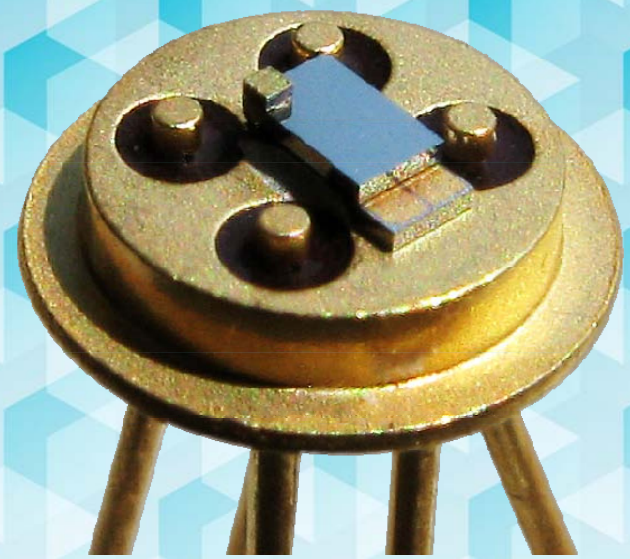
MPC-D403
MPC-D404

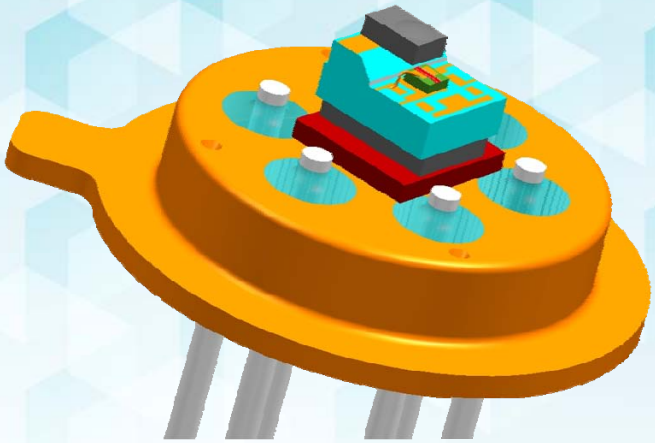
Ultra-small Peltier Coolers

High impedance

Low control current

High power efficiency





micr°pelt

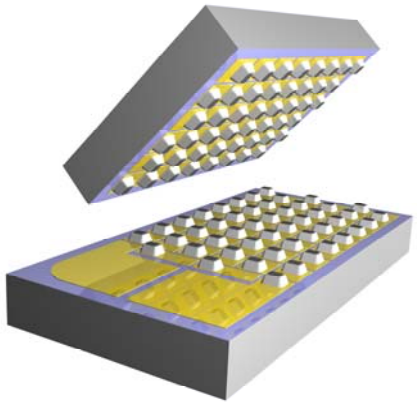
Cooling in new dimensions.

1. Introduction

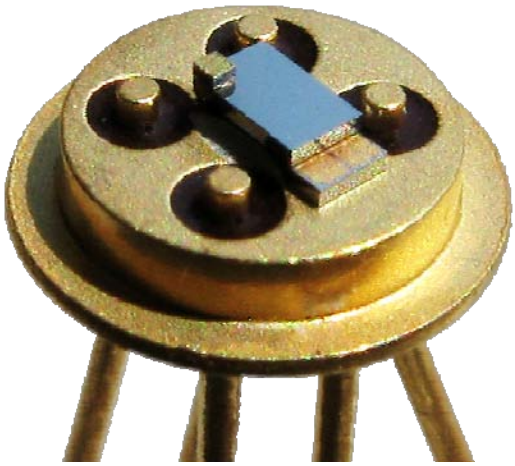
1.1 General description

The MPC-403 / D404 micro chip-sized thermoelectric coolers (TEC) offer a superior performance in the world-smallest available feature-sizes and can be handled in automated volume assembly processes.

Thanks to the patented wafer-based thin-film MEMS-like micro-structuring process, the MPC-D403 / D404 micro-cooler offer the industry's highest packing density of up to 50 thermoelectric leg pairs per mm^2.



MPC-D403



Micropelt TEC assembled in TO-package

By the high electrical impedance of the MPC-D403 / D404, a very power- and cost-efficient design for the control and drive circuitry can be realized (<1 cm^2).

