

	Specification	Symbol	Condition / Comment	FSWP 51-02	FSWP 71-02	FSWP 91-01	Unit		
ABSOLUTE MAXIMUM RATINGS	Maximum Operating Voltage	$V_{O(max)}$	$I_{off} < 50 \mu ADC$, $T_{case} = 70^\circ C$	5400	7200	9000	VDC		
	Maximum Isolation Voltage	V_I	Between HV switch and control input / GND	Standard & option GCF, ILC Devices with option DLC		30	kVDC		
	Max. Housing Insulation Voltage	V_{INS}	Between switch and housing surface, 3 minutes			50	kVDC		
	Maximum Turn-On Peak Current	$I_{P(max)}$	$T_{case} = 25^\circ C$	$t_r < 200 \mu s$, duty cycle $< 1\%$		25	ADC		
	Maximum Continuous Load Current	I_L	$T_{case} = 25^\circ C$ $T_{flange} = 25^\circ C$ $T_{inlet} = 25^\circ C$	Standard devices Devices with cooling option GCF Devices with cooling option ILC Devices with cooling option DLC		0.36 (0.52)* 1.17 (1.64)* 1.35 (1.90)* 3.69 (5.22)*	0.35 (0.5)* 1.12 (1.58)* 1.29 (1.83)* 3.54 (5)*	0.27 (0.39)* 0.87 (1.22)* 1 (1.41)* 2.74 (3.87)*	ADC
	Note: The bracket values* apply for the case, that both switch paths are used at a duty cycle of 50%.								
	Max. Continuous Power Dissipation	$P_{d(max)}$	$T_{case} = 25^\circ C$ $T_{flange} = 25^\circ C$ $T_{inlet} = 25^\circ C$	Standard devices Devices with cooling option GCF Devices with cooling option ILC Devices with cooling option DLC		15 150 200 1500		Watt	
	Linear Derating		Above $25^\circ C$	Standard devices Devices with cooling option GCF Devices with cooling option ILC Devices with cooling option DLC		0.33 3.33 4.44 33.3		W/K	
	Operating Temperature Range	T_O				-40...70		$^\circ C$	
	Storage Temperature Range	T_S				-40...90		$^\circ C$	
ELECTRICAL CHARACTERISTICS	Permissible Operating Voltage Range	V_O		0 - 5400	0 - 7200	0 - 9000	VDC		
	Typical Breakdown Voltage	V_{br}	NOTE: V_{br} is a test parameter for quality control purposes only. Not applicable in normal operation!	$I_{off} > 0.5 mA$	5900	8900	9900	VDC	
	Typical HV Quiescent Current	I_{off}	From internal safety discharge resistors. @0.8xV _O		20		μADC		
	Typical Output Impedance (with standard damping resistors)	R_{stat}	$T_{case} = 25^\circ C$, $T_{flange} = 25^\circ C$, $T_{fin} = 25^\circ C$, $T_{inlet} = 25^\circ C$	$0.1 \times I_{P(max)}$ $1.0 \times I_{P(max)}$	40 55	45 60	60 100	Ohm	
	Typical Propagation Delay Time	$t_{d(on)}$	Resistive load, $0.1 \times I_{P(max)}$, $0.8 \times V_{O(max)}$, 50-50%		120		ns		
	Typical Output Pulse Jitter	t_j	Impedance matched input, $V_{aux} / V_{ctrl} = 5.00 VDC$		100		ps		
	Typical Transition Time (Output Pulse Rise & Fall Time)	t_r / t_f (10-90%)	The rise and fall times can be customized by the options PRT and PFT.	$0.8 \times V_{O(max)}$, $C_L = 10 pF$ $0.8 \times V_{O(max)}$, $C_L = 47 pF$	6 11	8 13	10 16	ns	
	Typical di/dt of Output Current	di/dt	Capacitive load 1nF, output wiring $< 10 cm$ ($< 4 inch$)		5	5	4	A/ns	
	Internal HV Buffer Capacitance	C_B	3 seconds discharge time after disconnection of the HV		40		nF		
	Maximum Output Pulse Width	$t_{pw(max)}$			Infinitely				
	Minimum Output Pulse Width	$t_{pw(min)}$	Impedance matched control input		50		ns		
	Max. Continuous Switching Frequency	$f_{(max)}$	$V_{aux} = 5.00 VDC$ $T_{case} = 25^\circ C$ $T_{flange} = 25^\circ C$ $T_{inlet} = 25^\circ C$	Standard devices, normal mode Standard devices in HFS mode HFS mode / options GCF, ILC HFS mode / option DLC	50 150 300 3000	Note: Repetition rates above 50 kHz require a dual auxiliary power supply with +15/+120 V and a output power of approx. 63 mW / kHz.		kHz	
	Maximum Burst Frequency	$f_{b(max)}$			6		MHz		
	Maximum Number of Pulses / Burst	N	@ $f_{b(max)}$.		10		Pulses		
	Coupling Capacitance	C_C	HV side against control side	Standard devices & option DLC Devices with options GCF / ILC	6 25			pF	
	Natural Capacitance	C_N	Between switch poles		12	12	20	pF	
	Control Voltage Range	V_{ctrl}	The V_{ctrl} has no impact on the output pulse shape.		2-10				
	Auxiliary Supply Voltage Range	V_{aux}	The V_{aux} is not required in HFS mode.		4.5 - 5.5			VDC	
	Auxiliary Supply Current	I_{aux}	$V_{aux} = 5.00 VDC$, $T_{case} = 25^\circ C$	$0.1 \times f_{(max)}$ @ $f_{(max)}$	150 600			mADC	
