DESCRIPTION THERMAL MODEL FOR BMR520

FLEX INC.

Contents

General

The model is an estimation for the thermal behavior of BMR520, which is a SIP design with integrated heatsink and baseplate.

The model is intended for steady-state thermal simulations.

Model Description

The model is a readymade Flotherm 11.1 model. The model consists of four major components:

3D CAD Geometry

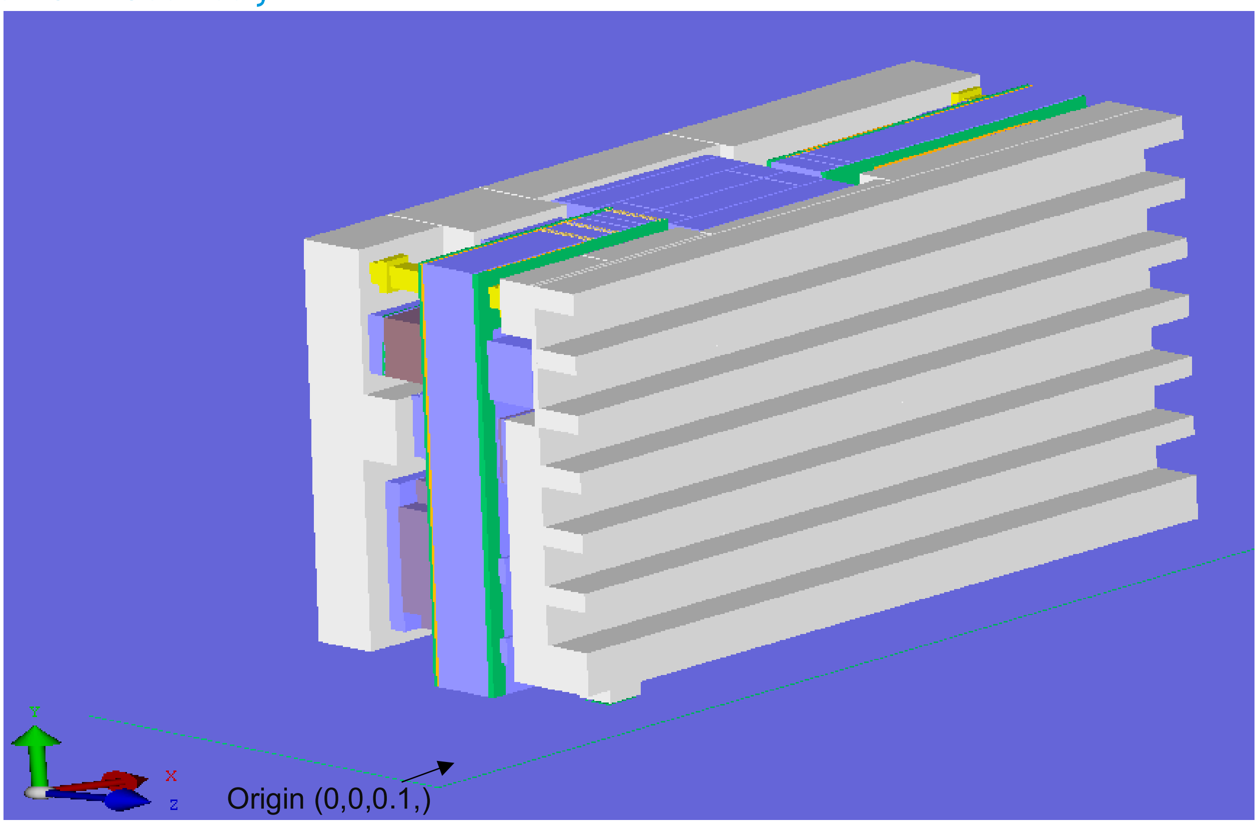

Figure 1 Model origin in lower left corner of PCB and axis orientation.

Origin has been placed so that [0,0,0.1] is in the lower left corner of the PCB.

Unit in file: [mm]

In the geometry most components are maintained per original design but have been simplified in FloMCAD to cuboids. The PCB has been simplified into 7 layers: Outer layers copper (detailed), next to outer layers (detailed), dielectric layers between outer and next outer layers, and finally a middle bulk layer. The vias in the PCB has been imported through FloMCAD as patches.

The model comes with a rudimentary grid constraint, which was used during the model development. It generates approx. 11 million cells. It was found difficult to capture the thermal behavior without a detailed resolution of the heatsink and layer 1 and 16. It is of course voluntarily to use this grid.

