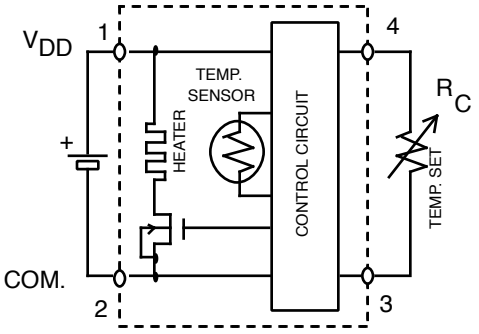
## DATA SHEET

**DN510**

# SUBMINIATURE PROPORTIONALLY CONTROLLED HEATER

### HEATER BLOCK DIAGRAM




### GENERAL DESCRIPTION

The DN510 is a subminiature proportionally controlled heater, whose temperature can be programmed with a single external resistor. This device is ideally suited for regulating the temperature of sensitive electronic components such as fiber optic components and crystal oscillators. The DN510 is in a ceramic package and can supply up to 14 watts of power from an unregulated power supply.

### FEATURES

- BERYLLIA BASE FOR GOOD THERMAL CONDUCTION
- REGULATION TEMPERATURE FROM 5˚C ABOVE AMBIENT TO 100˚C
- 28 TO 50 VOLT OPERATION
- ELECTRICALLY ISOLATED FROM THE CASE

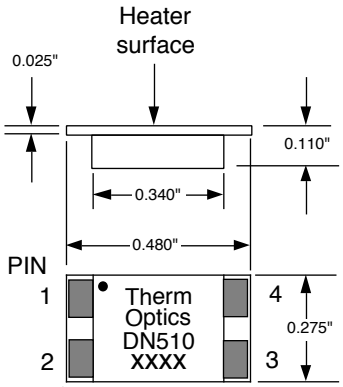
### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Supply Voltage | $V_{DD}$ | 50 | VDC |
| Power Dissipation | $P_D$ | 16 | Watts |
| Operating Temperature | $T_{max}$ | 120 | $^oC$ |
| Storage Temperature | $T_{min}$ | -65 to +150 | $^oC$ |

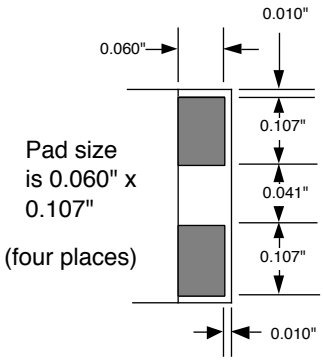
### OPERATING CHARACTERISTICS

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage (Pin 1 to Pin 4) | $V_{DD}$ | +28 | +50 | VDC |
| Steady State Supply Current @ $V_{DD}$ = +48 VDC | $I_S$ | 5.0 | 350 | mADC |
| Temperature Variation over Operating Voltage | $\Delta T_V$ | | 2 | $^oC$ |
| Temperature Variation with Load | $\Delta T_L$ | | 6 | $^oC$ |
| Control Temperature Range | $T_C$ | $T_A$ + 5 | 100 | $^oC$ |
| Control Resistor Value Pin 2 to Pin 3 (See Figure 1) | $R_C$ | 0 | | Ω |
| Maximum Control Temperature when $R_C$ = 0 Ohms | $T_{max}$ | | 120 | $^oC$ |
| Turn on power at start-up @ $V_{DD}$ = + 48Volts | $P_D$ | 14 | | Watts |

### OUTLINE DIMENSIONS



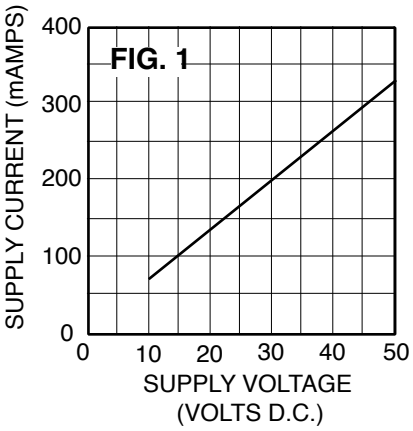

The DN510 electrical output pads are Pd-Pt-Ag and can be soldered. The solder used, such as SN-62, should contain silver to prevent leaching of the pads from the substrate.



