



Low switching losses  
Low reverse recovery charge  
Distributed amplified gate for high  $di_T/dt$

## Fast Thyristor Type TFIS143-400-15

|                                   |            |      |      |           |                                |      |  |
|-----------------------------------|------------|------|------|-----------|--------------------------------|------|--|
| Mean on-state current             |            |      |      | $I_{TAV}$ | 400 A                          |      |  |
| Repetitive peak off-state voltage |            |      |      | $V_{DRM}$ | 1000 ÷ 1500 V                  |      |  |
| Repetitive peak reverse voltage   |            |      |      | $V_{RRM}$ |                                |      |  |
| Turn-off time                     |            |      |      | $t_q$     | 10.0, 12.5, 16.0, 20.0 $\mu s$ |      |  |
| $V_{DRM}, V_{RRM}, V$             | 1000       | 1100 | 1200 | 1300      | 1400                           | 1500 |  |
| Voltage code                      | 10         | 11   | 12   | 13        | 14                             | 15   |  |
| $T_j, ^\circ C$                   | - 60 ÷ 125 |      |      |           |                                |      |  |

### MAXIMUM ALLOWABLE RATINGS

| Symbols and parameters |                                                                        | Units             | Values                                     | Test conditions                                                               |                                                                                                                                                                             |
|------------------------|------------------------------------------------------------------------|-------------------|--------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ON-STATE</b>        |                                                                        |                   |                                            |                                                                               |                                                                                                                                                                             |
| $I_{TAV}$              | Mean on-state current                                                  | A                 | 400                                        | $T_c = 92^\circ C$ ; Double side cooled;<br>180° half-sine wave; 50 Hz        |                                                                                                                                                                             |
| $I_{TRMS}$             | RMS on-state current                                                   | A                 | 628                                        | $T_c = 92^\circ C$ ; Double side cooled;<br>180° half-sine wave; 50 Hz        |                                                                                                                                                                             |
| $I_{TSM}$              | Surge on-state current                                                 | kA                | 9.0<br>10.5                                | $T_j = T_{jmax}$<br>$T_j = 25^\circ C$                                        | 180° half-sine wave;<br>$t_p = 10$ ms; single pulse;<br>$V_D = V_R = 0$ V;<br>Gate pulse: $I_G = I_{FGM}$ ; $V_G = 20$ V;<br>$t_{GP} = 50 \mu s$ ; $di_G/dt = 1$ A/ $\mu s$ |
|                        |                                                                        |                   | 9.5<br>11.0                                |                                                                               |                                                                                                                                                                             |
| $I^2t$                 | Safety factor                                                          | $A^2s \cdot 10^3$ | 400<br>550                                 | $T_j = T_{jmax}$<br>$T_j = 25^\circ C$                                        | 180° half-sine wave;<br>$t_p = 10$ ms; single pulse;<br>$V_D = V_R = 0$ V;<br>Gate pulse: $I_G = I_{FGM}$ ; $V_G = 20$ V;<br>$t_{GP} = 50 \mu s$ ; $di_G/dt = 1$ A/ $\mu s$ |
|                        |                                                                        |                   | 370<br>500                                 |                                                                               |                                                                                                                                                                             |
| <b>BLOCKING</b>        |                                                                        |                   |                                            |                                                                               |                                                                                                                                                                             |
| $V_{DRM}, V_{RRM}$     | Repetitive peak off-state and Repetitive peak reverse voltages         | V                 | 1000 ÷ 1500                                | $T_{jmin} < T_j < T_{jmax}$ ;<br>180° half-sine wave; 50 Hz;<br>Gate open     |                                                                                                                                                                             |
| $V_{DSM}, V_{RSM}$     | Non-repetitive peak off-state and Non-repetitive peak reverse voltages | V                 | 1100 ÷ 1600                                | $T_{jmin} < T_j < T_{jmax}$ ;<br>180° half-sine wave; single pulse; Gate open |                                                                                                                                                                             |
| $V_D, V_R$             | Direct off-state and Direct reverse voltages                           | V                 | $0.6 \cdot V_{DRM}$<br>$0.6 \cdot V_{RRM}$ | $T_j = T_{jmax}$ ;<br>Gate open                                               |                                                                                                                                                                             |

