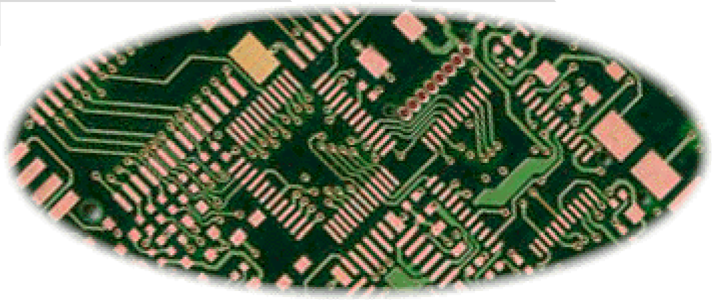
Elmatica

DNU Arendal
September 2008

Josse



Elmatica

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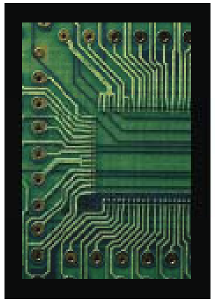
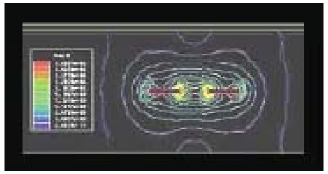
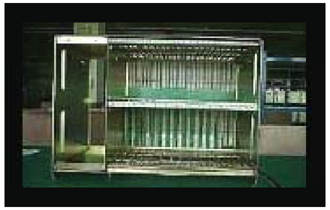
DESIGN FOR COST OPTIMIZATION



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This presentation will…….

- Present the cost impact of many of the PCB cost attributes.
- Help to provide some guidance of attribute selection during the design phase of the product.
- Provide realization that PCB's are custom designed and require early supplier involvement to achieve the most cost effective product.

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General information…

- Historically the industry has been able to gain cost reductions by transferring product across the globe. In order to remain competitive moving forward, it is essential that there is an understanding how to design for optimum cost effectiveness.

- Manufacturers tries to brings value in understanding that PCBs are custom products whose costs are driven by a multitude of different attributes including; size, material, technology, etc., and our technical involvement can help to minimize the impact of these costs on the final product.

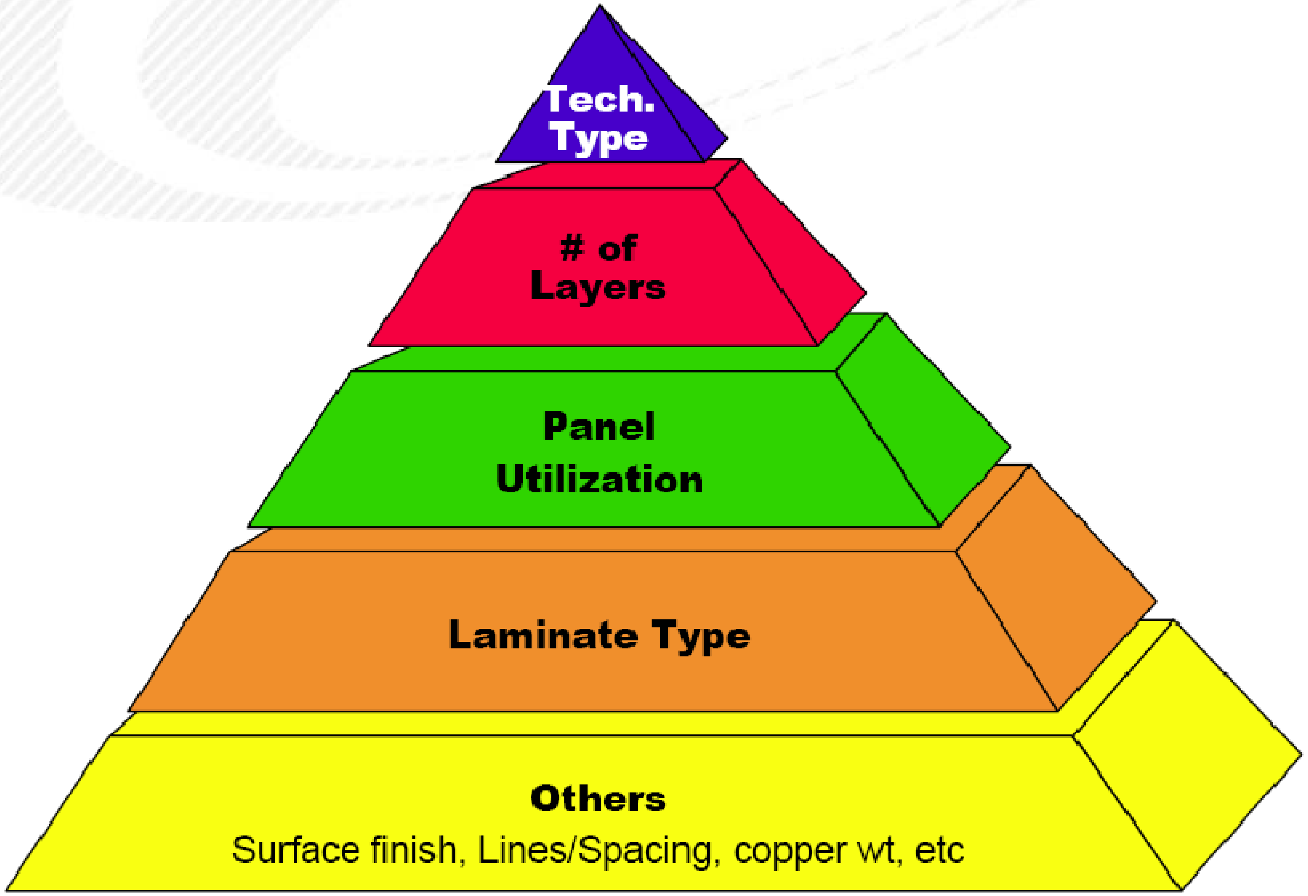
General information…continue

- All data shown in this presentation reflect average price adders to illustrate trends as attributes are changed.

