Amphenol Aerospace

CF-020400-065

Thermal Analysis

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Objectives

1. To determine that the critical components on the CF-020400-065 board are within their thermal limits for the following case:

   a) 85°C at sea level

   b) -40°C at sea level

   At 2 different power levels (predicted and worst case):

   a) Predicted Case – Total Power of 30.09 W

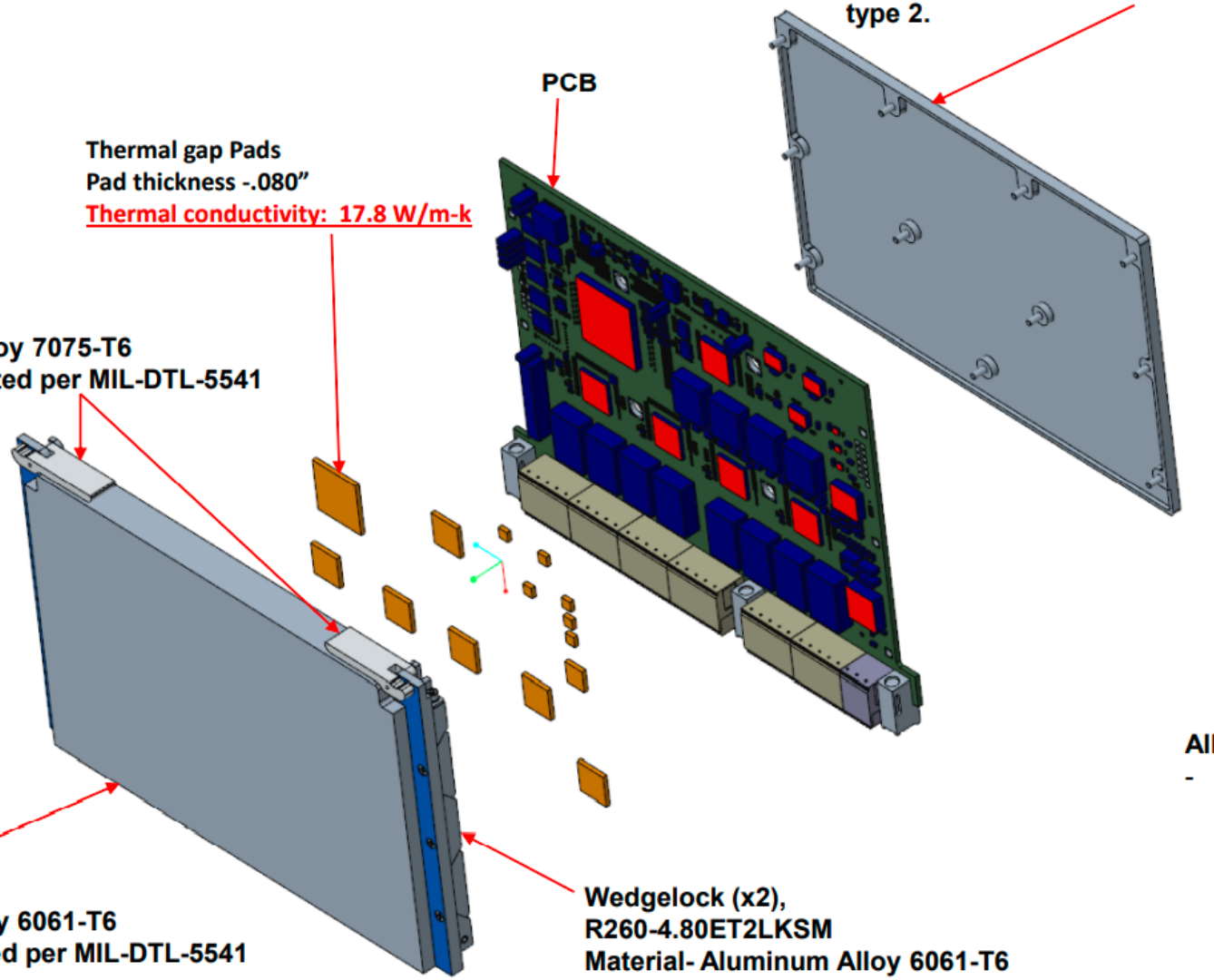
   b) Worst Case – Total Power of 40.99 W

Approach

1. This analysis was done using FloTHERM XT V2021.1 CFD software.
2. The updated thermal model was created from the cf-020400-065m_asm file provided for thermal analysis.
3. It was assumed that no neighboring devices were producing or sinking heat.
4. Thermal gap pad used for the components : Thermal conductivity of 17.8 W/m-K.
5. The critical components were modeled as 2-resistor networks with thermal resistance values found in the Thermal Analysis document provided by Amphenol Aerospace

Thermal Model Setup

Thermal Model Setup – Overview



Thermal Data

CF-065 Components			Power Cases		Thermal Resistance (C/W)	
Part	Desc.	Quantity	Predicted (W)	Worst Case (W)	R_{JC}	R_{JB}
BCM53570	U18	1	15.61	22.9	0.3	0.6
BCM84894	U2	1	6.02	7.52	1.26	2.38
LTM4650	U8	1	1.55	2.29	3.7	1.5
BCM54240	U14-17	4	1.52	1.82	9.8	10.3
MAXM17515	U46	1	0.32	0.4	6	1.5
MPM3686	U11	1	0.29	0.36	13	2.5
MPM3810	U32	1	0.08	0.09	13	11.5
MAXM17515	U47	1	0.07	0.08	6	1.5
MPM3810	U34	1	0.05	0.05	13	11.5
MAXM17515	U45	1	0.02	0.02	6	1.5
MPM3810	U33	1	0	0	13	11.5
Total			30.09	40.99		

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

Thermal Analysis

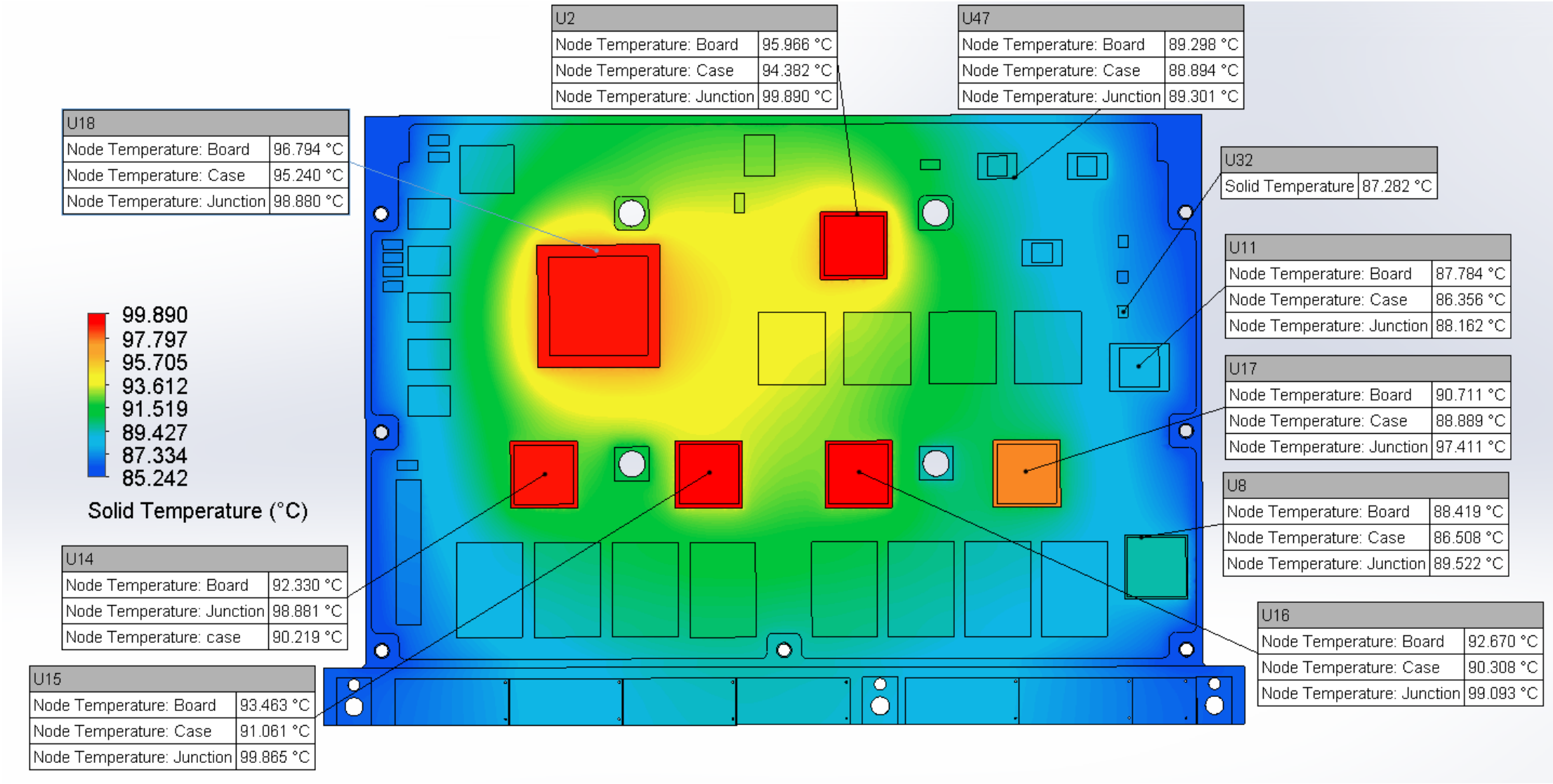
85 C Ambient, Predicted Power – Sim 1

Results Summary –Temperature Cases

Parameters				Sim 1		
Power Scenario				Predicted		
Cooling Rail Temperature °C				85		
Ambient Temp., °C				85		
Elevation, ft				0		
RESULTS						
Component	Desc.	Max. Limit, °C	Limit Type	Power, W	Result, °C	Margin, °C
BCM53570	U18	110	Junction	15.61	99.9	10.1
BCM84894	U2	110	Junction	6.02	99.9	10.1
LTM4650	U8	125	Junction	1.55	89.5	35.5
BCM54240	U14	110	Junction	1.52	90.2	19.8
BCM54241	U15	110	Junction	1.52	99.9	10.1
BCM54242	U16	110	Junction	1.52	99.1	10.9
BCM54243	U17	110	Junction	1.52	97.4	12.6
MAXM17515	U46	125	Junction	0.32	88.9	36.1
MPM3686	U11	125	Junction	0.29	88.2	36.8
MPM3810	U32	125	Junction	0.08	88.1	36.9
MAXM17515	U47	125	Junction	0.07	89.3	35.7
MPM3810	U34	125	Junction	0.05	87.6	37.4
MAXM17515	U45	125	Junction	0.02	88.8	36.2
MPM3810	U33	125	Junction	0	87.1	37.9