The typical workload operating parameters of the MPC-D403 / D404 range between 50 mA to 100 mA for the control current and a related voltage of about 1.5 V to 3.0 V.
The MPC-D403 / 404 have a maximum cooling power of 0.66 W, resp. 0.58 W (equivalent to >30 W/cm^2).

The MPC-D403 / D404 are the ideal choice for today's cost and performance sensitive fiber optic-, photonics- and sensor- applications.

1.2 Features

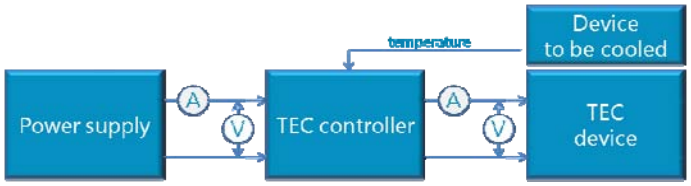
- High internal electrical resistance
- Small control currents at high-voltage
  - small footprint control electronics
  - low-cost peripheral components
- Power-efficient TEC-controller design
  - less system energy consumption and heat dissipation
- Very small feature-size 1.56 mm^2 & super thin 0.460 mm (460 µm)
  - miniaturization of fiber optic, photonics- and sensor-applications
- Suitable for high-volume packaging processes
- Key performance data:

T_a = 85 °C	**MPC-D403**	**MPC-D404**
R_{elec}	23 Ω	28 Ω
Q_{max}	0.67 W	0.59 W
ΔT_{max} Air	54 K	53 K
ΔT_{max} Vacuum	65 K	65 K
I_{max}	0.24 A	0.21 A
U_{max}	5.5 V	6.1 V
Footprint	2.0 mm^2	1.56 mm^2

1.3 Applications

Fast thermal control with a very small footprint for very low current thermal management

- **MPC-D403 / D404**
  temperature control of low Q active components
  - Laser diodes / VCSELs
  - Sensors
  - Photonics / Power LED's



Example: Q = 150 mW; ΔT = 20 K; R_{th} = 15 K/W

A traditional TEC (electrical resistance 0.5 Ω) requires a typical control current of up to 1 A and related voltage of about 0.3 V.

As result, the power control system requires expensive components, like output stages and filter components (L and C).

The power efficiency at high load currents will be limited to approx. 60 % to 70 % due to high parasitic elements within the system.

At its typical workload conditions within the control range, the efficiency will be limited to 20 % - 30 %.

1.4 Typical application diagram

TEC control & drive application can be developed with a very high efficiency, due to the high internal electrical resistance of the MPC-D403 / D404.

In comparison with traditional TEC devices, the MPC-D403 / D404 operate at much lower control currents at higher voltages, enabling very power-efficient control circuits with less power -consumption & -dissipation.

When using the MPC-D403 / D404, the overall system power balance (TEC-control and DC/DC converter) will be >50 % better compared to a traditional TEC Peltier element.
Traditional Peltier coolers do have a typical internal resistance of <1 Ω and operate at much higher currents and lower voltages, which has negative impact on the system costs and power house holding of the TEC-controller circuitry.

Micropelt's MPC-D403 / D404 operate at typical control current levels of up to 100 mA and related voltage of up to 3.0 V.

The control- and power-management circuitry can therefore be optimized to perform with a very high efficiency around 90 %, also during the typical workload conditions with a very small footprint (<1 cm^2).

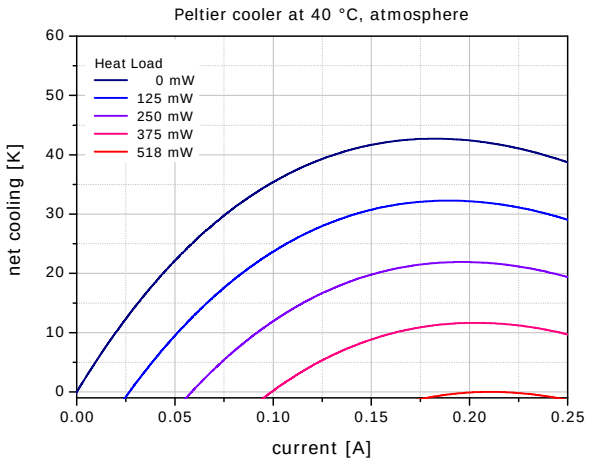
Working with Micropelt's MPC-D403 / D404 :

