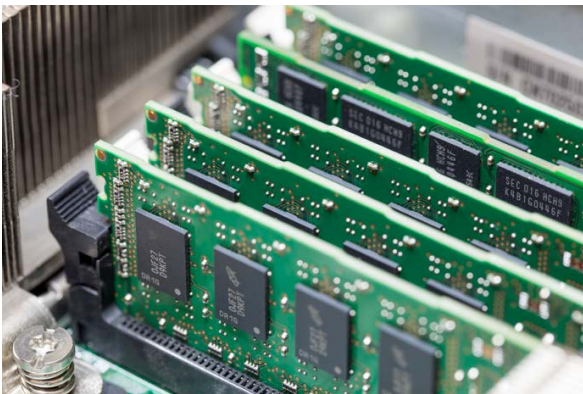# aPriori

Manufacturing Process Models for Electronics

Physics-Based Process Models

Overview

aPriori offers electronics design engineers, cost engineers, and commodity managers powerful manufacturing process models for the electronics industry. These include process models for Printed Circuit Board Assemblies (PCBA), Wire Harness, and Electronics Packaging.

aPriori's physics-based manufacturing process models address common manufacturing processes and deterministic routings to identify the lowest cost production method. Manufacturing Process Models allow engineering, manufacturing and purchasing professionals to explore cost saving production alternatives down to the machine level. Unlock manufacturability and sustainability insights early in design stages to make innovative changes and reduce engineering change orders (ECOs).

PCB Assemblies

Wire Harness

Key Benefits of Process Models for PCBA and Wire Harness

- Early visibility into the cost impact of design decisions, including exploration of options like single vs. double sided or different size PCBs.
- More effective negotiations with suppliers by providing detail on component costs, manufacturing costs and commercial costs.
- Easy calculation of the cost impact of Value Engineering explorations.
- Estimation of assembly costs that include wire harnesses and/or PCBAs, and mechanical components.
- Faster aggregation and analysis of data across product lines and business units.
- Centrally located process models and cost analyses drive consistency of costing across a team.

aPriori Process Models for PCBA and Wire Harness

Manufacturing Process Group	Supported Sub Processes and Operations
Printed Circuit Board Assemblies (PCBA)	• **Component Preparation** – Surface Mount Technology (SMT) Component Setup, Plated Through Hole (PTH) Component Setup, Bake Out, Label, Stencil, Automated Component Prep Automated, Manual Component Prep, Component Software Load, PEMS/MSDS • **Surface Mount Assembly (Single and Double Sided)** – PCB Load, PCB Flip, Screen Printing, Solder Jetting, Solder Paste Inspection, Adhesive Dispense, SMT Auto Placement, SMT Hand Placement, Automated Optical Inspection, SMT Visual Inspection, Reflow, Inline Wash, Automated Xray Inspection • **Plated Through Hole Assembly** – PTH Auto Insert, PTH Hand Install, Wave Solder, Selective Solder, Visual Inspection • **Testing** – Flying Probe Validation, InCircuit Test, Software Load, Functional Test, RF Test, Boundary Scan (JTAG), HiPot Test, Light Up Test, Bake In/Burn In Test, Environmental Test, Ion Chromatography, Conformance Certification • **Special Processing** – Depanelization, SMT Hand Solder, PTH Hand Solder, Jumper Wire Install, Adhesive Staking, Adhesive Underfill, Shunt Assembly, Heat Sink Install, Batch Wash, Conformal Coat, Potting, Final Assembly
Wire Harness	• Wire/Bundle/Conduit Prep – cut and strip • Wire Termination – wire marking, manual crimp, machine crimp, solder, tin, heat shrink • Connector Assembly • Splice – ultrasonic, butt, insulation displacement • Branch Covering • Braid • Harness Layout – form board setup/test, wire layout, branch layout, twist • Labeling – heat shrink label, wrap-around label • Testing – pull test, continuity test, hipot test

Costing PCBA and Wire Harness

For PCBA and Wire Harness, the estimates calculated by aPriori include costs for each component along with the manufacturing costs associated with assembling and testing the products. Costs are calculated using table-based design definitions that are standard imports into aPriori from various ECAD and PLM systems.

