

CBI Product Factsheet for Semiconductors for the Automotive Application in Slovakia

'Practical market insights on your product'

Economic growth in Slovakia is set to outperform the European Union's average level. The strong development of industrial manufacturing in Slovakia is driven by the automotive industry. Slovakia is the world leader in vehicle production per capita. R&D and capital investments in the electric vehicles sector are growing in Slovakia. DC exporters have good prospects in supplying the rapidly developing automotive industry with best-value and highquality semiconductors through local authorised distributors and Engineering Manufacturing Services (EMS) companies.

Product Definition

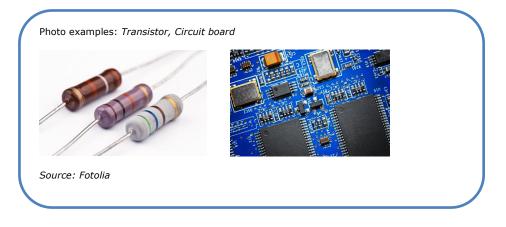
Semiconductors are materials that have electrical conductivity between that of a conductor and that of an insulator. They can display a range of useful properties such as passing current more easily in one direction than the other, variable resistance, and sensitivity to light or heat. Because the conductive properties of a semiconductor material can be modified by the controlled addition of impurities or the application of electrical fields or light, devices made with semiconductors are very useful for the amplification of signals, switching, and energy conversion. They are the foundation of modern electronics and are found in virtually all electronic devices today. They are particularly used in:

- Transistors
- Solar cells
- Light-emitting diodes (LEDs) and
- Integrated circuits

Semiconductors are applied in the production of all electronic equipment and assemblies for industrial, automotive and other applications.

Semiconductors are grouped under HS codes that start with 854221, 85429, 85044, 85411, 85412, 85413, 85415, 85419, 85319020, 85044050, 901380, and 901390.

Both brand names of semiconductors and the product quality are important to the buyer. Some of the international suppliers of semiconductors are: <u>NXP Semiconductors</u> (formerly a division of Philips), <u>Infineon Technologies</u> (subsidiary of Siemens AG), <u>Vishay Semiconductors</u>, <u>STMicroelectronics</u>. <u>ON semiconductor</u> has its development centre in Slovakia.



Product Specifications

Quality:

High product quality and compliance with international and the European standards on safety, as well as national legislation and practices are key for all European companies. The highest levels of quality can only be shown by following the ISO 9001, ISO/TS 16949 and ISO 26262 (for the automotive application) standards. The materials used, especially hazardous substances, have to comply with RoHS and must also fulfil REACH requirements (see "Buyer requirements" in this document).

In addition to the above mentioned standards, industry specific standards set by <u>JEDEC</u> (Joint Electron Device Engineering Council) for general semiconductor devices and <u>AEC</u> (Automotive Electronics Council) for semiconductors used in the automotive industry, are required by European (and Slovak) customers. These standards define several stress tests, which simulate the lifetime of semiconductors, and each customer defines the specific stress tests that must be successfully passed.

Overall, European (and Slovak) customers expect very low defect rates for semiconductors. When used in commercial or industrial applications, defect rates must not exceed 50 ppm, while integrated circuits used **in the automotive industry must be supplied with defect rates of close to 0 ppm.**

Key specifications for semiconductors include the voltage, current and frequency of semiconductors. To answer the demands of the current mega trends of 1) energy efficiency, 2) mobility, 3) security, new generation semiconductors **improve energy** efficiency, reduce operating noise, enable efficient digital power conversion, enable the construction of microcontrollers, and support the security of people's lives.

Labelling:

Products marketed in Slovakia must be labelled in accordance with the EU requirements, i.e., must provide product information and protect consumers' health, safety and interests.