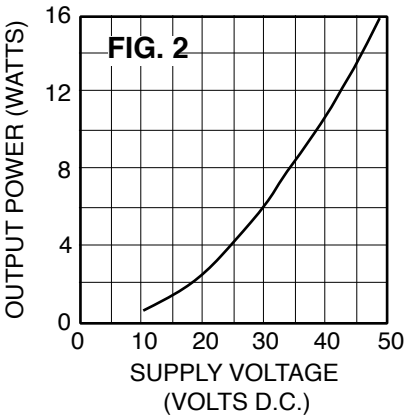
## Heater Temperature vs Temperature Set Resistor

| T °C | RS KΩ | T °C | RS KΩ | T °C | RS KΩ | T °C | RS KΩ |
|---|---|---|---|---|---|---|---|
| 0 | 360.1 | 29 | 79.6 | 58 | 20.2 | 87 | 4.6 |
| 1 | 340.6 | 30 | 75.8 | 59 | 19.3 | 88 | 4.4 |
| 2 | 322.3 | 31 | 72.2 | 60 | 18.4 | 89 | 4.1 |
| 3 | 305.0 | 32 | 68.8 | 61 | 17.5 | 90 | 3.9 |
| 4 | 288.7 | 33 | 65.5 | 62 | 16.7 | 91 | 3.6 |
| 5 | 273.4 | 34 | 62.5 | 63 | 15.9 | 92 | 3.4 |
| 6 | 259.0 | 35 | 59.5 | 64 | 15.2 | 93 | 3.2 |
| 7 | 245.4 | 36 | 56.8 | 65 | 14.5 | 94 | 3.0 |
| 8 | 232.5 | 37 | 54.1 | 66 | 13.8 | 95 | 2.8 |
| 9 | 220.4 | 38 | 51.6 | 67 | 13.2 | 96 | 2.6 |
| 10 | 209.0 | 39 | 49.2 | 68 | 12.5 | 97 | 2.4 |
| 11 | 198.3 | 40 | 46.9 | 69 | 11.9 | 98 | 2.2 |
| 12 | 188.1 | 41 | 44.8 | 70 | 11.4 | 99 | 2.0 |
| 13 | 178.5 | 42 | 42.7 | 71 | 10.8 | 100 | 1.8 |
| 14 | 169.4 | 43 | 40.7 | 72 | 10.3 | 101 | 1.68 |
| 15 | 160.8 | 44 | 38.9 | 73 | 9.8 | 102 | 1.52 |
| 16 | 152.7 | 45 | 37.1 | 74 | 9.3 | 103 | 1.37 |
| 17 | 145.1 | 46 | 35.4 | 75 | 8.9 | 104 | 1.23 |
| 18 | 137.8 | 47 | 33.8 | 76 | 8.4 | 105 | 1.09 |
| 19 | 131.0 | 48 | 32.3 | 77 | 8.0 | 106 | 0.95 |
| 20 | 124.5 | 49 | 30.8 | 78 | 7.6 | 107 | 0.82 |
| 21 | 118.3 | 50 | 29.4 | 79 | 7.2 | 108 | 0.70 |
| 22 | 112.5 | 51 | 28.1 | 80 | 6.8 | 109 | 0.58 |
| 23 | 107.0 | 52 | 26.8 | 81 | 6.5 | 110 | 0.46 |
| 24 | 101.8 | 53 | 25.5 | 82 | 6.1 | 111 | 0.35 |
| 25 | 96.9 | 54 | 24.4 | 83 | 5.8 | 112 | 0.25 |
| 26 | 92.2 | 55 | 23.2 | 84 | 5.5 | 113 | 0.14 |
| 27 | 87.8 | 56 | 22.2 | 85 | 5.2 | 114 | 0.04 |
| 28 | 83.6 | 57 | 21.2 | 86 | 4.9 | | |

