C1 HV switches with variable on-time, general purpose, MOSFET

● Versatile HV switch with true relay character ● On-time controllable by TTL signal ● Negligible dynamic switching losses due to fast transistion time ● Robust regarding overload and voltage reversal ● Excellent dv/dt immunity against HV transients

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 31-06-C: HTS = HV Transistor Switch, 3 = 3 kV, 1 = variable on-time, 06 = 60 Ampere, C = Compact.

Model [sorted by dimensions]	**Description / Comment** ● Preferred stock type ○ Limited stock X Not for new development		**Drawing** (PDF)	**Dimensions** [mm³]	Voltage [kV]	**Pk. Current** [A]	**On-Resist.** [Ω]	**On-Time** [ns]
HTS 11-14-C	●	COMPACT SERIES	PDF	79 x 38 x 17	1.2	140	1.2	50…∞
HTS 21-07-C	●	COMPACT SERIES	PDF	79 x 38 x 17	2.4	70	2.4	50…∞
HTS 31-06-C	●	COMPACT SERIES	PDF	79 x 38 x 17	3	60	5	50…∞
HTS 31-05-C	●	COMPACT SERIES. Very Low Natural Capacitance CN	PDF	79 x 38 x 17	3.6	50	7	50…∞
HTS 41-05-C	●	COMPACT SERIES	PDF	79 x 38 x 17	4.8	50	6	50…∞
HTS 61-03-C	●	COMPACT SERIES	PDF	79 x 38 x 17	6	30	10	50…∞
HTS 71-02-LC-C	●	COMPACT SERIES. Very Low Natural Capacitance CN	PDF	79 x 38 x 17	7.2	25	14	50…∞
HTS 91-02-C	●	COMPACT SERIES	PDF	79 x 38 x 17	9.6	25	12	50…∞
HTS 121-01-C	●	COMPACT SERIES	PDF	79 x 38 x 17	12	15	48	50…∞
HTS 181-01-C	●	COMPACT SERIES	PDF	79 x 38 x 17	18	12	60	50…∞
HTS 61-06-C	●	COMPACT SERIES	request	125 x 38 x 17	6	64	5	80…∞
HTS 101-02-LC-C	●	COMPACT SERIES. Very Low Natural Capacitance CN	request	125 x 38 x 17	10.8	25	21	80…∞
HTS 91-05-C	●	COMPACT SERIES	PDF	125 x 38 x 17	9.6	50	6	80…∞
HTS 121-03-C	●	COMPACT SERIES	request	125 x 38 x 17	12	32	20	80…∞
HTS 191-02-C	●	COMPACT SERIES. With HV pigtails (option PT-HV)	request	125 x 38 x 17	19.2	25	48	80…∞
HTS 241-01-C	●	COMPACT SERIES. With HV pigtails (option PT-HV)	request	140 x 38 x 20	24	15	96	80…∞
HTS 361-01-C	●	COMPACT SERIES. With HV pigtails (option PT-HV)	request	140 x 38 x 20	36	12	120	80…∞
HTS 051-64	●	All cooling options possible.	request	89 x 64 x 27	0.5	640	0.043	100…∞
HTS 11-30	●	All cooling options possible.	request	89 x 64 x 27	1	320	0.17	100…∞
HTS 21-14	●	All cooling options possible.	request	89 x 64 x 27	2	140	1	100…∞
HTS 31-06	●	All cooling options possible.	request	89 x 64 x 27	3	60	3	100…∞
HTS 41-03	●	All cooling options possible.	request	89 x 64 x 22.5	4	30	8	100…∞
HTS 51-06	●	All cooling options possible.	request	89 x 64 x 27	5	60	5	100…∞
HTS 61-03	●	All cooling options possible.	request	89 x 64 x 22.5	6	30	12	100…∞
HTS 61-02	●	All cooling options possible. Very Low Natural Capacitance CN	request	89 x 64 x 22.5	6	25	12	50…∞