Manufacturing costs are calculated in a similar manner to aPriori's other process models. Attributes that define the product cost drivers are pulled from the BOM and the individual components and passed to manufacturing simulation and analysis defined in the digital factory. This logic and data stored in the digital factory are used to determine:

- How each feature is made and assembled
- Which processes are required
- How much time each process will take
- How much that process will cost

Cost Modeling A PCB Assembly In Apriori

Component Data Sources for PCBA and Wire Harness Costing

Integration with SiliconExpert

aPriori integrates with SiliconExpert, a leading data provider for electronic components with access to over a billion part numbers from thousands of suppliers. Apriori users can utilize up-to-date data on electronic components from SiliconExpert in real time when costing a PCBA or Wire Harness. A subscription to SiliconExpert Webservices is required.
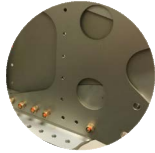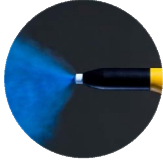
aPriori Component Library

The aPriori digital factory has a component library that contains data needed to cost each PCBA and wire harness. Key cost and physical data from the library are utilized to perform costing. The Component Library stores data for components specifically manufactured for your company, and components for which you have known or negotiated pricing. aPriori will not ship with a component library populated out of the box. aPriori's selection logic can help choose the lowest cost between SiliconExpert and the Component Library. With this capability, aPriori customers can accurately evaluate the should cost for the electronics assembly, and also identify components that offer the potential for renegotiation.

Process Models for Electronics Packaging

aPriori can derive the fully burdened cost of production for an extensive range of packaging products for electronics and electrical applications such as PCB packaging, shields, and heat sinks, electronics enclosures, and packaging for electronics subject to severe environmental stresses as in outdoor applications.

Manufacturing Process Group	Supported Sub Processes and Operations		Aerospace Application and Example Components
Assembly Joining	• Riveting • Lock Bolts • Nutplate Installation • Adhesive Bonding • Manual MIG Welding • Manual Spot Welding • Robotic MIG Welding	• Robotic Spot Welding • TIG Welding, Laser Welding • Electro-Beam Welding • Resistance* • Ultrasonic and Friction Welding* • Brazing* • Soldering*	Fastened Substructure and Skin Assemblies, Turbine Component Welding, Airfame Stucture
Heat Treatment	• Aging • Annealing (3 types) • Cyrogenic Freezing • Solutioning • Stress Relieving • Surface Hardening (3 types) • Tempering (2 types)	• Through Hardening (4 types) • Hot Isostatic Pressing • Normalization* • Chromizing* • Borizing* • Most Heat Treatments—both whole part and localized*	Engine components, Airframe Structure
Surface Treatment	• Shot Blast • Degreasing • Basic Painting • Anodizing • Powder-Coat Cart Painting • Wet-Coat Line Painting • One-Sided Fraction Painting • Plating (4 types)	• Silk Screening • Passivation • Vibratory Deburr • Chem Film* • Booth Painting* • Protective Coat* • Most Surface Treatments—both whole part and localized*	Structural components, Skins, Interior, Propulsion Systems
User-Guided Processes (for costing without CAD)	• Turret Press • Bend Brake • Stage Tooling	• Progressive Die • Injection Molding	Early Costing with Minimal CAD Definition

* Additional cost required to develop and deliver the processes listed with an asterisk. The aPriori Applied Services team may also be able to deliver processes not in this list after evaluating the requested processes and confirming the capability to develop a solution.

WANT TO LEARN MORE?

CLICK HERE to schedule a demo of the aPriori Manufacturing Insights Platform.

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