The eGaN® FET Journey Continues

Thermal Model of EPC2053

Efficient Power Conversion Corporation

EPC2053 FEA thermal simulation

EFFICIENT POWER CONVERSION

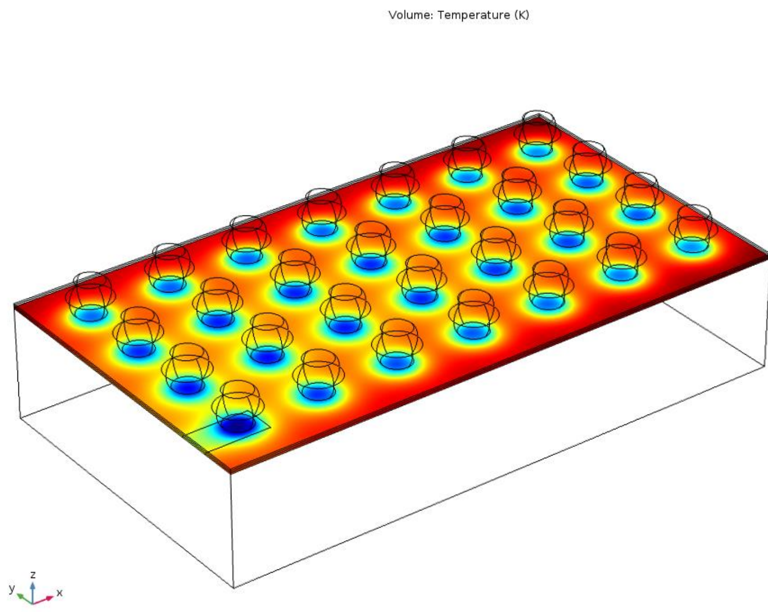
- The thermal model applies to EPC2053.
- A power dissipation of 1 W in the device active area is assumed.
- Finite element analysis (FEA) thermal simulations
  - $R_{\Theta JB}$ and $R_{\Theta JC}$ are obtained by stationary simulations.
  - $Z_{\Theta JB}$ and $Z_{\Theta JC}$ are obtained by transient simulations.
- R-C thermal model is generated.

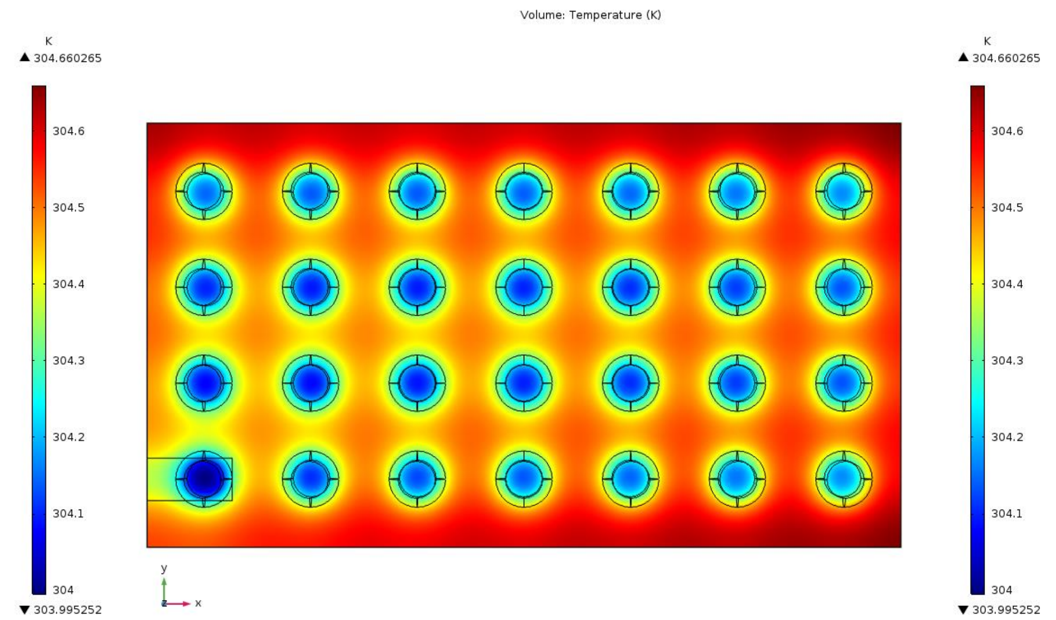
EPC2053 device structure

1
0.5
×10³ µm
0
-0.5
-1
200
0
-200
µm
-400
-600
1
0
×10³ µm
-1
z
y
x

Steady-state $R_{\Theta JB}$

Typical $R_{\Theta JB}$ = 4.7 °C/W



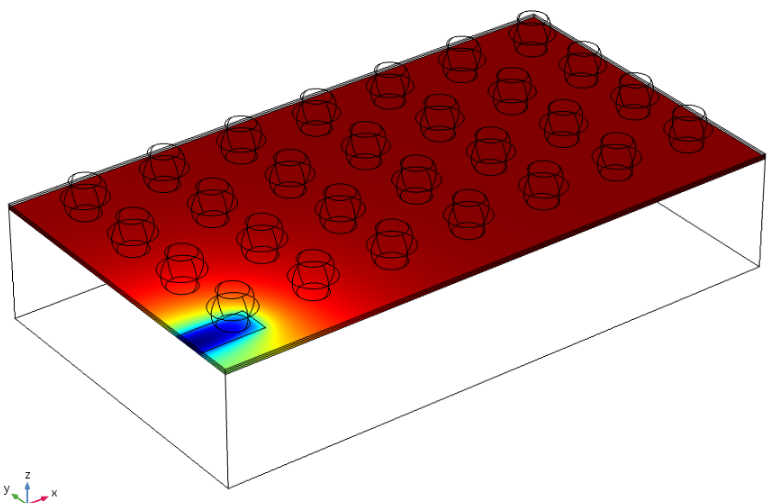


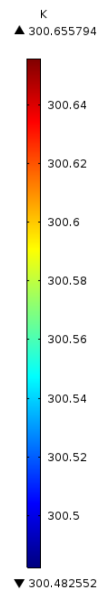
- Operating condition: Power = 1 W in the active area.
- Boundary condition: Temperature of top of solder bars set to be 300 K.

