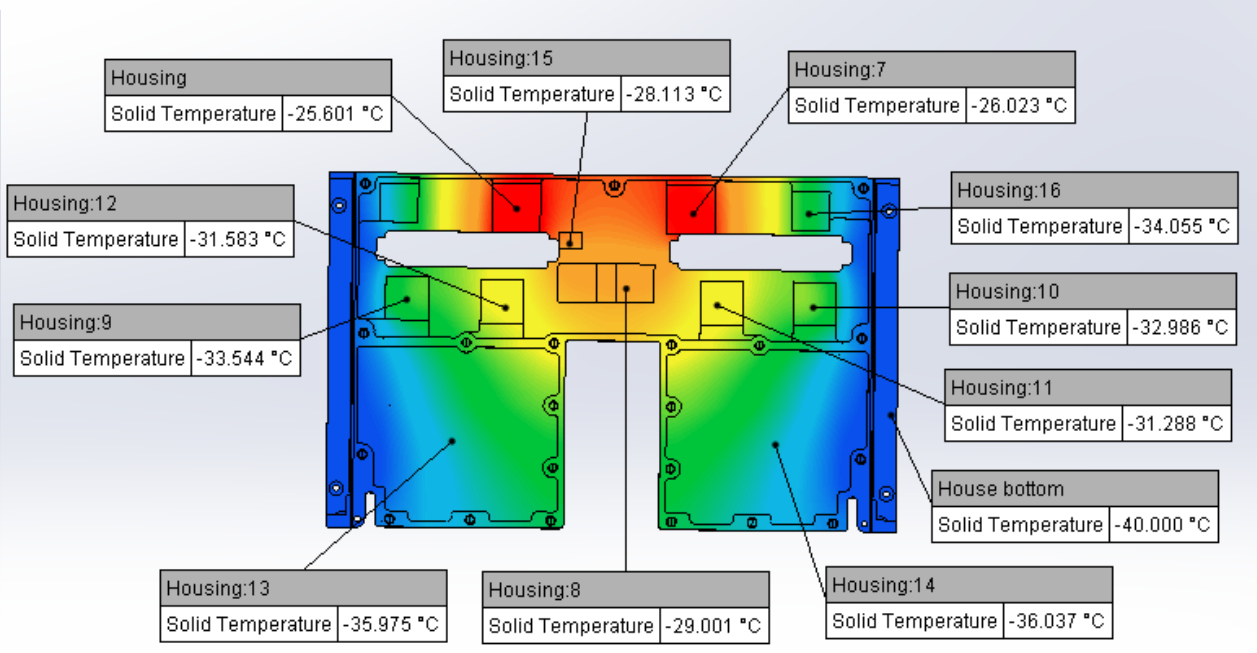
-40°C , sea level

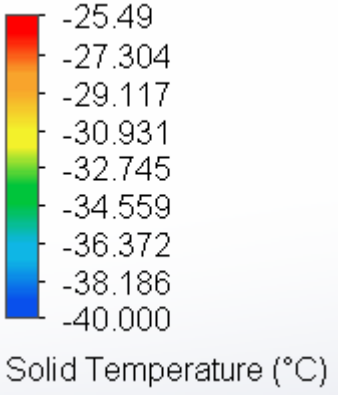


Housing Surface Temperature Plot

