Dynisco

In conjunction with JM Engineering Consulting

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Using DFM to Understand Printed Circuit Board Costs

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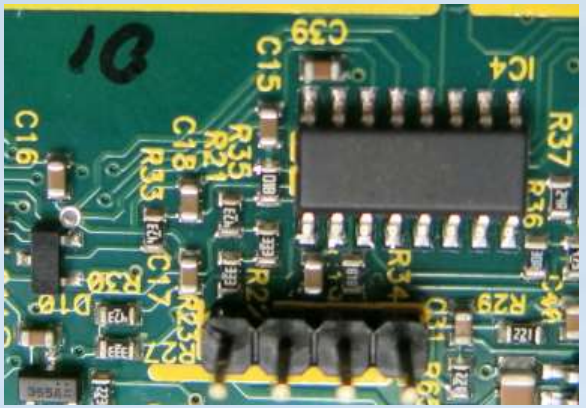
Using DFM to Understand PCB Costs

- How much cost do PCB's represent as a % of your design? Don't know?
- Dynisco example products:
  - Product 1 - PCB's comprise
    24% of total product cost
  - Product 2 - PCB's comprise
    10% of total product cost

If you're using DFM for fabricated components why leave your PCB's to chance?

When to Utilize DFM for PCBs



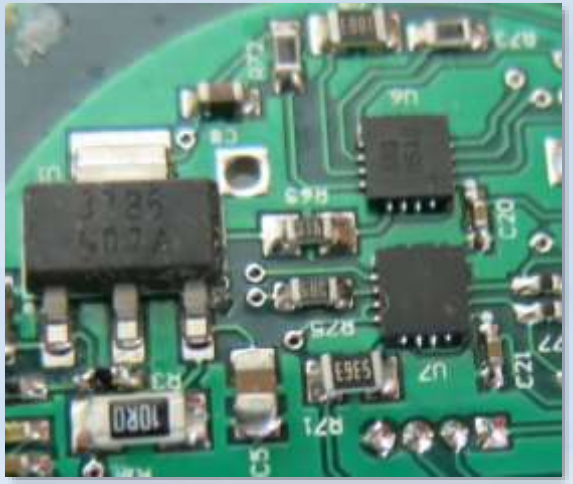
- DFM for PCBs areas of deployment:
  - Product Development
    - Lets you know the PCBA cost allocation as a percentage of the project early on
  - Should Cost Activities
    - Ensures you are paying proper prices for your legacy designs
    - Gives you data for negotiating proper prices
  - Competitive Benchmarking
    - How does your design compare to competitors
    - Requires identification of the components which can be challenging. Not all components have clear markings.

Successful Application Examples

- Product Development
  - Existing sensor design consists of 2 PCBA's. Product refresh reduced to 1 PCBA for savings of 12%. (Not to mention a better DFA index)
- Should Cost Activity
  - High volume sensor PCBA DFM used to renegotiate price for an 8% savings yielding $13K a year.
- Benchmarking
  - DFM utilized to fully cost 5 competitors units in comprehensive benchmark study.

Cost Components of a PCB Assembly

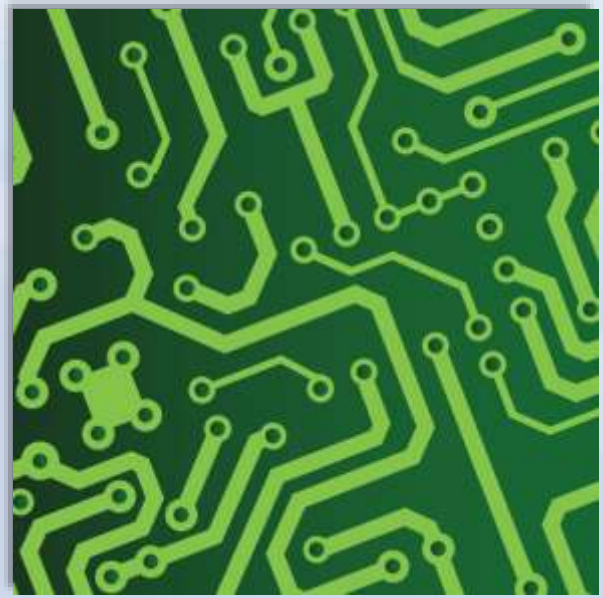
- As with any fabricated product the components of cost are similar:
  - Material
    - The board itself (different materials, number of layers, copper weight)
    - The components (through hole or surface mount)
    - Any coatings etc…
  - Setup
    - Automated placement equipment including the reels for components
    - Auto solder paste machine, solder ovens etc..



