

|                                                                                                                                                                                                  | Specification                                                 | Symbol                                                                                                                                                                                                                                                                                                                                                                                                     | Condition / Comment                                                                                                                                                                                                           | HTS 81-10-AC-GSM                                                                                              | Unit                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| ABSOLUTE MAXIMUM RATINGS                                                                                                                                                                         | Maximum Operating Voltage                                     | $V_{O(max)}$                                                                                                                                                                                                                                                                                                                                                                                               | $I_{off} < 50 \mu ADC$ , $T_{case} = 70^{\circ}C$                                                                                                                                                                             | $\pm 8$                                                                                                       | kVDC                                          |
|                                                                                                                                                                                                  | Maximum Isolation Voltage                                     | $V_i$                                                                                                                                                                                                                                                                                                                                                                                                      | Between HV switch and control / GND, continuously                                                                                                                                                                             | $\pm 20$                                                                                                      | kVDC                                          |
|                                                                                                                                                                                                  | Max. Housing Insulation Voltage                               | $V_{INS}$                                                                                                                                                                                                                                                                                                                                                                                                  | Between switch and housing surface, 3 minutes                                                                                                                                                                                 | $\pm 20$                                                                                                      | kVDC                                          |
|                                                                                                                                                                                                  | Maximum Turn-On Peak Current                                  | $I_{P(max)}$                                                                                                                                                                                                                                                                                                                                                                                               | $T_{case} = 25^{\circ}C$<br>$t_p < 200 \mu s$ , duty cycle $< 1\%$<br>$t_p < 1 ms$ , duty cycle $< 1\%$<br>$t_p < 10 ms$ , duty cycle $< 1\%$<br>$t_p < 100 ms$ , duty cycle $< 1\%$                                          | 100<br>59<br>36<br>27                                                                                         | ADC                                           |
|                                                                                                                                                                                                  | Maximum Continuous Load Current                               | $I_{L(max)}$                                                                                                                                                                                                                                                                                                                                                                                               | $T_{case} = 25^{\circ}C$<br>Standard devices<br>Devices with option DLC                                                                                                                                                       | 0.6<br>3                                                                                                      | ADC                                           |
|                                                                                                                                                                                                  | Max. Continuous Power Dissipation                             | $P_{d(max)}$                                                                                                                                                                                                                                                                                                                                                                                               | $T_{case} = 25^{\circ}C$<br>Standard devices & FC, forced air 4 m/s<br>Devices with option DLC                                                                                                                                | 12.5<br>1500                                                                                                  | Watt                                          |
|                                                                                                                                                                                                  | Linear Derating                                               |                                                                                                                                                                                                                                                                                                                                                                                                            | Above $25^{\circ}C$<br>Standard devices & FC, forced air 4 m/s<br>Devices with option DLC                                                                                                                                     | 0.28<br>2                                                                                                     | W/K                                           |
|                                                                                                                                                                                                  | Operating Temperature Range                                   | $T_o$                                                                                                                                                                                                                                                                                                                                                                                                      | Standard devices & options CF, GCF, ILC. (Option DLC)                                                                                                                                                                         | -40...70                                                                                                      | $^{\circ}C$                                   |
|                                                                                                                                                                                                  | Storage Temperature Range                                     | $T_s$                                                                                                                                                                                                                                                                                                                                                                                                      | Switches with option ILC may require frost protection!                                                                                                                                                                        | -50...90                                                                                                      | $^{\circ}C$                                   |
|                                                                                                                                                                                                  | Permissible Operating Voltage Range                           | $V_o$                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               | $0 \dots \pm 12$                                                                                              | kVDC                                          |
