PRODUCT CATALOG 2019

Power semiconductors

Factory of the Year 2018
“Excellent Location Safeguarding by Digitalization”

ABB's success story in power electronics began more than 100 years ago with the production of mercury-arc rectifiers in Switzerland. Over the past 60 years, ABB has played a pivotal part in the development of power semiconductors and their applications.

ABB is a leading supplier of power semiconductors with production facilities in Lenzburg, Switzerland, and Prague, Czech Republic, as well as a research laboratory for wide bandgap semiconductors in Baden-Dättwil, Switzerland.

In the renowned industrial competition «Factory of the Year 2018» ABB Semiconductors has won the prize in the category «Excellent Location Safeguarding by Digitalization».
The business unit receives the award for increasing its competitiveness through a digital connected production.

Exceeding quality requirements, guaranteeing reliability expectations and perpetual pioneering are our distinctions.

For more information please contact us or visit www.abb.com/semiconductors

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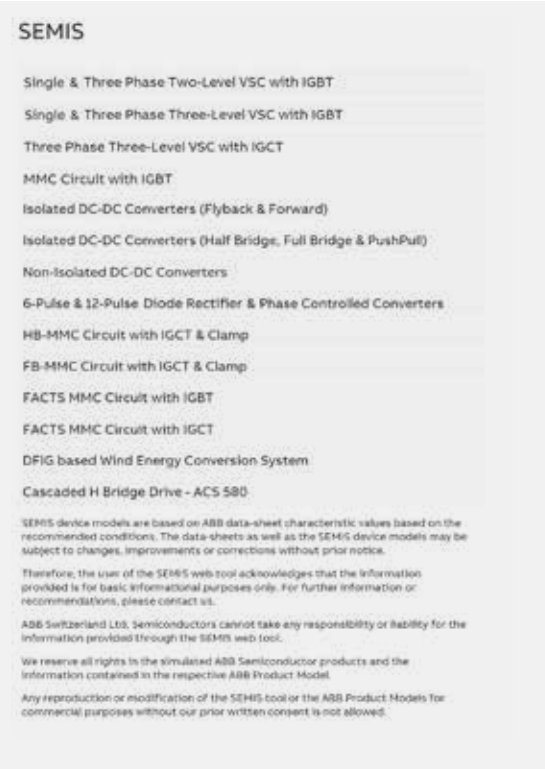
Applications

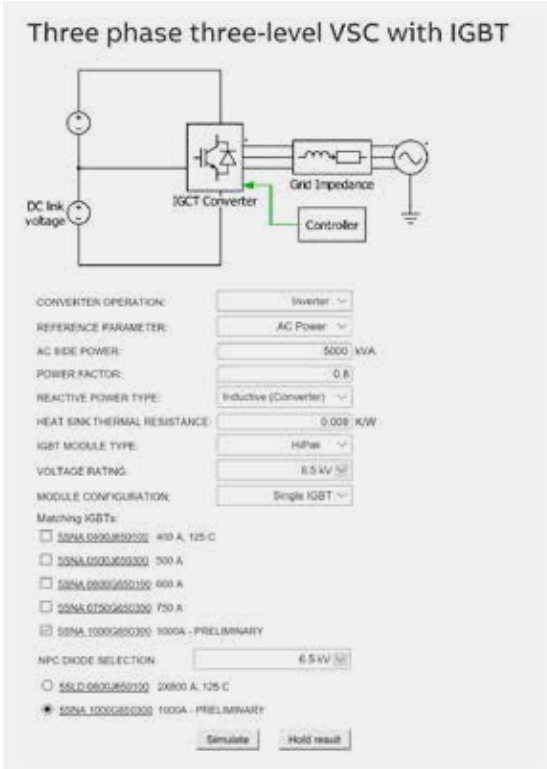
ABB's power semiconductors are key components in a variety of demanding applications in markets like power transmission & distribution, industrial, transportation and renewable energy. Customers rely on ABB's high quality power semiconductor products and use them in applications in power ranges from 50 kW to 10 GW.

1. Power transmission and distribution (HVDC, FACTS, STATCOM and others)
2. Industry (medium and low-voltage drives, soft starters, UPSs, high-power rectifiers, excitation systems and others)
3. Transportation (main and auxiliary drives, trackside power supply)
4. Renewable energy (converters for pumped hydro, wind turbines and solar)

SEMIS
Semiconductor simulation tool

ABB's semiconductor simulation tool SEMIS is a sophisticated web application to evaluate the optimal choice of high-power semiconductors in regards of thermal losses and device utilization. By selection of topology and definition of relevant circuit parameters, SEMIS performs an analysis of multiple system dependencies and evaluates power losses as well as thermal conditions enabling a verification of semiconductors' device capabilities.





The circuit parametrization is defined according the user specification with a high number of flexibilities to adapt the simulations to customer needs. With the steady-state analysis, the topology is simulated, and relevant parameters are evaluated.

Simulation results are displayed in graphical and tabular for fast and efficient initial results analysis.

For detailed analysis, semiconductor specific parameters are indicated in table form, enabling numerical analysis of each element. This also enables the detection of the crucial elements with highest thermal load for the best possible optimization in regards of cost efficiency and power losses. The numerical results listed indicate power losses and junction temperatures of all semiconductor devices according to the load and customer defined thermal resistances of cooling as well as input, output and control parameters.

SEMIS suits the needs of initiates and professionals. With the selection of the topology circuit, the list of definable parameters is indicated. By entering specific parameters, boundary conditions are set, and the suited semiconductors are listed for selection. If one or more ABB products are chosen, all parameters are set, and the system is ready to start the simulation.

The simulator calculates based on Jacobian analysis the on-state and dynamic power losses as well as the resulting thermal variations of semiconductors. Excess of permissible thermal limits generates alert messages to ensure a safe operation area for the specific semiconductor.

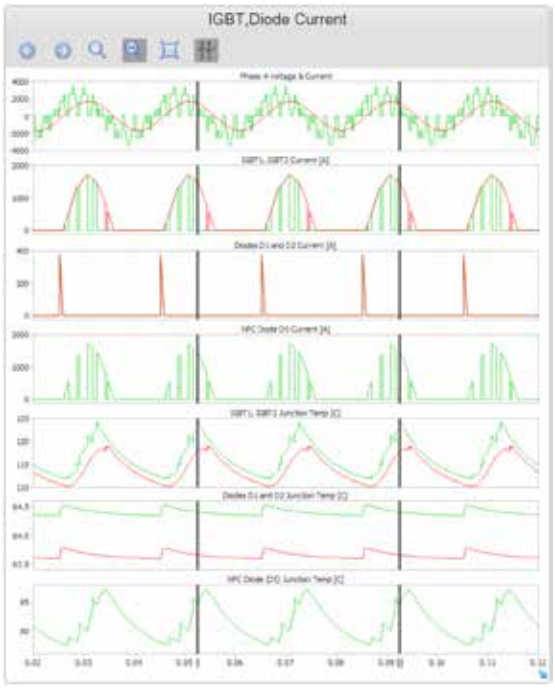
Detailed results are displayed in a table with electrical losses, junction temperatures, input and output as well as control parameters. For the verification the overall power effectiveness and the system efficiency are indicated revealing the power loss influence of the applied semiconductors.

The thermal conditions together with the combined power loss enable the detailed definition of the cooling system requirements. With the statement of the THD (total harmonic distortion) the output current quality is indicated and can be verified versus the local regulations or requirements.

With the capability to compare multiple ABB products and combinations, the influence of varying control parameters is revealed. This leads to an efficient and reliable product analysis according customer requirements enabling a tailor-made selection of ABB products.

As SEMIS is based on the PLECS simulation software, the device thermal models (in XML format) are available for download from our website, allowing PLECS users the flexibility to simulate ABB products based on manufacturers' data on their own.

For simulations exceeding the capabilities of SEMIS and simulation requirements of higher complexity, please contact your ABB sales agent or ABB Semiconductors for further support.



Device Losses & Temperatures

	Switching	Conduction	Combined Losses	Avg.Junction Temperature (Tj_Avg)
IGBT1	1.575 kW	1.403 kW	2.978 kW	118 °C
IGBT2	365.35 W	2.519 kW	2.885 kW	115 °C
D1	0 W	12.18 W	12.18 W	64 °C
D2	0 W	12.18 W	12.18 W	64 °C
NPC D5	272.59 W	811.77 W	1.084 kW	82 °C
Converter Losses	13.70 kW	28.82 kW	42.52 kW	
% Losses			1.05 %	

Converter AC Parameters

Real Power	Reactive Power	Phase Voltage (RMS)	Phase Current (RMS)	Output Frequency	Power Factor
3998 kW	2993 kVAR	1.414 kV	1.178 kA	50 Hz	0.80

DC Parameters & Control Parameters

DC Power	DC Voltage	Switching Frequency	Modulation Index
4041 kW	2.500 kV	450 Hz	0.80

Product outlook
4500 V reverse-conducting IGCT

A new platform for reverse-conducting integrated gate commutated thyristors (RC-IGCT) has been developed to meet the ever increasing demand for higher power capability coupled with lower operating losses.

The new devices offer more active area, larger controllable current, higher junction temperature and better cooling efficiency than the existing products.

The devices are available in two variants, one optimized for medium switching frequency applications, such as medium voltage drives and wind power converters, the second optimized for low switching frequency intended to be used in multilevel modular converters (MMC) for e.g. static synchronous compensators (STATCOM) or pumped hydro plants.

Design features:
- Device diameter increases within the same footprint by making better use of raw silicon wafers.
- Gate-circuit impedance minimization, by changing to a gate-contact infrastructure placed at the device periphery and also by improving routing of the gate contact through the housing.
- Movement of the gate contact to the periphery for better cooling, as the pole piece trenches for conveying the gate signal are no longer needed.
- Increase of the maximum controllable current by adjusting the HPT+ platform to be used with the RC-IGCT process flow.

Ratings of 4500 V, RC-IGCT

	Availability	Voltage rating	Current rating	Turn-off current	Housing
RC-IGCT, optimized for low switching frequency	Samples Q3/19	4500 V	GCT: 1300 A, Diode: 900 A	3600 A	L size
RC-IGCT, optimized for medium switching frequency	Samples Q3/19	4500 V	GCT: 1050 A, Diode: 750 A	3600 A	L size


ABB

IGBT and diode dies

When looking for chipsets featuring highest switching performance, ruggedness and reliability, ABB's IGBT chips with accompanying diodes are certainly the preferred choice.

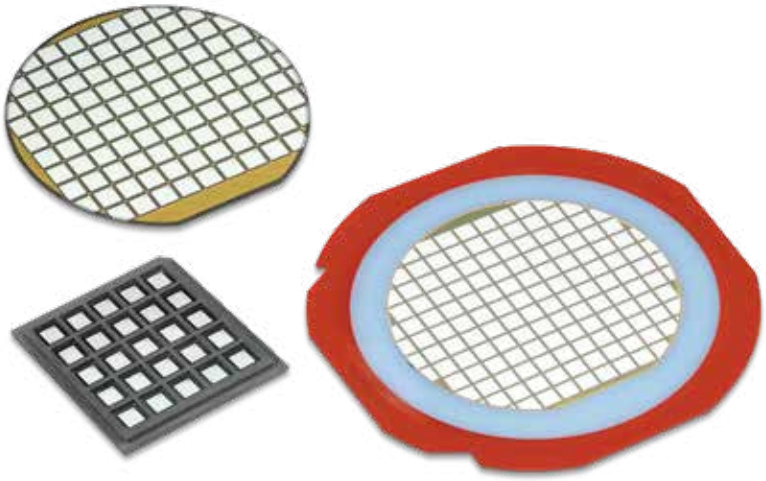


ABB Semiconductors' SPT (Soft Punch Through) chipsets and their improved versions with lower losses (SPT^{+} and SPT^{++}) are available at 1200 V and 1700 V. They feature highest output power per rated ampere due to a moderate chip shrinkage and thus larger die area compared to others.

Typical applications for 1200 V are power converters for industrial drives, solar energy, battery backup systems (UPS) and electrical vehicles. Applications for 1700 V also include industrial power conversion & drives, wind turbines and traction converters.

ABB's 1700 V SPT^{++} chipset is the world's first 1700 V chipset that offers an operational junction temperature of up to 175 °C. This allows the module designer to increase the power density of the IGBT modules significantly.

Diode dies

Part number	Type	Size A x B mm	Thickness µm	V_{PRM} (V)	I_F (A)	V_F (V) typ. 125 °C	Max. dies per wafer (W) or tray (T)
1.2 kV							
5SLY 76E1200 5SLY 86E1200	SPT^{+}	6.3 x 6.3	350	1200	50	1.85	361 (W)
5SLY 76F1200 5SLY 86F1200	SPT^{+}	7.4 x 7.4	350	1200	75	1.85	257 (W)
5SLY 76G1200 5SLY 86G1200	SPT^{+}	8.4 x 8.4	350	1200	100	1.85	198 (W)
5SLY 76J1200 5SLY 86J1200	SPT^{+}	10.0 x 10.0	350	1200	150	1.85	137 (W)

Part number	Type	Size A x B mm	Thickness µm	V_{PRM} (V)	I_F (A)	V_F (V) typ. 125 °C	Max. dies per wafer (W) or tray (T)
1.7 kV							
5SLZ 76E1700	SPT++/FSA	6.6 x 6.6	370	1700	50	1.75	326 (W)
5SLY 86E1700	SPT+	6.6 x 6.6	390	1700	50	2.1	326 (W)
5SLZ 76F1700	SPT++/FSA	7.7 x 7.7	370	1700	75	1.75	237 (W)
5SLY 86F1700	SPT+	7.7 x 7.7	390	1700	75	2.1	237 (W)
5SLY 86G1700	SPT+	8.6 x 8.6	390	1700	100	2.1	188 (W)
5SLZ 76G1700	SPT++/FSA	6.8 x 11.4	370	1700	100	1.75	177 (W)
5SLZ 86J1700	SPT++/FSA	10.2 x 10.2	370	1700	150	1.75	131 (W)
5SLY 86J1700	SPT+	10.2 x 10.2	390	1700	150	2.1	131 (W)
5SLZ 76L1700	SPT++/FSA	9.3 x 15.9	370	1700	225	1.75	92 (W)
5SLY 86M1700 5SLY 12M1700	SPT+	13.6 x 13.6	390	1700	300	2.1	69 (W) 25 (T)

IGBT dies

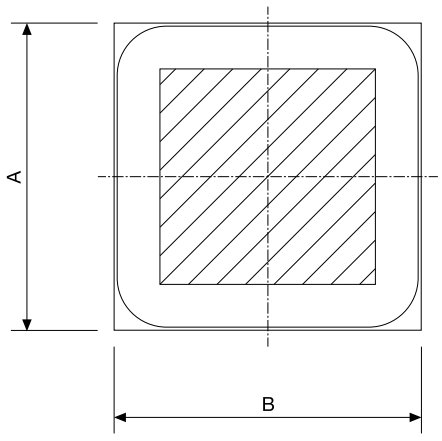
Part number	Type	Size A x B mm	Thickness µm	V_{CES} (V)	I_C (A)	I_{CM} (A)	V_{CEsat} (V) typ. 125 °C	Max. dies per wafer (W) or tray (T)
1.2 kV								
5SMY 76H1280 5SMY 86H1280	SPT+	9.1 x 9.1	140	1200	57	114	2.1	166 (W)
5SMY 76J1280 5SMY 86J1280	SPT+	10.2 x 10.2	140	1200	75	150	2.1	130 (W)
5SMY 76K1280 5SMY 86K1280	SPT+	11.2 x 11.9	140	1200	100	200	2.1	98 (W)
5SMY 76M1280 5SMY 86M1280	SPT+	13.5 x 13.5	140	1200	150	300	2.2	71 (W)
1.7 kV								
5SMY 86G1721	SPT+	8.6 x 8.6	209	1700	50	100	3.0	186 (W)
5SMY 86J1722	SPT+	10 x 10	209	1700	75	150	3.0	132 (W)
5SMY 76J1732 5SMY 86J1732	SPT+	10 x 10	190	1700	75	150	2.55	132 (W)
5SMY 76K1722 5SMY 86K1722	SPT+	11.3 x 11.3	209	1700	100	200	3.0	104 (W)
5SMY 76K1732 5SMY 86K1732	SPT++	11.3 x 11.3	190	1700	100	200	2.55	104 (W)
5SMY 86L1731	SPT++	7.4 x 19.9	190	1700	120	240	2.7	86 (W)
5SMY 86M1721	SPT+	13.6 x 13.6	209	1700	150	300	3.0	69 (W)
5SMY 86M1730	SPT++	13.6 x 13.6	190	1700	150	300	2.55	69 (W)
5SMY 86M1731	SPT++	13.9 x 14.0	190	1700	160	320	2.55	66 (W)
5SMY 76P1730	SPT++	15.9 x 16.9	190	1700	225	450	2.55	46 (W)

Please refer to page 54 for part numbering structure.

