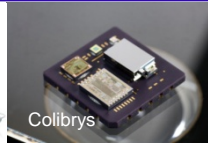
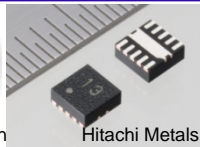


# MEMS Accelerometer, Gyroscope and IMU Market 2008-2013

*Automotive levels, consumer surges, market to reach \$3B*

**SAMPLE Version**



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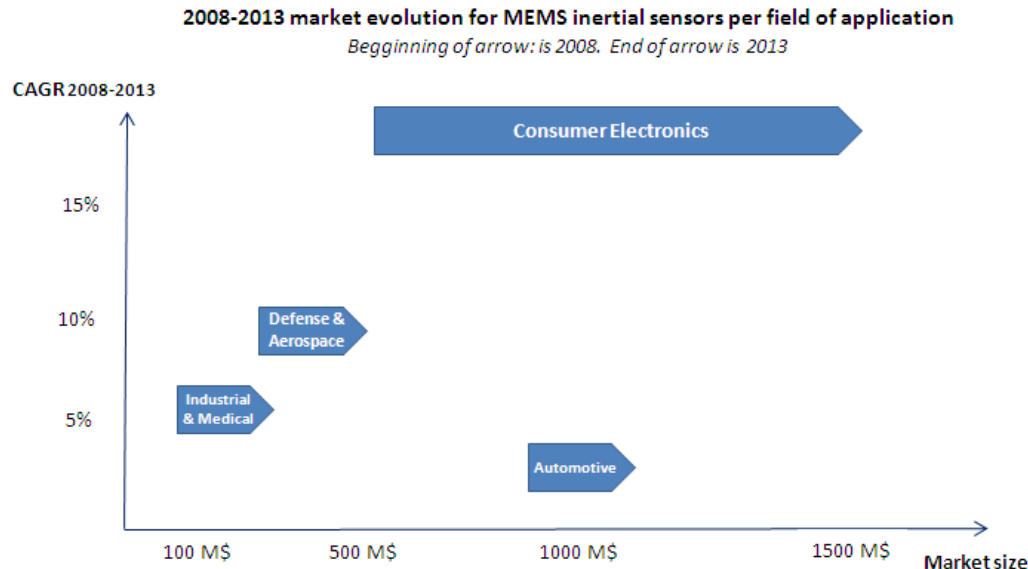
## Synthesis and future challenges

# Executive Summary

# Executive summary

## Major findings - Market

- Yole estimates the MEMS accelerometer & gyroscope market to represent 1.80B\$ in 2008
- 752M units of MEMS accelerometers and gyroscopes were produced worldwide in 2008
- This market is dominated by automotive and consumer electronics applications
  - The major part of this market still comes from automotive applications
    - But massive use of accelerometer and gyroscope is likely to stay limited to current established applications such as airbag, ESC and TPMS. The annual growth rate will be limited to 3.6% up to 2013
  - Consumer applications should overtake this in 2011
    - 21.1% annual growth is expected until 2013 for the consumer area! Indeed the adoption rate of motion sensors on many consumer electronics products is rising faster than ever
- MEMS inertial market will represent a 3B\$ market in 2013!



# Executive summary

## Major findings - Competition

- **The accelerometer market is dominated by Bosch and ST Microelectronics**
  - Bosch (including its Sensortec division) and ST Microelectronics are leading the global MEMS accelerometer market with about 35% of market share together in 2008
  - Bosch is leading the automotive field but is also successful in the consumer space with its Sensortec division
  - STM is leading the consumer electronics field and has recently benefited from key contracts such as the one with Apple
  - Their main challengers are Kionix, ADI, Freescale, VTI and Infineon, and new players continue to enter the market
- **The recent closure of Systron Donner is a big change in the gyroscope competitive landscape**
  - 3 players were leading the MEMS gyroscope market in 2008: Bosch, Systron Donner and Panasonic have, on average, 20% market share each
  - However the automotive part of Systron Donner shut down in the beginning of 2009, which is greatly impacting the automotive electronics field
  - Gyroscopes still face some difficulties to be massively adopted in the consumer electronics area since cost is often critical
    - MEMS gyroscopes offer very good dynamic response which makes them ideal for stabilization purposes. But compass functions can also be obtained by using a 3-axis accelerometer coupled to a 3D magnetometer, which can be a cheaper solution.
    - That is why magnetometers are currently gaining more and more traction from mobile phone manufacturers
    - However Invensense is highly successful with its dual axis gyro device: 5X growth is expected for 2009

