



Pull Flow Sequencer tool at Qimonda Portugal SA

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*À minha mãe, irmã e avós
que me apoiaram incondicionalmente.*

*E à Joana
que me acompanhou e ajudou sempre.*

Resumo

O presente documento descreve o projecto desenvolvido durante seis meses na Qimonda Portugal, empresa multinacional Alemã da área dos semicondutores electrónicos, que teve como objectivo a criação de ferramentas para o cálculo de Cycle Times necessários para o correcto funcionamento de um programa denominado “Pull Flow Sequencer” (PFS), de relatórios relativos ao mesmo para analisar e acompanhar o progresso semanal da produção e o suporte, optimização e implementação de uma nova versão do programa. Este baseia-se na filosofia de Just in Time (JIT), nomeadamente no Pull Flow, um método para melhorar as restrições tradicionais no flow da produção. O objectivo do programa é servir o cliente com o mínimo de custos possível, trabalhando com níveis calculados de WIP (Work In Process) de acordo com a capacidade de entrega do fornecedor e a quantidade de entrega acordada com o cliente. Para manter os níveis de WIP necessários na linha, as entregas enviam um sinal para os starts (deliveries), um kanban electrónico.

A implementação foi faseada, e incidiu nesta fase apenas numa das áreas (Assembly) e num dos dois tipos de produto, TSOP, um produto mais robusto e com menos falhas de processo. Os utilizadores finais deste programa são os operadores na linha que assim podem ter noção de que produtos devem ser produzidos em cada altura segundo os cálculos efectuados pelo programa.

No desenrolar do projecto surgiram complicações inerentes a uma mudança de filosofia de planeamento (push para pull), assim como alguns problemas relacionados com o próprio programa e dificuldade em calcular alguns parâmetros essenciais para o correcto funcionamento da ferramenta. O projecto Pull Flow Sequencer estava em progresso na Qimonda aquando do início da estadia na empresa, sendo que foram atribuídas várias tarefas e deliverables específicos dentro da Pull Flow Project Team a este projecto. A primeira foi a elaboração de um relatório da área produtiva onde foi implementado o PFS devido à necessidade de dar visibilidade a esta nova filosofia de planeamento. Na fase inicial foi criado em Excel e requeria algum trabalho de manutenção, sendo depois de um tempo de teste e optimização passado para uma plataforma em Business Objects. Isto implicou a criação de novas ferramentas para acomodar os novos dados, o que permitiu tornar o relatório automático e acessível. Outra das tarefas realizadas foi a criação de um ficheiro excel para o cálculo dos Raw Process Times (RPT) baseado nas complexidades dos produtos, capacidades e alocação das máquinas, tamanho médio de lotes e tempos de processo com o objectivo de obter um Cycle Time preciso para o correcto funcionamento do PFS. Por último, houve o desenvolvimento e a implementação de uma nova versão optimizada e user friendly do programa após vários debuggings e alterações.

Este projecto continua a ser implementado com sucesso, tendo começado no início de Janeiro o alargamento do uso do programa aos outros produtos existentes (BOC), ficando todos a serem geridos por este programa na área de Assembly. Futuramente pretende-se alargar o uso do programa às outras áreas produtivas.

Abstract

The present document describes the project developed during six months at Qimonda Portugal, a German multinational company in the electronic semiconductor area, which had an objective of creating the tools for a precise calculation of the Cycle Times needed for the correct functioning of a program called “Pull Flow Sequencer” (PFS) as well as reports in order to analyse and follow the weekly production progress and the support, optimization and implementation of a new PFS version. This tool is based in the Just in Time (JIT) philosophy, namely the Pull Flow, a method to improve the traditional restrictions in the production flow. The program's objective is to serve the client with the minimum possible cost, while working with calculated levels of WIP (Work In Progress) according to the supplier's capacity to deliver and customers agreed consumption. In order to maintain the necessary WIP levels, deliveries deplete a signal for releases, an electronic kanban.

The program implementation was phased, and in this period of time it was focused only in one of the productive areas (Assembly) and one of the two types of products, TSOP, a more robust and fail proof product. The final users of the tool are the line operators that by using it are able to have a notion of which products should be produced at each time according to the calculations effectuated by the program.

During the project roll out some complications inherent to a change of philosophy planning (push to pull) arouse, as well as some problems relative to the program and difficulties in calculating some essential parameters for the correct functioning of the tool.

The Pull Flow Project was already in progress at Qimonda at the time of the beginning of the stay at the company, and several tasks and specific deliverables in the Pull Flow Project Team were attributed to this project. The first was the elaboration of a report of the productive area where the PFS was implemented due to the necessity to give visibility to this new planning philosophy. In the early stage it was created in an excel file format which required some maintenance work, and after a test and optimization period a new report was built in a Business Objects platform. This implied the creation of new tools to accommodate the new data, which allowed making the report automatic and accessible. Another task that was effectuated was the creation of an excel file for the calculation of the Raw Process Times (RPT) based on the complexities of the products, equipment capacities and allocations, average lot size and process times with the objective to obtain a precise Cycle Time for the correct PFS functioning. At last, a new optimized and user friendly version of the program was developed and implemented after several debugging and changes.

This project continues to be implemented with success and the use of the program with the other existent products (BOC) started at the beginning of January with the objective to have all the products in the Assembly area managed by PFS. In the future it's intended to also use the program in the other productive areas.

Agradecimentos

Em primeiro lugar gostaria de agradecer a todas as pessoas que me acompanharam durante o meu percurso na Faculdade de Engenharia da Universidade do Porto e que contribuíram para a minha formação e ao meu orientador de projecto, José Oliveira, pelo seu apoio e disponibilidade demonstrada.

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1. Introduction

The present report is relative to a project developed during a six month internship period, from August 2008 until January 2009, at Qimonda Portugal S.A.. This internship corresponds to the last semester of the fifth year of the integrated Masters Degree in Industrial Engineering and Management at *Faculdade de Engenharia da Universidade do Porto*.

The report starts with a brief description of the company where the internship took place, followed by an explanation of the factory processes to better understand the project and its elements.

1.1 Presentation of Qimonda Portugal S.A.

Qimonda Portugal (QPT) is the only memory company producer in Portugal and is part of the group Qimonda AG founded on May 2006, with headquarters in Munich. This group is still part of the Infineon Group (75%), and resulted from a spin off. In Portugal the company is situated in Vila do Conde since April 1999 and is the biggest Qimonda's back-end (BE) site. QPT (figure 1) is also the greatest national exporter as well as the second biggest foreign investment in Portugal, with almost 700 million euros and more than 1900 workers.



Figure 1 – Qimonda PT

The word Qimonda has its own meaning (figure 2) and can help explain the philosophy and spirit the company has, as well as its objective:



Figure 2 – Meaning of Qimonda

- “Qi” stands for breathing and flowing energy.
- Combination of the English word “key” and the Latin “mundus”, and intuitively understood as “Key to the World”.
- The expressive character of the logo emphasizes the dynamic features of the brand and reflects the company's core values: Creative, Passionate and Fast.

Qimonda AG is divided in two types of sites: Back End (BE) and Front End (FE). A Front End is a site where, through a series of processes, the round silicium wafers (figure 3) are produced. These wafers contain the dies and can be produced in either 200mm or 300mm format, and the quantity of dies it contains depends on their size. At the end of the FE production process the wafers are taken to a BE, where they will be processed.

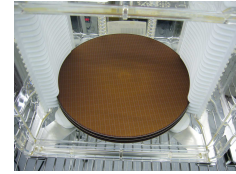


Figure 3 – Wafer

The picture below (figure 4) shows all the Global R&D (Research and Development) and manufacturing sites that Qimonda A.G. has:

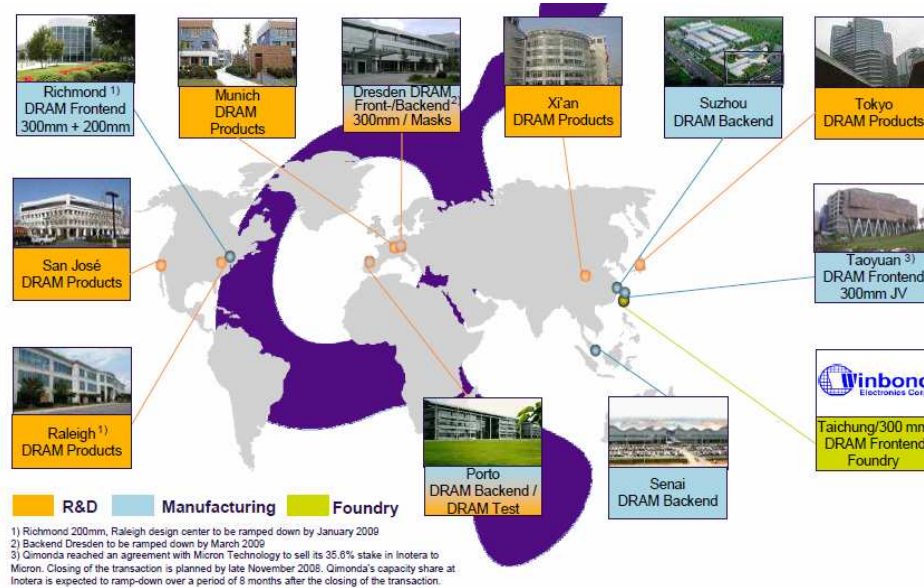


Figure 4 – Global R&D and Manufacturing

Porto's site is a BE, and it's the place where through several operations we obtain the final products: modules (figure 6) or chips (figure 5). In 2007, all the modules lines were transferred to Malacca (Malaysia), and Porto now only produces components. The chips are divided in two major groups, depending on the type of package: TSOP (Thin Small Outline Package) and TFBGA (Thin Fine-Pitch Ball Grid Array) or BOC (Board On Chip). TSOP is a chip more robust, bigger than BOC (figure 5), with a higher energy consumption, better performance and with a need of different and more expensive raw materials. They both have the same basic function, but due to its weaker characteristics; the TSOPs are starting to be discontinued.



Figure 5 – TSOP vs BOC



Figure 6 – Module

Qimonda AG is in the semiconductor industry, a very competitive industry where speed and innovation dictates the leaders. The company builds a wide and growing range of DRAM products (figure 7) for devices such as Sony's Playstation 3, Microsoft's X-Box , Nintendo's Wii, cellular phones, GPS and notebooks, having a strong portfolio of clients in the areas of infrastructure products, graphics, personal systems and consumer applications. It sells their products to strong costumers like Dell, Sony and Nintendo.



Figure 7 – Qimonda customers and applications

The semiconductor industry sector is going through a severe crisis, with a huge drop on the prices of the final products, totaling in some products a diminution of 60% of the selling price in less than one year. The last data available is still referent to the year of 2007, in which Qimonda A.G. was situated in the third position relative to the revenues income (figure 8), with a market share of almost 12,7%. Although this relatively good position for Qimonda, the financial markets crisis in 2008 has been aggravating the company's position, which has had to restructure itself and make extreme cuts in costs in order to maintain its competitiveness. Moreover, recently the company has issued a request for insolvency due to its current weak financial position and in an attempt to restructure in a faster way so it can survive the crisis.

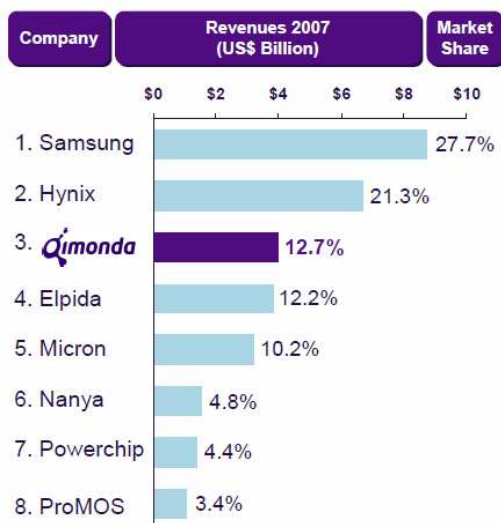


Figure 8 – Revenues 2007

1.2 Qimonda Production Process

At the beginning of the internship in order to better understand the Qimonda processes, a visit to the several productive areas took place and at the end a presentation and a report about them was made, which can be consulted in the appendix A. Although this information is present at the end of the report (appendix A – Productive Areas Presentation), a brief overview of the processes is also needed before introducing the project so that it can be better understood.

Porto's Production Process is divided into four major areas:

- WLA (Wafer Level Assembly)/RDL (Redistribution Layer)
- Wafer Test
- Assembly Operations
- Test Operations

Assembly and Test are the two main areas of a BE site but, in Porto's case, two FE operations, WLA and Wafer Test, also take place, making it the most flexible Qimonda Site.

1.2.1 - WLA/RDL and Wafer Test

The purpose of this area is to process the wafers in order to prepare each die for multi-die packaging. This technology was recently introduced and allows making components with more than one die inside, and is currently being produced only with two dies (Dual-die).

Since this area is the most delicate and photosensitive, it is performed under yellow light and in a 1k clean room (less than 1 thousand particles per cubic foot).

Wafer Test is the last phase of the FE production process with the objective to assure the physical and functional integrity as well as the high quality standards of the wafers and its components (dies) through a series of test operations and laser reworks in a 10k clean room.

The dies in the wafers don't have all the same quality, and this important information will be stored in a Wafer Map (figure 9) where we can see the quality of each one through colour and number coding.

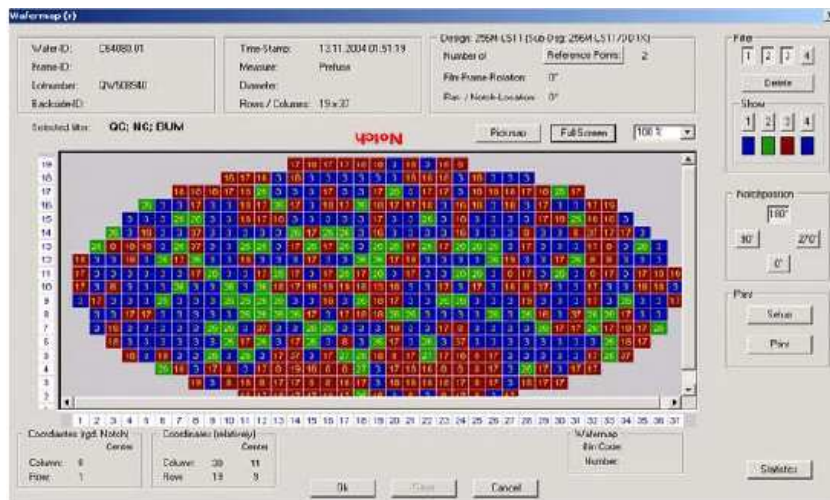


Figure 9 – Wafer Map

1.2.2 - Assembly Operations

1) Pre-Assembly

Pre-Assembly is the first area of the BE Operations where the wafers are submitted to a series of processes in order to prepare them for the next area. The wafers arrive to the area from a kardex (an automated system of elevators and storage racks that connects the warehouse directly to several areas) and go through the first operation, Dicing, where all the dies are individualized.

The next process is laminating, where the wafer's active part is protected with a grinding tape before the GMP (Grinding, Mounting and Peeling). With the Grinding operation the wafers thickness is reduced to a desired value, then they are mounted in a carrying frame (figure 10) so that they can be easily transported (Mounting) and finally Peeling, where the grinding tape will be removed.



Figure 10 – Wafers with carrying frames

2) Front Of Line (FOL)

The explanation of this area and End Of Line assumes a vital importance in order to better understand the project in course and some terms mentioned. So, in the figure 11, we can see the schematic of both the areas.

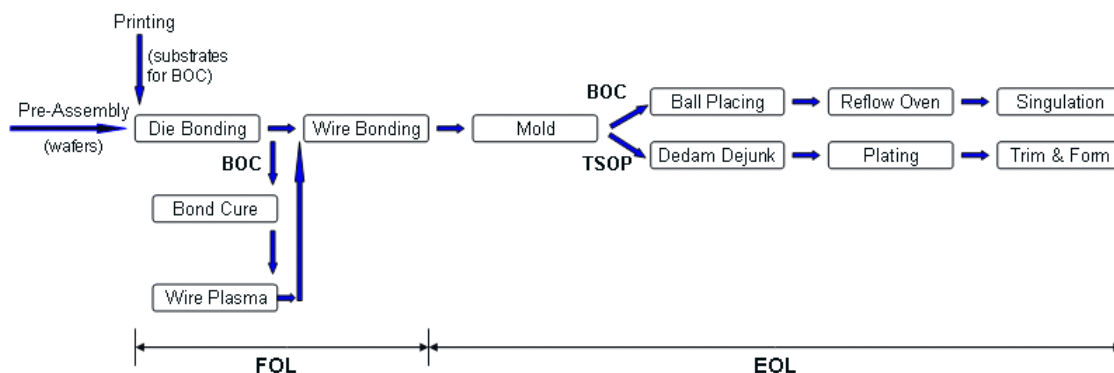


Figure 11 – FOL and EOL operations

In the FOL area the differentiation between the final products starts to be important, namely the package. Here we have two main types of products mentioned before: TSOP and BOC. The inputs of this area are the wafers from the Pre-Assembly or directly from other FE sites, the leadframes from the kardex for the TSOP products and the substrates from the Printing area for BOC products.

The Printing (figure 12) is a support area of Assembly where a special epoxy is deposited on the substrates destined to the BOC products and a cure operation takes place to prepare it for Die Bonding.

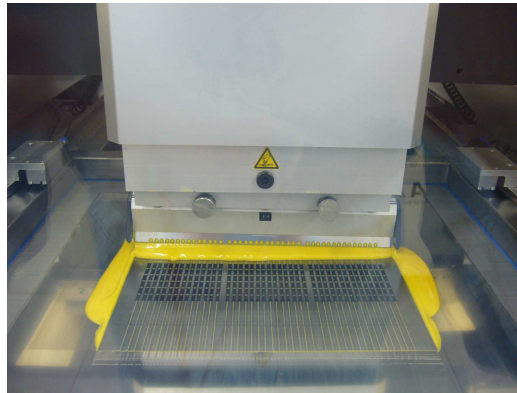


Figure 12 – Printing operation

Both TSOP and BOC products go through the same operations at FOL, first Die Bonding and then Wire Bonding. Although the operations are basically the same, there are some differences between the packages, mainly in the machines used and some support or extra operations needed. In Die Bond, the chips are taken from the wafers (figure 13) according to the wafer map and attached to the epoxy/tape of the substrates/leadframes (BOC/TSOP). The Wire Bond operation (figure 14) consists in the mechanical connection with gold wire between the die and the substrate/leadframe contacts to guarantee an excellent conduction between them.

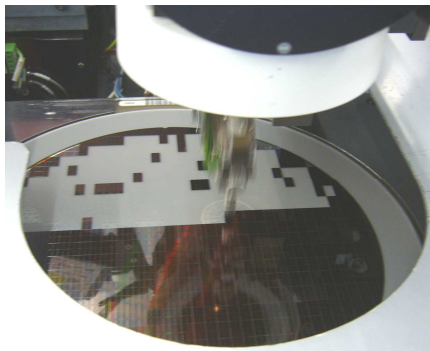


Figure 13 – Chips taken from the wafer

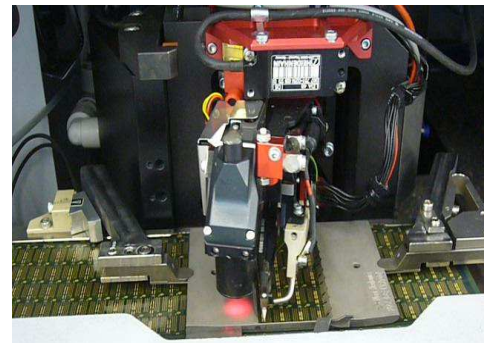


Figure 14 – BOC Wire Bond

3) End Of Line (EOL)

At EOL both packages need a similar operation, Mold, and afterwards they follow different sequences of operations. Mold consists in protecting the dies and respective contacts with an epoxy resin. The difference is that BOC needs an extra operation before and after Mold, Plasma Cleaning, to clean and activate the substrates surface by the action of a gas mixture.

The TSOP package goes through the following sequence of operations after Mold:

- Dedam Dejunk
- Plating
- Trim & Form

In Dedam Dejunk the shunt that unites the several leads of the leadframe is removed mechanically and then at Plating the leads are protected with a tin and lead alloy, simultaneously with the removal of the excess of resin that results from Mold on both processes. Finally, at Trim & Form, the leads are bended in the desired shape and the surplus is cut off (figure 15).

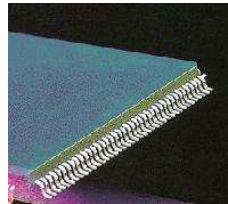


Figure 15 – Leads after Trim & Form

As for BOC, the list of processes followed is first Ball Placing and then Singulation. The Ball Placing operation consists in soldering the solder balls in the substrate and a cure operation at a Reflow Oven to assure their fixation, while at Singulation the units are individualized by a cut process.

1.2.3 - Test Operations

These operations are divided into three main areas: Burn In, Test and MSP (Mark, Scan & Pack).

The Burn In is an aging process with the objective (figure 16) of detecting premature flaws in the dies and is realized in an oven simulating extreme conditions by electric and temperature tests. In the end of this process the dies are segregated according to their quality: quality conformant, 2º quality and scrap.

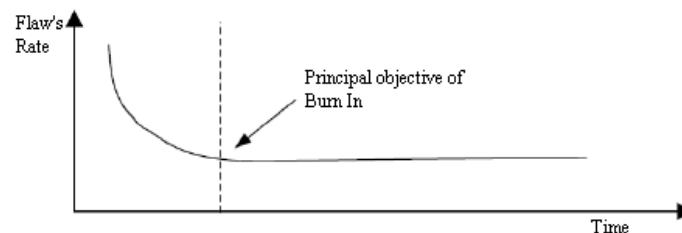


Figure 16 – Bathtub Curve

The main objective of the Test area is to prevent the arrival of units with defects to the client, so they go into several tests according to the product in case, which are divided in two main groups: Core Tests (high and low temperature tests) and Speed Tests. At MSP there are three main functions: mark the units (Mark), inspections (Scan) and packing (Pack) them in card boxes (figure 17). The difference between BOC and TSOP is that BOC units need an extra bake procedure in order to eliminate any humidity that they may have acquired during the process.



Figure 17 – Card boxes at MSP

1.3 Products granularity

Qimonda Portugal has an enormous variety of products, organized by several attributes, called granularity. The products can be referred to by different granularities, but in this project's case the most extensive characterization will be needed. A product can be defined by the following attributes:

- Generation – memory size
- Shrink – reduction in die/chip size
- Package – identifies a class of products (if it is green/black, TSOP/BOC, n° of leads/solder balls)
- Organization – relative to the number of gold wire links in the chip
- FE Location – location of the Frontend where the wafer that originates the product comes from
- BE Quality – quality of the product in the Backend: NC – Non Conformant....
- Customer/SPI(Special Parameter Indication) – this attribute is relative to special parameters for the product or a specific customer
- Substrate Type – the type of substrate the product uses, either Step2 (Standard), Step3, Step3 L or Step4

1.4 Organization and themes approached in the present report

After this Qimonda's presentation, the next topic to attend is a brief theoretical introduction to explain some terms and notions that will be used in this report so that the aim of the project is completely understood. Afterwards, the project's objective and concept is described as well as the implementation plan and support tasks needed. Every task taken in order to improve and optimize the project is described as well as the possible results that could be obtained until the time in question.

