What is a Resettable Fuse?

A **resettable fuse**, also known as a **polymeric positive temperature coefficient (PPTC)** fuse, is a type of fuse that can "reset" itself after an overload condition is cleared. It is designed to protect circuits from excessive current without needing to be replaced once it has tripped.

How Does it Work?

- A resettable fuse is made from **conductive polymer materials** that have a **positive temperature coefficient (PTC)**.
- **Under normal conditions**, the fuse allows current to flow freely because the polymer's resistance is low.
- **When excessive current flows**, the polymer heats up. As the temperature increases, the polymer's resistance increases sharply, which reduces the current flow through the fuse (acts like an open circuit).
- This **high resistance** interrupts the flow of current and effectively **protects the circuit** from damage due to overcurrent.
- As the fuse cools down (after the overcurrent situation is resolved), the resistance decreases, and the fuse **returns to its original state**, allowing current to flow again.

Types of Resettable Fuses:

1. **PTC (Positive Temperature Coefficient) Fuse:**
    - **Definition:** A **PTC** fuse is a type of resettable fuse that exhibits **increased resistance** as the temperature increases.
    - **Action:** When a current overload occurs, the temperature of the PTC material increases, which causes its resistance to rise sharply. This prevents excessive current from damaging the circuit. Once the overload is removed and the fuse cools, it returns to its low-resistance state.
    - **Application:** Used in low-power circuits, power supplies, and battery protection circuits.
2. **PPTC (Polymeric Positive Temperature Coefficient) Fuse:**
    - **Definition:** A **PPTC** fuse is a specific type of PTC fuse that is made from a **polymer-based material**.
    - **Action:** Works the same way as a PTC fuse—its resistance increases as it heats up due to excessive current, reducing the current flow to safe levels. Once it cools down, the resistance returns to its original value, and the current can flow again.
    - **Application:** Common in protecting devices like mobile phones, computers, USB hubs, and many other low-voltage electronic circuits.

Difference Between PTC and PPTC:

While **PTC** and **PPTC** are often used interchangeably, the main difference lies in the **material** used:

1. **PTC (Positive Temperature Coefficient) Fuse:**
    - **Material:** PTC fuses can be made from various materials that have the **positive temperature coefficient** property.
    - **Example Materials:** Ceramic, metal oxides, etc.
    - **Properties:** As the current increases, the temperature increases, causing a rise in resistance. This limits the current flow.
    - **Common Use:** More general purpose for a variety of circuit protection applications.
2. **PPTC (Polymeric Positive Temperature Coefficient) Fuse:**
    - **Material: Polymer-based** material with positive temperature coefficient.
    - **Example Material:** Typically made of a **polymer composite**, often filled with **carbon black** or similar materials that increase resistance as they heat up.
    - **Properties:** Faster response to overcurrent conditions, more flexible in terms of current ratings and reset time.
    - **Common Use:** Popular in **low-voltage electronics** like computers, mobile devices, and USB chargers.

How to Use a Resettable Fuse (PPTC or PTC):

1. **Select the Appropriate Fuse Rating:**
    - Choose a fuse with a **trip current** that is slightly higher than the normal operating current of your circuit but low enough to protect it from short circuits or excessive current.
    - Make sure the **voltage rating** matches the operating voltage of your circuit.
2. **Install the Fuse:**
    - The fuse is usually connected in **series** with the component or circuit it is protecting. In the event of an overcurrent, the fuse will reduce the current by increasing resistance, preventing damage.
3. **Operation:**
    - **During normal operation:** The fuse allows current to flow freely with minimal resistance.
    - **During an overload condition:** The fuse trips (resistance increases), limiting current.
    - **After the overload is cleared:** The fuse resets automatically and returns to normal operation.
4. **Benefits of Using Resettable Fuses:**
    - **No need for replacement** after an overload, unlike traditional fuses.
    - **Easy to use** and requires minimal maintenance.
    - **Cost-effective protection** for sensitive circuits or devices.

Advantages of Resettable Fuses

- **Self-resetting:** After a short overcurrent event, the fuse automatically resets, saving the hassle of manual replacement.
- **Cost-effective:** Resettable fuses are often cheaper in the long run than traditional fuses, as you don’t need to replace them after each overcurrent event.
- **Durable:** They can handle multiple overcurrent conditions and reset many times without losing performance.

When to Use a Resettable Fuse

- **Low-voltage applications**: When you're protecting **low-voltage circuits** (e.g., 5V, 12V circuits).
- **Devices requiring multiple protection cycles**: In devices like **USB chargers** or **batteries** that could face **short-circuit or overcurrent issues** from time to time.
- **Devices where replacement would be a hassle**: If you have a **remote device** or **hard-to-access circuit** where replacing fuses would be inconvenient.

Key Points to Consider

- **Resettable fuses do not protect against permanent shorts**: If the overcurrent condition persists for too long, the fuse will trip repeatedly. It's essential to ensure the overcurrent situation is resolved before relying on the reset feature.
- **Time to reset**: Resetting may take some time depending on the fuse type and the amount of current flowing. During this time, the circuit will remain protected but non-functional.

The Best Protection for your Circuit is NOT a Fuse!.....but a Resettable Fuse? EB#54