The eGaN® FET Journey Continues

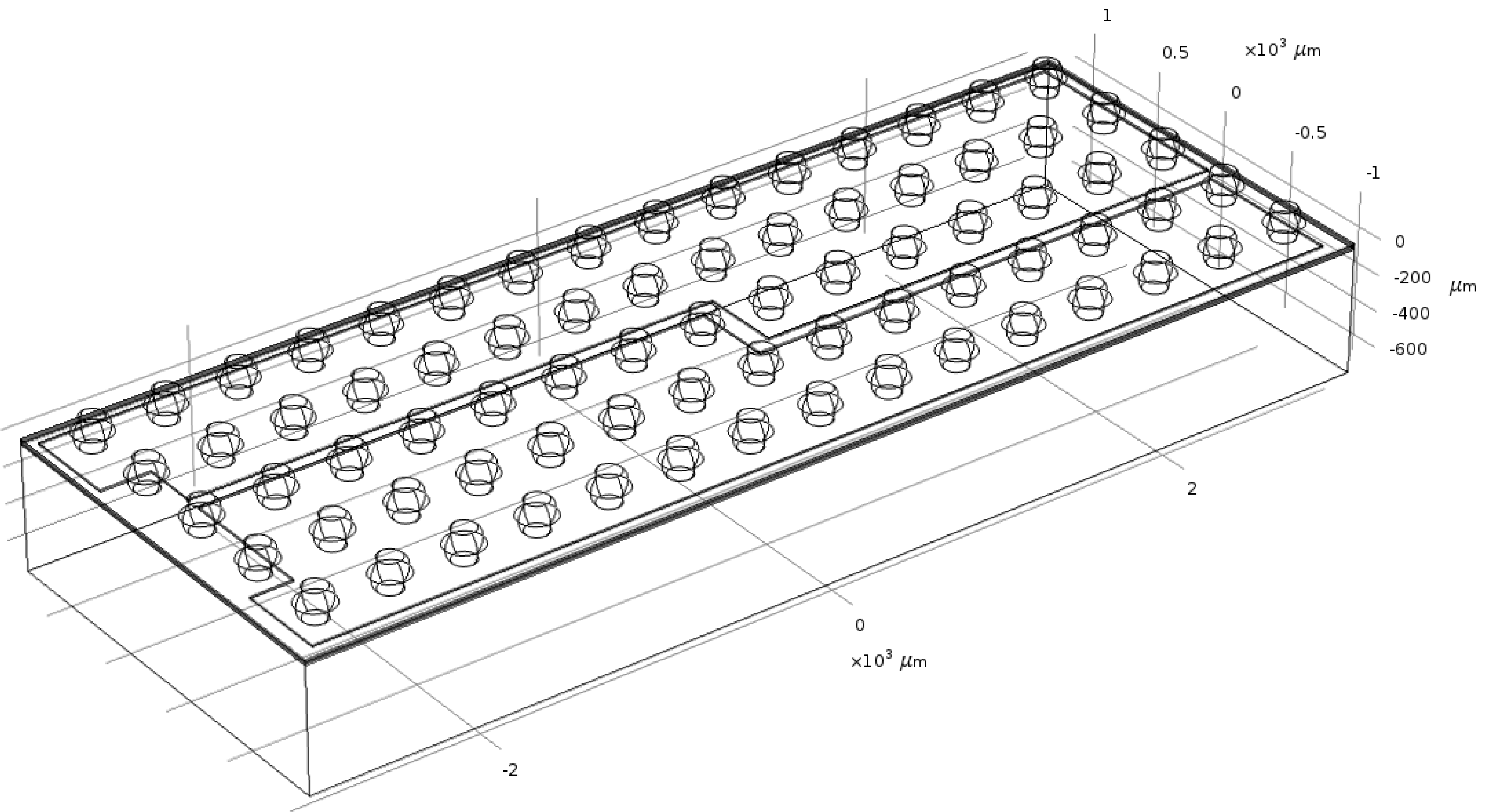
# Thermal Model of 1:1 Extra-Large Half-Bridge Products EPC2102, EPC2103, and EPC2104

