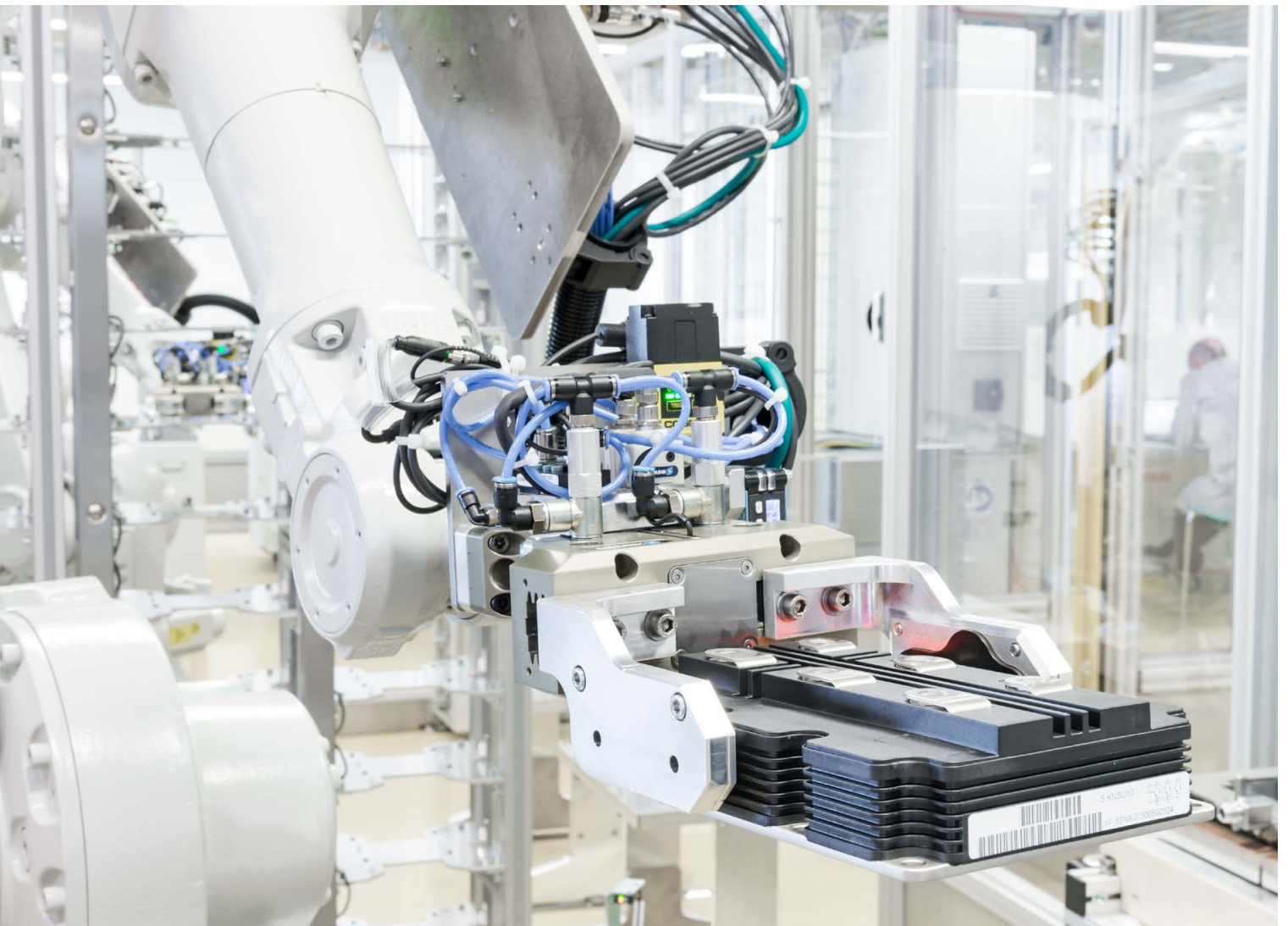


PRODUCT CATALOG 2021

# Power semiconductors



Over 100-years ago our journey into power electronics started in Switzerland with the production of mercury-arc rectifiers. Today, we offer one of the most diverse semiconductor offerings including thyristors, diodes, GTOs, IGCTs and IGBTs, manufactured at our Lenzburg, Switzerland and Prague, Czech Republic facilities.

With our research team we are developing the next generation power semiconductors and are set to continue pushing the boundaries of power electronics innovation.

Our advanced semiconductor technology has created almost unlimited control possibilities in HVDC transmission systems. We lie at the heart of traction converters driving high speed trains, metros and diesel-electric locomotives. And the many pumps, fans, roller tables, hoist and winches found through-out industry, rely on us. In future we are powering the next generation of e-vehicles enabling people to enjoy greener mobility. We are Hitachi ABB Power Grids – Semiconductors. And, together with you, we can shape the future of a smarter and greener society.

For more information please contact us or visit [www.hitachiabb-powergrids.com/semiconductors](http://www.hitachiabb-powergrids.com/semiconductors)

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## Diodes, thyristors, IGCTs and GTO press-packs

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# Product outlook

## LoPak 1200 V

A new LoPak with 1200 V voltage class is now available. It completes the LoPak portfolio with a high current of 2 x 900 A and can be used in various applications due to its compact and optimized high-performance design.

### Ratings

| Availability                                     | Voltage (V) | Current (A) | Housing |
|--------------------------------------------------|-------------|-------------|---------|
| 1200 V phase leg IGBT, samples available Q2/2021 | 1200        | 2 x 900     | LoPak1  |



## High-voltage LinPak

This LinPak with isolation voltage up to 10.2 kV will be available as sample in Q2 2021.

After establishing a standard with the low-voltage LinPak, Hitachi ABB Power Grids is offering a high isolation version of this module.

Like its LV version, it features very low stray inductance, highest current density, ideal current sharing and very good paralleling capability. The line-up expands from 3.3 kV to 6.5 kV.

### Ratings



| Voltage (V) | Current (A) |
|-------------|-------------|
| 3300        | 550         |
| 4500        | 450         |
| 6500        | 300         |

## Thyristor / diode modules

All thyristor / diode modules feature industry standard housings and very low losses together with the highest operating temperatures.

Typical applications are AC motor soft starters, variable speed drives and renewable energies. Features within high-power semiconductors are also used in our thyristor/diode module product line.

The benefits of these features include highest performance, outstanding reliability, increased overload capability and many more. The 60Pak diode-diode (DD) module with 2200 V is qualified and available in volume now. For more details see page 27. The lineup will be expanded rapidly to different voltages and configurations in the coming years.

Target ratings 50Pak and 60Pak



| Voltage ( V ) | Package   | Configuration<br>TT Thy/Thy<br>DD Dio/Dio<br>DT Dio/Thy<br>TD Thy/Dio |
|---------------|-----------|-----------------------------------------------------------------------|
| 6000          | 60Pak     | DD                                                                    |
| 5000          | 60Pak     | DD                                                                    |
| 2200          | 50, 60Pak | DD                                                                    |
| 1800          | 50, 60Pak | TT, DD, DT, TD                                                        |

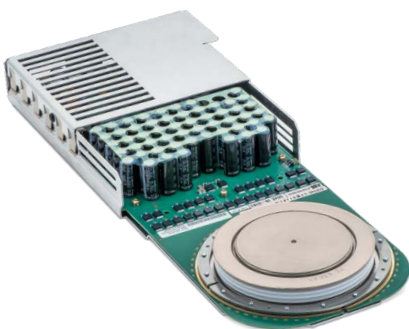
## 2500 V reverse-blocking IGCT

With the introduction of the newly developed 2.5 kV reverse-blocking Integrated Gate Commutated Thyristors (RB-IGCT), another powerful device is added to the successful and well-established IGCT product line.

The RB-IGCT is optimized for the lowest conduction losses and highest turn-off current capability. The conduction losses are reduced to less than 1000 W at 1000 A, a record low value for a power semiconductor device in this class.

To achieve the highest turn-off current capability of 7000 A, the well known and proven HPT<sup>+</sup> platform is used. Due to its outstanding performance, efficiency and reliability, the new RB-IGCT is the ideal device for Solid State Circuit Breakers (SSCB) used in renewables, transport electrification and modern edge grids.

Rating of 2500 V, RB-IGCT

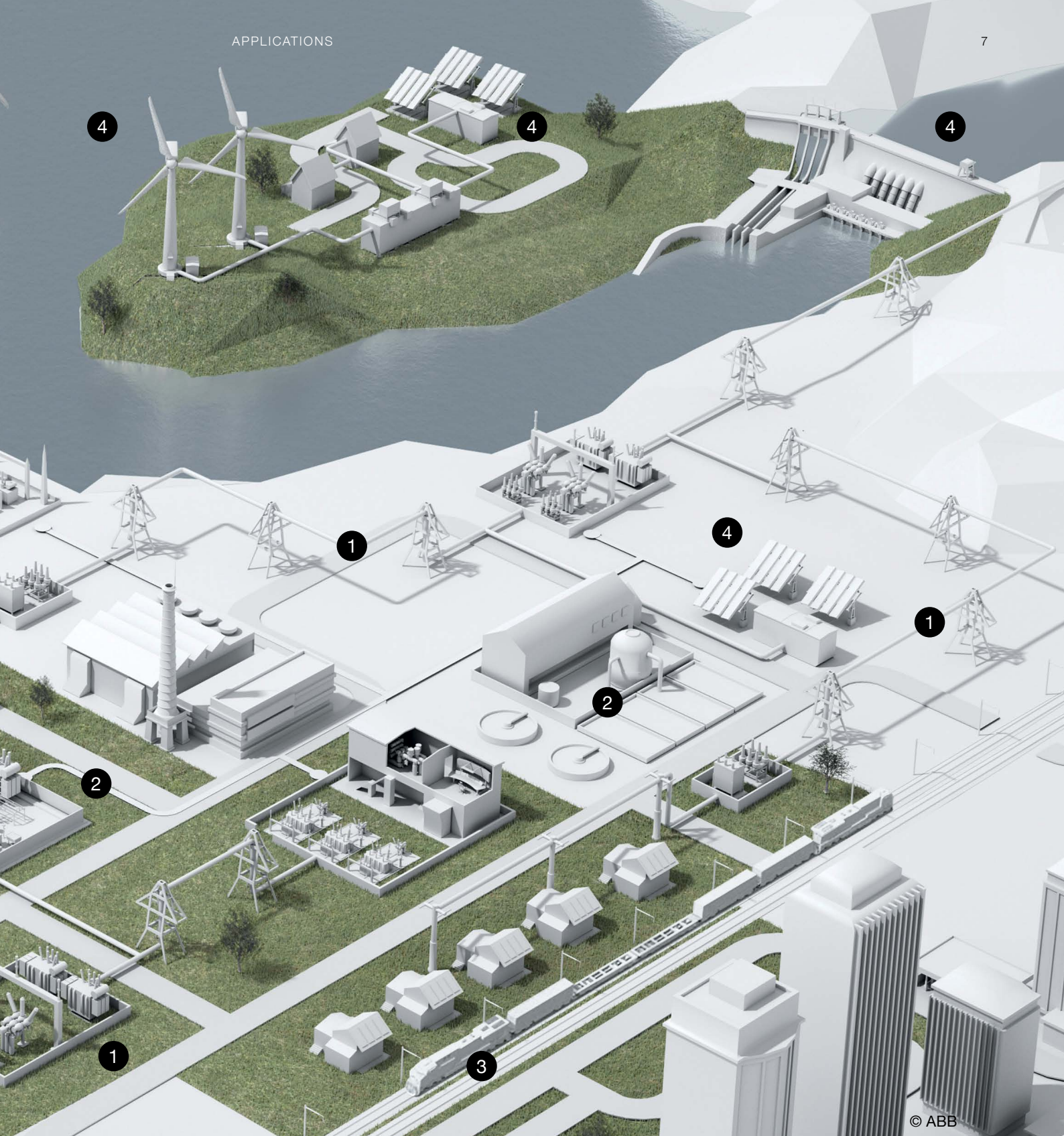


| Device  | Availability      | Voltage (V) | Turn-off current (A) | Housing |
|---------|-------------------|-------------|----------------------|---------|
| RB-IGCT | Samples available | 2500        | 7000                 | L size  |



## Applications

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



© ABB

- |          |                                                                                                                     |          |                                                                                                    |
|----------|---------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------------------------------------------------------------|
| <b>1</b> | Power transmission and distribution (HVDC, FACTS, STATCOM and others)                                               | <b>3</b> | Mobility (rail and subway main and auxiliary drives, trackside power supply / electrical vehicles) |
| <b>2</b> | Industry (medium and low-voltage drives, soft starters, UPSs, high-power rectifiers, excitation systems and others) | <b>4</b> | Renewable energy (converters for pumped hydro, wind turbines and solar)                            |

# SEMIS

## Semiconductor power loss simulation tool

SEMIS is Hitachi ABB Power Grids' semiconductor power loss simulation tool.

This web application enables the selection of the optimal high-power semiconductor by considering thermal losses and device utilization with various topologies, circuit parameters and control strategies to fit customer specific needs.

By selecting the topology and defining the relevant circuit and control parameters, SEMIS analyzes multiple system dependencies. Power losses as well as thermal conditions are evaluated, enabling the verification of semiconductors' device capabilities under various conditions.

### Topologies

Available topologies are listed in the respective sub-categories DC-DC, Voltage Source and Current Source converters. Please select according to your requirement.

**Voltage Source Converters**

**Current Source Converters**

**DC-DC Converters**

**VSC IGBT 1 Ph 2 L**  
  
 Device: IGBT, Diode, Resistor, Inductor, Capacitor  
 SEMIS  
 Simulate >

**VSC IGBT 1 Ph 3 L NPC**  
  
 Device: IGBT, Diode, Resistor, Inductor, Capacitor  
 Simulate >

**VSC IGBT 3 Ph 2 L**  
  
 Device: IGBT, Diode, Resistor, Inductor, Capacitor  
 Simulate >

**VSC IGBT 3 Ph 3 L**  
  
 Device: IGBT, Diode, Resistor, Inductor, Capacitor  
 Simulate >

**VSC IGBT 3 Ph 3 L**  
  
 Device: IGBT, Diode, Resistor, Inductor, Capacitor  
 Simulate >

**Half Bridge Multilevel Converter with IGBT**  
  
 Device: IGBT, Diode, Resistor, Inductor, Capacitor  
 Simulate >

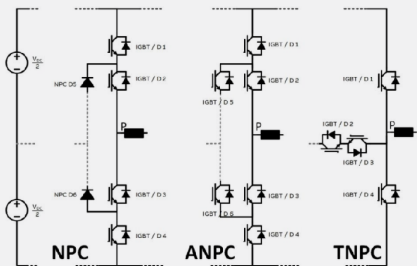
**Half Bridge Multilevel Converter with IGBT**  
  
 Device: IGBT, Diode, Resistor, Inductor, Capacitor  
 Simulate >

**Full Bridge Multilevel Converter with IGBT**  
  
 Device: IGBT, Diode, Resistor, Inductor, Capacitor  
 Simulate >

**Full Bridge Multilevel Converter with IGBT**  
  
 Device: IGBT, Diode, Resistor, Inductor, Capacitor  
 Simulate >

## 3 Phase 3 Level VSC

### IGBT based



Select Topology:

Converter Operation:

Ambient temperature:

System Frequency:

Switching frequency:

PWM strategy:

Modulation Index:

DC Voltage:

AC Reference Parameter:

AC Side Current (RMS):

Power Factor:

Reactive Power Type:

Heat Sink Thermal Resistance:

IGBT Module Type:

Voltage Rating:

Module Configuration:

Matching IGBTs:

☐ 5SNA 0400J650100 400 A, 125 C

☐ 5SNA 0500J650300 500 A, 125 C

☐ 5SNA 0600G650100 600 A, 125 C

☐ 5SNA 0750G650300 750 A, 125 C

☒ 5SNA 1000G650300 1000A, 150 C

NPC Diode Selection:

☒ 5SLD 0600J650100 2X600 A, 125 C

Analysis completed.

High power semiconductor applications are highly complex and, to reduce prototyping, require thermal loss evaluation prior to a detailed circuit analysis to find the best possible semiconductor for customized settings and conditions. More than 35 topologies are listed according to application fields or grouped as VSC, CSC and DC-DC converters. By selecting the topology circuit, the list of definable settings is indicated, enabling the highest flexibility in the definition of the system parameters.

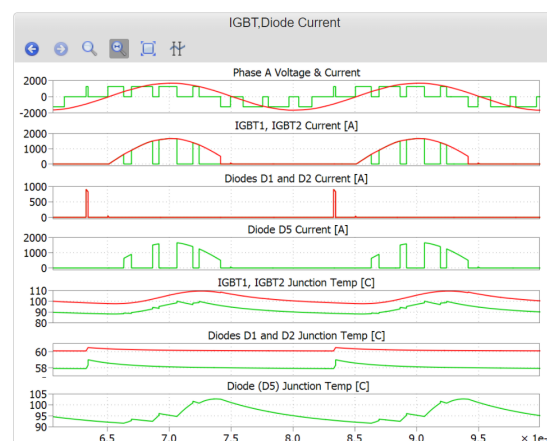
To start the simulation, circuit parameters are defined according to the user specification with significant flexibility enabling the simulations to be adapted to customer needs. With the selection of one or more Hitachi ABB Power Grids products, the system is ready for analysis.

The thermal impedance path, conduction and switching losses of each element of the topology as well as the control strategy are considered for the calculation of junction temperatures. This reveals critical elements or thermal paths enabling optimizations with the initial approach.

The simulator uses Jacobian steady-state analysis with the Plexim Plecs software to calculate the on-state and dynamic power losses, as well as the resulting thermal variations of semiconductors. If junction temperatures exceed the permissible limits, alert messages are generated to ensure a safe operating area for the specific semiconductor.

Detailed results are displayed as graphs, indicating the thermodynamic and electrical static behavior of each power semiconductor. With the phase voltage and current, the combined converter output is indicated. For each element, the current load indicates the switching.

