



# PROTON-ELECTROTEX RUSSIA

High power cycling capability  
Low on-state and switching losses  
Designed for traction and industrial applications

## Phase Control Thyristor Chip Type TG80-3200-10

|                                                       |            |     |     |                  |     |                       |      |  |
|-------------------------------------------------------|------------|-----|-----|------------------|-----|-----------------------|------|--|
| Maximum allowable mean on-state current <sup>1)</sup> |            |     |     | I <sub>TAV</sub> |     | 3200 A                |      |  |
| Repetitive peak off-state voltage                     |            |     |     | V <sub>DRM</sub> |     | 400...1000 V          |      |  |
| Repetitive peak reverse voltage                       |            |     |     | V <sub>RRM</sub> |     |                       |      |  |
| Turn-off time                                         |            |     |     | t <sub>q</sub>   |     | 250, 320, 400, 500 μs |      |  |
| V <sub>DRM</sub> , V <sub>RRM</sub> , V               | 400        | 500 | 600 | 700              | 800 | 900                   | 1000 |  |
| Voltage code                                          | 4          | 5   | 6   | 7                | 8   | 9                     | 10   |  |
| T <sub>j</sub> , °C                                   | -60...+140 |     |     |                  |     |                       |      |  |

### MAXIMUM ALLOWABLE RATINGS

| Symbols and parameters |                                                                           | Units                          | Values                                   | Test conditions                                                                                                                               |                                                                                                                                                                                                  |
|------------------------|---------------------------------------------------------------------------|--------------------------------|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ON-STATE               |                                                                           |                                |                                          |                                                                                                                                               |                                                                                                                                                                                                  |
| $I_{TAV}$              | Maximum allowable mean on-state current <sup>1)</sup>                     | A                              | 3200<br>4331                             | $T_c=104\text{ }^{\circ}\text{C}$ , Double side cooled<br>$T_c=85\text{ }^{\circ}\text{C}$ , Double side cooled<br>180° half-sine wave; 50 Hz |                                                                                                                                                                                                  |
| $I_{TRMS}$             | RMS on-state current <sup>1)</sup>                                        | A                              | 5024                                     | $T_c=104\text{ }^{\circ}\text{C}$ , Double side cooled<br>180° half-sine wave; 50 Hz                                                          |                                                                                                                                                                                                  |
| $I_{TSM}$              | Surge on-state current <sup>1)</sup>                                      | kA                             | 80.0<br>92.0                             | $T_j=T_{j\text{ max}}$<br>$T_j=25\text{ }^{\circ}\text{C}$                                                                                    | 180° half-sine wave;<br>$t_p=10\text{ ms}$ ; single pulse;<br>$V_D=V_R=0\text{ V}$ ;<br>Gate pulse: $I_G=2\text{ A}$ ;<br>$t_{GP}=50\text{ }\mu\text{s}$ ; $di_G/dt\geq 1\text{ A}/\mu\text{s}$  |
|                        |                                                                           |                                | 84.0<br>97.0                             | $T_j=T_{j\text{ max}}$<br>$T_j=25\text{ }^{\circ}\text{C}$                                                                                    | 180° half-sine wave;<br>$t_p=8.3\text{ ms}$ ; single pulse;<br>$V_D=V_R=0\text{ V}$ ;<br>Gate pulse: $I_G=2\text{ A}$ ;<br>$t_{GP}=50\text{ }\mu\text{s}$ ; $di_G/dt\geq 1\text{ A}/\mu\text{s}$ |
| $I^2t$                 | Safety factor <sup>1)</sup>                                               | $\text{A}^2\text{s}\cdot 10^3$ | 32000<br>42300                           | $T_j=T_{j\text{ max}}$<br>$T_j=25\text{ }^{\circ}\text{C}$                                                                                    | 180° half-sine wave;<br>$t_p=10\text{ ms}$ ; single pulse;<br>$V_D=V_R=0\text{ V}$ ;<br>Gate pulse: $I_G=2\text{ A}$ ;<br>$t_{GP}=50\text{ }\mu\text{s}$ ; $di_G/dt\geq 1\text{ A}/\mu\text{s}$  |
|                        |                                                                           |                                | 29200<br>39000                           | $T_j=T_{j\text{ max}}$<br>$T_j=25\text{ }^{\circ}\text{C}$                                                                                    | 180° half-sine wave;<br>$t_p=8.3\text{ ms}$ ; single pulse;<br>$V_D=V_R=0\text{ V}$ ;<br>Gate pulse: $I_G=2\text{ A}$ ;<br>$t_{GP}=50\text{ }\mu\text{s}$ ; $di_G/dt\geq 1\text{ A}/\mu\text{s}$ |
| BLOCKING               |                                                                           |                                |                                          |                                                                                                                                               |                                                                                                                                                                                                  |
| $V_{DRM}, V_{RRM}$     | Repetitive peak off-state and<br>Repetitive peak reverse voltages         | V                              | 400...1000                               | $T_{j\text{ min}} < T_j < T_{j\text{ max}}$ ;<br>180° half-sine wave; 50 Hz;<br>Gate open                                                     |                                                                                                                                                                                                  |
| $V_{DSM}, V_{RSM}$     | Non-repetitive peak off-state and<br>Non-repetitive peak reverse voltages | V                              | 500...1100                               | $T_{j\text{ min}} < T_j < T_{j\text{ max}}$ ;<br>180° half-sine wave; single pulse;<br>Gate open                                              |                                                                                                                                                                                                  |
| $V_D, V_R$             | Direct off-state and<br>Direct reverse voltages                           | V                              | $0.6\cdot V_{DRM}$<br>$0.6\cdot V_{RRM}$ | $T_j=T_{j\text{ max}}$ ;<br>Gate open                                                                                                         |                                                                                                                                                                                                  |