*Efficient Power Conversion Corporation*

# 1:1 XL half-bridge device FEA thermal simulation

- The thermal model applies to 1:1 half-bridge products including **EPC2102**, **EPC2103**, and **EPC2104**.
- Equal power density of Q1 and Q2 and a total power dissipation of 1 W in the device active area is assumed.
- $R_{\Theta JB}$ and $R_{\Theta JC}$ are obtained by static steady simulations.
- $Z_{\Theta JB}$ and $Z_{\Theta JC}$ are obtained by transient simulations. SPICE thermal model of RC network is generated.

# 1:1 XL half-bridge device structure



# Steady-State $R_{\Theta JB}$

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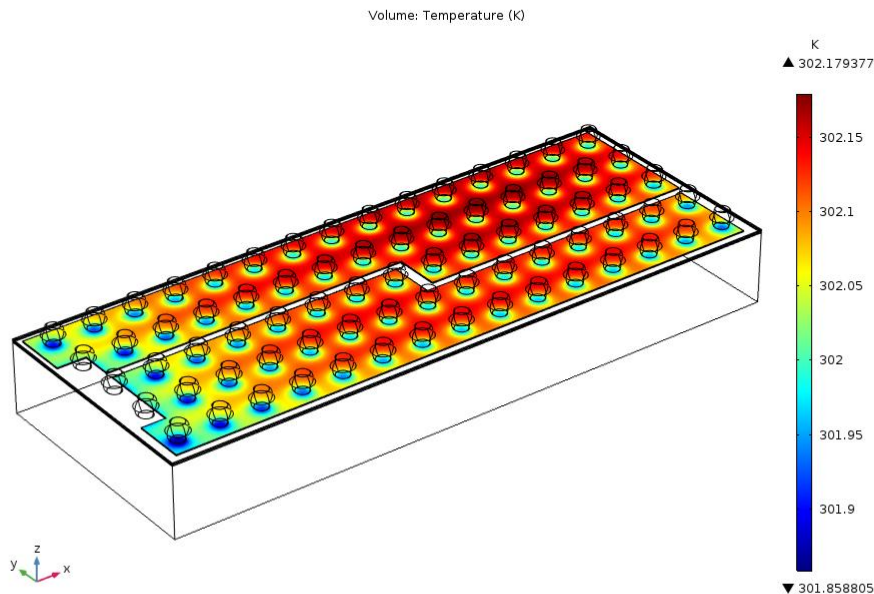
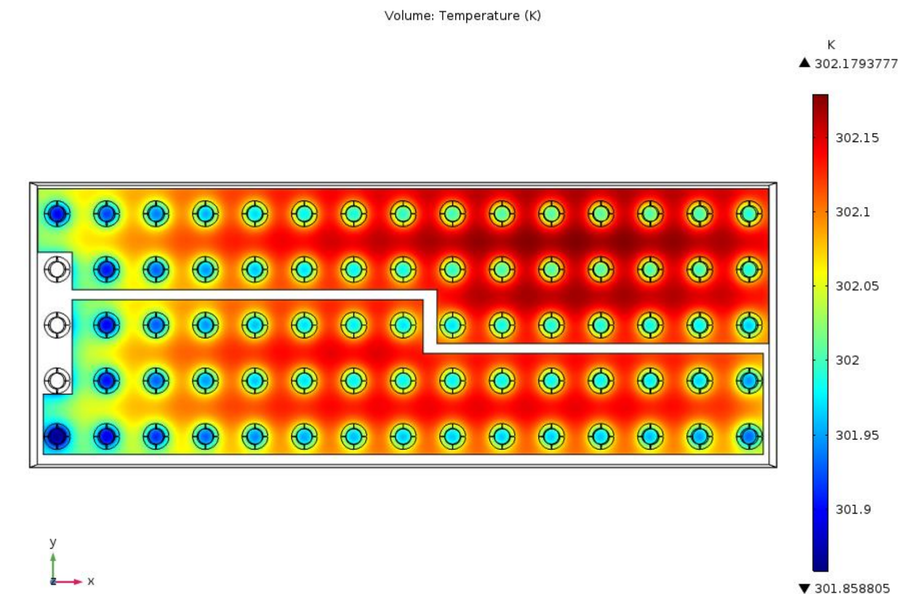
## Typical $R_{\Theta JB}$ = 2.2 °C/W

