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Overcoming Product Lifecycle Challenges:

From development to sustainment, the 5 P’s every plan should include

A SiliconExpert White Paper

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Abstract

It is unrealistic for an original equipment manufacturer (OEM) to expect that a product lifecycle plan can be executed from design and development to production and delivery without a bump or two along the roadmap. Accepting this and executing on a solid supply chain strategy that ensures uninterrupted manufacturing cycles and customer satisfaction is key to profitability.

Where to start? As is so prevalent today, volatile geo-risk situations, component obsolescence, counterfeit parts, component shortages, and more can directly impact your development, procurement, and product delivery. These disruptors could potentially drain millions from your bottom line.

This white paper will examine the external disruptors that impact an OEM's supply chain and the five "Ps" for effective product lifecycle planning. These are critical components of best practices parts-management and product life cycle planning strategies.

The 5 P's

Plan for Product Development and original project BOMs, Production, Obsolescence

Prepare for the unexpected

Prevent disruptions to Supply Chain, Production and Product Life Cycle Plan

Perform to your Product Life Cycle Plan

Protect profitability during the entire Product Life Cycle Plan

PLAN & PREPARE

A fool-proof product lifecycle strategy begins with a plan for efficient and optimized product design, development and production. This starts at the foundation of component selection. The right component choice can mitigate the risks posed by obsolescence, low market availability, environmental standards, non-compliant parts, and lack of replacement or cross-reference parts.

Planning for disruption first requires understanding the forces of change within the electronics industry.

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Impacted Areas of Product Lifecycle Plan

Lifecycle Plan Disruptors	DESIGN						PROCUREMENT						PRODUCTION			QUALITY			PROFITABILITY				
	Data validation	Increased Development Time	Search for Alternate Part	Unplanned Redesign Time	Unplanned Evaluation & Testing	Qualification Time & Expense	Parts Shortage	Inventory Search	Increased Part Cost	Longer Lead-times	Higher Inventory Carrying Costs	Increased Freight Costs	Unexpected Production Delays	Line Shutdowns	Missed Delivery Dates	Sorting, Inspecting and Testing	Customer Returns	Loss of Credibility at Customer	Lost Revenue	Higher Inventory Costs	Increased Material Costs	Increased Shipping Expenses	Lost Profits
Obsolescence Management																							
Obsolescence of active components	●	●	●	●	●	●	●		●	●	●	●	●	●	●				●	●	●	●	●
Obsolescence of passive components	●	●	●	●	●	●	●		●	●	●	●	●	●	●				●	●	●	●	●
Obsolescence of electromechanical components	●	●	●	●	●	●	●		●	●	●	●	●	●	●				●	●	●	●	●
Compliance Management																							
RoHS	●	●	●	●	●	●			●		●	●	●	●	●	●	●	●	●	●	●	●	●
California Prop 65	●	●	●	●	●	●			●		●	●	●	●	●	●	●	●	●	●	●	●	●
Conflict Minerals - Tungsten, Tantalum, TIN, Gold, Cobalt	●	●	●	●	●	●			●		●	●	●	●	●	●	●	●	●	●	●	●	●
REACH	●	●	●	●	●	●			●		●	●	●	●	●	●	●	●	●	●	●	●	●
Tariffs	●	●	●	●	●	●			●		●	●	●	●	●				●	●	●	●	●
Counterfeit Components																							
Active							●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
Passive							●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
Longer Lead Times	●		●				●	●	●	●	●	●	●	●	●				●	●	●		●
Component Shortages	●	●	●		●	●	●	●	●	●	●	●	●	●	●				●	●	●	●	●
Technology Advancements																							
Need for Second Source	●	●	●			●		●	●	●										●	●		
Resource Constraints																							
Product re-design	●	●	●	●															●				●
Data services	●																		●	●	●	●	●
Re-certifications						●													●				●
Testing and retesting	●				●														●				●
Supplier & Component Verifications																							
Auditing suppliers	●	●						●															
Supply chain continuity - vetting your supply chain	●	●						●															

Figure 1: Lifecycle plan disruptors and where their impact is felt throughout the plan.