Cost results, $	Previous	Current
Calculate		
material	5.54	5.54
setup	3.71	3.71
process	2.51	2.51
rejects	0.77	0.77
piece part	12.53	12.53
tooling	0.12	0.12
total	12.65	12.65
Tooling investment	2,460	2,460

Cost Components of a PCB Assembly

- Process
  - Process time for the automated placement equipment
  - Solder paste application and solder ovens
  - Any hand solder operations
- Rejects
  - Bare board process yield and reject rate after assembly have separate inputs
- Tooling
  - If you wish to have the tooling amortized across the parts
  - Includes programming labor for various machines.



Sample PCB DFM

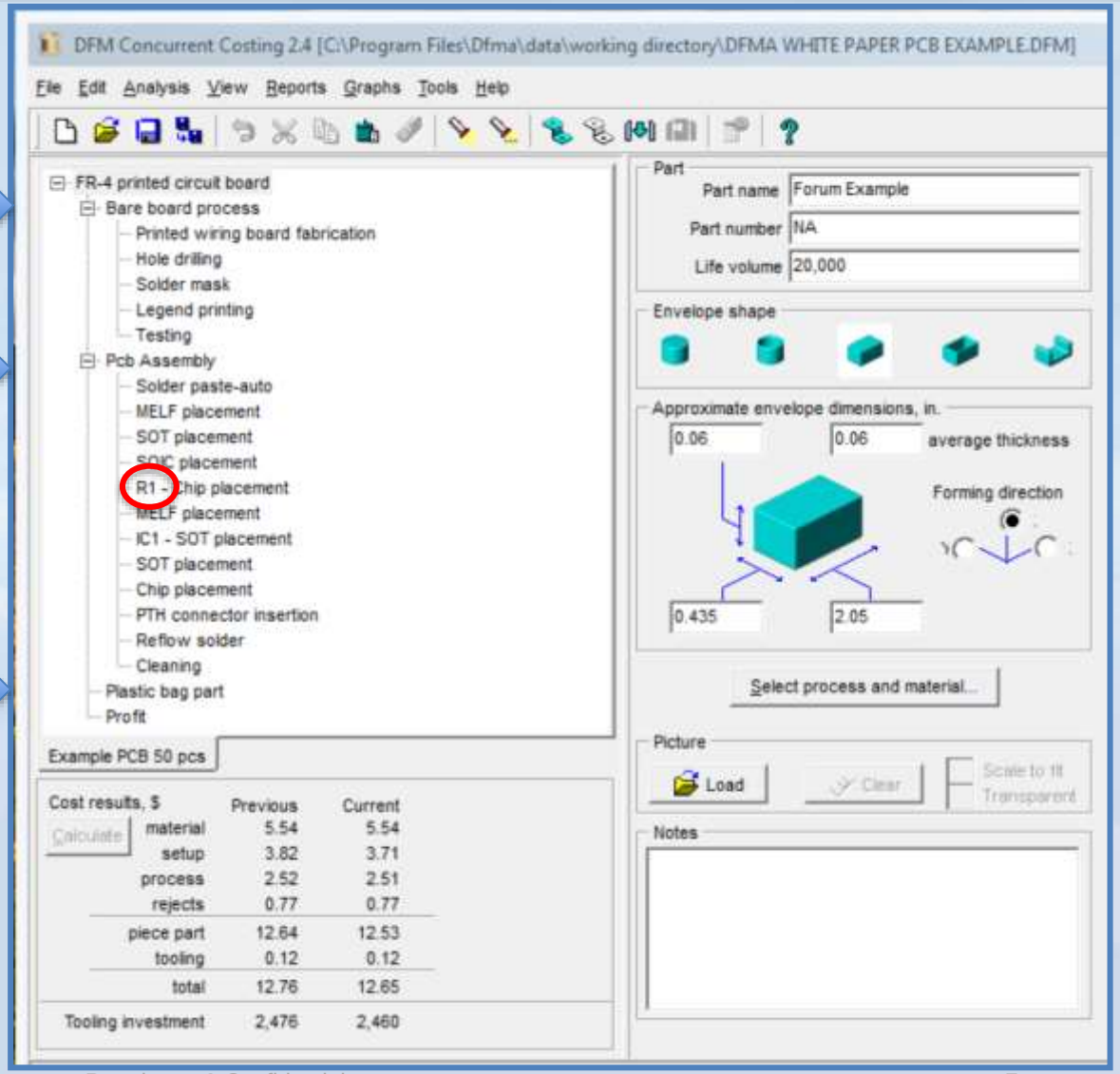
- Typical PCBA DFM

Bare board process

Component placement and other processes

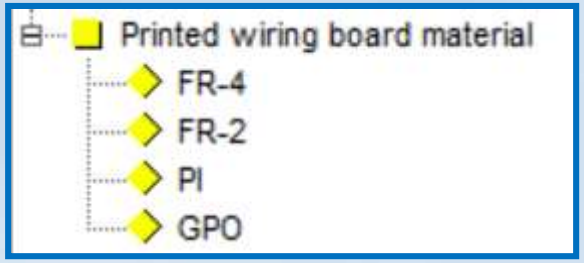
Secondary processes

You can structure to match a PCBA BOM with reference designations.

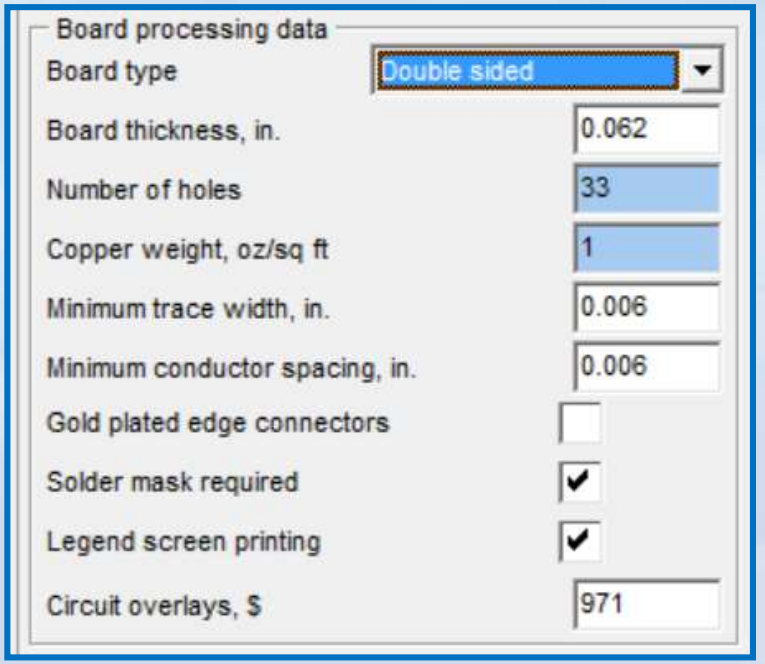


Key Inputs for Accuracy

- PCB material.
  - 4 materials to choose from.