The label information must also be electronically readable. Examples of suitable label technologies include:

- Bar Codes
- Data Matrices
- Radio Frequency ID



Semiconductors are typically labelled with the description of content, including the following types of information:

- type of product,
- model type,
- quantity,
- net and gross weight (in kilograms),
- supplier/manufacturer name
- supplier/manufacturer location,
- serial number,
- various environmental logos,
- country of origin,moisture sensitivity level,
- moisture sensitivity is
 temperature,
- tempera
 hours
- "sealed" date.

Packaging:

- Packaging for products marketed in Slovakia, must meet certain EU requirements. Make sure that your packaging:
 - has minimal weight and volume;
 - \circ has low levels of hazardous substances and materials in the packaging material;
 - is recyclable.
- Packaging must protect products from damage, moisture, and protect consumers from possible injuries. The supplier must test the semiconductor packaging for moisture sensitivity. The testing procedures are outlined in standards <u>EIA/JEDEC A112-A</u> and <u>EIA/JEDEC A113-B</u> and result in moisture sensitivity levels ranging from 1 to 6:
 - $\circ~$ JEDEC level 1 corresponds to a package that is not moisture sensitive.
 - Any package denoted level 2 or higher requires removal of moisture.
- Semiconductors are usually packed in one of three primary component containers: Stick magazines (also called shipping tubes), trays, or tapeand-reels.
 - Stick magazines are constructed of rigid clear or translucent polyvinylchloride (PVC) material. They are extruded in outlines that meet current industry standards and can be used to feed automated assembly processes. Stick magazines are usually packed and shipped in multiples of single magazines
 - Trays are constructed from carbon-powder or fibre materials that are selected according to the maximum temperature rating of the specific tray. They are moulded into rectangular JEDEC standard outlines, containing matrices of uniformly spaced pockets. The pocket protects the component during shipping and handling and the spacing provides exact component locations for standard industry automated-assembly equipment.
 - The tape-and-reel configuration is designed for feeding components to automatic-placement machines for surface mounting on board assemblies. This configuration can be used for all SMT packages and provides component lead isolation during shipping, handling, and processing. The complete configuration consists of a carrier tape with sequential individual cavities that hold individual components, and a cover tape that seals the carrier tape to retain the components in the cavities. In most cases, single reels of components are inserted into intermediate boxes before shipping.

Buyer Requirements

To assure durability and safety, products *must* comply with relevant EU regulations and standards, since Slovakia is one of the 28 EU member states. Compliance with 1) *must* requirements, and 2) *common* requirements, is a basic necessity for *all exporters* in the electronics and electrical engineering sector. Below you will find all standards that apply to **semiconductors**. Familiarise yourself with guidelines on the application of all *must and common* requirements.

Requirements you must meet

CE marking

- For the intra-European trade, semiconductors must be marked with the CE mark, which shows that the product was assessed before commercialisation and that it meets EU safety, health and environmental protection requirements. For semiconductors, the most important Directives on CE marking are:
 - Electromagnetic compatibility (EMC Directive 2004/108/EC).
 - Low voltage equipment (LVD 2006/95/EC),
 - Ecodesign for Energy related products (Directive 2009/125/EC), which are not standards but implementing measures,
 - RoHS (see below).

Considerations for action:

- Apply for CE marking for all your products, **before** approaching potential customers in Slovakia.
- The <u>European Commission page on CE marking</u> is a useful starting point to find out how the legislation on CE marking is relevant to you; it illustrates the key steps you need to take to comply and have your products CE marked.
- Check information for relevant standards and guidelines on the application of LVD, EMC and Ecodesign in the <u>Buyer Requirements</u> section on CBI's Market Intelligence platform.
- Familiarise yourself with standards that apply for semiconductors <u>here</u> (LVD) and <u>here</u> (EMC)
- Familiarise yourself with implementing measures on ecodesign here
- Read more about CE marking for <u>low voltage equipment</u> and <u>electromagnetic</u> <u>compatibility</u> in the EU Export Helpdesk

2. Chemicals

• Use of certain chemicals is restricted by the EU and is regulated through several Directives and Regulations. Suppliers of semiconductors must be aware of the buyers' expectations in the use of certain substances.

