



# PRODUCT CATALOG

[www.proton-electrotex.com](http://www.proton-electrotex.com)



JSC Proton-Electrotex is one of the Russian leaders in development and production of power semiconductor diodes, thyristors, modules, heatsinks, IGBTs and as well power units for various electric energy converters.

The main products of the Company are rectifying, avalanche and fast diodes and thyristors available in stud, disc and module design. Proton-Electrotex offers welding diodes with high current load capacity and low static losses both in housingless option and in ceramic housing. In 2016 the company launched IGBT modules in MIFA and MIAA designs. Until that moment IGBTs had been mainly imported to Russia from abroad.

Thyristors and diodes produced by Proton-Electrotex are pressure contact devices. Pressure contact design ensures longer service time in comparison to soldered design.

Manufacturing of semiconductor elements is based on two technologies: alloying technology and more advanced sintering technology – low temperature sintering of semiconductor elements with molybdenum disc using silver paste.

On the customer's request our devices can be mounted on air cooling heatsinks. We can also develop and produce power units for various applications based on semiconductor devices. Such units may optionally include air or liquid cooling system, a protection system and control system.



 <b>475</b> employees	 <b>20000</b> m <sup>2</sup> of prouction facilities	 <b>250000</b> pieces of products per year
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Main applications of our products are electric drives, mining transportation, traction, induction heating and melting, power grids, renewable energy sources, welding equipment.

High level of competence and wide experience in production and application of power semiconductors gave a start to the new direction of the company's activities - developing and manufacturing of power stacks according to the individual requirements of the Client. As of today, several large projects have already been implemented.



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# Symbols and Terms

## Letter symbols for thyristors

$V_{DRM}$ $V_{RRM}$	Repetitive peak off-state and reverse voltage
$I_{TAV}$	Mean on-state current
$I_{TRMS}$	RMS on-state current
$I_{TSM}$	Surge on-state current
$T_j$	Junction temperature
$T_{stg}$	Storage temperature
$T_c$	Case temperature
$M$	Tightening torque
$F$	Mounting force
$V_{TM}$	Peak on-state voltage
$V_{T(TO)}$	Threshold voltage
$r_T$	On-state slope resistance
$I_{RRM}$ $I_{DRM}$	Repetitive peak reverse and off-state current
$U_{GT}$	Gate trigger direct voltage
$I_{GT}$	Gate trigger direct current
$(dv_D/dt)_{crit}$	Critical rate of rise of off-state voltage
$(di_T/dt)_{crit}$	Critical rate of rise of on-state current
$t_q$	Turn-off time
$R_{thjc}$	Thermal resistance junction to case

## Letter symbols for diodes

$V_{RRM}$	Repetitive peak reverse voltage
$I_{FAV}$	Mean forward current
$I_{FRMS}$	RMS forward current
$I_{FSM}$	Surge forward current
$T_j$	Junction temperature
$T_{stg}$	Storage temperature
$T_c$	Case temperature
$M$	Tightening torque
$F$	Mounting force
$V_{FM}$	Peak forward voltage
$V_{(TO)}$	Threshold voltage
$r_T$	Slope resistance
$I_{RRM}$	Repetitive peak reverse current
$P_{RSM}$	Surge reverse power dissipation
$R_{thjc}$	Thermal resistance junction to case
$t_{rr}$	Reverse recovery time

## dv/dt value code

Symbol of group	0	P3	E3	A3	P2	K2	E2	A2	T1	P1	M1	K1	H1	E1	C1	B1
	0	1	2	3	4	5	6	7	8	–	9	–	–	–	–	–
$(dv_D/dt)_{crit}^*$ V/ $\mu$ s	Not limited	20	50	100	200	320	500	1000	1600	2000	2500	3200	4000	5000	6300	8000

## $t_q$ value code for phase control thyristors

Symbol of group	0	B2	C2	E2	H2	K2	M2	P2	T2	X2	A3	B3
	0	–	–	1	–	–	2	–	3	–	4	–
$t_q, \mu$ s	Not limited	800	630	500	400	320	250	200	160	125	100	80

## $t_q$ value code for fast thyristors

C3	E3	H3	K3	M3	P3	T3	X3	A4	B4	C4	E4
1	2	3	4	5	6	7	8	–	9	–	–
63	50	40	32	25	20	16	12,5	10	8	6,3	5

## $t_{rr}$ value code for fast recovery diodes

Symbol of group	0	T3	X3	A4	B4	C4	E4	H4	K4	M4	P4	T4	X4	A5	B5	C5	E5	H5
	0	–	–	–	–	–	1	2	3	4	5	6	–	7	–	8	–	9
$t_{rr}, \mu$ s	Not limited	16	12,5	10	8	6,3	5	4	3,2	2,5	2	1,6	1,25	1	0,8	0,63	0,5	0,4



## DEVICES IN DISC DESIGN

### Main Characteristics

- Mean on-state and forward currents up to 12500 A.
  - Blocking voltage up to 6500 V.
- High resistance to cyclic load due to pressure construction.
- Height of housing – 5, 8, 14, 20, 26, 35 mm.
- Diameter of semiconductor element – 24, 32, 40, 51, 56, 65, 70, 80, 90, 100 mm.

### Optional features

- Supply of devices assembled with heat sinks.
  - Selection of devices in group for parallel, serial and combined connection.
  - Production of the custom devices.

### Application

Power Semiconductor Disc Devices are used in rectifying installations, softstarters, invertors, welding equipment, power supply equipment, wind-powered generators, induction heating equipment.

## Phase Control Thyristors in Disc Housing Overview

5200					T263-1000		T283-2000	T193-2500 T393-2500	
4400		T933-160 T933-250	T243-400 T443-400 T343-400	T553-500 T553-630 T553-800	T163-1250	T273-1250 T373-1250	T183-2500	T193-3200 T393-3200	
3600	T123-160	T433-250	T443-500	T353-800 T453-630 T453-800		T173-1600 T373-1600		T193-3600 T393-3600	
2800		T133-320 T333-320	T443-630 T343-630	T353-1000	T163-1600	T173-2000 T373-2000	T183-3200	T193-4000 T393-4000	
2400		T133-400 T343-500 T333-400	T143-400	T153-630 T253-800 T453-1000 T253-1390					
1800	T123-320	T233-400 T233-500	T243-630 T243-800 T143-800 T343-800	T153-800 T253-1000 T253-1250 T453-1250 T353-1600	T163-2000	T173-2500 T373-2500 T273-3200	T183-4000	T193-5000 T393-5000	
1600			T243-500 T143-500 T143-630						
1000	T123-400	T133-500		T143-1000		T173-3200 T373-3200			
800	T123-500	T133-630	T143-1250	T153-1600 T153-2000					
Blocking voltage [V]	$\varnothing$ of the element [mm]	24	32	40	56	70	80	90	100

## Fast Thyristors in Disc Housing Overview

4000							TFI473-1600 • TFI873-1600
3600	TFI933-250						
3400					TFI353-800		
3000	TFI833-250				TFI353-700		
2800					TFI353-1000		TFI373-1600 • TFI773-1600
2500							TFI373-2000 • TFI773-2000
2400	TFI233-320 • TFI333-320 TFI233-400						
2200			TFI243-400 • TFI443-400 TFI643-400 • TFI243-500 TFI443-500 • TFI643-500 TFI243-630 • TFI443-630 TFI643-630		TFI253-800 • TFI253-1000 TFI253-1250		
2000							TFI673-2000 • TFI273-2000
1500	TFI333-400 • TFI533-400		TFI143-400 • TFI343-400 TFI543-400 • TFI143-500 TFI343-500 • TFI543-500 TFI143-630 • TFI343-630 TFI543-630		TFI153-800 • TFI153-1000 TFI153-1250		
1400	TFIS123-200				TFIS153-800 • TFIS153-1000		
1200	TFI133-400 • TFI433-400		TFIS133-400		TFIS343-500		TFI573-2000 • TFI173-2000
1100					TFIS143-500		
Blocking voltage [V]	$\varnothing$ of the element [mm]	32	40	56	80		

## Part numbering guide

TFI	133	-	400	-	12	-	A2	A4	-	N
1	2		3		4		5	6		7

1. T — Phase Control / TFI — Fast Thyristor / TFIS — Ultra Fast Thyristor
2. Design version
3. Mean on-state current, A
4. Voltage code
5. Critical rate of rise of off-state voltage
6. Group of turn-off time
7. Ambient conditions: N - normal; T - tropical

## Disc Phase Control Thyristors

Part Number	V <sub>DRM</sub> /V <sub>RRM</sub>		I <sub>TAV</sub> [A]	I <sub>TSM</sub> (T <sub>J</sub> =T <sub>Jmax</sub> )		T <sub>C</sub> °C	V <sub>TM</sub> (T <sub>C</sub> =25°C) [V]	I <sub>TM</sub> (T <sub>C</sub> =25°C) [A]	V <sub>T(TO)/</sub> T <sub>Jmax</sub> [V]	r <sub>T</sub> T <sub>Jmax</sub> [mΩ]	t <sub>q</sub> [μs]	T <sub>Jmax</sub> [°C]	R <sub>th(jc)</sub> [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 800</b>														
T153-1600	100	800	1600	30.0	32.0	100	1,5	5024	0,85	0,137	160, 200, 250, 320, 400, 500	140	0,018	T.D1
T123-500	100	800	500	6.0	7.0	100	1,55	1570	0,8	0,49	80, 100, 125, 160, 200, 250, 320, 400, 500	150	0,07	T.A1
T133-630	100	800	630	12.0	13.0	116	1,50	1978	0,8	0,34	125, 160, 200, 250, 320, 400, 500	150	0,04	T.B2
T143-1250	100	800	1250	30.0	32.0	100	1,5	3925	0,8	0,17	160, 200, 250, 320, 400, 500	150	0,03	T.C1
T153-2000	100	800	2000	45.0	48.0	90	1,5	6280	0,8	0,12	160, 200, 250, 320, 400, 500	140	0,018	T.D1
<b>Up to 1000 V</b>														
T123-400	1000	1000	400	5.5	6.0	110	1,65	1256	0,83	0,58	125, 160, 200, 250, 320, 400, 500	150	0,07	T.A1
T133-500	400	1000	500	10.0	11.0	120	1,50	1570	0,95	0,42	125, 160, 200, 250, 320, 400, 500	150	0,04	T.B2
T143-1000	1000	1000	1000	19.0	20.0	104	1,5	3140	0,85	0,27	160, 200, 250, 320, 400, 500	150	0,03	T.C1
T173-3200	400	1000	3200	65.0	69.0	104	1,5	10048	0,83	0,062	250, 320, 400, 500	140	0,0085	T.F1
T373-3200	1000	1000	3200	60.0	63.0	98	1,5	10048	0,83	0,062	250, 320, 400, 500	140	0,01	T.F5
<b>Up to 1800 V</b>														
T143-500	400	1600	500	11.0	12.0	94	1,6	1570	1	0,76	160, 200, 250, 320, 400, 500	125	0,032	T.C2
T143-630	400	1600	630	13.0	14.0	93	1,65	1978	1	0,38	160, 200, 250, 320, 400, 500	125	0,032	T.C2
T233-500	1000	1600	500	8.5	9.0	93	1,7	1570	0,95	0,51	125, 160, 200, 250, 320, 400, 500	125	0,04	T.B2
T243-630	1000	1800	630	10.0	11.0	85	1,7	1978	1,05	0,85	250, 320, 400, 500	125	0,03	T.C1
T233-400	1000	1800	400	8.0	9.0	82	1,7	1256	1,1	1,6	125, 160, 200, 250, 320, 400, 500	125	0,04	T.B2
T153-800	1000	1800	800	20.0	21.0	90	1,6	2512	0,95	0,75	200, 250, 320, 400, 500	125	0,018	T.D5
T253-1000	1000	1800	1000	22.0	24.0	90	1,8	3140	0,95	0,405	200, 250, 320, 400, 500	125	0,018	T.D5
T123-320	400	1800	320	5.0	6.0	89	1,75	1005	0,9	0,85	125, 160, 200, 250, 320, 400, 500	125	0,07	T.A1
T243-800	1000	1800	800	16.0	17.0	85	1,7	2512	1	0,33	160, 200, 250, 320, 400, 500	125	0,03	T.C1
T143-800	1000	1800	800	16.0	17.0	82	1,7	2512	1	0,33	160, 200, 250, 320, 400, 500	125	0,032	T.C2
T343-800	1000	1800	800	17.5	19.0	89	1,5	1570	0,85	0,32	200, 250, 320, 400, 500	130	0,035	T.C3
T453-1250	1000	1800	1250	24.0	26.0	90	1,8	3925	0,95	0,2	160, 200, 250, 320, 400, 500	125	0,018	T.D5
T253-1250	1000	1800	1250	28.0	30.0	90	1,6	3925	0,95	0,2	200, 250, 320, 400, 500	125	0,018	T.D5
T353-1600	1000	1800	1600	28.0	30.0	83	1,6	5024	0,8	0,165	160, 200, 250, 320, 400, 500	125	0,018	T.D5
T163-2000	1000	1800	2000	44.0	47.0	96	1,45	5000	0,85	0,120	250, 320, 400, 500	125	0,0100	T.E3
T173-2500	1000	1800	2500	54.0	57.0	94	1,55	7850	0,88	0,092	250, 320, 400, 500	125	0,0085	T.F2
T373-2500	1000	1800	2500	50.0	53.0	89	1,55	7850	0,88	0,092	250, 320, 400, 500	125	0,01	T.F5
T273-3200	1600	1800	3200	57.0	60.0	85	1,50	7850	0,81	0,084	250	125	0,0085	T.F2
T183-4000	1000	1800	4000	70.0	74.0	82	1,35	6300	0,85	0,080	320	125	0,0065	T.H1
T193-5000	1000	1800	5000	94.0	99.0	84	1,30	6300	0,90	0,060	400	125	0,0050	T.G5
T393-5000	1000	1800	5000	94.0	99.0	78	1,30	6300	0,90	0,060	400	125	0,0057	T.G6
<b>Up to 2400 V</b>														
T453-1000	1000	2400	1000	24.0	26.0	94	1,8	3140	0,95	0,31	160, 200, 250, 320, 400, 500	125	0,018	T.D5
T343-500	2000	2400	500	8.0	9.0	85	2	1570	1,2	1,2	250, 320, 400, 500	125	0,03	T.C1
T153-630	2000	2400	630	16.5	18.0	93	1,7	1978	1,2	1,05	320, 400, 500	125	0,018	T.D5
T133-400	1000	2400	400	7.0	8.0	87	1,80	1256	1,1	1,25	200, 250, 320, 400, 500	125	0,04	T.B3
T333-400	2000	2400	400	7.0	8.0	87	1,8	1256	1,1	1,25	200, 250, 320, 400, 500	125	0,04	T.B2
T143-400	1000	2400	400	9.0	10.0	97	1,9	1256	1,2	0,95	250, 320, 400, 500	125	0,032	T.C2
T253-800	2000	2400	800	17.0	18.0	95	1,7	2512	1,2	0,44	320, 400, 500	125	0,018	T.D5
T253-1390	2000	2400	1390	24.5	26.0	85	1,5	3140	0,85	0,22	160, 200, 250, 320, 400, 500	125	0,018	T.D5

