DESCRIPTION
THERMAL MODEL FOR

BMR491XXXX/852, BMR491XXXX/855
BMR491XXXX/856, BMR491XXXX/857

FLEX INC.

Contents

General

The model is an estimation for the thermal behavior of BMR 491 0208, which is a Through Hole Pin design. The model is valid for BMR491xxxx/852, BMR491xxxx/855, BMR491xxxx/856 and BMR491xxxx/857.

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

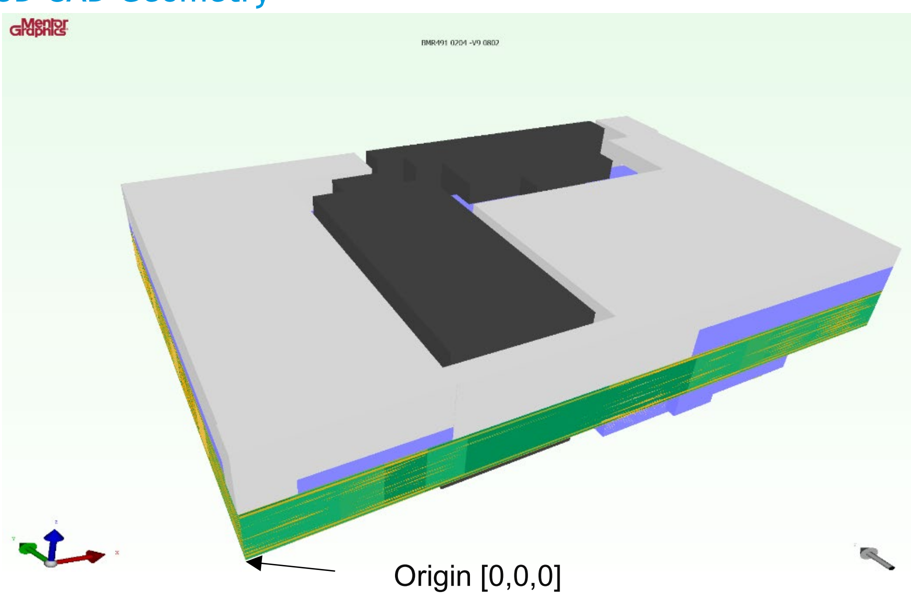


Figure 1. 3D geometry of the model

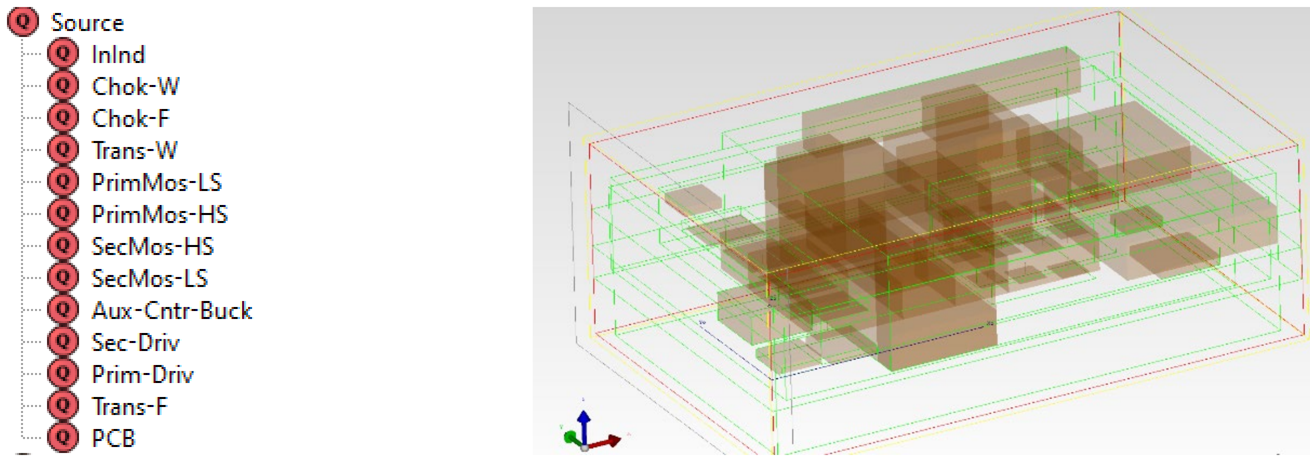
3D geometry is created by importing a CAD model in STEP format through the MCAD bridge. Components that are not contributing to the heat transfer have been removed from the geometry. The PCB has been imported through FloEDA bridge module. The level of modeling is detailed one which means each layer has its own material properties based on the layer copper coverage. This detailed level includes also dielectric layers and vias.

