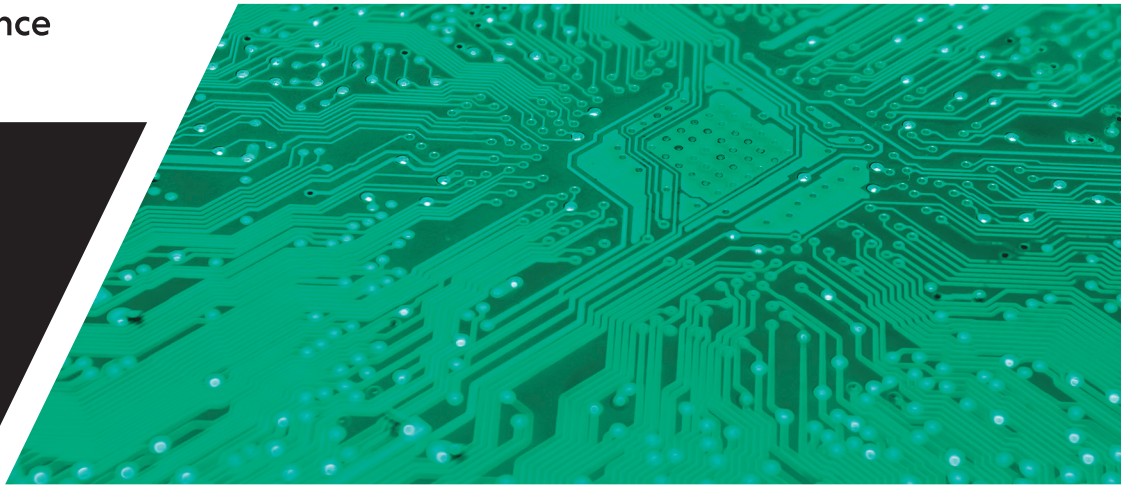
FARADFLEX®

TRANSFORM TO A

THINNER *FASTER* QUIETER PCB

Ultra Thin Laminates for Higher Performance PCBs, Modules & Chip Packages

Embedded Capacitance



A PRODUCT OF

OAK-MITSUI TECHNOLOGIES

MITSUI KINZOKU GROUP

THE NEXT GENERATION OF EMBEDDED CAPACITANCE MATERIAL

The rapid advancements in technology including the newest data phones, tablets, and high definition video streaming are demanding changes in PCBs, modules, and chip package designs. This has significantly impacted the data processing infrastructure from computers, servers, routers, switches, and data storage. The ICs, chipsets, memory, displays, and other components are now performing multi-functions and processing at speeds far greater than ever.

This requires thinner and lighter materials that can provide more power allowing faster data delivery with less power bus noise, enhanced signal integrity, reduced footprint, and more functionality. FaradFlex™ is the material solution providing the lowest inductance, for the best high speed power delivery, minimum noise, and optimum signal integrity.

FARADFLEX®

Embedded Capacitance Technology

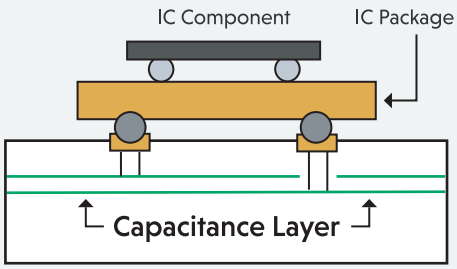
Embedded capacitance utilizes the technology of placing a capacitor plane inside the PCB to reduce overall inductance of the power distribution network, as well as free up surface real estate by eliminating some discrete capacitors.

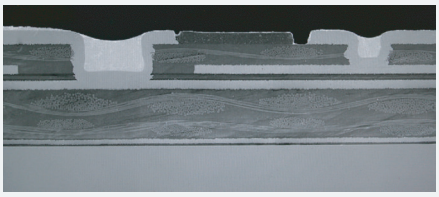
It is the reduced inductance that is a key performance factor in delivering the charge as system frequencies increase.

By using ultra thin dielectrics for the power/ground planes high speed switching noise can be reduced. Additionally, the thin power/ground planes can be used as a planar capacitor enabling the removal of surface mount decoupling capacitors along with traces, vias, and pads.