Sim 1 - Components Temperature Plot

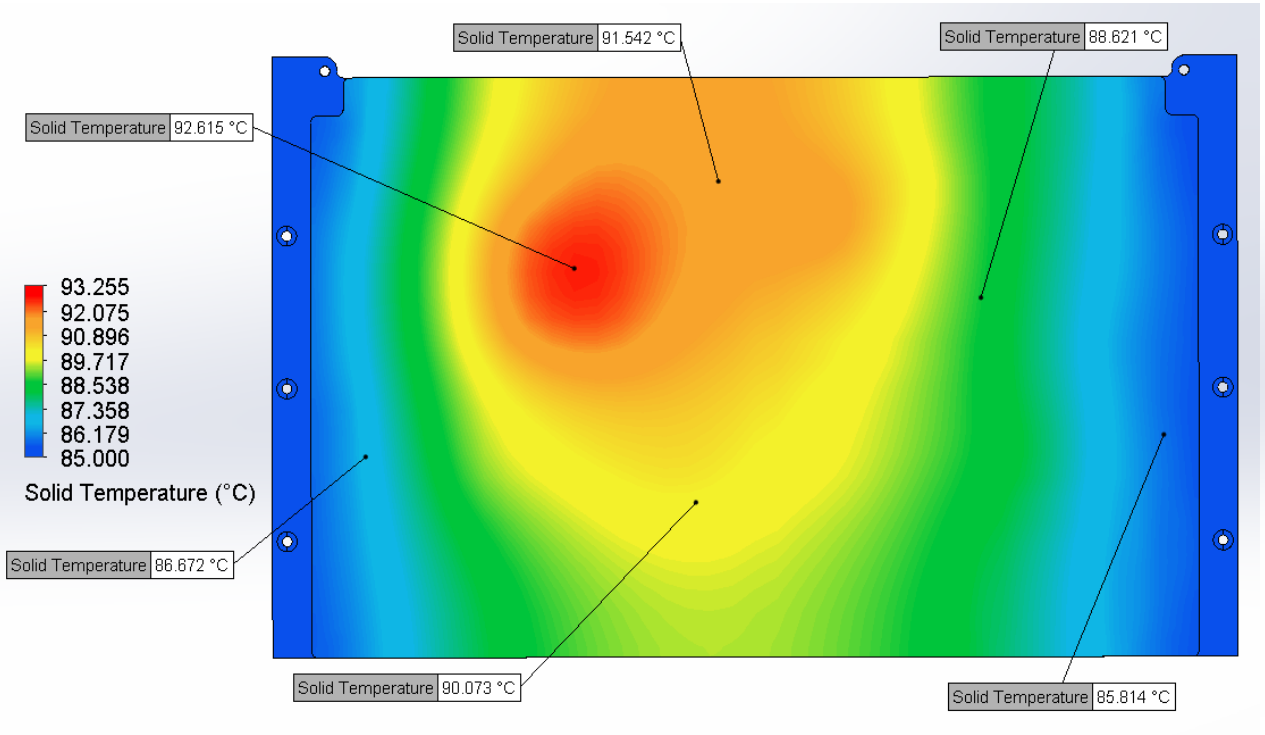
85°C , sea level



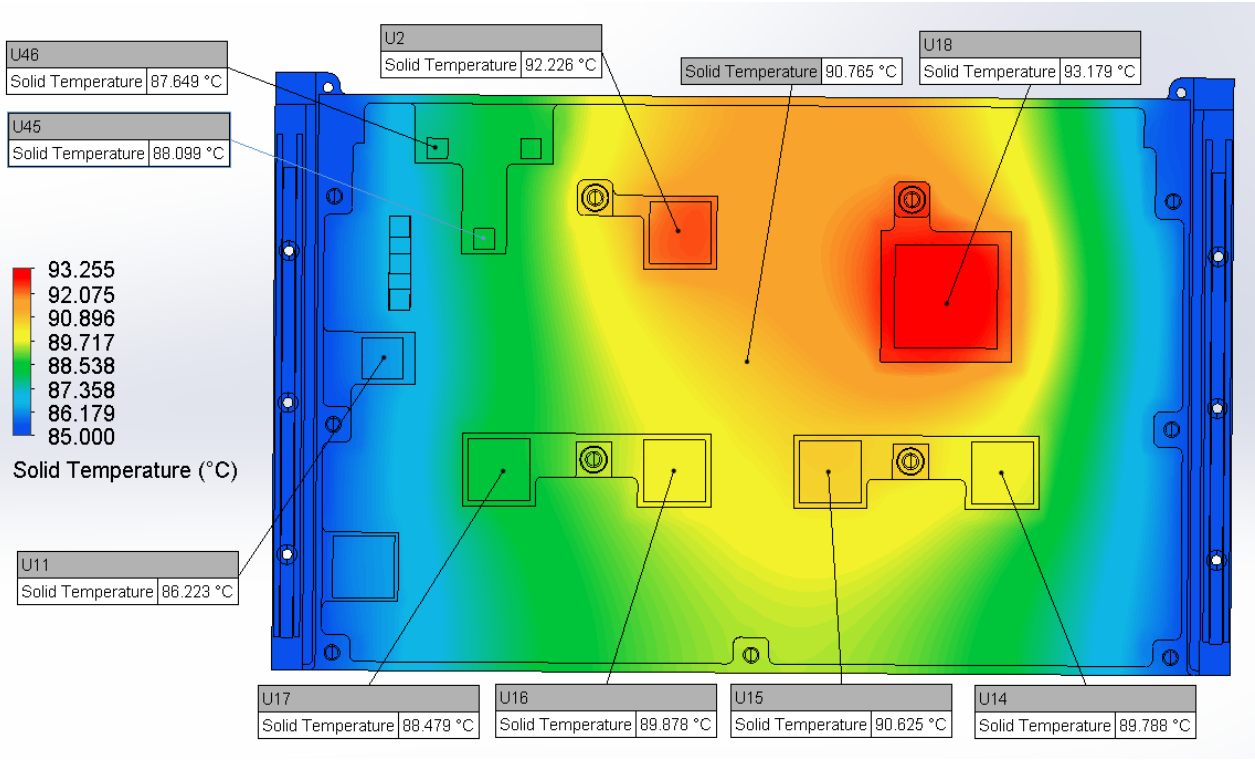
Note: only worst case MAXM17515 and MPM3810 components are probed

