CONTROLLED AVALANCHE RECTIFIER DIODES

Diffused silicon diodes in DO–4 metal envelopes, capable of absorbing transients and intended for power rectifier applications. The series consists of the following types:
Normal polarity (cathode to stud): BYX25–600 to BYX25–1400.
Reverse polarity (anode to stud): BYX25–600R to BYX25–1400R.

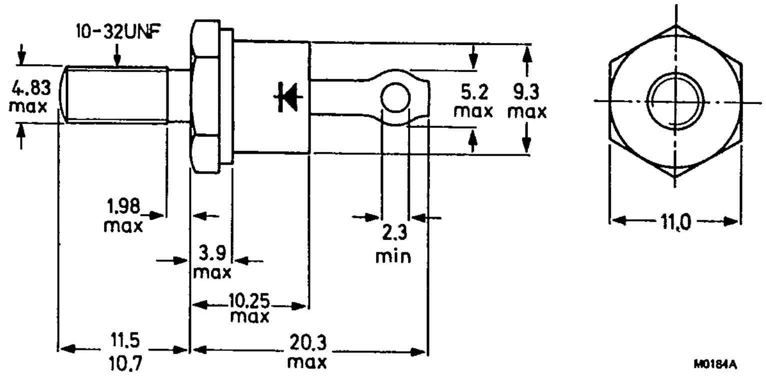
QUICK REFERENCE DATA

			BYX25–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	1200	1400	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	750	1000	1250	1450	1650	V
Average forward current	$I_{F(AV)}$	max.			20			A
Non-repetitive peak forward current	I_{FSM}	max.			360			A
Non-repetitive peak reverse power	P_{RSM}	max.			18			kW

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO–4.



Net mass: 7 g.

Diameter of clearance hole: max. 5.2 mm.

Accessories supplied on request:
see ACCESSORIES section

Supplied with device: 1 nut, 1 lock washer.

Nut dimensions across the flats: 9.5 mm

Torque on nut:
min. 0.9 Nm (9 kg cm),
max. 1.7 Nm (17 kg cm).

The mark shown applies to to the normal polarity types.

Products approved to CECC 50 009–022 available on request.

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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages*			BYX25–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	1200	1400	V
Continuous reverse voltage	V_R	max.	600	800	1000	1200	1400	V

Currents				
Average forward current (averaged over any 20 ms period) up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	20	A
Repetitive peak forward current	I_{FRM}	max.	440	A
Non-repetitive peak forward current t = 10 ms (half sine-wave); T_j = 175 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	360	A
I^2t for fusing	I^2t	max.	650	A^2s
Reverse power dissipation				
Average reverse power dissipation (averaged over any 20 ms period); T_j = 175 °C	$P_{R(AV)}$	max.	38	W
Repetitive peak reverse power dissipation t = 10 µs (square-wave; f = 50 Hz); T_j = 175 °C	P_{RRM}	max.	3	kW
Non-repetitive peak reverse power dissipation t = 10 µs (square-wave)				
T_j = 25 °C prior to surge	P_{RSM}	max.	18	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	3	kW
Temperatures				
Storage temperature	T_{stg}		−55 to +175	°C
Junction temperature	T_j	max.	175	°C

*To ensure thermal stability: $R_{th\ j\text{-}a} < 5$ K/W (a.c.)

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THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.3	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.5	°C/W

CHARACTERISTICS

			BYX25–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Forward voltage $I_F = 50$ A; $T_j = 25$ °C	V_F	<	1.8	1.8	1.8	1.8	1.8	V*
Reverse avalanche breakdown voltage $I_R = 5$ mA; $T_j = 25$ °C	$V_{(BR)R}$	>	750	1000	1250	1450	1650	V
		<	2400	2400	2400	2400	2400	V
Peak reverse current $V_R = V_{RWMmax}$; $T_j = 125$ °C	I_R	<	1.0	0.8	0.6	0.5	0.5	mA

*Measured under pulse conditions to avoid excessive dissipation.

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OPERATING NOTES

1. **Voltage sharing of series connected controlled avalanche diodes.**

   If diodes with avalanche characteristics are connected in series, the usual R and C elements for voltage sharing can be omitted.

2. The top connector should not be bent; it should be soldered into the circuit so that there is no strain on it.
   During soldering the heat conduction to the junction should be kept to a minimum by using a thermal shunt.