## Disc Phase Control Thyristors

Part Number	V <sub>DRM</sub> /V <sub>RRM</sub>		I <sub>TAV</sub> [A]	I <sub>TSM</sub> (T <sub>J</sub> =T <sub>Jmax</sub> )		T <sub>C</sub> °C	V <sub>TM</sub> (T <sub>C</sub> =25°C) [B]	I <sub>TM</sub> (T <sub>C</sub> =25°C) [A]	V <sub>T(TO)</sub> / T <sub>Jmax</sub> [V]	r <sub>T</sub> T <sub>Jmax</sub> [mΩ]	t <sub>q</sub> [μs]	T <sub>Jmax</sub> [°C]	R <sub>thjc</sub> [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 2800 V</b>														
T133-320	1000	2800	320	6.5	6.8	95	2,10	1005	1,15	1,5	200, 250, 320, 400, 500	125	0,04	T.B3
T333-320	2000	2800	320	6.5	6.8	95	2,1	1005	1,15	1,5	200, 250, 320, 400, 500	125	0,04	T.B2
T243-500	2000	2800	500	10.0	11.0	94	1,9	1570	1,04	0,735	250, 320, 400, 500	125	0,032	T.C2
T343-630	2000	2800	630	11.0	12.0	91	2	1978	1,15	0,4	250, 320, 400, 500	125	0,03	T.C1
T353-1000	2000	2800	1000	20.0	21.0	88	1,85	3140	1,1	0,38	320, 400, 500	125	0,018	T.D5
T163-1600	2000	2800	1600	35,0	37,0	99	1,75	5000	0,85	0,200	320	125	0,0100	T.E3
T173-2000	1600	2800	2000	50.0	53.0	99	1,75	6280	0,9	0,13	500, 630, 800	125	0,0085	T.F2
T373-2000	2000	2800	2000	46.0	49.0	94	1,75	6280	0,9	0,13	500, 630, 800	125	0,01	T.F5
T183-3200	2000	2800	3200	60.0	63.0	87	1,55	6300	0,90	0,115	400	125	0,0065	T.H1
T193-4000	2000	2800	4000	75.0	79.0	94	1,45	6300	0,85	0,070	500	125	0,0050	T.G5
T393-4000	2000	2800	4000	75.0	79.0	90	1,45	6300	0,85	0,070	500	125	0,0057	T.G6
T443-630	2000	2800	630	11.0	11.6	86	1,9	1978	1,15	0,4	250	125	0,035	T.C3
<b>Up to 3600 V</b>														
T453-630	3000	3600	630	14.0	15.0	95	2,2	1978	1,45	0,77	400, 500	125	0,018	T.D5
T123-160	3000	3600	160	3.2	3.4	97	2,30	503	0,95	3	200, 250, 320	125	0,08	T.A1
T433-250	3000	3600	250	6.5	7.0	100	2,5	785	1,2	2,1	250, 320, 400, 500	125	0,04	T.B3
T353-800	2800	3600	800	18.0	19.0	95	2	2512	1,3	0,4	400, 500	125	0,018	T.D5
T453-800	2800	3600	800	16.0	17.0	91	2,3	2512	1,45	0,45	400, 500	125	0,018	T.D5
T173-1600	2800	3600	1600	39.0	41.0	97	2,05	5024	1,15	0,22	500, 630, 800	125	0,0085	T.F2
T373-1600	3000	3600	1600	36.0	38.0	92	2,05	5024	1,15	0,22	500, 630, 800	125	0,01	T.F5
T193-3600	3000	3600	3600	72.0	76.0	91	1,7	6300	0,90	0,110	630	125	0,0050	T.G5
T393-3600	3000	3600	3600	72.0	76.0	86	1,70	6300	0,90	0,110	630	125	0,0057	T.G6
<b>Up to 4400 V</b>														
T443-400	3800	4200	400	7.5	8.0	85	2,3	1256	1,3	1,6	500, 630, 800	125	0,035	T.C2
T553-500	3800	4400	500	13.0	14.0	95	2,4	1570	1,25	1,65	500, 630, 800	125	0,018	T.D5
T553-630	3800	4400	630	14.0	15.0	92	2,3	1978	1,25	1,05	500, 630, 800	125	0,018	T.D5
T933-160	3800	4400	160	4.5	5.0	102	2,4	502	2,2	3,5	400, 500	125	0,04	T.B3
T933-250	3800	4400	250	5.0	5.3	94	2,6	785	1,3	2,3	500, 630, 800	125	0,04	T.B3
T243-400	3800	4400	400	8.0	9.0	92	2,35	1256	1,3	1,25	500, 630, 800	125	0,032	T.C2
T343-400	3800	4400	400	8.0	9.0	89	2,35	1256	1,3	1,25	500, 630, 800	125	0,035	T.C3
T553-800	3800	4400	800	15.0	16.0	89	2,6	2512	1,2	0,65	500, 630, 800	125	0,018	T.D5
T163-1250	3800	4400	1250	26,0	28,0	102	2,30	5000	1,05	0,250	630	125	0,0100	T.E3
T273-1250	3800	4400	1250	36.0	38.0	102	2,1	3925	1,2	0,3	630, 800	125	0,0085	T.F2
T373-1250	3800	4400	1250	33.0	35.0	98	2,1	3925	1,2	0,3	630, 800	125	0,01	T.F5
T183-2500	3800	4400	2500	44.0	47,0	88	1,9	6300	1,00	0,210	700	125	0,0065	T.H1
T193-3200	3800	4400	3200	60.0	63.0	91	1,80	6300	0,95	0,150	800	125	0,0050	T.G5
T393-3200	3800	4400	3200	60.0	63.0	86	1,80	6300	0,95	0,150	800	125	0,0057	T.G6
<b>Up to 5200 V</b>														
T263-1000	4600	5200	1000	26.0	28.0	106	2,8	5000	1.05	0.350	800	125	0,0100	T.E3
T283-2000	4600	5200	2000	35.0	37,0	93	2.5	6300	1.00	0.29	800	125	0,0065	T.H1
T193-2500	4600	5200	2500	55.0	58.0	98	2,10	6300	1	0,190	800	125	0,0050	T.G5
T393-2500	4600	5200	2500	55.0	58.0	94	2,10	6300	1,00	0,190	800	125	0,0057	T.G6



## Ultra Fast Thyristors

Part Number	V <sub>DRM</sub> /V <sub>RRM</sub>		I <sub>TAV</sub> [A]	I <sub>TSM</sub> (T <sub>J</sub> =T <sub>Jmax</sub> )		T <sub>C</sub> °C	V <sub>TM</sub> (T <sub>C</sub> =25°C) [V]	I <sub>TM</sub> (T <sub>C</sub> =25°C) [A]	V <sub>T(TO)</sub> /T <sub>Jmax</sub> [V]	r <sub>T</sub> T <sub>Jmax</sub> [mΩ]	t <sub>q</sub> [μs]	T <sub>Jmax</sub> [°C]	R <sub>thjc</sub> [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 1800 V</b>														
TFIS143-500	1000	1100	500	9.0	10.0	85	2.5	1570	1.4	0.8	5, 6.3, 8, 10	125	0,032	T.C3
TFIS343-500	1000	1100	500	9.5	10.0	89	2.5	1570	1.4	0.8	5, 6.3, 8, 10	125	0,03	T.C1
TFIS133-400	1000	1200	400	6.5	7.0	81	3.30	1256	1.8	0.95	5, 6.3, 8, 10	125	0,04	T.B2
TFIS123-200	1000	1400	200	3.5	3.7	83	3.3	628	1.4	3.2	6.3, 8, 10, 12.5	125	0,07	T.A1
TFIS153-1000	1000	1400	1000	19.0	20.0	78	2.5	3140	1.35	0.35	10, 12.5, 16, 20	125	0,021	T.D5
TFIS153-800	1000	1400	800	18.0	19.0	83	2.6	2512	1.5	0.5	8, 10, 12.5, 16	125	0,021	T.D5

## Fast Thyristors

Part Number	V <sub>DRM</sub> /V <sub>RRM</sub>		I <sub>TAV</sub> [A]	I <sub>TSM</sub> (T <sub>J</sub> =T <sub>Jmax</sub> )		T <sub>C</sub> °C	V <sub>TM</sub> (T <sub>C</sub> =25°C) [V]	I <sub>TM</sub> (T <sub>C</sub> =25°C) [A]	V <sub>T(TO)</sub> /T <sub>Jmax</sub> [V]	r <sub>T</sub> T <sub>Jmax</sub> [mΩ]	t <sub>q</sub> [μs]	T <sub>Jmax</sub> [°C]	R <sub>thjc</sub> [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 1200 V</b>														
TFH133-400	1000	1200	400	7.0	8.0	90	2.4	1256	1.35	0.85	10, 12.5, 16, 20	125	0,04	T.B2
TFH173-2000	1000	1200	2000	48.5	51.0	89	2.15	6280	1.4	0.08	10, 12.5, 16, 20	125	0,01	T.F5
TFI433-400	1000	1200	400	7.0	8.0	90	2.4	1256	1.35	0.85	10, 12.5, 16, 20	125	0,04	T.B3
TFI573-2000	1000	1200	2000	52.0	55.0	94	2.15	6280	1.4	0.08	10, 12.5, 16, 20	125	0,0085	T.F2
<b>Up to 1500 V</b>														
TFH143-400	1000	1500	400	8.0	9.0	90	2.85	1256	1.5	1.25	10, 12.5, 16, 20	125	0,032	T.C3
TFH143-500	1000	1500	500	9.0	10.0	85	2.4	1570	1.4	0.8	12.5, 16, 20, 25	125	0,032	T.C3
TFH143-630	1000	1500	630	10.0	11.0	80	2.3	1978	1.2	0.65	16, 20, 25, 32	125	0,032	T.C3
TFH153-1000	1000	1500	1000	20.0	21.0	80	2.25	3140	1.30	0.34	12.5, 16, 20, 25	125	0,021	T.D5
TFH153-1250	1000	1500	1250	21.0	23.0	70	2.1	3925	1.2	0.29	16, 20, 25, 32	125	0,021	T.D5
TFH153-800	1000	1500	800	19.0	20.0	85	2.5	2512	1.4	0.49	10, 12.5, 16, 20	125	0,021	T.D5
TFI333-400	1000	1500	400	7.0	8.0	90	2.4	1256	1.35	0.85	16, 20, 25, 32	125	0,04	T.B2
TFI343-400	1000	1500	400	8.5	8.9	92	2.85	1256	1.5	1.25	10, 12.5, 16, 20	125	0,03	T.C1
TFI343-500	1000	1500	500	9.5	10.0	89	2.4	1570	1.4	0.8	12.5, 16, 20, 25	125	0,03	T.C1
TFI343-630	1000	1500	630	10.5	12.0	83	2.3	1978	1.2	0.65	16, 20, 25, 32	125	0,03	T.C1
TFI533-400	1000	1500	400	7.0	8.0	90	2.4	1256	1.35	0.85	16, 20, 25, 32	125	0,04	T.B3
TFI543-400	1000	1500	400	8.0	9.0	90	2.85	1256	1.5	1.25	10, 12.5, 16, 20	125	0,032	T.C2
TFI543-500	1000	1500	500	9.0	10.0	86	2.4	1570	1.4	0.8	12.5, 16, 20, 25	125	0,032	T.C2
TFI543-630	1000	1500	630	10.0	11.0	80	2.3	1978	1.2	0.65	16, 20, 25, 32	125	0,032	T.C2
<b>Up to 2200 V</b>														
TFI273-2000	2000	2000	2000	40.0	42.0	85	2.2	6280	1.25	0.15	32, 40, 50, 63	125	0,01	T.F5
TFI673-2000	2000	2000	2000	43.0	46.0	91	2.2	6280	1.25	0.15	32, 40, 50, 63	125	0,0085	T.F2
TFI243-400	2000	2200	400	8.0	9.0	88	2.85	1256	1.5	1.4	25, 32, 40, 50	125	0,034	T.C3
TFI243-500	2000	2200	500	9.0	10.0	85	2.4	1570	1.4	0.8	32, 40, 50, 63	125	0,034	T.C3
TFI243-630	2000	2200	630	10.0	11.0	80	2.4	1978	1.2	0.65	32, 40, 50, 63	125	0,034	T.C3
TFI253-1000	1800	2200	1000	18.0	19.0	75	2.35	3140	1.2	0.47	20, 25, 32, 40	125	0,021	T.D5
TFI253-1250	1800	2200	1250	19.5	21.0	71	2.1	3925	1.25	0.30	20, 25, 32, 40	125	0,02	T.D5
TFI253-800	1800	2200	800	17.0	18.0	85	2.5	2512	1.4	0.49	20, 25, 32, 40	125	0,021	T.D5
TFI443-400	2000	2200	400	8.5	9.0	90	2.85	1256	1.5	1.4	25, 32, 40, 50	125	0,03	T.C1
TFI443-500	2000	2200	500	9.5	10.0	89	2.4	1570	1.4	0.8	32, 40, 50, 63	125	0,03	T.C1
TFI443-630	2000	2200	630	10.5	12.0	83	2.4	1978	1.2	0.65	32, 40, 50, 63	125	0,03	T.C1
TFI643-400	2000	2200	400	8.0	9.0	88	2.85	1256	1.5	1.4	25, 32, 40, 50	125	0,034	T.C2
TFI643-500	2000	2200	500	9.0	10.0	85	2.4	1570	1.4	0.8	32, 40, 50, 63	125	0,034	T.C2
TFI643-630	2000	2200	630	10.0	11.0	80	2.4	1978	1.2	0.65	32, 40, 50, 63	125	0,034	T.C2

## Fast Thyristors

Part Number	V <sub>DRM</sub> /V <sub>RRM</sub>		I <sub>TAV</sub> [A]	I <sub>TSM</sub> (T <sub>J</sub> =T <sub>Jmax</sub> )		T <sub>C</sub> °C	V <sub>TM</sub> (T <sub>C</sub> =25°C) [V]	I <sub>TM</sub> (T <sub>C</sub> =25°C) [A]	V <sub>T(TO)</sub> / T <sub>Jmax</sub> [V]	r <sub>T</sub> T <sub>Jmax</sub> [mΩ]	t <sub>q</sub> [μs]	T <sub>Jmax</sub> [°C]	R <sub>thjc</sub> [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 2800 V</b>														
TFI233-320	2000	2400	320	6.3	7.0	85	2,6	1005	1.5	1.25	25, 32, 40, 50	125	0,05	T.B3
TFI233-400	2000	2400	400	6.6	7.0	80	2,1	1256	1.4	0.87	50, 63	125	0,05	T.B3
TFI333-320	2000	2400	320	6.3	7.0	85	2,6	1005	1.5	1.25	25, 32, 40, 50	125	0,05	T.B2
TFI373-2000	2000	2500	2000	37.2	40.0	84	2,05	6280	1.30	0.15	40, 50, 63	125	0,01	T.F5
TFI773-2000	2000	2500	2000	40.0	42.0	90	2,05	6280	1.30	0.15	40, 50, 63	125	0,0085	T.F2
TFI353-1000	2000	2800	1000	19.0	20.0	81	2,4	3140	1.35	0.35	50, 63	125	0,02	T.D5
TFI373-1600	2000	2800	1600	34.5	37.0	90	2,26	5024	1.4	0.2	50, 63	125	0,01	T.F5
TFI393-2500*	2400	2800	2500	75.0	79.0	93	2,15	6300	1.4	0.12	50	125	0,006	T.G6
TFI773-1600	2000	2800	1600	37.0	39.0	95	2,26	5024	1.4	0.2	50, 63	125	0,0085	T.F2
<b>Up to 3600 V</b>														
TFI353-700	3000	3000	700	14.0	15.0	87	2,85	2512	1.5	0.5	40, 50, 63	120	0,02	T.D5
TFI833-250	3000	3000	250	5.7	6.0	94	3	785	1.7	2.2	50, 63	125	0,04	T.B3
TFI353-800	3000	3400	800	16.0	17.0	80	2,7	2512	1.30	0.7	63, 80, 100, 125	125	0,021	T.D5
TFI933-250	3200	3600	250	5.4	5.7	92	3,2	785	1.8	2.4	63, 80, 100, 125	125	0,04	T.B3
<b>Up to 4400 V</b>														
TFI473-1600	3800	4000	1600	30.0	32.0	85	2,7	5024	1.44	0.27	125, 160, 200	125	0,01	T.F5
TFI873-1600	3800	4000	1600	32.0	34.0	91	2,7	5024	1.44	0.27	125, 160, 200	125	0,0085	T.F2

## Rectifier Diodes in Disc Housings Overview

6500				D453-1250	
6000	D123-200			D353-800	
5000					D273-2500
4400	D123-250	D133-400 • D233-500 • D333-500	D143-630 • D243-800 • D443-800		D173-2500
3600				D353-1600 • D353-250	D173-3200
2800	D123-320	D133-500 • D133-630 • D333-630	D143-800		D173-4000
2600			D243-1000 • D443-1000		
2400				D253-1600	
2000		D333-800 • D133-800			D173-5000
1800	D123-500	D133-1000 • D233-1000	D143-1000 • D143-1250 • D343-1250	D253-2000	D173-6300
Blocking voltage [V] ∅ of the element [mm]	24	32	40	56	80