01 Diode dies

02 IGBT dies

01



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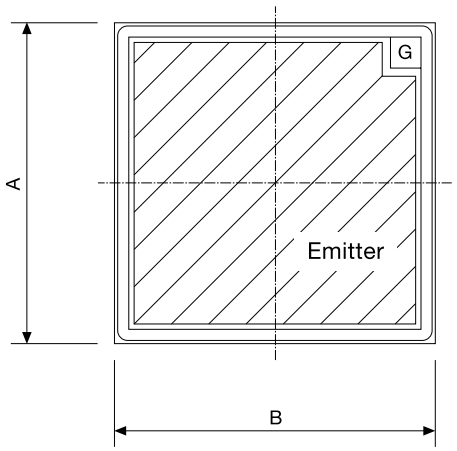


Medium-power IGBT modules

ABB enhances its successful IGBT module range into the medium-power segment. Starting with the 62Pak and the LoPak1, ABB brings the proven high quality and reliability of the HiPak modules to the medium-power IGBT segment

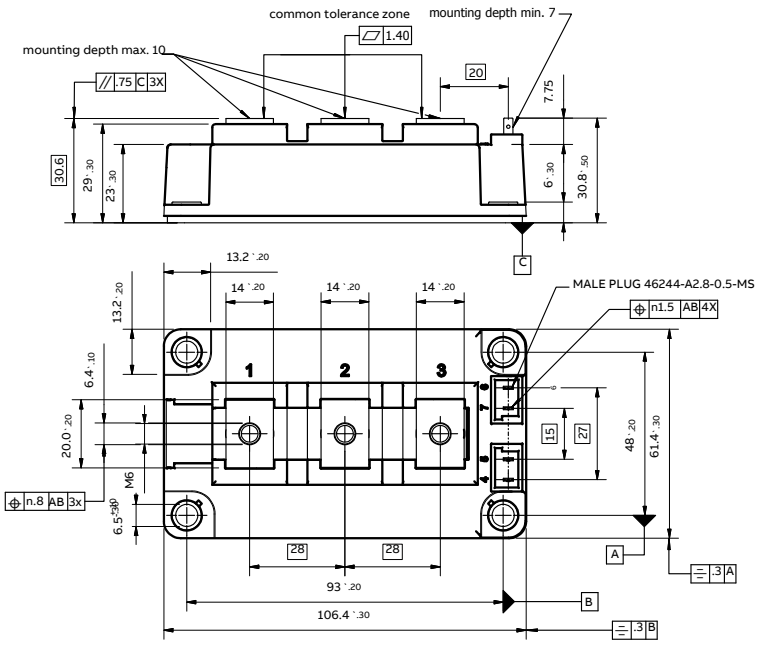
ABB's 62Pak modules have an advanced packaging technology that leverages the performance of the latest silicon technology:

- 1700 V SPT^{++} fast switching IGBT / diode chipset with lowest switching losses
- Full 175 °C operation temperature with full square SOA
- Best-in-class temperature cycling performance of bond-wire chip connection
- Standard package allowing drop-in replacement

Part number T_{vj} (operational) up to 175 °C	Voltage V_{CES} (V)	Current I_C (A)	Configuration	V_{CEsat} (V)	V_F (V)	Housing
1.7 kV						
5SNG 0150Q170300	1700	2 x 150	(5) - Phase leg IGBT	2.55	1.75	Q
5SNG 0200Q170300	1700	2 x 200	(5) - Phase leg IGBT	2.55	1.75	Q
5SNG 0300Q170300	1700	2 x 300	(5) - Phase leg IGBT	2.55	1.75	Q

Please refer to page 55 for part numbering structure.
Configurations on page 20

Q



Dimensions in mm

ABB's LoPak is 100 % mechanically compatible with the Econo-type dual IGBT modules. It sets a new benchmark with full switching performance up to 175 °C. It is specifically designed for excellent internal current sharing, offering optimal thermal utilization and increased robustness. Thus customers can expect larger safety margin and increased lifetime. Typical applications include:

- Wind power converters
- Variable speed drives
- Power supplies
- Power quality
- UPS
- Renewable energies

Part number T_{vj} (operational) up to 175 °C	Voltage V_{CES} (V)	Current I_C (A)	Configuration	V_{CEsat} (V)	V_F (V)	Housing
1.7 kV						
5SNG 0225R170300	1700	2 x 225	(5) - Phase leg IGBT	2.55	1.75	R
5SNG 0300R170300	1700	2 x 300	(5) - Phase leg IGBT	2.55	1.75	R
5SNG 0450R170300	1700	2 x 450	(5) - Phase leg IGBT	2.55	1.75	R

Please refer to page 55 for part numbering structure.
Configurations on page 20

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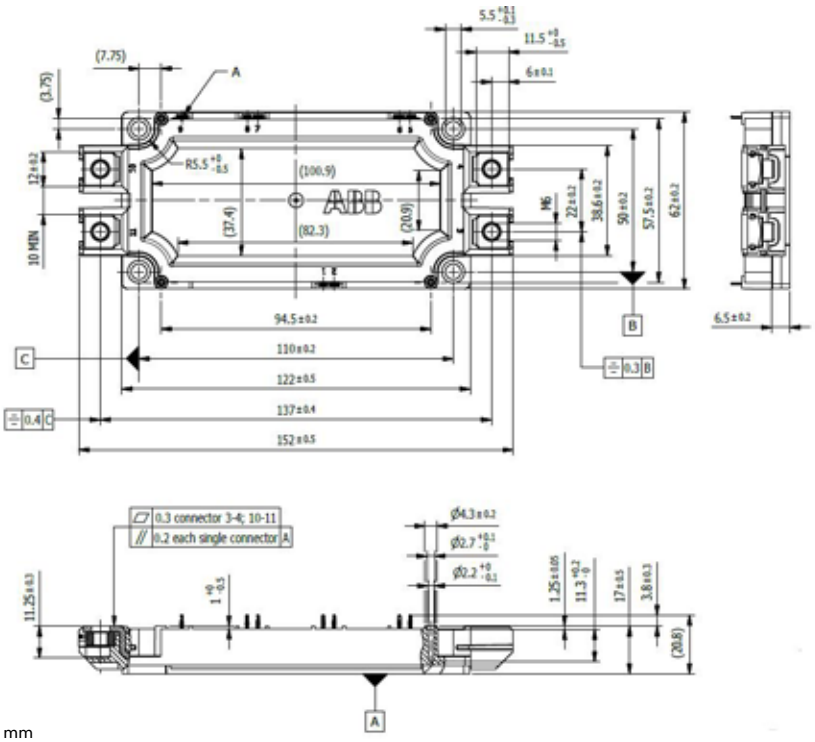
R



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Dimensions in mm

High-power IGBT and diode modules

ABB offers two categories of high-power IGBT and diode modules: Insulated and press-pack modules.

Insulated modules consist of the new innovative, low inductive phase leg LinPak and the well-established HiPak lineup with more than 15 years of successful track record.

Press-pack modules are a range of pressure contact IGBT modules also known as StakPak. StakPaks are ABB's flagship with record power ratings up to 4500 V and 3000 A.

ABB's high-power IGBT and diode module families are:

- LinPak IGBT & SiC MOSFET modules page 16
- HiPak IGBT and diode modules page 18
- StakPak IGBT press-pack modules page 22


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LinPak IGBT & SiC MOSFET modules

The LinPak is a new innovative solution for all power conversion applications. It enables the design of converters with lowest overall inductance, thus fast low switching loss chipsets can be used for the first time also in high-current applications.

These applications include amongst others traction, converters for wind turbines or other renewables, industrial drives, as well as power electronics for FACTS applications. In addition, the LinPak allows very easy parallel connection, thus the current rating of the inverters can be scaled up with just one article number.

This makes the supply chain and initial device design-in efforts significantly more efficient.

Thanks to its exceptional low stray inductance, the LinPak is the ideal package to demonstrate the performance of high-power SiC. ABB offers a SiC demonstrator module for customers to evaluate the SiC performance.

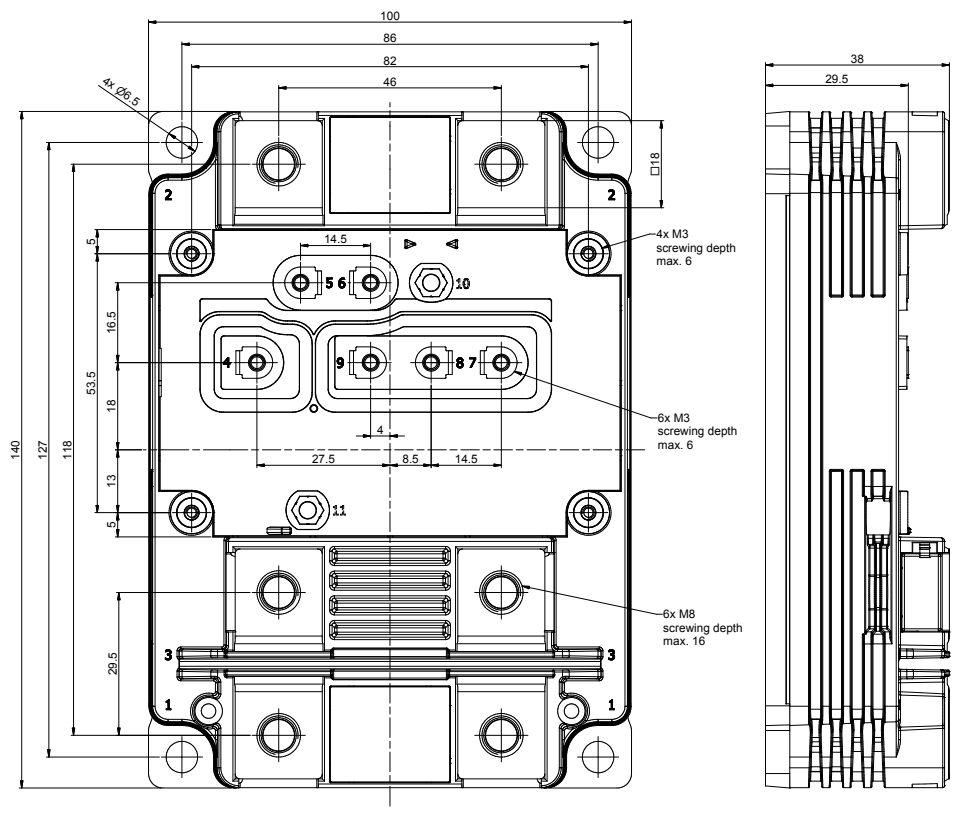
ABB's LinPak modules feature lowest switching losses and excellent robustness thanks to its low inductance.

Part number T_{vj} (operational) up to 175 °C	Voltage V_{CES} (V)	Current I_C (A)	Configuration	V_{CEsat} (V) typ. 125 °C	V_F (V) typ. 125 °C	Housing
1.7 kV						
5SNG 1000X170300	1700	2 x 1000	(5) – Phase leg IGBT	2.55	1.75	X
5SNG 0450X330300	3300	2 x 450	(5) – Phase leg IGBT	3.1	2.25	X

Please refer to page 55 for part numbering structure.
Configurations on page 20

Part number	Voltage V_{DSS} (V)	Current I_D (A)	Configuration *	$R_{DS(on)}$ (mΩ) typ. 25 °C	$R_{DS(on)}$ (mΩ) typ. 150 °C	Housing
5SFG 1100X170100 E.S. *	1700	2 x 1100	(5) – Phase leg MOSFET	2.85	4.4	X

* Contact factory



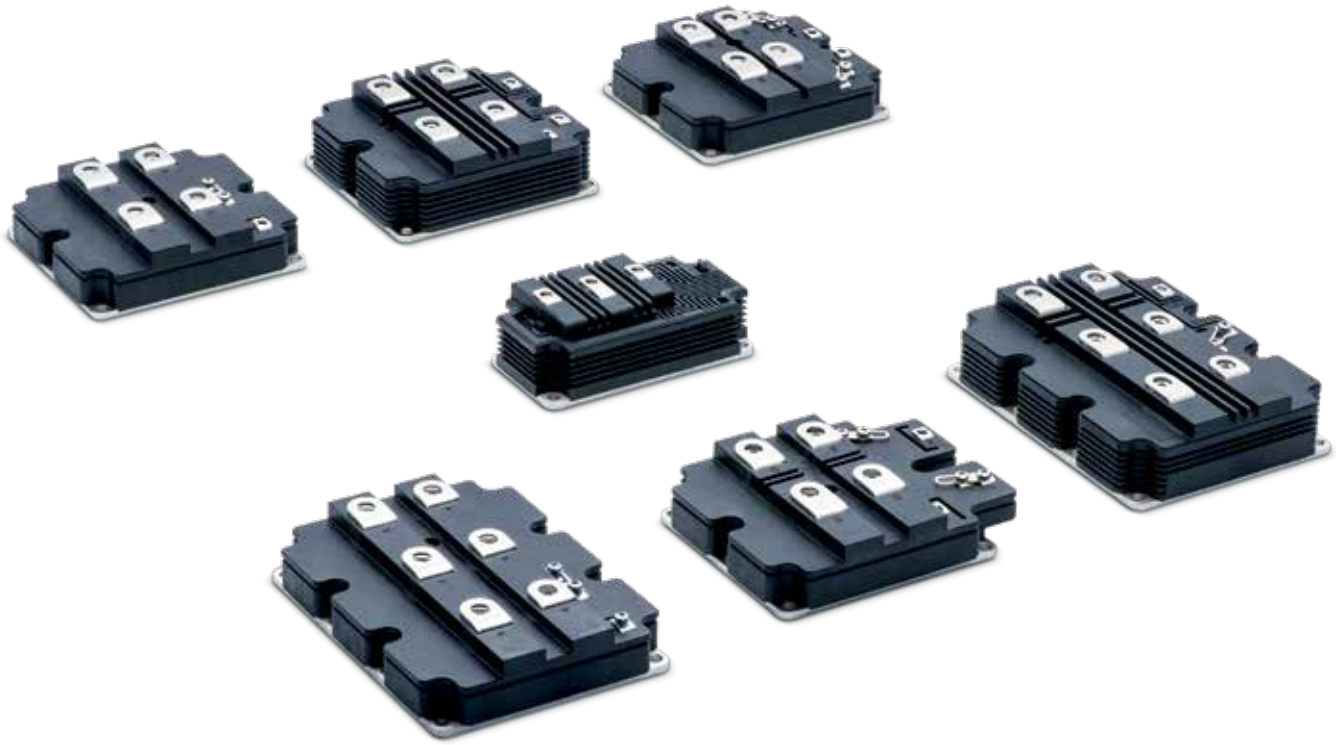
Dimensions in mm

HiPak IGBT and diode modules

Demanding high-power applications such as traction inverters, medium-voltage drives, wind turbine converters, HVDC or FACTS are looking for the highest reliability IGBT modules.

ABB's HiPak family of IGBT modules is the best fit to demanding applications, continuing to set new standards of robustness.

ABB's HiPak IGBT modules are available from 1700 V to 6500 V in various configurations. They all feature low losses combined with soft-switching performance and record-breaking Safe Operating Area (SOA).

