3M™ Embedded Capacitance Material (ECM)

Utilize a Proven Solution

- A UL certified and RoHS[2] compliant laminate with high capacitance density that can be embedded into PCBs and chip packages as either a power ground plane or a discrete capacitor
- Consists of a very thin layer of ceramic-filled epoxy sandwiched between two layers of copper foil
- Compatible with a large range of PCB material sets and with standard PCB fabrication and assembly processes, including lead-free
- Halogen-free[3] versions available along with a variety of panel sizes and copper thicknesses
- In production in telecom, computer, test and measurement, military/ aerospace, medical and consumer electronics applications

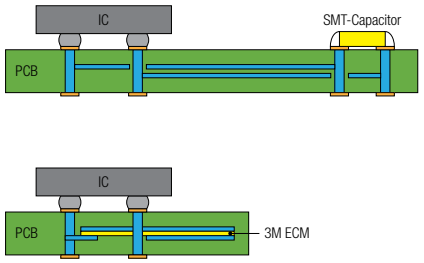
Simplify Design while Amplifying Performance

- Increases usable board area by allowing for the removal of many, if not all, capacitors equal to or below 0.1 µF and their associated solder joints and vias
- Improves power integrity by reducing power bus noise and PCB impedance
- Reduces EMI by decreasing resonance that causes EMI
- Dissipates heat better than thin FR-4 due to high thermal conductivity and low thermal impedance

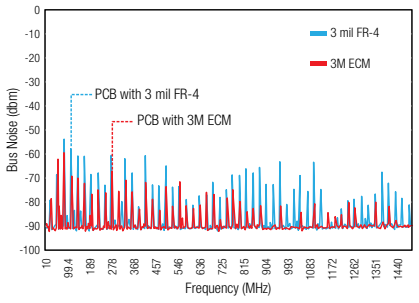
Enable Product Roadmaps

- Simplify board layout and routing
- Reduce PCB size, thickness and weight
- Add functionality on fixed form factors
- Lower spreading inductance
- Decrease need for EMC measures such as metal shells, tapes, etc.
- Reduce interference from digital circuits to analog/RF circuits in mixed signal applications
- Add PCB layers while maintaining similar PCB thickness
- Reduce design spins by solving noise issues early in the design cycle
- Improve PCB panel utilization
- Improve assembly yields and board reliability due to fewer components

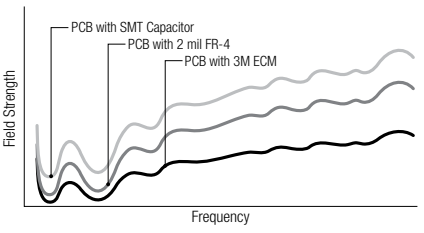
Allows for Capacitor Removal



Reduces Power Bus Noise



Reduces EMI



3M™ Embedded Capacitance Material

Property	Test Method	C0614	C1012	C2006	C3004	C4003
Capacitance/Unit Area (1 kHz)	Supplier Method	6.4 nF/in^2 (1.0 nF/cm^2)	10.0 nF/in^2 (1.6 nF/cm^2)	20.0 nF/in^2 (3.1 nF/cm^2)	30.0 nF/in^2 (4.65 nF/cm^2)	40.0 nF/in^2 (6.2 nF/cm^2)
Dielectric Thickness	Cross-section	14 µm (0.55 mils)	12 µm (0.47 mils)	6 µm (0.24 mils)	4 µm (0.16 mils)	3 µm (0.12 mils)
Copper Type	Supplier Method	RA	ED	RA	RA	RA
Capacitance Tolerance	Supplier Method	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 15%
Dielectric Constant (1 kHz)	Supplier Method	16	22	22	22	22
Dissipation Factor (1 kHz)	Supplier Method	0.005	0.010	0.010	0.010	0.010
Temperature Coefficient of Capacitance (TCC)	Supplier Method	Meets X7R requirements				
Dielectric Strength (Volts/Mil)	ASTM D149	3300	3000	3000	3000	3000
HiPOT Voltage	IPC-TM-650 2.5.7.2	100 V		Application Dependent*		
UL Flammability Rating	UL 94	94 V-0		In Process		
UL Relative Thermal Index (RTI)	UL 796	130°C	90°C[3]	In Process		
UL Solderability Limits	UL 796	288°C/30 sec.	288°C/20 sec.	In Process		
Glass Transition Temperature	Supplier Method (DSC)	120°C				
Moisture Absorption (wt %)	ASTM D570	0.11	0.10	0.10	0.10	0.10
CTE (ppm/C)	Supplier Method (TMA)	32 (x,y,z)	31 (x,y,z)	31 (x,y,z)	31 (x,y,z)	31 (x,y,z)
Degradation Temperature	IPC-TM-650 2.3.40	345°C	375°C	375°C	375°C	375°C
Peel Strength (pli)	IPC-TM-650 2.4.9 modified	3.8	6.0	4.0	4.0	4.0
Thermal Conductivity (W/m*K)	ASTM F433 modified	0.5				
Halogen Free[4]	IEC 61249-2-21	No	Yes	Yes	Yes	Yes

1) All test data provided are typical values and not intended to be specification values.

2) "RoHS compliant" means that the product or part does not contain any of the following substances in excess of the following maximum concentration values in any homogeneous material, unless the substance is in an application that is exempt under RoHS: (a) 0.1% (by weight) for lead, mercury, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers; or (b) 0.01% (by weight) for cadmium. Unless otherwise stated by 3M in writing, this information represents 3M's knowledge and belief based on information provided by third party suppliers to 3M.

3) Epoxy default RTI temperature.

4) Halogen Free is defined as both 1) no halogen compounds that are intentionally added to the product or used in the manufacturing process for the product and 2) any impurities present are less than 900 ppm bromine, less than 900 ppm chlorine and/or less than 1500ppm total bromine and chlorine. The latter are the levels set forth in certain industry standards for printed circuit boards, such as the International Electrotechnical Commission (IEC) 61249-2-21 standard. This information represents 3M/s knowledge and belief which may be based in whole or in part on information provided by 3rd party suppliers to 3M.

*Contact 3M for more information.

For more information, please visit our website to learn more: **www.3Mcapacitance.com**

Important Notice

All statements, technical information, and recommendations related to 3M's products are based on information believed to be reliable, but the accuracy or completeness is not guaranteed. Before using this product, you must evaluate it and determine if it is suitable for your intended application. You assume all risks and liability associated with such use. Any statements related to the product which are not contained in 3M's current publications, or any contrary statements contained on your purchase order shall have no force or effect unless expressly agreed upon, in writing, by an authorized officer of 3M.

Warranty; Limited Remedy; Limited Liability.

This product will be free from defects in material and manufacture for a period of one year from the time of purchase. **3M MAKES NO OTHER WARRANTIES INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.** If this product is defective within the warranty period stated above, your exclusive remedy shall be, at 3M's option, to replace or repair the 3M product or refund the purchase price of the 3M product. Except where prohibited by law, 3M will not be liable for any indirect, special, incidental or consequential loss or damage arising from this 3M product, regardless of the legal theory asserted.

Electronic Solutions Division
6801 River Place Blvd.
Austin, TX 78726-9000
1-888-845-3393
www.3Mcapacitance.com

80-0011-3700-1