DESCRIPTION THERMAL MODEL FOR BMR510

FLEX INC.

Contents

General

The model is an estimation for the thermal behavior of BMR510. The model is intended for steady-state thermal simulations.

Model Description

The model is a readymade Flotherm 11.1 model. It was created by importing a CAD model in STEP format through the MCAD bridge. Components that are not contributing to the heat transfer, have been removed from the geometry. The model consists of the four major components:

3D CAD Geometry

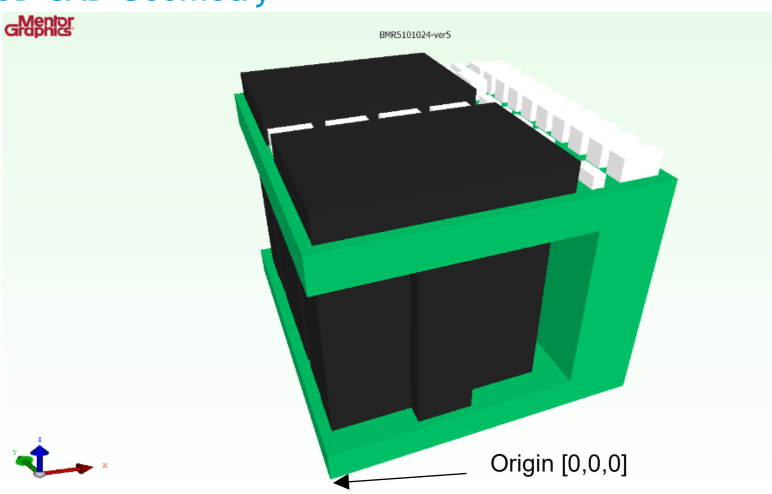


Figure 1. 3D geometry of the model

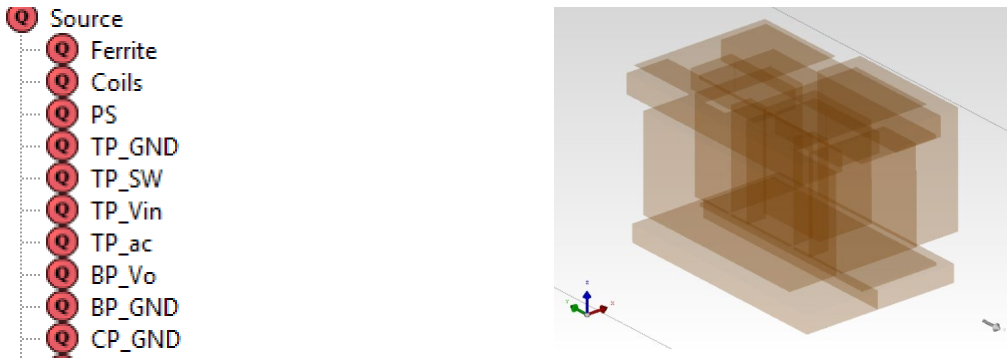
3D geometry is created by importing a CAD model in STEP format through the MCAD bridge (Figure 1). The PCBs have been simplified to a bulk geometry with a certain thermal conductivity in x- y and z directions to mimic the thermal performance of the detailed PCBs.

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

Unit in file: [mm]

Domains of power loss distribution

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



(a) (b)

Figure 2: Power loss setting: (a) list of heat sources, and (b) heat sources distribution over the model

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.

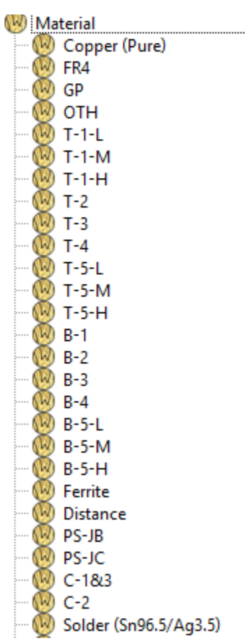


Figure 3. Domains of material data

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. These monitor points are shown in Figure 4.

Figure 4. Monitor points in the model.

Model Calibration

The simulated temperatures are shown in Figure 5 in a case of 13.5 V input, 0.8 V and 80 A output. The model is calibrated to have similar temperature as the actual result from products thermal verification report. Only conduction heat transfer is considered in this calculation. Temperature of the application board is set to 60 ℃ and baseplate to 70 ℃.

