



CBI
Ministry of Foreign Affairs

CBI Product Factsheet:

Transistors in Germany

Introduction

Germany's electrical and electronics sector is developing positively, and it is benefiting from its export orientation. Manufacturers in the automotive industry have a high demand for transistors, as do their counterparts in other industrial sectors (e.g. medical technology). These companies are constantly striving to optimise their supply, thus opening opportunities for exporters from developing countries. Cost-efficient solutions are in high demand. Nevertheless, these solutions must conform to high standard in terms of quality.

Product Definition

Transistors are classified under the broader product category of active components within the Electronics and Electrical Engineering (E&EE) sector. Transistors are semi-conductor components that are widely used to control voltage and current in nearly all common electrical devices. Typical transistor types sold in Europe include the following:

Type	HS Code
Transistors with a dissipation rate <1W (excl. photosensitive resistors)	85412100
Transistors other than photosensitive resistors, with a dissipation rate of <1W, in wafers not yet cut into chips F13	85412110
Transistors other than photosensitive resistors, with a dissipation rate of <1W, (excl. in wafers not yet cut into chips)	85412190
Transistors with a dissipation rate of <=1W (excl. photosensitive resistors)	85412900
Transistors other than photosensitive resistors, with a dissipation rate of <=1W, in wafers not yet cut into chips	85412910
Power MOS field-effective transistors (MOSFET) with a dissipation rate of 1W or more	85412920
Insulated gate bipolar transistors (IGBTs) with a dissipation rate of 1W or more	85412930
Transistors (excl. photosensitive resistors) with a dissipation rate of 1W or more	85412980
Transistors other than photosensitive resistors, with a dissipation of <=1W	85412990

Transistors are typically semi-conductor components for use in many common electrical devices and in many sectors (e.g. industrial, automotive, lighting, energy, medical, communication and consumer electronics). They are one of the most important parts of electrical circuits.

Product quality and design are highly important factors in the procurement of transistors. Nevertheless, well-known brands can play a crucial role in some applications. Established brands in electronic components are known for their superior quality and design. For this reason, industrial buyers may prefer established brands. The number of transistor suppliers operating worldwide is quite large. The following are amongst the leading manufacturers of transistors: [Diodes Incorporated](#), [Fairchild Semiconductor](#), [NXP Semiconductor](#), [Rohm Semiconductor](#), and [STMicroelectronics](#).

Product Specifications

Quality: Customers typically look for transistors that fulfil the following market requirements:

- Transistors have a wide range of specifications, and they can be classified according to construction, permissible power, type of integration and shape.
- Current market requirements for transistors include:
 - greater efficiency and minimised power loss;
 - ability to handle high temperatures (automotive applications: parts must handle between -40°C and 125°C in the motor compartment and -40°C and 85°C in the interior compartment);
 - shock resistance;
 - area-optimised devices.
- To assure durability and safety, products must comply with the relevant EU regulations and standards. The materials used, and especially any hazardous substances, must comply with RoHS, and they must fulfil the REACH requirements (see the heading 'Legislative requirements' in this document).

Labelling:

- The packaging of transistors is typically labelled with a description of the contents, 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

Packaging:

- Transistors are typically packaged in plastic bags and cardboard boxes.

Legislative Requirements

To assure the durability and safety, products must comply with the relevant EU regulations and standards. Compliance with European legislative and non-legislative requirements is a basic necessity for all exporters in the electronics and electrical engineering sector. The most important requirements that apply to your products are discussed below. Be sure that you are familiar with the applicable legal requirements with regard to labelling, hazardous substances, product safety and liability. Your products must comply with all EU directives.

Liability for defective products. The liability applies to all products manufactured or imported into the European market. Although the company that brings the product onto the European market is usually responsible, claims can be passed along to producers or exporters.

Tip:

- Be familiar with standards that apply specifically to your products. To ensure that your products are of high quality, review your quality assurance and testing procedure (e.g. by implementing an accredited quality management system; ISO 9001). Formulate labels, instructions for use and disclaimers carefully. Finally, be sure that your insurance covers product liability. Additional information is available in the document on EU legislation: [Liability for defective products](#). Other resources include the [EU Export Help Desk](#) and the [ITC standards map](#).

