Product catalog 2016

Power semiconductors

Power and productivity
for a better world™

Contents

This is ABB Semiconductors

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.

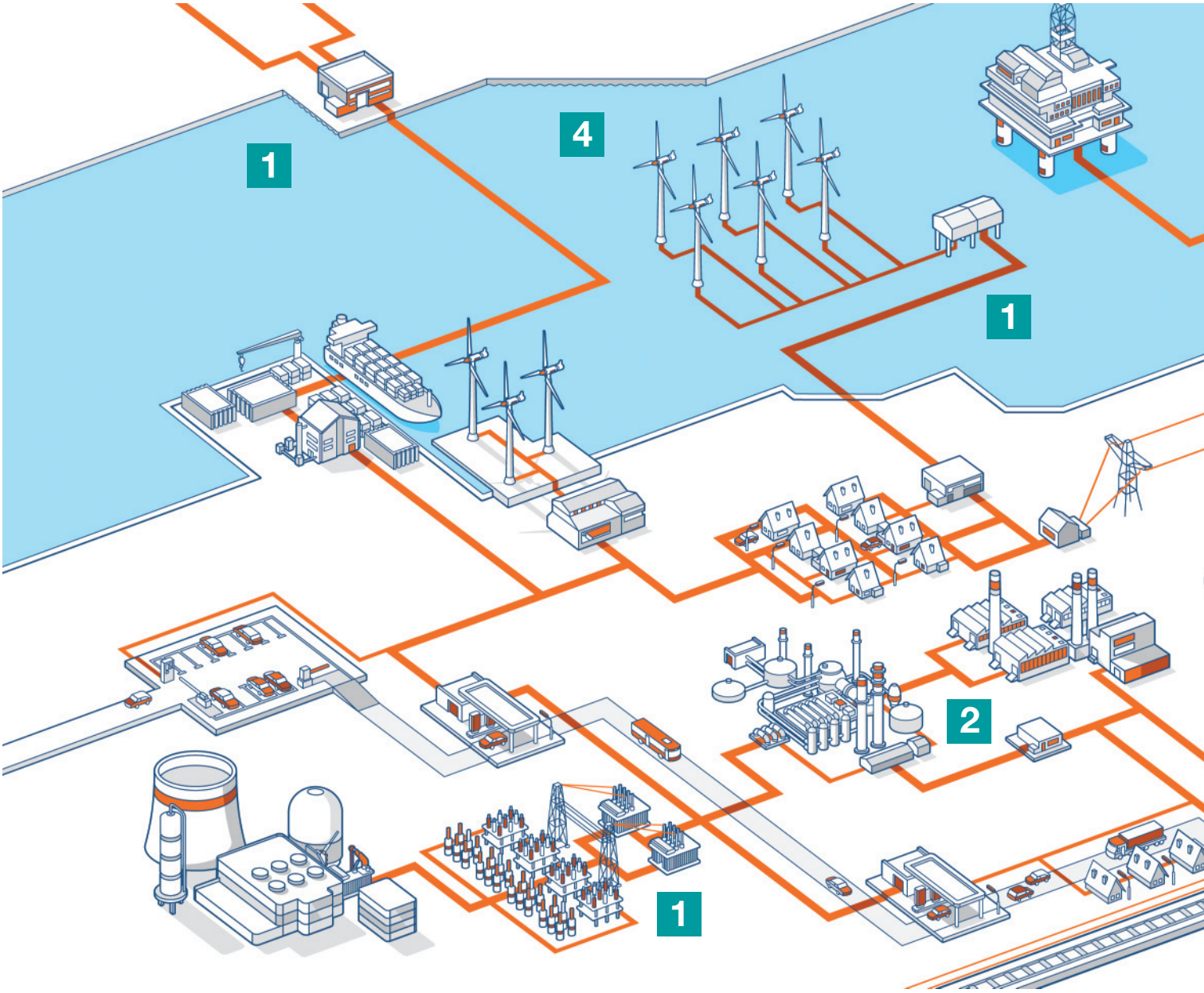
ABB is a leading supplier of power semiconductors with production facilities in Lenzburg, Switzerland, and Prague, Czech Republic, as well as a new research laboratory for wide bandgap semiconductors in Baden-Dättwil, Switzerland.

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

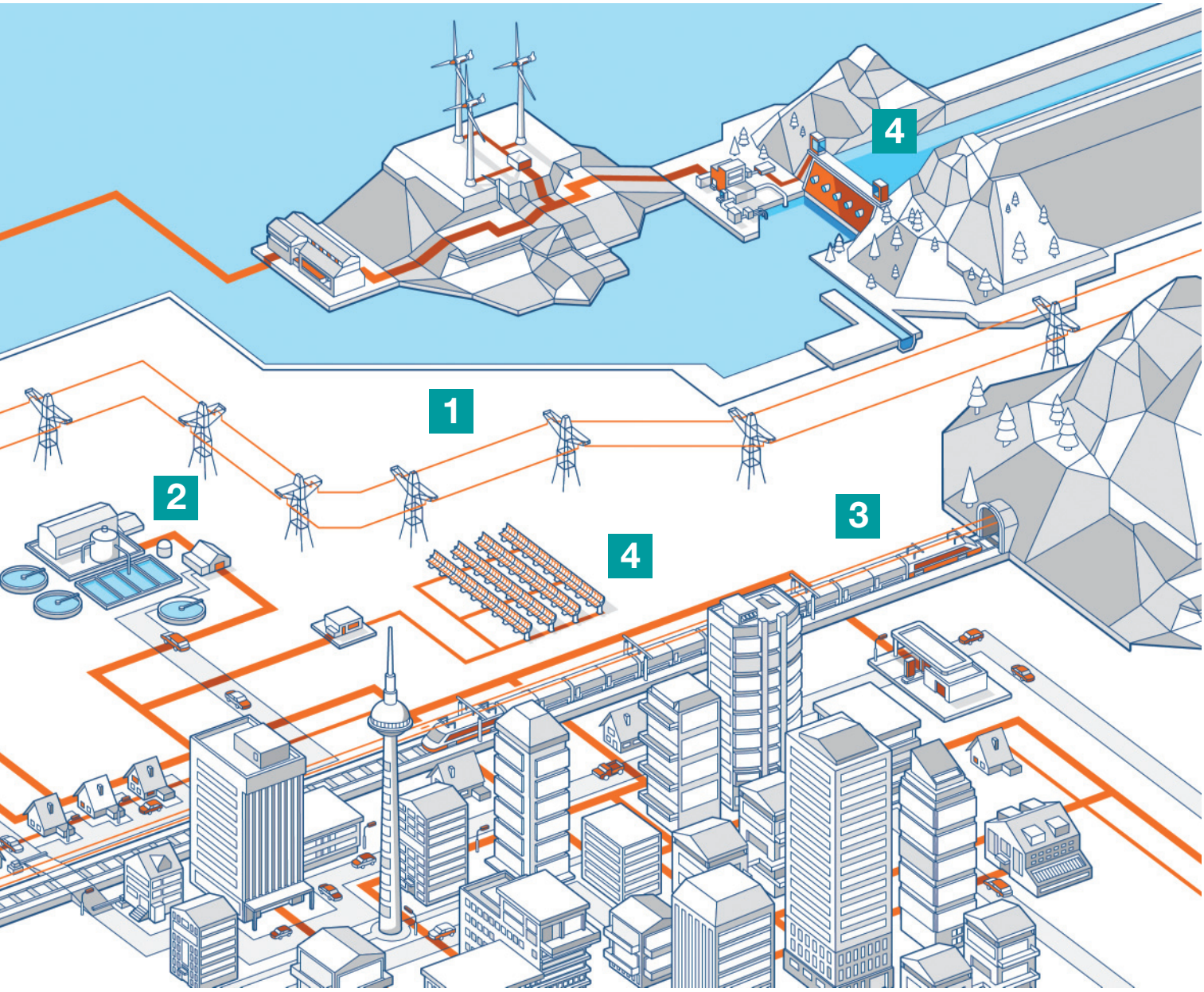
This product catalog provides an overview of ABB's full range of thyristor and IGBT power semiconductors.

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

Applications



ABB’s power semiconductors are key components in a variety of demanding applications in markets like power transmission & distribution, industrial, traction 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)

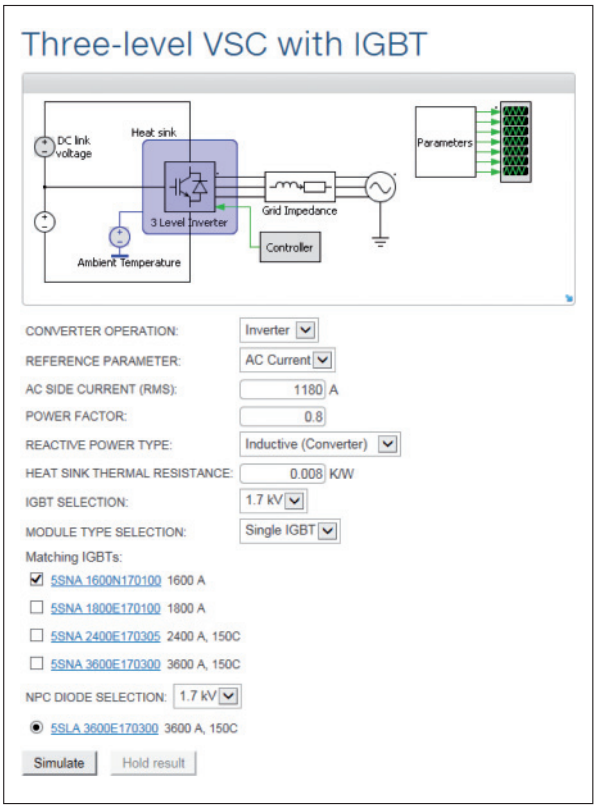
3 Traction (main and auxiliary drives, trackside power supply)

4 Renewable energy (converters for pumped hydro, wind turbines and solar)

SEMIS - Semiconductor simulation tool

ABB's Semiconductor Simulation tool SEMIS is a web-based tool, intended to assist engineers at an early design phase in selecting the semiconductor device best fitting their application in respect to thermal losses. For a system designer it is important to choose the appropriate semiconductor according to the parameters of the application without having to spend too much time and effort.

Two- and three-level voltage-source converter (VSC) topologies with HiPak and StakPak modules as well as with IGCTs are available for simulations on ABB Semiconductors' website.

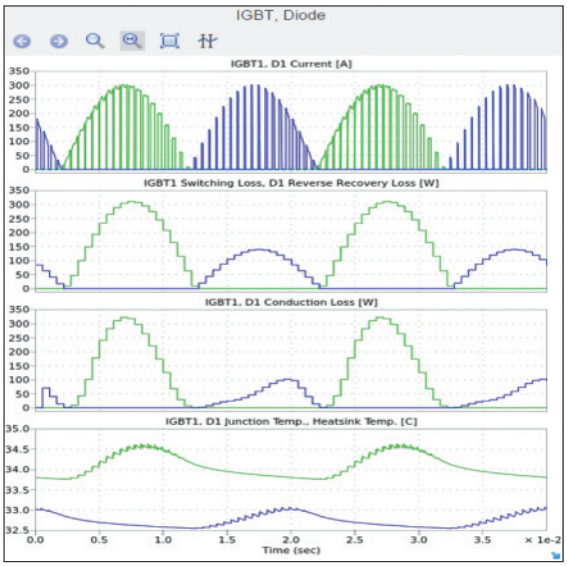


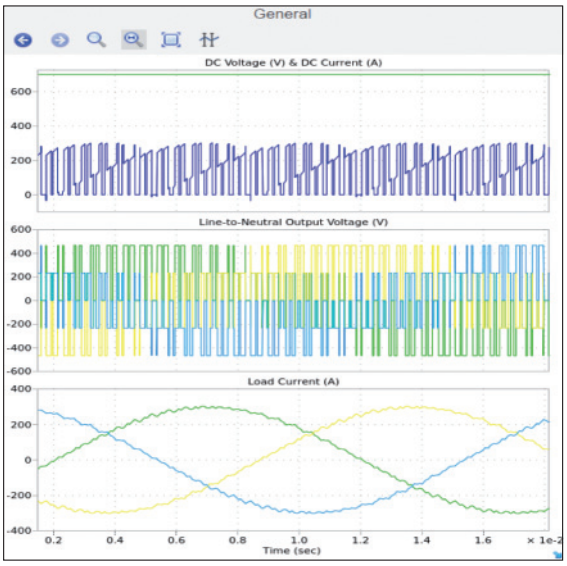
SEMIS offers a user friendly interface for parameter set up and provides a comprehensive steady state analysis for the selected ABB semiconductors.

Simulation results are obtained in both graphical and arithmetical form. Time based graphs such as semiconductor current, output voltage, output current and temperatures are presented. The arithmetical results are listed in tables and among others indicate the estimated semiconductor switching and conduction losses as well as the junction temperatures. Input and output values for voltage and current are also available. Multiple device selection and simulation for the same conditions is possible for direct product comparison.

To run SEMIS is straight forward: On **www.abb.com/semiconductors** you click on the *Simulation tool SEMIS* tile under 'Links and downloads', you input parameters like load power, power factor, heat sink thermal resistance, IGBT module voltage and type (single, dual half bridge or chopper).

SEMIS then lists the available HiPak IGBT modules on the screen and you just select your favorite and start the simulation.





Device Losses & Temperatures				
	Switching	Conduction	Combined Losses	Max. Junction Temperature
per IGBT	99.58 W	83.17 W	182.7 W	34.48 °C
per Diode	43.01 W	22.87 W	65.88 W	33.04 °C
Converter Losses	0.8555 kW	0.6362 kW	1.492 kW	

Output Parameters			
Real Power	Phase Voltage (True RMS)	Phase Current (True RMS)	Losses (%)
99.81 kW	198.0 V	210.4 A	1.491 %

Input Parameters			
DC Power	DC Voltage	Power Factor	Modulation Index
101.3 kW	700.0 V	0.8000	0.8000

SEMIS simulation results are time based graphs and tables with arithmetic values. The semiconductor losses are analytically calculated as switching and conduction losses. They are also presented on converter level, accounting for the total losses on all elements. Having the input power also available in the results, SEMIS calculates the total semiconductor losses as percentage of the absorbed power from the converter. In this way, the user gets an indication of the impact of the semiconductor selection in the overall efficiency of the converter. The semiconductor junction temperature T_j is another parameter included in the results allowing for assessing the thermal limits of operation. If permissible limits are exceeded for the junction temperature T_j or if the applied voltage is out of the recommended limits of the product to be simulated, then alert messages are prompted.

As SEMIS is based on the PLECS simulation software, the HiPak, StakPak, diode and IGCT thermal models (in XML format) are available for download from our website, so that PLECS users can use them to simulate ABB products accurately on their own.

Product outlook

Innovation and quality are key for success. It is our mission to drive innovation in power semiconductor technology together with our customers and to add value through best performance and quality. We are pushing to be the best and most forward-looking performer in our markets when it's about reliability.

ABB Semiconductors' vast range of thyristor and IGBT power semiconductors for industrial, traction, power generation & distribution and renewable energy markets will be expanded soon with the following new products.

LinPak IGBT modules

For the first time a high-power high reliable IGBT power module becomes available that addresses long sought customer requirements such as low overall stray inductance, high flexibility and highest current densities. The already presented 1,700 V, 2 x 1,000 A module will be ready for mass production in the 2nd half of 2016 and as well a 3,300 V, 2 x 450 A module will become available. The lineup will be expanded to higher voltages in the coming years.

Target ratings LinPak

LinPak	LinPak	Rating	Configuration NG Phase-leg IGBT
	AlSiC (LV)	1700 V / 2 x 1000 A	NG
	AlSiC (LV)	3300 V / 2 x 450 A	NG
	AlSiC (HV)	4500 V / 2 x 350 A	NG
	AlSiC (HV)	6500 V / 2 x 250 A	NG

LoPak1 medium-power phase-leg IGBT modules

Following ABB's product expansion into the medium-power segment, we will add a new industry standard phase-leg module to our portfolio. The LoPak1 is a low profile low inductive module that features the latest low loss 1,700 V SPT^{++} chipset and 175 °C junction operation temperature setting a new benchmark in the industry. This allows customers to use more converter output power per rated module amps yielding in a significant financial benefit.

Target ratings LoPak1

LoPak	Voltage (V)	Current (A)	Configuration NG Phase-leg IGBT
	1700	450	NG
	1700	300	NG
	1700	225	NG
	1700	600	NG
	1200	225...600	NG

Thyristor / diode modules

All thyristor / diode modules feature industry standard housings and are designed for very low losses and highest operating temperatures.
Typical applications are AC motor soft starters, variable speed drives and renewable energies. Features coming from high-power semiconductors are used in ABB's medium-power modules.
These features ensure benefits like highest performance under load cycling, a higher thermal utilization, increased overload capability and many more.