| ELECTRICAL CHARACTERISTICS                                                                                                                                                                       | Typical Breakdown Voltage                                     | $V_{br}$                                                                                                                                                                                                                                                                                                                                                                                                   | NOTE: $V_{br}$ is a test parameter for quality control purposes only. $I_{off} > 0.5 mA$                                                                                                                                      | 13.2                                                                                                          | kVDC                                          |
|                                                                                                                                                                                                  | Typical Off-State Current                                     | $I_{off}$                                                                                                                                                                                                                                                                                                                                                                                                  | $0.8 \times V_o$ , $T_{case} = 25 \dots 70^{\circ}C$ , reduced $I_{off}$ on request                                                                                                                                           | 20                                                                                                            | $\mu ADC$                                     |
|                                                                                                                                                                                                  | Typical Turn-On Resistance                                    | $R_{stat}$                                                                                                                                                                                                                                                                                                                                                                                                 | Each switching path<br>$t_p < 1 \mu s$ , duty cycle $< 1\%$<br>$0.1 \times I_{P(max)}$ , $T_{case} = 25^{\circ}C$<br>$1.0 \times I_{P(max)}$ , $T_{case} = 25^{\circ}C$<br>$1.0 \times I_{P(max)}$ , $T_{case} = 70^{\circ}C$ | 3.0<br>8.1<br>14.4                                                                                            | Ohm                                           |
|                                                                                                                                                                                                  | Residual Voltage<br>(Total Voltage drop on-state)             | $V_{res}$                                                                                                                                                                                                                                                                                                                                                                                                  | $T_{case} = 25^{\circ}C$<br>$I_L = 0.001 A$<br>$I_L = 0.01 A$<br>$I_L = 0.1 A$<br>$I_L = 1.0 A$<br>$I_L = 10.0 A$                                                                                                             | 0.012<br>0.12<br>1.2<br>16<br>72                                                                              | VDC                                           |
|                                                                                                                                                                                                  | Typical Propagation Delay Time                                | $t_{d(on)}$                                                                                                                                                                                                                                                                                                                                                                                                | Resistive load, $0.1 \times I_{P(max)}$ , $0.8 \times V_{O(max)}$ , 50-50%                                                                                                                                                    | 250                                                                                                           | ns                                            |
|                                                                                                                                                                                                  | Typical Output Pulse Jitter                                   | $t_j$                                                                                                                                                                                                                                                                                                                                                                                                      | Impedance matched input, $V_{aux} / V_{ctrl} = 5.00 VDC$                                                                                                                                                                      | 3                                                                                                             | ns                                            |
|                                                                                                                                                                                                  | Typical Turn-On Rise Time                                     | $t_{r(on)}$                                                                                                                                                                                                                                                                                                                                                                                                | Resistive load, 10-90%<br>$0.1 \times V_{O(max)}$ , $I_L = 0.1 \times I_{P(max)}$<br>$0.8 \times V_{O(max)}$ , $I_L = 0.1 \times I_{P(max)}$<br>$0.8 \times V_{O(max)}$ , $I_L = 1.0 \times I_{P(max)}$                       | 35<br>50<br>65                                                                                                | ns                                            |
|                                                                                                                                                                                                  | Typical Turn-Off Rise Time                                    | $t_{off}, t_q$                                                                                                                                                                                                                                                                                                                                                                                             | Resistive load, 10-90%<br>$0.1 \times V_{O(max)}$ , $I_L = 0.1 \times I_{P(max)}$<br>$0.8 \times V_{O(max)}$ , $I_L = 1.0 \times I_{P(max)}$                                                                                  | 40<br>90                                                                                                      | ns                                            |
|                                                                                                                                                                                                  | Maximum Turn-On Time                                          | $t_{on(max)}$                                                                                                                                                                                                                                                                                                                                                                                              | No limitation                                                                                                                                                                                                                 | $\infty$                                                                                                      |                                               |
|                                                                                                                                                                                                  | Minimum Turn-On Time                                          | $t_{on(min)}$                                                                                                                                                                                                                                                                                                                                                                                              | $t_{on(min)}$ can be customized. Please consult factory                                                                                                                                                                       | 150                                                                                                           | ns                                            |
|                                                                                                                                                                                                  | Minimum Turn-Off Time                                         | $t_{off(min)}$                                                                                                                                                                                                                                                                                                                                                                                             | $t_{off(min)}$ can be customized. Please consult factory                                                                                                                                                                      | 150                                                                                                           | ns                                            |