Steady-state $R_{\Theta JC}$

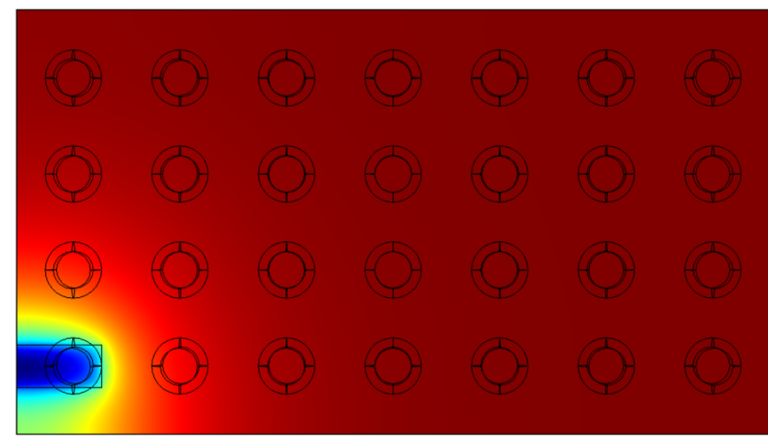
Typical $R_{\Theta JC}$ = 0.7 °C/W

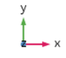
Volume: Temperature (K)

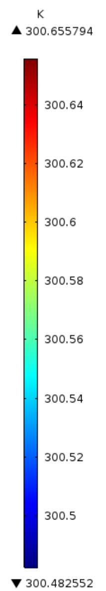




Volume: Temperature (K)







- Operating condition: Power = 1 W in the active area.
- Boundary condition: Temperature of bottom of the device backside set to be 300 K.

$Z_{\Theta JB}$ R-C thermal model

EPC
EFFICIENT POWER CONVERSION

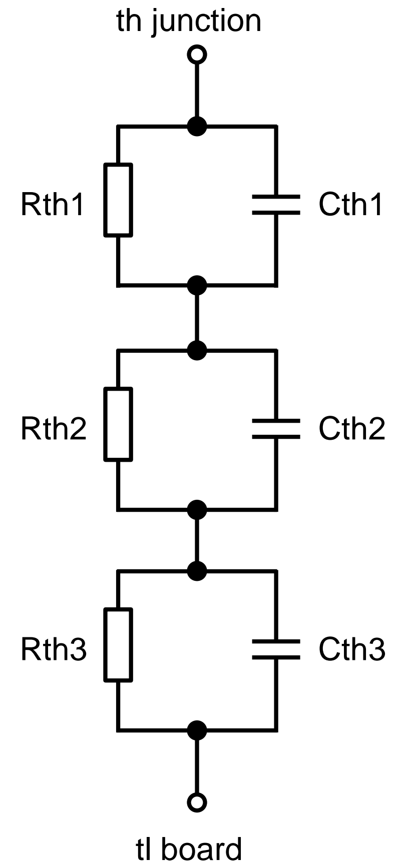
Transient junction temperature (Junction to Board, P = 1 W)

Finite element simulation
R-C thermal model

ΔT_J (°C)

Time (s)

Model Parameter	Value	Unit
Rth1	4.44E+00	°C/W
Rth2	1.69E-01	
Rth3	3.60E-02	
Cth1	8.71E-03	J/°C
Cth2	2.52E-03	
Cth3	1.37E-03	



$Z_{\Theta JC}$ R-C thermal model

EFFICIENT POWER CONVERSION

Transient junction temperature (Junction to Case, P = 1 W)

Finite element simulation

R-C thermal model

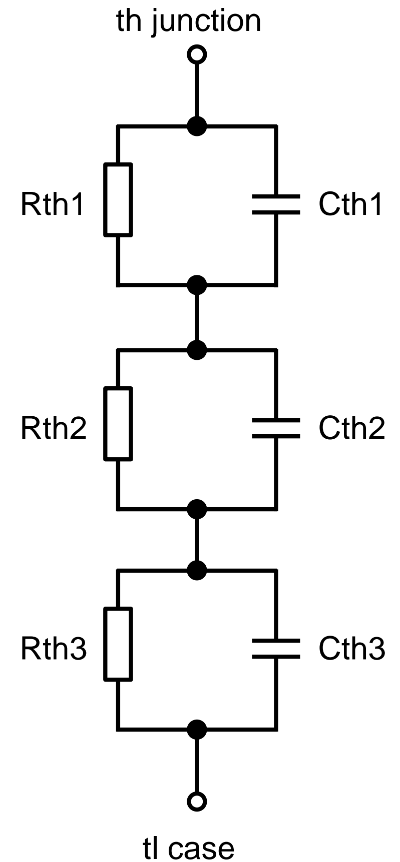
ΔT_J (°C)

0.7
0.6
0.5
0.4
0.3
0.2
0.1
0

10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^{0}

Time (s)

Model Parameter	Value	Unit
Rth1	5.17E-01	°C/W
Rth2	9.77E-02	
Rth3	2.98E-02	
Cth1	4.89E-03	J/°C
Cth2	2.59E-03	
Cth3	7.65E-04	



The end of the road for silicon…

but a clear road ahead for GaN FETs and ICs!