C01-11

Integral and Integrated Passives Webbook Update - Part 3

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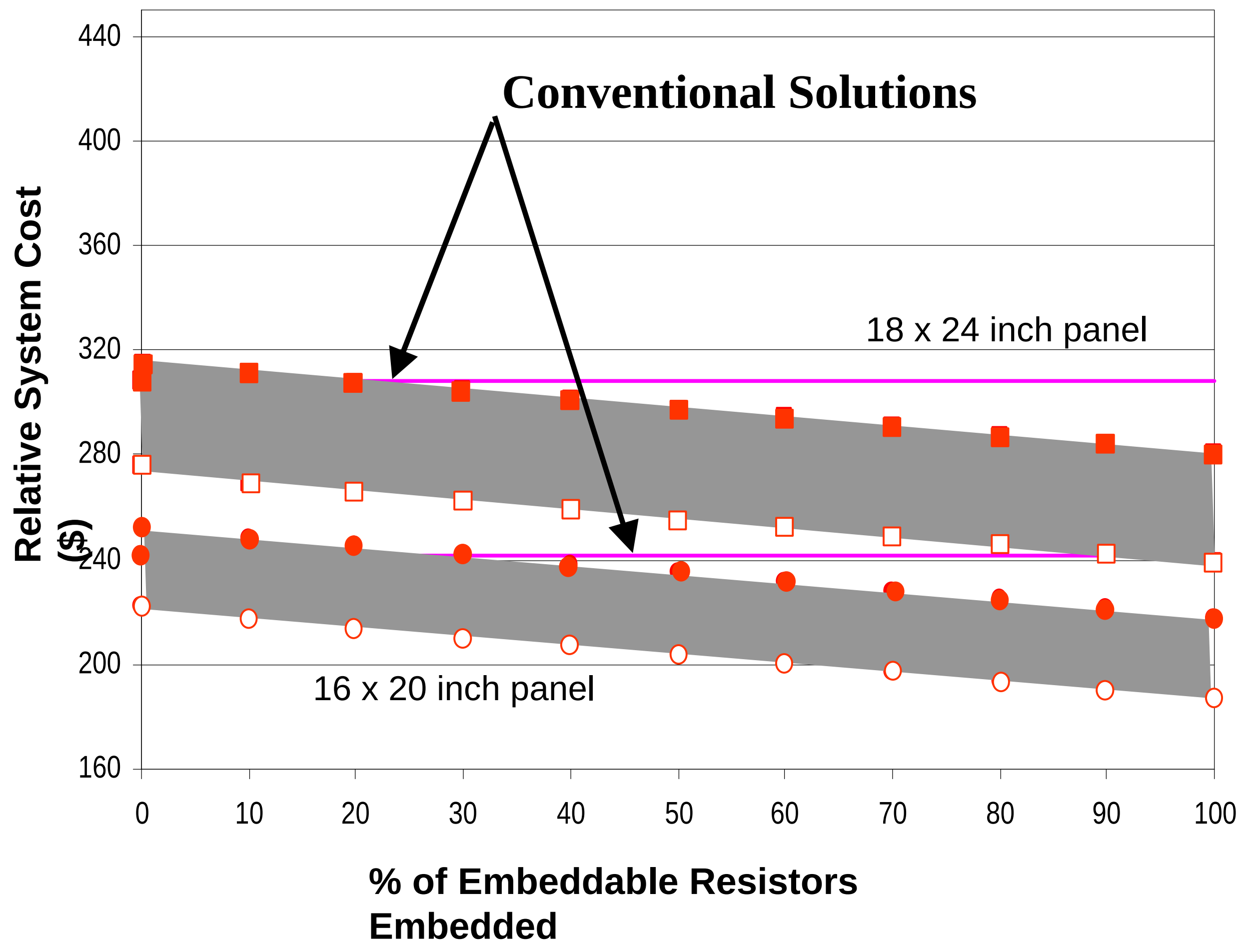
Objective: *Complete an updated review of state-of-the-art integral and integrated passive technologies. Compare size, cost, and performance for systems constructed with and without integral or integrated passive components (resistors and capacitors). Develop guidelines for determining when and how it makes sense to include integral and/or integrated passives within a system (i.e., what system characteristics, if any, indicate the opportunity for cost savings through the use of integral or integrated passives).*