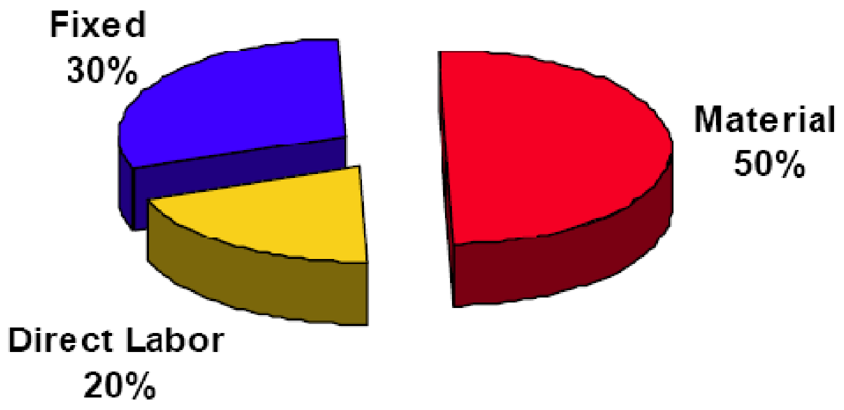
- Data in all the charts is derived from the following product conditions:

  Regular FR-4 Material
  5 mils (0.127mm) lines & spacing.
  25 mils (0.635mm) SMT pitch
  13 mils (0.3mm) Finished Hole Size
  50 holes/sq.in.
  SMOBC/HASL

Hierarchy of Cost impact

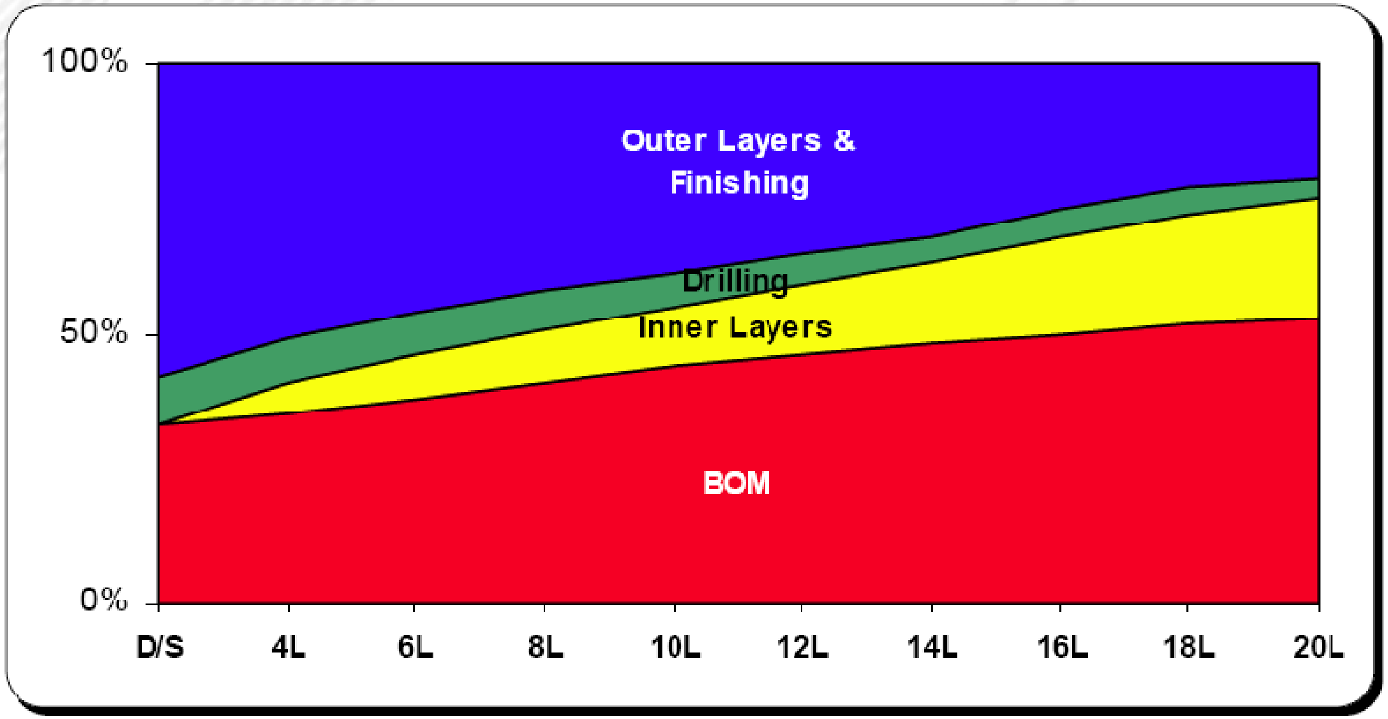


General Cost Breakdown



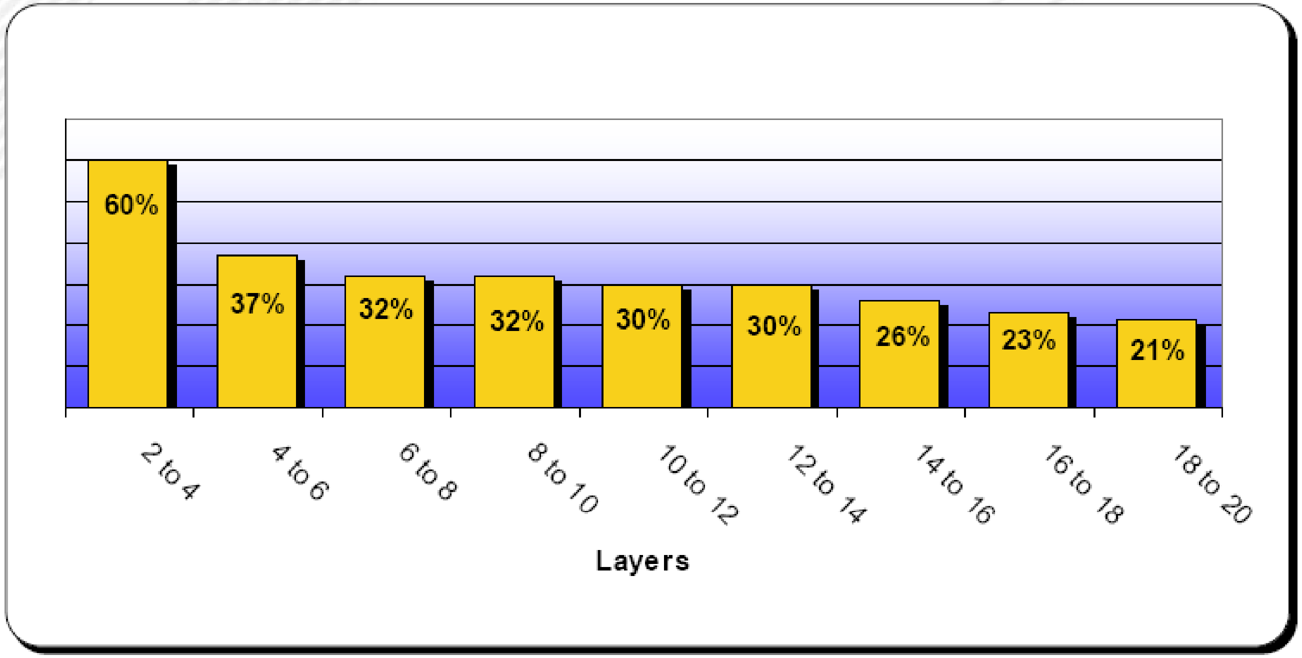
This chart represents the 'Total Manufacturing Cost'breakdown.

