

Imaging, BiCMOS ASIC and Silicon Photonics (IBP)

Eric Aussedat

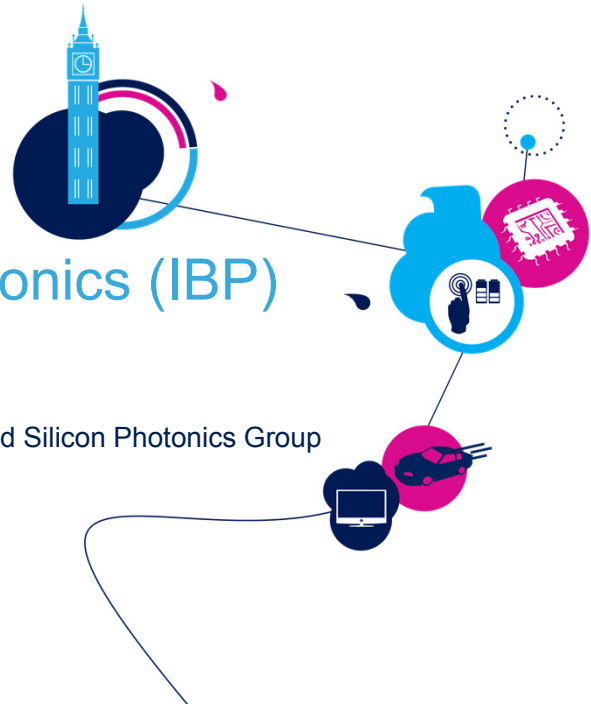
Corporate Vice President

General Manager, Imaging, BiCMOS ASIC and Silicon Photonics Group

Flavio Benetti

Group Vice President

General Manager, Mixed Processes Division



IBP Targets 2

Targeting leading position in all addressed applications

Imaging:

Within the Top 5 in image sensors

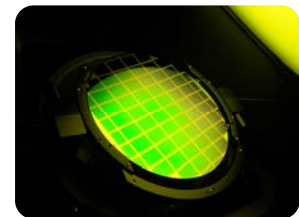
Within the Top 3 in cameras

Worldwide leader in proximity sensors and image processors

Mixed Processes:

The leader in optical interconnect & Silicon Photonics

Within the Top 2 in RF SOI



Strengthening IBP Fundamentals

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Focus on growing markets

Imaging:

- Camera phones
- Digital Still Camera
- Imaging sensor pervasion in new applications
- Proximity sensors, gesture recognition

MPD:

- Mobile Front-End (GaAs to CMOS)
- Optical ICs

Key differentiators

- Comprehensive & unique imaging solutions offering – one-stop-shop
- Design, manufacturing and packaging verticalization
- 28nm FD-SOI for imaging SoC

Enlarged leading customer base

- Expanding number of camera phones customers from 2 to 5
- Working with worldwide leaders in new markets
 - Gaming
 - Automotive
 - Healthcare
 - Mobile phone FE modules
 - Base station and servers

Technology & unique IP portfolio

Imaging

- In-house FSI and BSI processes
- High performance pixel technology
- Time of flight proprietary solution
- Broad-range image processing portfolio

MPD

- High performance BiCMOS roadmap
- Si Photonics process under development
- State of the art RF SOI for RF FE solutions

Solid manufacturing capability

Front-End

- In-house capacity in BiCMOS & RF SOI
- 12" dedicated imaging process capacity
- Secure outsourcing capabilities
- Silicon Photonics

Back-End

- Highly automated camera module assembly and test lines

Strong & experienced team

- Accumulating 20 years of experience in imaging and mixed process
- Significant increase of resources in Analog, SoC and Process R&D over the last 2 years