| TRIGGERING         |                                                                      |              |             |                                                                                                                                                        |
|--------------------|----------------------------------------------------------------------|--------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_{FGM}$          | Peak forward gate current                                            | A            | 10          | $T_j = T_{j \max}$                                                                                                                                     |
| $V_{RGM}$          | Peak reverse gate voltage                                            | V            | 5           |                                                                                                                                                        |
| $P_G$              | Gate power dissipation                                               | W            | 5           | $T_j = T_{j \max}$ for DC gate current                                                                                                                 |
| SWITCHING          |                                                                      |              |             |                                                                                                                                                        |
| $(di_T/dt)_{crit}$ | Critical rate of rise of on-state current non-repetitive ( $f=1$ Hz) | A/ $\mu$ s   | 630         | $T_j = T_{j \max}$ ; $V_D = 0.67 \cdot V_{DRM}$ ; $I_{TM} = 6400$ A;<br>Gate pulse: $I_G = 2$ A;<br>$t_{GP} = 50$ $\mu$ s; $di_G/dt \geq 2$ A/ $\mu$ s |
| THERMAL            |                                                                      |              |             |                                                                                                                                                        |
| $T_{stg}$          | Storage temperature                                                  | $^{\circ}$ C | -60...+50   |                                                                                                                                                        |
| $T_j$              | Operating junction temperature                                       | $^{\circ}$ C | -60...+140  |                                                                                                                                                        |
| MECHANICAL         |                                                                      |              |             |                                                                                                                                                        |
| F                  | Mounting force <sup>1)</sup>                                         | kN           | 40.0...50.0 |                                                                                                                                                        |
| $F_{cg}$           | Force on control gate                                                | N            | 7.8         |                                                                                                                                                        |