Low Inductance

Embedded Capacitor Design



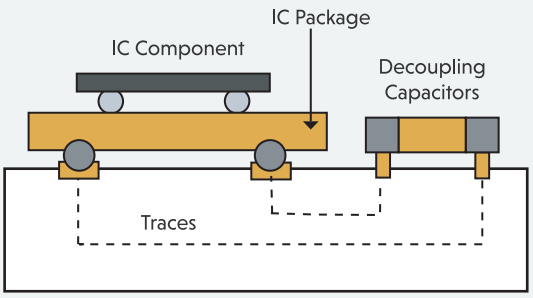


Cross section of embedded capacitor

VS

High Inductance

Traditional Surface Mount Decoupling Capacitor Design



Next Generation Ultra Thin Laminates

Oak-Mitsui Technologies has developed the FaradFlex™ family of thin substrates that is the next generation of embedded capacitance material.

There are two product groups: one based on advanced resin copper clad system and the other on high performance polymer film.

FaradFlex™ provides high capacitance, high Dk, and both low & high Df values. Manufacturing process of FaradFlex™ is very similar to that of typical PCB. Processing guideline and training are available upon request.

For Printed Circuit Boards

FaradFlex™ MCM and MCTM series are easy to process, and have been used commercially for the longest. These materials are commonly used in planar applications, most popular being telecom and high speed applications.

The laminate is constructed with copper and epoxy or other type resin bonded to a high performance polymer film. Common copper thicknesses offered are 5 microns, 18 microns (0.5 oz), 35 microns (1.0 oz), and 70 microns (2.0 oz).

Typical Benefits

- Best PDN (power delivery network)
- Low impedance/low inductance
- Reduced resonance over frequency (thinner is better)
- Removes discrete capacitors, traces, vias, and pads from surface
- Improves/increases design space
- Major reduction in PCBA failures including field failures
- Cost reduction due to reduction of components and assembly
- PCB size and weight reduction
- Reduction of EMI and Noise

Typical Applications

- High speed digital
- Analog and RF
- Automotive
- Aerospace
- Network telecommunications
- Handheld and commercial
- Industrial controls
- Medical device
- Security
- Test and measurement
- Super computers

rev032321

Properties	Test Method	Standard Dk			High Dk		New
		MC24M	MC12M	MC8M	MC12TM	MC8TM	MC24P
Dielectric Thickness, µm	Nominal	22	12	8	12	8	22
Cp @ 1 MHz, nF/in² (pF/cm²)	Nominal	1.2 (186)	2.0 (320)	3.1 (480)	4.2 (650)	6.5 (1010)	1.0 (150)
Dk (Dielectric Constant) @ 1 MHz/1 GHz	Mitsui Method	4.4/3.5	4.4/3.5	4.4/3.5	10.0/9.5	10.5/10.0	3.8/ -
Df (Loss Tangent) @1 MHz/1 GHz	Mitsui Method	0.015/0.016	0.015/0.020	0.016/0.021	0.015/0.020	0.020/0.021	0.013/ -
Peel Strength, kN/m 1 oz Cu	IPC TM-650 2.4.8C*	1.5	1.5	1.5	0.9	0.9	1.2
Breakdown Voltage, V	IPC TM-650 2.5.6.2A*	≥5000V	≥4000V	≥3500V	≥2500V	≥1500V	≥5000V
Tensile Strength, MPa (kpsi)	ASTM D-882A	219 (31.8)	194 (28.2)	126 (18.3)	153 (22.2)	127 (18.4)	219 (31.8)
Elongation, %	ASTM D-882A	36.0	13.5	8.5	31.4	14	36.0
CTE, ppm/°C, x-y, TMA	IPC TM-650 2.4.24.5*	24	23	32	28	22	24
Tg, °C, DMA	IPC TM-650 2.4.24.4*	183	187	188	189	191	185
Hi-Pot test (each panel)	IPC TM-650 2.5.7.2*	PASS (500V)	PASS (500V)	PASS (500V)	PASS (500V)	PASS (250V)	PASS (500V)
Thermal Stress (10 Sec Float @288°C), Times	Mitsui Method	>10	>10	>10	>10	>10	>10
Moisture Absorption %	TM-650 2.6.2.1*	1.3	1.3	0.5	0.8	0.5	1.3
THB, 85°C/85% RH/dc bias	Mitsui Method	PASS (50V)	PASS (50V)	PASS (35V)	PASS (50V)	PASS (35V)	PASS (50V)
HAST, 130°C/85% RH/dc bias	Mitsui Method w/GEA-700G	PASS (50V)	PASS (50V)	PASS (50V)	PASS (50V)	PASS (50V)	PASS (50V)
Flammability/Temp Rating	UL 94	V0 130°C	V0 130°C	V0 125°C	V0 130°C	V0 130°C	V0 130°C
PWB Processing	–	Both sides	Both sides	Both sides	Both sides	Both sides	Both sides