## Welding Diodes in Disc Housings Overview

400	D053-7100	D056-9500	D066-12500	D063-11500
Blocking voltage [V] ∅ of the element [mm]	51	56	65	65

## Fast Diodes in Disc Housings Overview

4400			DF443-320	DF453-800	DF973-1600
3600					DF373-2000
2800		DF233-400		DF253-630	DF273-1600
2400		DF233-200	DF243-800	DF253-1000	DF273-2000
1800			DF243-630 • DF243-1000	DF153-630	DF173-2000
1600	DF223-320				
1200	DF123-320	DF133-500	DF243-500	DF153-1000	
Blocking voltage [V] ∅ of the element [mm]	24	32	40	56	80

## Avalanche Diodes in Disc Housings Overview

6000				DA153-800	
3600			DA343-630		DA273-3200
3200				DA153-1600	
2800			DA243-500	DA153-1250 DA253-1600 DA153-2000	DA173-3200 DA173-4000
1800	DA123-320	DA333-500 DA133-500		DA253-2000	DA173-5000
Blocking voltage [V] ∅ of the element [mm]	24	32	40	56	80

## Part numbering guide

<b>D</b>	<b>123</b>	<b>-</b>	<b>500</b>	<b>-</b>	<b>18</b>	<b>-</b>	<b>N</b>
1	2		3		4		5

1. D — Rectifier diode / DF — Fast diode / DA — Avalanche diode / D — Welding diode
2. Design version
3. Mean forward current, A
4. Voltage code
5. Ambient conditions: N - normal; T - tropical

## Disc Rectifier Diodes

Part Number	$V_{DRM}/V_{RRM}$		$I_{FAV}$ [A]	$I_{FSM} (T_j=T_{jmax})$		$T_c$ °C	$V_{FM}$ ( $T_c=25^\circ\text{C}$ ) [V]	$I_{FM}$ ( $T_c=25^\circ\text{C}$ ) [A]	$V_{(T0)}/T_{jmax}$ [V]	$r_r T_{jmax}$ [mΩ]	$t_r/T_{jmax}$ [μs]	$T_{jmax}$ [°C]	$R_{thjc}$ [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 1800 V</b>														
D143-1000	1000	1800	1000	18.0	19.0	148	1,55	3140	1	0,227	-	190	0,027	D.C2
D123-500	1000	1800	500	7.5	8.0	137	1,55	1570	0,9	0,5	-	190	0,07	D.A1
D133-1000	1000	1800	1000	15.0	16.0	117	1,6	3140	0,95	0,35	-	190	0,04	D.B1
D233-1000	1000	1800	1000	16.0	17.0	117	1,6	3140	0,95	0,35	-	190	0,04	D.B2
D143-1250	1000	1800	1250	22.0	24.0	121	1,65	3925	0,95	0,25	-	190	0,032	D.C2
D343-1250	1000	1800	1250	20.0	21.0	114	1,65	3925	0,95	0,25	-	190	0,035	D.C3
D253-2000	1000	1800	2000	35.0	37.0	138	1,55	6280	0,95	0,1	-	190	0,018	D.D3
D173-6300	1000	1800	6300	76.0	80.0	102	1,4	12560	0,7	0,043	-	175	0,0085	D.F1
<b>Up to 2800 V</b>														
D133-800	1000	2000	800	12.0	13.0	145	1,6	2512	1	0,28	-	190	0,036	D.B2
D333-800	2000	2000	800	12.0	13.0	134	1,6	2512	1	0,27	-	190	0,045	D.B3
D173-5000	2000	2000	5000	60.0	63.0	109	1,65	12560	0,75	0,65	-	175	0,0085	D.F1
D253-1600	1800	2400	1600	35.0	37.0	147	1,5	5024	1	0,12	-	190	0,018	D.D3
D243-1000	2000	2600	1000	19.0	20.0	122	1,65	3140	0,95	0,28	-	175	0,032	D.C2
D443-1000	2000	2600	1000	18.0	19.0	117	1,65	3140	0,95	0,28	-	175	0,035	D.C3
D143-800	1800	2800	800	18.0	19.0	136	1,55	2512	1	0,41	-	175	0,027	D.C2
D133-500	2000	2800	500	11.0	11.6	140	1,7	1570	1,1	0,69	-	175	0,036	D.B2
D123-320	2000	2800	320	5.5	6.0	135	2	1005	1	1	-	175	0,07	D.A1
D133-630	2000	2800	630	12.0	13.0	133	1,6	1978	1,1	0,35	-	175	0,04	D.B2
D333-630	2000	2800	630	10.0	11.0	128	1,6	1978	1,1	0,35	-	175	0,045	D.B3
D173-4000	2000	2800	4000	55.0	58.0	124	1,8	12560	0,85	0,065	-	175	0,0085	D.F1
<b>Up to 3600 V</b>														
D353-1250	3000	3400	1250	24.0	26.0	100	2,2	3925	1,1	0,72	-	175	0,018	D.D2
D353-1600	3000	3600	1600	26.0	28.0	133	2	5024	0,85	0,15	-	175	0,018	D.D3
D173-3200	3000	3600	3200	50.0	53.0	109	1,8	10048	1,25	0,08	75	160	0,0085	D.F1
<b>Up to 4400 V</b>														
D143-630	2400	4000	630	10.5	12.0	112	2,1	1978	1,1	0,73	-	150	0,027	D.C2
D133-400	3800	4000	400	7.0	8.0	117	1,85	1256	1,1	1,21	-	150	0,036	D.B2
D123-250	3800	4400	250	4.0	4.0	108	2,2	785	1,1	1,6	-	150	0,078	D.A1
D233-500	3800	4400	500	7.5	8.0	106	2	1570	1,05	0,9	-	150	0,04	D.B2
D333-500	3800	4400	500	6.5	7.0	101	2	1570	1,05	0,9	-	150	0,045	D.B3
D243-800	3200	4400	800	13.5	15.0	99	2	2512	1	0,5	-	150	0,032	D.C2
D443-800	3800	4400	800	12.5	14.0	94	2	2512	1	0,5	-	150	0,035	D.C3
D173-2500	3800	4400	2500	41.0	43.1	116	1,8	7850	0,8	0,125	85	150	0,0085	D.F1
<b>Up to 6500 V</b>														
D273-2500	4600	5000	2500	40.0	42.0	112	1,9	7850	0,85	0,15	100	150	0,0085	D.F1
D123-200	4600	6000	200	3.0	4.0	116	2,5	628	1,1	2,6	-	150	0,07	D.A1
D353-800	4600	6000	800	12.0	13.0	100	2,4	2512	1,31	0,74	-	140	0,018	D.D3
D453-1250	4600	6500	1250	18.0	19.0	101	2,4	3925	0,95	0,4	65	150	0,018	D.D3

## Welding Diodes

Part Number	$V_{DRM}/V_{RRM}$		$I_{FAV}$ [A]	$I_{FSM} (T_j=T_{jmax})$		$T_c$ °C	$V_{FM}$ ( $T_c=25^\circ\text{C}$ ) [V]	$I_{FM}$ ( $T_c=25^\circ\text{C}$ ) [A]	$V_{(T0)}/T_{jmax}$ [V]	$r_r T_{jmax}$ [mΩ]	$t_r/T_{jmax}$ [μs]	$T_{jmax}$ [°C]	$R_{thjc}$ [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 400 V</b>														
D053-7100	200	400	7402	55.0	58.0	85	1,05	5000	0,75	0,029	-	170	0,009	D.Q1
D063-11500	200	400	11298	85.0	90.0	85	1,05	6300	0,73	0,026	-	180	0,0058	D.W1
D056-9500	200	400	11814	70.0	74.0	85	1,08	6300	0,74	0,030	-	180	0,0050	Housingless
D066-12500	200	400	14703	85.0	90.0	85	1,04	6300	0,72	0,026	-	180	0,0039	Housingless

## Disc Fast Recovery Diodes

Part Number	$V_{DRM}/V_{RRM}$		$I_{FAV}$ [A]	$I_{FSM} (T_j=T_{jmax})$		$T_c$ °C	$V_{FM}$ ( $T_c=25^\circ\text{C}$ ) [V]	$I_{FM}$ ( $T_c=25^\circ\text{C}$ ) [A]	$V_{(T0)}/T_{jmax}$ [V]	$r_T T_{jmax}$ [mΩ]	$t_{rr}/T_{jmax}$ [μs]	$T_{jmax}$ [°C]	$R_{thjc}$ [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 1800 V</b>														
DF123-320	1000	1200	320	6.0	7.0	108	1,70	1005	1,20	0,850	3,2	150	0,0700	D.A1
DF133-500	1000	1200	500	8.5	9.0	91	2,20	1570	1,25	0,350	2,5	125	0,0400	D.B1
DF243-500	1000	1200	500	12.0	13.0	97	2,30	1570	1,25	0,400	2,0	125	0,0320	D.C2
DF153-1000	1000	1200	1000	29.0	33.0	95	1,90	3140	1,15	0,200	2,5	125	0,0180	D.D3
DF223-320	1000	1600	320	5.0	6.0	102	2,20	1005	1,25	1,100	2,5	150	0,0700	D.A1
DF243-630	1000	1800	630	14.0	15.0	91	2,30	1978	1,20	0,300	3,2	125	0,0320	D.C2
DF243-1000	1000	1800	1000	15.0	16.0	68	1,80	3140	1,15	0,250	5,0	125	0,0320	D.C2
DF153-630	1000	1800	630	25.0	29.0	105	3,00	1978	1,25	0,300	2,5	125	0,0180	D.D3
DF173-2000	1000	1800	2000	50.0	58.0	93	1,80	6280	1,20	0,130	6,3	125	0,0085	D.F1
<b>Up to 2800 V</b>														
DF233-200	2000	2400	200	6.0	7.0	107	2,20	628	1,35	1,700	1,25	125	0,0400	D.B2
DF243-800	2000	2400	800	12.5	14.0	74	2,20	2512	1,30	0,350	5,0	125	0,0320	D.C2
DF253-1000	2000	2400	1000	22.0	24.0	89	2,20	3140	1,35	0,250	4,0	125	0,0180	D.D3
DF273-2000	2000	2400	2000	46.0	49.0	90	1,85	6280	1,30	0,150	8,0	125	0,0085	D.F1
DF233-400	2000	2800	400	7.0	8.0	94	1,90	1256	1,20	0,700	5,0	125	0,0400	D.B2
DF253-630	2000	2800	630	20.0	21.0	103	3,00	1978	1,35	0,350	3,2	125	0,0180	D.D3
DF273-1600	2000	2800	1600	44.0	47.0	98	2,10	5024	1,30	0,170	8,0	125	0,0085	D.F1
<b>Up to 3600 V</b>														
DF373-2000	3000	3600	2000	40.0	42.0	84	2,10	6280	1,40	0,200	16,0	125	0,0085	D.F1
<b>Up to 4600V</b>														
DF443-320	3800	4400	320	6.0	7.0	90	3,60	1005	1,50	2,000	4,0	125	0,0350	D.C3
DF453-800	3800	4400	800	13.5	15.0	85	2,90	2512	1,40	0,700	5,3	125	0,0180	D.D3
DF973-1600	4600	4600	1600	26.0	28.0	94	2	2000	-	-	5,0	150	0,008	D.F1

## Disc Avalanche Diodes

Part Number	$V_{DRM}/V_{RRM}$		$I_{FAV}$ [A]	$I_{FSM} (T_j=T_{jmax})$		$T_c$ °C	$V_{FM}$ ( $T_c=25^\circ\text{C}$ ) [V]	$I_{FM}$ ( $T_c=25^\circ\text{C}$ ) [A]	$V_{(T0)}/T_{jmax}$ [V]	$r_T T_{jmax}$ [mΩ]	$t_{rr}/T_{jmax}$ [μs]	$T_{jmax}$ [°C]	$R_{thjc}$ [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 1800 V</b>														
DA133-500	1000	1600	500	12.0	13.0	123	1,50	1570	0,95	0,330	-	150	0,0400	D.B2
DA123-320	1000	1800	320	5.5	6.0	110	1,60	1005	0,95	1,050	-	150	0,0700	D.A1
DA333-500	1000	1800	500	12.0	13.0	120	1,5	1570	0,95	0,44	-	150	0,04	D.B2
DA253-2000	1000	1800	2000	30.0	32.0	101	2,00	6280	0,95	0,220	-	175	0,0180	D.D3
DA173-5000	1000	1800	5000	60.0	63.0	84	2,00	12560	0,60	0,125	42	175	0,0085	D.F1
<b>Up to 2800 V</b>														
DA153-2000	1600	2000	2000	30.0	32.0	107	1,80	6280	0,95	0,190	-	175	0,018	D.D3
DA243-500	2000	2800	500	13.0	14.0	120	2,00	1570	1,00	0,800	-	150	0,0300	D.C2
DA153-1250	2000	2800	1250	22.0	24.0	121	1,9	3925	1,00	0,450	-	175	0,0180	D.D3
DA253-1600	2000	2800	1600	25.0	27.0	112	1,9	5024	1,00	0,300	-	175	0,0180	D.D3
DA173-3200	2400	2800	3200	45.0	47.3	115	2,20	10048	1,00	0,150	-	175	0,0085	D.F1
DA173-4000	2000	2800	4000	50.0	53.0	107	2,20	12560	1,00	0,100	-	175	0,0085	D.F1
<b>Up to 3600V</b>														
DA153-1600	2400	3200	1600	27.0	29.0	111	2,00	5024	0,95	0,320	-	175	0,0180	D.D3
DA343-630	2800	3600	630	12.0	13.0	100	1,9	1978	1,00	1,070	-	150	0,0300	D.C2
DA273-3200	3000	3600	3200	42.0	45.0	103	2,20	10048	1,05	0,200	-	175	0,0085	D.F1
<b>Up to 6000 V</b>														
DA153-800	4600	6000	800	14.0	15.0	108	2,2	2512	0,90	0,650	-	140	0,0180	D.D3



## DEVICES IN STUD DESIGN

### Application

Devices in stud design are used in railway transport: rectifier bridges, AC control, electric motor drives for industry and transport.

### Main Characteristics

- Mean on-state and forward currents up to 500 A.
- Blocking voltage up to 1800 V.
- Pressure contact design.
- Simple mounting.
- High resistance to cyclic load.
- Diodes can be supplied with direct and reverse polarity.
- Metric and inch thread.

### Optional features

- Selection of devices in groups for parallel, series and combined connection.
- Devices assembled with heat sinks.