|                                                                                                                                                                                                  | Max. Continuous Switching Frequency                           | $f_{(max)}$                                                                                                                                                                                                                                                                                                                                                                                                | @ $V_{aux} = 5.00 V$<br>Sw. shutdown if $f_{(max)}$ is exceeded<br>Standard devices without HFS option<br>Standard devices with HFS supply<br>Opt. HFS + sufficient cooling option                                            | 2.2<br>40<br>80                                                                                               | kHz                                           |
|                                                                                                                                                                                                  | Maximum Burst Frequency                                       | $f_{b(max)}$                                                                                                                                                                                                                                                                                                                                                                                               | Use option HFB for $> 10$ pulses within 20 $\mu s$ or less                                                                                                                                                                    | 500                                                                                                           | kHz                                           |
|                                                                                                                                                                                                  | Maximum Number of Pulses / Burst                              | $N_{(max)}$                                                                                                                                                                                                                                                                                                                                                                                                | @ $f_{b(max)}$<br>Note: Option HFB requires external buffer capacitors with a voltage rating of $> 630 VDC$ and a capacitance of 100nF per additional pulse<br>Standard<br>Option I-HFB<br>Option HFB                         | 10 Use option HFB for $> 10$<br>$> 100$<br>$> 1000$                                                           | Pulses                                        |
|                                                                                                                                                                                                  | Coupling Capacitance                                          | $C_C$                                                                                                                                                                                                                                                                                                                                                                                                      | HV side against control side                                                                                                                                                                                                  | $< 25$                                                                                                        | pF                                            |
|                                                                                                                                                                                                  | Natural Capacitance                                           | $C_N$                                                                                                                                                                                                                                                                                                                                                                                                      | Between switch poles, @ $0.5 \times V_{O(max)}$                                                                                                                                                                               | $< 50$                                                                                                        | pF                                            |
|                                                                                                                                                                                                  | Control Voltage Range                                         | $V_{ctrl}$                                                                                                                                                                                                                                                                                                                                                                                                 | The $V_{ctrl}$ has no impact on the output pulse shape.                                                                                                                                                                       | 2... 6                                                                                                        | VDC                                           |
|                                                                                                                                                                                                  | Auxiliary Supply Voltage Range                                | $V_{aux}$                                                                                                                                                                                                                                                                                                                                                                                                  | The +5 V supply is not required in the HFS mode.                                                                                                                                                                              | 5                                                                                                             | VDC                                           |
|                                                                                                                                                                                                  | Typical Auxiliary Supply Current                              | $I_{aux}$                                                                                                                                                                                                                                                                                                                                                                                                  | $V_{aux} = 5.00 VDC$ , $T_{case} = 25^{\circ}C$ .<br>Active current limitation above 1A.<br>$0.01 \times f_{(max)}$<br>@ $f_{(max)}$                                                                                          | 130<br>800                                                                                                    | mADC                                          |
|                                                                                                                                                                                                  | Fault Signal Output                                           |                                                                                                                                                                                                                                                                                                                                                                                                            | Switch will be turn off, if $t > f_{(max)}$ , $V_{aux} < 4.75 V$ or $T_{case} > 75^{\circ}C$<br>Fault condition is indicated by a logical "L"                                                                                 | H=4V, L=0.5V                                                                                                  | VDC                                           |
|                                                                                                                                                                                                  | Opt. HFS, Ext. Supply Voltage V1                              | $V_{HFS(V1)}$                                                                                                                                                                                                                                                                                                                                                                                              | Stability $\pm 3\%$ , current consumption $< 0.4 mA/kHz$ @ $25^{\circ}C$                                                                                                                                                      | 15                                                                                                            | VDC                                           |
|                                                                                                                                                                                                  | Opt. HFS, Ext. Supply Voltage V2                              | $V_{HFS(V2)}$                                                                                                                                                                                                                                                                                                                                                                                              | Stability $\pm 3\%$ , current consumption $< 0.9 mA/kHz$ @ $25^{\circ}C$                                                                                                                                                      | TBD                                                                                                           | VDC                                           |
|                                                                                                                                                                                                  | Intrinsic Diode Forward Voltage                               | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                      | $T_{case} = 25^{\circ}C$ , $I_F = 0.3 \times I_{P(max)}$                                                                                                                                                                      | $< 10$                                                                                                        | VDC                                           |
