Technological Trends in Soft-Termination MLCCs Adopting “Low-Silver Filler” to Solve Reliability Challenges in Next-Generation Automotive ECUs

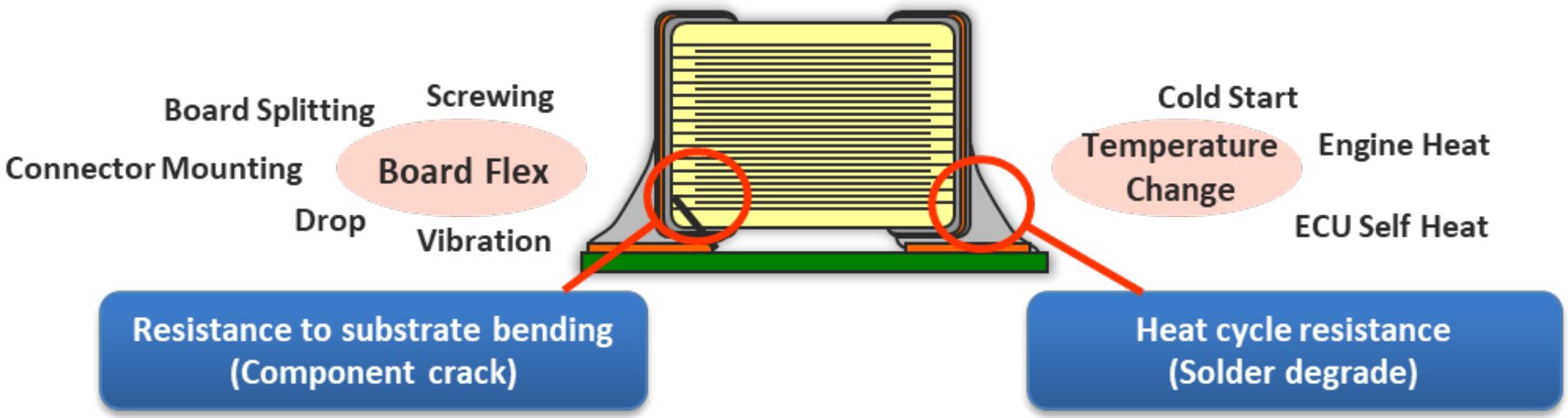
- Acquired VW 80808 Certification -

TAIYO YUDEN CO., LTD.
As of March 2026

01 The Role of Soft-Termination MLCCs in the Automotive Market

The automotive industry's accelerating transition toward CASE (Connected, Autonomous, Shared, Electric) has made in-vehicle electronics more critical than ever. Central to this advancement is the rapid integration of Electronic Control Units (ECUs), such as Domain Control Units (DCUs) that support Advanced Driver-Assistance Systems (ADAS), and the performance enhancement of System-on-Chip (SoC) designs. This leads to an increase in the number of Multilayer Ceramic Capacitors (MLCCs) mounted in physical stress-prone, harsh environments such as screw-fastening points or near the edges of boards.

These changes in the mounting conditions present a new challenge: an increased risk of mechanically induced capacitor cracking due to board flexure and vibration. One of the optimal solutions gaining traction to attention for this critical reliability concern is the "soft-termination MLCC," which utilizes a conductive polymer for its external electrodes. This soft-termination layer acts as a cushion, flexibly absorbing combined thermal and mechanical stress, thereby preventing cracks and fundamentally supporting the safety of automotive systems.

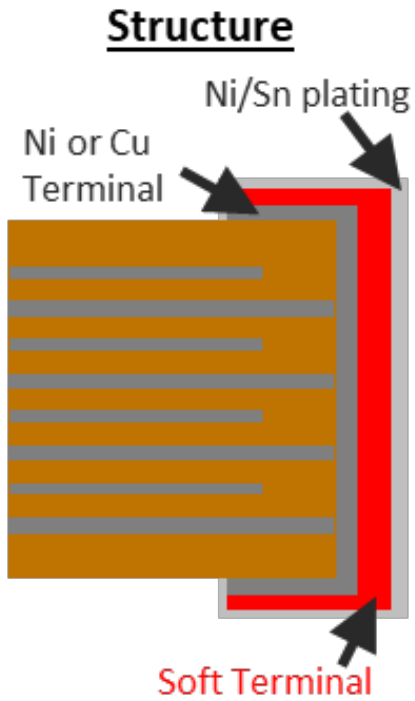


02 Four Factors Accelerating the Shift to Soft-Termination

The shift from standard MLCCs to soft-termination MLCCs in the automotive market is accelerated by four main factors:

1) Growing Demand for Fail-Safe Designs

To maintain the entire system in a safe state in the event of failure, the adoption of soft-termination products is strongly recommended, particularly in battery lines and low-voltage, high-power lines, to prevent short-circuit failures.



2) Increased Importance of Countermeasures for Board Flexure

With the adoption of thicker boards for higher power and the integration of heavy, large components, countermeasures against board flexure (bending stress) caused by vibration and shock during manufacturing and vehicle operation have become critical priority.

3) Thermal Stress from Smaller, Higher-Performance ECUs

High-density mounting not only increases thermal stress on the board but also causes rapid temperature changes (thermal shock) due to the introduction of advanced liquid-cooling systems. Soft-termination significantly contributes to mitigating this combined thermal and mechanical stress.

4) Replacement of Ta/Al Polymer Capacitors

To ensure a stable supply of components and reduce mounting area, there is a growing trend. Toward replacing conventional polymer capacitors with high-capacitance MLCCs. In such cases, soft-termination is increasingly selected to reduce the risk of cracking—a particular concern for large MLCCs—and to ensure sufficient mechanical strength.

03 Technological Innovation: Adoption of Low-Silver Filler

While the demand for soft-termination MLCCs is surging, a significant challenge has emerged from a manufacturing cost perspective. Conventional soft-termination layers rely on a large amounts of “silver filler,” a precious metal, to ensure conductivity, and the recent surge in silver market prices has threatened the cost stability of these products. In response, TAIYO YUDEN has leveraged its proprietary technologies to successfully develop a new soft-termination MLCC utilizing a ”low-silver filler.”

This technology achieves a powerful balance between high conductivity and the polymer flexibility essential for stress absorption, all while reducing silver usage to a minimum. The result is a sustainable supply system that mitigates the risk of material price fluctuations and delivers performance surpassing that of conventional soft-termination products.

Type	Old Soft-Termination	New Soft-Termination
Component Level Migration Standard Dew Test ISO 6270-2/AEC-Q102-001		
Component Level Migration High Severe Dew Test		
Temperature Cycling TC180,3,000 cycles		
Production Status Case-size code standard：EIA-198 (IEC 60384)	MP*1 0603 (1608) - 1210 (3225)	MP 0402 (1005) - 1210 (3225) UD*2 0201 (0603)

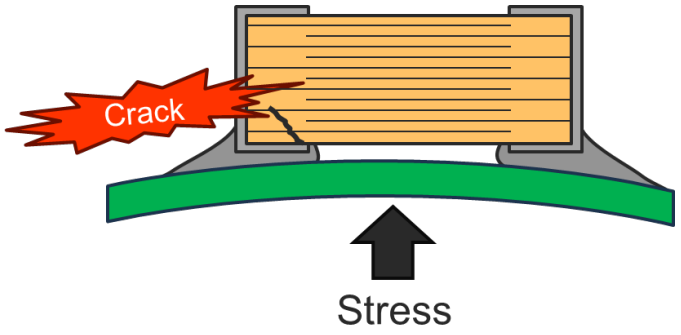
*1 Mass Production
*2 Under Development

04 Reliability to Withstand Harsh Environments

The newly developed soft-termination MLCC with ”low-silver filler” has demonstrated exceptional reliability in various tests simulating harsh environments specific to automotive applications.

