



**Fast Thyristor  
Type TFI233-400-24**

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

Mean on-state current	$I_{TAV}$	400 A	
Repetitive peak off-state voltage	$V_{DRM}$	2000 ÷ 2400 V	
Repetitive peak reverse voltage	$V_{RRM}$		
Turn-off time	$t_q$	50.0, 63.0 $\mu$ s	
$V_{DRM}, V_{RRM}, V$	2000	2200	2400
Voltage code	20	22	24
$T_j, ^\circ C$	- 60 ÷ 125		

**MAXIMUM ALLOWABLE RATINGS**

Symbols and parameters		Units	Values	Test conditions
<b>ON-STATE</b>				
$I_{TAV}$	Mean on-state current	A	400 545	$T_c = 80^\circ C$ ; Double side cooled; $T_c = 55^\circ C$ ; Double side cooled; 180° half-sine wave; 50 Hz
$I_{TRMS}$	RMS on-state current	A	628	$T_c = 80^\circ C$ ; Double side cooled; 180° half-sine wave; 50 Hz
$I_{TSM}$	Surge on-state current	kA	6.6 7.5	$T_j = T_{jmax}$ $T_j = 25^\circ C$ 180° half-sine wave; $t_p = 10$ ms; single pulse; $V_D = V_R = 0$ V; Gate pulse: $I_G = I_{FGM}$ ; $V_G = 20$ V; $t_{GP} = 50$ $\mu$ s; $di_G/dt = 1$ A/ $\mu$ s
			7.0 8.0	$T_j = T_{jmax}$ $T_j = 25^\circ C$ 180° half-sine wave; $t_p = 8.3$ ms; single pulse; $V_D = V_R = 0$ V; Gate pulse: $I_G = I_{FGM}$ ; $V_G = 20$ V; $t_{GP} = 50$ $\mu$ s; $di_G/dt = 1$ A/ $\mu$ s
$I^2t$	Safety factor	$A^2s \cdot 10^3$	210 280	$T_j = T_{jmax}$ $T_j = 25^\circ C$ 180° half-sine wave; $t_p = 10$ ms; single pulse; $V_D = V_R = 0$ V; Gate pulse: $I_G = I_{FGM}$ ; $V_G = 20$ V; $t_{GP} = 50$ $\mu$ s; $di_G/dt = 1$ A/ $\mu$ s
			200 260	$T_j = T_{jmax}$ $T_j = 25^\circ C$ 180° half-sine wave; $t_p = 8.3$ ms; single pulse; $V_D = V_R = 0$ V; Gate pulse: $I_G = I_{FGM}$ ; $V_G = 20$ V; $t_{GP} = 50$ $\mu$ s; $di_G/dt = 1$ A/ $\mu$ s
<b>BLOCKING</b>				
$V_{DRM}, V_{RRM}$	Repetitive peak off-state and Repetitive peak reverse voltages	V	2000÷2400	$T_{jmin} < T_j < T_{jmax}$ ; 180° half-sine wave; 50 Hz; Gate open
$V_{DSM}, V_{RSM}$	Non-repetitive peak off-state and Non-repetitive peak reverse voltages	V	2100÷2500	$T_{jmin} < T_j < T_{jmax}$ ; 180° half-sine wave; single pulse; Gate open
$V_D, V_R$	Direct off-state and Direct reverse voltages	V	0.6 $V_{DRM}$ 0.6 $V_{RRM}$	$T_j = T_{jmax}$ ; Gate open