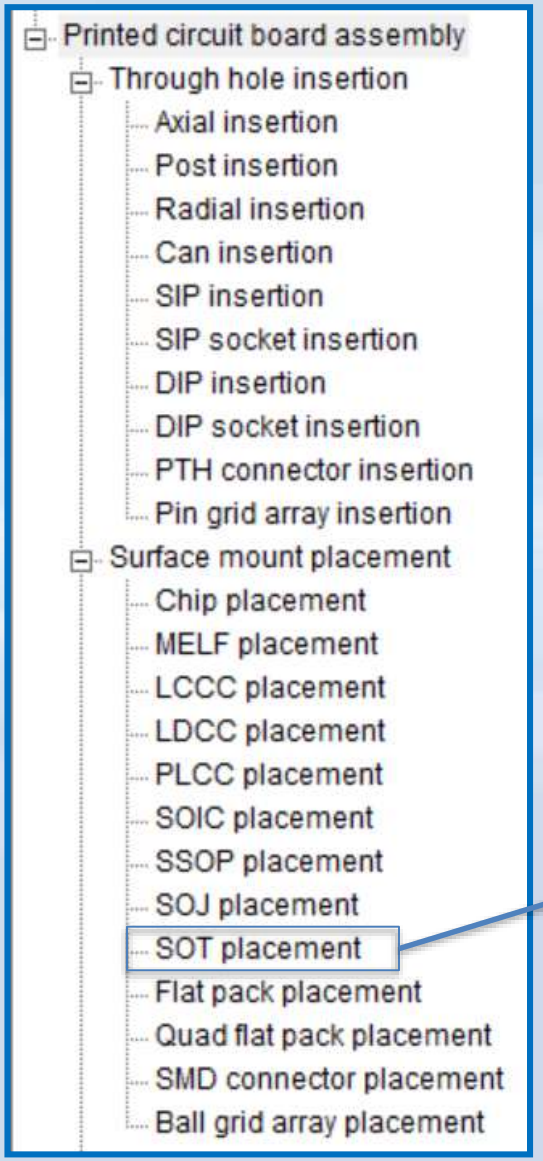


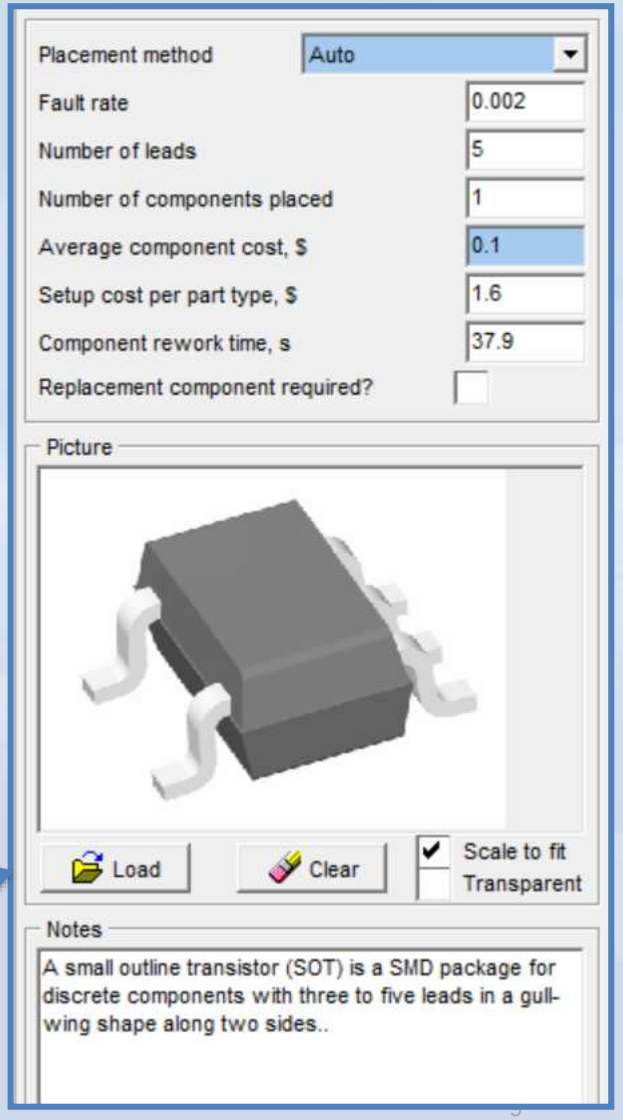
- The bare board process inputs
  - The board type, correct number of layers and copper weight.
  - The DFM module defaults to a high value for the number of holes. Example a 2” X 1” board defaults to 400 holes which even for through hole is quite high.
  - Selections for gold plated edge connectors, solder mask and screen printing.



Key Inputs for Accuracy

- Through hole and surface mount component selections.
- Selecting on a component shows you the general shape, description and available inputs.