Cost Breakdown



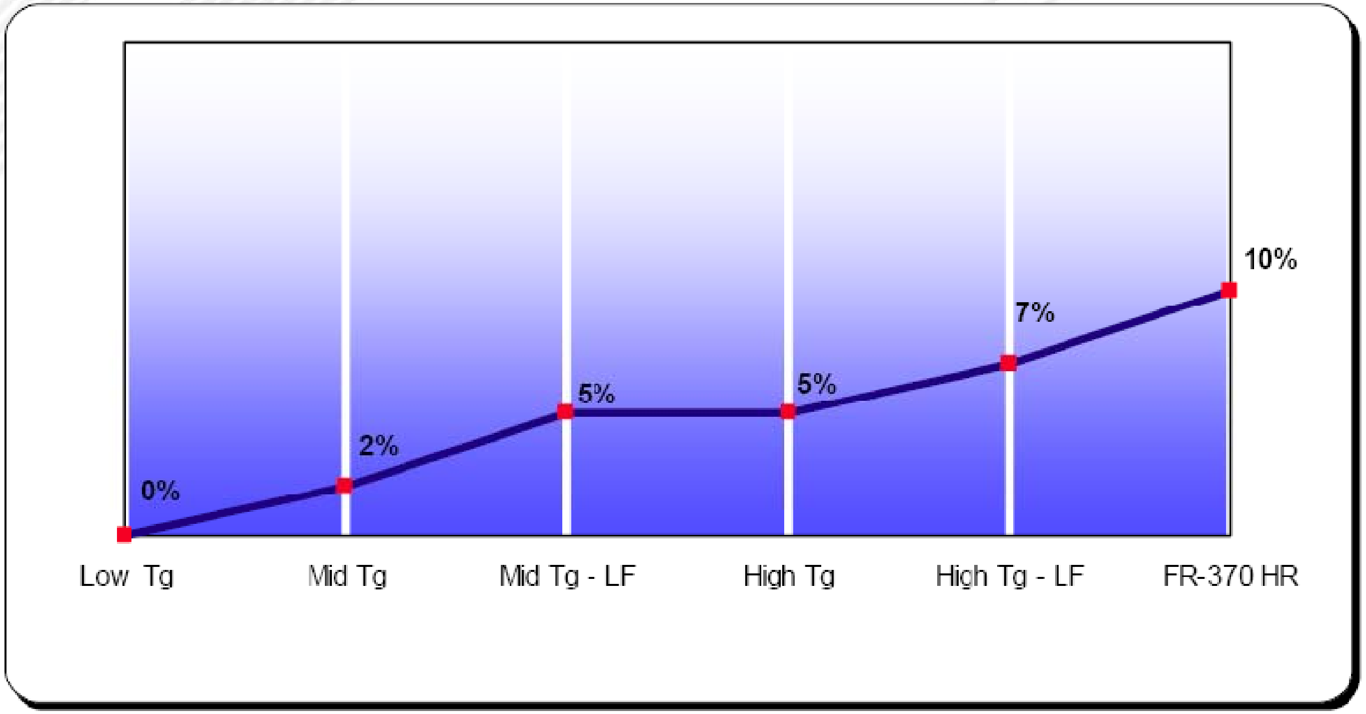
This chart represents the breakdown of the major cost components of a PCB..

Layer to Layer Differential



This chart illustrates the cost impact as you increase form one layer count to another.
All other product attributes are assumed to be identical.
A medium complexity product was used for comparison purposes.

Laminate Types



This data reflects the cost impact of different raw materials for a 10 layer board, and takes into consideration the variation in processing costs and yield implications.

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Material selection guide:

Laminate groups

Group	IPC 4101B/	Min Tg	Min Td	Max ZCTE
Low Tg	101/121	135	310	4,00 %
High Tg	99/124	150	325	3,50 %
Very High Tg	126/129	170	340	3,00 %

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Material selection guide:

Laminate groups related to PCB technology

Group	Standard spec	Laminate spec (Minimum values)			
	PCB thickness< 1,8 mm	**IPC 4101B/**	Min TG	Min Td	Max ZCTE
Low Tg	1-2 layer < 1,8 mm	101/121	135	310	4,00 %
Low Tg	ML 4-8 std < 1,8 mm	101/121	135	310	4,00 %
High Tg	ML 4-8 blind/buried	99/124	150	325	3,50 %
High Tg	ML 10+ std	99/124	150	325	3,50 %
Very High Tg	ML 10+ Blind/Buried	126/129	170	340	3,00 %

Group	Standard spec	Laminate spec (Minimum values)			
	PCB thickness > 1,8 mm	**IPC 4101B/**	Min TG	Min Td	Max ZCTE
High Tg	1-2 layer > 1,8 mm	99/124	150	325	3,50 %
High Tg	ML 4-8 std > 1,8 mm	99/124	150	325	3,50 %
Very High Tg	ML 4-8 blind/buried	126/129	170	340	3,00 %
Very High Tg	ML 10+ std	126/129	170	340	3,00 %
Very High Tg	ML 10+ Blind/Buried	126/129	170	340	3,00 %

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Tg - Glassforvandlingstemperatur

Tg er den temperauren der epoxyen går fra hard til myk form. Overgangen fra hard til mykere form starter noen grader under selve Tg punktet. Tg beaskrives i IPC TM650 2.4.24C og i TM650 2.4.25

T260/T288/T300 – Tid til delaminering

T260/288/300 er en test på den tiden det tar før laminatet delaminerer i den angitte temperatur. Testen viser tydelig hva laminatet tåler av loddetemperaturer. Testen beskrives i IPC TM650 2.4.24-1.