## Phase Control Thyristors in Stud Housings Overview

1600	T161-125 • 161-160 • 161-200	T261-200 • T171-200 • T171-250 • T171-320 T175-200 • T275-250 • T275-320 T371-200 • T471-250 • T471-320
800		T175-250 • T175-320 • T271-250 T271-320 • T371-250 • T371-320
Blocking voltage [V]		
∅ of the element [mm]	24	32

## Fast Thyristors in Stud Housings Overview

1400	TFI261-125 • TFI261-160	TFI271-160 • TFI271-200 • TFI271-250 TFI271-320 • TFI175-200 • TFI175-250 TFI371-200 • TFI371-250
Blocking voltage [V]		
∅ of the element [mm]	24	32

## Avalanche Thyristors in Stud Housings Overview

1200	TA271-250 • TA271-320	
Blocking voltage [V]		
∅ of the element [mm]	24	32

## Rectifier Diodes in Stud Housings Overview

1800	D161-200 • D161-250	D171-400 • D175-400 D271-400
1600	D161-320 • D161-400	
1200		D171-500 • D175-500 D271-500
Blocking voltage [V]		
∅ of the element [mm]	24	32

## Fast Diodes in Stud Housings Overview

1600	DF261-250	
1400	DF261-320	DF271-400 • DF271-500
Blocking voltage [V]		
∅ of the element [mm]	24	32

## Avalanche Diodes in Stud Housings Overview

1800	DA161-200	DA171-320
Blocking voltage [V]		
∅ of the element [mm]	24	32

## Part numbering guide

<b>TFI</b>	<b>261</b>	-	<b>125</b>	-	<b>14</b>	-	<b>A2</b>	<b>T3</b>	-	<b>N</b>
1	2		3		4		5	6		7

<b>DF</b>	<b>261</b>	-	<b>250</b>		-	<b>16</b>	-	<b>M4</b>	-	<b>N</b>
1	2		3	4		5		6		7

1. T — Phase control thyristor / TFI — Fast thyristor
2. Design version
3. Mean on-state current, A
4. Voltage code
5. Critical rate of rise of off-state voltage
6. Group of turn-off time
7. Ambient conditions: N - normal; T - tropical

1. D — Rectifier diode / DF — Fast diode / DA — Avalanche diode
2. Design version
3. Mean forward current, A
4. Polarity: X - Cathode to Stud; Anode to Stud - no symbol
5. Voltage code

## Stud Phase Control Thyristors

Part Number	V <sub>DRM</sub> /V <sub>RRM</sub>		I <sub>TAV</sub> [A]	I <sub>TSM</sub> (T <sub>J</sub> =T <sub>Jmax</sub> )		T <sub>C</sub> °C	V <sub>TM</sub> (T <sub>C</sub> =25°C) [V]	I <sub>TM</sub> (T <sub>C</sub> =25°C) [A]	V <sub>T(TO)/T<sub>Jmax</sub></sub> [V]	r <sub>T</sub> T <sub>Jmax</sub> [mΩ]	t <sub>q</sub> [μs]	T <sub>Jmax</sub> [°C]	R <sub>thjc</sub> [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 800 V</b>														
T175-250	100	800	250	12.0	14.0	125	1,4	785	0,95	0,76	125, 160, 200, 250, 320, 400, 500	150	0,07	T.SB3
T175-320	100	800	320	13.0	15.0	126	1,35	1005	0,8	0,34	125, 160, 200, 250, 320, 400, 500	150	0,07	T.SB3
T271-250	100	800	250	10.0	12.0	121	1,4	785	0,95	0,76	125, 160, 200, 250, 320, 400, 500	150	0,08	T.SB1
T271-320	100	800	320	11.5	13.0	122	1,35	1005	0,8	0,34	125, 160, 200, 250, 320, 400, 500	150	0,08	T.SB1
T371-250	100	800	250	10.0	12.0	121	1,4	785	0,95	0,76	125, 160, 200, 250, 320, 400, 500	150	0,08	T.SB2
T371-320	100	800	320	11.5	13.0	122	1,35	1005	0,8	0,34	125, 160, 200, 250, 320, 400, 500	150	0,08	T.SB2
<b>Up to 1800 V</b>														
T161-125	100	1600*	125	2.5	2.9	103	1,45	393	1,15	1,8	125, 160, 200, 250, 320, 400, 500	125	0,1	T.SA1
T161-160	100	1600*	160	4.0	4.6	99	1,55	502	1,05	1,36	125, 160, 200, 250, 320, 400, 500	125	0,1	T.SA1
T161-200	100	1600*	200	5.0	5.8	98	1,6	628	0,9	0,85	125, 160, 200, 250, 320, 400, 500	125	0,1	T.SA1
T261-200	100	1600*	200	4.0	5.0	99	1,55	502	1,05	1,36	125, 160, 200, 250, 320, 400, 500	125	0,1	T.SA1
T171-200	100	1600*	200	7.5	8.6	100	1,55	628	1	1,12	125, 160, 200, 250, 320, 400, 500	125	0,08	T.SB1
T175-200	100	1600*	200	9.0	10.4	103	1,75	628	1	1,12	125, 160, 200, 250, 320, 400, 500	125	0,07	T.SB3
T171-250	100	1600*	250	9.0	10.4	93	1,6	785	1	0,95	125, 160, 200, 250, 320, 400, 500	125	0,08	T.SB1
T171-320	100	1600*	320	10.0	12.0	90	1,6	1005	0,95	0,51	125, 160, 200, 250, 320, 400, 500	125	0,08	T.SB1
T275-250	100	1600*	250	10.5	12.1	97	1,75	785	1	0,95	125, 160, 200, 250, 320, 400, 500	125	0,07	T.SB3
T275-320	100	1600*	320	12.0	14.0	94	1,6	1005	0,95	0,51	125, 160, 200, 250, 320, 400, 500	125	0,07	T.SB3
T371-200	100	1600*	200	7.5	8.6	100	1,55	628	1	1,12	125, 160, 200, 250, 320, 400, 500	125	0,08	T.SB2
T471-250	100	1600*	250	9.0	10.4	93	1,6	785	1	0,95	125, 160, 200, 250, 320, 400, 500	125	0,08	T.SB2
T471-320	100	1600*	320	10.0	12.0	90	1,6	1005	0,95	0,51	125, 160, 200, 250, 320, 400, 500	125	0,08	T.SB2

\*1800 V by agreement with Proton-Electrotex

## Stud Fast Thyristors

Part Number	V <sub>DRM</sub> /V <sub>RRM</sub>		I <sub>TAV</sub> [A]	I <sub>TSM</sub> (T <sub>J</sub> =T <sub>Jmax</sub> )		T <sub>C</sub> °C	V <sub>TM</sub> (T <sub>C</sub> =25°C) [V]	I <sub>TM</sub> (T <sub>C</sub> =25°C) [A]	V <sub>T(TO)/T<sub>Jmax</sub></sub> [V]	r <sub>T</sub> T <sub>Jmax</sub> [mΩ]	t <sub>q</sub> [μs]	T <sub>Jmax</sub> [°C]	R <sub>thjc</sub> [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 1800 V</b>														
TFI261-125	800	1400	125	3.5	4.0	97	2,3	393	1,45	2,5	16, 20, 25, 32	125	0,1	T.SA1
TFI261-160	800	1400	160	4.0	4.6	94	4,6	502	1,2	1,8	20, 25, 32, 40	125	0,1	T.SA1
TFH175-200	1000	1400	200	6.5	7.5	99	1,96	628	1,16	0,95	20, 25, 32, 40	125	0,08	T.SB3
TFH175-250	1000	1400	250	7.5	8.6	97	1,8	785	0,94	0,75	25, 32, 40, 50	125	0,08	T.SB3
TFI271-160	1000	1400	160	5.0	5.8	95	2,2	502	1,65	1,7	16, 20, 25, 32	125	0,08	T.SB1
TFI271-200	1000	1400	200	6.0	6.9	95	1,96	628	1,31	1,1	20, 25, 32, 40	125	0,08	T.SB1
TFI271-250	1000	1400	250	7.0	8.1	93	1,8	785	1,05	0,85	25, 32, 40, 50	125	0,08	T.SB1
TFI271-320	1000	1400	320	9.0	10.4	86	1,8	1005	1	0,65	32, 40, 50, 63	125	0,08	T.SB1
TFI371-200	1000	1400	200	6.0	6.9	95	1,96	628	1,31	1,1	20, 25, 32, 40	125	0,08	T.SB2
TFI371-250	1000	1400	250	7.0	8.1	93	1,8	785	1,05	0,85	25, 32, 40, 50	125	0,08	T.SB2

## Stud Avalanche Thyristors

Part Number	V <sub>DRM</sub> /V <sub>RRM</sub>		I <sub>TAV</sub> [A]	I <sub>TSM</sub> (T <sub>J</sub> =T <sub>Jmax</sub> )		T <sub>C</sub> °C	V <sub>TM</sub> (T <sub>C</sub> =25°C) [V]	I <sub>TM</sub> (T <sub>C</sub> =25°C) [A]	V <sub>T(TO)/T<sub>Jmax</sub></sub> [V]	r <sub>T</sub> T <sub>Jmax</sub> [mΩ]	t <sub>q</sub> [μs]	T <sub>Jmax</sub> [°C]	R <sub>thjc</sub> [°C/W]	Package Type
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 1200 V</b>														
TA271-250	600	1200	250	8.0	9.0	100	1,90	785	0,95	1,700	160	140	0,08	T.SB1
TA271-320	600	1200	320	9.0	10.0	100	1,65	1005	0,8	0,97	160	140	0,08	T.SB1



## Stud Rectifier Diodes

Part Number	$V_{DRM}/V_{RRM}$		$I_{FAV}$ [A]	$I_{FSM} (T_j=T_{jmax})$		$T_c$ °C	$V_{FM}$ ( $T_c=25^\circ C$ ) [V]	$I_{FM}$ ( $T_c=25^\circ C$ ) [A]	$V_{(TO)}/T_{jmax}$ [V]	$r_T T_{jmax}$ [mΩ]	$t_{rr}/T_{jmax}$ [μs]	$T_{jmax}$ [°C]	$R_{thjc}$ [°C/W]	Package Type
	[V min]	[V max]		$t_p=10$ ms	$t_p=8,3$ ms									
<b>Up to 1800 V</b>														
<b>D171-500</b>	600	1200	500	14.0	15.5	105	1,4	1570	0,8	0,5	-	190	0,075	D.SB1
<b>D175-500</b>	1000	1200	500	16.0	17.0	140	1,4	1570	0,8	0,5	-	190	0,07	D.SB3
<b>D271-500</b>	1000	1200	500	15.0	16.0	133	1,4	1570	0,8	0,5	17	190	0,08	D.SB2
<b>D161-320</b>	300	1600	320	7.5	8.2	130	1.35*, 1.40*	1005	0,9	0,65	-	190	0,15	D.SA1
<b>D161-400</b>	300	1600	400	8.25	9.0	124	1,45	1256	0,9	0,50	-	190	0,13	D.SA1
<b>D161-200</b>	300	1800	200	5.5	6.0	145	1,35	628	0,9	0,85	-	190	0,15	D.SA1
<b>D161-250</b>	300	1800	250	6.4	7.0	140	1,35	785	0,9	0,77	-	190	0,15	D.SA1
<b>D171-400</b>	300	1800	400	14.0	15.5	145	1,45	1256	0,9	0,56	-	190	0,085	D.SB1
<b>D175-400</b>	1000	1800	400	15.0	16.0	149	1,6	1256	0,9	0,56	-	190	0,07	D.SB3
<b>D271-400</b>	1000	1800	400	14.0	15.0	143	1,45	1256	0,9	0,56	-	190	0,08	D.SB2

\* 1.35 - for the voltage range (0.3kV-1 kV); 1.40 - for the voltage range (1.1 kV-1.6 kV)

## Stud Fast Recovery Diodes

Part Number	$V_{DRM}/V_{RRM}$		$I_{FAV}$ [A]	$I_{FSM} (T_j=T_{jmax})$		$T_c$ °C	$V_{FM}$ ( $T_c=25^\circ C$ ) [V]	$I_{FM}$ ( $T_c=25^\circ C$ ) [A]	$V_{(TO)}/T_{jmax}$ [V]	$r_T T_{jmax}$ [mΩ]	$t_{rr}/T_{jmax}$ [μs]	$T_{jmax}$ [°C]	$R_{thjc}$ [°C/W]	Package Type
	[V min]	[V max]		$t_p=10$ ms	$t_p=8,3$ ms									
<b>Up to 1600 V</b>														
<b>DF271-500</b>	1000	1400	500	9.0	10.4	85	1,85	1570	1,20	0,530	4,0	150	0,0700	D.SB1
<b>DF261-320</b>	800	1400	320	5.3	6.1	90	1,7	1005	1,2	0,85	3.2, 4.0, 5.0, 6.3	150	0,1	D.SA2
<b>DF271-400</b>	800	1400	400	8.0	9.1	85	2,3	1256	1,2	0,8	3.2, 4.0, 5.0, 6.3	150	0,08	D.SB1
<b>DF261-250</b>	800	1600	250	4.5	5.2	101	2,2	785	1,25	1,1	2,5, 3.2, 4.0, 5.0	150	0,1	D.SA2

## Stud Avalanche Diodes

Part Number	$V_{DRM}/V_{RRM}$		$I_{FAV}$ [A]	$I_{FSM} (T_j=T_{jmax})$		$T_c$ °C	$V_{FM}$ ( $T_c=25^\circ C$ ) [V]	$I_{FM}$ ( $T_c=25^\circ C$ ) [A]	$V_{(TO)}/T_{jmax}$ [V]	$r_T T_{jmax}$ [mΩ]	$t_{rr}/T_{jmax}$ [μs]	$T_{jmax}$ [°C]	$R_{thjc}$ [°C/W]	Package Type
	[V min]	[V max]		$t_p=10$ ms	$t_p=8,3$ ms									
<b>Up to 1800 V</b>														
<b>DA161-200</b>	400	1800	200	7.5	8.2	115	1,4	628	0,8	1,05	-	150	0,13	D.SA1
<b>DA171-320</b>	400	1800	320	10.0	11.0	115	1,4	1005	0,8	0,44	-	150	0,085	D.SB1



## DEVICES IN MODULE DESIGN

### Application

Devices in module design are used in railway transport: rectifier bridges, AC control, electric motor drives for industry and transport.

### Main Characteristics

- Mean on-state and forward currents up to 1250 A.
- Blocking voltage up to 6500 V.
- Dimension of module copper baseplates 34\*94 (housing F), 50\*92 (housing C1), 70\*104 (housing E1), 60\*124 (housing A2), 77\*150 (housing D).
- Single-sided cooling through copper base plate.
- Simplicity of mounting.
- High resistance to cyclic load due to pressure contact design.
- Electrically isolated baseplate.
- Isolation voltage 3,0 kV AC per 1 minute or 3,6 kV DC per 1 second.
- Single and double components module.
- Modules of A2, F, D, E1 types are certified by UL standard (Underwriters Laboratories).

### Optional features

- Diode/thyristor combination in one housing.
- Module with fast thyristor and diode elements are available.
- Production of modules with high isolation.
- Stacks with heat sink.

## Thyristor Modules for Phase Control Overview

6500			MTx-240-65-A2		
4400			MTx-260-44-A2		MTx-400-44-D
3600	MTx-115-36-F	MTx-160-36-C1	MTx-320-36-A2	MT1-560-36-E	MTx-500-36-D
2800	MTx-130-28-F	MTx-200-28-C1	MTx-400-28-A2	MT1-635-28-E	MTx-630-28-D
2400			MTx-250-24-C1	MTx-430-24-A2	MT1-765-24-E
2200	MTx-165-22-F			MT1-765-22-E	MTx-740-24-D
1800	MTx-201-18-F	MTx-320-18-C1	MTx-540-18-A2 MT3-595-18-A2	MT1-830-18-E	MTx-800-18-D
1200			MTx-650-12-A2		
800					MTx-1250-8-D
Blocking voltage[V] baseplate width [mm]	34	50	60	70	77

## Diode Modules for Rectifier Overview

6500			MDx-320-65-A2		
4400			MDx-470-44-A2	MD1-950-44-E	MDx-800-44-D
3600	MDx-155-36-F	MDx-250-36-C1	MDx-515-36-A2		
3400					
2800	MDx-175-28-F	MDx-320-28-C1		MD1-1125-28-E	MDx-1000-28-D
2600			MDx-580-26-A2		
2200	MDx-215-22-F			MD1-1280-22-E	
1800	MDx-245-18-F	MDx-400-18-C1	MDx-660-18-A2		
Blocking voltage[V] baseplate width [mm]	34	50	60	70	77

## Part numbering guide

MT	3	-	540	-	18	-	A	-	N
1	2		3		4		5		6

- Types of module: MT: Thyristor module; MT/D: Thyristor-Diode module; MD/T: Diode-Thyristor module
- Circuit schematic (x):  
3 - serial connection; 4 - common Cathode; 5 - common Anode
- Average on-state current, A
- Voltage code
- Package type
- Ambient conditions: N - Normal

MD	3	-	660	-	18	-	A	-	N
1	2		3		4		5		6

- MD- Diode module
- Circuit schematic (x):  
3 - serial connection; 4 - common Cathode; 5 - common Anode
- Mean forward current, A
- Voltage code
- Package type
- Ambient conditions: N - Normal



## Single Thyristor Modules For Phase Control

Part Number	$V_{DRM}/V_{RRM}$		$I_{TAV}$ [A]	$I_{TSM} (T_I=T_{jmax})$		$V_{TM}$ ( $T_C=25^\circ C$ ) [V]	$I_{TM}$ ( $T_C=25^\circ C$ ) [A]	$V_{T(TO)}/T_{jmax}$ [V]	$r_T T_{jmax}$ [mΩ]	$t_q$ [μs]	$T_{jmax}$ [°C]	$R_{thjc}$ [°C/W]	Package Type	Baseplate/width [mm]
	[V min]	[V max]		tp=10 ms	tp=8.3 ms									
<b>Up to 3600 V</b>														
MT1-830-18-E	1000	1800	830 (85)	33.0	35.0	1,45	2500	0,80	0,240	250	130	0,0420	M.E	70/104
MT1-765-24-E	2000	2400	765 (81)	32.0	34.0	1,50	2500	0,85	0,277	320	125	0,0420	M.E	70/104
MT1-635-28-E	2600	2800	635 (85)	23.0	25.0	1,55	2500	0,95	0,350	320	125	0,0420	M.E	70/104
MT1-560-36-E	3000	3600	560 (85)	21.0	23.0	2,10	2500	1,05	0,470	400	125	0,0420	M.E	70/104