Determination of the heatsink thermal resistance

Example:

Assume a diode, used in a three phase rectifier circuit.

frequency	f	= 50 Hz
average forward current	I_{FAV}	= 10 A (per diode)
ambient temperature	T_{amb}	= 40 °C
repetitive peak reverse power dissipation in the avalanche region	P_{RRM}	= 2 kW (per diode)
duration of P_{RRM}	t	= 40 μs

From the left hand part of the upper graph on page 5 it follows that at I_{FAV} = 10 A in a three phase rectifier circuit the average forward power + average leakage power = 19.5 W per diode (point A). The average reverse power in the avalanche region, averaged over any cycle, follows from:

$$P_{RAV} = \delta \times P_{RRM}, \text{ where the duty cycle } \delta = \frac{40\ \mu s}{20\ ms} = 0.002$$

Thus: P_{RAV} = 0.002 x 2 kW = 4 W

Therefore the total device power dissipation P_{tot} = (19.5 + 4) W = 23.5 W (point B).

In order to avoid excessive peak junction temperatures resulting from the pulse character of the repetitive peak reverse power in the avalanche region, the value of the maximum junction temperature should be reduced. If the repetitive peak reverse power in the avalanche region is 2 kW; t = 40 μs; f = 50 Hz, the maximum allowable junction temperature should be 163 °C instead of 175 °C, thus 12 °C lower (see the lower graph on page 5).

Allowance can be made for this by assuming an ambient temperature 12 °C higher than before, in this case 52 °C instead of 40 °C.

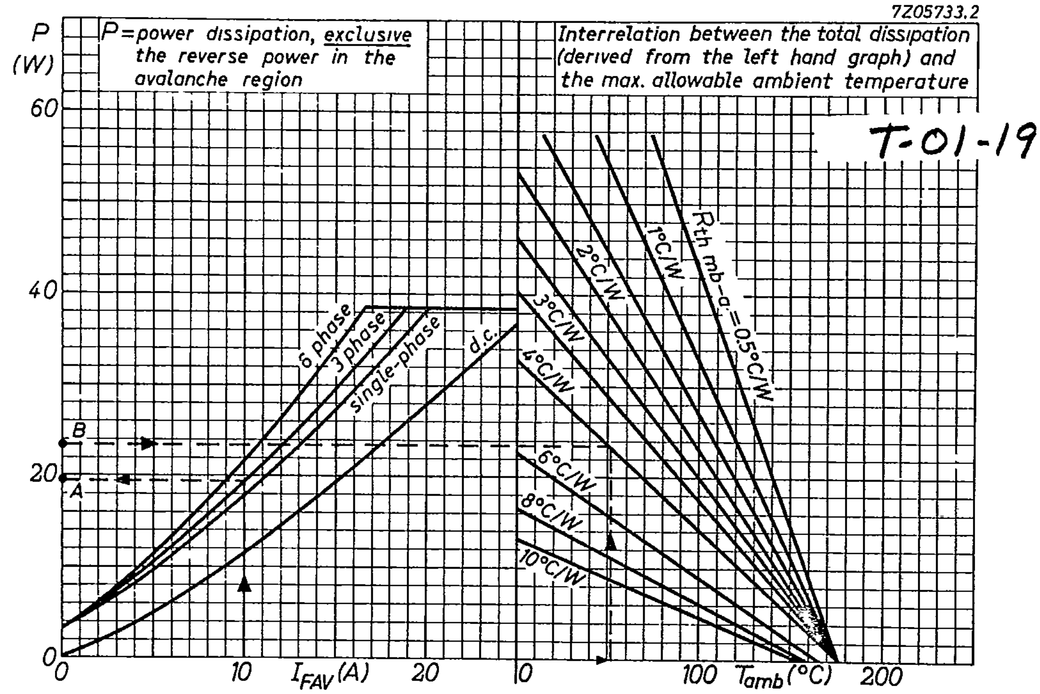
Using this in the curve leads to a thermal resistance

$$R_{th\ mb\text{-}a} \approx 4\ °C/W$$

The contact thermal resistance $R_{th\ mb\text{-}h}$ = 0.5 °C/W

Hence the heatsink thermal resistance should be:

$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h} = (4 - 0.5)\ °C/W = 3.5\ °C/W$$


7Z05733.2
P (W)
P=power dissipation, exclusive the reverse power in the avalanche region
Interrelation between the total dissipation (derived from the left hand graph) and the max. allowable ambient temperature
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6 phase
3 phase
single-phase
d.c.
$R_{th\ mb-a}$=0.5°C/W
1°C/W
2°C/W
3°C/W
4°C/W
6°C/W
8°C/W
10°C/W
B
A
0
20
40
60
0
10
I_{FAV} (A)
20
0
100
T_{amb} (°C)
200

