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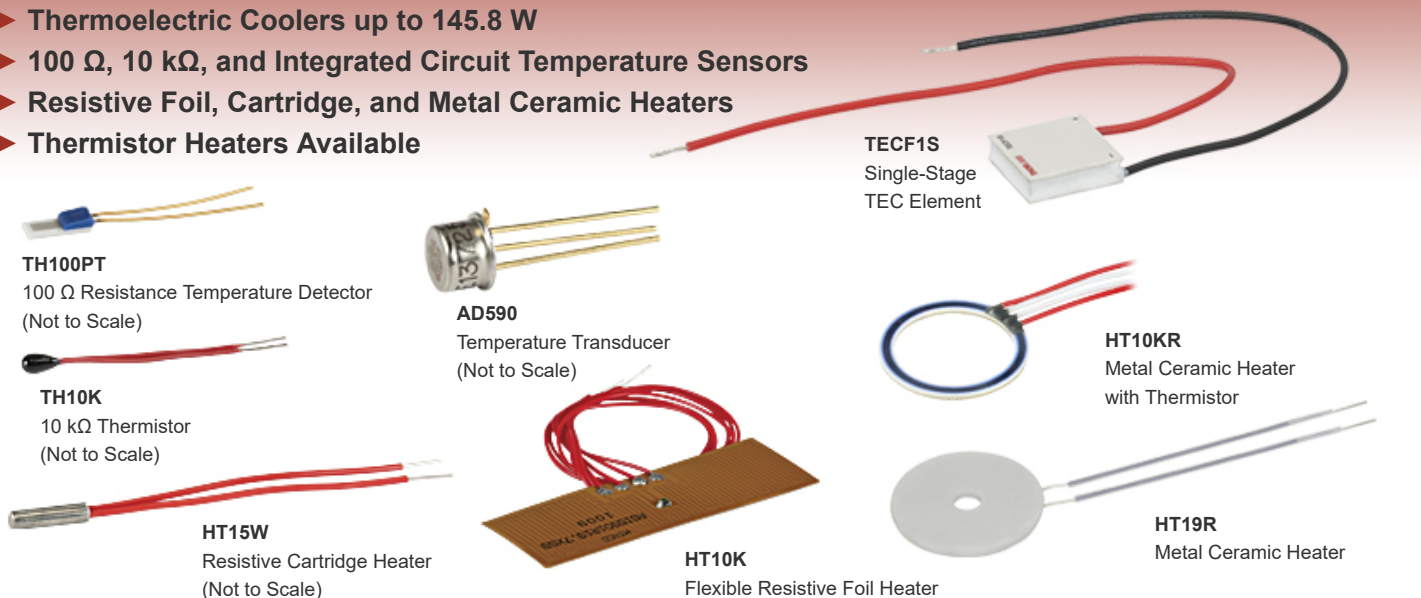


## HT10KR - November 8, 2021

Item # HT10KR was discontinued on November 8, 2021. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

### TEC ELEMENTS, RESISTIVE HEATERS, THERMISTORS, AND THERMOCOUPLES

- ▶ Thermoelectric Coolers up to 145.8 W
- ▶ 100 Ω, 10 kΩ, and Integrated Circuit Temperature Sensors
- ▶ Resistive Foil, Cartridge, and Metal Ceramic Heaters
- ▶ Thermistor Heaters Available



#### OVERVIEW

##### Features

- Thermoelectric Cooler (TEC) Elements are Compatible with:
  - TED4015 Temperature Controller
  - OEM Temperature Controllers
  - Rack Mountable Temperature Controllers

Thorlabs offers a wide range of thermal management accessories, including thermoelectric coolers, resistive heaters, thermistors, and temperature transducers. Thermoelectric coolers can both cool and heat, allowing for quick response to thermal drift or shock. These devices are ideal for total and precise temperature regulation. For applications that require only heating or steady-state regulation slightly above room temperature, resistive heaters are a reliable and easily regulated heat source. Regardless of application, temperature monitoring is essential for any temperature regulation system. Thorlabs' thermistors and thermocouples provide precise and accurate temperature measurements.

##### Thermoelectric Coolers

We offer a line of single-stage thermoelectric coolers, which can maintain temperature differentials of at least 73 °C for a 50 °C hot surface. Our dual-stage TEC (item # TECD2) provides a larger temperature differential between the hot and cold surfaces of the device; when the hot surface is 50 °C, it is capable of maintaining a differential of 108 °C in vacuum. The hot and cold surfaces of the dual-stage TEC are metalized copper for soldering in order to ease integration into the system.

