



DESCRIPTION THERMAL MODEL FOR PKU 4713A SERIES



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General

The model is based on and valid for PKU4713A (BMR676), which is a Through Hole Pin 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 family.

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. The model consists of the five major components:

1. Cuboid version of the geometry
2. Domains of power loss
3. Domains of material properties
4. Predefined monitor points
5. Predefined grid

3D CAD Geometry

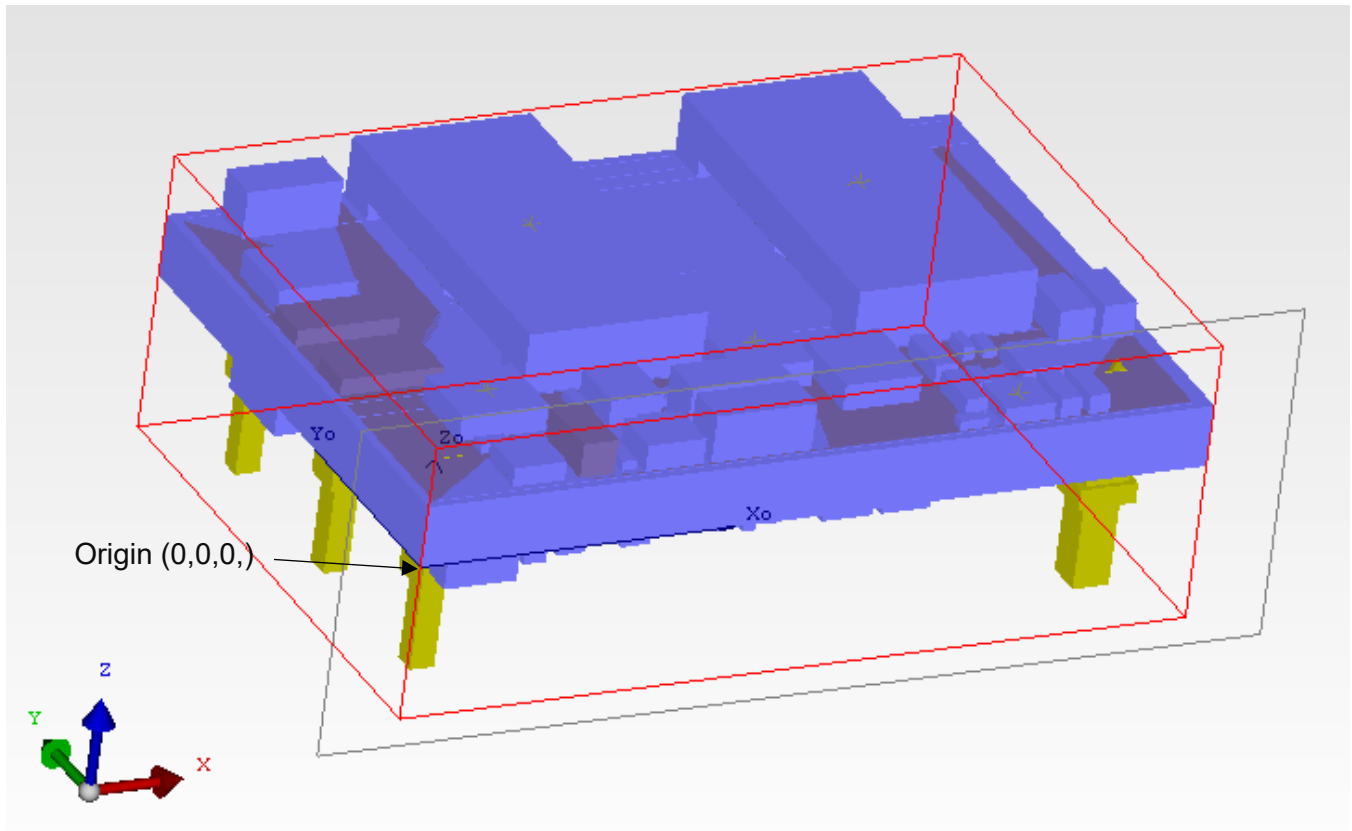


Figure 1 Model origin in lower left corner of PCB and axis orientation.

