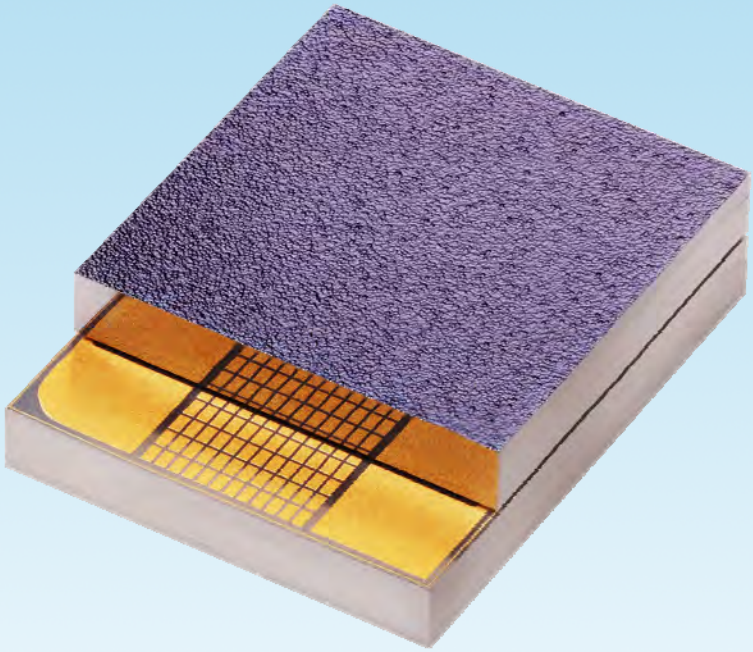
MPG-D751

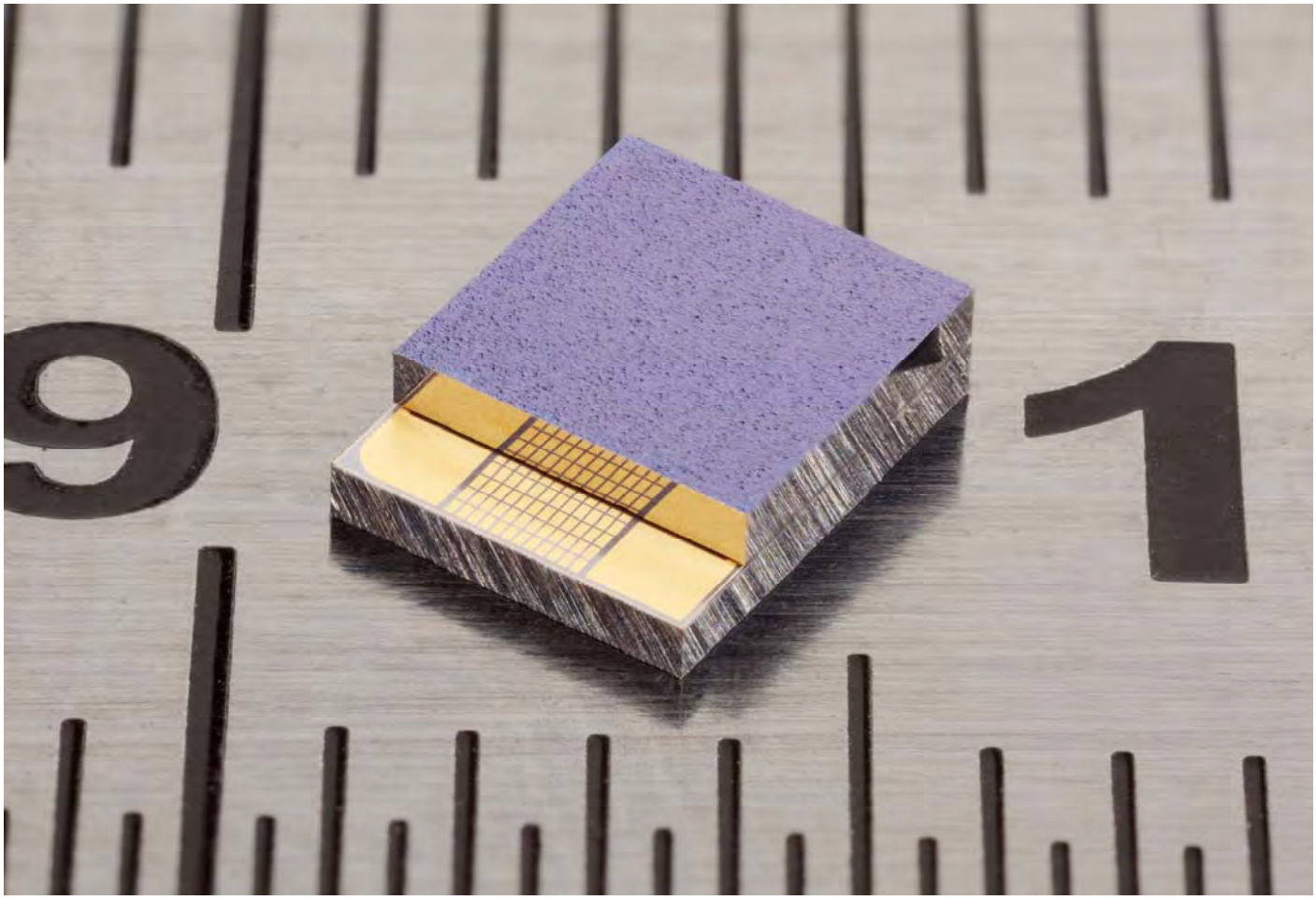
Thin Film Thermogenerator and Sensing Device