CE marking. As components, transistors are typically sold to equipment manufacturers. With a few exceptions, transistors must be marked with the CE mark. Transistors that are sold within assemblies, sub-assemblies or finished goods are not legally required to bear a CE mark. Driven by market requirements, however, nearly all customers continue to demand the CE mark for most components, particularly those that are critical to the application. The following directives may be relevant for transistors:

- Electromagnetic compatibility (EMC Directive 2004/108/EC),
- Low-voltage equipment (LVD 2006/95/EC),
- Eco-design for Energy-related products (Directive 2009/125/EC),
- Equipment for use in a potentially explosive atmosphere (ATEX Directive 94/9/EC),

Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive 2002/95/EC). Additional details are available in the section on RoHS below.

Tip:

- [Apply for CE marking](#), which is required by many customers, even if your product is a sub-system or part of a finished good and is thus not legally required to bear a CE mark. If you are a manufacturer, you should be familiar with the process of affixing the CE marking to transistors. The European Commission's insightful website '[Export Helpdesk](#)' illustrates the key steps to take from the beginning to the trading of the product. The following documents provide additional information on EU legislation:
 - [CE marking for Electromagnetic compatibility](#)
 - [CE marking for Low-Voltage Devices](#)
 - [CE marking for Eco-design of energy-related products](#)
 - [Directive 94/9/EC \(ATEX\)](#)

Waste of Electrical and Electronic Equipment (WEEE). If you are considering exporting electronic or electrical products to the EU, you be aware that EU buyers have obligations regarding the waste of these products. Producers in the

EU are obliged to participate in product take-back schemes. Although this does not directly affect exporters from developing countries, such requirements may have an impact when EU buyers ask their suppliers to meet specific design requirements or provide certain information.

Tip:

- Ensure that your product design complies with WEEE and enables product recycling, recovery or dismantling (note that these requirements may differ from one EU Member State to another). Formulate labels carefully, and mark products in accordance with WEEE (e.g. the symbol of the crossed-out wheeled bin). Obtain additional information on the EU legislation concerning [Waste Electrical and Electronic Equipment \(WEEE\)](#).



Labelling of energy-related products. Producers and exporters in the EU are obliged to indicate energy consumption by household appliances and other energy-related products (the list is being extended to include products used for industrial purposes. Be sure to check this when importing your products, and discuss it with your European customers).

Tip:

- Indicate all product details (e.g. energy class, performance, capacity) required by the EU. Consult the EU legislation on energy labelling for energy-using and energy-related products on the [EU website](#).

Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS). The directive bans the placing on the EU market of electrical and electronic equipment containing more than the agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl and polybrominateddiphenyl ether flame retardants.

Tip:

- Be sure that none of the hazardous substances referred to in the RoHS Directive is used in your production process. Exporters of electronic components are required to meet the standards specified under both the RoHS and the REACH directives, as they are complementary. The EU legislation on the Restriction of Hazardous Substances (RoHS) is available [on the EU website](#).

Non-legislative Requirements

Although compliance with non-legislative requirements remains voluntary, buyers often request such compliance. Many 'private' or 'voluntary' standards were originally established by industry players themselves. Although producers often perceive such standards as a barrier entering a market, compliance also constitutes an opportunity to enhance the export competitiveness of your products.



Quality management systems (QMS) – ISO 9001. If you plan to export to Europe, all products must meet the quality demands of the buyer. The ISO 9001 system was designed to ensure that products manufactured in and/or exported to Europe meet the needs of customers.

For automotive applications, components within assemblies, sub-assemblies and finished goods must meet the quality demands outlined in ISO/TS 16949 QMS.

Tips:

- Apply for ISO 9001 as quickly as possible. Understand the requirements of your target customers and, if you plan to target the automotive industry, obtain ISO/TS 16949.
- Consult the document ISO [Quality management systems](#).
- Requirements relating to automotive applications with regard to quality-management systems are also available on the [ISO website](#).



Functional Safety in accordance with ISO 26262. The ISO 26262 requirements focus on the functional safety of electrical and electronic systems in vehicles.

Tip:

- Apply for ISO 26262. Even though these requirements are not mandatory, they are sure to provide you with an advantage over other exporters from developing countries serving the vehicle industry. Consult the ISO website for additional information on the guidelines [ISO 26262](#).



Occupational health and safety in the electronic-components sector. Occupational health and safety (OHS) issues include all aspects relating to labour conditions, and they are very often part of the social requirements that EU buyers impose on their suppliers.

