

Next-Generation Wet Tantalum Capacitors for Space Applications

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The new MIL-PRF-39006/33, or CLR 93, series of wet tantalum capacitors has become the standard for new designs in aerospace applications. The CLR93 provides the highest capacitance in an established reliability design, with full H characteristic shock and vibration capability. In addition to the current CLR93 qualified values, there are additional higher CV ratings being developed and supported by two DLA drawings: 13017 and 15005. Vishay is supporting these new requirements with our T16 and T18 series of wet tantalum capacitors. This presentation will provide some background information on the devices and discuss lessons learned, ongoing testing, and the roadmap forward for this next generation of wet tantalum capacitors.

Since its introduction in 1975, the CLR79, and later the extended range CLR81, design became the wet tantalum capacitor of choice for avionics, military, and space (AMS) applications. These all-tantalum case designs provide a 3 V reverse capability, increased ripple current handling, and 300 thermal shock cycles, along with 500 g mechanical shock, 80 g sine vibration, and 53.79 g rms random vibration.

The Vishay SuperTan® series of all-tantalum case wet tantalum capacitors was introduced in 1988. The ST and STE series, with their proprietary palladium cathode system, provide extremely high capacitance values up to 10 000 μ F. These hybrid designs, which incorporate a tantalum anode with a non-tantalum cathode, provided a significant step forward in wet tantalum capacitor technology. Much higher capacitance-voltage (CV) ratings were now available within the same industry-standard case sizes. These designs provided reverse voltage (1 V) capability and the mechanical shock / vibration levels matched the industry base levels of 100 g shock and 20 g sine vibration. These designs have been widely accepted, and used in many ground-based and avionics applications. While used in space applications, they were never fully qualified due to the lack of a high vibration capability and other factors.

In 2013 Vishay released the T16 series of wet tantalum capacitors. The T16 combined the attributes of the CLR79 and CLR81 capacitors, with the extended capacitance of the Vishay SuperTan series. The T16 has high capacitance values but with a true reverse voltage characteristic, along with 300 thermal shock cycles capability. It also has the ability to withstand H characteristic vibration levels: 500 g shock, 80 g sine, and 53.79 g random. Multiple customers have used the T16 in aerospace applications utilizing proven qualification and testing programs. Initial qualification and approval to MIL-PRF-39006/33 was completed in 2016. The preliminary DLA drawing 20002, now under review, is the first attempt to make an industry standard for up-screening the M39006/33 parts for space applications.

Vishay has continued to forge ahead, releasing even higher capacitance values with the T18 series. The T18 also has the full high performance capabilities needed for aerospace applications. With high CV combinations, such as 1000 μF / 75 V and 470 μF / 100 V, it offers both weight and space spacings in critical aerospace applications.