	Specification	Symbol	Condition / Comment		401-20-GSM	701-20-GSM	901-20-GSM	Unit
ABSOLUTE MAXIMUM RATINGS	Maximum Operating Voltage	$V_{O(max)}$	I_{off} < 40 µADC, T_{case} = 70°C		± 40	± 70	± 90	kVDC
	Maximum Isolation Voltage	V_I	Between HV switch and control / GND, continuously		± 50	± 80	± 110	kVDC
	Max. Housing Insulation Voltage	V_{INS}	Between switch and housing surface, 3 minutes		± 70	± 100	± 130	kVDC
	Maximum Turn-On Peak Current	$I_{P(max)}$	T_{case} = 25°C	t_p< 200 µs, duty cycle <1%		200		
				t_p< 1 ms, duty cycle <1%		118		
				t_p< 10 ms, duty cycle <1%		72		
				t_p< 100 ms, duty cycle <1%		54		ADC
	Maximum Continuous Load Current	$I_{L(max)}$	T_{case} = 25°C	Standard devices		2.52		
				Devices with option DLC		33		ADC
	Max. Continuous Power Dissipation	$P_{d(max)}$	T_{case} = 25°C	Standard devices & FC, forced air 4 m/s	48	80	118	
				Devices with option DLC	3900	4100	4500	Watt
	Linear Derating		Above 25°C	Standard devices & FC, forced air 4 m/s	1.14	2.04	2.4	
				Devices with option DLC	142	356	456	W/K
	Operating Temperature Range	T_O	Standard devices & options CF, GCF, ILC. (Option DLC)			-40...70 (60)		°C
	Storage Temperature Range	T_S	Switches with option ILC may require frost protection!			-40...90		°C
	Max. Permissible Magnetic Field	B	Homogeneous steady-field, surrounding the whole switch			25		mT
	Max. Auxilliary Voltage	V_{aux}	Built-in overvoltage limiter (replaceable)			5.5		VDC
ELECTRICAL CHARACTERISTICS	Permissible Operating Voltage Range	V_O	Unipolar operation (one switch pole grounded or floated)		0... ± 40	0... ± 70	0... ± 90	kVDC
			Bipolar operation (positive & negative voltage applied)		0... ± 20	0... ± 30	0... ± 45	
	Typical Breakdown Voltage	V_{br}	**NOTE:** V_{br} is a test parameter for quality control purposes only. Not applicable in normal operation!	I_{off} > 0.5 mA	44	76	98	kVDC
	Typical Off-State Current	I_{off}	0.8xV_O, T_{case} =25...70°C, reduced I_{off} on request			< 40		µADC
	Typical Turn-On Resistance	R_{stat}	Each switching path	0.1 x $I_{P(max)}$, T_{case} =25°C	9	15	16	
			t_p < 1µs, duty cycle < 1%	1.0 x $I_{P(max)}$, T_{case} =25°C	17	35.9	32	
				1.0 x $I_{P(max)}$, T_{case} =70°C	31	72	79	Ohm
	Typical Propagation Delay Time	$t_{d(on)}$	Resistive load, 0.1 x $I_{P(max)}$, 0.8 x $V_{O(max)}$, 50-50%			250		ns
	Typical Output Pulse Jitter	t_j	Impedance matched input, V_{aux} / V_{ctrl} = 5.00 VDC			3		ns
	Typical Ouput Transition Time (Rise Time & Fall Time)	t_r, t_f	Resistive load, 10-90%	0.1 x $V_{O(max)}$, I_L = 0.1 x $I_{p(max)}$	12	14	15	
				0.8 x $V_{O(max)}$, I_L = 0.1 x $I_{p(max)}$	32	45	56	
				0.8 x $V_{O(max)}$, I_L = 1.0 x $I_{p(max)}$	36	50	62	ns
	Maximum Turn-On Time	$t_{on(max)}$	No limitation			∞		ns
	Minimum Turn-On Time	$t_{on(min)}$	can be customized. Please consult factory			250		ns
	Max. Continuous Switching Frequency	$f_{(max)}$	@ V_{aux}= 5.00 V	Standard devices without HFS option	1	TBD	TBD	
			Sw. shutdown if	Standard devices with HFS supply	80	80	80	
			$f_{(max)}$ is exceeded	Opt. HFS + sufficient cooling option	120	120	120	kHz
	Maximum Burst Frequency	$f_{b(max)}$	Use option HFB for >10 pulses within 20µs or less			500		kHz
	Maximum Number of Pulses / Burst	$N_{(max)}$	@ $f_{b(max)}$	Standard		>10		Pulses
			Note: Option HFB requires external buffer capacitors with a voltage rating of > 630VDC and a cpacitance of 100nF per additional pulse.	Option I-HFB		>100		
				Option HFB		>1000		
	Coupling Capacitance	C_C	HV side against control side			<100		pF
	Natural Capacitance	C_N	Between switch poles, @ 0.5 x $V_{O(max)}$			< 50		pF
	Control Voltage Range	V_{ctrl}	The V_{ctrl} has no impact on the output pulse shape.			3 ... 10		VDC
	Auxiliary Supply Voltage Range	V_{aux}	The +5 V supply is not required in the HFS mode.			4.5 ... 5.5		VDC
	Typical Auxiliary Supply Current	I_{aux}	V_{aux} = 5.00 VDC, T_{case} = 25°C.	0.01 x $f_{(max)}$	418	TBD	TBD	
			Active current limitation above 1A.	@ $f_{(max)}$	800	800	800	mADC
	Fault Signal Output		Switch will be turn off, if f > $f_{(max)}$, V_{aux} < 4.75V or T_{case} > 75°C			>4.0		
			Fault condition is indicated by a logical "L"			<0.8		VDC
	Opt. HFS, Ext. Supply Voltage V1	$V_{HFS(V1)}$	Stability ±3%, current consumption <0.4 mA/kHz @ 25°C			15		VDC
	Opt. HFS, Ext. Supply Voltage V2	$V_{HFS(V2)}$	Stability ±3%, current consumption <0.5 mA/kHz @ 25°C		260	TBD	TBD	VDC
	Intrinsic Diode Forward Voltage	V_F	T_{case} = 25°C, I_F = 0.3 x $I_{P(max)}$		36	57	74	VDC
	Diode Reverse Recovery Time	t_{rrc}	T_{case} = 25°C, I_F = 0.3 x $I_{P(max)}$, di/dt = 100 A/µs			<250ns		ns
HOUSING	Dimensions	LxWxH	Standard housing			Please contact the manufactured!		mm³
			Devices with option DLC					
	Weight		Standard housing			Please contact the manufactured!		Kg
			Devices with option DLC					