Considerations for action: Exporters of electronic components to Slovakia have to meet the requirements under both RoHS and REACH.

 Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS). The Directive sets maximum levels for lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE) in electronic equipment (0.01% by weight for cadmium and 0.1% for the other substances). The Directive covers all electronic components with the exception of the products mentioned in <u>Annex III</u> to the Directive. Since 2013, CE marking has been required in relation to RoHS compliance of final products. This includes technical documentation and a declaration of conformity.

Considerations for action:

 Make sure that you provide the Slovak buyer with all information required in relation to chemicals used in semiconductors. Fill out this information in the form required by your buyer, e.g., by providing information in Material Safety Data Sheets (MSDS) or software in which you declare the chemical content of your product (e.g. <u>BOMcheck</u> – a collective data system developed by a group of large electronics companies to collect chemical composition information from suppliers).

- Provide the EU buyer with technical documentation and a declaration of conformity for the products supplied.
- **REACH Regulation**. This legislation restricts the use of certain dangerous chemicals (as per <u>Annex XVII of the Regulation</u>) and sets requirements on indicating information about the chemicals used. Manufacturers are required to provide information on the properties of chemical substances used to their buyers.

Considerations for action: List all chemicals, including raw materials and additional materials used in your production process. Check the candidate list of <u>Substances of</u> <u>Very High Concern</u>.

Waste of Electrical and Electronic Equipment (WEEE). If you want to export
semiconductors to Slovakia, be aware that your EU/Slovak producers are obliged to
participate in product take-back schemes. This does not directly affect exporters
from developing countries, but specific requirements on the design may be set in
order to facilitate the reuse and recycling set out by WEEE.

Considerations for action: To have a better understanding of WEEE requirements, familiarise yourself with information published in <u>the EU Export Helpdesk</u>.

Common Buyer Requirements

Quality management systems (QMS). If you plan to export to Slovakia, all products must meet buyers' quality demands. ISO 9001 and 14001 are designed to make sure that the manufactured and/or exported products to Slovakia meet the needs of customers. For automotive application, components within an assembly, subassembly and finished goods have to meet quality demands outlined in *ISO/TS* 16949 QMS. Compliance with VDE (a European standard with several variations) is often also required by EU/Slovak buyers.

Considerations for action:

- Apply for ISO 9001 as quickly as possible and plan for ISO 14001. Understand your target customers' requirements and if you plan to target *automotive industry*, apply for ISO/TS 16949.
- Familiarise yourself with VDE requirements. This requirement is important going to the European market.
- Consider forming a Quality Assurance team within your company that will assure the high product quality required by EU/Slovak buyers.
- **Corporate Social Responsibility (CSR).** EU buyers increasingly look for products that have been manufactured with due respect for human rights, labour conditions and the environment. Larger EU companies even develop their own CSR policies and require suppliers to conform to these requirements. In particular, workers' health and safety are sensitive topics in Europe, and buyers want to avoid reputation loss.

Considerations for action:

- Understand what CSR policies are required by your customers by checking websites of electronic companies in Europe.
- An important initiative for the electronics sector is the <u>EICC Code of Conduct</u>. Most large electronics companies have implemented this code and require their suppliers to act in accordance with it.
- <u>SA 8000</u> is a certification standard for social conditions. Although this certification is not a requirement, the standard is publicly available, so you may want to be aware of the most important issues.

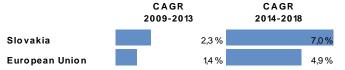
Consider implementing OHS - Occupational Health and Safety - that deals with aspects related to labour conditions. These requirements are not mandatory, but they will definitely give you an advantage over other DC exporters.

Macro-Economic Statistics

Cooperation with Slovak companies opens new growth opportunities to DC exporters. The economy and financial health have been rapidly developing in the last 5 years and the country's GDP growth is set to outperform European average GDP growth. The automotive industry is the engine driving the Slovak industry.

