# Fast Thyristor
# AT501S

## Key Parameters

| | | | |
|---|---|---|---|
| $I_{TAV(M)}$ | = | 500 | A |
| $V_{DRM}/V_{RRM}$ | = | 800, 900 | V |
| $I_{TSM}$ | = | 7 | kA |
| $V_{T0}$ | = | 1.5 | V |
| $r_T$ | = | 0.52 | mΩ |

## Properties

- International standard package
- Metal case with ceramic insulator
- Low on-state and switching losses
- High operation reliability
- Optimum power handling capability

## MAXIMUM ALLOWABLE RATINGS

| Symbols and parameters | | | Maximum Limits | | | Unit |
|---|---|---|---|---|---|---|
| $V_{DRM}$<br>$V_{RRM}$ | Repetitive peak forward voltage<br>Repetitive peak reverse voltage | $t_{vj}$ = -40 °C ... $t_{vj\ max}$ | 800 | | 900 | V |
| $V_{DSM}$ | Non-repetitive peak forward off-state voltage | $t_{vj}$ = -40 °C ... $t_{vj\ max}$ | 800 | | 900 | V |
| $V_{RSM}$ | Non-repetitive peak reverse voltage | $t_{vj}$ = +25 °C ... $t_{vj\ max}$ | 900 | | 1000 | V |
| $I_{TAVM}$ | Average on-state current | $t_C$ = 85 °C<br>$t_C$ = 52 °C | 500<br>765 | | | A<br>A |
| $I_{TRMSM}$ | RMS on-state current | | 1200 | | | A |
| $I_{TSM}$ | Surge current | $t_{vj}$ = 25 °C, $t_P$ = 10 ms<br>$t_{vj}$ = $t_{vj\ max}$, $t_P$ = 10 ms | 7.62<br>7 | | | kA<br>kA |
| $I^2t$ | $I^2t$-value | $t_{vj}$ = 25 °C, $t_P$ = 10 ms<br>$t_{vj}$ = $t_{vj\ max}$, $t_P$ = 10 ms | 290<br>245 | | | $kA^2s$<br>$kA^2s$ |
| $(dv/dt)_{cr}$ | Critical rate of rise of off-state voltage | $t_{vj}$ = $t_{vj\ max}$<br>$V_D$ = 0.67 $V_{DRM}$ | | 1) | 2) | |
| | | | L: | 500 | 50 | V/µs |
| $(di/dt)_{cr}$ | Critical rate of rise of on-state current | f = 50 Hz, $I_{GM}$ = 1.5 A<br>$di_G/dt$ = 2 A/µs<br>$V_D \leq 0.67\ V_{DRM}$ | 400 | | | A/µs |

## CHARACTERISTICS

| Symbols and parameters | | | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| $v_T$ | On-state voltage | $t_{vj} = t_{vj\ max}$, $I_T$ = 2300 A | | | 2.85 | V |
| $V_{(TO)}$ | Threshold voltage | $t_{vj} = t_{vj\ max}$ | | 1.5 | | V |
| $r_T$ | Slope resistance | $t_{vj} = t_{vj\ max}$ | | 0.52 | | mΩ |
| $I_{GT}$ | Gate trigger current | $t_{vj}$ = 25 °C, $v_D$ = 6 V | | | 300 | mA |
| $V_{GT}$ | Gate trigger voltage | $t_{vj}$ = 25 °C, $v_D$ = 6 V | | | 2.5 | V |
| $I_{GD}$ | Gate non-trigger current | $t_{vj} = t_{vj\ max}$, $v_D$ = 6 V | | | 40 | mA |
| $V_{GD}$ | Gate non-trigger voltage | $t_{vj} = t_{vj\ max}$, $v_D$ = 0.5 $V_{DRM}$ | | | 0.3 | V |
| $I_H$ | Holding current | $t_{vj}$ = 25 °C, $v_D$ = 6 V<br>$R_A$ = 5 Ω | | | 250 | mA |
| $I_L$ | Latching current | $t_{vj}$ = 25 °C, $v_D$ = 6 V<br>$R_{GK}$ ≥ 10 Ω, $I_{GM}$ = 1 A<br>$di_G/dt$ = 1 A/µs<br>$t_g$ = 20 µs | | | 2 | A |
| $i_D$, $i_R$ | Forward off-state and reverse current | $t_{vj} = t_{vj\ max}$<br>$v_D = V_{DRM}$, $v_R = V_{RRM}$ | | | 100 | mA |
| $t_{gd}$ | Gate controlled delay time | $t_{vj}$ = 25 °C, $I_{GM}$ = 1 A<br>$di_G/dt$ = 1 A/µs | | | 1.5 | µs |
| $t_q$ | Turn-off time | See Techn. Inf. | | | 1[3]: 10<br>2[3]: 12 | µs<br>µs |

