

Fast Thyristor

AT431S

Key Parameters

$I_{TAV(M)}$	=	430	A
V_{DRM}/V_{RRM}	=	1100, 1200	V
I_{TSM}	=	6000	A
V_{TO}	=	1.7	V
r_T	=	0.67	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} V_{RRM}	Repetitive peak forward voltage Repetitive peak reverse voltage	$t_{vj} = -40\text{ °C} \dots t_{vj\text{ max}}$	1100 1200	V
V_{DSM}	Non-repetitive peak forward off-state voltage	$t_{vj} = -40\text{ °C} \dots t_{vj\text{ max}}$	1100 1200	V
V_{RSM}	Non-repetitive peak reverse voltage	$t_{vj} = +25\text{ °C} \dots t_{vj\text{ max}}$	1200 1300	V
I_{TAVM}	Average on-state current	$t_C = 85\text{ °C}$ $t_C = 38\text{ °C}$	430 765	A A
I_{TRMSM}	RMS on-state current		1200	A
I_{TSM}	Surge current	$t_{vj} = 25\text{ °C}, t_P = 10\text{ ms}$ $t_{vj} = t_{vj\text{ max}}, t_P = 10\text{ ms}$	6500 6000	A A
I^2t	I^2t -value	$t_{vj} = 25\text{ °C}, t_P = 10\text{ ms}$ $t_{vj} = t_{vj\text{ max}}, t_P = 10\text{ ms}$	210 180	kA ² s kA ² s
$(dv/dt)_{cr}$	Critical rate of rise of off-state voltage	$t_{vj} = t_{vj\text{ max}}$ $V_D = 0.67 V_{DRM}$	L: 500	V/μs
$(di/dt)_{cr}$	Critical rate of rise of on-state current	$f = 50\text{ Hz}, I_{GM} = 1.5\text{ A}$ $di_G/dt = 2\text{ A/μs}$ $V_D \leq 0.67 V_{DRM}$	400	A/μs

CHARACTERISTICS

Symbols and parameters			Value			Unit
			min	typ	max	
V_T	On-state voltage	$t_{vj} = t_{vj \max}, I_T = 2300 \text{ A}$			3.18	V
$V_{(TO)}$	Threshold voltage	$t_{vj} = t_{vj \max}$	1.7			V
r_T	Slope resistance	$t_{vj} = t_{vj \max}$	0.67			mΩ
I_{GT}	Gate trigger current	$t_{vj} = 25^\circ\text{C}, v_D = 6 \text{ V}$			300	mA
V_{GT}	Gate trigger voltage	$t_{vj} = 25^\circ\text{C}, v_D = 6 \text{ V}$			2.5	V
I_{GD}	Gate non-trigger current	$t_{vj} = t_{vj \max}, v_D = 6 \text{ V}$			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	$t_{vj} = 25^\circ\text{C}, v_D = 6 \text{ V}$ $R_A = 5 \Omega$			200	mA
I_L	Latching current	$t_{vj} = 25^\circ\text{C}, v_D = 6 \text{ V}$ $R_{GK} \geq 10 \Omega, I_{GM} = 1 \text{ A}$ $di_G/dt = 1 \text{ A}/\mu\text{s}$ $t_g = 20 \mu\text{s}$			2	A
i_D, i_R	Forward off-state and reverse currents	$t_{vj} = t_{vj \max}$ $v_D = V_{DRM}, v_R = V_{RRM}$			100	mA
t_{gd}	Gate controlled delay time	$t_{vj} = 25^\circ\text{C}, I_{GM} = 1 \text{ A}$ $di_G/dt = 1 \text{ A}/\mu\text{s}$			1.5	μs
t_q	Turn-off time	See Techn. Inf.			1 ³⁾ : 10 2 ³⁾ : 12	μs μs