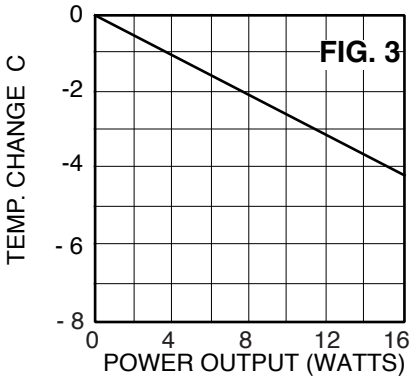
### MAX. START UP CURRENT VS. SUPPLY VOLTAGE




### MAX. THERMAL POWER AVAILABLE VS. SUPPLY VOLTAGE




### TYPICAL BASE TEMPERATURE CHANGE WITH POWER DISSIPATION




The base material of the DN510 is Beryllia which provides efficient energy transfer from the heating element located inside the heater and the heating surface of the DN510. The temperature drop across the Beryllia substrate, as a function of power transfer, is shown in figure 3.

The thermal interface between the DN510 heater and the device being heated causes a temperature drop. Care should be taken to make sure that a good thermal interface exists between the two surfaces.

### OPTIONS

1. The DN510 is normally supplied with leads. However, the heater can be supplied without them. The leaded device has #33 insulated magnet wire attached to the solder pads as shown in figure 4.

2. Operating temperature can be set at the factory by soldering a chip resistor between pins 3 and 4. Consult the the factory when specific heater temperatures are required.

3. The DN510 heater can be attached to the device to be heated by Ablefilm 561K thermally conductive adhesive film. A 0.005" thick 0.480" x 0.275" piece of this film is provided with each DN510 heater.

DN510
ACTUAL SIZE

FIG. 4

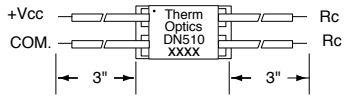
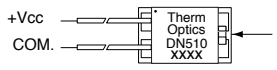



FIG. 5




A chip resistor is used to set the temperature of the heater.

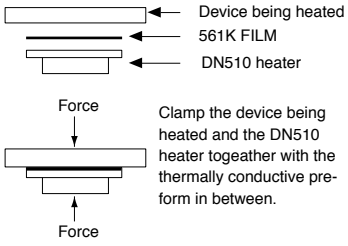



FIG. 7

Clamp the device being heated and the DN510 heater togeather with the thermally conductive pre-form in between.

**INSTRUCTIONS FOR APPLICATION OF THE FILM**

1. Place precut adhesive film between clean surfaces to be bonded.
2. Assemble components. Apply spring loaded clamp or dead weight to provide continuous pressure of at least one psi during the cure cycle.
3. Place assembly in a preheated oven and cure at one of the following schedules:
   1/2 hr @ 150˚C
   2 hrs @ 125˚C

### APPLICATIONS

Applications for the DN510 are to regulate the temperature of sensitive electronic components. One such application is employing the DN510 as the temperature controlling element in an oven controlled crystal oscillator. This application is illustrated in figure 8.

When using the DN510, care should be taken to thermally insulate the composite heater and the electronics package being heated from the surrounding environment. This will minimize the amount of power required to heat the package which in turn will reduce the temperature variation of the package over the ambient temperature extremes .

**OVEN CONTROLLED CRYSTAL OSCILLATOR APPLICATION USING THE DN510 HEATER**

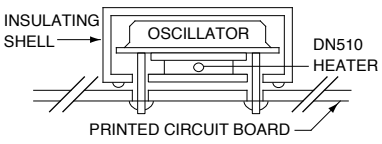



FIG. 7

**NOTES:**

1. All DN510 heaters are tested for gross leaks in Fluorocabon at 125˚C.
2. Do not reverse the voltage polarity on the input power leads. This can cause permanent damage to the device.

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