Sim 1 – Top Housing Surface Temperature Plot

85°C , sea level



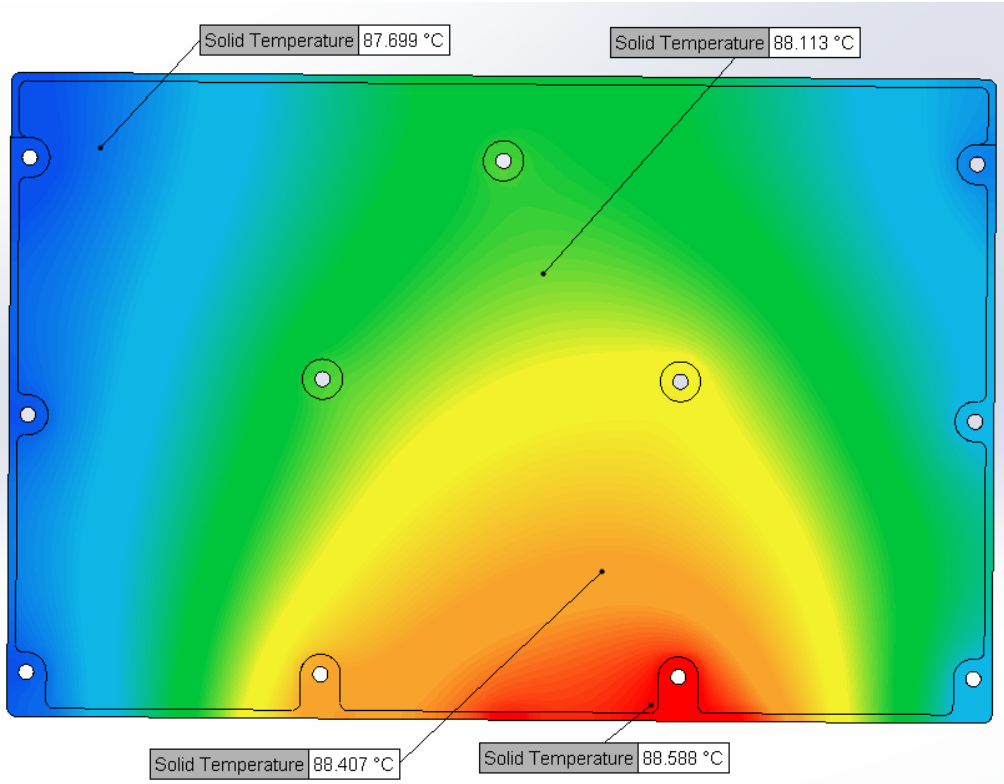
Top Side



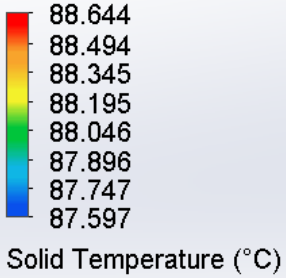
Bottom Side

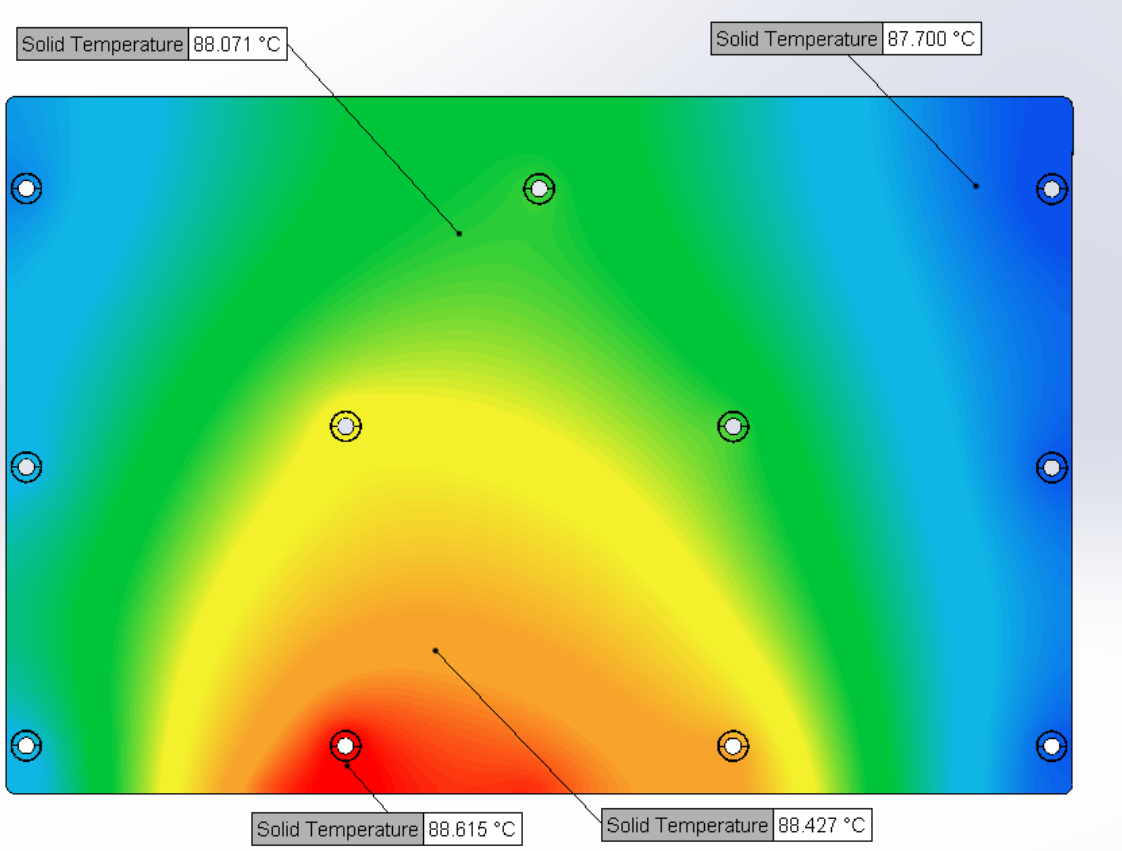
Sim 1 - Rear Cover Temperature Plot

85°C , sea level



Top Side





Bottom Side

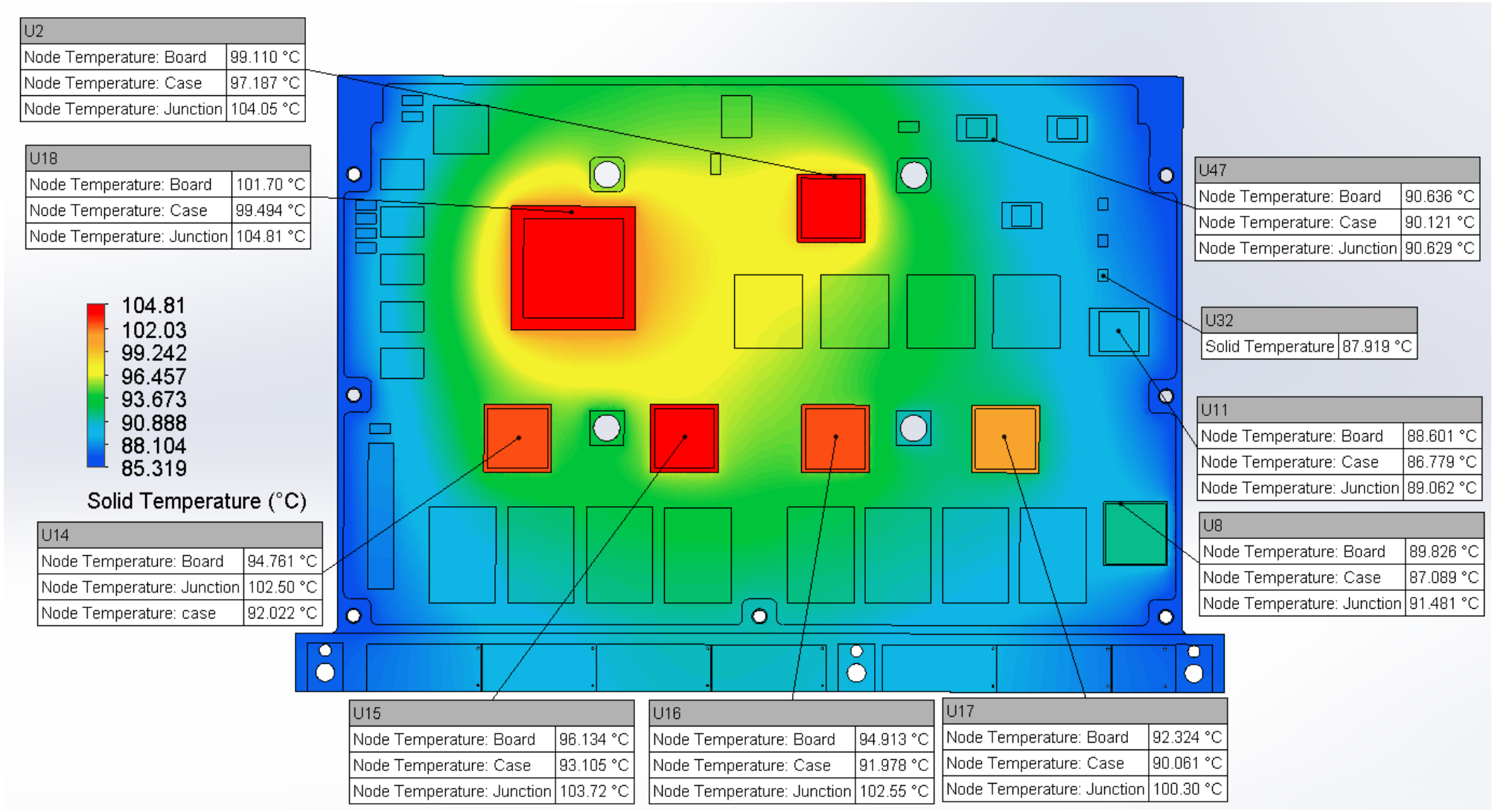
85 C Ambient, Worst Case Power – Sim 2

Results Summary –Temperature Cases

Parameters				Sim 2		
Power Scenario				Worst Case		
Cooling Rail Temperature °C				85		
Ambient Temp., °C				85		
Elevation, ft				0		
RESULTS						
Component	Desc.	Max. Limit, °C	Limit Type	Power, W	Result, °C	Margin, °C
BCM53570	U18	110	Junction	22.9	104.8	5.2
BCM84894	U2	110	Junction	7.52	104.1	5.9
LTM4650	U8	125	Junction	2.29	89.8	35.2
BCM54240	U14	110	Junction	1.82	102.5	7.5
BCM54241	U15	110	Junction	1.82	103.7	6.3
BCM54242	U16	110	Junction	1.82	102.6	7.4
BCM54243	U17	110	Junction	1.82	100.3	9.7
MAXM17515	U46	125	Junction	0.4	90.0	35.0
MPM3686	U11	125	Junction	0.36	89.1	35.9
MPM3810	U32	125	Junction	0.09	88.9	36.1
MAXM17515	U47	125	Junction	0.08	90.6	34.4
MPM3810	U34	125	Junction	0.05	87.7	37.3
MAXM17515	U45	125	Junction	0.02	89.9	35.1
MPM3810	U33	125	Junction	0	87.7	37.3

