

Ohmega[®] / FaradFlex[®]

EMBEDDED RESISTANCE / CAPACITANCE

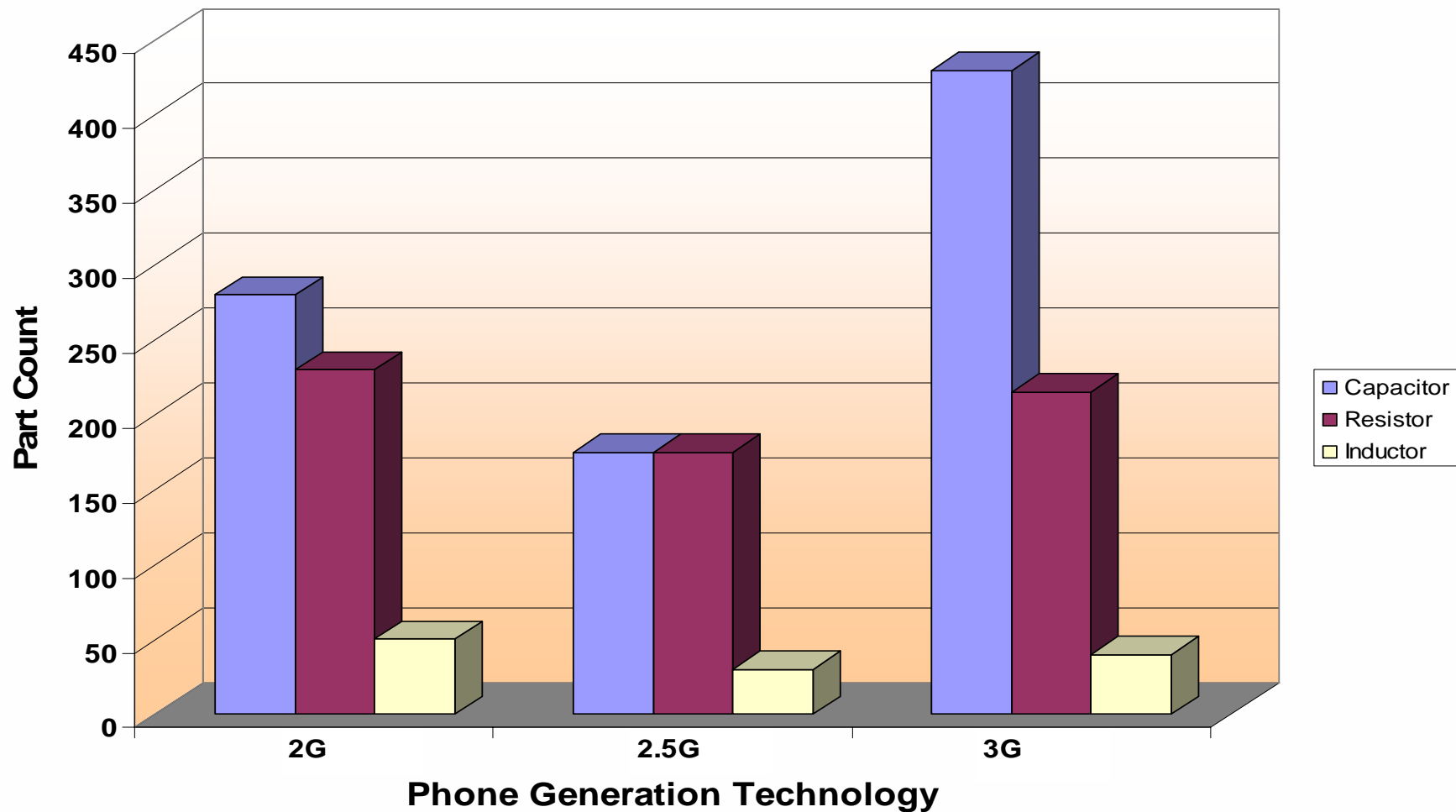
Bruce Mahler

Ohmega Technologies, Inc

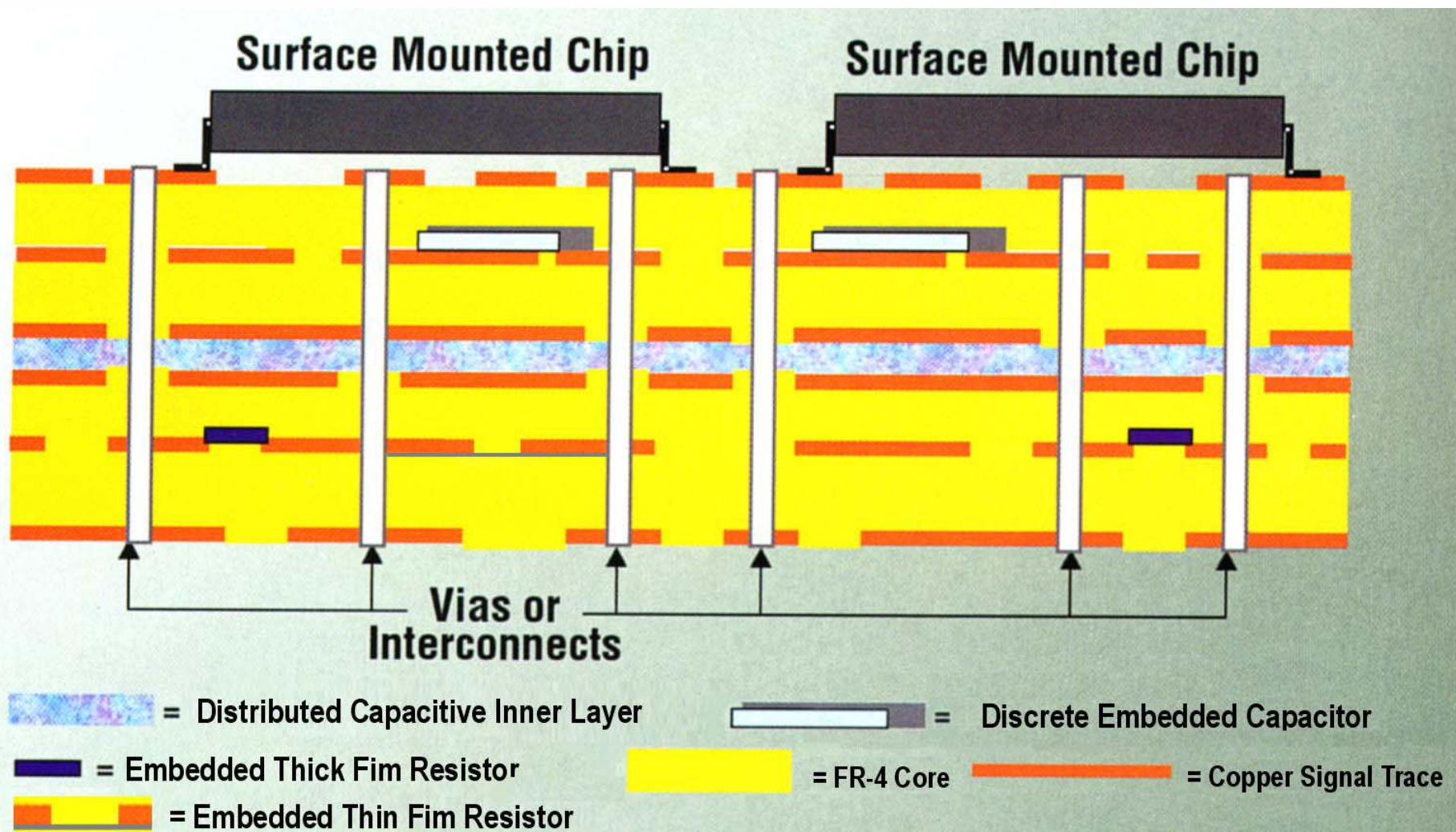
- Growing number of PCBs with embedded passives.
- Driven by high frequencies and miniaturization,
- Embedding resistors within existing layers.
- Embedding capacitance between layers.
- Many PCBs with both BR and BC in separate cores
- Technical advantages combining BR and BC in same core.
- Economic advantages of a combined BR and BC product