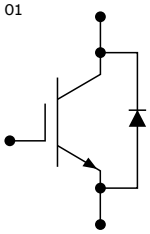


Part number T_{vj} (operational) up to 125 °C	Voltage V_{CES} (V)	Current I_C (A)	Configuration	V_{CEsat} (V) typ. 125 °C	V_F (V) typ. 125 °C	Housing
1.7 kV						
5SND 0800M170100	1700	2 x 800	(3) – Dual IGBT	2.6	1.7	M
5SNE 0800M170100	1700	800	(2) – Chopper	2.6	1.7	M
5SNA 1600N170100	1700	1600	(1) – Single IGBT	2.6	1.7	N1
5SNA 1600N170300	1700	1600	(1) – Single IGBT	2.4	1.67	N1
5SNE 1600E170300	1700	1600	(2) – Chopper	2.4	1.67	E
5SNA 1800E170100	1700	1800	(1) – Single IGBT	2.6	1.7	E
5SNA 2400E170100*	1700	2400	(1) – Single IGBT	2.6	1.7	E
5SNA 2400N170300	1700	2400	(1) – Single IGBT	3.0	1.95	N1
5SNA 2400E170305	1700	2400	(1) – Single IGBT	2.4	1.67	E
5SNE 2400E170300	1700	2400	(2) – Chopper	3.0	1.95	E
5SLA 3600E170300	1700	3600	(6) – Single Diode	–	1.95	E
5SNA 3600E170300	1700	3600	(1) – Single IGBT	3.0	1.95	E
2.5 kV						
5SNA 1500E250300*	2500	1500	(1) – Single IGBT	2.5	2.0	E
3.3 kV						
5SNG 0250P330305	3300	2 x 250	(5) – Phase leg IGBT	3.1	2.25	P
5SND 0500N330300	3300	2 x 500	(3) – Dual IGBT	3.1	2.25	N2
5SLG 0500P330300	3300	2 x 500	(7) – Phase leg Diode	–	2.25	P
5SNA 0800N330100	3300	800	(1) – Single IGBT	3.8	2.35	N1
5SNE 0800E330100	3300	800	(2) – Chopper	3.8	2.35	E
5SNA 1000N330300	3300	1000	(1) – Single IGBT	3.1	2.25	N1
5SNE 1000E330300	3300	1000	(2) – Chopper	3.1	2.25	E
5SLD 1000N330300	3300	2 x 1000	(4) – Dual Diode	–	2.25	N1
5SNA 1200E330100	3300	1200	(1) – Single IGBT	3.8	2.35	E
5SNA 1200G330100	3300	1200	(1) – Single IGBT	3.85	2.35	G
5SLD 1200J330100	3300	2 x 1200	(4) – Dual Diode	–	2.35	J
5SNA 1500E330305	3300	1500	(1) – Single IGBT	3.1	2.25	E
5SNA 1800E330400 **New**	3300	1800	(1) – Single IGBT	2.9	2.20	E
4.5 kV						
5SNG 0150P450300	4500	2 x 150	(5) – Phase leg IGBT	3.5	3.45	P
5SLG 0600P450300	4500	2 x 600	(7) – Phase leg Diode	–	3.5	P
5SNA 0650J450300	4500	650	(1) – Single IGBT	3.7	3.4	J
5SLD 0650J450300	4500	2 x 650	(4) – Dual Diode	–	3.4	J
5SNA 0800J450300	4500	800	(1) – Single IGBT	3.55	3.5	J
5SNE 0800G450300	4500	800	(2) – Chopper	3.55	3.5	G
5SNA 1200G450300	4500	1200	(1) – Single IGBT	3.55	3.5	G
5SNA 1200G450350	4500	1200	(1) – Single IGBT	3.55	3.5	G
5SLD 1200J450350	4500	2 x 1200	(4) – Dual Diode	–	3.5	J
6.5 kV						
5SNA 0400J650100	6500	400	(1) – Single IGBT	5.4	3.4	J
5SNA 0500J650300	6500	500	(1) – Single IGBT	3.9	3.4	J
5SNA 0600G650100	6500	600	(1) – Single IGBT	5.4	3.4	G
5SLD 0600J650100	6500	2 x 600	(4) – Dual Diode	–	3.4	J
5SNA 0750G650300	6500	750	(1) – Single IGBT	3.9	3.4	G
5SNA 1000G650300 **New**	6500	1000	(1) – Single IGBT	4.1	3.3	G

Please refer to page 55 for part numbering structure.
* not for new designs

Configurations

01



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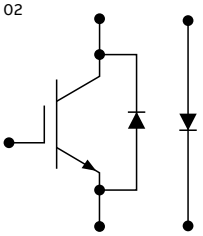

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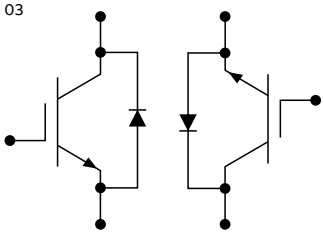

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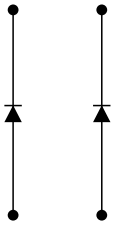

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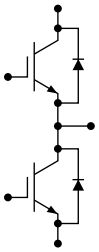

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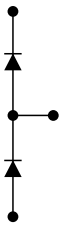

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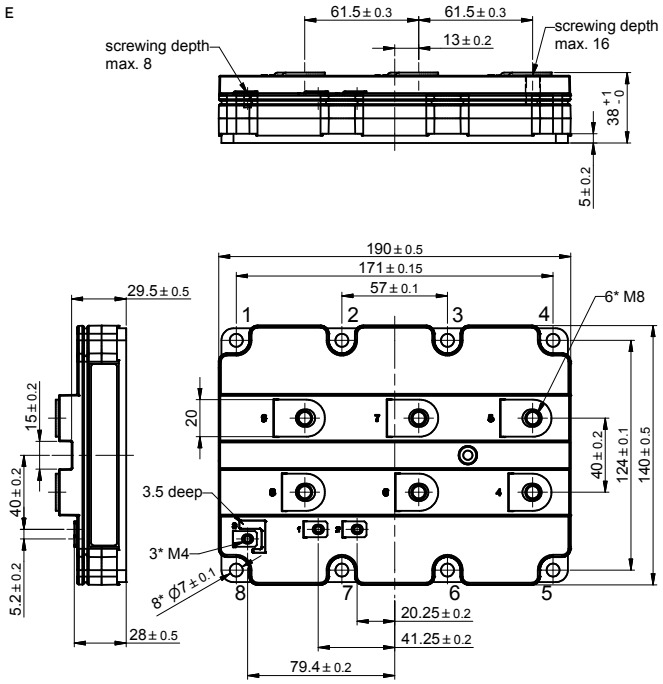

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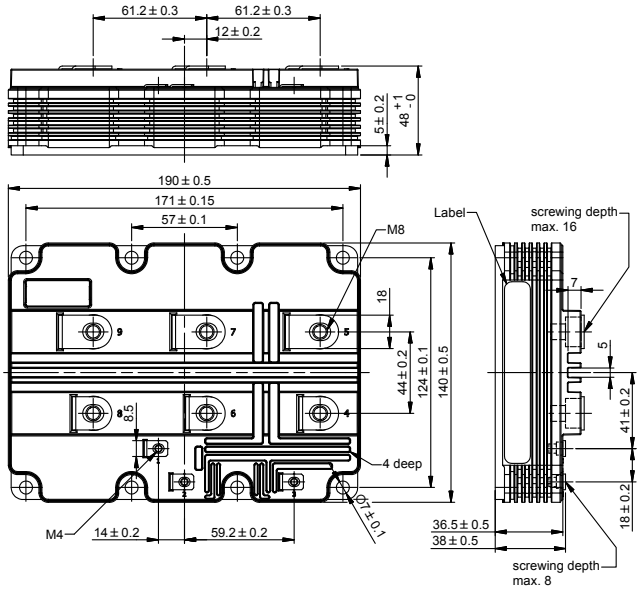

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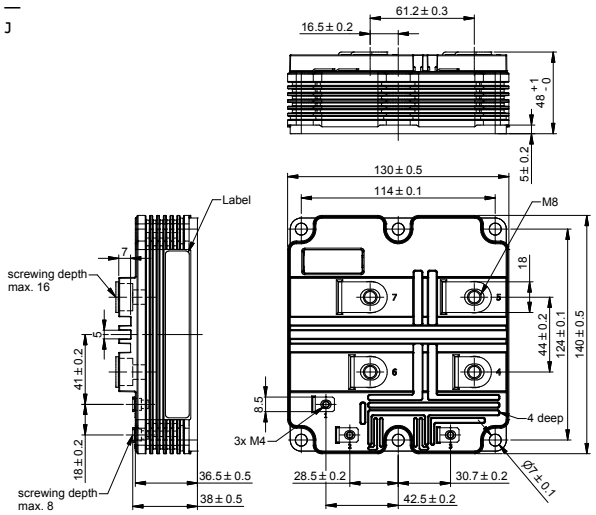

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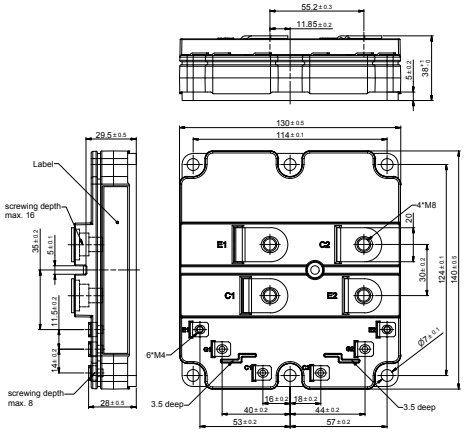

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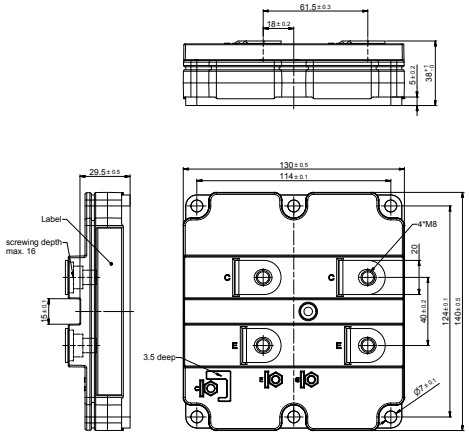

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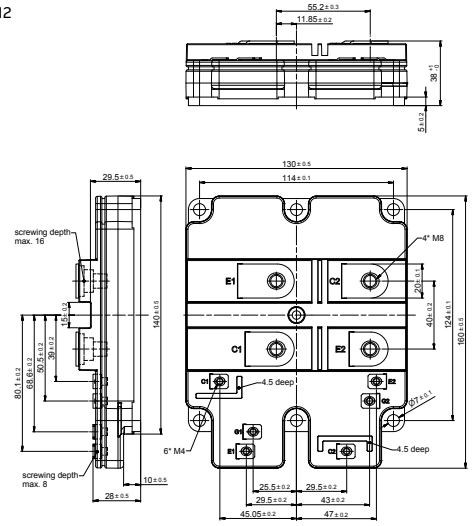

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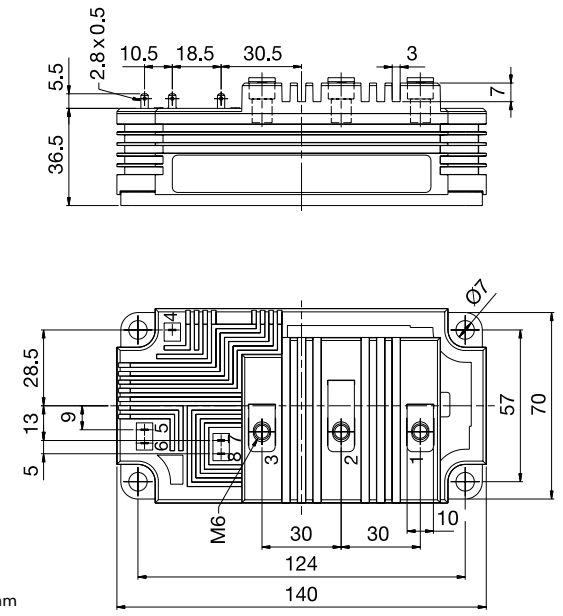

Dimensions in mm

StakPak IGBT press-pack modules

To enhance reliability and reduce cost in systems that require redundancy and series-connected IGBT modules, one should consider using ABB's StakPaks.

ABB's StakPak family uses a well proven concept in IGBT press-pack technology that:

- allows for easy mechanical and electrical series connection
- allows for easy stack design thanks to high tolerance for inhomogeneous mounting pressure
- guarantees a uniform chip pressure in multiple-device stacks
- provides a stable shorted state in case of failure
- long-term short-circuit failure mode (SCFM) available

ABB Semiconductors' StakPak IGBT modules are therefore a perfect match for applications like HVDC, FACTS, breakers and pulsed power.

Part number	Voltage V_{CES} (V)	Current I_C (A)	V_{CEsat} (V) typ. 125 °C	V_F (V) typ. 125 °C	IGBT-to-diode ratio	Housings	SCFM rating
5SNA 1300K450300	4500	1300	3.4	2.4	1:1	K	Yes
5SNA 2000K450300	4500	2000	3.4	2.4	1:1	K	Yes
5SNA 2000K451300	4500	2000	3.65	3.0	2:1	K	Yes
5SNA 2000K452300	4500	2000	3.65	3.0	2:1	K	No
5SNA 3000K452300	4500	3000	3.65	3.0	2:1	K	No
5SMA 3000L450300 **New**	4500	3000	3.1	–	1:0	L	No
5SJA 3000L520300 **New**	5200	3000	3.1	2.5	1:1 (BIGT)	L	No

Please refer to page 55 for part numbering structure.

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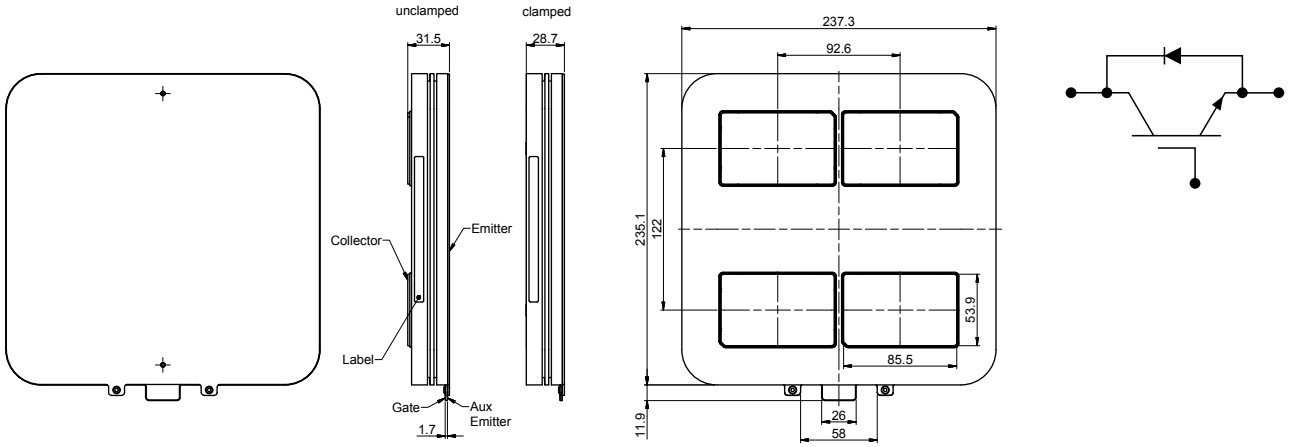
K



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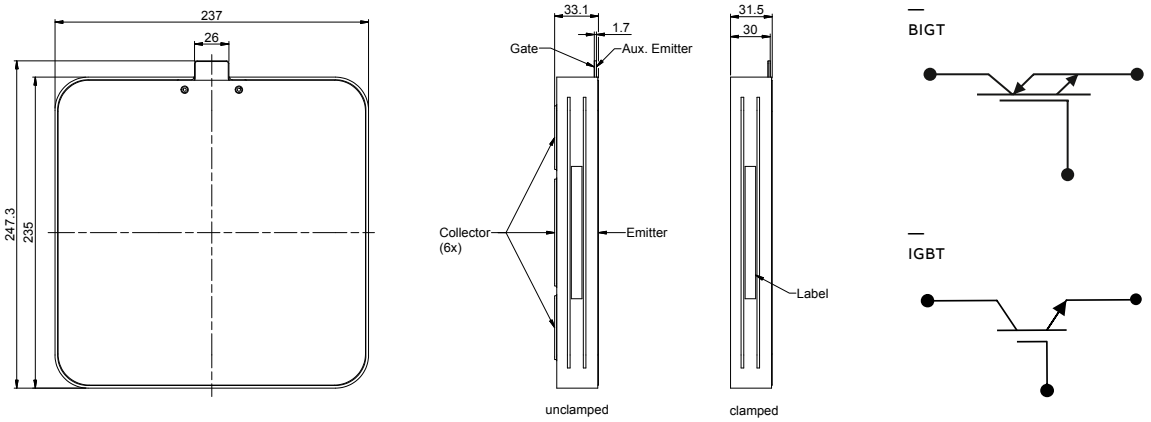


—
BIGT

—
IGBT

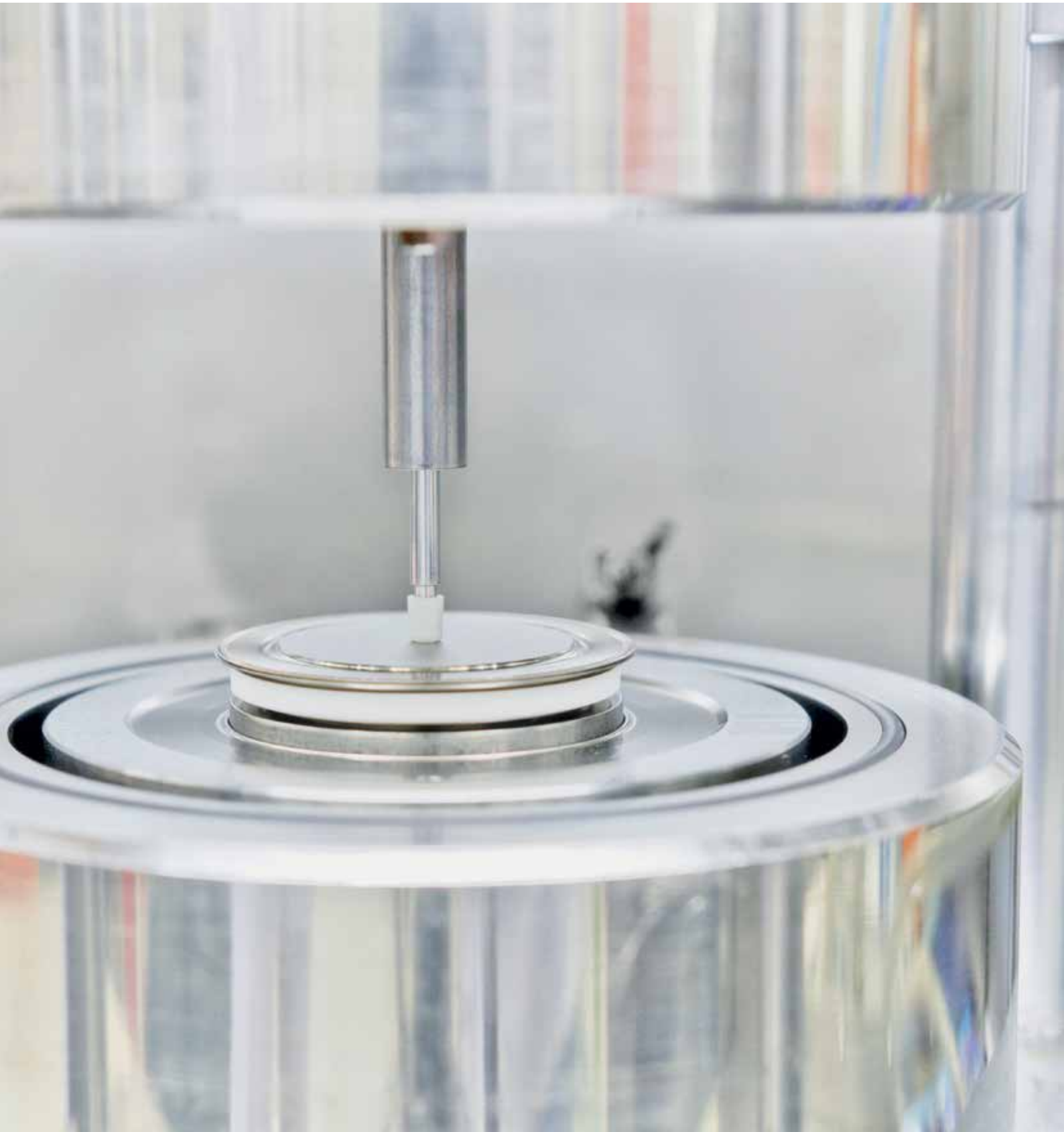
—
Dimensions in mm

Diodes

Diodes are used in a number of different applications. Each of these applications sets different requirements on the diodes' characteristics.