Slovakia is expected to have annual growth of approximately 7% in 2014-2018, and it is forecast to see growth of 6.3% in 2014. The in-country economic growth is expected to outperform the EU average, slowly recovering from the economic recession in 2012. The labour market remains weak and is set to see modest recovery.

Figure 1: GDP (current prices) Compound Annual Growth Rate (CAGR) for 2009-2013 and estimate for 2014-2018 for Slovakia and the EU



Source: IMF 2014, World Economic Outlook Database

Slovakia has a negligible market share of total GDP and of total manufacturing in Europe. But compared to other Eastern and Central European countries, Slovakia holds a significant economic position. The automotive industry in Slovakia accounts for 41% of the total Slovak industry. Slovakia is the world's largest car producer by capita. Volkswagen, KIA and PSA are the top 3 players in Slovakia. As a result of the flourishing vehicle production segment, car component makers have also shifted their operations to Slovakia, e.g. Johnson Controls, Schaeffler, Continental, Brose, Hella, ZF and others.

In terms of population, Slovakia contributes to only 1% to the total EU population.

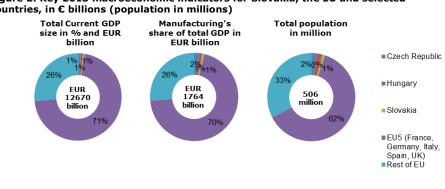


Figure 2: Key 2013 macroeconomic indicators for Slovakia, the EU and selected countries, in € billions (population in millions)

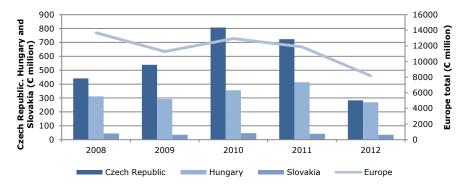
Source: IMF and OECD 2014

Trade Statistics

Production and consumption

The automotive industry is the driving force of the demand for semiconductors in Slovakia, and it is set to post solid growth through 2017. Production and the market size of semiconductors dipped in 2012, impacted by the economic recession in Europe and the production output slowdown in the customer industries.

Figure 3: Production of semiconductors in Hungary, Czech Republic and Slovakia, value in $\ensuremath{\varepsilon}$ million



Source: Eurostat Prodcom (May 2014)

 Slovakia is a significant cooperation partner for Western Europe in electronic components and electronic equipment. Slovakia accounts for 13% of total production of industrial electronics in Central and Eastern Europe. In the production of semiconductors, Slovakia holds a share of 25% of the total production output in Czech Republic, Slovakia and Hungary. Electronics production is the second strongest pillar in Slovak industry (after automotive).

Considerations for action: Actively pursue the cooperation opportunities in Slovakia by supplying local manufacturers of electronics with semiconductors. Names of local manufacturers can be found in the <u>Slovak Association of Electro-technical companies</u>; some companies are also listed in <u>the Slovak Investment and Trade Agency</u>. Consider an alliance with local manufacturers of semiconductors or other electronic components.

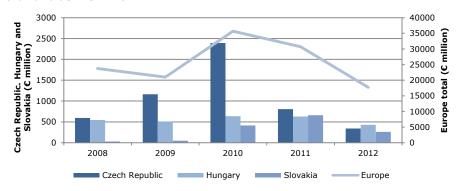


Figure 4: Apparent consumption of semiconductors in Hungary, Czech Republic and Slovakia value in € million

*Apparent consumption (Production + Imports – Exports)

The demand for semiconductors in Slovakia has seen significant growth in the last 5 years (up by an average annual growth of 70% between 2008 and 2012), driven by the exceptional development of the automotive industry and other industrial sectors in the country. Market experts project a 4% annual growth between 2014 and 2017 in Central and Eastern Europe, driving demand for electronic components and semiconductors in particular.

Considerations for action: Depending on your product offering, target the manufacturers of vehicles and automotive parts in Slovakia through authorised

distributors of semiconductors. Find out who are the major local suppliers of electronic components to this industry and actively approach the players.