## THERMAL PARAMETERS

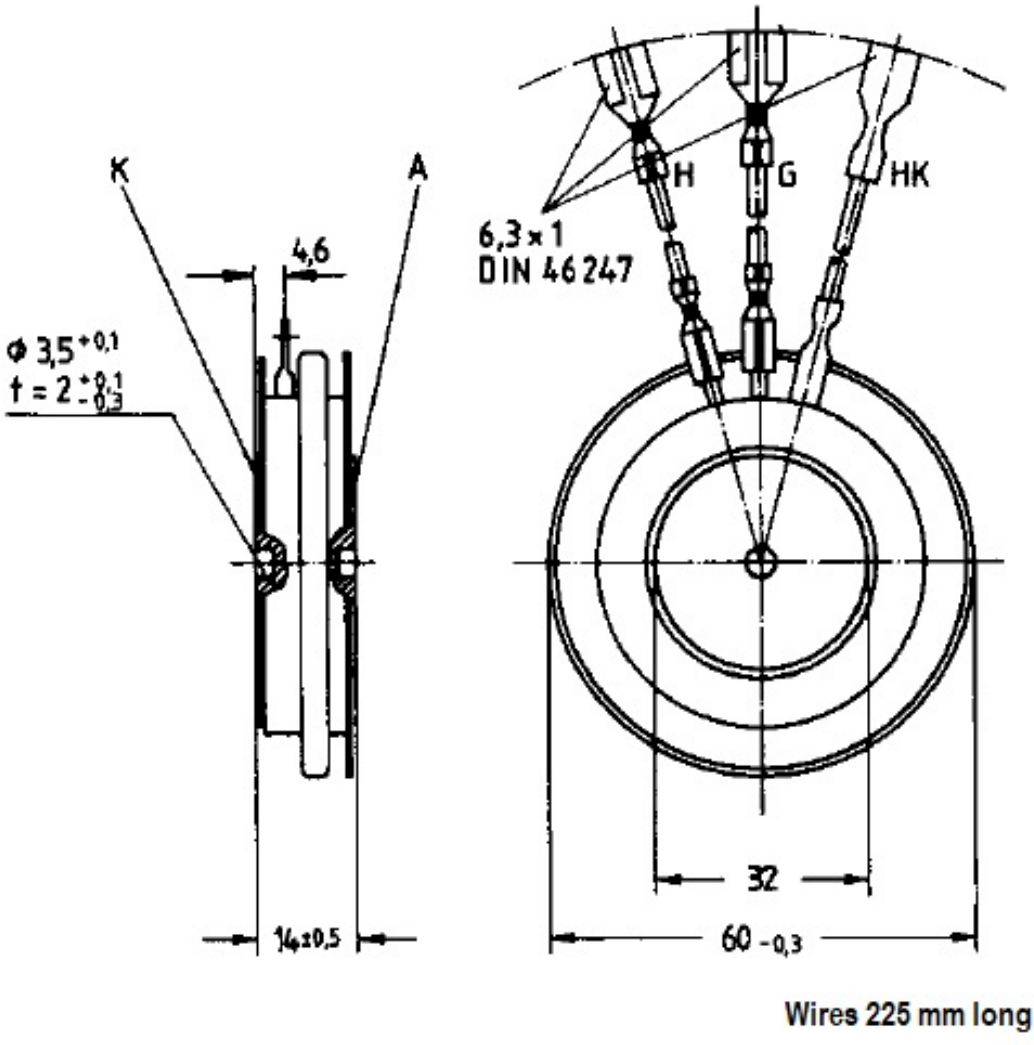
| Symbols and parameters | | | Value | Unit |
|---|---|---|---|---|
| $R_{th(j-c)}$ | Thermal resistance, junction to case | Two-sided cooling, θ = 180° el, sin<br>Two-sided cooling, DC<br>Anode-sided cooling, θ = 180° el, sin<br>Anode-sided cooling, DC<br>Cathode-sided cooling, θ = 180° el, sin<br>Cathode-sided cooling, DC | 0.0384<br>0.0350<br>0.0694<br>0.0660<br>0.0779<br>0.0745 | °C/W |
| $R_{th(c-h)}$ | Thermal resistance, case to heatsink | Two-sided<br>One-sided | 0.006<br>0.012 | °C/W |
| $t_{vj\ max}$ | Maximum junction temperature | | +125 | °C |
| $t_{c\ op}$ | Operating temperature range | | -40 ... +125 | °C |
| $t_{stg}$ | Storage temperature range | | -40 ... +150 | °C |

