DESCRIPTION
THERMAL MODEL FOR
BMR 350 2320/802

FLEX INC.

Contents

General

The model is an estimation for the thermal behavior of BMR 350 2320/802, which is a through hole pin design.

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

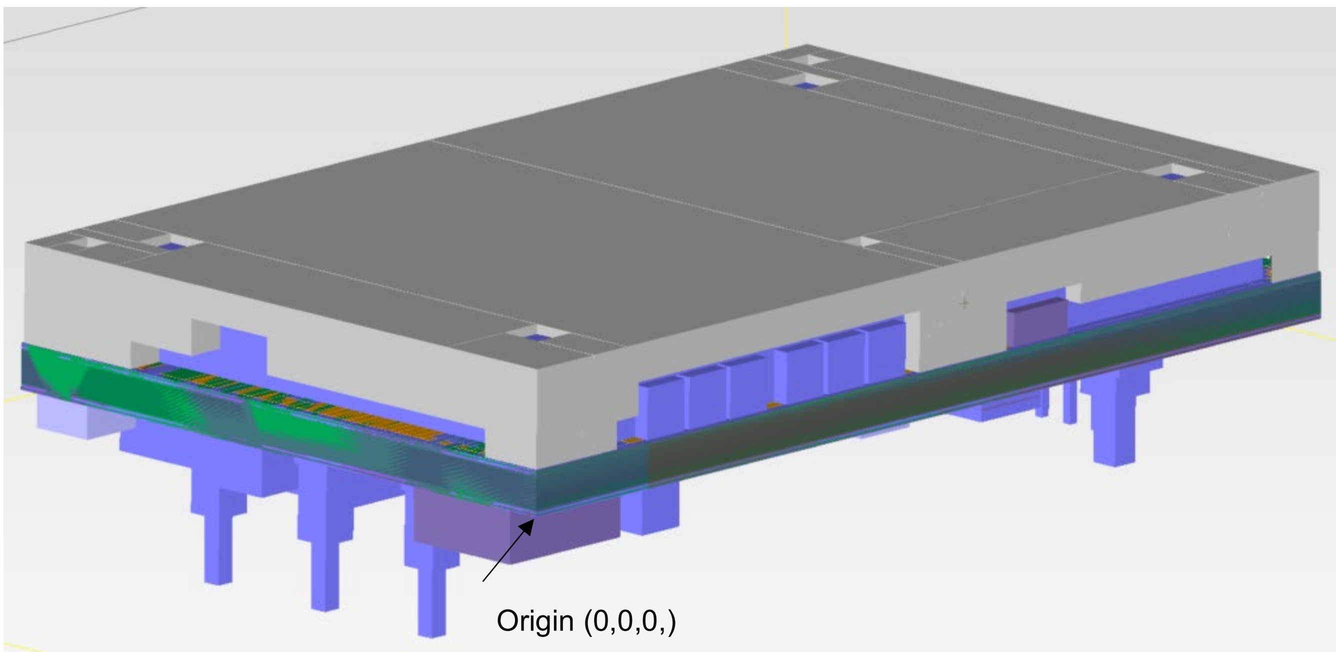


Figure 1 Model origin in lower left corner of PCB and axis orientation.

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

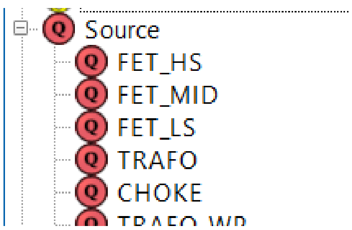
Unit in file: [mm]

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 including the blind vias, and finally a middle bulk layer.

The model comes with a rudimentary grid constraint, which was used during the model development. It generates approx. 10 million cells. It was found difficult to capture the thermal behavior without a detailed resolution of the baseplate. 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.*