Target ratings 20Pak, 34Pak, 50Pak, 60Pak and 77Pak

Voltage (V)	Package (ss) soldered (pp) press-pack	Configuration TT Thy/Thy DD Dio/Dio DT Dio/Thy TD Thy/Dio
6000	60, 77Pak (pp)	DD
5000	50, 60Pak (pp)	DD
2200	50, 60Pak (pp)	DD
1800	34, 50, 60Pak (ss, pp)	TT, DD, DT, TD
1200 - 1600	20, 34, 50, 60Pak (ss, pp)	TT, DD, DT, TD

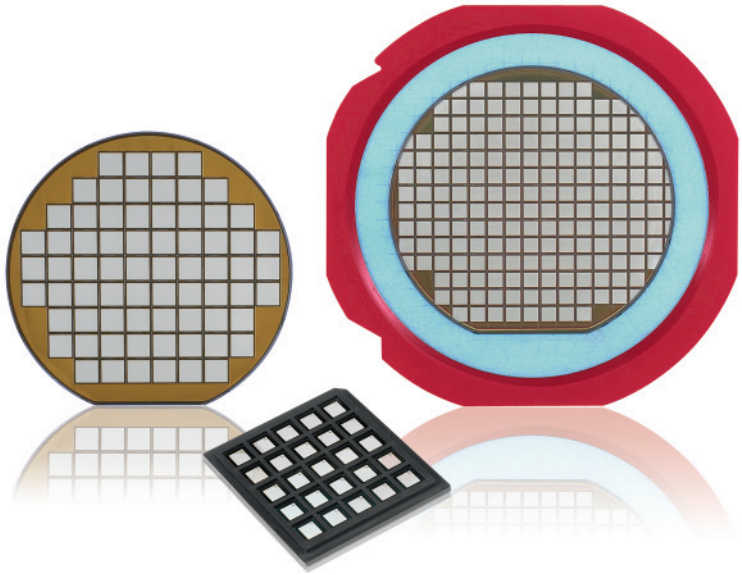
IGBT and diode dies

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 1,200 V and 1,700 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 1,200 V are power converters for industrial drives, solar energy, battery backup systems (UPS) and electrical vehicles. Applications for 1,700 V also include industrial power conversion & drives, wind turbines and traction converters.

ABB's 1,700 V SPT^{++} chipset is the world's first 1,700 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

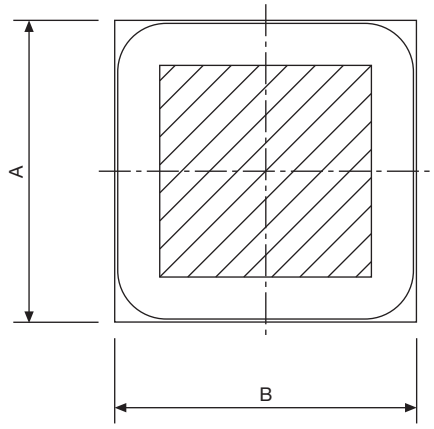
Part number	Type	Size A x B mm	Thickness µm	V_{RRM} (V)	I_F (A)	V_F (V) typ. 125°C	Max. dies per wafer (W) or tray (T)
1.2 kV							
5SLY 76E1200 5SLY 86E1200	SPT+	6.3 x 6.3	350	1200	50	1.85	361 (W)
5SLY 76F1200 5SLY 86F1200	SPT+	7.4 x 7.4	350	1200	75	1.85	257 (W)
5SLY 76G1200 5SLY 86G1200	SPT+	8.4 x 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)
1.7 kV							
5SLY 86E1700	SPT+	6.3 x 6.3	390	1700	50	2.1	326 (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)
5SLY 86J1700							131 (W)
5SLY 12J1700	SPT+	10.2 x 10.2	390	1700	150	2.1	36 (T)
5SLY 86M1700							69 (W)
5SLY 12M1700	SPT+	13.6 x 13.6	390	1700	300	2.1	25 (T)
5SLZ 86J1700	SPT++/FSA	10.2 x 10.2	370	1700	150	1.75	131 (W)

IGBT dies

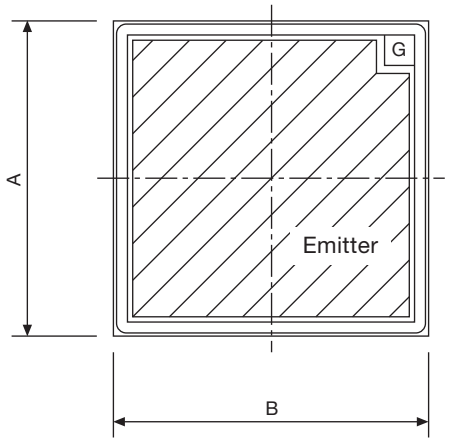
Part number	Type	Size A x B mm	Thickness µm	V_{CES} (V)	I_C (A)	I_{CM} (A)	V_{CEsat} (V) typ. 125°C	Max. dies per wafer (W) or tray (T)
1.2 kV								
5SMY 76H1280								
5SMY 86H1280	SPT$^+$	9.1 x 9.1	140	1200	57	114	2.1	166 (W)
5SMY 76J1280								
5SMY 86J1280	SPT$^+$	10.2 x 10.2	140	1200	75	150	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 86J1721								132 (W)
5SMY 12J1721	SPT$^+$	10.1 x 10.1	209	1700	75	150	3.0	36 (T)
5SMY 86K1721								102 (W)
5SMY 12K1721	SPT$^+$	11.4 x 11.4	209	1700	100	200	3.0	36 (T)
5SMY 86L1731 **New**	SPT^{++}	7.4 x 19.9	190	1700	120	240	2.7	86 (W)
5SMY 86M1721								69 (W)
5SMY 12M1721	SPT$^+$	13.6 x 13.6	209	1700	150	300	3.0	25 (T)
5SMY 86M1730	SPT^{++}	13.6 x 13.6	190	1700	150	300	2.55	69 (W)
5SMY 86M1731 **New**	SPT^{++}	13.9 x 14.0	190	1700	160	320	2.55	66 (W)

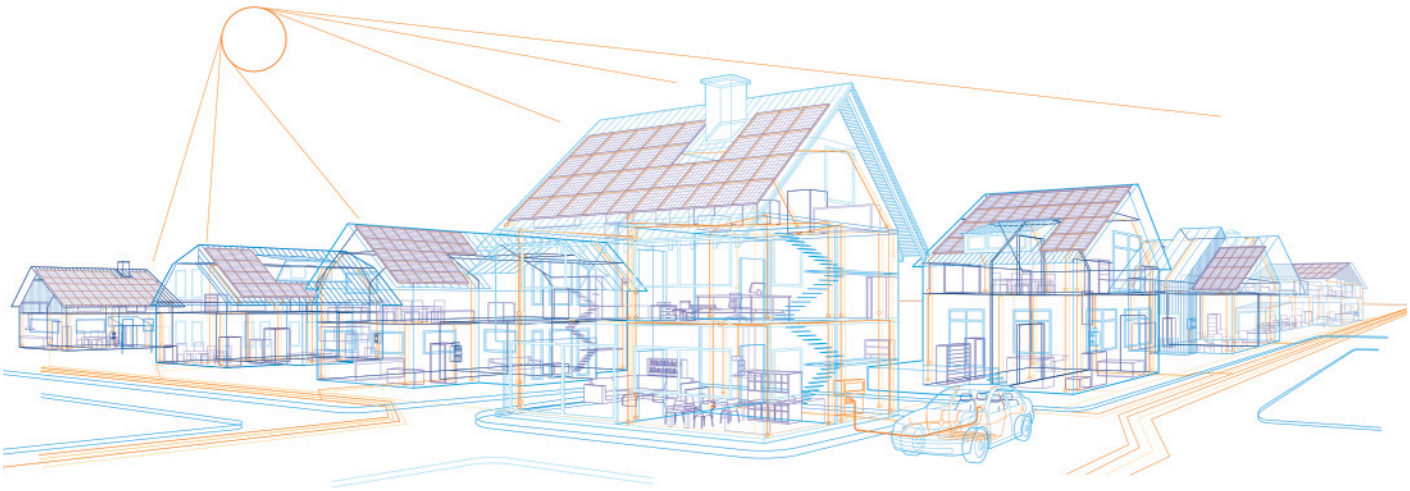
Please refer to page 72 for part numbering structure.

Diode dies



IGBT dies





Medium-power IGBT modules

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

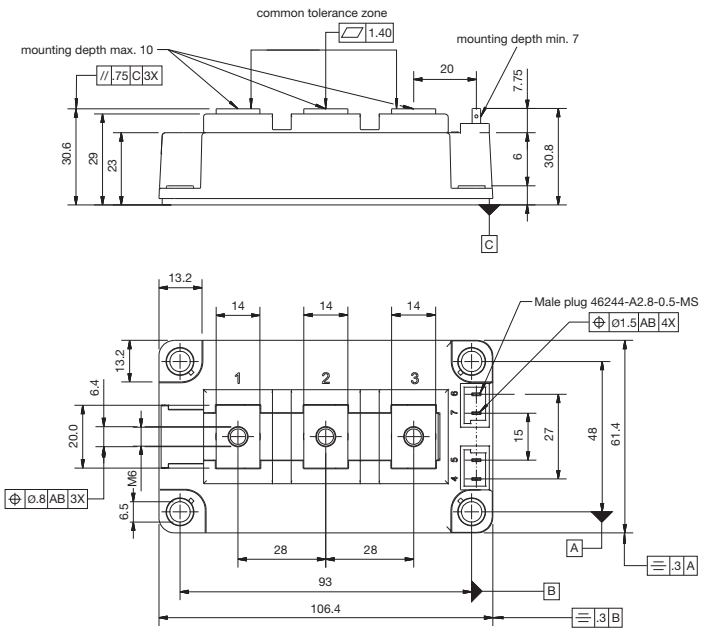
ABB's 62Pak modules have an advanced packaging technology that leverages the performance of the latest silicon technology:

- 1,700 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 allows drop-in replacement

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 0150Q170300	**New**	1700	2 x 150	(5) - Phase-leg IGBT	2.55	1.75	Q
5SNG 0200Q170300	**New**	1700	2 x 200	(5) - Phase-leg IGBT	2.55	1.75	Q
5SNG 0300Q170300	**New**	1700	2 x 300	(5) - Phase-leg IGBT	2.55	1.75	Q

Please refer to page 72 for part numbering structure.
* Configurations on page 22

Q



Dimensions in mm

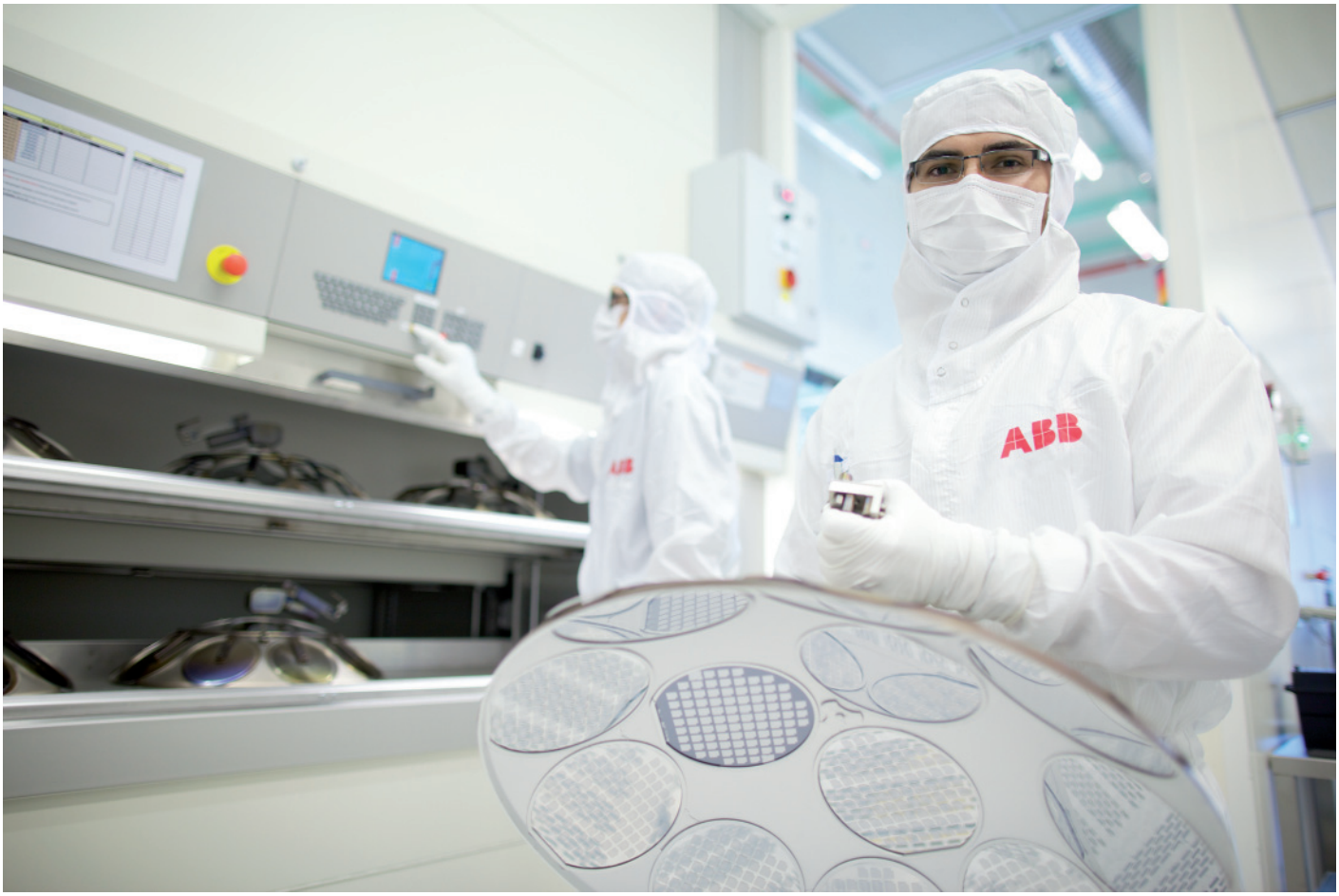
High-power IGBT and diode modules

ABB offers two families of high-power IGBT and diode modules: the HiPak and the StakPak modules. HiPak modules are a range of insulated high-power IGBTs in industry standard housings using the popular 190 x 140 mm, 130 x 140 mm and 140 x 70 mm footprints. StakPaks are press-pack IGBT modules.

HiPak modules are the perfect match for demanding high-power applications such traction, renewable energy (wind, solar), industrial drives and T&D.
The StakPak is a range of high-power IGBT press-packs and diodes in an advanced modular housing that guarantees uniform chip pressure in multiple-device stacks as for instances in high-voltage DC transmission (HVDC) applications.

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

- HiPak IGBT and diode modules → page 20
- StakPak IGBT press-pack modules → page 24

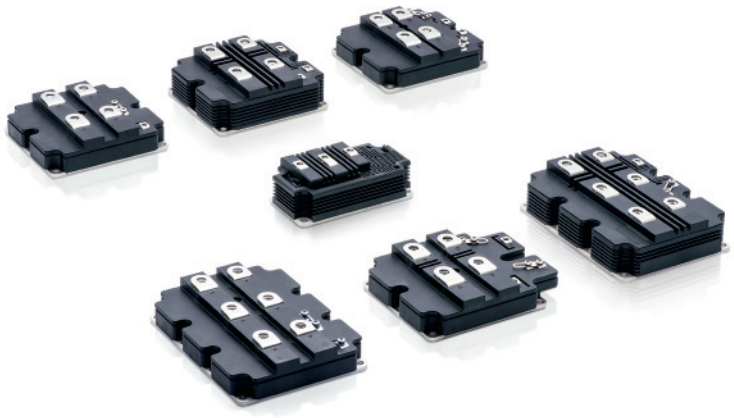


ABB

HiPak IGBT and diode modules

Demanding high-power applications such as traction inverters, medium voltage drives, wind turbines, 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 1,700 V to 6,500 V in various configurations. They all feature low losses combined with soft-switching performance and record-breaking Safe Operating Area (SOA).