THERMAL PARAMETERS

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

MECHANICAL PARAMETERS

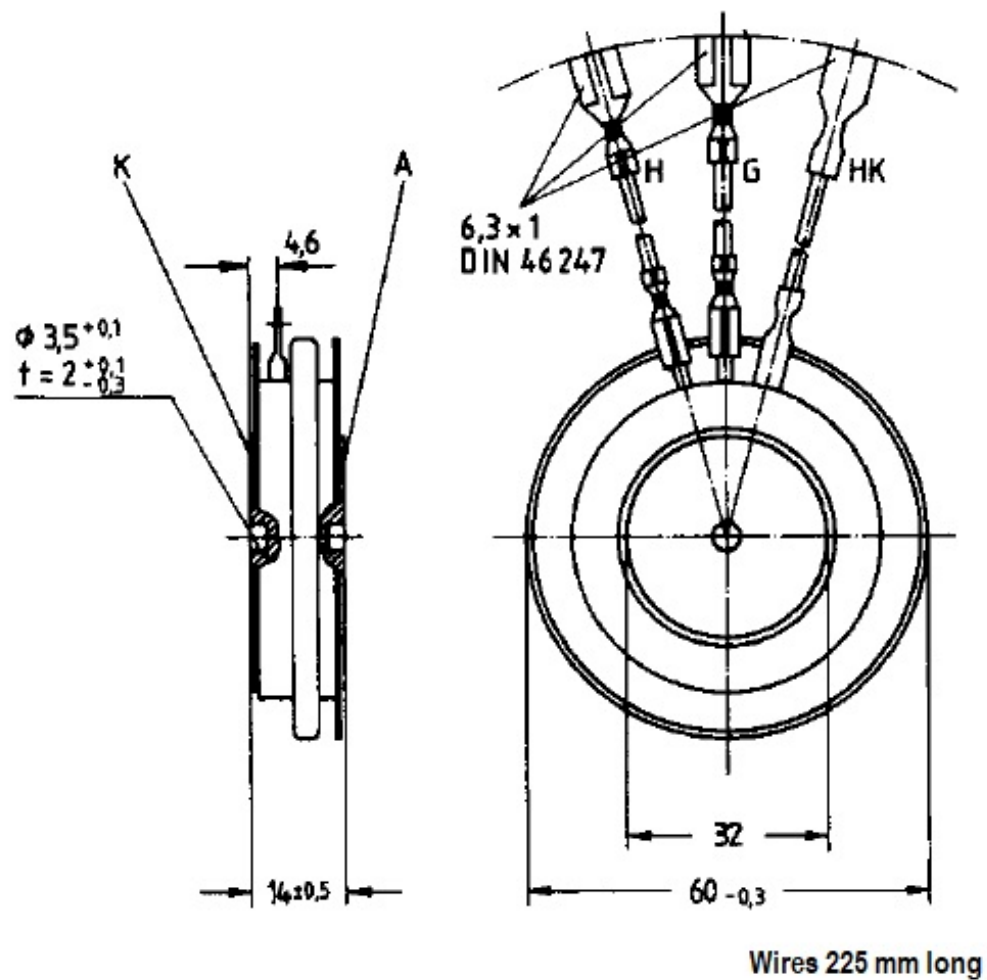
Symbols and parameters			Value	Unit
F	Clamping force		9 – 13	kN
W	Weight		150	g
D	Creepage distance		14	mm
a	Vibration resistance	f = 50 Hz	50	m/s ²

¹⁾ - Values to DIN IEC 747-6 (without prior commutation)

²⁾ - Immediately after circuit commutated turn-off time, see Parameters t_q

³⁾ - $-di_r/dt = 100 \text{ A}/\mu\text{s}$; $dv_o/dt = 50 \text{ V}/\mu\text{s}$

DIMENSIONS



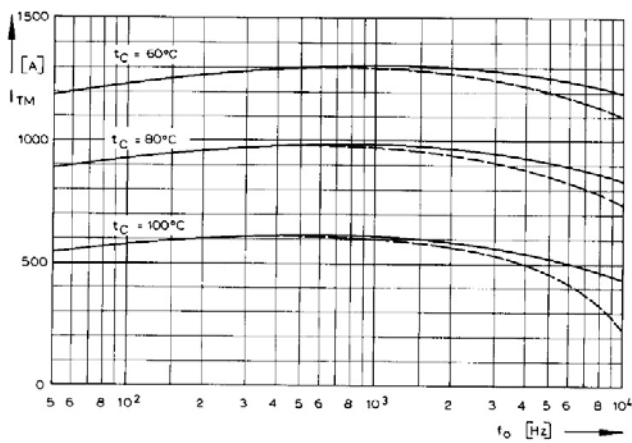


Fig. 1
 $-di_T/dt = 50 \text{ A}/\mu\text{s}$, RC-network $R \geq 15 \Omega$, $C \leq 0.15 \mu\text{F}$