For detailed analysis, semiconductor specific parameters are tabulated, enabling numerical analysis of each element and parameter for conduction and switching power losses and junction temperatures. Critical elements with the highest thermal load are discovered rapidly, leading to efficient optimization in relation to cost efficiency, power losses and cooling system. For verification of the system efficiency, the converter power effectiveness and the system efficiency are indicated. This reveals the power loss influence of the applied semiconductors in combination with the control strategy. By comparing multiple products and parameter combinations, the influence of varying parameters is revealed.



| Device Losses & Temperatures |           |            |                 |           |           |           |
|------------------------------|-----------|------------|-----------------|-----------|-----------|-----------|
|                              | Switching | Conduction | Combined Losses | TvjAvg    | TvjMax    | TvjBLS    |
| IGBT1                        | 784.39 W  | 1.235 kW   | 2.020 kW        | 92.50 °C  | 100.15 °C | 97.44 °C  |
| IGBT2                        | 79.70 W   | 2.345 kW   | 2.425 kW        | 102.66 °C | 109.46 °C | 109.46 °C |
| IGBT3                        | 189.07 W  | 2.368 kW   | 2.557 kW        | 106.10 °C | 113.66 °C | 113.15 °C |
| IGBT4                        | 675.45 W  | 1.228 kW   | 1.903 kW        | 89.31 °C  | 97.98 °C  | 95.93 °C  |
| D1                           | 34.09 W   | 22.00 W    | 56.09 W         | 58.12 °C  | 58.99 °C  | 58.05 °C  |
| D2                           | 0 W       | 22.05 W    | 22.05 W         | 60.17 °C  | 60.50 °C  | 60.24 °C  |
| D3                           | 0 W       | 26.15 W    | 26.15 W         | 61.37 °C  | 61.71 °C  | 61.70 °C  |
| D4                           | 5.97 W    | 26.16 W    | 32.12 W         | 56.35 °C  | 56.78 °C  | 56.66 °C  |
| D5                           | 135.20 W  | 1.053 kW   | 1.189 kW        | 96.10 °C  | 102.75 °C | 102.72 °C |
| D6                           | 120.13 W  | 1.054 kW   | 1.174 kW        | 95.43 °C  | 101.72 °C | 101.72 °C |
| Converter Losses             | 6.07 kW   | 28.14 kW   | 34.21 kW        |           |           |           |
| % Losses                     |           |            | 1.68 %          |           |           |           |

| Converter AC Parameters |            |                |                     |                     |                  |
|-------------------------|------------|----------------|---------------------|---------------------|------------------|
|                         | Real Power | Reactive Power | Phase Voltage (RMS) | Phase Current (RMS) | Output Frequency |
|                         | 2002 kW    | 1502 kVAR      | 707 V               | 1.180 kA            | 50 Hz            |
|                         |            |                |                     |                     | 0.80             |

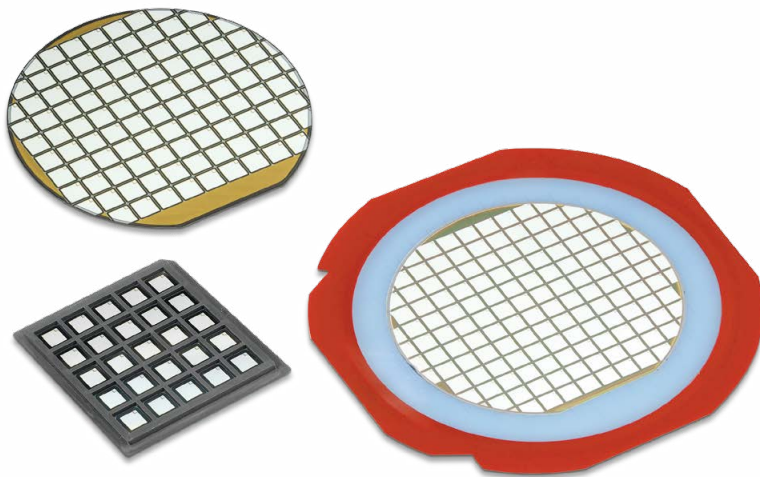
| DC Parameters & Control Parameters |          |            |                     |
|------------------------------------|----------|------------|---------------------|
|                                    | DC Power | DC Voltage | Switching Frequency |
|                                    |          |            | Modulation Index    |

By providing an efficient and reliable product analysis according to customer requirements, a tailor-made selection of Hitachi ABB Power Grids products can be made with ease. For customer simulations with more specific topologies and control strategies, the model's data is available in PLECS format for download from Hitachi ABB Power Grids' website. This enables simulation to the highest customization and adaptation of control strategies.

Simulations exceeding the capabilities of the online SEMIS tool and for simulations of higher complexity, please contact your Hitachi ABB Power Grids sales agent or Hitachi ABB Power Grids Semiconductors for further support.

# IGBT and diode dies

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



Hitachi ABB Power Grids' SPT (Soft Punch Through) chipsets and their improved versions with lower losses (SPT<sup>+</sup> and SPT<sup>++</sup>) 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.

Hitachi ABB Power Grids' 1700 V SPT<sup>++</sup> 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<br>mm | Thickness<br>μm | V <sub>PRM</sub> (V) | I <sub>F</sub> (A) | V <sub>F</sub> (V)<br>typ. 125 °C | Max. dies per wafer (W)<br>or tray (T) |
|------------------------------|------------------|------------------|-----------------|----------------------|--------------------|-----------------------------------|----------------------------------------|
| <b>1.2 kV</b>                |                  |                  |                 |                      |                    |                                   |                                        |
| 5SLY 76E1200<br>5SLY 86E1200 | SPT <sup>+</sup> | 6.3 x 6.3        | 350             | 1200                 | 50                 | 1.85                              | 361 (W)                                |
| 5SLY 76F1200<br>5SLY 86F1200 | SPT <sup>+</sup> | 7.4 x 7.4        | 350             | 1200                 | 75                 | 1.85                              | 257 (W)                                |
| 5SLY 76G1200<br>5SLY 86G1200 | SPT <sup>+</sup> | 8.4 x 8.4        | 350             | 1200                 | 100                | 1.85                              | 198 (W)                                |
| 5SLY 76J1200<br>5SLY 86J1200 | SPT <sup>+</sup> | 10.0 x 10.0      | 350             | 1200                 | 150                | 1.85                              | 137 (W)                                |

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

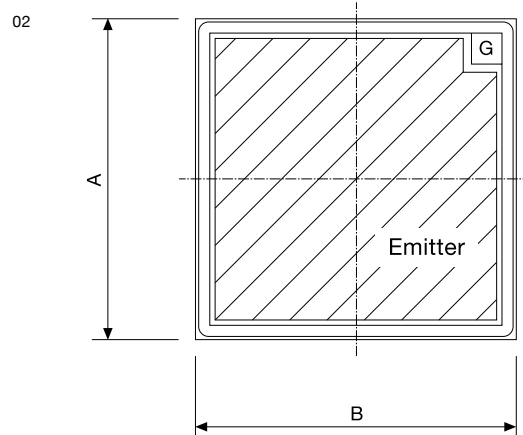
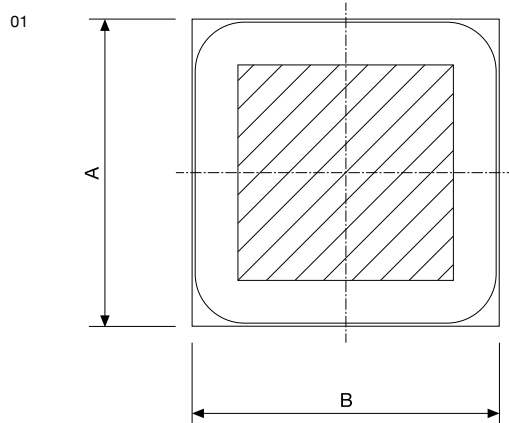
## IGBT dies

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

Please refer to page 58 for part numbering structure.

01  
Diode dies

02  
IGBT dies



# Medium-power IGBT modules

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



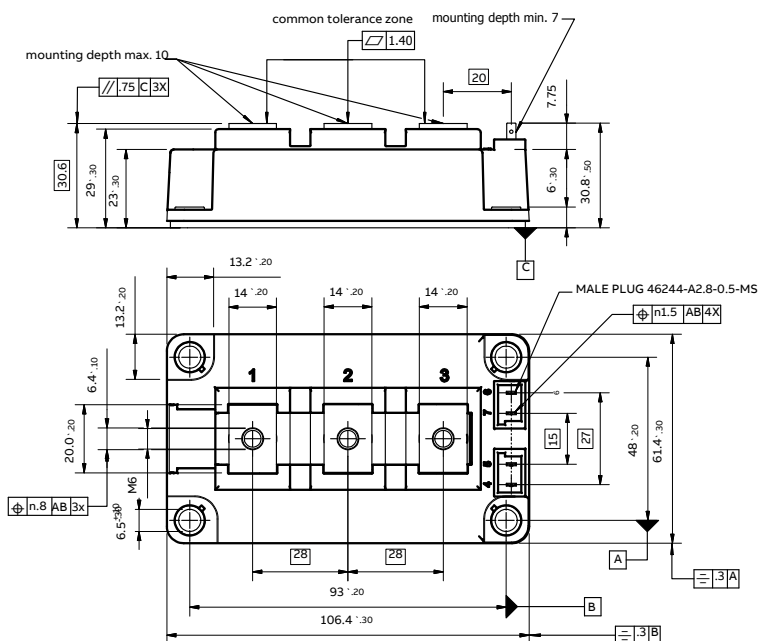
Hitachi ABB Power Grids' 62Pak modules have an advanced packaging technology that leverages the performance of the latest silicon technology:

- 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<br>$T_M$ (operational) up to 175 °C | Voltage $V_{CES}$ (V) | Current $I_c$ (A) | Configuration        | $V_{CESat}$ (V) | $V_F$ (V) | Housing |
|-------------------------------------------------|-----------------------|-------------------|----------------------|-----------------|-----------|---------|
| <b>1.7 kV</b>                                   |                       |                   |                      |                 |           |         |
| 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 59 for part numbering structure.  
Configurations on page 22

Q



Dimensions in mm

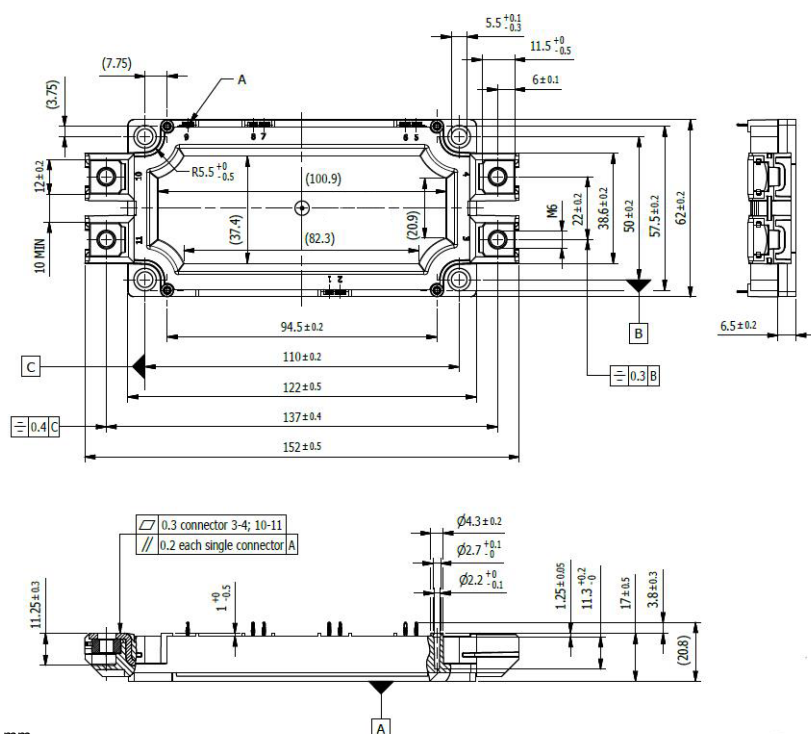


- Wind power converters
- Variable speed drives
- Power supplies
- Power quality
- UPS
- Renewable energies

| Part number<br>T (operational) up to 175 °C | Voltage V <sub>CES</sub> (V) | Current I <sub>C</sub> (A) | Configuration        | V <sub>CESat</sub> (V) | V <sub>F</sub> (V) | Housing     |
|---------------------------------------------|------------------------------|----------------------------|----------------------|------------------------|--------------------|-------------|
| 1.7 kV                                      |                              |                            |                      |                        |                    |             |
| 5SNG 0225R170300                            | 1700                         | 2 x 225                    | (5) - Phase leg IGBT | 2.55                   | 1.75               | R           |
| 5SNG 0225R170390                            | 1700                         | 2 x 225                    | (5) - Phase leg IGBT | 2.55                   | 1.75               | R incl. TIM |
| 5SNG 0300R170300                            | 1700                         | 2 x 300                    | (5) - Phase leg IGBT | 2.55                   | 1.75               | R           |
| 5SNG 0300R170390                            | 1700                         | 2 x 300                    | (5) - Phase leg IGBT | 2.55                   | 1.75               | R incl. TIM |
| 5SNG 0450R170300                            | 1700                         | 2 x 450                    | (5) - Phase leg IGBT | 2.55                   | 1.75               | R           |
| 5SNG 0450R170390                            | 1700                         | 2 x 450                    | (5) - Phase leg IGBT | 2.55                   | 1.75               | R incl. TIM |

Configurations on page 22

R



Dimensions in mm

# Power IGBT and diode modules

Hitachi ABB Power Grids offers three categories of high-power IGBT and diode modules: Insulated, press-pack and the newly launched SiC modules for e-mobility applications.

Insulated modules consist of the new innovative, low inductive phase leg LinPak and the well-established HiPak lineup with more than 15 years and more than 1 Million modules in the field.

Press-pack modules are a range of pressure contact IGBT modules also known as StakPak. StakPaks are Hitachi ABB Power Grids' flagship products with record power ratings up to 5200 V and more than 3000 A.

The new e-mobility module portfolio takes advantage of silicon carbide (SiC) technology, offering benefits like high-current rating in a small package and a with very low stray inductance.

Hitachi ABB Power Grids' power IGBT and diode module families are:

- RoadPak modules page 16
- LinPak IGBT & SiC MOSFET modules page 18
- HiPak IGBT and diode modules page 20
- StakPak IGBT press-pack modules page 24





# RoadPak SiC e-mobility module

The RoadPak is our newest innovative solution for all e-mobility applications. It enables the design of converters with lowest overall stray inductance, thanks to the latest generation of SiC MOSFET chipset and enhanced liquid cooling performance due to its pin-fin baseplate.

RoadPak applications include amongst others main drive train for xEVs, e-trucks, e-busses, traction auxiliary converters, as well as power electronics for xEV-charging. In addition, the RoadPak allows very easy low inductive connections, thus the current rating of the inverters can be scaled up with just one module type. This allows the use of RoadPak in a well defined converter portfolio based on various performance classes.

Thanks to its exceptional low stray inductance ( $<6\text{nH}$ ), the RoadPak is the ideal package to demonstrate the performance of high-power SiC. Hitachi ABB Power Grids offers in addition optimized gate units for RoadPak as well as a cooler for 3 RoadPaks in 3-phase-inverters configuration. Our RoadPak modules feature lowest switching losses, highest performance and excellent robustness. Our RoadPak modules feature lowest switching losses, highest performance and excellent robustness.

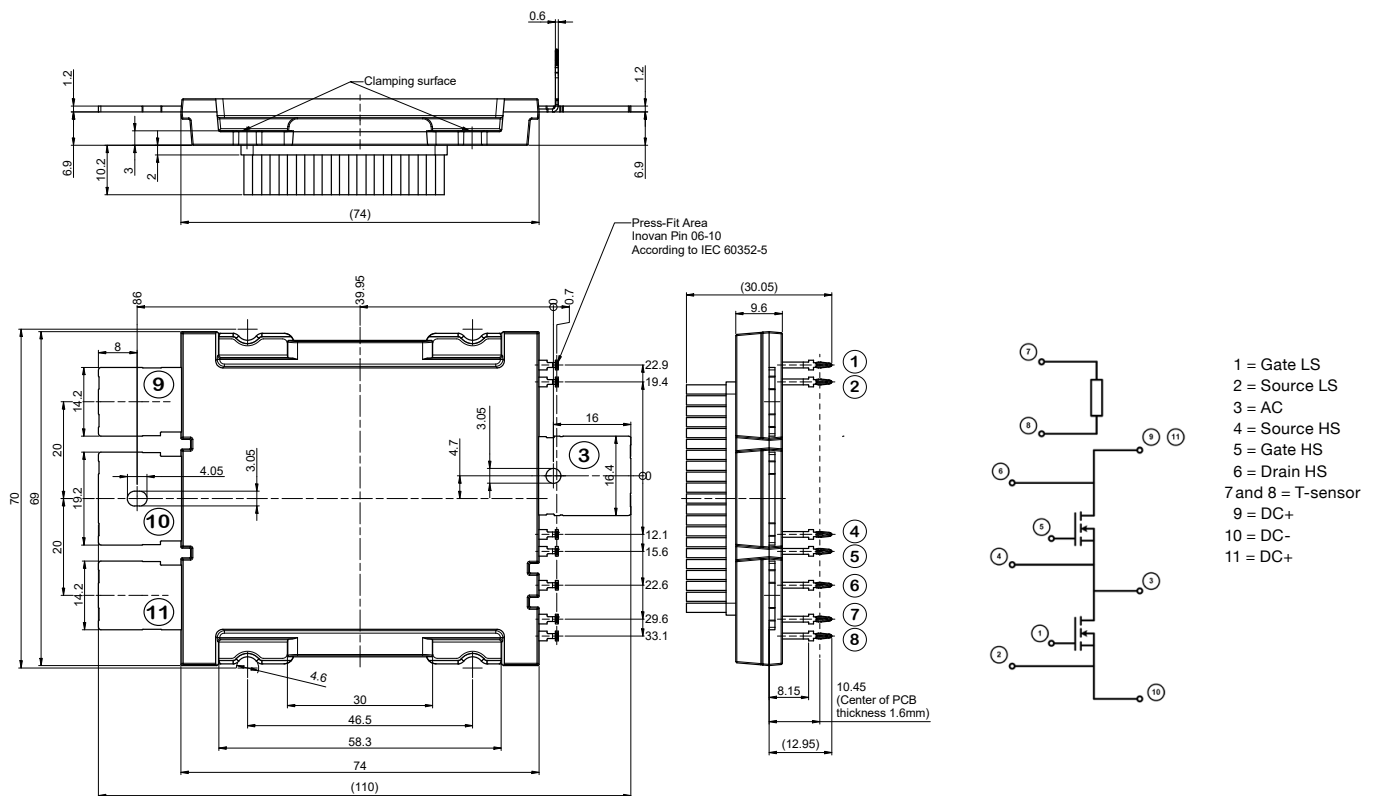


| Part number<br>$T_{vj}$ (operational) up to 175 °C | Voltage $V_{CES}$ (V) | Current $I_o$ (A) | Configuration          | $R_{DS(on)}$ (m $\Omega$ )<br>typ. 25 °C | $R_{DS(on)}$ (m $\Omega$ )<br>typ. 175 °C | Housing |
|----------------------------------------------------|-----------------------|-------------------|------------------------|------------------------------------------|-------------------------------------------|---------|
| 5SFG 0580B12000x                                   | 1200                  | 2 x 580           | (5) - Phase-leg MOSFET | 2.9                                      | 5.2                                       | B       |
| 5SFG 0780B12000x                                   | 1200                  | 2 x 780           | (5) - Phase-leg MOSFET | 2.4                                      | 4.2                                       | B       |
| 5SFG 0980B12000x                                   | 1200                  | 2 x 980           | (5) - Phase-leg MOSFET | 1.9                                      | 3.2                                       | B       |

Please refer to page 59 for part numbering structure.