Preliminary Datasheet



micropelt
Energy harvesting.

Small and Powerful



Thermoelectric power generation is based on the transfer of thermal energy through multiple couples of p-type and n-type thermoelectric legs. Micropelt uses compounds of Bismuth (Bi), Antimony (Sb), Tellurium (Te) and Selenium (Se) providing optimal efficacy at operating temperatures around ambient and up to 85 °C.

The generated output voltage is proportional to the number of leg pairs and the actual temperature difference ΔT across the thermogenerator.

$$U = N_{legpairs} \times \Delta T \times \alpha$$

α: Seebeck coefficient in µV/K (material related)

Thanks to its patented wafer-based thin-film MEMS-like micro-structuring process the Micropelt MPG thermogenerator series offers the industry's highest available packing density of up to 100 thermoelectric leg pairs per mm^2. As per Seebeck's law this translates into 1.4 V at as little as 10 °C of temperature difference.

Our scalable wafer fabrication concept offers unprecedented economies of scale for thermoelectric volume applications .

MPG-D751 Thin-film Thermogenerator Chip

Features

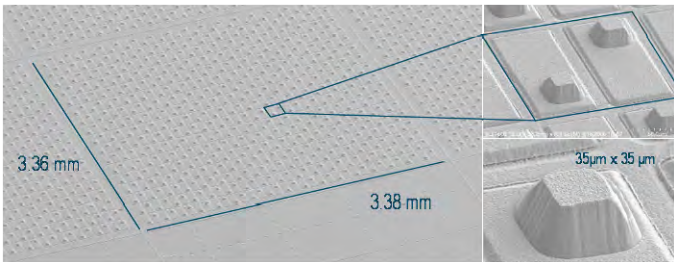
- Micro integrated device with high power density
- Component total height: 1090 µm
- Maintenance-free solid state operation
- Long life time
- Compatible with SMD placement and die bonding assembly, metalized surfaces optional
- Low weight, low thermal mass
- Fast response time < 3 msec (thinned substrate)
- Max. operating temperatures ≤ 85 °C
- High voltage output of up to 1.75 V per Watt of thermal input

Applications

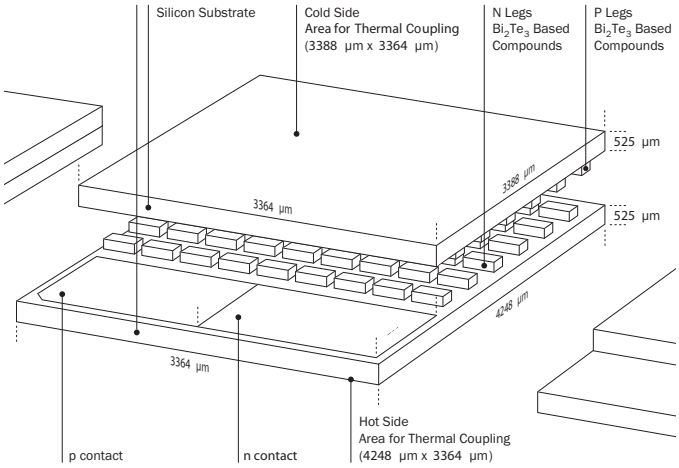
Generic power supply using waste heat to drive milliwatt (wireless) applications, including:

- Wireless sensor networks (WSN)
- Industrial process monitoring
- Condition monitoring
- Thermal event logging
- Thermal triggering
- Intelligent buildings and HVAC
- Automatic meter reading (AMR)
- Energy monitoring & control
- Highly sensitive and ultra-fast heat flux sensing

Thermoelectric legs on silicon wafer



MPG-D751 schematic drawing



Product dimensions and specifications

Type	Maximum Dimensions [mm] Top side Bottom side	Minimum Dimensions [mm] Top side Bottom side	Number of leg pairs	Thermal Resistance at 85 °C	Electrical Resistance at 23 °C	Net Seebeck Voltage at 23 °C	Thickness [µm]
MPG-D751	3.388 x 3.364 4.248 x 3.364	3.388 x 3.314 4.198 x 3.314	540	12.5 K/W	300 Ω	140 mV/K	1090