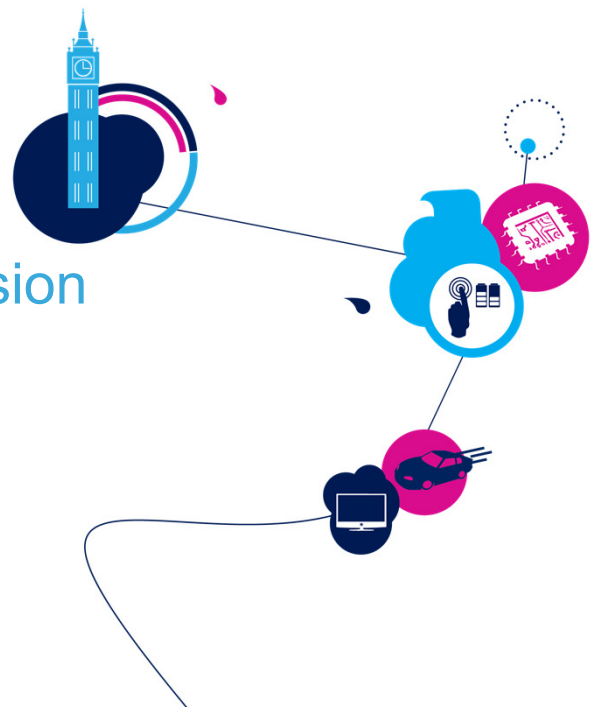


Mixed Processes Division

Flavio Benetti

Group Vice President

General Manager, Mixed Processes Division



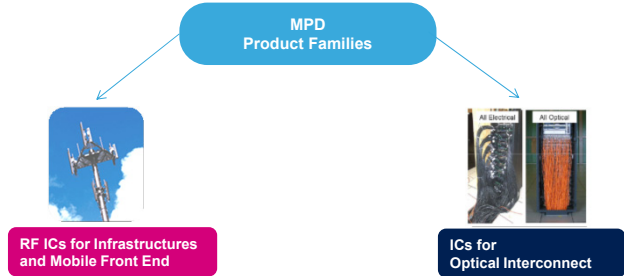
MPD Division and Market

MPD has two product families

- Optical Interconnect
- RF Infrastructure & Front End

Market trends

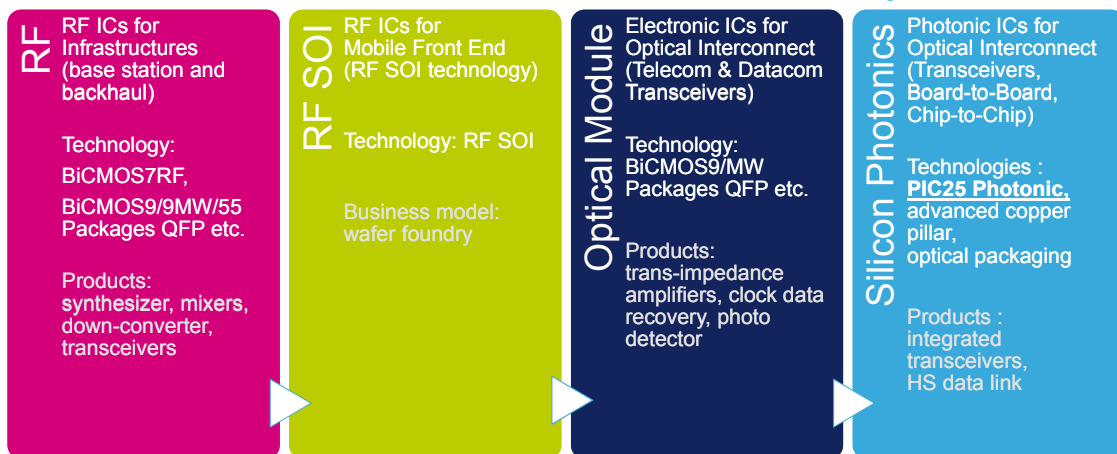
- Market strongly driven by data traffic growth both mobile and fiber connections
- RF Front-End market growing thanks to move from GaAs to silicon based solutions



TAM (US\$M)	2012	2016	CAGR Y16/12
ICs for Optical Interconnect (include Silicon Photonics)	369	562	11%
ICs for RF Infrastructure (Base Station and BackHauling)	254	339	7%
ICs for RF Front End (RF SOI)	276	735	27%
Total MPD market	899	1636	17%



MPD Division – Key Pillars



RF RF ICs for Infrastructures (base station and backhaul)

Technology: BiCMOS7RF, BiCMOS9/9MW/55 Packages QFP etc.