-40°C , sea level





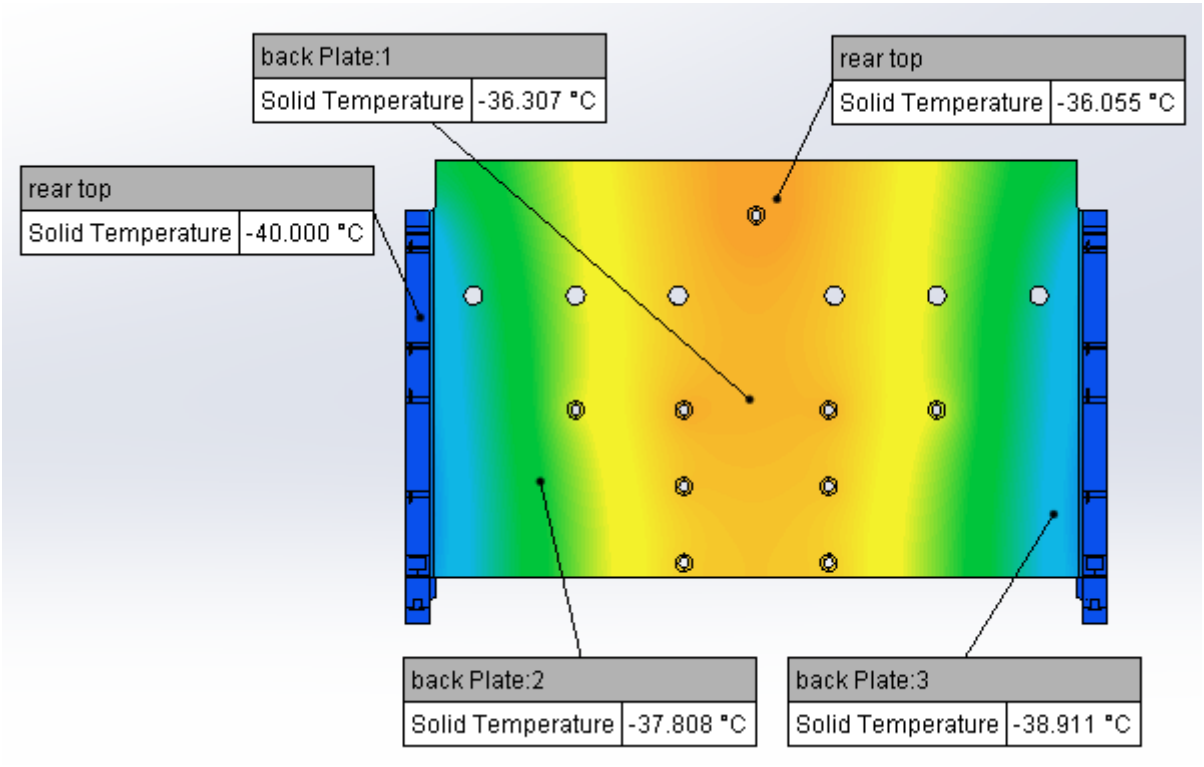


Top Side

Bottom Side

Rear Cover Temperature Plot

-40°C , sea level

