

Market and Lead time trends 2016 to 2018 (YTD visible)

W. Schex Arrow Central Europe

July 2018



Global megatrends



Demographic & social change



Climate change & scarce resources



Urbanization



Digital transformation

Key industry trends

– DCDC focus

Energy efficiency

Smart mobility

Robust security

Internet of Things

Fast & big data

Related trend areas (DCDC focus)

Renewable energies

Everything getting electrified

Sensors everywhere

5G infrastructure

Cloud computing

Growing security needs

Autonomous driving

xEVs/eCAVs

Industry 4.0

Robotics

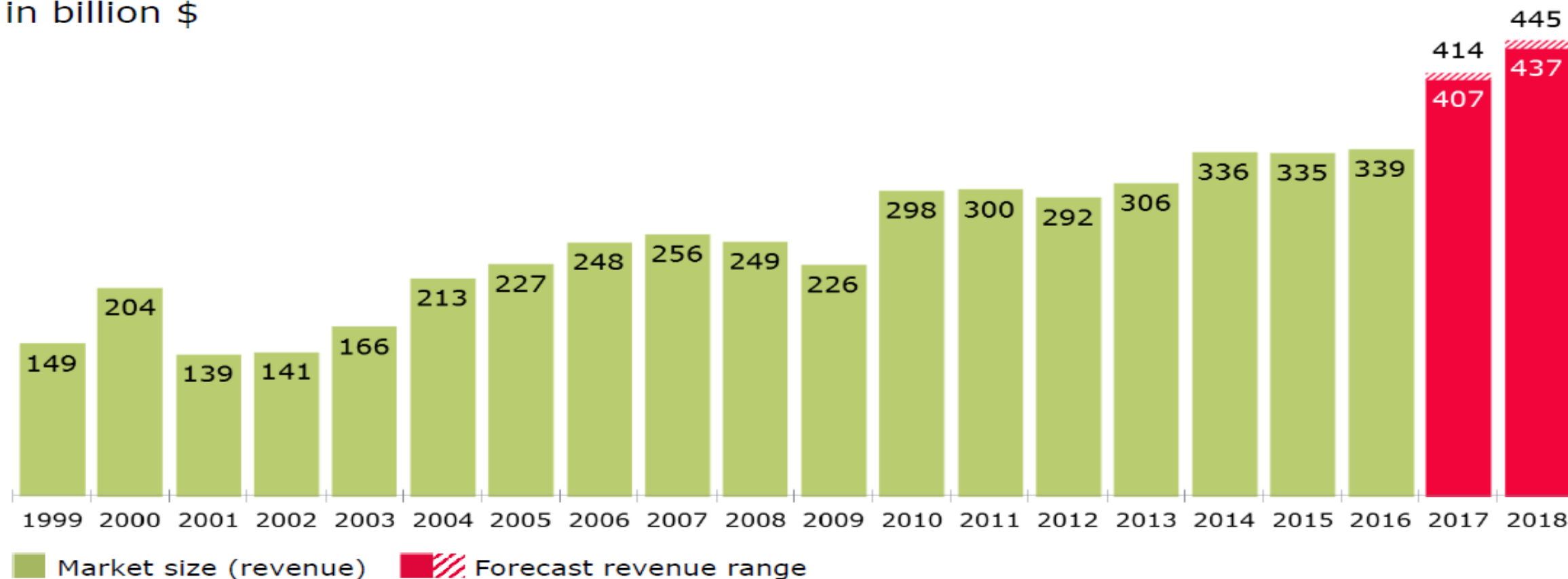
Seamless human + machine interface

Artificial intelligence

The outlook for the global semiconductor market remains positive

Global semiconductor market

in billion \$



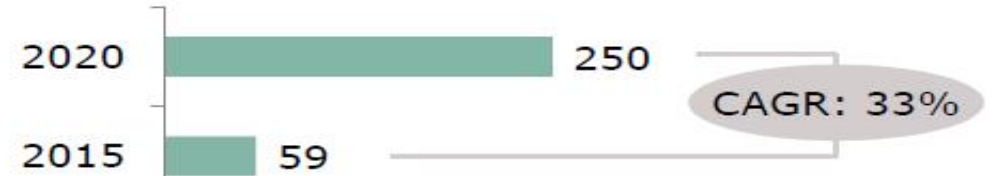
Source: WSTS for historical data. Forecast: \emptyset of WSTS, IHS Markit Technology Group, Gartner, IC Insights; last update 25 January 2018

