

| | | |
|--------------|----------------------|----|
| V_{DRM} | = 2800 | V |
| $I_{T(AV)M}$ | = 1512 | A |
| $I_{T(RMS)}$ | = 2375 | A |
| I_{TSM} | = 23.6×10^3 | A |
| $V_{(T0)}$ | = 1.02 | V |
| r_T | = 0.265 | mW |

Phase Control Thyristor

5STP 16F2801

Doc. No. 5SYA1064-01 March 05

- Low on-state and switching losses
- Designed for traction, energy and industrial applications
- Optimum power handling capability

Blocking

Maximum rated values ¹⁾

| Symbol | Conditions | 5STP 16F2801 | 5STP 16F2601 | 5STP 16F2401 |
|--------------------|--|-----------------------|--------------|--------------|
| V_{DRM}, V_{RRM} | $f = 50 \text{ Hz}, t_p = 10 \text{ ms}$ | 2800 V | 2600 V | 2400 V |
| dV/dt_{crit} | Exp. to 1880 V, $T_{vj} = 125^\circ\text{C}$ | 1000 V/ μs | | |

Characteristic values

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|-------------------------|-----------|---------------------------------------|-----|-----|-----|------|
| Forward leakage current | I_{DRM} | $V_{DRM}, T_{vj} = 125^\circ\text{C}$ | | | 150 | mA |
| Reverse leakage current | I_{RRM} | $V_{RRM}, T_{vj} = 125^\circ\text{C}$ | | | 150 | mA |

Mechanical data

Maximum rated values ¹⁾

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|----------------|--------|------------------|-----|-----|-----|----------------|
| Mounting force | F_M | | 20 | 22 | 24 | kN |
| Acceleration | a | Device unclamped | | | 50 | m/s^2 |
| Acceleration | a | Device clamped | | | 100 | m/s^2 |

Characteristic values

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---------------------------|--------|------------|-----|-----|------|------|
| Weight | m | | | | 0.48 | kg |
| Surface creepage distance | D_s | | 25 | | | mm |
| Air strike distance | D_a | | 13 | | | mm |

1) Maximum rated values indicate limits beyond which damage to the device may occur

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On-state

Maximum rated values ¹⁾

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|-----------------------------------|--------------|--|-----|-----|--------------------|----------------------|
| Average on-state current | $I_{T(AV)M}$ | Half sine wave, $T_c = 70^\circ\text{C}$ | | | 1512 | A |
| RMS on-state current | $I_{T(RMS)}$ | | | | 2375 | A |
| Peak non-repetitive surge current | I_{TSM} | $t_p = 10\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, $V_D = V_R = 0\text{ V}$ | | | 23.6×10^3 | A |
| Limiting load integral | I^2t | | | | 2.79×10^6 | A^2s |
| Peak non-repetitive surge current | I_{TSM} | $t_p = 8.3\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, $V_D = V_R = 0\text{ V}$ | | | 25.2×10^3 | A |
| Limiting load integral | I^2t | | | | 2.64×10^6 | A^2s |

Characteristic values

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|-------------------|------------|--|-----|-----|-------|------------------|
| On-state voltage | V_T | $I_T = 2000\text{ A}$, $T_{vj} = 125^\circ\text{C}$ | | | 1.55 | V |
| Threshold voltage | $V_{(T0)}$ | $I_T = 1900\text{ A} - 5800\text{ A}$, $T_{vj} = 125^\circ\text{C}$ | | | 1.02 | V |
| Slope resistance | r_T | | | | 0.265 | $\text{m}\Omega$ |
| Holding current | I_H | $T_{vj} = 25^\circ\text{C}$ | | 170 | | mA |
| | | $T_{vj} = 125^\circ\text{C}$ | | 90 | | mA |
| Latching current | I_L | $T_{vj} = 25^\circ\text{C}$ | | 450 | | mA |
| | | $T_{vj} = 125^\circ\text{C}$ | | 350 | | mA |