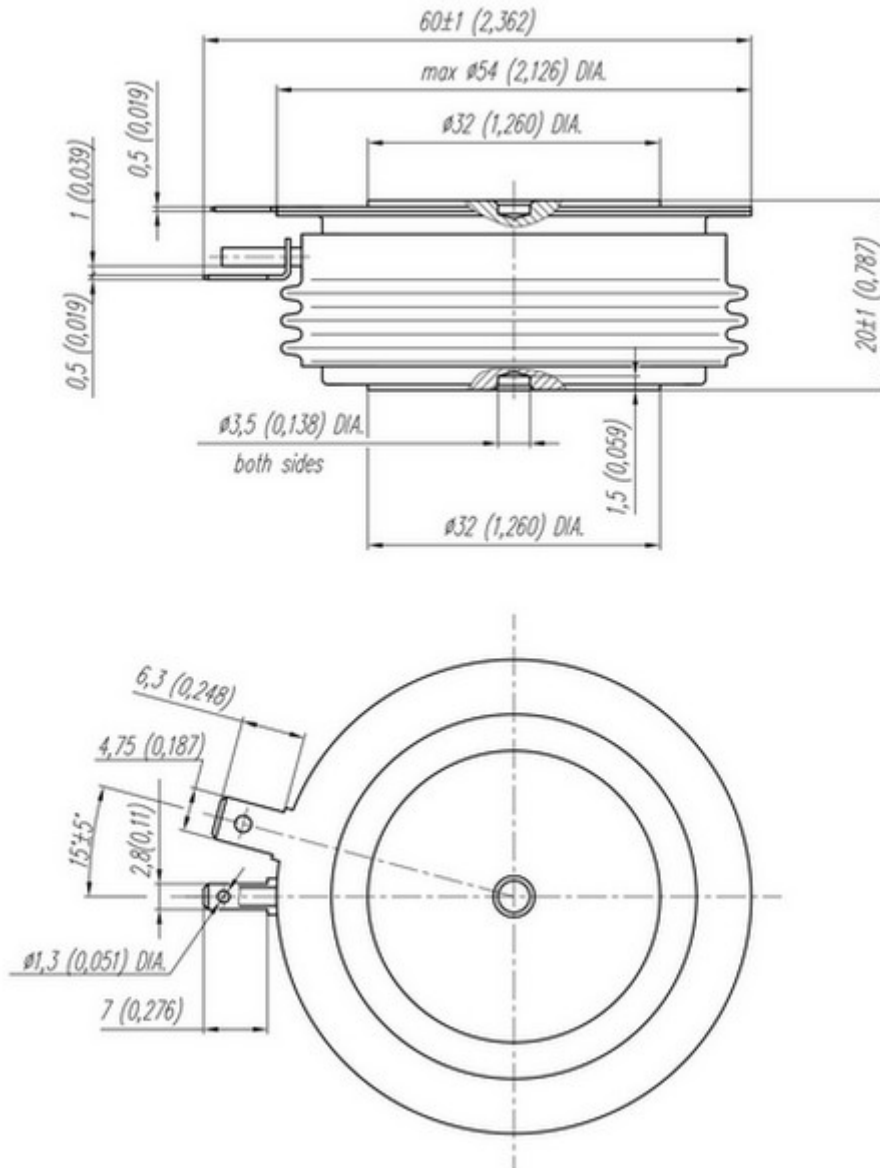
<b>TRIGGERING</b>				
$I_{FGM}$	Peak forward gate current	A	6	$T_j = T_{j\max}$
$V_{RGM}$	Peak reverse gate voltage	V	5	
$P_G$	Gate power dissipation	W	3	$T_j = T_{j\max}$ for DC gate current
<b>SWITCHING</b>				
$(di_T/dt)_{crit}$	Critical rate of rise of on-state current non-repetitive (f=1 Hz)	A/ $\mu$ s	1600	$T_j = T_{j\max}$ ; $V_D = 0.67 \cdot V_{DRM}$ ; $I_{TM} = 2 I_{TAV}$ ; Gate pulse: $I_G = I_{FGM}$ ; $V_G = 20$ V; $t_{GP} = 50$ $\mu$ 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	9.0 ÷ 11.0	
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	2.20	$T_j = 25$ $^{\circ}$ C; $I_{TM} = 1256$ A	
$V_{T(TO)}$	On-state threshold voltage, max	V	1.40	$T_j = T_{j\max}$ ;	
$r_T$	On-state slope resistance, max	m $\Omega$	0.870	$0.5 \pi I_{TAV} < I_T < 1.5 \pi I_{TAV}$	
$I_H$	Holding current, max	mA	500	$T_j = 25$ $^{\circ}$ C; $V_D = 12$ V; Gate open	
<b>BLOCKING</b>					
$I_{DRM}, I_{RRM}$	Repetitive peak off-state and Repetitive peak reverse currents, max	mA	50	$T_j = T_{j\max}$ ; $V_D = V_{DRM}$ ; $V_R = V_{RRM}$	
$(dv_D/dt)_{crit}$	Critical rate of rise of off-state voltage <sup>1)</sup> , min	V/ $\mu$ s	200, 320, 500, 1000	$T_j = T_{j\max}$ ; $V_D = 0.67 \cdot V_{DRM}$ ; Gate open	
<b>TRIGGERING</b>					
$V_{GT}$	Gate trigger direct voltage, max	V	4.00	$T_j = T_{j\min}$ $T_j = 25$ $^{\circ}$ C	V <sub>D</sub> =12 V; I <sub>D</sub> =3 A; Direct gate current
			2.50		
$I_{GT}$	Gate trigger direct current, max	mA	2.00	$T_j = T_{j\max}$	
			500		
			300		
$V_{GD}$	Gate non-trigger direct voltage, min	V	0.25	$T_j = T_{j\max}$ ; $V_D = 0.67 \cdot V_{DRM}$ ; Direct gate current	
$I_{GD}$	Gate non-trigger direct current, min	mA	10.00		
<b>SWITCHING</b>					
$t_{gd}$	Delay time, max	$\mu$ s	0.60	$T_j = 25$ $^{\circ}$ C; $V_D = 1000$ V; $I_{TM} = I_{TAV}$ ; $di/dt = 200$ A/ $\mu$ s;	
$t_{gt}$	Turn-on time <sup>2)</sup>	$\mu$ s	1.60, 2.00, 2.50, 3.20	Gate pulse: $I_G = I_{FGM}$ ; $V_G = 20$ V; $t_{GP} = 50$ $\mu$ s; $di_G/dt = 2$ A/ $\mu$ s	
$t_q$	Turn-off time <sup>3)</sup> max	$\mu$ s	50.0, 63.0	$dv_D/dt = 50$ V/ $\mu$ s	$T_j = T_{j\max}$ ; $I_{TM} = I_{TAV}$ ; $di_R/dt = -10$ A/ $\mu$ s; $V_R = 100$ V; $V_D = 0.67 V_{DRM}$
			63.0, 80.0		
$Q_{rr}$	Total recovered charge, max	$\mu$ C	400	$T_j = T_{j\max}$ ; $I_{TM} = 400$ A;	
$t_{rr}$	Reverse recovery time, typ	$\mu$ s	5.0	$di_R/dt = -50$ A/ $\mu$ s;	
$I_{rrM}$	Peak reverse recovery current, max	A	160	$V_R = 100$ V	