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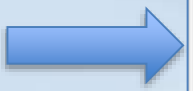
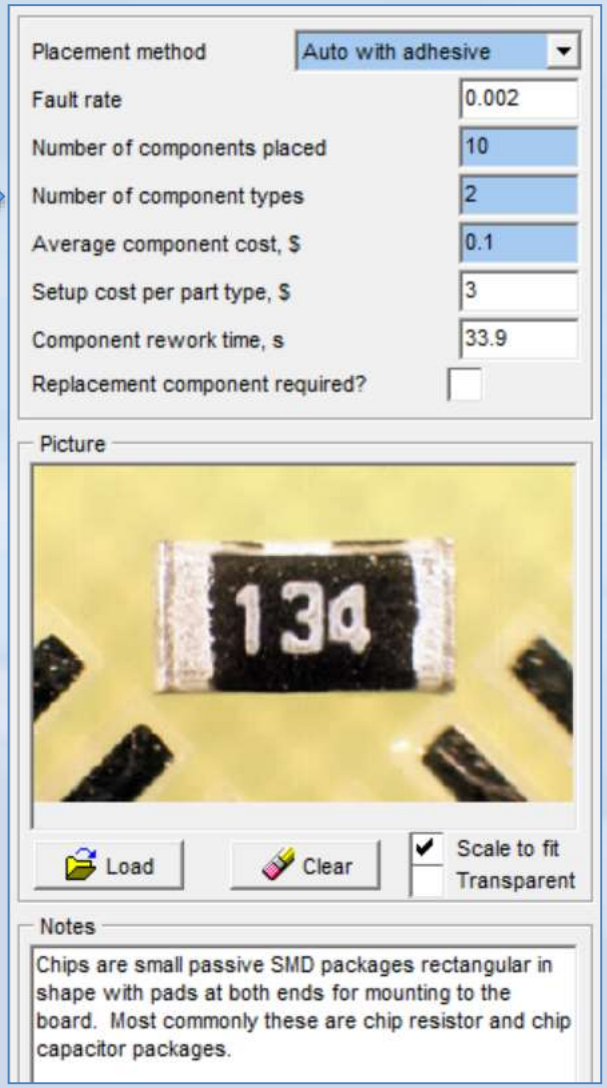
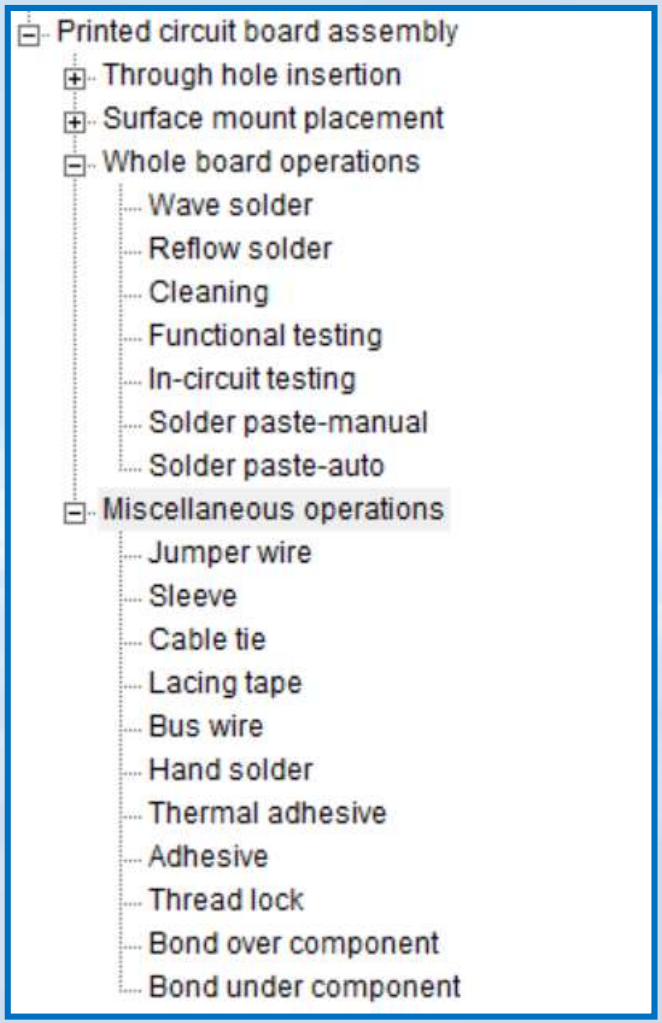
Key Inputs for Accuracy

- If there is a large mix of similar components you can enter them in one dialog by averaging the price and knowing the number of different components.