Td - den temperatur hvor materialet mister 5% av sin masse

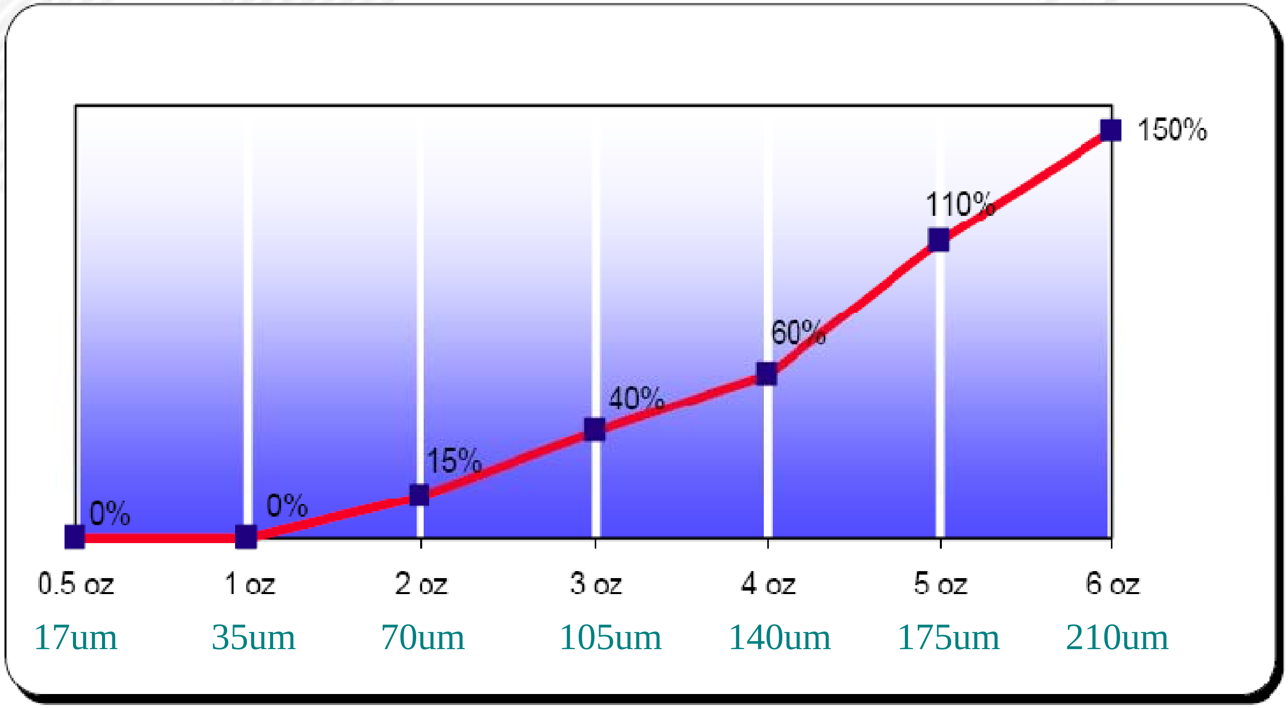
Td er grenseverdien i temperatur for når materialet brytes ned og mister 5% i vekt under oppvarming ved 10°C/min. opp til maksimalt 550°C. Testen viser hva laminatet tåler av temperatur før massen brytes ned. Testen beskrives i IPC 650 2.4.24-6.

Z-CTE – Termisk utvidelse i z-aksen (kortets tykkelse)

Z-CTE måles både som PPM per grad C, eller som den totale materialutvidelsen fra 50-260°C, målt i prosent. Spesielt er det interessant å vite utvidelsesgraden over Tg punktet. Her akselererer utvidelsen sterkt. Det er i dette området de gode laminatene skiller seg ut!