1.5 List of Abbreviations

Given the complexity and quantity of terms that are mentioned in this report, in the table below there's a summary of all the abbreviations used.

Table 1 – List of abbreviations used

ABF	Assembly Buffer	BE	Back End
BI	Burn In	BNR	Baunumber
BO	Business Objects	BOC	Board On Chip
Cassy	Assembly	CLIP	Current Line Item Performance
CPX	Complexity	CT	Cycle Time
DGR	Daily Going Rate	EOL	End Of Line
FE	Front End	FF Targets	Flow Factor Targets
FIFO	First In First Out	FOL	Front Of Line
GMP	Grinding Mounting and Peeling	IT	Information Technology
JIT	Just In Time	KPI	Key Process Indicator
MSP	Mark, Scan & Pack	NC	Non Conformant
P	Black Product	PCL	Production Control and Logistics
PFS	Pull Flow Sequencer	PG	Green Product
PL	Planning and Logistics Department	QPT	Qimonda Portugal
R&D	Research and Development	RDL	Redistribution Layer
RPT	Raw Process Times	SPI	Special Parameter Indication
TBF	Test Buffer	TFBGA	Thin Fine-Pitch Ball Grid Array
TSOP	Thin Small Outline Package	VFBGA	Very Fine-Pitch Ball Grid Array
WIP	Work In Process	WLA	Wafer Level Assembly
WTD	Week To Date		

2. Theoretical Notions

2.1 Pull Flow

Pull Flow is a planning methodology where the objective is to have a limited amount of work in progress (WIP), minimal inventories of raw materials and finished goods and only produce what the customer needs, so the production is pulled by the client. Parts arrive at the next workstation just in time and are completed and move through the process quickly.

This is based in a logic that nothing will be produced until it is needed and so the production necessities are created by actual demand for the product. The flow of material in a pull flow system is the following:

- when an item is sold/needed the market pulls a replacement from the last position in the system
- an order to the factory production line is triggered and a worker pulls another unit from an upstream station in the flow to replace the unit taken
- the upstream station then pulls from the next station further upstream and this process repeats itself until the release of raw materials

In order for the pull process to work smoothly, as in figure 18, high levels of quality at each stage of the process, strong vendor relations and a fairly predictable demand for the end product is necessary.

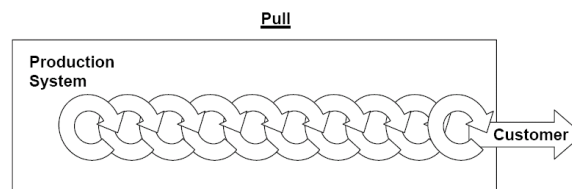


Figure 18 – Pull Flow Scheme

The Pull Flow production attacks waste (time, inventory and scrap), exposes problems and bottlenecks and achieves streamlined production, but requires:

- | | |
|--------------------------|--------------------------|
| - employee participation | - industrial engineering |
| - continuous improvement | - total quality control |
| - small lot sizes | |

According to Spearman, although the environmental improvements are certainly influential, there are three primary logistical reasons for the improvement performance of pull systems:^[1]

- Less congestion
- Easier WIP control
- WIP Cap (prevents a WIP explosion)

This is a way of planning complete opposite to Push Flow, where the production is pushed to the client, having as base predictions of the market, and there aren't explicit limits on the amount of WIP. In the page before we saw the schematic of the Pull Flow philosophy (figure 18) where all the production runs smoothly and coordinated, while in the figure 19 below we have the Push Flow Scheme where the production has several problems and excessive material.

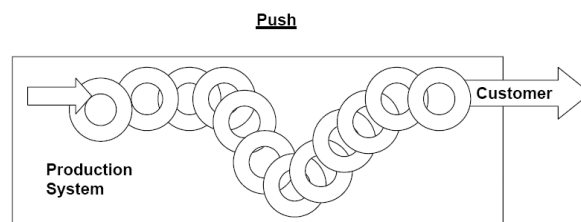


Figure 19 – Push Flow Scheme

2.2 JIT (Just In Time)

The Just-in-Time production philosophy began in Japan and is an integrated set of activities designed to achieve high-volume production using minimal inventories of parts that arrive at the workstation exactly when they are needed.

JIT was introduced by Taiichi Ohno with the “Toyota Production System” and, according to Ohno, it rests on two pillars: “autonomation” and just-in time production. Autonomation consists in determining the optimal way to perform a task and subsequently making it the best practice standard method and also involves “poke yoke”, which uses techniques to quickly check dimensions and quality attributes in order to allow workers to be responsible for their own quality.

If problems were found, the production line would stop until they were corrected, eliminating the need for rework lines and eventually most scrap. The Toyota Production System also promoted “5S”, “Seiri, Seiton, Seiso, Seiketsu and Shitsuke”, which are organizational and housekeeping techniques aimed at achieving autonomation and visual control. Relatively to JIT, Ohno considered that it involved two components: kanban and level production.

A kanban control system uses a signaling device to regulate JIT flows and, according to Ohno, it is a means through which JIT is achieved. In the Toyota Production System the two-card kanban was used, but there are other types like the electronic kanban. One benefit that kanban brings can be shown by the analogy of lowering the water (inventory) in a river to find the rocks (problems), being the end result a more efficient system with lower costs. Other benefits that they bring are:

- reduced WIP and Cycle Time
- smoother production flow
- improved quality

Concerning the leveling of the production, Ohno considered that it was fundamental to strategic pull and that it could be accomplished through the use of a takt time in order to smooth out the work flow by pacing the work according to customer demand.

In conclusion, the JIT philosophy has the objective of producing only what will be sold and in the necessary time, reducing excessive and unnecessary amounts of stock between processes. It intends to improve the competitiveness through a cost reduction, waste suppression, obtention of profit with a lower cost production and with significative investments in technology, being more effective in repetitive production. JIT is directly connected with quality because quality production implies gains for the company, the client's fidelization and reduction of production costs and waste.

2.3 Cycle Time and Raw Process Times

The Cycle time of a repetitive process is the average time between completions of successive units and Raw Process Time is the time it takes to perform a process with no waiting, interruption or downtime. Concerning now the Lead time, it's the time a determined product takes to go through a production line, from the time it starts being produced in the first step until the final product comes out of the last process. It includes process time, during which a unit is acted upon to bring it closer to an output, and delay time, during which a unit of work is spent waiting to take the next action.

2.4 Wip and Wip Target

Work in process (WIP) or in-process inventory consists of the unfinished products in a production process. They are not yet complete but either being fabricated or waiting in a queue or storage. Production management aims to minimize work in process. Work in process requires storage space, represents capital investment and presents a risk of expiration of the goods. A queue to a production step shows that the step is probably under-capacity with respect to other steps. Just-in-time (JIT) production is an effort to reduce work in process. Wip Target is a value of desired work in progress that is established or calculated in order to control the Wip quantity in the production line.

2.5 Business Objects (BO)

Business Objects is an integrated query, reporting and analysis informatic solution that allows business users to access the data in several ways. It allows not only to view standard reports, but also to analyze the data seen, perform queries to search new data and create reports in a user friendly way as well as to get access to almost real time data about all the aspects concerning a business. It is a Business Intelligence tool that ensures that every person connected within an organization has trusted and immediate access to the needed business information and is an essential tool that is widely used everyday at Qimonda PT.

3. The Pull Flow Sequencer Project at Qimonda Portugal

3.1 Scope and objectives of the project

Pull Flow Sequencer is an ongoing project at Qimonda Portugal since October 2007 and has been through several ups and downs and difficulties in implementation due to the necessary adjustments and changes in the mindset and all the implications it brings.

The Pull Flow Sequencer tool (figure 20) aims to be used in Porto semiconductor manufacturing operations by line personnel (operators, line controllers, supervisors, production engineers) to propose sequences of lots that should be released into the production at the beginning of the FOL (Assembly) manufacturing area considering various logistical and demand requirements, like the outstanding demand, existing WIP in the manufacturing area and the following logistical supermarket, deviation from target WIP, the product's required delivery period (consumption rate), and other requirements.

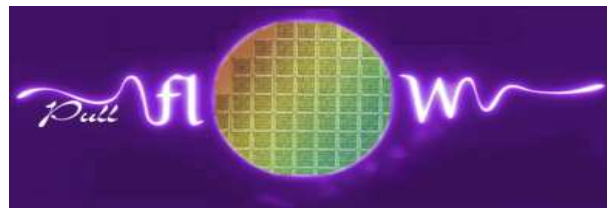


Figure 20 – PFS Logo

In a first test phase the program is supposed to be in use only in one area, Assembly, right before an area that is normally the bottleneck, Burn In area, and only for one type of product, TSOP.

The tool provides lot release sequence proposals and, if followed correctly, should improve the delivery reliability of the Cassy manufacturing area to its customer (Test Buffer/Burn In) and, at the same time, allow for an improvement in operations indicators (e.g. cycle time reduction by limiting excessive WIP, bottleneck capacity maximization by avoiding unnecessary setups) without disrupting the flow of products (e.g. by bottleneck starvation, or forced setup change due to unavailable product with continuous consumption).

This program was intended to replace the tool in use in the Assembly area, the Bond Scheduler, with the following features and inherent advantages:

- Sequence proposal for each product based on customer manufacturing area demand, helping the switch to pull flow manufacturing paradigm
- Consideration of deviation between WIP and target WIP per product, to limit excessive WIP accumulation and thus reduce cycle times
- Consideration of bottleneck setup avoidance strategy by proposing a set of lots to be released in a unique sequence group (Kanban Size), thus reducing the conversion times and increasing available bottleneck capacity
- Customer area and release area consumption rates adjustable online to help decisions on machine setup conversions
- Consideration of consumption rates in WIP target online recalculation to better accommodate minor production quantities, low runners, standard products and high runners
- Improved visualization capabilities for fast global overview and spontaneous decision making
- Logging capabilities that can be analyzed in order to improve the incorporated sequencing algorithms
- Customization by design to reduce solution maintenance efforts and flexibly to react to changes in manufacturing requirements (e.g. customized aggregation by product attributes, customized manufacturing area views, customized “sequences” (Lanes))

The main purpose (figure 21) is to follow the Pull Flow methodology to serve the customer with the What / When / Minimum cost. Pull Flow works with calculated WIP levels, according to supplier’s capacity to deliver and customer’s agreed consumption. In order to maintain the WIP levels, deliveries deplete a signal for releases.

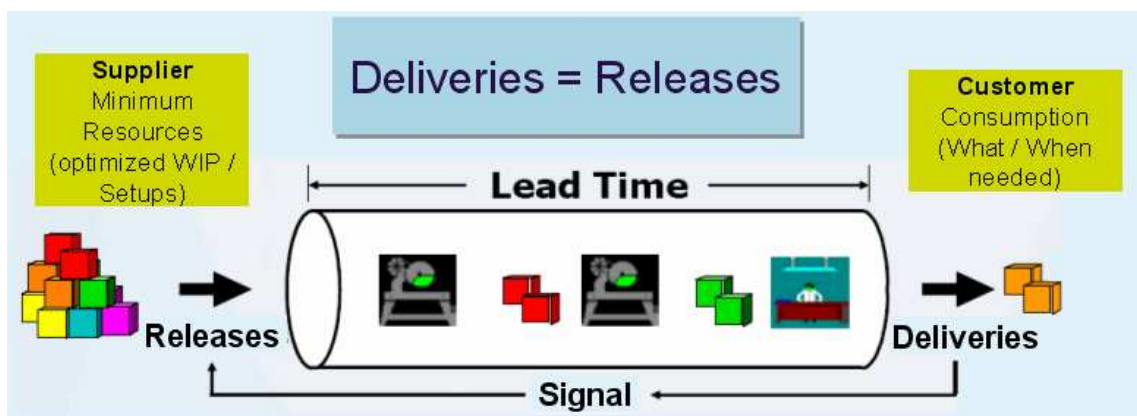


Figure 21 – PFS functioning

This project's main objectives are:

- Push only those materials that are required to fulfill deliveries to clients
- Maintain limited WIP and low cycle time
- Maintain output levels
- Less impact on system performance with WIP target errors
- Improve the efficiency in communicating needs to upstream processes
- Follow client's requirements

3.2 Before PFS

Qimonda has a traditional method of planning based on the Push philosophy, which normally carries some restrictions in the production flow:

- Major differences between what is planned and the clients' daily needs
- A lot of material is flowing but not always the one that is necessary
- Low efficiency in communicating needs to upstream processes

The Pull Flow Sequencer tool brings several changes, which are summarized in the table 2 below.

Table 2 – Changes PFS brings

	Before PFS	PFS
Lot starts	Based on Assembly Starts Plan	Based on Burn-In starts plan
Lot starts	Only consider lots available in supply buffer (ABF)	In addition, consider WIP in the line and WIP targets
Lot starts	Lots for all purposes together	Separation of lots in Engineering, Hot, Normal/Short, and Unassigned categories
WIP target	Based on assumption that all products will be produced in 7days	Based on individual Consumption Rate
Line Information	Conversion plan and lot list with some priorities	Conversion plan and lot list with priorities

3.3 The PFS Concept

The PFS program was applied in the FOL and EOL area (Assembly), having the Burn In area, which has a buffer before named Test Buffer, as a client and giving the requests necessary. Below (figure 22) we have a scheme of what the program intends to do.

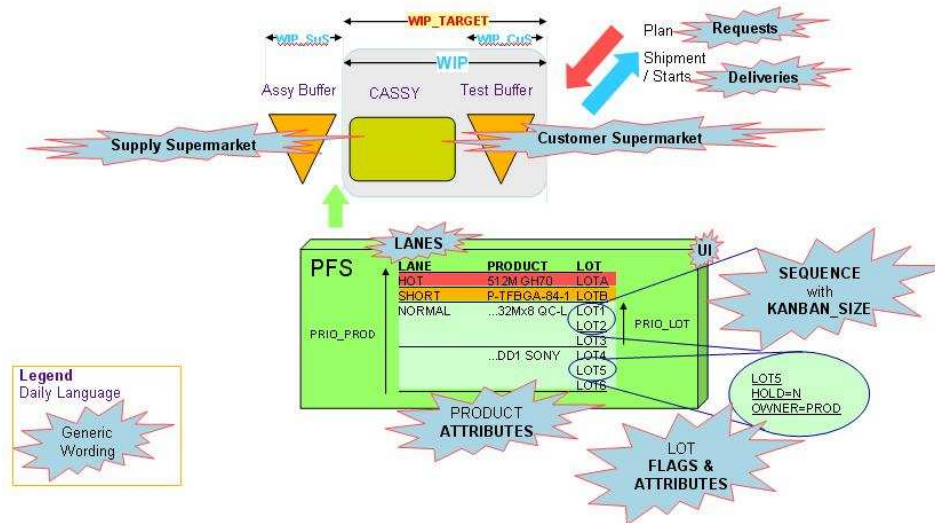


Figure 22 – PFS Concept

The solution should propose an ordered sequence of lot releases (“lot starts”) considering per configured product group: the outstanding deliveries to the customer, WIP levels in a group of defined operations against a targeted WIP level, visual division of sequences in sequencer groups (Lanes), and near-real-time status updates.

The visualization component should provide visual separation of sequencer groups, products, and lots, further, provide additional information to support shop-floor decisions, have functions for information filtering, logging facilities, user credentials validation for changeable variables, and provide functionality for selecting a specific lot and initiating a lot release (Move In).

In the upper part of the scheme we consider the Cassy area (Assembly) to be our productive line, where we will have a pre-calculated Wip Target in order to deliver when and what is needed to the client (Test Buffer/Burn In). A plan with the client needs (Burn In Area) is built, discriminating when the client needs a certain quantity of a product, and the data that will supply the PFS program is calculated, including Wip Target levels, product priorities, intended products start, delivery date and consumption rate. The program gathers all the information and establishes a prioritization of the products in five types of lanes:

- Engineering – engineering products (highest priority)
- Hot – products with high priority
- Normal – products normally assigned
- Short – products without lots to assign
- Unassigned – products unassigned

In “Engineering” products we have all the products from the engineering corridor, which normally have the highest priority in order to speed up the tests needed. “Hot” lots are the lots with a high priority, either due to their request priority or an approaching due date or if a product is behind schedule and in risk of failing a delivery deadline. “Normal” is where all the products with no special requirements or priority are assigned, while in “Short” we have products that are assigned, but there are no lots available for production to begin. At last, “Unassigned”, is where the products that don’t need to be produced are. This can be a temporary situation, when the products have a Wip level higher than the Target Wip and the product stops producing for a while to reach normal levels of Wip, or permanent, when the product finishes it’s week production.

The main principles of the concept are:

- Limitation of WIP and reduction of WIP variability in the area (factory physics)
- Prioritization of products according to request needs (Pull Principle)
- Visual grouping of prioritization levels (visualization component)
- Online correction of assumptions (current system state)
- Additional Information to support decision making (Decision Support System)

4. Plan and PFS project roll-out

The implementation of the project was phased and, as said before, took place at the FOL and EOL areas (Assembly) and also only in one type of product, TSOP, a more robust and flaw proof type of product than BOC. The internship objective was to be a part of the PFS Project Team, project that was already taking place at Qimonda, giving support in several aspects and having specific objectives, tasks and deliverables in order for the global project to succeed.

In this project's implementation several complications inherent to a change of planning philosophy from push to pull emerged, as well as some problems related to the program itself and difficulties in calculating some parameters essential for its correct functioning. In this chapter the several tasks that were effectuated in the internship's scope are described with detail and explained, as well as the possible results available at the end of the internship period relative to the project. A plan was laid out with the necessary tasks and timeline to make the internship project succeed (figure 23):

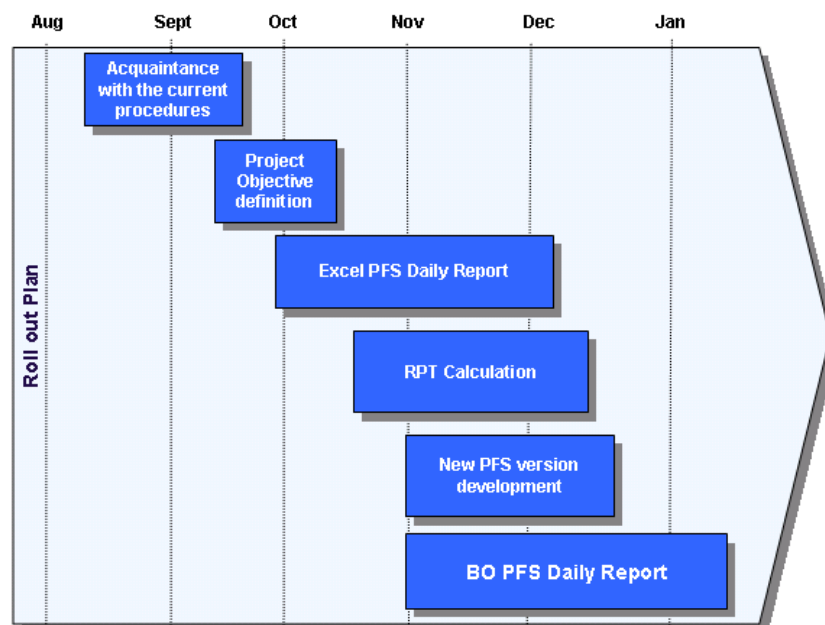


Figure 23 – Internship timeline

In the scheme below (figure 24) we can see the main tasks that were carried out during the internship and their subtasks, as well as the responsible and deliverables.

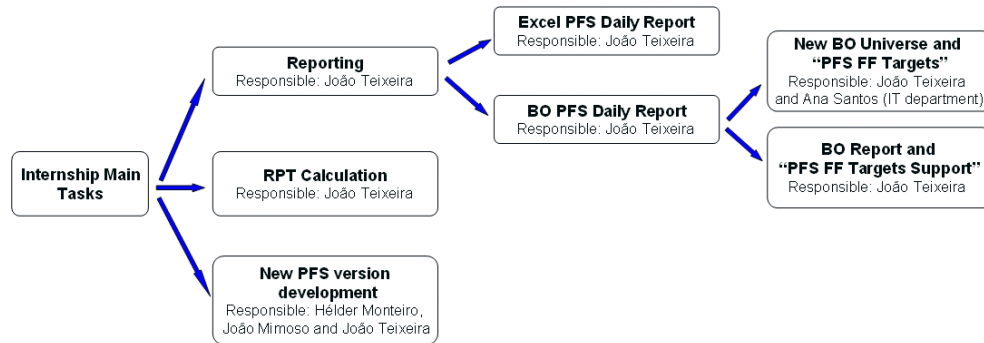


Figure 24 – Internship tasks

Regarding the timeline plan (figure 23) and the scheme (figure 24) presented before, the following tasks were carried out in each one:

- Acquaintance with the current procedures – At the beginning of the internship an induction to the company was realized as well as a visit to the productive areas and a presentation about them (appendix A – Productive Areas Presentation)
- Project Objective definition – definition of the project objectives, namely the tasks that appear after this step
- Excel PFS Daily Report – this includes the creation of the report and its maintenance, improvements and presentation
- RPT Calculation – creation of the file and all the support tasks it involved
- New PFS version development – development of an improved, more user friendly version, with Hélder Monteiro from IT department and João Mimoso, Production Engineer
- Bo PFS Daily Report – training in Business Objects (BO), creation of a new BO universe and FF Targets excel file with Ana Santos from IT department and finally the creation of the BO report and the excel file PFS FF Targets Support and its integration in the tools already existent

All the actions taken, except the new PFS version development, were a support to the PFS program, steps that were needed in order to make it functional and successful. In addition to this, along the project's development there was always a continuous participation in the improvement of the tool and debugging process.

4.1 Excel PFS Daily Report

The first item to be addressed was the lack of a tool that would allow the planners to track and visualize how the situation was developing in the line throughout the week. This task can be divided into two: an early stage where a semi-automatic tool was built in Excel and afterwards, after a try out and optimization period, another report was built, but in a Business Objects platform. One main difference between the both is that the excel based version is an online report, which means that all the data points to the moment of refresh, while the BO based report was made to show the situation at 23:00 pm of the day before the refresh in order to maintain coherence with the other reports from other production areas that are also used.

The excel report was created in early November to start looking at the Pull Flow methodology and philosophy in order to detect possible problems with PFS and start to change the mindset in the PCL department. At this time the tool was already being used at the Assembly Area for the TSOP products, but also with the program Start Scheduler active.

In order to get the values necessary for the report, some information already available was used:

- BO based information
- PFS Puppet Plan
- QPT Comp Cycle Time

To gather the necessary information from BO, four additional queries were built:

- o TBF Out – information of how many material leaves the Test Buffer in the week in question and until the moment of refresh of the query
- o TBF In – the same as TBF Out query, but for the material that entered the TBF
- o Week Starts – the amount of material that started this week in the Assembly Area
- o Wip Info – all the information about the Wip in the line at assembly area and TBF and the Wip Targets necessary to calculate the new Wip Targets for PFS

These reports give online information at the time of the refresh, and in order to speed up the process a macro was created to export the BO queries to text files, which are then imported to excel with another macro, where all the data is worked.