On request:

- Optimized gate unit
- Cooler for 3-phase inverter design



# 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 part 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. Hitachi ABB Power Grids offers a SiC demonstrator module for customers to evaluate the SiC performance.

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

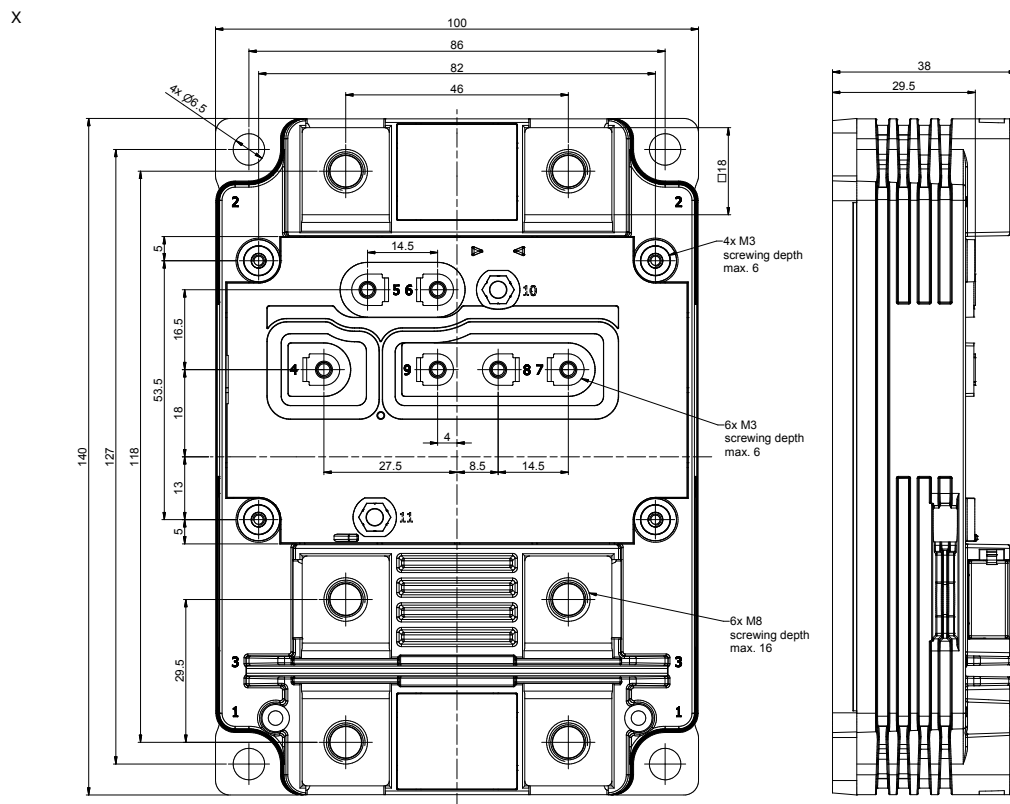


| Part number<br>$T_J$ (operational) up to 175 °C | Voltage $V_{CES}$ (V) | Current $I_C$ (A) | Configuration        | $V_{CESat}$ (V)<br>typ. 125 °C | $V_F$ (V)<br>typ. 125 °C | Housing |
|-------------------------------------------------|-----------------------|-------------------|----------------------|--------------------------------|--------------------------|---------|
| 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 59 for part numbering structure.  
Configurations on page 22

| Part number        | Voltage $V_{DSS}$ (V) | Current $I_D$ (A) | Configuration *        | $R_{DS(on)}$ (m $\Omega$ )<br>typ. 25 °C | $R_{DS(on)}$ (m $\Omega$ )<br>typ. 150 °C | Housing |
|--------------------|-----------------------|-------------------|------------------------|------------------------------------------|-------------------------------------------|---------|
| 5SFG 0900X170100 * | 1700                  | 2 x 900           | (5) – Phase leg MOSFET | 2.8                                      | 4.8                                       | X       |
| 5SFG 1800X170100 * | 1700                  | 2 x 1800          | (5) – Phase leg MOSFET | 1.4                                      | 2.4                                       | X       |
| 5SFG 0500X330100 * | 3300                  | 2 x 500           | (5) – Phase leg MOSFET | 3.6                                      | 6.6                                       | X       |
| 5SFG 1000X330100 * | 3300                  | 2 x 1000          | (5) – Phase leg MOSFET | 1.9                                      | 3.5                                       | X       |

\* Contact factory



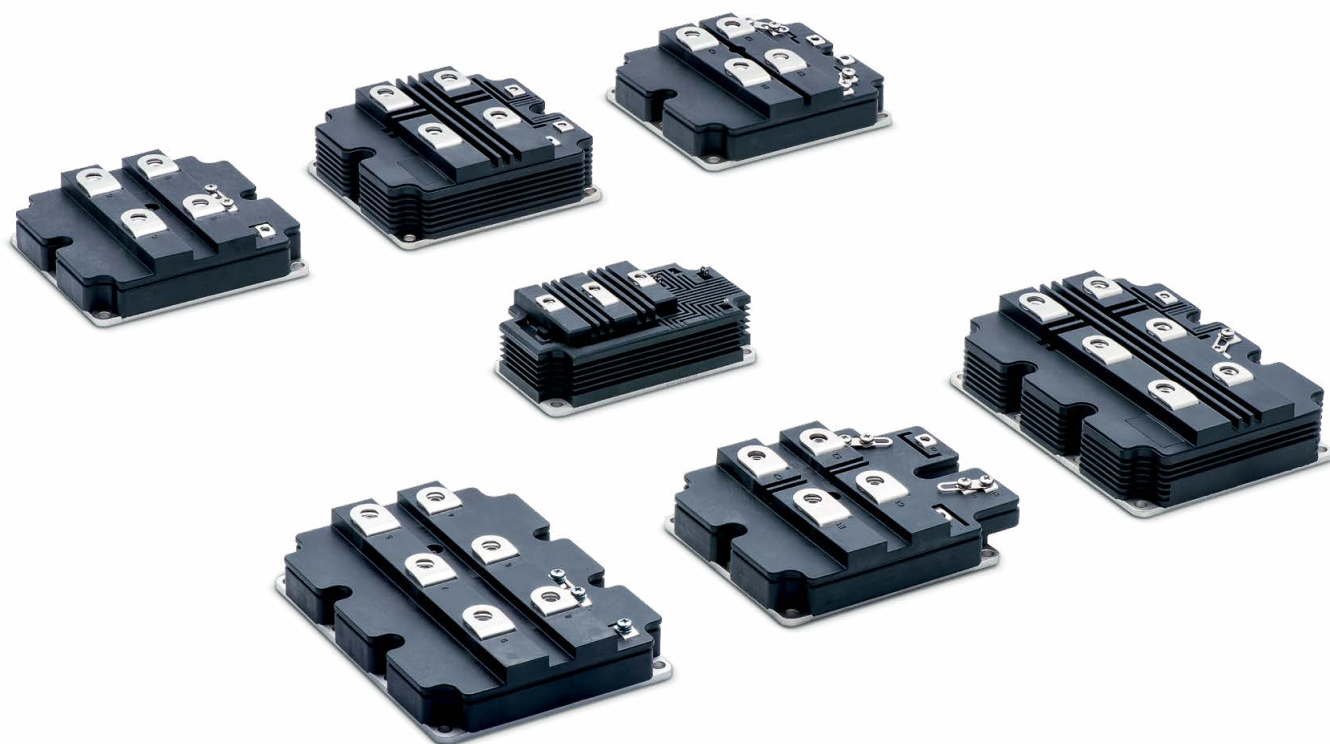
Dimensions in mm

# 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.

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

Hitachi ABB Power Grids' 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).

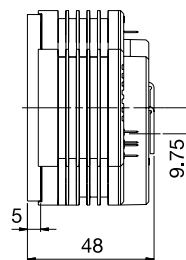
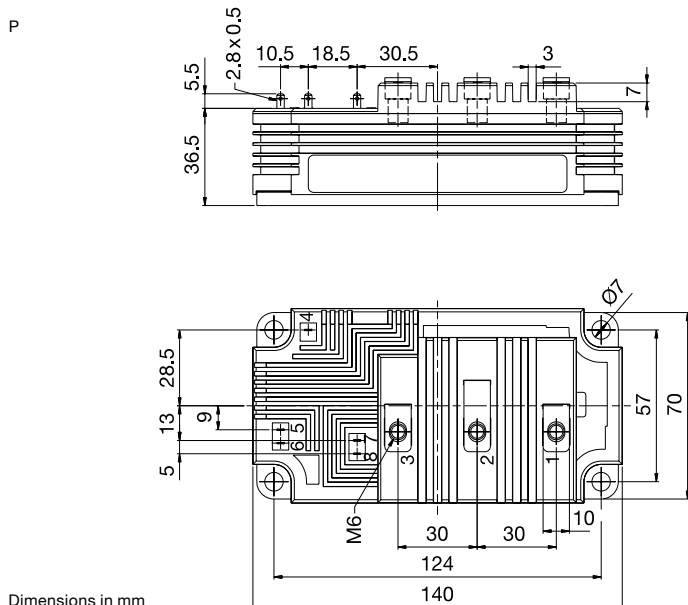
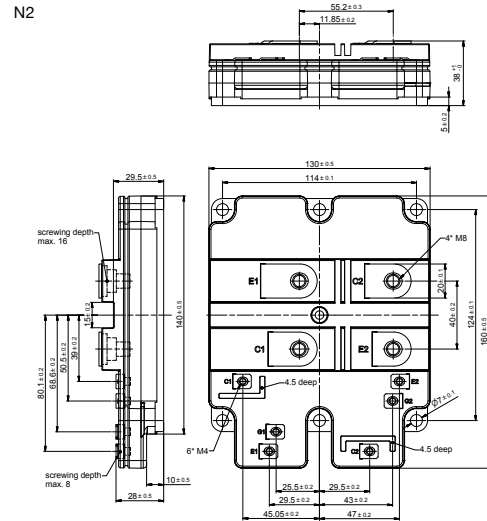
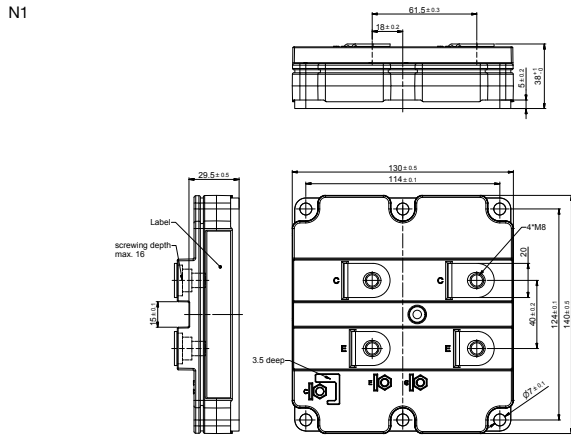
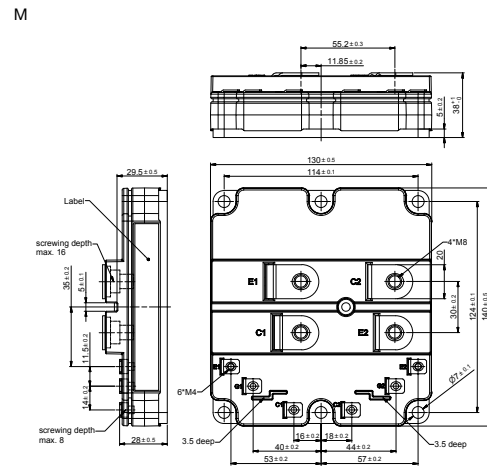
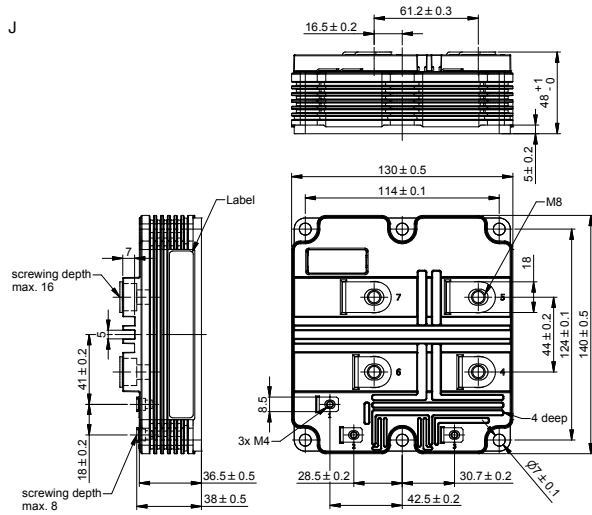


| Part number<br>$T_{\text{M}}$ (operational) up to 125 °C | Voltage $V_{\text{CES}}$ (V) | Current $I_{\text{C}}$ (A) | Configuration         | $V_{\text{CESat}}$ (V)<br>typ. 125 °C | $V_{\text{r}}$ (V)<br>typ. 125 °C | Housing |
|----------------------------------------------------------|------------------------------|----------------------------|-----------------------|---------------------------------------|-----------------------------------|---------|
| <b>1.7 kV</b>                                            |                              |                            |                       |                                       |                                   |         |
| 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       |
| 5SND 1200M170300 <b>New</b>                              | 1700                         | 2 x 1200                   | (3) – Dual IGBT       | 3.0                                   | 1.95                              | M       |
| 5SNE 1200M170300 <b>New</b>                              | 1700                         | 1200                       | (2) – Chopper         | 3.0                                   | 1.95                              | 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       |
| <b>3.3 kV</b>                                            |                              |                            |                       |                                       |                                   |         |
| 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 1200N330400 <b>New</b>                              | 3300                         | 1200                       | (1) – Single IGBT     | 2.9                                   | 2.20                              | N       |
| 5SNA 1500E330305                                         | 3300                         | 1500                       | (1) – Single IGBT     | 3.1                                   | 2.25                              | E       |
| 5SNA 1800E330400 <b>New</b>                              | 3300                         | 1800                       | (1) – Single IGBT     | 2.9                                   | 2.20                              | E       |
| 5SNA 1800G330400 <b>New</b>                              | 3300                         | 1800                       | (1) – Single IGBT     | 2.9                                   | 2.20                              | G       |
| <b>4.5 kV</b>                                            |                              |                            |                       |                                       |                                   |         |
| 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 1000J450300 <b>New</b>                              | 4500                         | 1000                       | (1) – Single IGBT     | 3.55                                  | 2.8                               | 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       |
| 5SLD 1200J450350                                         | 4500                         | 2 x 1200                   | (4) – Dual Diode      | –                                     | 3.5                               | J       |
| 5SLD 1500J450300 <b>New</b>                              | 4500                         | 2 x 1200                   | (4) – Dual Diode      | –                                     | 2.8                               | J       |
| 5SNA 1500G450300 <b>New</b>                              | 4500                         | 1500                       | (1) – Single IGBT     | 3.55                                  | 2.8                               | G       |
| 5SNA 1500G450350 <b>New</b>                              | 4500                         | 1500                       | (1) – Single IGBT     | 3.55                                  | 2.8                               | G       |
| <b>6.5 kV</b>                                            |                              |                            |                       |                                       |                                   |         |
| 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 0670J650300 <b>New</b>                              | 6500                         | 670                        | (1) – Single IGBT     | 4.1                                   | 3.3                               | J       |
| 5SNA 0750G650300                                         | 6500                         | 750                        | (1) – Single IGBT     | 3.9                                   | 3.4                               | G       |
| 5SNA 1000G650300                                         | 6500                         | 1000                       | (1) – Single IGBT     | 4.1                                   | 3.3                               | G       |
| 5SLD 1000J650300 <b>New</b>                              | 6500                         | 2 x 1000                   | (4) – Dual Diode      | –                                     | 3.3                               | J       |

Please refer to page 59 for part numbering structure.

\* not for new designs





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 Hitachi ABB Power Grids' StakPaks.

Hitachi ABB Power Grids' 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

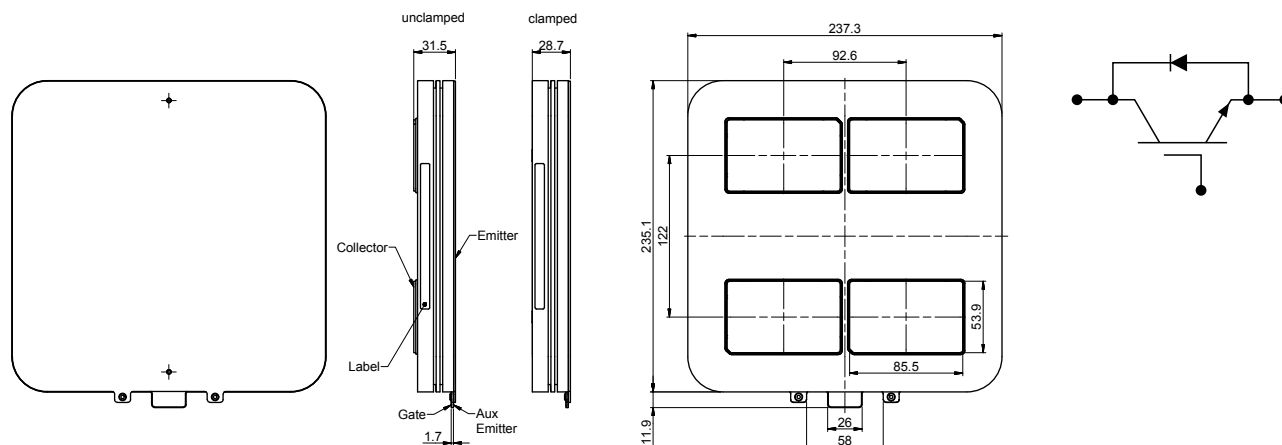
Hitachi ABB Power Grids' StakPak IGBT modules are therefore a perfect match for applications like HVDC, FACTS, breakers and pulsed power.



