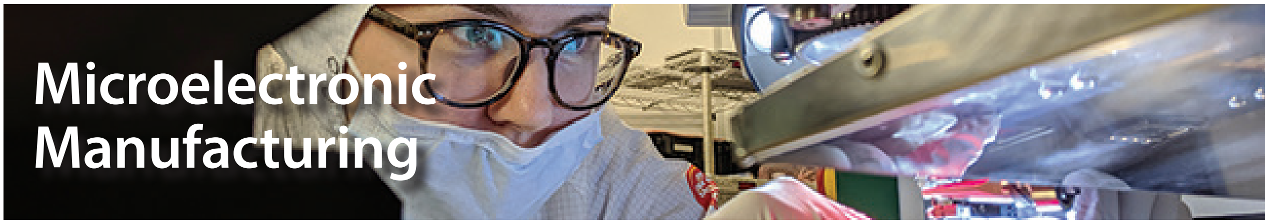


SILICON Heartland OH SMART MICROSYSTEMS

Product Launch – Ready for the Big Day?

William Boyce
SMART Microsystems Ltd.

PREVIOUS SMART ARTICLES HAVE DISCUSSED product design concepts and developing a robust manufacturing process in microelectronics. Some of the elements leading up to and ensuring the success of "the big day" (product launch) have been presented. In theory, if an organization executed on a robust design and a properly developed assembly process, there ought to be a flawless launch. If this is the case, then why are so many product launches flawed? Experience shows that, in some part, all new product launches have some degree of difficulty that needs to be overcome. That is why it is critical to do everything possible to make it successful. Whether launching a product or a subassembly for a product, the challenges can be equally as demanding. The key to a well-executed product launch is a thoughtful, well-documented plan that contains several crucial elements. A 3-year product volume ramp plan, a capacity ramp plan, FMEA, PFMEA, risk analysis, NPD readiness reviews, control plans, and engineering process reviews are just some of the many tools that are used by ISO organizations in preparation for product launch.

Many times the question is asked, "When is it a good time to start planning for product launch"? It is always important "to begin with the end in mind". Planning for product launch should begin on day one of the product concept. If the product concept has been properly vetted, then the design to cost (DTC) goal and projected volume product demand should be well understood at the beginning of the project. These two pieces of data, along with the upstream customer requirement, should drive the design, the process, and the 3-year product volume ramp plan. With these pieces in place, the design team can work toward a frozen design that meets the customer requirement. Meanwhile, the process team can be working concurrently to meet the projected launch date with a process capacity ramp plan that will exceed the projected volumes within the DTC goal. One approach is to design a scalable process that will meet 120% of the 3-year projected volume utilizing a single shift. This allows for flexibility to scale up the process capacity as demand grows while maintaining the option of

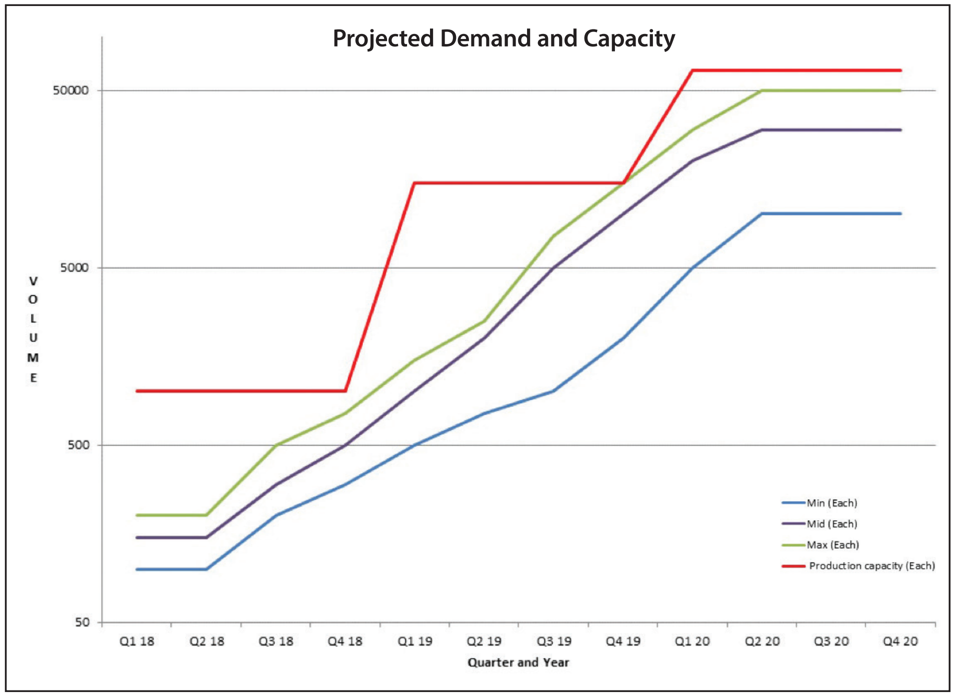
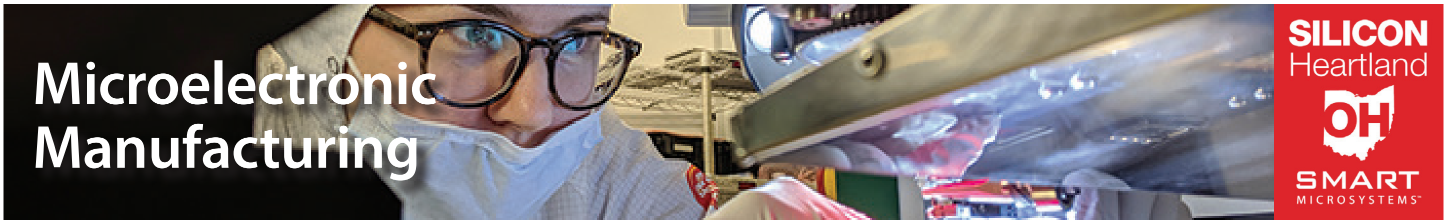