HTS 61-05	●	All cooling options possible. Very Low Natural Capacitance CN	request	89 x 64 x 22.5	6	50	6	100…∞
HTS 101-01	●	All cooling options possible.	request	89 x 64 x 22.5	10	15	36	50…∞
HTS 101-03	●	All cooling options possible.	request	89 x 64 x 22.5	10	30	18	100…∞
HTS 151-01	●	All cooling options possible.	request	89 x 64 x 22.5	15	12	50	50…∞
HTS 151-02	●	All cooling options possible.	PDF	89 x 64 x 22.5	15	24	25	100…∞
HTS 71-06	●	All cooling options possible.	request	135 x 64 x 27	7	60	6	120… ∞
HTS 71-12	●	All cooling options possible.	request	135 x 64 x 27	7	120	3	150… ∞
HTS 141-03	●	All cooling options possible.	request	135 x 64 x 27	14	30	28	150… ∞
HTS 141-06	●	All cooling options possible.	request	135 x 64 x 27	14	60	14	150… ∞
HTS 21-50	●	All cooling options possible.	request	178 x 64 x 27	2	500	0.3	200… ∞
HTS 51-20	●	All cooling options possible.	request	178 x 64 x 27	5	200	1.2	200… ∞
HTS 81-09	●	All cooling options possible.	request	178 x 64 x 27	8	90	5	200… ∞
HTS 91-06	●	All cooling options possible.	request	172 x 70 x 28	9	60	8	150… ∞
HTS 91-12	●	All cooling options possible.	request	172 x 70 x 28	9	120	4	150… ∞
HTS 161-03	●	All cooling options possible.	request	172 x 70 x 28	16	30	34	150… ∞
HTS 161-06	●	All cooling options possible.	request	172 x 70 x 28	16	60	17	150… ∞
HTS 181-06	●	All cooling options possible.	request	172 x 70 x 28	18	60	17	150… ∞
HTS 111-12	●	All cooling options possible.	request	200 x 70 x 28	11	120	4.7	150… ∞
HTS 221-03	●	All cooling options possible.	request	200 x 70 x 28	22	30	44	150… ∞
HTS 221-06	●	All cooling options possible.	request	200 x 70 x 28	22	60	22	150… ∞
HTS 241-06	●	All cooling options possible.	request	200 x 70 x 28	24	60	22	150… ∞
HTS 181-12	●	All cooling options possible.	request	263 x 70 x 35	18	120	8	150… ∞
HTS 331-03	●	All cooling options possible.	PDF	263 x 70 x 35	33	30	55	150… ∞
HTS 331-06	●	All cooling options possible.	PDF	263 x 70 x 35	33	60	27	150… ∞
HTS 361-06	●	All cooling options possible.	request	263 x 70 x 35	36	60	27	150… ∞
Old models		Switches are available, but not recommended for new development:	request					
HTS 31 (old ref.)	X	Use HTS 41-03 for new design	request	89 x 64 x 27	3	30	8	100…∞
HTS 51 (old ref.)	X	Use HTS 61-03 for new design	request	89 x 64 x 27	5	30	12	100…∞
HTS 81 (old ref.)	X	Use HTS 101-03 for new design	request	89 x 64 x 27	8	30	20	100…∞
HTS 121 (old ref.)	X	Use HTS 141-03 for new design	request	135 x 64 x 27	12	30	30	120… ∞
HTS 151 (old ref.)	X	Use HTS 161-03 for new design	request	178 x 64 x 31	15	30	35	150… ∞
HTS 201 (old ref.)	X	Use HTS 221-03 for new design	request	205 x 64 x 31	20	30	47	150… ∞
HTS 301 (old ref.)	X	Use HTS 331-03 for new design	request	267 x 64 x 31	30	30	74	150… ∞