Sim 2- Components Temperature Plot

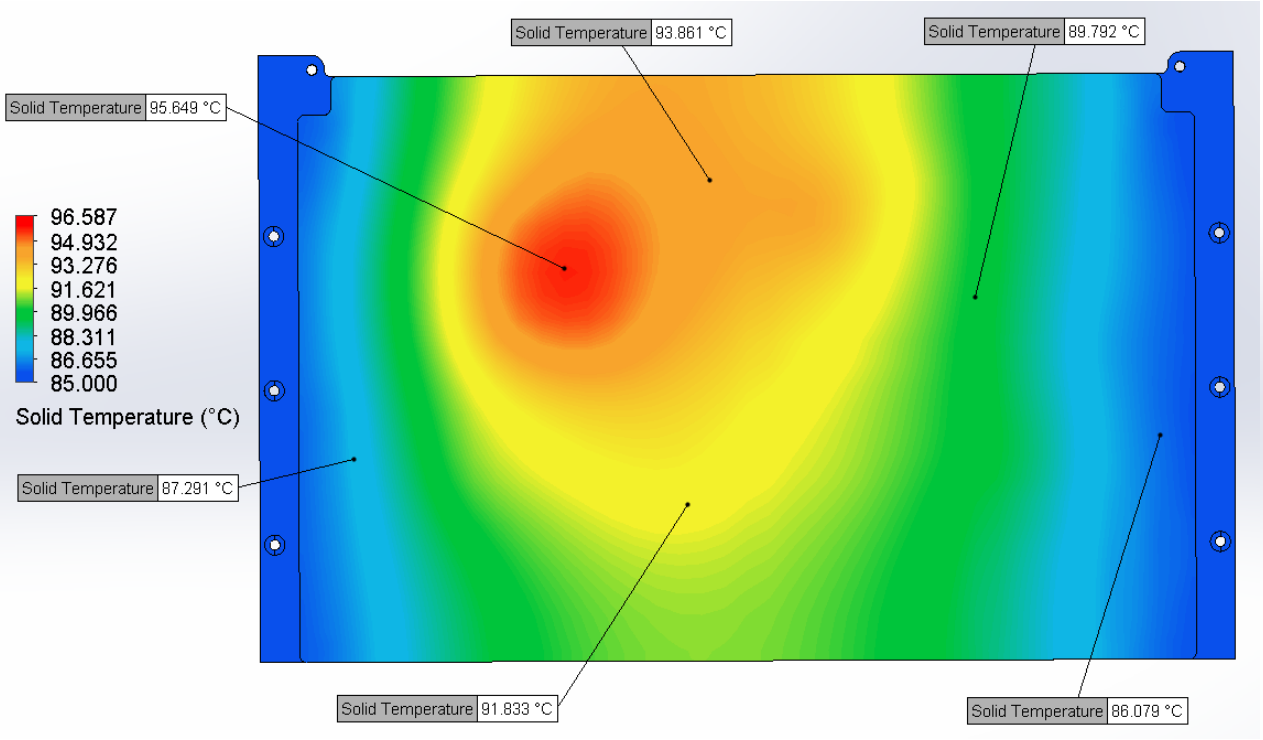
85°C , sea level



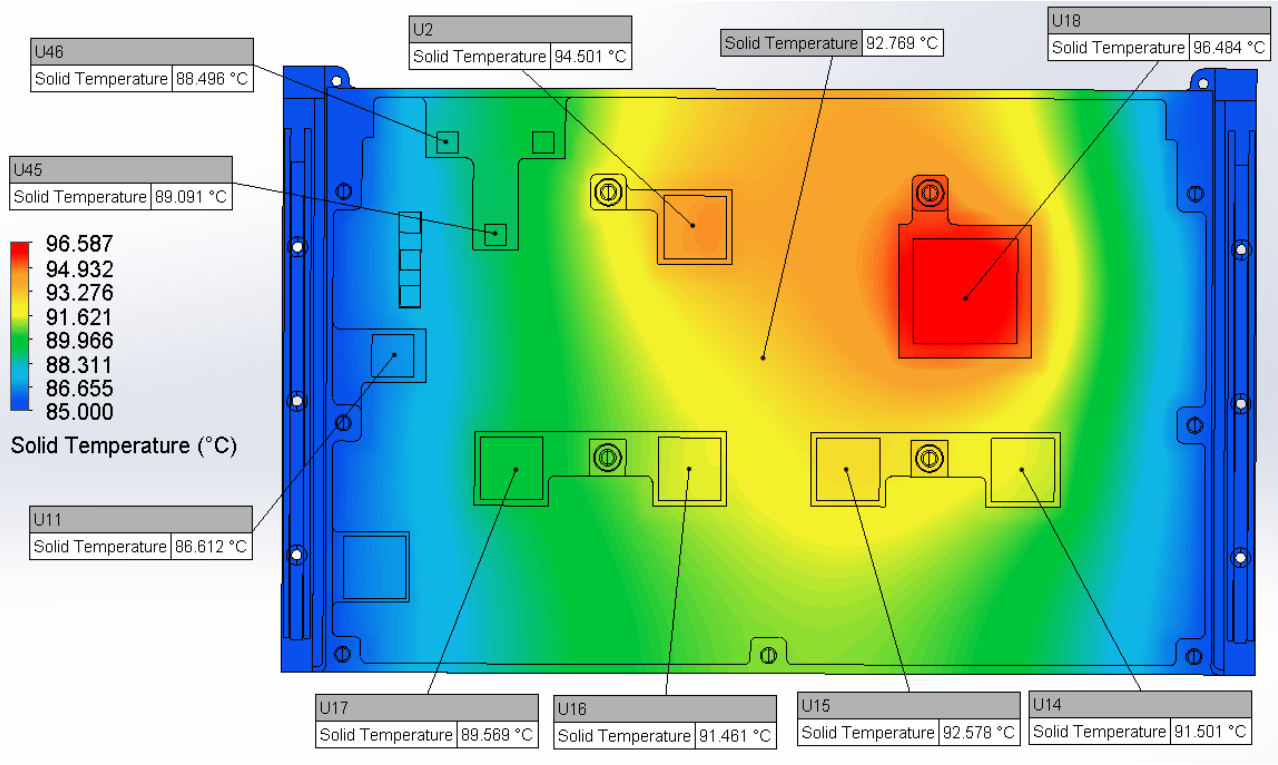
Note: only worst case MAXM17515 and MPM3810 components are probed