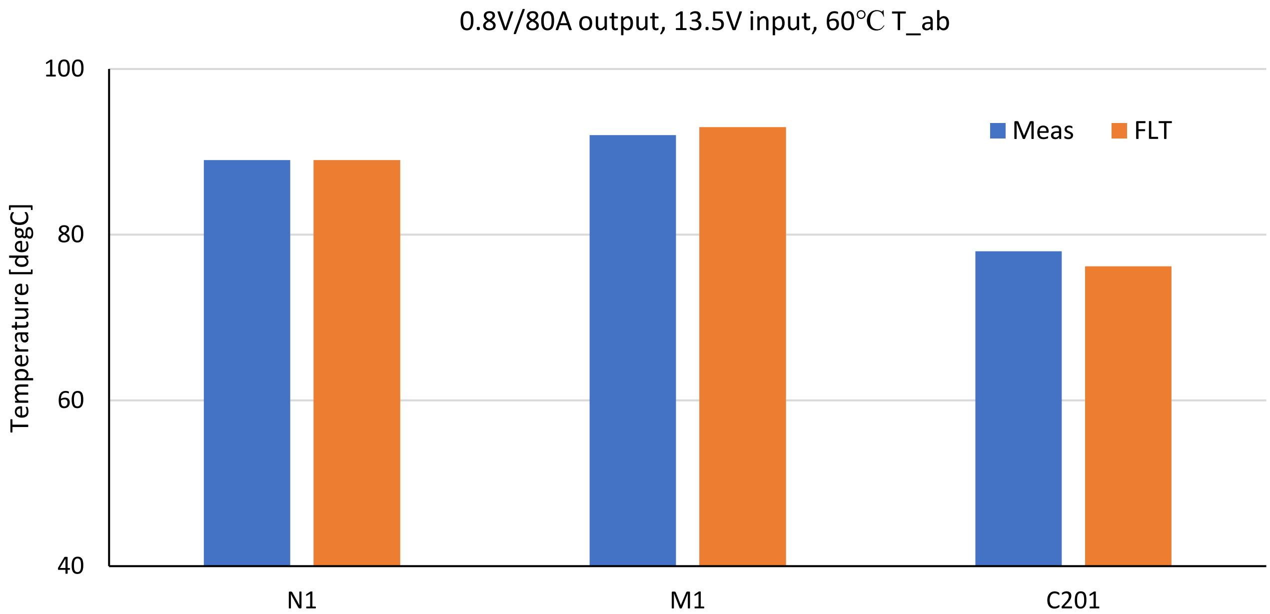


Figure 5: Comparison chart - Meas: measured result, FLT:Flotherm result.

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 13.5 V input, 0.8 V/ 80 A output.

If the model is rotated, make sure that the orientation of the orthotropic materials properties is 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

Data file for BMR510.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	2021-05-05	New Document
B	2022-01-31	Calibrated with actual data

Appendix 1 - Power Loss Distribution

Power loss distribution examples for BMR510.

Condition: Vin 13.5 V, Vout 0.8 V, Iout 80 A, 100 ℃.

Domain	Number of domains/ boundaries	Domain volume [mm^3]	per domain [W]	per volume [mW/mm^3]	Subtotal power loss [W]
PS	2		4.24		8.48
TP_GND	1		0.7		0.7
TP_SW	2		0.3		0.6
TP_Vin	1		0.02		0.02
BP_Vo	1		0.3		0.3
BP_GND	1		0.45		0.45
Ferrite	5	175		1.2	0.21
Coils	2		0.45		0.9
CP_GND	1		0.35		0.35
TP_ac	2		0.25		0.5
				Total (W)	**12.51**

Condition: Vin 13.5 V, Vout 0.8 V, Iout 70 A, 100 ℃.

Domain	Number of domains/ boundaries	Domain volume [mm^3]	per domain [W]	per volume [mW/mm^3]	Subtotal power loss [W]
PS	2		3.5		7
TP_GND	1		0.5		0.5
TP_SW	2		0.24		0.48
TP_Vin	1		0.02		0.02
BP_Vo	1		0.25		0.25
BP_GND	1		0.35		0.35
Ferrite	5	175		1.2	0.21

Coils	2		0.4		0.8
CP_GND	1		0.3		0.3
TP_ac	2		0.25		0.5
				Total (W)	**10.41**

Condition: Vin 13.5 V, Vout 0.8 V, Iout 60 A, 100 ℃.

Domain	Number of domains/ boundaries	Domain volume [mm^3]	per domain [W]	per volume [mW/mm^3]	Subtotal power loss [W]
PS	2		2.83		5.66
TP_GND	1		0.5		0.4
TP_SW	2		0.19		0.38
TP_Vin	1		0.02		0.02
BP_Vo	1		0.2		0.2
BP_GND	1		0.3		0.3
Ferrite	5	175		1.2	0.21
Coils	2		0.35		0.7
CP_GND	1		0.25		0.25
TP_ac	2		0.25		0.5
				Total (W)	**8.62**