THERMAL					
$R_{thjc}$	Thermal resistance, junction to case, max	°C/W	0.0500	Direct current	Double side cooled
$R_{thjc-A}$			0.1100		Anode side cooled
$R_{thjc-K}$			0.0900		Cathode side cooled
$R_{thck}$	Thermal resistance, case to heatsink, max	°C/W	0.0060	Direct current	
MECHANICAL					
w	Weight, max	g	176		
$D_s$	Surface creepage distance	mm (inch)	19.44 (0.765)		
$D_a$	Air strike distance	mm (inch)	12.10 (0.476)		

PART NUMBERING GUIDE								NOTES						
TFI	233	400	24	A2	E3	T4	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. TFI — fast inverter thyristor								$(dv_D/dt)_{crit,r}$ V/ $\mu$ s	200	320	500	1000		
2. Design version								2) Turn-on time						
3. Mean on-state current, A								Symbol of group	T4	P4	M4	K4		
4. Voltage code								$t_{gt,r}$ $\mu$ s	1.60	2.00	2.50	3.20		
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	E3		C3			
7. Group of turn-on time								$t_{qr}$ $\mu$ s	50.0		63.0			
8. Ambient conditions: N – normal; T – tropical														



All dimensions in millimeters (inches)

The information contained herein is confidential and protected by Copyright. In the interest of product improvement, Proton-Electrotex reserves the right to change data sheet without notice.