



# DESCRIPTION THERMAL MODEL FOR BMR323



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## General

The model is an estimation for the thermal behavior of BMR323. The model is intended for steady-state thermal simulations.

## Model Description

The model is made with Flotherm 2024, exported as a pdml assembly. The model consists of the three major components:

### 3D CAD Geometry

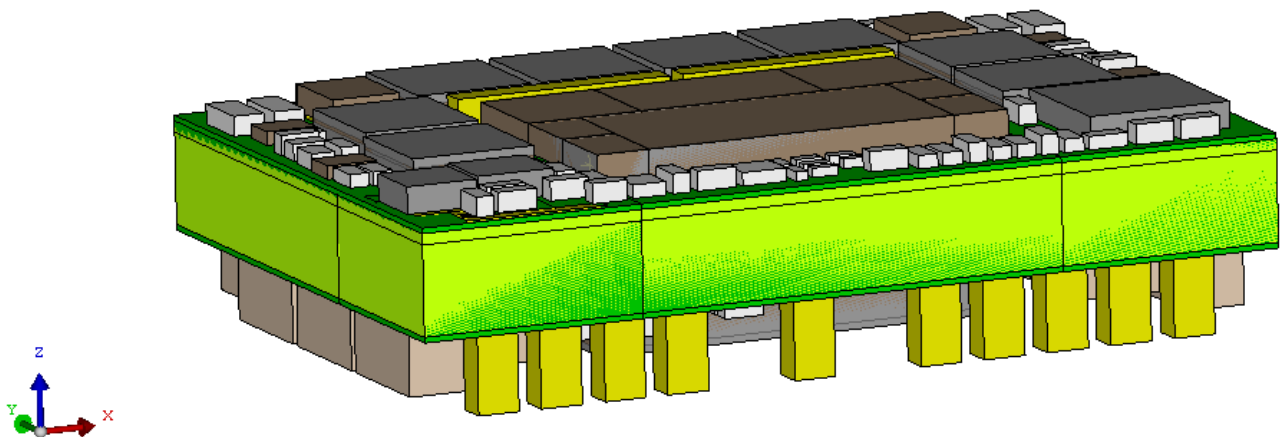


Figure 1. 3D geometry of the model

3D geometry is created by importing a CAD model in STEP format through the MCAD bridge. The PCBs have been simplified to a bulk geometry where the copper layers and vias have been taken into consideration by assigning anisotropic material properties to the PCBs domains.

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 operating conditions, are given in

