Semiconductors and integrated circuits

Part 1a August 1978

Rectifier diodes

Voltage regulator diodes

Transient suppressor diodes

Rectifier stacks

Thyristors

Triacs

SEMICONDUCTORS AND INTEGRATED CIRCUITS

PART 1a — AUGUST 1978

RECTIFIER DIODES, THYRISTORS, TRIACS

DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, sub-assemblies and materials; it is made up of three series of handbooks each comprising several parts.

ELECTRON TUBES	BLUE
SEMICONDUCTORS AND INTEGRATED CIRCUITS	RED
COMPONENTS AND MATERIALS	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

ELECTRON TUBES (BLUE SERIES)

Part 1a	December 1975	ET1a 12-75	**Transmitting tubes for communication, tubes for r.f. heating** Types PE05/25 to TBW15/25
Part 1b	August 1977	ET1b 08-77	**Transmitting tubes for communication, tubes for r.f. heating, amplifier circuit assemblies**
Part 2a	November 1977	ET2a 11-77	**Microwave tubes** Communication magnetrons, magnetrons for microwave heating, klystrons, travelling-wave tubes, diodes, triodes T-R switches
Part 2b	May 1978	ET2b 05-78	**Microwave semiconductors and components** Gunn, Impatt and noise diodes, mixer and detector diodes, backward diodes, varactor diodes, Gunn oscillators, sub-assemblies, circulators and isolators
Part 3	January 1975	ET3 01-75	**Special Quality tubes, miscellaneous devices**
Part 4	March 1975	ET4 03-75	**Receiving tubes**
Part 5a	March 1978	ET5a 03-78	**Cathode-ray tubes** Instrument tubes, monitor and display tubes, C.R. tubes for special applications
Part 5b	May 1975	ET5b 05-75	**Camera tubes, image intensifier tubes**
Part 6	January 1977	ET6 01-77	**Products for nuclear technology** Channel electron multipliers, neutron tubes, Geiger-Müller tubes
Part 7a	March 1977	ET7a 03-77	**Gas-filled tubes** Thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes
Part 7b	March 1977	ET7b 03-77	**Gas-filled tubes** Segment indicator tubes, indicator tubes, switching diodes, dry reed contact units
Part 8	May 1977	ET8 05-77	**TV picture tubes**
Part 9	March 1978	ET9 03-78	**Photomultiplier tubes; phototubes**

SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

Part 1a	**August 1978**	**SC1a 08-78**	**Rectifier diodes, thyristors, triacs** Rectifier diodes, voltage regulator diodes (> 1,5 W), transient suppressor diodes, rectifier stacks, thyristors, triacs
Part 1b	**May 1977**	**SC1b 05-77**	**Diodes** Small signal germanium diodes, small signal silicon diodes, special diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes
Part 2	**November 1977**	**SC2 11-77**	**Low-frequency and dual transistors**
Part 3	**January 1978**	**SC3 01-78**	**High-frequency, switching and field-effect transistors**
Part 4a	**June 1976**	**SC4a 06-76**	**Special semiconductors*** Transmitting transistors, field-effect transistors, dual transistors, microminiature devices for thick and thin-film circuits
Part 4b	**September 1978**	**SC4b 09-78**	**Devices for optoelectronics** Photosensitive diodes and transistors, light emitting diodes, photocouplers, infrared sensitive devices, photoconductive devices
Part 4c	**July 1978**	**SC4c 07-78**	**Discrete semiconductors for hybrid thick and thin-film circuits**
Part 5a	**November 1976**	**SC5a 11-76**	**Professional analogue integrated circuits**
Part 5b	**March 1977**	**SC5b 03-77**	**Consumer integrated circuits** Radio-audio, television
Part 6	**October 1977**	**SC6 10-77**	**Digital integrated circuits** LOCMOS HE4000B family
Signetics integrated circuits 1978			Bipolar and MOS memories Bipolar and MOS microprocessors Analogue circuits

* The most recent information on field-effect transistors can be found in SC3 01-78, on dual transistors in SC2 11-77, and on microminiature devices in SC4c 07-78.

