DESCRIPTION
THERMAL MODEL FOR
BMR 481 SERIES

FLEX POWER MODULES

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General

The model is an estimation for the thermal behavior of BMR 481 0021, which is an LGA design. The mechanical structure, PCB stack-up, components and materials are similar to other products in the same family, which means that this thermal model is applicable for several products within the BMR 481 family.

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

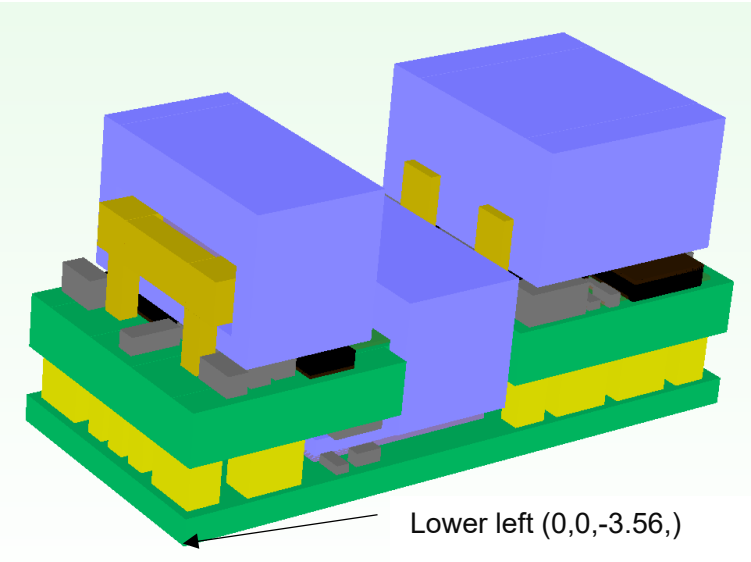


Figure 1

In the geometry most components are maintained per the original design but have been simplified in FloMCAD to cuboids. The PCB has been imported through FloEDA with resolution 19 of longest side.

Origin has been placed so that [0,0,-3.56] 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 combinations of module voltage and current, are given in *Appendix 1 - Power Loss Distribution*

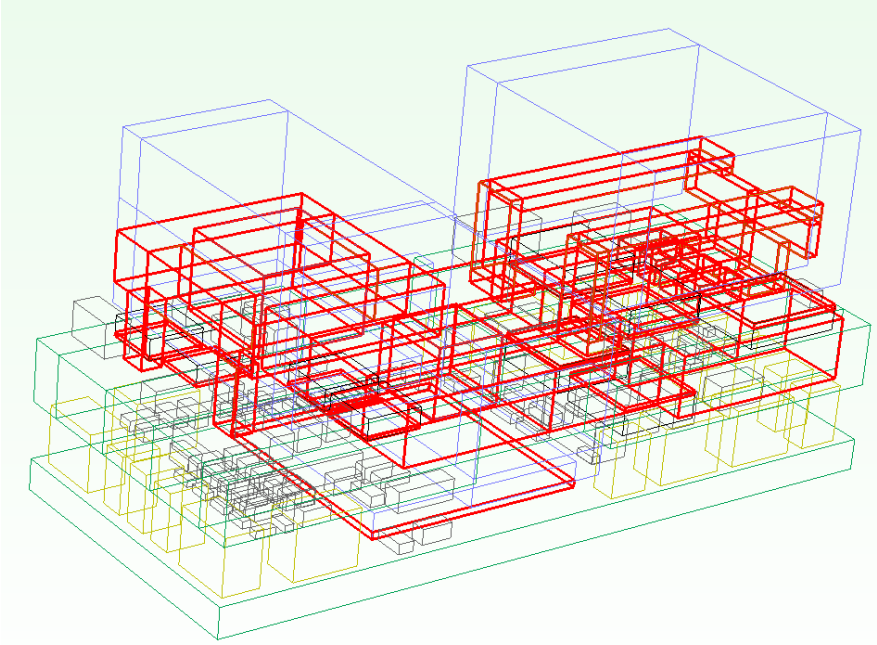
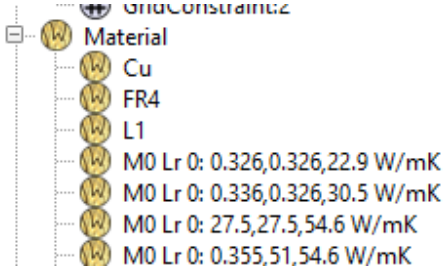


Figure 2 Domains of power losses

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) in the figures following.



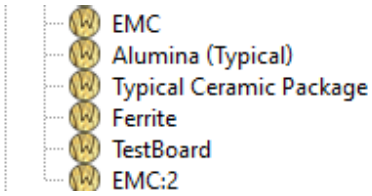


Figure 3: COMPS (Remaining) Heat Conductivity (30) [W/m/K]

The material data labeled “M0 Lr <xx>:..” are from the FloEDA import of the PCB, and are used in the two PCB assemblies TVA170112 and TVA170114.