Global Tariffs

Tariffs on imported and exported goods, levied in 2019, added a 10- to 25-percent duty to more than 800 electronics products.[1] These new tariffs have resulted in manufacturers with offshore factories increasing their component prices to cover the tariff inflation. The impact has been felt across the entire components market, affecting the prices and availability of resistors, capacitors, switches, connectors, amplifiers, microprocessors, oscillators, transistors, diodes, fans, and many more.

Tariffs have sent OEMs back to the drawing board to find cheaper components that align to the net target price for their own product. Now more than ever, development engineers must be more diligent in validating the parts they select.

From a tariff perspective, development engineers should plan for disruption and stay informed and enabled for part checks and cross-reference replacement. Manual validation would require a design engineer or supply chain manager first to consult the Harmonized Tariff Schedule of the United States (HTSUS), then identify the tariff impact status (Impacted/Possibly Impacted/Not Impacted) depending on the country of origin and HTSUS. They then would need to execute a cross-reference of the affected products to find replacements from another country. All of which must be done in a timely manner.

Component Obsolescence

OEMs build equipment with the intent of a long lifecycle that justifies a customer's investment. It is inevitable, however, that at some point during that equipment's lifecycle one (or a dozen or a hundred) of its components will be discontinued. This is especially true in today's technology market, where most components regularly outpace the expectations set by Moore's Law.

Back in 1965, Gordon Moore, the co-founder of Fairchild Semiconductor and Intel, wrote a paper in which he introduced his observation about the future of integrated circuits. This observation has come to be known as Moore's Law. Amazingly, over fifty years later, it is still holding true. Moore predicted that the number of transistors in a dense integrated circuit would double about every two years.

Between 2016 and 2019, the number of end-of-life (EOL) notifications increased by more than 300,000. Twenty years ago, the average component lifecycle ranged 10 to 12 years. Today it is four years.[2]

Traditional solutions for component obsolescence management included forecasted lifetime buys of its specified components or more reactionary aftermarket distributor purchases and, in the worst case, completely redesigning the end product.

All of these solutions pose inherent risks. Lifetime buys, for example, require a hefty upfront financial investment. They also result in increased warehousing costs to properly store the components to guard against moisture, oxidation, and dust.

Additionally, if the OEM miscalculates the quantity needed, it may come up short or on the other end of the spectrum it may find itself with an excess of parts. The OEM will eventually incur additional costs to store or dispose of the excess parts properly.

If an OEM chooses to purchase from an aftermarket distributor, it will likely pay a premium rate for marked-up parts and can never be assured of the quantity, quality or authenticity of those parts.

Redesigning the end product each time a component becomes obsolete is financially insurmountable. The time for redesign essentially halts all production and delivery.

The best strategy for mitigating obsolescence is to be prepared. A development engineer needs to be able to cross-reference their components by form, fit, and function and easily find replacements. All too often this happens after an EOL notice is received, sending the engineer on a mad Google search for a replacement. This type of reactive behavior increases risk of counterfeit parts (to be discussed later in this paper).

Planning for obsolescence and securing replacements requires engineering to identify and select parts with cross-reference options. This then leads to the question, where can you cross reference a part by form-fit-function that is available and within budget? There are proactive tools available to assist designer and supply chain for quick identification and replacement of parts.

Geo-Risk Mitigation

With the onset of COVID-19, the need for tracking and distilling information at a macro level is imperative. Overall supply chain risk scores are determined by assessing factors of geo-location combined with known risks:

- Where is the origin of the component and how will this impact downstream manufacturing?
- Does a part come from a single manufacturing location or are there multiple manufacturing sites?
- Who monitors these locations for disruptions?
- Would testing disruptions cause supply chain delivery gaps that could slow critical production lines?

From earthquakes and tsunamis to pandemics and political upheaval, knowing how these forces will affect your product's lifecycle plan is a game-changer when it comes to effective parts management strategy.

Compliance

Increasingly, climate change and the environment play a significant role in component selection. Governments around the world have put into place stringent regulations restricting sourcing, materials, packaging, and transport of both electronic components and finished end products.

Staying in the know and complying with environmental regulations can help OEMs avoid major expenses and lost hours down the road.

