How We Work

The following sections provide the step-by-step process we follow in designing a circuit board for our clients. Depending on your project requirements, some of the sections below may be skipped.

Phase 1: Project Information, Price Quote and Scheduling

The first stage of any project is to collect as much information about your project as possible. We use our Get a Quote page to help us gather the most accurate information so we can get a quote to you as quickly as possible. Be sure to include any supporting materials you may have, such as specifications, previous design files, CAD drawings, diagrams, screenshots and code examples.

We typically follow up with any questions within 1-2 business days. Once all our questions have been answered, we'll go ahead and quote for the entire project. **We typically quote hourly, although smaller, well-defined projects may be quoted for a flat fee.** The quote includes every phase, from idea to testing (if requested). Our quotes typically do NOT include the cost of manufacturing, which is quoted once the design stage is complete.

We will attempt to estimate manufacturing costs if requested. Please keep in mind, these costs vary widely depending on speed, quantity, components and manufacturer. The more information regarding the design that can be provided upfront (i.e. components, bill of material, old design files, etc.), the more likely our manufacturers can give us a more accurate budgetary quote.

Once the quoted amount has been agreed to, a contract will be written up based on the Contract Questionnaire form you have filled out. Our contracts are handled electronically by AND CO as well as our invoicing and payment system.

The project will be scheduled based on the engineer's availability and workload.

Phase 2: Brainstorming and Architecture

Now, we're off to the races! No specification? No problem! We can start all the way at the beginning with a few brainstorming sessions if needed. We'll walk through your idea with you and help develop a list of requirements for your prototype design.

Next, we'll do some fact-finding and component selection to determine the best devices to use in your architecture, such as a Bluetooth module or a CPU. If necessary, we will also mockup

code to determine utilization inside of a chip such as a microcontroller or FPGA. Finally, we'll put it all together in a nice diagram to help explain your awesome concept.

An architectural review will be held with you to determine any changes. Once the architecture looks good, we can move forward to the design phase.

Phase 3: Design

Time for some engineering! Next, we'll design out the proposed architecture before putting it into CAD. This starts with reading through all the necessary specifications and supporting documentation and moves on to areas which includes (but is not limited to):

- Power design and estimation
- Mechanical constraints
- Interfaces and High-Speed Signals
- Processors
- Memory
- Configuration
- Clocking
- IOs (input/output)
- User input (LEDs/buttons/switches)
- Connectors

We will provide you with questions about implementation details along the way along with updates on how the design is progressing.

Phase 4: CAD

Now for the part we've all been waiting for. With the design complete, we move on to entering the design into the CAD tool. **This phase includes library creation, schematic capture and PCB layout. We use Altium Designer as our standard CAD tool.** Reviews with the customer will be held after both schematic and layout are complete. Designs will also be reviewed with component vendors if necessary for additional verification.

Phase 5: Manufacturing

Once CAD is complete, the manufacturing files will be generated (typically called Gerbers or ODB++ files). These files can be sent to a contract manufacturer (CM) to generate a standard circuit board or used in-house at MSX Consulting to generate a rapid prototype.

In both cases, the board manufacturing process consists of three components: 1) component procurement, 2) bare board fabrication and 3) assembly. Components can be purchased by the CM, MSX Consulting or consigned by the client. Typically, we ask for at least 25% more of any components you will be consigning for attrition purposes.

Standard circuit boards, as defined by our quote form, are boards that are manufactured with a CM. They are typically more rugged, can be made with a variety of materials, meet very

demanding specifications and are typically built anywhere from 3 to 20 business days, depending on cost. MSX Consulting works with several CMs in both the Bay Area and China, and we will be glad to work with your CM as well. Please contact us for more information regarding our CMs' specific manufacturing capabilities.

Rapid prototypes, as defined by our quote form, are generated by MSX Consulting in-house on our own milling machine. These boards are required to be much simpler, with the following limits:

- Max Quantity: 10 boards
- Material: FR-1
- No soldermask
- Layers: 1-2
- Max Dimensions: 5.5 × 4.5 × 1.6 in (140 × 114 × 40.6 mm)
- Min trace/space: 6 / 6 mil (0.153 / 0.153 mm)
- Hand assembled

These designs are typically for proof-of-concept designs.

If you're not sure which type of board manufacturing is right for you, just ask us!

Phase 6: Bring-Up and Firmware

Well, your board looks wonderful, but does it work correctly? Next up is bring-up, where we test each individual system on the circuit board to ensure it is operating as specified. We will also run any functional tests that we have defined with you beforehand to ensure the boards will work as intended upon delivery.

If requested, we will also continue development of the firmware, which starts while manufacturing is taking place. Typically, we start with development platforms to test out the functionality of the code before uploading and testing the production version on your boards.

All done!

Once we have confirmed everything has been completed, the boards will be shipped off to you! We will now invoice the project via AND CO under NET15 terms. Enjoy your boards ☺

Ready to get started? Check out our FAQs and Get a Quote page.