Tip:

- Consider implementing a management system on OHS (e.g. OHSAS 18000). European buyers are becoming increasingly sensitive and are demanding transparency in the supply chain and with regard to labour conditions at all levels. Even though these requirements are not mandatory, compliance is sure to provide you with an advantage over other exporters from developing countries. Additional information on occupational health and safety in the electronic components sector [is available on the ISO website](#).



Electronic Industry Citizenship Coalition (EICC) Initiative. The most important sustainability initiative in the Electronics Sector, in Europe and internationally, focuses on social, ethical, health and safety, and environmental issues. Members are required to comply with the requirements of the Code. Some industry buyers can require their suppliers to follow the EICC code of conduct. This is especially relevant for first-tier suppliers.

Tip:

- Identify which of your potential clients or which industries are likely to require the EICC code of conduct. Try to implement this policy. It could provide you with an advantage over other exporters. Describe the steps that you have taken in this regard on your website and in your company's other literature. Consult the [EICC](#) website for additional information on the sustainability initiative.

Trade Statistics

Imports and Exports

Transistor exporters from developing countries are currently experiencing a strong demand for semi-conductor-based transistors in Europe, and especially in Germany. This growth is driven primarily by the automotive industry and industrial applications, both of which are strongly driven by exports and both of which benefit from the demand for manufactured products in various locations (e.g. emerging economies or the USA).

Trends in the German automotive market

Figure 1: Imports of transistors to Germany (2014), in %

	Share of total EU imports (2014)	CAGR* of total imports (2009-2014)	Imports from developing countries as a share of total imports (2014)	CAGR* of imports from developing countries (2009-2014)
Imports	40.3%	17%	29.4%	23.5%
*Compound annual growth rate				

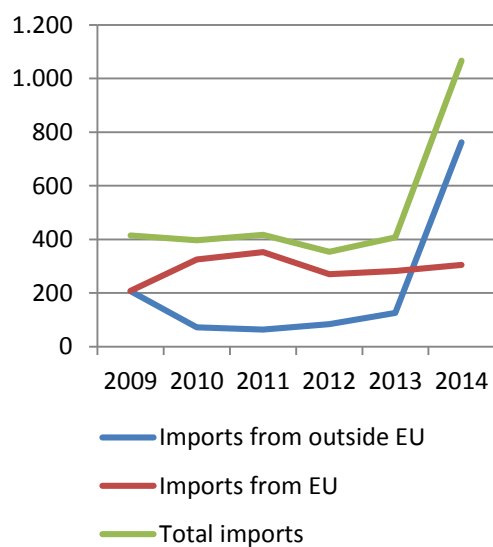
Source: Eurostat (2015)

Figure 2: Exports of transistors from Germany (2014), in %

	Share of total EU exports (2014)	CAGR* of total exports (2009-2014)	Exports from developing countries as a share of total exports (2014)	CAGR* of exports to developing countries (2009-2014)
Exports	62.3%	17.5%	5.8%	12.7%
*Compound annual growth rate				

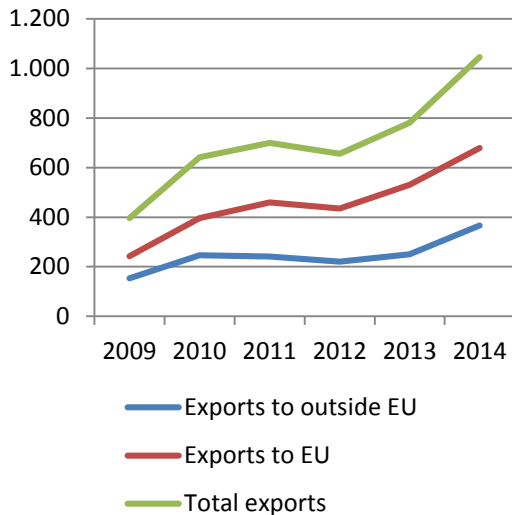
Source: Eurostat (2015)

Figure 3: Imports of transistors to Germany, value in € million



Source: Eurostat (2015)

Figure 4: Exports of transistors from Germany, value in € million



Source: Eurostat (2015)

Most important developments

The demand for semi-conductors in the automotive industry worldwide is expected to increase between 2012 and 2018 from USD 2.8 billion to USD 5.3 billion. Given that the automotive industry has remained one of the largest and most important industries in Europe and Germany, growth prospects are quite positive. Diverse aspects offer valid reasons for the massive growth. The German economy has recovered from the crisis, as has its national demand.