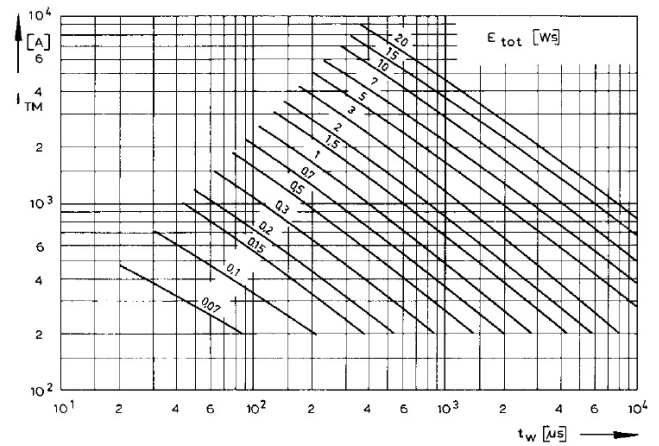


Fig. 4
 $-di_T/dt = 50 \text{ A}/\mu\text{s}$, RC-network $R \geq 15 \Omega$, $C \leq 0.15 \mu\text{F}$

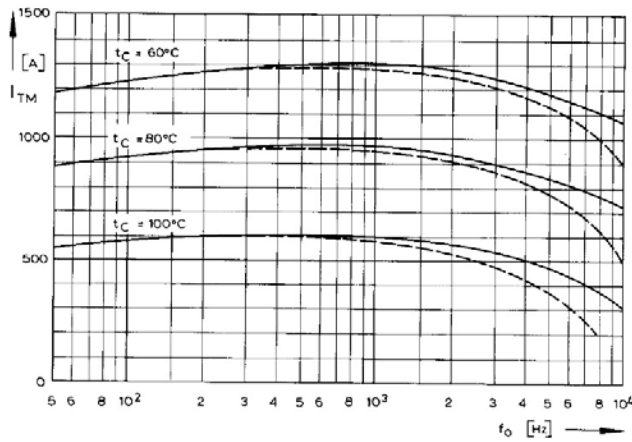


Fig. 2
 $-di_T/dt = 100 \text{ A}/\mu\text{s}$, RC-network $R \geq 12 \Omega$, $C \leq 0.22 \mu\text{F}$

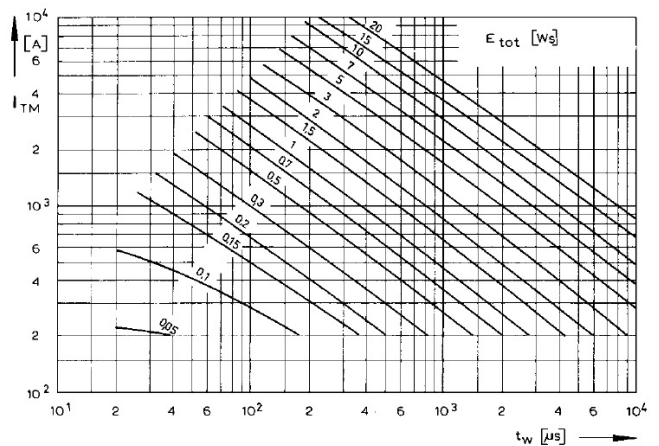


Fig. 5
 $-di_T/dt = 100 \text{ A}/\mu\text{s}$, RC-network $R \geq 12 \Omega$, $C \leq 0.22 \mu\text{F}$

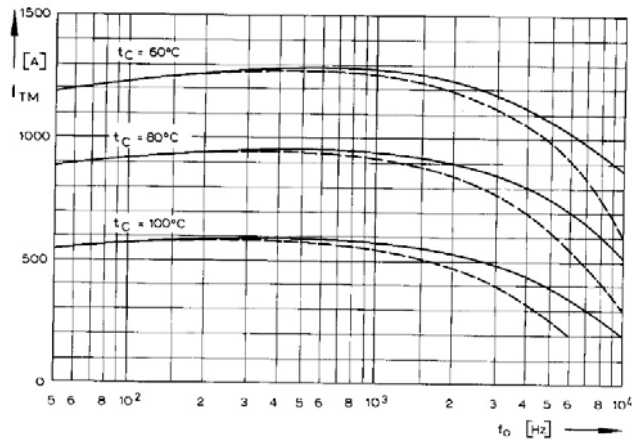


Fig. 3
 $-di_T/dt = 200 \text{ A}/\mu\text{s}$, RC-network $R \geq 6.8 \Omega$, $C \leq 0.33 \mu\text{F}$

