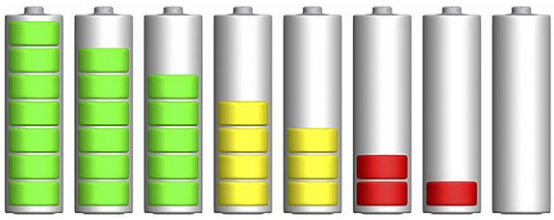
Vishay Non-Linear Resistors for Energy Storage Systems (ESS) / Battery Management Systems (BMS)

By Mandy Wandel

Energy storage systems (ESS) are getting more and more important, especially with the increased generation of renewable energy. It is essential to manage the power supply situation to provide energy when and where it is needed. In general, energy can be stored by using thermal, electro-mechanical, or electro-chemical technologies. In this article we want to focus on the electro-chemical technologies that are mainly batteries, the so-called battery energy storage system (BESS).

With the growing demand for safety, efficiency, range extension, short charging time, and long lifetime, a simple battery is not enough. To fulfill these requirements, a battery management system (BMS) is needed that monitors and controls the battery in terms of current, voltage, and temperature as a function of time at multiple points. Reliable and accurate thermal management is crucial for the battery lifetime.



Thanks to our broad portfolio of thermistors, we can offer multiple solutions for temperature measurement in this kind of application. Depending on the design, our Non-Linear Resistors Division can offer NTC SMD, through-hole NTC, RTDs, and thermistor assemblies. Customized solutions are also available to meet the individual requirements of our customers.

Which one is your design challenge?

TEMPERATURE MEASUREMENT OF BATTERY CELLS

For battery cell temperature monitoring, the use of flex PCBs with NTC SMDs are becoming more popular. In such flex circuit applications, it is very important to use NTC SMDs with soft terminations to withstand bending of the FPCB and vibrations without failure. Our NTCS series devices all use soft nickel barrier, tin-plated terminations. They are available in 0402, 0603, and 0805 case sizes with different R25, RT slope, or B values, and tolerances down to 1 %. Besides that, they are all AEC-Q200 qualified, and most part numbers are also c-UL-us recognized.

You want to know more about our SMD NTCs? Click here!

TEMPERATURE MEASUREMENT IN AREAS WITH HIGH VIBRATION, HIGH POWER, AND / OR HIGH DIFFERENTIAL VOLTAGE

Our NTCALUG NTC thermistors / sensors are widely used to measure surface temperatures. Thanks to their ring tongue terminal, they can easily be connected to a metal surface in the system by using a screw or bolt, and usually they are directly mounted to heatsinks, battery poles, and / or high voltage / power busbars. The standard NTCALUG family portfolio provides mechanical lug mounting options for different screw sizes from M2 to M8, with different cable diameters and material.

The thermo-electrical performance of the lug and the connecting leads is a critical aspect of the final assemblies. They result in a very wide range of standard sizes and customizable options being available to meet specific design requirements. Furthermore, the need to measure temperature on high voltage and current-conducting elements requires higher insulation voltage between the sensing surface or the mounted lug barrel and the NTC's terminations. Our NTCALUG series provides insulation voltage levels up to 4 kV_{AC} / 5.6 kV_{DC}.

TECHNICAL NOTE

For technical questions, contact: nlr@vishay.com

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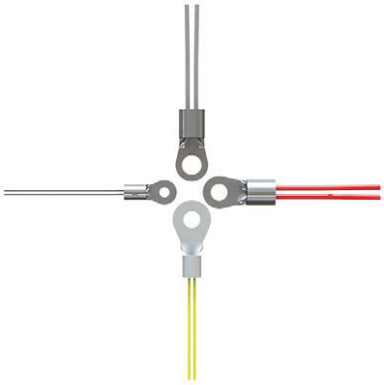
Available customization options include alternative cable lengths, wire stripping for soldering or splicing, reinforced cable insulation (e.g., shrink or silicon tube), harnesses, and integration of any connector for easier end-mounting or connection to control boards.

Want to know more about our NTCALUG series? Click here!



TEMPERATURE MEASUREMENT WITH HIGH ACCURACY AND FAST RESPONSE TIME

Our NTCLE317E4103SBA sensor features NiFe alloy AWG32 wires with the lowest thermal conductivity available on the market. Due to its excellent thermal decoupling, the device enables spot temperature measurement accuracy down to ± 0.5 °C, which is hardly achievable with higher heat conductive wire materials, such as copper (alloys).

To improve reliability in high humidity conditions, the NTCLE317 device provides high adhesive strength between its PEEK-insulated lead wires and encapsulating epoxy lacquer. The NTCLE317E4103SBA features a small maximum bead size diameter of 1.6 mm, resulting in a fast response time of less than 3 seconds in air. Its long - 75 mm - flexible leads allow for special mounting in confined areas or assembly requirements.

The device's outstanding accuracy and fast response time make it ideal for temperature sensing in BMS, including battery cells and packs.

Want to know more about our NTCLE317 series? Click here!

LIMITING INRUSH CURRENTS WITH BUILT-IN SAFETY AND HIGH ENERGY HANDLING

For limiting inrush currents during the charging or discharging operation of DC-link circuits or power inverters, among others, resistive technologies such as power resistors or power thermistors can be used. Our PTCEL series of specially designed inrush current limiting PTC thermistors offers some major advantages compared to other resistive technologies.

The radial-leaded PTCEL series features cold resistance values ranging from 60 Ω to 1500 Ω, high energy absorption levels up to 240 J, and high direct voltage levels up to 1000 V_{DC}. The PTCEL products are capable of handling 100 000 inrush current cycles with non-switching peak voltages up to 2 kV. In case of overload conditions, they exhibit a self-protecting characteristic with no risk of over-heating. In addition, they are all AEC-Q200 qualified as well as c-UL-us recognized.

Want to know more about our PTCEL series? Click here!

TECHNICAL NOTE