ATE1-TC-127 TEC Modules

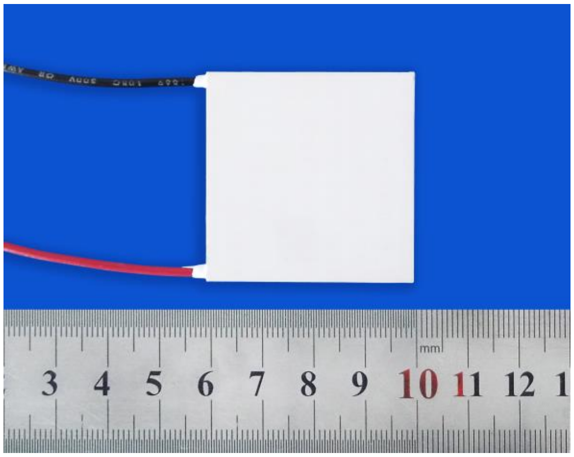

Figure 1. The Photo of Actual ATE1-TC-127-5R5AS

THERMAL LIFE STRENGTH:

1. Maximum temperature for short time (to mount a module into unit): 125°C
2. Recommended maximum operating temperature: 120°C
3. DT_{MAX} = 75 ℃@TH=25 ℃
4. ≥50,000 cycles by power on for 1 minute and power off for 1 minute
5. ≥20,000 cycles by driving TC to 20 ℃ then 80 ℃ then 20 ℃ then 80 ℃…

FEATURES

- Maximum Input Voltage: 17.5V
- Low Cost
- Longer thermal cycling operational life than standard TECs
- 100 % lead (Pb)-free and RoHS compliant

APPLICATIONS

Regulate the temperature of the target object with high changing speed and stabilize the temperature to a wide range with high precision. Thermal cycling TEC modules are widely used for temperature cycling applications, including instrumentation, PCR devices, thermal cyclers, chillers and analyzers, etc.

DESCRIPTIONS

This series of TEC (Thermoelectric Cooler) modules, ATE1-TC-127, has 127 pairs of Peltier elements inside with a maximum voltage of 16.2~17.5 Volt. They are designed for temperature cycling applications, in which a TEC module is exposed to demanding physical stresses as the module shifts from heating to cooling, and this can significantly reduce the operational life of a standard TEC. This thermal cycling TECs have significantly longer thermal cycling operational life than standard TECs.

This TEC module can be controlled by our TEC controllers to build highly stable and efficient temperature regulating systems. The ATE1-TC-127 series TECs can be used with our thermistors as well to achieve precise and stable temperature sensing.

The ATE1-TC-127 series TECs come in with highly flat bare ceramic surfaces on the both sides, they can be mounted onto flat metal surfaces by inserting thin layers of thermally conductive filler materials, the so-called thermal pads, or placing a thin layer of thermal paste. When mounting, make sure that proper pressure is applied constantly to keep good thermal contacting between the metal and the TEC plates, minimizing thermal resistance between them.

The TECs can withstand strong orthogonal forces applied to the surface, but very vulnerable to tangent forces, especially shocking tangent forces. A small shocking tangent force can cause the Peltier elements crack inside. The crack may not cause operation problem initially, but it will grow with time, causing the TEC resistance to increase slowly, by the end, the TEC will stop operating.

In the part number, for example, ATE1-TC-127-8AS, "TC" stands for thermal cycling; "8A" indicates the maximum current allowed for entering the TEC module; "S" represents sealed version. Without this "S" suffix means non-sealed version.

The ATE1-TC-127 TECs come with 2 insulated lead wires. The positive wire is in red color, and the negative wire is of black. The mechanical dimensions are shown in Figure 2, Figure 3 and Table 1.

There are two different maximum operating temperatures (instantaneous temperature). One is 100 ℃ for the TECs, whose part number is without an “**H**”, such as ATE1-TC-127-5R5AS, and the other is 200 ℃ for the TECs, whose part number is ended with an “**H**”, such as ATE1-TC-127-8AH.