Switching

Maximum rated values ¹⁾

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|----------------|--|-----|-----|------|------------------------|
| Critical rate of rise of on-state current | di/dt_{crit} | $T_{vj} = 125^\circ\text{C}$, $I_T = I_{T(AV)}$, Cont. $f = 50\text{ Hz}$ | | | 200 | $\text{A}/\mu\text{s}$ |
| Critical rate of rise of on-state current | di/dt_{crit} | $V_D \leq 1880\text{ V}$, $I_{FG} = 2\text{ A}$, $t_r = 0.3\ \mu\text{s}$ Cont. $f = 1\text{ Hz}$ | | | 1000 | $\text{A}/\mu\text{s}$ |
| Circuit-commutated turn-off time | t_q | $T_{vj} = 125^\circ\text{C}$, $I_{TRM} = 2000\text{ A}$, $V_R = 200\text{ V}$, $di_T/dt = -12.5\text{ A}/\mu\text{s}$, $V_D \leq 0.67 \cdot V_{DRM}$, $dv_D/dt = 50\text{ V}/\mu\text{s}$ | | 200 | | μs |

Characteristic values

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|-------------------------|----------|--|-----|------|-----|----------------|
| Recovery charge | Q_{rr} | $T_{vj} = 125^\circ\text{C}$, $I_{TRM} = 2000\text{ A}$, $V_R = 200\text{ V}$, $di_T/dt = -12.5\text{ A}/\mu\text{s}$ | | 2600 | | μAs |
| Gate turn-on delay time | t_{gd} | $V_D = 0.4 \cdot V_{RM}$, $I_{FG} = 2\text{ A}$, $t_r = 0.3\ \mu\text{s}$, $T_{vj} = 25^\circ\text{C}$ | | | 2 | μs |

Triggering

Maximum rated values ¹⁾

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---------------------------|--------------------|------------|-----|-----|-----|------|
| Peak forward gate voltage | V _{FGM} | | | | 12 | V |
| Peak forward gate current | I _{FGM} | | | | 10 | A |
| Peak reverse gate voltage | V _{RGM} | | | | 10 | V |
| Mean forward gate power | P _{G(AV)} | | | | 3 | W |

Characteristic values

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|----------------------|-----------------|--------------------------|------|-----|-----|------|
| Gate-trigger voltage | V _{GT} | T _{vj} = -40 °C | | | 4 | V |
| | | T _{vj} = 25 °C | | | 3 | |
| | | T _{vj} = 125 °C | 0.25 | | 2 | |
| Gate-trigger current | I _{GT} | T _{vj} = -40 °C | | | 500 | mA |
| | | T _{vj} = 25 °C | | | 250 | |
| | | T _{vj} = 125 °C | 10 | | 150 | |

Thermal

Maximum rated values ¹⁾

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|--------------------------------------|------------------|------------|-----|-----|-----|------|
| Operating junction temperature range | T _{vj} | | -40 | | 125 | °C |
| Storage temperature range | T _{stg} | | -40 | | 125 | °C |

Characteristic values

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|-------------------------------------|-----------------------|--|-----|-----|-----|------|
| Thermal resistance junction to case | R _{th(j-c)} | Double-side cooled F _m = 20...24 kN | | | 16 | K/kW |
| | R _{th(j-c)A} | Anode-side cooled F _m = 20...24 kN | | | 25 | K/kW |
| | R _{th(j-c)C} | Cathode-side cooled F _m = 20...24 kN | | | 45 | K/kW |
| Thermal resistance case to heatsink | R _{th(c-h)} | Double-side cooled F _m = 20...24 kN | | | 4 | K/kW |
| | R _{th(c-h)} | Single-side cooled F _m = 20...24 kN | | | 8 | K/kW |

Analytical function for transient thermal impedance:

$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_{th i} (1 - e^{-t/t_i})$$

| i | 1 | 2 | 3 | 4 |
|--------------------------|--------|--------|--------|--------|
| R _{th i} (K/kW) | 5.500 | 7.240 | 2.000 | 1.340 |
| τ _i (s) | 0.4653 | 0.1533 | 0.0375 | 0.0034 |

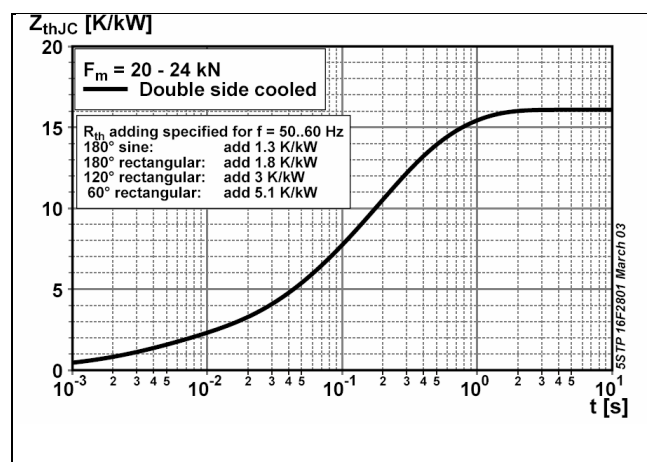


Fig. 1 Transient thermal impedance junction-to case.

