THERMOELECTRIC COOLER PERFORMANCE

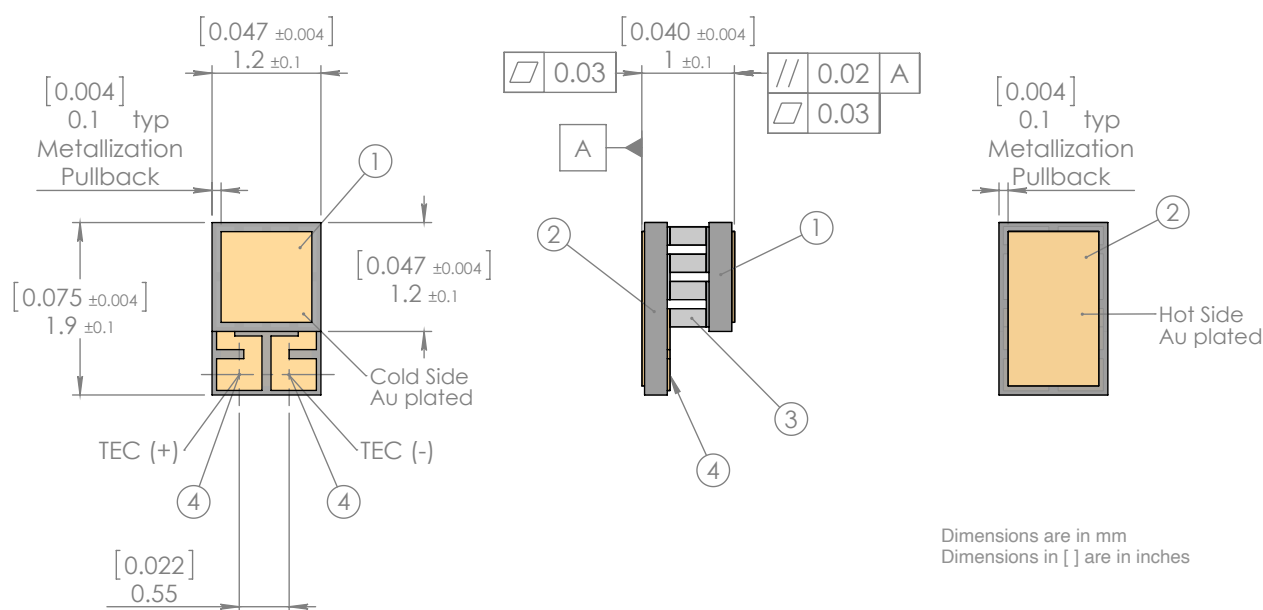| $\Delta Tmax$ K	Qmax W	Imax A	Umax V	ACR Ohm	Ambient Temperature	Conditions
71	0.28	0.5	1.0	1.6	+27ºC / 300K	Vacuum
75	0.31	0.5	1.1	1.8	+50ºC / 323K	Dry N2
82	0.33	0.5	1.2	2.0	+75ºC / 348K	Dry N2
84	0.34	0.5	1.3	2.1	+85ºC / 358K	Dry N2

0   1mm

Note: Thermoelectric Cooler performance values are specified for optimal conditions, assuming that TEC hot side (T_{hot}) is stabilized at ambient temperature (T_{amb})

## TE COOLER TECHNICAL DRAWING   1MD02-008-04

[0.047 ±0.004]
1.2 ±0.1

[0.004]
0.1 typ
Metallization
Pullback

[0.075 ±0.004]
1.9 ±0.1

[0.047 ±0.004]
1.2 ±0.1

Cold Side
Au plated

TEC (+)   TEC (-)