All non-geometrical values simulated by our simulation tool „mypelt". Data subject to continuous improvement.
mypelt: http://www.micropelt.com/products/mypelt.php

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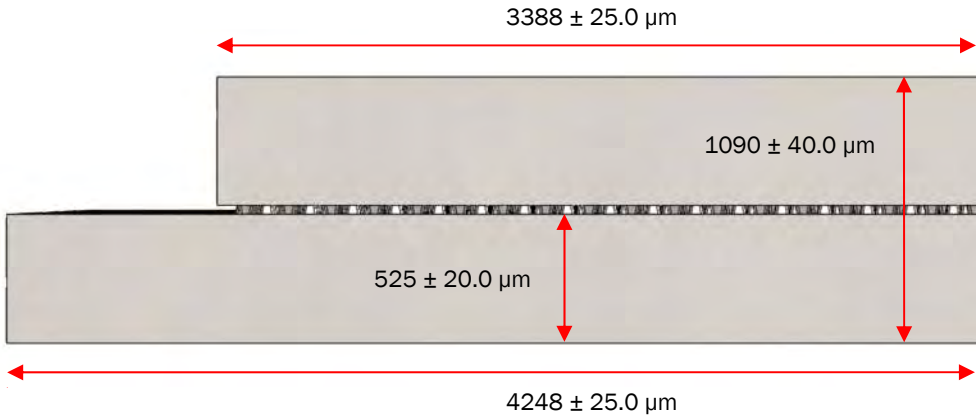
Chip dimensions

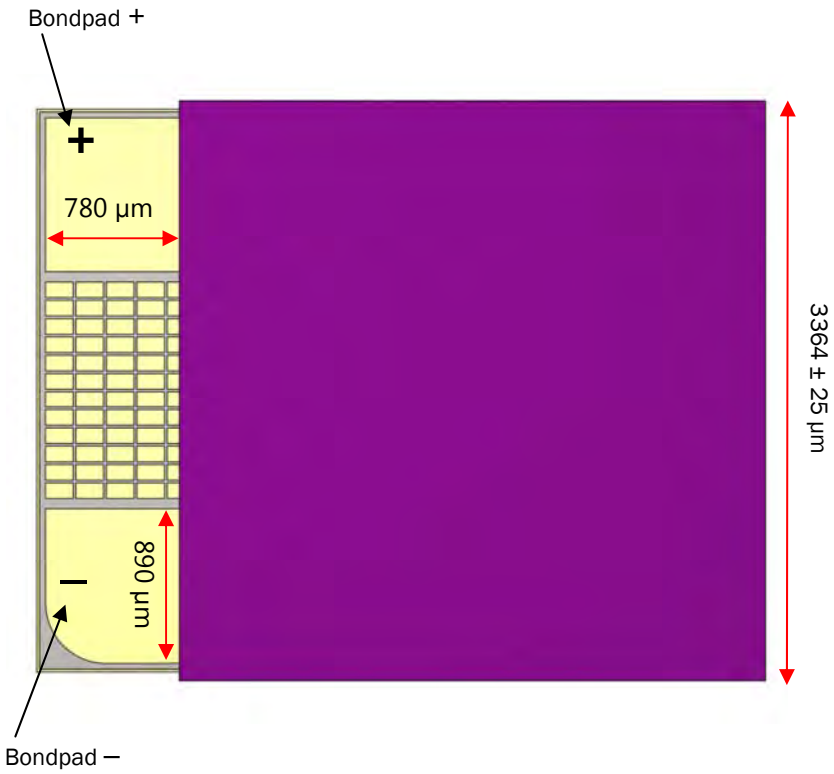
All dimensions are given in micrometers (µm). Drawings are not to scale.

Side view



Top view

Bondpad + is the V_{TEG} connection that outputs a positive voltage, when the heat flow is in the direction from the smaller, top side to the larger, bottom part of the MPG-D751.



Material information

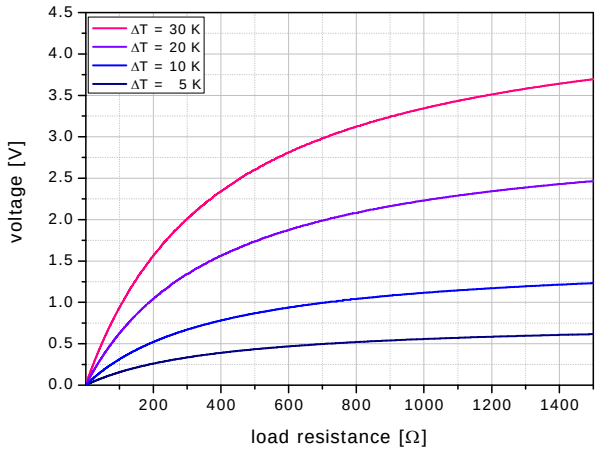
The backside material of the MPG-D751 chip is SiO_2. The MPG-D751 has Au bond pads, with a thickness of 2 µm. The used thermoelectric material bismuth-telluride has a thickness of 40 µm. Because of the open structure of the chip, the device must be handled and operated in low humidity environments.