## Double Thyristor Modules For Phase Control

Part Number	$V_{DRM}/V_{RRM}$		$I_{TAV}$ [A]	$I_{TSM} (T_I=T_{jmax})$		$V_{TM}$ ( $T_C=25^\circ C$ ) [V]	$I_{TM}$ ( $T_C=25^\circ C$ ) [A]	$V_{T(TO)}/T_{jmax}$ [V]	$r_T T_{jmax}$ [mΩ]	$t_q$ [μs]	$T_{jmax}$ [°C]	$R_{thjc}$ [°C/W]	Package Type	Baseplate/width [mm]
	[V min]	[V max]		tp=10 ms	tp=8.3 ms									
<b>Up to 1200 V</b>														
MTx-1250-8-D	100	800	1250(77)	34.0	36.0	1,3	3925	0,8	0,12	160	150	0,05	M.D	77/150
MTx-650-12-A2	1000	1200	650(85)	14.0	15.0	1,45	1978	0,85	0,28	160	140	0,065	M.A2	60/124
MTx-1000-12-D	1000	1200	1000(77)	32.0	34.0	1,3	3140	0,9	0,15	200	140	0,05	M.D	77/150
<b>Up to 1800 V</b>														
MTx-201-18-F	1000	1800	201(85)	6.0	7.0	1,40	500	0,8	0,97	125	130	0,18	M.F	34/94
MTx-320-18-C1	1000	1800	320(90)	8.5	9.0	1,40	785	0,75	0,5	160	130	0,11	M.C1	50/92
MTx-540-18-A2	1400	1800	540(85)	15.5	17.0	1,50	1570	0,85	0,32	250	130	0,065	M.A2	60/124
MT3-595-18-A2	1400	1800	595(85)	17.5	19.0	1,50	1570	0,84	0,31	320	135	0,065	M.A2	60/124
MTx-800-18-D	1400	1800	800(78)	28.0	30.0	1,45	2512	0,85	0,23	250	130	0,05	M.D	77/150
<b>Up to 2400 V</b>														
MTx-165-22-F	2000	2200	165(85)	4.7	5.0	1,50	500	0,8	1,35	160	125	0,18	M.F	34/94
MTx-250-24-C1	2000	2400	250(91)	7.6	8.0	1,50	785	0,8	0,7	200	125	0,11	M.C1	50/92
MTx-430-24-A2	2000	2400	430(85)	12.0	13.0	1,55	1256	1	0,41	250	125	0,065	M.A2	60/124
MTx-740-24-D	2000	2400	740(77)	24.5	26.0	1,55	3140	0,9	0,21	320	125	0,05	M.D	77/150
<b>Up to 2800 V</b>														
MTx-130-28-F	2400	2800	130(85)	3.4	4.0	1,8	500	0,85	2,4	250	125	0,19	M.F	34/94
MTx-200-28-C1	2600	2800	200(93)	5.5	6.0	2,0	785	0,9	1,1	250	125	0,11	M.C1	50/92
MTx-400-28-A2	2000	2800	400(82)	9.0	9.5	1,8	1256	1	0,65	250	125	0,065	M.A2	60/124
MTx-630-28-D	2600	2800	630(80)	21.0	23.0	1,4	1978	0,95	0,3	320	125	0,05	M.D	77/150
<b>Up to 3600 V</b>														
MTx-115-36-F	3000	3600	115(85)	2.5	2.6	2,45	500	0,95	3,000	400	125	0,19	M.F	34/94
MTx-160-36-C1	3000	3600	160(88)	4.0	5.0	2,5	785	1,2	2,3	400	125	0,11	M.C1	50/92
MTx-320-36-A2	3000	3600	320(85)	5.5	6.0	2,2	785	1,15	0,8	320	125	0,068	M.A2	60/124
MTx-500-36-D	3000	3600	500(85)	18.0	19.0	1,85	1570	1,1	0,4	400	125	0,05	M.D	77/150
<b>Up to 4400 V</b>														
MTx-260-44-A2	3800	4400	260(85)	5.0	6.0	2,3	628	1,4	1,3	500	125	0,068	M.A2	60/124
MTx-400-44-D	3800	4400	400(88)	14.0	15.0	2,7	2512	1,2	0,65	630	125	0,05	M.D	77/150
<b>Up to 6500 V</b>														
MTx-240-65-A2	4600	6500	240(85)	4.0	4.2	2,8	785	1,1	2,5	630	125	0,068	M.A2	60/124

Circuit Schematic: 3 – serial connection; 4 – common Cathode; 5 – common Anode

## Double Thyristor-Diode Modules For Phase Control

Part Number	V <sub>DRM</sub> /V <sub>RRM</sub>		I <sub>TAV</sub> [A]	I <sub>TSM</sub> (T <sub>J</sub> =T <sub>Jmax</sub> )		V <sub>TM</sub> (T <sub>C</sub> =25°C) [V]	I <sub>TM</sub> (T <sub>C</sub> =25°C) [A]	V <sub>T(TO)/</sub> T <sub>Jmax</sub> [V]	r <sub>T</sub> T <sub>Jmax</sub> [mΩ]	t <sub>q</sub> [μs]	T <sub>Jmax</sub> [°C]	R <sub>thjc</sub> [°C/W]	Package Type	Baseplate/ width [mm]
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 1200 V</b>														
MT/Dx-1250-8-D	100	800	1250(77)	34.0	36.0	1,3	3925	0,8	0,12	160	150	0,05	M.D	77/150
MD/Tx-1250-8-D	100	800	1250(77)	34.0	36.0	1,3	3925	0,8	0,12	160	150	0,05	M.D	77/150
MT/Dx-650-12-A2	1000	1200	650(85)	14.0	15.0	1,45	1978	0,85	0,28	160	140	0,065	M.A2	60/124
MD/Tx-650-12-A2	1000	1200	650(85)	14.0	15.0	1,45	1978	0,85	0,28	160	140	0,065	M.A2	60/124
MT/Dx-1000-12-D	1000	1200	1000(77)	32.0	34.0	1,3	3140	0,9	0,15	200	140	0,05	M.D	77/150
MD/Tx-1000-12-D	1000	1200	1000(77)	32.0	34.0	1,3	3140	0,9	0,15	200	140	0,05	M.D	77/150
<b>Up to 1800 v</b>														
MT/Dx-201-18-F	1000	1800	201(85)	6.0	7.0	1,4	500	0,8	0,97	125	130	0,18	M.F	34/94
MD/Tx-201-18-F	1000	1800	201(85)	6.0	7.0	1,4	500	0,8	0,97	125	130	0,18	M.F	34/94
MT/Dx-320-18-C1	1000	1800	320(90)	8.5	9.0	1,4	785	0,75	0,5	160	130	0,11	M.C1	50/92
MD/Tx-320-18-C1	1000	1800	320(90)	8.5	9.0	1,4	785	0,75	0,5	160	130	0,11	M.C1	50/92
MT/Dx-540-18-A2	1400	1800	540(85)	15.5	17.0	1,5	1570	0,85	0,32	250	130	0,065	M.A2	60/124
MD/Tx-540-18-A2	1400	1800	540(85)	15.5	17.0	1,5	1570	0,85	0,32	250	130	0,065	M.A2	60/124
MT/D3-595-18-A2	1400	1800	595(85)	17.5	19.0	1,5	1570	0,84	0,31	320	135	0,065	M.A2	60/124
MD/T3-595-18-A2	1400	1800	595(85)	17.5	19.0	1,5	1570	0,84	0,31	320	135	0,065	M.A2	60/124
MT/Dx-800-18-D	1400	1800	800(78)	28.0	30.0	1,45	2512	0,85	0,23	250	130	0,05	M.D	77/150
MD/Tx-800-18-D	1400	1800	800(78)	28.0	30.0	1,45	2512	0,85	0,23	250	130	0,05	M.D	77/150
<b>Up to 2400 V</b>														
MT/Dx-165-22-F	2000	2200	165(85)	4.7	5.0	1,5	500	0,8	1,35	160	125	0,18	M.F	34/94
MD/Tx-165-22-F	2000	2200	165(85)	4.7	5.0	1,5	500	0,8	1,35	160	125	0,18	M.F	34/94
MT/Dx-250-24-C1	2000	2400	250(91)	7.6	8.0	1,5	785	0,8	0,7	200	125	0,11	M.C1	50/92
MD/Tx-250-24-C1	2000	2400	250(91)	7.6	8.0	1,5	785	0,8	0,7	200	125	0,11	M.C1	50/92
MT/Dx-430-24-A2	2000	2400	430(85)	12.0	13.0	1,55	1256	1	1,41	250	125	0,065	M.A2	60/124
MD/Tx-430-24-A2	2000	2400	430(85)	12.0	13.0	1,55	1256	1	1,41	250	125	0,065	M.A2	60/124
MT/Dx-740-24-D	2000	2400	740(77)	24.5	26.0	1,55	3140	0,9	0,21	320	125	0,05	M.D	77/150
MD/Tx-740-24-D	2000	2400	740(77)	24.5	26.0	1,55	3140	0,9	0,21	320	125	0,05	M.D	77/150
<b>Up to 2800 V</b>														
MT/Dx-130-28-F	2400	2800	130(85)	3.4	4.0	1,8	500	0,85	2,4	250	125	0,19	M.F	34/94
MD/Tx-130-28-F	2400	2800	130(85)	3.4	4.0	1,8	500	0,85	2,4	250	125	0,19	M.F	34/94
MT/Dx-200-28-C1	2600	2800	200(93)	5.5	6.0	2	785	0,9	1,1	250	125	0,11	M.C1	50/92
MD/Tx200-28-C1	2600	2800	200(93)	5.5	6.0	2	785	0,9	1,1	250	125	0,11	M.C1	50/92
MT/Dx-400-28-A2	2000	2800	400(82)	9.0	9.5	1,8	1256	1	0,65	250	125	0,065	M.A2	60/124
MD/Tx-400-28-A2	2000	2800	400(82)	9.0	9.5	1,8	1256	1	0,65	250	125	0,065	M.A2	60/124
MD/Tx-630-28-D	2600	2800	630(80)	21.0	23.0	1,4	1978	0,95	0,3	320	125	0,05	M.D	77/150
MT/Dx-630-28-D	2600	2800	630(80)	21.0	23.0	1,4	1978	0,95	0,3	320	125	0,05	M.D	77/150
<b>Up to 3600 V</b>														
MT/Dx-115-36-F	3000	3600	115(85)	2.5	2.6	2,45	500	0,95	3	400	125	0,19	M.F	34/94
MD/Tx-115-36-F	3000	3600	115(85)	2.5	2.6	2,45	500	0,95	3	400	125	0,19	M.F	34/94
MT/Dx-160-36-C1	3000	3600	160(88)	4.0	5.0	2,5	785	1,2	2,3	400	125	0,11	M.C1	50/92
MD/Tx-160-36-C1	3000	3600	160(88)	4.0	5.0	2,5	785	1,2	2,3	400	125	0,11	M.C1	50/92
MT/Dx-320-36-A2	3000	3600	320(85)	5.5	6.0	2,2	785	1,15	0,8	320	125	0,068	M.A2	60/124
MD/Tx-320-36-A2	3000	3600	320(85)	5.5	6.0	2,2	785	1,15	0,8	320	125	0,068	M.A2	60/124
MT/Dx-500-36-D	3000	3600	500(85)	18.0	19.0	1,85	1570	1,1	0,4	400	125	0,05	M.D	77/150
MD/Tx-500-36-D	3000	3600	500(85)	18.0	19.0	1,85	1570	1,1	0,4	400	125	0,05	M.D	77/150
<b>Up to 4400 V</b>														
MT/Dx-260-44-A2	3800	4400	260(85)	5.0	6.0	2,3	628	1,4	1,3	500	125	0,068	M.A2	60/124
MD/Tx-260-44-A2	3800	4400	260(85)	5.0	6.0	2,3	628	1,4	1,3	500	125	0,068	M.A2	60/124
MT/Dx-400-44-D	3800	4400	400(88)	14.0	15.0	2,7	2512	1,2	0,65	630	125	0,05	M.D	77/150
MD/Tx-400-44-D	3800	4400	400(88)	14.0	15.0	2,7	2512	1,2	0,65	630	125	0,05	M.D	77/150
<b>Up to 6500 V</b>														
MT/Dx-240-65-A2	4600	6500	240(85)	4.0	4.2	2,8	785	1,1	2,5	630	125	0,068	M.A2	60/124
MD/Tx-240-65-A2	4600	6500	240(85)	4.0	4.2	2,8	785	1,1	2,5	630	125	0,068	M.A2	60/124

Circuit Schematic: 3 – serial connection; 4 – common Cathode; 5 – common Anode



## Single Diode Modules For Phase Control

Part Number	$V_{RRM}/V_{RRM}$		$I_{FAV}$ [A]	$I_{FSM} (T_j=T_{jmax})$		$V_{FM}$ ( $T_C=25^\circ C$ ) [V]	$I_{FM}$ ( $T_C=25^\circ C$ ) [A]	$V_{(TO)}/T_{jmax}$ [V]	$r_T, T_{jmax}$ [mΩ]	$t_{rr}/T_{jmax}$ [μs]	$T_{jmax}$ [°C]	$R_{thjc}$ [°C/W]	Package Type	Baseplate width/length [mm]
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 4400 V</b>														
MD1-1280-22-E	2000	2200	1280 (100)	40.0	42.0	1.3	3140	0.80	0,100	-	160	0,0420	M.E1	70/104
MD1-1125-28-E	2400	2800	1125 (100)	36.0	38.0	1,38	3140	0.80	0,170	-	160	0,0420	M.E1	70/104
MD1-950-44-E	4000	4400	950 (103)	34.0	35.7	1.5	2512	0.85	0.260	70	160	0,0420	M.E1	70/104

## Double Diode Module For Phase Control

Part Number	$V_{RRM}/V_{RRM}$		$I_{FAV}$ [A]	$I_{FSM} (T_j=T_{jmax})$		$V_{FM}$ ( $T_C=25^\circ C$ ) [V]	$I_{FM}$ ( $T_C=25^\circ C$ ) [A]	$V_{(TO)}/T_{jmax}$ [V]	$r_T, T_{jmax}$ [mΩ]	$t_{rr}/T_{jmax}$ [μs]	$T_{jmax}$ [°C]	$R_{thjc}$ [°C/W]	Package Type	Baseplate width/length [mm]
	[V min]	[V max]		tp=10 ms	tp=8,3 ms									
<b>Up to 1800 V</b>														
MDx-245-18-F	1000	1800	245(100)	8.1	9.0	1,3	500	0,75	0,64	-	150	0,18	M.F1	34/94
MDx-400-18-C1	1000	1800	400(106)	12.0	13.0	1,2	785	0,75	0,25	-	150	0,11	M.C1	50/92
MDx-660-18-A2	1000	1800	660(100)	19.0	20.0	1,4	1978	0,78	0,23	-	150	0,065	M.A2	60/124
<b>Up to 2800 V</b>														
MDx-215-22-F	2000	2200	215(100)	6.4	7.0	1,4	500	0,8	0,92	-	150	0,18	M.F1	34/94
MDx-580-26-A2	2000	2600	580(100)	14.0	15.0	1,5	1570	0,8	0,35	-	150	0,065	M.A2	60/124
MDx-175-28-F	2400	2800	175(100)	6.0	7.0	1,5	500	0,85	1,5	-	150	0,19	M.F1	34/94
MDx-320-28-C1	2000	2800	320(107)	8.5	9.0	1,4	785	0,85	0,45	27	150	0,11	M.C1	50/92
MDx-1000-28-D	2000	2800	1000 (91)	32.0	34.0	1,38	3140	0,8	0,150	-	150	0,05	M.D	77/150
<b>Up to 3600 V</b>														
MDx-155-36-F	3000	3600	155(100)	4.5	4.7	2	500	0,93	2	-	150	0,19	M.F1	34/94
MDx-250-36-C1	3000	3600	250(98)	5.0	6.0	2	785	0,9	1,57	-	150	0,11	M.C1	50/92
MDx-515-36-A2	3000	3600	515(100)	13.0	14.0	1,6	1256	0,8	0,5	-	150	0,065	M.A2	60/124
<b>Up to 4400 V</b>														
MDx-470-44-A2	3800	4400	470(100)	12.0	13.0	1,70	1256	0,85	0,6	-	150	0,068	M.A2	60/124
MDx-800-44-D	3800	4400	800(85)	23.0	25.0	1,77	2512	0,9	0,370	-	150	0,05	M.D	77/150
<b>Up to 6500 V</b>														
MDx-320-65-A2	4600	6500	320(100)	6.0	7.0	2,4	1570	0,95	1,1	-	140	0,068	M.A2	60/124