QPT Comp Cycle Time is an essential planning file at Qimonda, which calculates the Wip Targets and Cycle Times for all the areas as well as the correspondent plan as well as the main values for PFS, namely the Wip Target, the consumption values (Consumption Rate and In-week Priority) and the request for the week. These values are necessary not only to feed the PFS program, but also for the PFS Daily Report and PFS Puppet Plan.

PFS Puppet Plan is an excel file built by Eng. Peter Madera, the PFS Project Leader, which contains values of the PFS plan. Another excel file based on this one was built, which was named PFS Puppet Plan Update, and one of the first actions taken was to automate the information it needed to be updated from QPT Comp Cycle Time and some other BO reports. The gathering of information from PFS Puppet Plan Update to PFS Daily report was also automated, and has the name of the file suggests, its main purpose is to refresh and calculate data that will serve as a base for the Excel PFS Daily Report.

Concerning the Daily Report, we can see in the picture below (figure 25) the main interface where all the info is aggregated and some calculations made, but this is the basis of the report. We can also see the button to run the macro to update the report, “Run All”.

Week:	9	RUN ALL	Refresh Time:	9/8	min								
Weekday:	7												
Open Puppet Plan													
				DAILY NEEDS									
GEN	Shrin	PackageG	FullOr	BI Request Qty TODAY	BI Request Qty	TBF Deliveri	DELTA WTD	BU	Finishing Day	DGR2	DELTA BI REQUEST TOTAL	ALL DELIVERED?	TBF Wip Target
1G	GH70	PG-TFBGA-136	32Mx32	79	550	555	476	GD	7.00	79	5	YES	40
1G	GH70	PG-TFBGA-136	32Mx32	179	1,250	1,114	935	GD	7.00	179	-136	NO	90
256M	D11	PG-TFBGA-60	32Mx8	0	50	54	54	CD	2.00	0	4	YES	4
256M	D11	PG-TSOPIL-66	16Mx16	0	25	29	29	CD	1.00	0	4	YES	2
256M	D11	PG-TSOPIL-66	32Mx8	0	150	153	153	CD	4.00	0	3	YES	11
256M	LD11N	PG-VFBGA-90	8Mx32	0	25	13	13	CM	1.00	0	-12	NO	2
256M	S11N	PG-TSOPIL-54	16Mx16	0	50	54	54	CD	3.00	0	4	YES	4
256M	S11N	PG-TSOPIL-54	64Mx4	0	35	38	38	CD	1.00	0	3	YES	3
256M	T90C	PG-TFBGA-60	32Mx8	0	130	120	120	CM	3.00	0	-10	NO	10
256M	T90C	PG-TFBGA-84	16Mx16	215	1,500	1,356	1,141	CM	7.00	215	-144	NO	108
512M	D90	PG-TSOPIL-66	64Mx8	0	200	79	79	CD	5.00	0	-121	NO	15
512M	D90C	PG-TSOPIL-66	32Mx16	86	600	577	491	CM	7.00	86	-23	NO	43
512M	GH80	PG-TFBGA-136	16Mx32	80	560	584	504	GD	7.00	80	24	YES	40
512M	GH90	PG-TFBGA-136	16Mx32	58	400	352	294	GD	7.00	58	-48	NO	29
512M	GY70	PG-TFBGA-170	16Mx32	0	10	12	12	GD	1.00	0	2	YES	1
512M	T80C	PG-TFBGA-84	32Mx16	58	400	477	419	GD	7.00	58	77	YES	29
512M	D90	PG-TSOPIL-66	32Mx16	0	30	45	45	CD	1.00	0	15	YES	3
256M	GD11C	PG-TSOPIL-66	16Mx16	0	100	23	23	CM	5.00	0	-77	NO	8

Figure 25 – Excel PFS Daily Report main interface

After the file Puppet Plan Update is refreshed, this macro will perform the following actions in order to update the report:

- ⇒ Copy the necessary data from Puppet Plan Update
- ⇒ Copy the sheet PFS Consumption Values with the In week Priorities and Consumption Rates
- ⇒ Refresh Pivot Tables
- ⇒ Refresh the three BO reports and insert their resulting text files into the report
- ⇒ Insert the date and time of the report to execute the online calculations and for information on the update time

After all the needed data is in the report, some calculations are made in order for the report to be completely online:

- Wip Target

Wip Target is calculated based on the already existent Wip Target, which consists on half a day of production WIP and considering seven days of production. The PFS Wip Target is calculated by area, FOL and EOL, and is obtained by multiplying the Wip Target by 7 (number of days in the week) and dividing it by the Consumption Rate (the actual number of days that the product will be produced).

$$\text{PFS Wip Target} = \text{Wip Target} * 7 / \text{CR}$$

One calculation that is also executed is the days in which the product will be produced, and only in these days the PFS Wip Target assumes its value. In case the product has already finished producing the report looks to next week's plan and if the product is going to be produced the Wip Target takes the value of next week's correspondent, otherwise it is zero.

- Online Burn In Request

Regarding the Online Burn In Request, the calculation is based on the Consumption Rate, the total Burn In Request for the week and when the product will be produced, being a cumulative value and assuming the value zero when it shouldn't have started producing.

- Daily Going Rate (DGR)

As for DGR, we obtain it by dividing the Burn In Request of the week by the Consumption Rate and considering the values only in the planned productive days for each product. For example, in DGR a table is calculated (figure 26) with the days in which each product is produced regarding the In Week Priority (starting day) and the Consumption rate (number of days in production needed). The number "0" means that the product is not planned for that day, so the DGR of the product is zero, while the number "1" means the product is planned to produce and the DGR of that day is the one correspondent to that product.

							SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	
GEN	Shri	PackageG	FullO	In Week Priorit	CR	Finishing D	1	2	3	4	5	6	7	DGR
1G	GH70	PG-TFBGA-136	32Mx32	1	7.00	7.00	1	1	1	1	1	1	1	79
1G	GH70	PG-TFBGA-136	32Mx32	1	7.00	7.00	1	1	1	1	1	1	1	179
256M	D11	PG-TFBGA-60	32Mx8	1	1.00	1.00	1	0	0	0	0	0	0	50
256M	D11	PG-TSOPIL-66	16Mx16	1	1.00	1.00	1	0	0	0	0	0	0	25
256M	D11	PG-TSOPIL-66	32Mx8	1	5.00	5.00	1	1	1	1	1	0	0	30
256M	LD11N	PG-VFBGA-90	8Mx32	1	2.00	2.00	1	1	0	0	0	0	0	13
256M	S11N	PG-TSOPIL-54	16Mx16	2	2.00	3.00	0	1	1	0	0	0	0	25
256M	S11N	PG-TSOPIL-54	64Mx4	1	1.00	1.00	1	0	0	0	0	0	0	35
256M	T90C	PG-TFBGA-60	32Mx8	1	2.00	2.00	1	1	0	0	0	0	0	65
256M	T90C	PG-TFBGA-84	16Mx16	1	7.00	7.00	1	1	1	1	1	1	1	215
512M	D90	PG-TSOPIL-66	64Mx8	1	7.00	7.00	1	1	1	1	1	1	1	29
512M	D90C	PG-TSOPIL-66	32Mx16	1	7.00	7.00	1	1	1	1	1	1	1	86
512M	GH80	PG-TFBGA-136	16Mx32	1	7.00	7.00	1	1	1	1	1	1	1	80
512M	GH90	PG-TFBGA-136	16Mx32	1	7.00	7.00	1	1	1	1	1	1	1	58
512M	GV70	PG-TFBGA-170	16Mx32	1	1.00	1.00	1	0	0	0	0	0	0	10
512M	T80G	PG-TFBGA-84	32Mx16	1	7.00	7.00	1	1	1	1	1	1	1	58
512M	D90	PG-TSOPIL-66	32Mx16	1	1.00	1.00	1	0	0	0	0	0	0	30

Figure 26 - DGR

After all the values are calculated, the data has to be arranged in order to be presented in a user friendly way to facilitate comprehension. For that purpose two report sheets were created:

- Report Summary - contains a summary of the plan by type of product (BOC vs. TSOP), Business Units (purpose of the product: graphical, commodities...), equivalents of 1 GB (by Memory Size) and by Package.

Equivalents	1) 2)	3) 4)	5) 6)	7)	8) 9)	10) 11) 12)	13) 14)							
	FOL		EOL		WTD			Request						
	DGR Today	Week Starts	WIP	Δ	WIP	Δ	BI Req Qty	TBF In	Δ Del	TBF WIP	Δ	TBF Out	FW 906	FW 907
128M	0	17	0	0	4	4 ↑	18	16	-2	4	2	16	18	12
256M	64	512	40	24 ↑	46	20 ↑	488	521	32	10	-29	525	526	442
512M	283	2.401	262	176 ↑	229	142 ↑	2.703	2.522	-180	160	-50	2.532	2.863	2.176
1G	925	5.450	559	-179 ↓	947	209 ↓	5.961	5.864	-97	374	-98	5.864	6.525	6.085
Total	1.271	8.379	861	20	1.225	375 ↓	9.170	8.923	-247	547	-174	8.937	9.932	8.714

Package		FOL		EOL		WTD			Request					
	DGR Today	Week Starts	WIP	Δ	WIP	Δ	BI Req Qty	TBF In	Δ Del	TBF WIP	Δ	TBF Out	FW 906	FW 907
PG-TFBGA-136	295	1.719	239	65 ↑	220	46 ↓	1.979	1.600	-379 ↓	51	-105	1.610	2.151	2.212 A)
PG-TFBGA-170	97	512	35	-15 ↓	30	-20 ↓	530	650	120 ↓	54	11	650	670	453 B)
PG-TFBGA-60	678	4.615	416	-169 ↓	773	188 ↑	5.111	4.992	-119	385	-16	5.016	5.525	4.984
PG-TFBGA-84	378	2.872	313	236 ↑	252	175 ↑	2.855	2.993	138	53	-169	2.997	3.074	2.601
PG-TSOPII-54	0	138	0	0	12	12 ↑	206	148	-58	10	-7	194	206	87 C)
PG-TSOPII-66	318	2.361	183	94 ↑	200	111 ↑	2.505	2.405	-100	108	-88	2.413	2.692	1.725
PG-TFBGA-63	0	0	0	0	0	0	10	0	-10 ↓	0	-1	10	10	2
P-TSOPII-54	0	96	0	0	27	27 ↑	84	91	7	69	62	91	83	102
P-TFBGA-84	0	32	56	56 ↑	27	27 ↑	125	5	-120	33	24	10	125	107
P-TSOPII-66	0	85	0	0	0	0	60	92	32 ↑	0	-5	92	60	22
Total	1.766	12.430	1.242	267 ↓	1.541	566 ↑	13.465	12.976	-489	763	-289	13.083	14.596	12.295

Figure 27 – Report Summary

Explanation of the values presented in the report (figure 27):

- 1) Value of today's planned DGR
- 2) Quantity of material that has started since the beginning of the week
- 3) Quantity of Work In Process in the FOL area
- 4) Delta between the WIP and the Wip Target of the product in the FOL area
- 5) Quantity of Work In Process in the EOL area
- 6) Delta between the WIP and the Wip Target of the product in the EOL area
- 7) Value of the BI Request Quantity necessary from the beginning of the week until the moment of the report's refresh
- 8) Quantity of material that has been delivered to the Test Buffer since the start of the week
- 9) Delta between TBF In and "BI Req Qty"
- 10) Quantity of material in the Test Buffer
- 11) Delta between the TBF Wip and it's target WIP
- 12) Amount of material that has left the TBF since the beginning of the week
- 13) Request of material for this week
- 14) Request of material for next week

Example of an analysis of some packages in the report (figure 27):

A) This package has a lower value of TBF In than it should, 379k units behind schedule, but it's being compensated with a high value of Wip both in FOL and EOL;

B) In this case we have the opposite, over deliveries of this package according to the plan, 120k, but already less Wip in both FOL and EOL as the intended quantity for this week is almost reached (20k left);

C) In this package's case, the product wasn't planned to still be producing today (DGR=0), and only has 12k left at EOL, which isn't enough to fulfil the request quantity of this week. But, as we can see in TBF Out, already 194k (more 50K than TBF in) have left the TBF to the Burn In area this week, which means that there still was some material available at TBF in the beginning of the week which didn't need to be produced, and is enough to fulfil the Burn In's demand;

- Detailed Report – this report has a greater granularity, goes into a greater detail with all the products characteristics and is organized by package.

PG-TSOP11-66

										FOL		EOL		WTD						Request		
			FE	BE	Sub		DGR	Week							BI Request	TBF		TBF		TBF	FW	FW
		Site	Qual	SPI	Type	Today	Starts	WIP	Δ	WIP	Δ	Qty	WTD	Deliveries	Δ	WIP	Δ	Out	906	907		
256M	D11	16Mx16	QR2	QC	ALL	STD	0	29	0	0	0	0	25	29	4	0	-2	29	25	6		
256M	D11	32Mx8	QR2	QC	ALL	STD	30	107	14	-3	26	9	101	97	-4	3	-8	90	150	121		
512M	D90	64Mx8	IMI3	QC	ALL	STD	29	20	25	7	20	2	98	28	-70	0	-15	34	200	160		
512M	D90C	32Mx16	IMI3	QC	ALL	STD	86	318	22	-27	69	20	290	342	51	3	-40	345	600	760		
512M	D90	32Mx16	IMI3	QC	ALL	STD	0	45	0	0	0	0	30	45	15	0	-3	45	30	19		
256M	GD11C	16Mx16	QR2	QC	ALL	STD	20	0	0	-20	0	-20	28	3	-24	0	-8	3	100	52		
512M	D90	64Mx8	IMI3	NC-T	ALL	STD	15	35	0	-9	10	1	51	36	-15	0	-8	36	100	18		
512M	D80	32Mx16	QR3	QC	ALL	STD	0	32	0	0	32	32	30	23	-7	0	-3	23	30	18		A)
512M	D80	64Mx8	QR3	QC	ALL	STD	50	265	35	7	54	26	169	260	91	3	-22	263	350	611		B)
512M	D90	64Mx8	IMI3	NC-T	ALL	STD	15	35	0	-9	10	1	51	36	-15	0	-8	36	100	18		
512M	D80	32Mx16	QR3	QC	ALL	STD	0	32	0	0	32	32	30	23	-7	0	-3	23	30	18		
Total							245	918	96	-53	253	104	902	921	19	9	-120	927	1,715	1,801		

Figure 28 – Detailed Report

Example of an analysis of the detailed report in the picture above (figure 28) for two products:

A) This product has a red dot at the end of the line, which means that it shouldn't be producing today and hasn't already delivered the necessary material; there's no Wip at FOL, but at EOL there's 32k of material which is more than enough to fulfill the BI Request for the week in question (Fiscal Week 906), but means that there will be an over delivery (only 7k missing)

B) In this case we can see that the product has over delivered 91k until this moment and has a high level of Wip both at FOL and EOL, which means that the production should be slowed to reach the desired levels of Wip and avoid excessive over deliveries at the end of the week

Both reports have visual signals, arrows, to indicate and alert the cases in need of attention. These arrows alert to situations in which the delta is above or below zero according to the deviation between delta and the WIP or the BI Request Qty (according to the situation):

- 30% above ↑
- 15% above ↗
- 15% below ↓
- 30% below ↘

The other visual alerter, the red dots at the rightmost corner, is used to signal that the correspondent product should have already been produced according to the plan, but the requested quantity hasn't been delivered yet.

This report was presented three times a week for a two months period in the Daily PCL planning meeting in a PDF format and was sent everyday to the production planners and the head of the PCL department.

At appendix C a complete excel report can be consulted so that the final aspect and values can be better observed.

4.2 RPT Calculation

Pull Flow philosophy is to deliver the material necessary at the exact date and with the minimum cost possible. In order to make this possible, very accurate information is needed. Until some months ago, all the data about Cycle Times (CT) used in planning calculations was static and just a reference. Wip target is defined by the CT of a given products at a given area and since this is the core for PFS starts, a reliable, simple and intuitive method to calculate CT, accommodate the new philosophy and make it reliable and efficient was necessary.

The solution achieved was to calculate Raw Process Times for every product in the Assembly area, using machines capacity and restraints, product complexities and process times as a source, process which will be described in detail in the following pages.

Raw Process Time is basically the time that each product takes to be processed in a given operation/area, and the final value comes in hours/lot and doesn't take into account the time that the products have to wait in queue. This solution involved a huge amount of information, difficulties in getting the necessary data and a huge complexity in making the tool automatic in case of any new machines/product additions.

The inputs necessary to achieve the RPT calculation are the following:

- Complexities of the products (CPX)
- Average Lot Size
- Machines allocation
- Machines capacity

Below there's a scheme (figure 29) of how the RPT values are obtained:

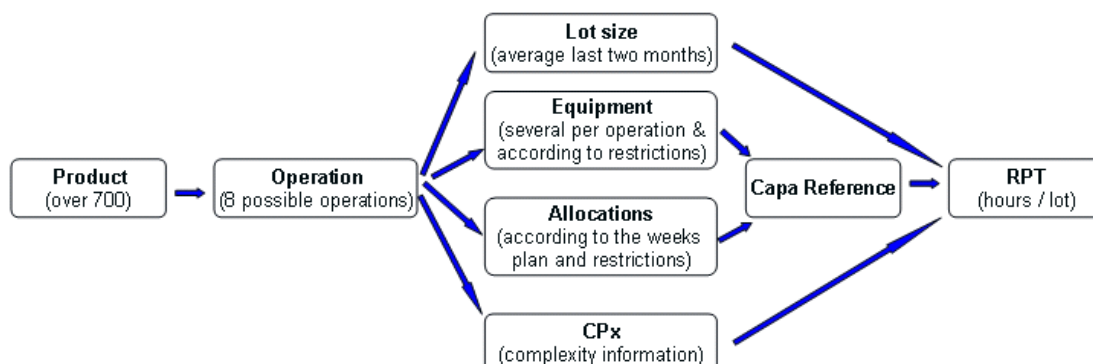


Figure 29 – RPT Scheme

In the present chapter all the figures relative to this file will have its values altered given that the analysis is not important for the report proposes and also due to the importance of the data present.

4.2.1 CPX Calculation

The complexity information of the products in each area was already available in the excel file AO Capa Profile. The complexity information is based on a given product that is considered as having a complexity value of one. Products with greater complexity will have a greater value than this, while simpler products will assume lower values, depending on each case (figure 30).

This was a matter of organizing all the information and creating a way of automatically getting the right values from entries with different keys and from the correct week. The case in which a product didn't have a complexity value was prevented by first introducing a CPX Summary sheet, which summarized all the information of the complexities by Package, and the product would take the complexity value of its package group and then, if it still wasn't available, the complexity would assume a value of one.

As we can see in the picture below (figure 30) and taking the product highlighted as an example, the Wire Bond operation has a greater complexity (1.25) then Die Bond (1.00) for this product, while the Mold operation is simpler than both (0.89). If we look at the product right below, which is of the same shrink (LD70) but with a greater memory size, we can see that at Die Bond the complexity is far greater (2.83), almost the triple than in the product highlighted.

CPX Calculation														
WEEK		Column CPX												
0914		106												
GE	Shri	PackageGroup	FullOr	FE Si	CPx Die	CPx Wire	CPx Mold	FBGA?	CPx Printing	CPx PLC	CPx BP	CPx SNG	CPx Mold Cure	CPx Bond Cure
128M	D11	PG-TFBGA-60	16Mx8	QR2	0.69	0.77	0.20	YES	0.21	0.19	0.23	0.53	0.82	0.01
128M	D11	PG-TFBGA-60	16Mx8	QR2	0.97	0.22	0.45	YES	0.27	0.58	0.83	0.26	0.17	0.12
128M	D11	PG-TFBGA-60	8Mx16	QR2	0.67	0.35	0.24	YES	1.06	0.52	0.16	0.04	0.46	0.17
128M	D11	PG-TSOPIL-66	16Mx8	QR2	0.88	0.38	0.52							
128M	D11	PG-TSOPIL-66	16Mx8	QR2	0.94	0.66	0.85							
128M	D11	PG-TSOPIL-66	8Mx16	QR2	0.89	0.76	0.26							
128M	D11C	PG-TSOPIL-66	16Mx8	SMI2	0.48	0.34	0.84							
128M	D11C	PG-TSOPIL-66	8Mx16	QR2	0.95	0.90	0.17							
128M	D11C	PG-TSOPIL-66	8Mx16	SMI2	0.42	0.71	0.83							
128M	D11	PG-TSOPIL-66	16Mx8	SMI2	0.56	0.98	0.64							
128M	D11	PG-TSOPIL-66	16Mx8	SMI2	0.50	0.34	0.67							
128M	D11	PG-TSOPIL-66	8Mx16	SMI2	0.51	0.81	0.55							
128M	D11	P-TFBGA-60	8Mx16	QR2	0.87	0.09	0.16	YES	0.44	0.40	0.90	0.56	1.00	0.92
128M	D11	P-TSOPIL-66	8Mx16	QR2	0.95	0.59	0.09							
256M	LD70	PG-VFBGA-90	8Mx32	GD3	1.00	1.25	0.89	YES	0.00	1.00	0.61	0.74	1.00	1.00
512M	LD70	PG-VFBGA-60	16Mx32	QR3	2.83	1.25	1.00	YES	0.00	1.00	0.65	0.80	1.00	1.00
1G	T70C	PG-TFBGA-84	64Mx16	IMI3	1.44	2.25	1.38	YES	1.95	1.25	1.17	1.23	1.25	1.75
128M	S17	P-TSOPIL-54	16Mx8	IFD2	0.19	0.37	0.73							
128M	S17	P-TSOPIL-54	16Mx8	IFD2	0.88	0.46	0.23							

Figure 30 – CPX Calculation

4.2.2 Lot Size

The objective in this part is to get the average lot size in the last two months for each product. For this purpose a BO report was created that would give the value of the average lot size in the wanted period of time and in each operation of Assembly for each product. These values were automatically exported to the RPT Calculation excel file, where they were worked and grouped by product and operation.

There was also created a Lot Size Summary sheet for the situation when products didn't have a lot size in this search, namely recent products or products that haven't been produced for more than two months. In the case it happened, the product would assume the default value of its package, or if necessary the value of the average lot size of the operation in cause.

In the figure 31 below is an example of the Lot Size Summary Sheet. Here we can see that taking the package PG-TFBGA-60 signaled as an example, the Die Bonding and Mold operations have similar average Lot Sizes in the last two months (~3400), while the Wire Bonding operation has a greater lot size (4325).

