FAST HIGH VOLTAGE TRANSISTOR SWITCHES

INTRODUCTION

The HTS 31-GSM push-pull switch consists of two alternately controlled solid-state switches which in turn are made up of a large number of MOSFETs lying parallel and in series. The HTS 31-GSM has all the merits of the well-known range of HTS switches, e.g. simple control, high galvanic isolation, precise switching characteristics, high reliability, long life and small size. The push-pull switch described here can be used above all to generate true square-wave pulses of high edge steepness on a predominantly capacitive or resistive load. Generator solutions with push-pull switches have distinct advantages over single switches with working resistors as regards power dissipation and pulse droop. In particular overlarge energy-storage capacitors and powerful high-voltage supplies can be dispensed with in the case of purely capacitive loading since no true power has to be provided for the whole pulse duration. Like the well-known digital CMOS-ICs an appreciable power dissipation arises only at higher frequencies. The rise and fall times at the switch output are virtually the same and for the first time it is possible to generate extremely precise, high-voltage, square-wave pulses cost-effectively with only one component. The HTS 31-GSM is equipped with a noise-immune control circuit which ensures at all times the right timing of the internal switching elements even in the most difficult operating conditions. By means of monitoring and conditioning of the input signal unsaturated switching cannot take place. A built-in thermotrigger with automatic reset provides protection from medium and long-term overheating.

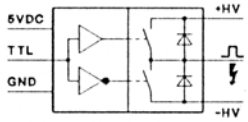
CONNECTION AND OPERATION

The HTS 31-GSM can generate positive, negative and bipolar pulses. The corresponding attachment circuit on the high-voltage side is shown in the adjacent diagram. In the interest of short transition times the buffer capacitor C_B ought to have at least ten times the value of the load capacitance C_L. The series resistors R_S are not absolutely necessary but are recommended for impedance matching and for damping build-up transients, for short-circuit protection and, on occasion, for unburdening the switch with regard to the capacitive power dissipation. In the case of a possible impedance matching it should be noted that the static on-resistance R_{stat} varies with the flowing load current. Consequently in the case of high capacitances and a correspondingly high pulse current the values for R_S can sometimes be reduced to achieve shorter transition times. It is best to determine the optimum value for R_S empirically in accordance with the individual requirements as regards edge steepness and transient response. With load capacitances of more than 1 nF the peak current should be limited to 30 Amperes by means of R_S.

The internal (parasitic) diodes are not allowed to be used in the case of normal operation since their relatively long reverse recovery time of approximately 1 μs could lead to an inadvertent turn-on of the respective switching path, resulting in a short

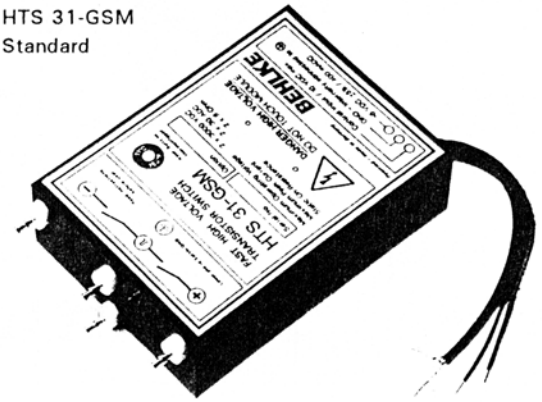
HTS 31-GSM 2 x 3000 VDC / 30 A

Variable On-Time
True Square Wave Pulses
Simple Connection

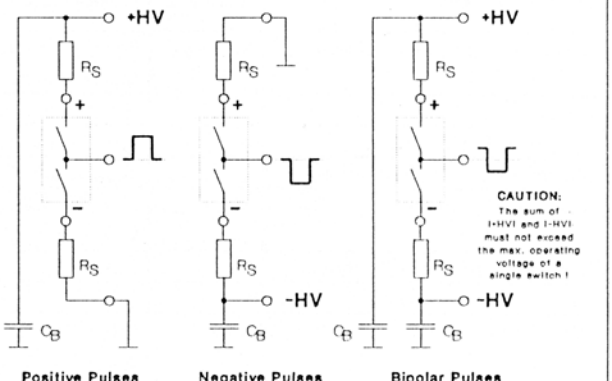


PUSH-PULL -PATENTED-

HTS 31-GSM
Standard



Basic Circuit Configurations



circuit in the bridge. For this reason inductive loads are permitted only when it is absolutely certain that there can be no current direction reversal, e.g. by building in fast series diodes and/or by using RC snubbers or clamping diodes. For the same reason and on account of the risk of overvoltage powerful oscillations must be damped by suitable series resistors when a high capacitive load is being switched. The wiring on the high-voltage side should be made as non-inductive as possible.

For further design recommendations please refer to the "General Instructions for Use".

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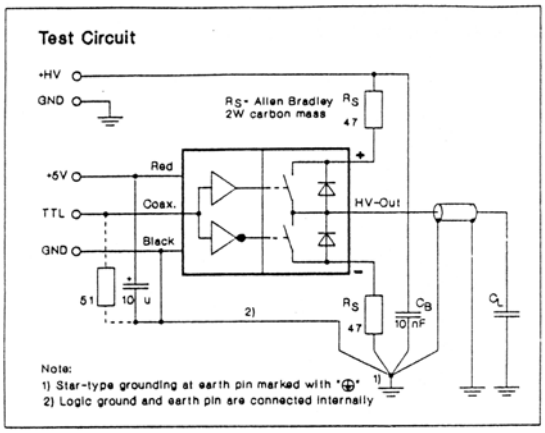

