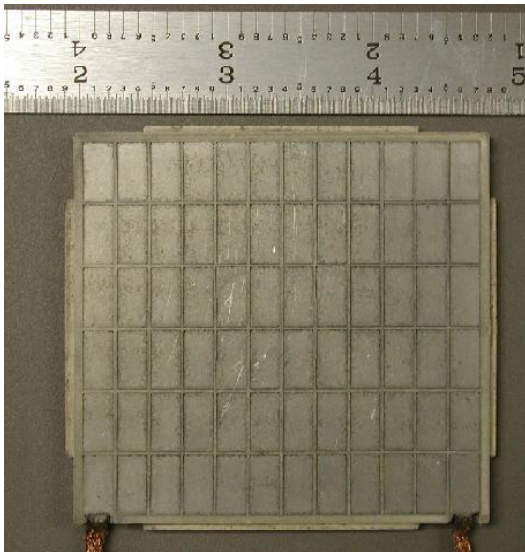


HZ-20 Thermoelectric Module

Uses Bismuth Telluride Based Semiconductors

Solid State Conversion of Heat To Electricity

Generate a highly reliable source of electrical power from any source of heat. For these and other applications:



POWER SUPPLIES

- Convert any source of heat to a reliable supply of electrical power in remote locations
- Convert heat from the combustion of hydrocarbon fuels to electricity creating a reliable power supply of remote unmanned stations.
- Cathodic protection
- Telecommunications

SELF POWERED DEVICES

- Heaters
- Furnaces
- Water heaters
- Barbecues

WASTE HEAT RECOVERY

- Vehicle engine heaters
- Engine exhaust powered alternator replacement
- Industrial operations such as cement plants, refineries, glass manufacturing, foundries, *etc.*
- Flare gas

RENEWABLE ENERGY

- Wood burning stoves
- Incinerators
- Solar salt ponds
- Geothermal
- Solar concentrators

THE HZ-20 THERMOELECTRIC MODULE

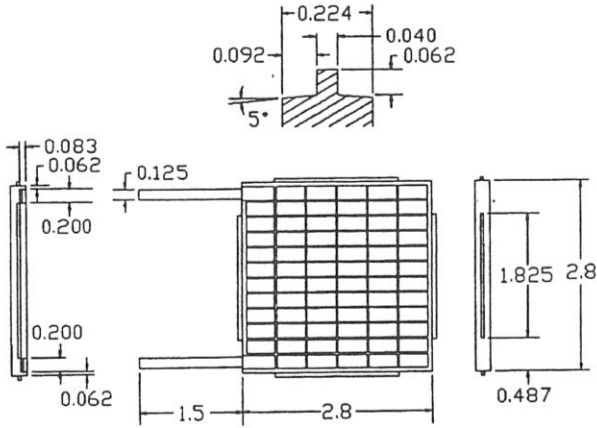
The HZ-20 module consists of 71 thermocouples arranged electrically in series and thermally in parallel. The thermocouples consist of “Hot Pressed”, Bismuth Telluride based semiconductors to give the highest efficiency at most waste heat temperatures as well as high strength capable of enduring rugged applications. The bonded metal conductors enable the HZ-20 module to operate continuously at temperatures as high as 250°C

(480°F) and intermittently as high as 400°C (750°F) without degrading the module.

While the HZ-20 is well suited for waste heat recovery, its reversible properties make it ideal as a thermoelectric cooler, especially for high temperature applications where sensitive electronic equipment must be cooled to below the ambient temperatures.