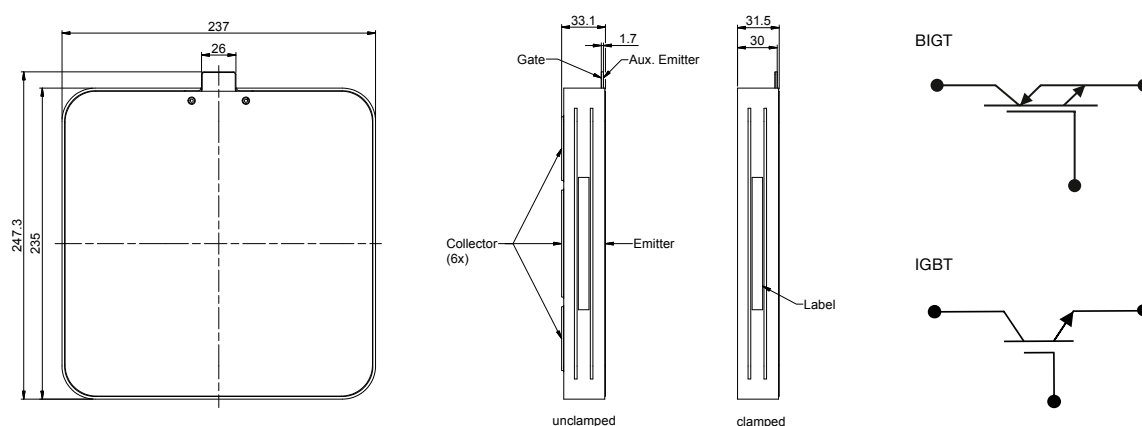
| Part number      | Voltage $V_{CES}$ (V) | Current $I_c$ (A) | $V_{CEsat}$ (V)<br>typ. 125 °C | $V_F$ (V)<br>typ. 125 °C | IGBT-to-diode<br>ratio | Housings | SCFM<br>rating |
|------------------|-----------------------|-------------------|--------------------------------|--------------------------|------------------------|----------|----------------|
| 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 | 4500                  | 3000              | 3.1                            | –                        | 1:0                    | L        | No             |
| 5SJA 3000L520300 | 5200                  | 3000              | 3.1                            | 2.5                      | 1:1 (BIGT)             | L        | No             |

Please refer to page 59 for part numbering structure.

K



L





# Diode and thyristor modules

## 60Pak

Hitachi ABB Power Grids' diode and thyristor modules feature industry standard housings and very low losses together with the highest operating temperatures.

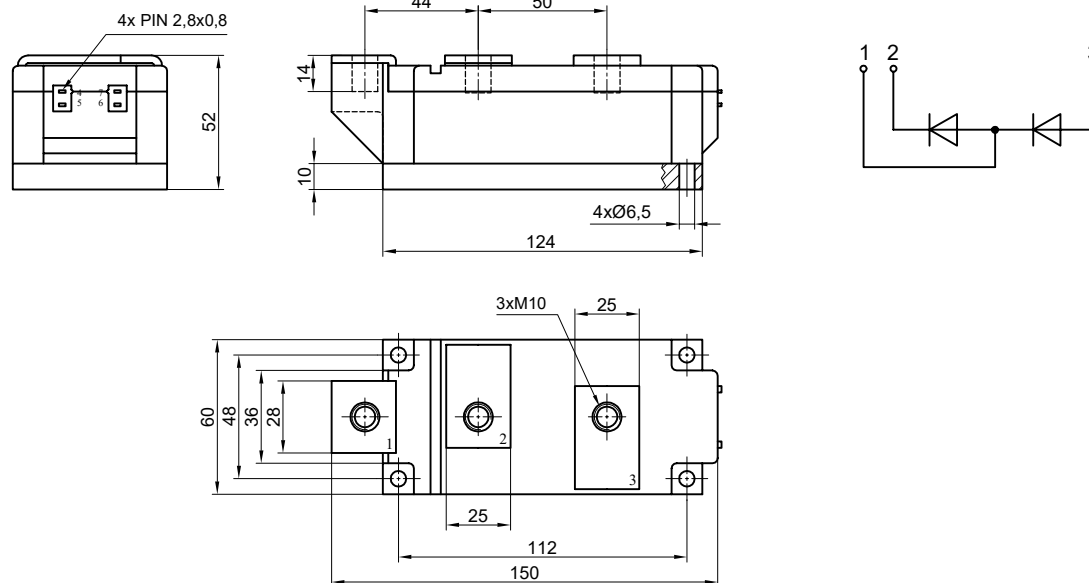


They provide the ultimate in reliability and are the epitome of quality. Whether efficiently driving industrial motors, smoothly accelerating fans and pumps, or supply power to demanding applications. The key benefits of the new 60Pak module are highest performance, outstanding reliability and increased overload capability. All highest quality Hitachi ABB Power Grids' assets wrapped in a standard industrial housing

| Part number    | $V_{RRM}$ (V) | $I_{FAV_m}$ (A) | Configuration             | Housing |
|----------------|---------------|-----------------|---------------------------|---------|
| 5SED 0890T2240 | 2200          | 889             | Diode / Diode (Phase leg) | 60 mm   |

Please refer to page 61 for part numbering structure.

T



Dimensions in mm

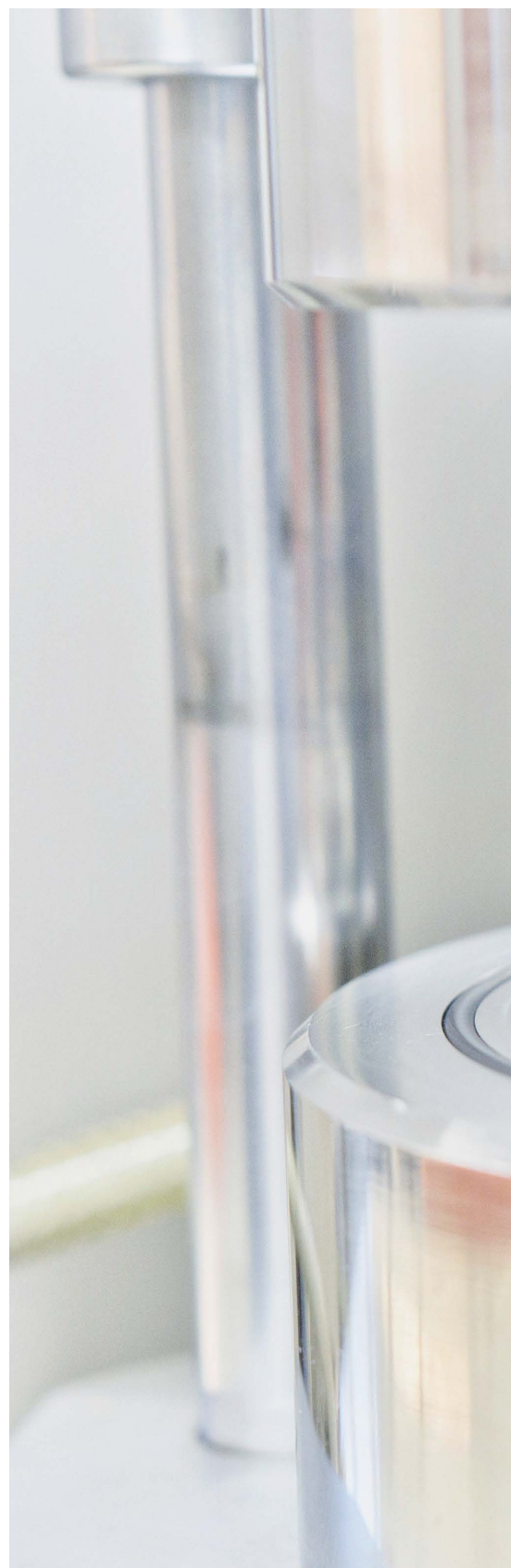
# Diodes

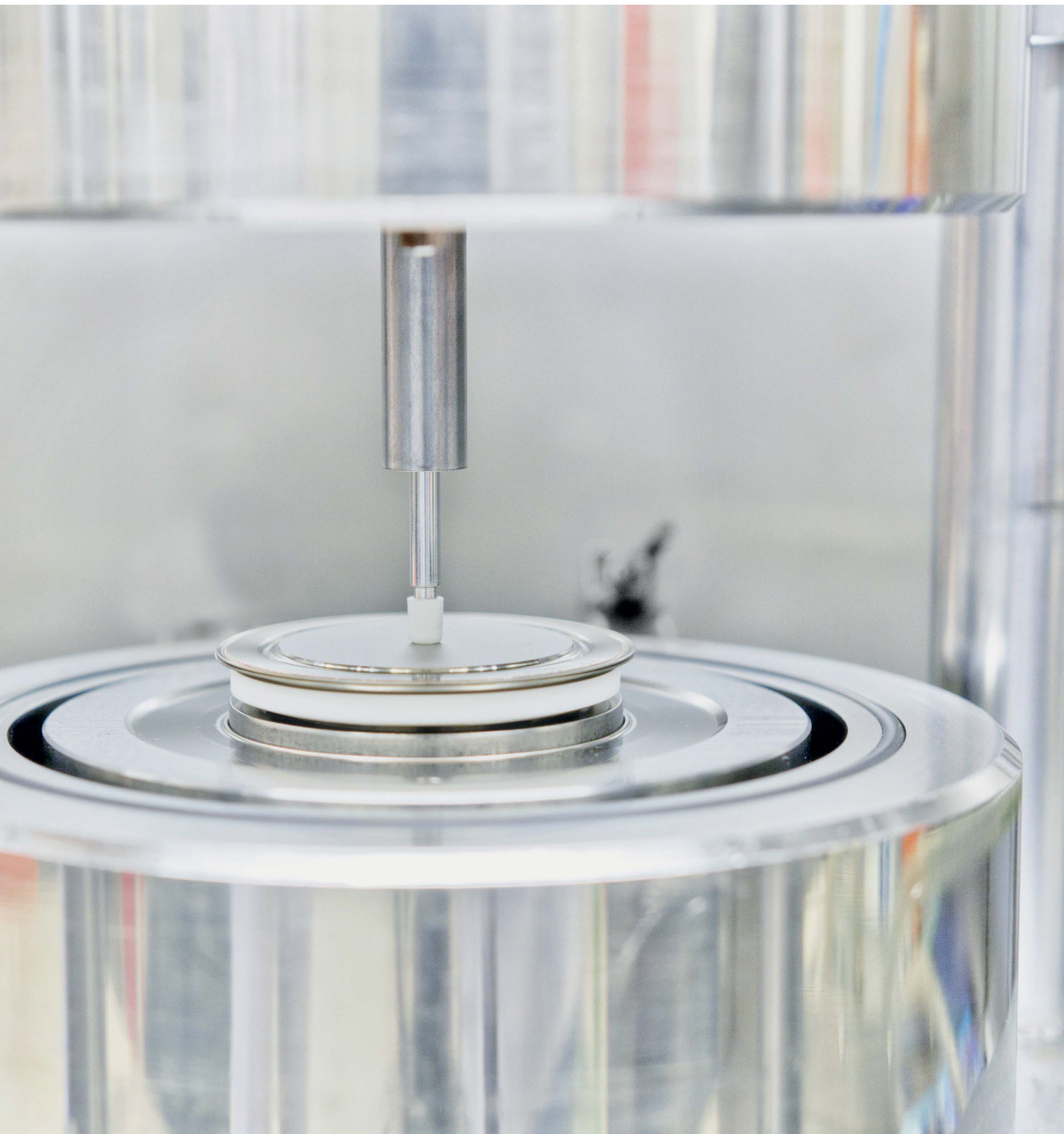
Diodes are used in a number of different applications. Each of these applications sets different requirements on the diodes' characteristics.

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.

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

- Fast recovery diodes page 30
- Standard rectifier and avalanche diodes page 32
- Welding diodes page 36





# Fast recovery diodes

Hitachi ABB Power Grids' 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.



The diodes are typically used in combination with IGCTs and GTOs as free-wheeling and clamp diodes, thus enabling full IGCT and GTO performance.

Our L-housing fast recovery diodes optimally match press-pack IGBT and IEGT applications where a  $di/dt$  of up to 5 kA/ $\mu$ s is required.

Fast recovery diode recommendations for various applications can be found in the application note – Applying fast recovery diodes. The latest version is available at [www.hitachiabb-powergrids.com/semiconductors](http://www.hitachiabb-powergrids.com/semiconductors)

## GTO free-wheeling diodes

| Part number  | V <sub>RRM</sub> | V <sub>DC</sub> | I <sub>FAVM</sub>      | I <sub>FSM</sub> |                  | V <sub>F0</sub>  | r <sub>F</sub>   | I <sub>rr</sub>  | Q <sub>rr</sub> | T <sub>VJM</sub> | R <sub>thJC</sub> | R <sub>thCH</sub> | F <sub>m</sub> | Housing |
|--------------|------------------|-----------------|------------------------|------------------|------------------|------------------|------------------|------------------|-----------------|------------------|-------------------|-------------------|----------------|---------|
|              |                  |                 | T <sub>C</sub> = 85 °C | 1 ms             | 10 ms            | T <sub>VJM</sub> | di dt = 300 A/μs |                  |                 |                  |                   |                   |                |         |
|              |                  |                 |                        | T <sub>VJM</sub> | T <sub>VJM</sub> |                  |                  | T <sub>VJM</sub> |                 |                  |                   |                   |                |         |
|              |                  |                 |                        |                  |                  |                  |                  |                  |                 |                  |                   |                   |                |         |
| 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 34/35.

Please refer to page 61 for part numbering structure.

## IGBT diodes

| Part number  | $V_{RRM}$ | $V_{DC}$ | $I_{FAVM}$           | $I_{FSM}$ | $V_{FO}$  | $r_F$ | $I_{rr}$                            | $Q_{rr}$ | $T_{VJM}$ | $R_{thJC}$ | $R_{thCH}$ | $F_m$ | Housing |
|--------------|-----------|----------|----------------------|-----------|-----------|-------|-------------------------------------|----------|-----------|------------|------------|-------|---------|
|              |           |          | $T_C = 70\text{ °C}$ | 10 ms     | $T_{VJM}$ |       | $di/dt = 5000\text{ A/}\mu\text{s}$ |          |           |            |            |       |         |
|              |           |          |                      | $T_{VJM}$ |           |       | $T_{VJM}$                           |          |           |            |            |       |         |
|              | 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 <sub>RRM</sub> | V <sub>DC</sub> | I <sub>FAVM</sub>      | I <sub>FSM</sub> |                  | V <sub>F0</sub>  | r <sub>F</sub> | I <sub>rr</sub> | di/dt | T <sub>VJM</sub> | R <sub>thJC</sub> | R <sub>thCH</sub> | F <sub>m</sub> | Housing |
|--------------|------------------|-----------------|------------------------|------------------|------------------|------------------|----------------|-----------------|-------|------------------|-------------------|-------------------|----------------|---------|
|              |                  |                 | T <sub>C</sub> = 70 °C | 1 ms             | 10 ms            | T <sub>VJM</sub> |                | max.            |       |                  |                   |                   |                |         |
|              |                  |                 |                        | T <sub>VJM</sub> | T <sub>VJM</sub> |                  |                |                 |       |                  |                   |                   |                |         |
|              | 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 34/35.

Please refer to page 61 for part numbering structure.

# Rectifier and avalanche diodes

Hitachi ABB Power Grids' 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 |
|--------------|-----------|----------------------|--------------------|-----------|-------|-------------------|-----------|------------|------------|-------|---------|
|              |           | $T_c = 85\text{ °C}$ | 10 ms<br>$T_{VJM}$ | $T_{VJM}$ |       | 20µs<br>$T_{VJM}$ |           |            |            |       |         |
|              | V         | A                    | kA                 | V         | mΩ    | kw                | °C        | K/kW       | K/kW       | kN    |         |
| 5SDA 11D1702 | 1700      | 1310                 | 15.0               | 0.74      | 0.21  | 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 34/35.

Please refer to page 61 for part numbering structure.

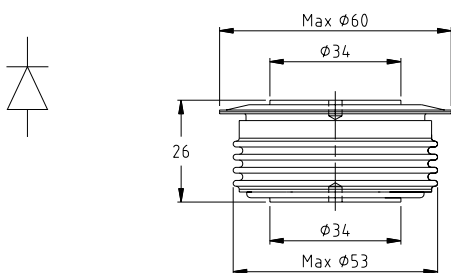
## Standard rectifier diodes

| Part number  | $V_{RSM}$ | $V_{RRM}$ | $I_{FAVM}$ | $I_{FSM}$          | $V_{FO}$  | $r_F$ | $T_{VJM}$ | $R_{thJC}$ | $R_{thCH}$ | $F_m$ | Housing |
|--------------|-----------|-----------|------------|--------------------|-----------|-------|-----------|------------|------------|-------|---------|
|              |           |           |            | 10 ms<br>$T_{VJM}$ | $T_{VJM}$ |       |           |            |            |       |         |
|              | 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    | T       |
| 5SDD 11D2800 | 2800      | 2800      | 1285       | 15.0               | 0.933     | 0.242 | 160       | 32.0       | 8.0        | 10    | D       |
| 5SDD 24F2800 | 2800      | 2800      | 2596       | 30.0               | 0.906     | 0.135 | 160       | 15.0       | 4.0        | 22    | F       |
| 5SDD 48H3200 | 3200      | 3200      | 4708       | 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    | T       |
| 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      | 3201       | 40.0               | 0.944     | 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       |
| 5SDD 75Y8500 | 8500      | 8500      | 6720       | 121                | 0.945     | 0.118 | 150       | 3.0        | 0.6        | 190   | Y       |

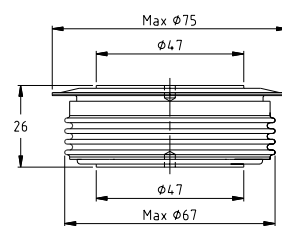
Drawings see page 34/35.

Please refer to page 61 for part numbering structure.