| System | Total Passives | Total Ics | Ratio |
|----------------------------|----------------|-----------|-------|
| CELLULAR PHONES | | | |
| Ericsson DH338 Digital | 359 | 25 | 14:1 |
| Ericsson E237 Analog | 243 | 14 | 17:1 |
| Philips PR93 Analog | 283 | 11 | 25:1 |
| Nokia 2110 Digital | 432 | 21 | 20:1 |
| Motorola Md 1.8 GHz | 389 | 27 | 14:1 |
| Casio PH-250 | 373 | 29 | 13:1 |
| Motorola StarTAC | 993 | 45 | 22:1 |
| Matsushita NTT DOCOMO 1 | 492 | 30 | 16:1 |
| CONSUMER PORTABLE | | | |
| Motorola Tango Pager | 437 | 15 | 29:1 |
| Casio QV10 Digital Camera | 489 | 17 | 29:1 |
| 1990 Sony Camcorder | 1226 | 14 | 33:1 |
| Sony Handy Cam DCR-PC7 | 1329 | 43 | 31:1 |
| OTHER COMMUNICATION | | | |
| Motorola Pen Pager | 142 | 3 | 47:1 |
| Infotac Radio Modem | 585 | 24 | 24:1 |
| Data Race Fax-Modem | 101 | 8 | 13:1 |
| PAD | | | |
| Sony Magic Link | 538 | 74 | 7:1 |
| COMPUTERS | | | |
| Apple Portable Logic Board | 184 | 24 | 8:1 |
| Apple G4 | 457 | 42 | 11:1 |