Sim 2 – Top Housing Surface Temperature Plot

85°C , sea level



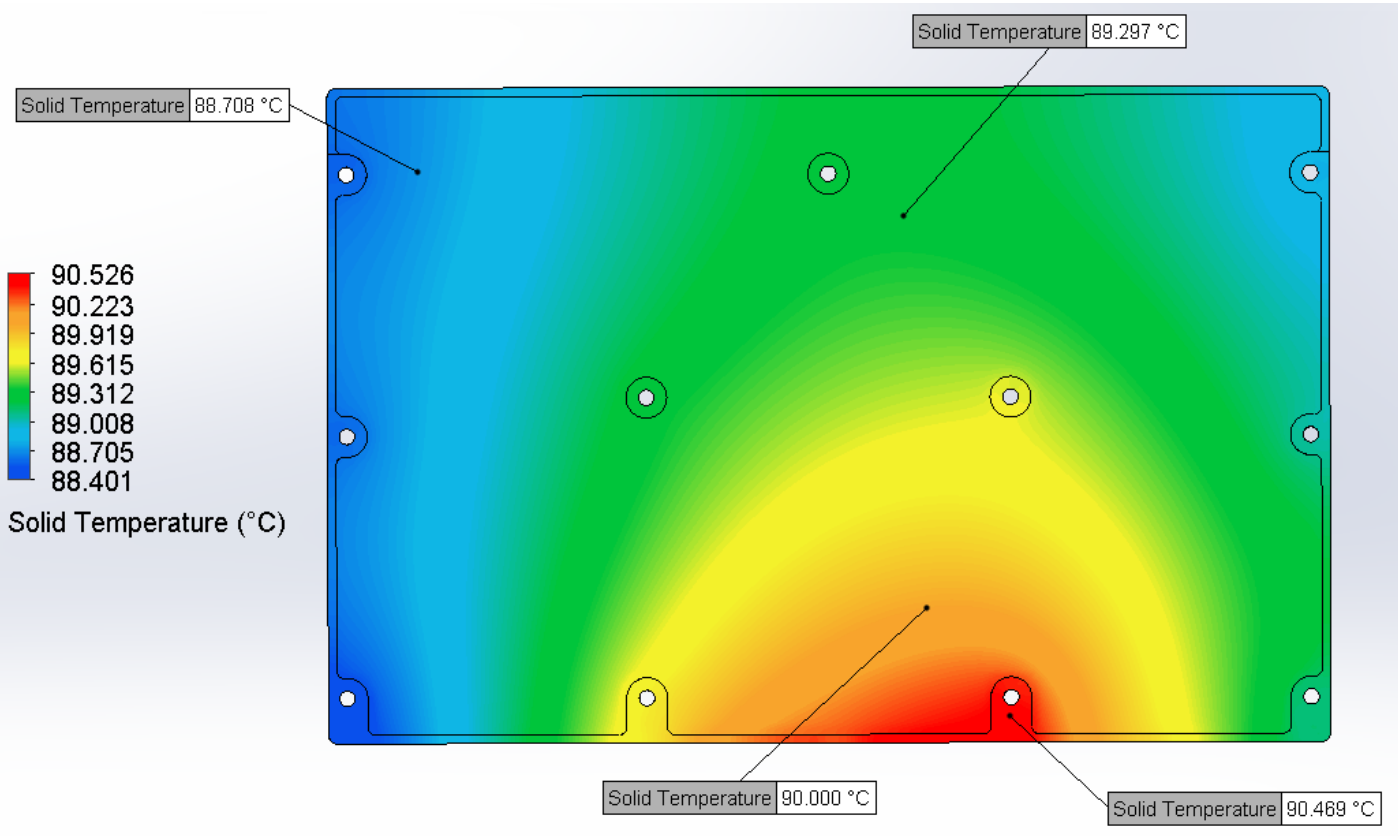
Top Side



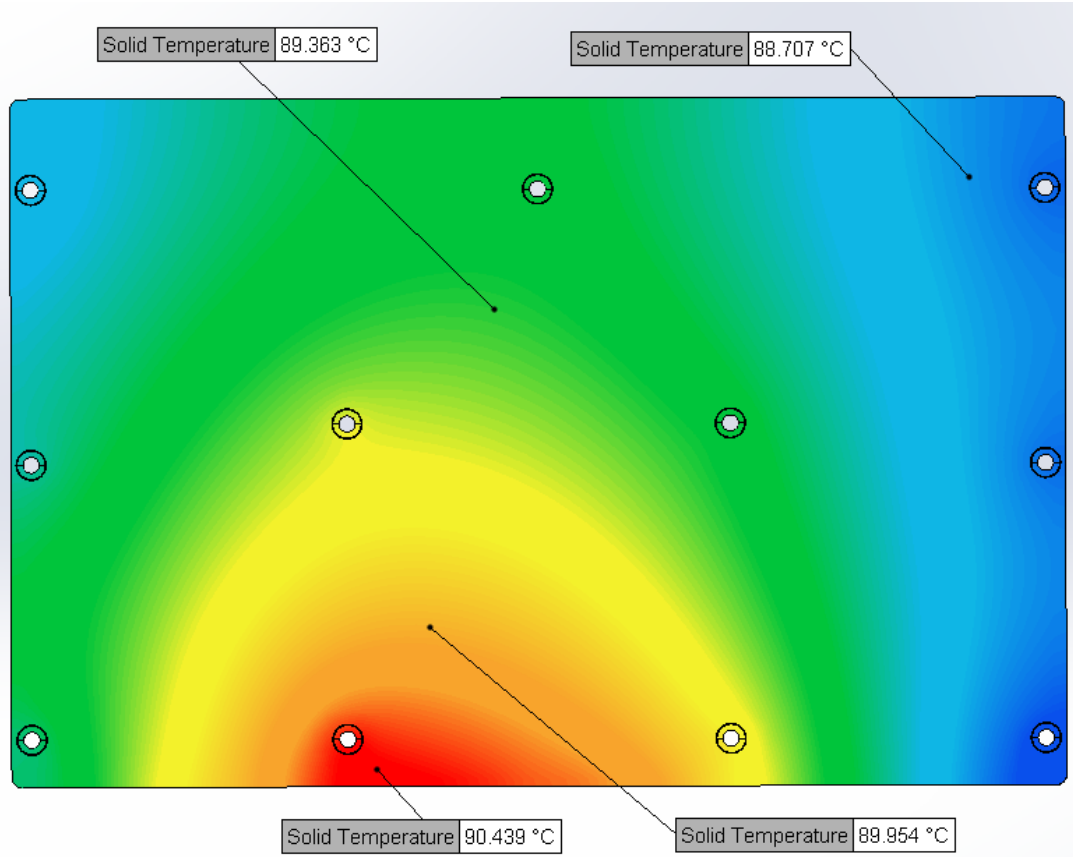
Bottom Side

Sim 2 - Rear Cover Temperature Plot

85°C , sea level



Top Side



Bottom Side

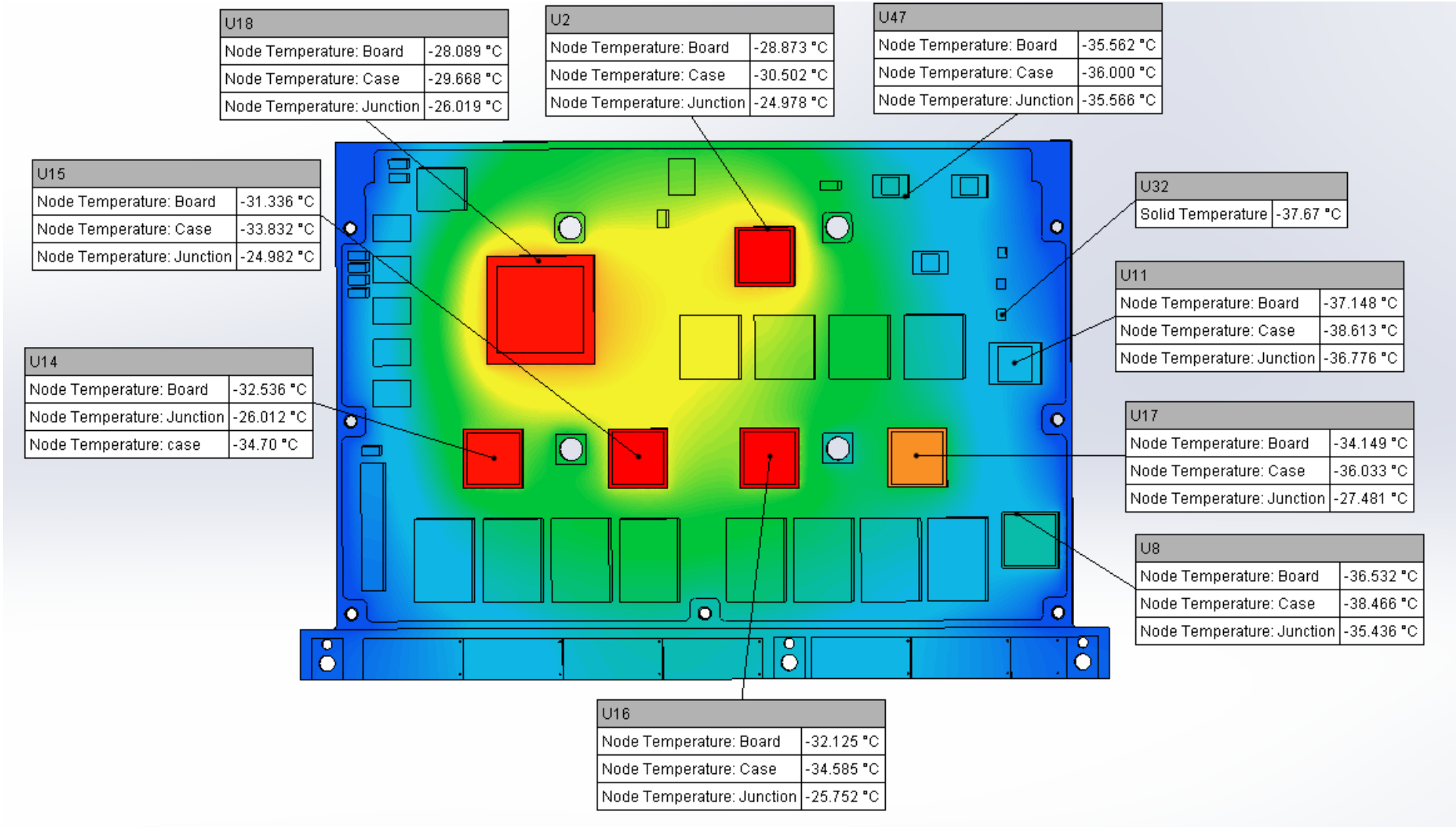
-40 C Ambient, Predicted Power – Sim 3

Results Summary –Temperature Cases

Parameters					Sim 3		
Power Scenario					Predicted		
Cooling Rail Temperature °C					-40		
Ambient Temp., °C					-40		
Elevation, ft					0		
RESULTS							
Component	Desc.	Min. Limit, °C °C	Max. Limit, °C	Limit Type	Power, W	Result, °C	Margin from Min, °C
BCM53570	U18	-40	110	Junction	15.61	-26.0	-14
BCM84894	U2	-40	110	Junction	6.02	-24.9	-15.1
LTM4650	U8	-40	125	Junction	1.55	-35.4	-4.6
BCM54240	U14	-40	110	Junction	1.52	-34.7	-5.3
BCM54241	U15	-40	110	Junction	1.52	-24.9	-15.1
BCM54242	U16	-40	110	Junction	1.52	-25.7	-14.3
BCM54243	U17	-40	110	Junction	1.52	-27.4	-12.6
MAXM17515	U46	-40	125	Junction	0.32	-37.2	-2.8
MPM3686	U11	-40	125	Junction	0.29	-36.7	-3.3
MPM3810	U32	-40	125	Junction	0.08	-37.6	-2.4
MAXM17515	U47	-40	125	Junction	0.07	-35.5	-4.5
MPM3810	U34	-40	125	Junction	0.05	-37.8	-2.2
MAXM17515	U45	-40	125	Junction	0.02	-36.8	-3.2
MPM3810	U33	-40	125	Junction	0	-38.0	-2