Fiber Channel Card

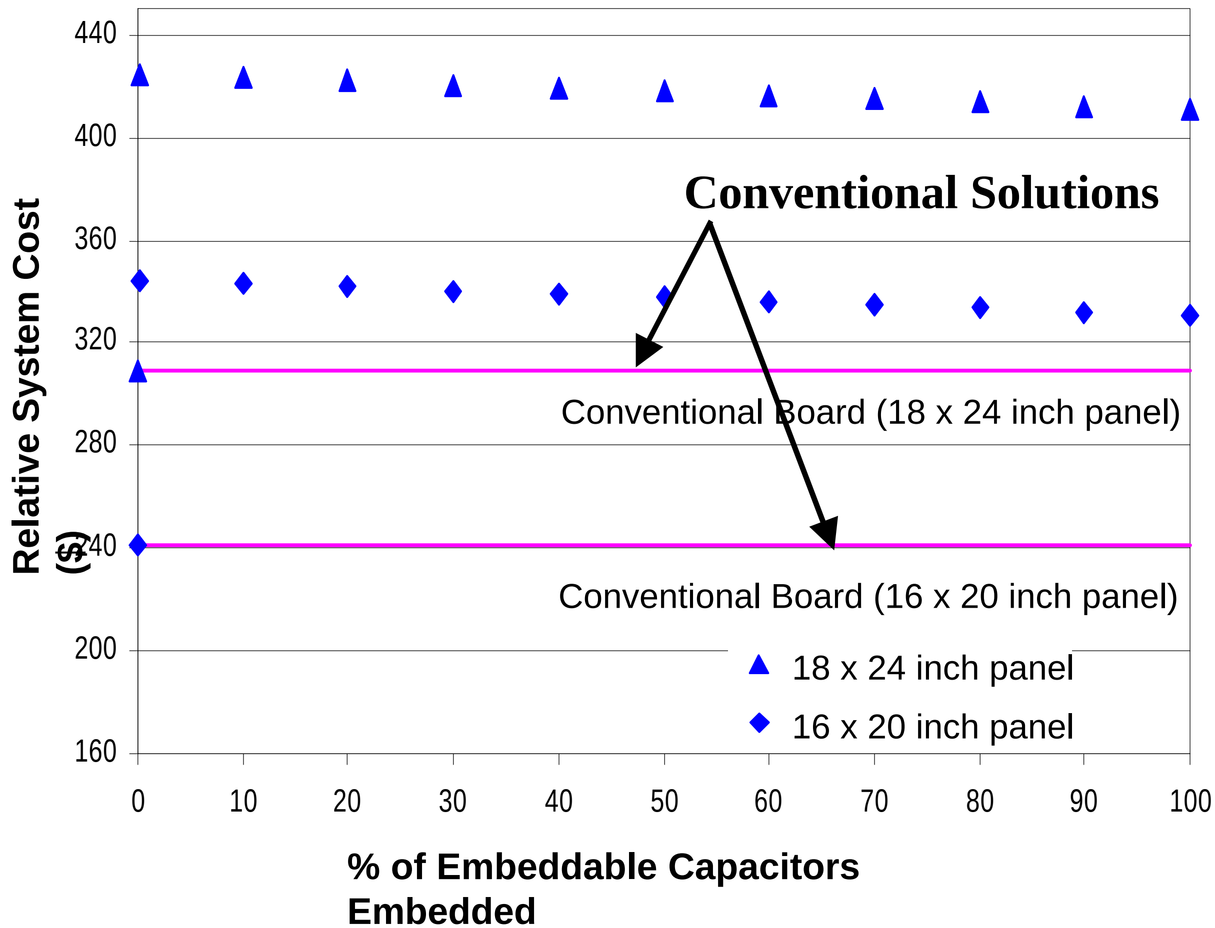
- 12 x 18 inch board
- 12 layers
- Embeddable Passives:
- 242 bypass capacitors
- 610 resistors

Bands represent all possible solutions. Actual answer depends on knowledge of routing statistics for the application