Lot Size Summary

Package	DIE	WIRE	MOLD	PLASMA	BALL PLACING	SINGULATION	BOND CURE	MOLD CURE	PLATING	IFM	Dedam Dejunk	Plasma BP	BURN IN	MSP
PG-TSOPIL-66	3745	4236	1340					1282	1876	1935	1758		1823	102
PG-TSOPIL-54	4635	3524	278					3771	437	2987	1327		1298	1479
PG-TFBGA-104	635	7658	3430	2077	1458	2317	2905	452				2210	1827	6962
PG-TFBGA-136	3771	2544	396	4953	816	2718	92	3966				3387	1766	2049
PG-TFBGA-170	2138	2510	6135	4149	558	1471	2586	3772				220	4294	4254
PG-TFBGA-54	4730	4938	114	4781	1601	4476	1161	5167				3351	843	3850
PG-TFBGA-60	3489	4325	3346	1865	203	4436	1449	5233				3461	2851	5975
PG-TFBGA-63	2340	2847	1928	2534	2172	1081	2543	4441				3307	5722	4955
PG-TFBGA-68	1739	5343	40	1136			1038	3370					1014	2701
PG-TFBGA-71	3659	3044	3608	667			1769	70					1911	3958
PG-TFBGA-84	41	7794	1084	1121	1200	3192	2704	847				971	4151	4484
PG-VFBGA-54	3422	1468	4367	311	1948	2768	3195	5151				1579	2124	5565
PG-VFBGA-60	3777	3757	2977	5165	3323	3563	1305	3093				564	992	812
PG-VFBGA-90	223	450	728	3541	3963	2644	4752	2659				489	6324	1620
P-TFBGA-60	2699	7549	2652	236	1349	1800	1154	5332				620	2582	2326
P-TFBGA-84	4898	5746	5320	4618	93	2686	1276	2263				826	2538	2721
P-TSOPIL-54	835	7327	3537					1983	6227	647	543		4968	3596
P-TSOPIL-66	1316	4115	374					4997	5026	2890	1935		4670	1276
PG-TFBGA-100														
PG-TFBGA-136	74	7231	4385	1707	2399	3040	202	5035				2667	1750	5053
PG-TFBGA-78	2811	3752	3710	4171	3962	4213	3151	2055				2311	3846	6078
PG-TFBGA-82														
PG-TFBGA-92	2696	8348	699	3358			2279	2929					2970	3882
PG-TFBGA-96	4100	6492	574	4927	1540	2576	4173	2381				3567	600	5915
P-TFBGA-54	2372	5104	2970	269	1231	3072	1547	4010				572	4164	2606
P-TFBGA-68	1788	3671	2751	1198			1271	2271					422	4911
P-VFBGA-54	1321	4477	2915	202	2976	4210	5071	1898				1098	4489	1032
AVERAGE	2530	4730	2386	2523	1811	2957	2172	3137	3391	2115	1391	1835	2797	3526

Figure 31 – Lot Size Summary

4.2.3 Capa Equipment

Capa equipment is a sheet where all the information about the machines capacity, restrictions and the week's allocation is gathered by Operation. All this information is gathered from AO Capa Profile, file which needed some reorganization and addition of keys, that were proposed to the responsible for the excel sheet (Appendix B).

After these changes, and with all the keys and restrictions present, this information was all arranged by operation, and the number of planned machines of each type was matched with each capacity for type of machine. This was also made in a way such that if any new machines are added or the allocations plan changed, when the file is refreshed, all these changes are reflected and updated.

In the figure below (figure 32) we have an example for the Die Bond Operation where we can see the several machines that exist for this operation with the allocations in the left table and in the right table the capacity of each machine.

As we can see the names of the machines in the equipment allocations and capacity tables are different, so it was necessary to cross the restrictions of each type of machine of each table to determine automatically which machine in the capacity table corresponded to the machine in the allocations side, with possible combinations of 1-n (allocations table – capacity table).

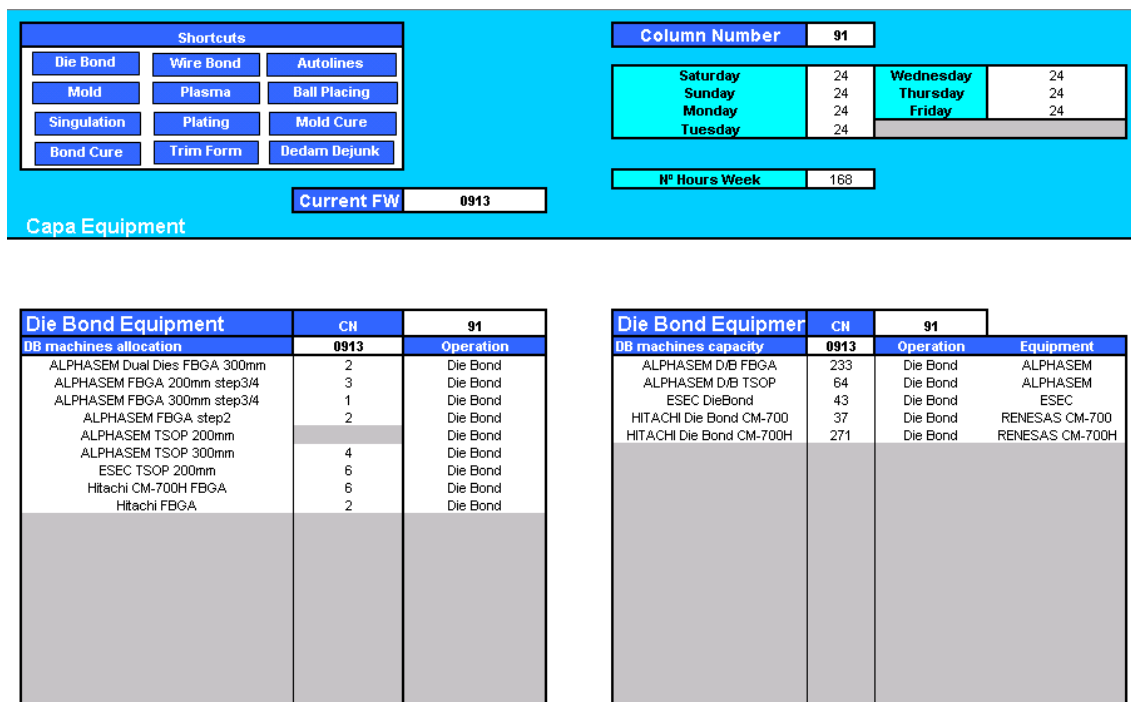


Figure 32 – Capa Equipment

4.2.4 Capa Reference

This worksheet is one of the most complex ones. The objective is to calculate the reference capacity for the weeks plan for each product and each operation.

A given product can go through different machines with different capacities. In this part we try to allocate the products to the different machines they can go through, considering the allocations that were made for the week in question and if the product normally is attributed to a certain kind of equipment using historical data.

In the figure below (figure 33) we can see the aspect of the worksheet. The operation in case is Die Bond, and we can see in 2) the names of all the machines from the table allocations and in 1) the correspondent names of the machines from the table capacity, and each machine is sub-divided in three columns.

Capa Reference

Shortcuts

Die Bond

Wire Bond

Mold

Plasma

Ball Placing

Singulation

Plating

Mold Cure

Bond Cure

Trim Form

Dedam Dejunk

Linha#

from:

18

DIE

to:

37

1)

2)

										ALPHASEM D/B FBGA										ALPHASEM D/B FBGA										ALPHASEM D/B FBGA										ALPHASEM D/B FBGA										ALPHASEM D/B TSOP																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
										ALPHASEM D/B FBGA 200mm step3/4										ALPHASEM FBGA 300mm step3/4										ALPHASEM FBGA step2										ALPHASEM TSOP 200mm																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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128M	S11C	PG-TSOPIL-54	QR2	0	0			STD	TSOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 33 – Capa Reference

The first column is relative to a BO report which searches in the last three months if a determined product goes through a determined type of machine. Those values are then exported to excel, and worked into this column. With this report we intend to get a notion of which products go through which machines, because the products normally go through the same machines. The value 0 will mean that in the last three months that product didn't go through the correspondent machine and 1 that it did.

The second column, “Cap”, gives us the capacity of the machine in cause and the third one shows us the planned allocation of machines of this type for this week. In the columns “Cap” and “Alloc” the values only appear on the lines (products) that fulfill the restrictions given by the Machine, take for example 3), where a machine that is only for BOC products with a wafer size of 300mm and for Step3/4 products will only appear in products that have the same characteristics.

There is an enormous amount of combinations possible considering the restrictions in both the machines side and products side and all had to be accounted for. The possible restrictions are:

- Wafer Size – 200mm; 300mm
- Type of Product – BOC; TSOP
- Step – Standard, Step3, Step3L, Step4
- Package type – PG(Green Product), P (black Product)
- Equipment

This calculation is made for every machine, for every product and for every operation. In the end, the value of the reference capacity for each product in each operation is calculated by a weighted average between all the columns of each machine. In order to automate the procedure, some spaces were left in all the operations that can be occupied by new machines automatically if they are added in the “AO Capa Profile” excel file.

The procedures to prevent null values in this case are to do the same calculations in another worksheet without considering the values from the first column (without the historical data). If the value is still null, then it assumes the value correspondent to its package, obtained from the “CapaRef Summary” worksheet.

4.2.5 RPT

This is the sheet that gathers all the values and makes the final calculations to obtain the Raw Process Times.

The figure below (figure 34) shows the aspect of this worksheet. This is where the update of the file is done, by pressing the “RUN ALL” button and inserting the two dates, 2/3 months ago (for BO reports), given next to the button when asked. As we can see in the figure 34 we have the Die operation expanded, showing all its columns. The column CPx Die is the complexity value calculated before, “Caparef” the value of the reference capacity for the given product in the Die operation and the column “Capap” is the Caparef value divided by the correspondent CPx. In the Lot Size column we have the quantity obtained before for this product and operation. The last column, RPT, is, as its name indicates, the Raw Process Time of the Die Operation for each product. The RPT is:

$$(N^{\circ} \text{ hours in the week} / \text{Capap}) * (\text{Lot Size}/1000)$$

This value comes in hours/lot.

RPT Calculation																							
										1° Refresh 2° Refresh													
RUN ALL										From: 2008-10-09 2008-09-09													
*usar datas referidas ao lado										To: 2008-12-09 2008-12-09													
										AAAA-MM-DD													
WEEK	0910											Column CPX	101										
															DIE				WIRE	FOL	MOLD	Plasma Cleaning	Ball Placing
Me	SHR	Package	Type	F1	Wafer Size	STEP	Org	S	F	CPx Die	CapaRef	Capap	Lot Size	RPT	RPT	RPT	RPT	RPT	RPT				
128M	D11	PG-TFBGA-60	FBGA	QR2	200mm	STANDARD	16Mx8	ALL	QC	1.00	315	315	5754	3.07	5.80	8.87	0.26		0.32				
128M	D11	PG-TFBGA-60	FBGA	QR2	200mm	STANDARD	16Mx8	ALL	NC-T	1.00	315	315	5754	3.07	5.80	8.87	0.26		0.32				
128M	D11	PG-TFBGA-60	FBGA	QR2	200mm	STANDARD	8Mx16	ALL	QC	1.00	315	315	5754	3.07	5.80	8.87	0.26		0.32				
128M	D11	PG-TSOPIL-66	TSOP	QR2	200mm	STANDARD	16Mx8	ALL	QC	1.04	280	269	5754	3.59	8.45	12.04	1.22		0.00				
128M	D11	PG-TSOPIL-66	TSOP	QR2	200mm	STANDARD	16Mx8	ALL	NC-T	1.04	280	269	5754	3.59	8.45	12.04	1.22		0.00				
128M	D11	PG-TSOPIL-66	TSOP	QR2	200mm	STANDARD	8Mx16	ALL	QC	1.04	280	269	5754	3.59	9.72	13.31	1.22		0.00				
128M	D11C	PG-TSOPIL-66	TSOP	SMI2	200mm	STANDARD	16Mx8	ALL	QC	1.04	228	219	4678	3.59	8.27	11.85	1.88		0.00				
128M	D11C	PG-TSOPIL-66	TSOP	QR2	200mm	STANDARD	8Mx16	ALL	QC	1.04	280	269	4678	2.92	9.51	12.42	1.88		0.00				
128M	D11C	PG-TSOPIL-66	TSOP	SMI2	200mm	STANDARD	8Mx16	ALL	QC	1.04	228	219	4678	3.59	9.51	13.09	1.88		0.00				
128M	D11	PG-TSOPIL-66	TSOP	SMI2	200mm	STANDARD	16Mx8	ALL	QC	1.04	228	219	5754	4.42	8.45	12.87	1.22		0.00				
128M	D11	PG-TSOPIL-66	TSOP	SMI2	200mm	STANDARD	16Mx8	ALL	NC-T	1.04	228	219	5754	4.42	8.45	12.87	1.22		0.00				
128M	D11	PG-TSOPIL-66	TSOP	SMI2	200mm	STANDARD	8Mx16	ALL	QC	1.04	228	219	5754	4.42	9.72	14.13	1.22		0.00				
128M	D11	P-TFBGA-60	FBGA	QR2	200mm	STANDARD	8Mx16	ALL	QC	1.00	330	330	5754	2.93	5.31	8.24	0.28		0.32				
128M	D11	P-TSOPIL-66	TSOP	QR2	200mm	STANDARD	8Mx16	ALL	QC	1.04	280	269	5754	3.59	9.72	13.31	1.22		0.00				
256M	LD70	PG-VFBGA-90	FBGA	QD3	300mm	STEP3L	8Mx32	ALL	QC	1.00	167	167	5471	5.50	8.49	14.00	0.35		0.28				
512M	LD70	PG-VFBGA-60	FBGA	QR3	300mm	STEP3	16Mx32	ALL	QC	2.83	160	57	5217	15.50	7.64	23.14	0.50		0.29				
1G	T70C	PG-TFBGA-84	FBGA	IM3	300mm	STEP3	64Mx16	ALL	QC	1.44	300	208	6422	5.18	7.09	12.27	0.95		0.48				
128M	S17	P-TSOPIL-54	TSOP	IFD2	200mm	STANDARD	16Mx8	ALL	QC	1.08	280	259	4805	3.11	6.15	9.27	1.49		0.00				
128M	S17	P-TSOPIL-54	TSOP	IFD2	200mm	STANDARD	16Mx8	ALL	NC-T	1.08	280	259	4805	3.11	6.15	9.27	1.49		0.00				
1G	T11	PG-TFBGA-68	FBGA	QD3	300mm	STANDARD	256Mx4	ALL	QC	1.60	335	209	4618	3.71	7.57	11.28	1.29		0.83				
1G	T11	PG-TFBGA-68	FBGA	QD3	300mm	STANDARD	128Mx8	ALL	QC	1.60	335	209	4618	3.71	8.05	11.76	1.29		0.83				
1G	T11	PG-TFBGA-68	FBGA	QD3	300mm	STANDARD	128Mx8	ALL	NC-T	1.60	335	209	4618	3.71	8.05	11.76	1.29		0.83				
1G	T11	PG-TFBGA-71	FBGA	QD3	300mm	STANDARD	512Mx4	ALL	QC	9.60	332	35	4618	22.47	35.34	57.81	0.94		1.10				
1G	T11	PG-TFBGA-71	FBGA	QD3	300mm	STANDARD	256Mx8	ALL	QC	9.60	332	35	4618	22.47	39.05	61.52	0.94		1.10				
512M	S14	PG-TSOPIL-54	TSOP	IFD2	200mm	STANDARD	32Mx16	ALL	QC	1.27	280	221	5217	3.97	5.00	8.97	1.38		0.00				
1G	T11	PG-TFBGA-92	FBGA	QD3	300mm	STANDARD	64Mx16	ALL	QC	1.60	332	207	4618	3.74	9.16	12.90	1.29		0.83				

Figure 34 – RPT Calculation

Taking the first product from the figure 34 as an example, we have that the product 128M D11 PG-TFBGA-60 that comes from the FE QR2 (Richmond 200mm), with a Step Standard (Step 2), an Organization 16x8, a Customer “All” and a quality conformant (QC) has a RPT of 3,07 for the Die Bond operation, which means that this product will take in Die Bond an average 3,07 hours per lot. We can also see that it takes 5,80 hours/lot in the Wire Bonding operation which gives a total of 8,87 hours/lot in the FOL area. The same logic can be done for the other products and operations shown.

After we obtain the RPT for all the operations we get the RPT per area (FOL/EOL), which will be used to calculate an accurate Cycle Time. The possibility of expanding this calculation to other areas as also been prepared, the scheme would be the same and some spaces have been prepared for this areas, the only problem would be the lack of information.

4.3 BO PFS Daily Report

After the trial and optimization period of the report in Excel, an automatic and less time consuming and error prone solution was required. The idea was to create a report that would be easily available to everyone and that would be automatically refreshed and sent everyday to everyone who needed it. For that purpose a new universe in Business Objects was created with the data that was not already available in the other existent universes and that was needed for the report.

The objective was to create a BO report with an aspect very similar, if not equal, to the excel version, that would give us the same data and visualization. The main difference between these reports is that the excel report was online, all the information was reported to the moment of the refresh, while the BO report points to the 23h00 pm of the day before.

In completing this task, the involvement of the IT department was necessary for creating the new universe in BO to accommodate the new data and providing an excel file that would allow to export the data to this universe, the PFS FF Targets mentioned before.

The BO report involved getting information from several universes and creating 19 queries (figure 35) in order to obtain all the needed data in one report and its organization was maintained similar to the excel version.

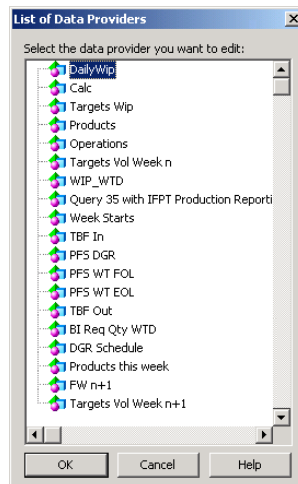


Figure 35 –Queries used in the report

Due to its complexity and number of queries, in the present report only two of them will be explained.

Starting by the query TBF In (figure 36), has its name indicates, its objective is to obtain the quantity of material that entered the TBF this week. In order to build this query it's necessary to use the universe FAB Xplorer V2.0 which gives online inventories and historic data to the detail of the lot, the universe with the greatest granularity available.

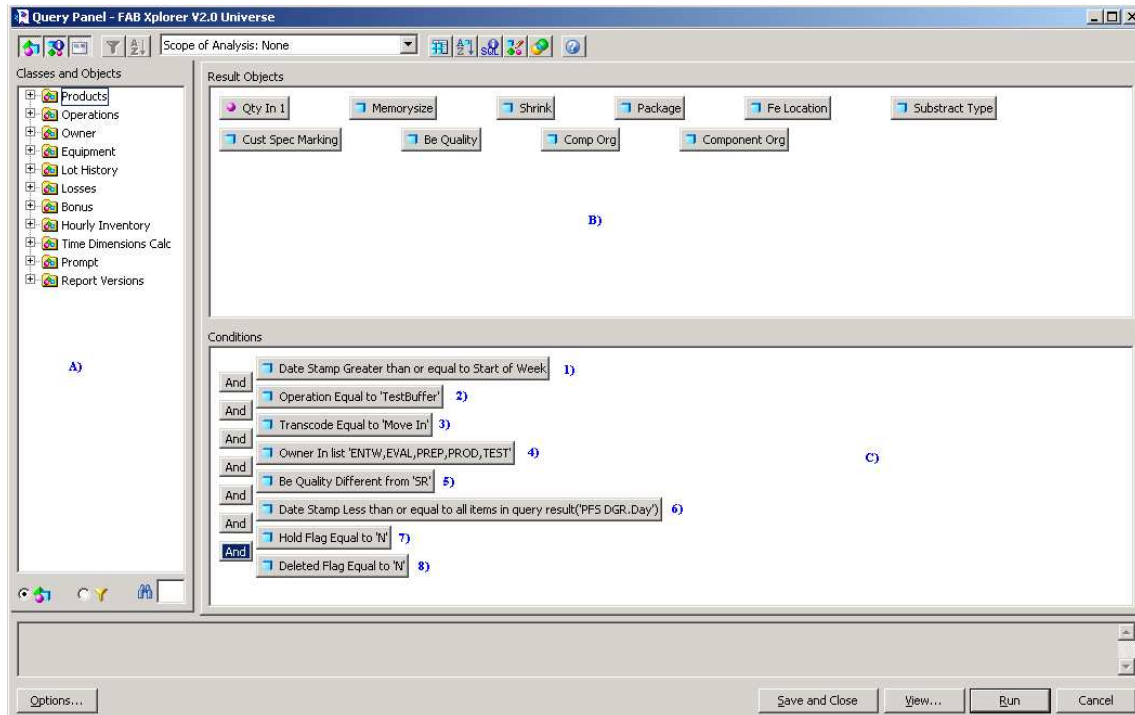


Figure 36 – Query TBF In

From this universe the products attributes where chosen (Memory Size, Shrink,...) and the Qty In 1, that will be the TBF IN, all visible in the top right window signaled by B) in the figure below. The left window, A), shows all the measures and dimensions available in the universe, while the bottom right window, C), shows the several restrictions that are also needed for the query to function properly. To obtain the correct time of period two restrictions were used, 1) and 6) to indicate the time of period from the start of the week until the day the refresh is made. At the restriction represented by 6), a result of another query is used which is the last day before the refresh, because all the data in the report is referent to the 23:00 of the day before the refresh. The restriction 3) defines the type of movement of the material, in this case, move in to the operation Test Buffer, 2). It is also necessary to define the type of material that is considered for production purposes represented in 4) and that the material is not scrap, 5). It is also necessary that the lot is not on hold, 7), and that it hasn't been deleted from the system, 8). With this we obtain the query TBF In.

Another example of a query uses is the “BI Req Qty WTD”, that gives us the request by the Burn In Area until the day before the refresh and uses the universe created for this report, the “IFPT Production Reporting V3”. This is a simple query as we can see in the figure below (figure 37), with all the attributes of the products selected as well as “Target PFS DGR Comp”, correspondent to the values that were inserted with the excel file “PFS FF Targets”. The only restrictions present in this universe are the time restraints, with the use of a subquery to obtain the correct week and the restriction “Until Yesterday” to give the values until the day before the refresh.

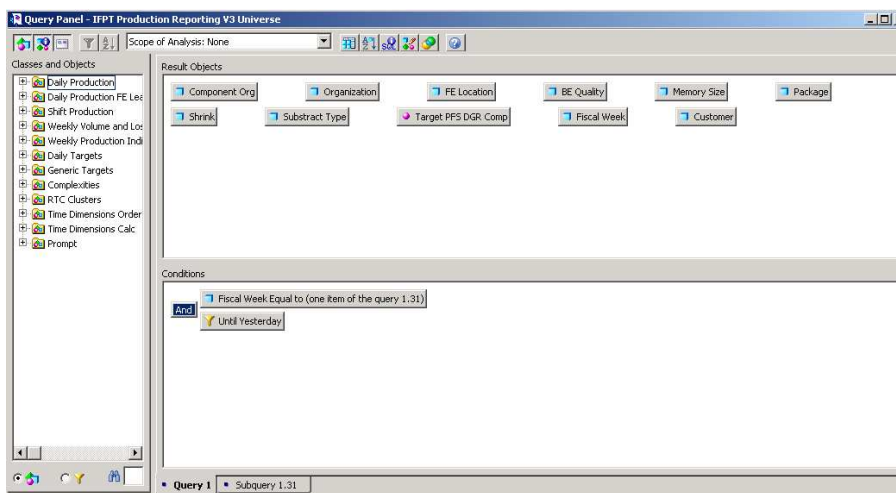


Figure 37 – Query BI Req Qty WTD

The report consists of two main parts, firstly a summary with the values organized by Type (BOC/TSOP and by Equivalents of 1GB, while the second part has the information shown by package. As in the excel version the report was explained in detail, in this section we have only a picture (figure 38) to show the final look of the report in BO and in the appendix D we have a complete report.