[0.022]
0.55

[0.040 ±0.004]
1 ±0.1

0.03

A

// 0.02 A
0.03

[0.004]
0.1 typ
Metallization
Pullback

Hot Side
Au plated

Dimensions are in mm
Dimensions in [ ] are in inches

TEC DESCRIPTION

- Cold Side (1) and Hot Side (2): Al_2O_3 (100%)
- Internal Assembly: Solder Sn-Sb (T_{melt}=230ºC)
- Cold Side (1) Surface: Au plated (0.2 - 0.3um)
- Hot Side (2) Surface: Au plated (0.2 - 0.3um)
- Terminal Contacts (4): Wire Bonding (WB) Pads
- TEC Polarity: reversed by default
- Bi-Te Material (3): high-grade, hot-extruded type
- Protective Coating: N/A (available by request)
- Integrated Thermistor: N/A (available by request)
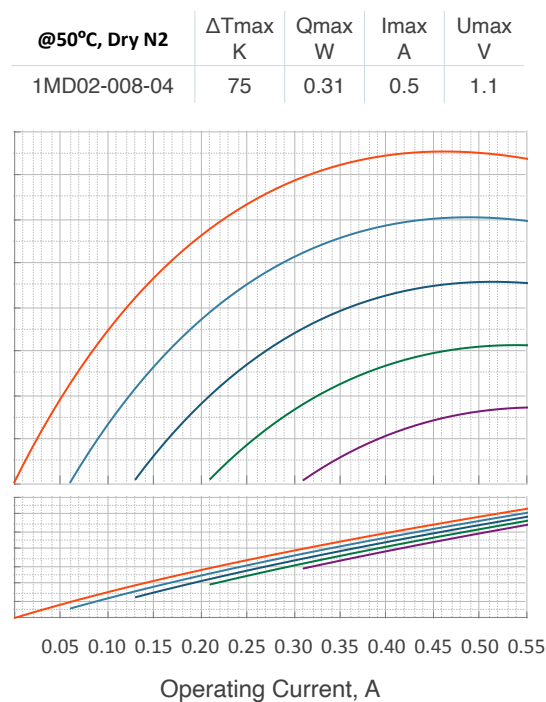
KEY FEATURES

- Super-HD pellets placement technology
- RoHS EU Compliant
- REACH EU Compliant
- TELCORDIA GR-468 (MIL-883) qualified
- Front porch with WB Pads (default)
- WB Posts or wired configurations are available
- Up to 225ºC short time processing (for mounting)
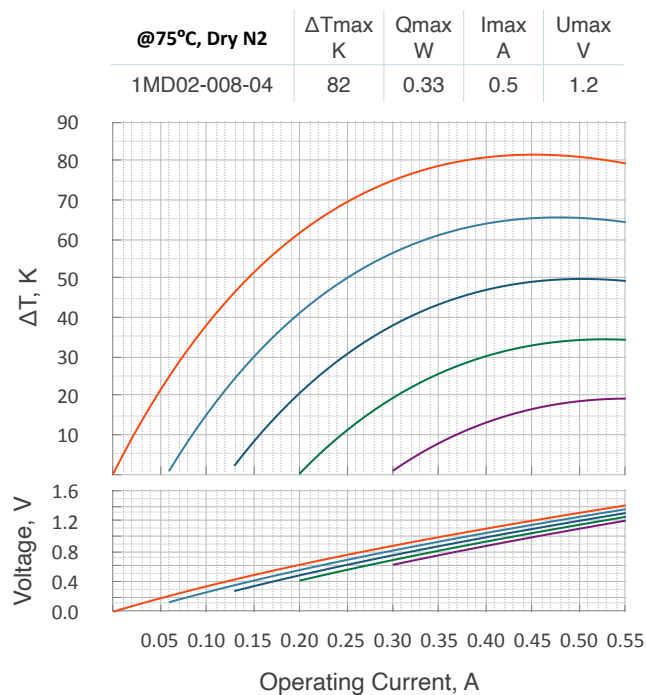- Wide range of additional manufacturing options (see Pages 3,4)
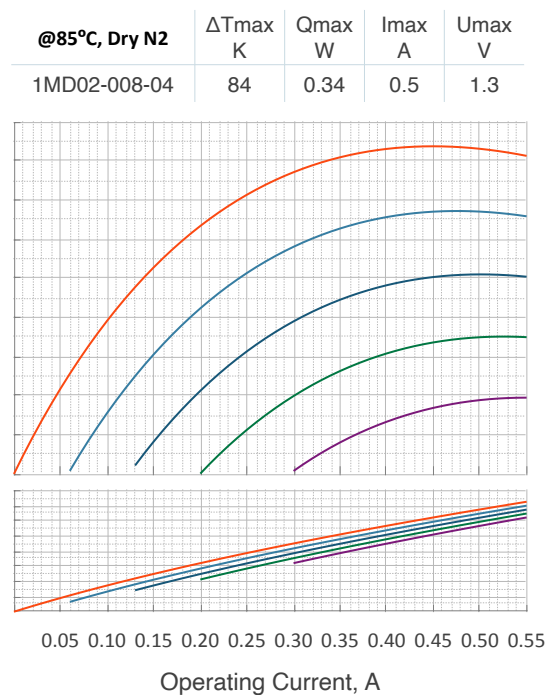
TE COOLER PERFORMANCE PLOTS (COOLING MODE)