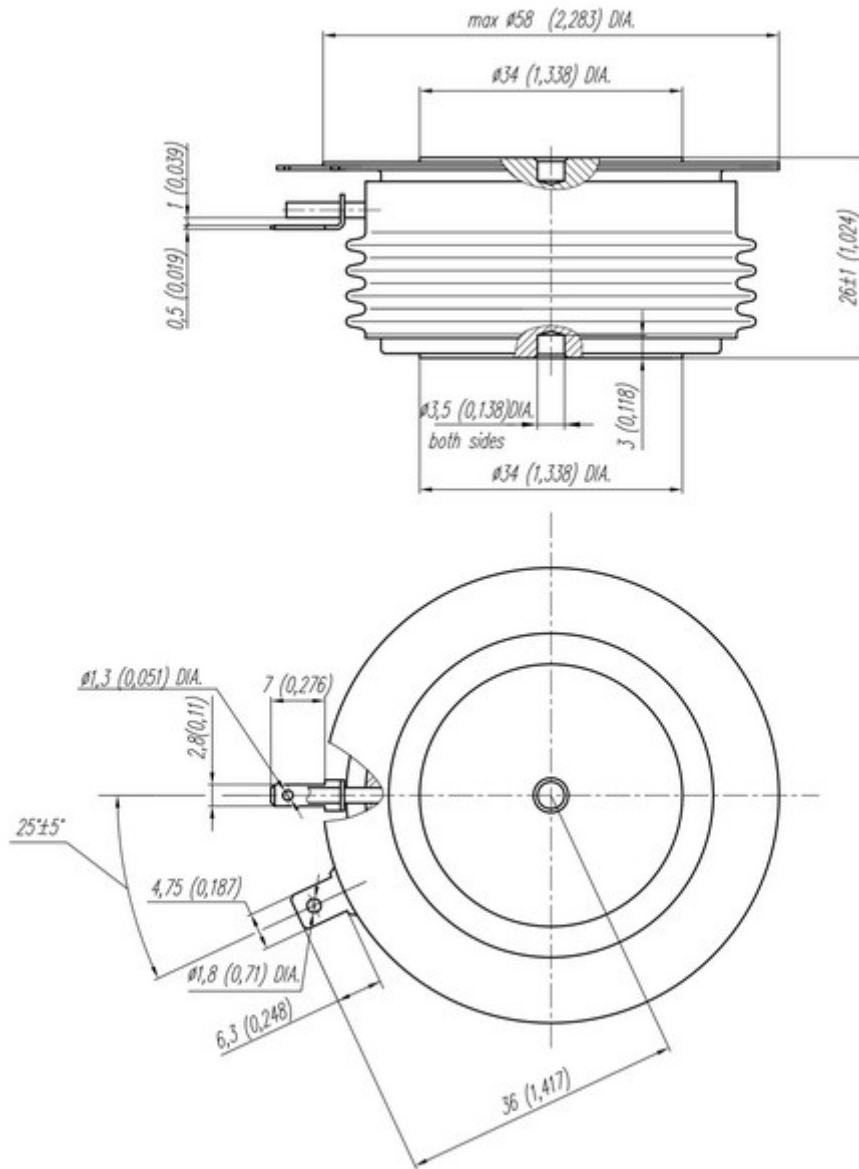
| <b>TRIGGERING</b>  |                                                                      |                  |             |                                                                                                                                                                           |
|--------------------|----------------------------------------------------------------------|------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_{FGM}$          | Peak forward gate current                                            | A                | 8           | $T_j = T_{j\max}$                                                                                                                                                         |
| $V_{RGM}$          | Peak reverse gate voltage                                            | V                | 5           |                                                                                                                                                                           |
| $P_G$              | Gate power dissipation                                               | W                | 8           | $T_j = T_{j\max}$ for DC gate current                                                                                                                                     |
| <b>SWITCHING</b>   |                                                                      |                  |             |                                                                                                                                                                           |
| $(di_T/dt)_{crit}$ | Critical rate of rise of on-state current non-repetitive ( $f=1$ Hz) | A/ $\mu$ s       | 2500        | $T_j = T_{j\max}$ ; $V_D = 0.67 \cdot V_{DRM}$ ; $I_{TM} = 2 I_{TAV}$ ;<br>Gate pulse: $I_G = I_{FGM}$ ; $V_G = 20$ V;<br>$t_{GP} = 50$ $\mu$ s; $di_G/dt = 2$ A/ $\mu$ s |
| <b>THERMAL</b>     |                                                                      |                  |             |                                                                                                                                                                           |
| $T_{stg}$          | Storage temperature                                                  | $^{\circ}$ C     | - 60 ÷ 50   |                                                                                                                                                                           |
| $T_j$              | Operating junction temperature                                       | $^{\circ}$ C     | - 60 ÷ 125  |                                                                                                                                                                           |
| <b>MECHANICAL</b>  |                                                                      |                  |             |                                                                                                                                                                           |
| F                  | Mounting force                                                       | kN               | 14.0 ÷ 16.0 |                                                                                                                                                                           |
| a                  | Acceleration                                                         | m/s <sup>2</sup> | 50          | Device clamped                                                                                                                                                            |