Sim 3 - Components Temperature Plot

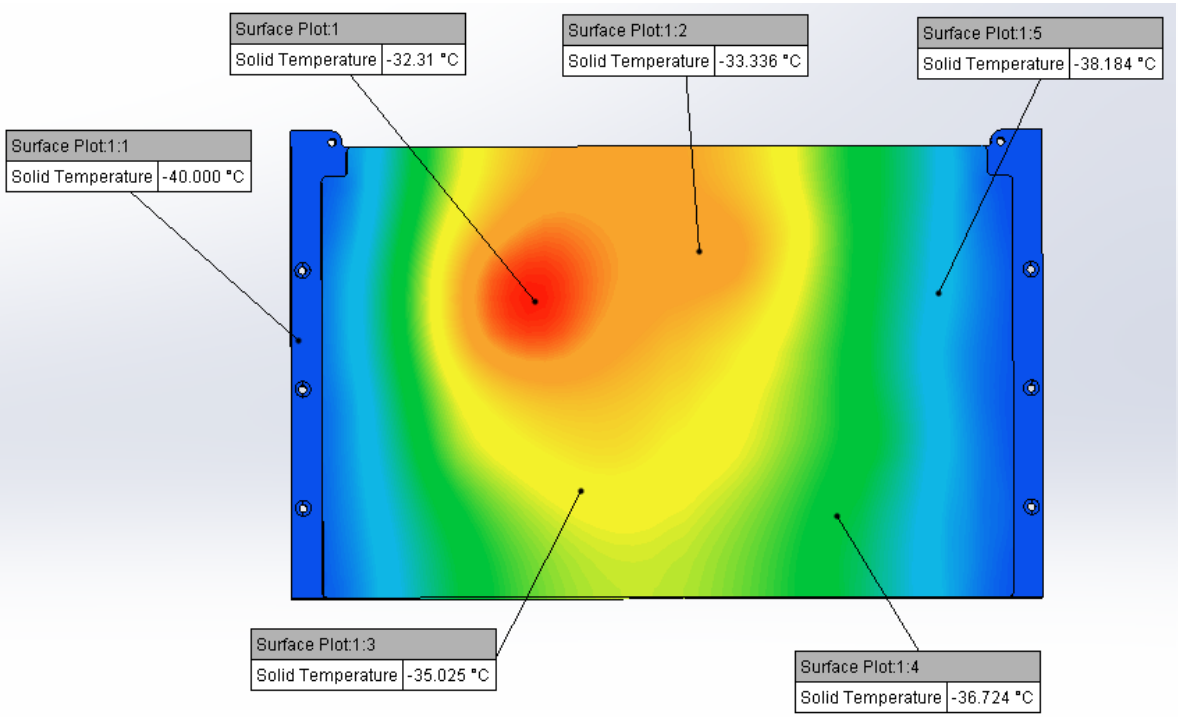
-40°C , sea level



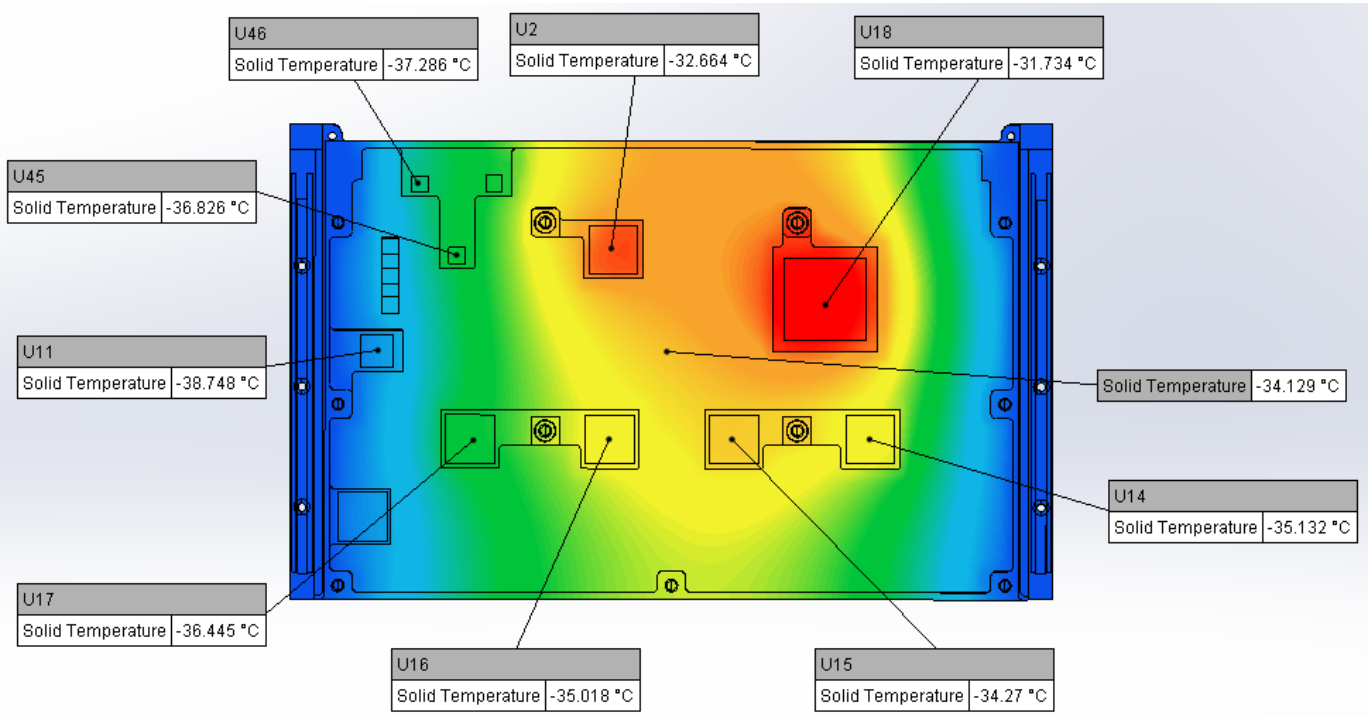
Note: only worst case MAXM17515 and MPM3810 components are probed