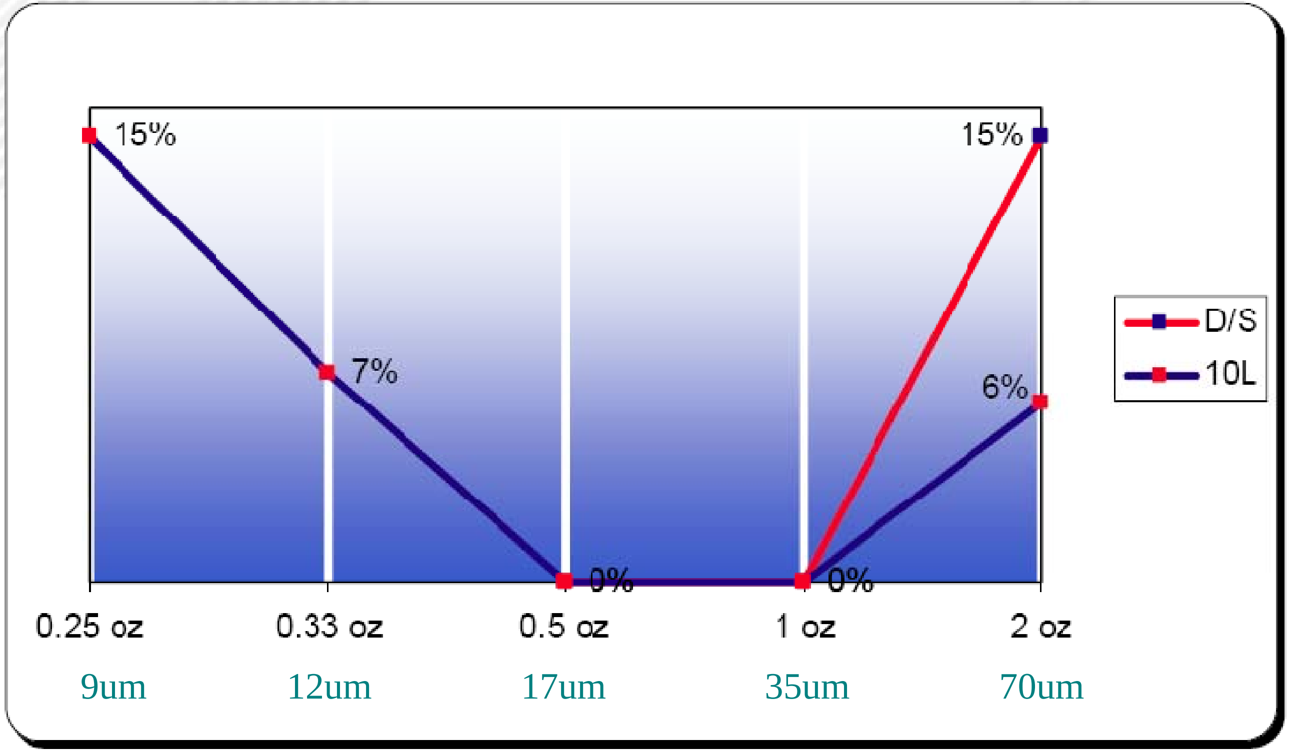
Z-CTE beskrives i IPC TM650 2.4.24C

Copper Thickness –Internal



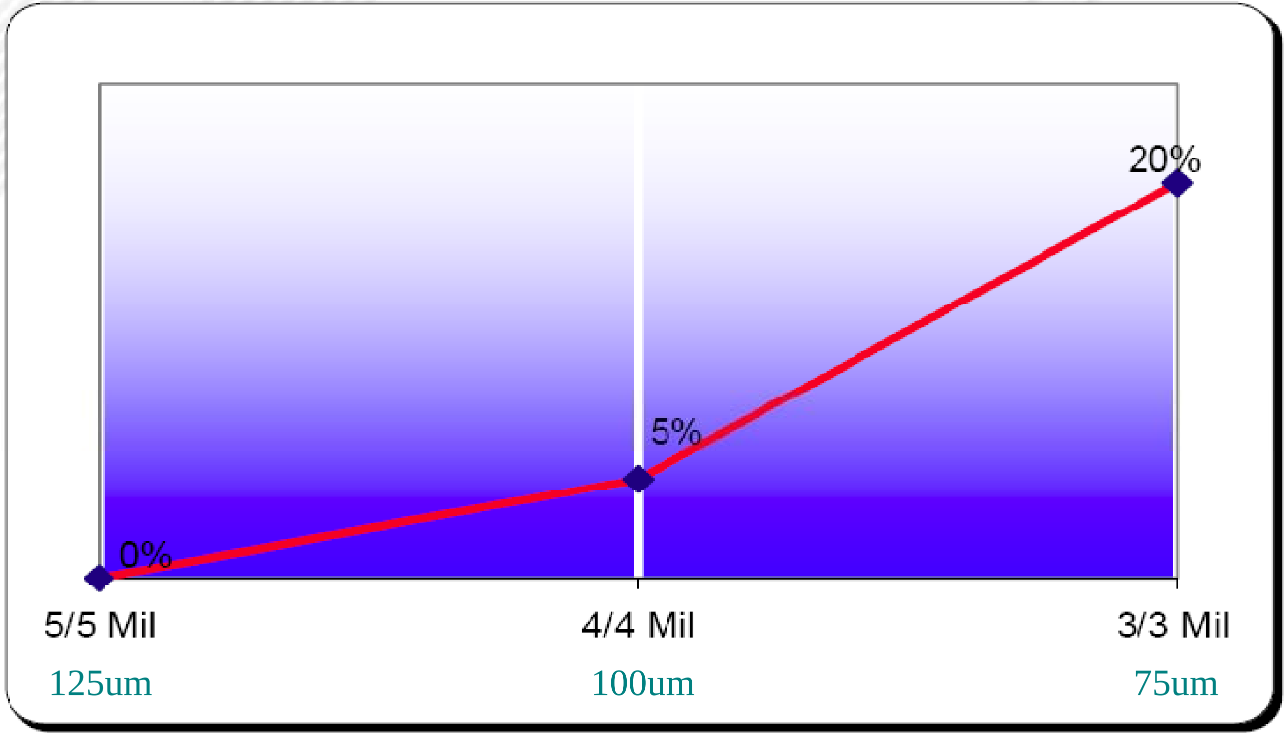
Data provided is reflective of the copper weight impact on a typical PCB. Increased material and processing costs are reflected in the data for 2 oz copper and greater.

Copper Thickness –Outer layers



Data is reflective of the starting copper weights prior to plating . Increased processing costs are reflected in the data for 70um copper,
and yield impacts are reflected in the data for copper weights less than 17um.

Layer Track Width & Spacing –Int./Ext.



This data takes into considerations the variation in processing costs and yield implications.

There is a slight decrease for lines and spacing greater than 6 mil (150um)

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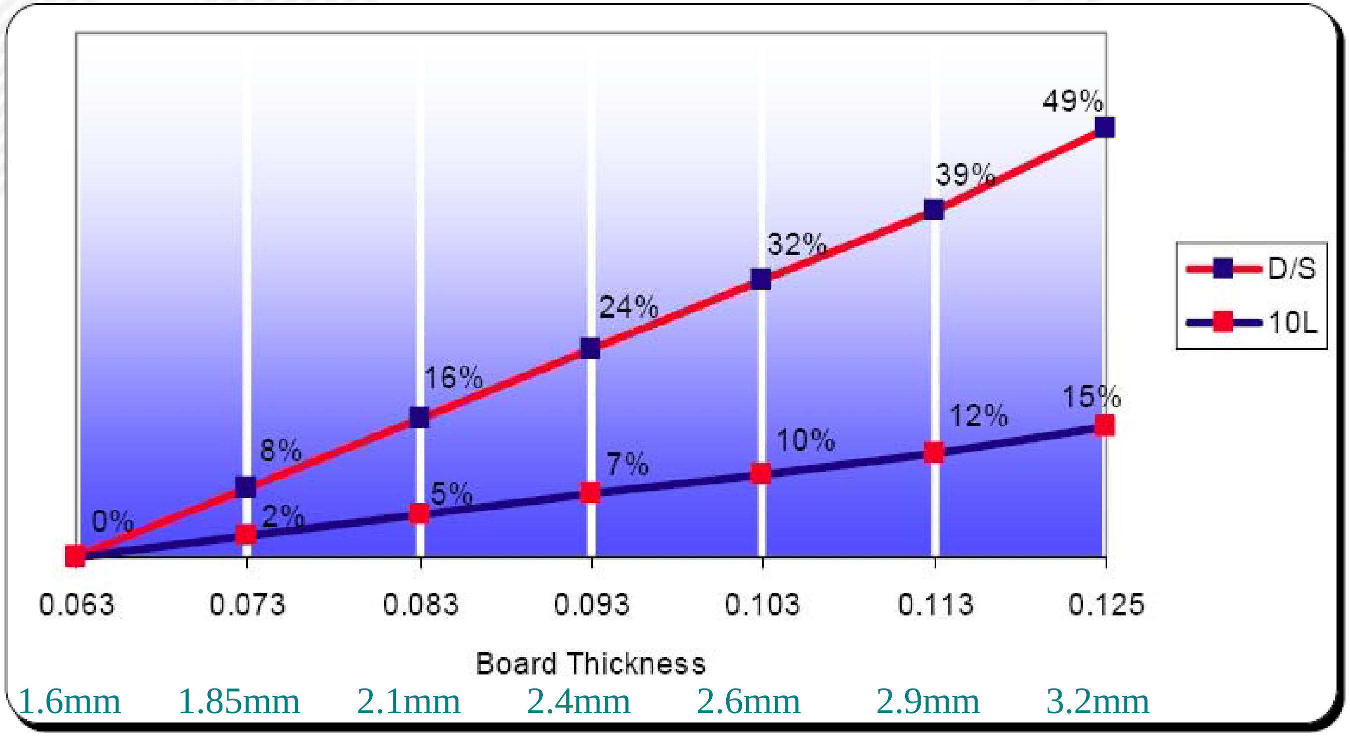
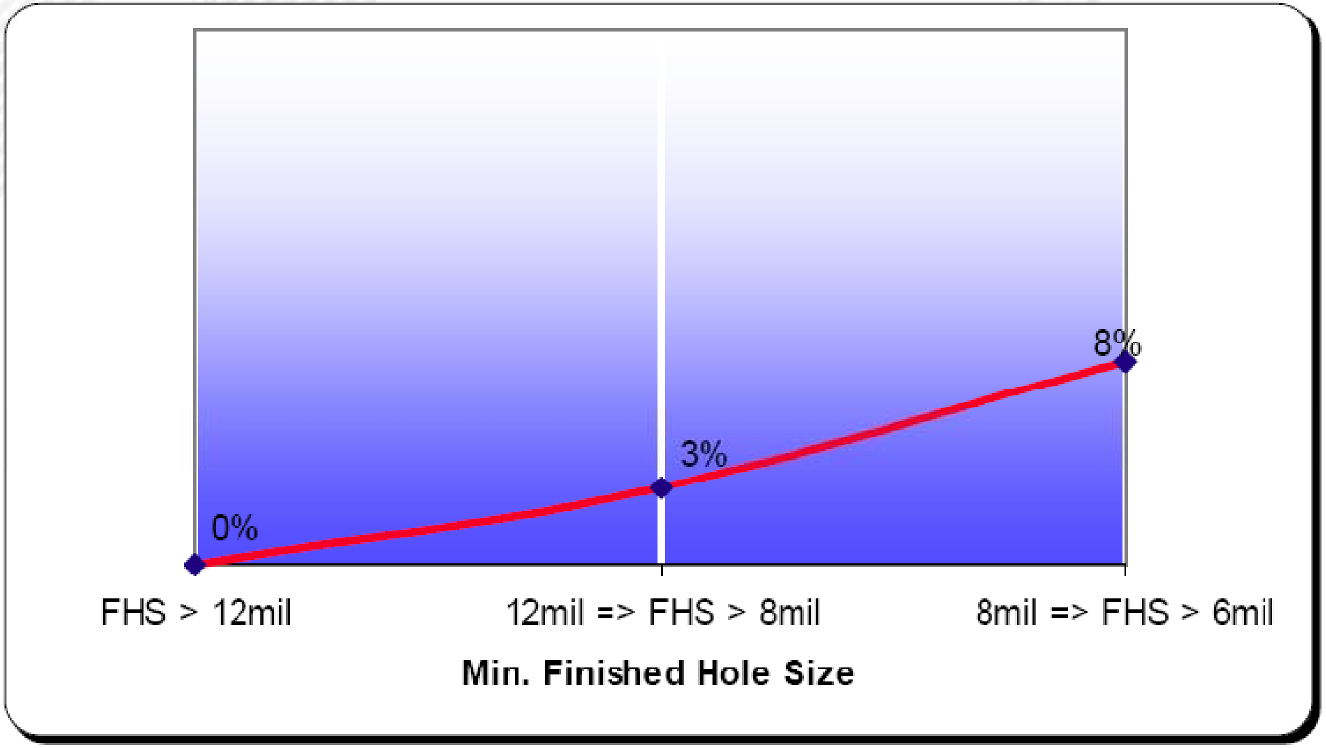
PCB Thickness