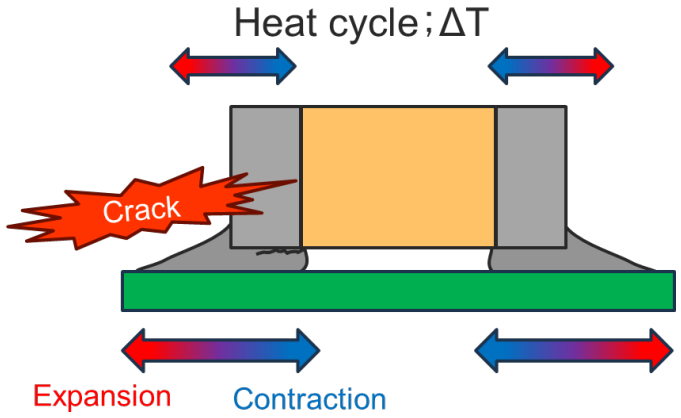
Board Flexure Resistance

Compared to the 2mm tolerance of standard MLCCs, this product guarantees resistance up to 5mm of flexure. In limit testing, it demonstrated remarkable durability, showing no critical failures (such as short circuits caused by cracking) even when subjected to 10mm of flexure.



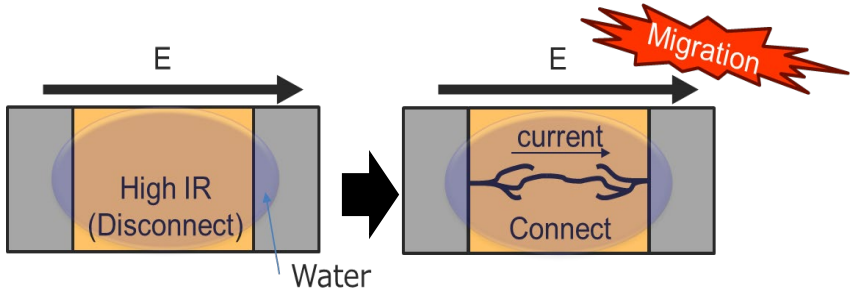
Heat Cycle Characteristics

Even under intense thermal cycling testing with repeated temperature swings from -40°C to +125°C, the product maintains stable characteristics over 2,000 to 3,000 cycles, demonstrating high connection reliability.



Migration Resistance

The product also exhibits an excellent inhibitory effect against ion migration (insulation degradation due to the movement of metal components), which is a concern in high-humidity and condensation-prone environments, ensuring long-term safety.



04 Automotive-Grade Lineup and Future Roadmap

This series has completed certification under global automaker Volkswagen's (VW) stringent proprietary reliability standard, "VW 80808", demonstrating that its quality meets global automotive requirements. The lineup currently spans a wide range of sizes from 1005 (1.0 x 0.5 mm) to 3225 (3.2 x 2.5 mm), covering the full spectrum of automotive applications, from critical systems like powertrain and safety, to body and infotainment. Looking ahead, TAIYO YUDEN plans to commercialize the 0603 size (0.6 x 0.3 mm) to meet the demand for further miniaturization and will continue to expand its high-capacitance lineup.

OEM approval status : Number of Approved Items

Soft-Termination Type	OEM	Spec	Number of Approved Items
New Soft-Termination	Volkswagen	VW80808	1169
Old Soft-Termination	Volkswagen	VW80808	162

As of 13 Oct. 2025

Temp. Char.	Case size (LxW) [mm]	Thickness (typ) [mm]	Rated Voltage [Vdc]	Capacitance (0.1pF 1pF 10pF 100pF 1,000pF 0.01uF 0.1uF 1uF 10uF 100uF 1,000uF)
X 7R X7S X7T	0.6x0.3			Under Development
	1.0x0.5	0.5	6.3 - 100.0	220pF - 1uF
	1.6x0.8	0.8	6.3 - 100.0	1000pF - 2.2uF
	2.0x1.25	1.25	4.0 - 250.0	1000pF - 22uF
	3.2x1.6	1.6	4.0 - 250.0	1000pF - 47uF
	3.2x2.5	1.9	16.0 - 100.0	0.022uF - 4.7uF
		2.5	6.3 - 100.0	2.2uF - 47uF

Leveraging the new ”low-silver filler” material and
world-class reliability (VW 80808 certified),
TAIYO YUDEN supports stable operation in
harsh automotive environments while
ensuring a reliable component supply.

Item Specs
TY-COMPAS

Contact