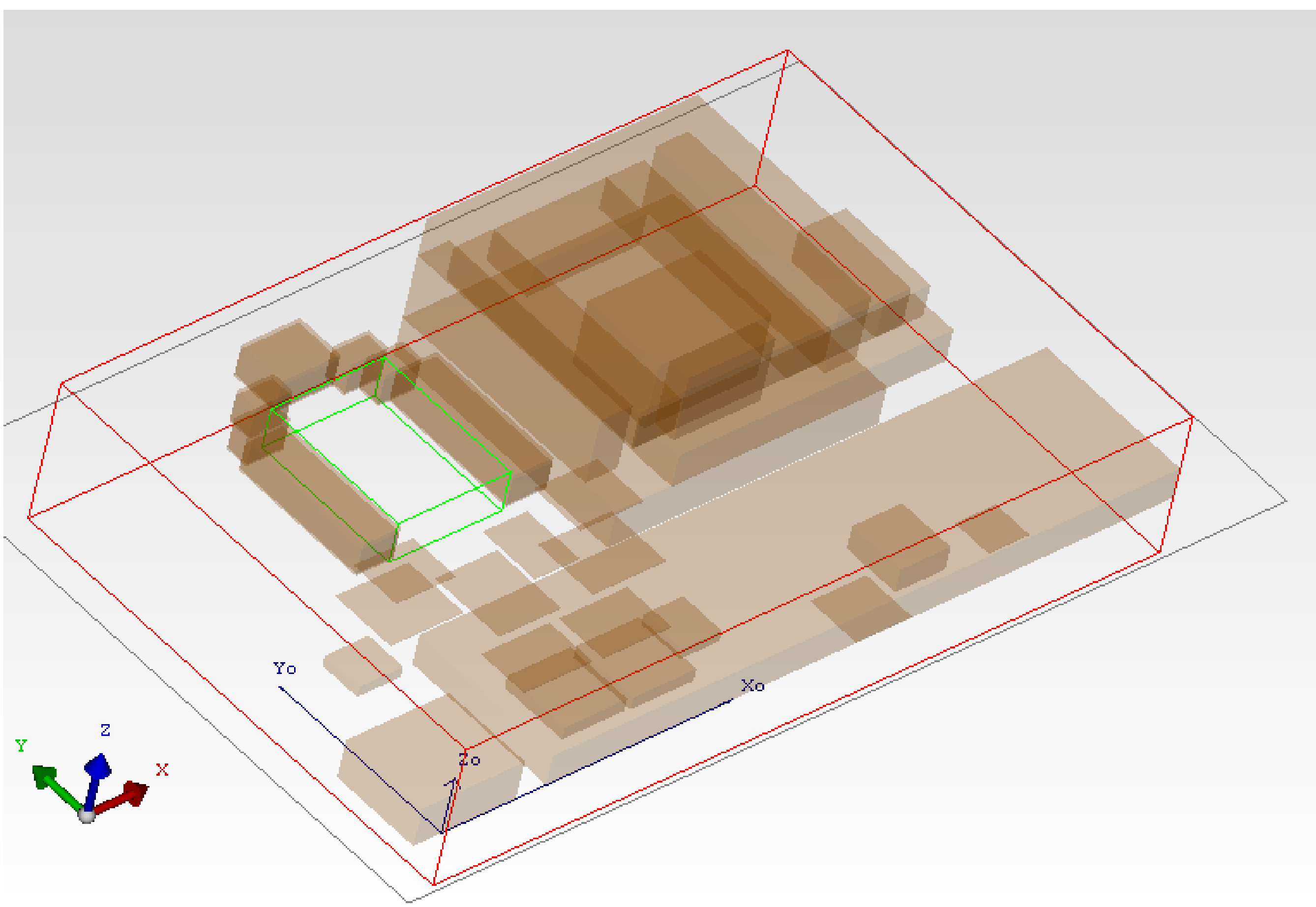


Figure 2: Heat Sources

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).

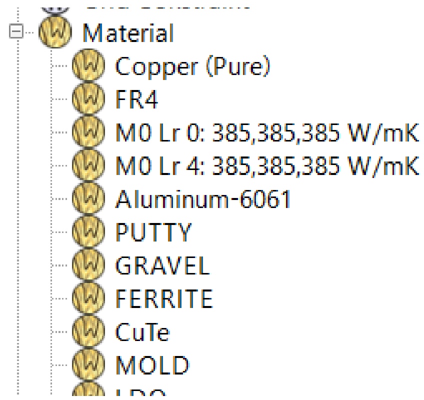


Figure 3. Domains of material data

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.

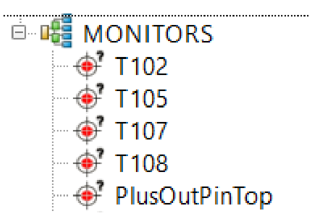


Figure 4. Probe points.

The probe points are chosen to correspond to the thermal verification measurements. They are not intended to serve as pass/fail criterions.

Model Calibration

The model has been calibrated to give temperatures as similar as possible compared to thermal verification document 1/102 65-BMR3502320_802P1A(600W) Vin=49[V], Vout=12[V], Iout=29[A]. The calibration was done using power loss settings per Appendix 1 - Power Loss Distribution.

Calibration data: Tamb=27.4[C], Air speed=3[m/s] (direction PosY), Ploss=7.2[W] (measured), 7.65[W] (simulated). Simulation module mounted on a 254x254x3.2[mm^3] testboard, with heat conductivity [200,200,1][W/m/K], in an enclosure with height 43.2[mm], with distance 20[mm] from testboard to top of enclosure.

Simulation temperatures are within +4.4/-0.1 [C] compared to measured values, except for N101 which is measured too low due to low conducting case.

