NASA-STD-8739.11 Tutorial Section T1. Thermal Sensors

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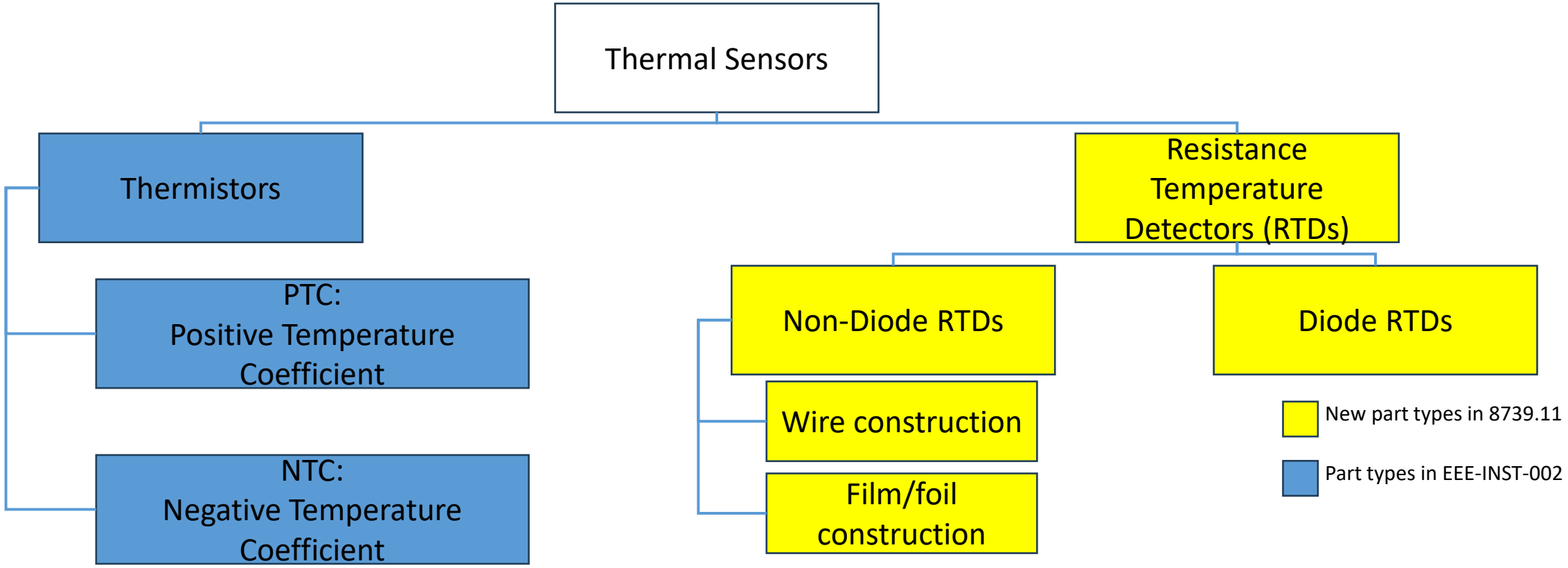
Acronyms

AEC	Automotive Electronics Council
COTS	Commercial-Off-The-Shelf
Cpk	Process Capability Index
DLA	Defense Logistics Agency
DoD	Department of Defense
DPPM	Defective Parts Per Million
EEEE	Electrical, Electronic, Electromechanical, Electro-Optical
EOL	End-Of-Line
ETW	Electronics Technology Workshop
ESD	Electro Static Discharge
FMEA	Failure Mode and Effects Analysis
GSFC	Goddard Space Flight Center
IL	In-Line
ILPM	Industry Leading Parts Manufacturer
LAT	Lot Acceptance Testing

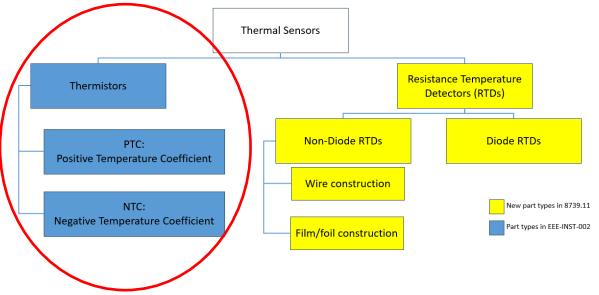
MEAL	Mission Environment, Application, and Lifetime
MIL-SPEC	Military Specification
NASA	National Aeronautics and Space Administration
NEPP	NASA Electronic Parts & Packaging (Program)
NESC	NASA Engineering & Safety Center
NTC	Negative Temperature Coefficient
PRT	Platinum Resistance Thermometer
PTC	Positive Temperature Coefficient
QML	Qualified Manufacturers List
QPL	Qualified Product List
RTDs	Resistance Temperature Detectors
R	Resistance
SMD	Standard Microcircuit Drawing
T	Temperature
XL-ETFE	Cross-linked ethylene-tetrafluoroethylene