## Appendix 1 - Power Loss Distribution.

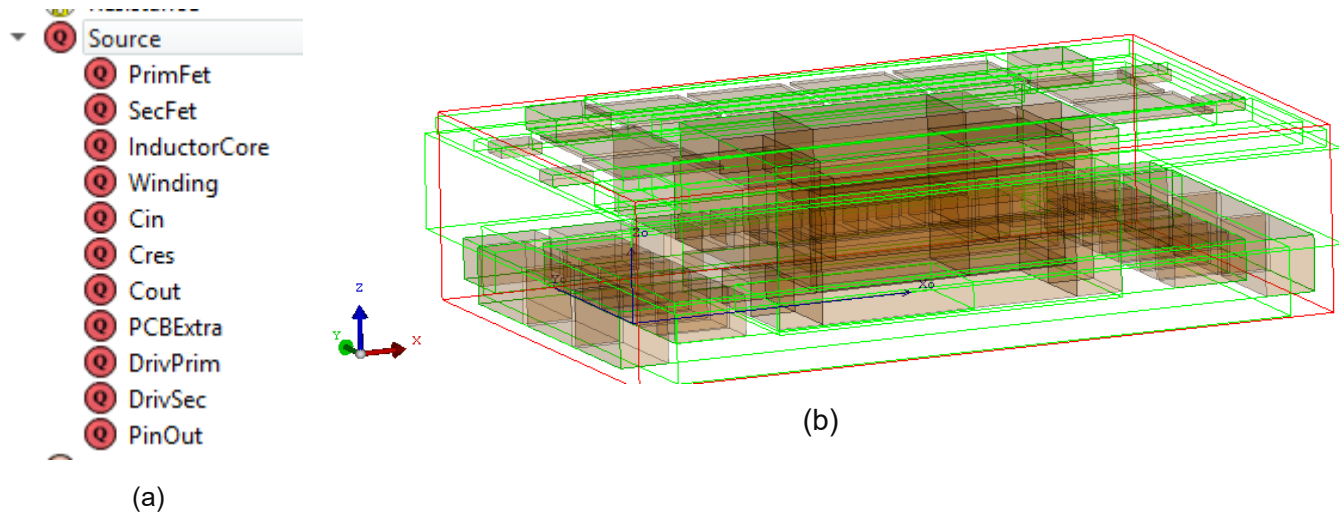


Figure 2: Power loss setting: (a) list of heat sources (examples), and (b) heat sources distribution in the model

**Note** that several of the power sources are defined as “**Non Linear Source**”, which means they are temperature dependent, as below example for source PrimFet shows:

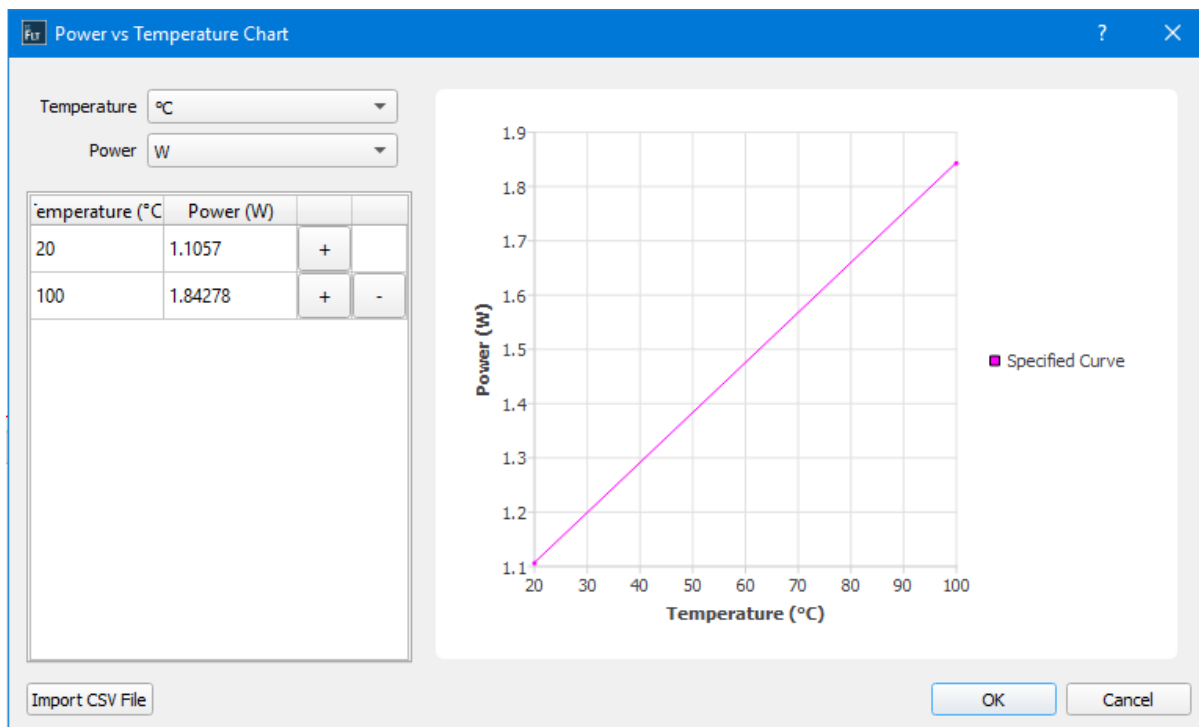


Figure 3. Temperature dependent power source PrimFet.