MacDermid M-Pass

Fiber Channel Card



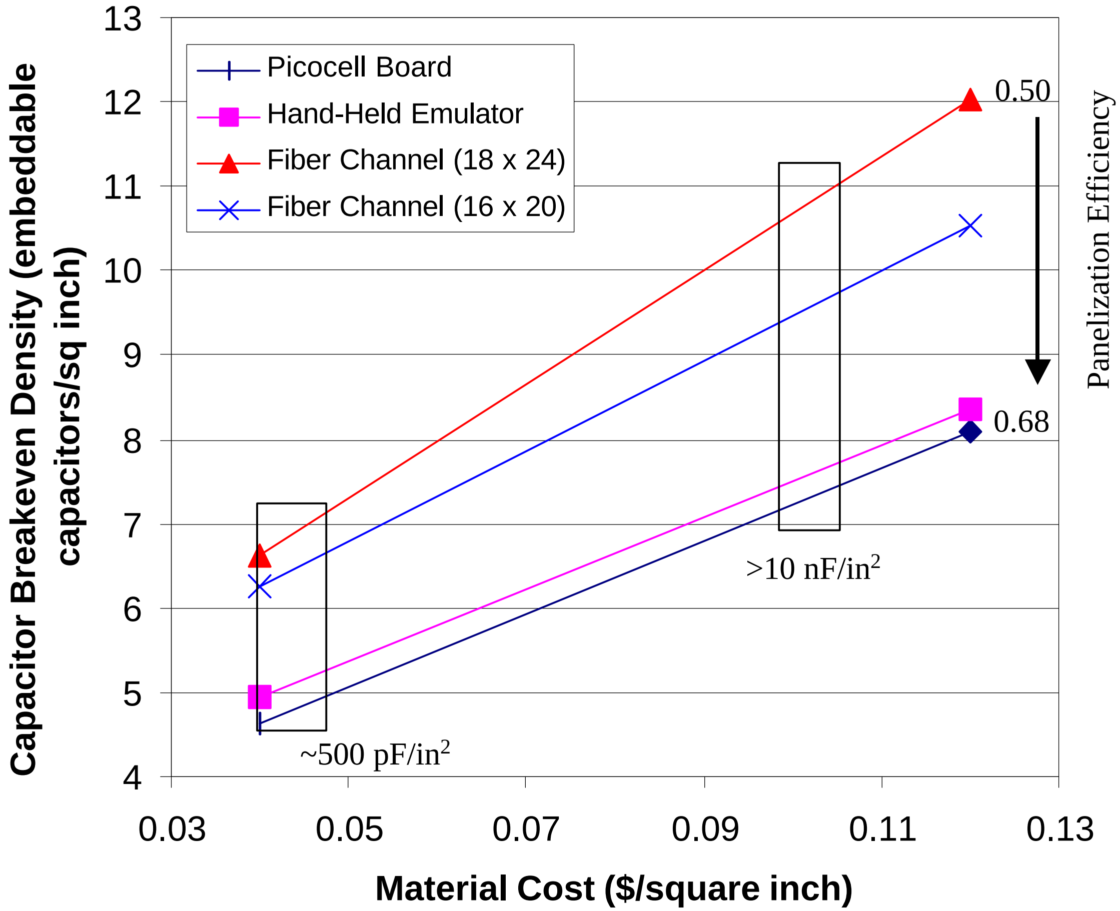
3M C-ply

1.12 embeddable bypass capacitors/square inch

FAR EAST LAYER PAIR FABRICATION

Update of General Bypass Capacitor Embedding Results

Bypass capacitors only – single layer substitution



Capacitor Crossover Density = the density of capacitors at which it becomes cost effective to use embedded capacitors for the specific application.

Assumptions (for this plot):