The TECs, which have the edge area be sealed, are to prevent moisture from getting into the Peltier elements and to extend the life time of the TECs. The advantage of the non-sealed TECs is that the efficiency is higher and can achieve higher maximum temperature difference between the two TEC plates.

For applications in moisture environments, sealed version is recommended, in order to achieve long life time and high reliability for the system.

For high end applications where good and reliable thermal contacts are needed between the TEC and the target object surfaces, the TEC ceramic surface can be metalized so that the TEC and the target object surfaces can be soldered together.

SPECIFICATIONS

Table 1. Specifications

Part #	IMAX (A)	VMAX (V)	QMAX (W)	DTMAX* (°C)	Dimension (mm)				1–4 PCs	5–24 PCs	25–99 PCs	≥100 PCs	Note
					L_c	L_h	W	H					
ATE1-TC-127-4ASH	4A	17.5	34.0	78	39.7	39.7	39.7	4.10	31.50	30.80	30.10	28.40	Sealed
ATE1-TC-127-5R5AS	5.5	16.2	59.4	74.5	40.0	40.0	40.0	3.90	35.99	35.65	35.05	34.35	Sealed
ATE1-TC-127-5R7AS	5.7	16.2	57.6	72.5	30.0	30.0	30.0	3.10	34.99	34.65	34.05	33.35	Sealed
ATE1-TC-127-6ASH	6.0	18.1	60.0	79.0	39.7	39.7	39.7	3.94	32.00	31.30	30.60	28.90	Sealed
ATE1-TC-127-6BSH	6.0	18.1	60.0	79.0	29.7	29.7	29.7	3.94	32.00	31.30	30.60	28.90	Sealed
ATE1-TC-127-7R8AS	7.8	16.2	82.1	72.5	40.0	40.0	40.0	3.80	36.99	36.65	36.05	35.35	Sealed
ATE1-TC-127-8AH	8.5	17.5	72.0	72.0	39.7	39.7	39.7	3.94	32.30	31.60	30.90	29.20	Non-sealed
ATE1-TC-127-8ASH	8.5	17.5	72.0	72.0	39.7	39.7	39.7	3.94	32.30	31.60	30.90	29.20	Sealed
ATE1-TC-127-12R1AS	12.1	16.2	128.7	74.5	55.0	55.0	55.0	4.60	46.49	45.26	44.03	42.79	Sealed

* DT_{MAX}: DT stands for Differential Temperature between TEC's 2 plates.

Table 2. Other information

Permitted vertical load	30-60N/cm2 (3-6kgf/cm2)
Recommended storage temperature and humidity	30°C, 60% RH below
Sealing material	Silica gel

APPLICATION INFORMATION

As shown in Table 1, the DT_{MAX}, the maximum temperature difference between the 2 TEC plates, is 72~74.5 ℃. This is the normal value for a single stage TEC module. When needing a higher DT_{MAX}, 2 or 3 stage TECs must be utilized. Contact us for details.

TEC modules can be used for stabilizing laser chip temperature, to stabilize the wavelength and the working lasing mode, resulting in less or no mode hopping and stable output power.

Inversely, when applying a temperature difference between the TEC 2 plates, electricity can be generated. Thus, the TECs can be called TEGs (thermoelectric Generators).

When designing a thermal system by using TECs, one should choose the TEC module in the following way:

1. To achieve the maximum efficiency, it is essential to minimize the thermal resistance between the TEC plate surface and heat sink surface and between the TEC plate and the target object surface. The best way to minimize the thermal resistance is to mount the TEC modules' plates to the heat-sink and to the thermal load by soldering them together. This requires metalizing the TEC plate surfaces first. The 2nd best way is to apply a thin layer of thermal paste between the TEC plates and the heat-sink and the target object surfaces. Constant pressure is needed between the TEC plates and heat-sink and the target object surfaces. Thermal pad material, or so called thermal filler pads, can be used to replace the thermal paste. But this may increase the thermal resistance between the TEC plates and the heat-sink and the target object surfaces. Therefore, thermal paste is recommended to be applied between the TEC plates and the heat-sink. One of such products is Type 44 Heat Sink Compound 1/2 FL.OZ. made by Allied. More detail technical data about this material can be found here: http://www.alliedelec.com/search/productdetail.aspx?SKU=7964390.. The 3rd best way is to use thermally conductive epoxy, to glue the TEC surface and the heat-sink and the target object surfaces together. This approach is the least reliable because the epoxy may lose its adhere power as time goes.