The two primary regulations affecting the electronics industry are RoHS and REACH. RoHS, or the Restriction of Hazardous Substances, went into effect in the European Union in 2006. This regulation restricts the use of six hazardous materials found in electrical and electronic products.

RoHS-Recast or RoHS 2 was published in 2011. Specifically, it is a CE-marking RoHS compliance surrounding the marking of products. RoHS 2 also added Categories 8 and 9, as well as additional compliance recordkeeping requirements. Then, in July 2019, RoHS 3 went into effect, banning four additional substances (all phthalates).

The second main directive, REACH (or Registration, Evaluation, Authorization and Restriction of Chemicals), places the burden of proof on companies. To comply with this regulation, companies must identify and manage the risks linked to the substances they manufacture and market in the EU. They have to demonstrate to ECHA (European Chemical Agency) how the substance can be used safely, and they must communicate the risk management measures to the users.

One of the major elements of the REACH regulation is the requirement to communicate information on chemicals up and down the supply chain. The list of harmful substances is continuously growing and requires organizations to constantly monitor any announcements and additions to the REACH scope.

The ECHA has published the REACH Authorization List, which lists Substances of Very High Concern (SVHCs). Currently, this Candidate List for Authorization comprises 205 SVHCs, some of which are already active on the Authorization List. To sell or use these substances, EU manufacturers, importers, and retailers must apply for authorization from the ECHA by submitting a chemical safety report on the risks entailed by the substance and analysis of possible alternative substances or technologies.

SCIP is the database for information on substances of concern in articles, as such, or in complex objects (products) established under the Waste Framework Directive (WFD). Starting January 5, 2021, companies supplying articles containing substances of very high concern on the Candidate List in a concentration above 0.1% weight by weight (w/w) on the EU market must submit information on these articles to ECHA.

The SCIP database ensures that the information on articles containing Candidate List substances is available throughout the whole lifecycle of products and materials, including at the waste stage. The information in the database is then made available to waste operators and consumers. A number of countries outside of the European Union have started to implement REACH regulations or are in the process of adopting a similar regulatory framework to approach a more globalized system of chemical registration under the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

The challenge posed by environmental regulation compliance is that standards continue to evolve. In 2019, RoHS banned four new substances, which impacted around 10,000 electronic components. REACH adds new substances to its Candidate List twice yearly, which literally can change the playing field overnight for OEMs. In June 2011, two new substances were added to the list and immediately impacted 4 million components. OEMs must track and meet hundreds of requirements regarding sourcing, packaging, and transport, as do their suppliers. Missing one change in regulation or failing to comply could have dire consequences.

Navigating these environmental regulations requires meticulous record-keeping and vigilant due diligence. Identifying, recording, updating, and maintaining a materials list for hundreds of thousands of parts is an insurmountable task for an engineer armed solely with an Excel spreadsheet and Google.

Even if manual efforts could track and log all the documentation required, inevitably an approved part will go EOL or a new substance will be added to REACH, requiring a completely new audit.

Environmental regulations are an ongoing, ever-changing concern that requires continuous attention and an automated response. REACH and RoHS are only the beginning. Governments all around the world have been developing similar restrictions that will impact electronics manufacturers moving forward.

The key to successful compliance management is being prepared to navigate the change. Software solutions like SiliconExpert's new P^5 Platform tracks billions of active parts across all main conflict mineral and environmental regulations and proactively alerts customers to impending impact.

Counterfeit Components

Since the electronic industry's inception, counterfeit components have made their way into even the most secure of supply chains. In the last decade, knockoffs, particularly from China, have become increasingly problematic.

The term "counterfeit" includes remarked parts, defective parts discarded by the manufacturer, and used parts refurbished from scrap assemblies. The risks posed by fake components are abundant and varied, including safety concerns, decreased performance, lost revenue, lost customers, and lost reputation.

Suppliers issue tips for spotting counterfeits. Some of these recommendations include visual inspection of measurements, lead spacing, component markings, mold cavities; x-ray inspection of die frames and wire bond integrity; electrical testing of the functional and parametric requirements at the recommended extreme operating temperatures; and decapsulating the component to view the part's inner workings via microscope. However, by the time an OEM receives a shipment of components, it is far enough into the development and production processes that discovering a counterfeit part inevitably will result in lost time and revenue.