## MECHANICAL PARAMETERS

| Symbols and parameters | | | Value | Unit |
|---|---|---|---|---|
| **F** | Clamping force | | 9 – 13 | kN |
| **W** | Weight | | 150 | g |
| **D** | Creepage distance | | 14 | mm |
| **a** | Vibration resistance | f = 50 Hz | 50 | m/s² |

[1] - Values to DIN IEC 747-6 (without prior commutation)
[2] - Immediately after circuit commutated turn-off time, see Parameters $t_q$
[3] - $-di_T/dt$ = 100 A/µs; $dv_D/dt$ = 50 V/µs

## DIMENSIONS



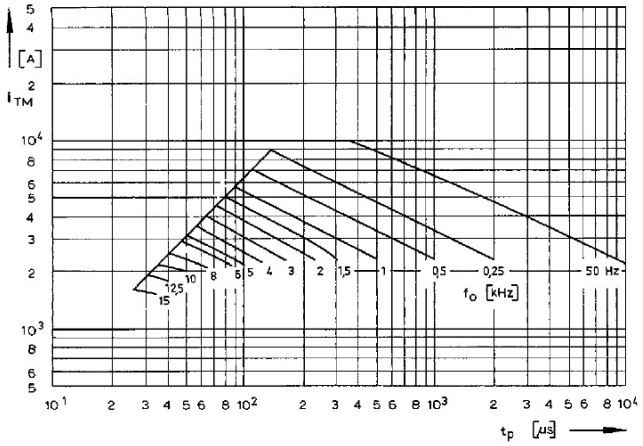



Fig. 1 $t_C$ = 60 °C

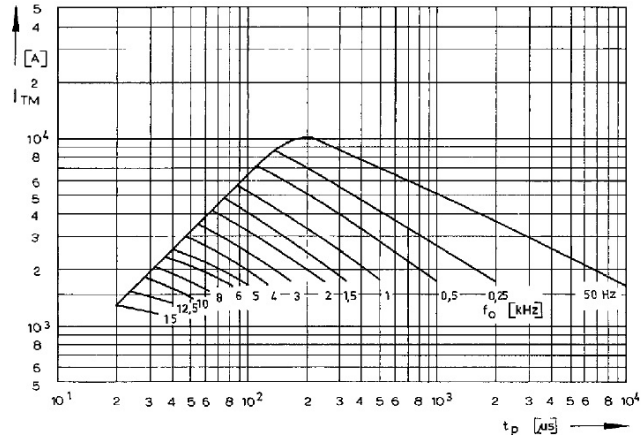



Fig. 2 $t_C$ = 80 °C

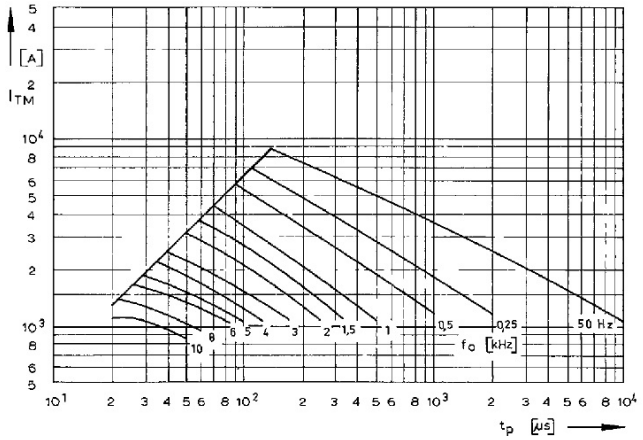
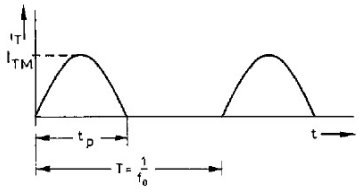



