

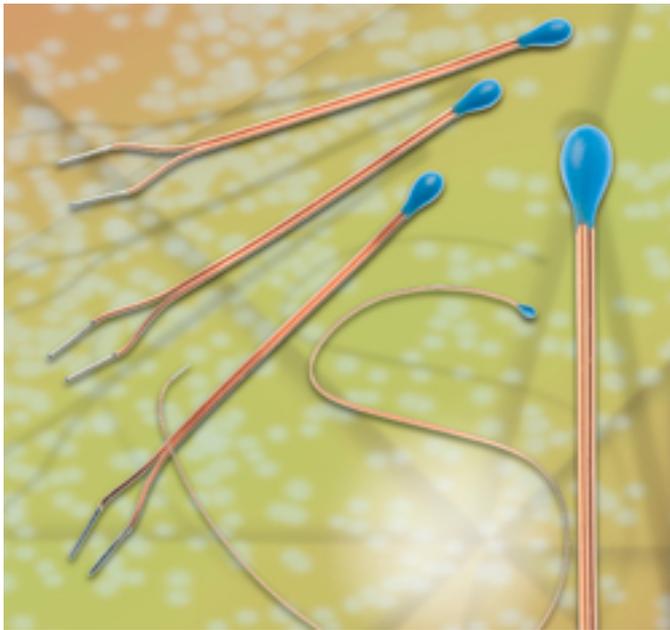
Passives - Putting The “Smart” In Smart Meters

Arthur Evans and Bill Kutsche, Murata Electronics North America
Millions of homes and businesses throughout the country are using smart meters which have passive components to thank for powering their “smart” abilities. Passives’ unique qualities are critical to smart meters and engineers should know about their important role in this rapidly growing industry. For starters, passives – from capacitors to RF switch connectors – provide the necessary decoupling, coupling, current limiting, bypassing, and filtering support among other things needed in smart grid application circuits. In addition, they are key to developing more efficient and feature rich smart meter technologies of the future. As smart meter deployment continues to build, engineers will have more opportunities to realize the power of passives in smart grid technology.

Many of the passive components used in smart meters are the same as those incorporated in a variety of electronic designs and fall into the below categories. The category list is surprisingly long and includes:

- capacitors
- resistors
- inductors
- ferrite beads
- RF switch connectors and RF cable assemblies
- RF low-pass & band- pass filters
- RF baluns
- RF chip antennas
- ESD protection devices
- thermistors
- ceramic and crystal resonators
- RFID tags

Based on content count, capacitors are one of the leading passive components used in smart meter designs. One of the main uses for capacitors are in the power supply lines where decoupling and coupling is needed for AC and DC voltage levels. Capacitors are also used around ICs and in RF filtering circuits for decoupling and filtering of unwanted noise of signal lines. It is important to note that in the RF filtering portions of the designs, high frequency capacitors are best suited for designs with specific filtering requirements because of their lower ESR characteristics in comparison to using standard capacitor products. It is here in the design that capacitors hold the highest piece count.



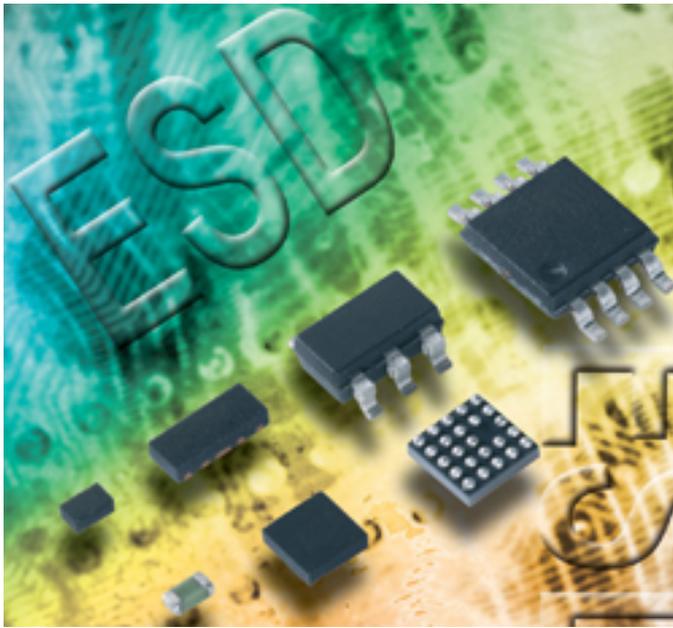
Another passive component that has a piece count rivaling that of capacitors is resistors, which provide the needed current limiting or bypassing functions in many different sections of the design. For example, resistors can be placed between the voltage and the signal lines where the supply voltage current may need to be limited so as not to damage other components because of over-current.

Inductance and EMI noise suppression passives also factor in to smart meter designs. Along with the capacitors, inductors are used to provide RF filter tuning for the high frequency designs. The main EMI passive components that have a large piece count are ferrite beads. They are typically deployed where signal noise may be present to remove their harmful effects from signal lines.