Demand is growing much faster than expected



The Power Semiconductor industry is likely in a super-cycle. Examples :

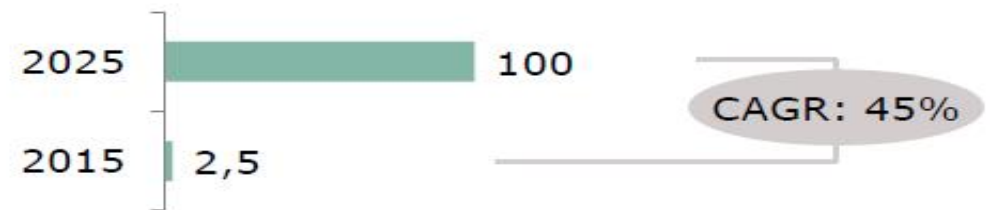
IoT market in [bn €]¹⁾



AI Server market in [bn €]²⁾



Electrical vehicles (NEVs) market [mn units]³⁾



Source: 1) Boston Consulting Group; 2) Bernstein; 3) Bank of Merrill Lynch

Raw material quotation in USD

Copper & Palladium – stable increasing prices

Copper in USD/tonne



Trends

- › Copper prices increased by more than 30% within a year
- › A strong demand outlook from China and India, a weaker US dollar and speculation from investors boosted prices.
- › Additional drivers for higher copper prices are
 - › increasing demand for electric vehicles (essential for electric motors, batteries, inverters, wiring and in charging stations).
 - › economic boom in China and India

Forecasts:

- › According to OECD world economy will continue to expand and **copper prices are expected to rise over 7,000 USD per tonne in 2018.**

Palladium in USD/oz



Trends

- Demand for palladium continues to grow. 80% of all palladium supply is used by automotive industry:
 - › Asia - high demand from growing affordability due to low interest rates and leasing programs)
 - › Global - tightening of emissions standards worldwide, steady growth in the use of catalytic converters

Forecasts:

- › **Sill high prices expected in 2018** due to shrinking and unreliable supply, coupled with firm demand

Source: <https://www.boerse.de/rohstoffpreise>

Lead Time Trends 2016 - 2018 Semi & PemCo

- *2016 Market Conditions*
 - Business 2016 over 2015 with single digit growth rate.
 - Fab load of suppliers at medium to high level ~85%.
 - Supplier capacity on stabel level to 2015.
 - Prices were stable; driven by constant exchange rate USD to Euro.
 - Longer leadtimes only on selected packages or technologies.

- *2016 Lead times*
 - Semiconductors: 10-14 weeks.
 - Passives: 16-20 weeks.
 - EMech & Connectors : 12-16 weeks.
 - Parts on Allocation: Only very few parts or packages / technologies.

Lead Time Trends 2016 - 2018 Semi & PemCo

- *2017 Market Conditions*
 - Global business growth >20%. Absolutely unexpected by all market analysts before.
 - Fab load of suppliers at high level >92%.
 - Suppliers had no real space for major capacity increases. Leadtimes for production equipment are > 12 months; so investments in capacity will show impacts earliest mid of 2018.
 - Lead times started to increase; first in Memory/PowerMos/MLCCs – then followed by other technologies.
 - Prices increases in some areas. Memory pricing started to move up rapidly. Also first exchange rate effects.

- *2017 Lead times*
- Semiconductors: 16-26 weeks.
 - Passives: 20-26 weeks.
 - EMech & Connectors : 14-20 weeks.
 - Parts on Allocation: Only very few parts or packages / technologies.