Fig. 3 $t_C$ = 100 °C

Fig. 1, 2, 3
Pulse generator:
$i_G$ = 1.5 A, $di_G/dt$ = 2 A/µs

RC-network:
R ≥ 8.2 Ω
C ≤ 0.22 µF
$v_{DM} \leq 0.85\ V_{DRM}$



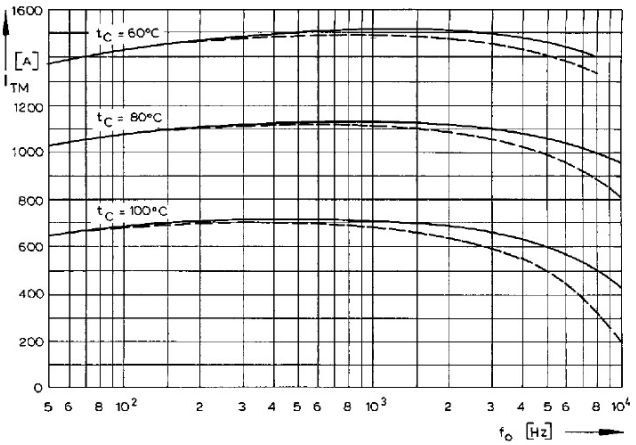




Fig. 4 -$di_T/dt$ = 50 A/µs
RC-network R ≥ 12 Ω, C ≤ 0.22 µF

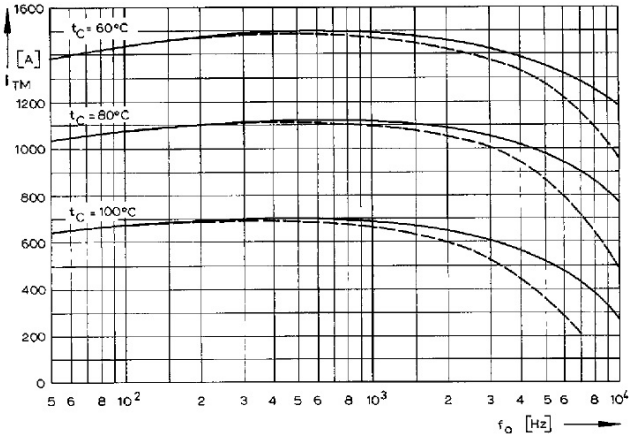



Fig. 5 -$di_T/dt$ = 100 A/µs
RC-network R ≥ 7.5 Ω, C ≤ 0.22 µF

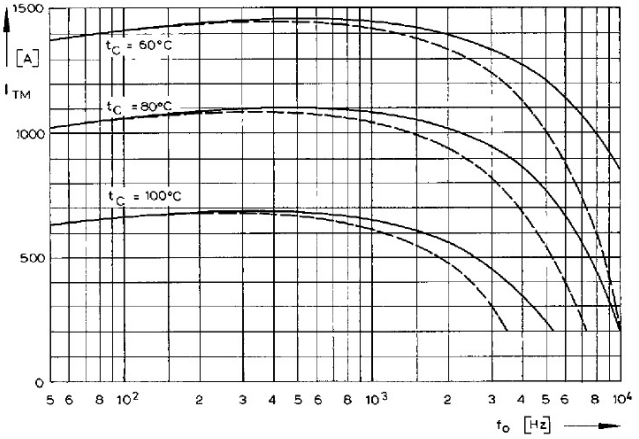
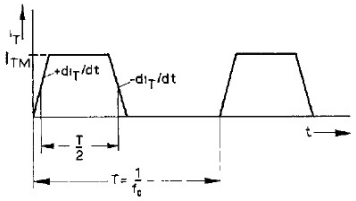