*Common copper weights: 0.5 oz, 1.0 oz, 2.0 oz

*Note: This chart provides typical values for FaradFlex™ products. *Indicates some modifications to test method. For a full list of our products please contact us.*

FARADFLEX®

For MEMS, Packages, & Modules

This series of FaradFlex™ products are used for maximum capacitance to replace discrete capacitors and improve power delivery. These FaradFlex™ materials are used in module boards for portable devices such as cell phones, PDAs and notebook computers. Some of the high Dk materials are available as a single sided resin coated copper. Common copper thicknesses offered are 5 microns, 18 microns (0.5 oz), and 35 microns (1.0 oz).

Typical Benefits

- Best PDN (power delivery network)
- Low impedance/low inductance
- Reduced resonance over frequency (thinner is better)
- Removes discrete capacitors, traces, vias, and pads from surface
- Improves/increases design space
- Major reduction in PCBA failures including field failures
- PCB size and weight reduction
- Reduction of EMI and Noise

Typical Applications

- Chip package
- Sensors, modules
- GPS, radar
- Aircrafts, drones
- Missile control
- Satellite systems
- RF/Wireless
- RF filters
- Diplexers, multiplexers
- Discrete capacitors

Properties	Test Method	High Dk/Low Df		High Dk		
		MC12LD	MC12ST	MC8TM	MC8T	MC3TB
Dielectric Thickness, µm	Nominal	12	12	8	8	3
Cp @ 1 kHz/1 MHz, nF/in²	Nominal	- /4.3	10.9/10.5	7.0/6.5	24.2/21.9	40.0/38.5
Dk (Dielectric Constant) @ 1 kHz/1 MHz	Mitsui Method	7.3@1MHz 7.9@1GHz	23.1/22.8	10/10.5	30.0/24.0	22.4/21.7
Df (Loss Tangent) @1 kHz/1 MHz	Mitsui Method	0.002@1MHz 0.0017@1GHz	0.006/0.005	0.020/0.020	0.020/0.025	0.010/0.008
Peel Strength, kN/m 0.5 oz Cu	IPC TM-650 2.4.8C*	0.70	0.70	0.77	0.70	0.70
Breakdown Voltage, V	IPC TM-650 2.5.6.2A*	≥300V	≥150V	≥1500V	≥200V	≥50V
Tensile Strength, MPa (kpsi)	ASTM D-882A	N/A	NA	127 (18.4)	NA	NA
Elongation, %	ASTM D-882A	N/A	NA	14	NA	NA
CTE, ppm/°C, x-y, TMA	IPC TM-650 2.4.24.5*	55	32 (@1) 97 (@2)	22	17 (@1) 42(@2)	32 (@1) 121 (@2)
Tg, °C, DMA	IPC TM-650 2.4.24.4*	215	160	191	191	136
Hi-Pot test (Sampling/Lot)	IPC TM-650 2.5.7.2*	N/A	PASS (50V)	PASS (100V)	PASS (50V)	PASS (20V)
Thermal Stress (10 Sec Float), Times	Mitsui Method	>10 (288°C)	>10 (288°C)	>10 (288°C)	>10 (288°C)	>10 (300°C)
Moisture Absorption %	TM-650 2.6.2.1*	0.37	0.14	0.5	0.4	0.2
THB, 85°C/85% RH/dc bias	Mitsui Method	PASS (10V)	PASS (3.7V)	PASS (35V)	PASS (3.7V)	PASS (3.7V)
HAST, 130°C/85% RH/dc bias	Mitsui Method w/GEA-700G	N/A	PASS (2.8V)	PASS (50V)	PASS (2.8V)	PASS (2.8V)
Flammability/Temp Rating	UL 94	N/A	NA	V0 130°C	V0 130°C	NA
PWB Processing	–	Sequential	Sequential	Both sides	Sequential	Sequential