All of our TECs work well with our TED4015 225 W Benchtop Laser Diode Temperature Controller and our rack-mountable temperature controllers, which are designed for the PRO800 Chassis. These TECs can also be driven by our OEM Temperature Controllers in SMT or THT Packages. When using a TEC for thermal regulation, care should be taken to electrically isolate the sides and leads of the TEC.

##### Quick Links

Single-Stage TEC Elements
Dual-Stage TEC Element
Flexible Resistive Foil Heaters
Resistive Cartridge Heater
Metal Ceramic Heaters
Metal Ceramic Heaters with Thermistors
Thermistors and Thermocouples

**Resistive Heaters**

Thorlabs offers four types of resistive heaters: foil, cartridge, metal ceramic, and metal ceramic with thermistor. The HT10K and TLK-H are resistive foil heaters with a pressure-sensitive adhesive backing and a 10 k $\Omega$  NTC thermistor integrated directly onto the heater. The HT15W is a miniature 15 W cartridge heater, which can be used for many applications requiring small areas to be heated. Our metal ceramic heaters come in either round (HT19R) or square (HT24S and HT24S2) geometries and provide fast thermal response. The HT10KR and HT19R2 are metal ceramic heaters with a 10 k $\Omega$  thermistor and can reach a maximum temperature of 75 °C and 90 °C, respectively. These small but high powered heaters are ideal for thermal regulation of optical components.

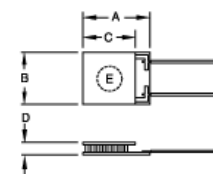
**Thermistors and Temperature Transducers**

We also offer three models of thermistors and temperature transducers. The TH10K is a 10 k $\Omega$  thermistor with 1 °C accuracy that is meant to be used in common TEC applications. The TH100PT is a 100  $\Omega$  platinum Resistance Temperature Detector (RTD) with a positive linear temperature response. The TH10K is compatible with the MTD415T TEC controller in an SMT package. The AD590 is an integrated circuit (IC) temperature transducer with an output current that is proportional to absolute temperature. All our thermistors and AD590 temperature transducers are compatible with the TED200C 12 W Benchtop Laser Diode Temperature Controller and our rack-mountable temperature controllers. For high temperature applications, constantan or manganese wires may be used.

### Single-Stage TEC Elements

Performance specifications are given in the table below as a function of  $T_H$ , the temperature of the hot surface of the TEC.  $I_{max}$  is the maximum allowed current across the TEC element and  $V_{max}$  is the maximum allowed voltage difference. These values should not be exceeded.  $Q_{max}$  is the maximum heat load that the TEC can handle;  $\Delta T_{max}$  is the maximum temperature difference between the hot and cold surfaces of the TEC in a dry nitrogen environment.

When choosing a TEC, it is important to know the heat load, or cooling capacity, of the system (how much heat must be transferred away from the device) and to match that load with a capable TEC. The TEC should be rated for a maximum heat load above that which is emitted by the system, and a sufficiently large heat sink must be attached to the hot surface. Proper thermal contact is necessary for optimal heat transfer. Ensuring that the TEC is of the proper size for the system is important as well as using thermal tape or grease to help facilitate heat transfer. It is important to note that the heat transfer efficiency is affected by the ambient environment; care must be taken to avoid condensation on the cold side. Large changes in background temperature or significant humidity can hamper heat flow. These factors should be taken into account when choosing an appropriate TEC.



Click to Enlarge  
General TEC Diagram  
\*E is only featured with TEC1.4-6

All the TECs available here, with the exception of the TEC3-2.5, TEC3-6, and TEC1.4-6, are silicone sealed to protect the core from moisture and condensation.

We offer several kinds of temperature controllers for our TECs. The TED4015 225 W TEC Controller is a benchtop laser diode temperature controller with excellent temperature stability. Our rack-mountable temperature controllers are also capable of excellent temperature stabilization and additionally are compatible with the PRO800 Chassis. For OEM, custom, or embedded systems, we offer OEM Temperature Controllers in SMT or THT Packages as well as on a PCB with mounting standoff.