Fig. 6 -$di_T/dt$ = 200 A/µs
RC-network R ≥ 8.2 Ω, C ≤ 0.22 µF

Fig. 4, 5, 6
Pulse generator:
$i_G$ = 1.5 A, $di_G/dt$ = 2 A/µs

$v_{DM} \leq 0.85\ V_{RM}$
$dv_R/dt \leq 600$ V/µs
$v_{RM} \leq 0.85\ V_{RRM}$



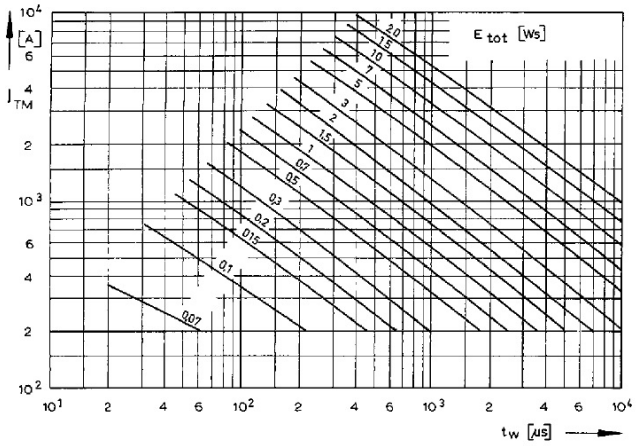



Fig. 7 -di$_T$/dt = 50 A/µs
RC-network R ≥ 12 Ω, C ≤ 0.22 µF

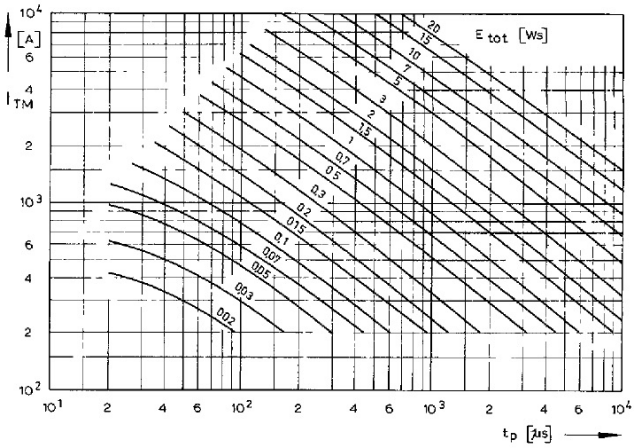



Fig. 10

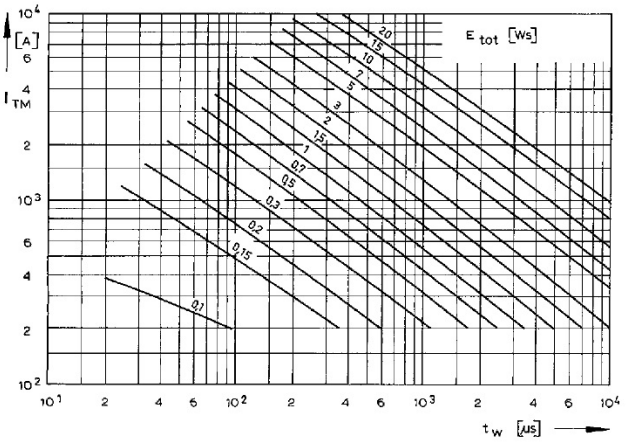



Fig. 8 -di$_T$/dt = 100 A/µs
RC-network R ≥ 7.5 Ω, C ≤ 0.22 µF

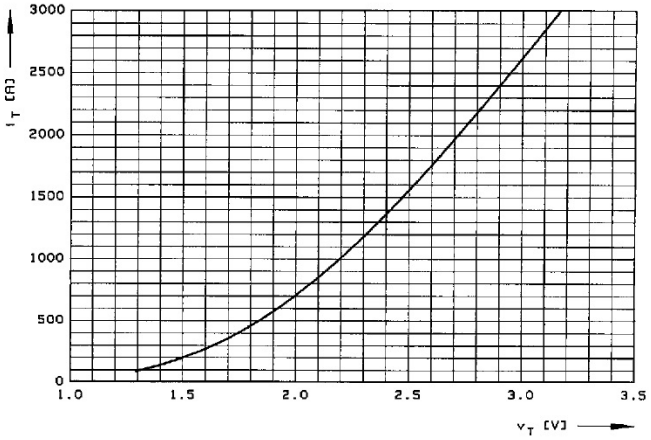



Fig. 11

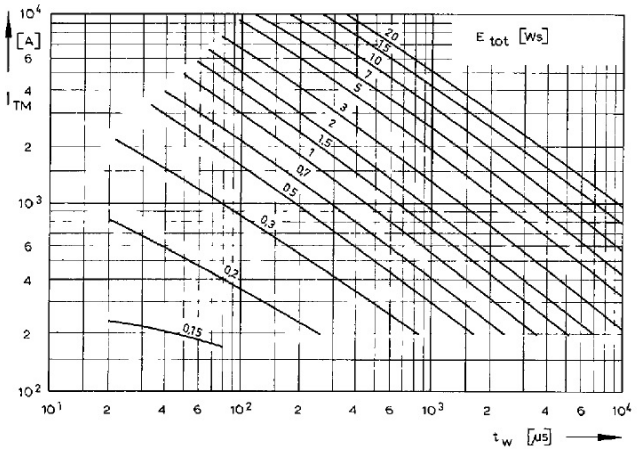



Fig. 9 -di$_T$/dt = 200 A/µs
RC-network R ≥ 8.2 Ω, C ≤ 0.22 µF