**Circuit Schematic:** 3 – serial connection; 4 – common Cathode; 5 – common Anode



## Main properties:

- Copper baseplate
- Al<sub>2</sub>O<sub>3</sub> DBC substrate
- Ultrasonic welding power terminals
- Bonding with copper wire
- Improved thermal cycling ability
- Conformance to RoHS
- Storage temperature down to -55°C

## Chip features

- **IGBT chip**
  - Trench FS — V-series IGBT (6th generation Fuji chips)
  - Low V<sub>CE(SAT)</sub>
  - Short-circuit duration of 10 μs at 150°C
  - Low inductance
- **FRD chip**
  - Fast and soft recovery
  - Low voltage drop

# MEDIUM FREQUENCY IGBT MODULES

## Application:

- AC motor drives
- Solar power converters
- Air conditioning systems
- High power converters and UPS

## Medium Frequency IGBT Modules Overview

1200	MIFA-xx12FA-100N MIFA-xx12FA-150N MIFA-xx12FA-200N	MIAA-xx12FA-200N MIAA-xx12FA-300N MIAA-xx12FA-400N	MIDA-xx12FA-300N MIDA-xx12FA-450N MIDA-xx12FA-600N
1700	MIFA-xx17FA-075N MIFA-xx17FA-100N MIFA-xx17FA-150N	MIAA-xx17FA-150N MIAA-xx17FA-200N MIAA-xx17FA-300N	MIDA-xx17FA-300N MIDA-xx17FA-450N
Voltage			
Width/length of baseplate	34/94	62/106,4	62/122

## Medium Frequency IGBT Modules

Part Number	V <sub>CES</sub> [V]	I <sub>cnom</sub> / I <sub>Inom</sub> [A]	V <sub>CE(SAT)</sub> (T <sub>J</sub> =25°C) [V]	V <sub>F</sub> (T <sub>J</sub> =25°C) [V]	E <sub>ON</sub> (T <sub>J</sub> =150°C) mJ	E <sub>OFF</sub> (T <sub>J</sub> =150°C) mJ	T V <sub>Jmax</sub> [°C]	R <sub>th(j-c)</sub> [°C/W]	R <sub>th(j-d)</sub> [°C/W]	Package Type	Baseplate width/length [mm]
<b>Up to 1200 V</b>											
MIAA-xx12FA-200N	1200	200	2,02	2,25	18,0	24,6	175	0,160	0,260	MIAA	61,4/106,4
MIAA-xx12FA-300N	1200	300	1,98	2,10	34,0	42,0	175	0,120	0,180	MIAA	61,4/106,4
MIAA-xx12FA-400N	1200	400	2,12	2,15	47,0	60,0	175	0,092	0,150	MIAA	61,4/106,4
MIFA-xx12FA-100N	1200	100	1,88	1,92	14,0	15,0	175	0,270	0,490	MIFA	34/94
MIFA-xx12FA-150N	1200	150	1,90	1,96	14,0	20,0	175	0,230	0,340	MIFA	34/94
MIFA-xx12FA-200N	1200	200	2,10	2,05	17,9	30,0	175	0,180	0,300	MIFA	34/94
MIDA-xx12FA-300N	1200	300	2,15	2,35	27,0	37,0	175	0,094	0,150	MIDA	62/122
MIDA-xx12FA-450N	1200	450	2,20	2,25	51,0	63,0	175	0,066	0,100	MIDA	62/122
MIDA-xx12FA-600N	1200	600	2,30	2,30	71,0	90,0	175	0,040	0,060	MIDA	62/122
<b>Up to 1700 V</b>											
MIAA-xx17FA-150N	1700	150	2,28	2,01	44,0	57,0	175	0,135	0,280	MIAA	61,4/106,4
MIAA-xx17FA-200N	1700	200	2,27	2,00	55,0	71,0	175	0,132	0,280	MIAA	61,4/106,4
MIAA-xx17FA-300N	1700	300	2,33	2,10	85,0	105,0	175	0,100	0,190	MIAA	61,4/106,4
MIFA-xx17FA-075N	1700	75	2,25	2,00	23,0	30,0	175	0,320	0,630	MIFA	34/94
MIFA-xx17FA-100N	1700	100	2,47	2,22	28,0	39,0	175	0,235	0,500	MIFA	34/94
MIFA-xx17FA-150N	1700	150	2,27	2,01	42,0	55,0	175	0,165	0,350	MIFA	34/94
MIDA-xx17FA-300N	1700	300	2,40	2,60	125,0	143,0	175	0,090	0,150	MIDA	62/122
MIDA-xx17FA-450N	1700	450	2,50	2,50	160,0	218,0	175	0,060	0,100	MIDA	62/122

## IGBT type designation

MIAA	-	xx	12	FA	-	200	N
1		2	3	4		5	6

### 1.Design:

- MIAA – 62 mm housing
- MIFA – 34 mm housing
- MIDA – low inductance 62 mm housing

### 2.Circuit configuration:

- HB – half bridge
- HC – high side chopper
- LC – low side chopper

### 3.Module class by maximum collector-emitter voltage:

- class 12 – 1200V; class 17 – 1700V

### 4.Modification of IGBT chips,

- including chip manufacturing technology

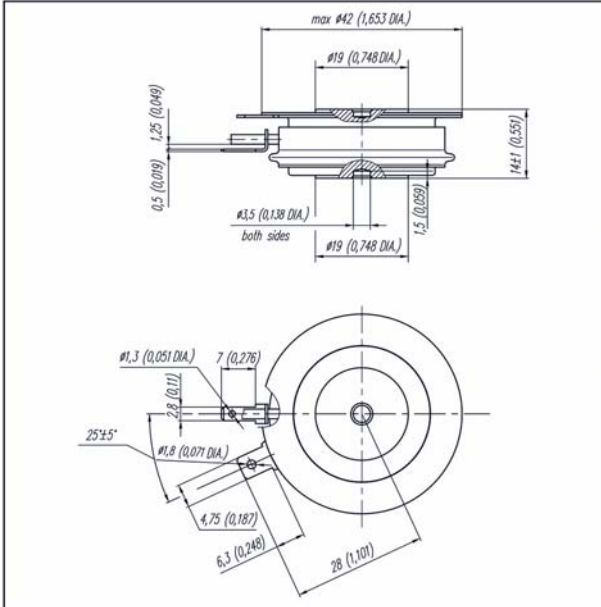
### 5.Nominal current

### 6.Ambient conditions



**Package Type T.A1**

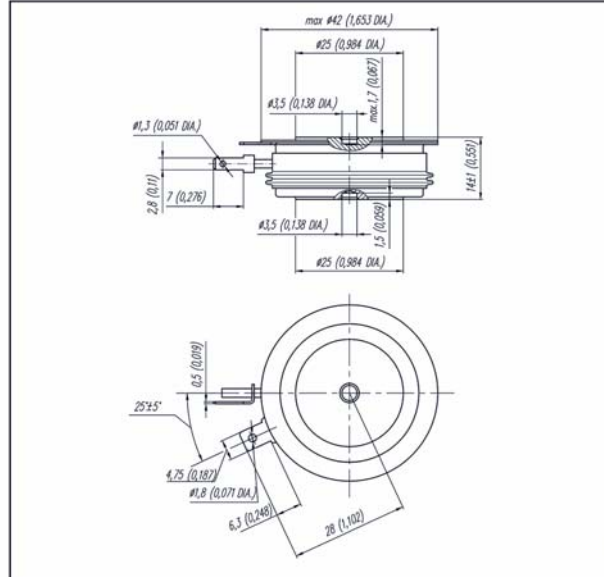
Mounting Force **5.0 ÷ 7.0 kN**  
Nominal Weight **70 g**



**D<sub>s</sub> 7.94 (0.313)** The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact.  
**D<sub>a</sub> 5.00 (0.197)** The air distance is defined as the shortest direct path between the anode flange and gate contact.

**Package Type T.B2**

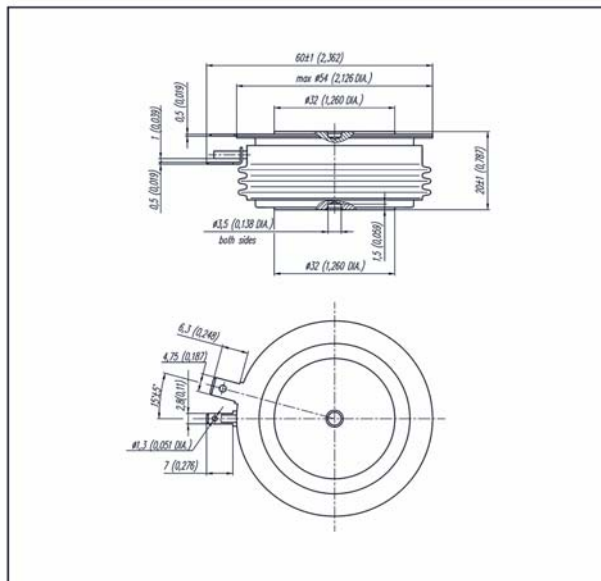
Mounting Force **9.0 ÷ 11.0 kN**  
Nominal Weight **110 g**



**D<sub>s</sub> 10.3 (0.405)** The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact.  
**D<sub>a</sub> 6.3 (0.248)** The air distance is defined as the shortest direct path between the anode flange and gate contact.

**Package Type T.B3**

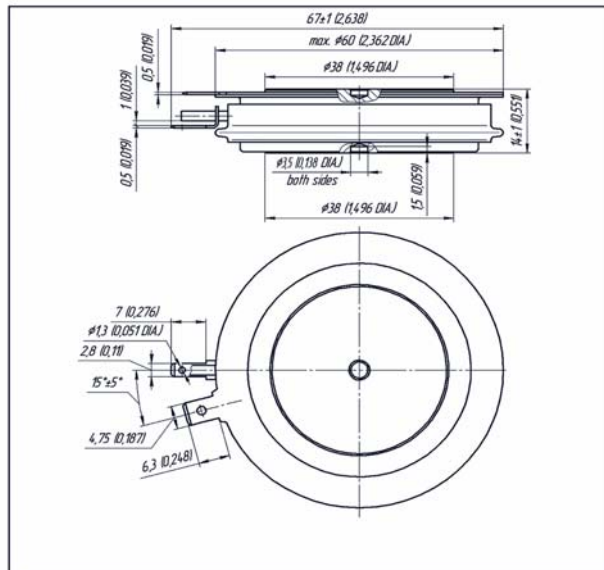
Mounting Force **9.0 ÷ 11.0 kN**  
Nominal Weight **180 g**



**D<sub>s</sub> 19.44 (0.765)** The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact.  
**D<sub>a</sub> 12.10 (0.476)** The air distance is defined as the shortest direct path between the anode flange and gate contact.

**Package Type T.C1**

Mounting Force **14.0 ÷ 16.0 kN**  
Nominal Weight **210 g**



**D<sub>s</sub> 7.86 (0.309)** The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact.  
**D<sub>a</sub> 6.10 (0.240)** The air distance is defined as the shortest direct path between the anode flange and gate contact.

**Package Type T.C2**

Mounting Force **14.0 ÷ 16.0 kN**  
Nominal Weight **260 g**

**D<sub>s</sub> 19.44 (0.765)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact*  
**D<sub>a</sub> 12.10 (0.476)** *The air distance is defined as the shortest direct path between the anode flange and gate contact*

**Package Type T.C3**

Mounting Force **14.0 ÷ 16.0 kN**  
Nominal Weight **280 g**

**D<sub>s</sub> 27.6 (1.087)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact*  
**D<sub>a</sub> 16.0 (0.630)** *The air distance is defined as the shortest direct path between the anode flange and gate contact*

**Package Type T.D1**

Mounting Force **24.0 ÷ 28.0 kN**  
Nominal Weight **330 g**

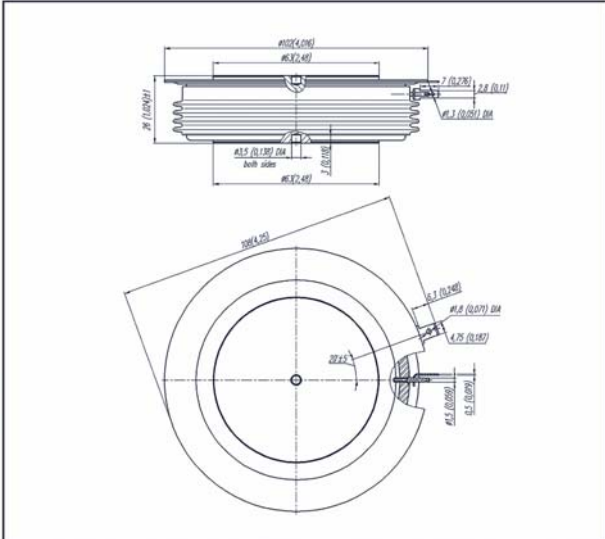
**D<sub>s</sub> 7.51 (0.295)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact*  
**D<sub>a</sub> 5.60 (0.220)** *The air distance is defined as the shortest direct path between the anode flange and gate contact*

**Package Type T.D5**

Mounting Force **24.0 ÷ 28.0 kN**  
Nominal Weight **510 g**

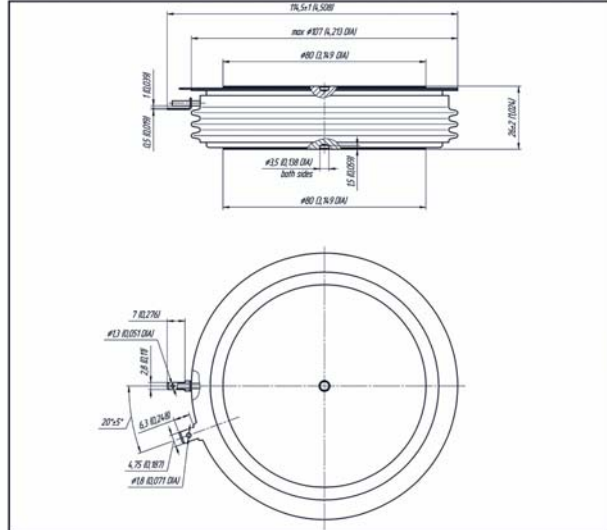
**D<sub>s</sub> 31.60 (1.244)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact*  
**D<sub>a</sub> 16.50 (0.649)** *The air distance is defined as the shortest direct path between the anode flange and gate contact*

**Package Type T.E3**

 Mounting Force **33.0 ÷ 40.0 kN**  
 Nominal Weight **1000 g**


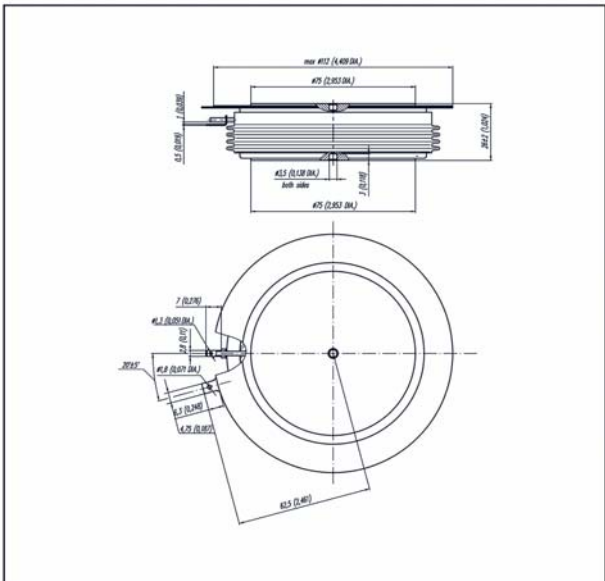
**D<sub>s</sub> 36.50 (1.437)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact.*  
**D<sub>a</sub> 16.50 (0.650)** *The air distance is defined as the shortest direct path between the anode flange and gate contact.*