Item #	$I_{max}$	$T_H = 27\text{ }^\circ\text{C}$			$T_H = 50\text{ }^\circ\text{C}$			AC Resistance @ 30 °C	Dimensions (See Above Diagram)					Performance Graphs
		$Q_{max}$	$V_{max}$	$\Delta T_{max}$	$Q_{max}$	$V_{max}$	$\Delta T_{max}$		A	B	C	D	E	
TECF1S	1.2 A	6.0 W	7.0 V	68.8 °C	6.7 W	7.9 V	77.9 °C	6.50 Ω	18.0 mm (0.71")	18.0 mm (0.71")	18.0 mm (0.71")	4.9 mm (0.19")	N/A	
TECF2S	1.9 A	9.7 W	8.2 V	66.4 °C	11.5 W	9.1 V	73.8 °C	3.30 Ω	18.0 mm (0.71")	18.0 mm (0.71")	18.0 mm (0.71")	3.4 mm (0.13")	N/A	
TECD2S	2.1 A	5.1 W	3.7 V	65.8 °C	5.7 W	4.2 V	74.7 °C	1.50 Ω	12.0 mm (0.47")	12.0 mm (0.47")	12.0 mm (0.47")	3.4 mm (0.13")	N/A	
TEC3-2.5	2.5 A	6 W	3.6 V	65 °C	6 W	4.1 V	73 °C	1.2 Ω @ 27 °C	20.5 mm (0.807")	16.0 mm (0.630")	16.0 mm (0.630")	4.0 mm (0.159")	N/A	a
TECH3S	3.7 A	35.3 W	14.3 V	64.8 °C	36.2 W	15.3 V	74.0 °C	3.80 Ω	30.0 mm (1.18")	30.0 mm (1.18")	30.0 mm (1.18")	3.2 mm (0.13")	N/A	
TECL4	3.8 A	77.1 W	32.3 V	68.5 °C	85.6 W	35.6 V	76.4 °C	6.00 Ω	50.0 mm (1.97")	50.0 mm (1.97")	50.0 mm (1.97")	5.3 mm (0.21")	N/A	
TECH4	4.6 A	44.8 W	15.2 V	66.3 °C	48.2 W	16.6 V	75.7 °C	2.50 Ω	40.0 mm (1.57")	40.0 mm (1.57")	40.0 mm (1.57")	3.8 mm (0.15")	N/A	
TEC3-6	5.6 A	13 W	3.6 V	65 °C	14 W	4.1 V	73 °C	0.5 Ω @ 27 °C	24.6 mm (0.969")	20.1 mm (0.791")	20.1 mm (0.791")	4.0 mm (0.159")	N/A	a
TECJ6	5.9 A	87.9 W	23.5 V	67.7 °C	103.5 W	26.2 V	76.1 °C	3.25 Ω	40.0 mm (1.57")	40.0 mm (1.57")	40.0 mm (1.57")	4.1 mm (0.16")	N/A	
TECD6	6.0 A	14.1 W	3.6 V	66.0 °C	15.1 W	3.9 V	74.5 °C	0.45 Ω	20.0 mm (0.79")	20.0 mm (0.79")	20.0 mm (0.79")	3.8 mm (0.15")	N/A	
TEC1.4-6	6.0 A	6 W <sup>b</sup>	1.7 V <sup>b</sup>	67 °C <sup>b</sup>	6.6 W	1.9 V	75 °C	0.27 Ω @ 25 °C	14.2 mm (0.560")	14.2 mm (0.560")	14.2 mm (0.560")	3.8 mm (0.150")	Ø5.0 mm (Ø0.20")	a
TECJ8	7.8 A	123.2 W	23.6 V	66.6 °C	145.8 W	27.8 V	74.5 °C	2.40 Ω	40.0 mm (1.57")	40.0 mm (1.57")	40.0 mm (1.57")	4.1 mm (0.16")	N/A	
TECH8	8.5 A	75.6 W	14.2 V	66.2 °C	84.2 W	15.7 V	75.0 °C	1.50 Ω	40.0 mm (1.57")	40.0 mm (1.57")	40.0 mm (1.57")	3.5 mm (0.14")	N/A	
TECH11	11.7 A	101.0 W	13.5 V	66.4 °C	110.0 W	15.0 V	75.5 °C	1.05 Ω	40.0 mm (1.57")	40.0 mm (1.57")	40.0 mm (1.57")	3.5 mm (0.14")	N/A	
TECD14	13.2 A	31.8 W	3.8 V	72.0 °C	34.0 W	4.2 V	75.0 °C	0.23 Ω	30.0 mm (1.18")	30.0 mm (1.18")	30.0 mm (1.18")	3.9 mm (0.15")	N/A	

- a. Performance graphs can be found on the spec sheet for this item. Click on the blue icon to view the TEC dimensions and specsheet.
- b. These values for the TEC1.4-6 are given at 25 °C.