Part number	Voltage V_{CES} (V)	Current I_C (A)	Configuration	V_{CEsat} (V) typ. 125°C	V_F (V) typ. 125°C	Housing
T_{vj} (operational) up to 125°C						
1.7 kV						
5SND 0800M170100	1700	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 1800E170100	1700	1800	(1) – Single IGBT	2.6	1.7	E
5SNA 2400E170100 *	1700	2400	(1) – Single IGBT	2.6	1.7	E
3.3 kV						
5SNE 0800E330100	3300	800	(2) – Chopper	3.8	2.35	E
5SNA 0800N330100	3300	800	(1) – Single IGBT	3.8	2.35	N1
5SLD 1200J330100	3300	1200	(4) – Dual Diode	-	2.35	J
5SNA 1200E330100	3300	1200	(1) – Single IGBT	3.8	2.35	E
5SNA 1200G330100	3300	1200	(1) – Single IGBT	3.85	2.35	G
T_{vj} (operational) up to 150°C						
1.7 kV						
5SNA 2400E170305	1700	2400	(1) – Single IGBT	2.4	1.67	E
5SNA 3600E170300	1700	3600	(1) – Single IGBT	3.0	1.95	E
5SLA 3600E170300	1700	3600	(6) – Single Diode	-	1.95	E
2.5 kV						
5SNA 1500E250300	2500	1500	(1) – Single IGBT	2.5	2.0	E
3.3 kV						
5SNG 0250P330305	3300	250	(5) – Phase-leg IGBT	3.1	2.25	P
5SLG 0500P330300	3300	500	(7) – Phase-leg Diode	-	2.25	P
5SND 0500N330300	3300	500	(3) – Dual IGBT	3.1	2.25	N2
5SLD 1000N330300	3300	1000	(4) – Dual Diode	-	2.25	N1
5SNA 1000N330300	3300	1000	(1) – Single IGBT	3.1	2.25	N1
5SNA 1500E330305	3300	1500	(1) – Single IGBT	3.1	2.25	E

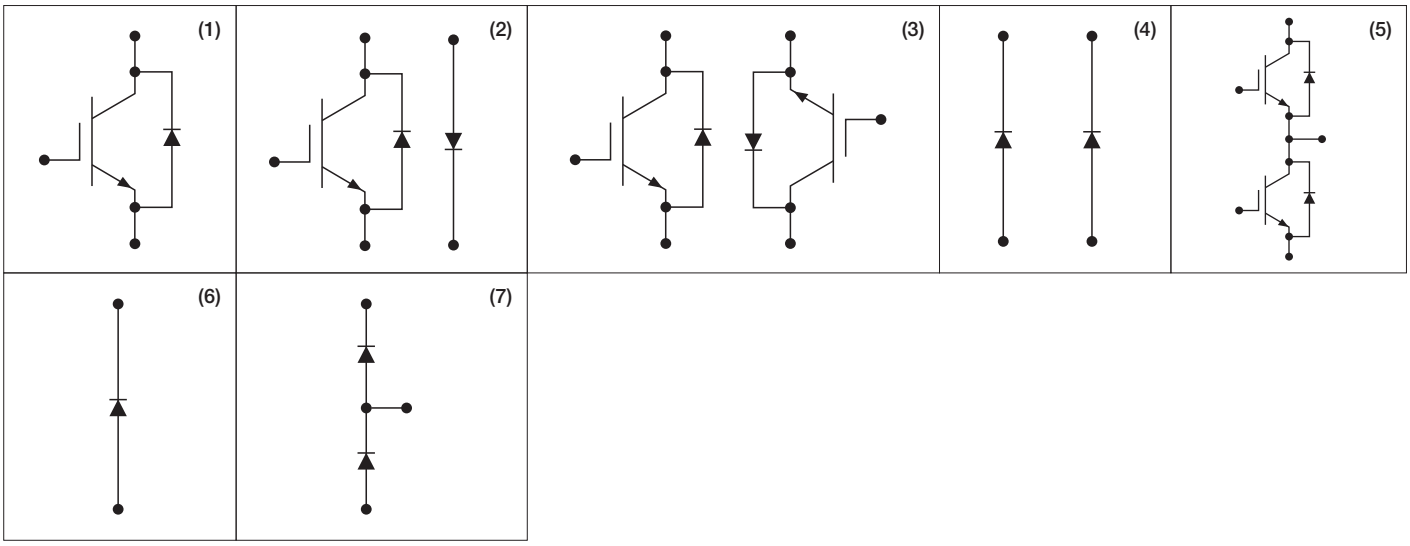
* not for new designs

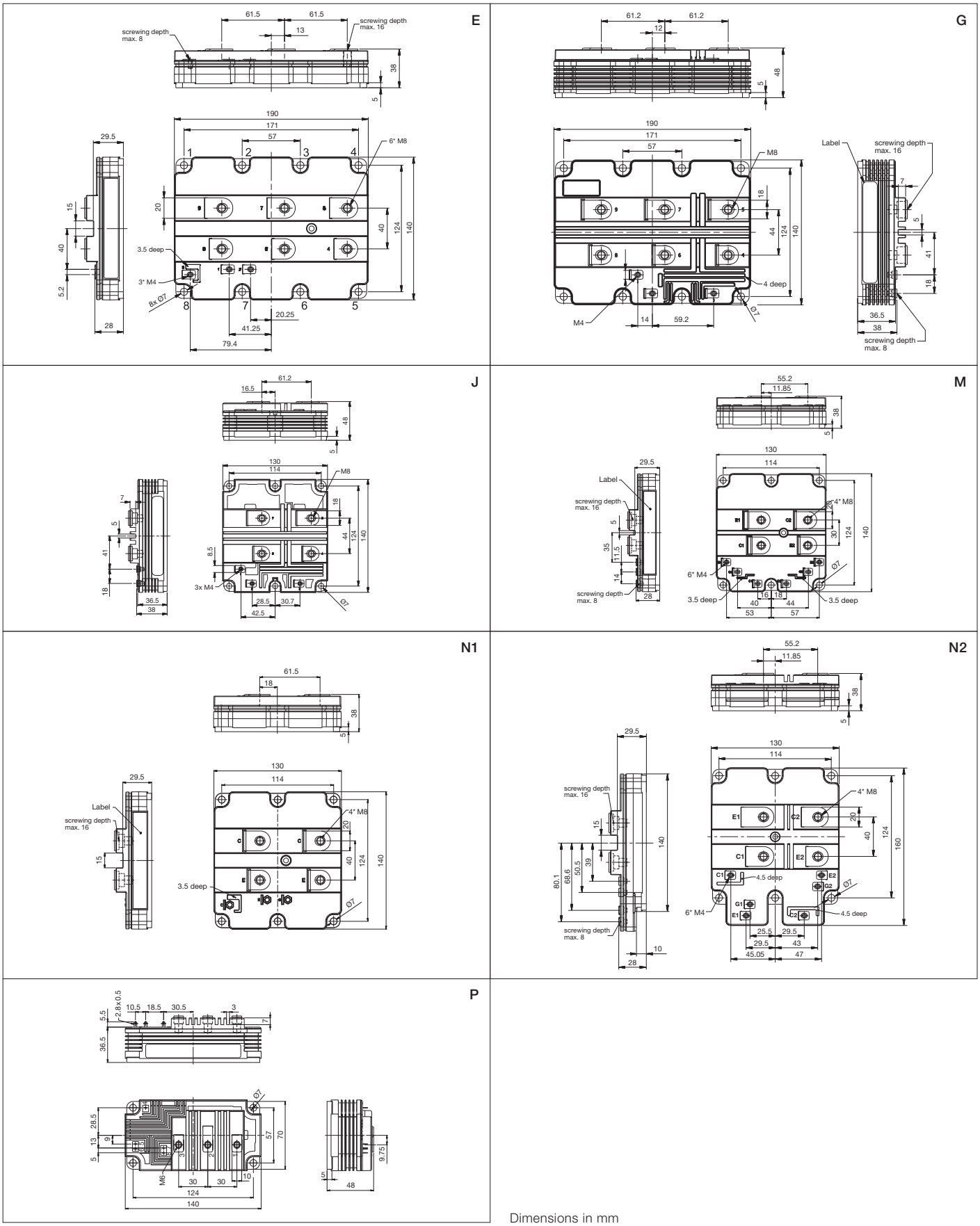
Please refer to page 72 for part numbering structure.

Part number	Voltage V_{CES} (V)	Current I_C (A)	Configuration	V_{CEsat} (V) typ. 125°C	V_F (V) typ. 125°C	Housing
T_{vj} (operational) up to 125°C						
4.5 kV						
5SNG 0150P450300	4500	150	(5) – Phase-leg IGBT	3.5	3.45	P
5SLG 0600P450300	4500	600	(7) – Phase-leg Diode	-	3.5	P
5SLD 0650J450300	4500	650	(4) – Dual Diode	-	3.4	J
5SNA 0650J450300	4500	650	(1) – Single IGBT	3.7	3.4	J
5SNA 0800J450300	4500	800	(1) – Single IGBT	3.55	3.5	J
5SLD 1200J450350	4500	1200	(4) – Dual Diode	-	3.5	J
5SNA 1200G450300	4500	1200	(1) – Single IGBT	3.55	3.5	G
5SNA 1200G450350	4500	1200	(1) – Single IGBT	3.55	3.5	G
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
5SLD 0600J650100	6500	600	(4) – Dual Diode	-	3.4	J
5SNA 0600G650100	6500	600	(1) – Single IGBT	5.4	3.4	G
5SNA 0750G650300	6500	750	(1) – Single IGBT	3.9	3.4	G

Please refer to page 72 for part numbering structure.

Configurations





Dimensions in mm

StakPak IGBT press-pack modules

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

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

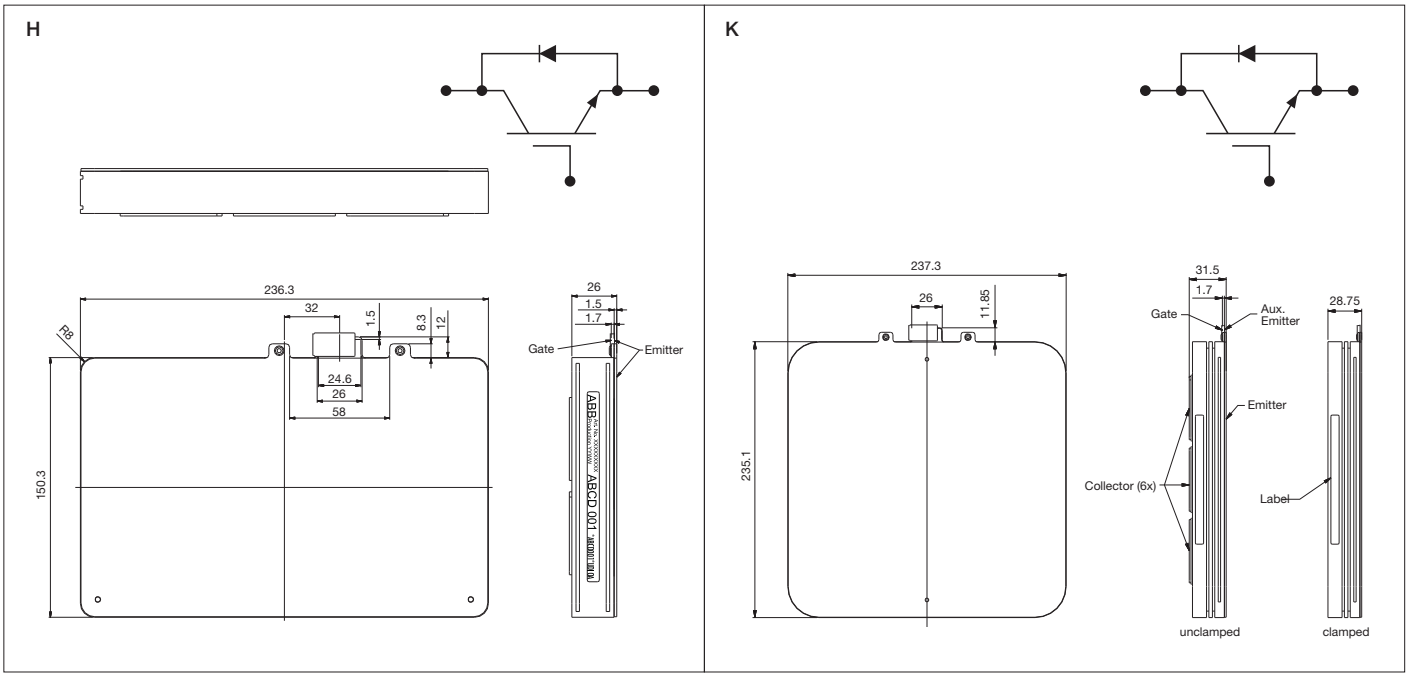
- allows for easy mechanical and electrical series connection
- allows for easy stack design thanks to high tolerance for inhomogeneous mounting pressure
- guarantees a uniform chip pressure in multiple-device stacks
- provides a stable shorted state in case of failure
- long-term short-circuit failure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

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

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
5SNR 10H2501 *	2500	1000	2.7	1.9	2:1	H	Yes
5SNR 13H2501 *	2500	1300	2.7	1.9	2:1	H	Yes
5SNR 20H2501 *	2500	2000	2.7	1.9	2:1	H	Yes
5SNA 1300K450300	4500	1300	3.4	2.3	1:1	K	Yes
5SNA 2000K450300	4500	2000	3.4	2.4	1:1	K	Yes
5SNA 2000K451300	4500	2000	3.5	3.0	2:1	K	Yes
5SNA 3000K452300 New	4500	3000	3.5	3.0	2:1	K	No

* not for new designs

Please refer to page 72 for part numbering structure.



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 → page 28
- Standard rectifier diodes → page 32
- Avalanche diodes → page 32
- Welding diodes → page 36


ABB

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), Current Source Inverters (CSIs) and snubbers. The diodes are typically used in combination with IGCTs and GTOs as free-wheeling, snubber and clamp diodes, thus enabling full IGCT and GTO performance.

ABB particularly developed L-housing fast recovery diodes to optimally match 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	1ms T_{VJM}	10ms T_{VJM}	T_{VJM}		di/dt=80 A/µs T_{VJM}						
	V	V	A	kA	kA	V	mΩ	A	µC	°C	K/kW	K/kW	kN	
5SDF 06D2504	2500	-	615	22.6	10.0	1.20	0.46	200	400	125	32	8	10	D
5SDF 06T2504	2500	-	615	22.6	10.0	1.20	0.46	200	400	125	32	8	10	T1
5SDF 12F2505	2500	-	1256	43.0	19.0	1.20	0.24	230	700	125	15	4	22	F
5SDF 12T2505	2500	-	1256	43.0	19.0	1.20	0.24	230	700	125	15	4	22	T2
5SDF 04D4504	4500	-	361	13.6	6.0	1.86	1.54	200	400	125	32	8	10	D
5SDF 04T4504	4500	-	361	13.6	6.0	1.86	1.54	200	400	125	32	8	10	T1
5SDF 08F4505	4500	-	767	33.9	15.0	1.81	0.73	230	700	125	15	4	22	F
5SDF 08T4505	4500	-	767	33.9	15.0	1.81	0.73	230	700	125	15	4	22	T2
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

* at di/dt = 300A/µs

Drawings see page 34f.
Please refer to page 74 for part numbering structure.

Snubber 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	1ms	10ms	T_{VJM}		di/dt=100 A/µs						
				T_{VJM}	T_{VJM}			T_{VJM}						
	V	V	A	kA	kA	V	mΩ	A	µC	°C	K/kW	K/kW	kN	
5SDF 05D2501	2500	1100	490	27.0	8.5	1.40	0.50	250	900	125	40	8	11	D
5SDF 03D4501	4500	2400	320	12.0	5.0	2.00	1.50	200	1000	125	40	8	11	D
5SDF 07H4501	4500	2400	900	40.0	16.0	1.80	0.90	260	1700	125	12	3	40	H1
5SDF 02D6002	6000	3000	250	11.4	3.6	2.50	2.50	260	2000	125	40	8	11	D

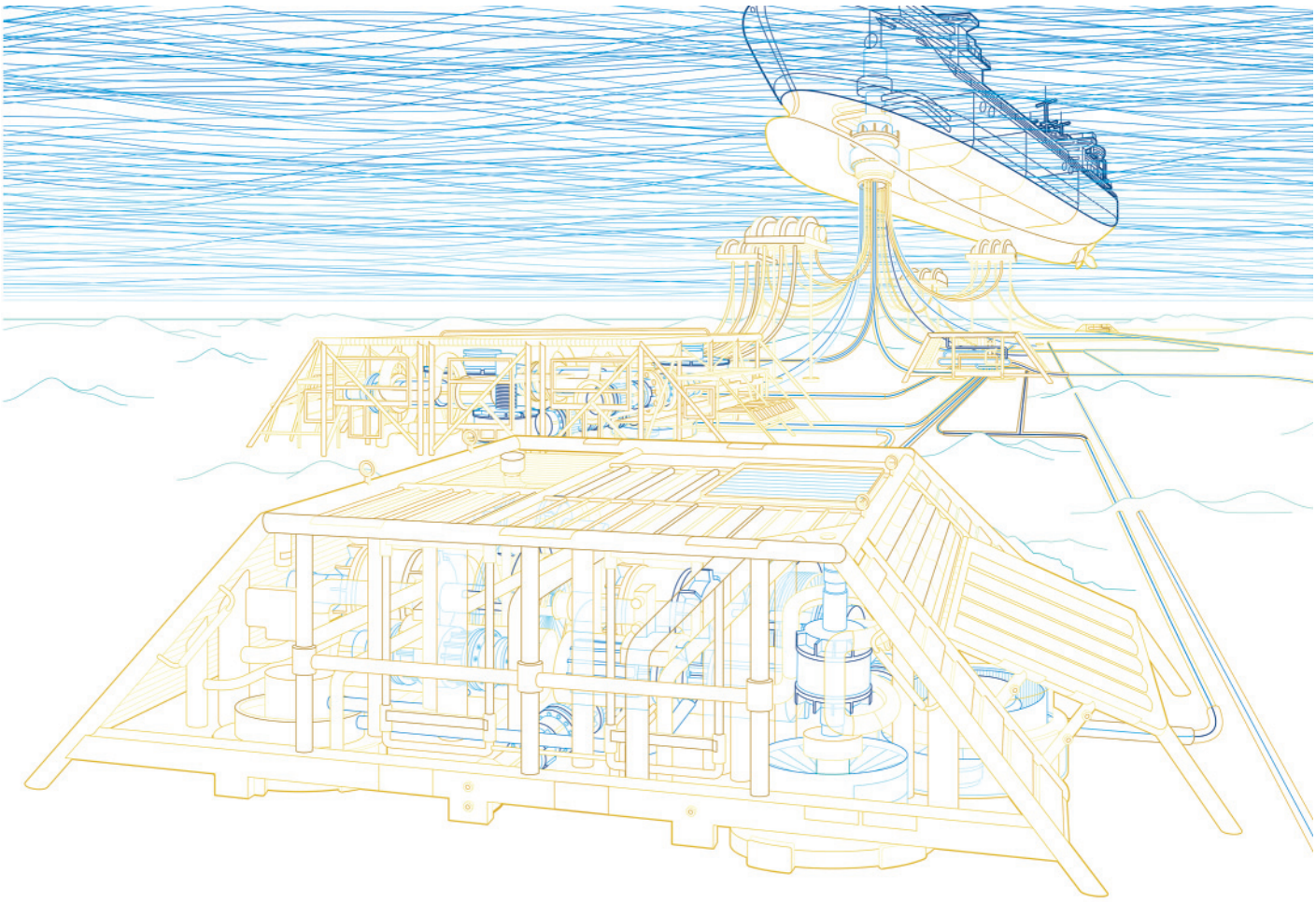
IGBT diodes

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	10ms	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	38.0	1.70	0.80	3600	5300	140	6	3	40	L3
5SDF 28L4521	4500	2800	2620	48.0	1.10	0.47	3700	10100	140	6	3	40	L3

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	1ms	10ms	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	1950	-	38.0	1.70	0.80	2400	1200	140	6	3	40	L3
5SDF 28L4520	4500	2800	2620	-	48.0	1.10	0.47	2800	1000	140	6	3	40	L3
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 34f.
Please refer to page 74 for part numbering structure.