Inverter applications ask for fast recovery diodes with soft-switching characteristics, high-current rectifiers demand diodes with low on-state losses, medium-power rectifiers benefit from diodes with avalanche capability and welding rectifiers require highest current in the smallest package.

ABB offers four press-pack diode families that meet these requirements:



Fast recovery diodes

ABB Semiconductors' comprehensive family of fast recovery diodes is optimized for enhanced Safe Operating Area (SOA) and controlled (soft) turn-off recovery. This makes these diodes very well suited for all converter applications.

ABB has a long history in producing high-power fast recovery diodes for applications such as Voltage Source Inverters (VSIs)- and Current Source Inverters (CSIs). The diodes are typically used in combination with IGCTs and GTOs as free-wheeling and clamp diodes, thus enabling full IGCT and GTO performance.

ABB particularly developed L-housing fast recovery diodes to optimally match press-pack IGBT and IEGT applications where a di/dt of up to 5 kA/µs is required.

Fast recovery diode recommendations for various applications can be found in the ABB application note – Applying fast recovery diodes. The latest version is available at www.abb.com/semiconductors.

GTO free-wheeling diodes

Part number	V_{RRM}	V_{DC}	I_{FAVM}		I_{FSM}	V_{F0}	r_F	I_{rr}	Q_{rr}	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
			T_C = 85 °C	1 ms	10 ms	T_{VJM}		di dt = 300 A/µs						
				T_{VJM}	T_{VJM}			T_{VJM}						
	V	V	A	kA	kA	V	mΩ	A	µC	°C	K/kW	K/kW	kN	
5SDF 13H4501	4500	2800	1200	60.0	25.0	1.30	0.48	800	3000	125	12	3	40	H1
5SDF 10H6004	6000	3800	1100	44.0	18.0	1.50	0.60	1000	6000	125	12	3	40	H1

Drawings see page 30.
Please refer to page 57 for part numbering structure.

IGBT diodes

Part number	V_{RRM}	V_{DC}	I_{FAVM}	I_{FSM}	V_{F0}	r_F	I_{rr}	Q_{rr}	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
			T_C = 70 °C	10 ms	T_{VJM}		di/dt = 5000 A/µs						
				T_{VJM}			T_{VJM}						
	V	V	A	kA	V	mΩ	A	µC	°C	K/kW	K/kW	kN	
5SDF 20L4521	4500	2800	1950	45.0	1.70	0.80	3600	5300	140	6	3	40	L2
5SDF 28L4521	4500	2800	2620	56.0	1.10	0.47	4100	10100	140	6	3	40	L2

IGCT diodes

Part number	V_{RRM}	V_{DC}	I_{FAVM}		I_{FSM}	V_{F0}	r_F	I_{rr}	di/dt	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
			T_C = 70 °C	1 ms	10 ms	T_{VJM}			max.					
				T_{VJM}	T_{VJM}									
	V	V	A	kA	kA	V	mΩ	A	A/µs	°C	K/kW	K/kW	kN	
5SDF 03D4502	4500	2800	275	10.0	5.0	2.15	2.80	355	300	115	40	8	16	D
5SDF 05F4502	4500	2800	435	32.0	16.0	2.42	2.10	610	430	115	17	5	20	F
5SDF 10H4503	4500	2800	1100	47.0	20.0	1.75	0.88	1520	600	125	12	3	40	H1
5SDF 20L4520	4500	2800	1970	–	45.0	1.56	0.80	2400	1200	140	6	3	40	L2
5SDF 28L4520	4500	2800	2620	–	56.0	1.10	0.47	2800	1000	140	6	3	40	L2
5SDF 02D6004	5500	3300	175	8.0	3.0	3.35	7.20	300	220	115	40	8	16	D
5SDF 04F6004	5500	3300	380	22.0	10.0	2.70	2.80	600	340	115	22	5	20	F
5SDF 08H6005	5500	3300	585	40.0	18.0	4.50	1.30	900	440	115	12	3	40	H1

Drawings see page 30.
Please refer to page 57 for part numbering structure.

Standard rectifier and avalanche diodes

ABB's two families of high-power rectifier diodes – standard rectifier diodes and avalanche diodes – are well-known for their outstanding reliability and excellent nominal and surge current capabilities.

The standard rectifier diodes are optimized for line frequency and low on-state losses. Their main applications are rectifiers for large AC drives, aluminum smelting and other metal refining as well as trackside supply.

The avalanche diodes are self-protected against transient overvoltages, offer reduced snubber requirements and feature maximum avalanche power dissipation. They are frequently used for input rectifiers in traction converters or high-voltage power rectifiers.

For safe and easy parallel or series connection, both types of diodes are available in groups of similar V_F or Q_{rr}, respectively.

Avalanche diodes

Part number	V_{RRM}	I_{FAVM}	I_{FSM}	V_{F0}	r_F	P_{RSM}	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
		T_C = 85 °C	10 ms T_{VJM}	T_{VJM}		20µs T_{VJM}					
	V	V	kA	V	mΩ	kw	°C	K/kW	K/kW	kN	
5SDA 11D1702	1700	1310	15.0	0.74	0.25	50	160	40	10	11	D
5SDA 27F2002	2000	2700	31.0	0.79	0.09	100	160	20	5	22	F
5SDA 10D2303	2300	1140	13.5	0.83	0.30	50	160	40	10	11	D
5SDA 24F2303	2300	2350	29.0	0.84	0.13	75	160	20	5	22	F
5SDA 09D2604	2600	1020	11.5	0.87	0.39	50	160	40	10	11	D
5SDA 08D3205	3200	910	9.2	0.93	0.52	50	160	40	10	11	D
5SDA 21F3204	3200	2110	26.0	0.89	0.17	75	160	20	5	22	F
5SDA 07D3806	3800	790	7.6	1.01	0.72	50	160	40	10	11	D
5SDA 16F3806	3800	1620	20.5	1.03	0.32	50	160	20	5	22	F
5SDA 06D5007	5000	690	7.0	1.10	1.01	50	160	40	10	11	D
5SDA 14F5007	5000	1410	17.5	1.13	0.44	50	160	20	5	22	F

Drawings see page 30.
Please refer to page 57 for part numbering structure.

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Standard recovery diodes

Part number	V_{RSM}	V_{RRM}	I_{FAVM}	I_{FSM}	V_{T0}	r_T	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
				10 ms T_{VJM}	T_{VJM}						
	V	A	A	kA	V	mΩ	°C	K/kW	K/kW	kN	
5SDD 70H2000	2000	2000	7030	65.0	0.861	0.046	190	8.0	2.5	50	H2
5SDD 65H2400	2400	2400	6520	59.0	0.870	0.057	190	8.0	2.5	50	H2
5SDD 51L2800	2800	2000	5380	65.0	0.770	0.082	175	8.0	3.0	70	L1
5SDD 60N2800	2800	2000	6830	87.0	0.800	0.050	160	5.7	1.0	90	N
5SDD 60Q2800	2800	2000	7385	87.0	0.800	0.050	160	5.0	1.0	90	Q
5SDD 11T2800	2800	2800	1285	15.0	0.933	0.242	160	32.0	8.0	10	T
5SDD 11D2800	2800	2800	1285	15.0	0.933	0.242	160	32.0	8.0	10	D
5SDD 24F2800	2800	2800	2600	30.0	0.906	0.135	160	15.0	4.0	22	F
5SDD 48H3200	3200	3200	4710	61.0	0.992	0.067	160	8.0	2.5	50	H2
5SDD 54N4000	4000	3600	5200	85.0	0.800	0.086	150	5.7	1.0	90	N
5SDD 40H4000	4000	4000	3847	46.0	0.900	0.133	160	8.0	2.5	50	H2
5SDD 08D5000	5000	5000	1028	12.0	0.894	0.487	160	32.0	8.0	10	D
5SDD 08T5000	5000	5000	1028	12.0	0.894	0.487	160	32.0	8.0	10	T1
5SDD 20F5000	5000	5000	1978	24.0	0.940	0.284	160	15.0	4.0	22	F
5SDD 38H5000	5000	5000	3814	45.0	0.903	0.136	160	8.0	2.5	50	H2
5SDD 36K5000	5000	5000	3638	45.0	0.903	0.136	160	9.2	2.5	50	K
5SDD 33L5500	5500	5000	3480	46.0	0.940	0.147	150	7.0	1.5	70	L1
5SDD 50N5500	5500	5000	4570	73.0	0.800	0.107	150	5.7	1.0	90	N
5SDD 06D6000	6000	6000	662	10.5	1.066	0.778	150	42.0	8.0	11	D
5SDD 10F6000	6000	6000	1363	17.5	1.015	0.407	150	20.0	5.0	22	F
5SDD 14F6000	6000	6000	1363	17.5	1.015	0.407	150	20.0	5.0	22	F
5SDD 31H6000	6000	6000	3246	40.0	0.894	0.166	150	8.0	2.5	50	H2
5SDD 50N6000	6000	6000	4210	71.2	0.800	0.134	150	5.7	1.0	90	N

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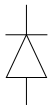
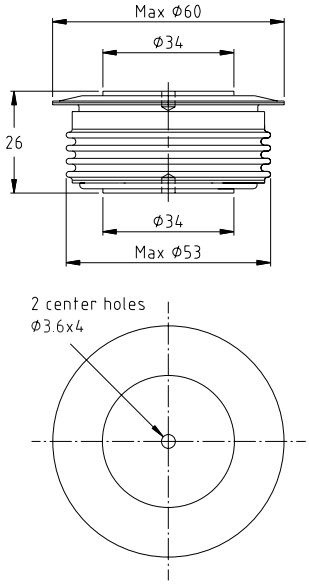
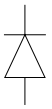
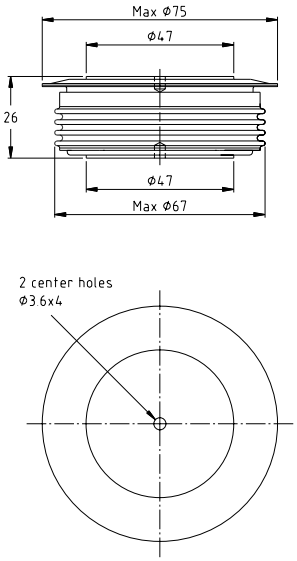
D



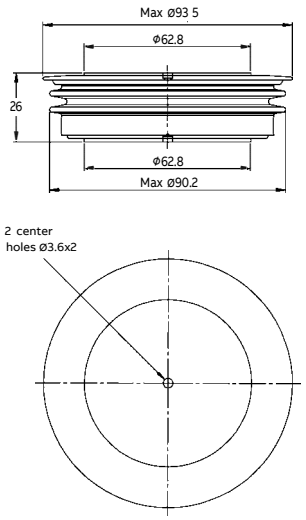

Max Ø60
Ø34
26
Ø34
Max Ø53
2 center holes
Ø3.6x4

—
F

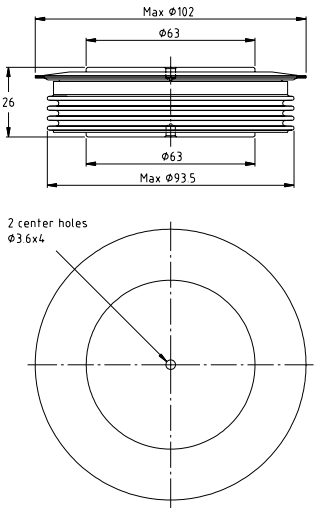



Max Ø75
Ø47
26
Ø47
Max Ø67
2 center holes
Ø3.6x4

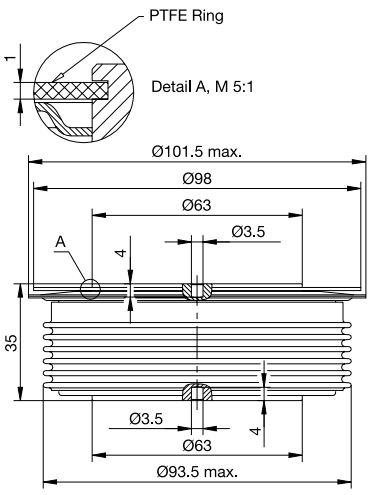
—
H1


Max Ø93.5
Ø62.8
26
Ø62.8
Max Ø90.2
2 center
holes Ø3.6x2

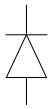
—
H2

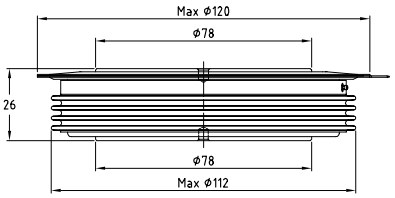

Max Ø102
Ø63
26
Ø63
Max Ø93.5
2 center holes
Ø3.6x4

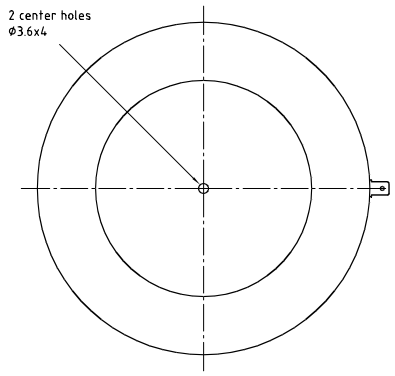
—
K


PTFE Ring
1
Detail A, M 5:1
Ø101.5 max.
Ø98
Ø63
Ø3.5
A
4
35
Ø3.5
4
Ø63
Ø93.5 max.

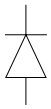
L1

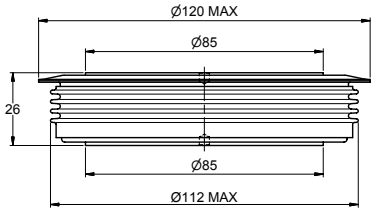


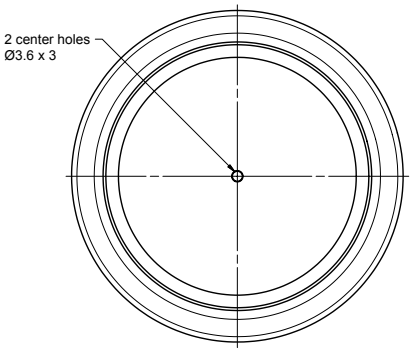




L2







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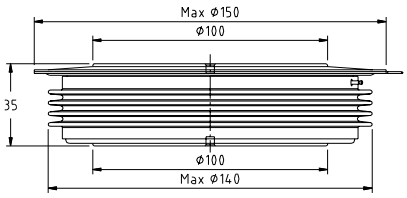

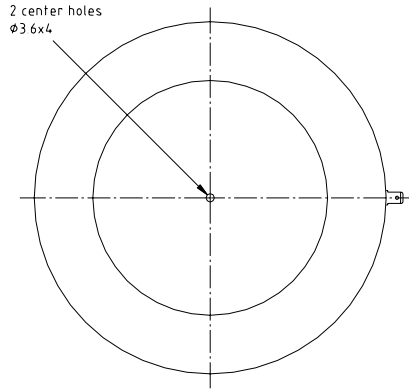

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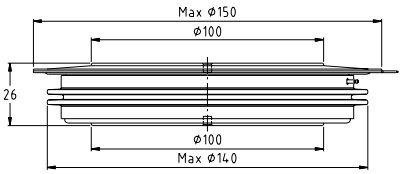

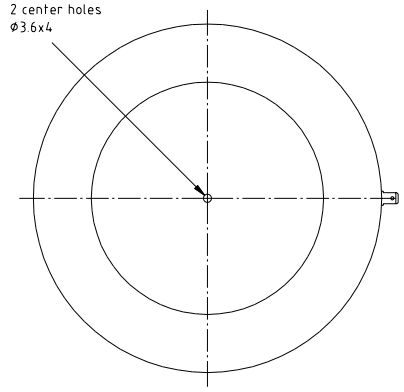

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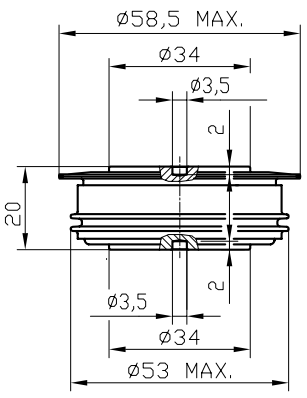


Dimensions in mm

Welding diodes

Almost every second car driving in Europe has been fabricated using ABB welding diodes, as most of the major welding equipment manufacturers rely on ABB's quality, reliability and performance.