2008 global MEMS Accelerometer market shares in value



2008 global MEMS Gyroscope market shares in value

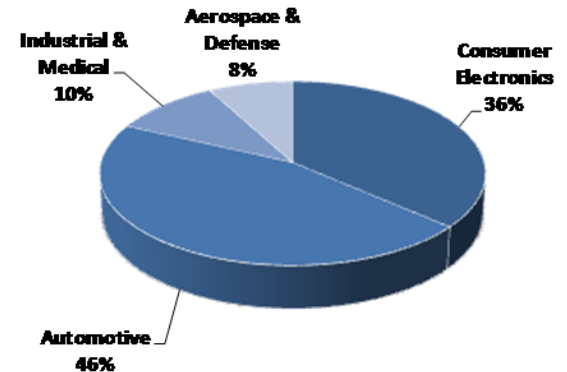


# Executive summary

## Major findings – Accelerometers

- **Massive integration of MEMS accelerometer on cell phones will boom the CE market**
  - Cellphone is the most promising market with XXX% CAGR2008-2013
  - Accelerometers are not limited to high end consumer products anymore: since the 1\$ ASP barrier has now been crossed, a massive adoption is expected
- **Automotive market will stay mainly limited to airbag application**
  - Since this is a mature application, the market here will be stable
  - The only growing applications are ESC and TPMS
- **Industrial, Medical & Defense fields will stay stable**
  - Applications are very fragmented in the industrial and medical fields, and no killer application is foreseen before 2013
  - The defense field is a mature market for MEMS accelerometers already. Growth should come from a new application enabled by high performance MEMS IMUs: munitions & rockets

**Applications for MEMS accelerometers  
Breakdown per field, 2008 (in value)  
(Total 1003M\$)**



**Applications for MEMS accelerometers  
Breakdown per field, 2013 (in value)**

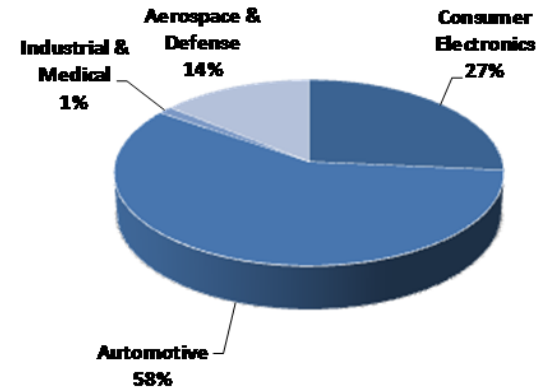


# Executive summary

## Major findings – Gyroscopes

- **MEMS gyroscopes for consumer electronics should overtake automotive applications in 2013**
  - In 2013 the cellphone market only will be about XXXM\$! OIS application is driving the adoption rate here
  - DCS should be the second big CE market for gyroscopes
- **The automotive field will slightly increase thank to regulation on ESC**
  - ESC will stay the major market here with penetration growing from XXX% in 2008 to XXX% in 2013
  - Rollover detection and GPS navigation are the two other markets for gyroscopes
- **Industrial & medical will remain niche applications for gyros**
  - MEMS gyroscopes are sometimes integrated to MEMS IMUs: life science application, antenna stabilization...
- **MEMS technology will see a significant growth in the defense area: XXX% CAGR<sub>2008-2013</sub>**
  - Tactical grade performance can now be achieved, which enable MEMS IMUs to be used in many applications: missiles, munitions, training, soldier equipment...

