



Closing the Gap Between Design and Production

DFM Strategies for Robust Electronic Products

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Overview

For every commercial Electronic Design there comes the time when the prototype stage is over and the production stage begins.

Let's talk about some strategies involving

DFM - Design for Manufacturing

DFT - Design for Testing

DFS - Design for Serviceability

... and the one simple design feature that makes all three areas better.

The Challenge

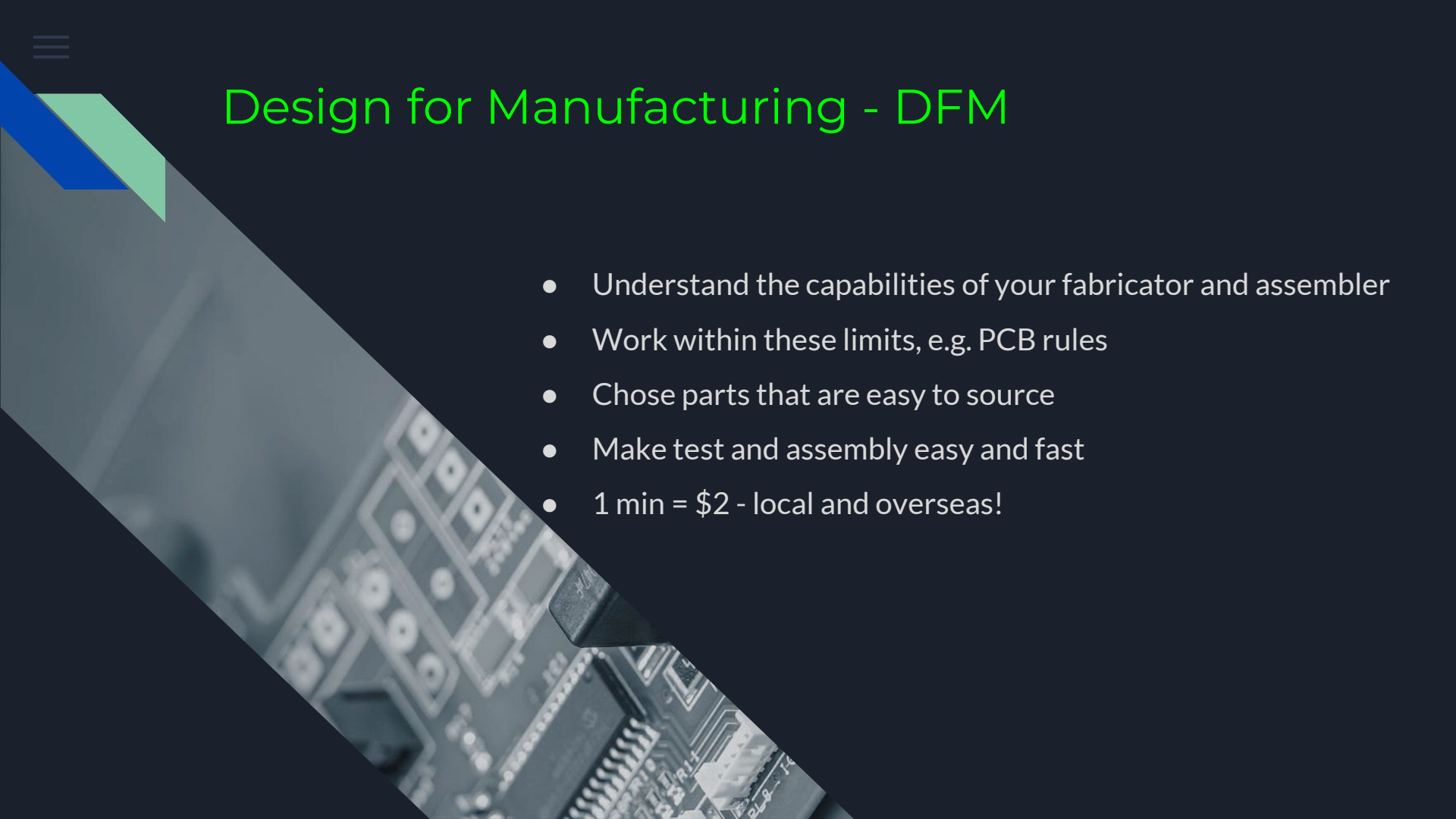


Turn This

into That




Design for Manufacturing - DFM

- Understand the capabilities of your fabricator and assembler
 - Work within these limits, e.g. PCB rules
 - Chose parts that are easy to source
 - Make test and assembly easy and fast
 - 1 min = \$2 - local and overseas!
- 




