



# TEMPERATURE CONTROL

## With Non-Linear Resistors



### Thermistors Sensors for Refrigeration



#### THERMISTORS SENSORS FOR REFRIGERATION

NTC sensors from Vishay are a key component for temperature measurement and control in refrigerators, freezers and deep-freezers, air conditioning, and floor heating. Our sensors feature insulated thermistor chips that are protected in a plastic housing, allowing for superior humidity and thermal cycling resistance. They are easily mounted and can be foamed into place and grouped with other features on an assembly bundle.

All Vishay NTC sensors are built using our own process, from powders to ceramics, and are finished with our own manufacturing assembly, allowing us to meet specific customer requirements. Our sensors can be customized to facilitate mounting or to suit specific end-customer demands, such as cable colors, specific white goods colors, cable grouping, labels, and packaging. The sensors' designs are also adaptable to various refrigerator models.

#### RESOURCES

- More information can be found on [www.vishay.com/thermistors](http://www.vishay.com/thermistors)
- For technical questions contact [nlr@vishay.com](mailto:nlr@vishay.com)

One of the World's Largest Manufacturers of  
Discrete Semiconductors and Passive Components



# TEMPERATURE CONTROL

## With Non-Linear Resistors



Resistors - Feature Insulated Thermistor Chips

### Technical Capabilities

**Various Locations in Appliances** — Vishay sensors can be mounted in various locations inside refrigerators, allowing for application-specific temperature measurement. They can measure the temperature inside the refrigerator cabinet, the freezer cabinet, the surface temperature of the freezer back panel, the evaporator tube temperature, or the compressor temperature. They can be mounted with adhesive tape, adhesive foam tape, a screw under a hood, or by clamping them onto a tube.

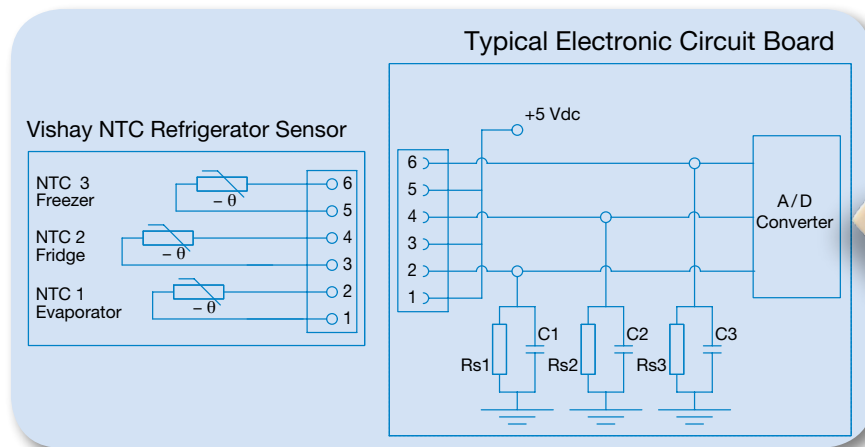
**Sensors Sizes** — A range of plastic cases is available to suit a wide variety of applications. Options include 7 mm x 25 mm, 8 mm x 30 mm, 9 mm x 30 mm, or 9 mm x 49 mm for the cylindrical shapes; and 7 mm x 7.5 mm x 25 mm for the flat surface measurements of the rectangular shapes. Other molding sizes are available on demand.

**Cables** — Flexible cables for use in cold storage environments are designed for single- or double-insulated applications where there are electrical and mechanical critical paths. Vishay offers various types of flexible cables, ranging from standard single-insulated 30- to 22-AWG cables with 2 x 0.5 mm<sup>2</sup> or 2 x 0.75 mm<sup>2</sup> conductors, to a specific double-insulated cable with 2 x 0.35 mm<sup>2</sup> conductors.

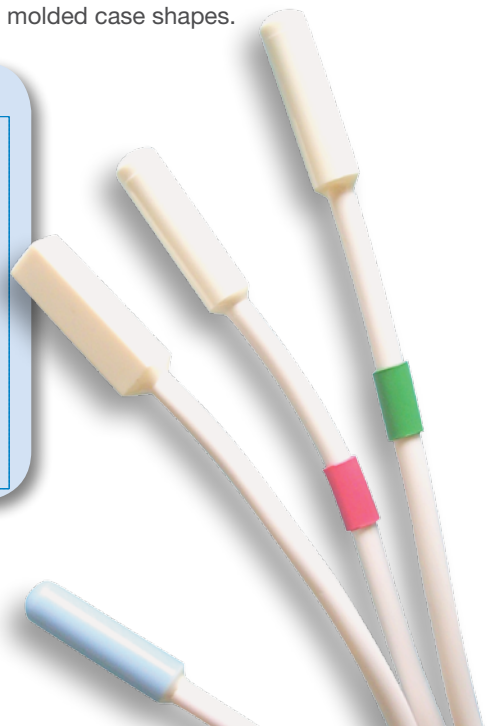
**RAST 2.5 mm Connectors** — There are a number of connectors available for use in wire-to-wire, wire-to-pcb, or pcb edge connections. Both crimping or insulation displacement connectors can be utilized, including the most commonly used RAST 2.5 mm connectors. Anywhere from two to five sensors can be grouped on the same connector, allowing for error-proof mounting and space savings on the circuit board. Other applications, such as the connection between the circuit board and the door switch, can also be grouped with these sensors on the same connector.

**Reliability** — Due to the high-reliability of Vishay's design and process, our sensor cables can be foamed-in-place, without the need for servicing throughout the lifetime of the refrigerators and freezers. To facilitate the assembly process, features such as colored markers and position markers can be added as a guide to the exact placement of the sensors and cables in the refrigerator.

Example of available cable styles and molded case shapes.