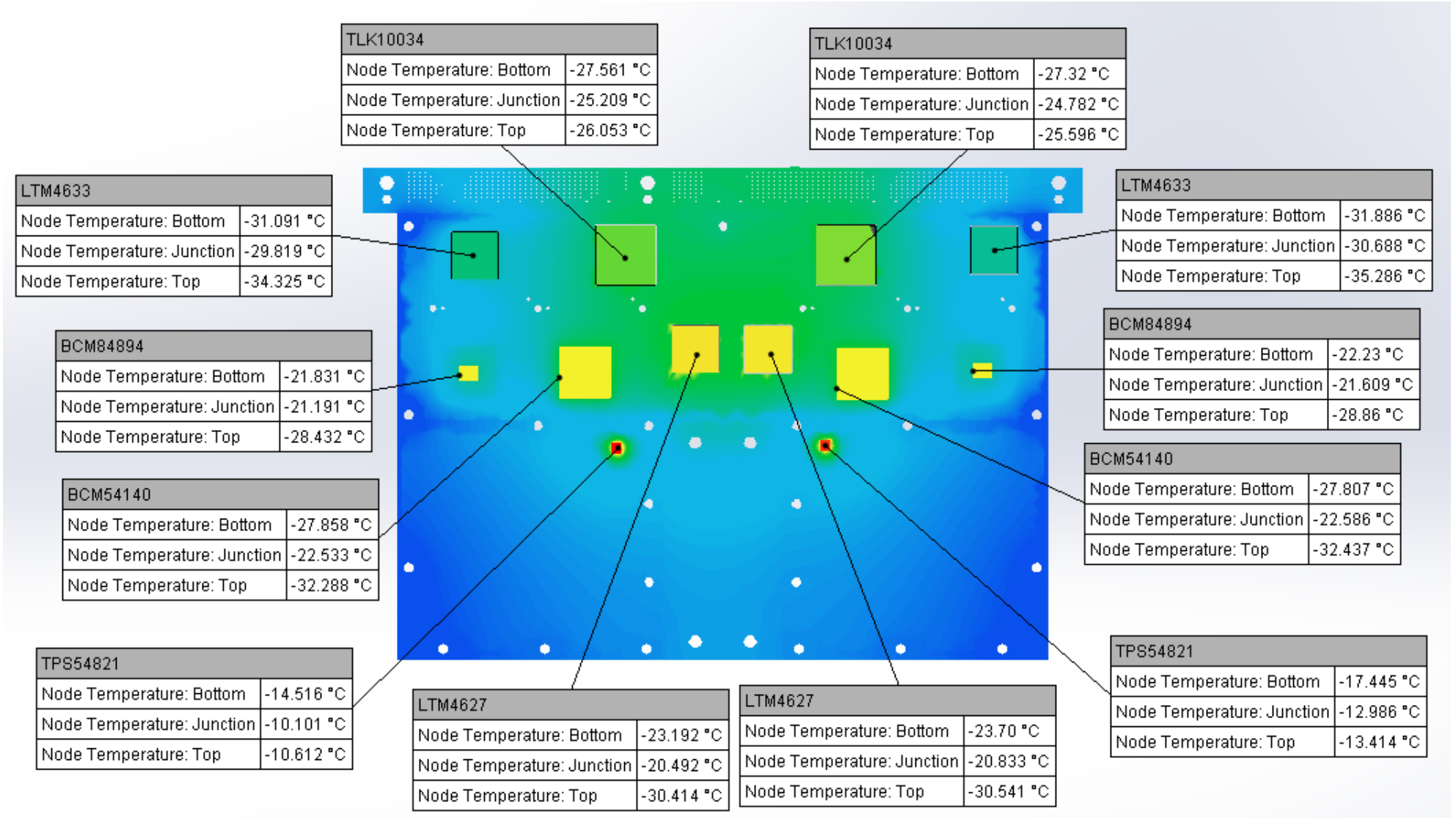


Top Side

-40C Ambient, Vertical, -40C Cooling Rails
Al 6061 T6 Housing & Al 6061 T6 Rear Cover
Predicted Power