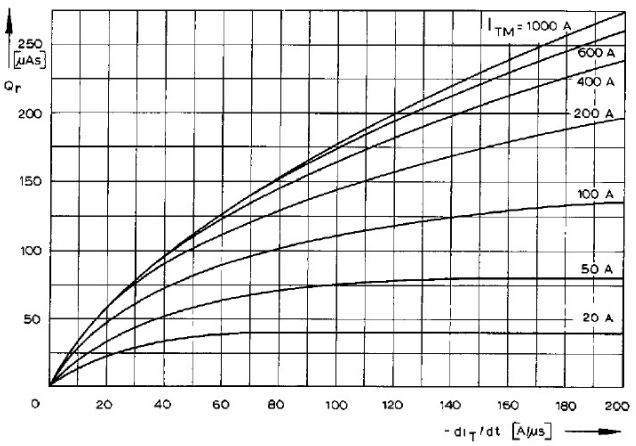



Fig. 12

Fig. 7, 8, 9
Pulse generator:
$i_G$ = 1.5 A, $di_G/dt$ = 2 A/µs

$v_{DM} \le 0.85\ V_{DRM}$
$dv_R/dt \le 600$ V/µs
$v_{RM} \le 0.85\ V_{RRM}$

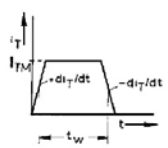
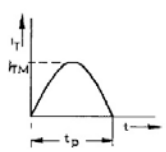



Fig. 10
Pulse generator:
$i_G$ = 1.5 A, $di_G/dt$ = 2 A/µs
$v_{DM} \le 0.85\ V_{DRM}$
$dv_R/dt \le 100$ V/µs
$v_{RM} \le 50$ V

RC-network:
R ≥ 8.2 Ω
C ≤ 0.22 µF



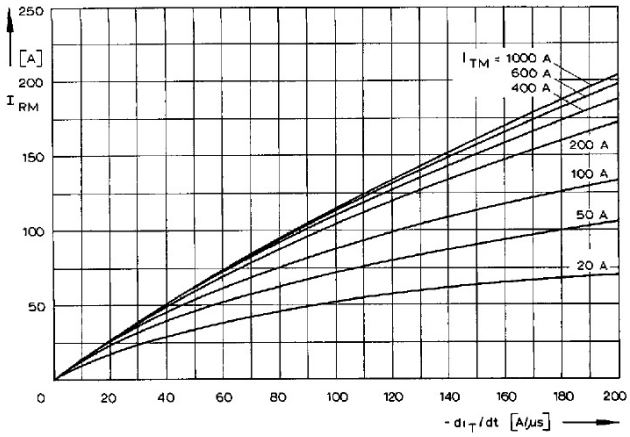



Fig. 13
Peak reverse recovery current
$I_{RM}$ = f(-di/dt), $t_{vj}$ = $t_{vj\ (max)}$, $v_R$ = 0.5 $V_{RRM}$, $v_{RM}$ = 0.8 $V_{RRM}$
Parameter: On-state current $I_{TM}$