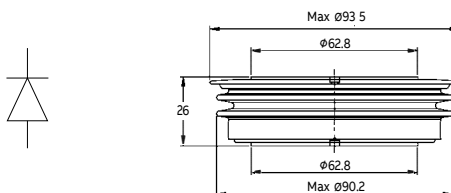
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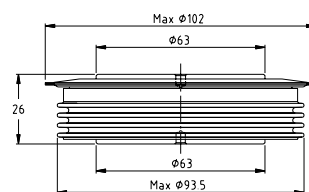
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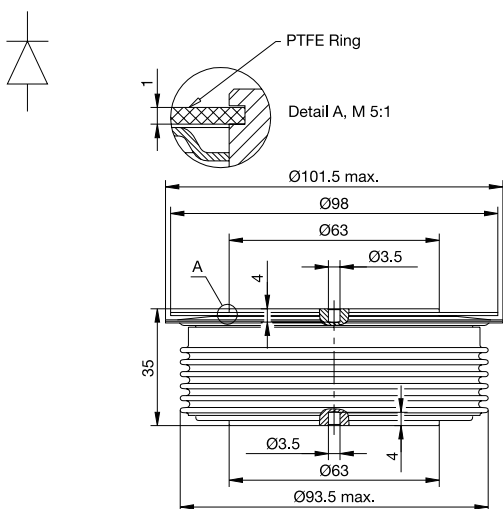
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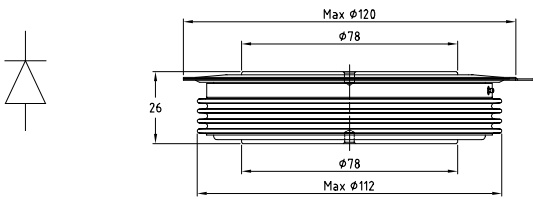
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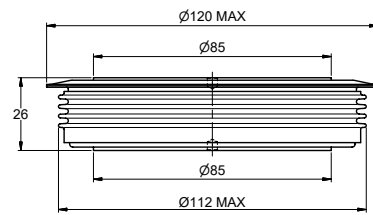
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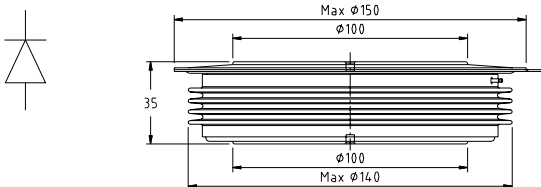
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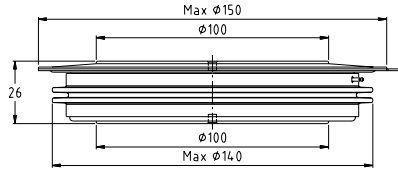
L2



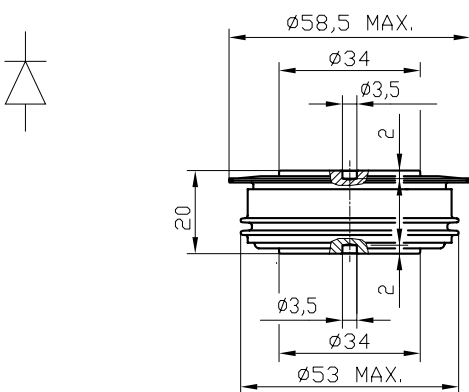
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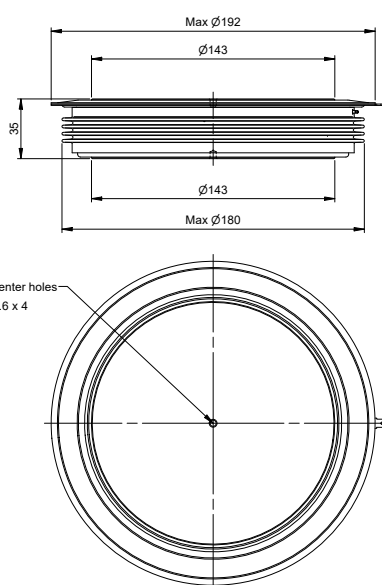
Q



T



Y



# Welding diodes

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



Hitachi ABB Power Grids' 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 |
|----------------|-----------|--------------------------------------------------------------|------------|------------------------------------|-----------|-----------|-----------|-----------|------------|------------|-------|---------|
|                |           | $T_J = 25\text{ }^{\circ}\text{C},$<br>$I_F = 5000\text{ A}$ |            | $T_C = 85\text{ }^{\circ}\text{C}$ |           | $T_{VJM}$ | $T_{VJM}$ |           |            |            |       |         |
|                | 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        | 37.5  | 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        | 37.5  | C       |
| 5SDD 92Z0401   | 400       | –                                                            | 1.03 *     | 9244                               | 60        | 0.78      | 0.031     | 180       | 5.6        | 3.6        | 36    | Z1      |
| 5SDD 0105Z0401 | 400       | –                                                            | 1.01 *     | 10502                              | 70        | 0.812     | 0.026     | 180       | 5.0        | 2.5        | 40    | Z2      |
| 5SDD 0135Z0401 | 400       | –                                                            | 0.92 *     | 13526                              | 85        | 0.758     | 0.021     | 180       | 3.9        | 2.6        | 52.5  | Z3      |

\* at 8000 A,  $T_{VJM}$

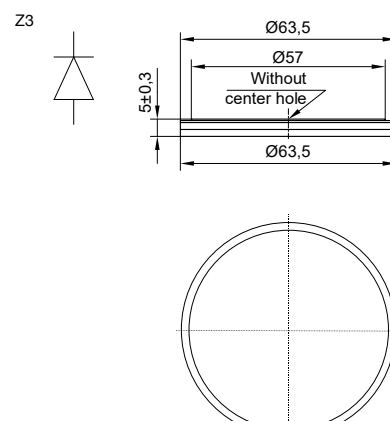
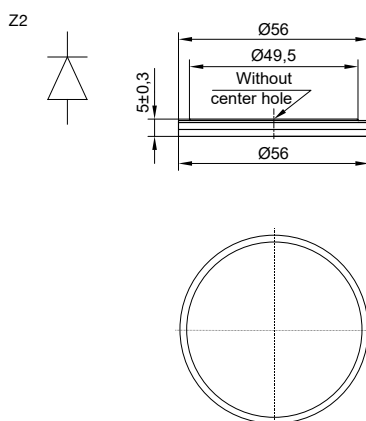
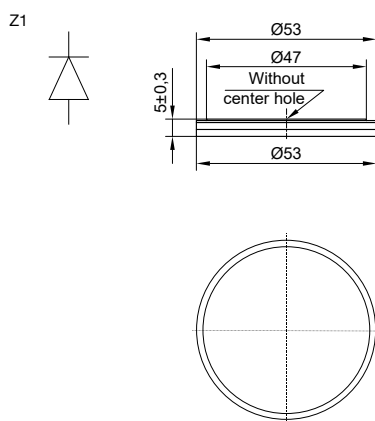
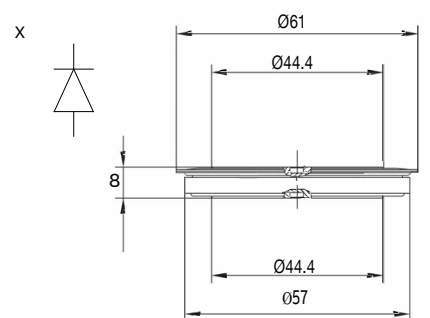
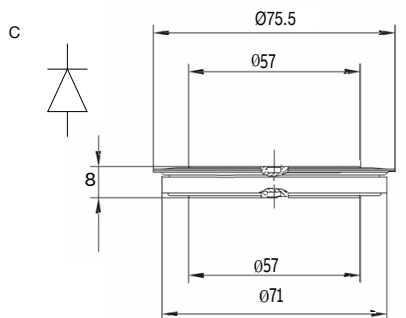
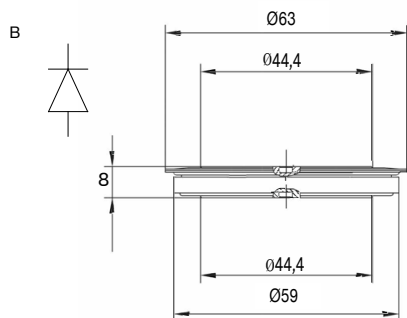
Please refer to page 61 for part numbering structure.

## 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 |
|----------------|-----------|------------------------------------|----------------------|--------------------|-----------|-----------|-----------|-----------|------------|------------|-------|---------|
|                |           | $T_{VJM}$<br>$I_F = 5000\text{ A}$ | $T_C = 85\text{ °C}$ | 10 ms<br>$T_{VJM}$ | $T_{VJM}$ | $T_{VJM}$ | $T_{VJM}$ |           |            |            |       |         |
|                | V         | V                                  | A                    | kA                 | V         | mΩ        | μC        | °C        | K/kW       | K/kW       | kN    |         |
| 5SDF 63B0400   | 400       | 1.14                               | 6266                 | 44                 | 0.962     | 0.036     | 180       | 190       | 10.0       | 5.0        | 22    | B       |
| 5SDF 63X0400   | 400       | 1.14                               | 6266                 | 44                 | 0.962     | 0.036     | 180       | 190       | 10.0       | 5.0        | 22    | X       |
| 5SDF 90Z0401   | 400       | 1.13                               | 9041                 | 48                 | 0.979     | 0.032     | 200       | 190       | 5.6        | 3.6        | 36.0  | Z1      |
| 5SDF 0102C0400 | 400       | 1.14 *                             | 10159                | 70                 | 0.977     | 0.022     | 300       | 190       | 6.0        | 3.0        | 37.5  | C       |
| 5SDF 0103Z0401 | 400       | 1.20 *                             | 10266                | 54                 | 0.998     | 0.027     | 230       | 190       | 5.0        | 2.5        | 40.0  | Z2      |
| 5SDF 0131Z0401 | 400       | 1.14 *                             | 13058                | 70                 | 0.977     | 0.022     | 300       | 190       | 3.9        | 2.6        | 52.5  | Z3      |

\* at 8000 A

Please refer to page 61 for part numbering structure.



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, we introduced the bi-directionally controlled thyristor (BCT), which consists of two integrated antiparallel thyristor functions on one silicon wafer.

Hitachi ABB Power Grids offers the following thyristor families:

- |                                                 |         |
|-------------------------------------------------|---------|
| • Bypass thyristor                              | page 39 |
| • Phase control thyristors (PCTs)               | page 40 |
| • Bi-directionally controlled thyristors (BCTs) | page 44 |



# Bypass thyristor



The bypass thyristor is a new semiconductor device that offers three modes of operation:

- Normal operation: Device is blocked permanently.
- Protection mode: Device is irreversibly shorted by a surge current event ( $I_{TSM} / I^2t$ ) triggered through the gate.
- SCFM mode: Continuous stable long-term short circuit mode.

A typical application is short-circuiting faulty cells in a multilevel converter topology (MMC). The thyristor housing will not rupture when passing currents up to, or exceeding, 363 kA or 217 MA<sup>2</sup>s. After a fault, the device operates as a stable short circuit for more than a year.

| Part number  | $V_{DRM}$ (V) | $V_{DCN}$ (V) | $I_{TSM}$ (kA) | Package (mm) |
|--------------|---------------|---------------|----------------|--------------|
| 5STP 10L8500 | 8400          | 4000          | 290            | L            |

Drawings see page 42.

# PCTs

## Phase control thyristors

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.



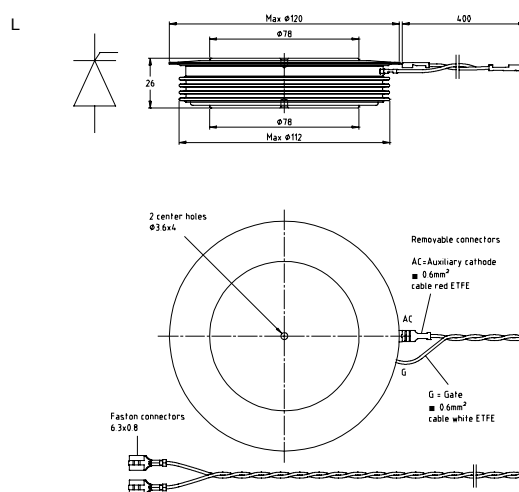
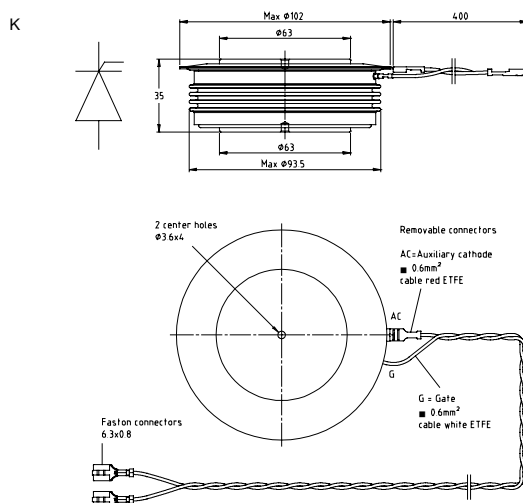
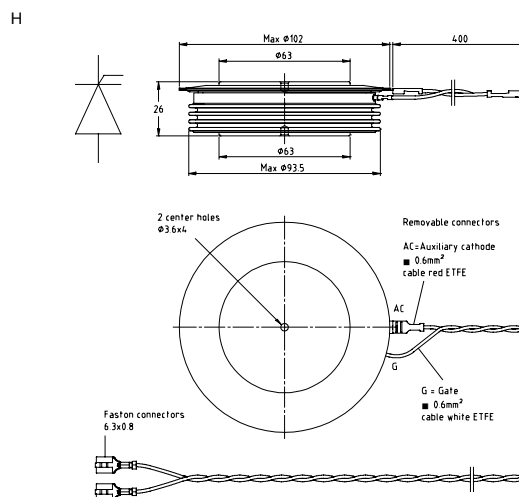
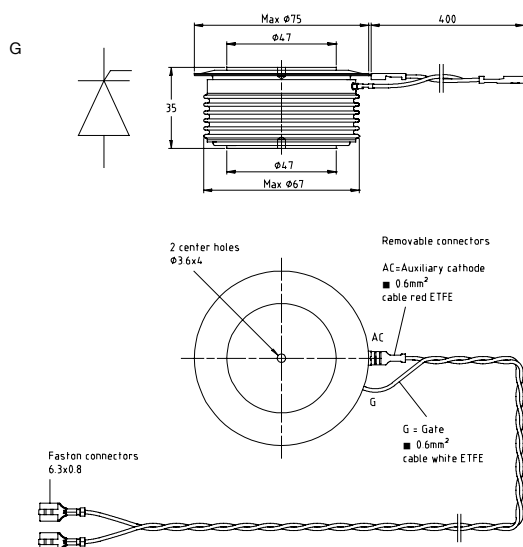
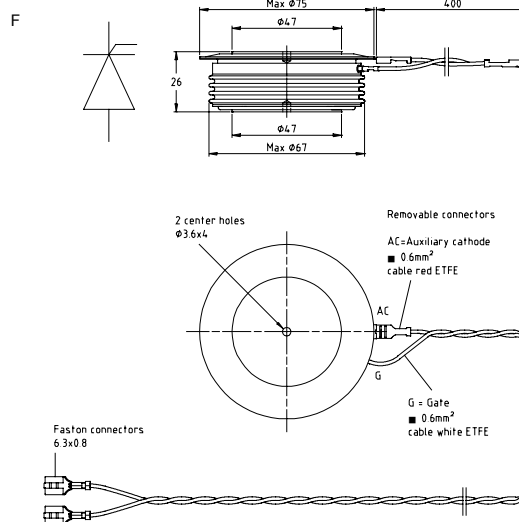
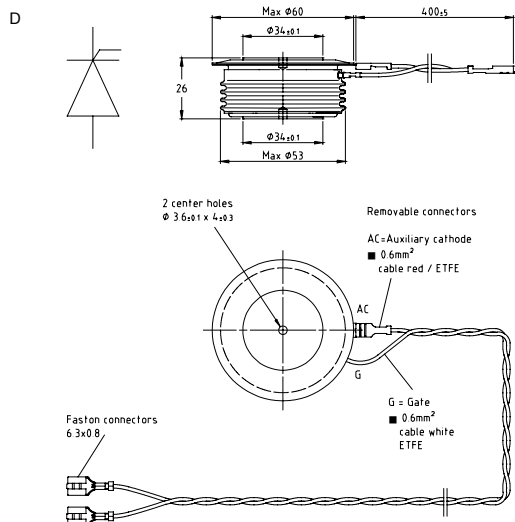
The field of PCT applications ranges from kW drives and MW rated line commutated frequency converters to GW converters for HVDC transmission.