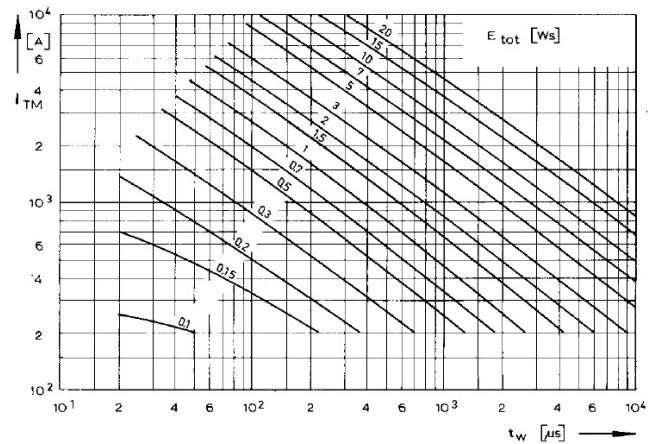


Fig. 6
 $-di_T/dt = 200 \text{ A}/\mu\text{s}$, RC-network $R \geq 6.8 \Omega$, $C \leq 0.33 \mu\text{F}$

Fig. 1, 2, 3
Pulse generator:
 $i_G = 1.5 \text{ A}$, $di_G/dt = 2 \text{ A}/\mu\text{s}$
 $-dv_R/dt \leq 600 \text{ V}/\mu\text{s}$, $v_{RM} \leq 0.67 V_{RRM}$
 $V_{DM} \leq 0.67 V_{DRM}$

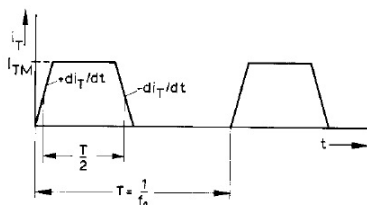
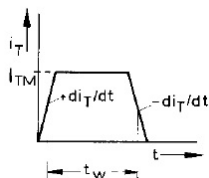


Fig. 4, 5, 6
Pulse generator:
 $i_G = 1.5 \text{ A}$, $di_G/dt = 2 \text{ A}/\mu\text{s}$



$V_{DM} \leq 0.67 V_{DRM}$
 $dv_R/dt \leq 600 \text{ V}/\mu\text{s}$
 $v_{RM} \leq 0.67 V_{RRM}$