COMPONENTS AND MATERIALS (GREEN SERIES)

Part 1	June 1977	CM1 06-77	**Assemblies for industrial use** High noise immunity logic FZ/30-series, counter modules 50-series, NORbits 60-series, 61-series, circuit blocks 90-series, circuit block CSA70(L), PLC modules, input/output devices, hybrid circuits, peripheral devices, ferrite core memory products
Part 2a	October 1977	CM2a 10-77	**Resistors** Fixed resistors, variable resistors, voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC), test switches
Part 2b	February 1978	CM2b 02-78	**Capacitors** Electrolytic and solid capacitors, film capacitors, ceramic capacitors, variable capacitors
Part 3	January 1977	CM3 01-77	**Radio, audio, television** FM tuners, loudspeakers, television tuners and aerial input assemblies, components for black and white television, components for colour television
Part 4a	October 1976	CM4a 10-76	**Soft ferrites** Ferrites for radio, audio and television, beads and chokes, Ferroxcube potcores and square cores, Ferroxcube transformer cores
Part 4b	December 1976	CM4b 12-76	**Piezoelectric ceramics, permanent magnet materials**
Part 5	July 1975	CM5 07-75	**Ferrite core memory products** Ferroxcube memory cores, matrix planes and stacks, core memory systems
Part 6	April 1977	CM6 04-77	**Electric motors and accessories** Small synchronous motors, stepper motors, miniature direct current motors
Part 7	September 1971	CM7 09-71	**Circuit blocks** Circuit blocks 100 kHz-series, circuit blocks 1-series, circuit blocks 10-series, circuit blocks for ferrite core memory drive
Part 8	February 1977	CM8 02-77	**Variable mains transformers**
Part 9	March 1976	CM9 03-76	**Piezoelectric quartz devices**
Part 10	April 1978	CM10 04-78	**Connectors**

GENERAL

Type designation
Rating systems
Letter symbols

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices — as opposed to integrated circuits —, multiples of such devices and semiconductor chips.

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

The first letter gives information about the material used for the active part of the devices.

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with band gap of 1,3 eV or more.
R. COMPOUND MATERIALS (e.g. Cadmium-Sulphide).

SECOND LETTER

The second letter indicates the function for which the device is primarily designed.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th\ j\text{-}mb} > 15\ ^oC/W$)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leqslant 15\ ^oC/W$)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15\ ^oC/W$)
G. MULTIPLE OF DISSIMILAR DEVICES — MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leqslant 15\ ^oC/W$)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th\ j\text{-}mb} > 15\ ^oC/W$)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15\ ^oC/W$)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leqslant 15\ ^oC/W$)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15\ ^oC/W$)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter W)

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.
This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

Sub-classification can be used for devices supplied in a wide range of variants called associated types. Following sub-coding suffixes are in use:

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: *ONE LETTER and ONE NUMBER*
   The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage
   A. 1% (according to IEC 63: series E96)
   B. 2% (according to IEC 63: series E48)
   C. 5% (according to IEC 63: series E24)
   D. 10% (according to IEC 63: series E12)
   E. 20% (according to IEC 63: series E6)
   The number denotes the typical operating (Zener) voltage related to the nominal current rating for the whole range.
   The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: *ONE NUMBER*
   The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R. The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: *ONE NUMBER*
   The NUMBER indicates the rated maximum repetitive peak reverse voltage (V_{RRM}) or the rated repetitive peak off-state voltage (V_{DRM}), whichever is the lower. Reversed polarity is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: *ONE NUMBER,* preceded by a hyphen (–)
   The NUMBER indicates the depletion layer in μm. The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER,* preceded by a stroke (/).
   The NUMBER indicates how many basic devices are assembled into the array.

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

Electronic device. An electronic tube or valve, transistor or other semiconductor device.

Note
This definition excludes inductors, capacitors, resistors and similar components.

Characteristic. A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

Bogey electronic device. An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Rating. A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

Note
Limiting conditions may be either maxima or minima.

Rating system. The set of principles upon which ratings are established and which determine their interpretation.

Note
The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

DESIGN MAXIMUM RATING SYSTEM

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

DESIGN CENTRE RATING SYSTEM

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power.

