

# 3M™ Embedded Capacitance Material (ECM)

## Utilize a Proven Solution

- A UL certified and RoHS<sup>2</sup> 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<sup>3</sup> 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

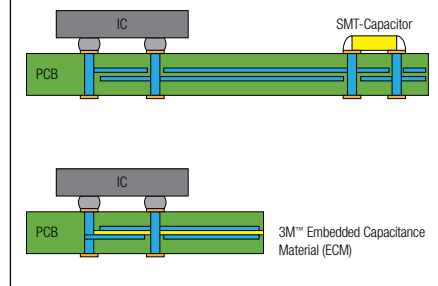
## Simplify Design while Amplifying Performance

- Increases usable board area by allowing for the removal of many, if not all, capacitors equal to or below 0.1  $\mu\text{F}$  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

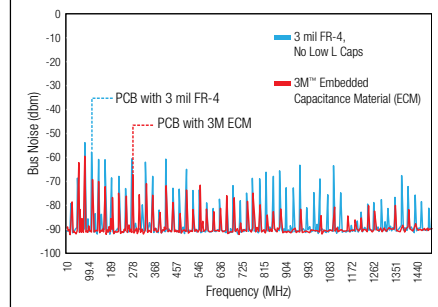
## Enable Product Roadmaps

- 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

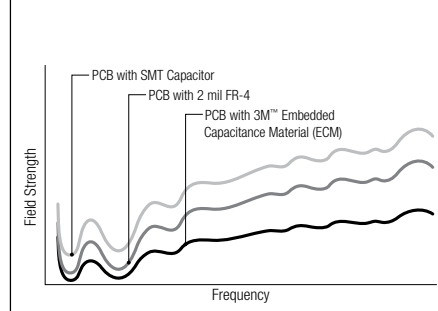
### Allows for Capacitor Removal



### Reduces Power Bus Noise



### Reduces EMI



## 3M™ Embedded Capacitance Material (ECM)

Property	Test Method	C0614	C1012	C2006
Capacitance/Unit Area (1 kHz)	Supplier Method	6.4 nF/in <sup>2</sup> (1.0 nF/cm <sup>2</sup> )	10.0 nF/in <sup>2</sup> (1.6 nF/cm <sup>2</sup> )	20.0 nF/in <sup>2</sup> (3.1 nF/cm <sup>2</sup> )
Dielectric Thickness	Cross-section	14 µm (0.55 mils)	12 µm (0.47 mils)	6 µm (0.24 mils)
Copper Type	Supplier Method	RA	ED or RA	RA
Copper Thickness	Cross-section	35 µm	35 µm (ED/RA) or 17 µm (ED)	35 µm RA
Capacitance Tolerance	Supplier Method	+/- 10%	+/- 10%	+/- 10%
Dielectric Constant (1 kHz)	Supplier Method	16	22	22
Dissipation Factor (1 kHz)	Supplier Method	0.005	0.010	0.010
Temperature Coefficient of Capacitance (TCC)	Supplier Method	Meets X7R requirements		
Dielectric Strength (Volts/Mil)	ASTM D149	3300	3000	3000
HiPOT Voltage	IPC-TM-650 2.5.7.2	100 V	100 V	50 V
UL Flammability Rating	UL 94	94 V-0		
UL Relative Thermal Index (RTI)	UL 796	130°C	90°C <sup>4</sup>	90°C <sup>4</sup>
UL Solderability Limits	UL 796	288°C/30 sec.	288°C/20 sec.	288°C/20 sec.
Glass Transition Temperature	Supplier Method (DSC)	120°C		
Moisture Absorption (wt %)	ASTM D570	0.11	0.10	0.10
CTE (ppm/C)	Supplier Method (TMA)	32 (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
Peel Strength (pli)	IPC-TM-650 2.4.9 modified	4.0	6.0 (ED)/4.0 (RA)	4.0 (RA)
Thermal Conductivity (W/m*K)	ASTM F433 modified	0.5		
Halogen Content (ppm)	BS EN 14582:2007	<400	None Detected	

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

2) "RoHS 2011/65/EU" means that the product or part does not contain any of the substances in excess of the maximum concentration values ("MCVs") in EU RoHS Directive 2011/65/EU. The MCVs are by weight in homogeneous materials. This information represents 3M's knowledge and belief, which may be based in whole or in part on information provided by third party suppliers to 3M. In the event any product is proven not to conform with 3M's Regulatory Information Appendix, then 3M's entire liability and Buyer's exclusive remedy will be in accordance with the Warranty stated below.

3) 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.

4) Epoxy default RTI temperature.

For more information, please visit our website to learn more: [www.3Mcapacitance.com](http://www.3Mcapacitance.com)

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