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

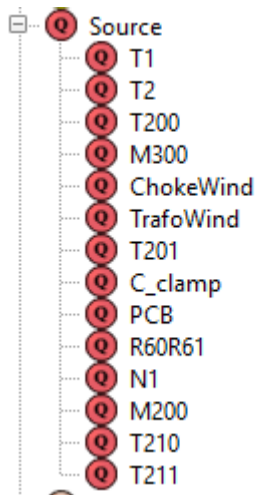


Figure 2: Heat Sources to be found as sources..

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.

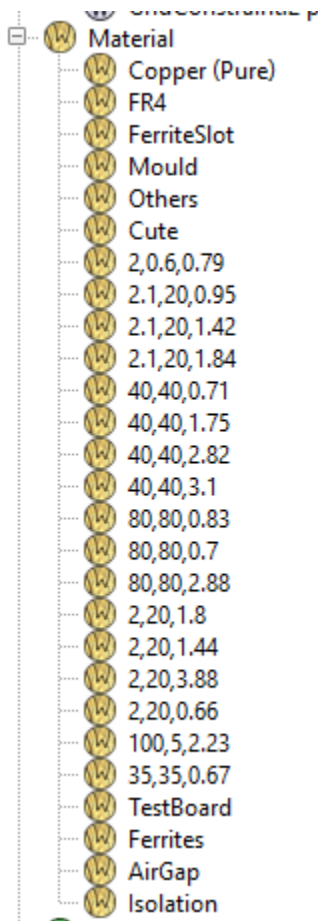
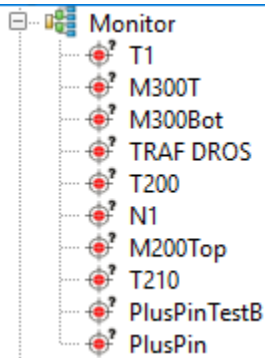


Figure 3. Domains of material data

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 the location in document 1/102 65-BMR 676 04 Rev A:



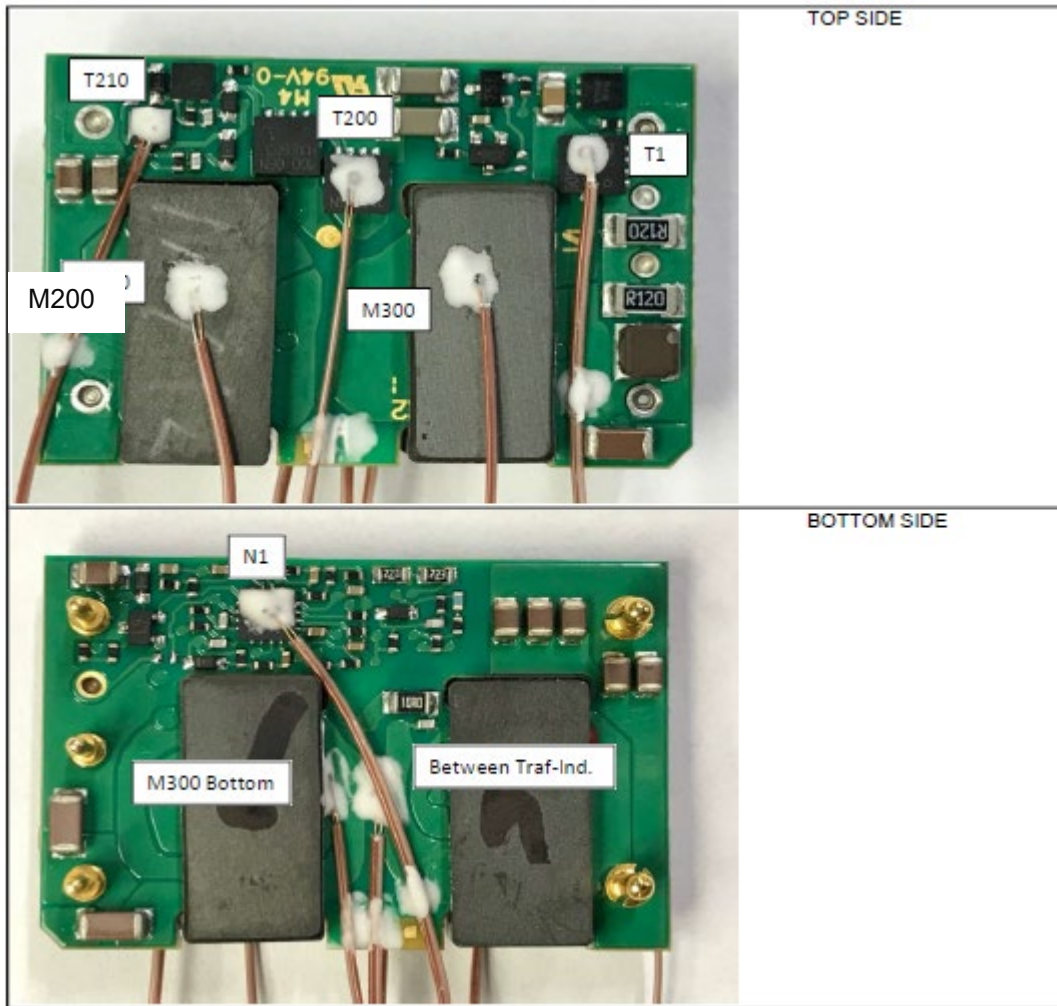


Figure 4. Thermocouple location. Note: The location of T210 is wrong in the picture. The correct location is the FET next to it, up to the right.

Grid Constraints

In order to capture the heat flux, a well distributed grid is recommended. The model has some pre-defined grid constraints that have been used in the calibration (see below). Of course, these constraints are optional to use.

- Grid Constraint
- GridConstraint:100x
- GridConstraint:50y
- GridConstraint:10z
- GridConstraint:5 pcs
- GridConstraint:2 pcs

Model Calibration

The model has been calibrated to give temperatures as similar as possible compared to thermal verification document 1/102 65-BMR 675 04 Rev A, for $V_{in}=52.5[V]$, $V_{out}=11.9[V]$, $I_{out}=5.8[A]$, $I_{in}=1.4[A]$, nat. conv. In addition, comparison have been made with both a detailed and a simplified FEM model made in COMSOL. Calculations were done with a set temperature of 34[C] on the pins.

Flotherm simulation temperatures are within ± 3 [degC] compared to measured values. Differences between the two simplified models (Flotherm and FEM) are considered to be related to differences in mesh.

