# Printed Circuit Board Cost Drivers...

TOP 10 - PCB manufacturing attributes that specifically affect the cost of a printed circuit board.

1. Number of Layers
2. Size of the PCB
3. Panel Utilization
4. Number of Holes
5. Trace Width & Spacing
6. Surface Finish
7. Base Material (Laminate & Copper)
8. Routing or Die Punching
9. Labor Costs
10. Fabricate Standard

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# Printed Circuit Board Cost Drivers....

So you are interested in understanding what really drives the cost of these current carrying, green boards with holes in them? Well you are not alone, unfortunately with many complex questions; the universal answer more often than not is it depends?

In an effort to dispel some of the ambiguity behind this question, we have developed an outline of the TOP 10 - PCB manufacturing attributes that specifically affect the cost of a printed circuit board for your reference and review.

Stating the obvious, the more thought and review that takes place as the PCB is being developed, with an eye towards these cost drivers will greatly assist in reducing your PCB costs. This list may not be an all inclusive list of cost drivers but it will cover a significant amount of the key elements that need to be taken into consideration when a PCB is being designed, and manufactured.

| TOP 10 Cost Drivers | |
|---|---|
| 1 | Printed Circuit Board (PCB) Layer Count and Technology |
| 2 | Size of the Printed Circuit Board (PCB) |
| 3 | Panel Utilization % / Number of PCB's on a Working Panel (Standard Working Panel 18inch x 24inch, 20inch x 24inch, 21inch x 24inch ) |
| 4 | Number of Holes / Sizes / Tolerance of Holes / Drilling Technology Used |
| 5 | Trace width and Spacing |
| 6 | Surface Finish of Board / Solder Mask Finish of Board |
| 7 | Base material (Laminate and Copper Thickness) |
| 8 | Routing or Die Punching of PCB Profile |
| 9 | Labor Cost / SG&A |
| 10 | Fabricate following IPC Class 1 / Class 2 / Class 3 |

Some of the above noted elements may be easily understood where other items may require further clarification. We will drill down (pun intended) below for your reference on each of these elements.

**1. Number of Layers –** Certainly the number of layers depends on the level of complexity of the PCB itself simply put, the higher the layer count, the more the cost to produce.

**2. Size of PCB –** Size matters, the larger the size of the board, the more material will be required to produce them.

**3. Panel Utilization –** This refers to the number of arrays / PCBs per array that can be produced on a working panel. Typically this is calculated by the % of utilization which is calculated by the total area for the PCB divided by the total panel area based on a typical 18inch x 24inch, 20inch x 24inch, 21inch x 24inch working panel. The higher the panel utilization percentage the lower the overall costs. A program with utilization above 80% is considered to be good. Features that need to be taken into consideration include, tooling holes, fiducials, coupons, as well as thieving rail sizes as required to process the arrays.

**4. Number of Holes –** Hole size, Number of holes, and variety of hole dimensions are major contributing factors on PCB costs. Depending on the number of sizes and the quantities each hole diameter equates to longer machine time, and more use of drill bits thus increased costs. If hole sizes become extremely small whereby laser drilling may be necessary this will also add significant costs to your PCB.

**5. Trace Width –** Trace Spacing – the width of the individual traces and how close they are to each other from a trace edge to trace edge can impact the cost based on the of the imaging / plating equipment / process capabilities. The tighter the trace width, fine trace widths will increase your PCB cost.

**6. Surface Finish –** The type of surface finish specified will impact your costs based on the surface material used, as well as the manufacturing process method needed to produce the boards. Typically, organic solder preservative OSP, Lead Free hot air solder leveling - HASL, or HASL is your lowest cost alternative, followed by immersion tin, immersion silver, flash gold, immersion gold, thick gold. There are several commonly-used alternative finishes, each of which has its own advantages and disadvantages that should be investigated before deciding on a particular surface finish.