Standard rectifier & 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 input rectifiers for large AC drives, aluminum smelting and other metal refining as well as trackside supply.

The **avalanche diodes** are self-protected against transient over-voltages, 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.

Standard recovery diodes

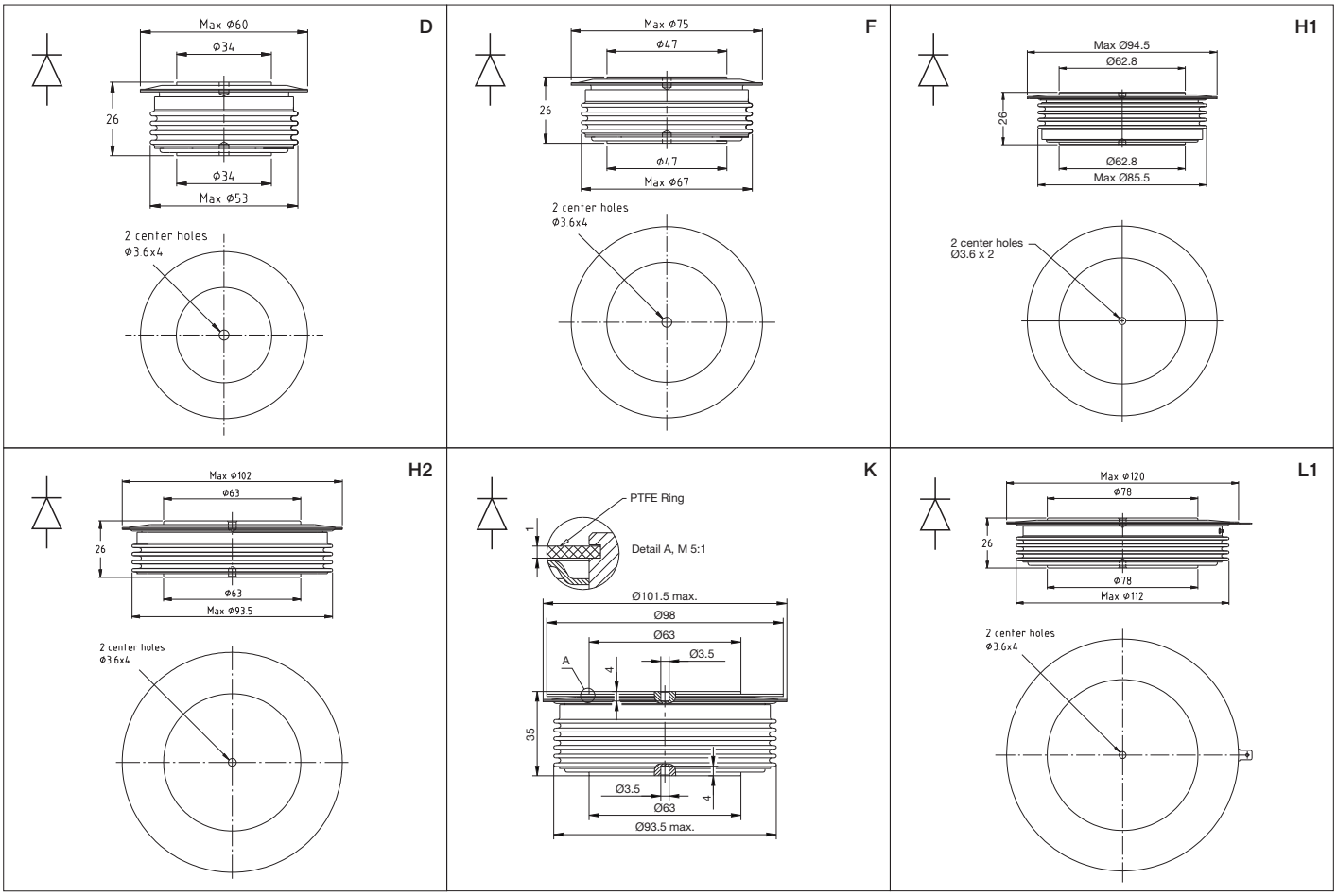
Part number	V_{RSM}	V_{RRM}	I_{FAVM}	I_{FSM}	V_{T0}	r_T	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
			T_C=85°C	10ms T_{VJM}	T_{VJM}						
	V	V	A	kA	V	mΩ	°C	K/kW	K/kW	kN	
5SDD 70H2000	2000	2000	7030	65.0	0.861	0.046	190	8.0	2.5	50	H2
5SDD 65H2400	2400	2400	6520	59.0	0.870	0.057	190	8.0	2.5	50	H2
5SDD 51L2800	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	T1
5SDD 11D2800	3000	2800	1285	15.0	0.933	0.242	160	32.0	8.0	10	D
5SDD 24F2800	3000	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 39K4000	4000	4000	3941	46.0	0.905	0.109	160	9.2	2.5	50	K
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 09D6000	6000	6000	845	11.0	0.893	0.647	150	32.0	8.0	10	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 31K6000	6000	6000	3097	40.0	0.894	0.166	150	9.2	2.5	50	K

Drawings see page 34f.
Please refer to page 74 for part numbering structure.

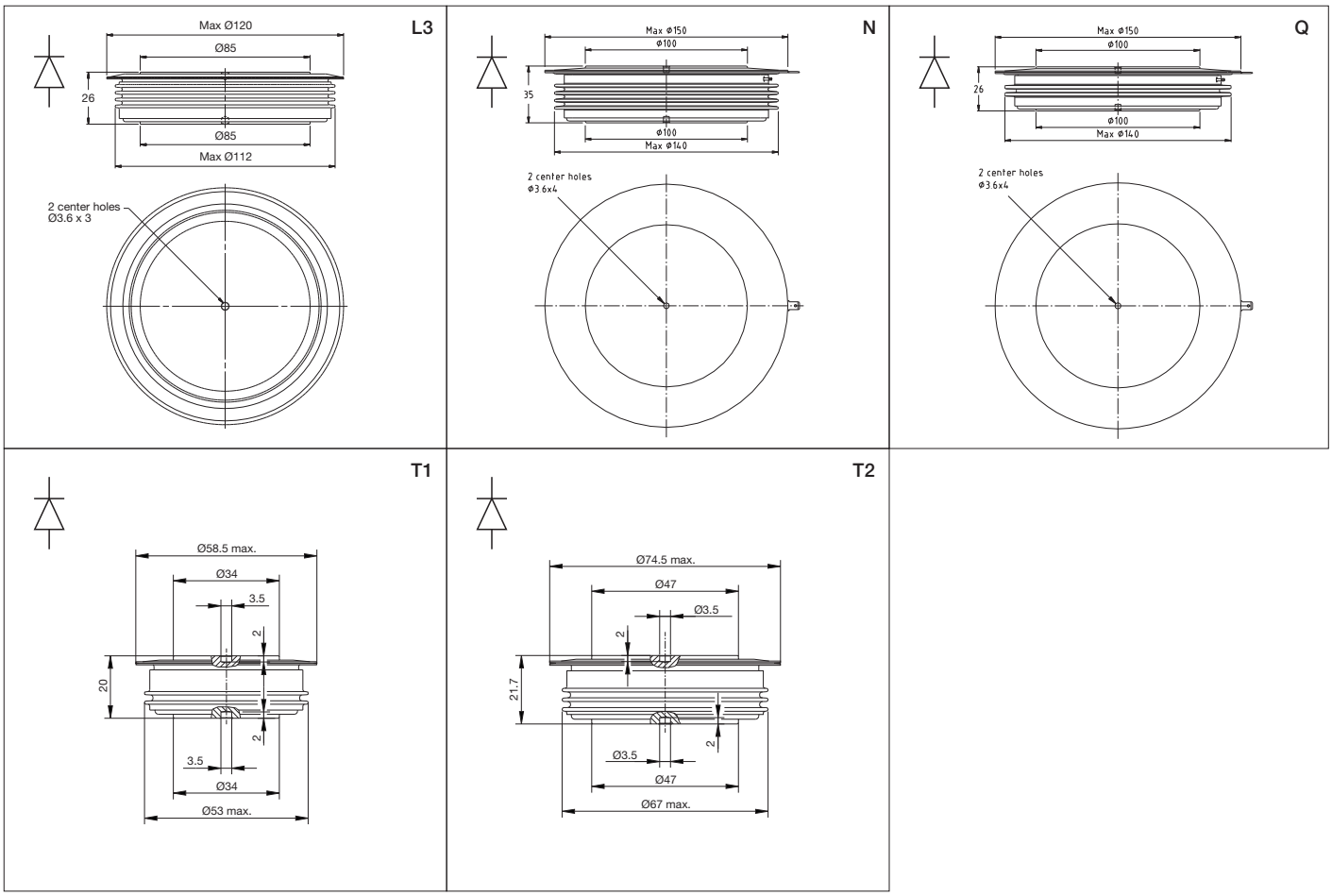
Avalanche diodes

Part number	V_{RRM}	I_{FAVM} T_C=85°C	I_{FSM} 10ms T_{VJM}	V_{F0} T_{VJM}	r_F	P_{RSM} 20µs T_{VJM}	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
	V	A	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

Please refer to page 74 for part numbering structure.



Dimensions in mm



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 small weight, 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	10ms 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	0.97	1.02	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

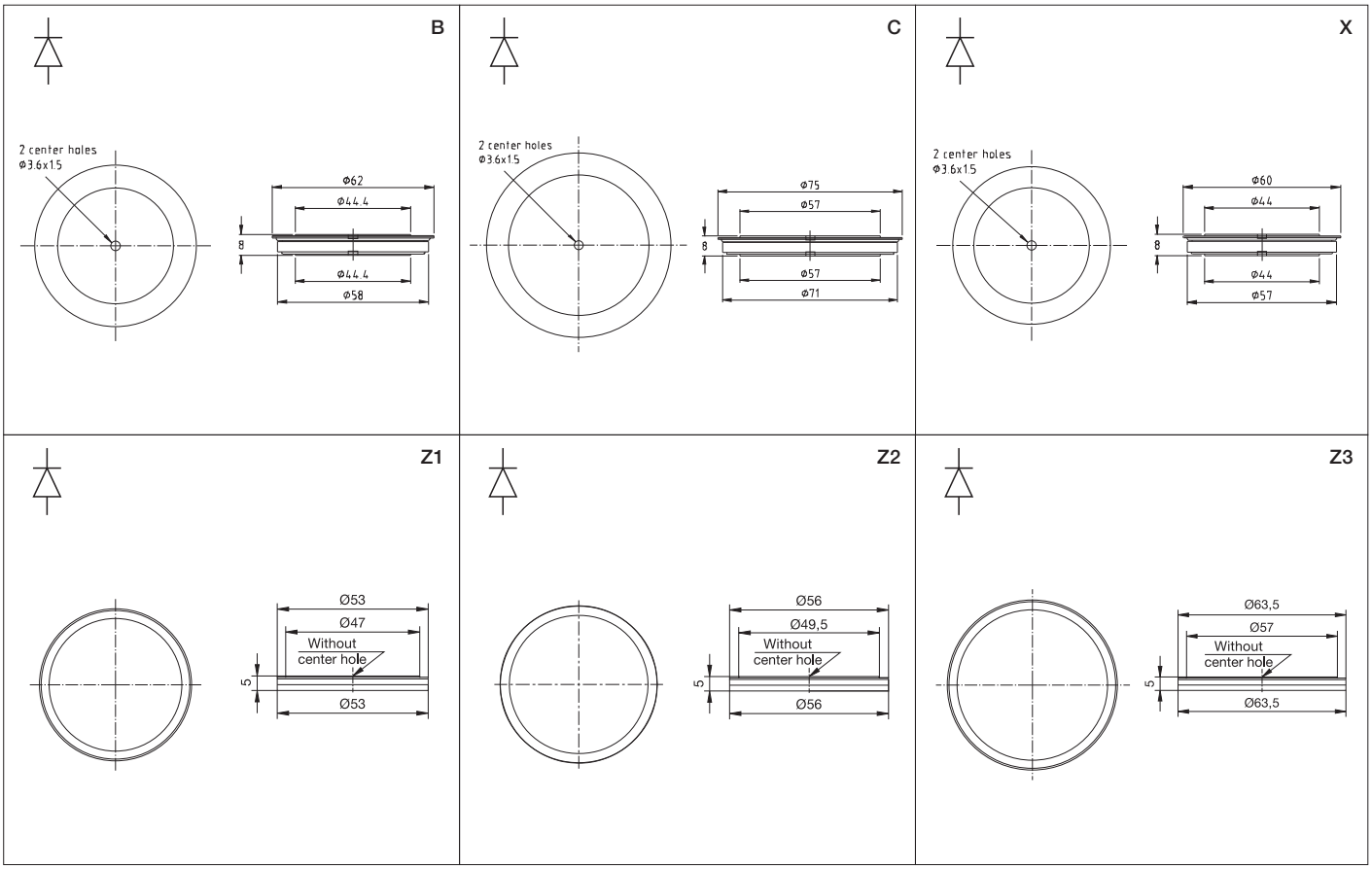
* at 8000 A, T_{VJM}

High frequency

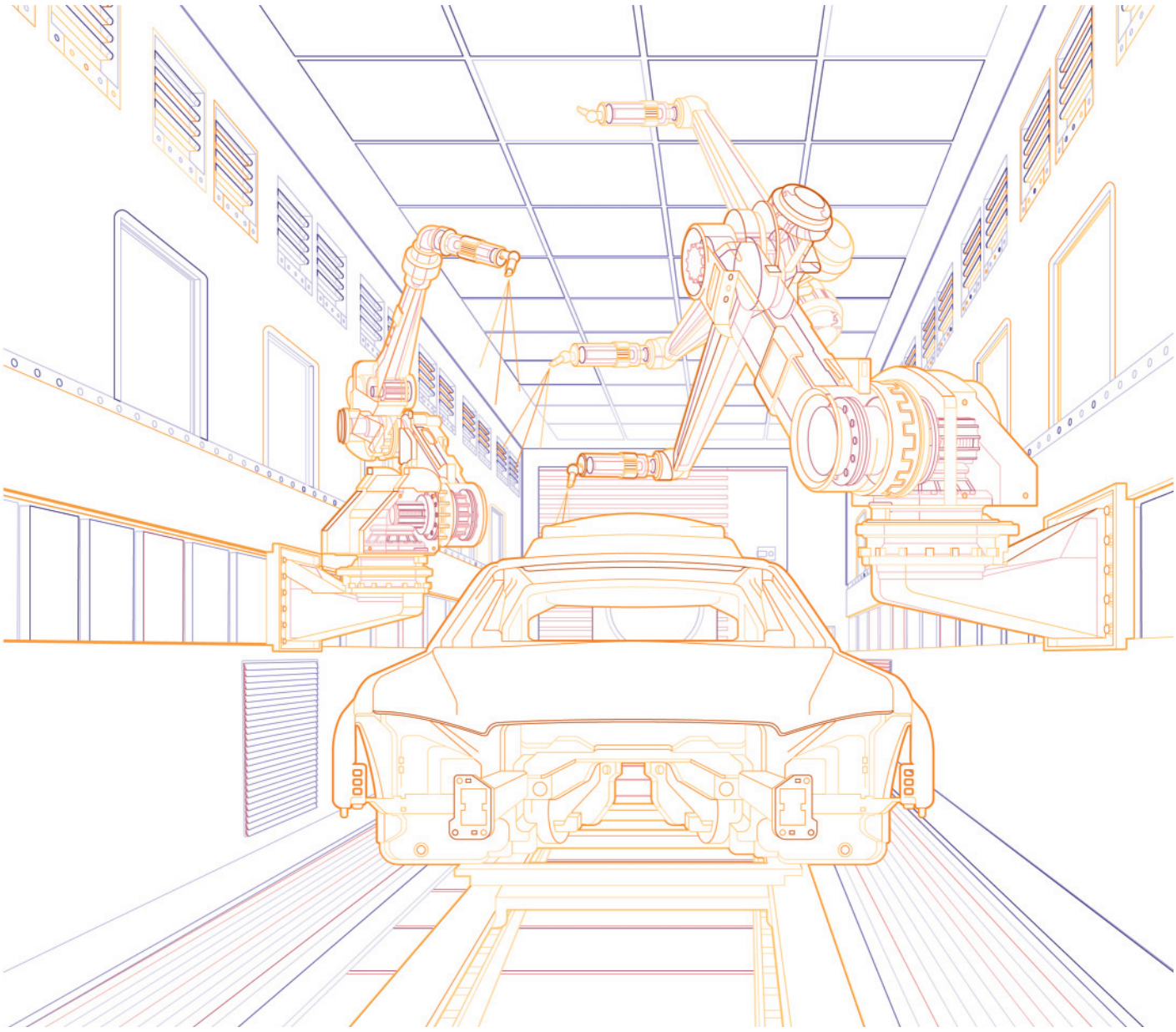
Part number	V_{RRM}	V_{Fmax}	I_{FAVM}	I_{FSM}	V_{F0}	r_F	Q_{rr}	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
		T_{VJM} I_F= 5000A	T_C=85°C	10ms T_{VJM}	T_{VJM}	T_{VJM}	T_{VJM}					
	V	V	A	kA	V	mΩ	µC	°C	K/kW	K/kW	kN	
5SDF 63B0400	400	1.14	6266	44	0.96	0.036	180	190	10.0	5.0	22	B
5SDF 63X0400	400	1.14	6266	44	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 74 for part numbering structure.