rev032321

*Common copper weights: 0.5 oz, 1.0 oz, 2.0 oz

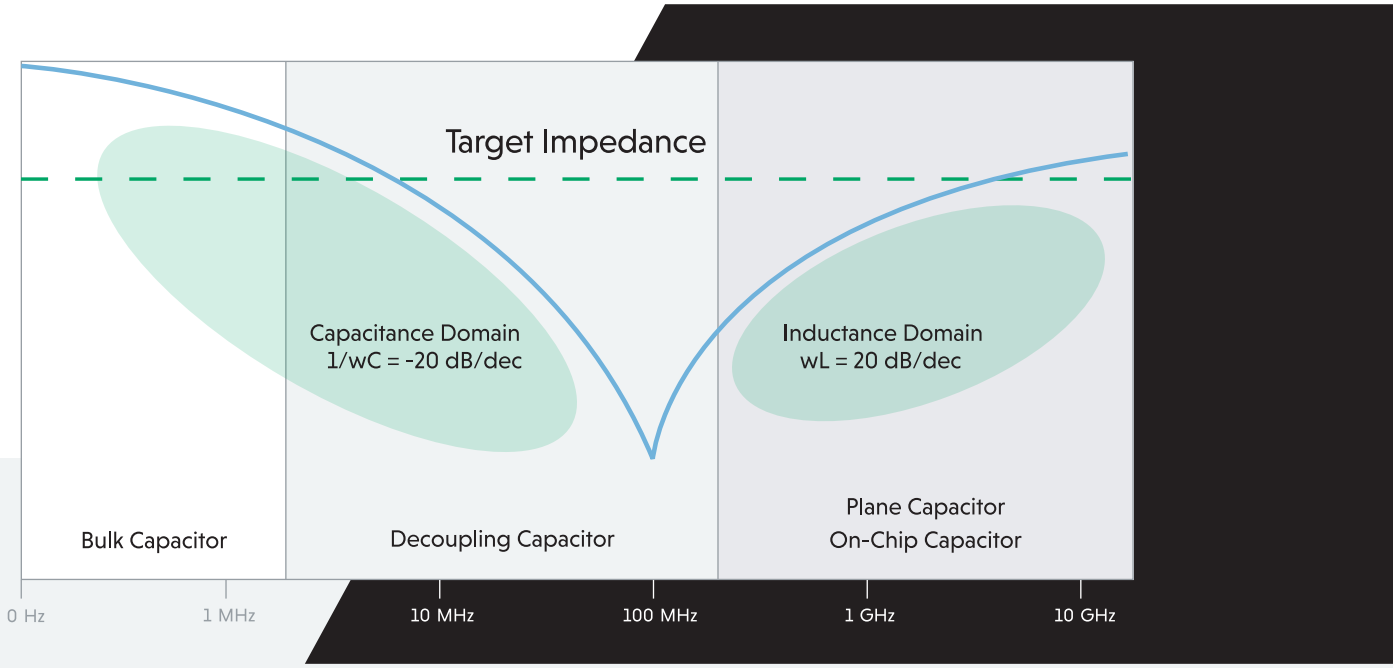
*Note: This chart provides typical values for FaradFlex™ products. *Indicates some modifications to test method. For a full list of our products please contact us.*