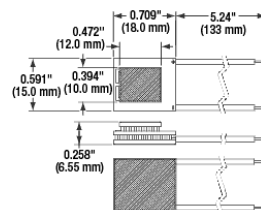
$Q_{max}$  = Maximum TEC Heat Load     $\Delta T_{max}$  = Maximum Temperature Differential  
 $V_{max}$  = Maximum Voltage

$I_{max}$  = Maximum Current  
 $T_H$  = Temperature of Hot Surface

Part Number	Description	Price	Availability
TECF1S	1.2 A Compact, Single-Stage TEC Element, $\Delta T = 68.8\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$19.10	Today
TECF2S	1.9 A Compact, Single-Stage TEC Element, $\Delta T = 66.4\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$19.10	5-8 Days
TECD2S	2.1 A Compact, Single-Stage TEC Element, $\Delta T = 65.8\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$14.85	Today
TEC3-2.5	2.5 A Single-Stage TEC Element, $\Delta T = 65\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$33.55	Today
TECH3S	3.7 A Compact, Single-Stage TEC Element, $\Delta T = 64.8\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$20.16	Today
TECL4	3.8 A Single-Stage TEC Element, $\Delta T = 68.5\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$50.92	Today
TECH4	4.6 A Single-Stage TEC Element, $\Delta T = 66.3\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$21.22	Today
TEC3-6	5.6 A Single-Stage TEC Element, $\Delta T = 65\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$33.83	Today
TECJ6	5.9 A Single-Stage TEC Element, $\Delta T = 67.7\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$38.19	Today
TECD6	6.0 A Single-Stage TEC Element, $\Delta T = 66.0\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$14.85	Today
TEC1.4-6	6.0 A Single-Stage TEC Element with Center Hole, $\Delta T = 67\text{ }^\circ\text{C}$ for $25\text{ }^\circ\text{C}$ Hot Surface	\$45.72	Today
TECJ8	7.8 A Single-Stage TEC Element, $\Delta T = 66.6\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$38.19	Today
TECH8	8.5 A Single-Stage TEC Element, $\Delta T = 66.2\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$21.22	Today
TECH11	11.7 A Single-Stage TEC Element, $\Delta T = 66.4\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$26.52	Lead Time
TECD14	13.2 A Single-Stage TEC Element, $\Delta T = 72.0\text{ }^\circ\text{C}$ for $27\text{ }^\circ\text{C}$ Hot Surface	\$21.22	Today

### Dual-Stage TEC Element

Specification	Value	Test Conditions (Vacuum)
$I_{\max}$	2.4 A	$Q = 0\text{ W}$ , $\Delta T = 108\text{ }^\circ\text{C}$ , $T_H = 50\text{ }^\circ\text{C}$
$V_{\max}$	9.2 V	$Q = 0\text{ W}$ , $I = 2.4\text{ A}$ , $T_H = 50\text{ }^\circ\text{C}$
$\Delta T_{\max}$	108 $^\circ\text{C}$	$Q = 0\text{ W}$ , $I = 2.4\text{ A}$ , $T_H = 50\text{ }^\circ\text{C}$
$Q_{\max}$	5.6 W	$I = 2.4\text{ A}$ , $\Delta T = 0\text{ }^\circ\text{C}$ , $T_H = 50\text{ }^\circ\text{C}$
$T_{H,\max}$	200 $^\circ\text{C}$	-
Resistance	2.664 - 3.251 $\Omega$	25 $^\circ\text{C}$ Ambient Temperature
Flatness / Parallelism of Two Faces	$\leq 0.10\text{ mm}$	-



Click for Details  
Dual-Stage TEC Dimensional Drawing

Our Dual-Stage Thermoelectric Cooler (TEC) is ideal for situations where additional cooling is required. The TECD2 provides a temperature difference between the hot and cold surfaces of up to 108  $^\circ\text{C}$  when the hot surface is at 50  $^\circ\text{C}$ . The hot and cold surfaces are metalized copper to allow for soldering. This TEC is designed to operate in vacuum levels of  $10^{-6}$  Torr with proper cleaning and bake out.

The performance values for our Dual-Stage TEC is given as a function of  $T_H$ , the temperature of the hot surface of the TEC.  $I_{\max}$  is the maximum allowed current across the TEC element and  $V_{\max}$  is the maximum allowed voltage difference. These values should not be exceeded.  $Q_{\max}$  is the maximum heat load that the TEC can handle;  $\Delta T_{\max}$  is the maximum temperature difference between the hot and cold surfaces of the TEC in vacuum.