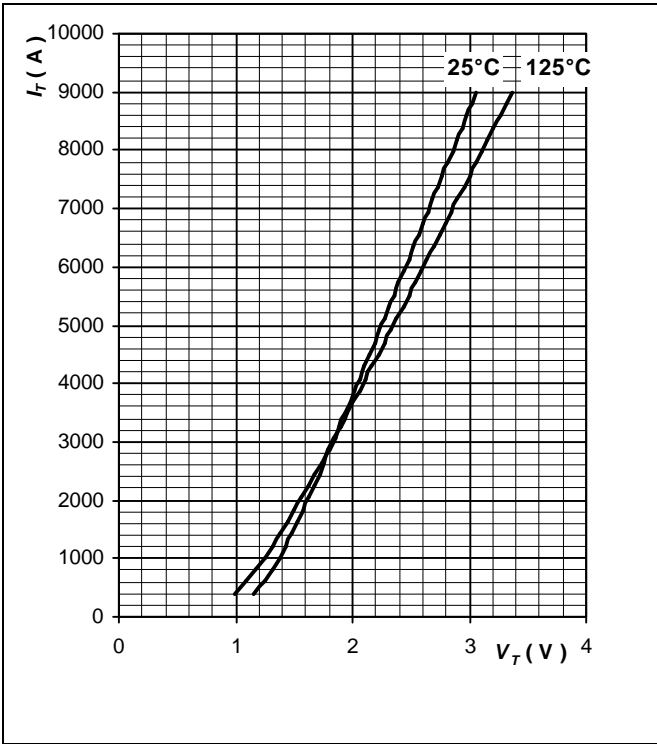


Fig. 2 Max. on-state voltage characteristics

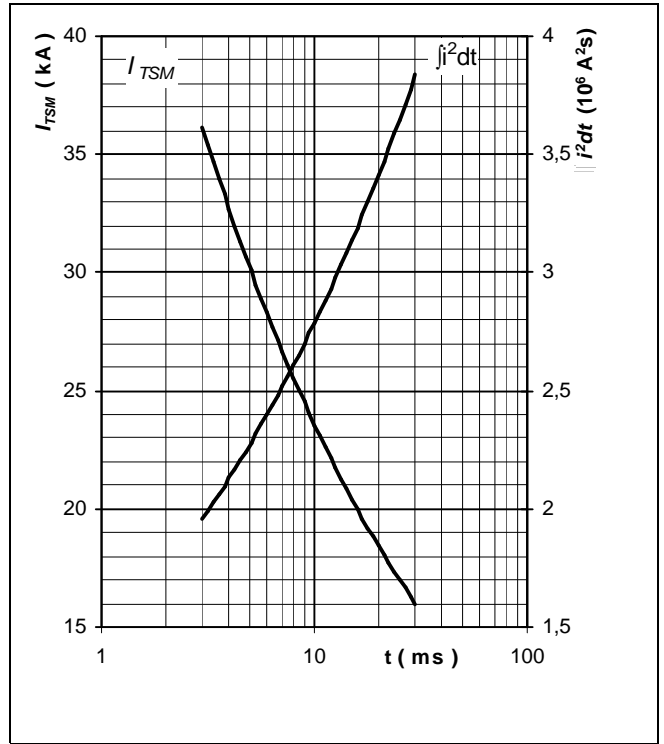


Fig. 3 Surge forward current vs. pulse length. Half sine wave, single pulse, $V_R = 0$ V