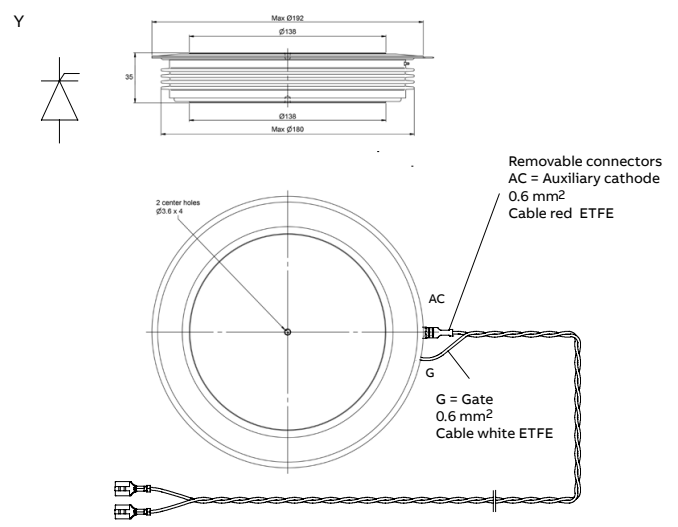
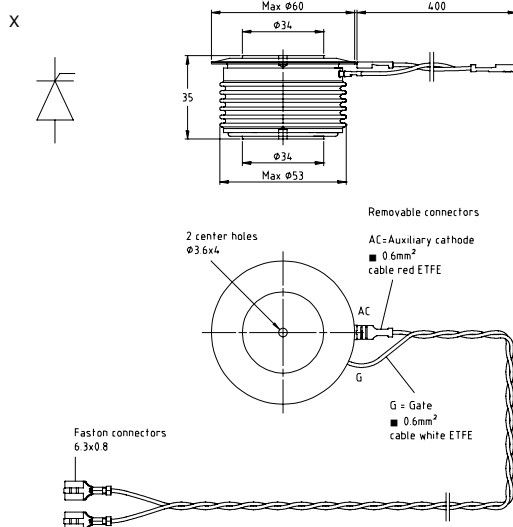
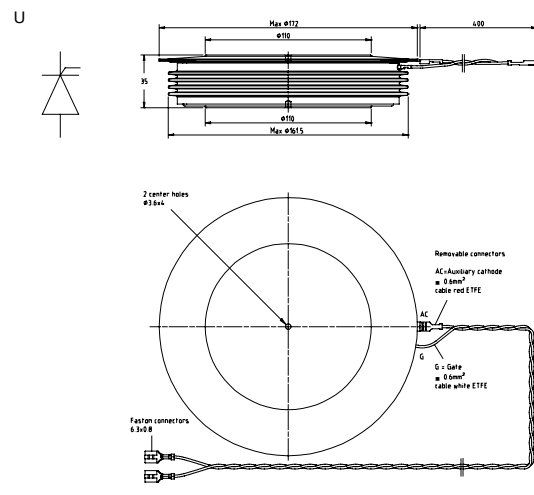
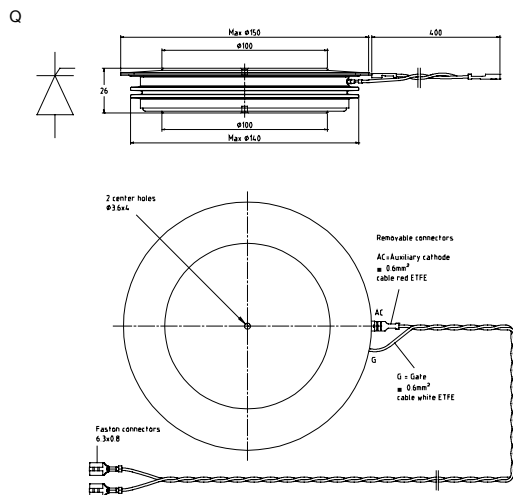
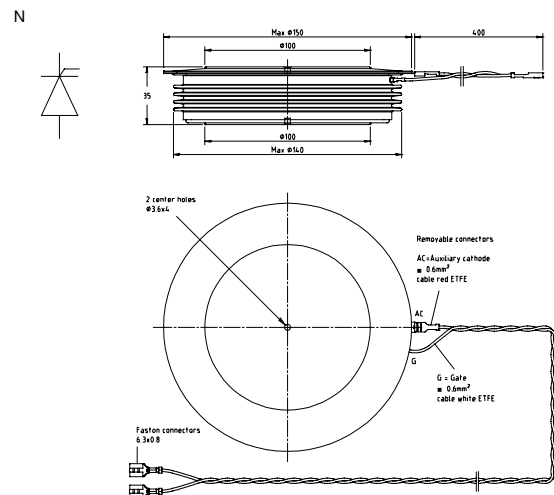
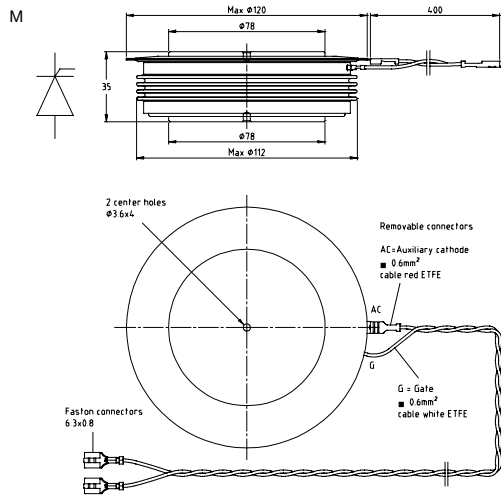
Hitachi ABB Power Grids offers the most complete range of high-power thyristors, including 6" devices. New products continue to be developed with focus on minimizing overall losses and maximizing power ratings.

Applications using two antiparallel thyristors can take advantage of Hitachi ABB Power Grids' innovative bi-directionally controlled thyristors (BCTs) that incorporate two antiparallel thyristors in a single housing (see page 44).

| Part number  | $V_{DRM}, V_{RRM}$ | $I_{TAVM}$           | $I_{TSM}$         | $V_{TO}$  | $r_T$ | $T_{VJM}$ | $R_{thJC}$ | $R_{thCH}$ | $F_m$ | Housing |
|--------------|--------------------|----------------------|-------------------|-----------|-------|-----------|------------|------------|-------|---------|
|              | $T_{VJM}$          | $T_C = 70\text{ °C}$ | 10 ms / $T_{VJM}$ | $T_{VJM}$ |       |           |            |            |       |         |
|              | V                  | A                    | kA                | V         | mΩ    | °C        | K/kW       | K/kW       | kN    |         |
| 5STP 07D1800 | 1800               | 760                  | 9.0               | 0.927     | 0.448 | 125       | 36.0       | 7.5        | 10    | D       |
| 5STP 18F1800 | 1800               | 1780                 | 21.0              | 0.923     | 0.188 | 125       | 17.0       | 4.0        | 22    | F       |
| 5STP 27H1800 | 1800               | 2940                 | 50.5              | 0.912     | 0.096 | 125       | 10.0       | 2.0        | 50    | H       |
| 5STP 42L1800 | 1800               | 4310                 | 64.0              | 0.81      | 0.080 | 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               | 640                  | 8.8               | 0.92      | 0.780 | 125       | 36.0       | 7.5        | 10    | D       |
| 5STP 16F2800 | 2800               | 1500                 | 18.0              | 0.956     | 0.297 | 125       | 17.0       | 4.0        | 22    | F       |
| 5STP 24H2800 | 2800               | 2780                 | 43.0              | 0.928     | 0.141 | 125       | 10.0       | 2.0        | 50    | H       |
| 5STP 33L2800 | 2800               | 3760                 | 65.5              | 0.929     | 0.100 | 125       | 7.0        | 1.5        | 70    | L       |
| 5STP 45N2800 | 2800               | 5250                 | 77.0              | 0.864     | 0.069 | 125       | 5.7        | 1.0        | 90    | N       |
| 5STP 45Q2800 | 2800               | 5710                 | 77.0              | 0.864     | 0.069 | 125       | 5.0        | 1.0        | 90    | Q       |
| 5STP 04D4200 | 4200               | 500                  | 7.1               | 1.14      | 1.288 | 125       | 36.0       | 7.5        | 10    | D       |
| 5STP 12F4200 | 4200               | 1190                 | 17.3              | 1.01      | 0.545 | 125       | 17.0       | 4.0        | 22    | F       |
| 5STP 18H4200 | 4200               | 2170                 | 32.0              | 0.982     | 0.274 | 125       | 10.0       | 2.0        | 50    | H       |
| 5STP 28L4200 | 4200               | 3290                 | 54.0              | 1.03      | 0.138 | 125       | 7.0        | 1.5        | 70    | L       |
| 5STP 38N4200 | 4200               | 4090                 | 64.5              | 0.973     | 0.126 | 125       | 5.7        | 1.0        | 90    | N       |
| 5STP 38Q4200 | 4200               | 4420                 | 64.5              | 0.973     | 0.126 | 125       | 5.0        | 1.0        | 90    | Q       |
| 5STP 04D5200 | 5200               | 420                  | 6.1               | 1.29      | 1.917 | 125       | 36.0       | 7.5        | 10    | D       |
| 5STP 17H5200 | 5200               | 1970                 | 34.0              | 0.994     | 0.343 | 125       | 10.0       | 2.0        | 50    | H       |
| 5STP 25L5200 | 5200               | 2830                 | 50.5              | 0.99      | 0.237 | 125       | 7.0        | 1.5        | 70    | L       |
| 5STP 25M5200 | 5200               | 2400                 | 50.5              | 0.99      | 0.237 | 125       | 9.0        | 1.5        | 70    | M       |
| 5STP 34N5200 | 5200               | 3450                 | 63.0              | 0.96      | 0.194 | 125       | 5.7        | 1.0        | 90    | N       |
| 5STP 34Q5200 | 5200               | 3720                 | 63.0              | 0.96      | 0.194 | 125       | 5.0        | 1.0        | 90    | Q       |
| 5STP 52U5200 | 5200               | 5200                 | 99.0              | 1.04      | 0.115 | 125       | 4.0        | 0.8        | 135   | U       |
| 5STP 03D6500 | 6500               | 340                  | 4.7               | 1.20      | 2.300 | 125       | 36.0       | 7.5        | 10    | D       |
| 5STP 03X6500 | 6500               | 390                  | 4.7               | 1.20      | 2.300 | 125       | 45.0       | 7.5        | 10    | X       |
| 5STP 08F6500 | 6500               | 850                  | 15.1              | 1.20      | 1.046 | 125       | 17.0       | 4.0        | 22    | F       |
| 5STP 08G6500 | 6500               | 730                  | 15.1              | 1.20      | 1.046 | 125       | 22.0       | 4.0        | 22    | G       |
| 5STP 12K6500 | 6500               | 1430                 | 31.5              | 1.15      | 0.647 | 125       | 11.0       | 2.0        | 50    | K       |
| 5STP 18M6500 | 6500               | 1830                 | 47.5              | 1.21      | 0.431 | 125       | 9.0        | 1.5        | 70    | M       |
| 5STP 26N6500 | 6500               | 2880                 | 65.0              | 1.12      | 0.290 | 125       | 5.7        | 1.0        | 90    | N       |
| 5STP 42U6500 | 6500               | 4300                 | 86.0              | 1.17      | 0.181 | 125       | 4.0        | 0.8        | 135   | U       |
| 5STP 48Y7200 | 7200               | 5040                 | 92.0              | 0.983     | 0.128 | 110       | 3.0        | 0.6        | 190   | Y       |
| 5STP 27N8500 | 8500               | 2660                 | 64.0              | 1.13      | 0.394 | 125       | 5.7        | 1.0        | 90    | N       |
| 5STP 27Q8500 | 8500               | 2870                 | 64.0              | 1.13      | 0.394 | 125       | 5.0        | 1.0        | 90    | Q       |
| 5STP 45Y8500 | 8500               | 4450                 | 90.0              | 1.06      | 0.168 | 110       | 3.0        | 0.6        | 190   | Y       |

Please refer to page 60 for part numbering structure.





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 Hitachi ABB Power Grids' BCTs – without jeopardizing reliability and performance.

Hitachi ABB Power Grids' 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 40), thus reaching the same levels of performance and reliability.

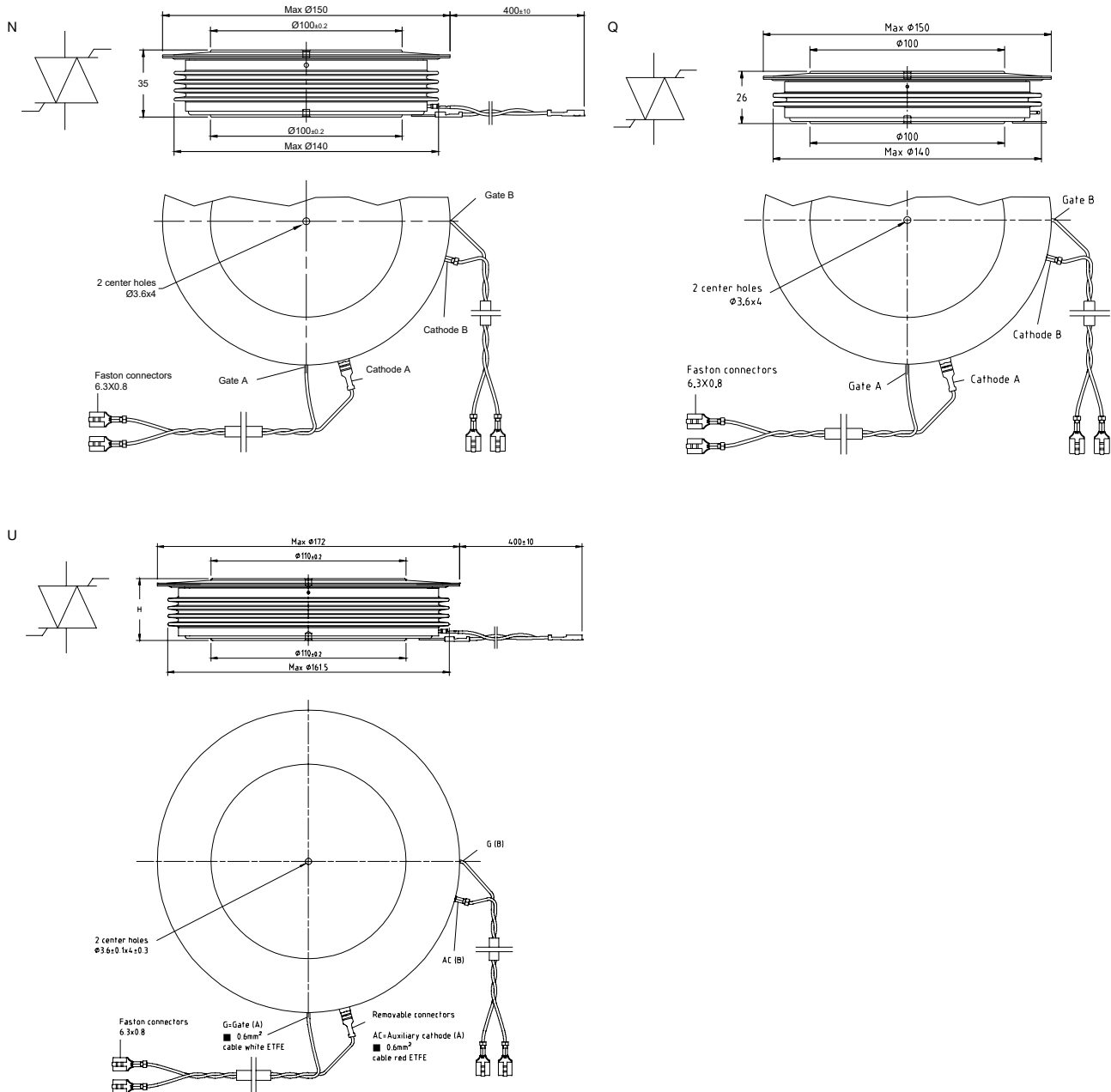
A table of replacement of PCTs by BCTs is given in the BCT application note which can be found at [www.hitachiabb-powergrids.com/semiconductors](http://www.hitachiabb-powergrids.com/semiconductors).



| Part number  | $V_{RM}$  | $I_{TRMS}^*$                       | $I_{TAVM}$                         | $I_{TSM}$          | $V_{TO}$  | $r_T$      | $T_{VJM}$          | $R_{thJC}$ | $R_{thCH}$ | $F_m$ | Housing |
|--------------|-----------|------------------------------------|------------------------------------|--------------------|-----------|------------|--------------------|------------|------------|-------|---------|
|              | $T_{VJM}$ | $T_C = 70\text{ }^{\circ}\text{C}$ | $T_C = 70\text{ }^{\circ}\text{C}$ | 10 ms<br>$T_{VJM}$ | $T_{VJM}$ |            |                    |            |            |       |         |
|              | V         | A                                  | A                                  | kA                 | V         | m $\Omega$ | $^{\circ}\text{C}$ | 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 60 for part numbering structure.



Dimensions in mm

# IGCTs

## Integrated gate-commutated thyristors

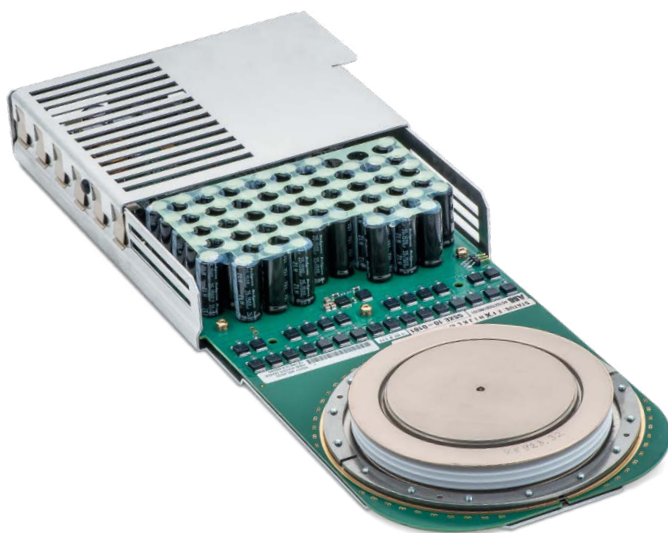
Within 20 years of its introduction, the IGCT has established itself as the semiconductor of choice for high-power frequency converters by meeting the requirements of today's demanding applications.

Hitachi ABB Power Grids' 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 installed in the Grimsel 2 power plant in the Swiss Alps.