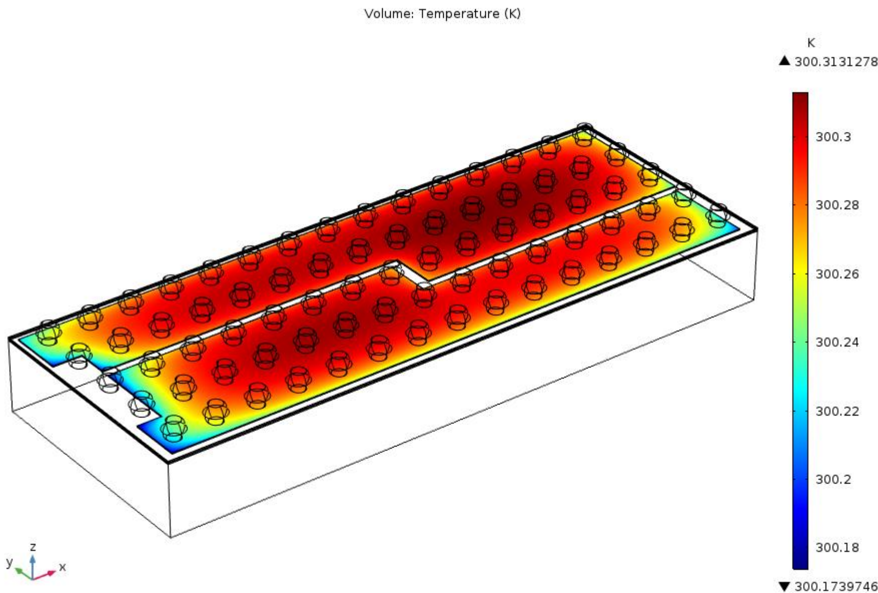


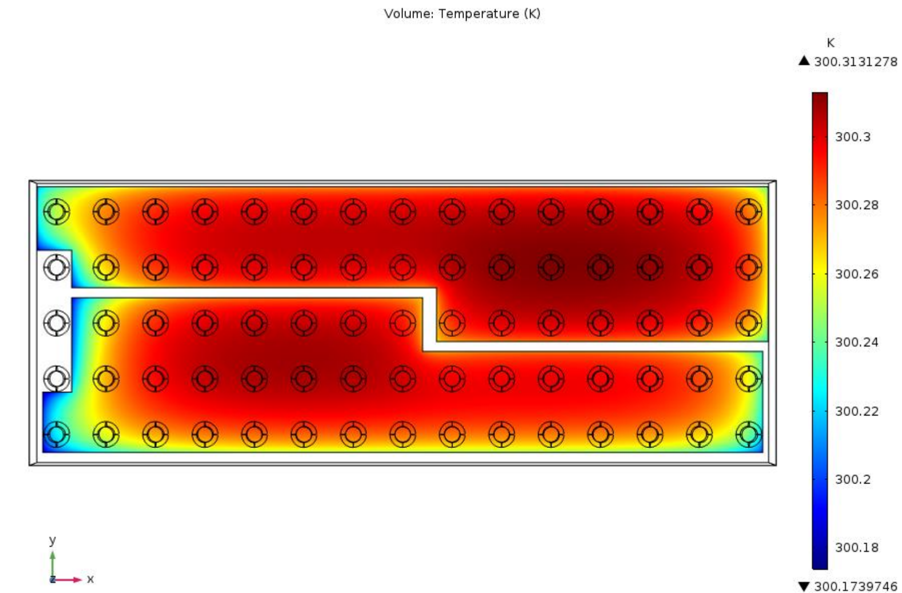




- Operating condition: Total power = 1 W with equal power density of Q1 and Q2.
- Boundary condition: Temperature of top of solder balls set to be 300 K.