It is important to understand that these sources do not have a value until there is a solution for the temperature, and therefore they do not show up in the model tree with values until there is a solution available.

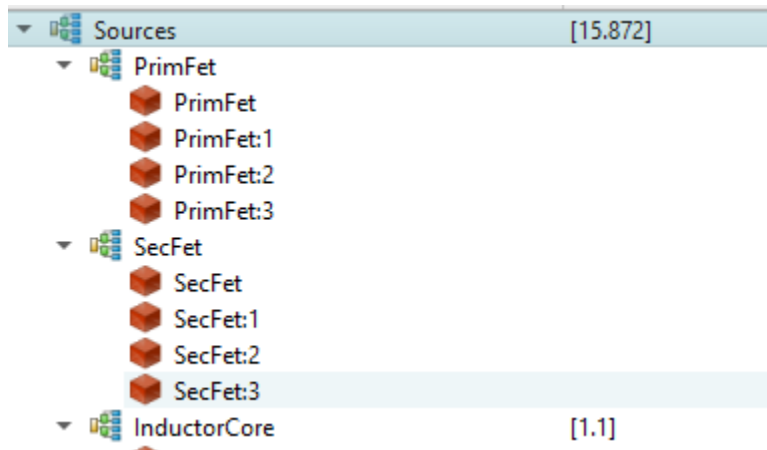


Figure 4. Temperature dependent power source PrimFet and SecFet do not have any initial values since there is no solution available yet. In contrast InductorCore is defined as Source/Volume, with no temperature dependency, and therefore the value exists.

Due to complex geometry some sources are defined as “**Source/Volume**”, which distributes a total power loss over several domains with equal power density. A limitation in FloTHERM is that this type of source cannot be defined with a temperature dependency. As a default setting the power loss in these types of sources have been given the value for 100[C]. Should there exist values for lower temperatures, then these are presented in the tables in Appendix 1 - Power Loss Distribution.

## 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.

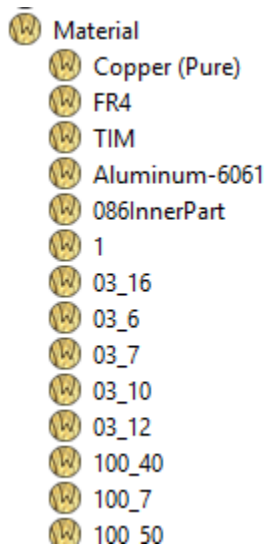


Figure 5. Domains of material data, generic examples

**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.

## Model Calibration

The model has been checked against measurements done in Jan-Apr 2025. The result can be seen in Figure 6. For the comparison a cold wall, thermal gap pad (2 mm, 7.5 W/m/K) and a test board was used.