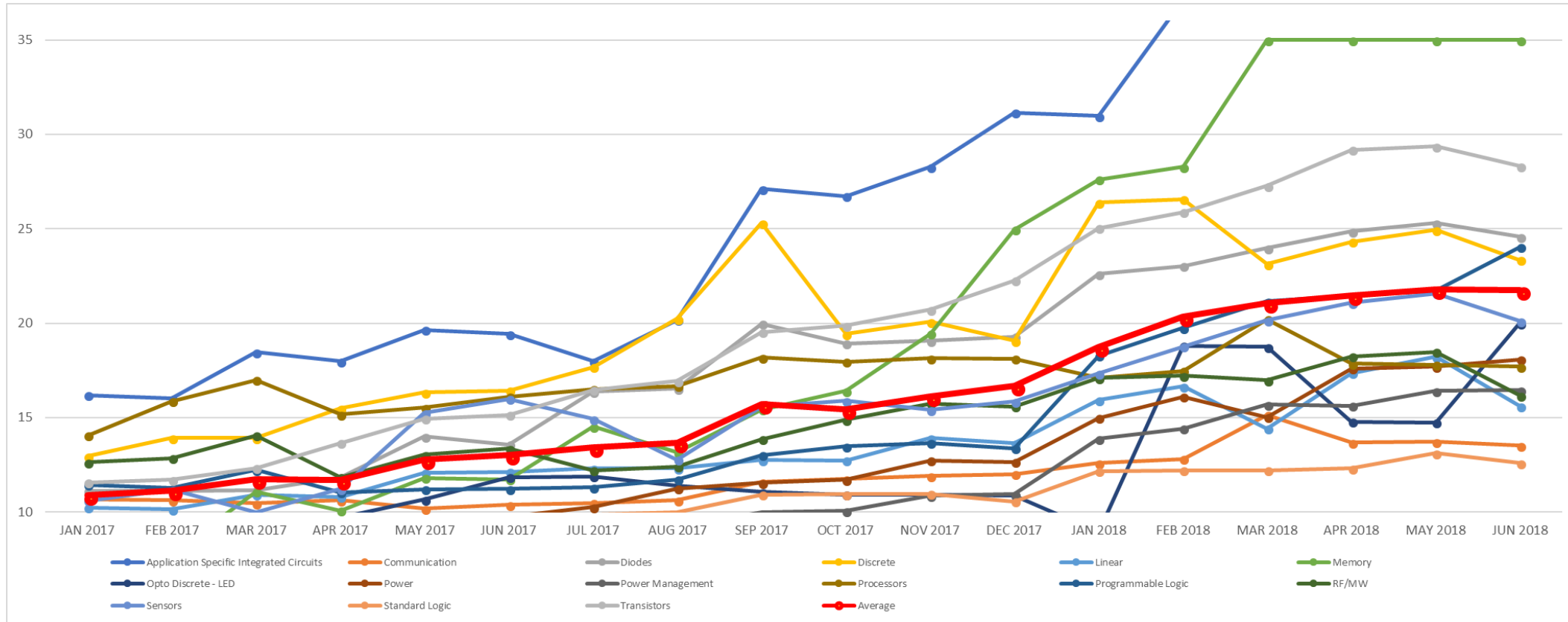
Lead Time Trends 2016 - 2018 Semi & PemCo

- *2018 Market Outlook*
 - Global business with mid single digit growth expectations.
 - Fab load of suppliers stay at high level >90%.
 - Longer Lead times to be continued; especially in Passives, Discrete & Memory area.
 - Slightly lower Lead Times expected for most other areas starting end of Q4/2018. Main reason: Supplier capacity increases will show first results.
 - Prices continue to increase in long Lead Time areas. Raw material & wafer prices with rapid increases.

- *2018 Lead times (current)*
 - Semiconductors: 18-30 weeks.
 - Passives: 28-40 weeks.
 - EMech & Connectors : 14-20 weeks.
 - Parts on Allocation: In specific packages / technologies.

Lead Time Trends 2016 - 2018 Semi & PemCo

Semiconductor Lead Time Trend by Key Technology (Year over Year; Source = SIA)



Meanwhile stable on high level in most Commodity areas. Memory (Flash, DDR) and Discretives have experienced most extensions. Other technologies (e.g. Standard Analog) and specific suppliers have more sporadic increases.