Import and export

Market experts expect further growth in international trade with developing countries, driven by the importance of outsourcing. DC exporters will benefit from the near-shoring trend (relocation of the production plants from Western European countries to nearby countries with lower production costs, such as Slovakia) by targeting the local OEMs in the automotive industry. Total imports and exports of semiconductors in Slovakia were recording a 29% and 33% CAGR in 2009-2013 respectively. Imports of semiconductors from developing countries increased by an average annual growth of 33% in 2009-2013, but exports to EU+EFTA countries recorded an average annual growth of 76% in 2009-2013. In 2013, both imports and exports of semiconductors in Slovakia saw a decline of 14% and 6% respectively, impacted by the slowdown in economic activity. Recovery is expected in 2014.

Figure 5: Import of semiconductors in Slovakia in 2013, %

	Share of imports from DCs of total in-country imports, 2013	2009-2013 CAGR* in imports from DCs	2009-2013 CAGR* in imports from EU+EFTA	2009-2013 CAGR*in total imports
Imports	2.0%	33.2%	23.4%	29.1%
*CAGR – Com	pound Annual Growth Rate			

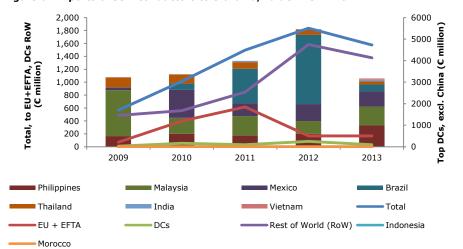


Figure 6: Imports of semiconductors to Slovakia, value in € million

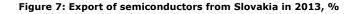
Source: Eurostat (May 2014)

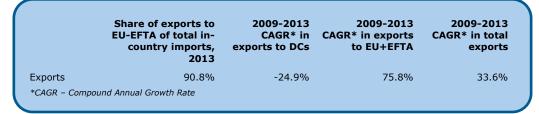
- Imports of semiconductors to Slovakia are driven by intra-European trade; the share of imports from DCs is nearly 2%. Slovakian imports of semiconductors from developing countries saw a 33% annual average growth in 2009-2013, while total imports of semiconductors recorded 29% growth. In 2013, international trade saw a dip, hit by the economic slowdown in Slovakia.
- After China, the Philippines, Malaysia and Mexico are the biggest exporters of semiconductors to Slovakia. Vietnam, India, and Mexico recorded the strongest growth rates in the last 5 years. Decision Etudes & Conseil consultants foresee the importance of Asian countries (excluding China) and other developing countries

growing in terms of the production of electronic components, driving the international trade in 2012-2017.

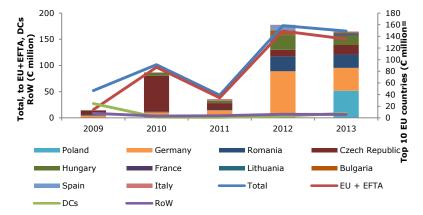
Considerations for action:

- DC exporters have good potential in Slovakia, a market with a low base, but rapidly growing imports of semiconductors from DCs. With the growing importance of nearshoring (countries within the European Union that have low-cost production possibilities), it is recommended to approach the major supplying countries such as Slovakia. Work on minimising the entry barriers and maximising your competitiveness. To achieve this ensure that you have:
 - o a value proposition,
 - o a product that answers the european quality standards,
 - o knowledge of the local language and/or outstanding business english,
- o good understanding of european business culture.









Source: Eurostat (May 2014)

 The declining value of exports of semiconductors in 2013 was impacted by the economic recession. Recovery is expected in 2014. In 2009-2013, the export value of semiconductors grew rapidly, driven by trade with Poland, Romania, Germany, Bulgaria, Lithuania, France and Hungary – all countries with rapidly growing industrial manufacturing capacities.

Considerations for action: Supplying the local market with semiconductors, DC exporters have a potential to reach out to other European markets through re-exports.