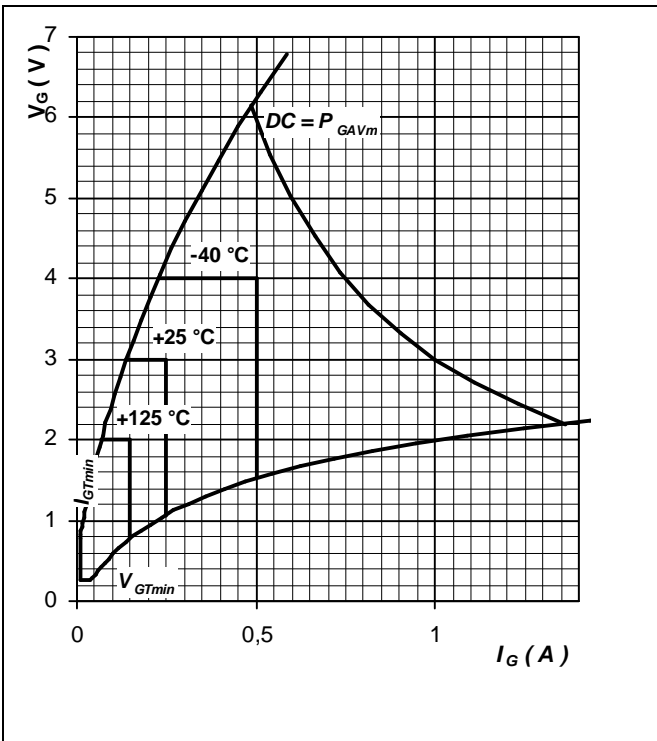


Fig. 4 Gate trigger characteristics

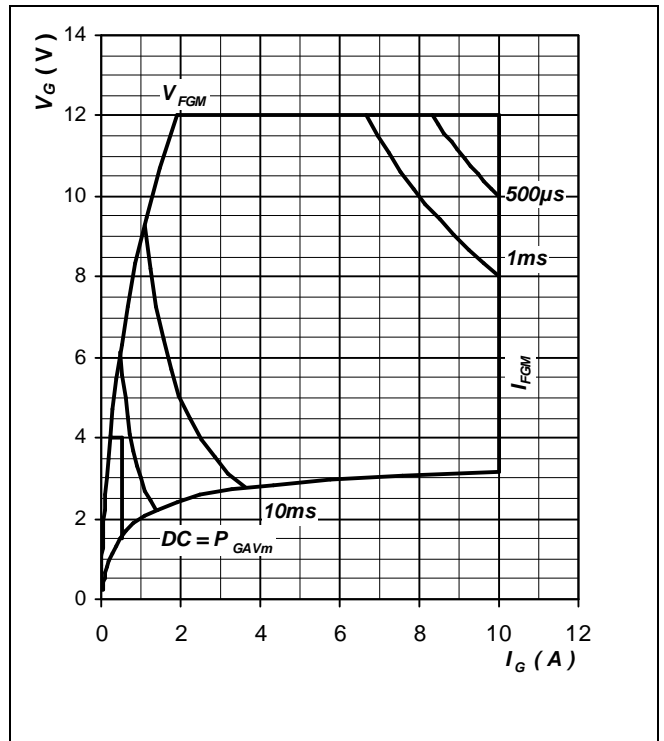


Fig. 5 Gate trigger characteristics

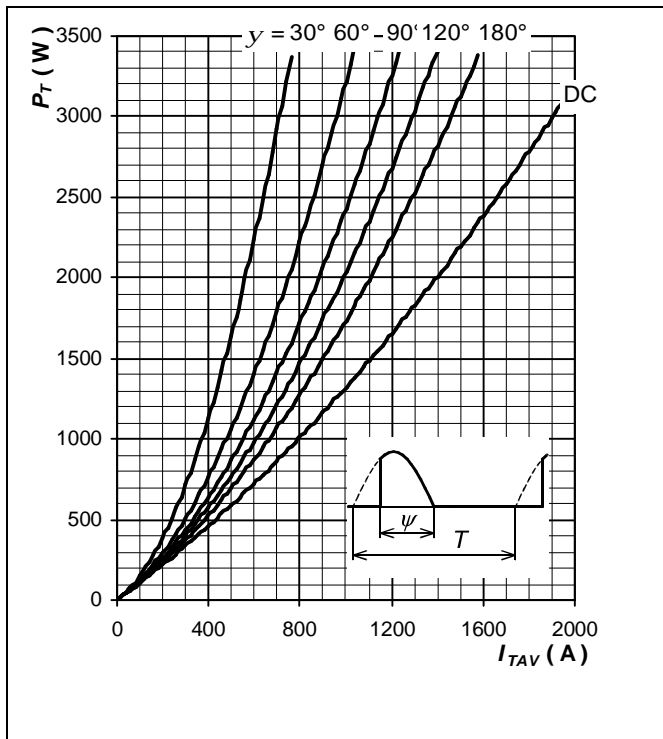


Fig. 6 Forward power loss vs. average forward current, sine waveform, $f = 50 \text{ Hz}$, $T = 1/f$

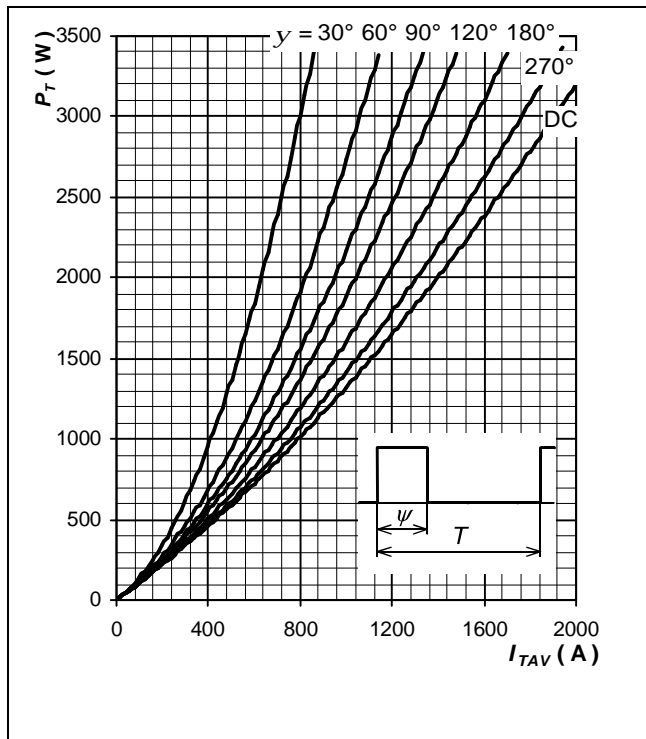


Fig. 7 Forward power loss vs. average forward current, square waveform, $f = 50 \text{ Hz}$, $T = 1/f$