When choosing a TEC, it is important to know the heat load of the system (how much heat must be transferred away from the device) and to match that load with a capable TEC. The TEC should be rated for a maximum heat load above that which is emitted by the system, and a sufficiently large heat sink must be attached to the hot surface. Proper thermal contact is necessary for optimal heat transfer. Ensuring that the TEC is of the proper size for the system is important as well as using thermal tape or grease to help facilitate heat transfer. It is important to note that the heat transfer efficiency is affected by the ambient environment; care must be taken to avoid condensation on the cold side. Large changes in background temperature or significant humidity can hamper heat flow. These factors should be taken into account when choosing an appropriate TEC.

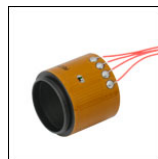
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Part Number	Description	Price	Availability
TECD2	2.4 A Dual-Stage TEC Element, $\Delta T = 108\text{ }^\circ\text{C}$ for $50\text{ }^\circ\text{C}$ Hot Surface	\$105.03	Today

### Flexible Resistive Foil Heaters



- ▶ Kapton (Polyimide) Foil Heaters with Integrated Thermistors
- ▶ 1" x 3" (25.4 mm x 76.2 mm) Heating Area
- ▶ Adhesive Backing for Easy Installation
- ▶ 10 W/in<sup>2</sup> (0.016 W/mm<sup>2</sup>) Heating Capacity



Click for Details  
SM1L10 Lens Tube  
Heated with the HT10K  
Foil Heater.

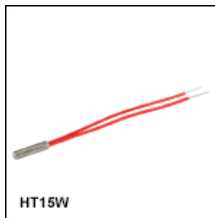
Item #	HT10K	TLK-H
Heater Resistance	19.7 Ω	
Sensor Type	NTC10K Thermistor	
Heating Capacity	10 W/in <sup>2</sup> (0.016 W/mm <sup>2</sup> ) @ 70 °C	
Size	1" x 3" (25.4 mm x 76.2 mm)	
Effective Heating Area	2.23 in <sup>2</sup> (1438.7 mm <sup>2</sup> )	
Minimum Bend Radius	0.5" (12.7 mm) in Thermistor Area, 0.030" (0.8 mm) in All Other Areas	
Temperature Range	-32 to 100 °C (-26 to 212 °F)	
Connector Type	Bare Wire Leads	6-Pin Hirose HR10A-7R-6S

These 1" x 3" (25.4 mm x 76.2 mm) foil heating elements are useful for many lab applications. They have an integrated thermistor for closed-loop temperature control and an acrylic pressure-sensitive adhesive backing for easy installation. Both models use the same heating element. The HT10K features bare wire leads for use with a user-provided connector.

Both foil heaters are flexible for use in applications such as heating lens tubes, as shown in the photo to the right. In this application, the lens tube can be isolated from the rest of the system using a Thermally Insulating Adapter.

Part Number	Description	Price	Availability
HT10K	Flexible Polyimide Foil Heater with 10 kΩ Thermistor	\$56.00	Today
TLK-H	Flexible Polyimide Foil Heater with 10 kΩ Thermistor and 6 Pin Hirose Connector	\$217.51	5-8 Days

### Resistive Cartridge Heater



- ▶ General Purpose Cartridge-Type Resistive Heater
- ▶ Compact Ø0.122" x 1/2" (Ø3.1 mm x 12.7 mm) Cylindrical Package
- ▶ 15 W Maximum Heating Power

Item #	HT15W
Heater Resistance	38.4 Ω ± 10%
Size	Ø0.122" x 1/2" (Ø3.1 mm x 12.7 mm)
Heating Capacity	15 W @ 24 V, 3.8 W @ 12 V, 0.90 W @ 6 V
Maximum Temperature	315 °C (600 °F) <sup>a</sup>
Connector Type	Bare Leads

The HT15W is a 15 W cartridge-shaped resistive heater with bare leads. It has a maximum heating capacity of 15 W at 24 V, and a maximum temperature of 315 °C (600 °F).

a. When installed in a Ø1/8" (Ø3.2 mm) bore in a metal block. The lead exits of the heater are insulated with a PTFE end cap. While the heater body may be operated at higher temperatures, the end cap should never exceed 260 °C (500 °F).