Sim 3 – Top Housing Surface Temperature Plot

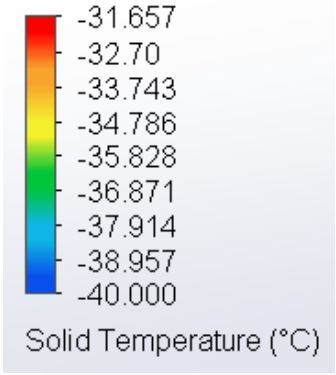
-40°C , sea level



Top Side

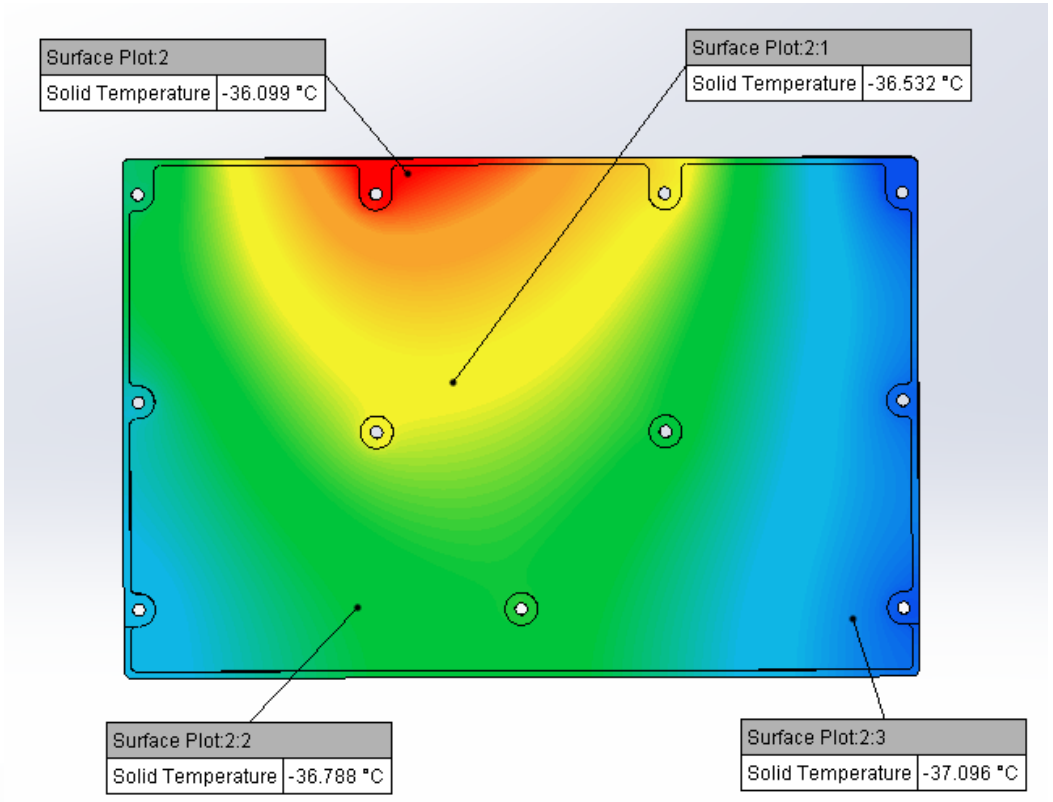


Bottom Side

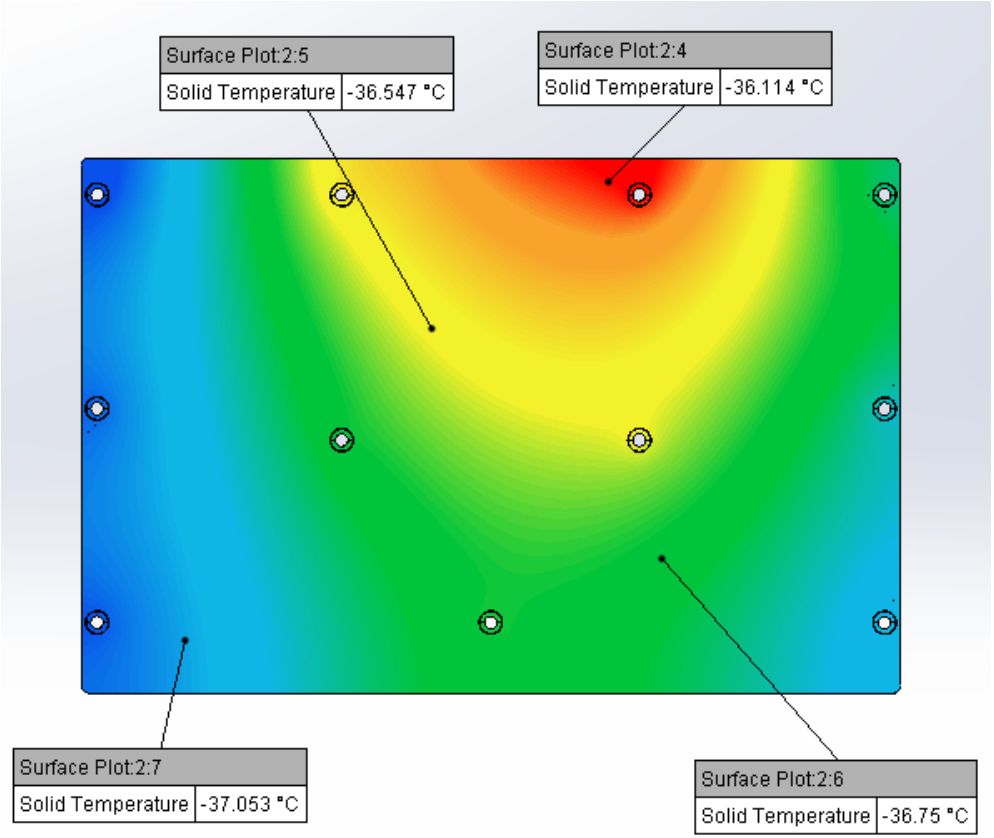


Sim 3 - Rear Cover Temperature Plot

-40°C , sea level



Top Side



Bottom Side

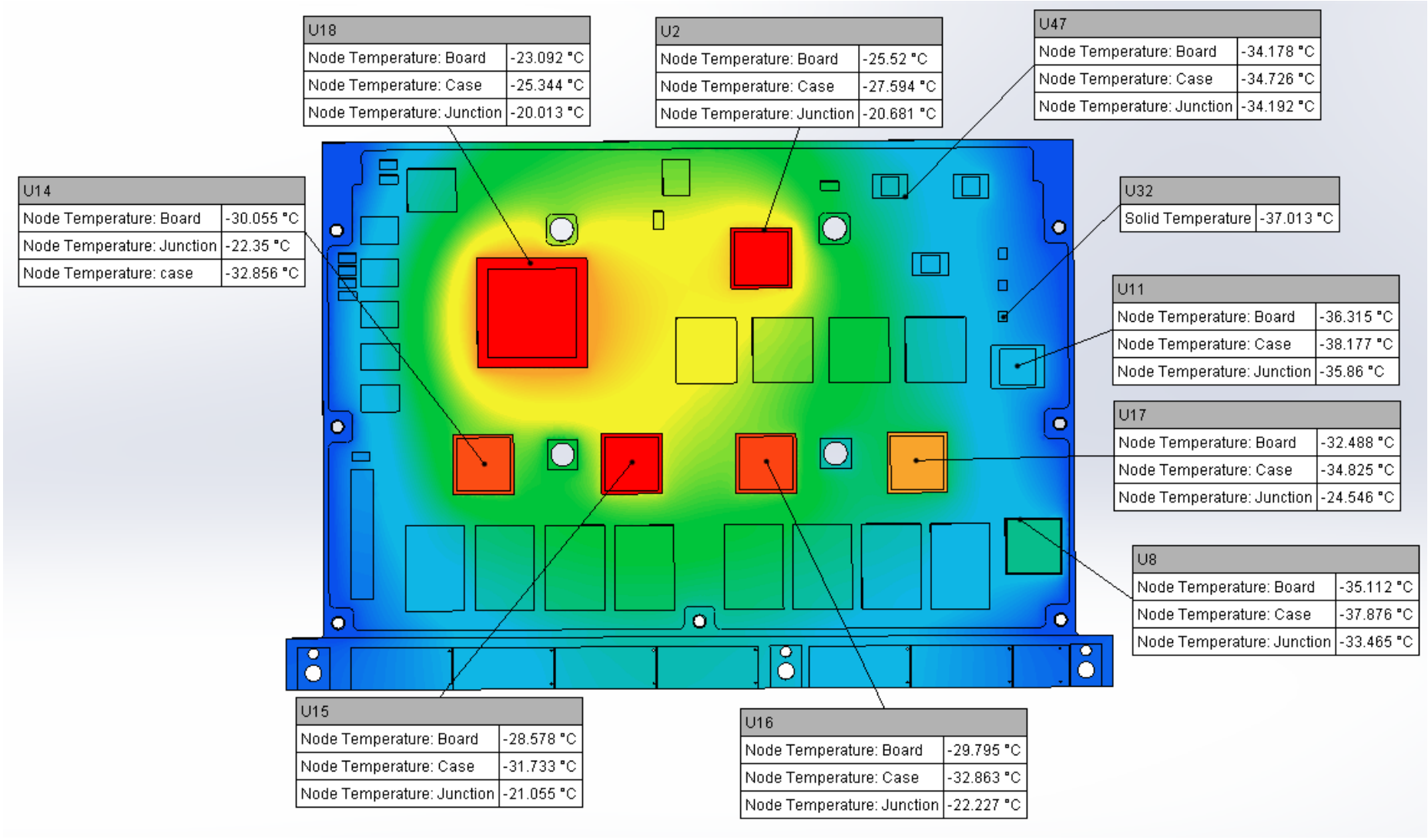
-40 C Ambient, Worst Case Power – Sim 4

Results Summary –Temperature Cases

Parameters					Sim 4		
Power Scenario					Worst Case		
Cooling Rail Temperature °C					-40		
Ambient Temp., °C					-40		
Elevation, ft					0		
RESULTS							
Component	Desc.	Min. Limit, °C	Max. Limit, °C	Limit Type	Power, W	Result, °C	Margin from Min, °C
BCM53570	U18	-40	110	Junction	22.9	-20.0	-20
BCM84894	U2	-40	110	Junction	7.52	-20.6	-19.4
LTM4650	U8	-40	125	Junction	2.29	-33.4	-6.6
BCM54240	U14	-40	110	Junction	1.82	-32.8	-7.2
BCM54241	U15	-40	110	Junction	1.82	-21.0	-19
BCM54242	U16	-40	110	Junction	1.82	-22.2	-17.8
BCM54243	U17	-40	110	Junction	1.82	-24.5	-15.5
MAXM17515	U46	-40	125	Junction	0.4	-37.2	-2.8
MPM3686	U11	-40	125	Junction	0.36	-35.8	-4.2
MPM3810	U32	-40	125	Junction	0.09	-37.0	-3
MAXM17515	U47	-40	125	Junction	0.08	-34.1	-5.9
MPM3810	U34	-40	125	Junction	0.05	-37.2	-2.8
MAXM17515	U45	-40	125	Junction	0.02	-36.8	-3.2
MPM3810	U33	-40	125	Junction	0	-37.4	-2.6