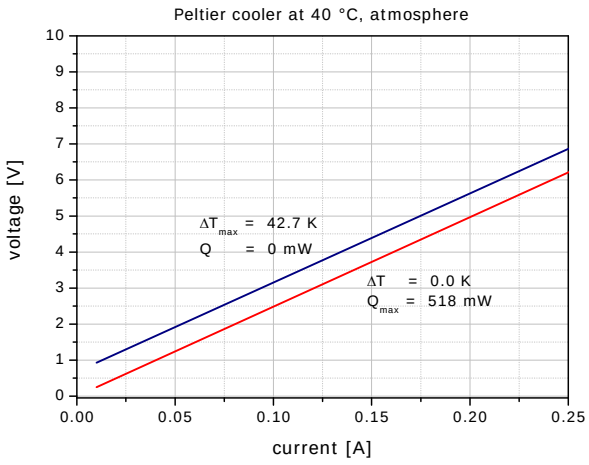
High electrical resistance & small control currents

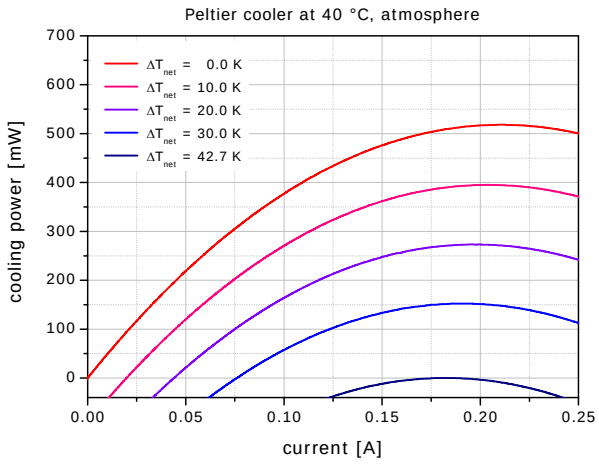
- Cost-savings for the required drive and filter components
- Much better energy-balance, both in max. and typical workload of the control range
  - max range: 90 % vs. 60 % - 70 %
  - low workload: 90 % vs. 20 % - 30 %
- Less energy consumption & heat dissipation
- Smaller footprint for the control & drive electronics