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

Subscripts

A, a	Anode terminal
(AV), (av)	Average value
B, b	Base terminal, for MOS devices: Substrate
(BR)	Breakdown
C, c	Collector terminal
D, d	Drain terminal
E, e	Emitter terminal
F, f	Forward
G, g	Gate terminal
K, k	Cathode terminal
M, m	Peak value
O, o	As third subscript: The terminal not mentioned is open circuited
R, r	As first subscript: Reverse. As second subscript: Repetitive. As third subscript: With a specified resistance between the terminal not mentioned and the reference terminal.
(RMS), (rms)	R.M.S. value
S, s	As first or second subscript: Source terminal (for FETS only) As second subscript: Non-repetitive (not for FETS) As third subscript: Short circuit between the terminal not mentioned and the reference terminal
X, x	Specified circuit
Z, z	Replaces R to indicate the actual working voltage, current or power of voltage reference and voltage regulator diodes.

Note: No additional subscript is used for d.c. values.

Upper-case subscripts shall be used for the indication of:

a) continuous (d.c.) values (without signal)

Example I_B

b) instantaneous total values

Example i_B

c) average total values

Example $I_{B(AV)}$

d) peak total values

Example I_{BM}

e) root-mean-square total values

Example $I_{B(RMS)}$

Lower-case subscripts shall be used for the indication of values applying to the varying component alone:

a) instantaneous values

Example i_b

b) root-mean-square values

Example $I_{b(rms)}$

c) peak values

Example I_{bm}

d) average values

Example $I_{b(av)}$

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: If it is necessary to indicate the terminal carrying the current, this should be done by the first subscript (conventional current flow from the external circuit into the terminal is positive).

Examples: I_B, i_B, i_b, I_{bm}

Diodes: To indicate a forward current (conventional current flow into the anode terminal) the subscript F or f should be used; for a reverse current (conventional current flow out of the anode terminal) the subscript R or r should be used.

Examples: I_F, I_R, i_F, $I_{f(rms)}$

Subscripts for voltages

Transistors: If it is necessary to indicate the points between which a voltage is measured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be omitted.

Examples: V_{BE}, v_{BE}, v_{be}, V_{bem}

Diodes: To indicate a forward voltage (anode positive with respect to cathode), the subscript F or f should be used; for a reverse voltage (anode negative with respect to cathode) the subscript R or r should be used.

Examples: V_F, V_R, v_F, V_{rm}

Subscripts for supply voltages or supply currents

Supply voltages or supply currents shall be indicated by repeating the appropriate terminal subscript.

Examples: V_{CC}, I_{EE}

Note: If it is necessary to indicate a reference terminal, this should be done by a third subscript

Example : V_{CCE}

Subscripts for devices having more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal followed by a number; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{B2} = continuous (d.c.) current flowing into the second base terminal

V_{B2-E} = continuous (d.c.) voltage between the terminals of second base and emitter

Subscripts for multiple devices

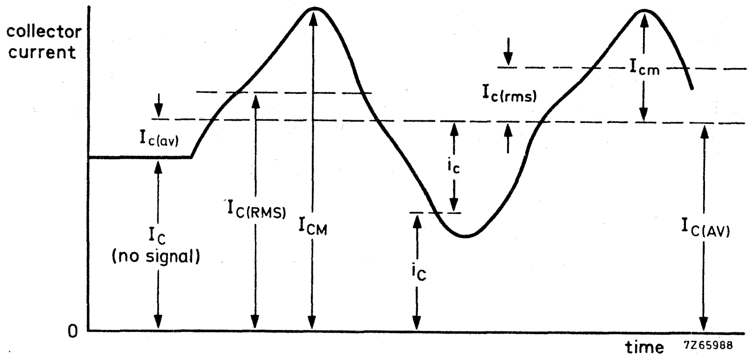
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{2C} = continuous (d.c.) current flowing into the collector terminal of the second unit

V_{1C-2C} = continuous (d.c.) voltage between the collector terminals of the first and the second unit.

Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (d.c.) current and a varying component.



LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Definition

For the purpose of this Publication, the term "electrical parameter" applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

Basic letters

The following is a list of the most important basic letters used for electrical parameters of semiconductor devices.