Products: synthesizer, mixers, down-converter, transceivers

RF SOI RF ICs for Mobile Front End (RF SOI technology)

Technology: RF SOI

Business model: wafer foundry

Optical Module Electronic ICs for Optical Interconnect (Telecom & Datacom Transceivers)

Technology: BiCMOS9/MW Packages QFP etc.

Products: trans-impedance amplifiers, clock data recovery, photo detector

Silicon Photonics Photonic ICs for Optical Interconnect (Transceivers, Board-to-Board, Chip-to-Chip)

Technologies: PIC25 Photonic, advanced copper pillar, optical packaging

Products: integrated transceivers, HS data link





RF for Infrastructure

Base Station and Backhaul

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- A solid roadmap for a growing and demanding market
 - Base Stations and Point-to-Point Backhaul
 - Mobile Backhaul equipment growing: \$9.1B by 2017*
- ST is developing a complete product family able to face the new network topology
 - Addressing Small Cells needs
 - Bringing new BiCMOS solutions to High Frequency Bands (up to 70GHz)



Down-converter, dual mixer and synthesizer for base station



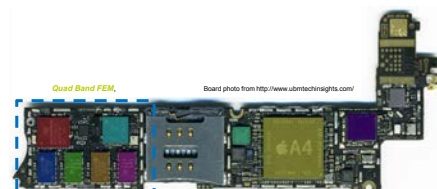
*Ovum

RF for Mobile Front End

RF SOI technology

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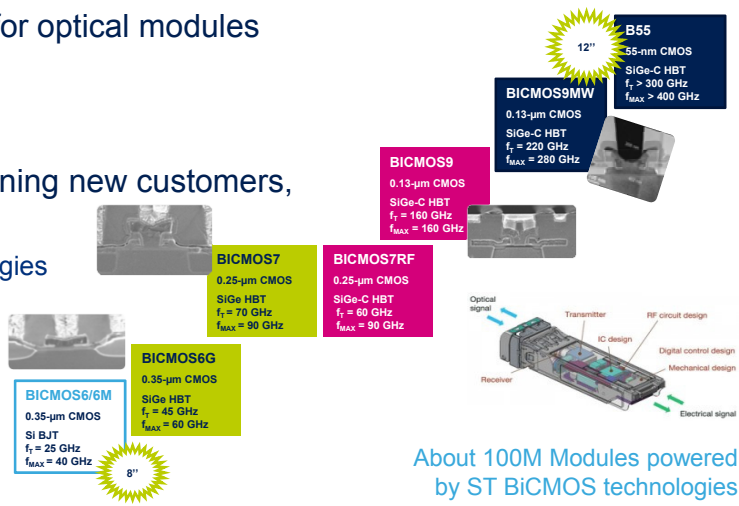
- ST is committed to be a long term player in ICs for Mobile and WiFi Front End and among the top 2 suppliers
- RF SOI Business moved from ST-Ericsson to MPD
 - H9SOI technology produced in ST Crolles fab since 2008
- ST is investing in RF SOI technologies for Mobile and WiFi Front-End
 - New optimized, state-of-the-art technology at final stage of qualification : H9SOI-FEM



Electronic ICs for Optical Interconnect Telecom & Datacom Transceivers

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- ST is a leading supplier of ICs for optical modules
 - Among the Top 3
 - Serving the leader
- Serving the top players and gaining new customers, thanks to
 - Wide range of BiCMOS technologies
 - Highest level of quality standard
 - Superior Engineering Support
 - Wide choices of Packages
 - Full Supply Chain support