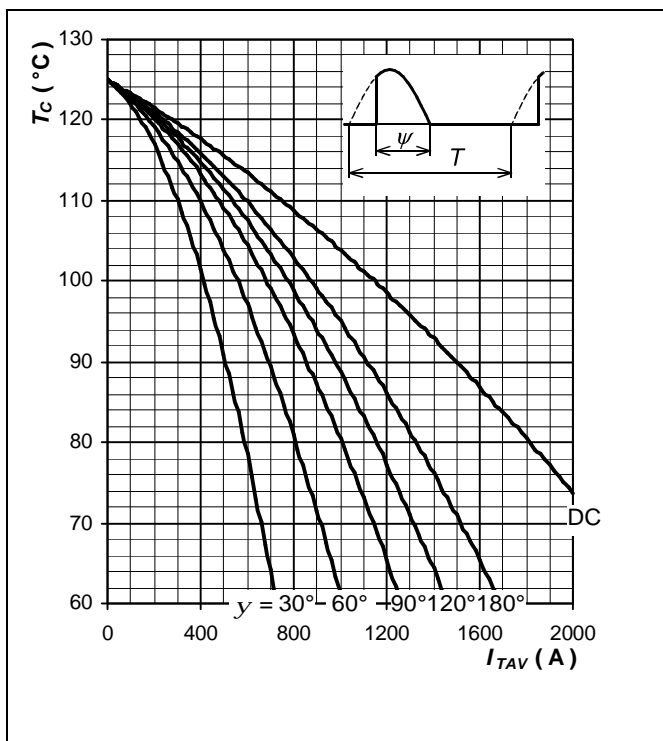


Fig. 8 Max. case temperature vs. average forward current, sine waveform, $f = 50 \text{ Hz}$, $T = 1/f$

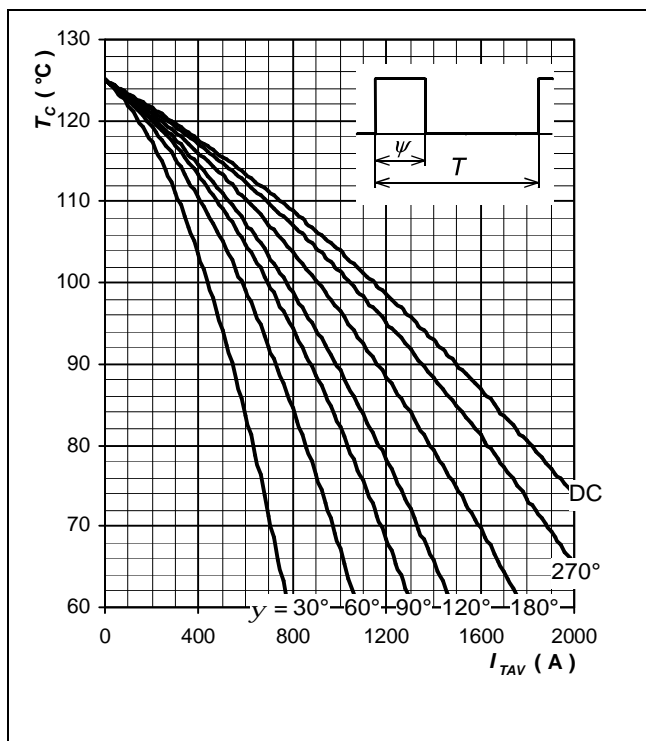


Fig. 9 Max. case temperature vs. average forward current, square waveform, $f = 50 \text{ Hz}$, $T = 1/f$