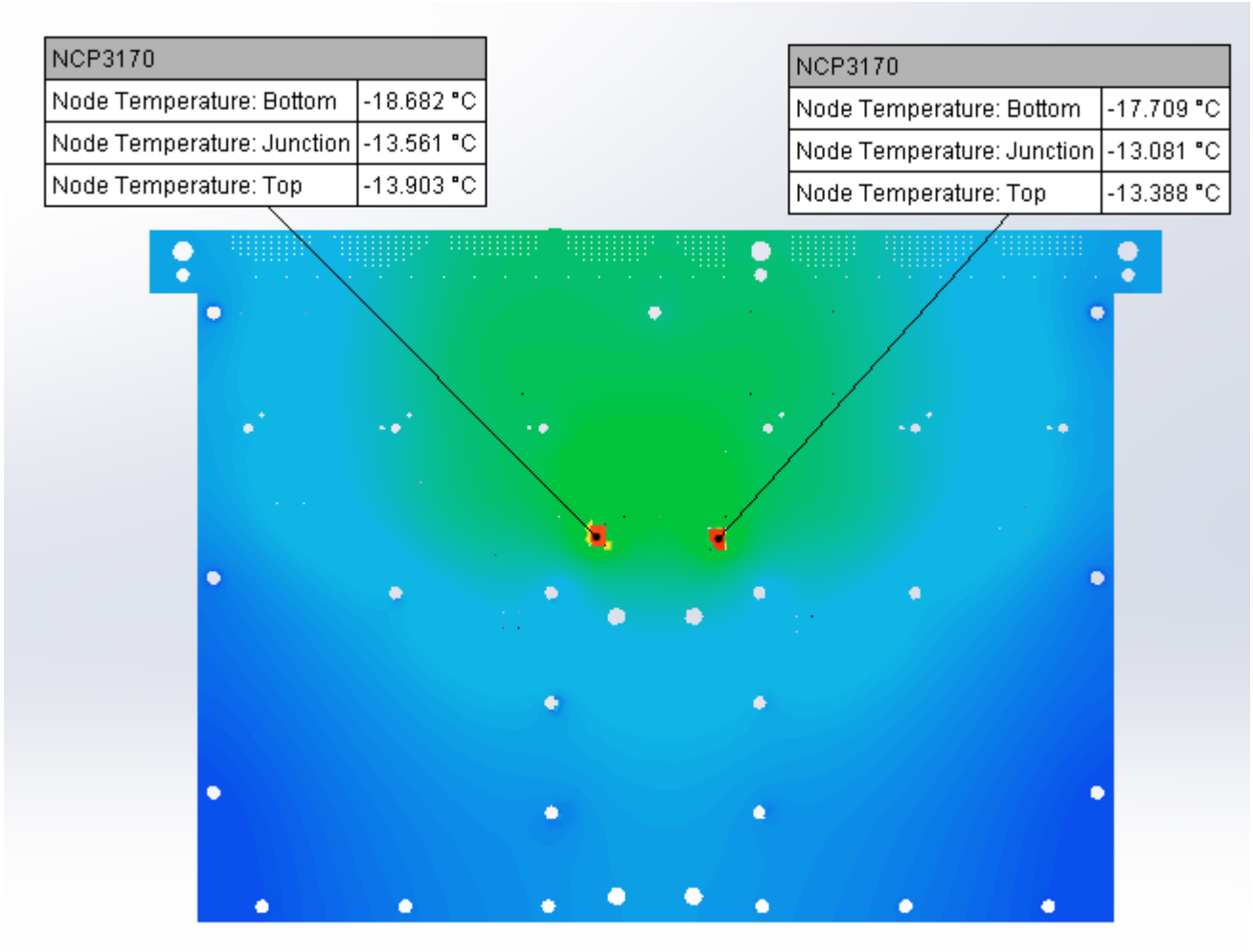
PCB Top Components Temperature Plot

-40°C , sea level



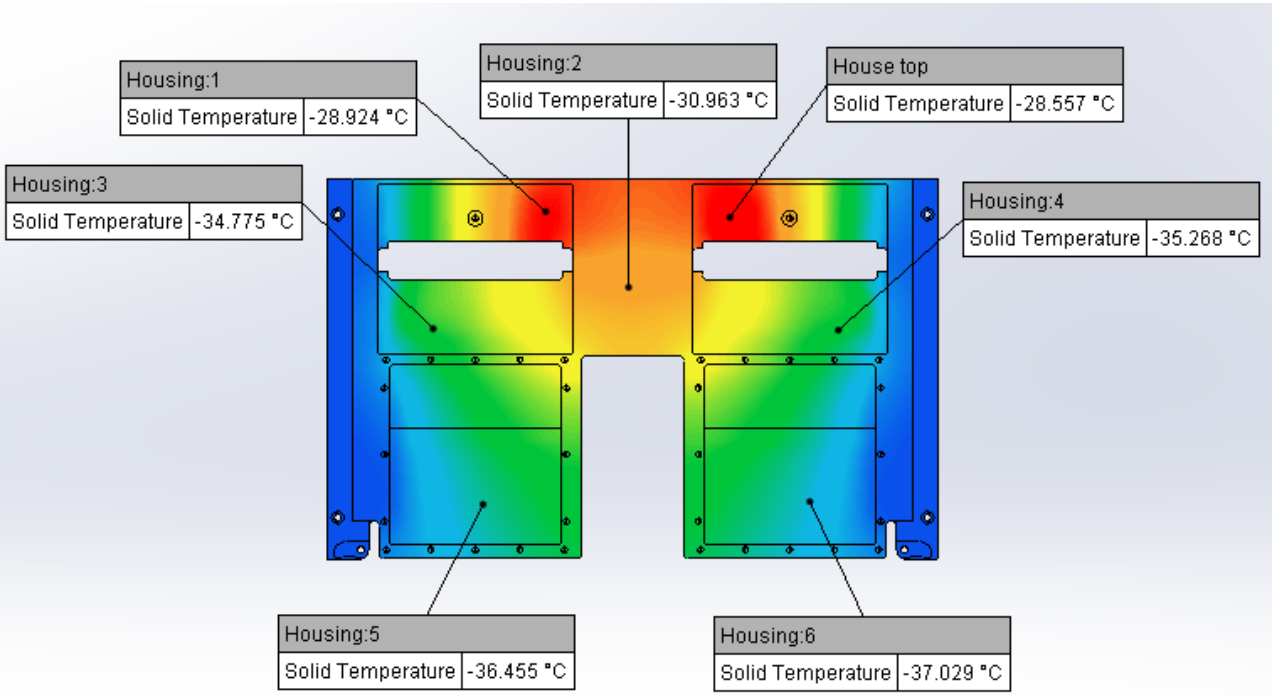