Dimensions in mm



Thyristors

High-power thyristors are used in applications ranging from 100 kW soft starters up to HVDC stations rated 8 to 10 GW. Besides commonly being used at line frequency, they are also found in kilohertz range applications like induction heating. Such applications can take advantage from devices where multiple functionalities are integrated in a single housing, like the integration of a diode and a thyristor or two antiparallel thyristors.

ABB offers the following thyristor families:

- Phase control thyristors (PCTs) → page 42
- Bi-directionally controlled thyristors (BCTs) → page 46
- Fast switching thyristors → page 48
- Reverse conducting thyristors (RCTs) → page 48


ABB

Phase control thyristors – PCTs

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 DC 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 46).

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	10ms T_{VJM}	T_{VJM}						
	V	A	kA	V	mΩ	°C	K/kW	K/kW	kN	
5STP 06T1600	1600	641	9.9	0.99	0.503	125	44.0	12.0	9	T4
5STP 10D1601	1600	969	15.0	0.93	0.302	125	32.0	10.0	10	D
5STP 10T1600	1600	969	15.0	0.93	0.302	125	32.0	10.0	10	T1
5STP 20F1601	1600	1901	27.3	0.95	0.152	125	16.0	4.0	22	F
5STP 20T1600	1600	1956	27.3	0.95	0.152	125	15.5	4.0	22	T2
5STP 34H1601	1600	3370	49.0	0.94	0.066	125	10.0	3.0	50	H
5STP 34T1600	1600	3370	49.0	0.94	0.066	125	10.0	3.0	50	T3
5STP 07D1800	1800	730	9.0	0.80	0.540	125	36.0	7.5	10	D
5STP 09D1801	1800	932	13.7	0.94	0.341	125	32.0	10.0	10	D
5STP 18F1800	1800	1660	21.0	0.83	0.230	125	17.0	4.0	22	F
5STP 18F1801	1800	1825	26.2	0.97	0.170	125	16.0	4.0	22	F
5STP 18T1800	1800	1870	26.2	0.96	0.170	125	15.5	4.0	22	T2
5STP 30H1801	1800	3108	47.0	0.98	0.081	125	10.0	3.0	50	H
5STP 30T1800	1800	3108	47.0	0.98	0.081	125	10.0	3.0	50	T3
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 09D2201	2200	863	12.0	0.98	0.414	125	32.0	10.0	10	D
5STP 17F2201	2200	1702	25.5	0.99	0.206	125	16.0	4.0	22	F
5STP 17T2200	2200	1743	25.5	0.99	0.206	125	15.5	4.0	22	T2
5STP 29H2201	2200	2855	45.0	1.00	0.107	125	10.0	3.0	50	H
5STP 29T2200	2200	2855	45.0	1.00	0.107	125	10.0	3.0	50	T3
5STP 06D2800	2800	620	8.0	0.92	0.780	125	36.0	7.5	10	D
5STP 08D2801	2800	792	10.6	1.06	0.492	125	32.0	10.0	10	D
5STP 08T2800	2800	792	10.6	1.06	0.492	125	32.0	10.0	10	T1
5STP 15T2800	2800	1589	23.6	1.02	0.265	125	15.5	4.0	22	T2
5STP 16F2800	2800	1400	18.0	0.82	0.370	125	17.0	4.0	22	F
5STP 16F2801	2800	1554	23.6	1.02	0.265	125	16.0	4.0	22	F
5STP 27H2801	2800	2670	43.0	1.04	0.127	125	10.0	3.0	50	H
5STP 27T2800	2800	2670	43.0	1.04	0.127	125	10.0	3.0	50	T3
5STP 33L2800	2800	3740	60.0	0.95	0.100	125	7.0	1.5	70	L

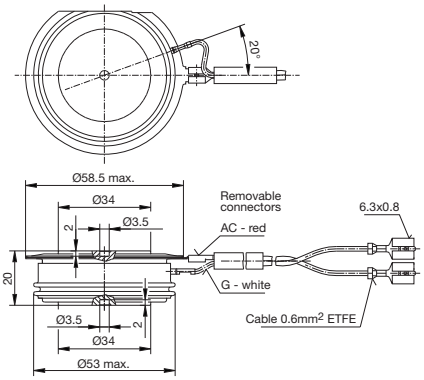
Please refer to page 73 for part numbering structure.

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	10ms T_{VJM}	T_{VJM}						
	V	A	kA	V	mΩ	°C	K/kW	K/kW	kN	
5STP 45N2800	2800	5080	75.0	0.86	0.070	125	5.7	1.0	90	N
5STP 45Q2800	2800	5490	75.0	0.86	0.070	125	5.0	1.0	90	Q
5STP 04D4200	4200	470	8.0	1.00	1.500	125	36.0	7.5	10	D
5STP 12F4200	4200	1150	19.0	0.95	0.575	125	17.0	4.0	22	F
5STP 21H4200	4200	2192	32.0	1.25	0.191	125	10.0	3.0	50	H
5STP 28L4200	4200	3170	52.0	0.97	0.158	125	7.0	1.5	70	L
5STP 38N4200	4200	3960	60.0	0.95	0.130	125	5.7	1.0	90	N
5STP 38Q4200	4200	4275	60.0	0.95	0.130	125	5.0	1.0	90	Q
5STP 04D5200	5200	440	5.0	1.20	1.600	125	36.0	7.5	10	D
5STP 17H5200	5200	1975	37.0	1.02	0.320	125	10.0	2.0	50	H
5STP 25L5200	5200	2760	55.0	1.00	0.225	125	7.0	1.5	70	L
5STP 25M5200	5200	2540	55.0	1.00	0.225	125	9.0	1.5	70	M
5STP 34N5200	5200	3600	55.0	1.03	0.160	125	5.7	1.0	90	N
5STP 34Q5200	5200	3875	55.0	1.03	0.160	125	5.0	1.0	90	Q
5STP 52U5200	5200	5120	85.2	1.04	0.115	125	4.0	0.8	135	U
5STP 03D6500	6500	380	4.5	1.20	2.300	125	36.0	7.5	10	D
5STP 03X6500	6500	350	4.5	1.20	2.300	125	45.0	7.5	10	X
5STP 08F6500	6500	830	16.0	1.24	1.015	125	17.0	4.0	22	F
5STP 08G6500	6500	720	16.0	1.24	1.015	125	22.0	4.0	22	G
5STP 12K6500	6500	1370	33.0	1.18	0.632	125	11.0	2.0	50	K
5STP 18M6500	6500	1800	50.0	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	80.0	1.24	0.162	125	4.0	0.8	135	U
5STP 48Y7200 * **New**	7200	4800	92.0	1.00	0.126	110	3.0	0.6	190	Y
5STP 37Y8500	8000	3720	90.0	1.22	0.220	110	3.0	0.6	190	Y
5STP 27N8500 * **New**	8500	2650	55.0	1.25	0.290	125	5.7	1.0	90	N
5STP 27Q8500 * **New**	8500	2900	55.0	1.25	0.290	125	5.0	1.0	90	Q

* Contact factory

Please refer to page 73 for part numbering structure.

T1



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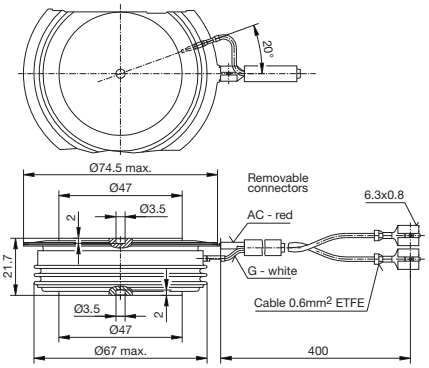

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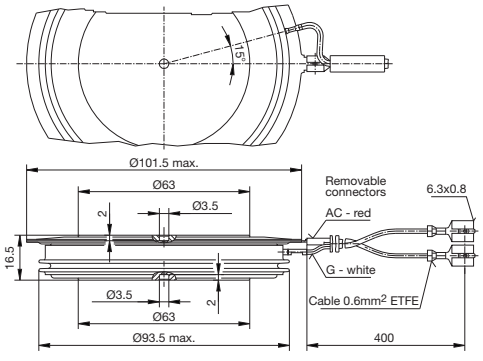

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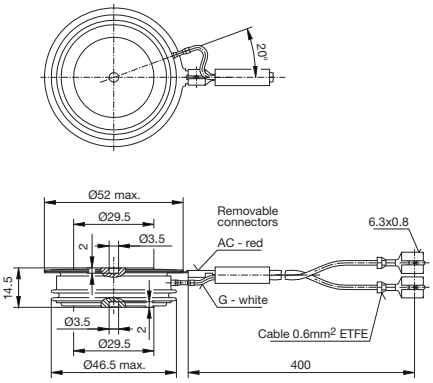
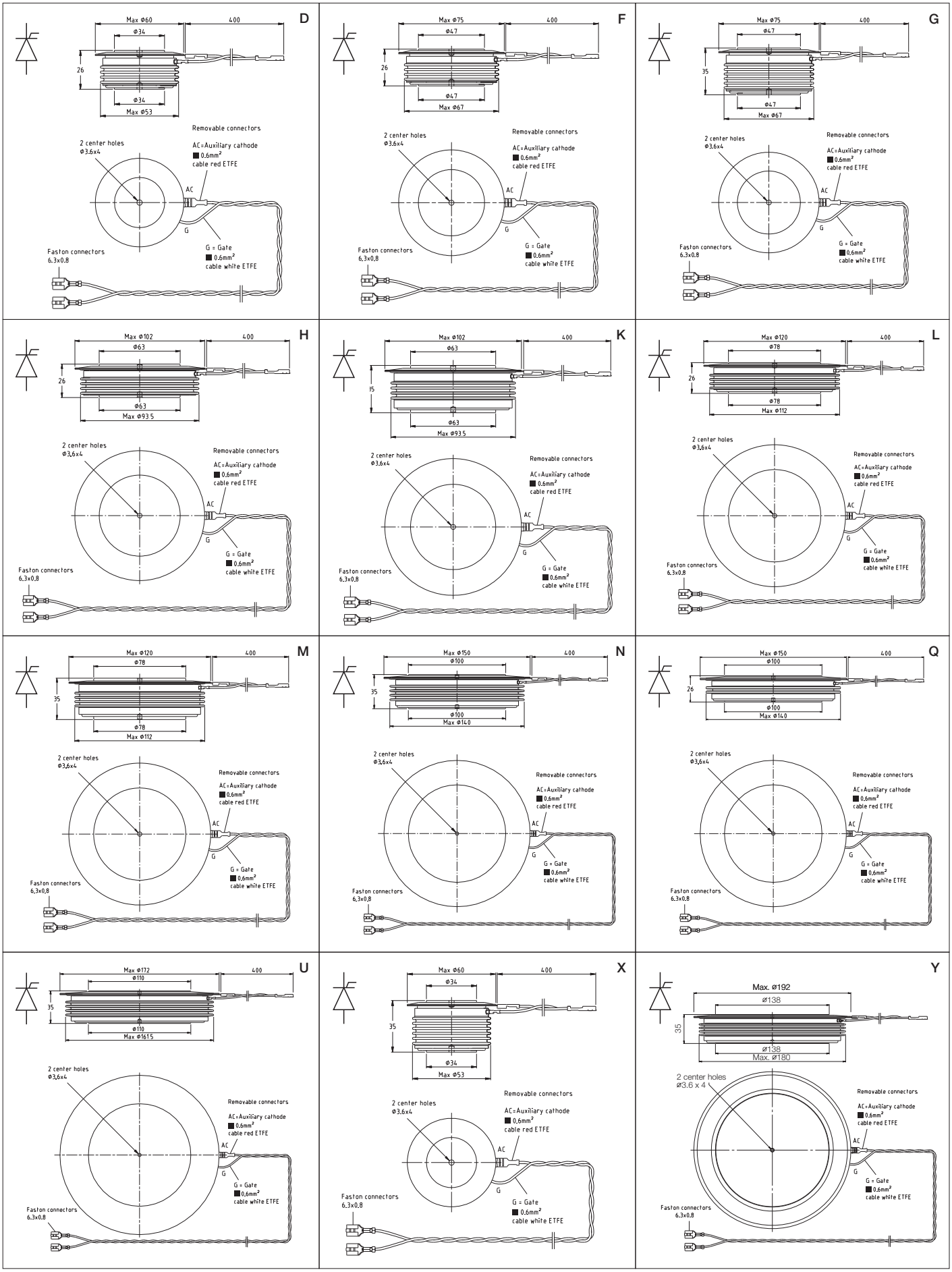


Dimensions in mm.



Dimensions in mm

Bi-directionally controlled thyristors – BCTs

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, nota bene.

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.

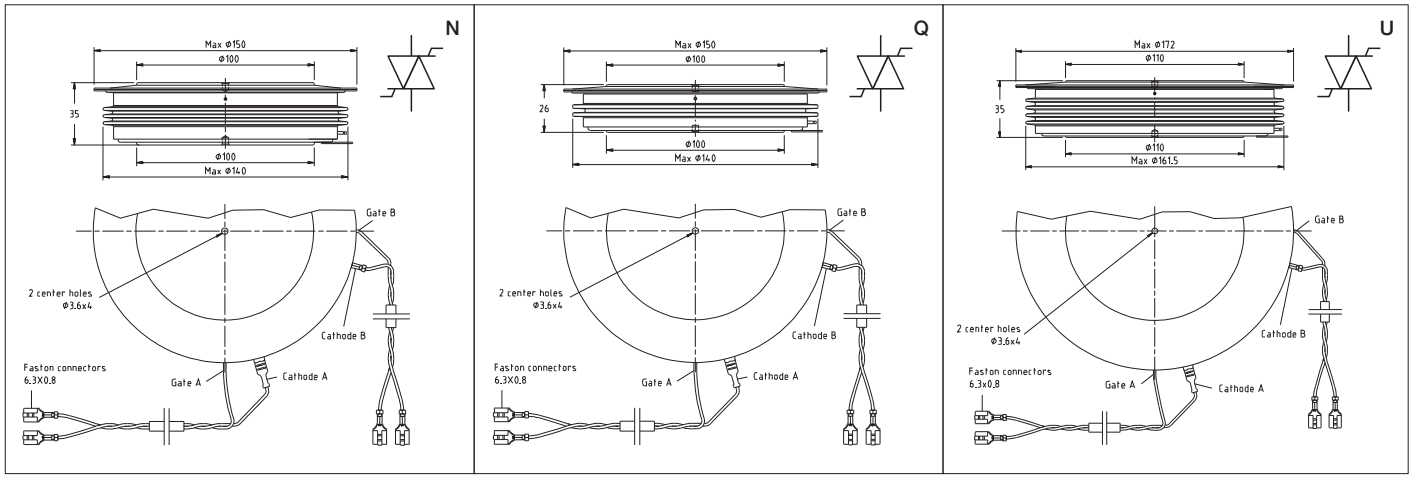
The BCT is designed, manufactured and tested using the same philosophy, technology and equipment as the well-established PCT (page 42), thus reaching the same levels of performance and reliability.

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_{RMS} *	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	10ms 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 73 for part numbering structure.



Dimensions in mm

Fast switching & reverse conducting thyristors

ABB offers three lines of fast switching thyristors: the standard fast thyristor, the medium frequency fast thyristor and the reverse conducting fast thyristor. All types feature optimized and very short turn-on and turn-off times, large critical rates of on-state current rise, high surge current ratings and a wide operating temperature range.

These thyristors are typically used in induction heating resonant inverters, DC chopper drives, UPS, pulse power and other fast switching applications.

The **standard fast thyristors** feature an amplifying gate structure and a special lifetime control technology, ensuring low on-state and switching losses, a low reverse recovery time and a high di/dt performance.

The **medium frequency fast thyristors** take advantage of the distributed gate technology. Their special cathode and gate designs allow for an effective operation in the medium frequency range of up to 10 kHz.

The **reverse conducting fast thyristors** feature a monolithically integrated free-wheeling diode. Several types of this thyristor are available as spare and replacement parts.