# Steady-State $R_{\Theta JC}$

## Typical $R_{\Theta JC}$ = 0.3 °C/W




- Operating condition: Total power = 1 W with equal power density of Q1 and Q2.
- Boundary condition: Temperature of bottom of the device backside set to be 300 K.

# $Z_{\Theta JB}$ SPICE Thermal Model

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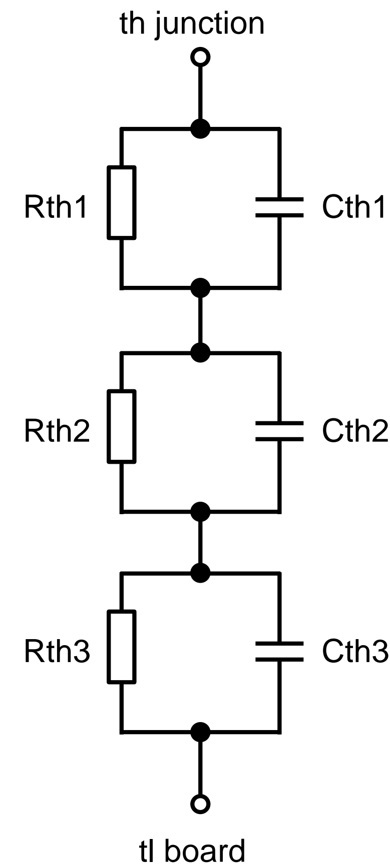
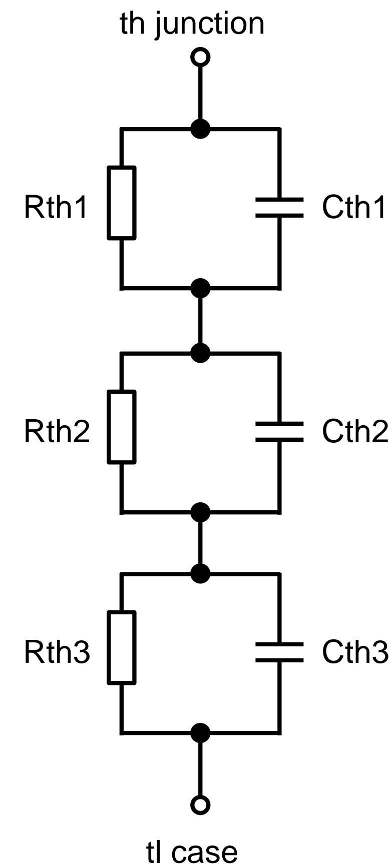
| Fitting parameter | Value | Unit |
|---|---|---|
| Rth1 | 2.08E+00 | °C/W |
| Rth2 | 7.28E-02 | |
| Rth3 | 2.55E-02 | |
| Cth1 | 2.12E-02 | J/°C |
| Cth2 | 7.79E-03 | |
| Cth3 | 1.63E-03 | |



# $Z_{\Theta JC}$ SPICE Thermal Model

| Fitting parameter | Value | Unit |
|---|---|---|
| Rth1 | 2.56E-01 | °C/W |
| Rth2 | 4.16E-02 | |
| Rth3 | 1.53E-02 | |
| Cth1 | 1.06E-02 | J/°C |
| Cth2 | 5.46E-03 | |
| Cth3 | 1.44E-03 | |



END OF
ROAD

***The end of the road for silicon…***

***but a clear road ahead for GaN FETs and ICs!***