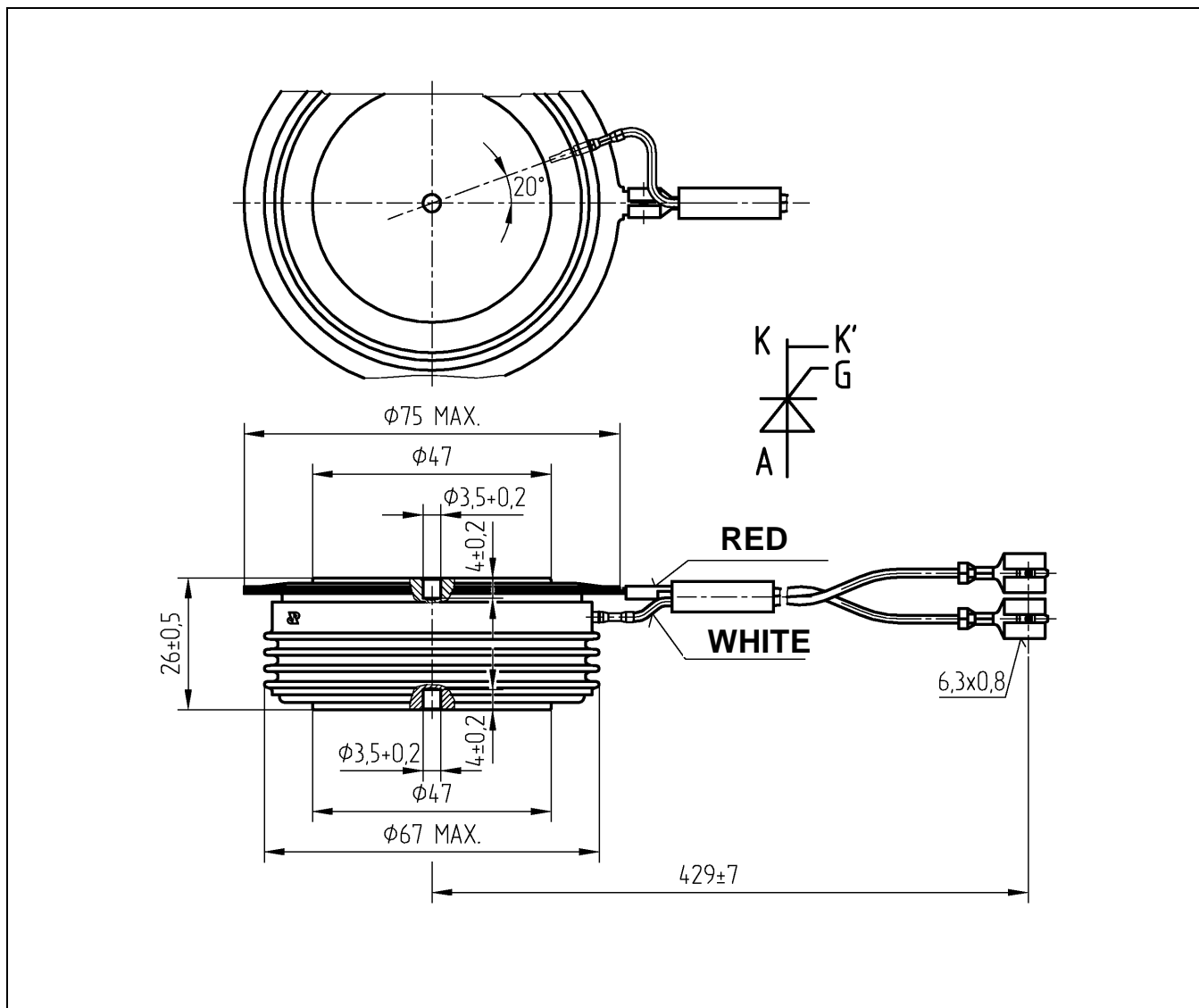


Fig. 10 Device Outline Drawing.

Related application notes:

| Doc. Nr | Titel |
|-----------|---|
| 5SYA2020 | Design of RC-Snubber for Phase Control Applications |
| 5SYA2034 | Gate-drive Recommendations for PCT's |
| 5SYA 2036 | Recommendations regarding mechanical clamping of Press Pack High Power Semiconductors |

Please refer to <http://www.abb.com/semiconductors> for actual versions.

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