**Applications for MEMS gyroscopes  
Breakdown per field, 2008 (in value)  
(Total 794M\$)**



**Applications for MEMS gyroscopes  
Breakdown per field, 2013 (in value)**



# Executive summary

## Major findings – IMU

- **IMU is the next very hot business topic for consumer electronics**
- **Multi-axis integration may be the only way to decrease prices sufficiently**
  - This strategy has been successfully chosen by Invensense
  - This also explains why ST Microelectronics gyroscope, for which production has just started, is a monolithic 2-axis gyroscope
- **For the same reason, "cluster" integration of several types of MEMS sensors is on the roadmap of inertial MEMS makers**
  - Clusters with 5 or 6 degrees of freedom (with accelerometers & gyroscopes or magnetometers), possibly coupled to other sensors (pressure sensors...), should emerge in 2010-2011
  - An overall difficulty here is to be able to fuse several types of inputs: highly complex algorithms will be required
- **Inertial Measurement Units (IMUs) which offer 5 or 6 DOF by combining accelerometers and gyroscopes are commonly used in the defense & aerospace industry**
  - A lot of progress is currently being made on MEMS IMUs for aerospace & defense applications, leading to very appealing performance and cost in the coming years
  - Market for MEMS IMU is in the XXXM\$ range here
- **This implementation offers new possibilities like dead reckoning navigation and guiding functions**
  - Now that MEMS accelerometers are cheap and that the level of integration of MEMS gyroscopes has increased, it would not be surprising to see MEMS IMUs integrated into our mobile phones. Handset makers have plenty of imagination about how to use such a cluster!
  - Yole believes that MEMS IMUs will be a very hot topic in just a few months
  - Monolithic accelerometer and gyroscope integration has already been detected from Sensordynamics
- **IMU market in the CE space should take off in 2011**
  - Components will be in sampling stage in 2010
  - This should be a XXXM\$ market in 2012 already!
- **In the automotive area, sensor clusters should remain limited to high end cars**
  - Market for IMU component will stay limited to XXXM\$ in 2013: few interest for cluster has been detected here
- **Industrial and medical motion measurement is a stable market for IMU**
  - Market for IMU component will stay limited to XXXM\$ in 2013
  - The major added value will be in the processing side

**Example of application covered  
MEMS inertial sensors for personal media players**

# Inertial components for PMPs Overview

- **Accelerometers are integrated on PMPs since several years**
  - HDD based MP3 players are using HDD protection feature similarly as notebooks
    - Hard disk drive (HDD) protection a feature designed to prevent
      - the damage to the hard disk drive
      - as well as to data disks incurred as a result of shock, fall or vibration
- **HMI functions using motion sensors are taking off since 2008**
  - Devices which use solid state memory are increasingly using those HMI functions
    - Apple has one more time done a good marketing job with its iPod Nano released in September 08
- **3 axis accelerometers are used as motion sensors**
  - A unique accelerometer chip is used for HDD protection and/or HMI features



*Apple iPod Nano features accelerometer*



*Apple iPod Classic*

# Inertial components for PMPs

## Market dynamics

- Main PMP manufacturers: Samsung, Apple, Sony, Microsoft...
- The global market of small size HDDs for mobile devices is growing very rapidly
  - 1,8 inch HDDs are integrated in MP3 players and Camcorders
    - Toshiba is the industry leader , with Apple as main customer (70% market shares in PMP)
    - The growth of the 1,8inch HDD activity is expected to remain steady until 2010
  - This market is predicted to decrease at long term with increasing usage of solid state memory: accelerometers are then irrelevant
    - However HMI function is a growth relay for accelerometers



*When the mobile device is in use, data is read and written by the read-write head.*



*When movement is detected, the read-write head is immediately retracted.*

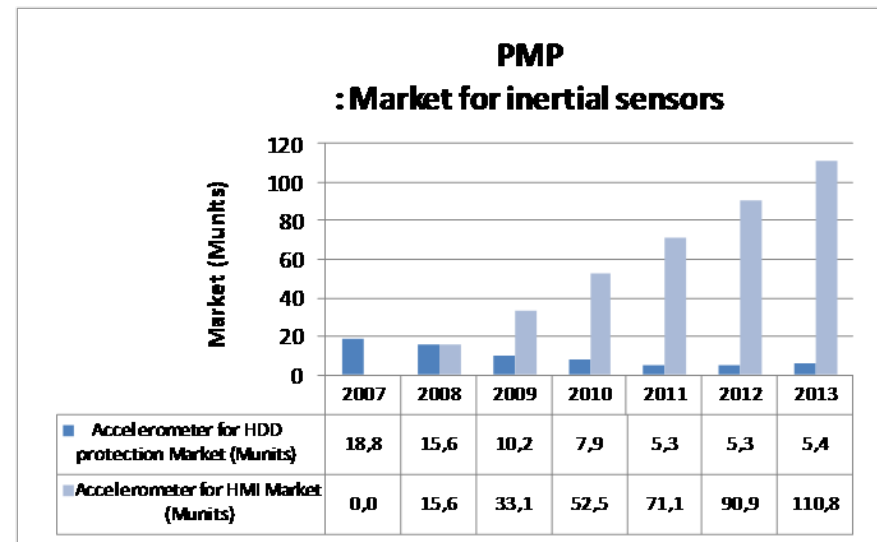
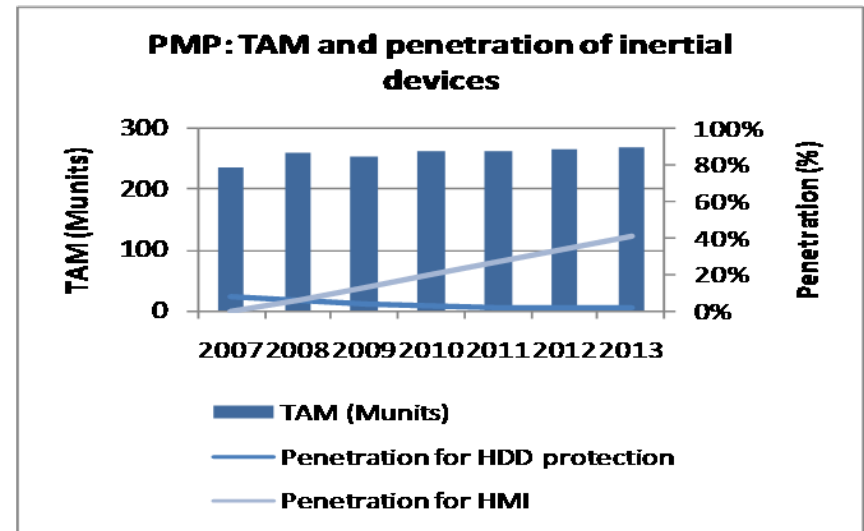