Properties of the 20 Watt Module, HZ-20		
Physical Properties	Value	Tolerance
Width and Length	2.95 in. (7.5 cm)	±0.01 (0.025)
Thickness	0.2 in. (0.508 cm)	±0.01 (0.025)
Special Order		±0.02 (0.005)
Weight	115 grams	±3 grams
Compressive Yield Stress	10 ksi (70 MPa)	Minimum
Number of active couples	71 couples	--
Thermal Properties		
Design Hot Side Temperature	230°C (450°F)	±10 (20)
Design Cold Side Temperature	30°C (85°F)	±5 (10)
Maximum Continuous Temperature	250°C (480°F)	--
Minimum Continuous Temperature	None	--
Maximum Intermittent Temperature	400°C (750°F)	--
Thermal Conductivity ¹	0.024 W/cm*K	+0.001
Heat Flux ¹	9.54 W/cm ²	±0.5
Electrical Properties (as a generator)¹		
Power ²	19 Watts	Minimum
Load Voltage	2.38 Volts	±0.1
Internal resistance	0.3 Ohms	±0.05
Current	8 Amps	±1
Open Circuit Voltage	5.0 Volts	±0.3
Efficiency	4.5%	minimum
¹ At design temperatures ² At matched load, please refer to the graphs for properties at various operating temperatures and conditions.		

ELECTRICAL PROPERTIES



Note: Power leads are braided copper wire.
All dimensions are in inches

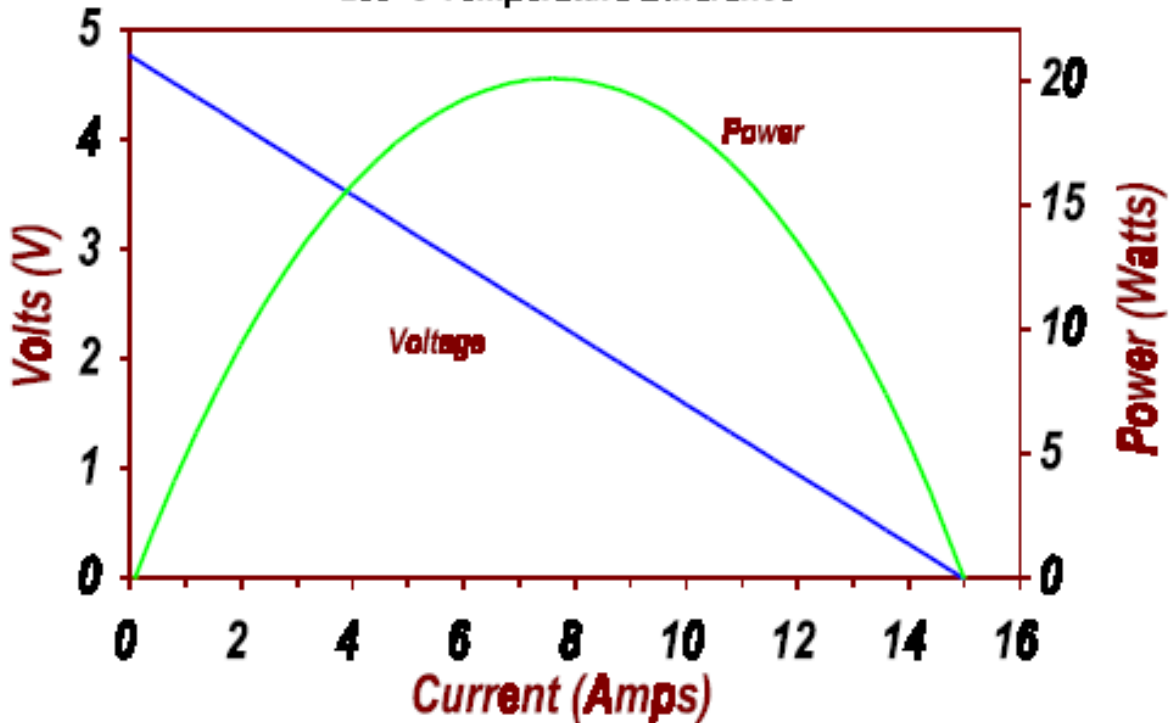
Many of the electrical properties of the HZ-20 are dependant upon the load to which it is connected. The Current-Voltage curve (I-V Curve) below exhibits the dependence of these properties as a function of the current.

It should be noted that the load at which maximum efficiency is obtained occurs at a higher voltage than does the point at which maximum power is obtained.