Figure 1. Projected Demand and Capacity.

a second shift for non-sustained periodic spikes in demand.

Failure mode effects analysis (FMEA) and process failure mode effects analysis (PFMEA) are great tools which lie at the core of any six sigma or quality program. These tools, when used properly, can provide valuable insight into the design and process weaknesses of a product. When coupled with a thoughtful risk analysis, the outcome is a stronger, more robust design and process. Even at the subassembly level periodic FMEA review is encouraged to ensure that all risk areas are being effectively addressed. Like all of the tools in this process, this information should flow from the top down. In other words, all of the elements of the FMEA should be derived from the top most customer-driven assembly down to the lowest component and subassembly. The information gained from the FMEA review should then be captured in a launch control document. As an example, if the FMEA review indicates a potential risk to the supply chain by some unknowns in the process, the control plan may require the buildup of some "safety stock" to mitigate that risk. Because safety stock has a cost associated with it, which is preferable not to carry for the life of the product, it will be used as a launch control only, and there will be a call out point for when it is eliminated. Preferably, this happens in production once it is demonstrated that safety stock is no longer required.

Other tools, like the engineering process reviews, can be used as inputs to the launch plan. Often time these tools are either overlooked or conducted independently in a format that is not captured in the launch plan. Engineering process reviews should definitely be captured in a launch plan. This way, full advantage of the product knowledge on the design team and the process knowledge of the process engineering team can be taken. Too often, a problem is encountered later in the product launch cycle, only to discover that some individuals with product tribal knowledge not only knew about it, but took the time to actually document it in



Microelectronic Manufacturing

a separate format, like an engineering design review or an Open Issue List (OIL), that never made its way back to the readiness review. This represents a tragic missed opportunity, not to mention an effect on the bottom line.

Finally, conducting formal and periodic new product development (NPD) readiness reviews is an essential element to a successful launch. If possible, these reviews should be conducted in person, at specified stages of development, containing members of all interested parties in the product launch. The reviews can be divided into four phases - concept phase, development, pre-launch, and production phases. For the meeting to be effective, design engineering, process engineering, sales (for the voice of the customer), purchasing, and management all need to be represented. These meetings should update any changes in the design or process, the status of the product relative to the DTC goal, the schedule, and any customer changes or inputs. A readiness review format that utilizes a traffic light process embedded in an NPD checklist format is effective. In the NPD traffic light process, each element of the review gets assigned one of 3 colors: green indicates an element is ready, yellow indicates a potential risk with follow-up, and red is an at risk element with recommended actions. Any quality organization recognizes that this meeting must be clearly and formally documented for it to be of value. A standardized form that has all of the critical elements can serve to facilitate the meeting and record the results. The final readiness review occurs just prior to the program launch date, and contains the results of all the documentation and preparation to date. If the preparation steps have been effective, all the critical launch control elements should be coded green and any yellow should have launch controls in place. There should never be a launch with a critical element coded red.

A robust design and a properly developed assembly process are necessary to ensure the success of a product launch. Whether building the entire product or a subassembly, there are always challenges that need to be overcome. It is important to have a thoughtful, well-documented plan that includes key elements – a 3-year product volume ramp plan, a capacity ramp plan, FMEA, PFMEA, risk analysis, NPD readiness reviews, control plans, and engineering process reviews – in order to have a well-executed product launch.

