	Specification	Symbol	Condition / Comment	1001-10-GSM	1201-10-GSM	1401-10-GSM	Unit
ABSOLUTE MAXIMUM RATINGS	Maximum Operating Voltage	$V_{O(max)}$	I_{off} < 50 µADC, T_{case} = 70°C	± 100	± 120	± 140	kVDC
	Maximum Isolation Voltage	V_I	Between HV switch and control / GND, continuously		± 180		kVDC
	Max. Housing Insulation Voltage	V_{INS}	Between switch and housing surface, 3 minutes		± 200		kVDC
	Maximum Turn-On Peak Current	$I_{P(max)}$	T_{case} = 25°C; t_p< 200 µs, duty cycle <1%		100		
			t_p< 1 ms, duty cycle <1%		59		
			t_p< 10 ms, duty cycle <1%		36		
			t_p< 100 ms, duty cycle <1%		27		ADC
	Maximum Continuous Load Current	$I_{L(max)}$	T_{case} = 25°C; Standard devices		1.26		
			Devices with option DLC		16.5		ADC
	Max. Continuous Power Dissipation	$P_{d(max)}$	T_{case} = 25°C; Standard devices & FC, forced air 4 m/s	60	75	92	
			Devices with option DLC	5500	6500	7500	Watt
	Linear Derating		Above 25°C; Standard devices & FC, forced air 4 m/s	1.425	1,741	1,867	
			Devices with option DLC	237,5	307,31	354,81	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... ± 100	0... ± 120	0... ± 140	kVDC
			Bipolar operation (positive & negative voltage applied)	0... ± 50	0... ± 60	0... ± 70	
	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	110	132	148	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, t_p < 1µs, duty cycle < 1%; 0.1 x $I_{P(max)}$, T_{case} =25°C	17.4	21.2	29.1	
			1.0 x $I_{P(max)}$, T_{case} =25°C	43	51.5	57.7	
			1.0 x $I_{P(max)}$, T_{case} =70°C	77.9	103.7	143.4	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 $I_{p(max)}$	16	18	20	
			0.8 x $V_{O(max)}$, I_L = 0.1 x $I_{p(max)}$	66	78	92	
			0.8 x $V_{O(max)}$, I_L = 1.0 x $I_{p(max)}$	72	81	102	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, Sw. shutdown if $f_{(max)}$ is exceeded; Standard devices without HFS option	0.9	0.7	0.5	
			Standard devices with HFS supply	30	30	30	
			Opt. HFS + sufficient cooling option	70	70	70	kHz
	Maximum Burst Frequency	$f_{b(max)}$	Use option HFB for >10 pulses within 20µs or less		400		kHz
	Maximum Number of Pulses / Burst	$N_{(max)}$	@ $f_{b(max)}$; Standard		>100		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		>1000		
			Option HFB		>10000		
	Coupling Capacitance	C_C	HV side against control side		<100		pF
	Natural Capacitance	C_N	Between switch poles, @ 0.5 x $V_{O(max)}$	13	11	9	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.	400	430	460	
			Active current limitation above 1A. 0.01 x $f_{(max)}$ @ $f_{(max)}$	1000	1000	1000	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	450	550	600	VDC
	Intrinsic Diode Forward Voltage	V_F	T_{case} = 25°C, I_F = 0.3 x $I_{P(max)}$	80	95	110	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	432x375x89	552x375x89	672x375x89	
			Devices with option DLC	432x375x131	552x375x131	672x375x131	mm^3
	Weight		Standard housing	20	27	37	
			Devices with option DLC	26	34	46	Kg

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 1001-10-GSM	Fast HV Push-Pull Switch, 100kV, 100 A
HTS 1201-10-GSM	Fast HV Push-Pull Switch, 120kV, 100 A
HTS 1401-10-GSM	Fast HV Push-Pull Switch, 140kV, 100 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
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**	