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

Model Calibration

The model has been calibrated to give temperatures as similar as possible for V_{in}=53[V], V_{out}=1[V], I=70[A], 4 [m/s], compared to thermal verification document 1/102 65-BMR 481 0021 Rev A. Direction of air for the calibration is in the x-direction.

Simulation temperatures are within ±3.1 [degC] compared to measured values, except for T7 which underestimates the temperature some 10 [degC]. At the moment the available data do not allow for an explanation.

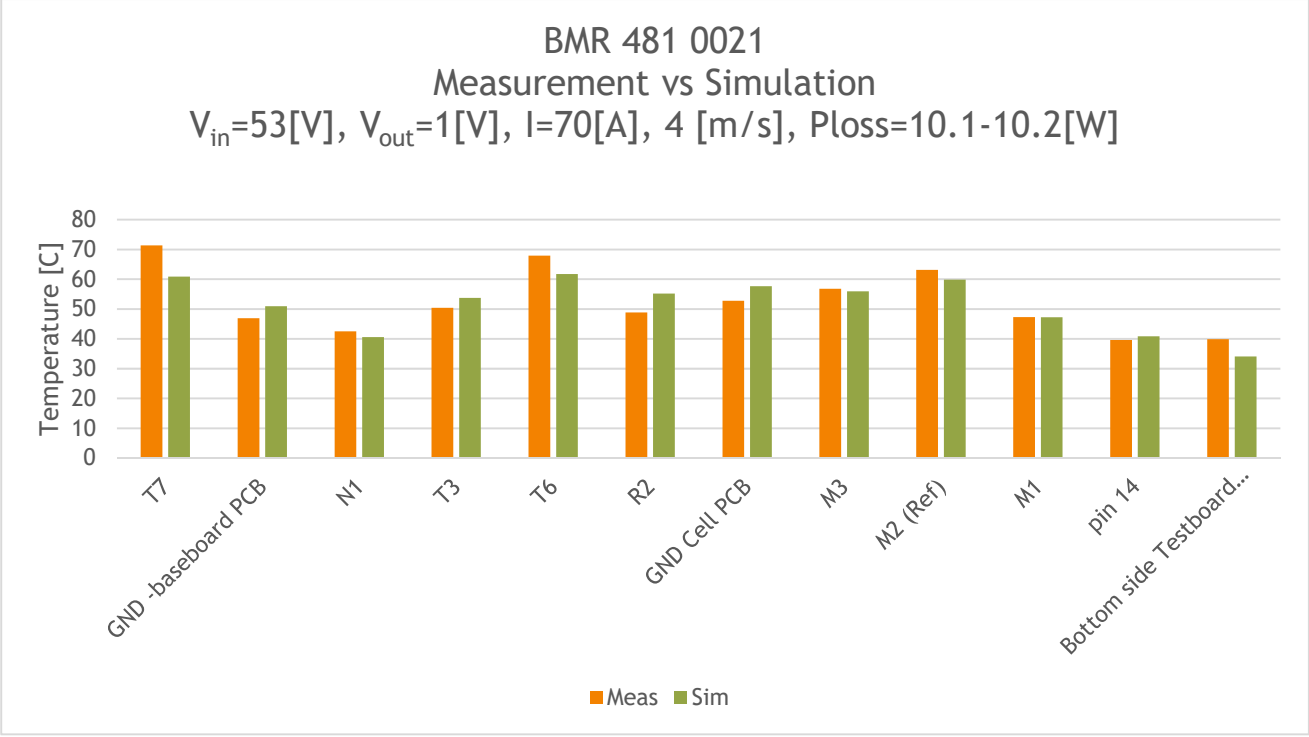


Figure 4: Model calibration result

Model Usage

Import the *.pdml file into the desired project.

Assign power losses per table in *Appendix 1 - Power Loss Distribution* to the domains in section *Domains of power loss distribution*. Default settings are for Vin=53 [V], Vout=1[V], Iout=70[A]

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

Thermal report 1/102 65 BMR 481 0021 Rev A

BMR 481 0021_A.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

Pa2	2018-12-21	Added Parasolid file format
B	2020-12-14	Flotherm version replacement.

Appendix 1 - Power Loss Distribution

Power loss distribution example for BMR 481.

V_{in}= 53V V_{out}= 1V I_{out}=70A

Domain	Number of domains	Power loss per domain [W]	Power loss per volume [mW/mm^3]	Subtotal [W]
PRIMFET	4	0.34	-	1.3545
SECFET	4	0.76	-	3.03
M1_Core	1	0.336	-	0.336
M2_Core	1	0.273	-	0.273
M3_Wind	14	-	45.71	1.717
N2	1	0.3087	-	0.3087
N1	1	0.07455	-	0.07455
C10_C15	6	0.013125	-	0.07875
M2_Wind	4	-	10.06	2.0055
M1_Wind	6	-	6.7	0.5565
PCB_Sec	3	-	2.2	0.3658
Total [W]				10.1