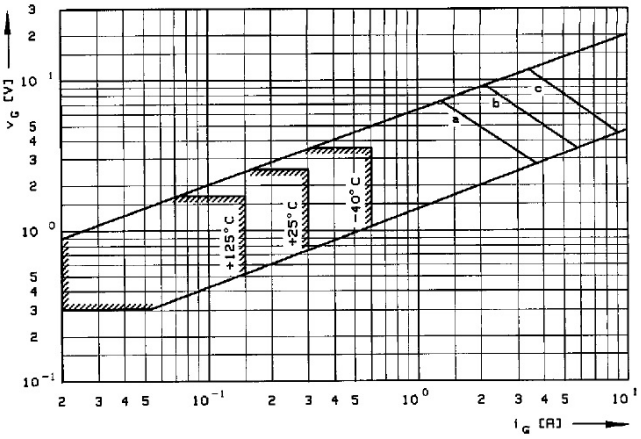



Fig. 15
Gate characteristic with triggering areas $v_G$ = f($I_G$), $V_D$ = 6 V
Parameter: Trigger pulse duration $t_g$ [ms]: a - 10; b - 1; c - 0.5
Maximum rated peak gate power dissipation $P_{GM}$ [W]:
a - 10; b - 20; c - 40

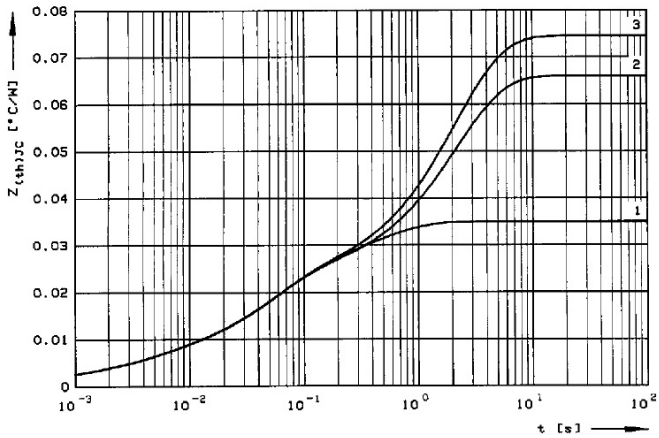



Fig. 14
Transient thermal impedance, $Z_{(th)JC}$ = f(t), DC
1 - Two-sided cooling
2 - Anode side cooling
3 - Cathode side cooling

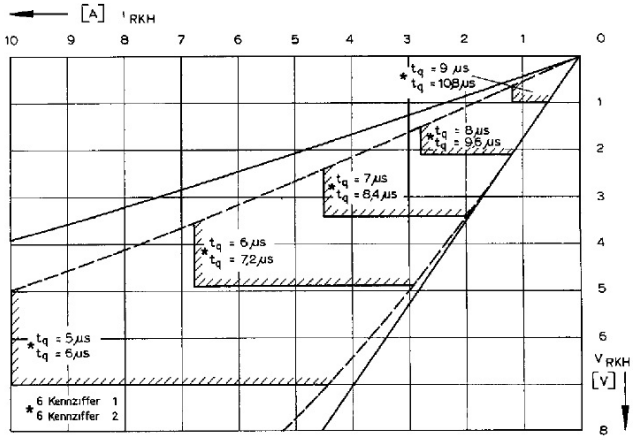



Fig. 16
Gate characteristic $i_{R\,KH}$ = f($V_{R\,KH}$) between terminals HK and K in reverse direction $I_{R\,KH\,RMS}$ = 5 A, $P_{R\,KH\,AV}$ = 20 W, $t_{R\,KH}$ = 14 µs
Parameter: Circuit commutated turn-off time $t_q$
— $t_{vj}$ = $t_{vj\ max}$
-- $t_{vj}$ = 25 °C