

A HV switches with current depending on-time, Thyristor / SCR

- Robust and inexpensive HV switch for discharge applications and for the generation of damped sinusoidal oscillations in connection with fast high voltage FDA free-wheeling diodes
- High peak current capability
- Extremely high di/dt without compromises in reliability and life expectancy due to a large number of single SCR's with individual gate drive
- Very overload tolerant
- Easy firing by a simple TTL trigger pulse (2-5 V)
- Very compact and light weight
- Many cooling options

Note: The model number contains coded information about voltage, current and turn-on behavior. The first digits stand for the voltage in kV, the last digit before the dash indicates the turn-on behavior (0 = fixed on-time, 1 = variable on-time). The digits after the dash indicate the current in Amperes x10. Special features are coded by the letters after a second dash. Example HTS 60-100-SCR: HTS = HV Thyristor Switch, 6 = 6 kV, 0 = current depending fixed on-time, 100 = 1000 Ampere, SCR = Silicone Controlled Rectifier (thyristor). The switch models are sorted by the dimension of housing and by maximum operating voltage within the dimension category.

Model [sorted by housing dimensions]	Description / Comment ● Preferred stock type ○ Lead time > 6 weeks X Not for new development	Dimensions [mm ³]	Voltage [kV]	Pk. Current [A]	Pk. Power [MW]	On-Time [μs]
HTS 60-100-SCR	● Tubular housing with HV pigtails. Cooling options not available.	135 x 20 x 20	6.4	1000	6.4	35...∞
HTS 60-200-SCR	● LED indicators. Very compact design - CF options partly not applicable!	80 x 38 x 25	6.4	2000	12.8	35...∞
HTS 120-100-SCR	● LED indicators. Very compact design - CF options partly not applicable!	80 x 38 x 25	12.8	1000	12.8	35...∞
HTS 40-1000-SCR	● Sync. I/O for parallel connection.	89 x 64 x 31	4	10000	40	35...∞
HTS 80-200-SCR	● Sync. I/O for parallel connection.	89 x 64 x 31	8	2000	16	35...∞
HTS 80-500-SCR	● Sync. I/O for parallel connection.	89 x 64 x 31	8	5000	40	35...∞
HTS 160-200-SCR	● Sync. I/O for parallel connection. HV connection by pigtails only.	89 x 64 x 31	16	2000	32	35...∞
HTS 150-200-SCR	● LED indicators. Very compact design - CF options partly not applicable!	103 x 70 x 35	15	2000	30	35...∞
HTS 300-100-SCR	● LED indicators. Very compact design - CF options partly not applicable!	103 x 70 x 35	30	1000	30	35...∞
HTS 60-1000-SCR	● Sync. I/O for parallel connection.	122 x 64 x 31	6	10000	60	35...∞
HTS 120-200-SCR	● Sync. I/O for parallel connection.	122 x 64 x 31	12	2000	24	35...∞
HTS 120-500-SCR	● Sync. I/O for parallel connection.	122 x 64 x 31	12	5000	60	35...∞
HTS 240-200-SCR	● Sync. I/O for parallel connection. HV connection by pigtails only.	122 x 64 x 31	24	2000	48	35...∞
HTS 80-1000-SCR	● Sync. I/O for parallel connection.	153 x 64 x 31	8	10000	80	35...∞
HTS 160-500-SCR	● Sync. I/O for parallel connection.	153 x 64 x 31	16	5000	80	35...∞
HTS 160-200-SCR	● Sync. I/O for parallel connection.	153 x 64 x 31	16	2000	32	35...∞
HTS 320-200-SCR	● Sync. I/O for parallel connection. HV connection by pigtails only.	153 x 64 x 31	32	2000	64	35...∞
HTS 100-1600-SCR	● LED indicators & Sync. I/O for parallel connection	179 x 103 x 35	10	16000	160	35...∞
HTS 200-800-SCR	● LED indicators & Sync. I/O for parallel connection	179 x 103 x 35	20	8000	160	35...∞
HTS 220-800-SCR	● LED indicators & Sync. I/O for parallel connection	179 x 103 x 35	22	8000	176	35...∞
HTS 120-1600-SCR	● LED indicators & Sync. I/O for parallel connection	204 x 103 x 35	12	16000	192	35...∞
HTS 240-800-SCR	● LED indicators & Sync. I/O for parallel connection	204 x 103 x 35	24	8000	192	35...∞
HTS 160-1600-SCR	● LED indicators & Sync. I/O for parallel connection	253 x 103 x 35	16	16000	256	35...∞
HTS 320-800-SCR	● LED indicators & Sync. I/O for parallel connection	253 x 103 x 35	32	8000	256	35...∞
HTS 320-200-SCR	● LED indicators. Very compact design - CF options partly not applicable!	206 x 70 x 35	32	2000	64	35...∞
HTS 640-100-SCR	● LED indicators. Very compact design - CF options partly not applicable!	206 x 70 x 35	64	1000	64	35...∞
HTS 400-200-SCR	● LED indicators. Very compact design - CF options partly not applicable!	250 x 70 x 35	40	2000	80	35...∞
HTS 800-100-SCR	● LED indicators. Very compact design - CF options partly not applicable!	250 x 70 x 35	80	1000	80	35...∞
HTS 220-1000-SCR	● LED indicators & Sync. I/O for parallel connection	252 x 150 x 40	22	10000	220	35...∞
HTS 240-1000-SCR	● LED indicators & Sync. I/O for parallel connection	252 x 150 x 40	24	10000	240	35...∞
HTS 240-1200-SCR	● LED's, Sync. I/O, housing style as before, but with separate control unit	170 x 150 x 30	24	12000	288	35...∞
HTS 440-1200-SCR	● Sync. I/O for parallel connection, separate control unit	312 x 200 x 45	44	12000	528	35...∞
HTS 600-200-SCR	○ With LED indicators. HV connection by pigtails only.	372 x 120 x 50	60	2000	120	35...∞
HTS 1200-100-SCR	○ With LED indicators. HV connection by pigtails only.	372 x 120 x 50	120	1000	120	35...∞
HTS 350-800-SCR	● LED indicators, with integrated free-wheeling diode, flange housing	372 x 200 x 45	35	8000	280	35...∞
HTS 500-1200-SCR	○ Sync. I/O for parallel connection, separate control unit	372 x 200 x 50	50	12000	600	35...∞
HTS 1500-1000-SCR	○ Sync. I/O for parallel connection, separate control unit	on request	150	10000	1500	35...∞