	HFS Supply Supply Voltage V1	$V_{HFS(V1)}$	$\pm 3\%$, current consumption 0.4 mA / kHz		15			VDC	
HFS Supply Supply Voltage V2	$V_{HFS(V2)}$	$\pm 3\%$, current consumption 0.3 mA / kHz		120			VDC		
Intrinsic Diode Forward Voltage	V_F	$T_{case} = 25^\circ C$, $I_F = 10 A$		5			VDC		
Diode Reverse Recovery Time	t_{rrc}	$I_F = 10A$		< 250			ns		
HOUSING	Dimensions	Standard housing Devices with option GCF or ILC Devices with option DLC		175 x 80 x 45 175 x 80 x 55 175 x 80 x 70			mm ³		
	Weight	Standard housing Devices with option GCF Devices with option ILC Devices with option DLC		700 1800 1050 1100			g		
FUNCTIONS	Control Signal Input:	LEMO 4-pole (pin 1). TTL compatible with 100 Ohm termination. Schmitt-Trigger characteristics. Control voltage 2-10 V (3...5 V for lowest jitter).							
	Inhibit Signal Input:	LEMO 4-pole (pin 2). TTL compatible, Schmitt-Trigger characteristics for the connection of external safety circuits. L = switch inhibited.							
OPTIONS	Fault Signal Output:	LEMO 4-pole (pin 3). Short circuit proof TTL output. Indicating switch and driver over-heat, over-frequency, low auxiliary or low HFS voltage. L = fault.							
	5V Auxiliary Supply:	LEMO 4-pole (pin 4 / shielding = return). The 5 V aux. power supply is used for rep rates up to 50 kHz. Above 50 kHz the HFS input must be used.							
	HFS Supply Input:	LEMO 3-pole. Rep rates $> 50 kHz$ requires additional driver supply voltages (pin1=GND, pin2=15V, pin3=120V). The 5V supply can be disconnected.							
	Monitor Signal Output:	SMC socket for scope connection via the included adapter cable. The HV output pulse is capacitively detected and the division (1000:1) is adjustable.							
	LED Indicators:	GREEN: "Auxiliary Power Good and switch B / ON". YELLOW: "Switch A / ON". RED: "Fault, switch A / OFF and switch B / ON"							
	HV Power Supply Input:	SHV-NIM socket. Plug is included in supply. DANGER-HIGH VOLTAGE! Please consider the internal buffer capacitor discharge time of 3 seconds!							
	HV Pulse Output:	Screw terminal at the front side of unit. Return / GND at the bottom side. Output connectors can be customized. Please consult Behlke.							
	Option UL94	Flame Retardant Casting Resin. Casting resin according to UL-94-V0. Minimum order quantity required. Option UL94 refers to the casting resin only. The housing mantle is always made as UL94-V0.							
	Option GCF	Grounded cooling flange. HV switch is mounted on a massive copper plate in insulation.. Coupling capacitance (ground capacitance) is increased by approx. 50%. For medium power applications.							
	Option ILC	Indirect liquid cooling. HV switch is mounted on a heat exchanger made of ceramics. For use with water. Demineralized water is recommended for less ground capacitance. Medium power applications.							
Option DLC	Direct liquid cooling. Internal cooling channel around the power semiconductors. Highly efficient cooling for extremely high power dissipation with non-conductive coolants such as GALDEN HT-135.								
Option PRT-xx	Customized output pulse rise time. The rise time is determined by the internal series damping resistor R_{S1} and the capacitive load C_L . Please specify your capacitive load C_L and the demanded rise time.								
Option PFT-xx	Customized output pulse fall time. The fall time is determined by the internal series damping resistor R_{S2} and the capacitive load C_L . Please specify your capacitive load C_L and the demanded fall time.								
Option NEG	Pulsers configured for negative voltages. Pulsers with selectable polarity and floating pulsers are also available. Please consult Behlke.								
Accessory HFSP-35	HFS dual driver supply for the HFS mode. 15/125 VDC, 35 Watt for max. 550 kHz repetition rate. 19" system cassette, 107x133x170 mm (21WUx3HU). Please indicate mains voltage (115 or 230V).								
Accessory HFSP-140	HFS dual driver supply for the HFS mode. 15/125 VDC, 140 Watt for max. 2.2 MHz repetition rate. 19" system cassette, 107x133x262 mm (21WUx6HU). Please indicate mains voltage (115 or 230V).								