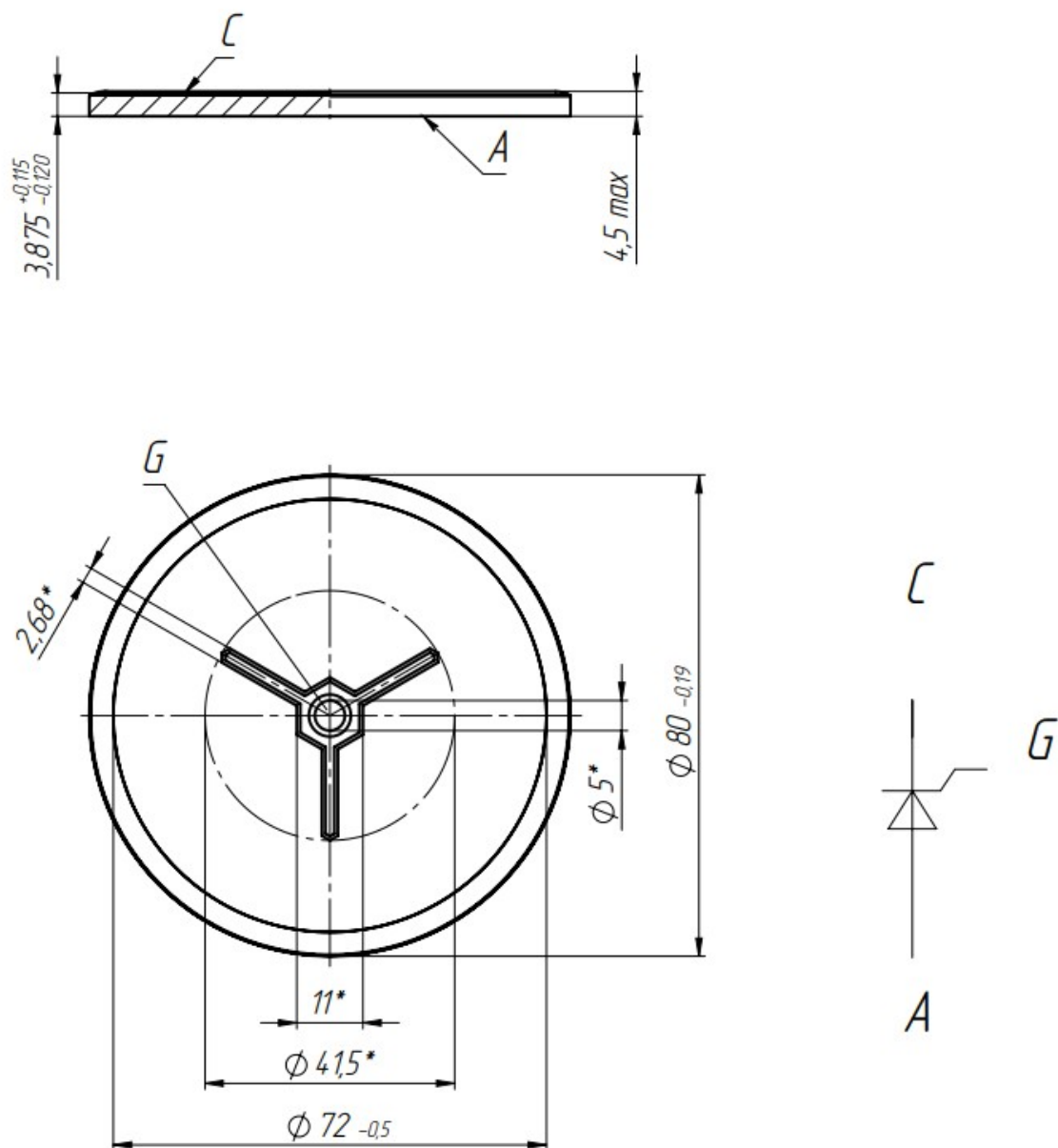
## CHARACTERISTICS

| Symbols and parameters                |                                                                     | Units | Values                                | Conditions                                                                                                                                                                                             |                                                                   |
|---------------------------------------|---------------------------------------------------------------------|-------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| ON-STATE                              |                                                                     |       |                                       |                                                                                                                                                                                                        |                                                                   |
| V <sub>TM</sub>                       | Peak on-state voltage <sup>1)</sup> , max                           | V     | 1.50                                  | T <sub>j</sub> =25 °C; I <sub>TM</sub> =10048 A                                                                                                                                                        |                                                                   |
| V <sub>T(TO)</sub>                    | On-state threshold voltage, max                                     | V     | 0.823                                 | T <sub>j</sub> =T <sub>j max</sub> ;                                                                                                                                                                   |                                                                   |
| r <sub>T</sub>                        | On-state slope resistance <sup>1)</sup> , max                       | mΩ    | 0.063                                 | 0.5 π I <sub>TAV</sub> < I <sub>T</sub> < 1.5 π I <sub>TAV</sub>                                                                                                                                       |                                                                   |
| I <sub>L</sub>                        | Latching current, max                                               | mA    | 1500                                  | T <sub>j</sub> =25 °C; V <sub>D</sub> =12 V;<br>Gate pulse: I <sub>G</sub> =2 A;<br>t <sub>GP</sub> =50 μs; di <sub>G</sub> /dt≥1 A/μs                                                                 |                                                                   |
| I <sub>H</sub>                        | Holding current, max                                                | mA    | 300                                   | T <sub>j</sub> =25 °C;<br>V <sub>D</sub> =12 V; Gate open                                                                                                                                              |                                                                   |
| BLOCKING                              |                                                                     |       |                                       |                                                                                                                                                                                                        |                                                                   |
| I <sub>DRM</sub> , I <sub>RRM</sub>   | Repetitive peak off-state and Repetitive peak reverse currents, max | mA    | 300                                   | T <sub>j</sub> =T <sub>j max</sub> ;<br>V <sub>D</sub> =V <sub>DRM</sub> ; V <sub>R</sub> =V <sub>RRM</sub>                                                                                            |                                                                   |