To mitigate the risk of counterfeit parts, a company must prepare and practice good procurement policies. These policies should include working with test laboratories; properly managing and heeding government-issued alerts; and collaborating with the rest of the industry.

Does it sound time-consuming and work-intensive? Well, it is. Organizations like the Semiconductor Industry Association (SIA) of the U.S. and Europe, Government Industry Data Exchange Program (GIDEP), and the Electronic Resellers Association International (ERAI) are working to develop anti-counterfeiting standards and specifications. However, because too many of these standards depend on identification methods aimed at constantly moving targets, everyone agrees that the best solution still is to follow the "golden rule" of component purchasing: ***Always purchase directly from the manufacturer or from the manufacturer's authorized dealer.***

Traceability is crucial. Electronics manufacturers can and should deploy third-party tools, which allow users to flag counterfeit parts via applications built into the parts database.

Component Shortages and Technology Advances

In the last few years, OEMs have faced waves of supply shortages, price hikes, and lengthening lead times. Initially spurred by the component industry's consolidation in 2015 and 2016, a constrained market was further squeezed by the rapidly evolving automotive market.

As car makers experiment with electric vehicles and add more bells and whistles to the dashboard (such as embedded systems, sensors, and artificial intelligence), the number of components also exponentially increases. Today there are 2,000 to 3,000 capacitors found in the average combustion-engine car. Some estimate that as more functions become electronics-dependent, cars could demand up to 22,000 MLCCs per vehicle.

Yearly releases of new and more advanced smartphones also contribute to component shortages in the industry. According to Jabil, 1.5 billion smartphones are manufactured each year. Each smartphone contains 1,000 capacitors.[3] This means 3 trillion MLCCs are being produced every year, half of which are used in smartphones. That's a lot of "disposable" components.

With no end in sight for consumer demand of smaller, faster, sexier-performing phones, component demand will not abate anytime soon.

Finally, and most recently, the promise of IoT is impacting the electronic component supply. Gartner estimated 20 billion devices would be connected to the IoT by 2020.[4] Indeed, it seems like every product imaginable has been re-designed to be "smart" including water filters, flip-flops, egg timers, and even diaper sensors.

Currently, passive components such as MLC capacitors, resistors, and diodes regularly see lead times averaging five to eight months. As technology advances drive component demand sky high, parts are now sourced by allocation with long lead times for replenishment. These are roadblocks few OEMs can afford. Shortage in supply drives extended production schedules, component price increases, and smaller net product margins.

Dealing with component shortages requires methodical and continuous production planning, second sources, and drop-in cross references. According to the SiliconExpert P^5 Platform, 2020 will see memory, DRAMs, chip resistors, and sensors, (especially infrared) most often on the "parts on allocation" list. OEMs must be able to find this information quickly to make informed, proactive decisions with updated, timely data.

The Bottom Line — Plan & Be Prepared

This whitepaper has reviewed just a handful of the pitfalls the supply chain and product lifecycle plan may fall prey to over time. It may seem like an impossible task to safeguard your supply chain. However, it can and must be done.

Planning ahead for component obsolescence or shortage is critical because it provides a failsafe backup plan if the components you need are not available. After all, redesigning an entire product for the sake of one obsolete component could have a devastating financial impact.

Electronic products are made of multiple components. The likelihood one or many of those components will become obsolete over the course of the product lifecycle is high. Traditionally, component engineers relied on their own knowledge of the available parts on the market, as well as the input of their distributors or contract manufacturers and manufacturers' websites to compare parametric data across the product type. However, data on these parts is not accessible at all times, making it extremely difficult to obtain and manage such information.

In order to make an informed and intelligent part selection decision, engineers go through the seemingly endless task of searching, finding and organizing data sheets, PCN product brochures, documents, and more. Then they must analyze and extract the relevant information. This process is time-consuming, with questionable accuracy and lack of comprehensive data.

Engineers are now consulting independent, third-party component databases that compare deep parametric, dimensional, and electrical characteristics. This allows them to quickly find and grade crosses between all the manufacturers they manage or track.

PREVENT

To mitigate unplanned and unquantifiable risks, original equipment manufacturers increasingly must partner across the electronics industry to ensure a comprehensive, sustainable, and long-term strategy that minimizes the effects of disruptive forces.