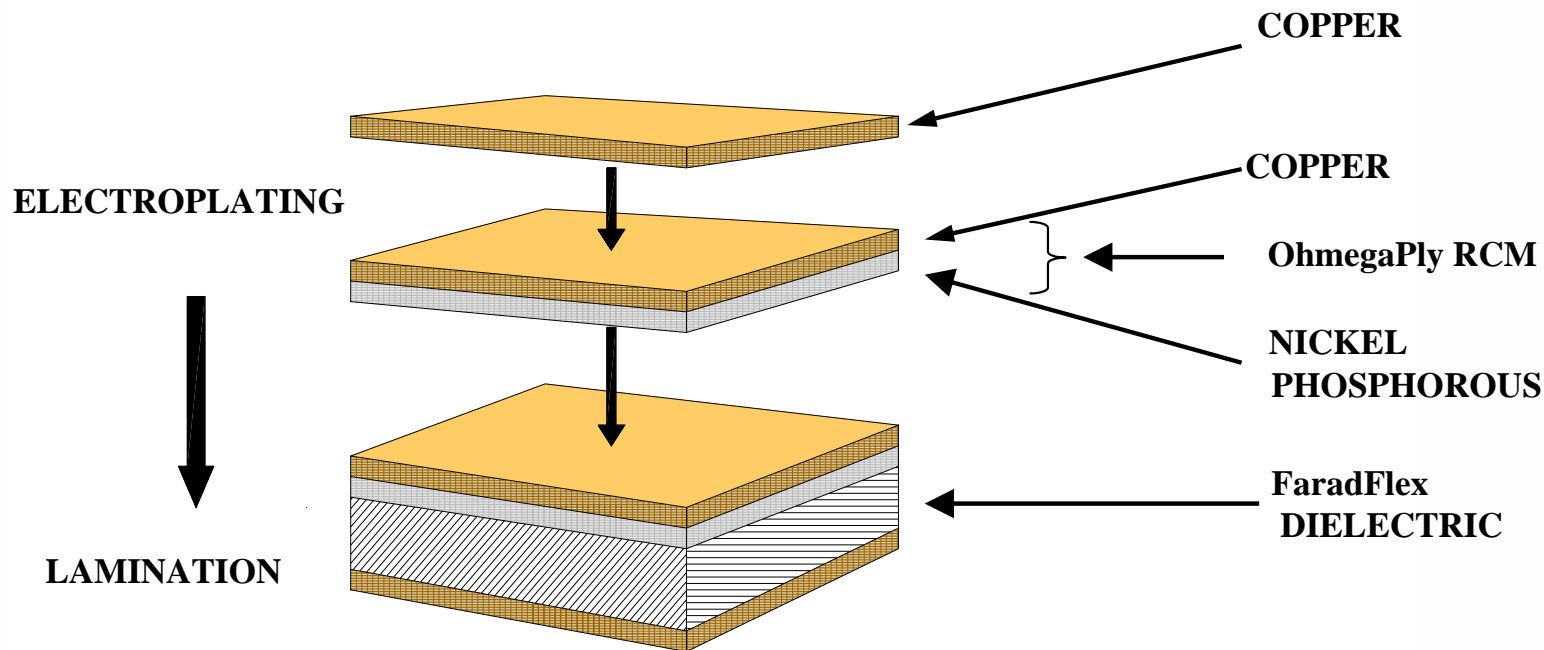
EMBEDDED PASSIVE PARTS IN PHONE



Cross Section View of PCB Board Containing Embedded Passive Component



Ohmega/FaradFlex[®] is a combined product of an OhmegaPly[®] thin film NiP alloy electrodeposited on copper foil that is laminated to a FaradFlex[®] dielectric material and subtractively processed to produce embedded RC Networks.



| Sheet Resistivity | Ohmega-Ply [®] Film Average Thickness | Material Tolerance |
|----------------------|---|--------------------|
| 10 Ω/\square | 1.00 Micron | 3% |
| 25 Ω/\square | 0.40 Micron | 5% |
| 50 Ω/\square | 0.20 Micron | 5% |
| 100 Ω/\square | 0.10 Micron | 5% |
| 250 Ω/\square | 0.05 Micron | 10% |

- Combined Laminate Product.
- Resistance and Capacitance in the same core.
- Developed to accommodate high density designs.
- Embedded Resistor and RC Networks
- Improve signal integrity by better impedance matching.
- Improve signal to noise ratios.
- Standard PCB Subtractive Processing.
- Greater cost effectiveness than separate BR and BC cores.

Electrical Advantages

1. Improved line impedance matching,
2. Shorter signal paths and reduced series inductance,
3. Eliminate the inductive reactance of the SMT device,
4. Reduced cross talk, noise and EMI