| (dv <sub>D</sub> /dt) <sub>crit</sub> | Critical rate of rise of off-state voltage <sup>2)</sup> , min      | V/μs  | 200, 320, 500, 1000, 1600, 2000, 2500 | T <sub>j</sub> =T <sub>j max</sub> ;<br>V <sub>D</sub> =0.67·V <sub>DRM</sub> ; Gate open                                                                                                              |                                                                   |
| TRIGGERING                            |                                                                     |       |                                       |                                                                                                                                                                                                        |                                                                   |
| V <sub>GT</sub>                       | Gate trigger direct voltage, max                                    | V     | 3.00<br>2.50<br>1.50                  | T <sub>j</sub> = T <sub>j min</sub><br>T <sub>j</sub> =25 °C<br>T <sub>j</sub> = T <sub>j max</sub>                                                                                                    | V <sub>D</sub> =12 V; I <sub>D</sub> =3 A;<br>Direct gate current |
| I <sub>GT</sub>                       | Gate trigger direct current, max                                    | mA    | 400<br>250<br>150                     | T <sub>j</sub> = T <sub>j min</sub><br>T <sub>j</sub> = 25 °C<br>T <sub>j</sub> = T <sub>j max</sub>                                                                                                   |                                                                   |
| V <sub>GD</sub>                       | Gate non-trigger direct voltage, min                                | V     | 0.35                                  | T <sub>j</sub> =T <sub>j max</sub> ;<br>V <sub>D</sub> =0.67·V <sub>DRM</sub> ;                                                                                                                        |                                                                   |
| I <sub>GD</sub>                       | Gate non-trigger direct current, min                                | mA    | 30.00                                 | Direct gate current                                                                                                                                                                                    |                                                                   |
| SWITCHING                             |                                                                     |       |                                       |                                                                                                                                                                                                        |                                                                   |
| t <sub>gd</sub>                       | Delay time, max                                                     | μs    | 1.00                                  | T <sub>j</sub> =25 °C; V <sub>D</sub> =600 V; I <sub>TM</sub> =I <sub>TAV</sub> ;<br>di/dt=200 A/μs;                                                                                                   |                                                                   |
| t <sub>gt</sub>                       | Turn-on time, max                                                   | μs    | 5.00                                  | Gate pulse: I <sub>G</sub> =2 A; V <sub>G</sub> =20 V;<br>t <sub>GP</sub> =50 μs; di <sub>G</sub> /dt=2 A/μs                                                                                           |                                                                   |
| t <sub>q</sub>                        | Turn-off time <sup>3)</sup> , max                                   | μs    | 250, 320, 400, 500                    | dv <sub>D</sub> /dt=50 V/μs; T <sub>j</sub> =T <sub>j max</sub> ; I <sub>TM</sub> = I <sub>TAV</sub> ;<br>di <sub>R</sub> /dt=-10 A/μs; V <sub>R</sub> =100V;<br>V <sub>D</sub> =0.67·V <sub>DRM</sub> |                                                                   |