Rs1: Typical 10 kΩ SMD, code CRCW060310k0FK  
 Rs2, Rs3: Typical 47 kΩ SMD, code CRCW060347k0FK  
 C1, C2, C3: Typical 100 nF, 25 V, code VJ0603X104KXX





# TEMPERATURE CONTROL

## With Non-Linear Resistors



Resistors - Feature Insulated Thermistor Chips

### Performance Data

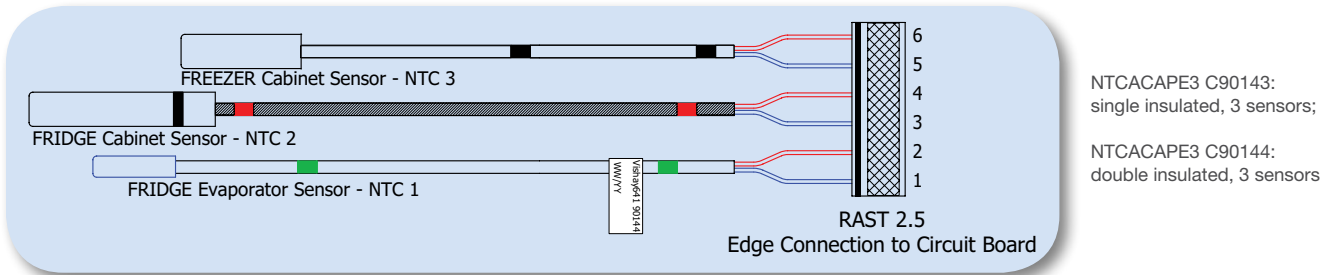
Test	Standard	Conditions	$\Delta R_{25}/R_{25}$ (Typical)
Dry Heat	IEC 60068-2-2	Storage at upper temperature, 1000 h	< 2 %
Cold Storage		Storage at lower temperature, 1000 h	< 2 %
Damp Heat, Steady State	IEC 60068-2-3	40 °C / 95 % RH, 56 days	< 2 %
Temperature Cycling	IEC 60068-2-14	- 40 °C / + 80 °C, 1000 cycles	< 2 %
Water Immersion		Water temp. 30 °C / biased 5 V with serial resistance, 4000 cycles (x20 minutes) minimum	< 2 %
Temperature Cycling		- 20 °C / +15 °C, immersion in water, 1500 h	< 2 %
Temperature Cycling		- 20 °C / + 25 °C, air 100,000 cycles	< 2 %
Voltage Proof		1250 V single insulated, or 3750 V double insulated, or 3750 V Class II, 1 min	
Insulation Test		500 Vdc	>> 100 M $\Omega$
Cold Storage Test		- 40 °C, under voltage, 10,000 h	< 2 %

### Features

- Key component for temperature sensing and electronic control
- Accurate Vishay NTC chips, enabling class A to class A+++ refrigerator grades
- Sensor design following class II insulation (principal + supplementary insulation for the sensor head)
- High adhesive strength between PVC wire and encapsulating lacquer
- Specifically developed design allows for a very good water, moisture and ice resistance: 6000 h in water immersion under voltage
- Suitable for evaporator temperature measurement. Very high number of thermal cycles resistant: 100 000 cycles
- The cables jackets are suitable for back-panel polyurethane foaming process (max. 100 °C, 5 min)
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- UL certification available on request
- The sensors are also available with single insulated cables, and with PVC-free cable

### Applications

- Temperature measurement, sensing and control:
- White goods
- Refrigerators
- Freezers, deep-freezers
- Ice cube makers
- Counter drinks coolers
- Backbar and catering coolers
- Display fridges
- Wine coolers





# TEMPERATURE CONTROL

## With Non-Linear Resistors



Resistors - Feature Insulated Thermistor Chips

### WORLDWIDE SALES CONTACTS

#### THE AMERICAS

##### UNITED STATES

VISHAY AMERICAS  
ONE GREENWICH PLACE  
SHELTON, CT 06484  
UNITED STATES  
PH: +1-402-563-6866  
FAX: +1-402-563-6296

#### ASIA

##### SINGAPORE

VISHAY INTERTECHNOLOGY ASIA PTE LTD.  
37A TAMPINES STREET 92 #07-00  
SINGAPORE 528886  
PH: +65-6788-6668  
FAX: +65-6788-0988

##### P.R. CHINA

VISHAY CHINA CO., LTD.  
15D, SUN TONG INFOPORT PLAZA  
55 HUAI HAI WEST ROAD  
SHANGHAI 200030  
P.R. CHINA  
PH: +86-21-5258 5000  
FAX: +86-21-5258 7979

##### JAPAN

VISHAY JAPAN CO., LTD.  
SHIBUYA PRESTIGE BLDG. 4F  
3-12-22, SHIBUYA  
SHIBUYA-KU  
TOKYO 150-0002  
JAPAN  
PH: +81-3-5466-7150  
FAX: +81-3-5466-7160

#### EUROPE

##### GERMANY

VISHAY ELECTRONIC GMBH  
DR.-FELIX-ZANDMAN-PLATZ 1  
95100 SELB  
GERMANY  
PH: +49-9287-71-0  
FAX: +49-9287-70435

##### FRANCE

VISHAY S.A.  
199, BD DE LA MADELEINE  
06003 NICE, CEDEX 1  
FRANCE  
PH: +33-4-9337-2727  
FAX: +33-4-9337-2726

##### UNITED KINGDOM

VISHAY LTD.  
SUITE 6C, TOWER HOUSE  
ST. CATHERINE'S COURT  
SUNDERLAND ENTERPRISE PARK  
SUNDERLAND SR5 3XJ  
UNITED KINGDOM  
PH: +44-191-516-8584  
FAX: +44-191-549-9556