ABB's comprehensive product range offers medium frequency (up to 2 kHz) and high frequency (up to 10 kHz) welding diodes. They all feature very low on-state voltage and very low thermal resistance. In addition, they are available in light package, thin and hermetically sealed ceramic housings or even housing-less, another welcomed feature for equipment that is mounted directly on robot arms.

Medium frequency

Part number	V_{RRM}	V_{Fmin}	V_{FMAX}	I_{FAVM}	I_{FSM}	V_{F0}	r_F	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
			T_j = 25 °C, I_F = 5000 A	T_C = 85 °C	10 ms T_{VJM}	T_{VJM}	T_{VJM}					
	V	V	V	A	kA	V	mΩ	°C	K/kW	K/kW	kN	
5SDD 71X0200	200	–	1.05	7110	55	0.74	0.026	170	10.0	5.0	22	X
5SDD 71B0200	200	–	1.05	7110	55	0.74	0.026	170	10.0	5.0	22	B
5SDD 0120C0200	200	–	0.92 *	11000	85	0.75	0.020	170	6.0	3.0	36	C
5SDD 71X0400	400	0.95	1.00	7110	55	0.74	0.026	170	10.0	5.0	22	X
5SDD 71B0400	400	–	1.05	7110	55	0.74	0.026	170	10.0	5.0	22	B
5SDD 0120C0400	400	0.83*	0.88 *	11350	85	0.74	0.018	170	6.0	3.0	36	C
5SDD 92Z0401	400	–	1.03 *	9250	60	0.78	0.031	180	5.6	3.6	22	Z1
5SDD 0105Z0401	400	–	1.01 *	10502	70	0.812	0.026	180	5.0	2.5	30	Z2
5SDD 0135Z0401	400	–	0.92 *	13500	85	0.758	0.021	180	3.9	2.6	35	Z3

* at 8000 A, T_{VJM}

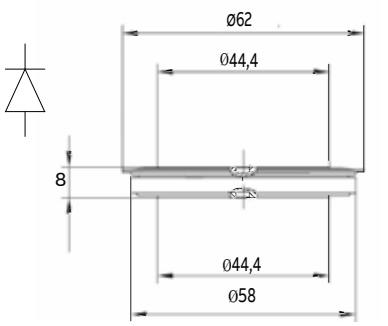
High frequency

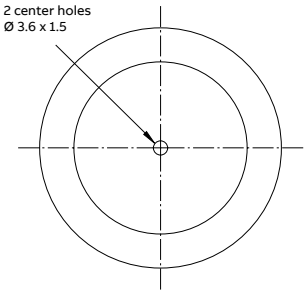
Part number	V_{RRM}	V_{FMAX}	I_{FAVM}	I_{FSM}	V_{F0}	r_F	Q_{rr}	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
		T_{VJM} I_F = 5000 A	T_C = 85 °C	10 ms T_{VJM}	T_{VJM}	T_{VJM}	T_{VJM}					
	V	V	A	kA	V	mΩ	µC	°C	K/kW	K/kW	kN	
5SDF 63B0400	400	1.14	6266	44	0.96	0.036	180	190	10.0	5.0	22	B
5SDF 63X0400	400	1.14	6266	44	0.96	0.036	180	190	10.0	5.0	22	X
5SDF 90Z0401	400	1.13	9041	48	0.98	0.032	200	190	5.6	3.6	22	Z1
5SDF 0102C0400	400	1.14 *	10159	70	0.98	0.022	300	190	6.0	3.0	35	C
5SDF 0103Z0401	400	1.20 *	10266	54	1.00	0.027	230	190	5.0	2.5	30	Z2
5SDF 0131Z0401	400	1.14 *	13058	70	0.98	0.022	300	190	3.9	2.6	35	Z3

* at 8000 A

Please refer to page 57 for part numbering structure.

B





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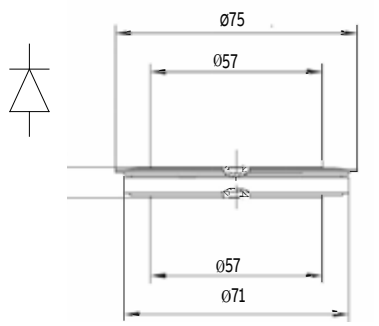

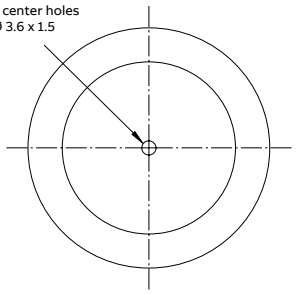

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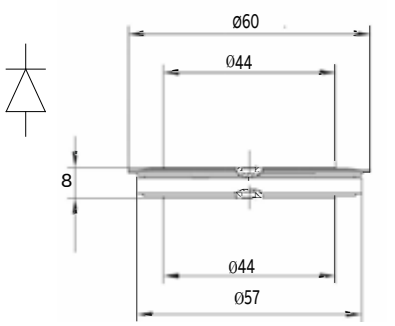

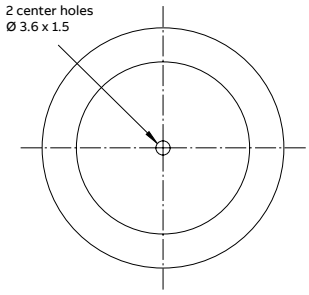

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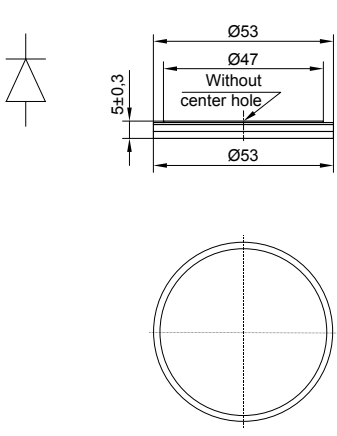

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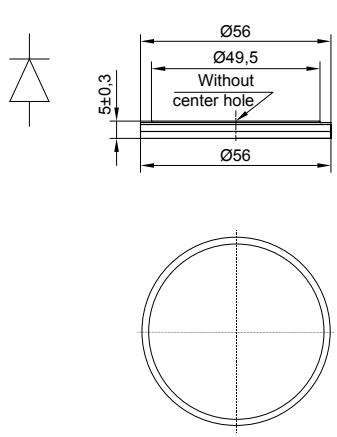

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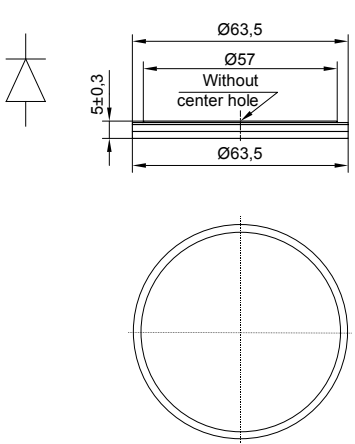


Dimensions in mm

Thyristors

High-power thyristors are used in applications ranging from 100 kW drives up to HVDC stations rated above 10 GW.

Since many applications use antiparallel connected thyristors, ABB has introduced the bi-directionally controlled thyristor (BCT), which consists of two integrated antiparallel thyristor functions on one silicon wafer.

ABB offers the following thyristor families:

- Phase control thyristors (PCTs) page 35
- Bi-directionally controlled thyristors (BCTs) page 40

PCTs
Phase control thyristors

ABB Semiconductors' phase control thyristor has been the backbone of the high-power electronics industry since its introduction almost 50 years ago and has set benchmark reliability records over many years.

The field of PCT applications ranges from kW drives and MW rated line commutated frequency converters to GW converters for HVDC transmission.

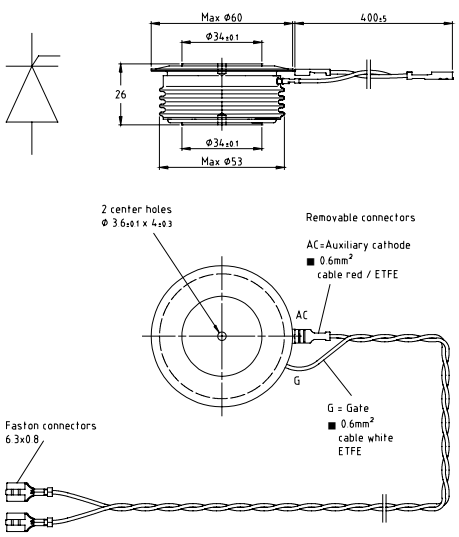
ABB was the first company to introduce 6" thyristor products and offers the most complete range of high-power thyristors. New thyristor products continue to be developed with focus on minimizing overall losses and maximizing the power rating of the device.

Applications using two antiparallel thyristors can take advantage of ABB's innovative bi-directionally controlled thyristors (BCTs) that incorporate two antiparallel thyristors in a single housing (see page 40).

Part number	V_{DRM}, V_{RRM}	I_{TAVM}	I_{TSM}	V_{T0}	r_T	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
	T_{VJM}	T_C = 70 °C	10 ms / T_{VJM}	T_{VJM}						
	V	A	kA	V	mΩ	°C	K/kW	K/kW	kN	
5STP 07D1800	1800	730	9.0	0.80	0.540	125	36.0	7.5	10	D
5STP 18F1800	1800	1660	21.0	0.83	0.230	125	17.0	4.0	22	F
5STP 27H1800	1800	3000	50.5	0.88	0.103	125	10.0	2.0	50	H
5STP 42L1800	1800	4170	64.0	0.85	0.082	125	7.0	1.5	70	L
5STP 50Q1800	1800	6100	94.0	0.90	0.050	125	5.0	1.0	90	Q
5STP 06D2800	2800	620	8.8	0.92	0.780	125	36.0	7.5	10	D
5STP 16F2800	2800	1400	18.0	0.82	0.370	125	17.0	4.0	22	F
5STP 24H2800	2800	2625	43.0	0.85	0.160	125	10.0	2.0	50	H
5STP 33L2800	2800	3740	65.5	0.95	0.100	125	7.0	1.5	70	L
5STP 45N2800	2800	5080	77.0	0.86	0.070	125	5.7	1.0	90	N
5STP 45Q2800	2800	5490	77.0	0.86	0.070	125	5.0	1.0	90	Q
5STP 04D4200	4200	470	7.1	1.00	1.500	125	36.0	7.5	10	D
5STP 12F4200	4200	1150	17.3	0.95	0.575	125	17.0	4.0	22	F
5STP 18H4200	4200	2192	32.0	1.25	0.191	125	10.0	3.0	50	H
5STP 28L4200	4200	3170	54.0	0.97	0.158	125	7.0	1.5	70	L
5STP 38N4200	4200	3960	64.5	0.95	0.130	125	5.7	1.0	90	N
5STP 38Q4200	4200	4275	64.5	0.95	0.130	125	5.0	1.0	90	Q
5STP 04D5200	5200	440	6.1	1.20	1.600	125	36.0	7.5	10	D
5STP 17H5200	5200	1975	34.0	1.02	0.320	125	10.0	2.0	50	H
5STP 25L5200	5200	2760	50.5	1.00	0.225	125	7.0	1.5	70	L
5STP 25M5200	5200	2379	50.5	1.00	0.225	125	9.0	1.5	70	M
5STP 34N5200	5200	3600	63.0	1.03	0.160	125	5.7	1.0	90	N
5STP 34Q5200	5200	3875	63.0	1.03	0.160	125	5.0	1.0	90	Q
5STP 52U5200	5200	5120	99.0	1.04	0.115	125	4.0	0.8	135	U
5STP 03D6500	6500	380	4.7	1.20	2.300	125	36.0	7.5	10	D
5STP 03X6500	6500	350	4.7	1.20	2.300	125	45.0	7.5	10	X
5STP 08F6500	6500	830	15.1	1.24	1.015	125	17.0	4.0	22	F
5STP 08G6500	6500	720	15.1	1.24	1.015	125	22.0	4.0	22	G
5STP 12K6500	6500	1370	31.5	1.18	0.632	125	11.0	2.0	50	K
5STP 18M6500	6500	1800	47.5	1.20	0.430	125	9.0	1.5	70	M
5STP 26N6500	6500	2810	65.0	1.12	0.290	125	5.7	1.0	90	N
5STP 42U6500	6500	4250	86.0	1.24	0.162	125	4.0	0.8	135	U
5STP 48Y7200	7200	4840	92.0	1.06	0.115	110	3.0	0.6	190	Y
5STP 27N8500 **New**	8500	2450	64.0	1.09	0.420	125	5.7	1.0	90	N
5STP 27Q8500 **New**	8500	2630	64.0	1.09	0.420	125	5.0	1.0	90	Q
5STP 45Y8500	8500	4240	90.0	1.10	0.160	110	3.0	0.6	190	Y

Please refer to page 56 for part numbering structure.

D



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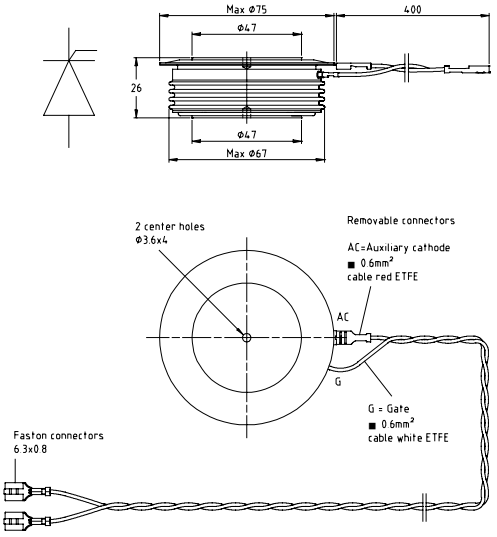

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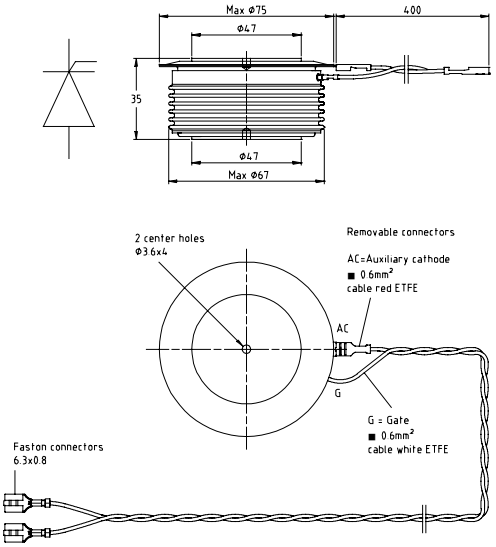

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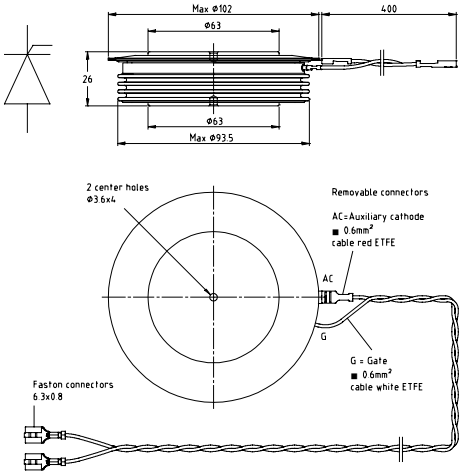

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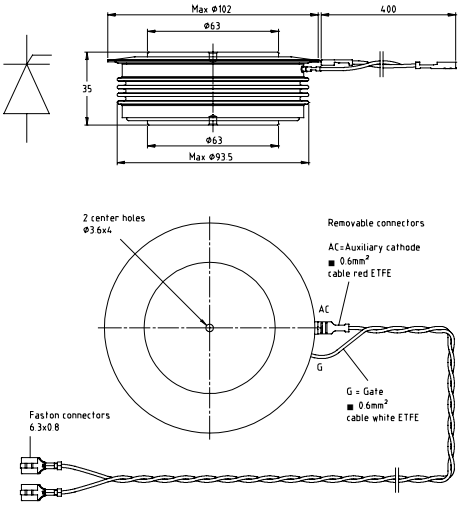