2. Electrical parameters MPC-D403

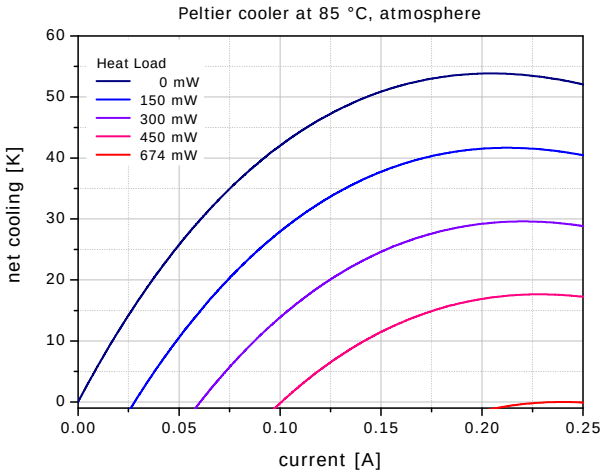
T_a = 40 °C MPC-D403

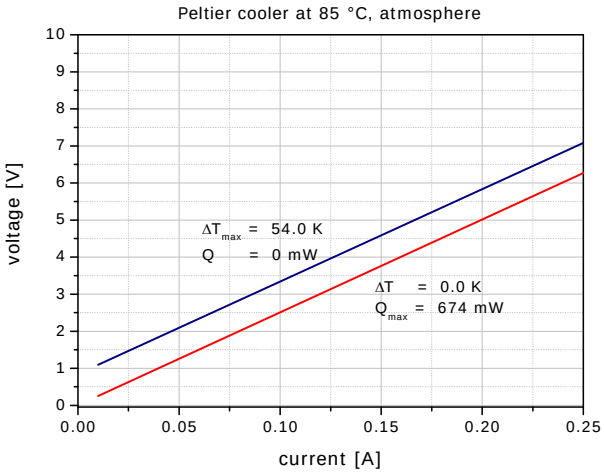


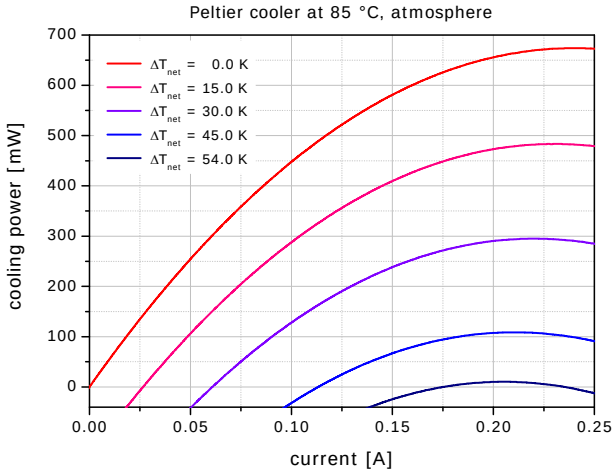




T_a = 85 °C MPC-D403

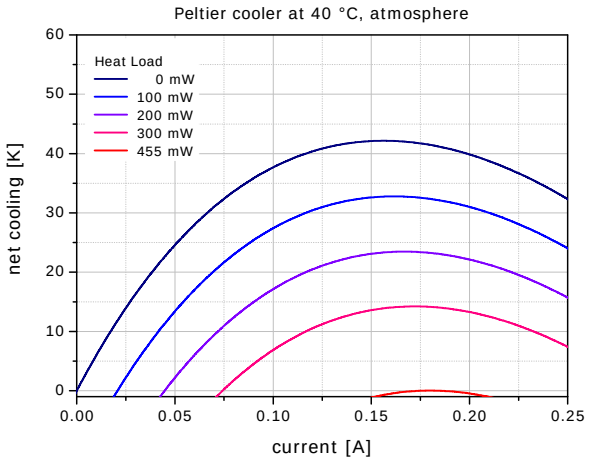


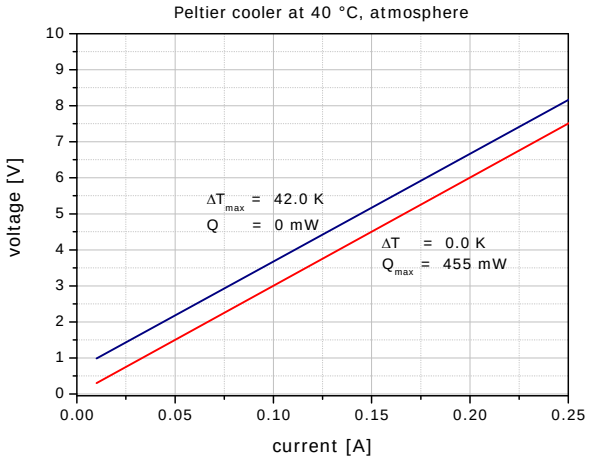


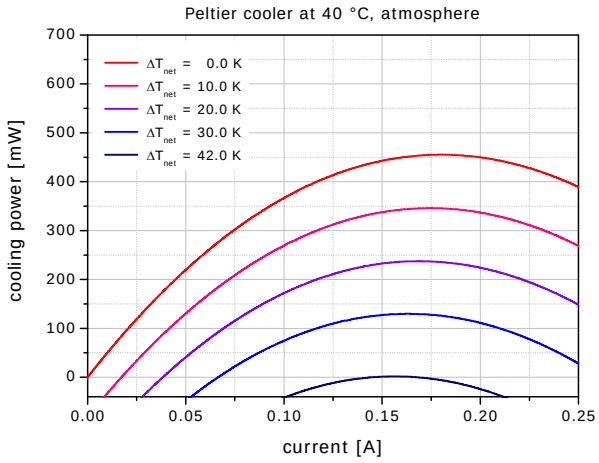


2. Electrical parameters MPC-D404

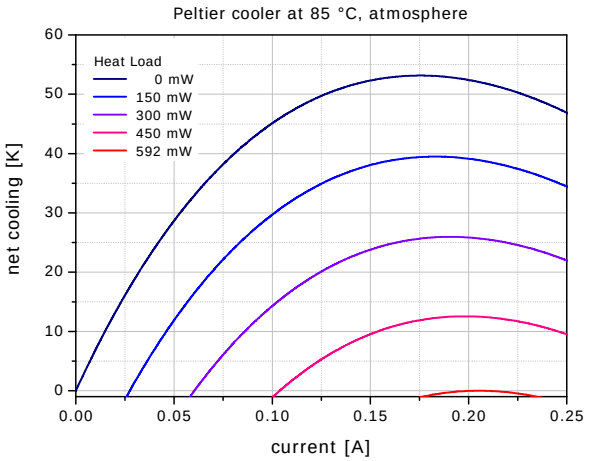
T_a = 40 °C MPC-D404