Note: Any other customized voltage between 1 and 150 kV (AC/DC) and any other customized peak current between 1 and 100 kA is possible at moderate lead times (normally 4-8 weeks). We do not charge extra costs for customized switches, if they can be realized on an existing platform. Please consult Behlke. We recommend direct liquid cooling (option DLC) or ceramic cooling fins (option CF-CER) or water cooling (option ILC) for the cooling at operating voltages above approx. 40 kV. Due to the strong electromagnetic fields, which can be caused by the high di / dt capability of the switches, a separate control unit (option SEP-C) is recommended in all cases of unfavorable load circle wiring with large induction loop areas. This applies especially for very large switching modules and if the di/dt is > 5 kA / μs. For applications with small and medium switching modules we recommend printed circuit boards (eventually in multilayer technique) to minimize the stray inductance and to keep the areas of induction loops small. A design with printed circuit boards ensures also a reproducible EMC behavior of the whole electronic system. Please ensure in any case, that the load circle is in proper distance to the control circle to avoid magnetic feed-back effects, otherwise the internal safety electronics will detect a fault condition and the switch will be locked for 2 sec. after every shot. Most switches indicate this by a red LED.

Options (1)

HFB	High Frequency Burst: Improved burst capability of driver by means of external buffer capacitors. Recommended if more than 10 pulses with less than 10 μs spacing are generated.
HFS	High Frequency Switching: External supply of auxiliary driver voltage (50-350 VDC according to type). Necessary if the specified "Maximum Operating Frequency" shall be exceeded.(2)
LP	Low Pass: Low pass filter at the control input. Propagation delay time will be increased by ~50 ns. Jitter + 500 ps. Improved noise immunity and less critical wiring in high speed applications. (3)
ST	Stage Tapping: Connectors at the individual stages of stack in order to utilize single power semiconductors. To achieve fast rise times also at very low operating voltages (<0.01xV _o).
ISO-25	25 kV Isolation: Isolation Voltage increased to 25 kVDC. Housing dimensions may change for some models.
ISO-40	40 kV Isolation: Isolation Voltage increased to 40 kVDC. Housing dimensions may change for some models. Only in connection with option PT-HV.