B, b = susceptance; imaginary part of an admittance

C = capacitance

G, g = conductance; real part of an admittance

H, h = hybrid parameter

L = inductance

R, r = resistance; real part of an impedance

X, x = reactance; imaginary part of an impedance

Y, y = admittance;

Z, z = impedance;

Upper-case letters shall be used for the representation of:

a) electrical parameters of external circuits and of circuits in which the device forms only a part;

b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

Subscripts

General subscripts

The following is a list of the most important general subscripts used for electrical parameters of semiconductor devices:

F, f = forward; forward transfer
I, i (or 1) = input
L, l = load
O, o (or 2) = output
R, r = reverse; reverse transfer
S, s = source

Examples: Z_S, h_f, h_F

The upper-case variant of a subscript shall be used for the designation of static (d.c.) values.

Examples : h_{FE} = static value of forward current transfer ratio in common-emitter configuration (d.c. current gain)

R_E = d.c. value of the external emitter resistance.

Note: The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript shall be used for the designation of small-signal values.

Examples: h_{fe} = small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration

$Z_e = R_e + jX_e$ = small-signal value of the external impedance

Note: If more than one subscript is used, subscripts for which both styles exist shall either be all upper-case or all lower-case

Examples: h_{FE}, y_{RE}, h_{fe}

Subscripts for four-pole matrix parameters

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer

Examples: h_i (or h_{11})
h_o (or h_{22})
h_f (or h_{21})
h_r (or h_{12})

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples: h_{fe} (or h_{21e}), h_{FE} (or h_{21E})

Distinction between real and imaginary parts

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts should be used. If basic symbols for the real and imaginary parts exist, these may be used.

Examples: $Z_i = R_i + jX_i$
$y_{fe} = g_{fe} + jb_{fe}$

If such symbols do not exist or if they are not suitable, the following notation shall be used:

Examples: Re (h_{ib}) etc. for the real part of h_{ib}
Im (h_{ib}) etc. for the imaginary part of h_{ib}

LETTER SYMBOLS FOR RECTIFIER DIODES, THYRISTORS AND TRIACS

based on IEC publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power.

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

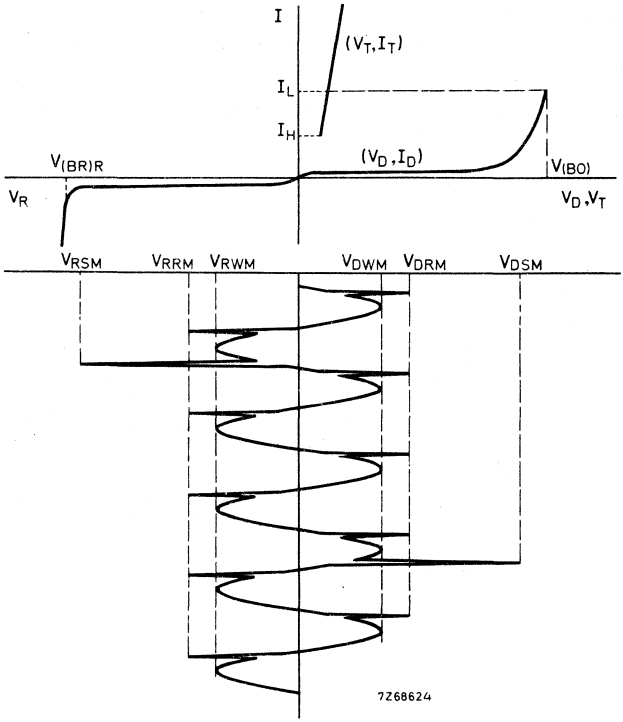
Subscripts

G, g	Gate terminal
F, f	Forward *)
D, d	Forward off-state *); non-triggered (gate voltage or current)
T, t	Forward on-state *); triggered (gate voltage or current)
R, r	As first subscript: Reverse
	As second subscript: Repetitive
(AV), (av)	Average value
M, m	Peak or crest value
(RMS), (rms)	R.M.S. value
(BR)	Breakdown
(BO)	Breakover
H	Holding
L	Latching
Q, q	Turn-off
S, s	As second subscript: Non-repetitive
W	Working

Note: For power rectifier diodes, thyristors and triacs the terminals are not indicated in the subscript, except for the gate-terminal of thyristors and triacs.