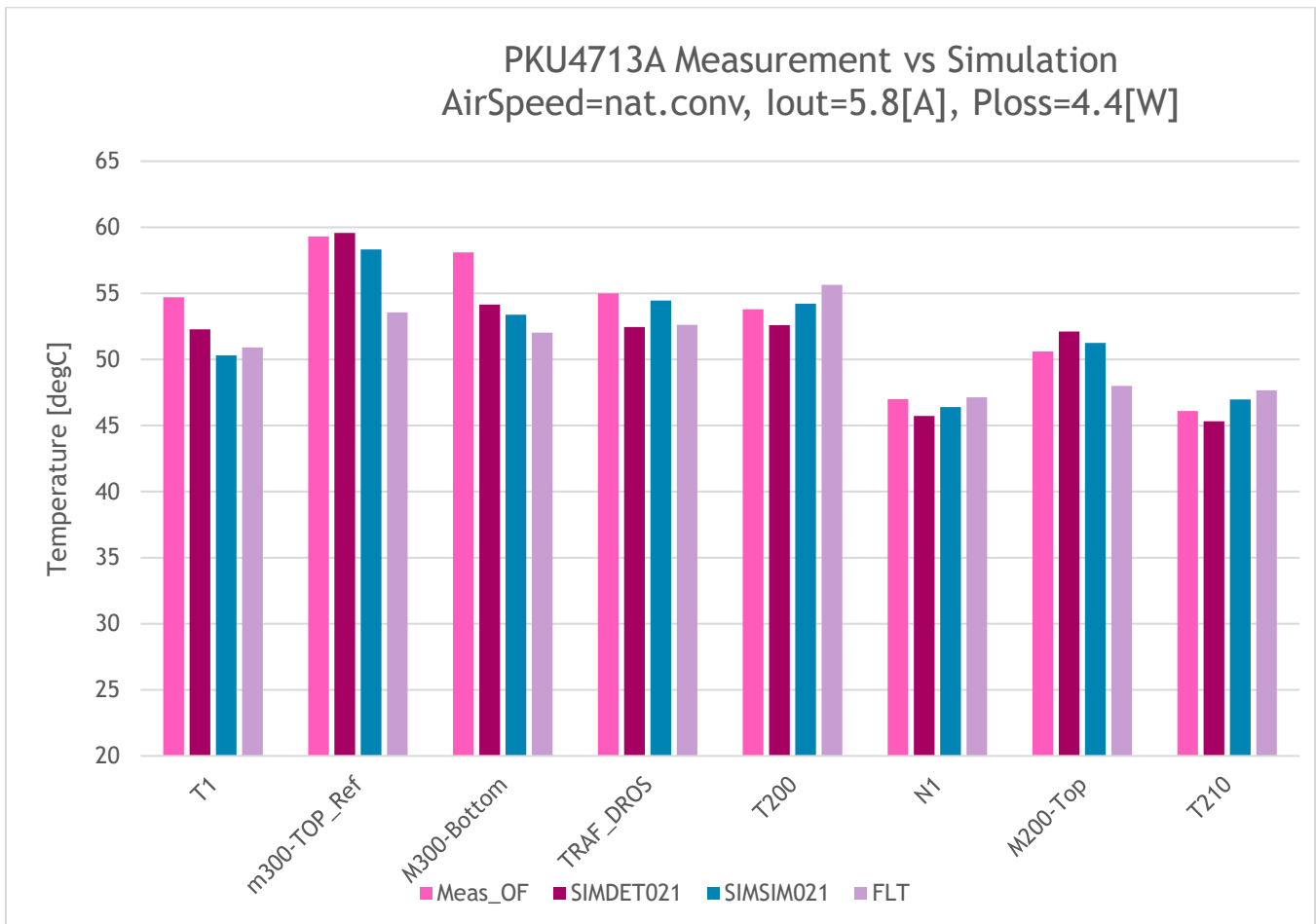


Figure 5: Model calibration result. Meas_OF=Measured values. SIMDET021=Detailed FEM model. SIMSIM021=Simplified model with same geometry and material domains as the present flotherm model. FLT=This model, Flotherm



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 69.5[W] output power.

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

Thermal report 1/102 65-BMR 676 04 Rev A

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	2020-03-17	New Document
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Appendix 1 - Power Loss Distribution

Power loss distribution example for BMR 676 04/1162.

$V_{in} = 52.5[V]$ $V_{out} = 11.9[V]$ $I_{in} = 1.4[A]$ $I_{out} = 5.8A]$

Domain	Number of domains	Domain volume [mm ³]	Per domain [W]	Per volume [mW/mm ³]	Total [W]
T1	1		0.458		0.458
T2	1		0.002		0.002
T200	1		0.37		0.37
M300	2		0.15		0.3
CHOKEWIND	1		0.47		0.47
TRAFOWIND	1		0.8		0.8
T201	1		0.18		0.18
C_clamp	1		0.044		0.044
PCB	3	942		0.399	0.375
R60R61	2		0.5		1
N1	1		0.1		0.1
M200	2		0.1		0.2
T210	1		0.05		0.05
T211	1		0.05		0.05
Total [W]					4.4