**Package Type T.F1**

 Mounting Force **40.0 ÷ 50.0 kN**  
 Nominal Weight **1500 g**


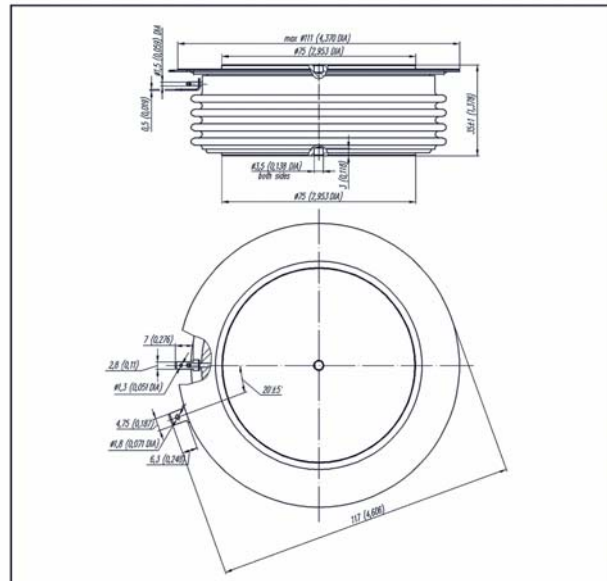
**D<sub>s</sub> 27.37 (1.077)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact.*  
**D<sub>a</sub> 16.00 (0.629)** *The air distance is defined as the shortest direct path between the anode flange and gate contact.*

**Package Type T.F2**

 Mounting Force **40.0 ÷ 50.0 kN**  
 Nominal Weight **1500 g**


**D<sub>s</sub> 36.6 (1.441)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact.*  
**D<sub>a</sub> 16.2 (0.638)** *The air distance is defined as the shortest direct path between the anode flange and gate contact.*

**Package Type T.F5**

 Mounting Force **40.0 ÷ 50.0 kN**  
 Nominal Weight **1600 g**


**D<sub>s</sub> 55.13 (2.170)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact.*  
**D<sub>a</sub> 25.10 (0.988)** *The air distance is defined as the shortest direct path between the anode flange and gate contact.*

**Package Type T.G5**

Mounting Force **70.0 ÷ 90.0 kN**  
Nominal Weight **2200 g**

**D<sub>s</sub> 44.60 (1.756)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact*  
**D<sub>a</sub> 15.70 (0.618)** *The air distance is defined as the shortest direct path between the anode flange and gate contact*

**Package Type T.G6**

Mounting Force **70.0 ÷ 90.0 kN**  
Nominal Weight **2700 g**

**D<sub>s</sub> 62.09 (2.444)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact*  
**D<sub>a</sub> 23.40 (0.921)** *The air distance is defined as the shortest direct path between the anode flange and gate contact*

**Package Type T.H1**

Mounting Force **60.0 ÷ 70.0 kN**  
Nominal Weight **1900 g**

**D<sub>s</sub> 36.50 (1.437)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode flange and the gate contact*  
**D<sub>a</sub> 16.50 (0.650)** *The air distance is defined as the shortest direct path between the anode flange and gate contact*

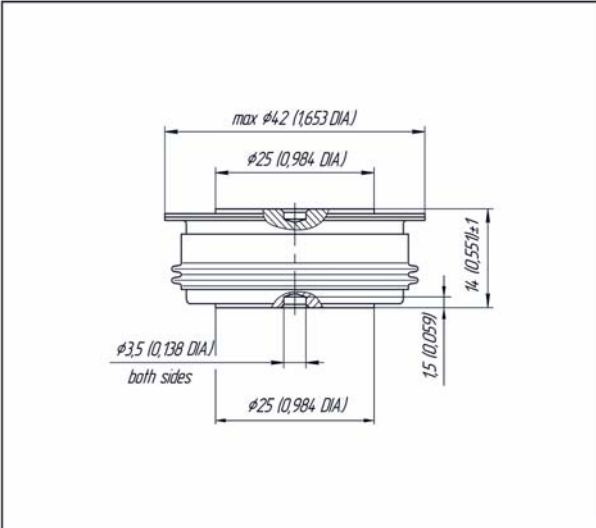
**Package Type D.A1**

Mounting Force **5.0 ÷ 7.0 kN**  
Nominal Weight **65 g**

**D<sub>s</sub> 11.74 (0.462)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges*  
**D<sub>a</sub> 11.60 (0.457)** *The air distance is defined as the shortest direct path between the anode and cathode flanges*

**Package Type D.B1**

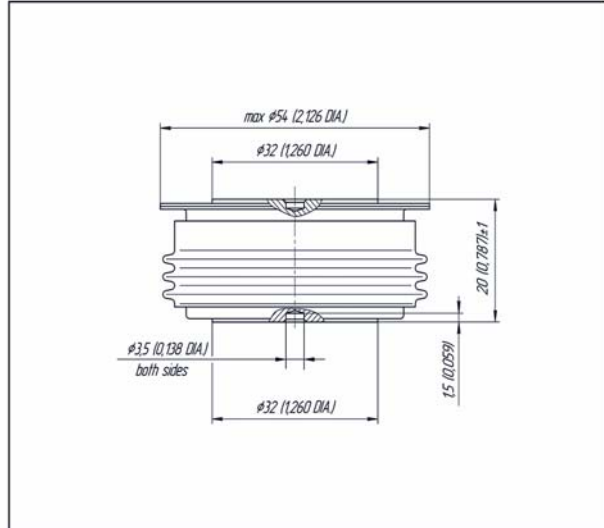
Mounting Force **9.0 ÷ 11.0 kN**  
Nominal Weight **110 g**



**D<sub>s</sub> 11.1 (0.437)** The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges  
**D<sub>a</sub> 11.6 (0.457)** The air distance is defined as the shortest direct path between the anode and cathode flanges

**Package Type D.B2**

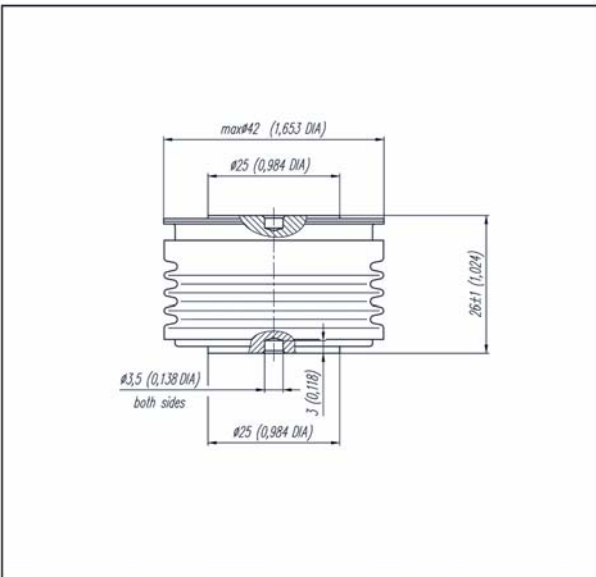
Mounting Force **9.0 ÷ 11.0 kN**  
Nominal Weight **180 g**



**D<sub>s</sub> 23.69 (0.933)** The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges  
**D<sub>a</sub> 19.10 (0.752)** The air distance is defined as the shortest direct path between the anode and cathode flanges

**Package Type D.B3**

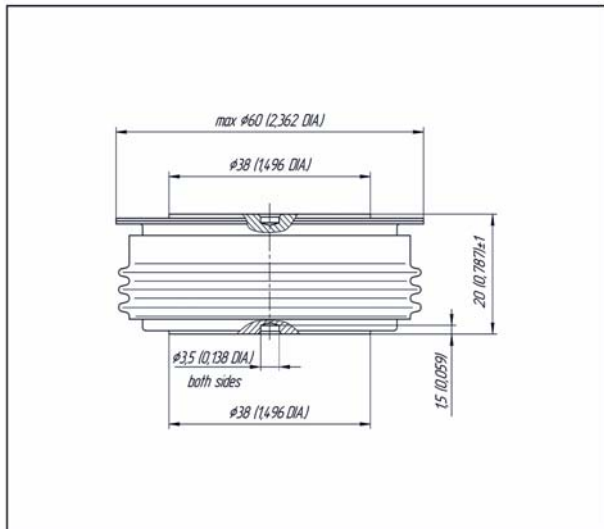
Mounting Force **9.0 ÷ 11.0 kN**  
Nominal Weight **210 g**



**D<sub>s</sub> 30.77 (1.211)** The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges  
**D<sub>a</sub> 24.40 (0.960)** The air distance is defined as the shortest direct path between the anode and cathode flanges

**Package Type D.C2**

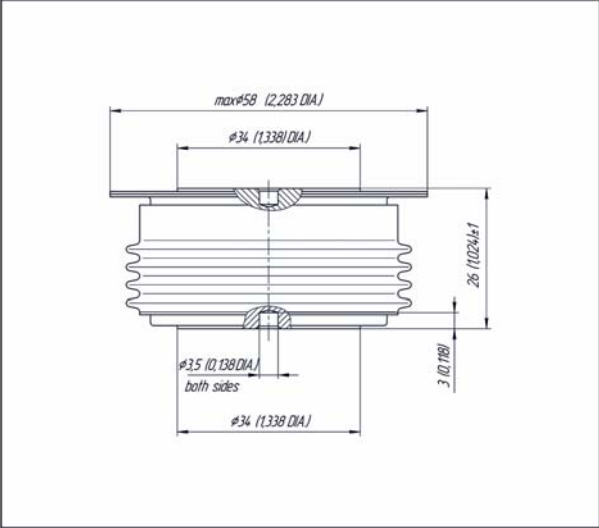
Mounting Force **14.0 ÷ 16.0 kN**  
Nominal Weight **260 g**



**D<sub>s</sub> 23.69 (0.933)** The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges  
**D<sub>a</sub> 19.10 (0.752)** The air distance is defined as the shortest direct path between the anode and cathode flanges

**Package Type D.C3**

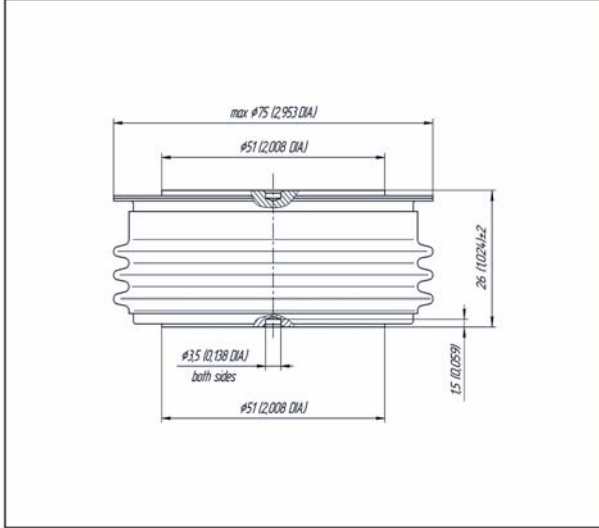
Mounting Force **14.0 ÷ 16.0 kN**  
 Nominal Weight **280 g**



**D<sub>s</sub> 33.3 (1.311)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges*  
**D<sub>a</sub> 22.5 (0.886)** *The air distance is defined as the shortest direct path between the anode and cathode flanges*

**Package Type D.D2**

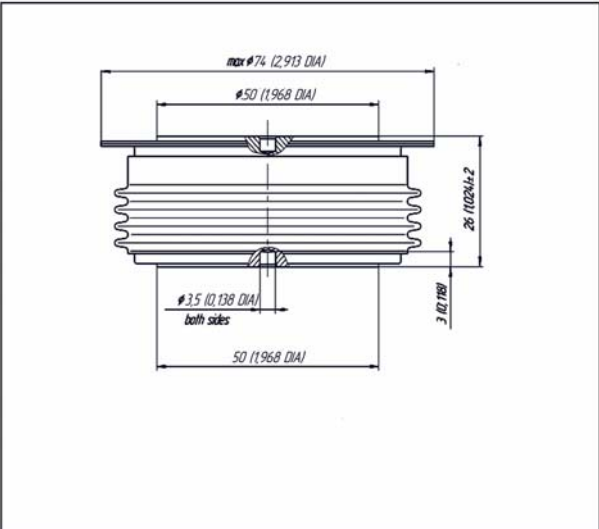
Mounting Force **24.0 ÷ 28.0 kN**  
 Nominal Weight **550 g**



**D<sub>s</sub> 33.72 (1.327)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges*  
**D<sub>a</sub> 24.50 (0.964)** *The air distance is defined as the shortest direct path between the anode and cathode flanges*

**Package Type D.D3**

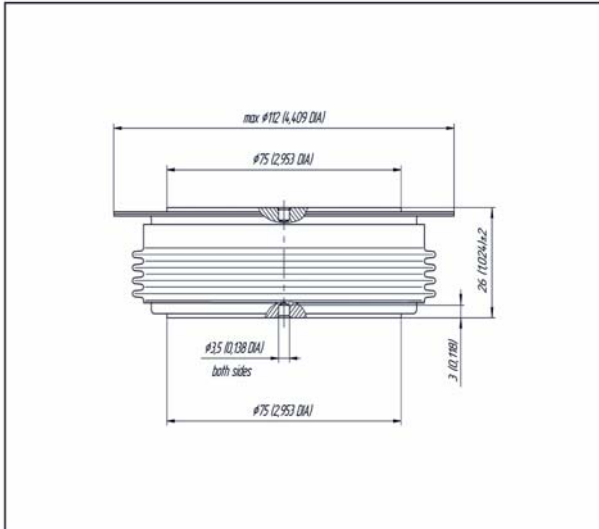
Mounting Force **24.0 ÷ 28.0 kN**  
 Nominal Weight **510 g**



**D<sub>s</sub> 38.84 (1.529)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges*  
**D<sub>a</sub> 22.50 (0.886)** *The air distance is defined as the shortest direct path between the anode and cathode flanges*

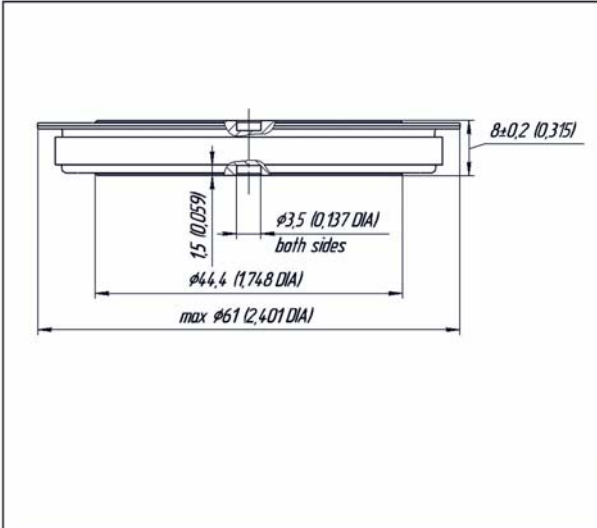
**Package Type D.F1**

Mounting Force **40.0 ÷ 50.0 kN**  
 Nominal Weight **1500 g**



**D<sub>s</sub> 41.4 (1.630)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges*  
**D<sub>a</sub> 23.1 (0.909)** *The air distance is defined as the shortest direct path between the anode and cathode flanges*

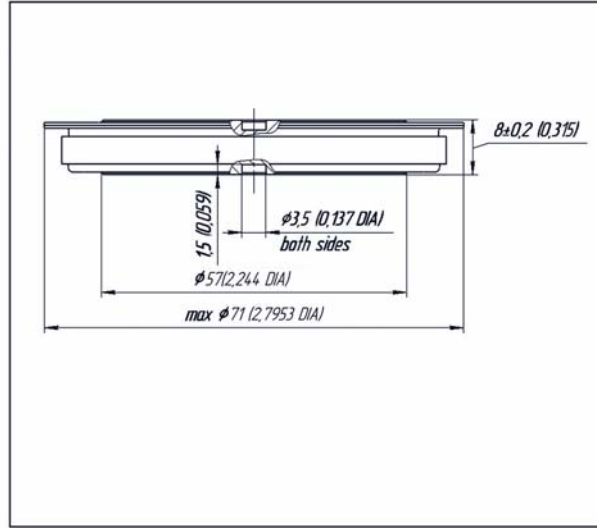
**Package Type D.Q1**

 Mounting Force **30.0 ÷ 36.0 kN**  
 Nominal Weight **140 g**


**D<sub>s</sub> 4.0 (0.157)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges*

**D<sub>a</sub> 4.0 (0.157)** *The air distance is defined as the shortest direct path between the anode and cathode flanges*

