GE’s Thermometrics temperature sensor solutions
Global Excellence in Temperature Sensors

The Thermometrics temperature product line contributes more than 70 years of technology experience in the design and manufacture of high quality sensors to the GE Sensing & Inspection Technologies portfolio of sensor-based solutions.

Thermometrics pioneered lead frame technology, unifying the probe terminal and thermistor lead into a single constructed metal substrate. This innovation was the building block to today’s fully automated volume production process, which ensures the highest degree of quality and performance.

GE continues to invest in leading edge temperature sensor and sensor packaging technology for the Thermometrics product line, particularly in developing custom solutions for industry and for specific customer application needs. From chips to value-added assemblies and for temperature ranges from -196°C to 1150°C, Thermometrics products play a vital role in measurement, control and protection of industrial- and consumer-based applications worldwide.
High-performance, competitively priced products for a wide range of applications

Aerospace
- Anti-icing
- Environmental control systems
- Temperature scanning systems

Transportation
- Engine management
- Dashboard display sensors
- Cabin comfort sensors—non-contact infrared, solar and light
- Circuit protection
- Safety systems
- Coolant/transmission fluid pressure/temperature
- Exhaust gas temperature
- Air quality
- Active/passive incar

Industrial
- Circuit protection
- Temperature measurement and control
- Liquid level detection
- High voltage protection
- Short circuit and other hazard protection
- Process control
- Boilers and water heaters

Commercial
- High voltage and short circuit protection
- HVAC
- Energy management
- Liquid level detection
- Telecommunications equipment
- Computers
- Office machines

Healthcare
- Tympanic temperature
- Heart/lung machines
- Thermal dilution catheters (heart)
- Urinary catheters
- Oral and skin temperature
- Sleep apnea
- Esophageal catheters
- Glucose monitoring
- Body mapping
- Oxygen tents
- Clinical mattresses
- Humidifiers
- Anesthesia
- Fluid heaters
- Sterilizers
- Culture ovens
- Cryogenics

Consumer
- Electronics
- Level control
- Appliances
- Overload protection
- Boilers and water heaters
- Food and beverage

Calibration Services
- Primary temperature standard
- NIST calibration services
Critical information for real time decisions

For Flight
From cabin comfort to test cell systems monitoring, our sensors play a role in temperature measurement for commercial, civil and military aerospace applications—fixed-wing and rotary, and both engine and airframe.
Sensors monitor engine thrust, reliability and emissions in test cells, while also monitoring test cell throughput. In the cabin, our HVAC sensors provide climate control for a comfortable environment while a variety of other sensors monitor temperature in appliances like coffee makers, microwaves and refrigerators.

On the Road
Today’s increasingly complex engine management systems rely upon sensors to monitor, measure and control vehicle performance including fuel economy, safety, and control of exhaust emissions.
Our comprehensive product range includes temperature sensors for use in coolant or transmission fluid; high temperature sensors to measure exhaust gas temperature; IR, gas and humidity sensors for cabin comfort; and solar and light sensors.
Our single-piece leadframe construction reduces the number of interconnections and ensures more reliable performance.

At the Office
Electronic circuitry and sensitive system components demand thermistor protection and control. Our custom-design capability and problem solving expertise mean that we can offer innovative solutions in circuit protection; and temperature measurement and control.
Our sensors excel at applications such as process control energy management, HVAC systems, power supplies, transformers, motor soft start and general time delay units. They are used to control critical process temperature.
Our simple-to-integrate sensors are designed to meet the rapidly changing demands of deregulated and global markets for high-technology sensors.
Today’s consumers expect their everyday appliances to deliver reliable and efficient performance. Electronic sensors offer improved accuracy over electro-mechanical solutions and are designed to perform over a very wide range of temperatures and specifications. Our sensors play a vital part in measuring and controlling the temperature of water, steam, air and food. They are also used for flow measurement, level control, and overload protection and in combination with other sensors for multiple functions. Temperature sensors can be found all around the home in boilers and water heaters, washing machines, dishwashers, stoves, microwave ovens, irons, toasters, refrigerators and deep freezers.

For Healthcare

We have developed state-of-the-art, high-performance sensors known for their accuracy, reliability and small size. Used extensively for heart catheters, esophageal stethoscopes, fever thermometers, skin sensors, blood analyzers, incubators, respiration monitors and hypodermic needle sensors, they help meet many temperature-related requirements. Innovative work on small precision sensors continues for cancer research. Thermistors measure the temperature of cells and with precise monitoring, doctors can use heat to destroy diseased cells in tumors.