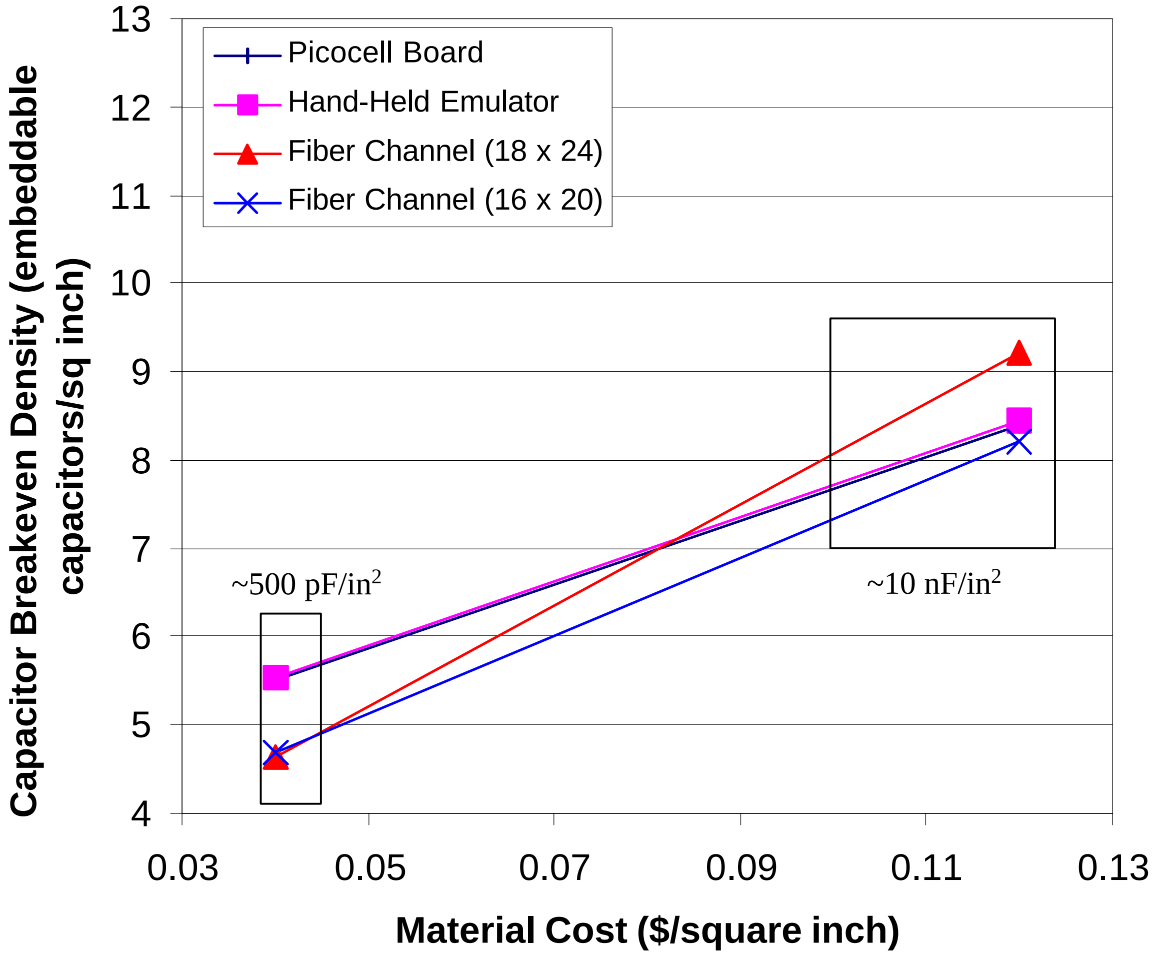
- The number of boards fabricated on a panel is constant as capacitors were embedded
- The number of board layers required for routing is constant as capacitors were embedded

Actual capacitor densities:

- Fiber Channel Board – 1.12 caps/in^2
- Picocell Board – 2.76 caps/in^2
- NEMI Hand Held Emulator – 23.44 caps/in^2
- Avionics Functional Demonstrator – 3.34 caps/ in^2
- Telecom Board – 3.78 caps/ in^2

DOMESTIC LAYER PAIR FABRICATION

Update of General Bypass Capacitor Embedding Results



Bypass capacitors only – single layer substitution

NIST Advanced Embedded Passives Technology (AEPT) Consortium

NCMS
Nortel
Compaq
Delphi
Merix
(Sanmina)
MicroFab
Coretec
ESI
3M
Dupont
MacDermid
(Ormet)
CALCE
Cadence
(ITRI)

NIST work is supplementing the work in the C01-11 project:

	CALCE C01-11	CALCE Involvement in NIST AEPT Consortium
Shared	• Model enhancements: – Ohmega-Ply – Single/double sided – Others … • Model implementation • Case studies: – Boeing – Others …	• Original model formulation • Case studies: – Picocell (Nortel) – NEMI emulators – StorTek Fiber channel board – Nortel boards – Others …
Proprietary	• Integrated passives models • Technology review web book	• Process models • Detailed emulator tradeoff studies

Benefits to Members

- Web-based capability to perform application-specific tradeoff analysis for the conversion of discrete passives to embedded passives
- Generalized embedded bypass capacitor results indicating embeddable capacitor densities necessary for economic viability
- On-line application case studies
- Up-to-date review of embedded and integrated passive technologies including a comprehensive materials summary

C02-03 Project Preview

Tradeoff Tool Extensions:

- Resistor laser trimming throughput models – with ESI
- Generalize model inputs and outputs - with Merix
- Additional case studies
- Integrated passives tradeoff analysis
- Integration with Cadence Allegro – with Cadence*

Board Reliability Analysis:

- Merix will build embedded resistor test vehicles for environmental testing of M-Pass resistors
- Negotiating to build C-Ply test vehicle

Webbook Updates:

- New materials will be added (and old ones subtracted) as things change

*Subject to approval by the NIST AEPT Consortium