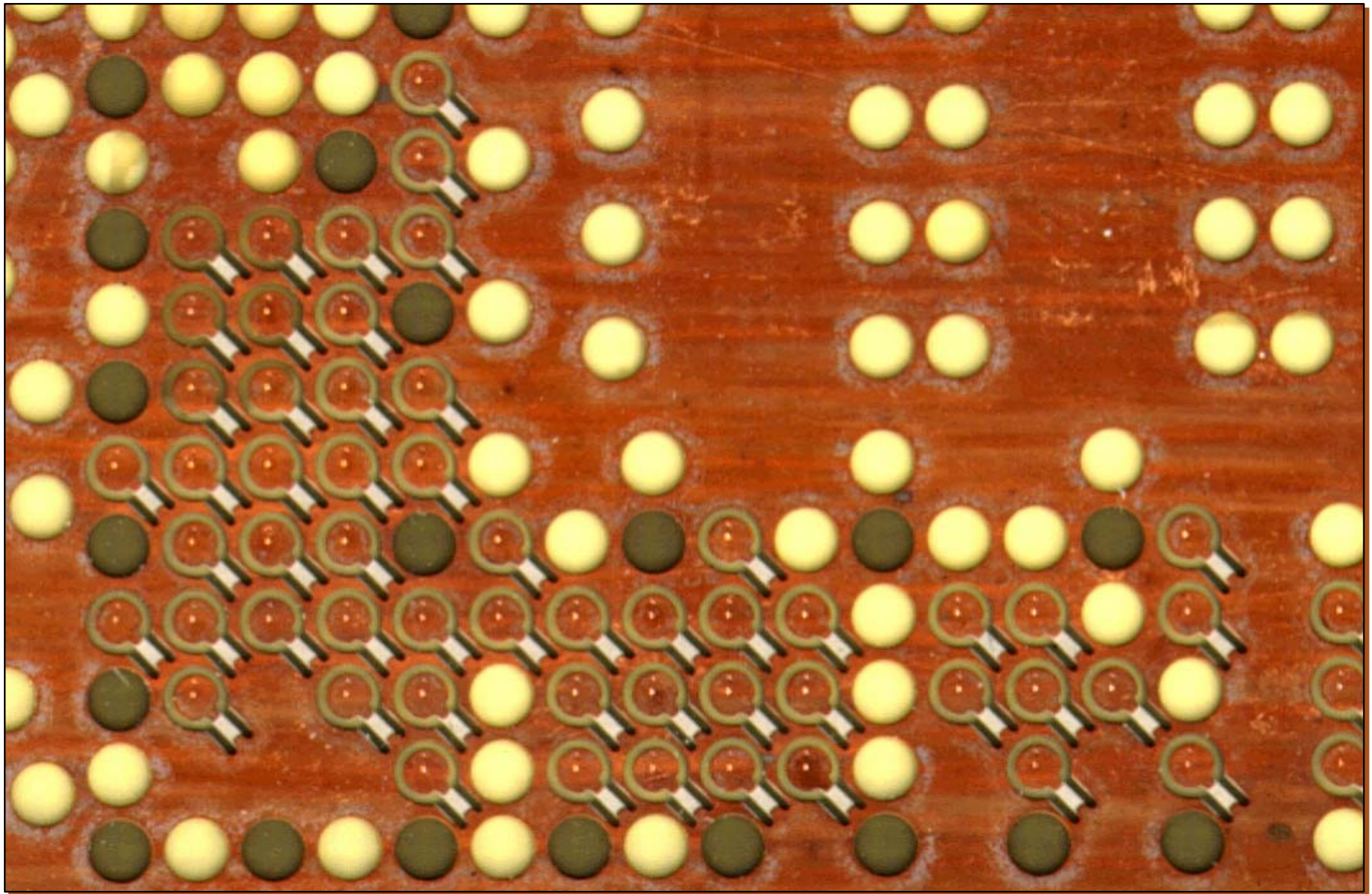
PCB Design Advantages

1. Increase active component density & reduced form factors,
2. Improved wireability due to elimination of via.
3. Improved reliability due to elimination of solder joints.