Too often, OEMs rely on non-standardized, non-measurable methods for part selection. This can lead to last-minute, rushed decisions. One such method is the use of traditional search engines to find electronic parts data. While traditional search engines are sometimes useful for finding obscure documentation, they lack the context of vertical search engines that specialize in searching for data on electronics parts only.

Vertical Search

The use of traditional horizontal search engines such as Google to locate parts information has resulted in a number of costly inefficiencies. Significant numbers of man-hours are lost to data combing. Part selection is sub-optimal and at-risk parts are either not identified as such or cannot accurately have their level of risk determined.

In addition, traditional search engines are mostly text-based and lack the intelligence to understand the proper context of a given search string. As an example, if an OEM googles a part number, the returned results could be a vehicle identification number, a social security number, or a book's ISBN number. It searches without any context, pulling irrelevant numbers from any industry.

By contrast, the use of vertical search engines can provide much more useful parts data along with pre-performed analysis of that data. In effect, the use of vertical search engines can turn data into actionable intelligence which can reduce man-hours, cut costs, and improve part selection and risk management.

By focusing on a single topic, vertical search engines seek to provide users with a “one-stop shop” for data on a given subject rather than the mass of web searched, scattered information. Vertical search engines understand part number searches by automatically and intelligently narrowing search focus to improve results.

Vertical search engines frequently employ parametric search, allowing users to locate the optimal part along a number of parameters. Depending on the product type, these parameters can include vendor, type, number of channels per chip, technology, rail-to-rail, power supply type, typical gain bandwidth product, minimum CMRR range, and minimum/maximum operating temperature.

With vertical search, users can also filter through any or all of these parameters to more accurately narrow search results. Vertical search also can provide access to market availability, environmental compliance, and cross-reference data, often within a single click. By placing all of this data in a single location, vertical search enables users to make more intelligent product selections.

Even if a Google search were able to return search results on the correct part, it is unlikely the searcher would find everything needed and available to know on a particular component. With a vertical electronic parts search engine, all relevant component information such as obsolescence data, market availability, and environmental compliance data automatically populates from one search. Datasheets, parts lifecycle status, and other valuable information can also be located and identified quickly. This all leads to man-hours saved, freeing users to concentrate on other more profit-driven tasks.

PERFORM

Third-Party Databases

Manually performing part search and selection processes is time-consuming and error-prone, and can result in incorrect or incomplete part numbers, missing information on various part attributes, and a host of other inconveniences and errors. With a third-party database, all the data on millions of parts is in one place, compiled over the course of decades.

Some OEMs have turned to third-party databases, such as SiliconExpert P^5 Platform. Subscribers can see a significant ROI to their investment. Savings range from a couple of hundred thousand to several million, based on costs of re-design, re-qualification, production delay avoidance, man hours of research and information gathering and regulatory cycles. On top of that, this realization can happen in as little as a month or two.

Third-party component databases use unbiased historical and algorithmic methods to predict component events. They cover thousands of manufacturers and billions of parts, executing obsolescence forecasts and assigning risk grades based on factors such as market availability, technological improvements, and the historical obsolescence behavior of a given manufacturer.

To understand how a third-party database outperforms traditional solutions, take the example of an OEM affected when REACH adds a new substance to its Candidate List. In this instance, third party database automatically identifies the change. It collects the information, analyzes the impact and then distill the data down to the component level. The database is quickly and accurately updated to reflect their findings and alerts are sent to subscribers who may be affected.

In the case of component obsolescence or counterfeit risk, subscribers can upload an end product's bill of materials (BOM) and then receive a report detailing components most likely to be counterfeited and those at highest risk for PCN and EOL. The report also confirms the reliability of multiple sources. This information is made available in the time it takes an OEM's component engineer to refill his coffee cup and settle down to his spreadsheet to begin manual cross-check.

PROTECT

Business Intelligence-as-a-Service

As reviewed, third-party databases are an excellent solution for more proactive part management. However, not every database is created equal. And not all are built nor managed to 100% protect your profitability.