Fig.2

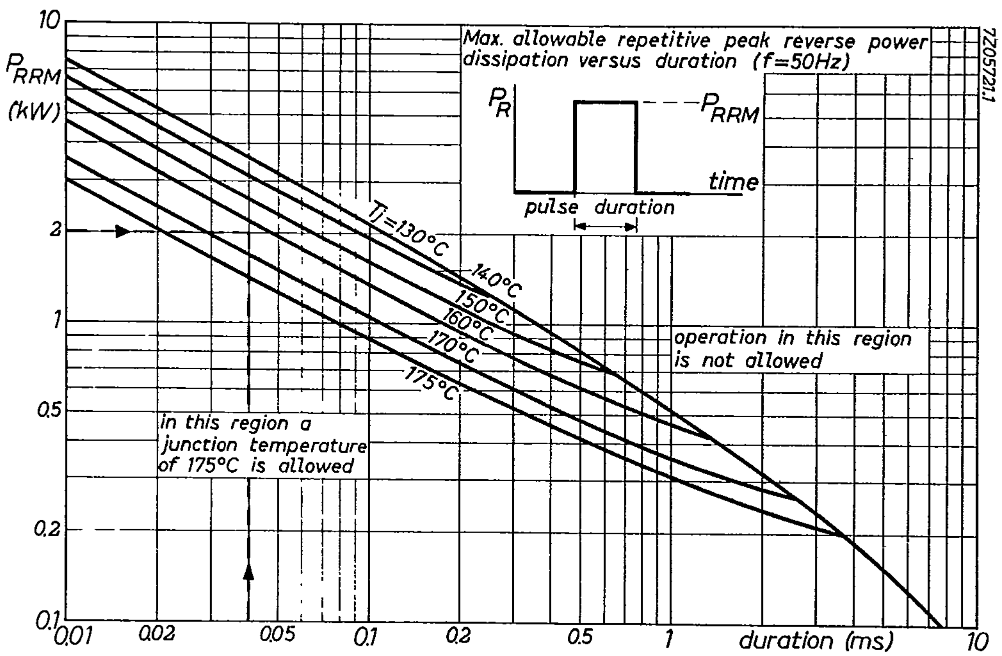
7Z05721.1
P_{RRM} (kW)
Max. allowable repetitive peak reverse power dissipation versus duration (f=50Hz)
P_R
P_{RRM}
time
pulse duration
T_j=130°C
140°C
150°C
160°C
170°C
175°C
operation in this region is not allowed
in this region a junction temperature of 175°C is allowed
10
2
1
0.5
0.2
0.1
0.01
0.02
0.05
0.1
0.2
0.5
1
duration (ms)
10

Fig.3

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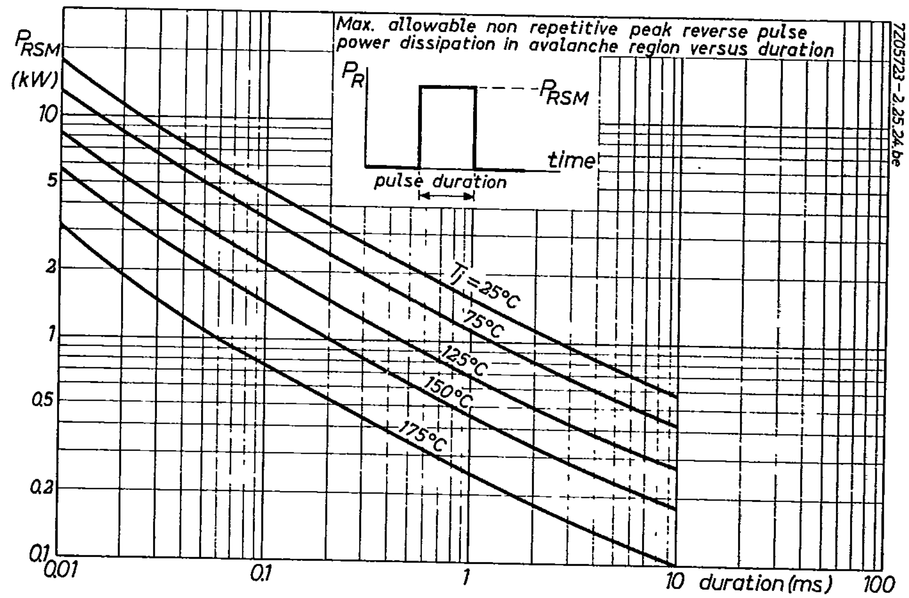

