THE pcb design MAGAZINE

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PCB Designers and Design Engineers

Communication is Key

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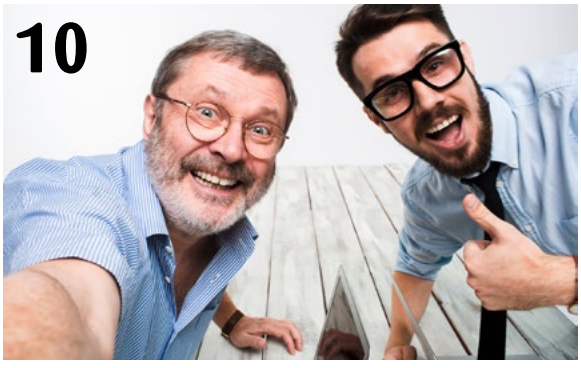
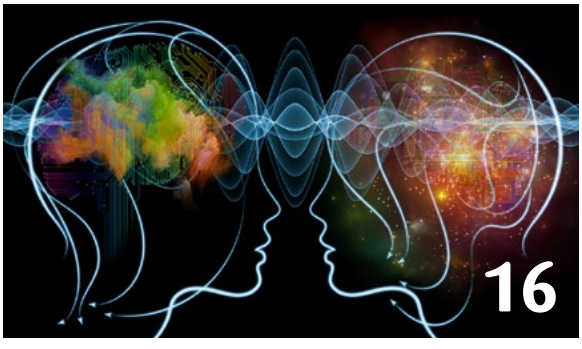
Feature Content





Design Engineers and PCB Designers

Some PCB designers say that working with their design engineers is one of their biggest hurdles. Others say it all comes down to a lack of communication. We asked a variety of engineers and designers to discuss the reasons for this divide, and what can be done to address this problem. This month we have feature articles by design instructor Rick Hartley and Analog Home's Steve Hageman, as well as interviews with lead designer Andy Critcher of Total Board Solutions and Randy Faucette, director of engineering at Better Boards Inc.

Designers and Design Engineers: Two Sides of the Same Coin

Andy Critcher, TBS

by Andy Shaughnessy

Andy and Sue Critcher have been the lead designers at Total Board Solutions Limited, an UK-based design bureau, since its founding in 1998. I asked Andy to share his opinion about the friction between some PCB designers and their engineers, and what can be done to improve communications between these groups.

Andy Shaughnessy: ***Andy, tell us a little bit about your company and how you operate.***

Andy Critcher: Total Board Solutions Limited (TBS) is a design services bureau based in the UK. We fit into our customer's design process, providing whatever is not a core competency. This means that for some customers we perform just the layout portion of their design while for others we enter the schematic, libraries, create the layout and even get the boards fabricated and assembled—no two customers are exactly the same. When working with startups we provide the link between the concept, or idea, and product realization; providing knowledge of design process, fabricators capabilities and our experience when discussing the inevitable tradeoffs between the requirement and what is possible.

Shaughnessy: ***A recent survey of our PCB designer readers found that there's often friction between PCB designers and engineers. Some designers say, only half-jokingly, that their EEs are their biggest challenge. Why do you think there's such disconnect?***

Critcher: Looking solely from the PCB side, I think that the disconnect mainly arises from the lack of understanding of what a PCB designer actually does, it is perceived as a simple task of dot joining and that anyone can do it. I know that this is a bit of a cliché but it does seem to hold true. As an example, in a number of the companies that I have worked with, PCB progress meetings are held and the PCB designer is never asked to attend; their input can be easily be determined by the engineering team/project manager.

This perception is backed up by the lack of formal qualification for PCB designers—for my generation, we generally started off as mechanical draughtsman in the traditional drawing office and then moved to the PCB section.

This perception means that the status of the PCB designer is quite low, so when they advise the engineer that something is not possible this can be met with a certain amount of derision. The engineer possibly thinks that the PCB designer is just being obstructive, while conversely, the PCB designer thinks that the engineer is very dismissive of his knowledge, capabilities, opinion, etc.