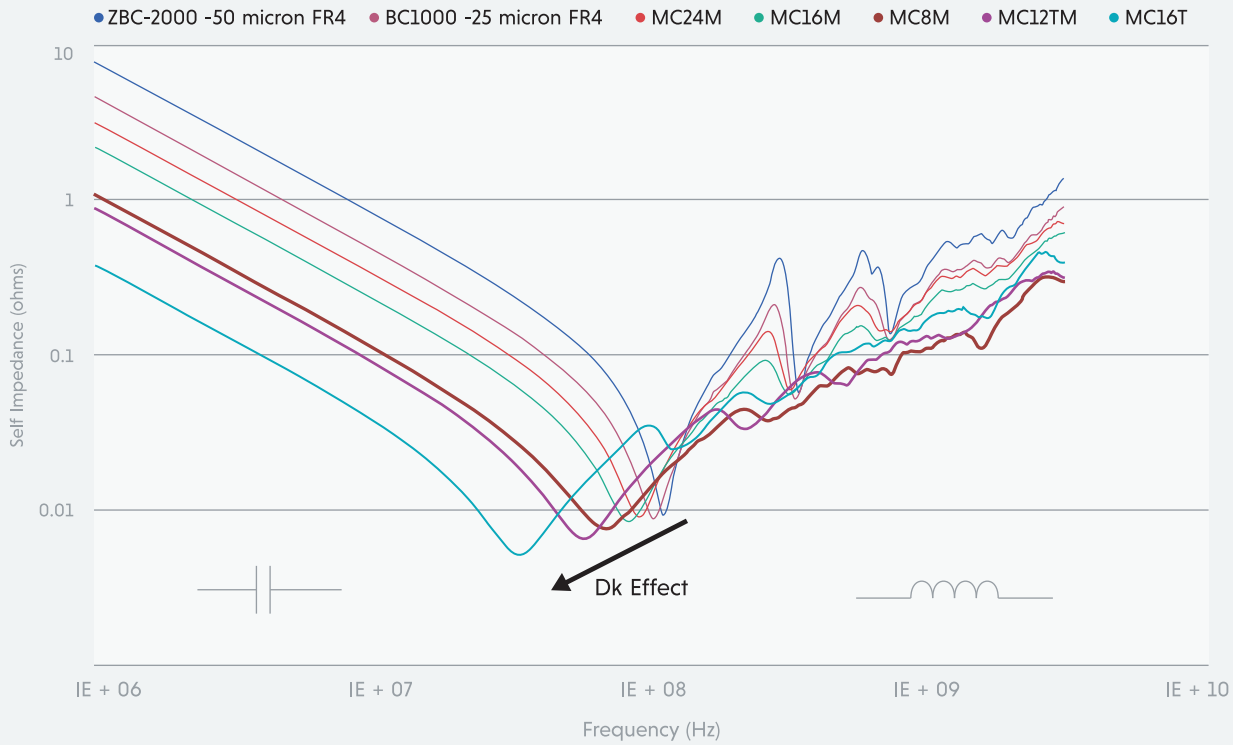
FaradFlex™ Compared to Traditional Material

FaradFlex™ is 1/2 to 1/6 the thickness compared to the typical "thinnest" laminate using glass cloth reinforcement.

FaradFlex™ increases thermal transfer from the PCB due to the ultra thin power/ground substrate.

FaradFlex™ has 10 times greater dielectric withstanding voltage than the traditional FR-4 laminates and similar materials.