|                                                                                                                                                                                                  | Diode Reverse Recovery Time                                   | $t_{rrc}$                                                                                                                                                                                                                                                                                                                                                                                                  | $T_{case} = 25^{\circ}C$ , $I_F = 0.3 \times I_{P(max)}$ , $di/dt = 100 A/\mu s$                                                                                                                                              | $< 255$                                                                                                       | ns                                            |
| HOUSING                                                                                                                                                                                          | Dimensions                                                    | $L \times W \times H$                                                                                                                                                                                                                                                                                                                                                                                      | Standard housing<br>Devices with option CF, non-isolated cooling fins<br>Devices with option DLC                                                                                                                              | Please contact the manufacturer!                                                                              | mm <sup>3</sup>                               |
|                                                                                                                                                                                                  | Weight                                                        |                                                                                                                                                                                                                                                                                                                                                                                                            | Standard housing<br>Devices with option CF, non-isolated cooling fins<br>Devices with option DLC                                                                                                                              | Please contact the manufacturer!                                                                              | g                                             |
| FUNCTIONS                                                                                                                                                                                        | Control Signal Input                                          | Pin 1 / Yellow. TTL compatible with Schmitt-Trigger characteristics. Control voltage 2-10 V (3-5 V recommended for low jitter).                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                                                                                               |                                               |
|                                                                                                                                                                                                  | Logic GND / 5V Return                                         | Pin 2 / Black. The ground pin is internally connected with the safety earthing terminal (threaded insert) on bottom side.                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                               |                                                                                                               |                                               |
|                                                                                                                                                                                                  | 5V Auxiliary Supply                                           | Pin 3 / Red. 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. TTL output, short circuit proof. Indicating switch & driver over-heat, over-frequency, low auxiliary voltage. L = Fault.                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                               |                                                                                                               |                                               |
|                                                                                                                                                                                                  | Inhibit Signal Input                                          | Pin 5 / Green. 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                                        | A) Standard switches and switches with option CF, GCF: Thermo trigger $75^{\circ}C$ , response time $< 60 s$ @ $3 \times P_{d(max)}$ , $\Delta T = 25K$ (50 to $75^{\circ}C$ ). Separate driver protection. B) Switches with option DLC: $65^{\circ}C$ , response time $< 3 s$ @ $3 \times P_{d(max)}$ , $\Delta T = 25K$ (40 to $65^{\circ}C$ ), coolant flow $> 3 l / min$ . Separate driver protection. |                                                                                                                                                                                                                               |                                                                                                               |                                               |
|                                                                                                                                                                                                  |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                                                                                               |                                               |
| ORDERING                                                                                                                                                                                         | HTS 81-10 AC-                                                 | Transistor Switch, 8 kVDC, 100 ADC                                                                                                                                                                                                                                                                                                                                                                         | Option LP<br>Low Pass. Input filter for increased noise immunity.                                                                                                                                                             | Option CCF<br>Ceramic Flange Housing. $P_{d(max)}$ can be increased by the factor 3 to 15.                    |                                               |
|                                                                                                                                                                                                  |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                            | Option S-TT<br>Soft Transition Time. Slower switching speed for simplified EMC.                                                                                                                                               | Option CF<br>Copper Cooling Fins. $P_{d(max)}$ can be increased by the factor 3 to 10.                        |                                               |
|                                                                                                                                                                                                  |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                            | Option HFB<br>High Frequency Burst, Improved burst capability by driver.                                                                                                                                                      | Option GCF<br>Grounded Cooling Flange (copper). $P_{d(max)}$ can be increased by the factor 3 to 15.          |                                               |
|                                                                                                                                                                                                  |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                            | Option HFS<br>High Frequency Switching (two auxiliary supply inputs V1 & V2)                                                                                                                                                  | Option ILC<br>Indirect Liquid Cooling (for water). $P_{d(max)}$ can be increased by the factor 3 to 15.       |                                               |
|                                                                                                                                                                                                  |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                            | Option CCS<br>Ceramic Cooling Surface. $P_{d(max)}$ can be increased by the factor 2                                                                                                                                          | Option DLC<br>Direct Liquid Cooling (for FPE/PFC). $P_{d(max)}$ can be increased by the factor 10 to 100. 15. |                                               |
|                                                                                                                                                                                                  | FOR FURTHER PRODUCT OPTIONS PLEASE REFER TO THE OPTIONS PAGE. |                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                                                                                               |                                               |
| Customized switching units are available on request. All data and specifications subject to change without notice. Please visit <a href="http://www.behlke.com">www.behlke.com</a> for up-dates. |                                                               |                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                                                                                               | Revision 19-02-2019 ©2017 All rights reserved |