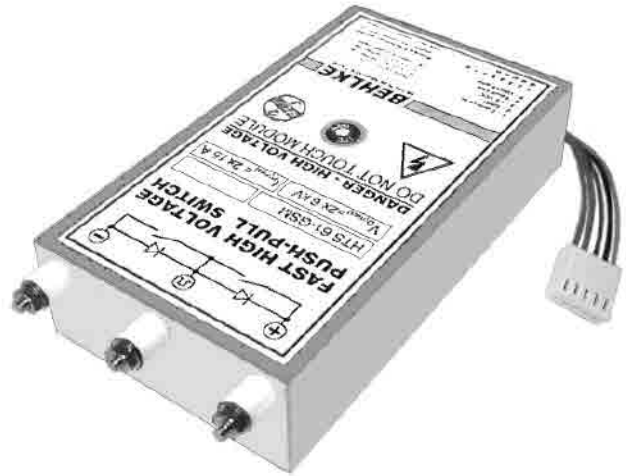


FAST HIGH VOLTAGE TRANSISTOR SWITCHES

The switching modules of the series HTS-GSM consist of two identical MOSFET switching paths that form a so-called half bridge circuit respectively push-pull circuit. Both switching paths are controlled by a common driver, which also provides a logic signal negation for one of the switches. The switches are mutually passively locked, so that a short in the bridge is excluded under all circumstances, including if the control input is disturbed by electromagnetic interferences (due to bad EMC design, for example). Especially in pulse generator applications with capacitive load, the push-pull principle has considerable advantages in comparison with the conventional circuitry using a single-switch with a working resistor. Push-pull circuits do not require large energy storage capacitors for a low pulse drop and, because there are no working resistor power losses, the efficiency of a push-pull pulser is excellent regardless of pulse width, frequency and duty cycle. The pulsers draw only currents for charging the connected load capacitance. Thanks to an extremely precise timing of the switches, there are also almost no cross currents in the bridge, except peak charging currents of the switch natural capacitances.

The switches are controlled by positive going signals of 3 to 10 Volts amplitude. Fault conditions as overfrequency, thermal overload (long-term overload) and incorrect auxiliary supply set the switching path A in off-state and the switching path B in on-state. Faults are indicated as an "L" signal at the fault signal output. Without 5VDC supply, both switching paths (A and B) are in off-state. That implies, without 5VDC the output potential could be undefined if the HV is still applied. To ensure a defined high voltage output potential in such cases, pull-up or pull-down resistors must be connected to the output. For further design recommendations, please refer to the general instructions.