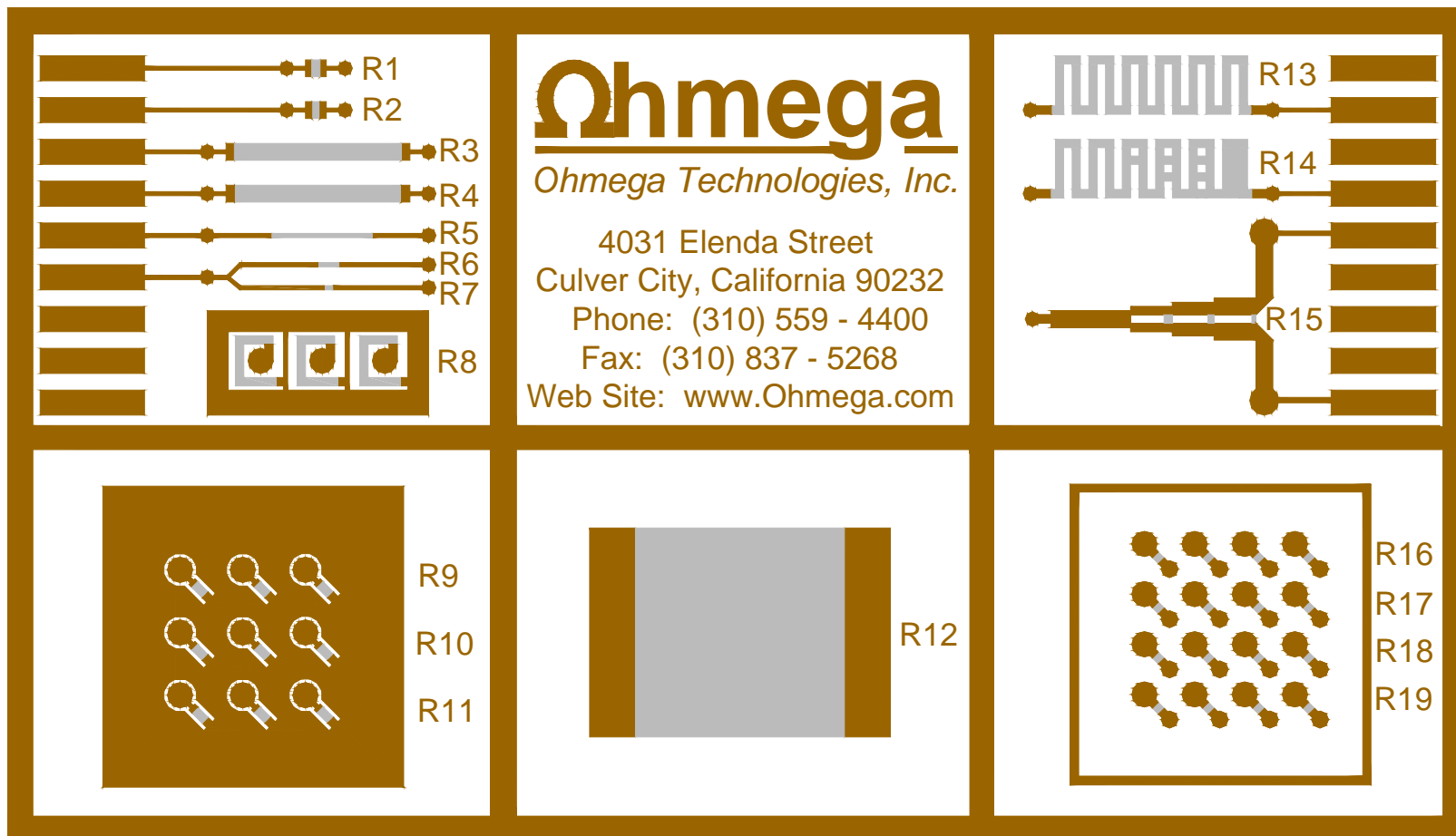
Economic Advantages

1. Elimination of discrete resistors and capacitors.
2. Improved assembly yield
3. Board densification and/or size reduction