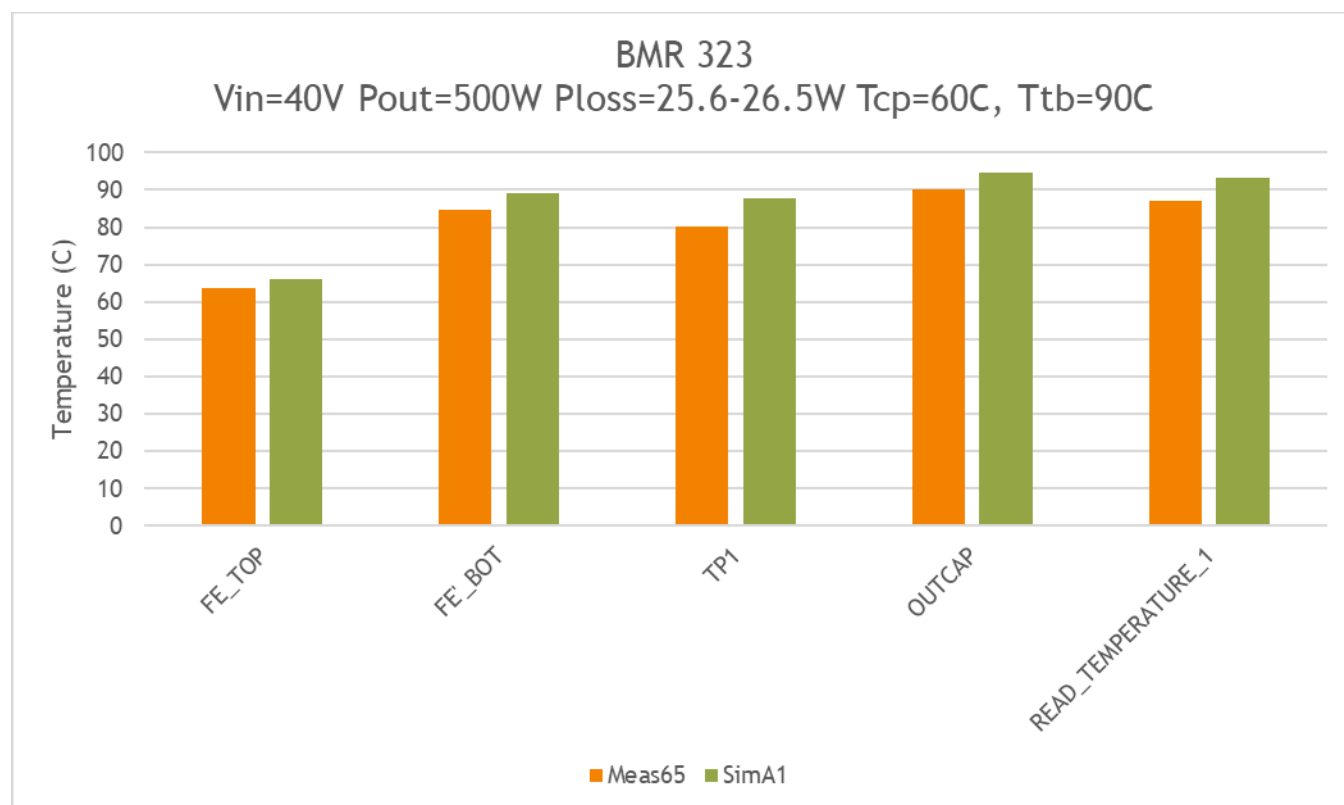


Figure 6 Results from comparison of simulation versus measurements.

## Model Usage

Import the \*.pdml file into the target project. Adjust the dissipated power by altering the thermal sources per

Figure 2, according to



Appendix 1 - Power Loss Distribution. Default settings are for  $V_{in}=40V$  and  $P_{out}=500W$

The localized grids and grid constraints are not necessary parts of the model. Choose grid settings per best practice in FloTHERM.

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.



## Additional Information

Model has been constructed with SI units.

### References

19010-BMR323A1.pdml

BMR323-Gxx-Flotherm inputs with Aux.xlsx

### 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	2025-05-02	New Document
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## Appendix 1 - Power Loss Distribution

BMR323 Default power loss distribution for Vin=40V, Pout=500W, temperature ~100 [C]

Domain	Number of domains/ boundaries	Domain volume [mm <sup>3</sup> ]	per domain [W]	per volume [mW/mm <sup>3</sup> ]	Subtotal power loss [W]
Prim_Fets	4		1.843		7.37
Sec_Fets	4		0.883		3.53
InductorCore	18	389.23		2.826	1.1
Winding	5	404.46		33.9862	13.746
Cin	6		0.04531625		0.272
Cres	14		0.01264198		0.1769
Cout	14		0.02410229		0.3374
PCBExtra (not used)					
DrivPrim	4		0.0815		0.326
DrivSec	2		0.35		0.7
PinOut (not used)					
				<b>Total (W)</b>	<b>27.56</b>