PCB Bottom Components Temperature Plot

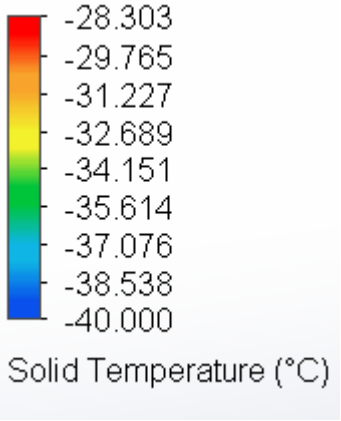
-40°C , sea level



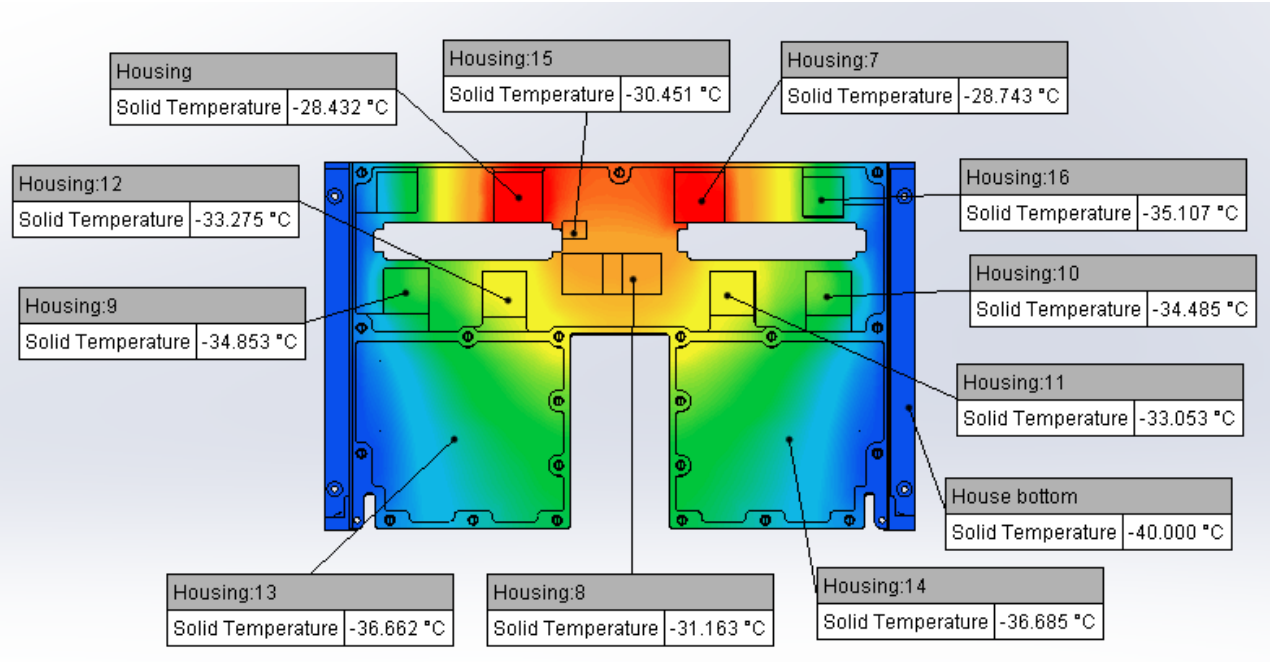
Housing Surface Temperature Plot