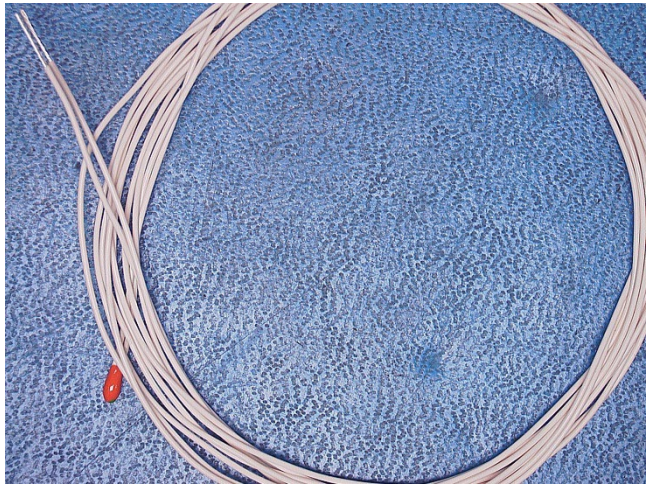
Covered Part Types

- Thermal sensors are two-terminal devices with well-defined, repeatable temperature characteristics designed for sensitivity over a specified temperature range.



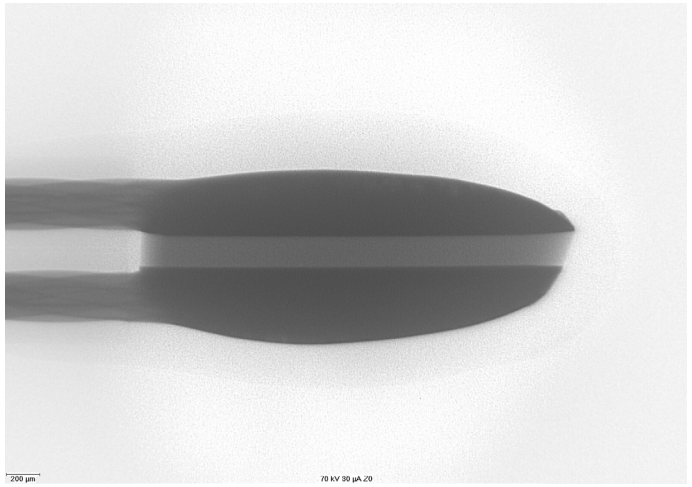
Construction: PTC and NTC Thermistors





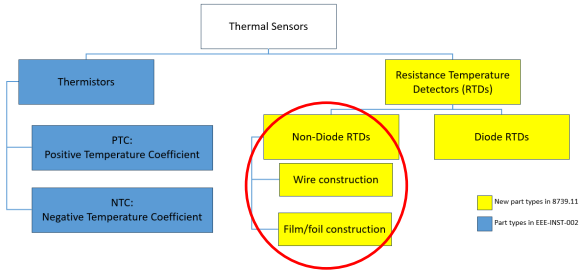
PTC/NTC External view

PTC/NTC External view closeup



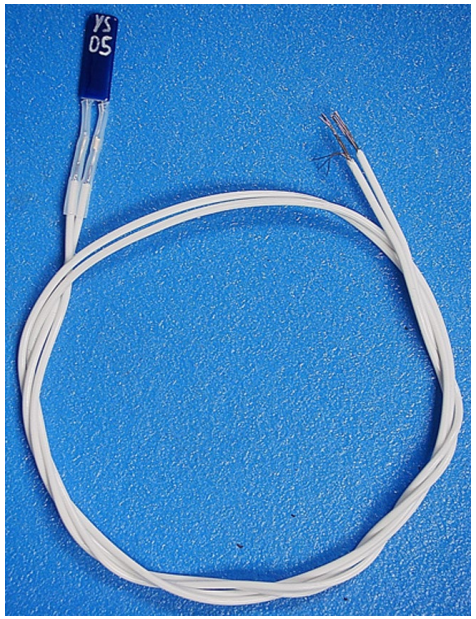