## 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 |
|-------------------|-----------|----------|-----------|------------|--------------------|-------------------|--------------------|---------------------|-----------|-----------|------------|------------|-------|-----------|---------|
|                   |           |          |           |            | $T_c = 85^\circ C$ | 3 ms<br>$T_{VJM}$ | 10 ms<br>$T_{VJM}$ | 4000 A<br>$T_{VJM}$ | $T_{VJM}$ | $T_{VJM}$ |            |            |       |           |         |
|                   | V         | V        | V         | A          | A                  | kA                | kA                 | V                   | V         | mΩ        | °C         | K/kW       | K/kW  | kN        |         |
| 5SHY 35L4520      | 4500      | 2800     | 17        | 4000       | 1700               | 50                | 32                 | 2.70                | 1.40      | 0.33      | 125        | 8.5        | 3     | 40        | Fig. 1  |
| 5SHY 35L4522      | 4500      | 2800     | 17        | 4000       | 2100               | 56                | 35                 | 2.00                | 1.15      | 0.21      | 125        | 8.5        | 3     | 40        | Fig. 1  |
| 5SHY 45L4520      | 4500      | 2800     | 17        | 4500       | 1430               | 39                | 28                 | 2.60*               | 1.70      | 0.45      | 125        | 8.5        | 3     | 40        | Fig. 1  |
| 5SHY 55L4500      | 4500      | 2800     | 17        | 5000       | 1870               | 50                | 33                 | 2.35                | 1.22      | 0.28      | 125        | 8.5        | 3     | 40        | Fig. 1  |
| 5SHY 65L4521**New | 4500      | 2800     | 17        | 6500       | 2660               | –                 | 36                 | 2.30                | 1.11      | 0.297     | 125        | 6.8        | 2.2   | 60        | Fig. 1  |
| 5SHY 65L4522**New | 4500      | 2800     | 17        | 6000       | 2260               | –                 | 32,5               | 2.95                | 1.29      | 0.414     | 125        | 6.8        | 2.2   | 60        | Fig. 1  |
| 5SHY 50L5500      | 5500      | 3300     | 17        | 3600       | 1290               | 40                | 26                 | 4.10                | 1.66      | 0.62      | 125        | 8.5        | 3     | 40        | Fig. 1  |
| 5SHY 42L6500      | 6500      | 4000     | 17        | 3800       | 1290               | 40                | 26                 | 4.10                | 1.88      | 0.56      | 125        | 8.5        | 3     | 40        | Fig. 1  |

- Optimized for snubberless turn-off  
- Contact factory for series connection

\* at 2000 A

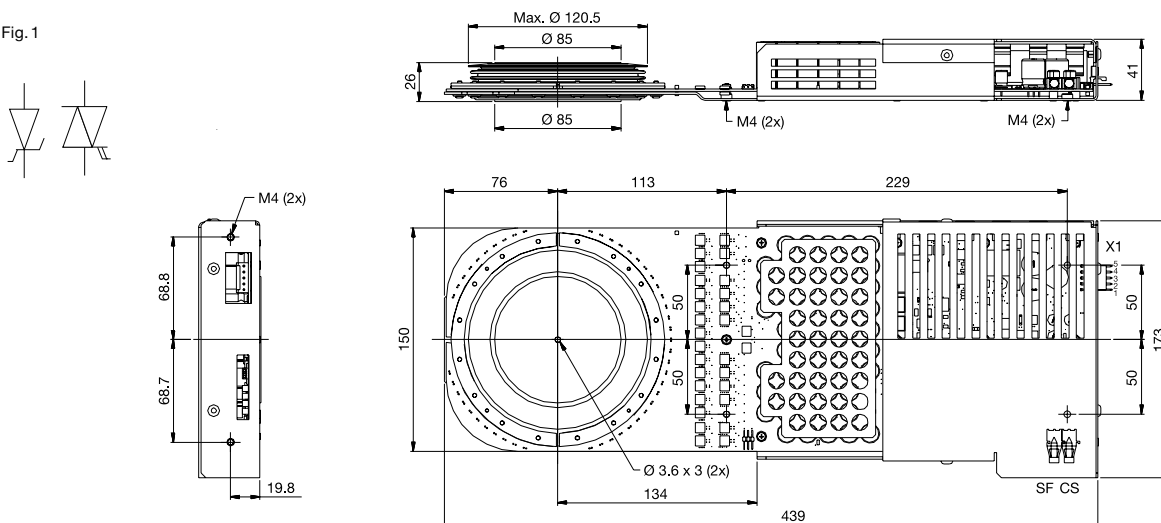
## Reverse conducting IGCTS

| Part number        | $V_{DRM}$ | $V_{DC}$ | $I_{TGQM}$ | $I_{TAVM}/I_{FAVM}$ | $I_{TSM}/I_{FSM}$  | $V_T/V_F$ | $V_{T0}/V_{F0}$ | $r_T/r_F$ | $T_{VJM}$ | $R_{thJC}$ | $F_m$ | $V_{GIN}$ | Outline |
|--------------------|-----------|----------|------------|---------------------|--------------------|-----------|-----------------|-----------|-----------|------------|-------|-----------|---------|
|                    |           |          |            | $T_c = 85^\circ C$  | 10 ms<br>$T_{VJM}$ | $T_{VJM}$ | $T_{VJM}$       |           |           |            |       |           |         |
|                    | V         | V        | A          | A                   | kA                 | V         | V               | mΩ        | °C        | K/kW       | kN    | V         |         |
| 5SHX 26L4520 GCT   | 4500      | 2800     | 2200       | 1010                | 17.0               | 2.95      | 1.80            | 0.53      |           | 13         |       | 28-40     | Fig. 1  |
| Diode part         |           |          |            |                     | 390                | 10.6      | 5.40            | 2.70      | 1.24      | 125        | 26    | 44        | Fig. 1  |
| 5SHX 19L6020 GCT   | 5500      | 3300     | 1800       | 840                 | 18.0               | 3.45      | 1.90            | 0.90      |           | 13         |       | 28-40     | Fig. 1  |
| Diode part         |           |          |            |                     | 340                | 7.7       | 6.40            | 2.70      | 2.23      | 125        | 26    | 44        | Fig. 1  |
| 5SHX 36L4520** New | 4500      | 2800     | 3600       | 1040                | 15.0               | 2.70      | 1.59            | 0.74      | 125       | 11         |       | 28-40     | Fig. 1  |
| Diode part         |           |          |            |                     | 730                |           | 3.60            | 1.88      | 1.15      | 125        | 14    | 44        | Fig. 1  |
| 5SHX 36L4521** New | 4500      | 2800     | 3600       | 1280                | 20.0               | 2.00      | 1.24            | 0.51      | 125       | 11         |       | 28-40     | Fig. 1  |
| Diode part         |           |          |            |                     | 910                | 20.0      | 2.60            | 1.46      | 0.76      | 125        | 14    | 44        | Fig. 1  |

- Monolithically integrated free-wheeling diode optimized for snubberless turn-off  
Please refer to page 60 for part numbering structure.

\*\*Contact factory

Fig. 1



## Fast recovery diode recommendation

For all asymmetric and reverse conducting IGCTS, Hitachi ABB Power Grids 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.hitachiabb-powergrids.com/semiconductors](http://www.hitachiabb-powergrids.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.



Hitachi ABB Power Grids 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.

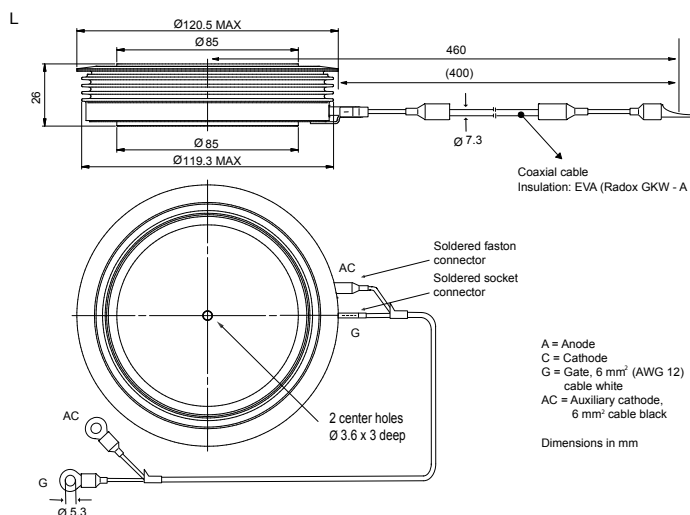
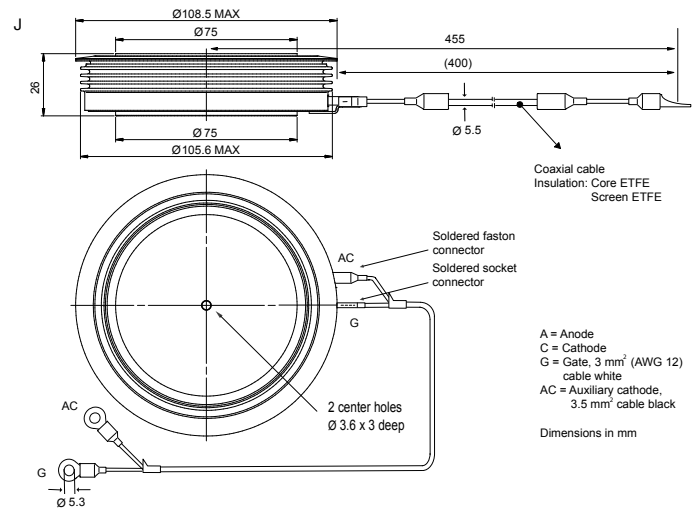
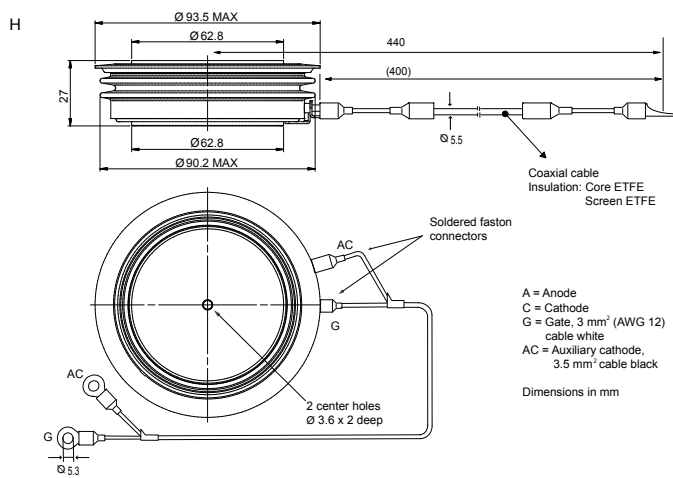
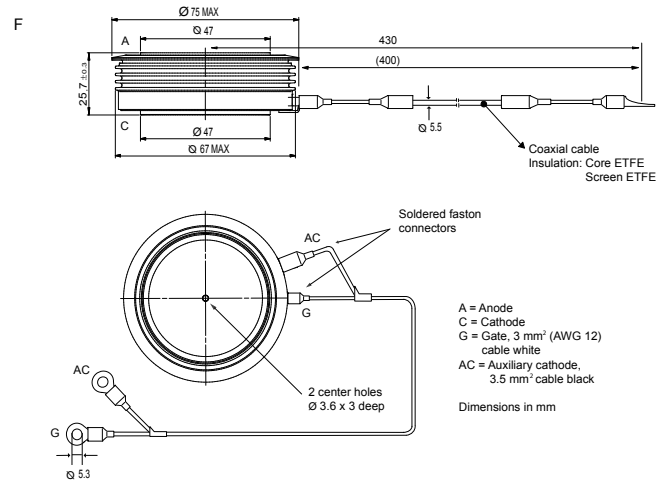
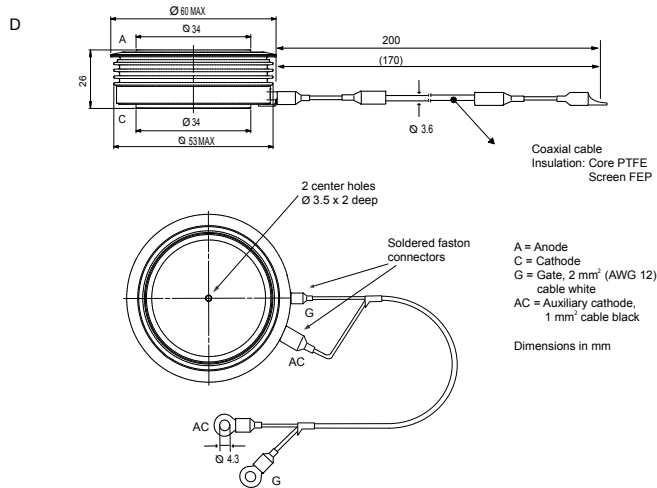
### Asymmetric GTOs

| Part number  | $V_{DRM}$ | $V_{DC}$ | $V_{RRM}$ | $I_{TGQM}$ at $C_S$ |               | $I_{TAVM}$                         | $I_{TSM}$          | $V_T$                   | $V_{TO}$  | $r_T$      | $T_{VJM}$          | $R_{thJC}$ | $R_{thCH}$ | $F_m$ | Outline |
|--------------|-----------|----------|-----------|---------------------|---------------|------------------------------------|--------------------|-------------------------|-----------|------------|--------------------|------------|------------|-------|---------|
|              |           |          |           |                     |               | $T_C = 85\text{ }^{\circ}\text{C}$ | 10 ms<br>$T_{VJM}$ | $I_{TGQM}$<br>$T_{VJM}$ | $T_{VJM}$ |            |                    |            |            |       |         |
|              | V         | V        | V         | A                   | $\mu\text{F}$ | A                                  | kA                 | V                       | V         | m $\Omega$ | $^{\circ}\text{C}$ | 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

| Part number  | $V_{DRM}$ | $V_{DC}$ | $V_{RRM}$ | $I_{TGQM}$ | $C_S$ | $I_{TAVM}$ | $I_{TSM}$ | $V_T$ | $V_{TO}$ | $r_T$ | $T_{VJM}$ | $R_{thJC}$ | $R_{thCH}$ | $F_m$ | Outline |
|--------------|-----------|----------|-----------|------------|-------|------------|-----------|-------|----------|-------|-----------|------------|------------|-------|---------|
| 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 60 for part numbering structure.



### Fast recovery diode recommendation

For all GTO types, Hitachi ABB Power Grids 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.hitachiabb-powergrids.com/semiconductors](http://www.hitachiabb-powergrids.com/semiconductors).

# Test systems for high-power semiconductors

Hitachi ABB Power Grids designs, manufactures and offers CE compliant customized power semiconductor test systems.

Hitachi ABB Power Grids offers 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

Hitachi ABB Power Grids 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 Hitachi ABB Power Grids 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 | $V_{\text{ce sat}} / V_{\text{pinch-off}}$ | Turn-on / turn-off |
|--------------------------------------------|---------------------------|----------------------|---------------------------|-------------------------|----------------|----------------------------------|--------------------------------------------|--------------------|
| <b>BiPolar test systems 4.5 kV</b>         |                           |                      |                           |                         |                |                                  |                                            |                    |
| 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                  |
| <b>IGBT test systems</b>                   |                           |                      |                           |                         |                |                                  |                                            |                    |
| 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                  |

#### Reliability test systems

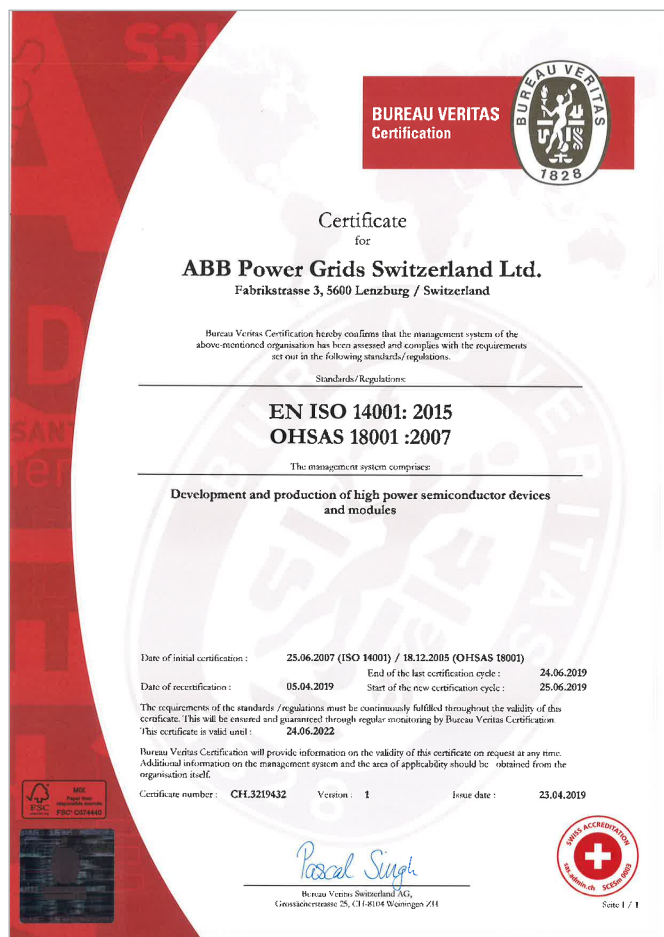
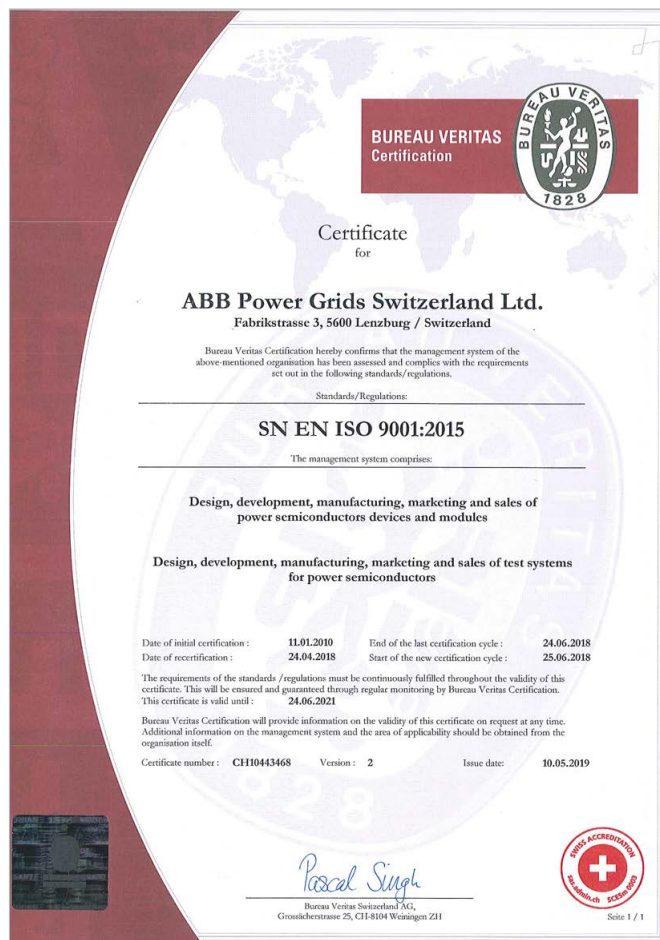
- High temperature reverse bias
- Intermittent operating life
- Surge current

#### 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

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





THE INTERNATIONAL CERTIFICATION NETWORK

# CERTIFICATE

CQS has issued an IQNet recognized certificate that the organization:

ABB Power Grids Czech Republic s.r.o.  
Průmyslová 137, Dolní Staré Město, 541 01 Trutnov, Czech Republic

Local product group Semiconductors  
Novodvorská 1768/138a, 142 21 Praha 4, Czech Republic

has implemented and maintains a  
**Quality Management System**

for the following scope

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

which fulfils the requirements of the following standard:

## ISO 9001:2015

Issued on: 2019 – 10 – 01

Expires on: 2022 – 08 – 13

This attestation is directly linked to the IQNet Partner's original certificate and shall not be used as a stand-alone document