Electrical parameters

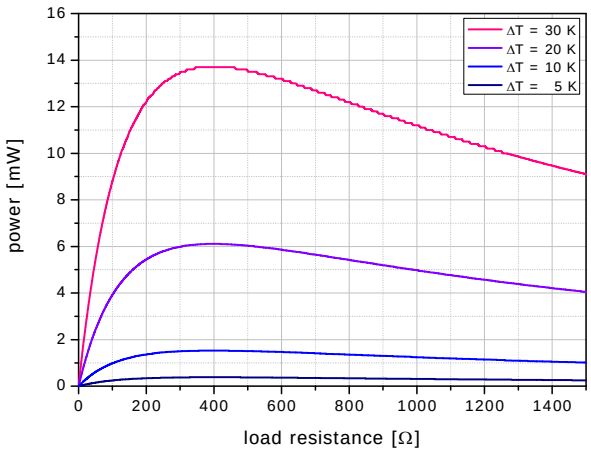
Simulations: Generated voltage and electrical power at ambient temperature 25 °C.

Please note: Simulations assume effective ΔT of 5/10/20/30 K across the thermogenerator element.

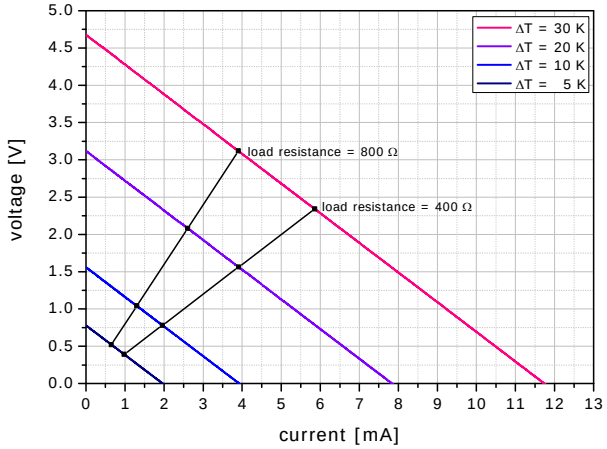
Voltage versus load resistance



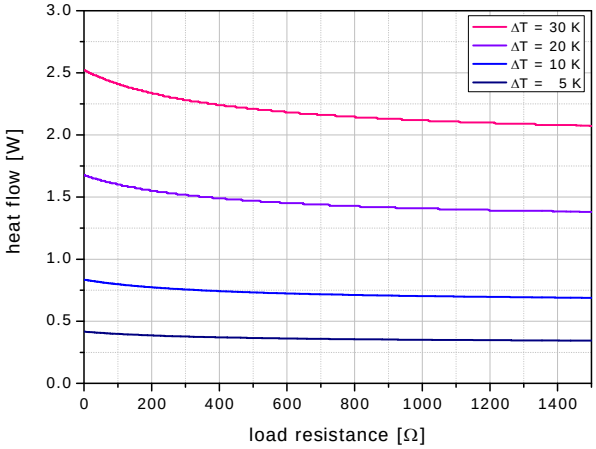
Power versus load resistance



Voltage versus current at different load resistances



Heat flow versus load resistance at different ΔT



Application Engineering - eval kits and integrated systems

TE-CORE - ThermoHarvesting Module

TE-CORE - ThermoHarvesting power module with integrated DC-Booster and power management.

TE-CORE /RF Wireless Sensor System

TE-CORE /RF is a fully functional, low-cost, self-powered wireless sensor node, designed for evaluation and prototyping.

It measures and transmits temperature and voltage data. All power needed for its operation is harvested from excess or waste heat.

Micropelt offers evaluation units for energy harvesting exploration as well as fully integrated wireless energy harvesting powered sensor- and actuator systems for building automation and industrial applications.

Wireless thermostatic radiator valve powered by Micropelt thermogenerator

One room controller can operate numerous maintenance-free heating radiators in residential and commercial buildings.

Thanks to its independent functionality, the battery-free radiator valve is essential for the single room controller, especially when it comes to renovation and modernization work.

qmNODE wireless sensor system for failure prevention in electrical distribution systems

The qmNODE is a self-sufficient, wireless and battery-free sensor system to continuously monitor the condition of electrical distribution installations.

A retrofit solution to conductors of electrical power (busbar, switchboard, busway, junction, switch-gear).

qmNODE sensor avoids installation blackouts, process downtime and missing production and sales revenues.