PTC/NTC Xray view

Construction: Non-Diode RTDs

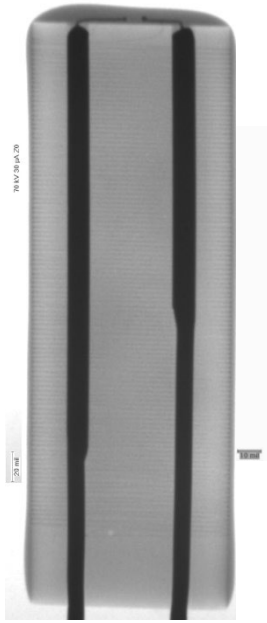


Wire construction

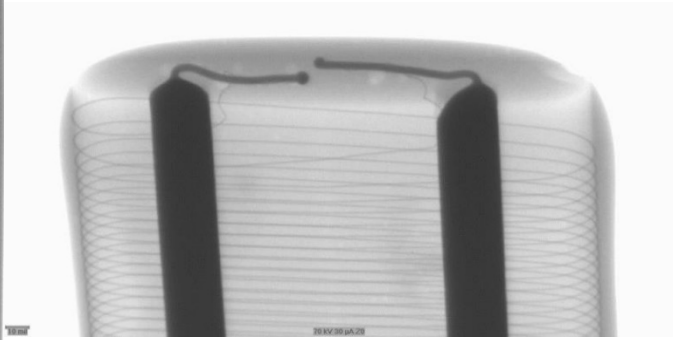
Film/foil construction



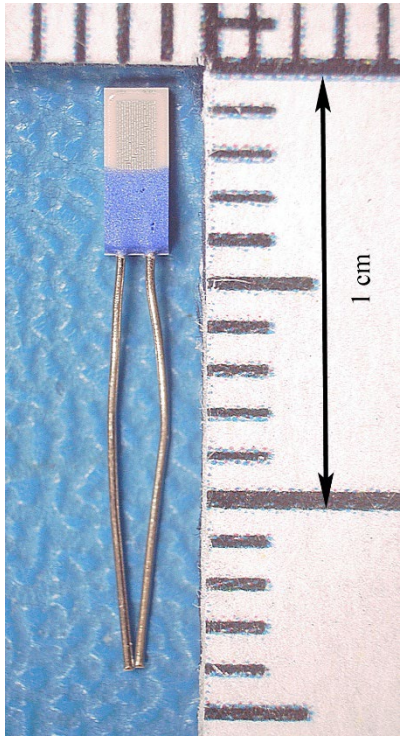
Platinum Wire Resistance Thermometer (PRT) External view



Platinum Wire Resistance Thermometer (PRT) X-ray



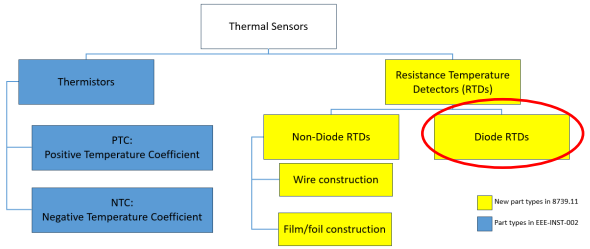
Platinum Wire Resistance Thermometer (PRT) Close up X-ray