Market Trends

- E-Mobility and renewable energy, electronic lighting, advanced manufacturing and big data are the top growth drivers for the semiconductor industry:
 - E-mobility and renewables drive the demand for more efficient and new generation semiconductors.
 - Electronic lighting has substituted traditional lighting that is already banned in Europe.
 - Advanced manufacturing creates demand for more intelligent products with the integration of small processors with high performance and low energy consumption.
 - Big data requires more advanced data processing and analysis and secure storage solutions.
- The following semiconductors are key to many applications that answer the aforementioned trends:
 - o sensors
 - o LEDs
 - Processors
 - o Memories
 - o controllers

Considerations for action: Depending on your production capabilities, build your product proposition around the following product groups: sensors, processors, memories, controllers and LEDs. Consider diversification of your products based on different applications.

• The use of semiconductors in the automotive industry is set to increase, as "connected car" applications will drive an increase in semiconductor use in vehicles by 8 to 10% annually over the coming years. Experts expect body electronics, chassis, safety and energy-related technologies to provide most of the semiconductor-related revenue in automotive applications. (Source: KPMG)

Considerations for action: Actively pursue opportunities in the automotive application. Find out where automotive production facilities are located in Europe and target these regions through authorised semiconductor distributors.

 R&D investments in the automotive and other industries are growing rapidly in Slovakia. In the automotive industry, R&D investments grew nearly 6-fold in 2008-2010 and this is set to grow further, driven by the state aid programme "The Incentives Act". The Slovak R&D network is well-connected with academia and the state (for financial support). Construction of plants with the latest technologies and initiatives in the field of electric vehicles are the key investment areas in Slovakia. Collaboration between suppliers, manufacturers, universities and research institutes is expanding and becoming more significant in Slovakia.

Considerations for action: Consider partnering with global companies active in the automotive industry. Find out what companies have initiated research into electric vehicles and other value-added areas and actively contribute to the R&D process through cooperation. Actively participate in innovation forums in Slovakia and share your development ideas in order to attract the attention of local players.

• The traditional semiconductor business is highly consolidated and has growth challenges (the long-term growth rate is set to decline). Value-added business in semiconductors is referred to as "More than Moore" (by adding

new features such as more current, higher voltages, faster switching instead of just expanding the number of transistors on a chip) and it is set to grow twice as fast as the traditional business (Source: Roland Berger).

Considerations for action: Continue innovating and investing in value-added semiconductors by adding new features to transistors. If you are unable to develop your own capabilities for advanced semiconductors, consider a strategic alliance with high-end manufacturers of semiconductors.

 The shift to the next generation of semiconductors (450mm wafer) will have a significant impact on the industry. This move requires huge investments and Intel, Samsung, TSMC, Globalfoundries and IBM have already made their first investments. The EU supports 450mm wafer production and there are five pilot lines located in Europe (Source: Roland Berger). Besides, experts believe that a raw material transition from silicon-based chips to carbon nanotubes or grapheme is inevitable, as the ability to scale silicon to 10 nanometers and below is diminishing (Source: KPMG).

Considerations for action: Since the shift to the next generation of semiconductors requires a huge investment, consider cooperating with one of the advanced semiconductor producers.

For more information on market trends, please refer to <u>CBI Trendmapping for</u> <u>Electronics and Electrical Engineering</u>.

Market Channels and Segments

- The importance of authorised distributors is growing in Europe. OEMs are increasingly shifting their multi-partner cooperation approach to a single-provider. An authorised distributor is the core element in the supply chain. Besides, there are EMS suppliers that provide value-added services:
 - o resolving complex logistics problems,
 - providing local support services,
 - sourcing hard-to-find components,
 - \circ $\;$ providing small volume procurement,
 - \circ $\;$ minimising costs and saving time for OEMs/ODMs.

Considerations for action: Find out who are the leading authorised distributors and EMS providers in Slovakia and consider partnering with them. <u>Semecs, AVEX electronics, SGS Technologies</u> are some of the *EMS suppliers* present in Slovakia. You will find distributors and EMS companies in Slovakia through local directories and associations.