Lead Time Trends 2016 - 2018 Semi & PemCo

Semiconductor volumes 2011 to 2018 by territory (Year over Year; Source = SIA)

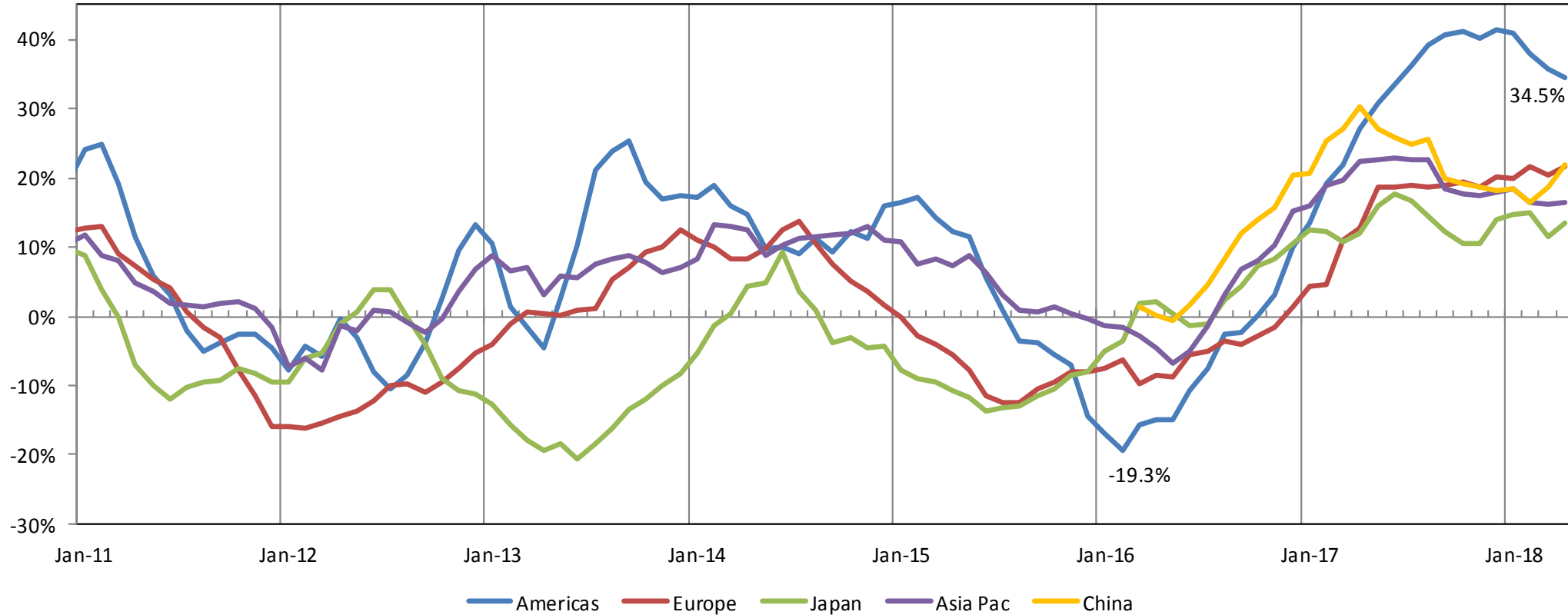


Chart:

- Indicates historical consumption of products by territory.
- Shows historical peaks in demand that lead to critical supply situations; e.g. mid 2013 over 2012.
- Shows globally increasing demand starting Q3/16.

Lead Time Trends 2016 - 2018 Semi & PemCo

- *Current supply issues*
 - Critical supply issues in Memory (mainly DDR, NAND Flash).
 - Critical supply in Discretes (Small Signal; MosFets; IGBT).
 - Critical supply in Passives (MLCC, Tantalums).
 - Tight supply in Standard Analog and Electromechanicals (e.g. Relays).

Based on our historical experience these product families might be followed by others.