HTS 651-03	X	Use HTS 701-10-LC2 (product group C3) for new development	request	290x150 x 40	65	30	110	150… ∞

Options (1)

B-CON	**Beginners Configuration:** The standard switch is equipped with various options to simplify first time experiments for users, which are unexperienced with high voltage and high frequency circuit design. The beginners configuration includes option FH and PT-HV for easy wiring and attachment without printed circuit boards, as well as option LS-C, LP and S-TT for an uncritical EMC behavior. Unexperienced users should also consider the combination with option I-PC or PC to avoid possible difficulties from the high voltage wiring and / or high frequency noise behavior. (2)
MBC	**Mechanical Backward Compatibility** to the previous switch models. All connectors, dimensions and attachment identical to the "historical" switch models such as HTS 81,51,31 ff.
HFB	**High Frequency Burst:** Improved burst capability of driver by means of external buffer capacitors. Recommended if > 10 pulses with < 10 µs spacing are generated.
HFS	**High Frequency Switching:** Ext. supply of auxiliary driver voltage (50-350 VDC according to type). Necessary if the specified "Max. 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. (3)
UFTR	**Ultra Fast Thermotrigger:** Advanced temperature protection for the high-voltage switch. Switch shut down within 5 seconds if Pd(max) is exceeded by 300% @ ΔT=25K (50to75°C)
UFTS	**Ultra Fast Thermosensor:**Temperature measurement directly on the power semiconductors by means of a special sensor with high electrical isolation and low thermal impedance.
S-ON	**Soft Turn-On:** "Turn-On Rise Time" increased by ~20%. Simplified EMC design and less critical wiring if the shortest possible edge steepness is not required. (3)
S-OFF	**Soft Turn-Off**: "Turn-Off Rise Time" increased by ~20%. Simplified EMC design and less critical wiring if the shortest possible edge steepness is not required. (3)
S-TT	**Soft Transition Time:** "Turn-On Rise Time" & "Turn-Off Rise Time" increased by ~20%. Simplified EMC design and less critical wiring if the shortest possible edge steepness is not required. (3)
TT-C	**Customized Transition Time:** Customized rise & fall times to meet individual design requirements. (2)
MIN-ON	**Minimum On-Time:** Individually increased Minimum On-Time to ensure a minimum on duration indepently of control signal. For safety relevant circuits.
MIN-OFF	**Minimum Off-Time:** Individually increased Minimum Off-Time to ensure a minimum off duration indepently of control signal. For safety relevant circuits.
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.
LNC	**Low Natural Capacitance:** C_N reduced by approx. 30%. To minimize cap. power losses in applications with high switching frequency and high switching voltage ($Pc= V^2 \times C \times f$).
LL	**Low Leakage Current:** Off-state current reduced to less than 10% of the specified value. Not available in connection with the cooling fin options and for switches of the UF series.
LN	**Low Noise:** Internal power driver modified for zero noise emission for a specific period of time. Relevant in conjunction with sensitive detector amplifiers (e.g. SEV/MCP) only. (2)
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. capacitors, snubbers, damping resistors, diodes, opto couplers). (2)
PC	**Pulser Configuration.** Switch combined with custom specific part components. Integrated in a flange housing with hv connectors according to the customers specifications. (2)
I-FWD	**Integrated Free-Wheeling Diode:** Built-in parallel diode with short recovery time. In connection with inductive load only.
I-FWDN	**Integrated Free-Wheeling Diode Network:** Built-in parallel diode plus serial blocking diode with short recovery time. In connection with inductive load only.
I-TS	**Integrated Thermo Sensor:** Integrated temperature sensor for external temperature measurements according to customers specifications (NTC, KTY, PT-100 etc).
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. For improved noise immunity. (3)
PT-C	**Pigtail for Control Connection:** Flexible leads (l=75 mm) with AMP-modu plug. Refers to switching modules with pins only. Suggested for modules with options CF & GCF.
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 for extremely fast circuits.
ST-HV	**Screw Terminals for HV Connection:** Threaded inserts at the bottom of module for PCB attachment. Operation above 25 kV requires liquid insulation (Galden®/Oil) or potting.
SEP-C	**Separated Control Unit.** Control unit with LED indicators in a separate housing (dim. 79x38x17 mm). Linkage cable (<1m) with plug. Control unit with soldering pins or pigtails.
FOI-I	**Fibre Optics Input / Inhibit:** Additional optical inhibit input to turn-off the switch by using the inhibit input with a fibre-optical signal (only in combination with option SEP-C) (2)
FOI-C	**Fibre Optics Input / Control:** Additional optical control input to trigger the switch with a fibre-optical signal (only in combination with option SEP-C) (2)
FOO-F	**Fibre Optical Output / Fault:** Additional optical output to read-out the failure condition with a fibre-optical signal (only in combination with option SEP-C) (2)
UL94	**Flame Retardant Casting Resin:** Casting resin according to UL-94-VO. Minimum order quantity required. (2)
FH	**Flange Housing:** Plastic flange housing for isolated attachment on conductive surfaces. Ideal if the switch is not intended for printed circuit boards. Option PT-HV is suggested.
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 mm or less. 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. $P_{d(max)}$ will be increased by approx. 20-30%. (2)
CF	**Copper Cooling Fins d = 0.5 mm:** Fin height 35 mm. Nickel plated. For air cooling with forced or natural convection as well as for liquid cooling with non-conductive coolants.
CF-1	**Copper Cooling Fins d = 1 mm:** Fin thickness 1.0 mm instead of 0.5 mm. The Max. Power Dissipation Pd(max) will be increased by ~80 %. For air or liquid cooling (e.g. Galden® or oil).
CF-X2	**Copper Cooling Fins "XL":** Fin area enlarged by factor 2. Recommended for natural air convection. No significant cooling power improvement in connection with forced air or liquid cooling.
CF-X3	**Copper Cooling Fins "XXL":** Fin area enlarged by factor 3. Recommended for natural air convection. No significant cooling power improvement in connection with forced air or liquid cooling.
CF-CS	**Copper Cooling Fins with customized shape:** Individual shape to meet specific OEM requirements. (2) Can be combined with options CF-1, CF-D and CF-S for increased cooling power.
CF-LC	**Copper Cooling Fins for liquid cooling:** Double fins, nickel plated copper, height 20 mm. For the immersion in oil tanks etc. Forced convection recommended. Combinable with opt. CF-S.
CF-D	**Double Copper Cooling Fins:** Approx. 100% more cooling power, approx. 2mm spacing between fins, forced convection recommended. Combinable with opt. CF-S, CF-X2, CF-X3 and CF-CS.
CF-S	**Copper Cooling Fins:** Semiconductors soldered on fins. Approx. 30% to 100% more cooling power (type depending). Combinable with options CF-D, CF-X2, CF-X3 and CF-CS.
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 due to 2 mm spacing between fins. Height 35 mm.
CCS	**Ceramic Cooling Surface:** Top side of switching module made of ceramics. Heat transfer properties similar to alumina. Max. 20 kVDC isolation. Forced convection recommended.
CCF	**Ceramic Cooling Flange:** Bottom side of switching module made of a plano grinded ceramic plate. Integrated metal frame for uniform and safe contact pressure. Max. 40 kVDC isolation.
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 medium power. Max. isolation voltage 40kV. Increased coupling capacitance C_C.
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 arround 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 ambients, 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. **REV 19-APRIL-2016**