For productive, proactive, and on-time product lifecycle planning, you need a platform aligned to all facets of potential disruption. It must:

- Find your part quickly
- Manage all obsolescence and strategic risks
- Ensure product compliance with data on RoHS, REACH, and conflict minerals
- Access second sources
- Provide cross-reference data
- Manage lead time, pricing, and availability that supports schedules and budgets
- Forecast risks to ensure supply chain continuity
- Understand BOM risk to avoid redesigns, re-qualifications, or shortages
- Detect and avoid counterfeit parts early in the product development phase
- Develop products confidently by sourcing the right parts from the beginning
- Manage market risk with insights that keep you ahead of supply shifts

SiliconExpert's P^5 Platform delivers on the "5 P's of Product Life Cycle Planning." From plan to prepare, prevent to perform, to protecting profitability. Its readily available, sophisticated, relevant, and up to-the-minute data mitigates risks from the supply chain. It empowers users to achieve profitability through re-allocation of time and money, securing a profit margin with no unanticipated costs or uninterrupted production cycles, while ensuring on-time shipment and delivery of products.

Conclusion

The effects of a supply chain disruption reach far beyond a late product shipment; indeed, they are felt across the manufacturer's organization and impact customer industries as well. Obsolete or counterfeit parts, dynamic technology advances, and ever-changing compliance requirements affect the design engineer, the procurement team, the production line, shipping and transport, the C-suite, and the entire employee roster. When a component reaches end of life or experiences long lead times due to materials shortages, the ensuing redesign, re-qualification, inventory-carrying costs, line shutdowns, and missed delivery dates result in lost revenue and reduced profits. These in turn can trigger layoffs, lost wages, and a ripple effect that can be felt across industries and even some economies. The electronics industry won't achieve different results by continuing to rely on the same outdated responses.

Today, manufacturers can access accurate, current data on suppliers and millions of active parts, collected over two decades and updated and expanded by the minute. Rather than existing in silos, it's now possible to collate information across all factions of the product lifecycle, from the design stage to the end user. By following this digital thread (parsed and processed data and its resulting business intelligence), every manufacturer can develop a proactive and informed supply chain strategy built from the ground up, starting in the design stage and carrying through to equipment maintenance at the customer site years later.

Meeting the product lifestyle challenge no longer requires herculean efforts across engineering, procurement, production, and delivery. With an informed strategy and software tools that provide accurate part search; bill-of-materials management, grading, and risk assessment; cost avoidance calculation; compliance assessment; cross-referencing capabilities; and accurate and timely alerts—all at their fingertips—all manufacturers can make smart design decisions that protect their supply chains, reputations, sales channels, and profits, no matter what external forces may come into play.

About SiliconExpert

SiliconExpert provides the relevant data and insight needed to remove risk from a Product Lifecycle Plan.

For 20 years, SiliconExpert has been delivering on strategic product lifecycle planning with its advanced data platform. The newest platform release, P^5, delivers on accuracy, timeliness, comprehensiveness, and leads the industry by covering hundreds of product lines over billions of parts and thousands of suppliers.

SiliconExpert ensures companies design and maintain sustainable products with transformative visibility to their supply chain. With 400 electrical, software and data engineers handcrafting its component database, SiliconExpert delivers the most comprehensive intelligence tool and professional services portfolio in the industry.

Customers globally use SiliconExpert's solutions to manage risk, avoid redesigns, and mitigate obsolescence in innovative industries such as, but not limited to, consumer electronics, telecommunications, automotive, medical, and aerospace.

SiliconExpert customers include leading commercial and government OEMs, top-tier authorized distributors, contract manufacturers and component suppliers. End-of-life (EOL) forecasting, cross-reference search (form, fit, and function alternatives), lifecycle statuses, parametric data, and product change notice (PCN) alerts are a few of the features of SiliconExpert's suite of products that provide BOM management and obsolescence mitigation solutions.

SiliconExpert Technologies, in collaboration with the University of Maryland's Center for Advanced Life Cycle Engineering (CALCE), has integrated advanced risk analysis with obsolescence forecast algorithms designed specifically for its components database. Utilizing four risk factors—lifecycle, multi-sourcing, environmental compliancy, and market availability—the algorithm assigns a risk grade and obsolescence forecast to all parts within all product lines of the database.
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