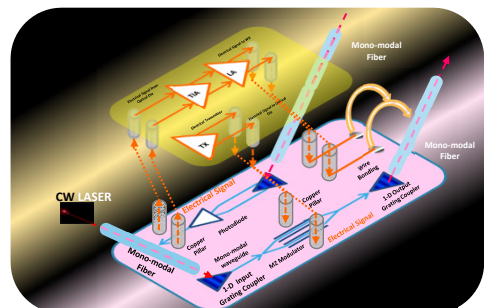
About 100M Modules powered by ST BiCMOS technologies in the field today



Photonic ICs for Optical Interconnect Silicon Photonics

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- ST aims to be the market leader supplier providing industrial, volume oriented, Silicon Photonics technology, named PIC25
 - PIC25, a variant of Luxtera licensed technology, was set up in ST in early 2012
- PIC25, mainly fabricated using 65nm line, is successfully being implemented in 12" Crolles fab
 - Production start expected in 4Q 2014
- One award by a major player and another expected within the next quarter
 - First project application could be in the domain of short-range connectivity



Silicon Photonics is a technology that allows processing and manipulation of light signals on silicon, bringing a dramatic increase in processing speed and outstanding power consumption reduction.



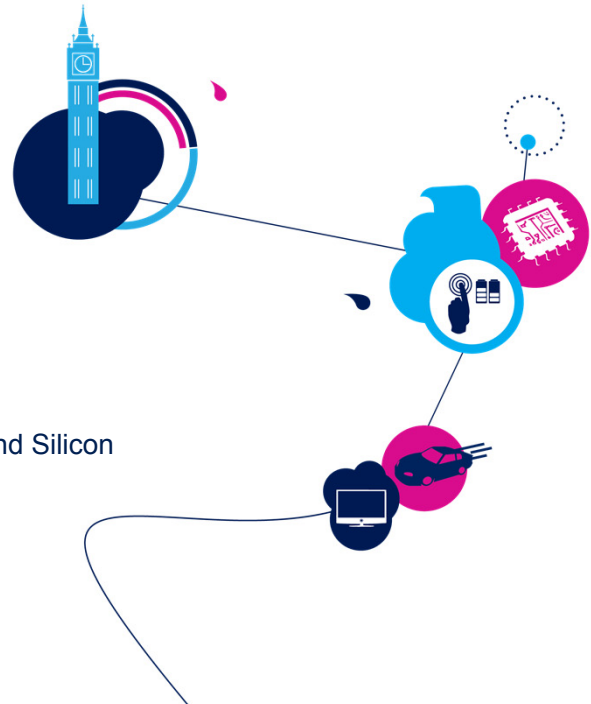
Imaging

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Photonics Group



Imaging – Market Trends

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- Continuous growth in existing and new applications
 - Camera phones
 - Camera and secondary camera penetration
 - Touch screen phone requiring proximity detection
 - CMOS image sensor for digital still camera
 - New segments (automotive, etc.) and new applications (gaming, etc.) requiring image sensors, photonic sensors, optical modules and ISP/SOC
- As a result, TAM expected to grow from \$14B in 2012 to \$26B in 2016