Design for Testing - DFT

- Production Test is not a Design Verification
 - Test automation varies with quantities
 - Ideal production test: Start button -> green / red LED
 - Even better: Start button -> green / red LED + failed test info
 - Reduce time/cost and test fatigue
- 



Design for Serviceability - DFS

- Modular design
 - Easy Access
 - Standardisation of components and tools
 - Error proof design (unique connectors)
 - Diagnostic
- 



In short

DFM - understand your manufacturer

DFT - simple and structured testing

DFS - easy to maintain and repair



There are a lot of details in these concepts

What is one thing that we can use in most designs to make all 3 areas better...



Would you rather be a

GP

or a Vet ?



Get an insight into the health of your system

In most microcontroller systems today you will have a spare serial port



Use this port to create a

diagnostic interface

that can support every stage of the product cycle from design via production to service



Serial diagnostic interface

Design - troubleshoot HW and FW

Field Test - log data, diagnostic

Production - automate testing

Installation - configuration

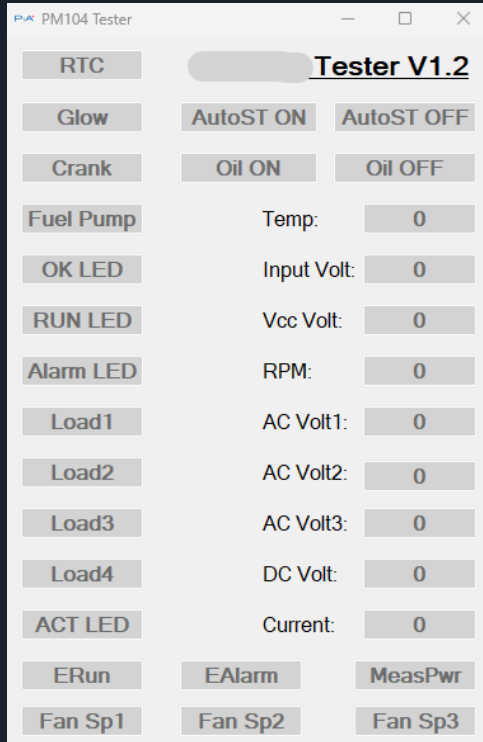
Operation - log data, self test

Maintenance - read logs

Service - diagnostic

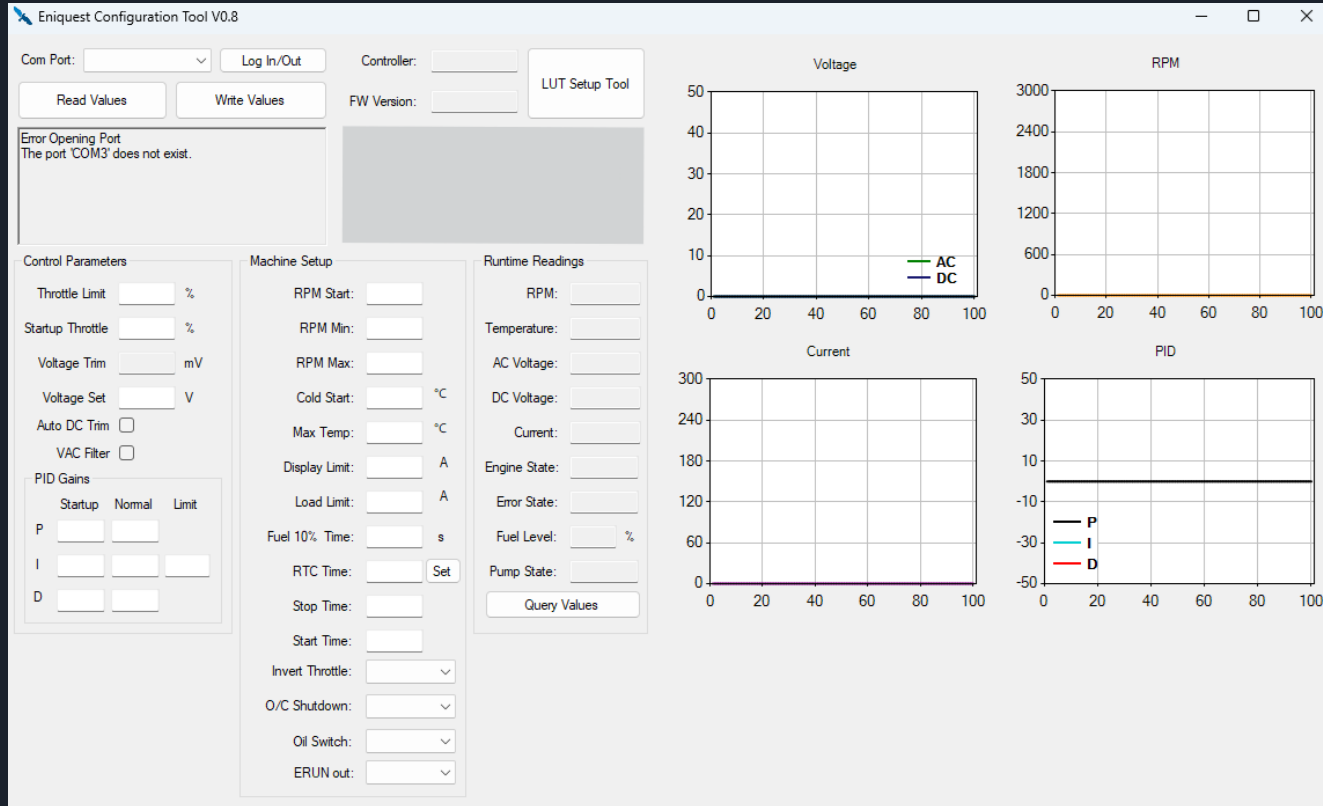


User interface examples: Production Test



- DUT is placed on test jig
- PC controls target via serial connection.
- On completion, each test box goes green for pass or red for fail.
- Test steps proceed mostly automatically
- Prompts guide user through the sequence if interaction is required
- Test records are generated from PC software

User interface examples: Configuration tool



The screenshot displays the 'Eniqest Configuration Tool V0.8' interface. At the top, it includes fields for 'Com Port', 'Log In/Out', 'Controller', and 'FW Version', along with 'Read Values', 'Write Values', and 'LUT Setup Tool' buttons. An error message states: 'Error Opening Port The port 'COM3' does not exist.' The interface is divided into several sections:

- Control Parameters:** Includes fields for Throttle Limit, Startup Throttle, Voltage Trim, Voltage Set, Auto DC Trim, and VAC Filter. It also features a PID Gains table with columns for Startup, Normal, and Limit, and rows for P, I, and D gains.
- Machine Setup:** Contains fields for RPM Start, RPM Min, RPM Max, Cold Start, Max Temp, Display Limit, Load Limit, Fuel 10% Time, RTC Time, Stop Time, Start Time, Invert Throttle, O/C Shutdown, Oil Switch, and ERUN out.
- Runtime Readings:** Includes fields for RPM, Temperature, AC Voltage, DC Voltage, Current, Engine State, Error State, Fuel Level, and Pump State, with a 'Query Values' button.
- Plots:** Four graphs are shown: 'Voltage' (AC and DC), 'RPM', 'Current', and 'PID' (P, I, D). The Voltage plot shows AC (green) and DC (blue) lines. The RPM plot shows a single orange line. The Current plot shows a single purple line. The PID plot shows three lines: P (black), I (cyan), and D (red).

User interface examples: Remote operation

The screenshot shows a software window titled "Eniquest Generator Controller". At the top, there are "File" and "Help" menus. Below the menus are two buttons: "Activate" and "Deactivate". A "Status" section contains a large "Start/Stop" button. Below this, the "Status" is displayed as "Disconnected" and there is an "Error code" field. A "Readouts" section contains several data fields: Frequency, Coolant temp., Fuel level, Oil pressure, Oil temperature, Total power, Run hours, and S/W Version. At the bottom, there are three columns for "Phase 1", "Phase 2", and "Phase 3", each containing fields for Voltage, Current, and Load.

- Remote operation
- Remote diagnostic



Remember

- 01 Talk to your manufacturer
-> understand their requirements, play to their strength
- 02 Talk to your product (easier to be a GP than a Vet)
-> implement a diagnostic port
- 03 Make DFM, DFT and DFS part of your design process,
not an afterthought



Thank you!



We only scratched the surface today

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