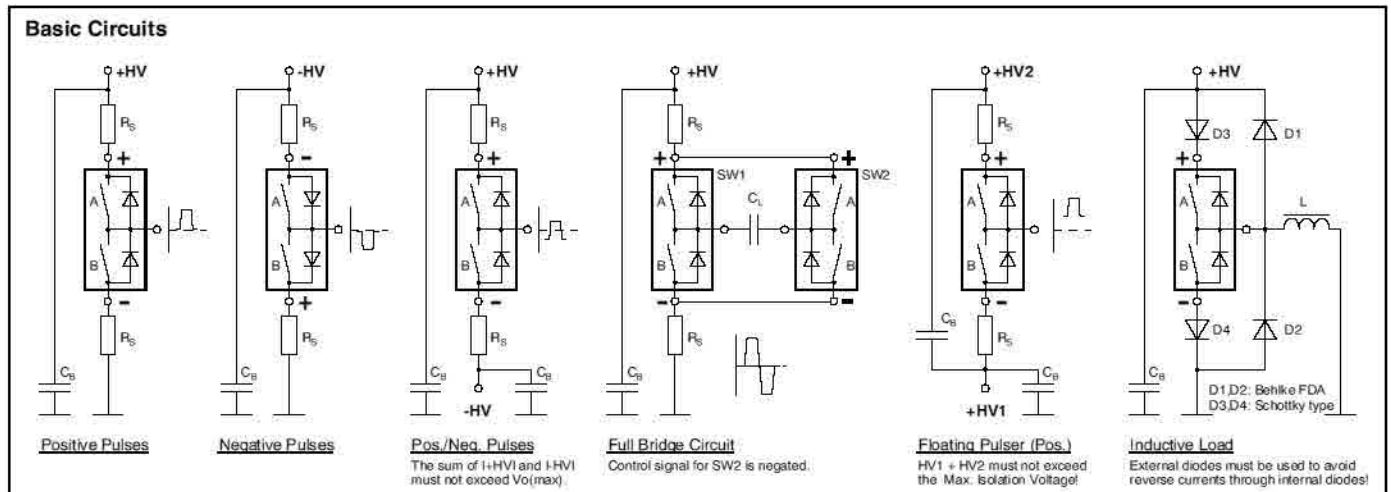
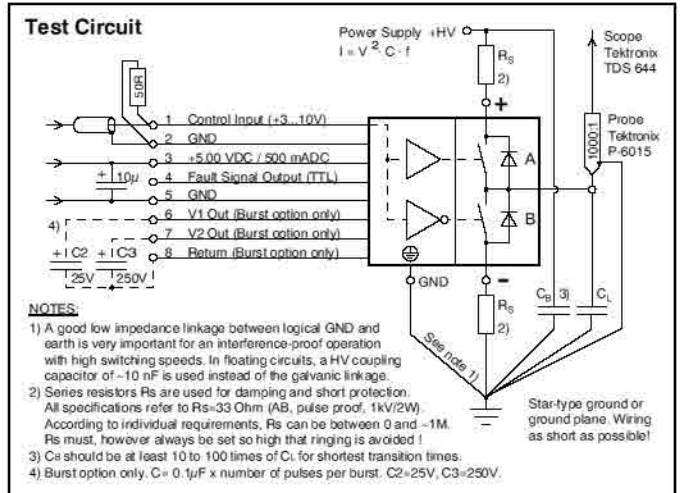
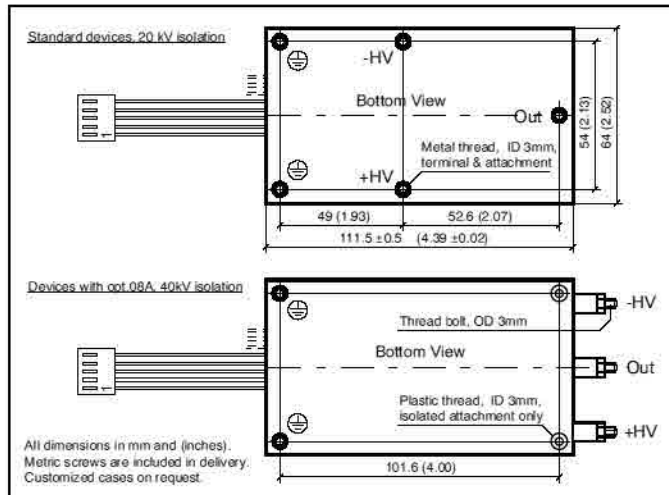
HTS 41-03-GSM 2x 4kV / 30 A
HTS 61-01-GSM 2x 6kV / 15 A



- Fast transition times, rise time and fall time ~10 ns
- Variable pulse width from 150 ns to infinity
- No pulse droop and very low ripple on the pulse top
- No working resistor power, small buffer capacitors