Sim 4 - Components Temperature Plot

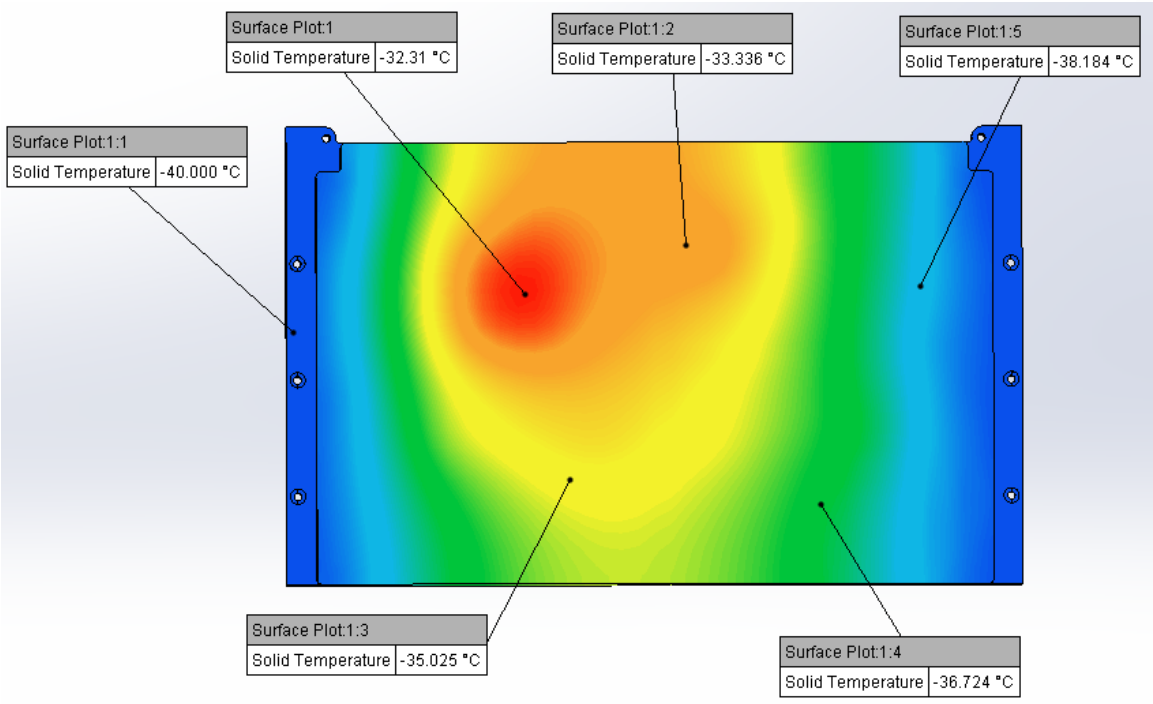
-40°C , sea level

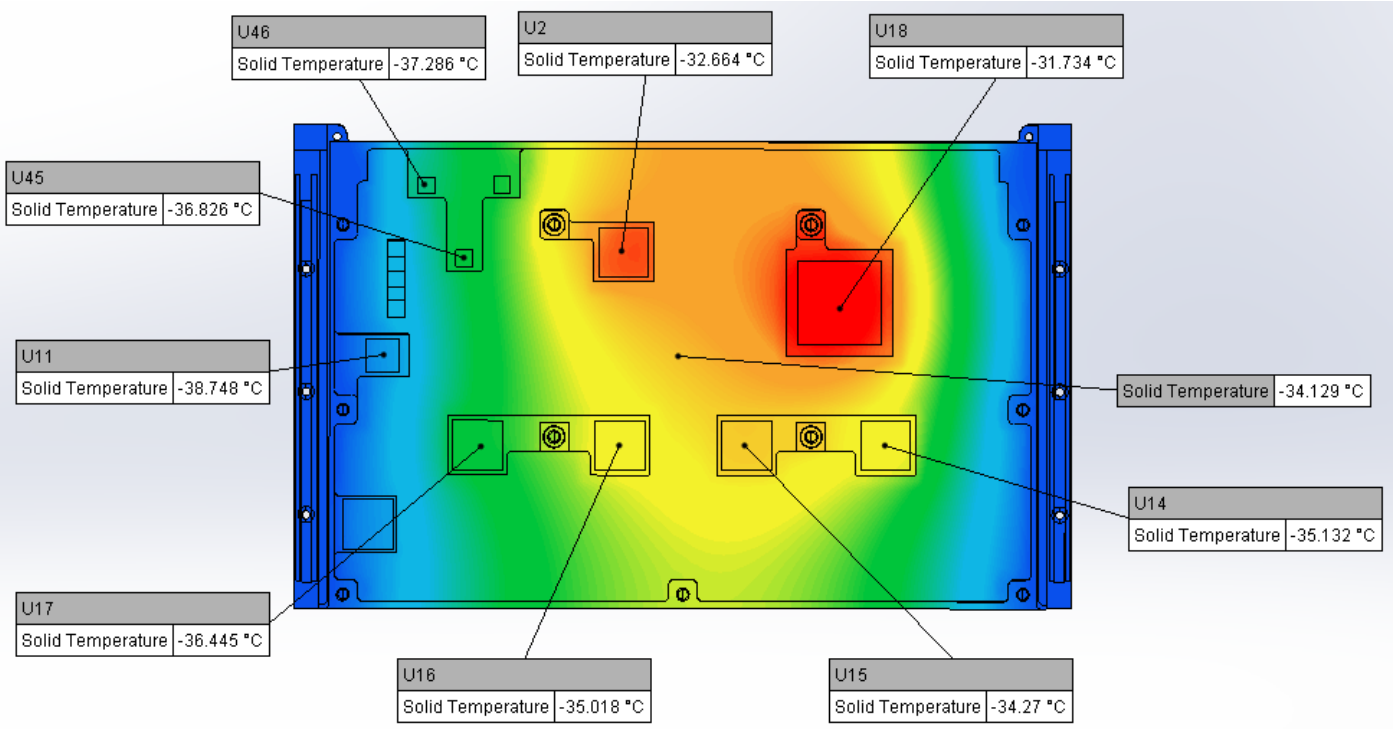


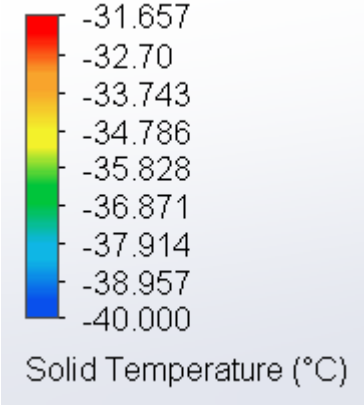
Note: only worst case MAXM17515 and MPM3810 components are probed

Sim 4 – Top Housing Surface Temperature Plot

-40°C , sea level





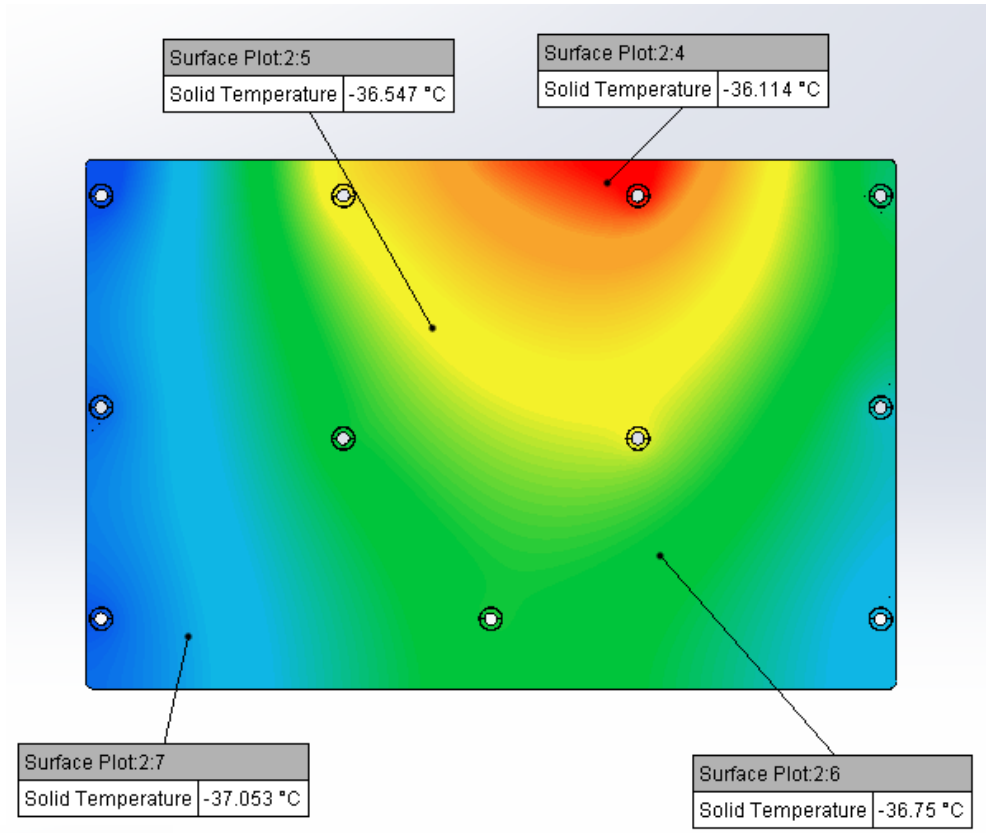


Top Side

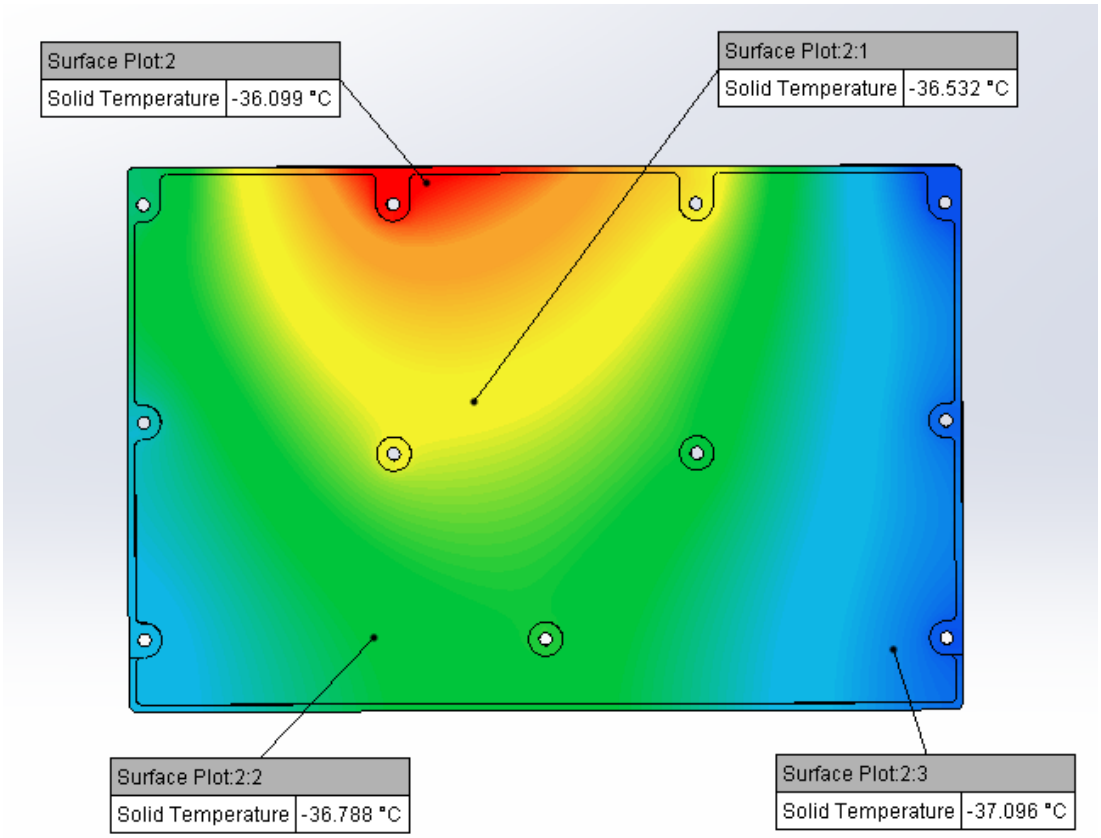
Bottom Side

Sim 4 - Rear Cover Temperature Plot

-40°C , sea level



Top Side



Bottom Side