In the Plant

Our custom-design capability and problem solving expertise mean that we can provide innovative solutions in circuit protection, temperature measurement and control, liquid level detection and gas flow measurement. We have one of the most extensive product ranges of industrial temperature sensors in the world.

With new markets emerging worldwide, our global sensor manufacturing centers meet local content demands and allow us to exceed specific customer requirements. Along with the best manufacturing and test equipment, our strict manufacturing processes and quality procedures ensure the highest standards for your applications.
NTC or PTC?

Thermistors are thermally sensitive resistors with either a negative resistance/temperature coefficient (NTC) or positive resistance/temperature (PTC) coefficient. GE offers a wide range of both types of thermistors from component level through complete assemblies. Both types of thermistors are solid state ceramic components, known for their exceptional quality and long life.

**NTC Thermistors**

NTC thermistors are manufactured from the oxides of transition metals and can operate over the range of -196°C to 1000°C. Choose an NTC thermistor when a continuous change of resistance with temperature is required.

**PTC Thermistors**

PTC thermistors are temperature-dependent resistors manufactured from doped barium titanate and are available with transition temperatures from 60°C to 200°C. Choose a PTC thermistor for self reset-capable fuse and heater applications.

What are the key characteristics of NTCs?
- Defined sensitivity to temperature
- Sensitivity to electrical power input
- Sensitivity to changes in thermal conductivity

What are the main applications for NTC thermistors?
- Temperature measurement and control
- Temperature compensation
- Surge suppression
- Power measurement
- Fluid level-flow detection
- Customized solutions

What are the key characteristics of PTCs?
- Large change in resistance at a preset temperature
- Ability to self-regulate temperature
- Current-limiting capability
- Sensitivity to changes in thermal conductivity
- Standard and custom design geometries

What are the main applications for PTC thermistors?
- Over-temperature protection
- Over-current protection
- Surge generation
- Current stabilization
- Fluid level-flow detection
- Self regulating heaters

GE is a world leader in beta curve selections and high voltage circuit applications.
# NTC Thermistors

<table>
<thead>
<tr>
<th>Description</th>
<th>Codes</th>
<th>Temperature Measurement</th>
<th>Temperature Control</th>
<th>Surge Suppression</th>
<th>Power Measurement</th>
<th>Fluid Level/Flow Detection</th>
<th>Key Features</th>
<th>Typical Uses</th>
</tr>
</thead>
</table>
| Epoxy and silicone-coated chip thermistors | TK95, EC95, MF65, SC50, NK, C100, NDP, NDL | DC95, MC65, SC30, ND, MS, NDK, NDM, TC | ✓ | ✓ | ✓ | • Interchangeability options down to ±0.1°C accuracy 0 to 100°C range  
• Head size 0.8 to 2.4 mm  
• Automated assembly | Automotive engine management, air conditioning, medical, clinical thermometers, blood analysis |
| Glass encapsulated DO-35 package | DK, GE, TH | | ✓ | ✓ | | • Tmax 300°C  
• Hermatic seal  
• High voltage insulation  
• Bandoliered for auto PCB insertion | Battery packs, toasters, hair dryers, automotive transmissions, smoke detectors, environmental control |
| Discs with radial leads | RL10, RL14, RL20, RL30, RL35/40/45 | | ✓ | ✓ | ✓ | • Operation at high currents  
• Wide range of resistance vs temperature curves  
• Custom design | Automotive engine temperature, temperature compensation |
| Discs for inrush current limiting | CL, TP, TSD | | | | ✓ | • Continuous current ratings 1.1 to 16 A  
• Cold resistances 0.7 to 120 W  
• Some UL-approved versions | Soft start for switch mode power supplies, filament lamp circuits |
| Surface mount chips | NHQ, NHQM, NHQMM, TM | | | | ✓ | • 0402, 0603, 0805, 1206 sizes  
• Ni barrier terminations  
• Resistance tolerances down to ±1% | Rechargeable battery packs, LCD temperature compensation |
<table>
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<tr>
<th>Description</th>
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<th>Typical Uses</th>
</tr>
</thead>
</table>
| Glass-encapsulated surface mount chips | DKM MELF | • Tmax 250°C  
• Suitable for harsh environments and soldering profiles | SMD circuitry |
| Bare bead thermistor | BB05/07/11 | • Fast time constant, 0.11 secs  
• Extremely small size 0.13 to 0.25 mm  
• High stability | RF & microwave power measurements |
| Glass-coated beads | B05/07/10/16 B35/43 | • Hermetically sealed  
• Small size, 0.13 mm to 1.1 mm  
• Tmax 300°C | Gas chromatography, thermal conductivity analysis, gas flow measurement, liquid level sensing |
| Glass-encapsulated beads, rods, probes | BR11/14/16/23  
BR32/42/55  
P20/25/30  
P60/65/85/100  
R60/65/85/100  
SP60/65/85/100  
FP07/10/14 | • Robust  
• Hermetically sealed  
• Tmax 300°C  
• Interchangeable matched pairs available  
• Some models with intermittent operation to 600°C | Liquid level sensing, gas flow measurement, fluid temperature, pulse suppression |
| Glass encapsulated chips with leads | GC32  
GC14/16  
GC11 | • Long-term stability  
• Chip technology  
• Size  
• Response  
• Accuracy | Medical catheters, military/aerospace, airflow, blood analysis |
| Leadless chip thermistors | NDU HM | • Silver or gold electrodes suitable for wire bonding  
• Small size | Hybrid circuits, glucose monitors, digital thermometers |
## NTC Thermistors