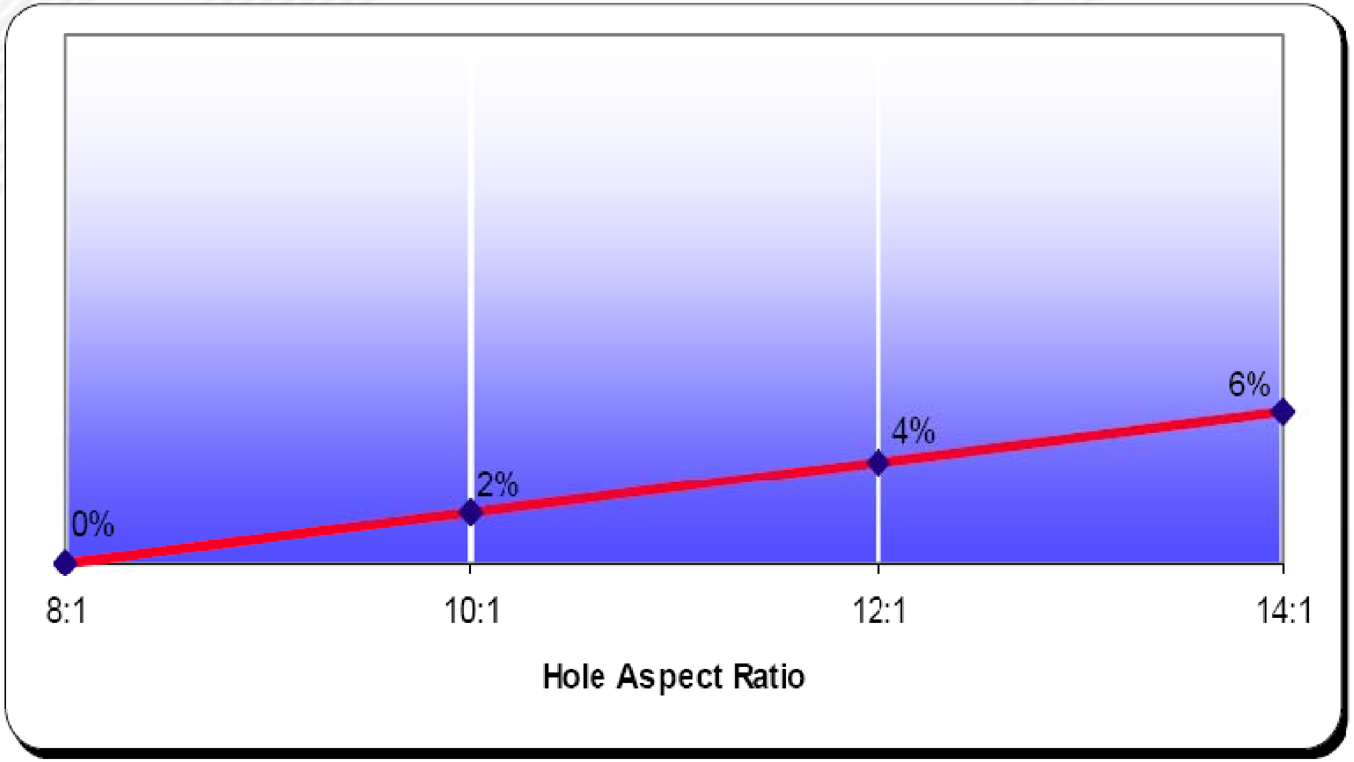
Data reflects additional material costs & lower productivity through manufacturing

Minimum Finished Hole Size



This data reflects the minimum drilled hole size in an 62 mils thick PCB.
PCB thicker than 62 mils will increase cost.