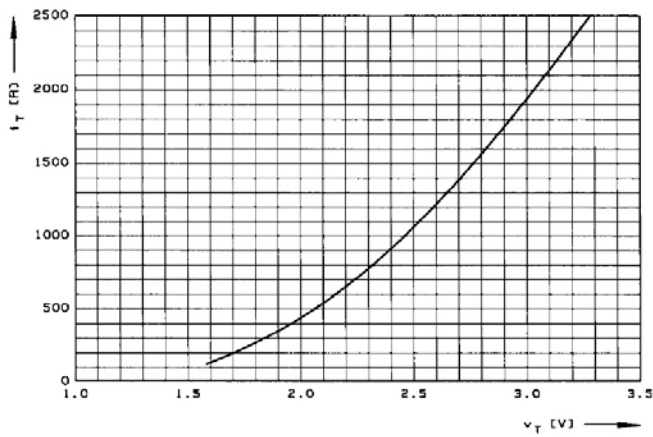


Fig. 7

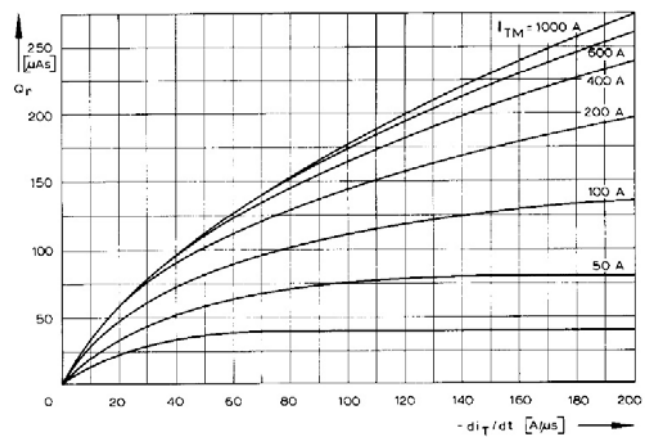


Fig. 10

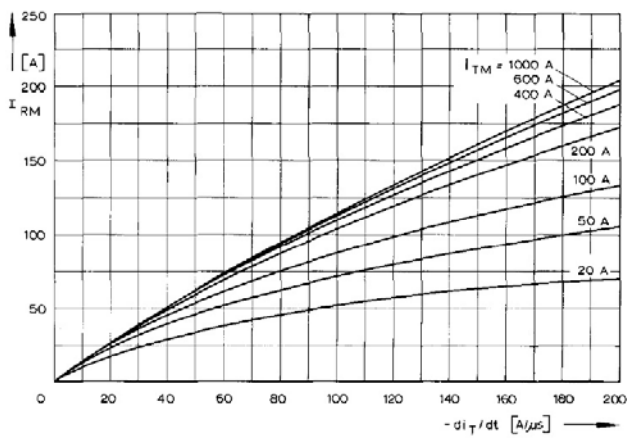


Fig. 8
Peak reverse recovery current
 $I_{RM} = f(-di_T/dt)$, $t_{vj} = t_{vj(max)}$, $V_R = 0.5 V_{RRM}$, $V_{RM} = 0.8 V_{RRM}$
Parameter: On-state current I_{TM}

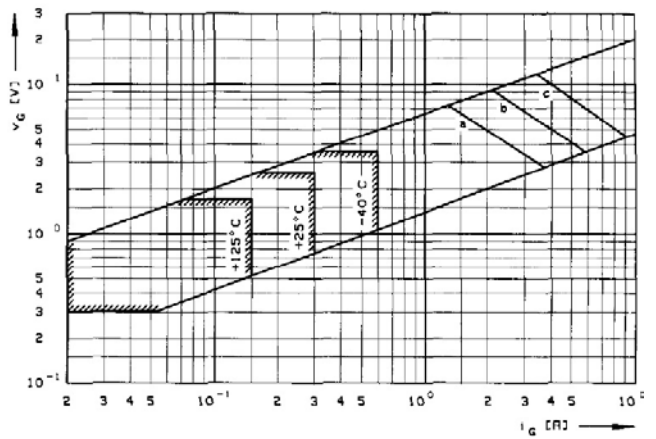


Fig. 11
Gate characteristic with triggering areas $V_G = f(I_G)$, $V_D = 6 V$
Parameter: Trigger pulse duration t_g [ms]: a - 10; b - 1; c - 0.5
Maximum rated peak gate power dissipation P_{GM} [W]:
a - 10; b - 20; c - 40

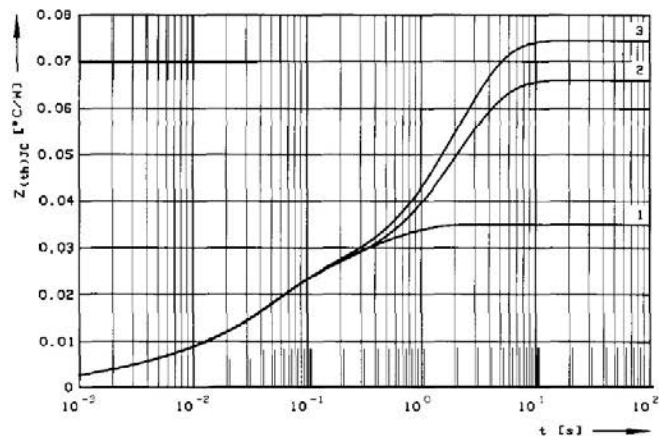


Fig. 9
Transient thermal impedance $Z_{(th)JC} = f(t)$, DC
1 — Two-sided cooling
2 — Anode side cooling
3 — Cathode side cooling

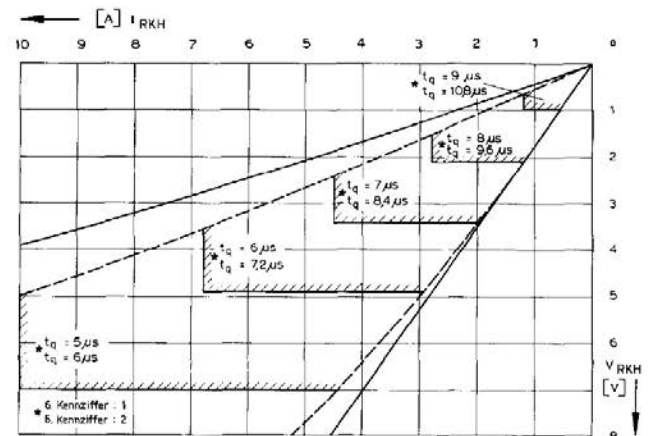


Fig. 12
Gate characteristic $I_{RKH} = f(V_{RKH})$ between terminals HK and K in reverse direction
Parameter: Circuit commutated turn-off time t_q
— $t_{vj} = t_{vj(max)}$
-- 25 °C