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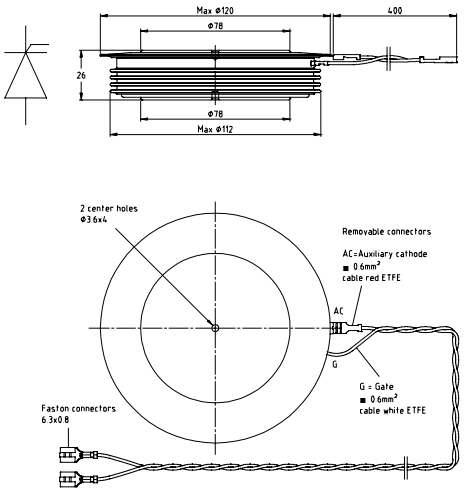
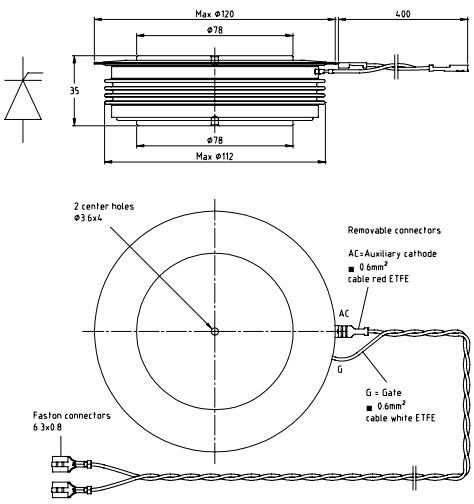


Dimensions in mm

M



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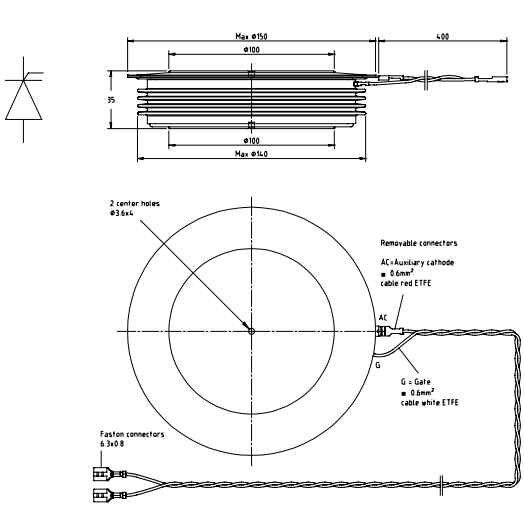

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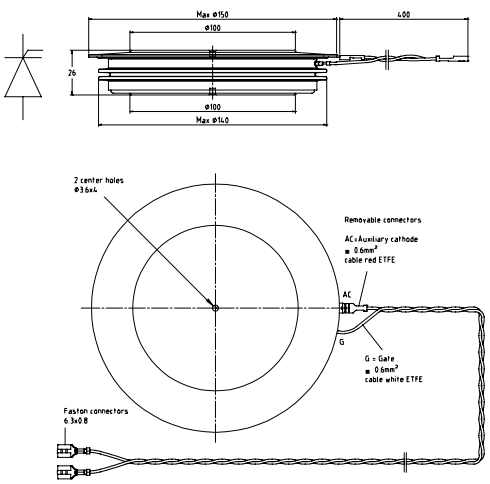

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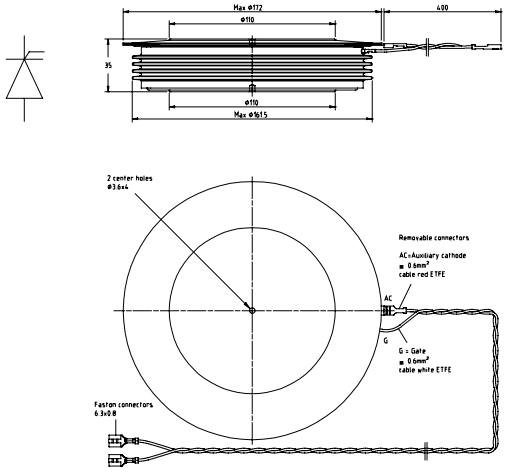

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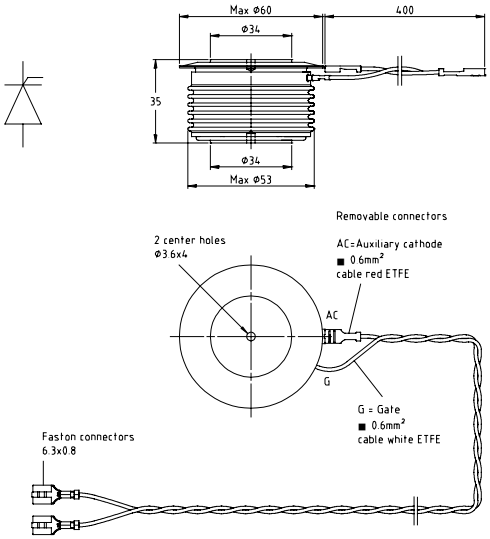

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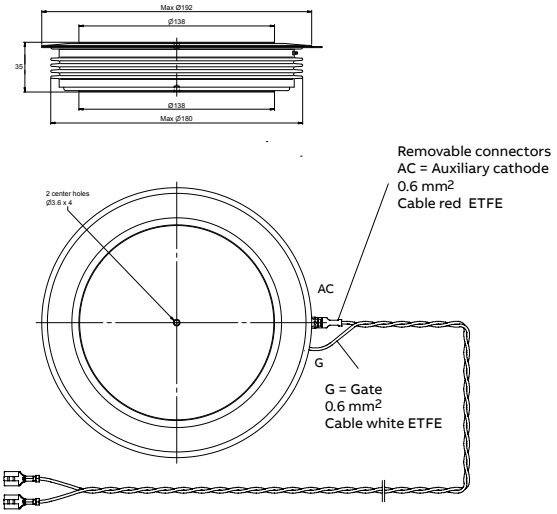


Dimensions in mm

BCTs
Bi-directionally controlled thyristors

Improved volume consumption and reduced part count for SVC, 4-quadrant DC-drive or soft starter equipment in the magnitude of 25 percent compared with equally rated PCT-solutions are possible with ABB's BCTs – without jeopardizing reliability and performance.

ABB's innovative bi-directionally controlled thyristor (BCT) features two monolithically integrated antiparallel thyristors in a single housing. The two thyristor halves are individually triggered and have a separation region enabling the design of high-voltage devices with the dynamic capability of discrete devices.

The BCT is designed, manufactured and tested using the same philosophy, technology and equipment as the well-established PCT (page 35), thus reaching the same levels of performance and reliability.

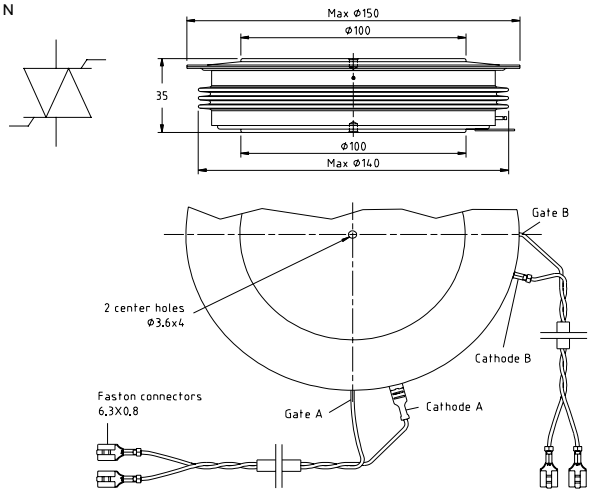
A table of replacement of PCTs by BCTs is given in the BCT application note which can be found at www.abb.com/semiconductors.

Part number	V_{RM}	I_{TRMS}*	I_{TAVM}	I_{TSM}	V_{T0}	r_T	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
	T_{VJM}	T_C = 70 °C	T_C = 70 °C	10 ms T_{VJM}	T_{VJM}						
	V	A	A	kA	V	mΩ	°C	K/kW	K/kW	kN	
5STB 24N2800	2800	5400	2430	43.0	0.85	0.160	125	11.4	2.0	90	N
5STB 24Q2800	2800	5840	2630	43.0	0.85	0.160	125	10.0	2.0	90	Q
5STB 18N4200	4200	4260	1920	32.0	0.96	0.285	125	11.4	2.0	90	N
5STB 17N5200	5200	4000	1800	29.0	1.02	0.320	125	11.4	2.0	90	N
5STB 25U5200	5200	4400	1980	42.0	1.06	0.219	110	8.5	1.6	135	U
5STB 13N6500	6500	3120	1405	22.0	1.20	0.600	125	11.4	2.0	90	N
5STB 18U6500	6500	3510	1580	29.7	1.20	0.458	110	8.5	1.6	135	U

* AC full-wave

Please refer to page 56 for part numbering structure.

N



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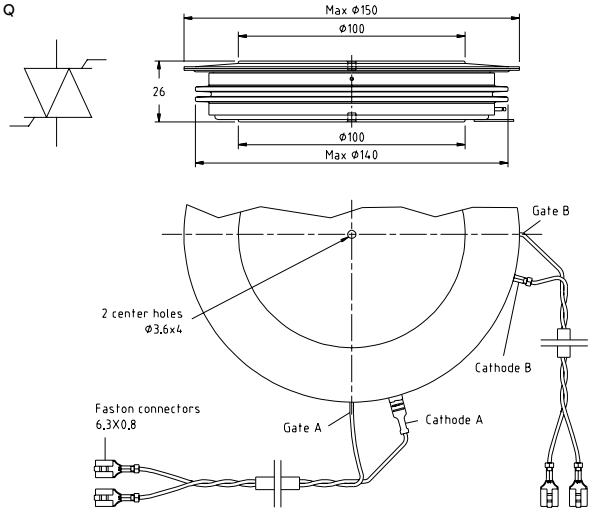

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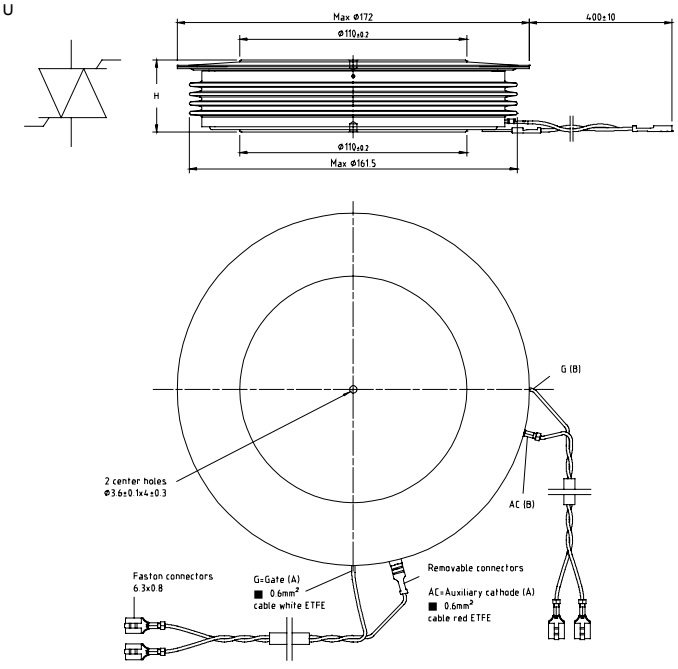


Dimensions in mm

IGCTs
Integrated gate-commutated thyristors

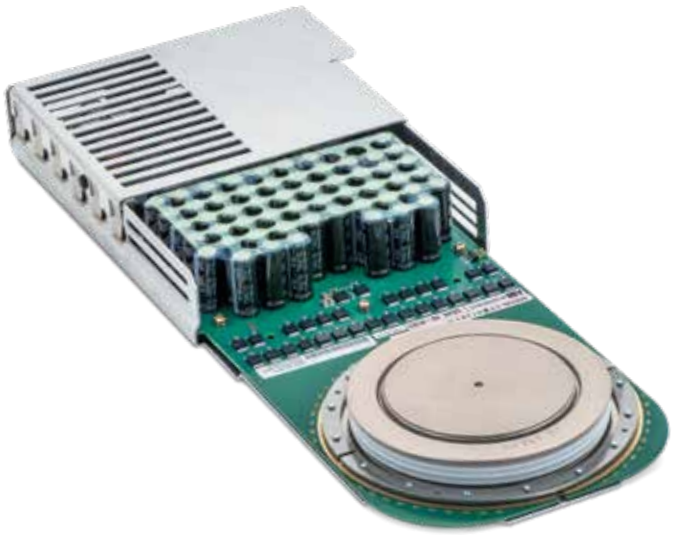
Within 20 years of its introduction, the IGCT has established itself as the semiconductor of choice for high-power frequency converters by meeting the requirements of today's demanding applications.

ABB Semiconductors' IGCTs are used in a multitude of applications due to their versatility, efficiency and cost-effectiveness. With their low on-state voltage, they achieve the lowest running costs by reaching inverter efficiencies of 99.6 percent and more.

Single inverters of over 15 MVA can be realized without series or parallel connection, thus achieving the highest inverter power densities in the industry.

The number of applications featuring IGCTs is manifold: medium-voltage drives (MVDs), marine drives, co-generation, wind power converters and STATCOMs, to name just a few.

The latest record performance using IGCTs was achieved with the world's most powerful frequency converter (100 MVA) for variable speed pumped hydropower application that ABB has installed to the Grimsel 2 power plant in the Swiss Alps.



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Asymmetric IGCTs

Part number	V_{DRM}	V_{DC}	V_{RRM}	I_{TGQM}	I_{TAVM}	I_{TSM}		V_T	V_{T0}	r_T	T_{VJM}	R_{thJC}	R_{thCH}	F_m	V_{GIN}	Outline
					T_C = 85 °C	3 ms T_{VJM}	10 ms T_{VJM}	4000 A T_{VJM}	T_{VJM}	T_{VJM}						
	V	V	V	A	A	kA	kA	V	V	mΩ	°C	K/kW	K/kW	kN	V	
5SHY 35L4520	4500	2800	17	4000	1700	50	32	2.70	1.40	0.33	125	8.5	3	40	28-40	Fig. 1
5SHY 35L4521	4500	2800	17	4000	1700	50	32	2.70	1.40	0.33	125	8.5	3	40	28-40	Fig. 1
5SHY 35L4522	4500	2800	17	4000	2100	56	35	2.00	1.15	0.21	125	8.5	3	40	28-40	Fig. 1
5SHY 45L4520 **New**	4500	2800	17	4500	1430	39	28	2.60*	1.70	0.45	125	8.5	3	40	28-40	Fig. 1
5SHY 55L4500	4500	2800	17	5000	1870	50	33	2.35	1.22	0.28	125	8.5	3	40	28-40	Fig. 1
5SHY 50L5500	5500	3300	17	3600	1290	40	26	4.10	1.66	0.62	125	8.5	3	40	28-40	Fig. 1
5SHY 42L6500	6500	4000	17	3800	1290	40	26	4.10	1.88	0.56	125	8.5	3	40	28-40	Fig. 1

- Optimized for snubberless turn-off
- Contact factory for series connection
* at 2000 A

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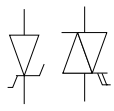
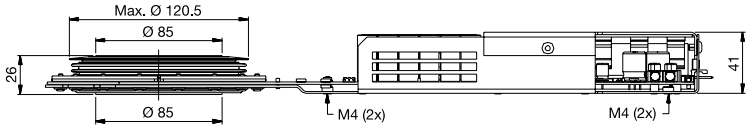
Reverse conducting IGCTs

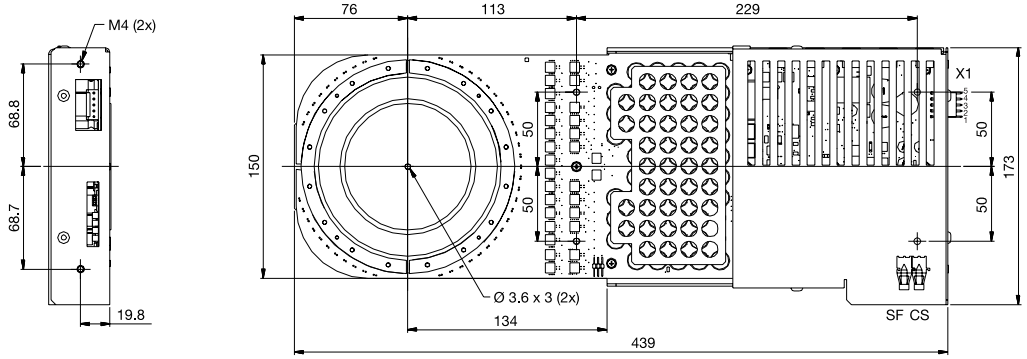
Part number	V_{DRM}	V_{DC}	I_{TGQM}	I_{TAVM}/I_{FAVM}	I_{TSM}/I_{FSM}	V_T/V_F	$V_{T0}V/_{F0}$	r_T/r_F	di/dt max.	I_{rr}	T_{VJM}	R_{thJC}	F_m	V_{GIN}	Outline
				T_C = 85 °C	10 ms T_{VJM}	I_{TGQM} T_{VJM}	T_{VJM}								
	V	V	A	A	kA	V	V	mΩ	A/µs	A	°C	K/kW	kN	V	
5SHX 26L4520 GCT	4500	2800	2200	1010	17.0	2.95	1.80	0.53				13			
Diode part				390	10.6	5.40	2.70	1.24	650	900	125	26	44	28-40	Fig. 1
5SHX 19L6020 GCT	5500	3300	1800	840	18.0	3.45	1.90	0.90				13			
Diode part				340	7.7	6.40	2.70	2.23	510	780	125	26	44	28-40	Fig. 1

- Monolithically integrated free-wheeling diode optimized for snubberless turn-off
Please refer to page 56 for part numbering structure.

