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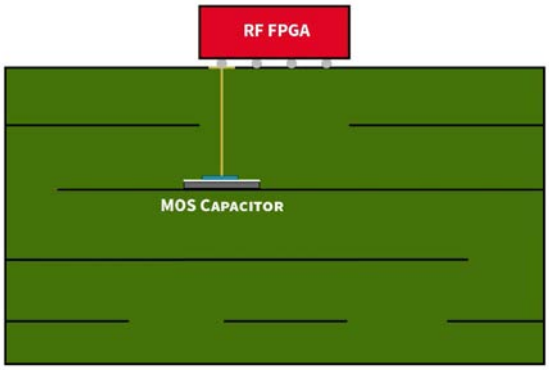
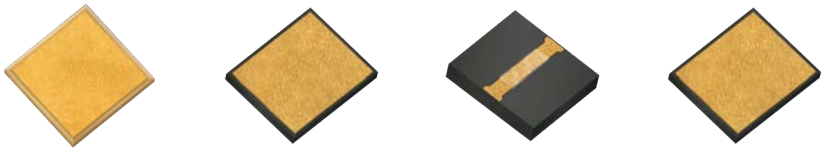
EMBEDDABLE SOLUTIONS

GENERAL OVERVIEW

As RF systems begin to push into higher frequencies within smaller form factors, there has been a recent shift in the industry towards embedding passive components. By integrating ultra-thin capacitors into the printed circuit board, designers will see increased board space, improved RF performance, and significantly reduced trace inductance.

For seamless embedding in RF applications, KYOCERA AVX offers a wide range of single layer capacitors: SLC, MOS, MIS, MIM, and more in development.





SLC | **MOS/MIS Capacitor** | **MIM Capacitor** | **Single Layer Resistance Capacitor**

EMBEDDING MLCC'S VS SLC'S

	Embedded MLCC	Embedded SLC and MOS Capacitors
Typical RF Applications	MLCC's are not recommended for RF embedding use	Coupling, Impedance Matching, High-Speed Decoupling
Profile	**Thick-** Z dimension makes it difficult to use in non-surface mount situations	**Ultra Thin-** Z dimension allows for optimal embeddable design
Q-Factor	**Moderate-** Adequate Q in low to mid frequencies and falls off near SRF	**High-** Improved frequency response and RF performance **Tunable-** Resistance Capacitor can replace an inline resistor in cases that require it
CTE Mismatch Risk	**High-** The low CTE of ceramic can cause cracks and delamination on the MLCC over time	**Low-** SLCs can be customized for embedding with better material matching
Design Flexibility	**Low-** 2 termination on MLCC's limit versatility in layouts	**High-** Components can be made rectangular or square to match design needs. Large surface area available for via placement.

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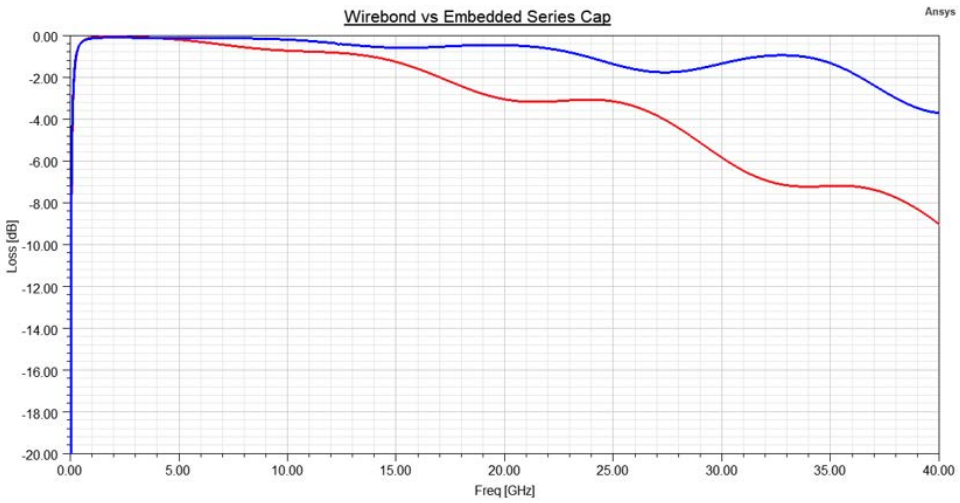
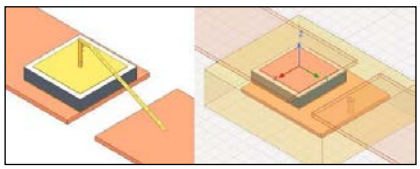
EMBEDDABLE SOLUTIONS

WIREBOND VS. EMBEDDED-MODELED PERFORMANCE

MOS Cap Performance Modeled in Ansys HFSS



Wirebond Series Cap Embedded Series Cap



Left: 10pF MOS capacitor on Rogers 4350 test board with wirebond connection.

Right: 10pF MOS capacitor embedded in epoxy filled Rogers 4350 test board with via to transmission line.

Wirebond performance degrades at 5GHz.

Embedded method allows cap performance to extend beyond 20GHz with minimal loss.

PRODUCT LINEUP

MOS Capacitor	
Dielectric	SiO_2
Frequency	≤100 GHz
Capacitance	1 - 1,200 pF
Voltage	25 - 200 V_{DC}
Thickness	5 - 10 MIL

MIS Capacitor	
Dielectric	SiON
Frequency	≤100 GHz
Capacitance	1 - 1,800 pF
Voltage	25 - 200 V_{DC}
Thickness	5 - 10 MIL

MIM Capacitor	
Substrate	Alumina, Quartz
Frequency	≤100 GHz
Capacitance	1 - 15 pF
Voltage	100 V_{DC}
Thickness	5, 10 MIL

Single Layer Ceramic Capacitor	
Dielectric	NPO-X7R
Frequency	≤100 GHz
Capacitance	1.0 pF - 10 nF
Voltage	25 - 200 V_{DC}
Thickness	4.5 -12 MIL

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