| THERMAL             |                                                          |      |        |                |                     |
|---------------------|----------------------------------------------------------|------|--------|----------------|---------------------|
| R <sub>thjc</sub>   | Thermal resistance, junction to case <sup>1)</sup> , max | °C/W | 0.0085 | Direct current | Double side cooled  |
| R <sub>thjc-A</sub> |                                                          |      | 0.0187 |                | Anode side cooled   |
| R <sub>thjc-K</sub> |                                                          |      | 0.0153 |                | Cathode side cooled |
| MECHANICAL          |                                                          |      |        |                |                     |
| m                   | Weight, max                                              | g    | 194    |                |                     |

| PART NUMBERING GUIDE                                    |     |      |     |      |      | NOTES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                 |      |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |
|---------------------------------------------------------|-----|------|-----|------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------|------|----|----|----|----|----|----|----------------------------------------------|-----|-----|-----|------|------|------|------|-----------------|----|----|----|----|----------------------|-----|-----|-----|-----|
| TG                                                      | 80  | 3200 | 10  | A2   | E2   | 1) Depending on the specifications of the housing used. The specified values are relevant when using the Proton-Electrotex T.F2 housing.<br><br>2) Critical rate of rise of off-state voltage                                                                                                                                                                                                                                                                                                                         |  |                 |      |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |
| 1                                                       | 2   | 3    | 4   | 5    | 6    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                 |      |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |
| 1. Phase Control Thyristor Chip with a distributed gate |     |      |     |      |      | <table><tr><th>Symbol of Group</th><th>P2</th><th>K2</th><th>E2</th><th>A2</th><th>T1</th><th>P1</th><th>M1</th></tr><tr><td>(dv<sub>0</sub>/dt)<sub>crit</sub>, V/μs</td><td>200</td><td>320</td><td>500</td><td>1000</td><td>1600</td><td>2000</td><td>2500</td></tr></table><br>3) Turn-off time (dv <sub>D</sub> /dt=50 V/μs)<br><table><tr><th>Symbol of Group</th><th>M2</th><th>K2</th><th>H2</th><th>E2</th></tr><tr><td>t<sub>qf</sub>, μs</td><td>250</td><td>320</td><td>400</td><td>500</td></tr></table> |  | Symbol of Group | P2   | K2 | E2 | A2 | T1 | P1 | M1 | (dv <sub>0</sub> /dt) <sub>crit</sub> , V/μs | 200 | 320 | 500 | 1000 | 1600 | 2000 | 2500 | Symbol of Group | M2 | K2 | H2 | E2 | t <sub>qf</sub> , μs | 250 | 320 | 400 | 500 |
| Symbol of Group                                         | P2  | K2   | E2  | A2   | T1   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  | P1              | M1   |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |
| (dv <sub>0</sub> /dt) <sub>crit</sub> , V/μs            | 200 | 320  | 500 | 1000 | 1600 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  | 2000            | 2500 |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |
| Symbol of Group                                         | M2  | K2   | H2  | E2   |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                 |      |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |
| t <sub>qf</sub> , μs                                    | 250 | 320  | 400 | 500  |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                 |      |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |
| 2. Maximum diameter, mm                                 |     |      |     |      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                 |      |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |
| 3. Mean on-state current, A                             |     |      |     |      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                 |      |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |
| 4. Voltage code                                         |     |      |     |      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                 |      |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |
| 5. Critical rate of rise of off-state voltage, V/μs     |     |      |     |      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                 |      |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |
| 6. Turn-off time (dv <sub>D</sub> /dt=50 V/μs)          |     |      |     |      |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                 |      |    |    |    |    |    |    |                                              |     |     |     |      |      |      |      |                 |    |    |    |    |                      |     |     |     |     |

## OVERALL DIMENSIONS



*\*Dimensions for reference.*

All dimensions in millimeters

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