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Let's look at the issue from the engineer's perspective. By providing design consultancy, we are fortunate enough to be a lot more involved in the engineer's world, including some of the problems that they have to deal with as part of the overall product development. One engineer explained that the design part was relatively straightforward, but the need to meet cost, functionality, component sourcing, obsolescence, test plans, as well as reading through 150+ pages of documentation on a device's timing "makes life interesting." As PCB designers, we tend to have a lot of questions, especially about the newer technology, so we can bombard the engineer with a number of questions concerning unfamiliar topics expecting immediate answers, and normally at this point the pressure to get it finished is already building.

***Shaughnessy:** What do you think is the proper role for a PCB design engineer?*

Critcher: This is a difficult one to answer. There are so many aspects of the design engineer's role that are not obvious to the PCB designer, such as component selection, obsolescence management, test plans/specs, etc. I thought that I would answer this question in relation to their interaction with the PCB designer.

The definition of the circuit itself goes without saying; the engineer should also drive the PCB layout with the necessary constraints to ensure that the PCB will function to within spec. So, together with the circuit diagram the engineer should also indicate the following (this list is not exhaustive)

a. Impedance requirements
b. Trace length/matching requirements
c. Current handling requirements
d. Stackup requirements
e. Placement constraints
f. Connector locations
g. Board outline (could be the mechanical engineer)

Depending upon the software and the individual company process, the engineer may be able to enter these constraints directly into the schematic capture tool.

***Shaughnessy:** What do you think is the proper role for a PCB designer?*

Critcher: The role of the PCB designer is to take the data from the engineer and create the layout, drawings, fabrication and assembly data while adhering to constraints and the relevant standards, including both company, IPC and any specific to the manufacture.

The PCB has many outside influences such as enclosure, thermal, EMC requirements that may not be under the remit of the engineer so they should also liaise with these people or teams.

Essentially the PCB designer takes all the design requirement inputs from the various sources and then has to find a solution that hits as many as the requirements as possible. At this

point the PCB designer essentially drives the physical design.

I think that to be effective in this role it helps to have a working knowledge of signal integrity, power integrity, and RF and analogue layout techniques. In my experience, I have found that in larger companies, there is a level of specialization for engineers; this tends not to be the case for PCB designers so they are "au fait" with multiple disciplines.

The PCB designer should also keep up with the latest technologies for components, board fab and assembly.

Shaughnessy: *Some PCB design tools are marketed directly to the design engineer, not the PCB designer. Do you think PCB designers are being squeezed out?*

Critcher: In general the answer is no; in my experience I find that this may be practical for smaller design teams or for less complex PCB layout, but when the design is either mixed-technology (RF, digital and analogue) or a complex layout with large component and net counts, a dedicated PCB designer is the most successful solution.

There are a number of reasons why I think this. Firstly, it is NOT that the engineer is not capable of performing the layout task, but more with regard to the pressures on design teams to deliver on time to meet the time-to-market requirements most design teams need to parallel as many tasks as possible, layout included.

Further to this, the schematic is generally a living document that evolves as the layout proceeds due to marketing requirements or simulation results, etc.—the engineer cannot perform two discrete tasks at the same time—to maximize the time efficiency of the design team as a whole separating the two tasks makes sense.

On a practical side, the electronic engineering teams are generally split via the design disciplines already mentioned—RF, analogue and digital—would this mean that each engineer would take it in turns to layout their section?

The PCB tool set is a complicated environment; although the new breed of tools provide ways to support the entry of the complex data sets such as constraints, the complexity continues to increase ahead of the tools. Essentially the environments are not really for the casual user. The automation of the applications increases but the need to enter the constraint data and drive the tool successfully requires the user to use the toolset day-in and day-out to be efficient. In many instances the engineer could spend a few weeks to over a month away from the tools themselves as they test and commission the PCBs.