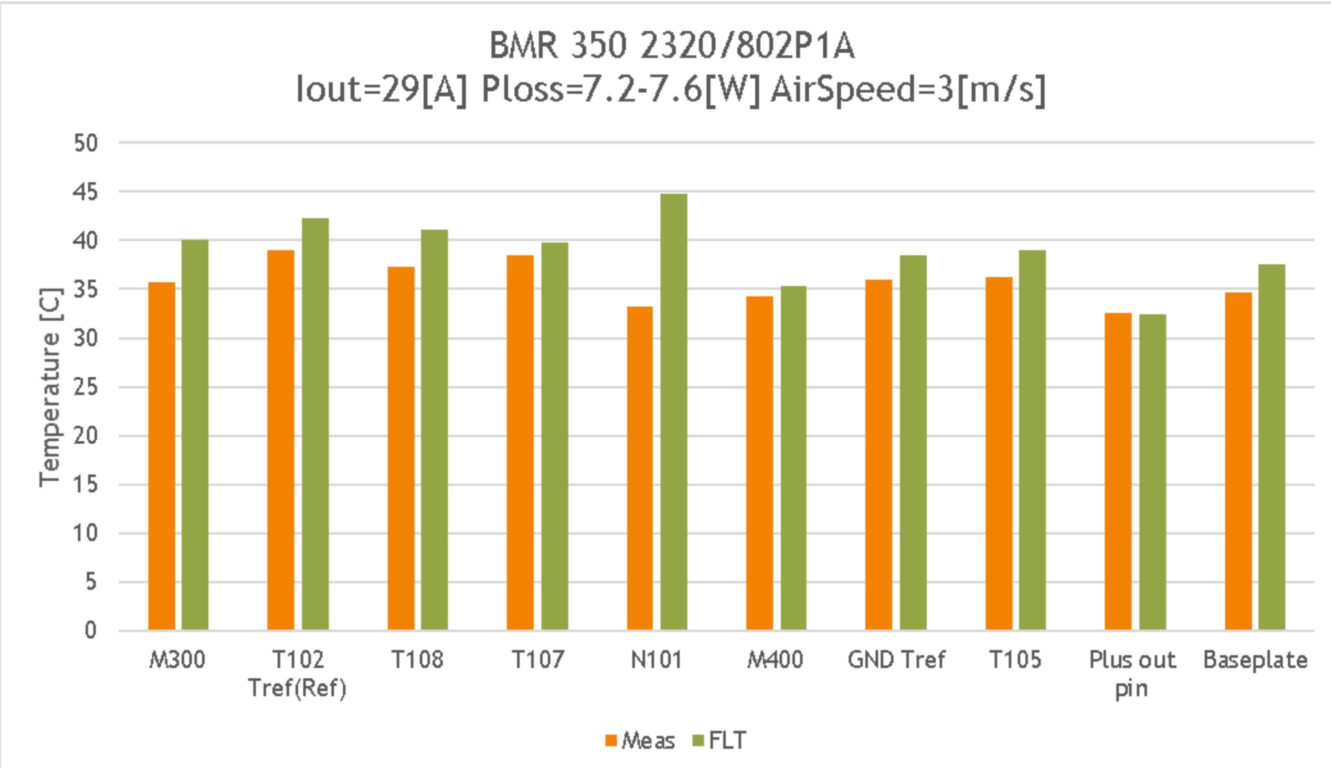


Figure 5: Model calibration result. N101 is measured on top of a low conductiong case, thus the value is uncertain.

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 Vout=12[V], Iout=29[A], 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

BMR3502320_802A.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	2022-06-30	New document.

Appendix 1 - Power Loss Distribution

Power loss distribution examples for BMR350 2320/802.

V_{in}= 49V, V_{out}= 12V, I_{out}= 29A, T_{ref} ≈ 100℃

Domain	Number of domains	Per domain [W]	Total [W]
High side FET T101, T105	2	0.31	0.62
Mid FET T102, T106	2	0.51	1.02
Low side FET T103,T104,T107, T108	4	0.39	1.56
TRAFO (Core, M300)	(*)	(*)	1.69
CHOKE (Core, M400)	(*)	(*)	0.28
TRAFOWIND primary (M300)	(*)	(*)	0.19
TRAFOWIND secondary (M300)	(*)	(*)	0.44
CHOKEWIND (M400)	(*)	(*)	0.17
Primary driver (N107, N110)	2	0.14	0.28
Secondary driver (N104, N105)	2	0.15	0.3
Aux Circuit (N111)	1	0.4	0.4
Aux Inductor (M2)	1	0.3	0.3
LDO (N101)	1	0.1	0.1
INPUT CHOKE	1	0.1	0.1
GND PCB	1	0.2	0.2
Total [W]			**7.65**

(*) Defined as Source/Volume. Adjust source so that the total adds up.