2. To achieve high COP, Coefficient of Performance, which is defined as:

   COP = thermal power / electric power,

   the ratio between the TEC's output thermal power and the input electric power. Apparently, a high COP leads to low power system consumption, thus, high efficiency. The key to achieve high COP is to design the system with a low maximum temperature difference between the 2 TEC plates (the hot side and the cold side), DT. When the operating DT can be kept to be ≤ 30°C, the COP can be as high as 2, a very good result.

3. When the required maximum temperature difference is low, such as < 30 ℃, a large TEC module can be used to drive small thermal load, resulting in a low DT, thus high COP and efficiency.

4. It is not hard to design in a TEC system, but does require some understanding of heat transfer and a good grasp of your applications.

MECHANICAL DIMENSIONS

The mechanical dimensions of the ATE1-TC-127 series TECs are shown below. The ATE1-TC-127 series TECs come in square shape, small size, and light weight.

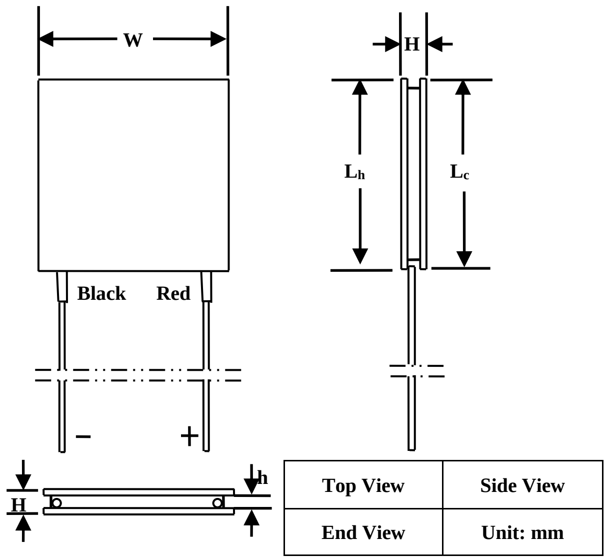

Figure 2. Mechanical Dimensions of Sealed ATE1-TC-127

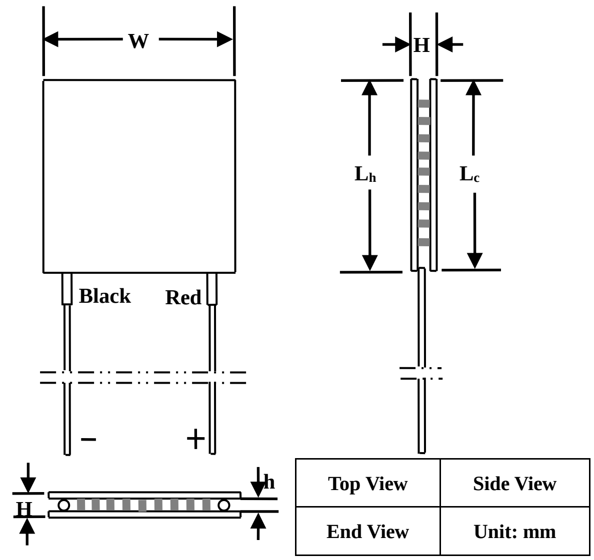

Figure 3. Mechanical Dimensions of Non-sealed ATE1-TC-127

Note: As Figure 2 shows, when the red lead wire is on the right, then the top surface is the cold side of the TEC.

CAUTIONS

1. Never apply electricity to TEC modules without having heat sinks attached properly.
2. Always keep the current less than I_{MAX}, to avoid thermal run-away disaster.

NOTICE

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