Desktop Intelligence - PFS Daily Operational Report - Assembly - [Teixeira Joa - @qbo]

File Edit View Insert Format Tools Data Analysis Window Help

100%

Variables

- Be Quality
- BE Quality(BI Req Qty WTD)
- BE Quality(Daily Wip)
- BE Quality(DGR Scheme)
- BE Quality(PFS DGR)
- BE Quality(PFS WTD)
- BE Quality(PFS WTD F)
- BE Quality(Products)
- BE Quality(Products)
- BE Quality(WIP WTD)
- BU
- Capacity
- Comp Org(TBF In)
- Comp Org(TBF Out)
- Component Org(BI F)
- Component Org(Daily)
- Component Org(DGR)
- Component Org(PFS)
- Component Org(PFS)
- Component Org(PFS)
- Component Org(Prod)
- Component Org(Prod)
- Component Org(Tar)
- Component Org(Tar)

PFS Daily Operational Report - Assembly - Summary Data refers to Day 6 Refreshed on January 14, 2009 at 10

Header

Type	Week Starts	FOL			EOL			DGR	BI Request Qty WTD	TBF In	TBF WIP	TBF Out	FW n	FW n+1
		WIP	Wip Target	Δ	WIP	Wip Target	Δ							
BOC STANDARD			0	0	0	0	0	0	125	110	-15	-7	110	-15
TSOP STANDARD	1,201	158	88	70	214	88	126	299	986	1,134	148	115	47	1,075
BOC STEP3	2,447	559	287	272	580	287	293	456	1,783	2,043	260	361	233	1,803
BOC STEP4	1,898	382	298	84	284	298	-14	473	1,894	2,144	251	223	89	2,279
Total	5,545	1,099	673	426	1,079	673	406	1,229	4,787	5,431	644	699	362	5,268
Equivalents														
	Week Starts	WIP	Wip Target	Δ	WIP	Wip Target	Δ	DGR	BI Request Qty WTD	TBF In	TBF WIP	TBF Out	FW n	FW n+1
256M	125	10	8	2	11	8	3	25	124	135	11	14	7	124
512M	673	129	104	25	164	104	60	183	653	673	20	30	-18	713
1024M	3,701	790	471	319	711	471	240	762	2,981	3,546	565	584	371	3,341
2048M		23	0	23	0	0	0	3	7		-7	-1	-3	10
Total	4,499	952	583	369	886	583	304	973	3,765	4,354	589	628	359	4,178

Figure 38 – BO PFS Daily Report

4.3.1 Uploading the information to the new BO universe

The new BO universe needed to have updated information in an easy and automatic way. With that purpose the excel file FF Targets PFS and PFS FF Targets Support were created and a file that has been mentioned before, QPT Comp Cycle Time 0809, was modified. The intended flow is demonstrated in the scheme below (figure 39):

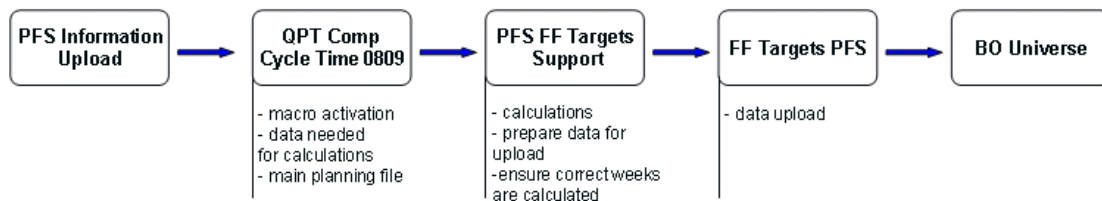


Figure 39 – BO information upload process

The file QPT Comp Cycle Time 0809 was already used to calculate the plan, Wip Targets, PFS data, Cycle Times and to upload the plan information for a reporting universe. The objective in putting this file the trigger of the PFS data upload to BO was to make everything possible in the same file so that whenever the plan was changed and the other existent reporting universe uploaded, the BO universe for PFS could also be easily uploaded. Another reason was to prevent the QPT Comp Cycle Time 0809 file becoming slow to process because it's of extreme importance and highly used by several planners and the PFS FF Targets Support has already a considerable size given the calculations needed. For this to happen only a new worksheet was added to the excel file, worksheet Wip PFS, that showed the Wip Target already calculated for a Pull Flow methodology. The other steps for the information upload are explained in the following chapters.

4.3.1.1 PFS FF Targets Support

This excel's objective is to calculate the necessary data for the file FF Targets PFS. As mentioned before, it runs in the background through the execution of a macro in QPT Comp Cycle Time 0809.

The first step is to use the data that is calculated for PFS in QPT Comp Cycle Time 0809, to create a kind of schedule of when each product will be produced. The In week Priority values we have are relative to the Burn In area, so each product's lead time needs to be subtracted in order to get the intended start in the FOL area.

With the schedules of both areas available, the daily Wip Target and DGR are calculated for a four weeks period of time. The PFS Wip Target is obtained as explained in the excel PFS Daily Report, by getting the values of the Wip Target, multiplying it by 7 (number of days) and dividing it by the consumption rate (number of days the product is planned to be produced). The DGR is easily obtained by dividing the Burn In request for the week by the consumption rate.

In the picture below (figure 40) we can see an example of the schedule for the EOL Wip Target, showing a two weeks schedule:

	200913								200914									
	BI	WT							BI	WT								
	Req	EOL	1	2	3	4	5	6	7	Req	EOL	1	2	3	4	5	6	7
1G_GH70_PG-TFBGA-136_32Mx32_QD3_QC-C_ALL_STEP3	250	40	40	40	40	40	0	0	0	461	72	72	72	72	72	72	72	72
1G_GH70_PG-TFBGA-136_32Mx32_QR3_QC-C_ALL_STEP3	400	63	63	63	63	63	0	0	0	815	128	128	128	128	128	128	128	128
1G_GV70_PG-TFBGA-170_32Mx32_QR3_QC-F_ALL_STEP4	200	41	41	0	0	0	0	50	50	242	50	50	50	50	50	35	35	35
1G_T70N_PG-TFBGA-60_128Mx8_IMB3_QC_ALL_STEP4	175	18	18	18	0	0	0	0	0	800	78	78	78	78	78	78	78	78
1G_T70N_PG-TFBGA-60_128Mx8_QD3_QC_ALL_STEP4	100	10	10	0	0	0	0	0	0	60	6	6	6	0	0	0	0	0
1G_T70N_PG-TFBGA-60_256Mx4_IMB3_QC_ALL_STEP4	175	18	18	18	0	0	0	0	0	1000	98	98	98	98	98	98	98	98
1G_T70N_PG-TFBGA-84_64Mx16_IMB3_QC_ALL_STEP4	25	3	0	0	0	0	0	0	0	250	25	25	25	25	25	25	25	23
256M_D11_PG-TFBGA-60_64Mx4_QR2_QC_ALL_STANDARD	50	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256M_D11_PG-TSOPII-66_32Mx8_QR2_QC_ALL_STANDARD	15	2	0	0	0	0	0	0	0	10	1	1	0	0	0	0	0	0
256M_D11_P-TSOPII-66_16Mx16_QR2_QC_ALL_STANDARD	40	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256M_GD11C_PG-TSOPII-66_16Mx16_QR2_QC_ALL_STANDARD	140	14	14	14	0	0	0	0	0	350	35	35	35	35	35	35	35	35
256M_S11N_PG-TSOPII-54_16Mx16_QR2_QC_ALL_STANDARD	80	8	0	0	0	0	0	0	0	50	5	5	5	0	0	0	0	0
256M_S11N_PG-TSOPII-54_32Mx8_QR2_QC_ALL_STANDARD	105	11	11	0	0	0	0	0	0	50	5	5	5	0	0	0	0	0
256M_T90C_PG-TFBGA-84_16Mx16_QR3_QC_ALL_STEP3	0	0	0	0	0	0	0	0	0	40	5	0	5	0	0	0	0	0
512M_D80_PG-TFBGA-60_64Mx8_QR3_QC_ALL_STEP3	100	9	9	0	0	0	0	0	0	21	2	2	0	0	0	0	0	0
512M_D80_PG-TSOPII-66_32Mx16_QR3_QC_ALL_STANDARD	100	10	10	0	0	0	0	0	0	15	2	2	0	0	0	0	0	0
512M_D80_PG-TSOPII-66_64Mx8_QR3_QC_ALL_STANDARD	325	32	32	32	32	32	0	0	0	225	22	22	22	22	22	22	12	12
512M_D80C_PG-TSOPII-66_64Mx8_QR3_QC_ALL_STANDARD	100	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
512M_D90_PG-TSOPII-66_32Mx16_IMB3_QC_ALL_STANDARD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7
512M_D90_PG-TSOPII-66_64Mx8_IMB3_QC_ALL_STANDARD	25	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0
512M_D90_P-TSOPII-66_32Mx16_IMB3_QC_ALL_STANDARD	25	3	0	3	0	0	0	0	0	22	3	3	0	0	0	0	0	0
512M_D90C_PG-TSOPII-66_32Mx16_IMB3_QC_ALL_STANDARD	65	7	0	0	0	0	0	0	0	453	45	0	0	45	45	45	45	45
512M_GH80_PG-TFBGA-136_16Mx32_QR3_QC-C_ALL_STEP3	300	71	71	71	71	0	0	18	18	75	18	0	0	0	0	0	0	0
512M_GH80_PG-TFBGA-136_16Mx32_QR3_QC-C_SON_STEP3	0	0	0	0	0	0	0	24	24	100	24	24	0	0	24	24	0	0
512M_GH90_PG-TFBGA-136_16Mx32_QR3_QC-C_ALL_STEP3	15	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
512M_T80_PG-TFBGA-60_128Mx4_WEC3_QC_ALL_STEP3	400	19	19	19	19	19	19	0	0	60	3	0	3	3	0	0	0	67
512M_T80_PG-TFBGA-60_64Mx8_WEC3_QC_ALL_STEP3	125	6	6	6	6	0	0	0	0	152	7	0	7	7	7	7	0	5

Figure 40 – PFS FF Targets Support Wip Target EOL Schedule

Taking the product signaled by 1) as an example we can see that there is planned a Wip Target of 41k of this product in the first day of the first week (200913), and then 50k at day 6 and 7. This Wip Target of 50k is correspondent to a request only due in the second week (200914), but due to its lead time the production at FOL needs to start in the first week at day 6 in order to be available in the following week when requested. The same happens in the second week, where in the first four days the production continues with the 50k Wip Target, but at days 5, 6 and 7 the Wip Target takes the value of 35k already correspondent to a request of the following week.

The same procedure is done for DGR, but in this case the value is the intended deliveries rate to Burn In and not the intended rhythm of production, it is calculated without the lead time difference, giving the quantity that Burn In needs to receive each day for the plan to be fulfilled.

The dates of the four weeks that need to be uploaded also have to be precisely calculated and converted to the necessary format so that the FF Targets PFS excel file is correctly loaded.

Afterwards, all this data is summarized into two worksheets with the PFS DGR and PFS Wip Target, and the dates and days are inserted automatically, to make everything ready and in the necessary format to be exported to the PFS FF Targets excel file.

4.3.1.2 FF Targets PFS

FF (Flow factor) Targets PFS is an excel file developed in partnership with IT. The goal is to feed the necessary data to the new BO universe in order to maintain an automated and actualized BO report. The data that needs to be uploaded is the DGR and the Wip Targets FOL and EOL. For each one, there's a sheet to store the values of a four weeks period time: the week before, this week, next week and the following. The information is calculated in a separate file, PFS FF Targets Support, and then transferred to this excel file to be uploaded. To upload it's just necessary to save the file, and the data will be sent to the BO database.

The data uploaded has to contain four weeks:

- Week n-1
- Week n (present)
- Week n+1
- Week n+2

The excel file automatically checks if the days of the weeks are the correct ones and if they aren't shows a warning specifying the wrong values and doesn't allow uploading.

As we can observe in the figure 41 below, the DGR sheet in this case, this file shows all the products that exist in the left side, in the top right the weeks and days, and below the values.

This excel file needs to be run and saved every time there's a change in the plan so that it is reflected in the report as well.

PFS DGR - ASSY										
Entry	Gener	Shrink	Back age	Organ	Front	Spare	SP	Full	Substrate	
FOL	256M	D11	PG-TFBGA-60	16	QR2	QC	ALL	64Mx4	STANDARD	
FOL	256M	D11	PG-TFBGA-60	16	QR2	QC	ALL	32Mx8	STANDARD	
FOL	256M	D11	PG-TFBGA-60	16	QR2	NC-T	ALL	32Mx8	STANDARD	
FOL	256M	D11	PG-TFBGA-60	16	QR2	QC	ALL	16Mx16	STANDARD	
FOL	256M	D11	PG-TFBGA-60	16	SM12	QC	ALL	64Mx4	STANDARD	
FOL	256M	D11	PG-TSOP11-66	16	QR2	QC	ALL	64Mx4	STANDARD	
FOL	256M	D11	PG-TSOP11-66	16	QR2	QC	ALL	32Mx8	STANDARD	
FOL	256M	D11	PG-TSOP11-66	16	QR2	NC-T	ALL	32Mx8	STANDARD	
FOL	256M	D11	PG-TSOP11-66	16	QR2	QC	ALL	16Mx16	STANDARD	
FOL	256M	D11	PG-TSOP11-66	16	IM13	QC	ALL	32Mx8	STANDARD	
FOL	256M	D11	PG-TSOP11-66	16	IM13	NC-T	ALL	32Mx8	STANDARD	
FOL	256M	D11	P-TSOP11-66	16	QR2	QC	ALL	32Mx8	STANDARD	
FOL	256M	D11	P-TSOP11-66	16	QR2	NC-T	ALL	32Mx8	STANDARD	
FOL	256M	D11	P-TSOP11-66	16	QR2	QC	ALL	16Mx16	STANDARD	
FOL	256M	D11	P-TSOP11-66	16	VEC2	QC	ALL	32Mx8	STANDARD	
FOL	256M	D11	P-TSOP11-66	16	VEC2	NC-T	ALL	32Mx8	STANDARD	
FOL	256M	D11	P-TSOP11-66	16	SM12	QC	ALL	64Mx4	STANDARD	
FOL	256M	D11	P-TSOP11-66	16	SM12	QC	ALL	32Mx8	STANDARD	
FOL	256M	D11	P-TSOP11-66	16	SM12	NC-T	ALL	32Mx8	STANDARD	
FOL	256M	D11	P-TSOP11-66	16	SM12	QC	ALL	16Mx16	STANDARD	
FOL	256M	GH11	PG-TFBGA-136	32	QR2	QC-C	ALL	8Mx32	STANDARD	
FOL	256M	GT11M	PG-TFBGA-84	16	IFD2	QC-F	ALL	16Mx16	STANDARD	
FOL	256M	GT11M	PG-TFBGA-84	16	QR2	QC-F	ALL	16Mx16	STANDARD	
FOL	256M	LS11	PG-TFBGA-54	16	QR2	QC	ALL	16Mx16	STANDARD	
FOL	256M	LS14	PG-TFBGA-54	16	IFD2	QC	ALL	16Mx16	STANDARD	
FOL	256M	LS14	P-TFBGA-54	16	IFD2	QC	ALL	16Mx16	STANDARD	
FOL	256M	SI1N	PG-TFBGA-54	16	QR2	QC	ALL	64Mx4	STANDARD	
FOL	256M	SI1N	PG-TFBGA-54	16	QR2	QC	ALL	32Mx8	STANDARD	
FOL	256M	SI1N	PG-TFBGA-54	16	QR2	NC-T	ALL	32Mx8	STANDARD	
FOL	256M	SI1N	P-TSOP11-54	16	QR2	QC	ALL	64Mx4	STANDARD	
FOL	256M	SI1N	PG-TSOP11-54	16	QR2	QC	ALL	64Mx4	STANDARD	
FOL	256M	SI1N	PG-TSOP11-54	16	QR2	QC	ALL	32Mx8	STANDARD	
FOL	256M	SI1N	PG-TSOP11-54	16	QR2	NC-T	ALL	32Mx8	STANDARD	
FOL	256M	SI1N	PG-TSOP11-54	16	QR2	QC	ALL	16Mx16	STANDARD	
FOL	256M	S14	P-TFBGA-54	16	QR2	QC	ALL	64Mx4	STANDARD	
FOL	256M	S14	P-TFBGA-54	16	QR2	QC	ALL	32Mx8	STANDARD	
FOL	256M	S14	P-TFBGA-54	16	QR2	NC-T	ALL	32Mx8	STANDARD	

Figure 41 – FF Targets PFS DGR

4.4 New PFS Version

After a try-out period of the PFS program in the line, a new version was released in December, which was a user friendly version and had several enhancements relative to the one before. This was due to some bugs and needs that arouse with the program usage and the need for a continuous improvement of the tool and better adaptation to the user needs. The new version brought some main changes:

- visual changes - lots and products were separated (products located in the upper window and when a determined product is selected the correspondent existent lots are shown in the window below) - more organized and intuitive
- manual override available – enables to “force” a product to keep producing even if the program’s calculations say otherwise
- percentage of the fulfilled plan week to day available – enables checking if the plan laid out is being carried out successfully or if the production is behind schedule
- more intuitive interface
- bug fixing of some problems
- totals for some parameters allowing a quick check if the plan loaded is the correct one

Basically, the program proposes the products existent in the plan in several lanes accordingly to several criteria and sorts then accordingly to the existent calculated values.

The tool’s user interface has several attributes:

- visual indication of Sequencers or lanes (by color coding)
- ordered Listing of lanes, with ordered products
- ordering by a prioritization rule that is independent for each lane and product
- indication of product by customizable attribute granularity
- additional indication of product number (Baunumber), and customizable lot attributes (e.g. Hold flag, Owner, ...)
- user selectable filtered views (lane filter, attribute filter, ...)
- Indication of Consumption Rate and In-Week-Priority for viewed area and customer area on aggregated product level
- Justification of move-ins which are from lower sequence priorities

In the picture below (figure 42) we can see the aspect of the new version of the PFS program.

Figure 42 – PFS Program

In the explanation that follows keep in mind the highlighted product, also marked as I), that will be given as an example most of the times. First, we have five types of group columns:

- Lane
- Product
- Release Location
- Request Location
- Additional Info

The Lane column, A), shows the existent lanes at the moment, which have been referred before, and as we can see in the picture 42 they're separated by colour (Unassigned – blue; Normal/Short – green; Hot – red) and by a dotted line. The reference product, I), is inserted in the Normal lane in this case.

The group column Product, B), is mainly relative to the products attributes and we have several sub columns:

- Manual override – this is relative to a manual override of the program calculations, forcing the product to move to the Normal lane in order to keep producing, one of the new features of the new version, and that can be only activated (Y) by users with certain privileges. In the case of the product being explained, this item is not activated (N).

- 3) Generation – information about the product’s memory size (256M)
- 4) Shrink – information about the shrink of the product (D11)
- 5) Package (PG-TSOPII-66)
- 6) Organization (16Mx16)
- 7) FE Location (QR2)
- 8) FE Quality (QC)
- 9) Customer (All)
- 10) Substrate type (Standard)
- 11) Business week – business week in which the product is supposed to be produced and the data shown corresponds

Concerning now the group column Release Location, C), that is relative to the planned data of the release location, the Assembly area, we have only two sub columns:

- 12) Consumption Rate – the planned consumption rate of the product at FOL (3days)
- 13) Starting day – the day that the product is planned to start at FOL (Monday)

The column group Request Location, D), is similar to C), but with data relative to the request location, the Burn In area, and there are also two sub columns:

- 14) Consumption Rate – the planned consumption rate of the product at Burn In (3days)
- 15) Starting day – the day that the product is planned to start at Burn In (Wednesday – normally most of the products have a Cycle Time of two days at FOL and EOL, so they will be available at Burn In two days after starting to be produced at FOL)

Considering the last group column, Additional Info, E), that concerns the information on parameter values used for the algorithm, we have several sub columns. Not all are showed in the picture 42, only the most important:

- 16) Plan - relative to the plan that this product has for the week in question (100k)
- 17) Die Bonders – number of die bonders (equipment for the first operation of the FOL) that are necessary in order to fulfill the week’s plan (0,8)
- 18) Done – quantity of material that has been delivered to the TBF (19,964k)
- 19) WTD (Week To Date) – percentage of the delivered material according to what was planned to produce until the moment (42% - the product in case is behind the deliveries plan); this percentage column has been another addition to the PFS program with the new version in order to allow an immediate and easier notion of the plan’s roll out
- 20) Starts – number of starts that are necessary at FOL in order to fulfill the week’s plan and considering all the Wip in the line and deliveries effectuated (48,170k)
- 21) DGR (Daily Going Rate) – Quantity that it’s supposed to produce per day (33,333k)

22) Reason – column relative to commentaries that are automatically inserted when the products get unassigned, which has been an addition with the new PFS version; the product in case isn't unassigned, but we can that below in the unassigned lane there are other marked products:

II) No lots – means that although the product still needs to be produced, it is unassigned because there are no lots available to start production

III) Sufficient Wip – this comment reveals that although the deliveries to the TBF haven't all been made yet, there is enough Wip available in the line in order to fulfill the necessary request and no more starts are necessary

IV) Delivered – there is no need to start more material because the request for the week has already been fulfilled

23) ABF – Wip existent at the Assembly Buffer at the moment (14,440k)

24) Wip Target – Calculated Wip target for the product in the FOL and EOL areas (58,029k)

25) Wip – Wip at FOL and EOL areas at the moment (31,866k)

26) Delta Wip – equal to Wip Target minus Wip (26,163k)

As mentioned before, in this new version the products and lots were separated in two different windows. In the earlier version of the program both the products and the lots available appeared together, which caused some confusion and a long and not so immediate list. At F), the window below, we can see the lots that are available for the product selected, I). The information available at this place is relative to the product's baunumber, the lot number, the quantity of the lot and time that the lot has been in operation.

Above each sub column, the place where the numbers signaling the columns are, there's a white box with an asterisk that allows the use of a filter in order to better find the wanted products and filter out the unwanted information. It's possible to filter only the TSOP or BOC products, a determined shrink or package as well as the memory size. The columns and correspondent sub columns with the various attributes can also be edited in order to be shown or not accordingly to the user's preferences.

Finally, at G), we have a bar with totals for the request (plan), ABF, Wip and quantity delivered. This was also another change effectuated with the new version, which allows to quickly check if the loaded plan is the correct one and, together with the use of the filter functionality, obtain totals by package, shrink or memory size.