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Another area that the PCB designer has a certain amount of experience is in the actual fabrication and assembly process; this is generally accumulated over a number of years working with these disciplines. Pre-preg suitability etc., all goes into the pot.

The PCB designer spends a lot of time taking input from different engineers and this helps hone their skill set; taking input from multiple sources helps the designer solve future problems by being able to draw on the gathered experience from the different sources.

In the same way that many companies have a dedicated signal integrity team, the idea of a dedicated PCB makes sense for the same reason.

Shaughnessy: *With more and more engineers doing PCB design work (half of the attendees at some PCB design and layout classes are electronics engineers), what do you think is the solution to this friction?*

Critcher: I think that the solution to the friction is communication, integration and pa-

tience; situations like this cannot be fixed overnight.

Over the years I have noticed that when I work with companies who have a 'design team' comprising electronic engineers, PCB designers, mechanical engineers signal integrity engineers etc. who are tasked with a specific board or product design there is less friction.

I have seen most friction when the 'teams' are divided by function/discipline rather than by project teams. I also tend to see that the team is more effective when the aims/goals are shared; this especially works well where a concurrent design process is needed.

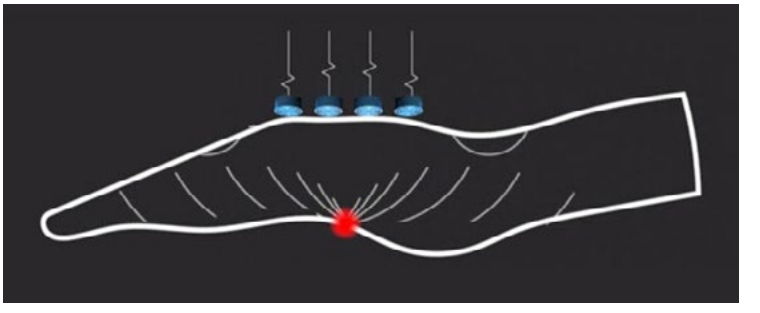
Shaughnessy: ***Is there anything else you'd like to add?***

Critcher: I think that the ability to perform the design of the PCB in parallel across the design team today is critical in many cases. If we have a single person performing each individual task in series this would not help reduce the design time.

Shaughnessy: ***Thanks for your time, Andy.***

Critcher: Thank you. **PCBDESIGN**

University of Sussex Research Brings 'Smart Hands' Closer to Reality



Using your skin as a touchscreen has been brought a step closer after UK scientists successfully created tactile sensations on the palm using ultrasound sent through the hand.

The University of Sussex-led study - funded by the Nokia Research Centre and the European Research Council - is the first to find a way for users to feel what they are doing when interacting with displays projected on their hand.

This solves one of the biggest challenges for technology companies who see the human body, particularly the hand, as the ideal display extension for the next generation of smartwatches and other smart devices.

Current ideas rely on vibrations or pins, which both need contact with the palm to work, interrupting the display.

However, this new innovation, called SkinHaptics, sends sensations to the palm from the other side of the hand, leaving the palm free to display the screen.

The device uses 'time-reversal' processing to send ultrasound waves through the hand. This technique is effectively like ripples in water but in reverse - the waves become more targeted as they travel through the hand, ending at a precise point on the palm.

It draws on a rapidly growing field of technology called haptics, which is the science of applying touch sensation and control to interaction with computers and technology.

Professor Sriram Subramanian, who leads the research team at the University of Sussex, says that technologies will inevitably need to engage other senses, such as touch, as we enter what designers are calling an 'eye-free' age of technology.

"Wearables are already big business and will only get bigger. But as we wear technology more, it gets smaller and we look at it less, and therefore multisensory capabilities become much more important," he says.

"If you imagine you are on your bike and want to change the volume control on your smartwatch, the interaction space on the watch is very small. So companies are looking at how to extend this space to the hand of the user. What we offer people is the ability to feel their actions when they are interacting with the hand."