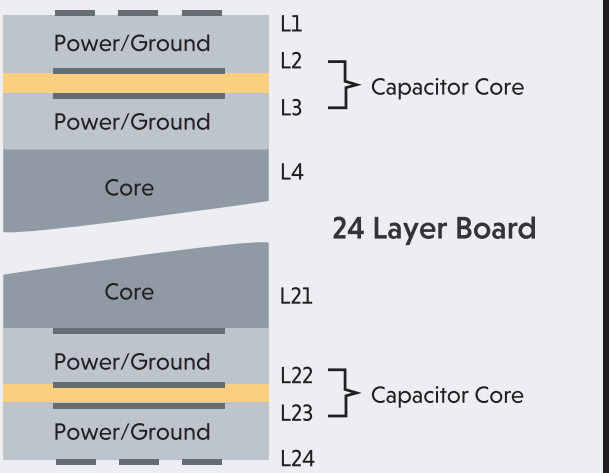


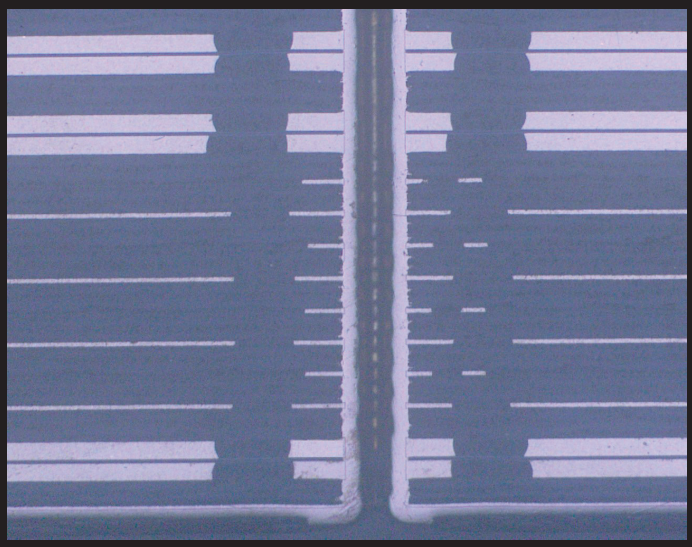
FARADFLEX®

FaradFlex™ for Enhanced Performance

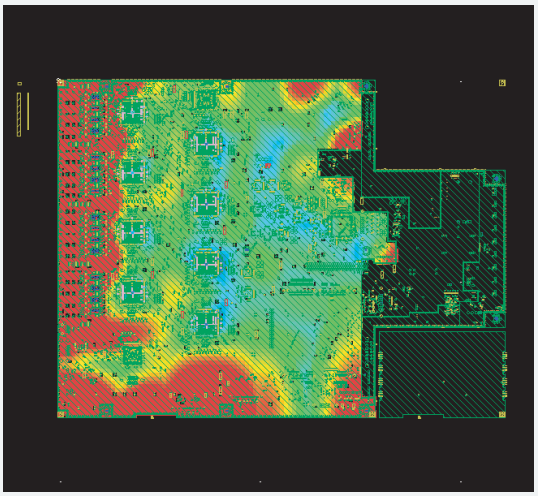
Oak-Mitsui Technologies' FaradFlex™ is the answer for high speed cutting edge designs that require optimized power distribution, lower inductance, reduced EMI, less noise, minimal loss, more design space, better reliability, and improved RF properties.

Stack-Up Examples

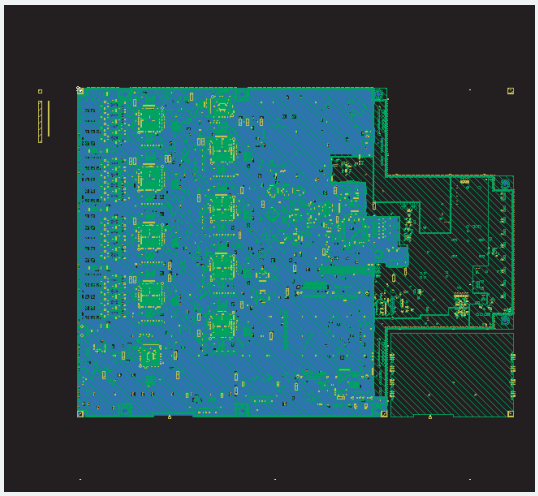




Reduces PCB Noise



Standard FR-4 core with decoupling capacitors



MC24M without decoupling capacitors

EMIStream

Developed by NEC
Simulation provided by TechDream, Inc.

WWW.FARADFLEX.COM

FARADFLEX®

A PRODUCT OF
OAK-MITSUI TECHNOLOGIES
MITSUI KINZOKU GROUP

US MAIN OFFICE INFORMATION

1030 Hoover Boulevard
Frankfort, Kentucky 40601
sales@faradflex.com
502-682-0165
www.faradflex.com

WORLDWIDE LOCATIONS

Silicon Valley, California
Tsimshatsui Kowloon, Hong Kong
Selangor Darul Ehsan, Malaysia
Shanghai, China
Nantou City, Taiwan
Seoul, Korea