Domains of power loss distribution

There are several sources for power loss. The power loss for each of them, at certain module total power, are given in *Appendix 1 - Power Loss Distribution.*

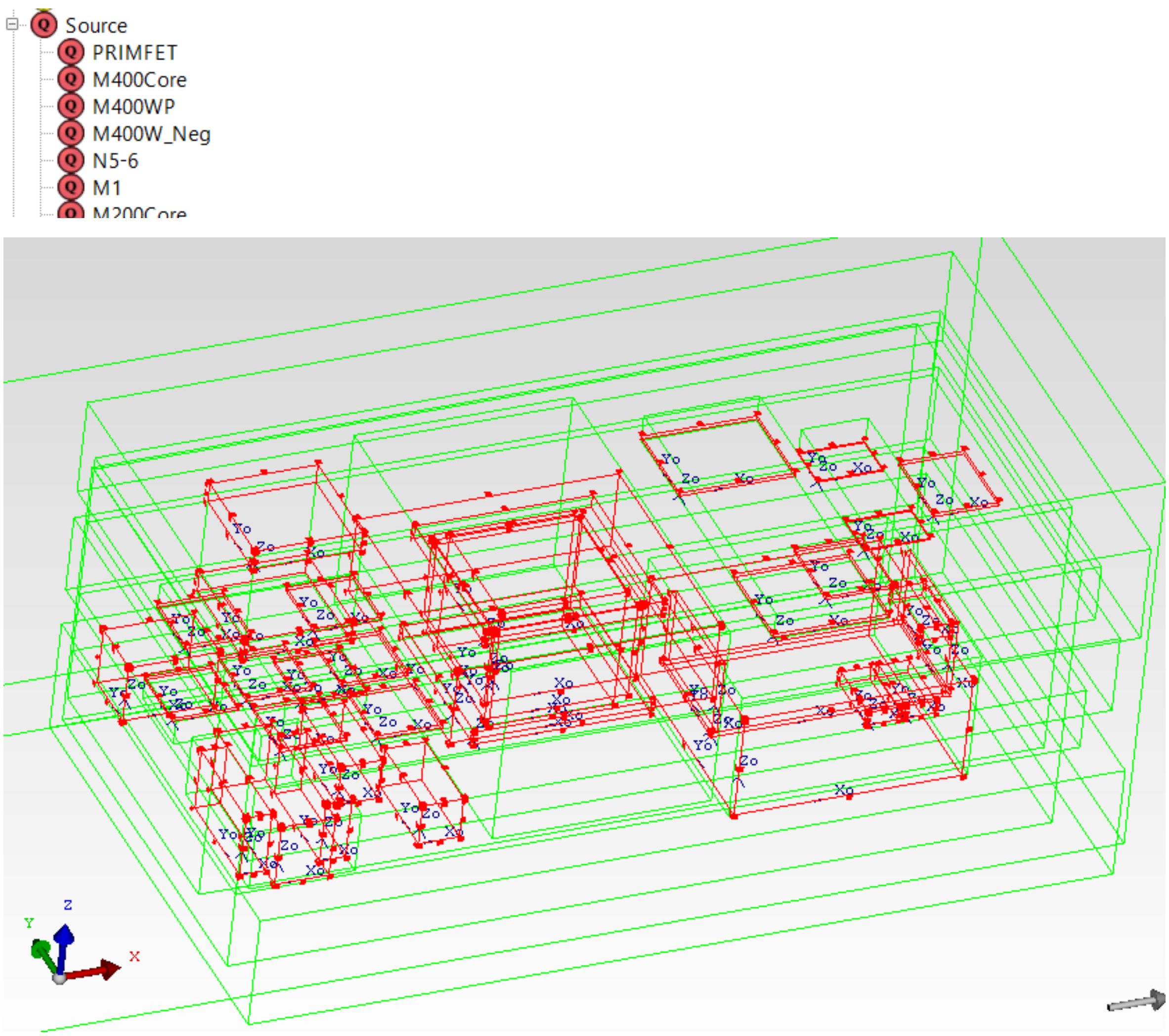

Figure 2: Heat Sources

It can be noted that some sources have a negative value. This is to compensate for domains not having power loss.

Domains of material data

There are several material domains. The heat conductivity for each of them is given either as isotropic, or anisotropic values in x-,y-, and z-direction (x,y,z) per the following list.

Figure 3. Domains of material data

Note. The given heat conductivities are only intended to model the temperature distribution of the module in this application. The values should not be treated as physically true or transferable to other applications.

Monitor points

The model comes with predefined monitor points which corresponds to measured probe points:

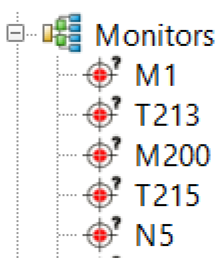

Figure 4. Probe points.

Model Calibration

The model has been calibrated to give temperatures as similar as possible compared to thermal verification document “Worksheet in Blade thermal simulation input” V_{in}=48[V] V_{out}=12[V], I_{in}=6.6[A] I_{out}=25A]. The calibration was done using power loss settings per Appendix 1 - Power Loss Distribution.

Calibration data: Airspeed=1.5[m/s], Air direction=Neg x (output to input), Ambient temp=21.3[C], Ploss=17.7-17.8[W]. Testboard: 254[mm]x254[mm], 16x1[Oz], 3[mm]

Simulation temperatures are within +3.7/-6.7 [C] compared to measured values.