Tip:

- Enter the German market with a value-for-money proposition. This will not be enough, however, as the requirements concerning the quality of products and services are high. Consult with procurement managers from manufacturers and distributors who are interested in purchasing transistors to find out about their specific requirements.

The import of transistors from China to Germany has been undergoing a massive increase, from around EUR 40 million in 2009 to EUR 210 million in 2014. Trade with Malaysia and the Philippines underwent particularly notable expansion in the period 2009–2014, primarily due to better-priced product offerings, in addition to short production times and favourable delivery terms. During the same period, however, trade from other countries (e.g. India) experienced considerable fluctuation.

Tip:

- Any developing country with profound expertise and high product quality has opportunities for entering the European market. Optimise your production process in order to meet all current market requirements, including those relating to the quality and design of products, short production times and favourable delivery terms.

German exports of transistors are exhibiting an upward trend both inside and outside the EU. Exports to other EU countries have been especially dynamic, given that Germany occupies a more competitive position in comparison to other EU countries.

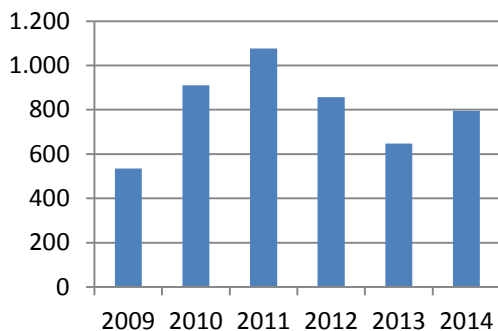
Tip:

- There is a possibility to target other European countries through re-exports. It is important to note, however, that growth rates in other European countries are not as high as those in Germany.

Production and Consumption

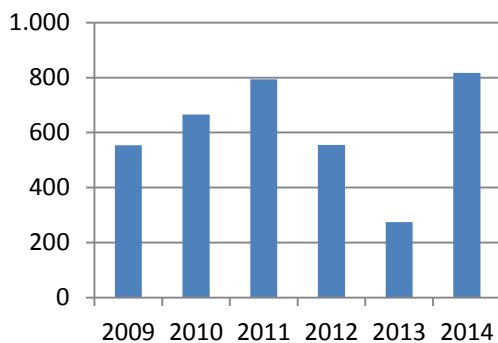
Due to the strong demand for German cars and machinery, worldwide consumption is high in these sectors. Although quality and excellence in engineering translate into a competitive edge for German manufacturers in the global market, these manufacturers also face strong competition. This is having a major impact on the supply chain. Parts of the production process have been shifted overseas to locations with lower costs. Cost-efficient solutions are important, but not at the expense of quality and safety.

Figure 5: Production of transistors in Germany, value in € million



Source: Eurostat Prodcom (2015)

Figure 6: Consumption of transistors in Germany, value in € million



Source: Eurostat Prodcom (2015)

Most important developments

Gartner, a world leader in market intelligence concerning technology, predicts a general growth of 4% on average in the industrial sector. Given that Germany is highly involved in the production and export of industrial goods, this trend is likely to apply to its industrial production as well. It is followed by the automotive segment (e.g. window regulators, central-locking systems, side mirrors), which has experienced slightly less growth. Growth is expected for IGBT transistors in the household-appliance segment (e.g. clothes dryers, washing machines). Bipolar transistors are less expensive, and they are used in applications in the lighting industry.

Tip:

- Consider supplying the specific demands of German manufacturers, and be sure to focus on your strengths.

Semi-conductor production in Europe is expected to decrease further, while production in the USA is expected to remain at the same level, and Taiwan is expected to take over the leading position from Japan globally.

Tip:

- The decline in the production of parts based on semi-conductors in Europe is opening new market potential for suppliers from developing countries. Be sure to that potential buyers are aware of your products. Attend trade fairs.

For additional information on trade statistics, consult [CBI Trade Statistics for Electronics and Electrical Engineering](#).