-40°C , sea level





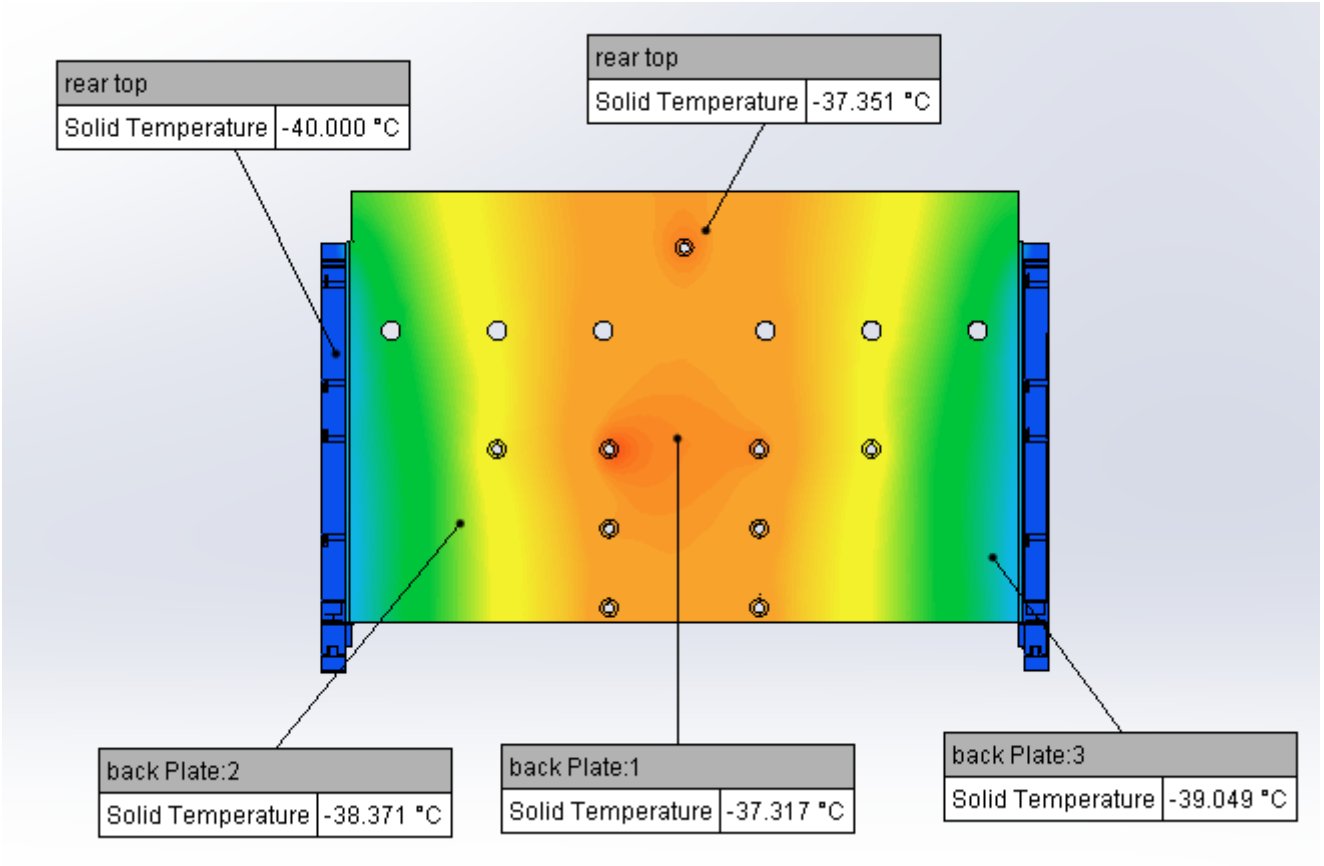
Top Side



Bottom Side

Rear Cover Temperature Plot

-40°C , sea level



Top Side