*Upon impact, the retracted read-write head does not scratch the hard disk. Precious data is protected.  
(source Fujitsu)*

# Inertial components for PMPs

## Total available market and penetration

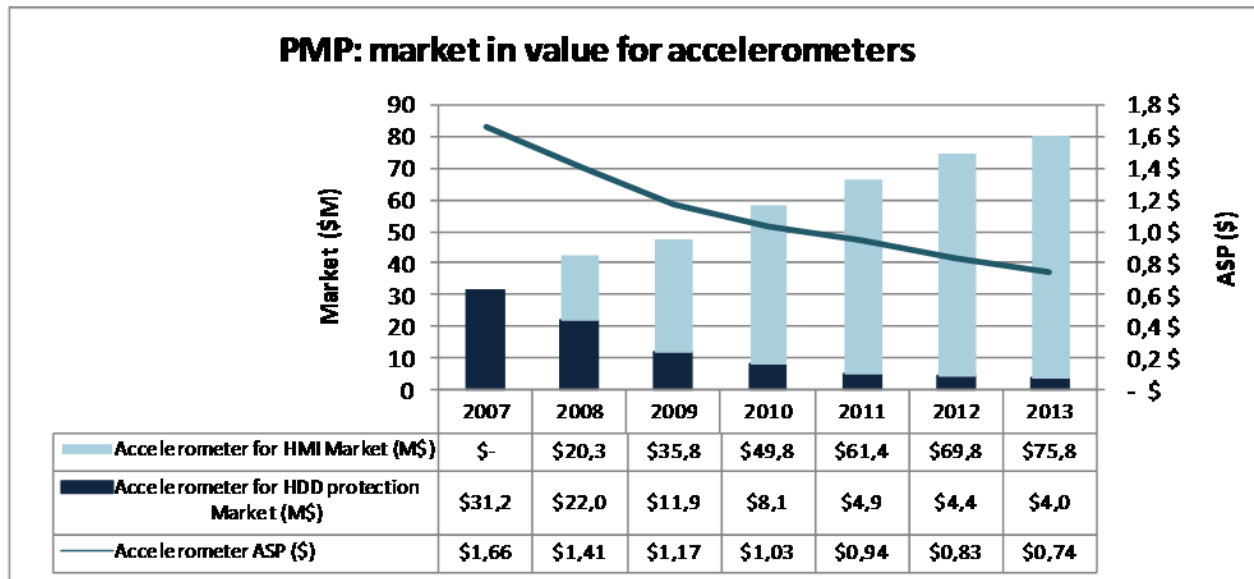
- Penetration rate of motion sensors is growing on PMPs
  - High capacity (>20G) devices feature protected magnetic HDDs
  - Devices with SSD are increasingly using accelerometers for HMI
- Since HDD based PMPs are disappearing, only accelerometers for HMI functions in flash-based PMPs will emerge



# Inertial components for PMPs

## Market and players

- **STM is the leading player worldwide**
  - STM is now leading this market thanks to its contract with Apple
  - Challengers are ADI, Kionix, Freescale
- **Extremely low priced devices are expected: target price is under \$1**



More information on:



[www.yole.fr](http://www.yole.fr)



[www.i-micronews.com](http://www.i-micronews.com)