5. Results and conclusions

Firstly, concerning the excel file RPT Calculation, the implementation was successful and its values are being used in order to correctly calculate a more precise Cycle Time that is used for planning and is the base for several calculations at Qimonda, such as Wip Targets.

Concerning the PFS daily reports, the excel file was successfully implemented and presented for a period of time, and recently the PFS BO report has taken its place and the universe is available for anyone to consult and use the PFS information.

The PFS program was, in the first phase, functioning in the line with another one active, the Start Scheduler, and the operators could choose which one to use for the TSOP products. The usage rate of the PFS program was high indicating a good acceptance by the line personnel, but with a few bumps in its path as can be seen in the graph (figure 43) below.

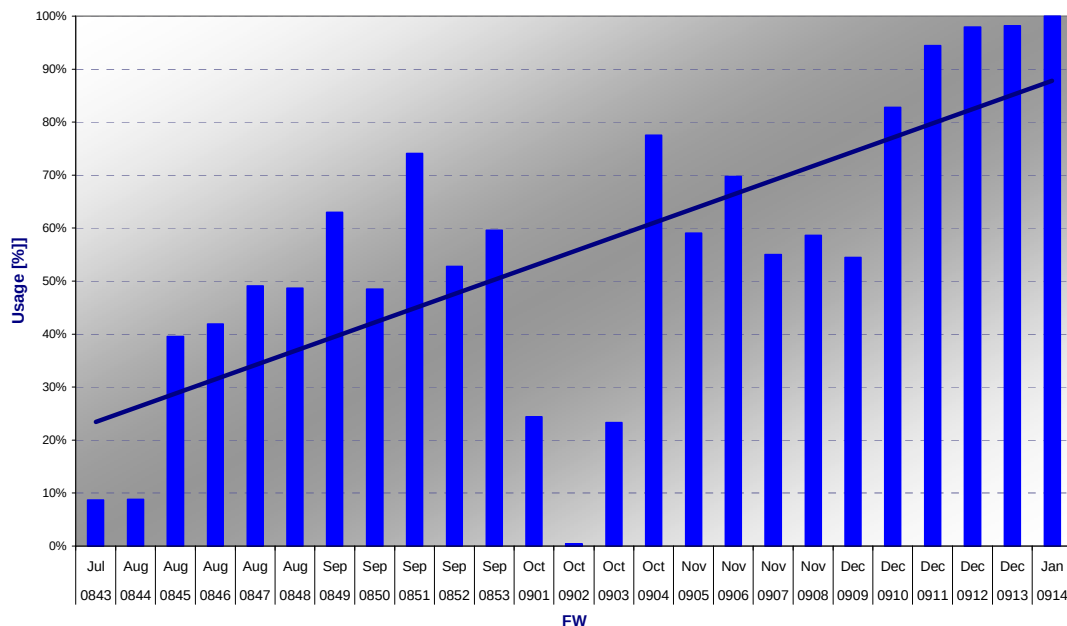


Figure 43 – PFS TSOP usage at Assembly area

Observing the graph, we can see that the first two weeks had a very low usage, normal for the start, as well as the first three weeks in October, these due to a bug in the program. In the last three weeks we can already see the usage at almost 100%.

Some low values of the PFS usage were due to some problems that occurred, which can be seen in the table below (Table 3):

Table 3 – Problems that occurred with PFS

Month	Week	Problems
July	0843-0844	Program usage kick off
August	0845-0848	Missing operator permissions
September	0850	All Designs associated with alternative baunumbers
September	0852	Burn-In plan contained customers unavailable in Assembly
September	0853	Wrong Plan loaded for FW 0853 during weekend
October	0901	New PFS version installed (bug blocking application)
October	0902	Bug recurrence; Developer on vacation
October	0903	Bug fixed after weekend
October	0904-0907	Plan not available on weekend – data upload problems

In the third week of December, and after a release of a new optimized PFS version, a decision to make the tool the main program available for the operators to use with TSOP products at FOL and EOL was taken, and the Start Scheduler would only function in case of need. From then on, the usage was nearly 100%. In the beginning of January another step forward was taken with the implementation of the PFS tool also for BOC products at Assembly, in a similar way that happened first with TSOP, the operators have the choice of which program to use (Start Scheduler vs. PFS).

The next item to be addresses is the CLIP for the TSOP products in this area over the time is presented (figure 44).

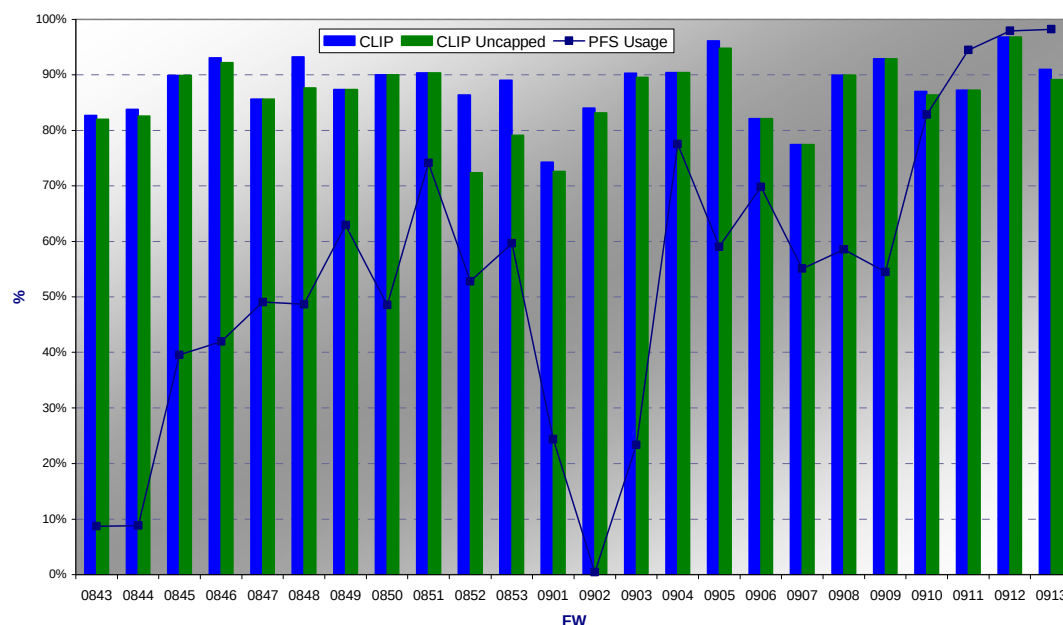


Figure 44 – CLIP and CLIP Uncapped TSOP at Assembly

CLIP (Current Line Item Performance) is a KPI (Key Process Indicator) used by Qimonda, which gives the fulfilment percentage of the plan (deliveries vs. plan). Another KPI shown in the graph is the CLIP Uncapped, which is similar to the CLIP, but penalizes overdeliveries, one of the aspects that the PFS tool minimizes.

A correct analysis is difficult to obtain at the time because we almost only have values relative to the use of both programs simultaneously, the only exceptions are the last three weeks. This aspect can influence severely the results obtained, as well as the weekly variations in the plans, fails in the equipment, etc... With this we can not say that the CLIP has improved with the use of this new tool due to the lack of information and the number of variables in play, but we can clearly see that the algorithm of the program works correctly and allows obtaining very high CLIP and CLIP Uncapped performances.

Another advantage that the Pull Flow philosophy brings is the diminution of the Wip in the line and its inherent advantages. In the graphic below (figure 45) we can see that over the time the gap (delta) between Wip and Wip Target is being continuously reduced from which we can infer that the tool allows to better control the Wip at the line. The only exception is the week 0912 that may be considered as an exception because it's relative to the Christmas week when the factory stopped producing for two days. After this stop, at the start up of the equipments, normally many problems appear.

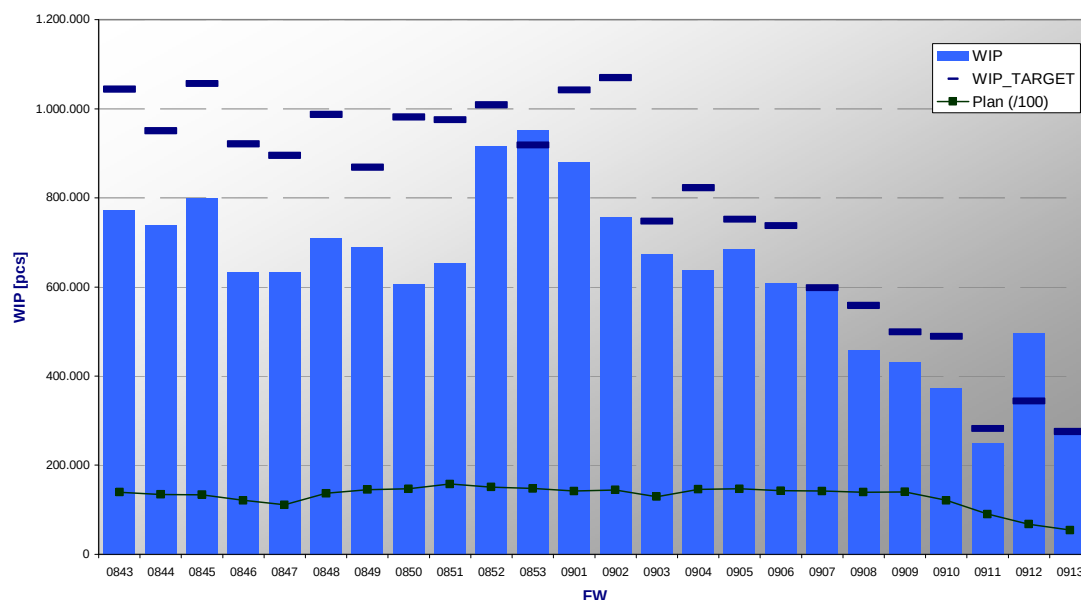


Figure 45 – Wip and Wip Target at the Assembly area

In order to see if the volume produced each week at the Assembly area could influence the results, an additional part was added in the graph with the plan for the week divided by 100 in order to appear in the scale. From here we see that the production has been almost constant and with low variation during the time with the exception of the last two/three weeks.

6. References and Bibliography

- [1] W. Hopp, M. Spearman, *To Pull or Not to Pull: What Is the Question?*, Manufacturing & Service Operations Management **6** (2004) 133-148
- [2] E. Laan, R. Teunter, *Simple Heuristics for push and pull remanufacturing policies*, European Journal of Operational Research **175** (2006) 1084-1102
- [3] R. Ahmadi, H. Matsuo, *A mini-line approach for pull production*, European Journal of Operational Research **125** (2000) 340-358
- [4] J. Meredith, U. Akinc, *Characterizing and structuring a new make-to-forecast production strategy*, Journal of Operations Management **25** (2007) 623-642
- [5] M. Ball, C. Chen, Z. Zhao, *Available to Promise*, Robert H. Smith School of Business, University of Maryland
- [6] www.qimonda.com
- [7] <http://eu-intranet.qimonda.com/Porto/en/en/index.htm>
- [8] Howson, Cindi. "Business Objects XI: The Complete Reference".2006. McGraw Hill
- [9] R. Chase, F. Jacobs, N. Aquilano. "Operations Management for Competitive Advantage with Global Cases".2001. McGraw Hill International Edition

APPENDIX A: Productive Areas Presentation



We are Qimonda



Setembro, 2008

Ariana Campos
João Teixeira
Pedro Muacho

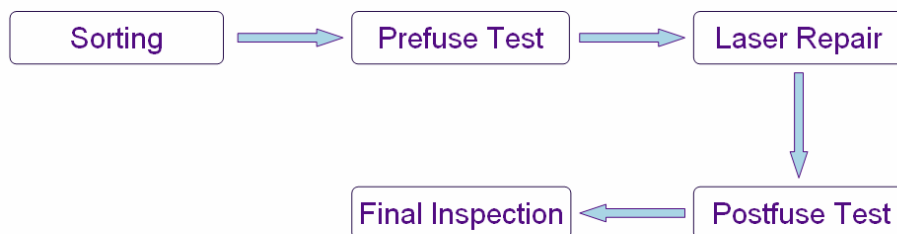
Áreas Internas



Wafer Test



→ Process Flow



Wafer Test



→ Sorting

- ❖ Transferir, distribuir e mapear wafers



→ Prefuse Test

- ❖ Detecta defeitos funcionais

→ Laser Repair

- ❖ Activação de zonas de memória de spare em chips reparáveis



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

Wafer Test



→ Postfuse Test

- ❖ Garantir que o laser actuou nos fuses correctos e que estão funcionais

→ Final Inspection

- ❖ Confirmação visual da actuação do laser
- ❖ Garantia da integridade física das unidades



WTEST

PREASSY

FOL

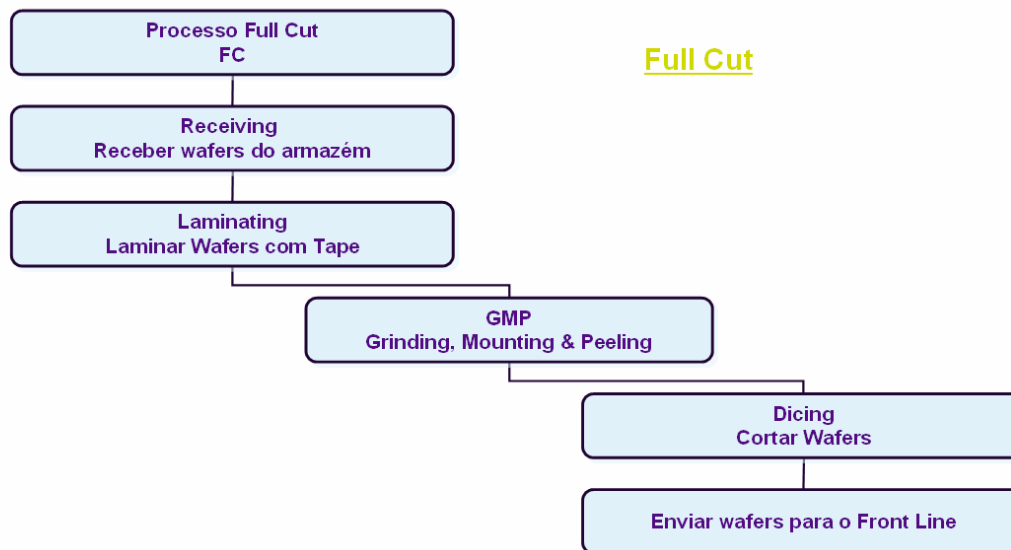
EOL

BUI

TEST

MSP

Pre-Assembly



WTEST

PREASSY

FOL

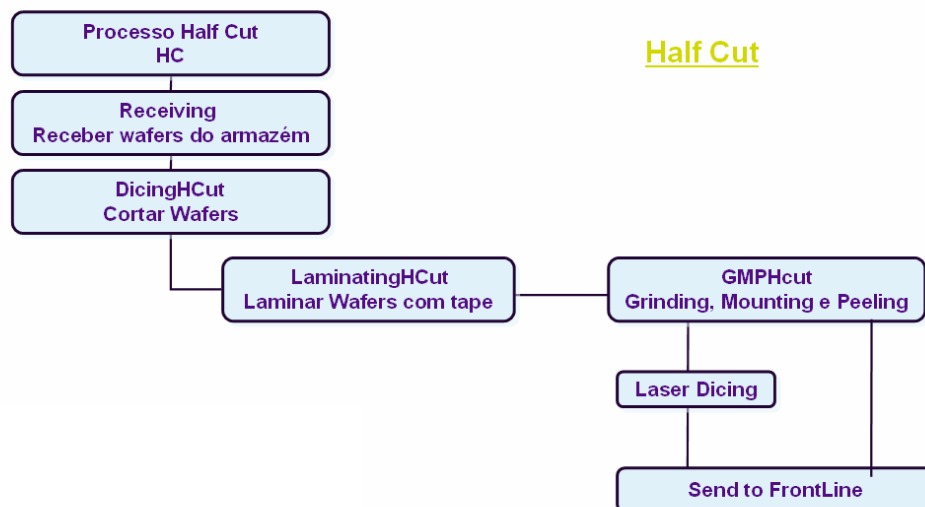
EOL

BUI

TEST

MSP

Pre-Assembly



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

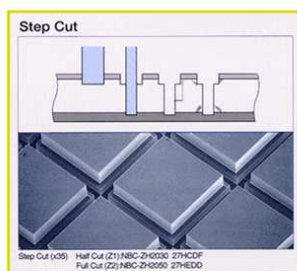
Pre-Assembly



→ Dicing

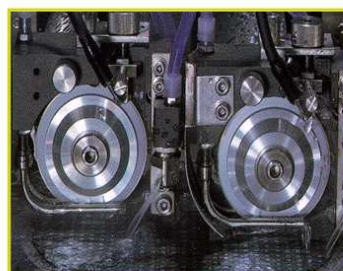
Full Cut

Step Cut : Z1 determina a largura
Z2 define a profundidade



Half Cut

Z1, Z2 avançam em simultâneo



WTEST

PREASSY

FOL

EOL

BUI

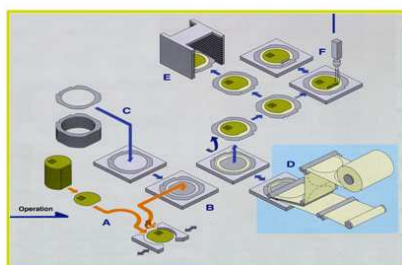
TEST

MSP

Pre-Assembly



→ Laminating



❖ Protecção da parte activa das wafers com tape

Grinding standard tape

D-DAF - BLANK SILICON:
- Semicondutores
- Substrato

1G T70N Dual Die

• [Video 1](#)

• [Video 2](#)

WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

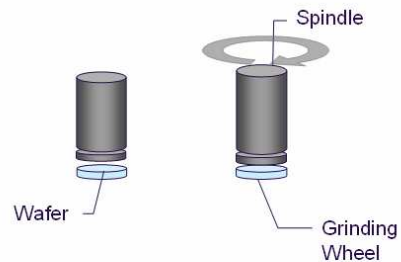
Pre-Assembly



→ Grinding

Full Cut

- Polimento especial



Half Cut

Z1- Desbaste grosso

Z2- Desbaste fino



WTEST

PREASSY

FOL

EOL

BUI

TEST

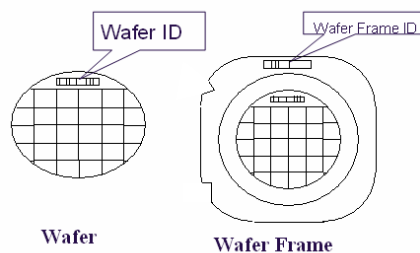
MSP

Pre-Assembly



→ Mounting

- ❖ Ligação wafer-frame > dicing tape



→ Peeling

- ❖ Retirar Laminating tape da parte activa da Wafer

WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

Pre-Assembly



→ Laser Dicing

- ❖ Corte por feixe de radiação laser
- ❖ Tecnologia D-DAF (produtos Dual Die)
- ❖ Individualização do die
- ❖ Lavagem e secagem da Wafer no final (Spinner)



Remover coating

WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

Pre-Assembly



→ Inspeção Final

Inspeção visual a 100%:

- Alinhamento dos Notches do Lote
- Dies Partidos
- Cortes que ultrapassaram as extremidades da wafer
- Partículas ou bolhas de ar
- Quebras na wafer



Inspeção aos cortes:

- 1 wafer por cada lote
- 6 pontos



WTEST

PREASSY

FOL

EOL

BUI

TEST

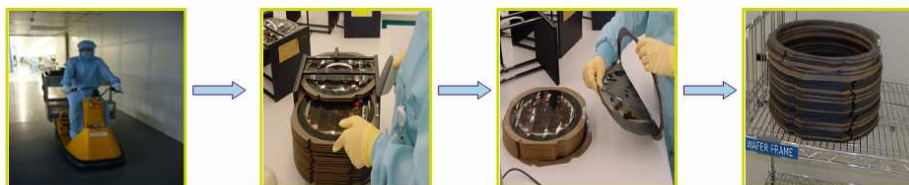
MSP

Pre-Assembly



→ Abatimento de frames

- ❖ Reaproveitamento de frames vindas do área de Bond através do Jordan



WTEST

PREASSY

FOL

EOL

BUI

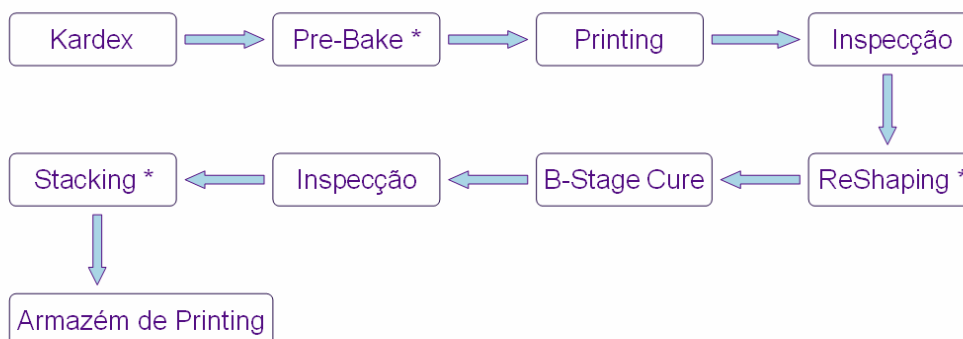
TEST

MSP

FOL - Printing



→ Process Flow



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

FOL - Printing



→ Operação de Pre Bake

- ❖ Desumidificação do substrato
- ❖ Usado apenas para produtos Sony



→ Operação de Printing

- ❖ Colocação de adesivo no substrato
- [Video Printing](#)



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

FOL - Printing



→ Operação B-Stage Cure

- ❖ Levar a epoxy a um estado propício para o Die Bonding

- ❖ 3 zonas {
 - Pre Heat
 - Curing
 - Cooling



→ Armazém de Printing

- ❖ Segue FIFO
- ❖ Quadro de referência em função das Die Bonders
- ❖ Cartão Next Lot na lunch box mais antiga



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

FOL - Printing



→ Mesa de Inspeção

❖ Inspeção visual

Se não está
printado
Se tem bolhas de
epoxy

❖ 1 substrato por lote ao microscópio



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

FOL - Printing



→ Problemas de qualidade

- ❖ Falta de adesivo
- ❖ Offset
- ❖ Irregularidade no adesivo
- ❖ Excesso ou falta de acetona
- ❖ Altura do adesivo excessiva detectada no perfilómetro



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

FOL - Printing



→ Sala de limpeza de Stenceis

- ❖ Lavagem de stenceis e dummies
- ❖ Banheira de ultra-sons para lavar lâminas
- ❖ Lavagem necessária {
 - sempre que se faz um Setup
 - se a máquina estiver parada mais do que 3h



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

FOL - Printing



→ Sistema Pull-Flow

- ❖ Controla a produção



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

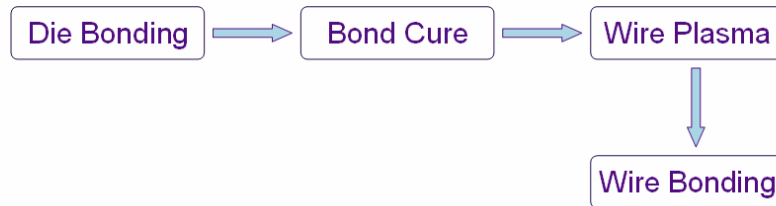
FOL - Bond



→ TSOP



→ BOC



WTEST

PREASSY

FOL

EOL

BUI

TEST

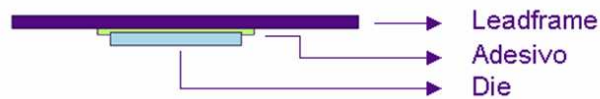
MSP

FOL - Bond



→ TSOP Die Bonding

❖ União mecânica do die com a leadframe



WTEST

PREASSY

FOL

EOL

BUI

TEST

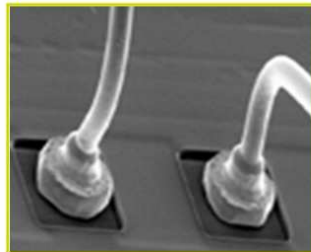
MSP

FOL - Bond



→ TSOP Wire Bonding

- ❖ Ligação eléctrica entre os bond pads do semiconductor e os leads da frame, usando fio de ouro.