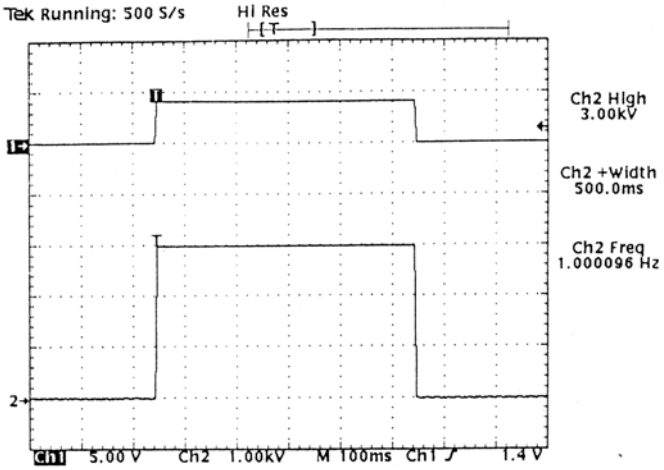

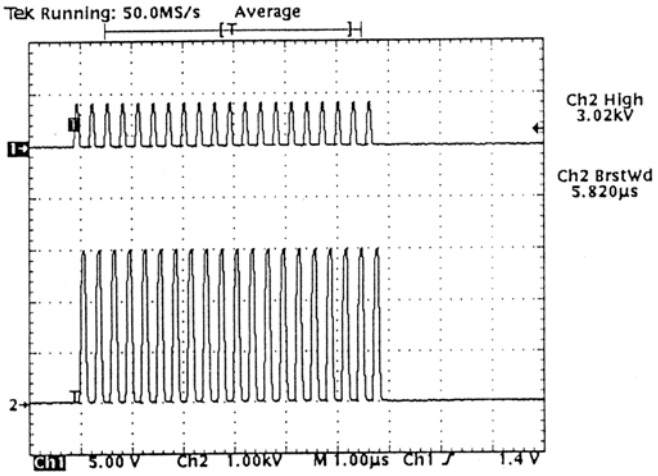

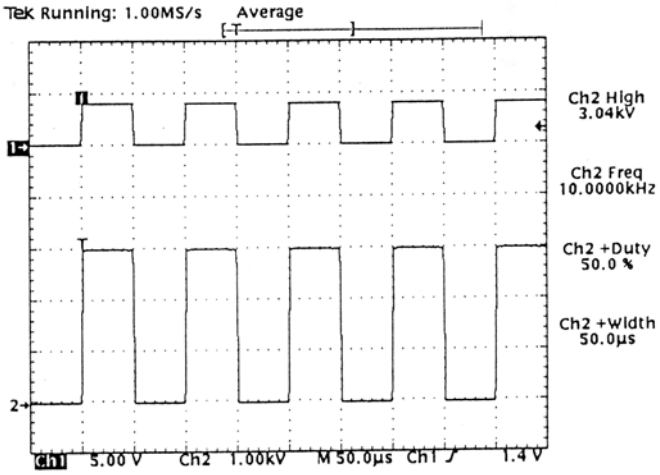

SPECIFICATION	SYMBOL	CONDITION / COMMENT	HTS 31-GSM	UNIT
Maximum Operating Voltage	$V_{O(max)}$	Positive or negative pole grounded Bipolar mode	±3000 +1500 / -1500	VDC
Isolation	V_I	HV side against control side	>10000	VDC
Maximum Peak Current	$I_{P(max)}$	t_p < 10 µs, duty cycle < 1%	30	ADC
Maximum Continuous Current	I_L	T_{case} = 25°C	500	mADC
Static On-Resistance	R_{stat}	I_L = 0.1 x $I_{P(max)}$ I_L = $I_{P(max)}$	8 24	Ω
Maximum Off-State Current	I_{off}	0.8 x V_O	<10	µADC
Turn-On Delay Time	$t_{d(on)}$	0.5 x V_O, C_L = 20 pF, R_S=47Ω	80	ns
Turn-On Rise Time	$t_{r(on)}$	0.8 x V_O, C_L = 20 pF, R_S=51Ω 0.8 x V_O, C_L = 100 pF, R_S=33Ω 0.8 x V_O, C_L = 200 pF, R_S=33Ω	10 15 21	ns
Typical Turn-On Jitter	$t_{j(on)}$	V_{aux}=5.0 VDC, V_{tr}=5VDC, f=1kHz	300	ps
Pulse Width Range	t_p		80 ns to infinity	
Maximum Burst Frequency	$f_{b(max)}$	Use option 01 for > 20 pulses / 20µs burst	4	MHz
Maximum Continuous Frequency	$f_{c(max)}$	@ V_{aux} = 5.00 VDC, note $P_{d(max)}$ limitations	40	kHZ
Continuous Power Dissipation	$P_{d(max)}$	T_{case}= 25 °C, derating 0.2 W/°C above 25°C	10	Watts
Temperature Range	T_O	Extented temperature range on request	-30-70	°C
Switch Natural Capacitance	C_N	@ $V_{O(max)}$	70	pF
Coupling Capacitance	C_C	HV side against control side	15	pF
Diode Reverse Recovery Time	t_{rrc}	I_F = 0.2 x $I_{P(max)}$	1	µs
Auxiliary Supply Voltage	V_{aux}	Stabilized to ± 5%	5	VDC
Auxiliary Supply Current	I_{aux}	@ $fc_{(max)}$	400	mADC
Control Voltage	V_{tr}		2-10	VDC
Dimensions		Case only	89x64x27	mm^3
Weight			250	g

ORDERING INFORMATION:

HTS 31-GSM	Push-Pull Switch, 2x3kV	**Option 02**	UL-94-VO Casting Resin	All data and specifications subject to change without notice.
Option 01	High Frequency Burst	**Option 06**	Soldering Pins for PCBs	