@27°C, Vacuum	ΔTmax K	Qmax W	Imax A	Umax V
1MD02-008-04	71	0.28	0.5	1.0
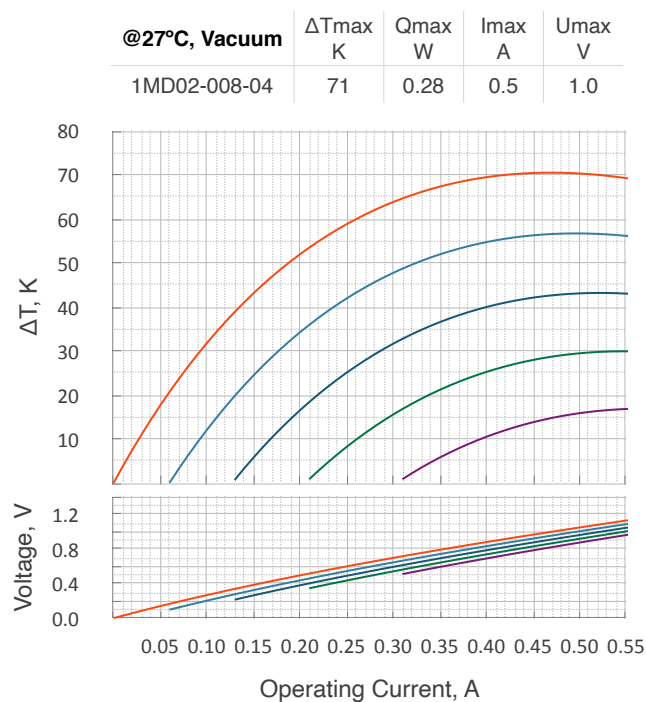
Heatload, W	0.0	0.06	0.11	0.17	0.22
% from Qmax	0%	20%	40%	60%	80%

@50°C, Dry N2	ΔTmax K	Qmax W	Imax A	Umax V
1MD02-008-04	75	0.31	0.5	1.1

Heatload, W	0.0	0.06	0.12	0.19	0.25
% from Qmax	0%	20%	40%	60%	80%

@75°C, Dry N2	ΔTmax K	Qmax W	Imax A	Umax V
1MD02-008-04	82	0.33	0.5	1.2

Heatload, W	0.0	0.07	0.13	0.20	0.26
% from Qmax	0%	20%	40%	60%	80%

@85°C, Dry N2	ΔTmax K	Qmax W	Imax A	Umax V
1MD02-008-04	84	0.34	0.5	1.3

| Heatload, W	0.0	0.07	0.14	0.20	0.27
% from Qmax	0%	20%	40%	60%	80%

Note: Thermoelectric cooler performance values and plots are specified at optimal conditions, assuming TEC hot side is stabilized at ambient temperature ($T_{hot}=T_{amb}$). The performance data is specified for four most common ambient condition modes. Please, contact TEC Microsystems GmbH directly for estimations under different conditions, if required.
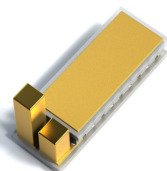
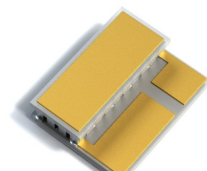## THERMOELECTRIC COOLER TERMINAL CONNECTION OPTIONS
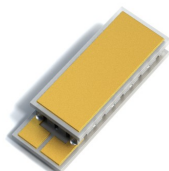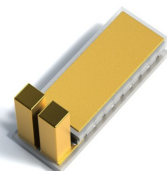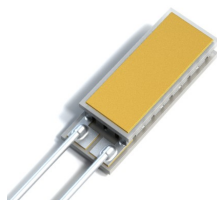
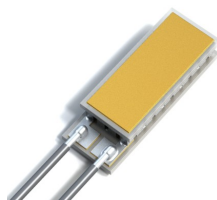◉ Wire Bonding (WB) Pads   ☐ Wire Bonding Posts   ☐ Wire Bonding Posts (variable)   ☐ Side Wire Bonding (WB) Pads
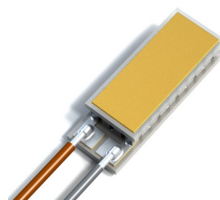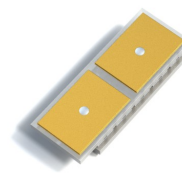
☐ Terminal Wires (blank)   ☐ Terminal Wires (insulated)   ☐ Terminal Wires (insulated, color-coded)   ☐ SMD / Flip-chip (contacts on hot side)

● - By default thermoelectric cooler is provided with Wire Bonding (WB) Pads. Various TEC terminal connection options are available by request. In case of terminal wires wire type, material, length and diameter can be specified by customer.