Document # 12345

PROCESS
FAILURE MODES AND EFFECTS
(PROCESS FMEA)

_____ System
__X__ Subsystem
_____ Component

Design Responsibility __________ Company X

Prepared by: Bill

Key Dates ____________________________.

FMEA Date (rev A) . 1/1/2018

Core Team:

Process Step/Function	Requirement	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s) Mechanism(s) of Failure	Controls Prevention	Occur	Controls Detection	Detect	RPN	Recommended Action(s)	Responsibility & Target Completion Date	Actions Taken Completion Date	Sev	Occ	Det	RPN
Header Assembly																		
Operation 105: Kit Materials	Purpose: Provides all the proper materials for the build	Kitted Wrong wire - Wire too small	Will not bond	4		Inproper marking	Operator training, Process Specs, Machine Set Up/PM's	4	Bonder will not work, rev control software	2	32							
		Kitted Wrong wire - Wire too large	Will not load in wire bonder	1		Improper marking or improper reading by operator	Not able to process	4	Wont feed in equipment	2	8							
		Kitted Wrong wire - wrong material	Will not bond	4		Inproper marking	Operator training, Process Specs, Machine Set Up/PM's	4	Bonder will not work, rev control software	2	32							
		Damaged Sense element	no or weak output	7		Inproper handeling	Operator training, Process Specs, Machine Set Up/PM's	3	FFT	3	63							
		Incorrect Number of Parts/Material	Cannot complete build	1		Operator error	Not able to process	1	not able to complete	5	5							
		Wrong Capilary kitted	Will not bond wire properly	5		Improper marking or improper reading by operator	Operator training, Process Specs, Machine Set Up/PM's	3	Pull test	2	30							
		Incorrect adhesive	Will not bond wire properly	6		Improper marking or improper reading by operator	Operator training, Process Specs, Machine Set Up/PM's	3	Inspect	3	54							
Operation 110: Prep Adhesive	Transfer adhesive from primary container to 3cc dispense syringe barrels	Material out of date	Poor adhesion or bondline thickness	7		Incorrect labeling	Scheduled inventory logging	2	Work instructions / traveler	5	70							
			Will not process in dispense	3				5		3	45							
			Does not cure properly	5				5	Final test	3	75							
Operation 115: 100% Incomming Inspection	Purpose: Inspect headers and die before assembly	Rejecting good material	Insufficient materil to complete build	1		Inpropper or insufficient training	Work instructions and training	3	Visual Inspection	8	24							

Figure 2. Example of PFMEA.

Concept Phase NPD Review Checklist

FOCUS ELEMENT APPROVAL	GYR STATUS LIGHT		CONCEPT	REQUIRED FOR B LEVEL	RESP.	Eng RESP.	PROGRAM NEED DATE	TARGET DATE	COMP. DATE	ACTIONS (if Required)
Marketing	g		IDENTIFY CUSTOMER REQUIREMENTS	YES						
Quality	r		REVIEW LESSONS LEARNED	YES						
MKT Mgr	y		DTC Status	YES						
Engineering	g		Q tools	YES						
Director	r		Tooling Make/buy	YES						
Eng Manager	y		Process Budget	YES						
Eng	g		COMPLETE COMPETITIVE ANALYSIS	YES						
Sales	r		Kickoff Meeting	YES						
Eng	y		DOCUMENT PROGRAM SCHEDULE	YES						
Eng	g		PREPARE RISK ASSESSMENT	YES						
Eng Manager	r		New Order checklist complete	YES						
Eng	y		FMEA complete	YES						
Eng	g		PFMEA Complete	YES						
Eng Manager	g		Customer Contact assigned	YES						
Director			CONCEPT PHASE EXIT REVIEW	YES						

Figure 3. SMART Concept Phase Review Checklist.

William Boyce is the Engineering Manager at SMART Microsystems. He is detail-oriented and is a hands-on engineering leader with a wide range of diverse skills from his background in automotive sensing.

He has served in senior engineering roles over the last 24 years with accomplishments that include manufactured automotive sensors. He also led new product development teams that created over $25 million in new revenue per year. He is certified in EIT and Six Sigma Green Belt and is an industry recognized expert in Al wire bonding. Additionally, he designed and led the metrology lab and machine shop at Sensata.

Mr. Boyce earned a Bachelor of Science in Engineering degree from the University of Rhode Island and has been a member of the IMAPS New England Chapter for over 10 years.