FUNCTIONS	
Control Signal Input	**Pin 1** / Yellow (LS-C: Pin 1). TTL compatible (LS-C: With 100Ω termination). Schmitt-Trigger characteristics. Control voltage 2-10 V (3-5 V for low jitter).
Logic GND / 5V Return	**Pin 2** / Black (LS-C: Shielding). The ground pin is internally connected with the safety earthings terminals (threaded inserts) on bottom side.
5V Auxiliary Supply	**Pin 3** / Red (LS-C: Pin 4). The 5 V input is used for rep rates up to the specified max. frequency $f_{(max)}$. Higher rep rates require option HFS.
Fault Signal Output	**Pin 4** / Orange (LS-C: Pin 3). TTL output, short circuit proof. Indicating switch & driver over-heat, over-frequency, low auxiliary voltage. L = Fault.
Inhibit Signal Input	**Pin 5** / Green (LS-C: Pin 2). TTL compatible, Schmitt-Trigger characteristics for the connection of external safety circuits. L = Switch Inhibited.
LED Indicators	**GREEN**: "Auxiliary power good, switch OFF". **YELLOW**: "Control signal received, switch ON". **RED**: "Fault condition, switch OFF"
Temperature Protection	Switches with option DLC: 65°C, response time < 3 s @ 3xPd(max), ΔT=25K (40 to 65°C), coolant flow > 3l / min. Separate driver protection.

ORDERING

HTS 401-20-GSM	Fast HV Push-Pull Switch, 40kV, 200 A
HTS 701-20-GSM	Fast HV Push-Pull Switch, 70kV, 200 A
HTS 901-20-GSM	Fast HV Push-Pull Switch, 90kV, 200 A

Option LP	Low Pass. Input filter for increased noise immunity.	**Option I-PC**	Integrated part components according to customer specification.
Option HFB	High Frequency Burst (improved capability by external capacitors)	**Option UL-94**	Flame retardant casting resin, UL94-V0
Option HFS	High Frequency Switching (two auxiliary supply inputs V1 & V2)	**Option I-FWD**	Integrated Free-Wheeling Diode. In connection with inductive load only.
Option I-HFS	Integrated High Frequency Burst	**Option I-FWDN**	Integrated Freewheeling Diode Network. In connection with inductive load.
Option S-TT	Soft Transition Time decrease the rise and fall time by 20%	**Option PT-C**	Pigtail for control connection: Flexible leads (l=75mm) with lemo
Option Min-On	Individually increased "Min. On-Time" to avoid unwanted triggering	**Option SEP-C**	Separated control unit. Control unit with LED indicators in a separate
Option Min-Off	Individually increased "Min. Off-Time" to avoid unwanted triggering	**Option TH**	Tubular Housing
Option PCC	Pulser Configuration. Switch combined with custom specific parts.	**Option CF**	Copper Cooling Fins. $P_{d(max)}$ can be increased by the factor 3 to 10.
Option ISO-40	40kV Isolation. Isolation Voltage increased to 40kV.	**Option GCF**	Grounded Cooling Flange. $P_{d(max)}$ can be increased by the factor 3 to 15.
Option ISO-80	80kV Isolation. Isolation Voltage increased to 80kV.	**Option ILC**	Indirect Liquid Cooling (for water). $P_{d(max)}$ can be increased by the factor 3 to
Option ISO-120	120kV Isolation. Isolation Voltage increased to 120kV.	**Option DLC**	Direct Liquid Cooling. $P_{d(max)}$ can be increased by the factor 10 to 100.
Option ISO-200	200kV Isolation. Isolation Voltage increased to 200kV.	**FOR FURTHER PRODUCT OPTIONS PLEASE REFER TO THE OPTIONS PAGE.**	

