A Semiconductor Manufacturers Perspective on Obsolescence and Counterfeiting

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Topics

• Semiconductor Manufacturing
  - Historical
  - Today
  - The Future
• Obsolescence Drivers
• Counterfeit Contributors
  - Market requirements
  - Software costs
  - Internet sourcing
• Semiconductor industry anti counterfeit activity
• Conclusions
In the early days of manufacturing everything was done “in house.”

Some semiconductor manufacturers even had their own distribution operations to hold stock, service small volume needs and offer kitting services.
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Today

Grow Crystals → Prepare Wafers → Wafer Fabrication → Device Assembly → Test and Finishing

Many manufacturers contract out all operations
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Why the change?

In semiconductor manufacturing

volume = cost reduction = increased profit

But

Keeping up with technology change
is very expensive
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Growth in size of silicon crystals/wafers being used

1960 to 1970
1-inch (25 mm)
2-inch (51 mm)

1970 to 1980
3-inch (76 mm)
4-inch (100 mm)
5-inch (130 mm) or 125 mm (4.9 inch)

1980 to 1990
150 mm (5.9 inch, usually referred to as "6 inch")

1990 to 2000
200 mm (7.9 inch, usually referred to as "8 inch")

2000 to 2015
300 mm (11.8 inch, usually referred to as "12 inch")

2015 to ????
450 mm (17.7 inch, usually referred to as "18 inch")
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The Future?

- Small number of advanced wafer foundries
  - Subcontractors, e.g., TSMC, Global
  - Very limited number of semiconductor manufacturers owned, e.g., Intel, Samsung
- Limited number of large volume subcontract assembly and test operations
- Some manufacturers will retain assembly and test operations to preserve their brand
- A few manufacturers will retain wafer fabrication, assembly and test operations for specific products e.g., analog functions, special processing (rad hardness, military temperature functionality), high power and high voltage (TI, LTC, etc.)
- A very small number of manufacturers will establish and maintain all production facilities needed to support the older technology products for long term requirement applications (Rochester Electronics)
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Product Characteristics – Today

• Average consumer lifecycle 2-5 years maximum
• Very little product second sourcing
• Volume process technology development driven primarily by portable markets
Semiconductor Market Dynamics

Worldwide Semiconductor End Use Market – Historical

Source: Semiconductor Industry Association (SIA) and World Semiconductor Trade Statistics (WSTS) program
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Product Characteristics – Today

• Average consumer lifecycle 2-5 years maximum
• Very little product second sourcing
• Volume process technology development driven primarily by portable markets
• Growing number of markets with long term requirements but relatively limited volumes
• Application Software development and qualification costs significantly outpace hardware costs in many applications
• Supply and demand tend to go through a 4 year peak and trough cycle
Semiconductor Manufacturing

- Software costs growing much faster than hardware costs
  - Over 3x today and growing
  - Large financial motivation to do whatever it takes to avoid software changes

Figure 1: Software and architectural design costs are rising rapidly for advanced SoCs (Source: IBS, 2009)
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Obsolescence Drivers

• Manufacturers moving to the latest technology have to consider the cost of re-tooling older products
  - Latest Fabrication facility costs over $5B
  - Only Intel, Samsung, Global, and TSMC at 14nm
• Fabless companies have to rely on foundries for their process technology
• Over $100M investment to get leading edge silicon shipped for every new product in mask costs plus design cost.
• Consumer product pace (2-5 years) demands frequent technology upgrade
• RoHS, REACH

Obsolescence presents a significant opportunity, *but not the only one*, for counterfeiters
Counterfeit Drivers

Obsolescence

Shortages

Drive to buy cheaper

“Dumb” ‘e’ procurement

Criminals who want to make money
Counterfeit Contributors

Within the Semiconductor Industry

• Outsourcing by fabless companies
  - Inadequate controls on foundries and assembly operations
  - Inadequate control of scrap material
• Legislation leading to E-Waste (the source and the supply)
  - Used, but Authentic parts
• Growth in long term systems markets
  - Transport, avionics, industrial, medical
  - Systems designed for long term with no funded refresh cycles
  - Consistent continuity demanded by users
• Poorly handled returns through some distribution channels
• Peaks and troughs in supply
Counterfeit Contributors

By Users (Equipment manufacturers and operators)

• Inadequate understanding of market conditions by purchasers
  - Understocking, overstocking, surplus sale
• Growth in supply chain “brokerage”
• Difficulty in checking and identifying good product
• Lack of component engineering staff within supply chain
  - The mistaken belief that Authentic always means Reliable
  - A used Authentic part is of unknown Reliability
  - Fakes can pass through visual inspection and nominal test conditions
• Internet sourcing
# Counterfeit Contributors

## Typical web search example

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Counterfeit Contributors

Are they genuine new unused or sourced this way?

Photographs courtesy of and © Infineon Technologies AG
Counterfeit ICs come from four sources

- Salvaged out of e-waste
- Stolen from the supply chain
- Illegally diverted from destruction and recycling
- Manufactured without licensing

Two things in common:
- **No assurance** product will meet manufacturers specifications
- **No intention** to meet the OEM’s expected performance
Semiconductor Industry Anti Counterfeit Activity

• Worldwide promotion of awareness and dangers to users and throughout the semiconductor industry.
• Semiconductor industry *in house* guidelines, recommended controls (throughout manufacturing and authorised supply chain) and recommendations for purchasing being promoted
• Trade Mark and IP protection and enforcement
• Seizures and prosecutions
• Working with legislative, investigative and prosecution authorities
• Training border control staff
• Closure of web “suspect” sources with ISPs and search “engines”
Conclusions

- Semiconductor industry is doing what it can to counter the problem
- Counterfeiters are continuing to “work smarter”
- Bulk shipment seizures are possible but tracking and tracing shipments of small packages and parcels is proving extremely difficult
- E-Waste is a large source of authentic complex products – both current and obsolete
- Buyers, supply chain participants and users need to help themselves
- Industry standards for checking and mitigation can help but will not eliminate the problem 100%
Rochester Electronics Leads the Industry In The Fight Against Counterfeiting

The Electronics Authorized Directory is the “Official Manufacturers’ Distributor Authorization Reference Manual” and is making it easy to avoid counterfeit product by safely purchasing through authorized distribution!

The Semiconductor Industry Association Anti-Counterfeiting Task Force [SIA ACTF]
Rochester worked with the Semiconductor Industry Association (SIA) in the formation of the SIA Anti-Counterfeiting Task Force, which continues to work domestically and internationally to prevent counterfeit components from entering the supply chain.