 Internet blogs are another new sales channel for semiconductor suppliers who want to attract high-end customers. Manufacturers use the blog to showcase their expertise by posting technical topics and discussing them. This enables direct interaction with a customer's design team. This approach has proven successful in many markets.

Considerations for action: Consider specialised internet blogs in order to demonstrate your professional skills and experience. You can also talk about your innovations, through intelligence centres in order to introduce your company and ideas.

For more information on market channels and segments, please refer to <u>CBI</u> <u>Channels and Segments for Electronics for Electronics and Electrical Engineering</u>

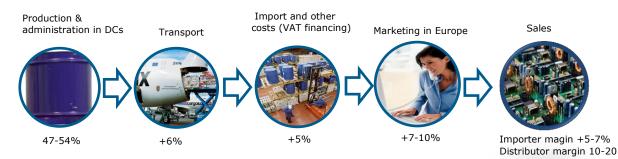
Price

Semiconductors have a wide price range, from €0.05 to €10 in Europe, depending on the specifications and application. Suppliers that are present in several European countries have harmonised their prices; any differences in pricing may occur because of the difference in logistics, taxes and other local costs.

Semiconductors	OEM volume price range, €	
Integrated circuits	0.30-10.00	
Transistors and diodes	0.05-5.00	
LEDs and LCDs/assemblies	0.10-5.00 (€5 refers to a LED/LCD assembly)	

Be aware of different costs and value chain margins that add to the product price. Production and administration costs of the manufacturer are usually 47-54% of the end price (OEM volume price). Production and administration costs should include all raw material costs, development, labour, and other fixed and administration costs. To develop a unique selling proposition, DC exporters will have to understand their own costs, liabilities and responsibilities, and analyse product market price levels.

Figure 9:



Field of Competition

See <u>CBI Market Competitiveness for Electronics and Electrical Engineering</u> and <u>CBI Buyers' Black Box</u>, as the market competitiveness of semiconductors in Slovakia does not differ significantly from this general overview.

Main Sources

- Eurostat, URL:
- <u>http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home</u>Eurostat Prodcom, URL:
- <u>http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/introduction</u>
 Organisation for Economic Co-operation and Development (OECD), URL:
- International Monetary Fund (IMF), URL:
- http://www.imf.org/external/index.htm
- Slovak Investment and Trade Development Agency, URL: <u>http://www.sario.sk</u>

- KPMG Global Semiconductor Outlook, published in December 2013
- Opportunities and Challenges Beyond Moore's Law, Roland Berger, February 2014
- Decision Etudes & Conseil, URL: http://www.decision.eu/
- Distributors' and Manufacturers' Association of Semiconductor Specialists, URL: <u>http://www.dmass.com/</u>
- The European Semiconductor Industry Association (ESIA), URL: <u>http://www.eeca.eu/esia/home</u>

More information:

CBI market information: Promising EU export markets.

EU Expanding Exports Helpdesk - http://exporthelp.europa.eu - go to 'trade statistics'. Eurostat - http://exp.eurostat.ec.europa.eu/newxtweb - statistical database of the EU. Several queries are possible. For trade, choose 'EU27 Trade Since 1995 By CN8'. Use the guide 'Understanding Eurostat: Quick guide to easy comext' (http://exp.eurostat.ec.europa.eu/newxtweb/downloadobject.do?keepsessionkey=true&fil enameOut=User guide EASY Comext EN 2 0 1.pdf&mimeType=application/pdf&object ID=2567&objectType=LOB&disposition=attachment">http://exp.eurostat.ec.europa.eu/newxtweb/downloadobject.do?keepsessionkey=true&fil enameOut=User guide EASY Comext EN 2 0 1.pdf&mimeType=application/pdf&object ID=2567&objectType=LOB&disposition=attachment) for instructions. International Trade Statistics - http://www.trademap.org - you have to register

This survey was compiled for CBI by Global Intelligence Alliance in collaboration with CBI sector expert Günther Fandrich

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