Hole Aspect Ratio



Since aspect ratio is not linear this data reflects aspect ratios within ___ capabilities..

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Aspect Ratio Capability

Mechanical Drill

Hole Size \ Aspect Ratio	Board Thickness (mil)											
	450	400	320	270	220	190	160	120	100	80	60	40
7.9									13	10	8	5
9.8							16	12	10	8	6	4
11.8						16	14	10	8	7	5	3
13.8					16	14	12	9	7	6	4	3
15.7				17	14	12	10	8	6	5	4	3
17.7				15	12	11	9	7	6	5	3	2
19.7			16	14	11	10	8	6	5	4	3	2
21.7			15	12	10	9	7	6	5	4	3	2
23.6		17	14	11	9	8	7	5	4	3	3	2
25.6		16	13	11	9	7	6	5	4	3	2	2
27.6		14	12	10	8	7	6	4	4	3	2	1
29.5		14	11	9	7	6	5	4	3	3	2	1
31.5		13	10	9	7	6	5	4	3	3	2	1
33.5		12	10	8	7	6	5	4	3	2	2	1
35.4	13	11	9	8	6	5	5	3	3	2	2	1
37.4	12	11	9	7	6	5	4	3	3	2	2	1
39.4	12	10	8	7	6	5	4	3	3	2	2	1

- Production Capability (green)
- Reduced Producibility (yellow)
- Development (red)

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Laser Drill

Aspect Ratio		Depth							
	(mil)	7.0	6.0	5.0	4.0	3.0	2.5	2.0	1.5
Ablated Holesize (mil)	(um)	178	152	127	102	76	64	51	38
10.0	254	0.7	0.6	0.5	0.4	0.3	0.3	0.2	0.2
9.0	229	0.8	0.7	0.6	0.4	0.3	0.3	0.2	0.2
8.0	203	0.9	0.8	0.6	0.5	0.4	0.3	0.3	0.2
7.0	178	1.0	0.9	0.7	0.6	0.4	0.4	0.3	0.2
6.0	152		1.0	0.8	0.7	0.5	0.4	0.3	0.3
5.0	127			1.0	0.8	0.6	0.5	0.4	0.3
4.0	102				1.0	0.8	0.6	0.5	0.4
3.0	76					1.0	0.8	0.7	0.5
2.5	64						1.0	0.8	0.6

- Production Capability (green)
- Reduced Producibility (yellow)
- Development (red)

- The hole chart must list PTH & NPTH separately from the BBV holes.
- Minimum annular ring required for laser drill is 4 mil per side.

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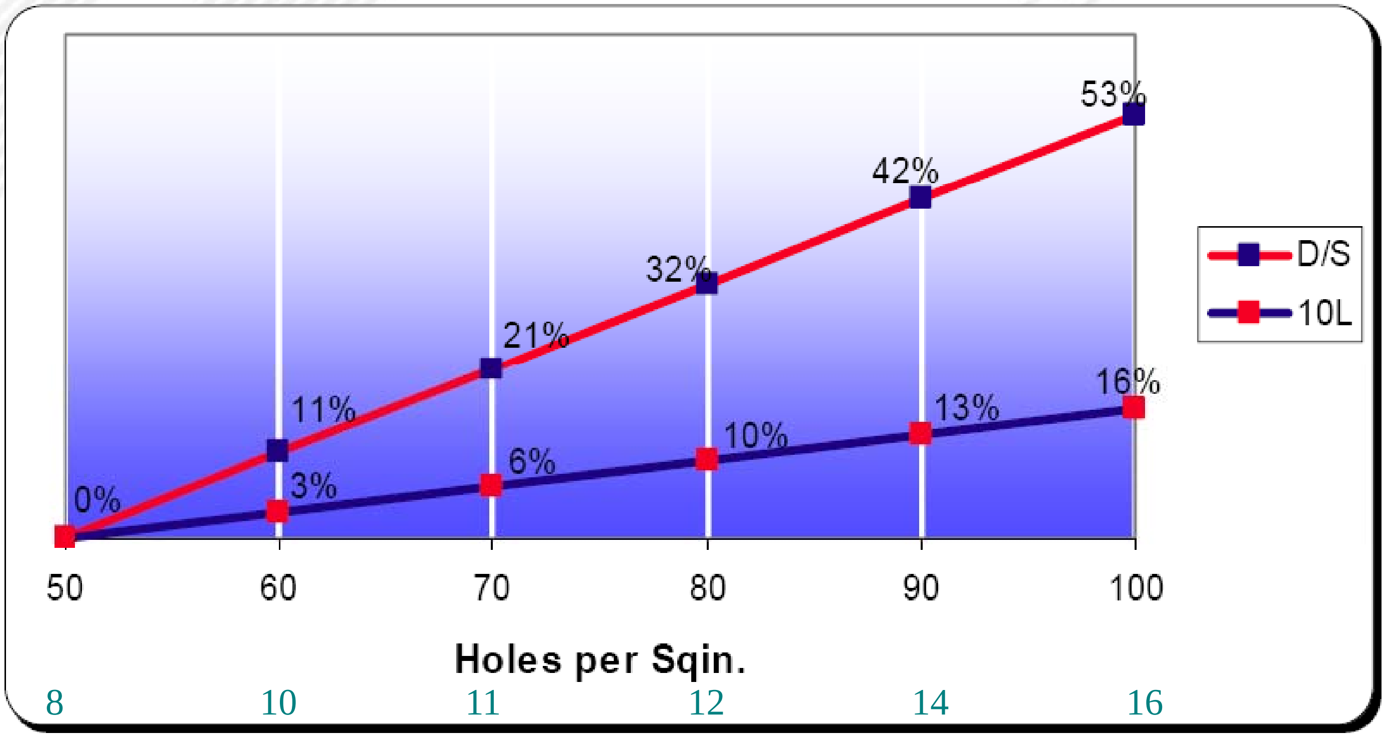
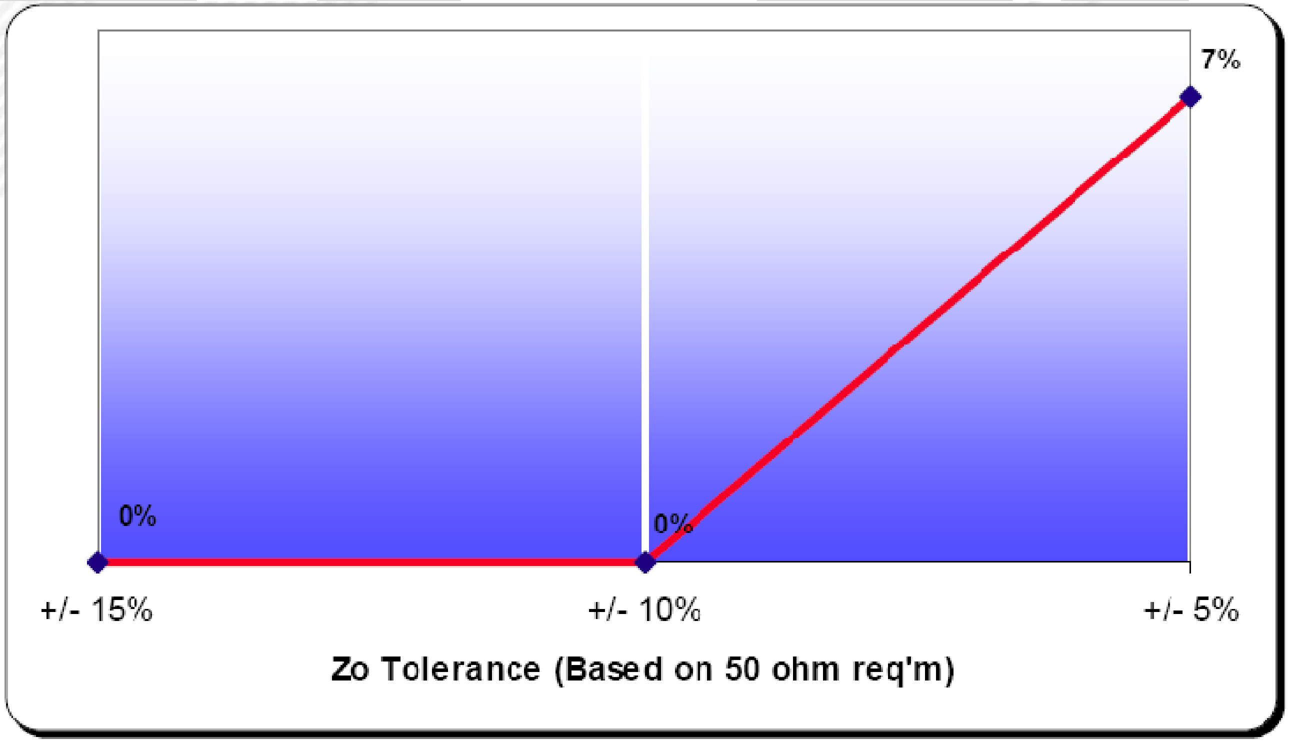
Hole Density