Registration Number: CZ – 2104/2019



*Alex Stoichitoiu*  
Alex Stoichitoiu  
President of IQNet

*Tomáš Hruška*  
Tomáš Hruška  
President of CQS



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THE INTERNATIONAL CERTIFICATION NETWORK

# CERTIFICATE

CQS has issued an IQNet recognized certificate that the organization:

ABB Power Grids Czech Republic s.r.o.  
Průmyslová 137, Dolní Staré Město, 541 01 Trutnov, Czech Republic

Local product group Semiconductors  
Novodvorská 1768/138a, 142 21 Praha 4, Czech Republic

has implemented and maintains a  
**Environmental Management System**

for the following scope

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

which fulfils the requirements of the following standard:

## ISO 14001:2015

Issued on: 2019 – 10 – 01

Expires on: 2022 – 08 – 13

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Registration Number: CZ – 112/2019



*Alex Stoichitoiu*  
Alex Stoichitoiu  
President of IQNet

*Tomáš Hruška*  
Tomáš Hruška  
President of CQS



**IQNet Partners\*:**  
AENOR Spain AFNOR Certification France APCER Portugal CCC Cyprus CISQ Italy  
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THE INTERNATIONAL CERTIFICATION NETWORK

# CERTIFICATE

CQS has issued an IQNet recognized certificate that the organization:

ABB Power Grids Czech Republic s.r.o.  
Průmyslová 137, Dolní Staré Město, 541 01 Trutnov, Czech Republic

Local product group Semiconductors  
Novodvorská 1768/138a, 142 21 Praha 4, Czech Republic

has implemented and maintains a  
**Occupational Health and Safety Management System**

for the following scope

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

which fulfils the requirements of the following standard:

## ISO 45001:2018

Issued on: 2019 – 10 – 01

Expires on: 2022 – 08 – 13

This attestation is directly linked to the IQNet Partner's original certificate and shall not be used as a stand-alone document

Registration Number: CZ – 113/2019



*Alex Stoichitoiu*  
Alex Stoichitoiu  
President of IQNet

*Tomáš Hruška*  
Tomáš Hruška  
President of CQS



**IQNet Partners\*:**  
AENOR Spain AFNOR Certification France APCER Portugal CCC Cyprus CISQ Italy  
CQC China CQM China CQS Czech Republic Cro Cert Croatia DQS Holding GmbH Germany FCAV Brazil  
FONDONORMA Venezuela ICONTEC Colombia Inspecta Sertifiointi Oy Finland INTECO Costa Rica  
IRAM Argentina JQA Japan KPC Korea MIRTEC Greece MSZT Hungary Nemko AS Norway NSAI Ireland  
NYCE-SIGE Mexico PCBC Poland Quality Austria Austria RR Russia SII Israel SIQ Slovenia  
SIRIM QAS International Malaysia SQS Switzerland SRAC Romania TEST St Petersburg Russia TSE Turkey YUQS Serbia  
IQNet is represented in the USA by: AFNOR Certification, CISQ, DQS Holding GmbH and NSAI Inc.

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## Further information

### Product Environmental Compliance Information

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 Power Grids Switzerland Ltd., Semiconductors and/or ABB Power Grids Czech Republic s.r.o. do not intentionally release any substance or preparation (mixtures);
- ABB Power Grids Switzerland Ltd., Semiconductors and/or ABB Power Grids Czech Republic s.r.o. 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);
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ABB Power Grids Switzerland Ltd., Semiconductors

# Further information

## Symbols

| Symbol         | Description                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------|
| $di/dt_{\max}$ | 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                                                                               |
| $I_T$          | On-state current thyristor                                                                                                        |
| $I_{TAVM}$     | 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                                                                                                      |
| $R_{DS(on)}$   | Drain-source on resistance                                                                                                        |
| $r_F$          | 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                                                                                     |
| $V_{DSS}$      | Drain-source 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       |
| IGBT short circuit safe operating area (SOA) capability and testing                         | 5SYA 2095       |
| Paralleling of IGBT modules                                                                 | 5SYA 2098       |
| Mounting Instructions for 62Pak                                                             | 5SYA 2106       |
| Use and installation instructions for LoPak1 modules – Thermal paste                        | 5SYA 2113       |
| Use and installation instructions for LoPak1 – Pre-applied Thermal Interface Material (TIM) | 5SYA 2142       |

### 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       |

**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 |
|----------------------------------------------------------------------------|-----------------|
| General Environmental Conditions For High Power Semiconductors             | 5SZK 9118       |
| Handling, packing and storage conditions for sawn wafer dies and bare dies | 5SZK 9114       |

# 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<sup>+</sup> and SPT<sup>++</sup> / Z = Enhanced trench / FSA, FCE diode

#### Type

76 = Unsawn wafer die / 86 = Sawn wafer die

12 = Picked die (waffle pack)

#### Die size in mm<sup>2</sup>

|   |     |   |                        |
|---|-----|---|------------------------|
| A | 4   | – | 8.99 mm <sup>2</sup>   |
| B | 9   | – | 15.99 mm <sup>2</sup>  |
| C | 16  | – | 24.99 mm <sup>2</sup>  |
| D | 25  | – | 35.99 mm <sup>2</sup>  |
| E | 36  | – | 48.99 mm <sup>2</sup>  |
| F | 49  | – | 63.99 mm <sup>2</sup>  |
| G | 64  | – | 80.99 mm <sup>2</sup>  |
| H | 81  | – | 99.99 mm <sup>2</sup>  |
| J | 100 | – | 120.99 mm <sup>2</sup> |
| K | 121 | – | 143.99 mm <sup>2</sup> |
| L | 144 | – | 168.99 mm <sup>2</sup> |
| M | 169 | – | 195.99 mm <sup>2</sup> |
| N | 196 | – | 224.99 mm <sup>2</sup> |
| O | 225 | – | 255.99 mm <sup>2</sup> |
| P | 256 | – | 288.99 mm <sup>2</sup> |
| Q | 289 | – | 323.99 mm <sup>2</sup> |
| R | 324 | – | 360.99 mm <sup>2</sup> |
| S | 361 | – | 399.99 mm <sup>2</sup> |

#### Blocking voltage (V/100)

#### Version number

**IGBT and diode modules**

5SN D 0800 M 17 0 1 00

**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**

A = RoadPak A-Sample  
 B = RoadPak B-Sample  
 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 (thermal paste/TIM)  
 S = LoPak3  
 X = LinPak

**Blocking voltage (V/100)****Package variation**

0 = Standard

**Technology variation**

1 = SPT / 3 = SPT<sup>+</sup> and SPT<sup>++</sup> / 4 = TSPT<sup>+</sup> (Enhanced trench cell technology)

**Version number**

IGCT

Product group

5SHX = Reverse conducting IGCT  
5SHY = Asymmetric IGCT

Max. turn-off current (I/100)

Housing

Blocking voltage (V/100)

Version number

5SHY 35 L 45 20

GTO

Product group

5SGA = Asymmetric GTO  
5SGF = Fine pattern GTO

Max. turn-off current (I/100)

Housing

Blocking voltage (V/100)

Version number

5SGA 20 H 25 01

Phase control thyristors

Product group

5STP = Phase control thyristors  
5STB = Bi-directionally controlled thyristors

Average on-state current (I/100)

Housing

Blocking voltage (V/100)

Version number

5STP 26 N 65 00

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**

Bipolar Power modules

5SE D 0890 T 22 4 0

**Product group**  
5SE

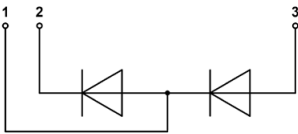
**Configuration**  
D ... Diode/Diode

**Average on-state current (I/100)**

**Housing**  
T ... 60Pak

**Blocking voltage (V/100)**

**Connection**  
4 ...



**Version number**

# Further information

## Worldwide distributors

### Australia, New Zealand & South

#### East Asia

Si-Chips Power Technologies Ltd.  
19/F, Lee Garden One, 33 Hysan Avenue,  
Causeway Bay, Hong Kong  
Tel. +61 3 9008 7271  
Fax +61 3 9646 4434  
E-Mail [info@si-chip.com](mailto:info@si-chip.com)  
Web [www.si-chip.com](http://www.si-chip.com)

#### Austria

ABB AG  
Electrification Products Division  
Brown-Boveri-Straße 3,  
2351 Wiener Neudorf, Austria  
Tel. +43 1 60109 6530  
Fax +43 1 60109 8600  
E-Mail [AT-LPKC@abb.com](mailto:AT-LPKC@abb.com)

#### Brazil

ABB Ltda.  
Rod. Senador Jose Ermirio de Moraes, km  
11, S/N,  
18087-125 Sorocaba, Sao Paulo, Brazil  
Mobile +55 11 98354 6348  
E-Mail [luis-carlos.araujo@br.abb.com](mailto:luis-carlos.araujo@br.abb.com)

#### China

Sun.King Technology Group Limited  
9-A Ronghui Park, Yuhua Road, Zone B,  
Airport Industrial Park, Shunyi District,  
101300 Beijing, China  
Tel. +86 10 5630 1111  
Fax +86 10 5630 1112  
E-Mail [info@sunking-tech.com](mailto:info@sunking-tech.com)  
Web [www.sunking-tech.com](http://www.sunking-tech.com)

#### Czech Republic

TUNKR, spol. s r.o.  
Dlouhá 33, Pribyslavice,  
664 83 Czech Republic  
Tel. +420 739 457 033  
E-Mail [info@tunkr.cz](mailto:info@tunkr.cz)  
Web [www.tunkr.cz](http://www.tunkr.cz)

#### France

ABB Power Grids France  
7 boulevard D'Osny, CS 88570 Cergy,  
95892 Cergy Pontoise, France  
Tel. +33 1 3440 2549  
Fax +33 1 3440 2424  
Mobile +33 6 7016 8341  
E-Mail [jean-francois.le\\_luyer@hitachi-powergrids.com](mailto:jean-francois.le_luyer@hitachi-powergrids.com)

#### Germany

Finepower GmbH  
Carl-Zeiss-Ring 21,  
D-85737 Ismaning, Germany  
Tel. +49 89 3090758-25  
Mobile +49 1761 43848 93  
E-Mail [info@finepower.com](mailto:info@finepower.com)  
Web [www.finepower.com](http://www.finepower.com)

GvA Leistungselektronik GmbH  
Boehringer Strasse 10 – 12,  
68307 Mannheim, Germany  
Tel. +49 621 789 9210  
Fax +49 621 789 9299  
E-Mail [info@gva-leistungselektronik.de](mailto:info@gva-leistungselektronik.de)  
Web [www.gva-leistungselektronik.de](http://www.gva-leistungselektronik.de)

Hauber&Graf Electronics GmbH  
Höpfigheimer Str. 8,  
71711 Steinheim/Murr, Germany  
Tel. +49 7144 33905-0  
Fax +49 7144 33905-55  
E-Mail [info@hg-electronics.de](mailto:info@hg-electronics.de)  
Web [www.hg-electronics.de](http://www.hg-electronics.de)

#### Hungary

Budaker Ltd.  
H-1222 Budapest, Nagytétényi út 48.  
Tel. +36 1 424 5094  
Fax +36 1 228 2291  
E-Mail [abb@budaker.hu](mailto:abb@budaker.hu)  
Web [www.budaker.hu](http://www.budaker.hu)

#### India

Pankaj Electronics  
A-09, Sector 67, Noida - 201301, India  
Tel. +91 784 0051401/402/403/404  
E-Mail [sales@pankaj.biz](mailto:sales@pankaj.biz)  
Web [www.pankajelectronics.com](http://www.pankajelectronics.com)

#### Italy

ABB S.p.A.  
Business Motion  
Via L. Lama 33,  
20099 Sesto S. Giovanni (Mi), Italy  
Tel. +39 02 2414 8494  
Mobile +39 335 8310569  
E-Mail [igor.tacconi@it.abb.com](mailto:igor.tacconi@it.abb.com)

#### Japan

Kyocera Corporation  
Tokyo Office  
6F, 3-32-42, Higashishinagawa,  
Shinagawa-ku, Tokyo  
140-8810, Japan  
Tel. +81 3 6364 5600  
E-Mail [sales-domestic@kyocera.jp](mailto:sales-domestic@kyocera.jp)  
Web [www.global.kyocera.com](http://www.global.kyocera.com)

#### Korea

Milim Syscon Co., Ltd  
B214 Biz Center, 124 Sagimakgol-Ro,  
Jungwon-Gu, Seongnam-Si,  
462-721 Gyeonggi-Do, Korea  
Tel. +82 31 776 2288  
Fax +82 31 776 2292  
E-Mail [hjlim@milimsys.com](mailto:hjlim@milimsys.com)  
Web [www.milimsys.com](http://www.milimsys.com)

#### Netherlands and Belgium

KWx B.V.  
Aston Martinlaan 41,  
3261 NB Oud-Beijerland, Netherlands  
Tel. +31 186 633600  
Fax +31 186 633605  
E-Mail [halfgeleiders@kwx.nl](mailto:halfgeleiders@kwx.nl) /  
[i.karbass@kwx.nl](mailto:i.karbass@kwx.nl)  
Web [www.kwx.nl](http://www.kwx.nl)

#### Poland

Dacpol Sp. z o.o.  
ul. Pulawska 34, PL-05-500 Piaseczno  
Tel. +48 22 70 35 220  
E-Mail [czynne@dacpol.eu](mailto:czynne@dacpol.eu)  
Web [www.dacpol.eu/en](http://www.dacpol.eu/en)

**Russia**

ABB Power Grids Ltd.  
Nakhimovskiy prospect 58,  
117335, Moscow, Russia  
Tel. +7 495 777 2220  
Mobile +7 919 410 2527  
Fax +7 495 956 6276  
E-Mail alexander.shkitskiy@hitachi-  
powergrids.com

**Slovakia**

ZTS Eltop, spol. s.r.o.  
Mierové námestie 24,  
018 51 Nová Dubnica, Slovakia  
Tel. +421 42 4430031  
Fax +421 42 4430031  
Mobile +421 905 349742  
E-Mail ztseltop@ztseltop.sk  
Web www.ztseltop.sk

**South Asia (Singapore, Malaysia, Vietnam and Thailand)**

Infomatic Pte. Ltd.  
80 Changi Road, 05-11,  
CentroPod@Changi, Singapore 419715  
Tel. +65 8504 6740  
Mobile +65 8478 0572  
E-Mail info@infomatic.com.sg  
Web www.infomatic.com.sg

**South Africa**

ABB South Africa  
2 Lake Road, Longmeadow  
Business Estate (North)  
1609 Modderfontein, Gauteng,  
South Africa  
Tel. +27 10 202 5727  
Mobile +27 60 524 2875  
E-Mail carel.oberholzer@za.abb.com

**Spain / Portugal**

Iberica Semiconductores  
de Potencia S.L.  
Alejandro Gamella, 4 , Oficina 207  
28400 – Collado Villalba (Madrid), Spain  
Tel. +34 918 499 620  
Fax +34 911 881 311  
E-Mail info@ibersp.com  
Web www.ibersp.com

**Sweden**

ABB AB  
Control Technologies Service Center  
72159 Västerås, Sweden  
Tel. +46 21 32 50 00  
E-Mail offer.selog@se.abb.com

**Switzerland**

PowerParts AG  
Schareggstrasse 1,  
5506 Mägenwil, Switzerland  
Tel. +41 62 896 7080  
Fax +41 62 896 7088  
E-Mail abb@powerparts.ch  
Web www.powerparts.ch

**Taiwan**

Industrade Co., Ltd  
10 F, No. 29-1, Section 2,  
Zhong Zheng East Road  
Tamsui District, 25170 New Taipei City,  
Taiwan, R.O.C.  
Tel. +886 2 2809 1251  
Fax +886 2 2808 4990  
E-Mail info@industrade.com.tw  
Web www.industrade.com.tw

**Turkey**

Protek Teknik Elektrik Ltd.Sti.  
Aeropark Plaza Yenişehir Mah.Osmanlı  
Bulvarı No:11A  
34912 Kurtköy/ Pendik-İstanbul/Turkey  
Tel. +90 216 685 10 10  
Fax +90 212 235 46 09  
E-Mail protek@protek-teknik.com.tr  
Web www.protek-teknik.com.tr

**UK**

PPM Power  
65 Shrivenham Hundred Business Park  
Watchfield, Swindon, SN6 8TY, Wiltshire,  
UK  
Tel. +44 1793 784 389  
Fax +44 1793 784 391  
E-Mail sales@ppm.co.uk  
Web www.pppm.co.uk

**USA**

5S Components Inc.  
630 Fifth Avenue, East McKeesport,  
PA 15035, USA  
Tel. +1 412 967 5858  
Fax +1 412 967 5868  
E-Mail info@5SComponents.com  
Web www.5SComponents.com

5S Components Inc. (West Coast Office)  
818 Escalona Drive, Santa Cruz,  
CA 95060, USA  
Tel. +1 412 736 5920  
Fax +1 412 967 5868  
E-Mail info@5SComponents.com  
Web www.5SComponents.com

C&H Technology Inc.  
6121 Baker Road, Suite 108,  
Minnetonka, MN 55345  
Tel. +1 952 933-6190 /  
+1 800 274-4284  
E-Mail sales@chtechnology.com  
Web www.chtechnology.com

Richardson RFPD (Headquarters)  
1950 S. Batavia Avenue  
Suite 100, Geneva, IL 60134, USA  
Tel. +1 630 262 6800  
E-Mail rfpsales@richardsonrfpd.com  
Web https://www.richardsonrfpd.com/  
Supplier/Index/ABB

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**ABB Power Grids Switzerland Ltd.****Semiconductors**

A Hitachi ABB Joint Venture

Fabrikstrasse 3

CH-5600 Lenzburg

Switzerland

Tel: +41 58 586 14 19

Fax: +41 58 586 13 06

E-Mail: [abbsem@hitachi-powergrids.com](mailto:abbsem@hitachi-powergrids.com)

**[www.hitachiabb-powergrids.com/semiconductors](http://www.hitachiabb-powergrids.com/semiconductors)**

**ABB Power Grids Czech Republic s.r.o.****Semiconductors**

A Hitachi ABB Joint Venture

Novodvorska 1768/138a

142 21 Praha 4

Czech Republic

Tel: +420 261 306 250

Fax: +420 261 306 308

E-Mail: [semiconductors.cz@hitachi-powergrids.com](mailto:semiconductors.cz@hitachi-powergrids.com)

**[www.hitachiabb-powergrids.com/semiconductors](http://www.hitachiabb-powergrids.com/semiconductors)**