Aside from standard passives such as capacitors, inductors and ferrite beads, a number of passive technologies are being implemented as the application evolves. Basic elements of the traditional electric meter include passive forms of current and voltage sensing technologies already. However, within the smart meters market there is an emergence of new sensing requirements, such as chip and string type thermistors for determining temperature levels of the electronics assembly (cold temperatures may trigger a heater within the meter to stabilize the environment around temperature-sensitive electronics).

Passives - Putting The "Smart" In Smart Meters

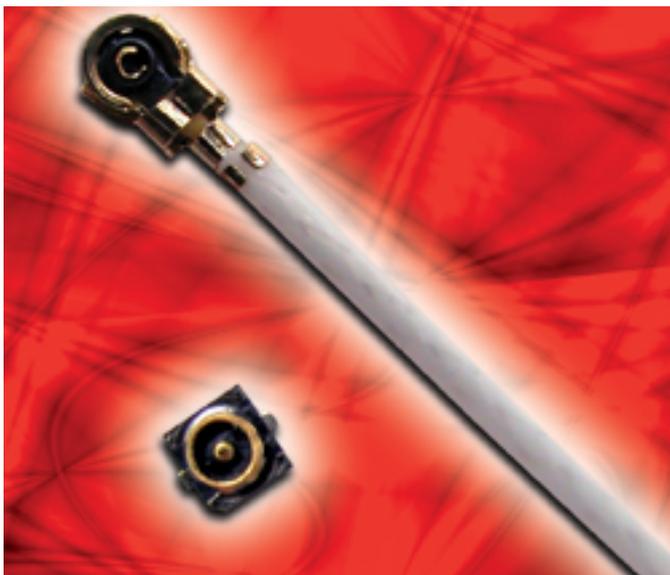
Published on Electronic Component News (<http://www.ecnmag.com>)



In addition, ESD protection devices may provide for contact and air ESD condition protection of communication interfaces such as RS-232, wireless antenna ports, etc.

RF related passives also make a large impact on smart meter design. RF switch connectors and RF cable assemblies, for example, enable the manufacturing level test of the communications RF I/O port and the RF-shielded cabling of the communications board RF I/O port to the main assembly or antenna. RF low-pass and band-pass filters are utilized for RF front-end circuit conditioning and filtering of harmonics and other unwanted signal frequencies. In the RF front-end section chip antennas are often used and baluns are necessary to enable the transition to and from differential signaling.

Additional passives include ceramic and crystal resonators which are used to provide microprocessor clock signals.



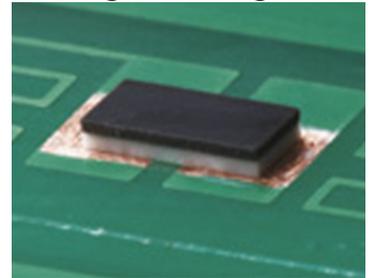
What many engineers may not know is the role that RFID tags play, specifically enabling efficient asset tracking and quality control. This area in particular is seeing an unprecedented surge in demand because of changes in manufacturing. Early in smart meter adoption, the manufacturing of the electric meters was a relatively low-volume process and was

Passives - Putting The "Smart" In Smart Meters

Published on Electronic Component News (<http://www.ecnmag.com>)

not as cost burdened with traditional bar-code labeling of assembly boards. However, now high-volume production drives the search for new cost efficiencies so passive, programmable RFID tag devices with integral memory provide an optimized solution.

Unlike passives placed in automotive applications, passives for smart meters do not need to be altered to fit specific timing or temperature ranges. In fact, most of the passives used in smart meter designs are standard offering components, which save time and money. Though the Advanced Metering Infrastructure (AMI) smart meter itself is a relatively new application, the technologies making up the feature sets of smart meters have existed for some time. Many of these technologies have existed in wireless applications (e.g., ZigBee, WiFi, WiMAX, ISM 900MHz). Others have long been a part of the many other elements as well as the long-evolving design of the solid-state meters and Automatic Meter Reading



(AMR) meters. Of course some technologies are now being developed that attempt to create a more smart meter-specific solution which ultimately should reduce ownership costs for the meter manufacturers, utilities and consumers. But these technologies for the most part remain under development as smart meter standards continue to evolve.

As the smart meter market continues to develop, passives will need to meet new demands. For example, in many smart metering designs, there is an increasing requirement for higher reliability components to make sure the units can meet the life expectancy needed in the field. This means that in some applications, more robust passive components may be used to achieve increased reliability. Some designs have already incorporated these components. Because many smart meter units need to be in the field for 10 or more years, passive components used in these designs may be required to meet or exceed that timeframe. Also, as industry standards take on more clarity and are increasingly adopted, the resulting technology directions will drive innovation throughout the smart meter market.

Source URL (retrieved on 11/27/2014 - 5:11pm):

<http://www.ecnmag.com/articles/2010/12/passives-%E2%80%93-putting-%E2%80%93-smart-meters>