—
Fig.1







—
Dimensions in mm

Fast recovery diode recommendation
For all asymmetric and reverse conducting IGCTs, ABB offers matching free-wheeling, neutral point (NPC) and clamp diodes.

The actual choice of the diode depends on the specific application. Please see application note 5SYA 2064, Applying fast recovery diodes, on www.abb.com/semiconductors.

GTOs
Gate turn-off thyristors

One might be assuming that the rapid advance of the IGBT would spell an equally rapid end to the GTO era. The demand for these devices, however, is still strong today.

ABB offers a broad portfolio of asymmetric GTOs with proven field reliability in various traction and industrial applications.

Asymmetric GTOs are divided in two categories: Fine pattern and standard. Fine pattern GTOs with buffer layer have exceptionally low on-state and dynamic losses and are optimized for fast switching.

Asymmetric GTOs

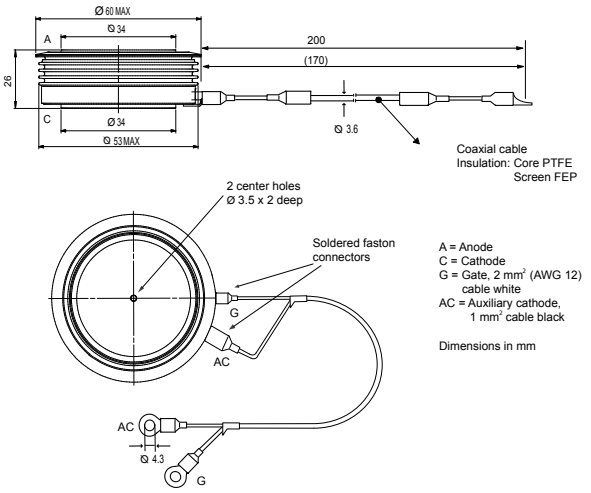
Part number	V_{DRM}	V_{DC}	V_{RRM}	I_{TGQM} at C_S		I_{TAVM}	I_{TSM}	V_T	V_{T0}	r_T	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Outline
						T_C = 85 °C	10 ms T_{VJM}	I_{TGQM} T_{VJM}	T_{VJM}						
	V	V	V	A	µF	A	kA	V	V	mΩ	°C	K/kW	K/kW	kN	
5SGA 15F2502	2500	1400	17	1500	3	570	10.0	2.80	1.45	0.90	125	27	8	15	F
5SGA 20H2501	2500	1400	17	2000	4	830	16.0	2.80	1.66	0.57	125	17	5	20	H
5SGA 25H2501	2500	1400	17	2500	6	830	16.0	3.10	1.66	0.57	125	17	5	20	H
5SGA 30J2501	2500	1400	17	3000	5	1300	30.0	2.50	1.50	0.33	125	12	3	40	J
5SGA 06D4502	4500	2800	17	600	1	210	3.0	4.00	1.90	3.50	125	50	8	11	D
5SGA 20H4502	4500	2200	17	2000	4	710	13.0	3.50	1.80	0.85	125	17	5	20	H
5SGA 30J4502	4500	2800	17	3000	6	930	24.0	4.00	2.20	0.60	125	12	3	40	J
5SGA 40L4501	4500	2800	17	4000	6	1000	25.0	4.40	2.10	0.58	125	11	3	40	L

Asymmetric fine pattern GTOs with buffer layer

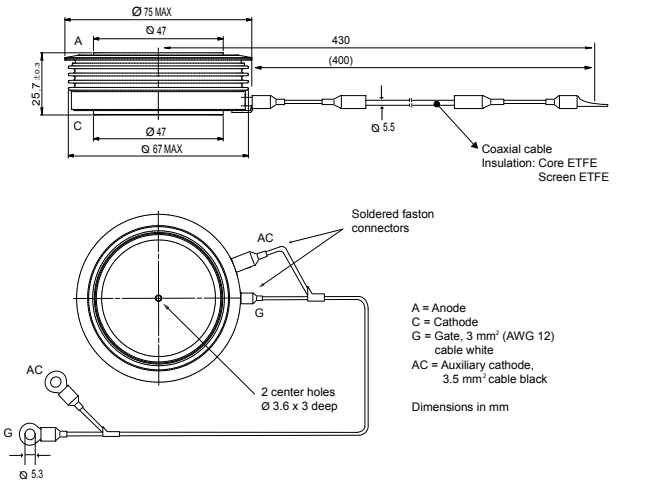
5SGF 30J4502	4500	3000	17	3000	3	960	24.0	3.90	1.80	0.70	125	12	3	33	J
5SGF 40L4502	4500	2800	17	4000	6	1180	25.0	3.80	1.20	0.65	125	11	3	33	L

Please refer to page 56 for part numbering structure.

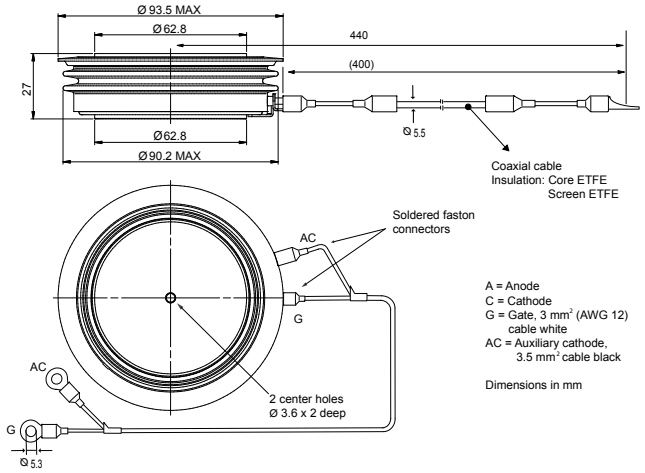
D



F



H



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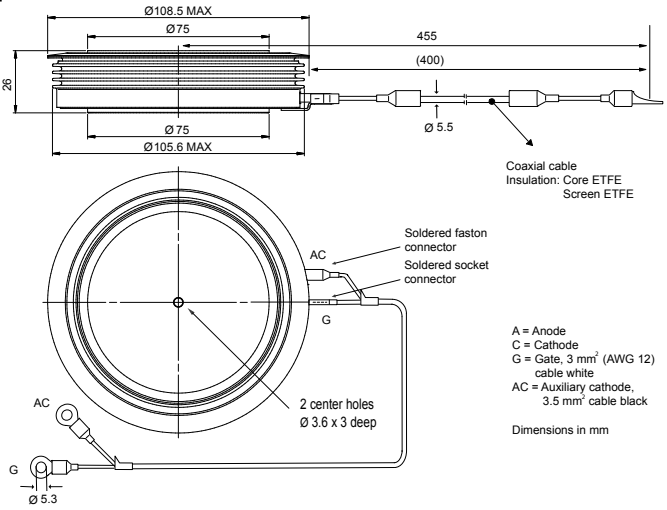
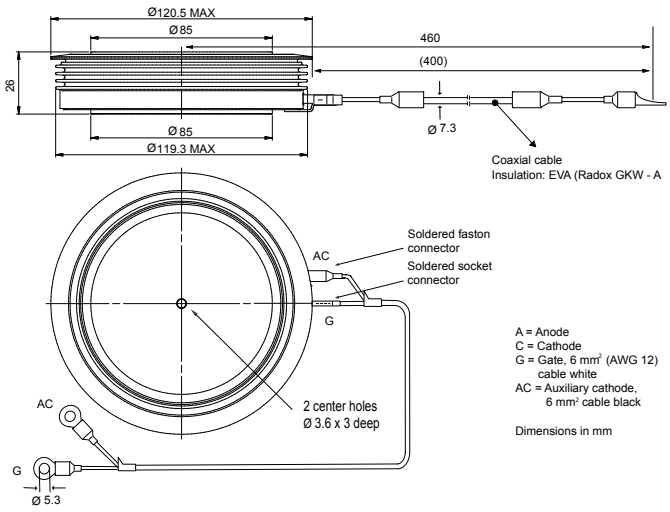


L



Dimensions in mm

Fast recovery diode recommendation
For all GTO types, ABB offers matching free-wheeling and snubber diodes.
The actual choice of the diode depends on the specific application.
Please see application note 5SYA 2064, Applying fast recovery diodes, on www.abb.com/semiconductors.

Test systems for high-power semiconductors

ABB Semiconductors is well known as one of the leading suppliers of power semiconductors. Good to know that ABB Semiconductors also designs, manufactures and offers CE compliant customized power semiconductor test systems.

More than 30 years of experience and proximity to semiconductor development, production and application enable ABB to offer test systems for various environments like research & development, laboratory, production or failure analysis. Highest quality assurance, safe handling, as well as remote or on-site service capability are guaranteed.

High-power semiconductor test systems
ABB offers static and dynamic production test systems for most types of power semiconductor devices like diodes, PCTs, BCTs, GTOs, IGCTs and IGBTs. They can handle dies, substrates, submodules, modules, wafers and press-pack devices. Also reliability test systems for high temperature reverse bias, intermittent operating life or surge current tests are available.
Auxiliary tester parts include clamping, capacitor discharge, pre-heating, data acquisition and parameter extraction units as well as programmable IGBT and thyristor gate units.

Parameters
The ABB test systems cover the range of up to 14 kV and 10 kA and use configurable stray inductances down to 60 nH. During testing, the clamped device under test (DUT) can be precisely heated up to 200 °C for production systems or cooled down to -40 °C in an environmental chamber for engineering systems. The clamping units can handle devices up to 240 mm in diameter and can apply a clamping force of up to 240 kN.

Automation
Our test systems are designed for easy integration into automated handling equipment. The test system's software is compatible to commercial control systems such as manufacturing execution systems (MES) and computer-aided quality assurance (CAQ).

	Blocking voltage AC or DC	Gate characteristics	On-state, forward voltage	Reverse recovery charge	Critical dV/dt	Circuit-commutated turn-off time	V_{cesat} / $V_{pinch-off}$	Turn-on / turn-off
Bipolar test systems 4.5 kV								
Thyristor and diode static / dynamic	X	X	X	X	X	X		
GTO and diode static	X	X	X					X
GTO and diode dynamic	X			X				X
IGBT test systems								
IGBT and diode dies static	X	X					X	
IGBT and diode substrates static / dynamic	X	X		X			X	X
IGBT and diode modules static	X	X					X	
IGBT and diode modules dynamic				X				X
Baseplates flatness								

Reliability test systems
- High temperature reverse bias
- Intermittent operating life
- Surge current

Auxiliary unit
- Clamping unit
- Capacitor discharge unit
- Pre-heating unit
- Programmable IGBT and thyristor gate units
- Data acquisition and parameter extraction units

Further information
Certificates

ABB is committed to the highest ethical, environmental and business standards. ABB Semiconductors has been awarded the ISO certifications for manufacturing, design and development of high-power semiconductor devices and modules (ISO 9001, 14001 and OHSAS 18001).


BUREAU VERITAS
Certification

Certificate
for

ABB Switzerland Ltd.
Fabrikstrasse 3, 5600 Lenzburg / Switzerland

SN EN ISO 9001:2015

Design, development, manufacturing, marketing and sales of power semiconductors devices and modules

Design, development, manufacturing, marketing and sales of test systems for power semiconductors


BUREAU VERITAS
Certification

Certificate
for

ABB Schweiz AG, Semiconductors
Fabrikstrasse 3, 5600 Lenzburg / Switzerland

SN EN ISO 14001:2015
BS OHSAS 18001:2007

Development and production of high power semiconductor devices and modules

IQNet
THE INTERNATIONAL CERTIFICATION NETWORK

CERTIFICATE

IQNet and CQS
hereby certify that the organization

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Vyskočilova 1561/4a, 140 00 Praha 4, Czech Republic
ABB s.r.o., Local product group Semiconductors
Novodvorská 1768/138a, 142 21 Praha 4, Czech Republic

for the following processes

Design, development and manufacturing of:
• silicon single crystals, wafers and special products
• high power semiconductor devices and modules

has implemented and maintains a

Quality Management System

which fulfils the requirements of the following standard

ISO 9001 : 2015

Issued on: 2016 – 08 - 15
Validity date: 2019 – 08 - 14

Registration Number: **CZ – 2157/2016**

IQNet — CQS

Michael Drechsel
President of IQNet

Tomáš Hruška
President of CQS

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Novodvorská 1768/138a, 142 21 Praha 4, Czech Republic

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ISO 14001 : 2015

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Michael Drechsel
President of IQNet

Tomáš Hruška
President of CQS

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Novodvorská 1768/138a, 142 21 Praha 4, Czech Republic

for the following processes

Design, development and manufacturing of:
• silicon single crystals, wafers and special products
• high power semiconductor devices and modules

has implemented and maintains a

Occupational Health and Safety

which fulfils the requirements of the following standard

BS OHSAS 18001 : 2007

Issued on: 2016 – 08 - 15
Validity date: 2019 – 08 - 14

Registration Number: **CZ – 170/2016**

IQNet — CQS

Michael Drechsel
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IRAM Argentina JQA Japan KFQ Korea MIRTEC Greece MSET Hungary Nemko AS Norway NSAI Ireland PCBC Poland
Quality Austria Austria RR Russia SIQE Mexico SI Israel SIQ Slovenia SIRIM QAS International Malaysia
SQS Switzerland SRAC Romania TEST St Petersburg Russia TSE Turkey YUQS Serbia
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Further information
REACH Declaration

ABB Switzerland Ltd. – Semiconductors,
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E-mail	carsten.mueller@ch.abb.com
Reference No.	5SYS 5623-01
Page	1/1
Date	December 1st, 2016

To whom it may concern

Declaration regarding the REACH-Regulation

With reference to the Regulation (EC) N° 1907/2006, issued by the European Union for the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), please be aware that:

- during normal and reasonably foreseeable conditions of use, products and related accessories, which are articles according to REACH, manufactured by ABB Switzerland Ltd., Semiconductors and/or ABB s.r.o., Czech Republic do not intentionally release any substance or preparation (mixtures);
- ABB Switzerland Ltd., Semiconductors and/or ABB s.r.o., Czech Republic continuously assess their products for content of Substances of Very High Concern (SVHC), as included in the "Candidate List" by the European Chemicals Agency (ECHA);
- ABB Switzerland Ltd., Semiconductors and/or ABB s.r.o., Czech Republic continuously undertake communications throughout their supply chain in order to collect information about suppliers' compliance with REACH Regulation.

According to our current best knowledge all devices of the entire product portfolio manufactured by ABB Switzerland Ltd , Semiconductors and/or ABB s.r.o., Czech Republic do not contain SVHC substances exceeding 0.1% w/w.

Relevant for our chip customers only: the dicing tape (film) as carrier for bare die products contains the following substance in concentration above the 0.1% w/w limit:

- Bis (2-ethylhexyl)phthalate (DEHP), CAS 117-81-7, EC 204-211-0.

In the event we discover that any SVHC is present above the reporting threshold, we will inform you according to the requirements of the REACH directive.