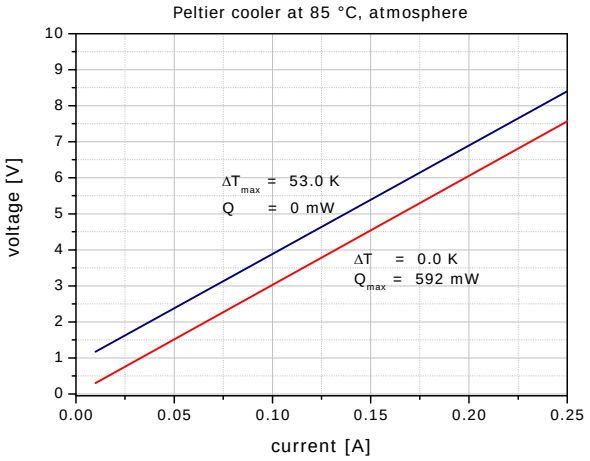


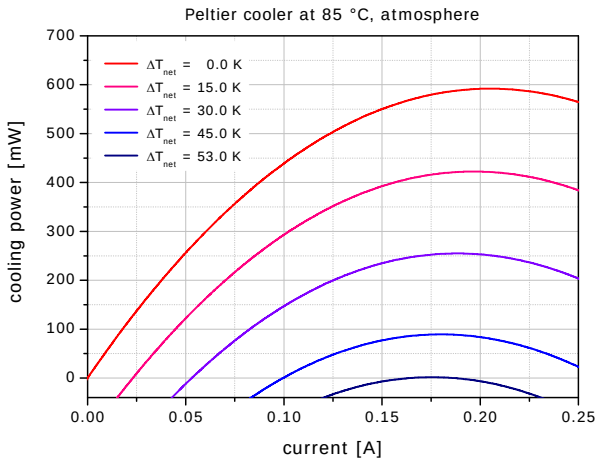




T_a = 85 °C MPC-D404

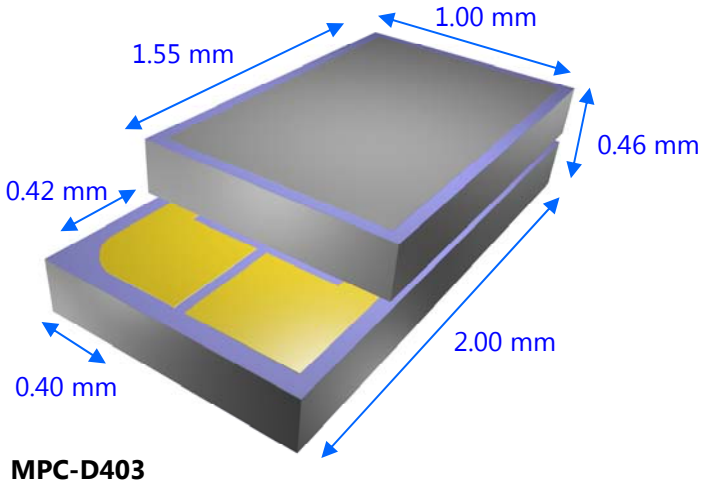




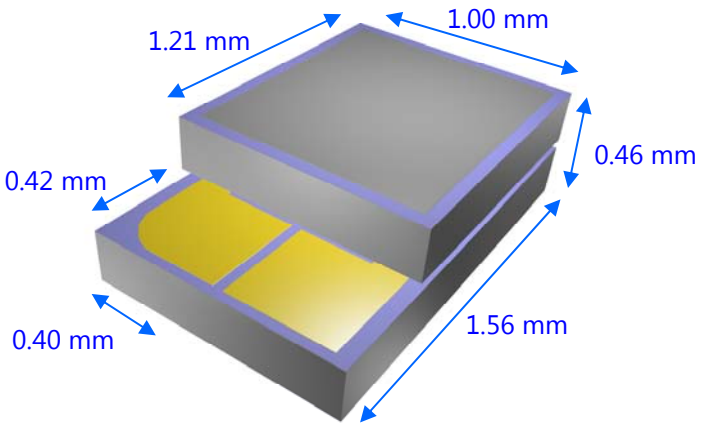


3. Application information

3.1 Product dimensions



MPC-D403



MPC-D404

3.2 Handling & Assembly

Recommendations regarding handling of Micropelt's TEC devices are given in the application note "Assembly Instructions for Thermoelectric Thin Film Devices".