50%+

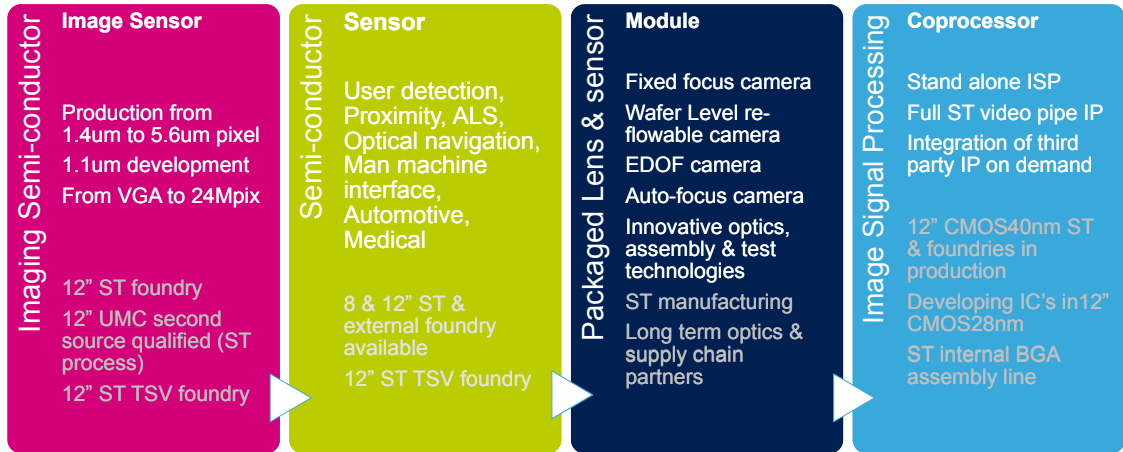

DSC
CCD → CMOS


Automotive


Gaming

Source: ST

Imaging Division – Key Pillars



Imaging: Key Products Driving Growth

Camera phones:

- From re-flowable to moving optics camera
- FSI & BSI sensors
- HDR sensors & chipset



Entered New Applications:

- Digital Still Camera
- Automotive, security & Medical
- Microdisplays

New range of imaging dedicated SoC & open market Imaging Signal Processor devices

Innovative proximity sensors based on proprietary Time of Flight technology FlightSense™



Imaging Strategy Execution

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Camera phones

- Sensors
 - Ramp-up of Back Side Illumination (BSI) process one quarter ahead of schedule for smartphone maker flagship device
 - Including brand new technology concept
 - High Performance Pixel: DTI, Vertical Diode, large pixel, HDR, low dark optimization
 - Investment of color capacity into Crolles 300mm ready in 3Q13 (+100%)
 - 65nm Back Side Illumination process development with UMC under execution as planned
- Modules
 - Mass production in large volumes of 5 Mega pixel Auto Focus camera
 - Mass production of 8 Mega pixel Auto Focus camera
 - Mass production of several large volumes Fixed Focus cameras (from 720p to 5Mpix resolutions)
- ISP's
 - Mass production of large volume ISP for smartphone maker flagship handset (40nm)

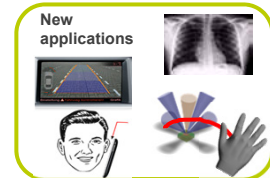


Imaging Strategy Execution

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New markets, new applications

- Digital Still Camera
 - Three quarters of mass production of full frame sensors for high end DSLR market (Mastering 2D stitching technology)
- Automotive and Security
 - Sampling automotive & security HDR sensor and ISP in 3Q13
 - Sampling automotive and security ISP in 3Q13
 - Several design wins/ins under execution
- Gaming
 - Mass production of large volume ISP for new gaming platform (40nm)
- Proximity sensing solutions
 - Design-wins on industrial and consumer applications: Mass Production 2H13
- Design win for large volume **optical mouse sensor**
- **Near infrared detection ASIC** for large display optical touch (AIO PC's) in production



Imaging Strategy Execution

Microdisplays

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- ST acquired 40% of MicroOled company
 - ST gradually taking over full supply chain
 - New product design in ST CMOS technology
 - FE manufacturing
 - Color line
 - Packaging and test



- In production on Electronic View Finder and Customer Goggles since 4Q12
- ST and MicroOled partnering to compete for new design wins in Electronic View Finder (EVF) and Augmented Reality areas



Conclusion

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Imaging

- ST is pursuing its redeployment in imaging, aligning product development resources, process R&D efforts and FE and BE manufacturing capacity
- The strategy execution is on track, with major programs in all targeted segments, technologies and applications
- The efforts are focused on the goal to become a highly recognized leader in this industry

Mixed Processes

- Exploit full potential of BiCMOS and RF CMOS technologies:
 - Dominate Optical Module IC market
 - Gain share in RF networking market
 - Become a reference player in mobile and WiFi Front-End market
 - Gain share in segments still dominated by GaAs technologies today
- Become the leader in Silicon Photonics, with a one-stop-shop approach
- Cover the short-term optical module market to long-term Chip-to-Chip connectivity