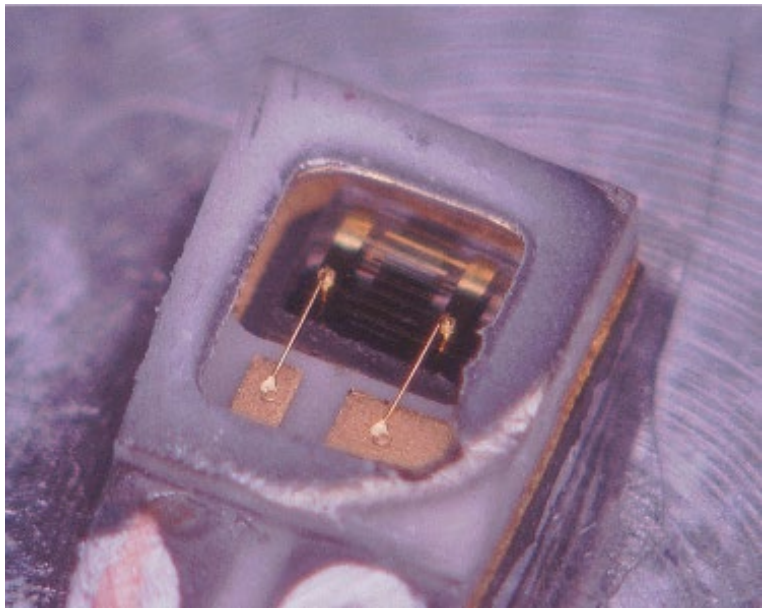


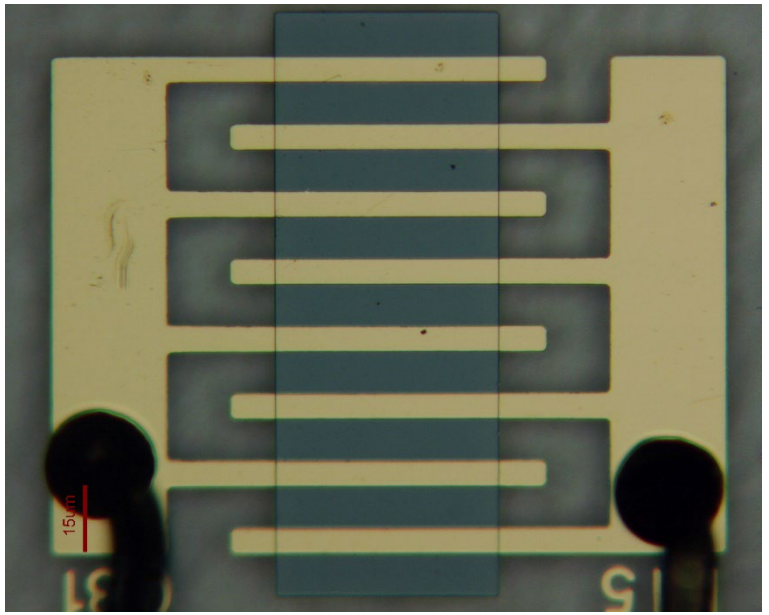
Platinum Thin Film RTD External view

Platinum Thin Film RTD Close up external view

Construction: Diode RTDs







Key Considerations

- New in NASA-STD-8739.11, Key Considerations have been added for certain sections. This information is intended to provide technical guidance in part selection and applications, beyond the traditional tables provided for screening and lot acceptance.
  - Thermistors have larger temperature sensitivity (ΔR/ΔT) than RTDs, but are usually restricted to a narrower optimal temperature range and less linear in their response.
  - No ESD rating is applied to thermal sensors, but some are sensitive to electrical overstress, e.g., PRTs, because of their fine wire diameters or film cross-sections.
  - Glass-encapsulated PRTs require exceptionally careful handling and lead-bending, to avoid fracturing the fine wire embedded in the glass.
  - Some leadwire insulation types can off-gas fluorine which can lead to acidic gas formations that can attack metals. See cross-linked ethylene-tetrafluoroethylene (XL-ETFE) insulation in Section W1 for Wire and Cable.

Major Changes from EEE-INST-002

- In NASA-STD-8739.11 the section was expanded from just Thermistors to now include Resistance Temperature Detectors (RTDs) – non-diode and diode types
- Allowable devices for Use-As-Is used to be only MIL-PRF-23648 and S-311-P-18, but now also include:

Thermistor, Chip	S-311-P-827	Use as is
Platinum Thin Film Sensors, Thermistors	ESCC 4006	Use as is (if from manufacturer certified to spec)
Thin Film Platinum Resistance Thermometer (PRT)	S-311-P-842	Use as is
Thermistor, Chip	MIL-PRF-32192	Use as is for resistance rations A, B

- Screening and LAT changes:
  - Thermistor testing changes:
    - Screening no longer includes preconditioning
    - Lot Acceptance testing (LAT) no longer includes short time overload and low temperature storage, thermal time constant, or thermal outgassing
  - RTD testing: new screening and LAT tables
- Derating changes
  - Thermistors added an explanation on calculating allowable derating power for Negative Temperature Coefficient (NTC) thermistors
  - RTD derating: new derating tables

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