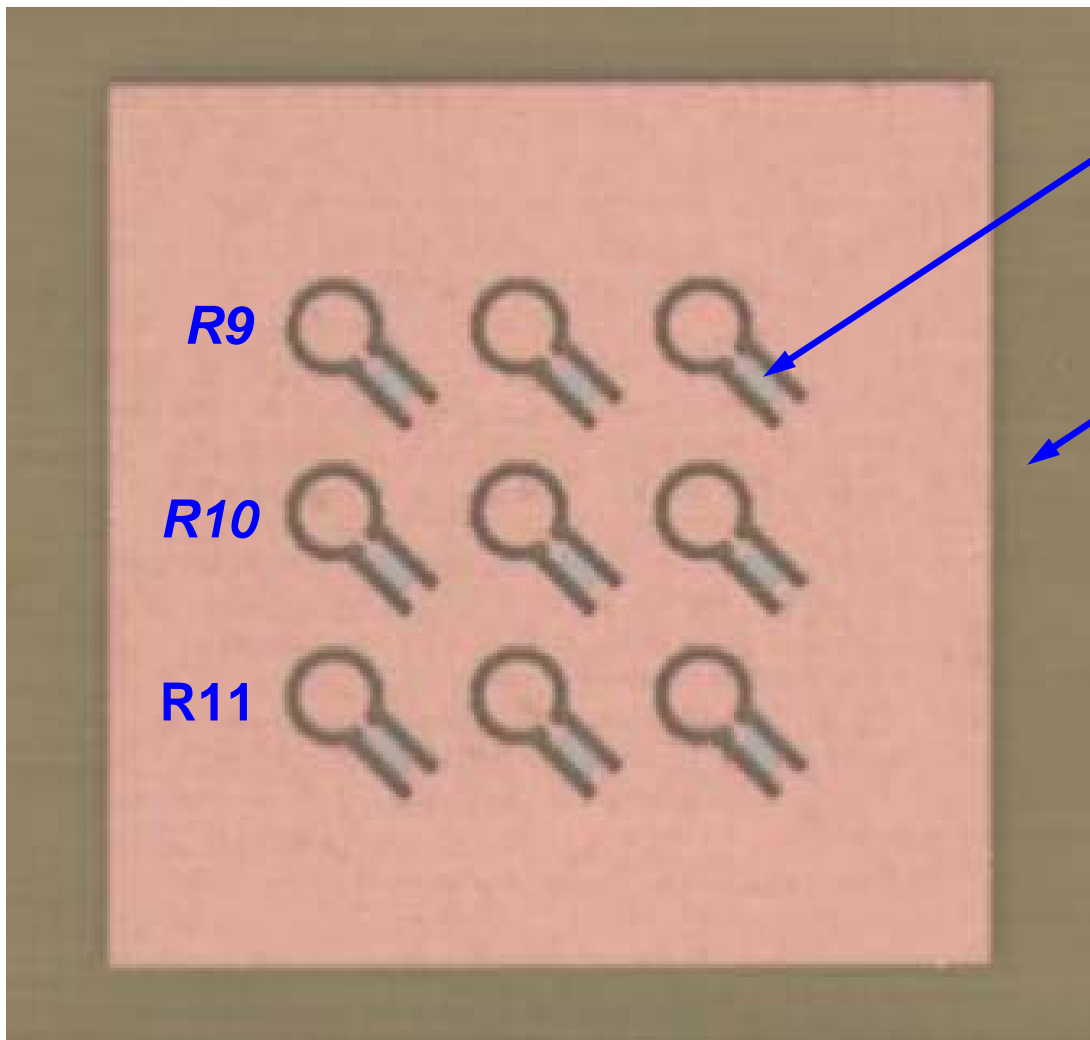
| Properties | Method | Ohmega/FaradFlex Core |
|--|-----------------------|-----------------------|
| Copper Weight, μm | Nominal | 35 |
| Sheet Resistivity, ohms / square | Nominal | 10-250 |
| Dielectric Thickness, μm | Nominal | 24 |
| Cp@ 1MHz, nF/in ² (pF/cm ²) | IPC-TM 650 2.5.5.3 | 1.0 (155) |
| Dk @1MHz | IPC-TM 650 2.5.5.3 | 4.4 |
| Loss Tangent @ 1MHz | IPC-TM 650 2.5.5.3 | 0.015 |
| Peel Strength, lbs/in | IPC-TM 650 2.4.9 | 5.0 |
| Dielectric Strength, kV/mil | IPC-TM 650 2.5.6.3 | 5.3 |
| Tensile Strength, Mpa(kpsi) | ASTM D-882 A | 152(22.0) |
| Elongation, % | ASTM D-882 A | 18.5 |



▲ *Example of combined product with terminating resistors in an existing layer.*



▲ *Example of RC Networks in Demo PCB*



OhmegaPly[®] resistors

Faradflex[®] material

Resistors (R9, R10 & R11)

• 44 Ω nominal

Capacitance (0.6 nF)

• 1.2 nF/in²

- Ohmega/FaradFlex results in reliable embedded passives on a single embedded core.
- Meets all OhmegaPly Specifications.
- FaradFlex doubles the capacitance of ZBC cores.
- Any PCB manufacturer capable of making BR and BC cores can produce Ohmega/FaradFlex PCBs.
- Cost advantage of combined product due to reduced form factors, layer count and elimination of greater numbers of SMTs.

The author would like to express his thanks for assistance in this project to:

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