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<tr>
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<th>Temperature Measurement</th>
<th>Control Temperature Compensation</th>
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<th>Power Measurement</th>
<th>Fluid Level/Flow Detection</th>
<th>Key Features</th>
<th>Typical Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cryogenic thermistors</td>
<td>RL1004 RL060628 RL060628 CTP60 CTP65 CTP85 CTP100</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>Suitable for use at very low temperatures—down to -196°C</td>
<td>Cryogenic temperature measurement</td>
</tr>
<tr>
<td>Unleaded discs</td>
<td>KU UD20 0706 1403 1703 1803 2006 3006</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>Wide range of resistance vs temperature curves</td>
<td>Automotive engine temperature sensing</td>
</tr>
</tbody>
</table>

- **Description Codes**
  - KU
  - UD20
  - 0706
  - 1403
  - 1703
  - 1803
  - 2006
  - 3006

- **Key Features**
  - Suitable for use at very low temperatures—down to -196°C
  - Wide range of resistance vs temperature curves
  - Custom design

- **Typical Uses**
  - Cryogenic temperature measurement
  - Automotive engine temperature sensing
## PTC Thermistors

<table>
<thead>
<tr>
<th>Description</th>
<th>Codes</th>
<th>Over Temperature</th>
<th>Surges Generation</th>
<th>Current Stabilization</th>
<th>Fluid Level/Flow Detection</th>
<th>Key Features</th>
<th>Typical Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor protection</td>
<td>YA, YB, YC, YD, YF, YG, PTD</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>• Small insulated head</td>
<td>Protection of industrial motors and transformers, submarine motors</td>
</tr>
<tr>
<td>Surface sensors</td>
<td>YK, YR, PTA, PTE</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>• Screw-in or bolt-on configurations</td>
<td>Semi-conductor heat sinks, enclosure panels, power supplies</td>
</tr>
<tr>
<td>Wired devices - general purpose</td>
<td>YM120, YP, YS4019, YS4020, PTF, PTO</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>• Ratings up to 1000 Vrms</td>
<td>Transformer protection, electronic lighting, instrument/DMM protection</td>
</tr>
<tr>
<td>Surface mount devices</td>
<td>YSM, YSM 4021, PTSM</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>• High power SMD PTCs</td>
<td>Telecom line protection, DMM instrument protection, electronic lighting control</td>
</tr>
<tr>
<td>Circuit protection</td>
<td>YS</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>• Custom designed for electronic circuit applications</td>
<td>Telecom primary and secondary protection</td>
</tr>
</tbody>
</table>

### Description Codes
- Over Temperature
- Surges Generation
- Current Stabilization
- Fluid Level/Flow Detection
- Key Features
- Typical Uses

### Features
- Small insulated head
- Long insulated flexible wire
- Switch temperatures 30 to 180°C
- DIN compliance
- MOD approval

- Screw-in or bolt-on configurations
- Flexible or solid wire
- Switch temperature 30 to 140°C

- Ratings up to 1000 Vrms
- Switch currents up to 2A

- High power SMD PTCs
- Compatible with SMD assembly
- Ratings up to 1000 Vrms
- Switch currents up to 2A
- Conformance to ITU-T K20/21

- Custom designed for electronic circuit applications
- Excellent thermal shock and power handling performance
- Conformance to ITU-T K20/21
<table>
<thead>
<tr>
<th>Description</th>
<th>Codes</th>
<th>Over Temperature</th>
<th>Over Current</th>
<th>Surge Generation</th>
<th>Current Stabilization</th>
<th>Fluid Level/Flow Detection</th>
<th>Self-regulating Heaters</th>
<th>Key Features</th>
<th>Typical Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-regulating heaters</td>
<td>YH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Temperature regulation on range of supply voltage</td>
<td>Medical equipment, in-line diesel fuel heaters, LCD heaters, stabilization of electronic components, wax motors, saw devices, air fresheners outside camera lenses</td>
</tr>
<tr>
<td></td>
<td>PTH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Voltage ratings 12 to 240 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Reference temperatures 40 to 180°C</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Custom shapes</td>
<td></td>
</tr>
<tr>
<td>Liquid level sensing</td>
<td>YL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Water resistant housing</td>
<td>Tea urns, fuel storage systems, industrial plants, laboratory water stills, vending machines</td>
</tr>
<tr>
<td></td>
<td>JYA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• High sensitivity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Axial and radial formats</td>
<td></td>
</tr>
</tbody>
</table>
## Probes and Assemblies