Market Trends

Most important developments

Technological development: As one of the leading industries in Europe, the automotive industry is a technological driver for transistors. Original Equipment Manufacturers (OEMs) have generally strived to increase the performance of cars while decreasing fuel consumption. That has directed a focus towards control electronics (e.g. transistors). In the future, IGBT and MOSFET transistors are expected to replace conventional transistors (e.g. bipolar transistors).

Tip:

- Be sure to adapt to current trends and stay abreast of technological developments; otherwise, you will jeopardise your chances of partnering with and supplying to European companies. Prepare to be able to supply customers with IGBT and MOSFET in the midterm (about three years).

Product innovation: Miniaturisation has been a constant trend in product innovation within the field of electronics, including transistors.

Due to the low level of technological innovation in the area of performance components, however, integrated circuits will be playing a more important role, especially in e-cars.

Tip:

- Follow the trends in the market, and try to anticipate new developments as early as possible. Invest time and resources in monitoring the market, including establishing connections with potential partners and clients.

Product and service quality: In the automotive industry, OEMs are tightening product requirements with regard to lifetime and wear. High reliability in terms of short lead times and just-in-time delivery is another prerequisite for transistor suppliers. Distributors operate within a highly competitive environment. That makes flexibility and reliability key issues in terms of delivery.

Tip:

- Insufficient product and service quality are fatal errors when attempting to enter the German or European market. It is important to build a good and reliable reputation.

Political measures: Several EU Directives have been issued that specify stricter emission levels. This has increased the use of electronics in engines to increase efficiency.

Tip:

- Stay abreast of legislative developments in order to anticipate changes that are likely to affect the market demand for certain technologies.

For additional information on market trends, consult [CBI Trends for Electronics and Electrical Engineering](#).

Market Channels and Segments

The [CBI Market Channels and Segments for Electronics and Electrical Engineering](#) provides a general overview.

Market Competitiveness

The document [CBI Competition for Electronics and Electrical Engineering](#) provides a general overview.

What are the end-market prices for transistors?

Price range for transistors

Transistors have a wide price range. Approximate price ranges are indicated in the table below. For example, prices for transistors range from €0.0081 to €800 in Europe, depending upon specifications. Suppliers in several European countries have harmonised their prices; any differences in pricing are due to differences in logistics, taxes and other local costs.

Most important groups of transistors for industrial, automotive, lighting, communication and consumer applications	OEM volume price range, in €
(Regular) Transistors	0.0081 – 800
Bipolar transistors	0.02 – 246
IGBTs	– 180
MOSFET	0.11 – 210

Producers in developing countries should be aware of differences in costs and value-chain margins that could add to the product price. The production and administration costs of the manufacturer usually account for 44%–51% of the end price (OEM volume price). The production and administration costs should include all costs for raw materials, development and labour, as well as other fixed and administration costs. To develop a unique selling proposition, exporters from developing countries should understand their own costs, liabilities and responsibilities, and they would do well to analyse product market price levels.

OEM volume price breakdown	Margin
Production and administration costs	44% – 51%
Marketing and sales costs in developing countries	3%
Freight to Europe and other related costs	6%
Import and other (e.g. VAT, financing) costs	5%
Marketing costs in Europe	7%
Importer margin	8% – 10%
Distributor margin	15% – 25%

Useful resources

Leading trade fairs in Europe

- [Electronica](#), world's leading fair for electronic components, systems and applications
- [Embedded World](#), world's leading fair for embedded technologies
- [CeBIT](#), world's largest fair for computers
- [Hannover Messe](#), world's leading fair for industrial applications and automation
- [SPS IPC DRIVES](#), Europe's leading fair for electrical automation
- [Light & Building](#), world's largest fair for light and building applications

Important resources

- [Eurostat](#)
- [Eurostat Prodcom](#)
- [FBDI](#)
- [Mouser Electronics](#)
- [Rohm Semiconductor](#)
- [ZVEI](#)
- [Future Electronics](#)
- [Gartner](#)
- [PCIM](#)

Additional information

CBI market information:

- [Trade Statistics for Electronics and Electrical Engineering;](#)
- [Trends for Electronics and Electrical Engineering;](#)
- [Market Channels and Segments for Electronics and Electrical Engineering;](#)
- [Competition for Electronics and Electrical Engineering;](#)
- [10 Tips for Doing Business in the Electronics and Electrical Engineering sector](#)
- [Finding Buyers in the Electronics and Electrical Engineering sector](#)



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April 2016