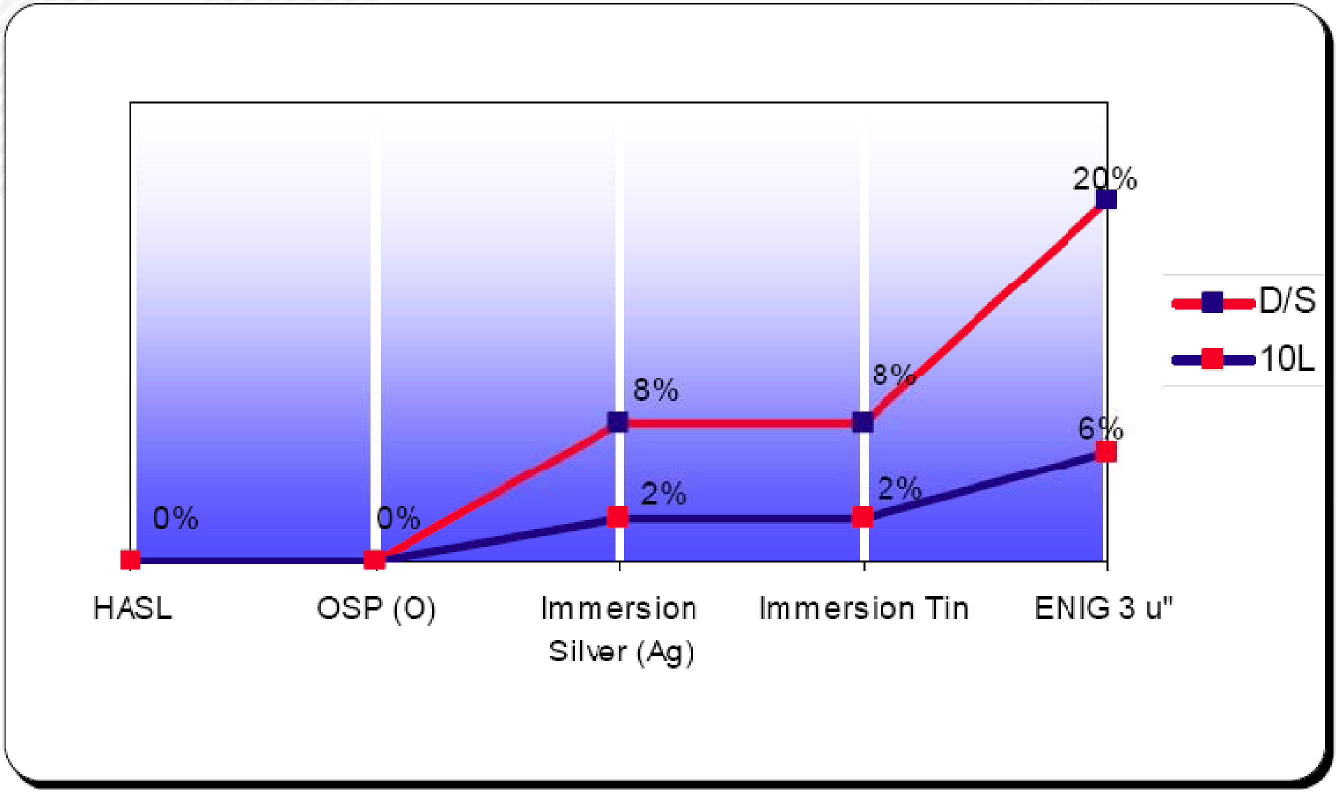
This data solely reflects the cost implications of increasing the number of holes per square inch. (square cm)

Controlled Impedance



Cost factors and tolerances are based on a nominal impedance value of 50 Ohms.
Standard working tolerance is +/-5 ohms or 10%, whichever is greater.
Additional costs will be incurred if 100% testing is required.

Surface Finishes



Data reflects the cost impact of surface finishes after soldermask application.

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Conclusion

- **E**arly **S**upplier **I**nvolvement (**ESI**) will facilitate minimizing cost adders at the products conceptually stage thus contributing to cost improvement for the life of the product.

- Elmatica brings value in understanding that PCB's are custom products and our technical involvement can help to minimize the impact of these cost on the final product

- The model base line at our manufacturer will move as technology capabilities continue to rise. This is indicative of a very dynamic PCB industry.

Source: VIASYSTEMS

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Takk for meg