<table>
<thead>
<tr>
<th>Description</th>
<th>Codes</th>
<th>Temperature Measurement</th>
<th>Control Temperature Compensation</th>
<th>Surge Suppression</th>
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<th>Fluid Level/Flow Detection</th>
<th>Key Features</th>
<th>Typical Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>General purpose sensors</td>
<td>GT, JA, JB, JE, JF, JP, M series, T series</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>• Tmax 225°C</td>
<td>Domestic ovens, combination microwave ovens, industrial process control</td>
</tr>
<tr>
<td>Fast response surface sensors</td>
<td>JC, JW, JD, JS2945 Substrate</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Response time down to 250 ms</td>
<td>Gas boiler control, domestic water systems, air conditioners, showers, vending machines, radiator inlet-outlet, automotive temperature sensing, aerospace de-icing</td>
</tr>
<tr>
<td>Refrigeration, low temperature</td>
<td>JL, JM, JL EVAP A1424 EVAP for HVAC A1447-A1450</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Low temperature</td>
<td>Low temperature appliances, air conditioning evaporators, industrial and domestic refrigeration, automotive</td>
</tr>
<tr>
<td>Eyelet</td>
<td>JR M2000</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Ease of installation</td>
<td>Semiconductor heatsinks, enclosure panels, surface temperature measurement, PC fan control, power supplies, air conditioning ducts</td>
</tr>
<tr>
<td>Medical products</td>
<td>Custom assemblies</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>• Clinically approved materials</td>
<td>Thermometer probes, catheters, skin sensors, fluid flow</td>
</tr>
</tbody>
</table>
## Probes and Assemblies

<table>
<thead>
<tr>
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<th>Key Features</th>
<th>Typical Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical products</td>
<td>AB6</td>
<td>✔</td>
<td></td>
<td></td>
<td>• Clinically approved materials • Custom designs • Size • Accuracy</td>
<td>Medical catheters (thermodilution, esophageal, foley, ablation, vital sign monitors)</td>
</tr>
<tr>
<td></td>
<td>MA100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MA600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automotive subassemblies</td>
<td>Lead frame</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>• Designed for automated assembly • Reduced overall sensor cost • Enhanced reliability</td>
<td>Automotive engine temperature</td>
</tr>
<tr>
<td>Automotive assemblies</td>
<td>Brass assemblies, etc.</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>• Custom designed • In-house overmolding capability • Large variety of connector options</td>
<td>Automotive coolant temperature indication</td>
</tr>
<tr>
<td>Composite NTC/PTC</td>
<td>KY</td>
<td></td>
<td></td>
<td></td>
<td>• Constant resistance over normal operating temperature range (accomplished by using NTC/PTC paired thermistors)</td>
<td>Automotive coolant dashboard sensor</td>
</tr>
</tbody>
</table>
### IR thermopile sensors

**Description**
IR thermopile sensors

**Codes**
ZTP

**Key Features**
- Non-contact temperature sensing
- Fast response
- Temperature compensated
- Sensing elements/modules
- Single and dual zone available

**Typical Uses**
Microwave ovens, automotive air conditioning, ear thermometers, Cooktop surface control

### High temperature sensors

**Description**
High temperature sensors

**Codes**
JTC JTR PT100 PT200 PT1000

**Key Features**
- Operation up to 1150°C
- Flexible sensor
- Industry standard connection
- Customized OEM solutions
- RTD, thermocouples and NTC technologies

**Typical Uses**
Industrial and process control, food and beverage processing, automotive
About us

GE has united the technological innovation and experience of industry leaders in the design and manufacture of advanced sensing and measurement solutions into one world-class business—GE Sensing & Inspection Technologies.

GE’s sensing products measure temperature, pressure, liquid level, moisture and humidity, gas concentration, and flow rate for applications ranging from environmental, medical, and pharmaceutical to automotive, aerospace, chemical, and petrochemical.

From high-quality hand-held and portable field calibrators to stand-alone measurement instruments and systems, GE provides end-to-end solutions that can help you monitor, protect, and control your critical processes and applications.