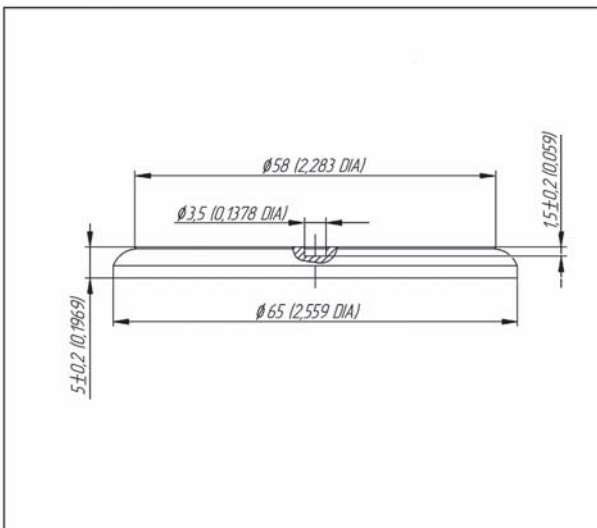
**Package Type D.W1**

 Mounting Force **60.0 ÷ 70.0 kN**  
 Nominal Weight **220 g**


**D<sub>s</sub> 4.0 (0.157)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges*

**D<sub>a</sub> 4.0 (0.157)** *The air distance is defined as the shortest direct path between the anode and cathode flanges*

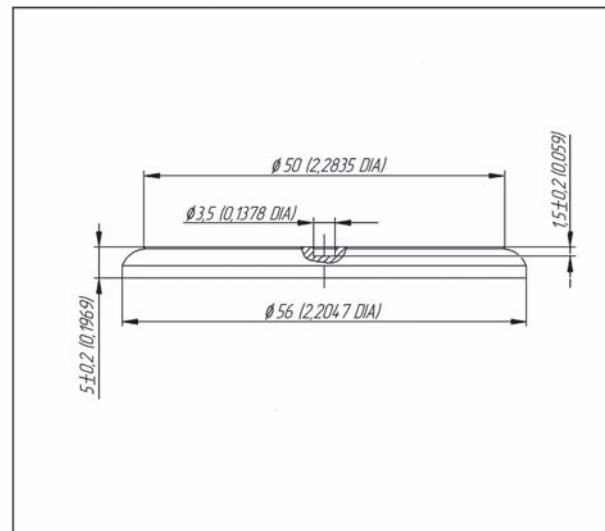
**Package Type Housingless**

 Mounting Force **60.0 ÷ 70.0 kN**  
 Nominal Weight **155 g**


**D<sub>s</sub> 2.0 (0.079)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges*

**D<sub>a</sub> 2.0 (0.079)** *The air distance is defined as the shortest direct path between the anode and cathode flanges*

**Package Type Housingless**

 Mounting Force **45.0 ÷ 50.0 kN**  
 Nominal Weight **110 g**


**D<sub>s</sub> 2.0 (0.079)** *The surface creepage distance is defined as the shortest path along the ceramic surface between the anode and cathode flanges*

**D<sub>a</sub> 2.0 (0.079)** *The air distance is defined as the shortest direct path between the anode and cathode flanges*

### Package Type T.SA1

<b>Tightening torque</b>	<b>20 ÷ 30 Nm</b>
<b>Nominal Weight</b>	<b>250 g</b>

<b>D<sub>s</sub></b>	<b>12.4(4.882)</b>	Surface creepage distance
<b>D<sub>a</sub></b>	<b>12.4(4.882)</b>	Air strike distance

Package type	Type of screw	W	H
T.SA1-MA	Metric Screw-thread	M20x1,5	16 (0,63)
T.SA1-IA	Inch Screw-thread	3/4"-16UNF	27 (1,07)

Polarity for the USA customs

Polarity	Example of code designation	Reference designation	Anode	Colors Cathode	Gate
Anode to stud	T220-SA1-IA-18		-	Black tube	White

Polarity for Europe customs (on default)

Polarity	Example of code designation	Reference designation	Anode	Colors Cathode	Gate
Anode to stud	T220-SA1-MA-18		-	Red tube	White

\*Please inform us about type of color marking (for the USA or Europe)

### Package Type T.SB1

<b>Tightening torque</b>	<b>25 ÷ 35 Nm</b>
<b>Nominal Weight</b>	<b>440 g</b>

<b>D<sub>s</sub></b>	<b>12.4(4.882)</b>	Surface creepage distance
<b>D<sub>a</sub></b>	<b>12.4(4.882)</b>	Air strike distance

Package type	Type of screw	W	H
T.SB1-MA	Metric Screw-thread	M24x1,5	18 (1,08)
T.SB1-IA	Inch Screw-thread	3/4"-16UNF	27

Polarity for the USA customs

Polarity	Example of code designation	Reference designation	Anode	Colors Cathode	Gate
Anode to stud	T355-SB1-IA-18		-	Black tube	White

Polarity for Europe customs (on default)

Polarity	Example of code designation	Reference designation	Anode	Colors Cathode	Gate
Anode to stud	T355-SB1-MA-18		-	Red tube	White

\*Please inform us about type of color marking (for the USA or Europe)

### Package Type T.SB2

<b>Tightening torque</b>	<b>25 ÷ 35 Nm</b>
<b>Nominal Weight</b>	<b>440 g</b>

<b>D<sub>s</sub></b>	<b>12.4(4.882)</b>	Surface creepage distance
<b>D<sub>a</sub></b>	<b>12.4(4.882)</b>	Air strike distance

Package type	Type of screw	W	H
T.SB2-MA	Metric Screw-thread	M24x1,5	18 (1,08)
T.SB2-IA	Inch Screw-thread	3/4"-16UNF	27

Polarity for the USA customs

Polarity	Example of code designation	Reference designation	Anode	Colors Cathode	Gate
Anode to stud	T355-SB2-IA-18		-	Black tube	White

Polarity for Europe customs (on default)

Polarity	Example of code designation	Reference designation	Anode	Colors Cathode	Gate
Anode to stud	T355-SB2-MA-18		-	Red tube	White

\*Please inform us about type of color marking (for the USA or Europe)

### Package Type T.SB3

<b>Mounting Force</b>	<b>1.5 ÷ 2.5 Nm</b>
<b>Nominal Weight</b>	<b>500 g</b>

<b>D<sub>s</sub></b>	<b>12.4(4.882)</b>	Surface creepage distance
<b>D<sub>a</sub></b>	<b>12.4(4.882)</b>	Air strike distance

Package type	Type of screw	W	H
T.SB3-MA	Metric Screw-thread	M24x1,5	18 (1,08)
T.SB3-IA	Inch Screw-thread	3/4"-16UNF	27

Polarity for the USA customs

Polarity	Example of code designation	Reference designation	Anode	Colors Cathode	Gate
Anode to stud	T395-SB3-18		-	Black tube	White

Polarity for Europe customs (on default)

Polarity	Example of code designation	Reference designation	Anode	Colors Cathode	Gate
Anode to stud	T395-SB3-18		-	Red tube	White

\*Please inform us about type of color marking (for the USA or Europe)



### Package Type **D.SA1**

Tightening torque	<b>20 ± 30 Nm</b>
Nominal Weight	<b>250 g</b>

<b>D<sub>s</sub></b> 12.4(4.882)	Surface creepage distance
<b>D<sub>a</sub></b> 12.4(4.882)	Air strike distance

Package type	Type of screw	W	H
D.SA1-MA	Metric Screw-thread	M20x1,5	16 (0,63)
D.SA1-IA	Inch Screw-thread	3/4"-16UNF	27 (1,07)

Polarity for the USA customs

Polarity	Example of code designation	Reference designation	Colors	
			Anode	Cathode
Normal	Cathode to stud	D465-SA1- <b>IAX</b> -18	Red tube	-
Reverse	Anode to stud	D465-SA1- <b>IA</b> -18	-	Black tube

Polarity for Europe customs (on default)

Polarity	Example of code designation	Reference designation	Colors	
			Anode	Cathode
Normal	Anode to stud	D465-SA1- <b>MA</b> -18	-	Red tube
Reverse	Cathode to stud	D465-SA1- <b>MAX</b> -18	Black tube	-

\*Please inform us about type of color marking (for the USA or Europe)

### Package Type **D.SA2**

Mounting force	<b>1.5 ± 2.5 kN</b>
Nominal Weight	<b>300 g</b>

<b>D<sub>s</sub></b> 12.4(4.882)	Surface creepage distance
<b>D<sub>a</sub></b> 12.4(4.882)	Air strike distance

Package type	Type of screw	W	H
D.SA2-MA	Metric Screw-thread	M24x1,5	18 (1,08)
D.SA2-IA	Inch Screw-thread	3/4"-16UNF	27

Polarity for the USA customs

Polarity	Example of code designation	Reference designation	Colors	
			Anode	Cathode
Normal	Cathode to stud	D655-SA2 <b>X</b> -18	Red tube	-
Reverse	Anode to stud	D655-SA2-18	-	Black tube

Polarity for Europe customs (on default)

Polarity	Example of code designation	Reference designation	Colors	
			Anode	Cathode
Normal	Anode to stud	D655-SA2-18	-	Red tube
Reverse	Cathode to stud	D655-SA2 <b>X</b> -18	Black tube	-

\*Please inform us about type of color marking (for the USA or Europe)

### Package Type **D.SB1**

Tightening torque	<b>25 ± 35 Nm</b>
Nominal Weight	<b>440 g</b>

<b>D<sub>s</sub></b> 12.4(4.882)	Surface creepage distance
<b>D<sub>a</sub></b> 12.4(4.882)	Air strike distance

Package type	Type of screw	W	H
D.SB1-MA	Metric Screw-thread	M24x1,5	18 (1,08)
D.SB1-IA	Inch Screw-thread	3/4"-16UNF	27

Polarity for the USA customs

Polarity	Example of code designation	Reference designation	Colors	
			Anode	Cathode
Normal	Cathode to stud	D715-SB1- <b>IAX</b> -18	Red tube	-
Reverse	Anode to stud	D715-SB1- <b>IA</b> -18	-	Black tube

Polarity for Europe customs (on default)

Polarity	Example of code designation	Reference designation	Colors	
			Anode	Cathode
Normal	Anode to stud	D715-SB1- <b>MA</b> -18	-	Red tube
Reverse	Cathode to stud	D715-SB1- <b>MAX</b> -18	Black tube	-

\*Please inform us about type of color marking (for the USA or Europe)

### Package Type **D.SB2**

Tightening torque	<b>25 ± 35 Nm</b>
Nominal Weight	<b>470 g</b>

<b>D<sub>s</sub></b> 12.4(4.882)	Surface creepage distance
<b>D<sub>a</sub></b> 12.4(4.882)	Air strike distance

Package type	Type of screw	W	H
D.SB2-MA	Metric Screw-thread	M24x1,5	18 (1,08)
D.SB2-IA	Inch Screw-thread	3/4"-16UNF	27

Polarity for the USA customs

Polarity	Example of code designation	Reference designation	Colors	
			Anode	Cathode
Normal	Cathode to stud	D715-SB2- <b>IAX</b> -18	Red tube	-
Reverse	Anode to stud	D715-SB2- <b>IA</b> -18	-	Black tube

Polarity for Europe customs (on default)

Polarity	Example of code designation	Reference designation	Colors	
			Anode	Cathode
Normal	Anode to stud	D715-SB2- <b>MA</b> -18	-	Red tube
Reverse	Cathode to stud	D715-SB2- <b>MAX</b> -18	Black tube	-

\*Please inform us about type of color marking (for the USA or Europe)

### Package Type **D.SB3**

Mounting force	<b>1.5 ÷ 2.5 kN</b>
Nominal Weight	<b>500 g</b>

<b>D<sub>s</sub></b>	<b>12.4(4.882)</b>	Surface creepage distance
<b>D<sub>a</sub></b>	<b>12.4(4.882)</b>	Air strike distance

Polarity	Example of code designation	Reference designation	Colors	
			Anode	Cathode
Normal	Cathode to stud	D790-SB3X-18	Red tube	-
Reverse	Anode to stud	D790-SB3-18	-	Black tube

Polarity	Example of code designation	Reference designation	Colors	
			Anode	Cathode
Normal	Anode to stud	D790-SB3-18	-	Red tube
Reverse	Cathode to stud	D790-SB3X-18	Black tube	-

\*Please inform us about type of color marking (for the USA or Europe)

### Package Type **M.A2**

Nominal Weight **1500 g**

<b>MT3</b>	<b>MT4</b>	<b>MT5</b>	<b>MD3</b>	<b>MD4</b>	<b>MD5</b>
------------	------------	------------	------------	------------	------------

<b>MT/D3</b>	<b>MD/T3</b>	<b>MT/D4</b>	<b>MD/T4</b>	<b>MT/D5</b>	<b>MD/T5</b>
--------------	--------------	--------------	--------------	--------------	--------------

Mounting Torque (M6) **6.00 Nm** (Tolerance ±15%)  
 Terminal Connection Torque (M10) **12.00 Nm** (Tolerance ±15%)

\* The screws must be lubricated

### Package Type **M.C1**

Nominal Weight **800 g**

<b>MT3</b>	<b>MT4</b>	<b>MT5</b>	<b>MD3</b>	<b>MD4</b>	<b>MD5</b>
------------	------------	------------	------------	------------	------------

<b>MT/D3</b>	<b>MD/T3</b>	<b>MT/D4</b>	<b>MD/T4</b>	<b>MT/D5</b>	<b>MD/T5</b>
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Mounting Torque (M6) **6.00 Nm** (Tolerance ±15%)  
 Terminal Connection Torque (M8) **9.00 Nm** (Tolerance ±15%)

\* The screws must be lubricated

### Package Type **M.D**

Nominal Weight **3500 g**

<b>MT3</b>	<b>MT4</b>	<b>MT5</b>	<b>MD3</b>	<b>MD4</b>	<b>MD5</b>
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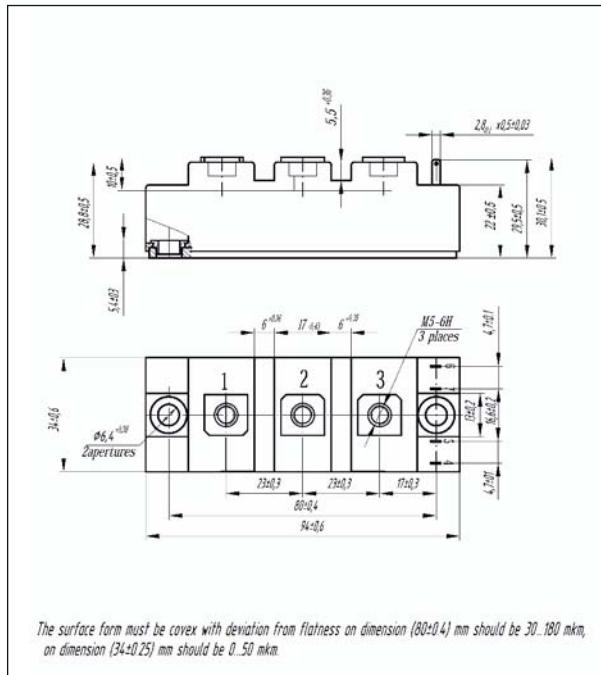
<b>MT/D3</b>	<b>MD/T3</b>	<b>MT/D4</b>	<b>MD/T4</b>	<b>MT/D5</b>	<b>MD/T5</b>
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Mounting Torque (M8) **6.00 Nm** (Tolerance ±15%)  
 Terminal Connection Torque (M12) **18.00 Nm** (Tolerance ±10%)

\* The screws must be lubricated



## Package Type MIFA



## Proton-Electrotex, JSC

19, Leskova Str.,  
Orel, 302040, Russia  
Tel.: +7 (4862) 44-04-56  
44-06-42 / 44-04-26  
[www.proton-electrotex.com](http://www.proton-electrotex.com)



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