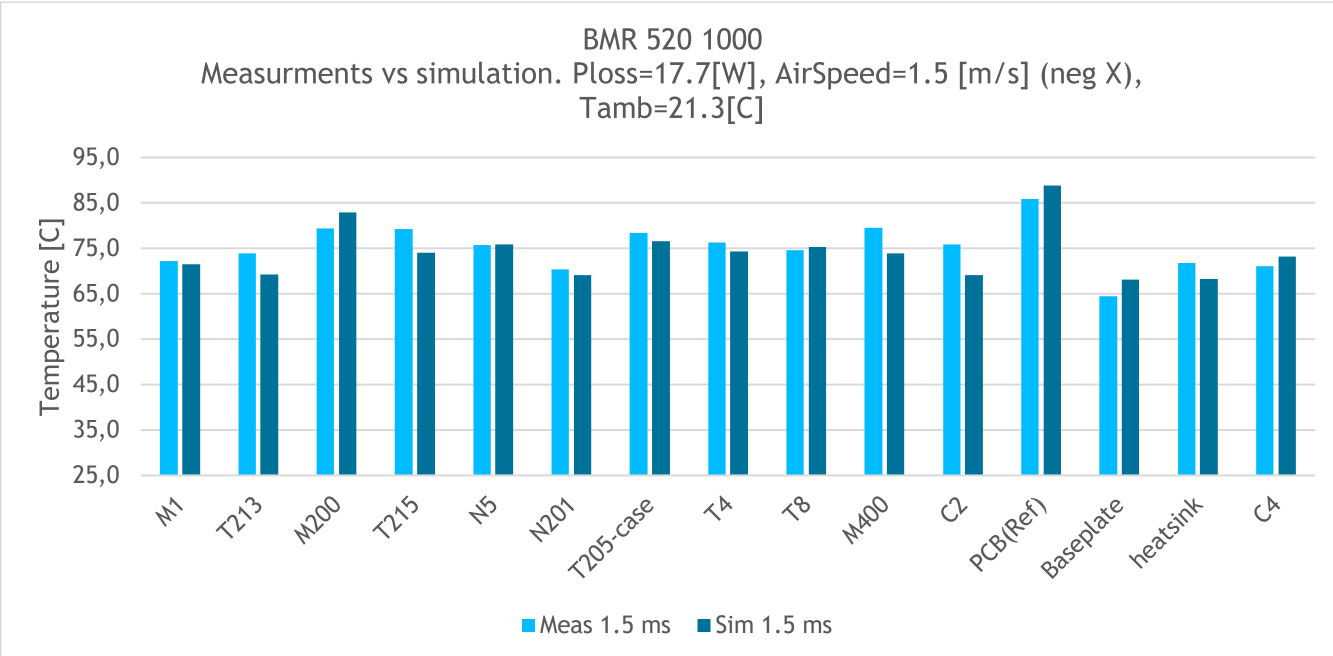

Figure 5: Model calibration result.

Model Usage

Import the *.pdml file into the desired project.

Adjust the dissipated power by altering the thermal sources per Figure 2, according to Appendix 1 - Power Loss Distribution. Default settings are for V_{in}=48[V] V_{out}=12[V], I_{in}=6.6[A] I_{out}=25A], T≈100[C]

If the model is rotated, make sure that the orientation of the orthotropic materials properties are preserved (also rotated).

Do not change the order of power sources and geometry objects, as this can change the power and material settings.

The module temperatures can be monitored in predefined monitor points.

Additional Information

Model has been constructed with SI units.

Reference

BMR520A.pdml

Disclaimer

The model and model documentation described herein are provided for the sole purpose of facilitating thermal modeling of a structure where the referenced product is included. It should not and cannot be interpreted neither as a detailed description of the product itself, nor as a statement of the product's performance.

The model has been constructed on a best effort basis, but we cannot accept liability for any discrepancy between model predictions and actual values.

Revision history

A	2022-01-21	New document
B	2022-03-28	Product name update

Appendix 1 - Power Loss Distribution

Power loss distribution example for BMR520.

V_{in}=48[V] V_{out}=12[V], I_{in}=6.6[A] I_{out}=25A], T_{ref} ≈ 100℃

Source	Each [W]	Total [W]
T1/T2/T5/T6	0.43	1.72
T3/T4/T7/T8	0.43	1.72
M400(core)	0.904	0.904
M400(P)	1.4	1.4
M400(S)	2.18	2.18
N5/N6	0.32	0.64
M1	0.556	0.556
M200(core)	1.2	1.2
M200(winding)	1.8	1.8
C1/C2	0.01	0.02
C3/C4	0.05	0.1
T205/T206	1.868	3.736
T214/T215	0.5	1
N201	0.21	0.21
shunt R	0.42	0.42
N202	0.1	0.1
Total		17.71