**7. Base Material (Laminate and Copper) –** The base material laminate that is specified will impact your costs, simply put if you do not have specific requirements and or characteristic that dictate a certain base laminate to be used, let your PCB supplier of choice use a suitable laminate that they are currently using and familiar with. Certainly it must meet your specification needs, but from a supply / cost perspective, this will allow you insured supply of base laminates at the lowest possible cost. Typically , the cost of High Tg material (Tg170 &Tg150) is higher than Normal Tg material ( Tg135 ) .

The Copper in a PCB is rated in ounces, and represents the thickness of 1 ounce of copper rolled out to an area of 1 square foot. For example a PCB that uses 1 oz. copper has a normal thickness of 1.4mils. The base copper thickness used, or how much the product is going to be platted up to meet the required thickness will impact your cost. Typically the lowest cost option is 1/2 oz of copper, and it typically increases up from there in 1 oz. increment up to 9 oz. Most boards fall in the 1 – 2 oz. range as a general rule.

| Boards Weight | |
|---|---|
| 1/2 oz. | 0.7 mils |
| 1 oz. | 1.4 mils |
| 2 oz. | 2.8 mils |

**8. Routing or Die Punching PCB Profile –** There are different methods used to remove the laminate material to develop the profile of a pcb. The main methods, are routing which incorporates a high speed routing bit cutter to remove the laminate materials. The other method is by producing a punch which would remove the laminate during a punch process. Typically the punch process is a lower cost option, but it will have some additional tooling costs to develop the punch tool.

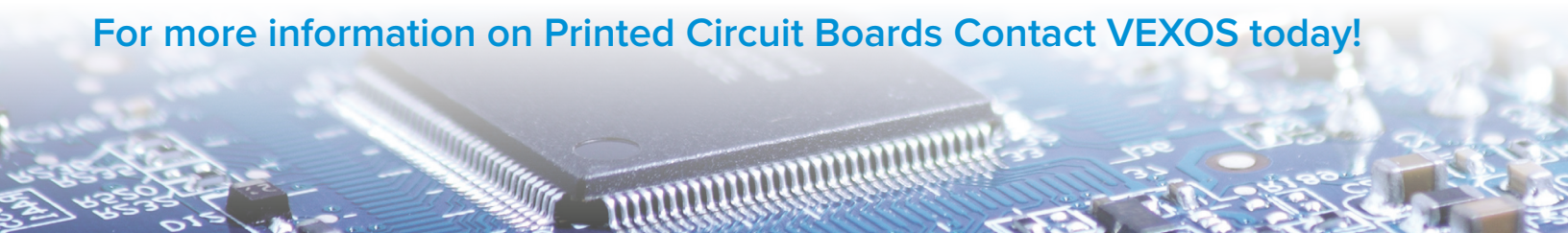
**9. Labor Costs –** Lastly labor cost is a significant factor in producing printed circuit boards. Most board assembly facilities incorporate a batch processing manufacturing process, which will require significant handling for each of the individual processes, as well as moving the product from process to process. Using lower labor cost manufacturing locations, will most probably reflect a lower cost unit cost.

**10. Fabricate Standard –** Other items that may impact your costs include the level of IPC standard the board is to be produced to, as an example, IPC Class 2 which is a general standard and commonly used in standard electronics, IPC Class 3, is more stringent, and finally Military standards which will also impact your board costs.