Standard fast thyristors

Part number	V_{DRM}, V_{RRM}	I_{TAVM}	I_{TSM}	V_{T0}	r_T	Q_{rr}	t_q	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
	T_{VJM}	T_C=70°C	10ms T_{VJM}	T_{VJM}		1) T_{VJM}	2) T_{VJM}					
	V	A	kA	V	mΩ	µAs	µs	°C	K/kW	K/kW	kN	
5STF 13F1220	1200	1252	21.0	1.772	0.248	-	20.0	125	16.0	4.0	22	F
5STF 15F1232	1200	1532	21.0	1.283	0.209	-	32.0	125	16.0	4.0	22	F
5STF 07D1413	1400	710	12.0	1.652	0.347	190	12.5	125	32.0	10.0	10	D
5STF 07T1413	1400	710	12.0	1.652	0.347	190	12.5	125	32.0	10.0	10	T1
5STF 09D1420	1400	847	13.0	1.231	0.317	380	20.0	125	32.0	10.0	10	D
5STF 09T1420	1400	847	13.0	1.231	0.317	380	20.0	125	32.0	10.0	10	T1
5STF 12F2040	2000	1202	17.0	1.999	0.218	550	40.0	125	16.0	4.0	22	F
5STF 14F2063	2000	1440	17.0	1.602	0.170	1100	63.0	125	16.0	4.0	22	F
5STF 23H2040	2000	2322	42.0	1.516	0.111	1200	40.0	125	10.0	3.0	50	H
5STF 28H2060	2000	2667	47.0	1.198	0.103	2400	60.0	125	10.0	3.0	50	H
5STF 10F3080	3000	1003	13.0	2.562	0.246	1000	80.0	125	16.0	4.0	22	F
5STF 11F3010	3000	1112	14.0	2.149	0.258	1600	100.0	125	16.0	4.0	22	F

1) at I_T = 500(1000) A, di_T/dt = -50A/µs, V_R = 100 V 2) at I_T = 500(1000) A, di_T/dt = -50A/µs, V_R = 100 V, V_D = 2/3 V_{DRM}, dV/dt = 50V/µs

Medium frequency fast thyristors

Part number	V_{DRM}, V_{RRM}	I_{TAVM}	I_{TSM}	V_{T0}	r_T	Q_{rr}	t_q	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
	T_{VJM}	T_C=70°C	10ms T_{VJM}	T_{VJM}		1) T_{VJM}	2) T_{VJM}					
	V	A	kA	V	mΩ	µAs	µs	°C	K/kW	K/kW	kN	
5STF 18F1210	1200	1779	22.0	1.374	0.094	380	10.0	125	16.0	4.0	22	F
5STF 06D1408	1400	568	11.0	2.311	0.365	80	8.0	125	32.0	10.0	10	D
5STF 06T1408	1400	568	11.0	2.311	0.365	80	8.0	125	32.0	10.0	10	T1
5STF 07D1414	1400	736	12.0	1.683	0.274	160	12.5	125	32.0	10.0	10	D
5STF 07T1414	1400	736	12.0	1.683	0.274	160	12.5	125	32.0	10.0	10	T1
5STF 16F1413	1400	1526	21.0	1.628	0.121	300	12.5	125	16.0	4.0	22	F
5STF 17F1420	1400	1693	21.0	1.403	0.114	670	20.0	125	16.0	4.0	22	F
5STF 06D2020	2000	557	8.0	2.348	0.386	240	20.0	125	32.0	10.0	10	D
5STF 06T2020	2000	557	8.0	2.348	0.386	240	20.0	125	32.0	10.0	10	T1
5STF 07D2032	2000	679	9.0	1.849	0.306	440	32.0	125	32.0	10.0	10	D
5STF 07T2032	2000	679	9.0	1.849	0.306	440	32.0	125	32.0	10.0	10	T1
5STF 12F2025	2000	1191	17.0	2.125	0.185	410	25.0	125	16.0	4.0	22	F
5STF 15F2040	2000	1489	17.0	1.605	0.144	1000	40.0	125	16.0	4.0	22	F
5STF 05D2425	2400	517	7.0	2.551	0.430	260	25.0	125	32.0	10.0	10	D
5STF 05T2425	2400	517	7.0	2.551	0.430	260	25.0	125	32.0	10.0	10	T1
5STF 06D2440	2400	617	8.0	2.045	0.365	450	40.0	125	32.0	10.0	10	D
5STF 06T2440	2400	617	8.0	2.045	0.365	450	40.0	125	32.0	10.0	10	T1

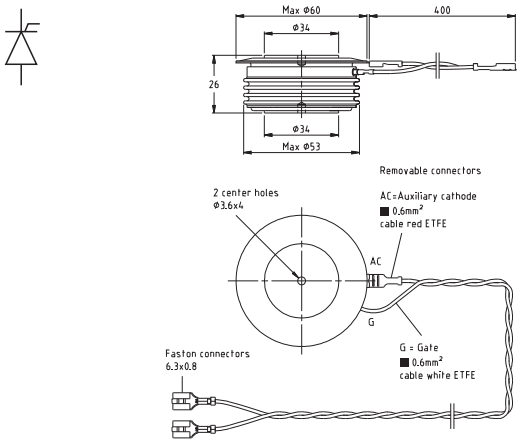
1) at I_T = 500(1000) A, di_T/dt = -50A/µs, V_R = 100 V 2) at I_T = 500(1000) A, di_T/dt = -50A/µs, V_R = 100 V, V_D = 2/3 V_{DRM}, dV_D/dt = 50V/µs

Reverse conducting fast thyristors

Part number	V_{DRM}	I_{TAVM} / I_{FAVM}	I_{TSM} / I_{FSM}	V_{T0} / V_{F0}	r_T / r_F	t_q	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
		T_C=70°C	10ms T_{VJM}	T_{VJM}		T_{VJM}					
	V	A	kA	V	mΩ	µs	°C	K/kW	K/kW	kN	
5STR 03T2040 FST	2000	360	5.0	1.55	1.010	40.0	125	55	10	10	T1
Diode part		223	3.5	1.34	2.100	4.0	125	88	-	-	
5STR 10T2520 FST	2500	857	14.0	2.04	0.321	20.0	125	20	3	30	T5
Diode part		388	6.0	1.49	1.066	4.0	125	50	-	-	

Please refer to page 73 for part numbering structure.

D



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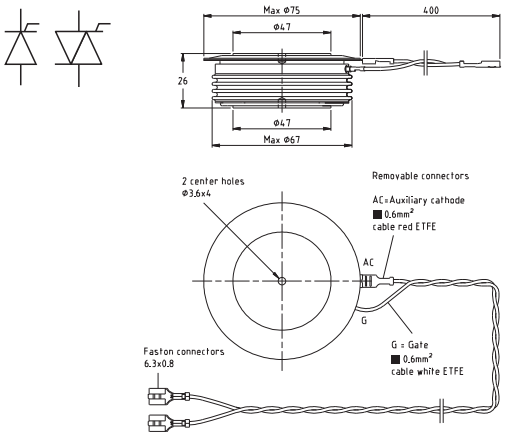

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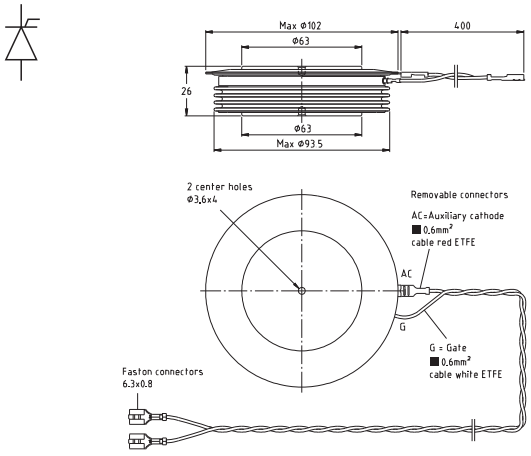
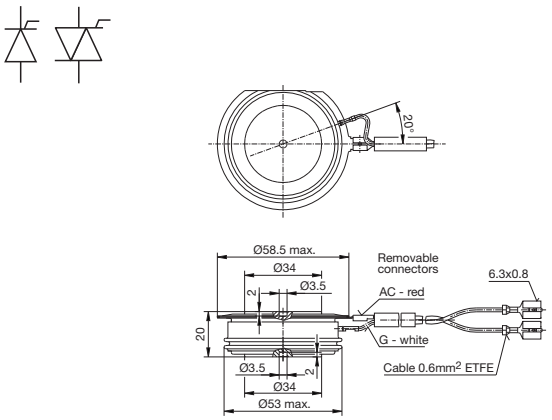
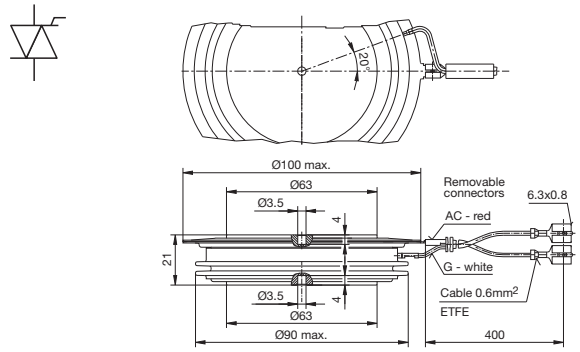


T1



T5



Dimensions in mm

Integrated gate-commutated thyristors – IGCTs

Within 15 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.

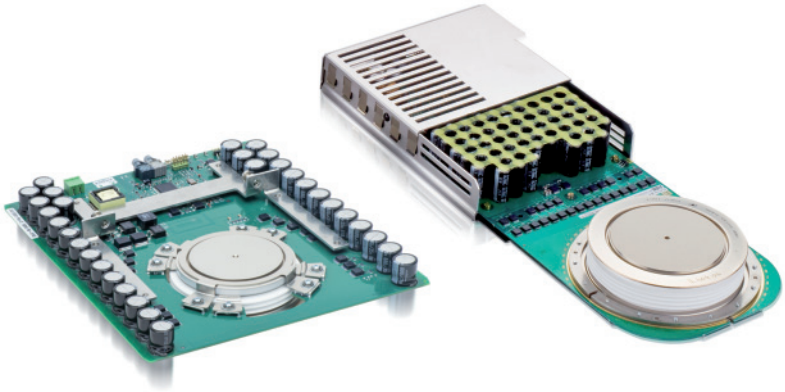
ABB Semiconductors' IGCTs are used in a multitude of applications due to their versatility, efficiency and cost-effectiveness. With their low on-state voltage, they achieve the lowest running costs by reaching inverter efficiencies of 99.6 percent and more.

Single inverters of over 15 MVA can be realised 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.

ABB's most recent IGCT development is the 6,500 V reverse blocking (RB) IGCT. This symmetrical IGCT is optimized for the current source inverter technology in medium voltage drive and breaker applications.



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	3ms	10ms	4000A	T_{VJM}							
						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 40L4511	4500	2800	17	3600	1430	39	28	3.50	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

Reverse blocking IGCTs

Part number	V_{DRM}	V_{RRM}	I_{TGQM}	I_{TAVM}	V_T	V_{T0}	r_T	T_{VJM}	R_{thJH}	F_m	V_{GIN}	Outline
				T_C=85°C	800A	T_{VJM}						
					T_{VJM}							
	V	V	A	A	V	V	mΩ	°C	K/kW	kN	V	
5SHZ 11H6500	6500	6500	1100	490	5.87	2.92	3.69	125	14	20	19-21	Fig. 2

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	I_{rr}	T_{VJM}	R_{thJC}	F_m	V_{GIN}	Outline
				T_C=85°C	10ms	I_{TGQM}	T_{VJM}		max.						
					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 73 for part numbering structure.

Fig. 1

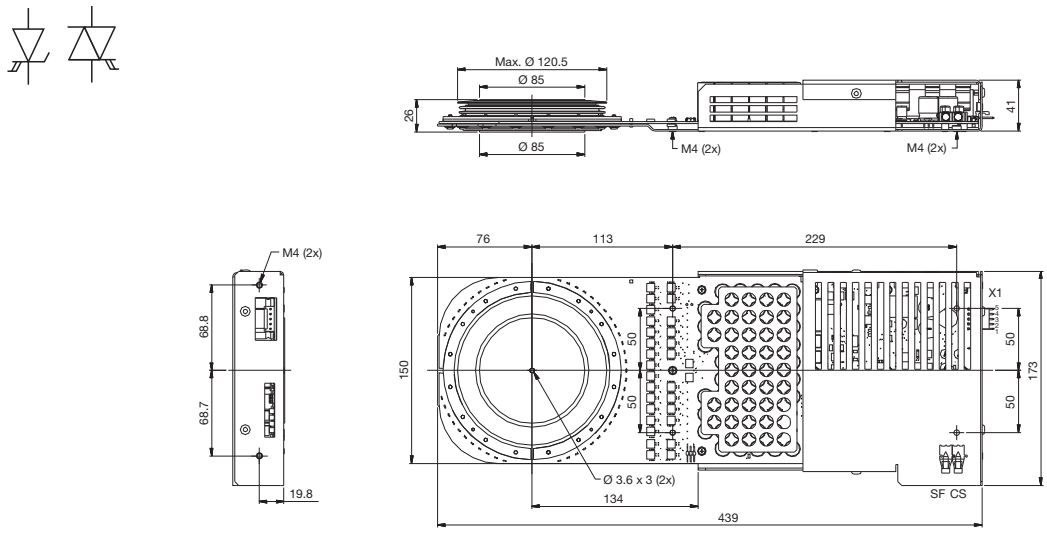
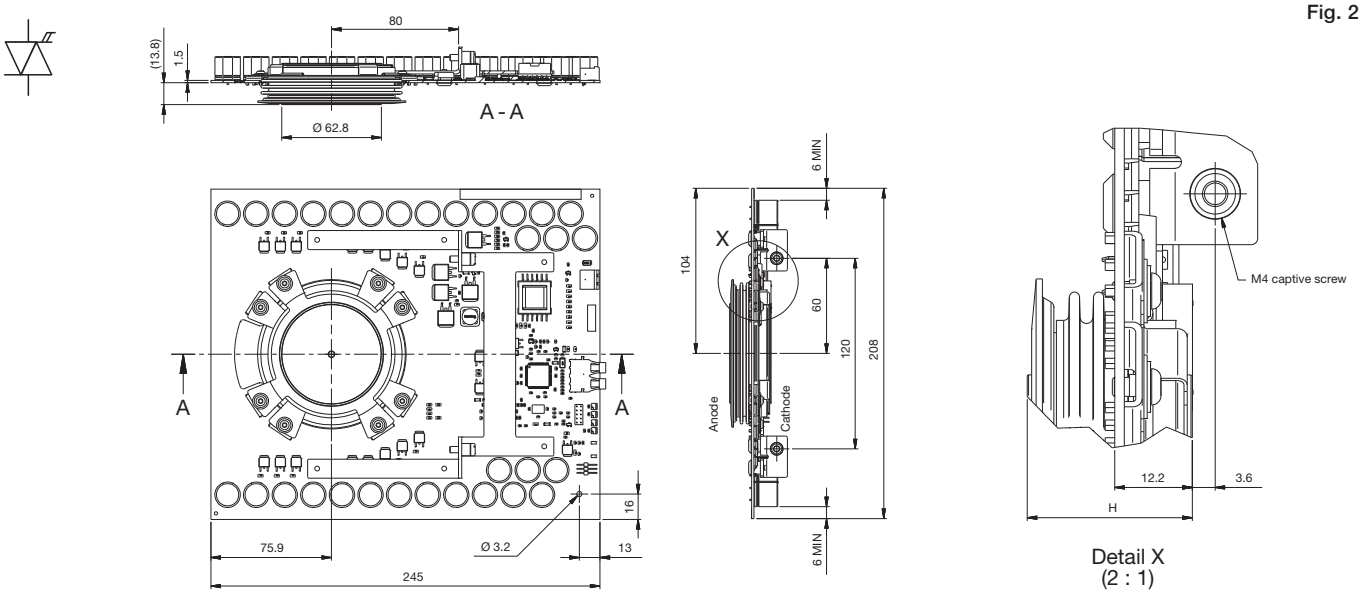


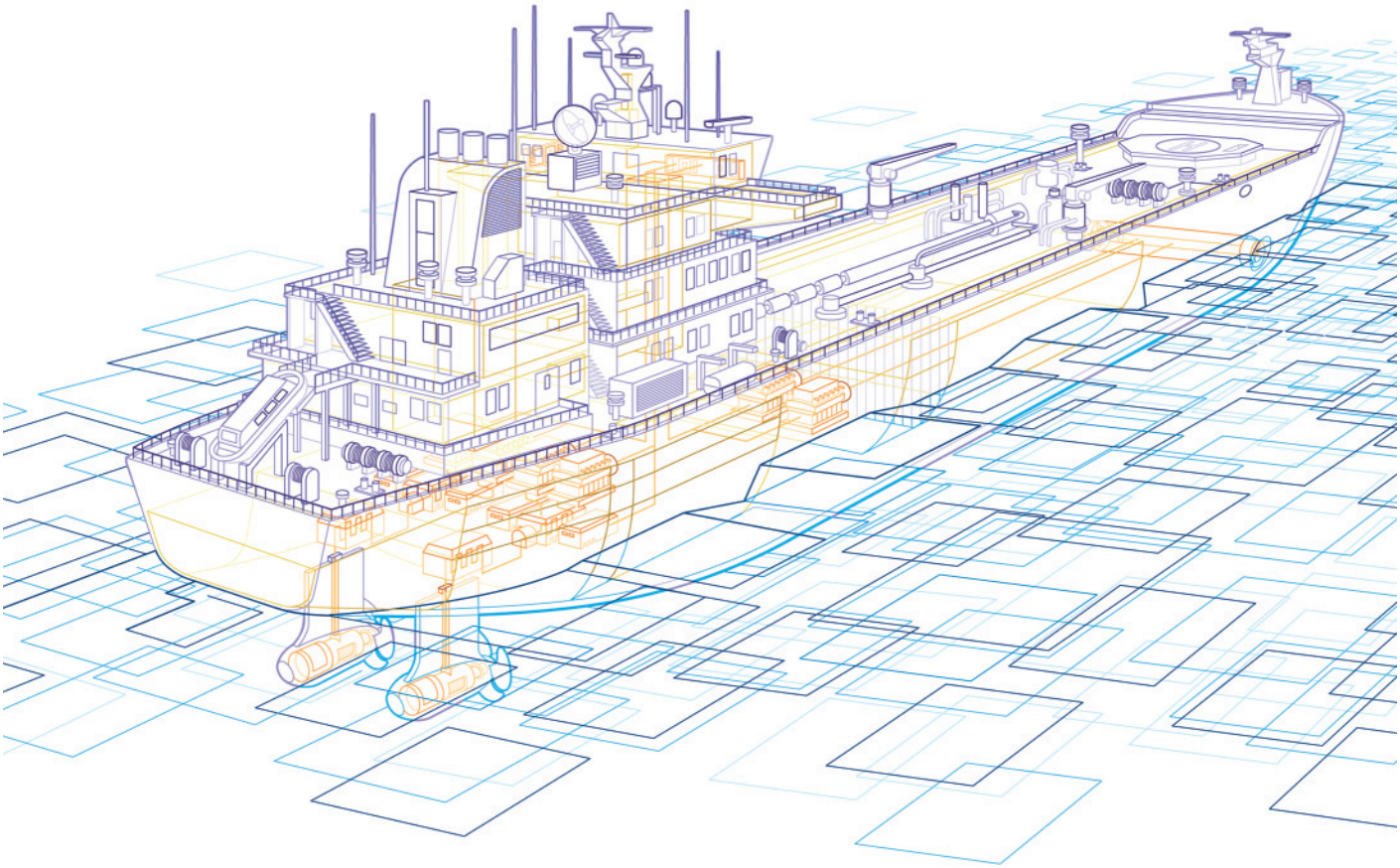
Fig. 2



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.