- *2018 Lead times outlook*
 - Lead times in Q3/2018 on Q1/18 levels in all major product families.
 - We do not expect an „Overall Allocation“ – but tight supply situations may appear in many areas. Driver is increasing demand in Asia; especially in mobile phone industry; and electric vehicle production ramping up. Improvements (if any) not before end of Q4/2018.
 - Business outlook for 2018 on low 2 digit growth compared to 2017.

Lead Time Trends 2016 - 2018 Semi

Reasons for critical situation – Semi

Increased Demand

Since 1st half of 2017 significantly increased demand in certain market segments:

- Automotive
- E-Mobility (e-bikes / vehicles)
- Communication / Entertainment
- Smart Home Appliances
- Battery drive tools (mower robot)
- Usage trends require more DRAM and NAND memories
- Content increase: Cloud, Servers

Environmental Aspects

Local governments launched new laws and restrictions to protect the environment:

- Restrictions of working hours in Aluminum mines
- Close of factories in dedicated areas to avoid further pollution
- Increased safety standards
- Limited wafer fabs; they are mostly “sold out” already

Limited Investments

Manufacturers did not invest much due to constant fab utilization and flat market growth rates over the last decade. Also negative revenues appeared in some technologies.

- Memory
- PowerMos
- Small Signal
- MicroControllers

Strategic Decisions

Due to economic reasons, manufacturers decided to change production portfolio from lower to high ASP parts.

- Less Commodity in Small Signal
- Higher densities in Memory, move to new technologies.
- High Voltage MosFet instead of Low Voltage
- Defocus on “low ASP” parts

Many of above mentioned reasons are locally driven (mainly Asia) or even do not concern ARROW franchised manufacturers direct but business is effected in a global manner as demands have shifted significantly within suppliers.

>>Suppliers are totally booked out & overloaded<<

Lead Time Trends 2016 - 2018 Semi

Consequences, Reactions and Recommendations

Leadtimes Development

Raise of L/T at concerned items and series to 30+ weeks up to “real Allocation” in particular cases.

- Some MFR announced Allocation officially, some avoid to use the word “Allocation”
- Some MFR grant certain allowances/qty's to distributors
- Parts are flagged either as “Supplier Allocation” or “Arrow Initiated /LT >25weeks” in SWB
- Investments taken by suppliers will come to effect Q4/18 earliest.

Price Development

Most of affected suppliers started already to obsolete old prices and increase standard price books, frames and also (customer) quotes:

- Raw materials and costs for energy & transportation have raised significantly
- Increases of up to 250% (!!!) in Memory
- Existing PO backlog may also be concerned with immediate effect
- Further Price increases already announced
- Customer quote validities partially cut off, and limited to just 3 months only. In Memory 4 weeks max.

SALES Call to Action

- Review your SO backlog NOW and inform your customers accordingly
- Ask customer for alternative parts on their AVL or get alternative parts and/or MFRs approved immediately
- Ask customers to have joint visits with suppliers
- Price validity no longer than 1 month – then SO must be booked.
- Do not quote long term price validity w/o having appropriate supplier quote

PM to help protecting our business by

- Reviewing our PO backlog constantly
- Building further longterm PO pipeline where possible
- Supporting sales and customers to find alternative parts
- Asking for additional quantities even we have to pay higher prices

>> Situation will remain at least until end of 2018 <<

Lead Time Trends 2016 - 2018 Semi & PemCo

- *Arrow reaction on current situation*
 - Extended pipeline towards suppliers in volume and timing.
 - Increased inventory level to currently ~600 M\$ value.
 - Frequently update of leadtimes in our IT system.
- ***Customer reactions highly recommended***
 - Check consumption and runrates of minimum next 6 months.
 - Enlarge firm orderbook towards Arrow for minimum 6 months; better 12 months.
 - Have more than one vendor approved – helpful to have more options in case of tight supply.
- *Current detailed Lead time table*
 - Arrow Leadtime table with monthly updates by supplier / technology.

Thought for the day...

“A recent RFQ from China for power devices in relation to power train for Electronic Vehicles, if true, will require Infineon's entire annual capacity”



Five Years Out

