Micromax™ PTC085

Electronic Inks and Pastes

PTC Carbon Resistor

Micromax™ PTC085 Carbon-based PTC resistor can be used in self-regulating heating circuits that operate at <80°C. The Positive Temperature Coefficient (PTC) of the cured film can be used to design circuits which heat up quickly to an equilibrium temperature and then stabilize at that temperature without external controls.

Product benefits

- Self-thermostating temperature control
- Power reducation at operating temperature
- Fast warm-up to operating temperature
- Thermal stability at 90°C for 24hrs
- Power on/off cycling stability - with rapid plateau
- Adhesive compatibility - wide range/choice available

Product characteristics (Self-regulating features)

For heating / de-misting applications, the required heater resistance is designed around the approximate ~15KΩ/ paste by placing varying geometry resistors in series or parallel. Depending on the power applied and the ambient temperature when the circuit is powered up, it will rapidly heat and self-regulate at the designed operating temperature. At this point, a considerable increase in resistance will have occurred and a lower power consumption will result.

Product information

Solvent or thinner	Micromax™ 8199	
Maximum Service Temperature	80	°C

Rheological properties

Viscosity	20 - 30[1]	Pa.s

[1]: Brookfield RVT, #14 spindle, 10 rpm, 25°C

Application technique

Drying time	10 - 20[2]	min
Drying temperature	130[2]	°C
Recommended film thickness, dried	6 - 10[3]	µm

[2]: box oven

[3]: 280 mesh stainless steel

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Typical mechanical properties

Adhesion, pull tape	no material transfer[4]	class

[4]: 3M Scotch Tape #600

Electrical properties

Surface resistivity	1.5E7 - 2.5E7	mOhm per square

Storage and stability

Shelf life	6[5]	months

[5]: in unopened containers, from date of shipment, at temperature <25 °C

Additional information

How to use

Design & compatibility

- Design
  - While the chemical make-up of the Micromax™ composition PTC085 is patented by Celanese, it is advisable to check that specific designs and applications do not infringe on any other patents. Heater circuits typically consist of Micromax™ PTC085 carbon composition overprinted on a silver termination having inter-digitized tracks. The overprinted carbon composition forms a wide geometry resistor and the distance along the width (between the inter-digitized tracks) is generally used to target the final heater circuit resistance value. The gap (or spacing) between the silver tracks, determines the power density and consequently the heating characteristics of the circuit.
- Compatibility of adhesives
  - If an adhesive is used directry over the PTC composition, it is essential that the compatibility of the adhesive is tested to ensure that the performance of the heater is not compromised by any adhesive interactions. Adhesive incompatibility may result in erratic / excessive resistance shifts and/or significant changes in PTC characteristics. See Figure 1 for more details.

Processing

- Applications
  - When the heater circuit is powered, it will rapidly heat and self-regulate / equilibrate at a designated temperature. This equilibrium temperature is influenced primarily by a very large increase in

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circuit resistance. This is non-linear and generally referred to as Resistance Magnification (or PTC effect).
    - In addition, the equilibrium temperature can be altered by the design and more specifically, the spacing between the silver tracks. An example is given, where seven heater temperatures are plotted, with each having a termination spacing from 0.5mm through 2.3mm. Within the first few power cycles, a permanent resistance shift is to be expected and the magnitude will be dependent primarily on the maximum operating conditions. This has been found to be typically less than 10%. It may also result in a slight reduction in PTC performance.
    - Consequently, it may be necessary to accommodate this shift within the initial design.
    - Better temperature stability can be expected from Micromax™ PTC085. Improved stability can be seen though to 2000 cycles (Power on / off cycles) when comparing to its predecessor Micromax™ 7282.
- Terminations
    - Micromax™ PE825, Micromax™ PE826, Micromax™ 5025, or Micromax™ 5065 polymer thick film silver ink.
- Substrates
    - 125µm print treated and heat stabilized polyester
- Screen types
    - Polyester, Stainless Steel
- Printing
    - Semi-automatic and manual printers
    - The composition should be thoroughly mixed before use. This is best achieved by slow, gentle, hand stirring with a clean burr-free spatula (flexible plastic or stainless steel) for 1-2 minutes. Cre must be taken to avoid air en-trapment. Printing should be performed in a clean and well-ventilated area.
    - Note : Optimum printing characteristics are generally achieved in the room temperature range of 20°C - 23°C. It is therefore important that the material, in its container, is at this temperature prior to commencement of printing. Avoid leaving paste on the screen for extended periods of inactivity.
    - Depending on the amount of paste on the screen and the number of parts to be printed, paste should be added to the screen routinely to prevent the paste from drying out.
- Typical circuit line thickness
    - 6 - 10 µm
    - Printed with 280 mesh stainless steel screen
- Work life
    - > 1 hour
- Clean-up solvent

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    - Ethylene glycol diacetate
- Drying
    - Box oven : 130 °C for 10-20 minutes
    - Reel-to-reel : 140 °C for 2 minutes
    - Allow prints to level at room temperature, then dry in a well-ventilated oven or conveyor dryer.
- Hysteresis effect
    - After the removal of power from a heater circuit, the polymer PTC composition exhibits a hysteresis effect. This is basically a "time lag" in the circuits' ability to return to its original starting resistance. This does not affect the self-regulating performance but may result in erroneous resistance measurements.

Properties

Dried Properties

Test	Properties
R Magnification Factor (25-85 °C)	8 - 10

Information in this datasheet shows anticipated typical physical properties for Micromax™ PTC085 based on specific controlled experiments in our labs and are not intended to represent the product specifications, details of which are available upon request.

Storage and shelf life

Containers should be stored, tightly sealed, in a clean, stable environment at room temperature (<25 °C). Shelf life of material in unopened containers is six months from date of shipment. Some settling of solids may occur and compositions should be thoroughly mixed prior to use.

Safety and handling

For safety and handling information pertaining to this product, read Safety Data Sheet (SDS).

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Figure 1
Adhesive Compatibility Check

Composition	Adhesive Type
Micromax™ PTC085	Lohmann Duplocoll 361.2
	Avery Dennison HPA1902
	Lohman DC249
	3M 476MP

PTC085 has more extensive range of compatible adhesives.

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