Gate turn-off thyristors – GTOs

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 both asymmetric and symmetric 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.

Symmetric GTOs feature full reverse voltage, low on-state and turn-off losses.

Asymmetric GTOs

Part number	V_{DRM}	V_{DC}	V_{RRM}	I_{TGQM} at C_S		I_{TAVM} T_C=85°C	I_{TSM} 10ms T_{VJM}	V_T I_{TGQM} T_{VJM}	V_{T0} T_{VJM}	r_T T_{VJM}	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
	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	F1
5SGA 20H2501	2500	1400	17	2000	4	830	16.0	2.80	1.66	0.57	125	17	5	20	H1
5SGA 25H2501	2500	1400	17	2500	6	830	16.0	3.10	1.66	0.57	125	17	5	20	H1
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	D1
5SGA 20H4502	4500	2200	17	2000	4	710	13.0	3.50	1.80	0.85	125	17	5	20	H1
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

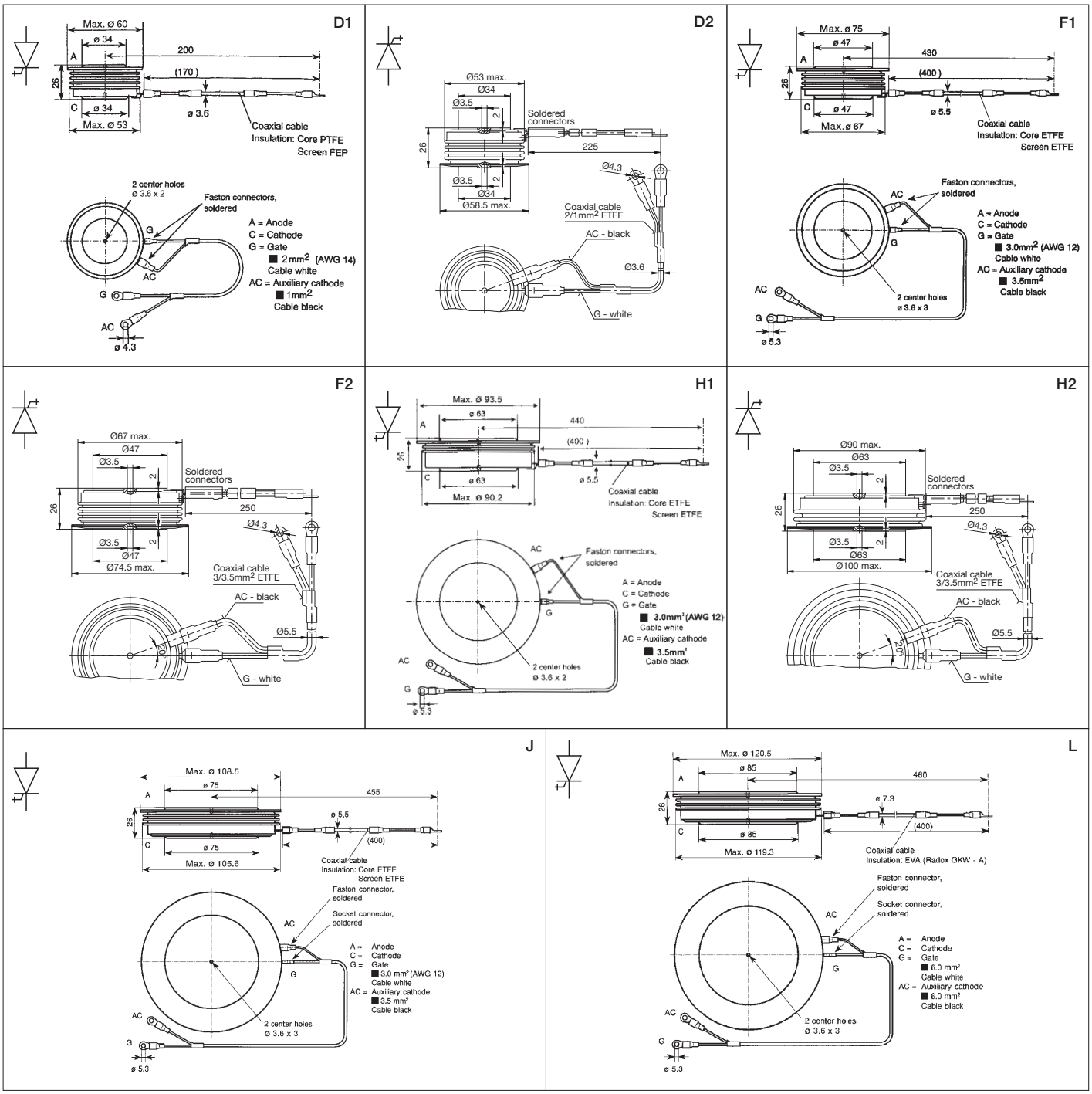
Asymmetric fine pattern GTOs with buffer layer

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	40	L

Symmetric GTOs

Part number	V_{DRM}, V_{RRM}	I_{TGQM} at C_S		I_{TAVM} T_C=70°C	I_{TSM} 10ms T_{VJM}	V_T I_{TGQM} T_{VJM}	V_{T0} T_{VJM}	r_T T_{VJM}	T_{VJM}	R_{thJC}	R_{thCH}	F_m	Housing
	V	A	µF	A	kA	V	V	mΩ	°C	K/kW	K/kW	kN	
5SGS 08D2500	2500	800	2	395	4.5	3.20	1.63	1.90	125	40.0	12.0	5	D2
5SGS 12F2500	2500	1200	3	630	10.0	3.20	1.49	1.38	125	24.0	8.0	10	F2
5SGS 16H2500	2500	1600	4	760	14.0	3.78	1.81	1.18	125	18.0	6.0	15	H2
5SGS 08D4500	4500	800	2	285	4.0	4.33	1.77	3.10	115	40.0	12.0	5	D2
5SGS 12F4500	4500	1200	3	442	7.6	4.50	2.28	1.79	115	24.0	8.0	10	F2
5SGS 16H4500	4500	1600	4	600	12.0	4.45	2.30	1.30	115	18.0	6.0	15	H2

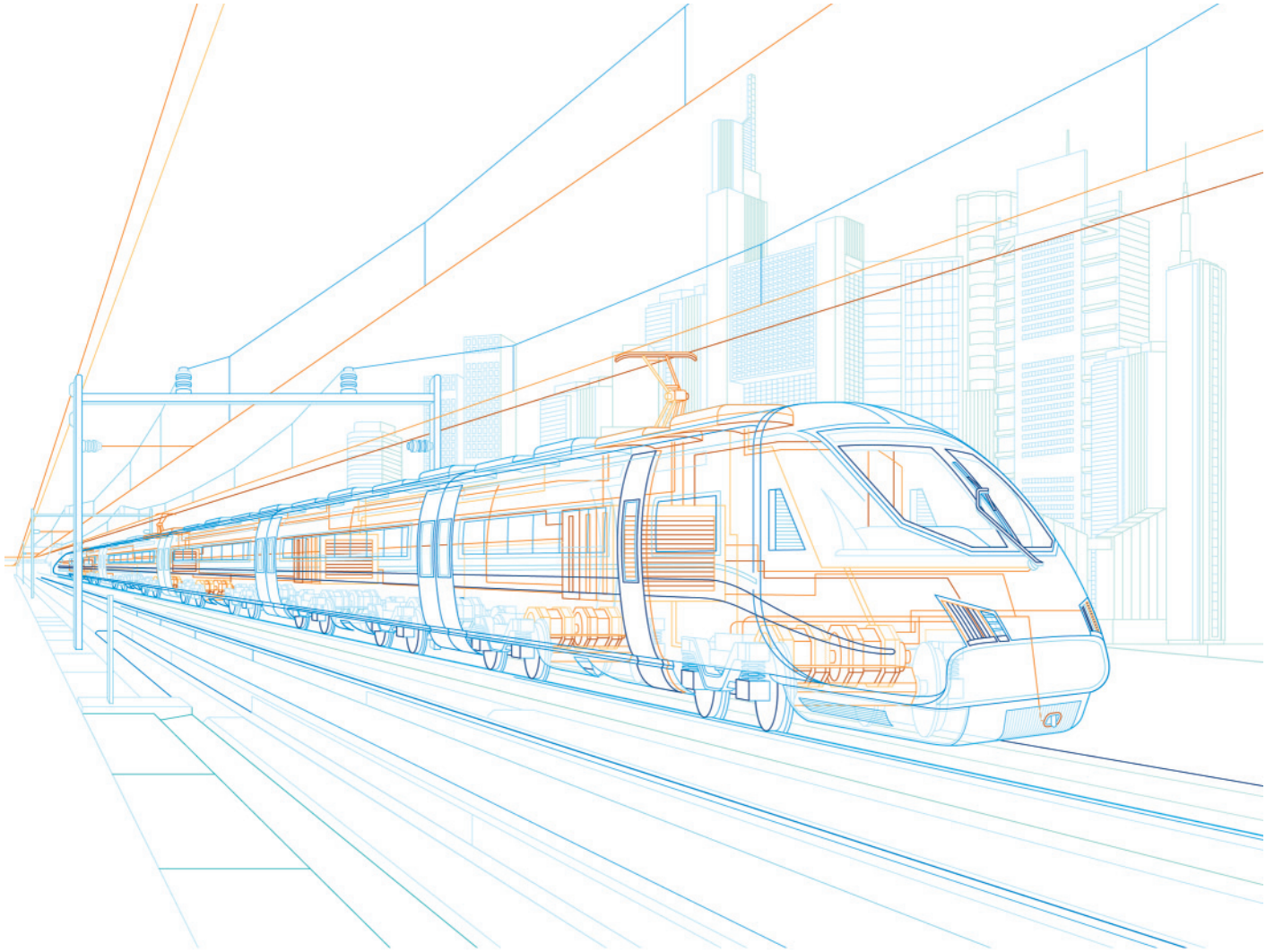
Please refer to page 73 for part numbering structure.



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.



Silicon surge voltage suppressors

ABB's power semiconductor devices exhibit impressive robustness against inadmissibly high surge voltages. In certain applications, however, silicon surge voltage suppressors are used still today as they protect for example power thyristors against small and medium power surges (eg 200 kW over 10 μs) and thus allow the use of thyristors with lower voltage capability and much smaller snubber circuits.

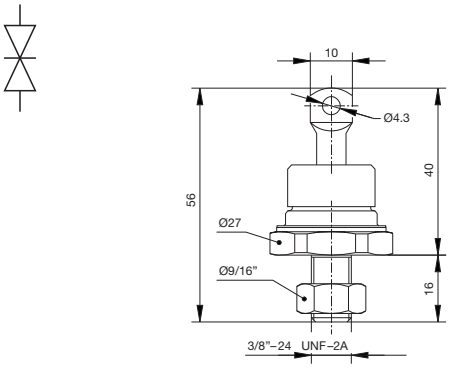
ABB Semiconductors' silicon surge voltage suppressors feature symmetric blocking characteristics with avalanche breakdown capability and offer an effective protection against repetitive and non-repetitive over-voltages. Several types of surge voltage suppressors are available as spare and replacement parts.

Part number ** = V_R / 100V	V_R T_{VJ} = 60°C	Tolerance T_{VJ} = 60°C	I_{RM} for base width				T_{VJM}	R_{thJH}	Housing
			10µs	100µs	1ms	10ms			
	V	V	A	A	A	A	°C	K/kW	
5SSA 50R**00	500, 600	±60	500	135	33	7.5	125	600	R
5SSA 38R**00	700, 800	±60	380	100	25	4.5	125	600	R
5SSA 30R**00	900, 1000	±60	300	80	21	4.0	125	600	R
5SSA 26R**00	1100, 1200	±60	260	67	18	3.6	125	600	R
5SSA 23R**00	1300, 1400	±60	230	58	15	3.4	125	600	R
5SSA 20R**00	1500, 1600	±60	200	50	13	3.0	125	600	R
5SSB 50X**00	450, 550	±50	500	135	33	7.5	125	500	X
5SSB 38X**00	650, 750	±50	380	100	25	4.5	125	500	X
5SSB 30X**00	850, 950	±50	300	80	21	4.0	125	500	X
5SSB 26X**00	1050, 1150	±50	260	67	18	3.6	125	500	X
5SSB 23X**00	1250, 1350	±50	230	58	15	3.4	125	500	X
5SSB 20X**00	1450, 1550	±50	200	50	13	3.0	125	500	X
5SSB 30X**00	1650, 1750, 1850, 1950	±50	300	80	21	4.0	125	250	X
5SSB 26X**00	2050, 2150, 2250, 2350	±50	260	67	18	3.6	125	250	X
5SSB 23X**00	2450, 2550, 2650, 2750	±50	230	58	15	3.4	125	250	X
5SSB 20X**00	2850, 2950	±50	200	50	13	3.0	125	250	X

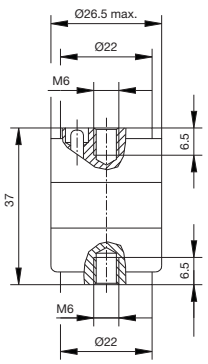
** = V_R/100V

Please refer to page 74 for part numbering structure.

R



X



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 a matter of course.

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 or modules. 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								
Thyristor and diode static / dynamic	X	X	X	X	X	X		
Gate turn-off thyristor and diode static	X	X	X					X
Gate turn-off thyristor 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 has been awarded the ISO certifications for manufacturing, design and development of high-power semiconductor devices and modules (ISO 9001, 14001 and OHSAS 18001).

ABB Switzerland Ltd., Semiconductors, is also certified according to IRIS Revision 02 which is a globally recognized standard unique to the railway sector for the evaluation of management systems. It complements the internationally recognized ISO 9001 quality standard introducing rail specific requirements.

BUREAU VERITAS Certification

Certificate
for

ABB Switzerland Ltd
Fabrikstrasse 3, 5600 Lenzburg / Switzerland

Bureau Veritas Certification hereby confirms that the management system of the above-mentioned organisation has been assessed and complies with the requirements set out in the following standards/regulations.

Standards/Regulations:

SN EN ISO 9001 : 2008

The management system comprises:

Design and development and manufacturing of high power semiconductor devices and modules

Date of initial certification: **11.01.2010**

The requirements of the standards/regulations must be complied with throughout the period of validity of this certificate. This will be ensured through regular monitoring by Bureau Veritas Certification.

Date of certification: **25.06.2015** Valid until: **24.06.2018**

Bureau Veritas Certification will provide information on the validity of this certificate on request at any time. Additional information on the management system and the area of applicability should be obtained from the organisation itself.

Certificate number: **CH8605250** Version: **1**

Issue date: **25.06.2015**

Bureau Veritas Certification (Switzerland) AG,
Grossächerstrasse 25, CH-8104 Weiningen ZH

Page 1 / 1

BUREAU VERITAS Certification

Certificate
for

ABB Schweiz AG, Seminconductors
5600 Lenzburg / Switzerland

Bureau Veritas Certification hereby confirms that the management system of the above-mentioned organisation has been assessed and complies with the requirements set out in the following standards / regulations.

Standards/Regulations:

SN EN ISO 14001 : 2004
BS OHSAS 18001 : 2007

The management system comprises:

Development and production of high power semiconductor devices and modules

Date of initial certification: **25.06.2007 (ISO 14001)**
18.12.2005 (BS OHSAS 18001)

The requirements of the standards/regulations must be complied with throughout the period of validity of this certificate. This will be ensured through regular monitoring by Bureau Veritas Certification.

Date of certification: **25.06.2013** Valid until: **24.06.2016**

Bureau Veritas Certification will provide information on the validity of this certificate on request at any time. Additional information on the management system and the area of applicability should be obtained from the organisation itself.