Please contact info@micropelt.com
for more information.

3.3 Ordering information

Engineering samples are available from stock.
Currently backside metallization is TiPt.

- MPC-D403-M22
- MPC-D404-M22

For high volumes customized metallization is possible.

Please contact info@micropelt.com

Chip ID	Dimensions [mm] cold side hot side bond-pads	Thickness [mm] (H)
MPC-D403	1.55 x 1.0 2.0 x 1.0 0.42 x 0.40	0.460
MPC-D404	1.21 x 1.0 1.56 x 1.0 0.42 x 0.40	0.460

4. Appendix

Thermal Engineering

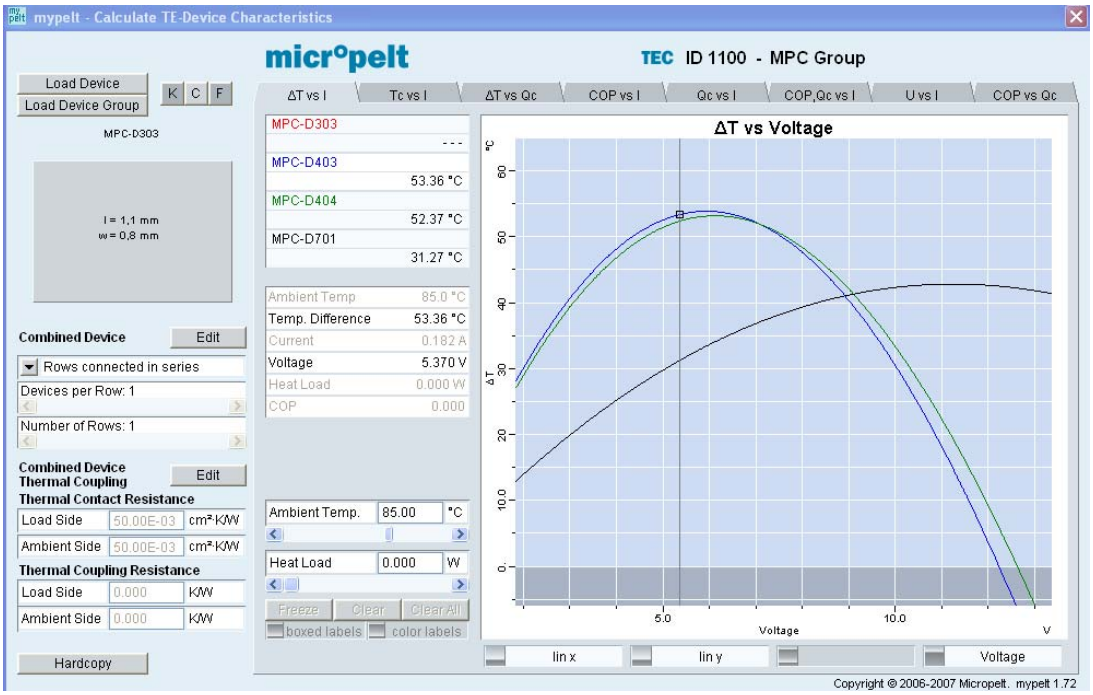
Micropelt's patented micro-structuring process of thermoelectric thin films allows for adaptation of electrical, thermal and physical properties of a cooler — to optimally match your system's requirements. One-off charges apply and scale economies may be reduced. Make your choice.
Please submit your specification — we look forward to exploring your options.

Prototyping

Micropelt devices are a new class of TECs. If you feel uncomfortable handling and assembling them, let us do that for you first - giving you a head start for a quick launch of your new product.

mypelt Simulation Tool

For those who want to check device matching with actual application data beforehand we have built our simulation tool mypelt. You will find it on our homepage. Select any device and see what it can do for you from all relevant viewpoints. Link to mypelt http://www.micropelt.com/products/mypelt.php



Micropelt GmbH
Emmy-Noether-Strasse 2
79110 Freiburg
Germany
Office: +49 (0)761 / 15 63 37-0
Mail: info@micropelt.com
www.micropelt.com

micropelt
Cooling in new dimensions.