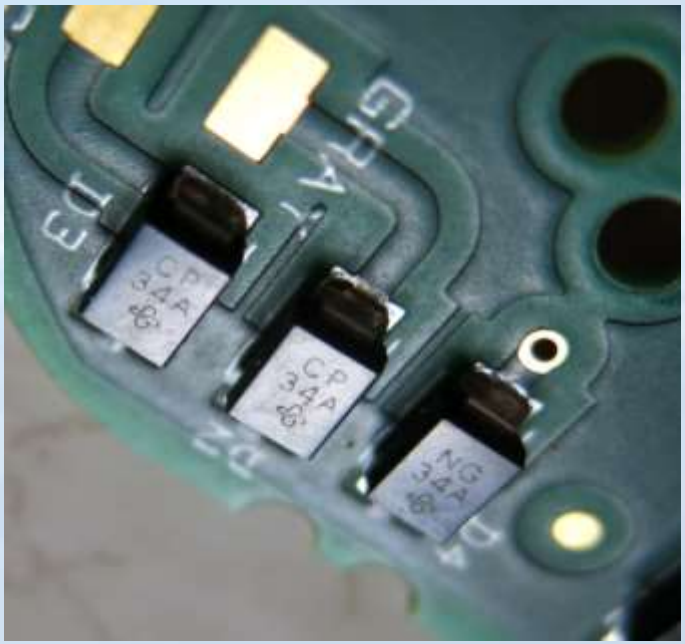
Key Inputs for Accuracy



- Whole board ops
  - Wave or reflow solder
  - Functional and in circuit testing if specified.
- Miscellaneous operations
  - Manual operations to circuit board assemblies.

Key Inputs for Accuracy

- Component identification for benchmarking

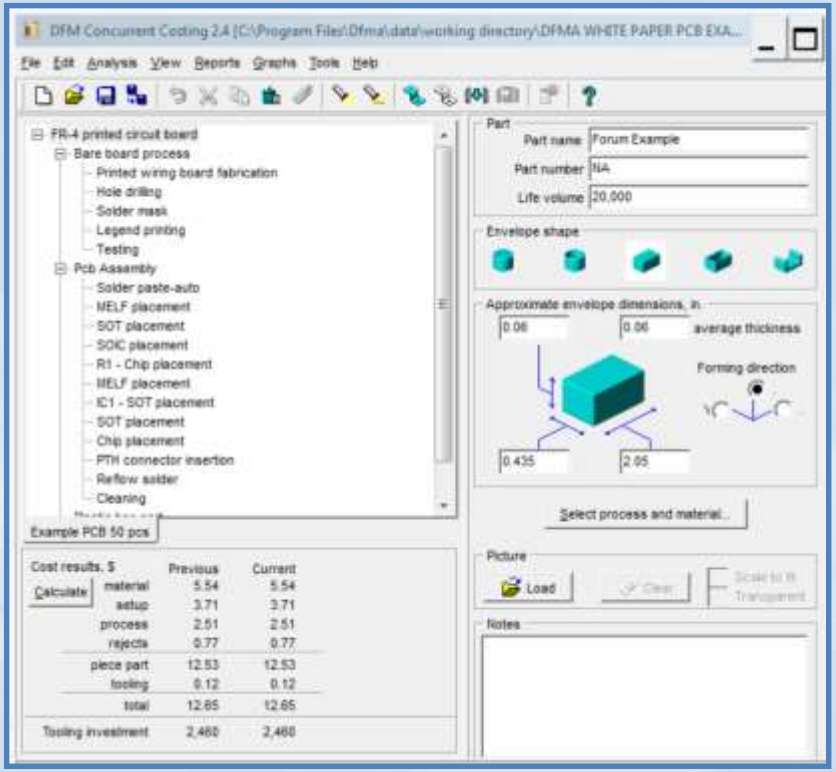


- Entering the component markings and component type, determined from the reference designation (D for diode in this case), into a search engine will often yield results.
- Costs can be estimated from sites such as Digikey, Mouser and Newark.

Integrating PCB's into DFA

- If multiple boards are utilized, DFM and DFA can be used to determine the best cost and DFA index for your design.

DFM and PCB assemblies



Include PCB's in the DFM process for product development, should-costing, and benchmarking

Questions?