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

FOL - Bond



→ TSOP Inspeção

- ❖ Die Bonding: inspecção visual feita ao microscópio
 - orientação do chip relativamente a leadframe;
 - precisão do posicionamento
 - verificar a laminação
- ❖ Wire Bonding: inspecção é feita através do monitor
 - precisão do posicionamento
 - verificar a soldadura



WTEST

PREASSY

FOL

EOL

BUI

TEST

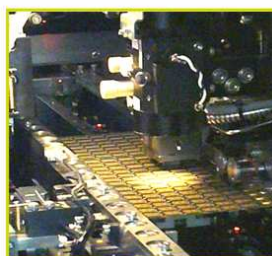
MSP

FOL - Bond



→ BOC Die Bonding

- ❖ União mecânica do die com o substrato



WTEST

PREASSY

FOL

EOL

BUI

TEST

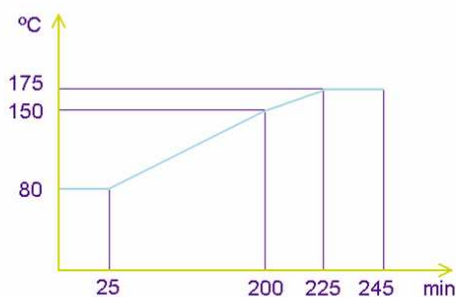
MSP

FOL - Bond



→ BOC Bond Cure

- ❖ Solidificação da epoxy
- ❖ Duração total: ~ 4h



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

FOL - Bond



→ BOC Wire Plasma

- ❖ Limpa eventuais impurezas no substrato depois do processo de cura
- ❖ Duração de, aproximadamente, 9min
- ❖ Os substratos são submetidos a cinco operações:

1. Pumping Down
2. Gas Supply
3. Plasma Process
4. Flushing
5. Venting

WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

FOL - Bond



→ BOC Wire Bonding

- ❖ Ligação mecânica através de fio de ouro entre o bond pad (die) e o finger (substrato), consoante a configuração pré-definida pelo produto.



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

FOL - Bond



→ BOC Inspeção

❖ Inspeção Visual

- Lamination Control
- Chip Placement Control
- Contaminações ou dies partidos

❖ Testes Destrutivos

- Pull Test (TPU): avalia a resistência mecânica do fio de ouro
- Shear Test (TSH): avalia a resistência da soldadura no bond pad

WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

FOL - Bond



→ BOC Inspeção

❖ Wire Tests: NSD (Non Stick Detector)

- Ball-Non-Stick
- Tail-Lift-Off
- Wedge-Non-Stick

❖ Testes Dimensionais (em x,y,z)

- Diâmetro da bola
- Altura da bola
- Altura do loop

WTEST

PREASSY

FOL

EOL

BUI

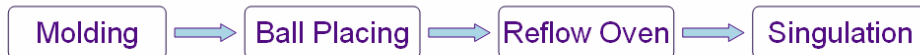
TEST

MSP

EOL



→ BOC



→ TSOP



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

EOL



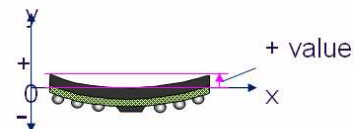
→ BOC Molding

- ❖ Encapsulamento dos semicondutores e do bond channel com Mold Compound.



Curiosidade:

Existe um processo de arrefecimento do material para evitar Warpage o Turn Over



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

EOL



MOLD BOC

- Shots de 2 substratos
- Operação de MOLD efectuada na Tool

Turn Tables

- Temperatura $\approx 185^{\circ}\text{C}$
- Fingers Turn Tables evitam Warpage
- Colocação dos substratos na Tool



cull

WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

EOL



Pellet (Mold Compound)

- Tempo de estabilização ≈ 12 h
- Tempo de validade ≈ 36 h
- Prazo de validade mesmo a baixas temperaturas
- Abastecimento directo Armazém Pellet Holder – MONMOB

Pellet Holder

- Abastecimento da linha
- Ligação a EOL através de sistema pneumático



WTEST

PREASSY

FOL

EOL

BUI

TEST

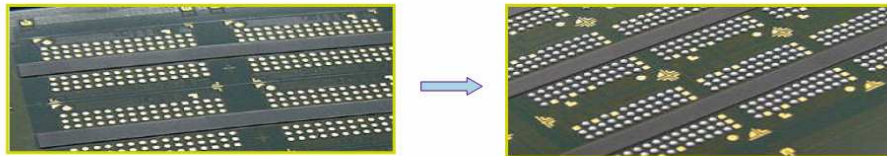
MSP

EOL



→ BOC Ball Placing

- ❖ Colocação das bolas de solda nos ball pads do substrato



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

EOL



→ BOC Reflow Oven

- ❖ Garante a fixação das bolas de solda



5 zonas de aquecimento

+

1 zona de arrefecimento

→ BOC Singulation

- ❖ Individualização das unidades do substrato

WTEST

PREASSY

FOL

EOL

BUI

TEST

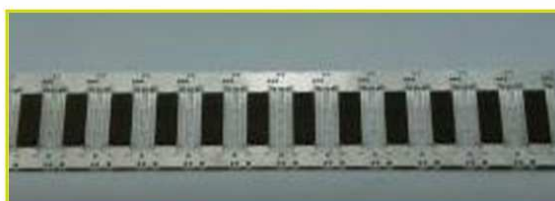
MSP

EOL



→ TSOP Molding

- ❖ O processo de molding dos TSOP é em tudo idêntico ao dos BOC.



WTEST

PREASSY

FOL

EOL

BUI

TEST

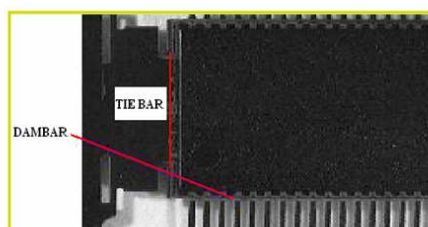
MSP

EOL



→ TSOP Dedam/Dejunk

- ❖ Corte mecânico do shunt ou dambar que une os diversos leads
- ❖ Remoção dos excessos de resina resultantes do Molding



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

EOL



→ TSOP Plating

- ❖ Remoção dos restantes excessos de mold compound
- ❖ Revestimento os leads com uma liga → espessura suficiente para a solda

1. Loading
2. Banhos
3. Plating
4. Unloading

→ Raio X
Bent Test



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

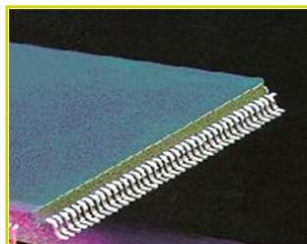
EOL



→ TSOP Trim & Form

- ❖ Individualização das unidades provenientes do Plating
- ❖ Dá forma desejada aos leads

1. Pre-Cut
2. Pre-Form
3. Final Form
4. Final Cutting



• Video TSOP Trim & Form

WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

EOL



→ TSOP Inspeção

Level-off }
Spread } **Projector de perfis e micrómetros**
Stand-off }

Planicidade } **Próprio equipamento**



Coplanarity; spread; stand off – teste feitos pela máquina
Level off – teste manual

Inspeção visual
danos no encapsulamento
danos nos leads (lead intrusion)



WTEST

PREASSY

FOL

EOL

BUI

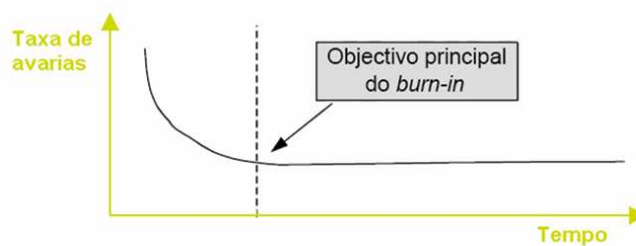
TEST

MSP

Burn In



- ❖ Processo de envelhecimento
- ❖ Detecção prematura de falhas nas unidades



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

Burn In



1. **Load:** Trays → Board's ou BIB's

2. **Burn In:** As unidades são sujeitas a stress eléctrico e de temperatura
Permite uma triagem segundo o tipo de classificação:

- Sa1 – Pass
- Sa2 – 2ª Qualidade
- Sa3 - Sucata



3. **Unload:** Boards → Trays

WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

Test



Requisitos:



Compatibilidade entre os diversos fornecedores

Precaver variabilidades nos processos produtivos

Monitorizar continuamente os processos de *BackEnd* e *FrontEnd* ↑ **Yield**

Amadurecimento
do Produto →

Inexistência de falhas
Não surgimento de
reclamações

→ **TTR**

WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

Test



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

Test



→ Handler

Colocação das unidades no Hifix → Interligação físico /elétrica



Conversão de Handlers



Hifix + Change Kit

↓
Tooling

WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

Test



→ Testes



2 tipos teste:

Low Temp test (-10°, -25°, -40°)

High temp test (85°C a +95°C)

CORE Test

DDR2 e sup. → + Speed Test

Designação dos testes

2 caracteres

WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

MSP



→ Funções Principais

- ❖ Marcação das unidades
- ❖ Inspeções
- ❖ Embalamento



WTEST

PREASSY

FOL

EOL

BUI

TEST

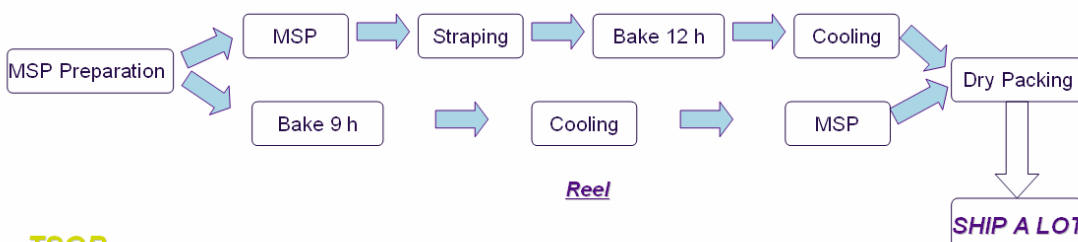
MSP

MSP



BOC

Tray



Reel

TSOP



WTEST

PREASSY

FOL

EOL

BUI

TEST

MSP

MSP



→ QA Packing Check & Ship a Lot

- ❖ Verificação das Labels
- ❖ Qseals
- ❖ Colocação em Kardex



WTEST

PREASSY

MSP

EOL

BUI

TEST

MSP

Thank you

**The World's Leading
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APPENDIX B: AO Capa Profile Proposed Changes

AO - Capa Profile Proposed Changes

04 November, 2008

João Teixeira – QPT PL PCL



AO-Capa Profile Proposed Changes



Proposed Changes to AO Capacity Profile:

➤ Where?

In the sheets "Equipment" and "Equipment Max. Capa"

➤ What?

Add collums specifying some restrictions and equipment names and correct some aspects

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AO-Capa Profile Proposed Changes



Example (Sheet "Equipment"):

1) Add the following fields in the unused collums C to Y:

- Operation
- Equipment
- WS (Wafer Size)
- Type (TSOP/FBGA)
- Step (STEP2/3/4)
- Package (GP/P)

	A	B	C	D	E	F	G	H	I
1	Machines Allocation								
2									
3									
4									
114	Die Bond Facilit								
115	DB Hacks Capacity								
116									
117	Wire Bond Equipment		Restrictions						
118	Wire Bond machines allocation		Operation	Equipment	WS	Type	Step	Package (GP/P)	
119	Num	ESEC 3000p TSOP	WIRE BOND	ESEC 3000p	ALL	TSOP	ALL	ALL	
120	Num	ESEC 3000p FBGA	WIRE BOND	ESEC 3000p	ALL	FBGA	ALL	ALL	
121		ESEC 3100 TSOP (Tsunami)	WIRE BOND	TSUNAMI 3100	ALL	TSOP	ALL	ALL	
122		ESEC 3100 FBGA (Tsunami)	WIRE BOND	TSUNAMI 3100	ALL	FBGA	ALL	ALL	
123		ESEC 3100+ FBGA (Tsunami)	WIRE BOND	TSUNAMI 3100+	ALL	FBGA	ALL	ALL	
124		Shinkawa TSOP	WIRE BOND	SHINKAWA	ALL	TSOP	ALL	ALL	
125		Shinkawa FBGA	WIRE BOND	SHINKAWA	ALL	FBGA	ALL	ALL	
126									
133									
134	Total Capacity WB								
135	WB TSOP Capacity								
136	WB BOC Capacity								
143									
145	Mold Equipment		Restrictions						
146	Mold machines allocation		Operation	Equipment	WS	Type	Step	Package (GP/P)	
147	Mold	AMS-38M2 TSOP	MOLD	AMS-38M2	ALL	TSOP	ALL	ALL	
148	Mold	AMS-38M2 FBGA Step2	MOLD	AMS-38M2	ALL	FBGA	STEP2	ALL	
149	Mold	AMS-38M2 FBGA Step3	MOLD	AMS-38M2	ALL	FBGA	STEP3	ALL	
150	Mold	AMS-38M2 FBGA Step4	MOLD	AMS-38M2	ALL	FBGA	STEP4	ALL	
151	Mold	AMS-309 FBGA Step2	MOLD	AMS-309	ALL	FBGA	STEP2	ALL	
152	Mold	AMS-309 FBGA Step3	MOLD	AMS-309	ALL	FBGA	STEP3	ALL	
153	Mold	AMS-309 FBGA Step4	MOLD	AMS-309	ALL	FBGA	STEP4	ALL	
154	Mold	AMS-408 FBGA Step3	MOLD	AMS-408	ALL	FBGA	STEP3	ALL	
159									
160	Total Mold Capacity								
161	Mold TSOP Capacity								
162	Mold BOC Step2 Capacity								
163	Mold BOC Step3 Capacity								
164	Mold BOC Step4 Capacity								
165	Total Mold BOC								
184									
185									
186	Plasma Equipment								

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AO-Capa Profile Proposed Changes



- 2) Changes only needed in the allocations part (as shown in the picture below)
- 3) Add some empty rows after each group of equipment allocations in each operation (hidden) – possible future additions

[illegible]

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AO-Capa Profile Proposed Changes



- #### 4) Correct some confusing and repeated information

Die Bond Equipment		Restrictions					
DB machines allocation	Operation	Equipment	WS	Type	Step	Package	
ESEC TSOP 200mm	DIE BOND	ESEC	200	TSOP	ALL	ALL	
ALPHASEM TSOP 200mm	DIE BOND	ALPHASEM	200	TSOP	ALL	ALL	
ALPHASEM TSOP 300mm	DIE BOND	ALPHASEM	300	TSOP	ALL	ALL	
.PH ALPHASEM FBGA 200mm	DIE BOND	ALPHASEM	200	FBGA	ALL	ALL	
.PH ALPHASEM FBGA 300mm	DIE BOND	ALPHASEM	300	FBGA	ALL	ALL	
ALPHASEM Dual Dies FBGA 200mm	DIE BOND	ALPHASEM DUAL DIES	200	FBGA	ALL	ALL	
ALPHASEM Dual Dies FBGA 300mm	DIE BOND	ALPHASEM DUAL DIES	300	FBGA	ALL	ALL	
.PH ALPHASEM FBGA for Step3	DIE BOND	ALPHASEM	ALL	FBGA	STEP3	ALL	
.PH Die Bond Alphensem Face ups	DIE BOND	ALPHASEM FACE UPS	ALL	ALL	ALL	ALL	
Hitachi TSOP 200mm	DIE BOND	HITACHI	200	TSOP	ALL	ALL	
Hitachi TSOP 300mm	DIE BOND	HITACHI	300	TSOP	ALL	ALL	
Hitachi FBGA 200mm	DIE BOND	HITACHI	200	FBGA	ALL	ALL	
Hitachi FBGA 300mm	DIE BOND	HITACHI	300	FBGA	ALL	ALL	
Hitachi FBGA	DIE BOND	HITACHI	ALL	FBGA	ALL	ALL	
Hitachi CM-700H FBGA 200mm	DIE BOND	HITACHI CM-700H	200	FBGA	ALL	ALL	
Hitachi CM-700H FBGA 300mm	DIE BOND	HITACHI CM-700H	300	FBGA	ALL	ALL	
Hitachi CM-700H FBGA	DIE BOND	HITACHI CM-700H	ALL	FBGA	ALL	ALL	
Total capacity D/B							
DB TSOP 200mm Capacity							
DB TSOP 300mm Capacity							
DB BOC 200mm Capacity							
DB BOC 300mm Capacity							
DB Dual Dies 200mm Capacity							

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AO-Capa Profile Proposed Changes



Sheet "Equipment Max. Capa":

- In the hidden and unused collums E to J add the same fields
- Changes necessary in Lines: 6 to 233
- Fields (Restrictions) all filled (picture below is just an example)

Max. Equipment	Reference Capacities	dCp key	Operation	Equipment	WS Type	Step	Package
DBG Laminator 300mm/200mm [wfs]		C-LAM-(RAC0500F12)					
DBG DICING 300mm [wfs]		C-DIC-(DFD_5360)					
DBG DICING 200mm [wfs]		C-DIC-(DFD_5360)-200					
Dicer Accretech 300mm [wfs]		C-DIC-(A-WD-300T0)-300					
Dicer Accretech 200mm [wfs]		C-DIC-(A-WD-300T0)-200					
GMP Disco (200mm) [wfs]		C-GRD-(DFG_860)-200					
GMP Disco (300mm) [wfs]		C-GRD-(DFG_860)-300					
GMP Accretech 200mm [wfs]		C-GMP-(PG300RM)-200					
GMP Accretech 300mm [wfs]		C-GMP-(PG300RM)-300					
Substrate PRINTING		C-SBP-(EKRA)					
Memmert Ovens for Printing cure			PRINTING	Printer	ALL		
Despatch Cure Ovens			PRINTING CURE		ALL		
HITACHI Die Bond CM-700		C-DBO-(CM-700)*	DIE BOND	HITACHI CM-700	ALL		
HITACHI Die Bond CM-700H		C-DBO-(CM-700H)	DIE BOND	HITACHI CM-700 H	ALL		
ESEC DieBond	TSOP 200mm only	C-DBO-(2007_LOC)*	DIE BOND	ESEC	200 TSOP		
ALPHASEM D/B FBGA		C-DBO-(SL_8022_HSL)_FBGA	DIE BOND		ALL		
ALPHASEM D/B TSOP	TSOP 300mm	C-DBO-(SL_8022_HSL)_TSOP	DIE BOND		300 TSOP		
Die Bond Datacon			DIE BOND		ALL		
Memmert Ovens for Bond cure			BOND CURE		ALL		
Wire Bond ESEC 3006/3008 TSOP		C-WBO-(300*)	WIRE BOND	ESEC 3006/3008	ALL TSOP		
Wire Bond ESEC 3088p		C-WBO-(3088p)*	WIRE BOND	ESEC 3088p	ALL		
Wire Bond SHINKAWA		C-WBO-(VC-3000)	WIRE BOND	SHINKAWA	ALL		
Wire Bond TSUNAMI 3100		C-WBO-(3100)*	WIRE BOND	TSUNAMI 3100	ALL		
Wire Bond TSUNAMI 3100+		C-WBO-(3100Plus)	WIRE BOND	TSUNAMI 3100+	ALL		
Plasma Cleaner 30LF	EOL	C-PLC-(DT_30LF)	PLASMA CLEANING	Tetra 30LF	ALL		
Plasma Cleaner 100LF		C-PLC-(Tetra-100LF)	PLASMA CLEANING	Tetra 100LF	ALL		
Plasma Cleaner 150LF		C-PLC-(Tetra-150LF)	PLASMA CLEANING	Tetra 150LF	ALL		
Mold AMS-36M2 (TSOP Black)		C-MOL-(AMS-36M2)-TSOP	MOLD	AMS-36M2	ALL TSOP		P
Mold AMS-36M2 (TSOP Green)		C-MOL-(AMS-36M2)-TSOP-GREEN	MOLD	AMS-36M2	ALL TSOP		PG
Memmert Ovens for Post Mold cure TSOP			MOLD	AMS-408	ALL FBGA STEP3		ALL
MOLD FICO AMS-408 FBGA Step3		C-MOL-(AMS-408)	MOLD	AMS-408	ALL FBGA STEP2		ALL
MOLD FICO AMS-306i FBGA Step2			MOLD	AMS-306i	ALL FBGA		ALL

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Thank you

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APPENDIX C: Excel PFS Daily Report

PFS Daily Operational Report -FOL and EOL

Week 8

Weekday 6

Type	FOL				EOL		WTD			Request			
	DGR Today	Week Starts	WIP	Δ	WIP	Δ	BI Req Qty	TBF IN	Δ Del	TBF WIP	Δ	TBF Out	FW 908 FW 909
TSOP	240	1,785	135	-18	245	89 ↑	1,943	1,977	33	9	-162	2,005	2,300 1,874
BOC STD	0	0	0	0	0	0	60	0	-60 ↓	0	-5	0 ↓	60 2
BOC STEP3	853	4,486	677	-115	582	-210 ↓	5,314	4,843	-471	18	-461	4,561	6,576 5,716
BOC STEP4	733	3,542	382	-182 ↓	735	177 ↑	3,887	3,622	-265	26	-338	4,127	5,054 4,613
Total	1,826	9,813	1,194	-314 ↓	1,562	56	11,204	10,442	-763	53	-966	10,693	14,000 12,205

BU	FOL				EOL		WTD			Request			
	DGR Today	Week Starts	WIP	Δ	WIP	Δ	BI Req Qty	TBF IN	Δ Del	TBF WIP	Δ	TBF Out	FW 908 FW 909
CD	877	4,626	488	-228 ↓	826	110 ↑	5,071	4,513	-558	33	-436	4,838	6,448 4,817
CM	342	2,375	242	-66 ↓	264	-47 ↓	2,732	2,656	-76	9	-229	2,656	3,261 3,609
GD	546	2,407	388	-35	364	-59	3,074	2,798	-275	9	-272	2,489 ↓	3,866 3,283
Aaseon(NC-T)	61	405	76	14 ↑	108	52 ↑	328	475	147 ↑	2	-29	710 ↑	425 495
Total	1,826	9,813	1,194	-314 ↓	1,562	56	11,204	10,442	-763	53	-966	10,693	14,000 12,205

