

Reliable In-Car MLCC Bonds with Conductive Adhesive

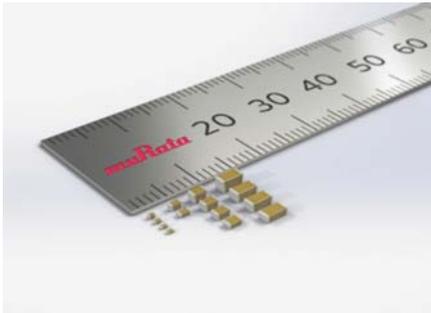


Photo 1: Exteriors of the GCB Series

This article presents the GCB Series (Photo 1), which are multi-layer ceramic capacitors developed by Murata Manufacturing Co., Ltd. It is a set of multi-layer ceramic capacitors designed for devices that are placed in severe thermal environments, such as locations surrounding an automotive engine room. It can be used at high temperatures of more than 150°C and is compatible with conductive adhesive.*1

Background of Development

In recent years, the automotive industry has seen rapid advances in the electronic control of various functions for improvement of safety and environmental performance, increasing the usage rates of in-car electronic devices. Among them, electronic components incorporated in an engine room tend to be exposed to severe thermal environments. In addition, there is an increasing need for placing components, like an IC near a heat source because of decreases in the size of electronic devices, and in some cases, temperatures near the components exceed 150°C; therefore,

components put in such a place need to have not only high reliability but high thermal resistance. In order to ensure the operation of circuits in such high-temperature environments, Murata Manufacturing has developed multi-layer ceramic capacitors capable of being used at temperatures of up to 200°C and being bonded using conductive adhesive, by developing new external electrodes that use the high-temperature strength characteristic of ceramics.

Compatible with Conductive Adhesive

Figure 1 shows a typical structure of the GCB Series. The series uses nickel (Ni) and palladium (Pd) for the plating of its external electrodes, and is the first of its kind to be compatible with conductive adhesive. This plating structure ensures the high reliability of joints made with conductive adhesive even in high-temperature environments. Also, since silver (Ag) is not used for the external electrodes, the risk of a short-circuit fault associated with the high temperature migration of Ag, which is a potential issue with conventional products compatible with conductive adhesive (GCG Series), has been significantly reduced, thus achieving higher thermal resistance than that of the conventional products.

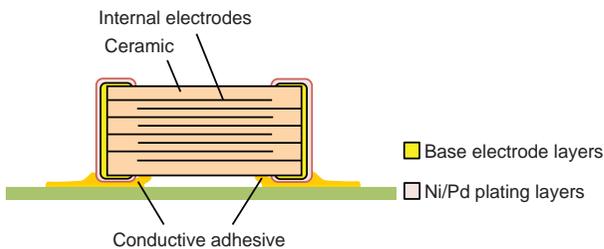


Figure 1: Example structure of the GCB Series

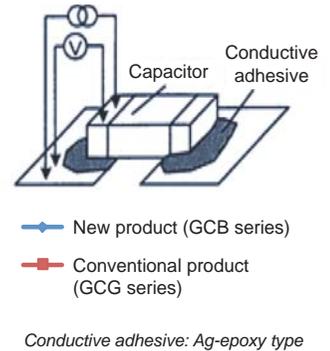
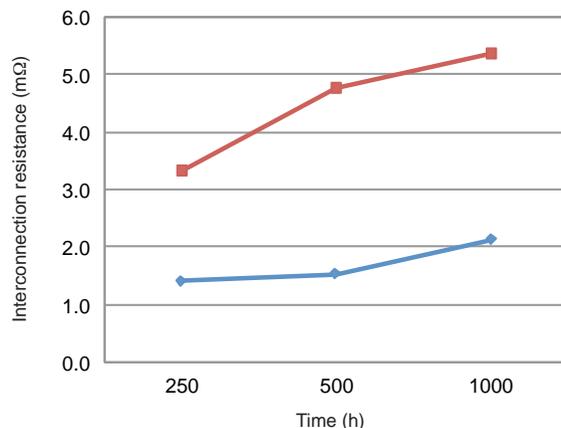


Figure 2: Interconnection resistances between a terminal electrode and a land in a high-temperature electrical environment

Table 1: Product lineup and electrical characteristics of the GCB Series

Dimension LxW (mm)	Dimension code* mm (inch)	Temperature characteristics	Operating temperature range	Rated voltage	Capacitance	Part number example ³
1.0x0.5, 1.6x0.8	1005M(0402), 1608M (0603)	X8R (EIA)	-55 to 150°C	16 to 100Vdc	1 to 470nF	GCB155R91H102K****
1.0x0.5, 1.6x0.8	1005M(0402), 1608M (0603)	X9M (Temperature characteristics symbol in Murata)	-55 to 200°C	10 to 50Vdc	1 to 470nF	GCB188M91E103K****

*M: Metric Unit

Effects of GCB Series

Figure 2 illustrates the results of measurements of the resistance between a terminal electrode and a land that was carried out after exposure to a high temperature of 200°C.

Although the interconnection resistances increase with exposure time, the increase rate of the new product is lower than that of the conventional product, which shows that the new product has excellent properties.

Product Lineup & Electrical Characteristics

Table 1 lists the product lineup and electrical characteristics of the GCB Series.

Murata Manufacturing plans to commercialize a new product capable of being used at temperatures of up to 200°C, in addition to a product capable of being

used at 150°C, which is the maximum operating temperature of conventional products. Both products comply with AEC-Q200², a reliability test standard required for automotive components, and are suitable for power trains and safety devices incorporated in in-car high-temperature environments.

Future Plans

Murata Manufacturing has already started supplying samples of the GCB Series described above, and aims to start mass production by the end of this year. The GCB Series has not only high thermal resistance, but also has external electrodes with high corrosion resistance, as compared with those of conventional products. The company will offer a wide range of solutions that use such an advantage of the new external electrodes,

and will continue to further expand its product portfolio to contribute to development in electronics society.

Notes:

^{*1} *Conductive adhesive: Absorbs a stress caused by the expansion and contraction of substrates and components due to thermal change, offering a long thermal cycling life.*

^{*2} *AEC-Q200: Reliability test standard required for automotive components, established by the Automotive Electronics Council.*

^{*3} *Part number example: Unofficial part numbers during development.*

About This Article:

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