Fig.4

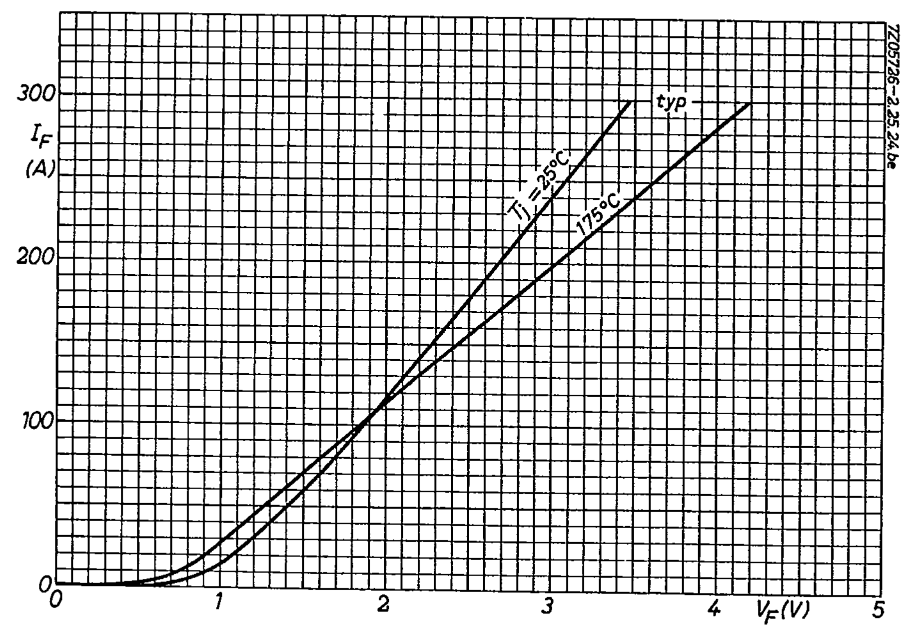

Fig.5

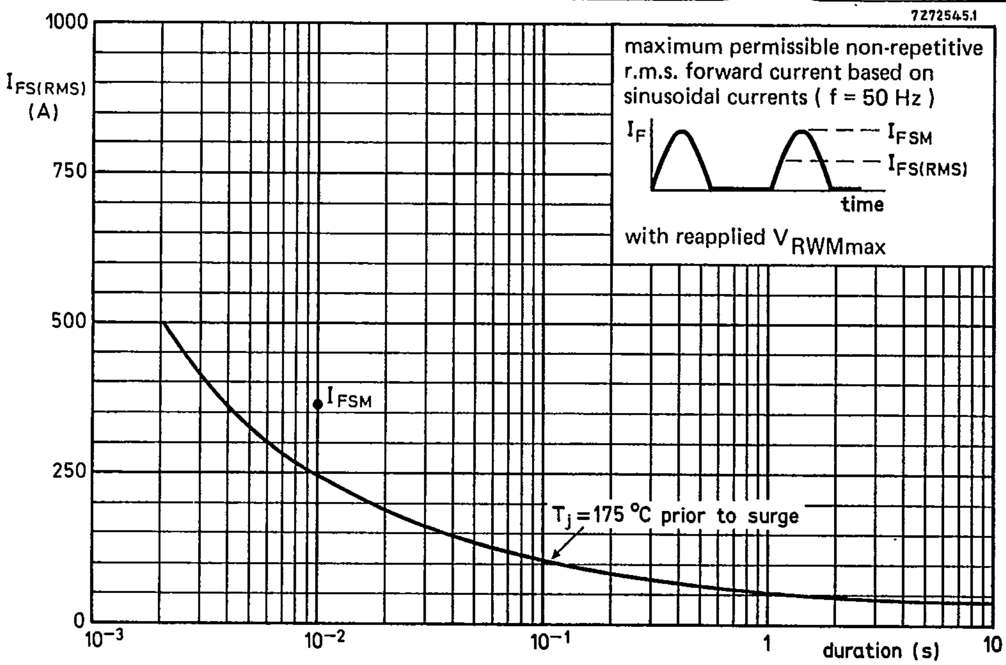
7Z72545.1
1000
$I_{FS(RMS)}$
(A)
750
500
250
0
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
$I_{FS(RMS)}$
time
with reapplied V_{RWMmax}
I_{FSM}
T_j = 175 °C prior to surge

Fig.6