THERMOELECTRIC COOLER SURFACE OPTIONS

Standard ceramics surface options, available without price change.
The metallization and pre-tinning are possible to apply for one side or both TEC sides.
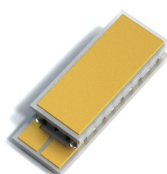
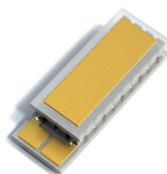◉ Au plated (both sides)   ☐ Pre-tinned with solder   ☐ Blank ceramics (no metallization)

Advanced ceramics surface options, available by request

☐ Custom metallization gap   ☐ Customized Au pattern   ☐ Selective zone pre-tinning over Au pattern
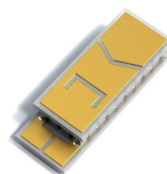
● - By default thermoelectric cooler is provided with Au plated ceramics surfaces (both sides). This is the universal solution, suitable for soldering and gluing. Surface solution can be specified for each TEC side (top and bottom ceramics surfaces) individually.

1MD02 SERIES THERMOELECTRIC COOLERS OVERVIEW

Top Ceramics
(Cold Side)

Front porch with
Wire Bonding Pads

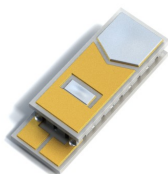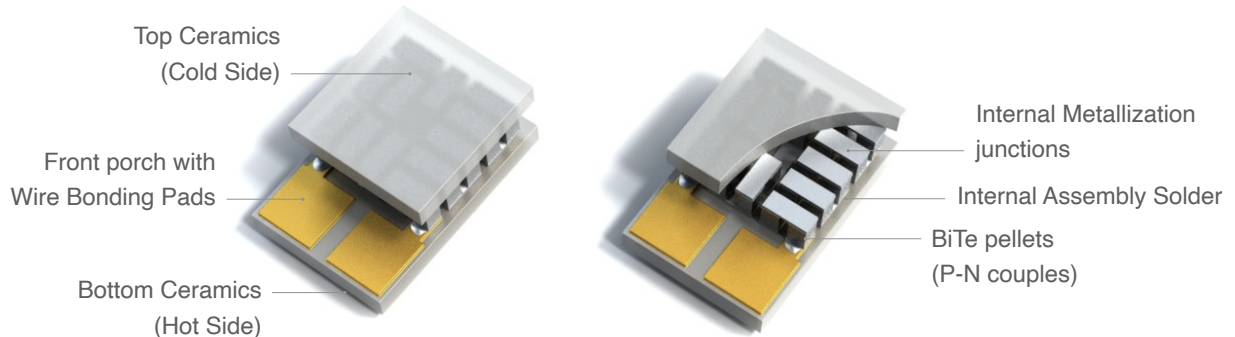Bottom Ceramics
(Hot Side)

Internal Metallization
junctions

Internal Assembly Solder

BiTe pellets
(P-N couples)

- SuperHD BiTe pellets placement technology, more than 1100 BiTe pellets per cm^2 density.
- Low-current ultra-miniature Thermoelectric Coolers with a focus on telecom applications.
- Thermoelectric Coolers from 1MD02 Series have a front porch on bottom ceramics for optimal wires or WB pads/posts integrating. The default TEC manufacturing configuration has Wire Bonding (WB) Pads.
- Thermoelectric Coolers manufacturing configurations with Wire Bonding (WB) Posts, various terminal wires or special SMD solutions are available by request.
- Thermoelectric Cooler internal Assembly Solder by default: Sn-Sb, Tmelt=230ºC, other solutions are available by request.
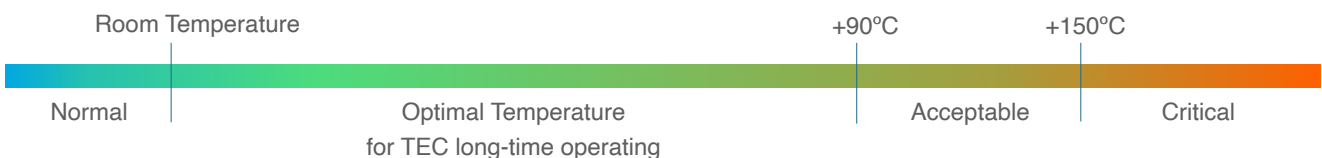
RoHS Compliant

APPLICATION TIPS

- Maximum **short time process** temperature is 220˚C (TEC assembly solder has Tmelt=230˚C).
- Maximum **long time operating** temperature is 150˚C.
- Use thermoelectric cooler only with an appropriate heat sink attached to the hot side.
- Connect thermoelectric cooler to DC power supply in according to TEC polarity.
- Do not exceed DC current and voltage higher than Imax and Umax values.
- Use temperature ramping and avoid thermal shocks during soldering and/or baking processes.
- Check FAQ on TEC Microsystems web for more details about TECs operating and handling.