Yours sincerely,
ABB Switzerland Ltd. - Semiconductors

Dr. Jürgen Bernauer
Manager Product Group Semiconductors

Mojmír Bálous
Local Product Group Manager

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Further information
Symbols

Symbol	Description
C_S	Snubber capacitance
di/dt_{max}	Maximum rate of rise or decline of on-state current
dV/dt	Maximum rate of rise of off-state voltage
F_m	Mounting force
I_C	DC collector current
I_{CM}	Peak collector current
I_F	Diode nominal mean forward current
I_{FAVM}	Max. average forward current (180° sine wave)
I_{FSM}	Max. surge peak forward current for a 180° sine wave; no voltage reapplied after surge
I_{RM}	Max. peak avalanche current for a single 180° sine wave pulse
I_{RMS}	Max. rms on-state current (AC full wave)
I_{rr}	Max. (typ. for IGBT diode) reverse recovery current
I_T	Forward current
I_{TAVM}	Max. average on-state current (180° sine wave)
I_{TGQM}	Max. turn-off current
I_{TSM}	Max. surge peak on-state current for a 180° sine wave; no voltage reapplied after surge
P_{RSM}	Max. surge avalanche power dissipation (single pulse)
Q_{rr}	Max. reverse recovery charge
r_F	Forward slope resistance
r_T	On-state slope resistance
R_{thCH}	Thermal resistance case to heatsink
R_{thJC}	Thermal resistance junction to case
R_{thJH}	Thermal resistance junction to heatsink
T_C	Case temperature
t_q	Turn-off time
T_{VJ}	Junction temperature
T_{VJM}	Max. junction temperature
V_{CES}	IGBT collector-emitter voltage
V_{CEsat}	Collector-emitter saturation voltage
V_{DC}	Max. DC voltage rating for 100 FIT, 100 percent duty
V_{DRM}	Max. repetitive peak forward blocking voltage
V_F	Forward voltage drop
V_{F0}	Forward threshold voltage
V_{Fmax}	Max. forward voltage drop
V_{Fmin}	Min. forward voltage drop
V_{GIN}	Input voltage of IGCT gate drive
V_R	Symmetrical peak avalanche voltage at a sinusoidal current pulse with 20 A peak, 10 µs pulse width and 60 °C junction temperature
V_{RM}	Max. repetitive peak blocking voltage
V_{RRM}	Max. repetitive peak reverse blocking voltage
V_{RSM}	Max. surge peak reverse blocking voltage
V_T	On-state voltage drop
V_{T0}	On-state threshold voltage

Further information
Documentation

IGBT dies and modules

Document title	Document number
Mounting instructions for StakPaks	5SYA 2037
Mounting instructions for HiPak modules	5SYA 2039
Failure rates of IGBT due to cosmic rays	5SYA 2042
Load-cycling capability of HiPak IGBT modules	5SYA 2043
Thermal runaway during blocking	5SYA 2045
Voltage ratings of high-power semiconductors	5SYA 2051
Applying IGBTs	5SYA 2053
IGBT diode safe operating area	5SYA 2057
Surge currents for IGBT diodes	5SYA 2058
Applying IGBT and diode dies	5SYA 2059
Thermal design and temperature ratings of IGBT modules	5SYA 2093
Paralleling of IGBT modules	5SYA 2098
Mounting Instructions for 62Pak	5SYA 2106
Mounting instructions for LinPak modules	5SYA 2107

Diodes

Document title	Document number
High-current rectifier diodes for welding applications	5SYA 2013
Design of RC snubbers for phase control applications	5SYA 2020
High-power rectifier diodes	5SYA 2029
Mechanical clamping of press-pack high-power semiconductors	5SYA 2036
Field measurements on high-power press-pack semiconductors	5SYA 2048
Voltage ratings of high-power semiconductors	5SYA 2051
Failure rates of fast recovery diodes due to cosmic rays	5SYA 2061
Applying fast recovery diodes	5SYA 2064
Parameter selection of high-power semiconductor for series and parallel connection	5SYA 2091

Thyristors

Document title	Document number
Bi-directionally controlled thyristors	5SYA 2006
Design of RC snubbers for phase control applications	5SYA 2020
Gate-drive recommendations for phase control and bi-directionally controlled thyristors	5SYA 2034
Mechanical clamping of press-pack high-power semiconductors	5SYA 2036
Field measurements on high-power press-pack semiconductors	5SYA 2048
Voltage definitions for phase control and bi-directionally controlled thyristors	5SYA 2049
Voltage ratings of high-power semiconductors	5SYA 2051
Switching losses for phase control and bi-directionally controlled thyristors	5SYA 2055
Parameter selection of high-power semiconductor for series and parallel connection	5SYA 2091
Surge currents for phase control thyristors	5SYA 2102

—
IGCTs

Document title	Document number
Applying IGCT gate units	5SYA 2031
Applying IGCTs	5SYA 2032
Mechanical clamping of press-pack high-power semiconductors	5SYA 2036
Failure rates of IGCTs due to cosmic rays	5SYA 2046
Field measurements on high-power press-pack semiconductors	5SYA 2048
Voltage ratings of high-power semiconductors	5SYA 2051

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GTOs

Document title	Document number
Mechanical clamping of press-pack high-power semiconductors	5SYA 2036
Field measurements on high-power press-pack semiconductors	5SYA 2048
Voltage ratings of high-power semiconductors	5SYA 2051

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Environmental specifications

Document title	Document number
Storage of diodes, PCTs, GTOs	5SZK 9104
Transport of diodes, PCTs and GTOs	5SZK 9105
Operation of pressure contact IGCTs	5SZK 9107
Storage of IGCTs	5SZK 9109
Transport of IGCTs	5SZK 9110
Storage of HiPaks	5SZK 9111
Transport of HiPaks	5SZK 9112
Operation of industry HiPaks	5SZK 9113
Handling, packing and storage conditions for sawn wafer dies and bare dies	5SZK 9114
Operation of industry press-pack diodes, PCTs and GTOs	5SZK 9115
Operation of traction press-pack diodes, PCTs and GTOs	5SZK 9116
Operation of traction HiPaks	5SZK 9120

Further information
Part numbering structure

IGBT and diode dies

5SM Y 86 M 12 80

Product group
5SM = IGBT
5SL = Diode

Technology
X = SPT / Y = SPT^{+} and SPT^{++} / Z = Enhanced trench / FSA, FCE diode

Type
76 = Unsawn wafer die / 86 = Sawn wafer die
12 = Picked die (waffle pack)

Die size in mm²

A	4	–	8.99 mm²
B	9	–	15.99 mm²
C	16	–	24.99 mm²
D	25	–	35.99 mm²
E	36	–	48.99 mm²
F	49	–	63.99 mm²
G	64	–	80.99 mm²
H	81	–	99.99 mm²
J	100	–	120.99 mm²
K	121	–	143.99 mm²
L	144	–	168.99 mm²
M	169	–	195.99 mm²
N	196	–	224.99 mm²
O	225	–	255.99 mm²
P	256	–	288.99 mm²
Q	289	–	323.99 mm²
R	324	–	360.99 mm²
S	361	–	399.99 mm²

Blocking voltage (V/100)

Version number

IGBT and diode modules

Product group
5SF = SiC MOSFET
5SJ = BIGT
5SL = Diode
5SM = IGBT
5SN = IGBT and diode

Configuration
A = Single device (can include diode)
D = Dual switch in one package
E = Chopper, switch on low side
G = Phase leg

Nominal collector current rating (A)

Housing
E = HiPak2, 40 mm
G = HiPak2 HV, 44 mm
H = Press-pack
J = HiPak1 HV, 44 mm
K = Press-pack
L = Press-pack
M = HiPak1, 30 mm
N1 & N2 = HiPak1, 40 mm
P = HiPak0
Q = 62Pak
R = LoPak1
S = LoPak3
X = LinPak

Blocking voltage (V/100)

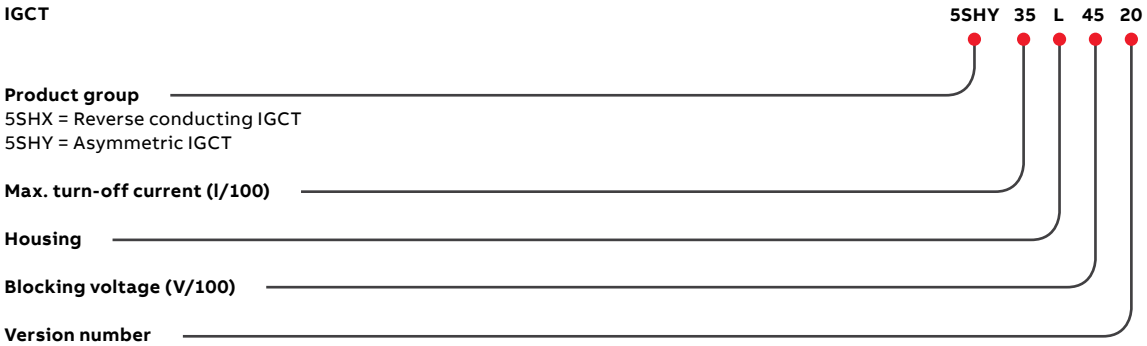
Package variation
0 = Standard

Technology variation
1 = SPT / 3 = SPT^{+} and SPT^{++} / 4 = TSPT^{+} (Enhanced trench cell technology)

Version number

—

IGCT



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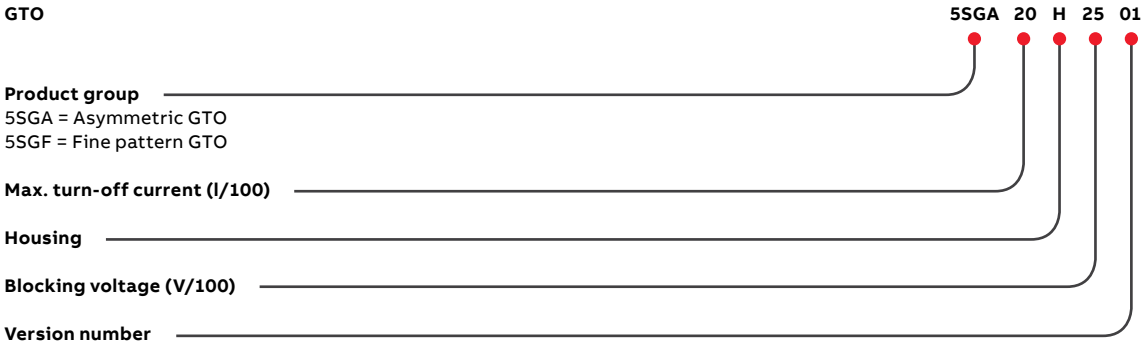
GTO



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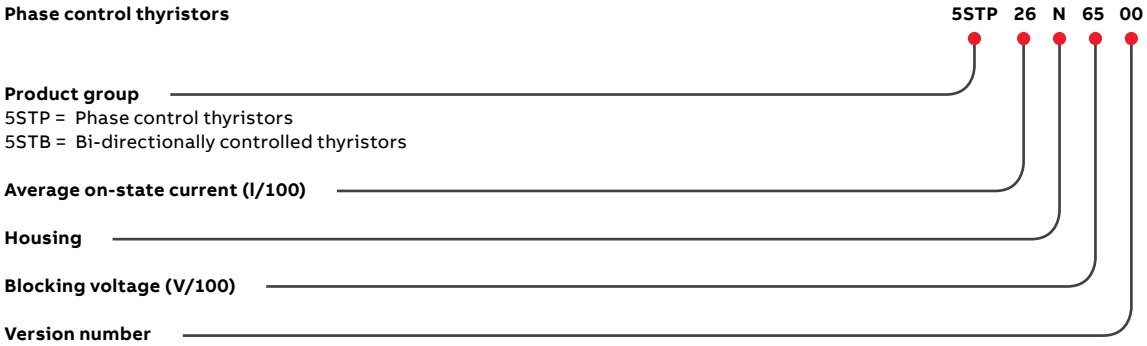
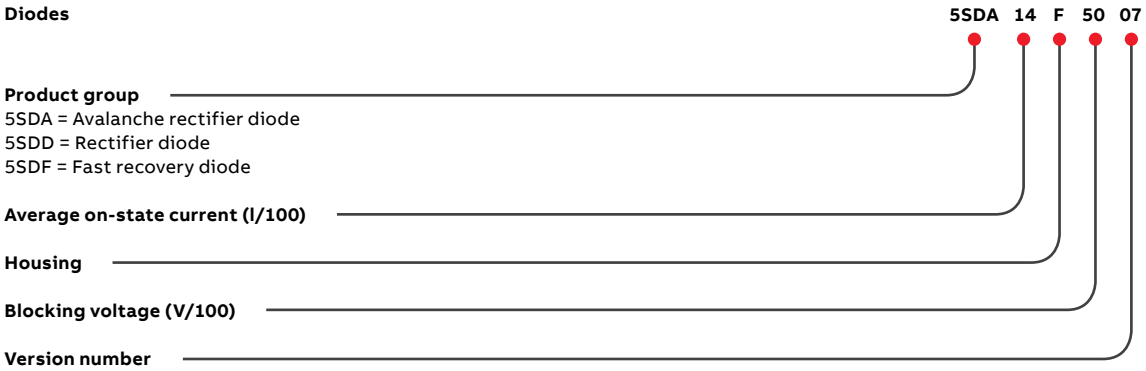
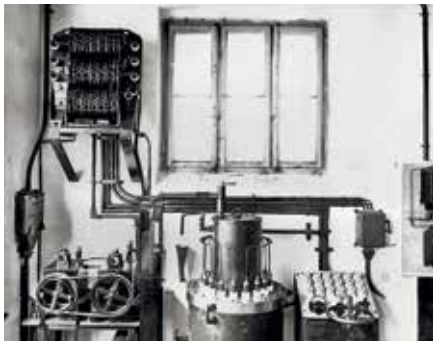
Phase control thyristors



Diodes


5SDA 14 F 50 07
Product group
5SDA = Avalanche rectifier diode
5SDD = Rectifier diode
5SDF = Fast recovery diode
Average on-state current (I/100)
Housing
Blocking voltage (V/100)
Version number

Further information
Perpetual innovation



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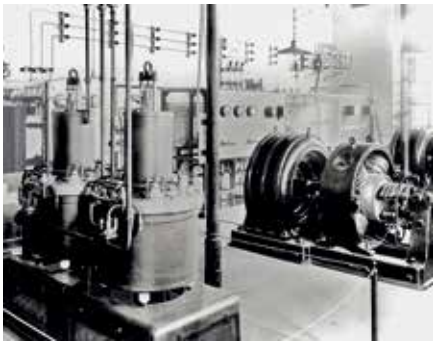
1913
BBC begins development and production of mercuryarc rectifiers



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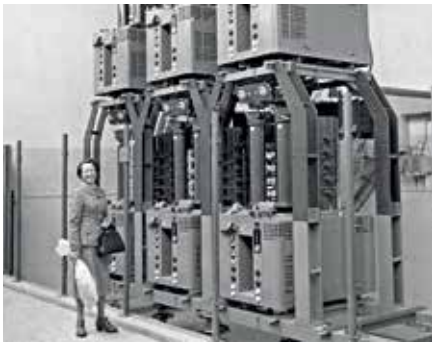
1915
BBC mercury-arc rectifiers used in the Limmattal tramline Zurich – Dietikon, Switzerland

—
1938
First locomotive using multianode mercury-arc rectifiers from BBC Mannheim, Germany

—
1939
First HVDC transmission line (pilot installation) Wettingen – Zurich, Switzerland

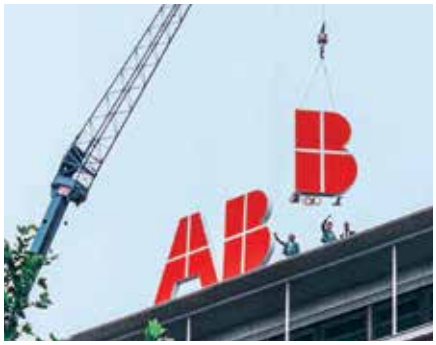
—
1954
BBC develops the first germanium diode



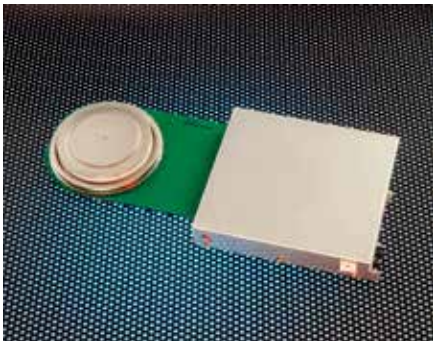
—
1954
First commercial HVDC transmission line connecting Gotland island with the Swedish mainland (ASEA)

—
1964
First locomotive using BBC silicon diodes (RE 4/4 Series 161, BLS)

—
1981
Inauguration of BBC high power semiconductor factory in Lenzburg, Switzerland



—
1988
ASEA (Sweden) and BBC (Switzerland) merge to form ABB (Asea Brown Boveri)



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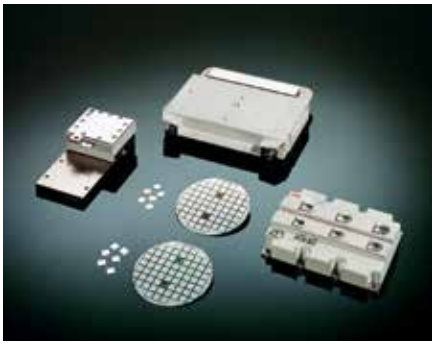
1996
ABB begins production of IGCT in Lenzburg, Switzerland



—
1998
Opening of ABB production facility for BiMOS in Lenzburg, Switzerland

—
2010
Inauguration of expanded production facility at ABB Semiconductors in Lenzburg, Switzerland

—
2012
Successful design and development of ABB's hybrid HVDC breaker

—
2014
Inauguration of ABB's new power electronics advanced research lab in Dättwil, Switzerland

—
2016
62Pak - Medium-power IGBT modules and BiGT StakPak

—
2017
Release of 1.7 kV and 3.3 kV LinPaks

Further information
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