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29 Jan 2013

Thick and Thin Film MIL-PRF-55342 Resistors

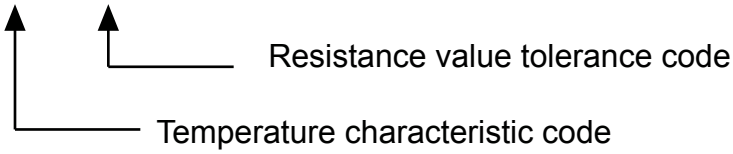
MIL-PRF-55342 resistors are made using thick and thin film technology. Thick film resistors are made by screenprinting thick film pastes onto 96% alumina substrates. The deposited films are sintered at temperatures ranging from 600-1000 °C. Thin film devices are made by sputtering thin films onto 99.6% alumina substrates using a vacuum plasma process. Thin film resistors are patterned using photolithography processes. Despite their names, thick and thin film technologies are not differentiated by the thickness of deposits but rather the deposition and patterning processes.

Thick film resistors provide for resistance tolerances as tight as ±1% and temperature coefficient of resistance (TCR) as low ±100 ppm/°C. Thin film resistors provide precision performance (±0.1% tolerance and ±25 and ±50 ppm/°C temperature coefficient of resistance).

While the part number does not specifically define the technology used to build the resistor, the resistance value tolerance and temperature characteristic codes define part numbers that can only be supplied by thin film devices. Devices with temperature characteristic codes E and H or resistance value tolerance codes A, B, and C can only be thin film devices. All other part numbers with temperature characteristics K or M and tolerances of ±1% and higher will most likely be supplied with a thick film device. Allowable substitution does permit the supply of a thin film device (0.1% & 25ppm) to part number that would be typically supplied by a thick film device (1% & 100ppm), but we do not want to supply the more expensive thin film device to a thick film order.

Here are some example part numbers:

M55342**K**06B1**E**10R - thick film device
M55342**K**06B1**B**10R - thin film device
M55342**E**06B1**B**10R - thin film device
M55342**E**06B1**E**10R - thin film device
M55342**H**06B1**B**10R - thin film device

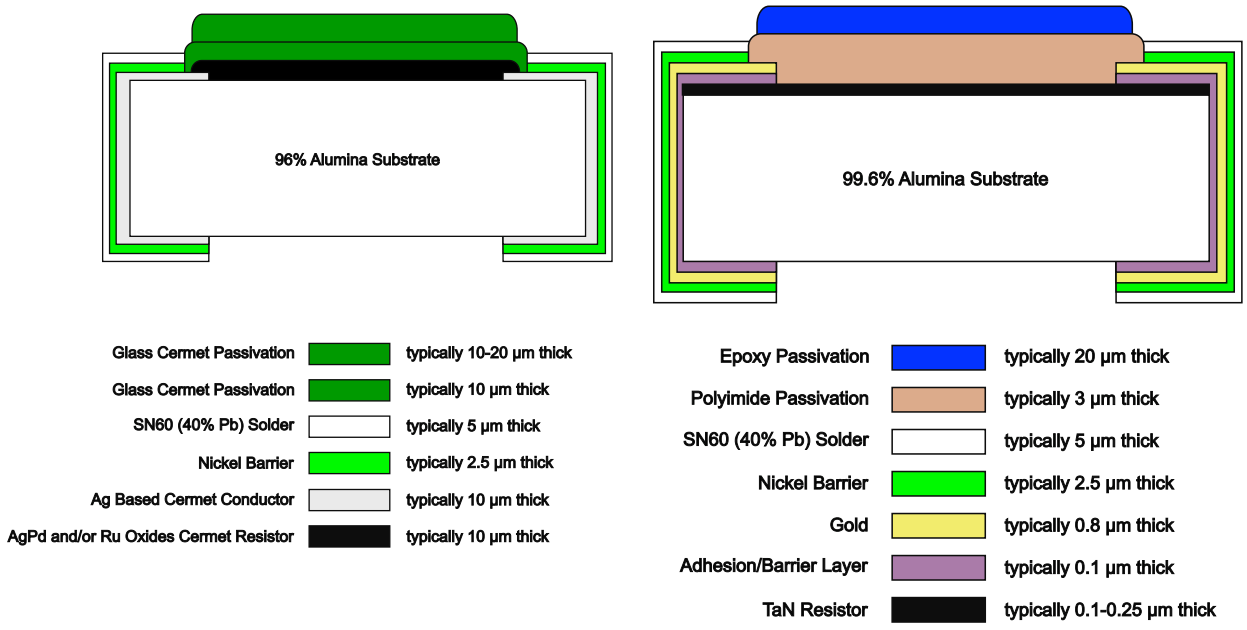


The construction of a thick film resistor is shown in Figure 1. Thick film resistors have resistor elements comprised of a lead borosilicate glass and a conductive phase. This conductive phase can be alloys of silver and palladium (mΩ to 100Ω) or oxides of ruthenium or iridium (10Ω to 20 GΩ). The sheet resistance value is varied by the ratio

of glass and conductive phase in the resistor element. Thick film resistors are usually patterned as blocks (Figure 2).

The construction of a thin film resistor is shown in Figure 1. State of the Art, Inc. uses a mixture of TaN and NiCr or other metals as the resistor element for MIL-PRF-55342 resistors. The sheet resistance value is varied by the thickness of the film (20 – 200 Ω/square). This comparatively narrow range of sheet resistance necessitates the use of serpentine meander patterns to achieve high resistance value (Figure 2).

Both thick and thin film resistors are passivated to protect the resistor element from manufacturing processes and the environment.



Thick film resistor Thin film resistor

Figure 1. Schematic cross section showing the construction of thick and thin film resistors.

Block pattern Serpentine meander pattern

Figure 2. Block and serpentine meander pattern resistor elements.