BMR323 Default power loss distribution for Vin=40V, Pout=500W, temperature ~20 [C]

Domain	Number of domains/ boundaries	Domain volume [mm <sup>3</sup> ]	per domain [W]	per volume [mW/mm <sup>3</sup> ]	Subtotal power loss [W]
Prim_Fets	4		1.1057		4.423
Sec_Fets	4		0.69388		2.775
InductorCore	18	389.23		2.826	1.1
Winding	5	404.46		23.257	10.62
Cin	6		0.035		0.21
Cres	14		0.009764		0.137
Cout	14		0.0186154		0.261
PCBExtra (not used)					
DrivPrim	4		0.0815		0.326
DrivSec	2		0.35		0.7
PinOut (not used)					
				<b>Total (W)</b>	<b>20.55</b>



BMR323 Default power loss distribution for Vin=54V, Pout=500W, temperature ~100 [C]

Domain	Number of domains/ boundaries	Domain volume [mm <sup>3</sup> ]	per domain [W]	per volume [mW/mm <sup>3</sup> ]	Subtotal power loss [W]
Prim_Fets	4		1.015		4.06
Sec_Fets	4		0.426		1.7
InductorCore	18	389.23		2.826	1.1
Winding	5	404.46		16.225	6.56
Cin	6		0.048		0.288
Cres	14		0.0047		0.066
Cout	14		0.0136		0.19
PCBExtra (not used)					
DrivPrim	4		0.0815		0.326
DrivSec	2		0.35		0.7
PinOut (not used)					
				<b>Total (W)</b>	<b>14.99</b>

BMR323 Default power loss distribution for Vin=54V, Pout=500W, temperature ~20 [C]

Domain	Number of domains/ boundaries	Domain volume [mm <sup>3</sup> ]	per domain [W]	per volume [mW/mm <sup>3</sup> ]	Subtotal power loss [W]
Prim_Fets	4		0.609		2.436
Sec_Fets	4		0.3347		1.3388
InductorCore	18	389.23		2.826	1.1
Winding	5	404.46		12.53	5.068
Cin	6		0.0368		0.2208
Cres	14		0.00364		0.051
Cout	14		0.0105		0.147
PCBExtra (not used)					
DrivPrim	4		0.0815		0.326
DrivSec	2		0.35		0.7
PinOut (not used)					
				<b>Total (W)</b>	<b>11.39</b>

BMR323 Default power loss distribution for Vin=54V, Pout=600W, temperature ~100 [C]

Domain	Number of domains/ boundaries	Domain volume [mm <sup>3</sup> ]	per domain [W]	per volume [mW/mm <sup>3</sup> ]	Subtotal power loss [W]
Prim_Fets	4		1.484		5.94
Sec_Fets	4		0.64		2.56
InductorCore	18	389.23		2.826	1.1
Winding	5	404.46		24.576	9.94
Cin	6		0.062		0.372
Cres	14		0.007		0.098
Cout	14		0.0186		0.26
PCBExtra (not used)					
DrivPrim	4		0.0815		0.326
DrivSec	2		0.35		0.7
PinOut (not used)					
				<b>Total (W)</b>	<b>21.3</b>

BMR323 Default power loss distribution for Vin=54V, Pout=600W, temperature ~20 [C]

Domain	Number of domains/ boundaries	Domain volume [mm <sup>3</sup> ]	per domain [W]	per volume [mW/mm <sup>3</sup> ]	Subtotal power loss [W]
Prim_Fets	4		0.89		3.56
Sec_Fets	4		0.503		2.01
InductorCore	18	389.23		2.826	1.1
Winding	5	404.46		19	7.68
Cin	6		0.048		0.29
Cres	14		0.005		0.07
Cout	14		0.014		0.2
PCBExtra (not used)					
DrivPrim	4		0.0815		0.326
DrivSec	2		0.35		0.7
PinOut (not used)					
				<b>Total (W)</b>	<b>15.94</b>