

从容应对高速互连中的电磁挑战

DuPont™ Laird™ 高性能材料



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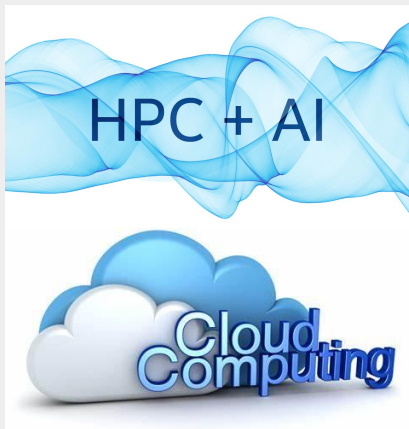
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内容

- 数据中心高速连接面临的电磁挑战
- DuPont™ Laird™ 吸波材料为解决高速互连中的电磁问题独辟蹊径
- 吸波材料改善串扰的仿真示例
- 吸波材料改善高速I/O 辐射仿真示例
- DuPont™ Laird™ 吸波材料介绍
- 杜邦在中国本土的研发生产能力

数据中心高速连接面临的电磁挑战

驱动：高速、低延时



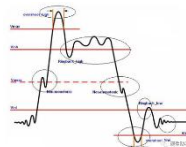
高密度

- 更小的引脚间距
- 更短的传输距离
- 集成与组合



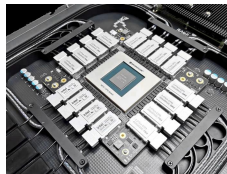
高频

- PCIe5 向 PCIe6演进
- 关注频率从24GHz到40GHz



光传输

- 高密
- 硅光封装
- 共封装CPO
- 更高基频-50GHz



- 更严重的串扰问题！
- 更多谐振！

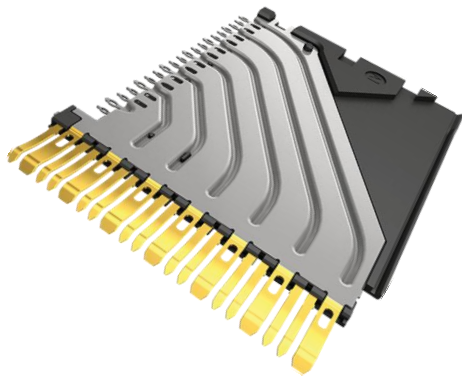
- 更多谐振！
- 更严重的电磁泄露！
- 更严重的串扰问题！

- 更严重的电磁泄露！
- 更严重的串扰问题！
- 更多谐振！
- 复杂系统电磁干扰问题！

DuPont™ Laird™ 吸波材料为解决高速互连中的电磁问题独辟蹊径

传统解决方案：导电材料

- 接地/共地，屏蔽
- 目前广泛采用



图片来源：互联网

痛点：

- 随着频率上升，串扰和谐振越来越难解决
- 高密度，没有足够空间
- 结构复杂，制造难度大，成本高
- 尺寸敏感，高速I/O的电磁辐射难以解决

杜邦解决方案：电磁波吸收材料

- 高磁损，高介电损耗，将电磁能量转化成热
- 高效改善串扰问题
- 抑制谐振
- 同时提高连接器EMI性能
- 对尺寸不敏感，改善HS I/O的频效



仿真示例 - 吸波材料改善串扰

仿真目的 Objective:

吸波材料对远串 (S41) 的影响

Absorber impact to FEXT(S41)

仿真软件 Simulation software:

HFSS

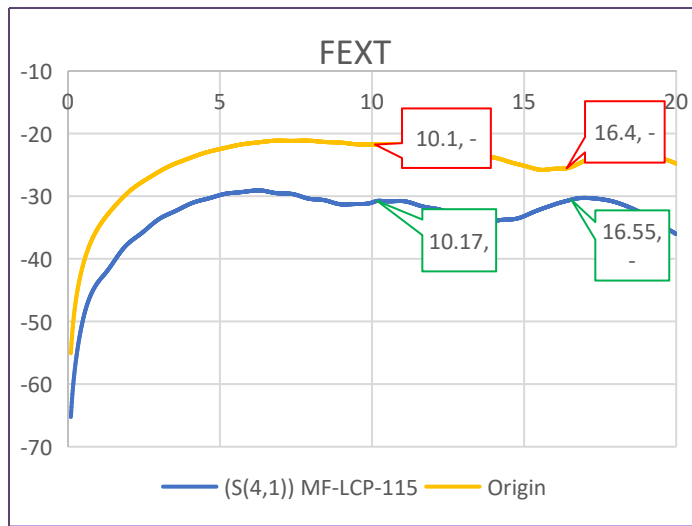
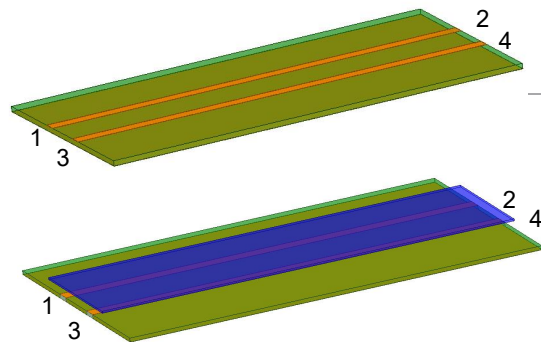
仿真频率 Frequency:

0-20GHz

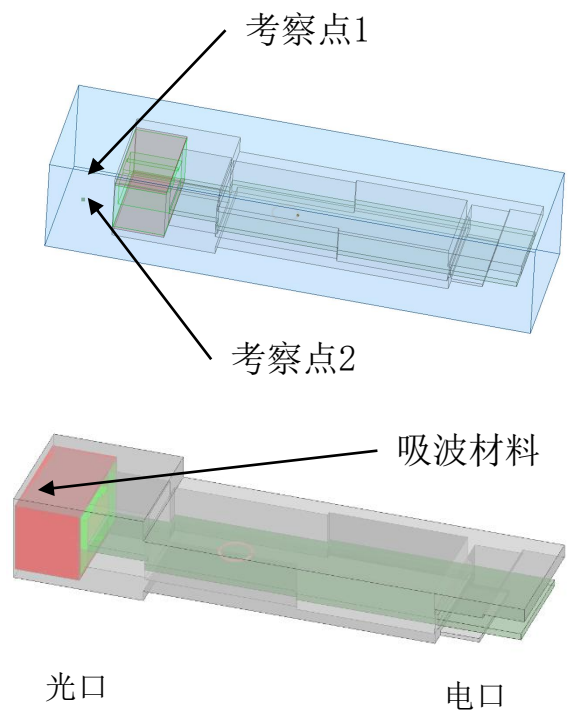
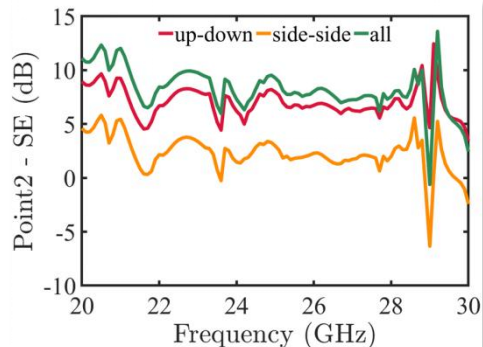
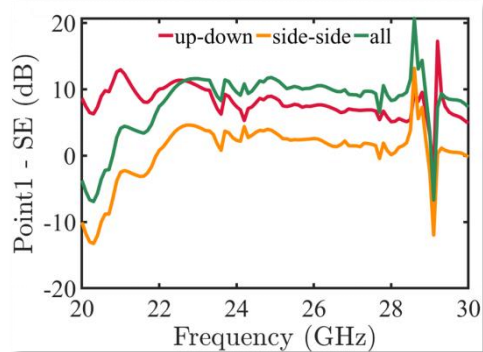
仿真模型 Model: 微带线 Microstrip

- 2.3mm(W) x 80mm(L) x 10mm (Gap)
- 基材 Substrates: Rogers RO4003 (1mm)
- 阻抗 Impedance: 50Ω
- 吸波材料 Absorber: Eccosorb™ MF-LCP-115 (0.5mm)

结论: 吸波材料对于抑制串扰非常有效!



仿真示例 - 吸波材料抑制高速I/O辐射



仿真目的 Objective:

吸波材料对QSFP模块光口辐射的影响
Absorber impact to radiation at Optical fiber I/O of QSFP module

仿真模型 Simulation Model: 100GB QSFP

- 考察点1位于光口正中
- 考察点2位于光口正在下方1/4处
- 吸波材料 Absorber:
MF-LCP-115

结论: 吸波材料可以有效提高I/O高频的频效!