Certificate number: **CH7104653** Date: **19.06.2013**

Bureau Veritas Certification (Switzerland) AG,
Grossächerstrasse 25, CH-8104 Weiningen ZH

SCESm 003

IRIS Certification

BUREAU VERITAS Certification

C E R T I F I C A T E

awarded to

ABB Switzerland Ltd
Fabrikstrasse 3
5600, Lenzburg
Switzerland

BUREAU VERITAS CERTIFICATION

confirms, as an IRIS approved certification body, that the Management System of the above organization has been assessed and found to be in accordance with the

International Railway Industry Standard (IRIS)
Revision 02, June 2009

for the activities of Design and Development and Manufacturing
for the scopes of certification: 4 (Power system), 5 (Propulsion), 6 (Auxiliary systems)
of high power semiconductor devices and modules.

Certificate valid from: 25/06/2015 Certificate valid until: 24/06/2018*

Current date: 08/07/2015
Certificate-Register-No: CHE - IR - 000 579

* Providing that the subsequent surveillance audits are successful before the validity date of the previous audit.
Certification body address: 67/71 Boulevard du Château, 92200 Neuilly-sur-Seine, France

1/1

ELEKTROTECHNICKÝ ZKUŠEBNÍ ÚSTAV

ELECTROTECHNICAL TESTING INSTITUTE - CZECH REPUBLIC
ELEKTROTECHNISCHE PRÜFANSTALT - TSCHECHISCHE REPUBLIK
INSTITUT ELECTROTECHNIQUE D'ESSAIS - RÉPUBLIQUE TCHÈQUE
ЭЛЕКТРОТЕХНИЧЕСКИЙ ИСПЫТАТЕЛЬНЫЙ ИНСТИТУТ - ЧЕШСКАЯ РЕСПУБЛИКА

Pod Lisem 129, 171 02 Praha 8 - Troja

The Electrotechnical Testing Institute Certification Body No. 3004 for certification of management systems, accredited by the Czech Accreditation Institute, o.p.s. in accordance with ČSN EN ISO/IEC 17021, grants the

CERTIFICATE

No.: 8130124

for the Quality System in accordance with

EN ISO 9001:2008

to the Firm

ABB s.r.o.

Štětkova 1638/18, 140 00 Praha 4, Czech Republic

because it ascertained that the Quality System of the Firm in the field:

Power semiconductor devices and modules
Silicon single crystal, wafers and special applications

in the following locations: Workplaces: ABB s.r.o., Local business unit Semiconductors
Novodvorská 1768/138a , 142 21 Praha 4, Czech Republic

complies with all requirements of the above mentioned Standard documented by the Report No.: 302410-01 of: 30.07.2013

The validity of the Certificate is limited till: 14.8.2016

The Certified Organization is subject to annual check-ups carried out by the Certification Body. Any change within the organization concerning the certification shall be followed up and approved by the Electrotechnical Testing Institute. The validity of this Certificate may be suspended or cancelled in the event of non-compliance with the Standard on the basis of which the Certificate was issued.

Certificate granted: 15.8.2013
corrigendum 5.9.2013

Prague

Miroslav Sedláček
Certification and Inspection Manager

Stamp

302410-01

ELEKTROTECHNICKÝ ZKUŠEBNÍ ÚSTAV

ELECTROTECHNICAL TESTING INSTITUTE - CZECH REPUBLIC
ELEKTROTECHNISCHE PRÜFANSTALT - TSCHECHISCHE REPUBLIK
INSTITUT ELECTROTECHNIQUE D'ESSAIS - RÉPUBLIQUE TCHÈQUE
ЭЛЕКТРОТЕХНИЧЕСКИЙ ИСПЫТАТЕЛЬНЫЙ ИНСТИТУТ - ЧЕШСКАЯ РЕСПУБЛИКА

Pod Lisem 129, 171 02 Praha 8 - Troja

The Electrotechnical Testing Institute Certification Body No. 3004 for certification of management systems, accredited by the Czech Accreditation Institute, o.p.s. in accordance with ČSN EN ISO/IEC 17021, grants the

CERTIFICATE

No.: 8130125

for the Environmental Management System in accordance with

EN ISO 14001:2004

to the Firm

ABB s.r.o.

Štětkova 1638/18, 140 00 Praha 4, Czech Republic

because it ascertained that the Environmental Management System of the Firm in the field:

Power semiconductor devices and modules
Silicon single crystal, wafers and special applications

in the following locations: Workplaces: ABB s.r.o., Local business unit Semiconductors
Novodvorská 1768/138a , 142 21 Praha 4, Czech Republic

complies with all requirements of the above mentioned Standard documented by the Report No.: 302411-01 of: 30.07.2013

The validity of the Certificate is limited till: 14.8.2016

The Certified Organization is subject to annual check-ups carried out by the Certification Body. Any change within the organization concerning the certification shall be followed up and approved by the Electrotechnical Testing Institute. The validity of this Certificate may be suspended or cancelled in the event of non-compliance with the Standard on the basis of which the Certificate was issued.

Certificate granted: 15.8.2013
corrigendum 5.9.2013

Prague

Miroslav Sedláček
Certification and Inspection Manager

Stamp

302411-01

ELEKTROTECHNICKÝ ZKUŠEBNÍ ÚSTAV

ELECTROTECHNICAL TESTING INSTITUTE - CZECH REPUBLIC
ELEKTROTECHNISCHE PRÜFANSTALT - TSCHECHISCHE REPUBLIK
INSTITUT ELECTROTECHNIQUE D'ESSAIS - RÉPUBLIQUE TCHÈQUE
ЭЛЕКТРОТЕХНИЧЕСКИЙ ИСПЫТАТЕЛЬНЫЙ ИНСТИТУТ - ЧЕШСКАЯ РЕСПУБЛИКА

Pod Lisem 129, 171 02 Praha 8 - Troja

The Electrotechnical Testing Institute Certification Body No. 3004 for certification of management systems, accredited by the Czech Accreditation Institute, o.p.s. in accordance with ČSN EN ISO/IEC 17021, grants the

CERTIFICATE

No.: 8130126

for the Occupational health and safety management system in accordance with

BS OHSAS 18001:2007

to the Firm

ABB s.r.o.

Štětkova 1638/18, 140 00 Praha 4, Czech Republic

because it ascertained that the Occupational health and safety management system of the Firm in the field:

Power semiconductor devices and modules
Silicon single crystal, wafers and special applications

in the following locations: Workplaces: ABB s.r.o., Local business unit Semiconductors
Novodvorská 1768/138a , 142 21 Praha 4, Czech Republic

complies with all requirements of the above mentioned Standard documented by the Report No.: 302412-01 of: 30.07.2013

The validity of the Certificate is limited till: 14.8.2016

The Certified Organization is subject to annual check-ups carried out by the Certification Body. Any change within the organization concerning the certification shall be followed up and approved by the Electrotechnical Testing Institute. The validity of this Certificate may be suspended or cancelled in the event of non-compliance with the Standard on the basis of which the Certificate was issued.

Certificate granted: 15.8.2013
corrigendum 5.9.2013

Prague

Miroslav Sedláček
Certification and Inspection Manager

Stamp

302412-01

Further information
REACH Declaration

Power and productivity
for a better world™

ABB Switzerland Ltd. – Semiconductors,
Fabrikstrasse 3, CH – 5600 Lenzburg

From Carsten Müller
Business area HSE Management
Phone direct +41 79 596 40 51

E-mail carsten.mueller@ch.abb.com

Reference No. 5SYS 5623-00
Page 1/1
Date December 1st, 2015

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

Mojmir Balous
Local Product Group Manager

ABB Switzerland Ltd.
Semiconductors
Fabrikstrasse 3
5600 Lenzburg
Switzerland

ABB s.r.o
Semiconductors
Novodvorská 1768/138a
142 21 Praha 4 Hlavní město Praha
Czech Republic

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 HiPak modules 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

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

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
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

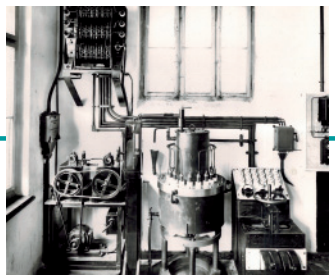
GTOs

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

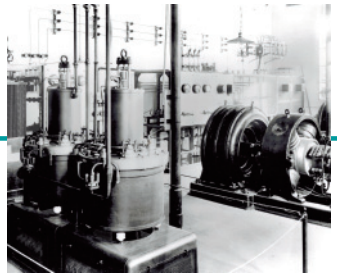
Environmental specifications

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 industry press-pack diodes, PCTs and GTOs	5SZK 9116
Operation of traction HiPaks	5SZK 9120

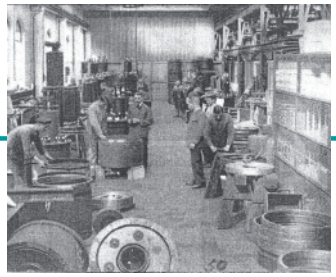
Further information
Perpetual innovation



1913
BBC begins development and production of mercury-arc rectifiers



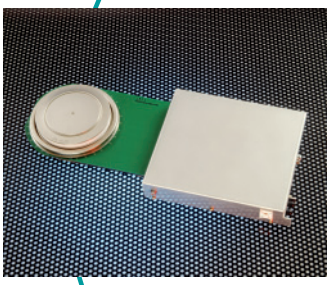
1915
BBC mercury-arc rectifiers used in the Limmattal tramline Zurich – Dietikon, Switzerland



1921
Opening of BBC production facility for mercury-arc rectifiers in Lampertheim, Germany

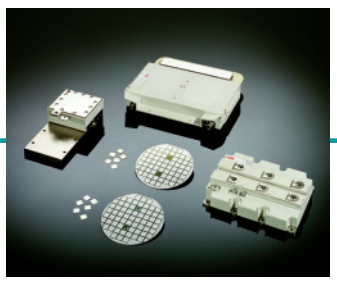
1988
ASEA (Sweden) and BBC (Switzerland) merge to form ABB (Asea Brown Boveri)

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



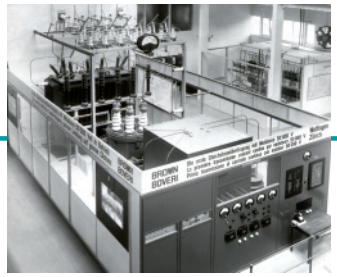
1996
ABB begins production of IGCT in Lenzburg, Switzerland

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



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

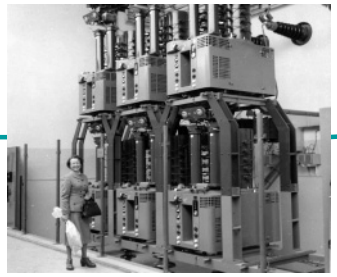
1938
First locomotive using multi-anode mercury-arc rectifiers from BBC Mannheim, Germany



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

1954
BBC develops the first germanium diode

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



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

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

2015
LinPak - the new standard for fast high-power switching.

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
- E = 36.00 – 48.99
- F = 49.00 – 63.99
- G = 64.00 – 80.99
- H = 81.00 – 99.99
- J = 100.00 – 120.99
- K = 121.00 – 143.99
- L = 144.00 – 168.99
- M = 169.00 – 195.99

Blocking voltage (V/100)

Version number

IGBT and diode modules

5SND 0800 M 17 0 1 00

Product group
- 5SNA = Single IGBT module / IGBT press-pack
- 5SND = Dual IGBT module
- 5SNE = Low side chopper
- 5SNG = Phase-leg IGBT module
- 5SNR = IGBT press-pack
- 5SLA = Single diode module
- 5SLD = Dual diode module
- 5SLG = Phase-leg diode module

Nominal collector current rating (A)

Package
- E = HiPak2, 40 mm
- G = HiPak2 HV, 44 mm
- H = Press-pack standard
- J = HiPak1 HV, 44 mm
- K = Press-pack HV
- M = HiPak1, 30 mm
- N1 & 2 = HiPak1, 40 mm
- P = HiPak0
- Q = Phase-leg IGBT

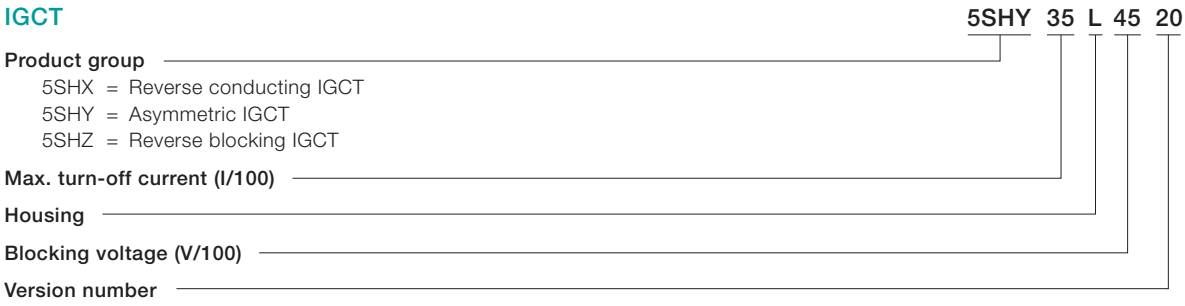
Blocking voltage (V/100)

Package variation
- 0 = standard

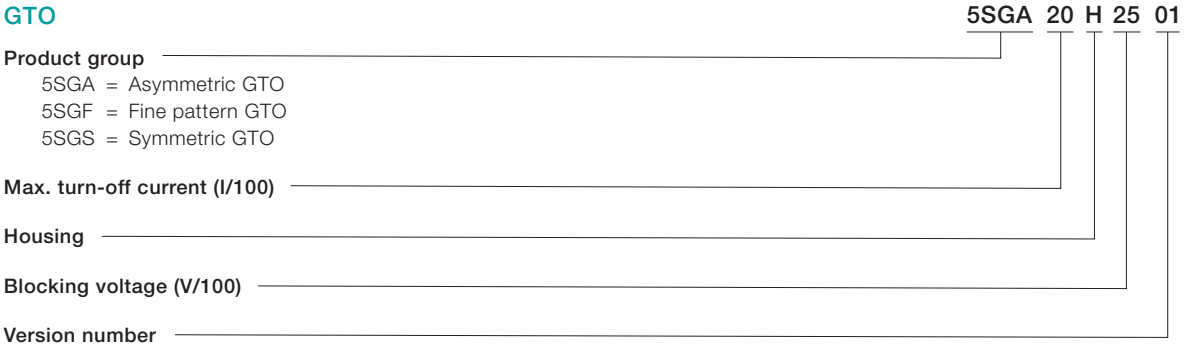
Technology variation
- 1 = SPT / 3 = SPT+ and SPT++

Version number

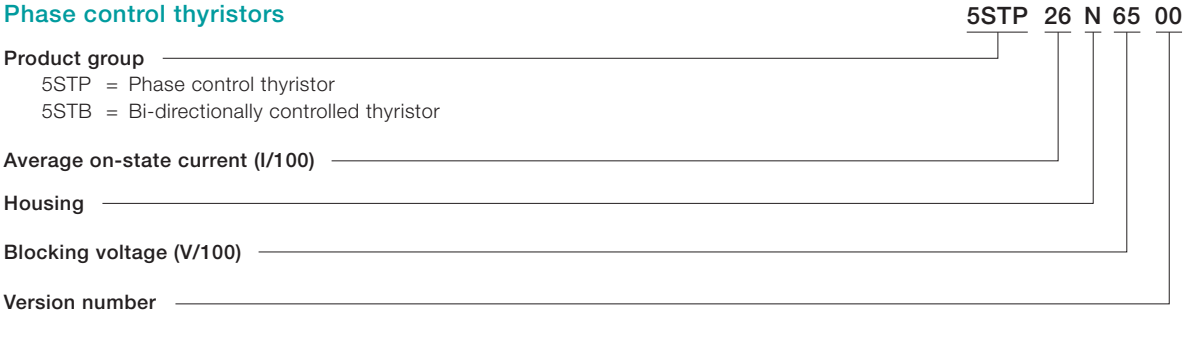
IGCT



GTO

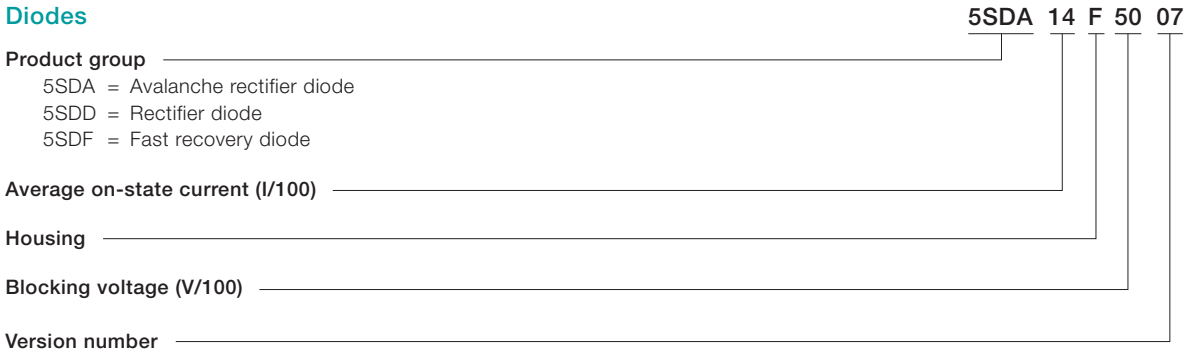


Phase control thyristors



Fast and reverse conducting thyristors

Diodes



Surge voltage suppressors

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

Symbol	Description
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

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