## CHARACTERISTICS

| Symbols and parameters |                                                                     | Units      | Values                 | Conditions                                                                                     |                                                                                                                   |
|------------------------|---------------------------------------------------------------------|------------|------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>ON-STATE</b>        |                                                                     |            |                        |                                                                                                |                                                                                                                   |
| $V_{TM}$               | Peak on-state voltage, max                                          | V          | 3.20                   | $T_j = 25$ $^{\circ}$ C; $I_{TM} = 1256$ A                                                     |                                                                                                                   |
| $I_H$                  | Holding current, max                                                | mA         | 500                    | $T_j = 25$ $^{\circ}$ C;<br>$V_D = 12$ V; Gate open                                            |                                                                                                                   |
| <b>BLOCKING</b>        |                                                                     |            |                        |                                                                                                |                                                                                                                   |
| $I_{DRM}$ , $I_{RRM}$  | Repetitive peak off-state and Repetitive peak reverse currents, max | mA         | 100                    | $T_j = T_{j\max}$ ;<br>$V_D = V_{DRM}$ ; $V_R = V_{RRM}$                                       |                                                                                                                   |
| $(dv_D/dt)_{crit}$     | Critical rate of rise of off-state voltage <sup>1)</sup> , min      | V/ $\mu$ s | 200, 320, 500, 1000    | $T_j = T_{j\max}$ ;<br>$V_D = 0.67 \cdot V_{DRM}$ ; Gate open                                  |                                                                                                                   |
| <b>TRIGGERING</b>      |                                                                     |            |                        |                                                                                                |                                                                                                                   |
| $V_{GT}$               | Gate trigger direct voltage, max                                    | V          | 4.00<br>2.50<br>2.00   | $T_j = T_{j\min}$<br>$T_j = 25$ $^{\circ}$ C<br>$T_j = T_{j\max}$                              | $V_D = 12$ V; $I_D = 3$ A;<br>Direct gate current                                                                 |
| $I_{GT}$               | Gate trigger direct current, max                                    | mA         | 500<br>300<br>200      | $T_j = T_{j\min}$<br>$T_j = 25$ $^{\circ}$ C<br>$T_j = T_{j\max}$                              |                                                                                                                   |
| $V_{GD}$               | Gate non-trigger direct voltage, min                                | V          | 0.25                   | $T_j = T_{j\max}$ ; $V_D = 0.67 \cdot V_{DRM}$ ;                                               |                                                                                                                   |
| $I_{GD}$               | Gate non-trigger direct current, min                                | mA         | 10.00                  | Direct gate current                                                                            |                                                                                                                   |
| <b>SWITCHING</b>       |                                                                     |            |                        |                                                                                                |                                                                                                                   |
| $t_{gd}$               | Delay time, max                                                     | $\mu$ s    | 0.86                   | $T_j = 25$ $^{\circ}$ C; $V_D = 600$ V; $I_{TM} = I_{TAV}$ ;<br>$di/dt = 200$ A/ $\mu$ s;      |                                                                                                                   |
| $t_{gt}$               | Turn-on time <sup>2)</sup>                                          | $\mu$ s    | 2.00, 2.50, 3.20, 4.00 | Gate pulse: $I_G = I_{FGM}$ ; $V_G = 20$ V;<br>$t_{GP} = 50$ $\mu$ s; $di_G/dt = 2$ A/ $\mu$ s |                                                                                                                   |
| $t_q$                  | Turn-off time <sup>3)</sup> , max                                   | $\mu$ s    | 10.0, 12.5, 16.0, 20.0 | $dv_D/dt = 50$ V/ $\mu$ s                                                                      | $T_j = T_{j\max}$ ;<br>$I_{TM} = 400$ A;<br>$di_R/dt = -10$ A/ $\mu$ s;<br>$V_R = 100$ V;<br>$V_D = 0.67 V_{DRM}$ |
|                        |                                                                     |            | 12.5, 16.0, 20.0, 25.0 | $dv_D/dt = 200$ V/ $\mu$ s                                                                     |                                                                                                                   |
| $Q_{rr}$               | Total recovered charge, max                                         | $\mu$ C    | 80                     | $T_j = T_{j\max}$ ; $I_{TM} = 400$ A;                                                          |                                                                                                                   |
| $t_{rr}$               | Reverse recovery time, typ                                          | $\mu$ s    | 2.0                    | $di_R/dt = -50$ A/ $\mu$ s;                                                                    |                                                                                                                   |
| $I_{rrM}$              | Peak reverse recovery current, max                                  | A          | 80                     | $V_R = 100$ V                                                                                  |                                                                                                                   |