MF-LCP-115 主要特性

主要特性 Key Features

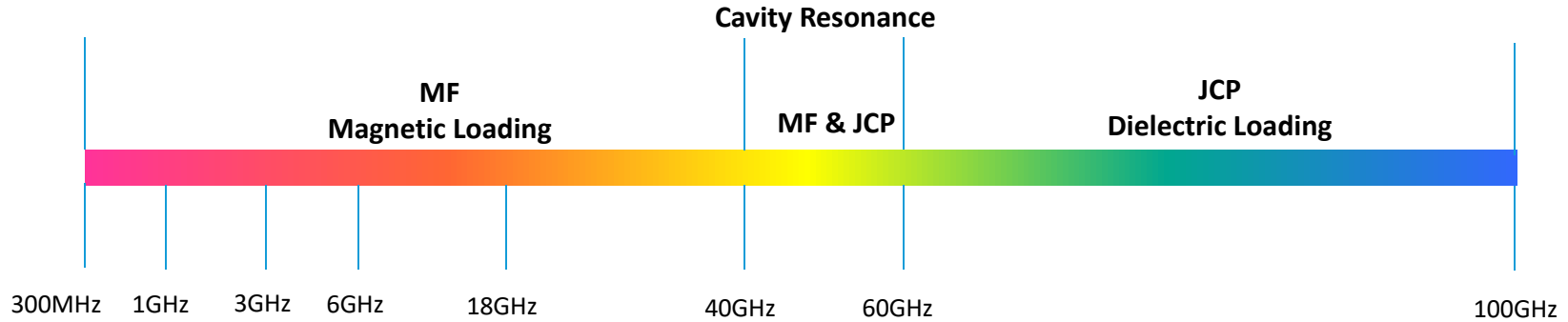
- LCP基材的磁性吸波材料，用于高至40GHz频段
LCP (Liquid Crystal Plastic) based and magnetic loaded for frequency up to 40GHz
- 用于高效的注塑成型工艺，适合大规模生产
Cost effective solution designed for injection molded parts with high volume
- 优异的热稳定性，可耐受回流焊
Outstanding temperature stability, Reflow compliant
- 针对高速连接器应用设计的独特的电磁性能
Unique electromagnetic performance designed high-speed connectors
- 平衡的机械强度和流动性
Balanced mechanical strength and flowability



PROPERTIES	UNIT	TYPICAL VALUE
Color		Dark Grey
Operation Temperature	°C	-40 - 170
Volume resistivity	$\Omega \cdot \text{cm}$	$>10^{15}$
Tensile Strength	MPa	40
Tensile Elongation	%	0.5
Izod notched Impact strength	J/m	22
Flexural Strength		60
Flexural Modules		13
Heat Deflection Temperature	°C	190
CTE, Parallel to Flow		20
Transverse to Flow	E-6/°C (20-150°C)	70
UL Flammability		UL V0 Pending

*Data for design engineer guidance only. Observed performance varies in application. Engineers are reminded to verify the material in application.

DuPont™ Laird™ 注塑吸波材料



	Eccosorb MF-PP	Eccosorb MF-TPE	Eccosorb MF-PA	Eccosorb MF-LCP
Thermoplastic matrix	PP	TPE	PA	LCP
Tensile strength (Mpa)	10,5	6	47	40
Temperature (C)	85	85	170	170
Typical property	General use	Flexible	High temp.	High temp. reflow
Typical application	Cover / Terminator	Terminator	Cover / Terminator	High Speed Connectors

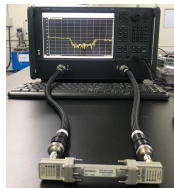
	Eccosorb JCP-PBT-252	Eccosorb JCP-PBT-NT	Eccosorb JCP-PA	Eccosorb JCP-PP9
Thermoplastic matrix	PBT	PBT	PA	PP
Tensile strength (Mpa)	95	130	100	15
Temperature (C)	130	170	170	100
Typical property	general use	general use	High Temp. Snap fit	Flexible / Impact absorbing
Typical application	ADAS radar radome	ADAS radar radome	Radar brackets	Radar brackets

杜邦在中国本土的研发生产能力



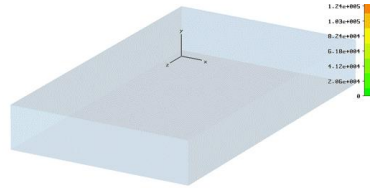
吸波材料开发和生产

- ✓ 杜邦材料科学助力吸波材料配方本土开发
- ✓ 快速开发和打样
- ✓ 注塑吸波材料造粒
- ✓ 吸波材料片材生产



吸波性能测试

- ✓ 吸波材料电磁参数测试和表征
- ✓ 远场反射测试
- ✓ 近场能量衰减测试
- ✓ 客户定制测试



电磁仿真

- ✓ 同时拥有HFSS和CST仿真能力
- ✓ 可以在本地为客户提供设计仿真支持



模具设计和注塑工艺支持

- ✓ 提供模流分析数据包
- ✓ 模具设计支持
- ✓ 注塑工艺参数及应用指南
- ✓ 现场技术支持



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