Equivalents	FOL				EOL		WTD			Request			
	DGR Today	Week Starts	WIP	Δ	WIP	Δ	BI Req Qty	TBF IN	Δ Del	TBF WIP	Δ	TBF Out	FW 908 FW 909
128M	0	0	0	0	0	0 ↑	8	4	-4 ↓	0	-1	4 ↓	8 0
256M	64	414	51	-5	48	-28 ↓	441	460	19	1	-39	455	541 459
512M	294	1,746	233	-31	246	-19	2,050	1,845	-206	12	-172	1,733 ↓	2,497 1,957
1G	982	4,664	525	-231 ↓	877	127 ↑	5,276	4,882	-393	27	-462	5,379	6,783 6,456
Total	1,340	6,824	809	-268 ↓	1,171	80	7,775	7,191	-584	39	-673	7,570	9,828 8,871

Package	FOL				EOL		WTD			Request			
	DGR Today	Week Starts	WIP	Δ	WIP	Δ	BI Req Qty	TBF IN	Δ Del	TBF WIP	Δ	TBF Out	FW 908 FW 909
PG-TFBGA-136	373	1,686	285	-15	207	-93 ↓	2,005	1,761	-244	9	-174	1,441 ↓	2,529 2,435
PG-TFBGA-170	58	226	43	0	76	33 ↑	324	343	19	0	-30	346	412 375
PG-TFBGA-60	688	3,424	394	-122 ↓	617	106 ↑	3,975	3,419	-556	26	-340	3,927	5,054 4,353
PG-TFBGA-84	424	2,391	263	-134 ↓	368	-29	2,700	2,727	27	9	-236	2,712	3,380 2,887
PG-TSOPII-54	0	215	0	0	14	14 ↑	262	237	-25	3	-18	232	260 30
PG-TSOPII-66	230	1,445	130	-14	178	30 ↑	1,542	1,573	31	6	-132	1,605	1,885 1,784
P-TSOPII-54	10	56	5	-3 ↓	53	45 ↑	57	70	13	0	-6	70 ↑	73 50
P-TFBGA-84	43	301	74	-25 ↓	49	-50 ↓	231	215	-16	0	-22	263	300 243
P-TSOPII-66	0	69	0	0	0	0	83	97	14	0	-6	97 ↑	82 10
PG-TFBGA-104	0	0	0	0	0	0	26	0	-26 ↓	0	-2	0 ↓	25 38
Total	1,826	9,813	1,194	-314 ↓	1,562	56	11,204	10,442	-763	53	-966	10,693	14,000 12,205

Package**PG-TFBGA-104**

512M GRD70 32Mx16	FE Site	BE Qual	SPL	Sub Type	DGR Today	Week Starts	FOL		EOL		WTD		Request				
							WIP	Δ	WIP	Δ	BI Request Qty WTD	TBF Deliveries	TBF		TBF Out	FW 908	FW 909
													WIP	Δ			
QD3	QC-C	ALL	STEP3	0	0	0	0	0	0	0	26	0	0	-26	0	25	38
			Total	0	0	0	0	0	0	0	26	0	0	-26	0	25	38

PG-TFBGA-136

	FE Site	BE Qual	SPL	Sub Type	DGR Today	Week Starts	FOL		EOL		WTD		Request					
							WIP	Δ	WIP	Δ	BI Request Qty WTD	TBF Deliveries	TBF WIP	Δ	TBF Out	FW 908	FW 909	
1G GH70 32Mx32	QD3	QC-C	ALL	STEP3	51	219	12	-24	45	9	274	280	6	0	-22	280	301	353
1G GH70 32Mx32	QD3	QC-C	ALL	STEP3	186	838	131	-17	97	-51	1,000	893	-107	0	-93	897	1,300	1,421
512M GH80 16Mx32	QD3	QC-C	ALL	STEP3	86	333	111	40	47	-24	462	311	-151	0	-43	0	600	389
512M GH90 16Mx32	QD3	QC-C	ALL	STEP3	38	231	31	-6	18	-19	204	190	-15	8	-11	190	260	223
1G GH70 32Mx32	QD3	QC-L	ALL	STEP3	4	49	0	-2	0	-2	22	50	29	1	-1	49	19	16
1G GH70 32Mx32	QD3	QC-L	ALL	STEP3	8	16	0	-6	0	-6	43	37	-6	0	-4	26	50	33
Total							285	-15	207	-93	2,005	1,761	-244	9	-174	1,441	2,529	2,435

PG-TFBGA-170

512M GV70 16Mx32	FE Site	BE Qual	SPL	Sub Type	DGR Today	Week Starts	FOL		EOL		WTD		Request						
							WIP	Δ	WIP	Δ	BI Request Qty WTD	TBF Deliveries	TBF		FW 908	FW 909			
													WIP	Δ			WIP	Δ	Out
	QD3	QC-F	ALL	STEP3	0	0	0	0	0	0	12	10	-2	→	0	-1	13	12	0
	QD3	QC-F	ALL	STEP4	58	226	43	0	76	33	312	333	21		0	-29	333	400	375
1G GV70 32Mx32	QD3	QC-F	ALL	STEP4	58	226	43	0	76	33	324	343	19		0	-30	346	412	375
				Total	58	226	43	0	76	33	324	343	19		0	-30	346	412	375

Weekday 6

Week 08

PFS Daily Operational Report -FOL and EOL

PG-TFBGA-60

	FE Site	BE Qual	SPI	Sub Type	DGR Today	Week Starts	FOL		EOL		BI Request Qty WTD	WTD		Request	
							WIP	Δ	WIP	Δ		TBF Deliveries	TBF Δ	TBF Out	FW 908 909
1G T70 128Mx8	QD3	QC ALL		STEP3	0	0	0	0	0	0	50	0	-50	0	50 20
512M D90 128Mx4	IM13	QC ALL		STD	0	0	0	0	0	0	60	0	-60	0	60 2
512M D80 64Mx8	QR3	QC ALL		STEP3	25	36	27	11	20	4	84	10	-74	10	100 55
1G T70N 128Mx8	IM13	NC-T ALL		STEP4	61	405	76	14	108	52	328	475	-147	2	425 496
1G T70N 256Mx4	IM13	QC ALL		STEP4	422	1,464	0	-202	142	-60	2,269	1,795	-474	7	2,950 1,019
1G T70N 128Mx8	IM13	QC ALL		STEP4	140	1,219	248	51	309	112	753	858	-105	17	979 2,404
512M T80 128Mx4	QR3	QC ALL		STEP3	40	188	28	-12	38	-2	215	166	-49	0	275 332
512M T80C 64Mx8	QR2	QC ALL		STEP3	0	0	0	0	0	0	90	20	-70	0	90 0
512M T80C 64Mx8	QR3	QC ALL		STEP3	0	82	0	0	0	0	76	81	-5	0	75 25
1G T70N 256Mx4	QD3	QC ALL		STEP4	0	30	15	15	0	0	50	15	-35	0	50 0
Total							394	-122	617	106	3,975	3,419	-556	26	5,054 4,353

PG-TFBGA-84

	FE Site	BE Qual	SPI	Sub Type	DGR Today	Week Starts	FOL		EOL		BI Request Qty WTD	WTD		Request	
							WIP	Δ	WIP	Δ		TBF Deliveries	TBF Δ	TBF Out	FW 908 909
256M T90C 16Mx16	QR3	QC ALL		STEP3	243	1,219	203	-14	174	-43	1,306	1,364	58	0	1,700 1,661
256M T90G 16Mx16	QR3	QC-F ALL		STEP3	0	74	0	0	1	1	100	73	-27	0	100 0
512M T80G 32Mx16	QR3	QC-F ALL		STEP3	115	421	60	-20	80	0	618	621	3	0	800 435
512M T80C 32Mx16	QR2	QC ALL		STEP3	14	31	0	-40	12	-28	19	25	6	5	40 36
512M T80C 32Mx16	QR3	QC ALL		STEP3	0	238	0	0	1	1	200	257	57	4	200 262
512M T80C 32Mx16 WEC3	QC ALL			STEP3	0	208	0	0	0	0	280	240	-40	0	280 174
1G T70N 64Mx16	IM13	QC ALL		STEP4	52	198	0	-60	100	40	176	147	-29	0	260 319
Total							263	-134	368	-29	2,700	2,727	27	9	3,380 2,887

PG-TSOP11-54

	FE Site	BE Qual	SPI	Sub Type	DGR Today	Week Starts	FOL		EOL		BI Request Qty WTD	WTD		Request	
							WIP	Δ	WIP	Δ		TBF Deliveries	TBF Δ	TBF Out	FW 908 909
128M S11C 8Mx16	QR2	QC ALL		STD	0	0	0	0	2	2	25	0	-25	0	25 0
256M S11N 16Mx16	QR2	QC ALL		STD	0	81	0	0	11	11	75	81	6	3	75 26
256M S11N 64Mx4	QR2	QC ALL		STD	0	103	0	0	0	0	102	102	0	0	100 0
512M S14 32Mx16	IFD2	QC ALL		STD	0	31	0	0	1	1	50	53	3	0	50 3
128M S11N 16Mx8	QR2	QC ALL		STD	0	0	0	0	0	0	10	0	-10	0	10 1
Total							0	0	14	14	262	237	-25	3	260 30

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Weekday 6

Week 08

PFS Daily Operational Report -FOL and EOL

PG-TSOPIL-66

FE	BE	Site	Qual	SPL	Sub	Type	DGR	Today	Week	Starts	FOL		EOL		BI Request	WTD		TBF		Request				
											WIP	Δ	WIP	Δ		Deliveries	Δ	WIP	Δ	Out	FW	FW	908	909
256M	D11	16Mx16	QR2	QC	ALL	STD	0	8			0	0	0	0	14	28	14	↑	0	-1	28	↑	14	25
256M	D11	32Mx8	QR2	QC	ALL	STD	0	109			0	0	3	3	112	109	-3	0	-8	109	110	87		
512M	D90	64Mx8	IMI3	QC	ALL	STD	33	82			31	7	27	3	78	102	23	↑	0	-10	102	↑	130	88
512M	D90C	32Mx16	IMI3	QC	ALL	STD	71	338			39	-5	69	25	338	305	-77	↑	0	-36	309	↑	496	332
256M	GD11C	16Mx16	QR2	QC	ALL	STD	14	61			0	-7	3	-7	33	61	28	↑	0	-3	61	↑	40	36
512M	D80C	32Mx16	QR3	QC	ALL	STD	0	53			0	0	3	3	172	159	-13	0	-13	176	170	1,002		
512M	D80	64Mx8	QR3	QC	ALL	STD	112	650			60	-9	73	4	602	666	63	6	-50	677	780	133		
512M	D80C	64Mx8	QR3	QC	ALL	STD	0	144			0	0	0	0	148	144	-4	0	-11	144	145	81		
Total/											130	-14	178	30	↑	1,542	1,573	31	6	-132	1,605	1,885	1,784	

P-TFBGA-84

	FE	BE	Site	Qual	SPL	Sub	DGR	Today	Week	FOL			EOL			BI Request	WTD			TBF			Request		
										WIP	Δ	WIP	Δ	WIP	Δ		WIP	Δ	WIP	Δ	WIP	Δ	Out	FW	908
512M	T80	32Mx16	WEC3	QC	ALL	STEP3	43	301		74	-25	49	-50	49	-50	231	215	-16	0	-22	263	300	243		
						Total	43	301		74	-25	49	-50	49	-50	231	215	-16	0	-22	263	300	243		

P-TSOPIL-54

FE	BE	Site	Qual	SPL	Sub	DGR	Type	Today	Week	Starts	FOL			EOL			BI Request	WTD			TBF			Request			
											WIP	Δ	WIP	Δ	WIP	Δ		Qty	WTD	Deliveries	Δ	WIP	Δ	Out	FW	908	909
256M	S11N	32Mx8	QR2	QC	ALL	STD	0	0	0	0	0	0	0	0	0	0	0	23	23	0	-2	23	23	0			
512M	S14	64Mx8	IFD2	QC	ALL	STD	10	56			5	-3	53	45	53	45	34	47	14	14	0	-4	47	50	50		
Total/											5	-3	53	45	53	45	57	70	13	0	-6	70	73	50			

P-TSOPIL-66

FE	BE	Site	Qual	SPL	Sub	DGR	Type	Today	Week	Starts	FOL			EOL			BI Request	WTD			TBF			Request			
											WIP	Δ	WIP	Δ	WIP	Δ		Qty	WTD	Deliveries	Δ	WIP	Δ	Out	FW	908	909
512M	D90	32Mx16	IMI3	QC	ALL	STD	0	69			0	0	0	0	0	0	56	69	13	↗	0	-4	69	↗	55	10	
128M	D11	8Mx16	QR2	QC	ALL	STD	0	0			0	0	0	0	0	0	27	28	1	0	-2	28	0	27	0		
Total/											0	0	0	0	0	0	83	97	14	0	-6	97	82	10			

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APPENDIX D: BO PFS Daily Report

PFS Daily Operational Report - Assembly - Summary

Data refer to Day 6

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Version v1

Type	Week Starts	FOL			EOL			DGR	BI Request Qty WTD	TBF In	Δ	TBF WIP	Δ	TBF Out	Δ	FW n	FW n+1
BOC STANDARD			0	0	0	0	0	0	125	110	-15		-7	110	-15	125	
TSOP STANDARD	1,201	158	88	70	214	88	126	299	986	1,134	148	115	47	1,075	89	1,185	1,970
BOC STEP3	2,447	559	287	272	580	287	293	456	1,783	2,043	260	361	233	1,803	21	2,238	4,508
BOC STEP4	1,898	382	298	84	284	298	-14	473	1,894	2,144	251	223	89	2,279	386	2,352	1,132
Total	5,545	1,099	673	426	1,079	673	406	1,229	4,787	5,431	644	699	362	5,268	480	5,900	7,610

Equivalents	Week Starts	FOL			EOL			DGR	BI Request Qty WTD	TBF In	Δ	TBF WIP	Δ	TBF Out	Δ	FW n	FW n+1
256M	125	10	8	2	11	8	3	25	124	135	11	14	7	124	-3	124	144
512M	673	129	104	25	164	104	60	183	653	673	20	30	-18	713	121	835	1,790
1024M	3,701	790	471	319	711	471	240	762	2,981	3,546	565	584	371	3,341	360	3,728	3,485
2048M		23	0	23	0	0	0	3	7		-7		-1		-3	10	20
Total	4,499	952	583	369	886	583	304	973	3,765	4,354	589	628	359	4,178	475	4,697	5,439

PFS Daily Operational Report - Assembly - Summary

Data refer to Day 6

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Package	FOL				EOL				DGR	BI Request Qty WTD	TBF In		TBF WIP	TBF Out		FW n	FW n+1			
	Week Starts	WIP	Wip Target	Δ	WIP	Wip Target	Δ	Δ			Δ	Δ								
PG-TFBGA-136	1,666	362	210	152	382	210	172	↑	290	1,161	1,465	304	↗	262	179	1,223	62	1,451	2,313	
PG-TFBGA-60	1,930	418	223	195	334	223	111	↑	451	1,882	2,029	147		322	190	2,029	147	2,317	2,303	
PG-TFBGA-84	588	139	46	93	↑	100	46	54	↑	111	449	524	75	0	-32	575	126	560	614	
PG-TSOPIL-54	80	13	0	13	2	0	2	↑	13	100	105	5		-6	110	10	100	125		
PG-TSOPIL-66	1,106	146	88	58	↑	166	88	78	↑	287	864	1,029	165	↗	115	54	955	91	1,063	1,800
P-TSOPIL-66	15	0	0	0	46	0	46	↑	0	22	-22	0		-1	10	-12	22	45		
P-TFBGA-84			10	-10	↘	0	10	-10	↘	28	112	18	-94	↘	-8	105	-7	140	200	
PG-TFBGA-63		14	0	14	0	0	0	0	↑	2	3	-3	0		-4	-3	5	10		
PG-TFBGA-170	161	8	96	-88	↘	52	96	-44	↘	48	194	262	68	↗	0	-14	261	67	242	200
Total	5,545	1,099	673	426		1,082	673	409		1,229	4,787	5,431	644		699	362	5,268	480	5,900	7,610

PG-ITBGA-136	FOL							EOL										
	Week Starts	WIP	Wip Target	Δ	WIP	Wip Target	Δ	DGR	BI Request Qty WTD	TBF In	Δ	TBF WIP	Δ	TBF Out	Δ	FW n	FW n+1	
1G GH70 x32	1,532	362	154	208 ↑	361	154	207 ↑	255	1,021	1,235	214 ↑	262	189	994	-27	1,276	2,093	
512M GH80 x32	109	1	56	-55 ↓	20	56	-36 ↓	35	140	205	65 ↑		-10	120	-20	175	200	
	1,641	362	210	152	381	210	171	290	1,161	1,440	279	262	179	1,114	-47	1,451	2,293	

PG-TFBGA-60	FOL				EOL				DGR	BI Request Qty WTD	TBF In		TBF WIP	TBF Out		FW n	FW n+1
	Week Starts	WIP	Wip Target	Δ	WIP	Wip Target	Δ	Δ			Δ	Δ					
1G T70N x4	751	67	88	-21 ⬇️	61	88	-27 ⬇️	200	800	1,027	227 ⬆️	164	107	956	156	1,000	200
1G T70N x8	776	264	84	180 ⬆️	125	84	41 ⬆️	175	700	671	-29	59	10	826	126	860	708
1G T70 x8	247	46	19	27 ⬆️	66	19	47 ⬆️	33	67	142	75 ⬆️	99	93	43	-24	100	260
512MD80 x4			2	-2 ⬇️		2	-2 ⬇️	0	0		0				0		
512MD80 x8			3	-3 ⬇️	1	3	-2 ⬇️	0	21		-21		-1		-21	21	155
512MD90 x4			0	0	0	0	0 ⬆️	0	80	65	-15 ⬇️		-5	65	-15	80	
512MD90 x8			0	0	0	0	0 ⬆️	0	45	45	0		-3	45	0	45	
512MT80 x4			0	0	0	0	0 ⬆️	12	48	3	-45 ⬇️		-3	9	-39	60	
512MT80 x8	155	40	27	13 ⬆️	80	27	53 ⬆️	30	122	75	-47 ⬇️		-9	82	-39	151	900
	1,929	418	223	195	334	223	111	451	1,882	2,028	146	322	190	2,027	145	2,317	2,223

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PFS Daily Operational Report - Assembly - Summary

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PG-TFBGA-84	FOL							EOL							TBF							FW	
	Week Starts	WIP	Wip Target	Δ	WIP	Wip Target	Δ	DGR	BI Request Qty WTD	TBF In	Δ	TBF WIP	Δ	TBF Out	Δ	FW n	FW n+1						
1G T70N x16	210	42	30	12 ↑	49	30	19 ↑	50	200	185	-15	0	-14	235	35	250	24						
256M T90C x16			0	0	0	0	0	0	40	38	-2		-2	38	-2	40							
512M T80C x16	140	29	0	29 ↑	0	0	0 ↑	17	33	110	77 ↑		-3	110	77	50	105						
512M T80G x16	238	67	16	51 ↑	49	16	33 ↑	44	176	189	13		-13	192	16	220	200						
	588	139	46	93	98	46	52	111	449	522	72		0	-32	574	125	560	320					

PG-TSOPIL-54	FOL				EOL				DGR	BI Request Qty WTD	TBF In		TBF WIP	TBF Out		FW n	FW n+1
	Week Starts	WIP	Wip Target	Δ	WIP	Wip Target	Δ	Δ			Δ	Δ					
256M S11N x16	54	13	0	13	0	0	0	↑	13	50	53	3	-3	53	3	50	125
256M S11N x8	26		0	0	2	0	2	↑	0	50	52	2	-3	52	2	50	
	80	13	0	13	2	0	2		13	100	105	5	-6	105	5	100	125

PG-TSOPIL-66	FOL				EOL				DGR	BI Request Qty WTD	TBF In			TBF WIP	TBF Out		FW n	FW n+1
	Week Starts	WIP	Wip Target	Δ	WIP	Wip Target	Δ	Δ			Δ	Δ	Δ					
256MD11 x8	0	0	0		0	0		0	7	7	0	-0	11	4	7			
256M GD11C x16	418	25	32	-7 ▾	41	32	9 ▴	88	350	390	40	55	35	341	-9	350	350	
512M D80 x16		0	0	0	0	0	0 ▴	0	12	13	1	0	-1	16	4	12		
512MD80 x8	200	54	16	38 ▴	53	16	37 ▴	48	193	190	-3	37	24	184	-9	241	799	
512MD90C x16	488	66	40	26 ▴	71	40	31 ▴	151	302	422	120 ▴	16	-10	402	100	453	325	
	1,106	146	88	58	165	88	77	287	864	1,023	159	109	48	955	91	1,063	1,474	

P-TSOPH-66	FOL						EOL						TBF						FW	
	Week Starts	WIP	Wip Target	Δ	WIP	Wip Target	Δ	DGR	BI Request Qty WTD	TBF In	Δ	TBF WIP	Δ	TBF Out	Δ	FW n	FW n+1			
512M D90 x16	15	0	0		45	0	45	↑	0	22	-22		-1	10	-12	22	45			
	15	0	0		45	0	45		0	22	-22		-1	10	-12	22	45			

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P-TFBGA-84		FOL			EOL			DGR	BI Request Qty	WTD	TBF In	Δ	TBF WIP	Δ	TBF Out	Δ	FW n	FW n+1
Week Starts	WIP	Wip Target	Δ	WIP	Wip Target	Δ												
512M T80 x16		10	-10	↘	0	10	-10	↘	28	112	18	-94	↘	-8	105	-7	140	200
		10	-10		0	10	-10		28	112	18	-94		-8	105	-7	140	200

PG-TFBGA-63		FOL			EOL			DGR	BI Request Qty	WTD	TBF In	Δ	TBF WIP	Δ	TBF Out	Δ	FW n	FW n+1
Week Starts	WIP	Wip Target	Δ	WIP	Wip Target	Δ												
1G T70N x4	2	0	2	↑	0	0	0	↑	0	0	0	0	0	0	0	0	5	10
1G T70N x8	11	0	11	↑	0	0	0		2	3	-3		-0		-3		5	10
	13	0	13		0	0	0		2	3	-3		-0		-3		5	10

PG-TFBGA-170		FOL			EOL			DGR	BI Request Qty	WTD	TBF In	Δ	TBF WIP	Δ	TBF Out	Δ	FW n	FW n+1		
Week Starts	WIP	Wip Target	Δ	WIP	Wip Target	Δ														
1G GV70 x32	161	8	96	-88	↘	48	96	-48	↘	48	194	262	68	↗	0	-14	261	67	242	200
	161	8	96	-88		48	96	-48		48	194	262	68		0	-14	261	67	242	200