| THERMAL      |                                           |              |                  |                |                     |
|--------------|-------------------------------------------|--------------|------------------|----------------|---------------------|
| $R_{thjc}$   | Thermal resistance, junction to case, max | °C/W         | 0.0320           | Direct current | Double side cooled  |
| $R_{thjc-A}$ |                                           |              | 0.0704           |                | Anode side cooled   |
| $R_{thjc-K}$ |                                           |              | 0.0576           |                | Cathode side cooled |
| $R_{thck}$   | Thermal resistance, case to heatsink, max | °C/W         | 0.0060           | Direct current |                     |
| MECHANICAL   |                                           |              |                  |                |                     |
| w            | Weight, max                               | g            | 280              |                |                     |
| $D_s$        | Surface creepage distance                 | mm<br>(inch) | 27.60<br>(1.087) |                |                     |
| $D_a$        | Air strike distance                       | mm<br>(inch) | 16.00<br>(0.630) |                |                     |

| PART NUMBERING GUIDE                                 |     |     |    |    |    |    |   | NOTES                                         |      |      |      |      |
|------------------------------------------------------|-----|-----|----|----|----|----|---|-----------------------------------------------|------|------|------|------|
| TFIS                                                 | 143 | 400 | 15 | A2 | A4 | P4 | N | 1) Critical rate of rise of off-state voltage |      |      |      |      |
| 1                                                    | 2   | 3   | 4  | 5  | 6  | 7  | 8 | Symbol of group                               | P2   | K2   | E2   | A2   |
| 1. TFIS — fast high frequency inverter thyristor     |     |     |    |    |    |    |   | $(dv_D/dt)_{crit}$ , V/ $\mu$ s               | 200  | 320  | 500  | 1000 |
| 2. Design version                                    |     |     |    |    |    |    |   | 2) Turn-on time                               |      |      |      |      |
| 3. Mean on-state current, A                          |     |     |    |    |    |    |   | Symbol of group                               | P4   | M4   | K4   | H4   |
| 4. Voltage code                                      |     |     |    |    |    |    |   | $t_{gt}$ , $\mu$ s                            | 2.00 | 2.50 | 3.20 | 4.00 |
| 5. Critical rate of rise of off-state voltage        |     |     |    |    |    |    |   | 3) Turn-off time ( $dv_D/dt=50$ V/ $\mu$ s)   |      |      |      |      |
| 6. Group of turn-off time ( $dv_D/dt=50$ V/ $\mu$ s) |     |     |    |    |    |    |   | Symbol of group                               | A4   | X3   | T3   | P3   |
| 7. Group of turn-on time                             |     |     |    |    |    |    |   | $t_{qr}$ , $\mu$ s                            | 10.0 | 12.5 | 16.0 | 20.0 |
| 8. Ambient conditions: N – normal; T – tropical      |     |     |    |    |    |    |   |                                               |      |      |      |      |



All dimensions in millimeters (inches)

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