PUSH-PULL

MOSFET
TECHNOLOGY



BEHLKE

TECHNICAL DATA

Specification	Symbol	Condition / Comment		41-03-GSM	61-01-GSM	Unit
Maximum Operating Voltage	$V_{O(max)}$	$I_{off} < 10 \mu ADC$		2 x 4000	2 x 6000	VDC
Minimum Operating Voltage	$V_{O(min)}$	Increased transition times below $0.1 \times V_{O(max)}$		0		VDC
Typical Breakdown Voltage	V_{br}	Static voltage, $I_{off} > 1 \text{ mADC}$, $T_{case} = 70^\circ C$		2 x 4400	2 x 8000	VDC
Galvanic Isolation	V_i	Continuously	HV terminals at bottom (Standard) HV terminals at front (Opt.08A)	20000 40000		VDC
Max. Peak Current Capability	$I_{P(max)}$	$T_{case} = 25^\circ C$	$t_p < 10 \mu s$, duty cycle $< 1\%$	2 x 30	2 x 15	ADC
Max. Continuous Load Current	I_L	$T_{case} = 25^\circ C$ $T_{lin} = 25^\circ C$	Standard plastic case Opt.03, incr. thermal conductivity Opt. 04, cooling fins (air $> 4 \text{ m/s}$)	2 x 1.06 2 x 0.66 2 x 1.48	2 x 0.25 2 x 0.29 2 x 0.66	ADC
Static On-Resistance	R_{stat}	$T_{case} = 25^\circ C$	$0.1 \times I_{P(max)}$ $1.0 \times I_{P(max)}$	2 x 7.2 2 x 16	2 x 32 2 x 80	Ω
Maximum Off-State Current	I_{off}	$0.8 \times V_O$, $T_{case} = 25 \dots 70^\circ C$, reduced I_{off} on request		10		μADC
Propagation Delay Time	t_d	Resistive Load		140		ns
Typical Output Transition Time (Rise Time & Fall Time)	t_r, t_f	$0.8 \times V_O$ 10-90% Standard device (Bottom terminals)	$R_S = 33 \Omega$, $C_L = 10 \text{ pF}$ $R_S = 33 \Omega$, $C_L = 50 \text{ pF}$ $R_S = 33 \Omega$, $C_L = 100 \text{ pF}$ $R_S = 33 \Omega$, $C_L = 200 \text{ pF}$ $R_S = 22 \Omega$, $C_L = 1000 \text{ pF}$	9 11 15 21 63	14 22 33 52 105	ns
Minimum Output Pulse Width	$t_{p(min)}$	Reduced output pulse width on request.		130		ns
Maximum Output Pulse Width	$t_{p(max)}$			No limitation, up to ∞		
Minimum Pulse Spacing	$t_{ps(min)}$	(Switch recovery time)		400		ns
Typical Output Pulse Jitter	t_j	$V_{aux} = 5.0 \text{ VDC}$ $V_{tr} = 5.0 \text{ VDC}$	Fixed switching frequency, $> 2 \text{ kHz}$ Swept frequency, $< 2 \text{ kHz}$	0.1 2		ns
Max. Continuous Switching Frequency	$f_{(max)}$	Please note possible $P_{d(max)}$ limitations. Increased switching frequency on request.		20		kHz
Maximum Burst Frequency	$f_{b(max)}$	Use option 01 for > 10 pulses per $20 \mu s$ burst		2.5		MHz
Maximum Continuous Power Dissipation	$P_{d(max)}$	$T_{case} = 25^\circ C$ $T_{lin} = 25^\circ C$	Standard plastic case Opt.03, incr. thermal conductivity Opt. 04, cooling fins (air $> 4 \text{ m/s}$)	2 x 5 2 x 7 2 x 35		Watts
Linear Derating		Above $25^\circ C$	Standard plastic case Opt.03, incr. thermal conductivity Opt. 04, cooling fins (air $> 4 \text{ m/s}$)	2 x 0.11 2 x 0.15 2 x 0.77		W/K
Temperature Range	T_O			-40...70		$^\circ C$
Typical Natural Capacitance	C_N	Capacitance between + and - terminal of one switch path	$0.1 \times V_{O(max)}$ $0.8 \times V_{O(max)}$	< 100 < 35		pF
Typical Coupling Capacitance	C_C	Both switches against ground respectively control		< 20		pF
Reverse Recovery Time of the intrinsic diodes (Parasitic MOSFET Diodes)	t_{rr}	Note: The internal diodes are too slow to be used periodically in forward direction (danger of bridge-short). Free-wheeling diode networks must be applied in case of inductive load or high stray inductance!		$I_F = 2 \text{ A}$	500...1000	ns
Auxiliary Supply Voltage	V_{aux}	Stabilized to $\pm 5\%$		5.00		VDC
Auxiliary Supply Current	I_{aux}	@ f_{max} (Limitation of approx. 1 A recommended)		500		mADC
Control Signal	V_{tr}	$> 3 \text{ VDC}$ recommended for low jitter		3...10		VDC
Fault Signal Output		Short circuit proof, source/sink current max. 10 mA	Ready = High Fault = Low	≥ 4.0 ≤ 0.8		VDC
Dimensions	LxWxH	Standard plastic case (Without connectors) With option 04 (cooling fins)		112x64x27 112x64x62		mm ³
Weight		Standard plastic case With option 04 (cooling fins)		290 380		g

Ordering Information

HTS 41-03-GSM	Push-pull transistor switch	Option 05	High power metal case (on request only)
HTS 61-01-GSM	Push-pull transistor switch	Option 06	Control connection: Pins instead of pigtail & plug
Option 01	High frequency burst	Option 08A*	40kV isolation, HV front terminals
Option 03	Increased thermal conductivity	Option 08B*	80kV isolation, HV front terminals, enlarged case
Option 04	Cooling fins, non isolated, for vertical air stream only		* Not recommended for switching speeds $< 15 \text{ ns}$