ISO-80	80 kV Isolation: Isolation Voltage increased to 80 kVDC. Housing dimensions may change for some models. Only in connection with option PT-HV.
ISO-120	120 kV Isolation: Isolation Voltage increased to 120 kVDC. Housing dimensions may change for some models. Only in connection with option PT-HV.
I-PC	Integrated Part Components: Integration of small part components according to customer's specifications (e.g. buffer capacitors, snubbers, damping resistors, diodes, opto couplers).(2)
I-FWD	Integrated Free-Wheeling Diode: Built-in parallel diode with short recovery time. In connection with inductive load only.
LS-C	LEMO socket for Control Connection. Input Z=100Ω. An assembled linkage cable (1m/3ft) with two plugs and one socket is included in supply. Improved noise immunity. (3)
PT-C	Pigtail for Control Connection: Flexible leads (l=75 mm) with AMP-Modu plug. Only for switches with pins, which must be replaced by pigtails in case of any cooling option except option ITC.
PIN-C	Pins for Control Connection: Gold plated pins for printed circuit board designs (special sockets available). This option is only relevant for switching modules which have pigtails as standard.
PT-HV	Pigtails for HV Connection: Flexible leads with cable lugs. For increased creepage. PT-HV is standard for all types with >25 kV switching voltage. Not recommended in extremely fast circuits.
ST-HV	Screw Terminals for HV Connection: Threaded inserts at the bottom of module (if not standard). For PCB design. Operation above 25 kV requires liquid insulation (Galden®/Oil) or potting.
UL94	Flame Retardant Casting Resin: Casting resin according to UL-94-VO. Minimum order quantity required. (2)
TH	Tubular Housing: Tubular instead of rectangular housing. Adaption to specific ambient conditions or in case of difficult assembly situations. (2)
FC	Flat Case: Height of standard plastic housings reduced to 19 / 25 mm. Not in combination with cooling options CF, GCF and DLC.
ITC	Increased Thermal Conductivity: Special moulding process to increase the thermal conductivity of the module. Pd(max) will be increased by approx. 20-30%. (2)
CF	Non-Isolated Cooling Fins: Standard sizes in categories I to VII according to model. Nickel plated copper 0.5 mm, fin height 35 mm. For air and liquid cooling (e.g. Galden® or oil).
CF-1	Non-Isolated Cooling Fins d=1mm: Nickel plated copper 1.0 mm instead of 0.5 mm. The Max. Power Dissipation will be increased by ~80 %. For air and liquid cooling (e.g. Galden® or oil).
CF-X2	Non-Isolated Cooling Fins enlarged by x2: Fin area enlarged by factor 2. Not relevant in connection with liquid cooling.
CF-X3	Non-Isolated Cooling Fins enlarged by x3: Fin area enlarged by factor 3. Not relevant in connection with liquid cooling and forced air convection.
CF-CS	Non-Isolated Cooling Fins with customized shape: Individual shape to meet specific OEM requirements. (2)
CF-LC	Non-isolated Cooling Fins optimized for liquid cooling: Double fins, nickel plated copper, height 20 mm. For the immersion in oil tanks etc. Forced convection recommended.
CF-GRA	Non-isolated Cooling Fins made of graphite. Very light weight compared to copper at similar heat transfer, but reduced heat capacity. 0.5 or 1 mm thickness, height 35 mm.
CF-CER	Isolated Cooling Fins made of ceramics. Heat transfer properties similar to alumina. Forced convection recommended, height 35 mm.
CCS	Ceramic Cooling Surface. Top side of switching module made of ceramics. Heat transfer properties similar to alumina. 20 kVDC isolation. Forced convection recommended.
C-DR	Cooling for Driver: Extra cooling for the driver and control electronics. Recommended in combination with option HFS at higher switching frequencies. (2)
GCF	Grounded Cooling Flange: Nickel-plated copper flange for High Power applications. Max. isolation voltage 40kV. Increased coupling capacitance. In combination with option SPT-C only.
GCF-X2	Grounded Cooling Flange, Max. Continuous Power Dissipation increased by x2: Thermal resistance "Switch to Flange" reduced for twice the power capability. (2)
ILC	Indirect Liquid Cooling: Liquid cooling for all kind of conductive coolants incl. water. Internal heat exchanger made of ceramics. For medium power dissipation.
DLC	Direct Liquid Cooling: Internal cooling channels around the power semiconductors. The most efficient cooling for high frequency applications. Non-conductive coolants only.
HI-REL	High Reliability / MIL Versions: Available on request. (2)

(1) New option code: Data sheets may differ from this coding system (especially older ones) and do not indicate all possible options as per above table. (2) Please consult factory for detailed information.
(3) These options are EMC-relevant and are recommended for industrial power applications, difficult noise ambient, prototype experiments with flying leads and for users without special EMC design experience.

Further information, data sheets and drawings are available on request. All data and specifications subject to change without notice. BEHLKE POWER ELECTRONICS 03-11-2011

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