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*



(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.

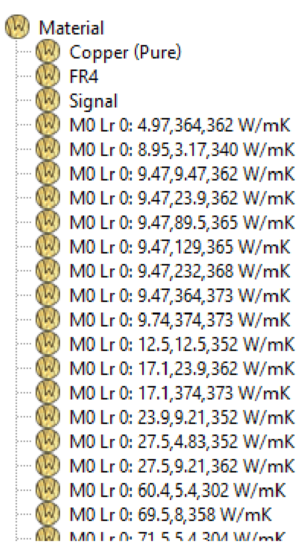


Figure 3. Domains of material data

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 here

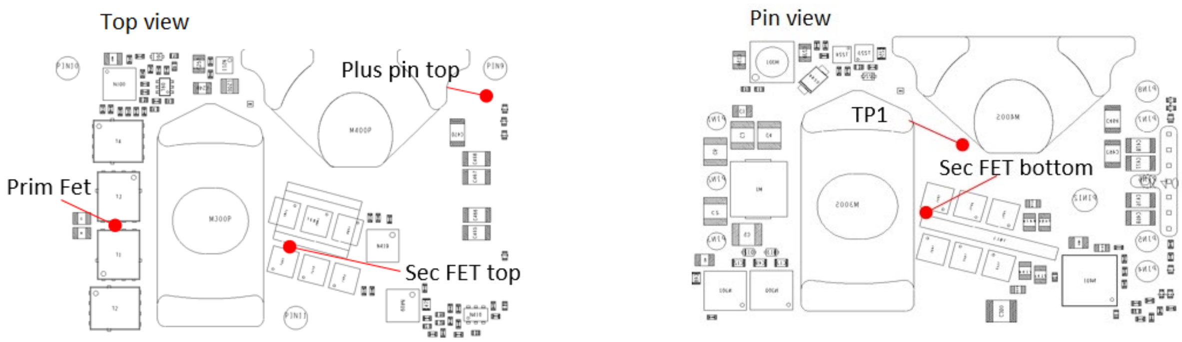


Figure 4. Monitor points in the model.

Model Calibration

The model has been calibrated to give temperatures as similar as the product’s wind tunnel thermal verification report in a case of 54Vin, 12Vout, 1540Aout with the airspeed of 4 m/s in y-direction.

Flotherm simulation temperatures of majority of important components are within ± 2 [C] compared to thermal verification report (see Figure 6.).

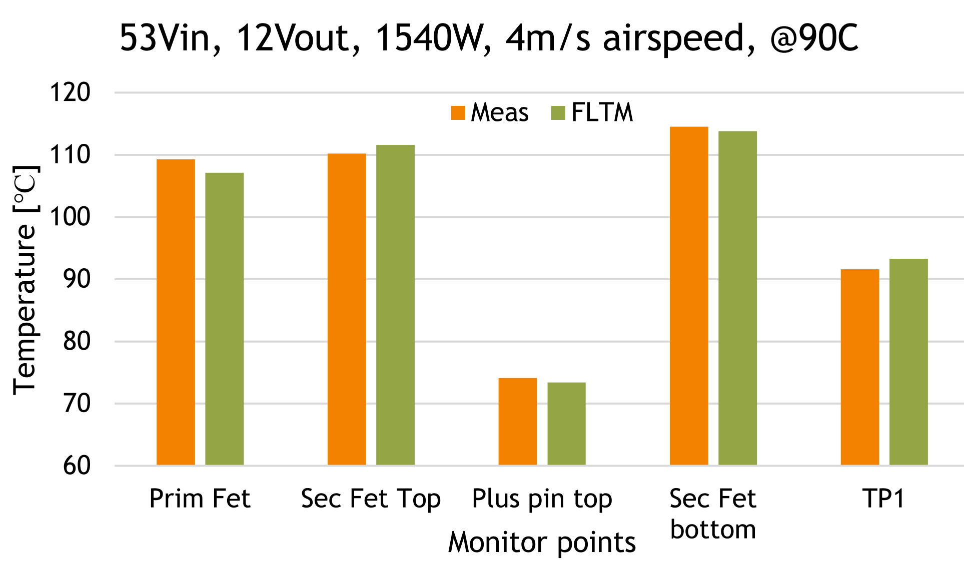


Figure 6: Model calibration result: Meas – measured results, FLTM – Flotherm simulation results.