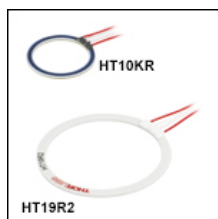
Part Number	Description	Price	Availability
HT15W	15 W Resistive Cartridge Heater, Ø0.122" x 1/2" (Ø3.1 mm x 12.7 mm)	\$45.19	Today

### Metal Ceramic Heaters

Item #	HT19R	HT24S	HT24S2
Heater Power	19 W @ 24 V 4.8 W @ 12V 1.2 W @ 6 V		24 W @ 24 V 6.1 W @ 12 V 1.5 W @ 6 V
Heater Resistance	30 Ω ± 10%		23.5 Ω ± 10%
Dimensions	Ø0.906" (23.0 mm) O.D. Ø0.157" (4.0 mm) I.D.	0.787" (20.0 mm) Square	1.143" (28.0 mm) Square
Dimensional Tolerance	±0.02" (0.5 mm) O.D. ±.004" (0.1 mm) I.D.		±0.02" (0.5 mm)
Thickness	0.05" (1.3 mm)		0.07" (1.7 mm)
Thickness Tolerance		±0.002" (0.05 mm)	
Lead Length		1.97" (50.0 mm)	
Max Temperature		400 °C	

Part Number	Description	Price	Availability
HT19R	19 W Metal Ceramic Heater, 23 mm O.D., 4 mm I.D.	\$47.88	Today
HT24S	24 W Metal Ceramic Heater, 20 mm x 20 mm	\$47.88	Today
HT24S2	24 W Metal Ceramic Heater, 28 mm x 28 mm	\$47.88	Today

### Metal Ceramic Heaters with Thermistors



- ▶ General Purpose Metal Ceramic Heaters with Thermistors
- ▶ HT10KR: 10 W, 25.0 mm Outer Diameter
- ▶ HT19R2: 19 W, 50.0 mm Outer Diameter


These Metal Ceramic Ring Heaters contain 10 kΩ thermistors. The HT10KR Ø25 mm heater is also incorporated in our GCH25R Cap Heater for Ø25 mm glass cells.

Item #	HT10KR	HT19R2
Heater Power	10 W @ 24 V ± 10%	19 W @ 24 V ± 20%
Heater Resistance	50 Ω ± 10%	30 Ω ± 10 %
Outer Diameter <sup>a</sup>	25.0 mm (0.984")	50.0 mm (1.968")
Inner Diameter <sup>a</sup>	20.0 mm (0.787")	43.0 mm (1.692")
Thickness <sup>b</sup>	2.25 mm (0.088")	1.9 mm (0.07")
Lead Length <sup>a</sup>	305.0 mm (12.01")	
Max Temperature	75 °C	90 °C

- a. For tolerances on these dimensions, see the spec sheets by clicking on the red Docs icons (📄) below.
- b. This specification includes the thickness of the ceramic ring and the thermistor.

Part Number	Description	Price	Availability
HT10KR	10 W Metal Ceramic Ring Heater with 10 kΩ Thermistor, 25 mm OD, 20 mm ID	\$61.80	Today
HT19R2	19 W Metal Ceramic Ring Heater with 10 kΩ Thermistor, 50 mm OD, 43 mm ID	\$63.00	Today

### Thermistors and Thermocouples

AD590		TH10K <sup>a</sup>		TH100PT	
Linear Current Output	1 $\mu$ A / K	Temp. Accuracy	$\pm 1$ °C	Rating	100 $\Omega$ @ 0 °C
Operating Range	-55 °C to 150 °C	Dissipation Constant	1.4 mW/°C	Temp. Coefficient	$3.85 \times 10^{-3}$ / K
Power Supply Range	4 to 30 V	Time Constant	15 s	Accuracy	Class B Tolerance ( $\pm 0.3$ °C @ 100 $\Omega$ )
Bottom View (Click to Enlarge)		Operating Range	-50 to 150 °C	Operating Range	-70 to 400 °C (-94 to 752 °F)
		Temp. Coefficient	-4.40 %/°C		

a. @ 25 °C. We also offer an Excel file which quickly calculates measured resistance for a given temperature or temperature for a measured resistance.

Part Number	Description	Price	Availability
AD590	Temperature Transducer	\$15.15	Today
TH10K	10 k $\Omega$ Thermistor	\$4.53	Today
TH100PT	100 $\Omega$ Platinum Resistance Temperature Detector	\$9.80	Today