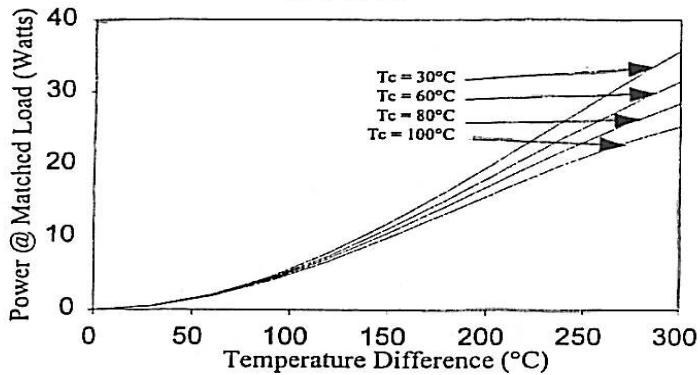
The Current-Voltage Curve displayed below illustrates the modules properties when the hot surface of the module is at 230°C (450°F) and the cold surface of the module is at 30°C (90°F). For a Current-Voltage Curve at other temperatures, please contact Hi-Z Technology.

Current - Voltage Curves

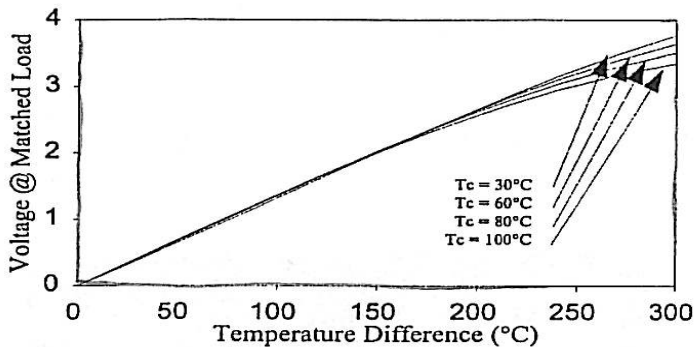
200° C Temperature Difference



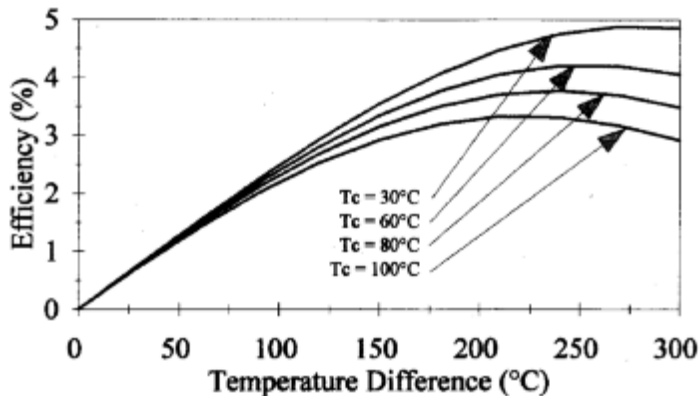
Power



Voltage



Efficiency



TEMPERATURE DEPENDENCE

All thermoelectric devices are very temperature dependent.

The figures shown to the left illustrate how key thermoelectric properties of the HZ-20 module vary as the hot and cold surface temperatures are varied.

AVAILABLE OPTIONS:

- DC-DC converter
 - Input 1.5 V-15V
 - Output 15 V (adjustable)
 - 30 Watts
- Heat Sink
 - Fan Cooled
 - Free Convection
 - Water Cooled
- Heat Transfer Grease
- Ceramic, Electrically Insulating Wafers
- Silicone, Thermally conductive Pads

All statements, technical information and recommendations contained herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is no guaranteed. Neither seller nor manufacturer shall be liable for any injury, loss or damage including but not limited to special, incidental or consequential damages arising out of the use or the inability to use the product. Before using, user shall determine the suitability of the product for his intended use, and user assumes all risk and liability whatsoever in connection therewith. No statement or recommendation contained herein shall have any force or effect unless in an agreement signed by officers of seller and manufacturer.

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