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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 54Vin, 12Vout, and 1540W at 90C.

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

19010-BMR4910208-revC.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	2021-08-03	New Document
B	2022-08-10	Power loss table updated at 90C
C	2022-10-18	Power loss tables updated with more cases.
D	2023-12-04	Update on Appendix according to model file

Appendix 1 - Power Loss Distribution

Power loss distribution examples for BMR 491 3208/857 and BMR 491 3209/862.

Condition: 54Vin, 12Vout, Output Power:1540[W]

Domain	Number of domains/ boundaries	Domain volume [mm³]	per domain [W]	per volume [mW/mm³]	Subtotal power loss [W]
InInd	1		0.12		0.12
Chok-W	5	903		10.25	9.26
Chok-F	3	1714		0.052	0.09
Trans-W	4	1166		8.23	9.55
PrimMos-HS	2		2.02		4.04
PrimMos-LS	2		1.98		3.96
SecMos-HS	6		1.54		9.24
SecMos-LS	6		1.64		9.84
Sec-Driv	2		0.79		1.58
Aux-Cntr-Buck	3		0.64		1.93
Prim-Driv	2		0.66		1.32
Trans-F	3	2842		1.20	3.41
PCB	1	1133		2.44	2.76
				Total (W)	**57.09**

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Power loss distribution examples for BMR 491 2307/856.

Condition: 54Vin, 12.1Vout, Output Power:1400[W]

Domain	Number of domains/ boundaries	Domain volume [mm³]	per domain [W]	per volume [mW/mm³]	Subtotal power loss [W]
InInd	1		0.11		0.11
Chok-W	5	903		8.12	7.33
Chok-F	3	1714		0.052	0.09
Trans-W	4	1166		7.54	8.79
PrimMos-HS	2		1.55		3.10
PrimMos-LS	2		1.76		3.52
SecMos-HS	6		1.18		7.08
SecMos-LS	6		1.27		7.62
Sec-Driv	2		0.66		1.32
Aux-Cntr-Buck	3		0.54		1.62
Prim-Driv	2		0.55		1.10
Trans-F	3	2842		0.93	2.65
PCB	1	1133		1.48	1.68
				Total (W)	**46**

Power loss distribution examples for BMR 491 2205/852.

Condition: 54Vin, 12Vout, Output Power:1300[W]

Domain	Number of domains/ boundaries	Domain volume [mm^3]	per domain [W]	per volume [mW/mm^3]	Subtotal power loss [W]
InInd	1		0.10		0.10
Chok-W	5	903		7.86	7.10
Chok-F	3	1714		0.052	0.09
Trans-W	4	1166		7.00	8.16
PrimMos-HS	2		1.35		2.70
PrimMos-LS	2		1.5		3.00
SecMos-HS	6		1.11		6.66
SecMos-LS	6		1.22		7.32
Sec-Driv	2		0.66		1.32
Aux-Cntr-Buck	3		0.54		1.62
Prim-Driv	2		0.55		1.10
Trans-F	3	2842		0.80	2.27
PCB	1	1133		1.46	1.65
				Total (W)	**43**

Power loss distribution examples for BMR 491 3206/855.

Condition: 54Vin, 10.4Vout, Output Power:1300[W]

Domain	Number of domains/ boundaries	Domain volume [mm³]	per domain [W]	per volume [mW/mm³]	Subtotal power loss [W]
InInd	1		0.10		0.10
Chok-W	5	903		10.85	9.80
Chok-F	3	1714		0.064	0.11
Trans-W	4	1166		9.22	10.75
PrimMos-HS	2		1.35		2.70
PrimMos-LS	2		1.50		3.00
SecMos-HS	6		1.45		8.70
SecMos-LS	6		1.54		9.24
Sec-Driv	2		0.66		1.32
Aux-Cntr-Buck	3		0.54		1.62
Prim-Driv	2		0.55		1.10
Trans-F	3	2842			3.14
PCB	1	1133			2.42
				Total (W)	**54**