220

150

Room Temperature   +90ºC   +150ºC

Normal   Optimal Temperature   Acceptable   Critical
                for TEC long-time operating

TEC Lifetime depends on Ambient Temperature (T_{amb}) and can be estimated by Arrhenius equation

Optimal T_{amb} ———   … ~ 300000 hours
T_{amb}=150ºC ———   ~10000 hours
T_{amb}=200ºC ——— ~100 hours
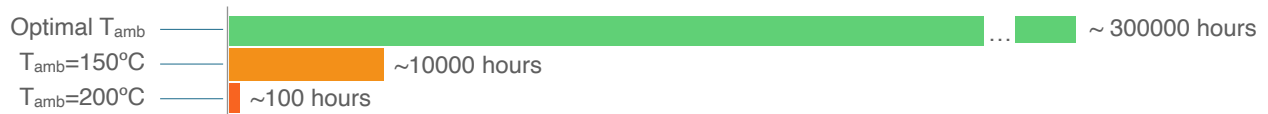
Term "Lifetime" for TEC is taken from Telcordia GR-468 Standard. The criteria of failure is TEC AC Resistance (ACR) change for more than 5%. It doesn't mean TEC stops operating, but certain performance degradation appears.

IMPORTANT NOTES

1. Thermoelectric Cooler (TEC) performance in this datasheet is specified in typical ambient condition modes (Vacuum, +27°C; Dry N2, +50°C; Dry N2, +75°C and Dry N2, +85°C. TEC performance may differ under other conditions. Please, contact TEC Microsystems for for detailed analysis and additional TEC performance info.

2. TEC ACR and Umax values are sensitive to ambient temperature. These values can be different from those specified in the datasheet at other ambient conditions. ACR and Umax rise with ambient temperature increasing.

3. TEC dTmax is specified at zero heatload, while Qmax is specified at zero dT (check Fig.1 for example). TEC dTmax and Qmax values rise with ambient temperature (check Fig. 2 for example).

4. Thermoelectric coolers have the best performance in the temperature range from near room up to +80..90°C. TEC cooling performance is getting lower at ambient temperatures below 0°C. TECs are not suitable to operate at cryogenic temperatures.

Fig. 1 - Understanding dTmax and Qmax

Fig. 2 - Same TEC dTmax and Qmax parameters at different ambient temperatures
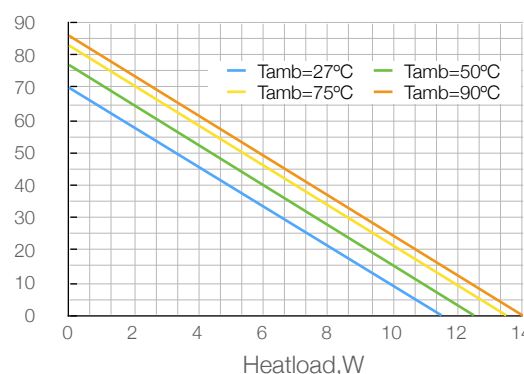
5. Driving TEC at Imax or Umax level doesn't mean the max cooling performance mode. The real optimal mode may depend on operating conditions, required dT level and application heatload. In fact a better performance can be reached at operating current and voltage lower than Imax and Umax values specified in datasheet.

6. It is strongly recommended to avoid a direct mounting of thermoelectric cooler to pure Copper, Aluminium or Nickel materials as well as a mounting of objects from these materials on TEC cold side. Any material with high CTE (Coefficient of Thermal Expansion) may affect on TEC lifetime and/or even damage TEC in case of improper mounting, thermal shock or temperature cycling. In case of above mentioned materials necessity, it is recommended to use some elastic "soft" solders or glues with large modulus of elasticity (Indium-based solders or silicon-based thermoconductive glues).

7. TEC Microsystems GmbH confirms that all thermoelectric coolers are qualified and meet the requirements of Telcordia GR-468 Standard (based on MIL-883). The up-to-date Reliability Report is available by request. TEC Microsystems GmbH warranties thermoelectric coolers lifetime no less than 250K-300K operating hours under normal application conditions.

8. Additional information about thermoelectric coolers operating and handling, all the most important questions and answers, are available on TEC Microsystems web in FAQ section (link).

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