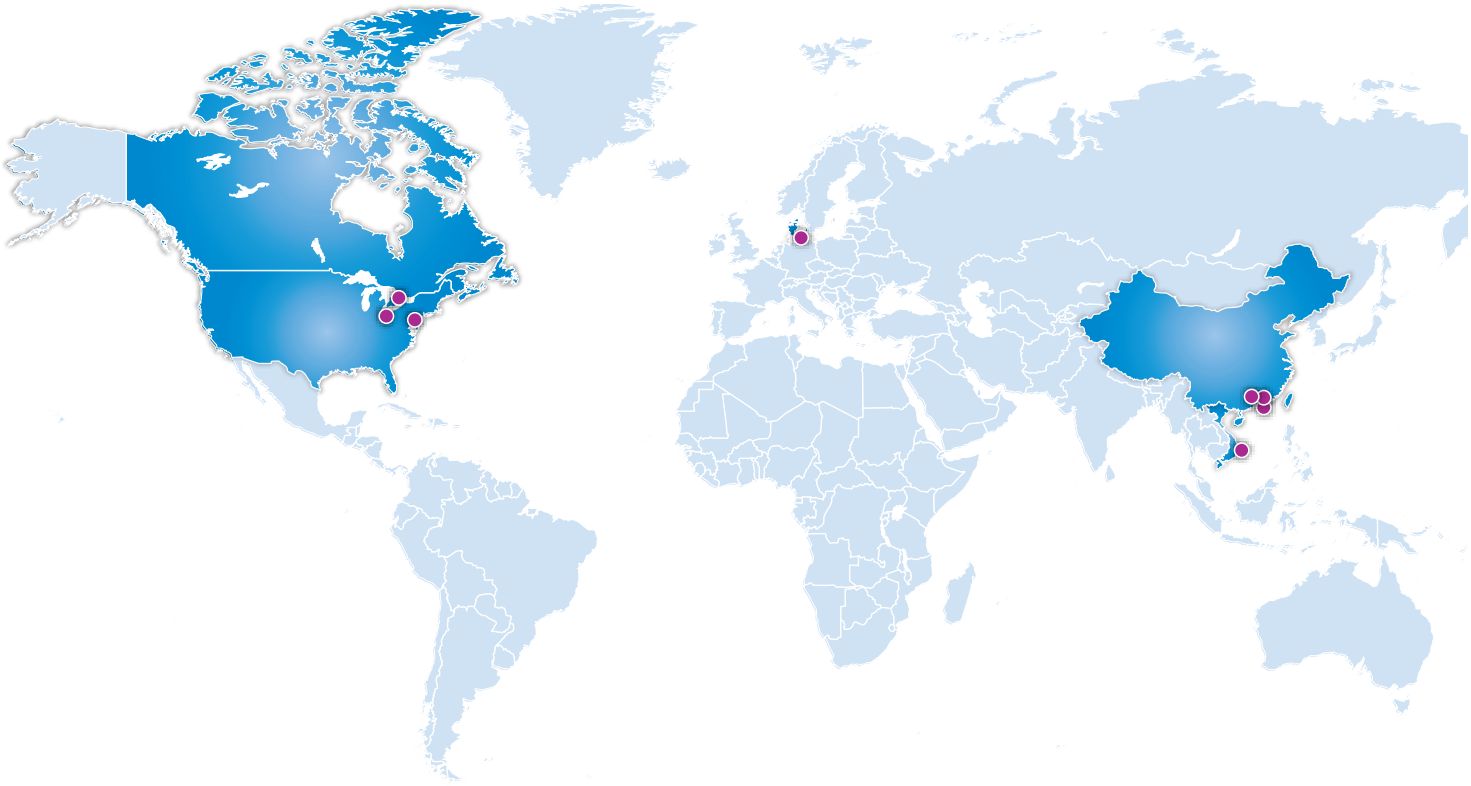
**Well now you have it, the key cost drivers to produce printed circuit boards. Certainly this is not the be all end all list of cost drivers but this will provide you with an understanding of the TOP 10 Items to review when trying to drive our cost within a printed circuit board.**

**Should this not produce the results and or meet your expectations, the most logical suggestion would be to give VEXOS a call and let us help you with your printed circuit board sourcing initiatives. You can be assured that we with our many years of experience, we will be able to reduce your costs where possible.**

## For more information on Printed Circuit Boards Contact VEXOS today!



# Locations



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