*) For the anode-cathode voltage of thyristors and triacs, F is replaced either by D or by T, to distinguish between "off-state" (non-triggered) and "on-state" (triggered).

Example of the use of letter symbols



Simplified thyristor characteristic together with an anode-cathode voltage as a function of time (no gate signal).

RECTIFIER DIODES

General purpose

$I_{F(AV)max}$ A		V_{RRMmax} (V) 150	300	500	600	650	800	1000	1200	1250	1600
0,36	BYX10										●
0,8	BYX36	●	●		●						
1,33	BY226					●					
1,33	BY227									●	
1,4	BYX22				●				●		
6	BYX49		●		●				●		
6	BYX38		●		●				●		
10	BYX98		●		●				●		
10	BYX72	●	●	●							
12	BYX42		●		●				●		
15	BYX99		●		●				●		
30	BYX96		●		●				●		●
47	BYX52		●		●				●		
47	BYX97		●		●				●		●
150	BYX32				●		●	●	●		●

Avalanche

$I_{F(AV)max}$ A		V_{RWMmax} (V) 400	600	800	1000
1,5	BYX45		●	●	●
2	BYW54		●		
2	BYW55			●	
2	BYW56				●
2	1N5060	●			
2	1N5061		●		
2	1N5062			●	
9,5	BYX39		●	●	●
20	BYX25		●	●	●
48	BYX56		●	●	●

Bridges

$I_{O(AV)max}$ A		$V_{I(RMS)max}$ (V) 50	60	80	220	280
1	BY179					●
1,4	BY164		●			
4,8	BY224				●	●
4,8	BY225	●		●		

Voltage tripler units

E.H.T. output: 1,7 mA; 27,5 kV

BG1895 – 541/641
BG1897 – 541/542
BG1897 – 641/642
BG1898 – 541/641

Efficiency diodes

$I_{F(AV)max}$ A	I_{FWMmax} A		V_{RRMmax} (V) 50	600	750	1500
1,2		BY188	●			
	5	BY223				●
	10	BY277		●	●	

Fast soft-recovery

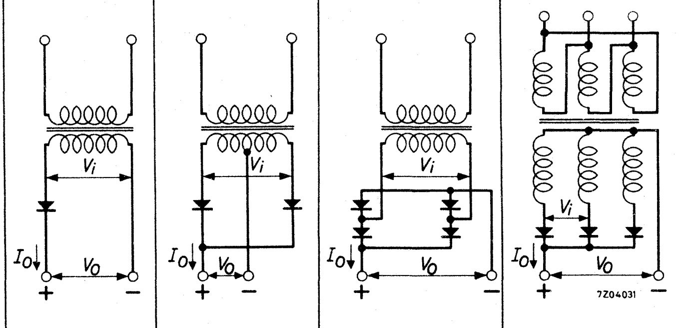
$I_{F(AV)max}$ (A)	Type	50	100	150	200	300	350	400	500	600	800	1000
		V_{RRMmax} (V)										
0,4	BA157							●				
0,4	BA158									●		
0,4	BA159											●
0,4	BY206						●					
0,4	BY207									●		
0,75	BY208									●	●	●
0,8	BY406						●					
0,8	BY407									●		
1,2	BYX55						●			●		
6	1N3879	●										
6	1N3880		●									
6	1N3881				●							
6	1N3882					●						
7	BYW19										●	●
7	BYX50				●	●						
7	BYX71						●			●		
12	1N3889	●										
12	1N3890		●									
12	1N3891				●							
12	1N3892					●						
14	BYX30				●	●		●	●	●		
22	BYX46				●	●		●	●	●		
Very fast recovery												
7	BYW29	●	●	●								
12	BYW30	●	●	●								
25	BYW31	●	●	●								
35	BYW92	●	●	●								

E.H.T. rectifiers

$I_{F(AV)max}$ (mA)	Type	1,8	7,5	12,5	18	23	27,5	37,5	115 to 225
		V_{RRMmax} (kV)							
2	BY477					●			
2	BY478						●		
2,5	BY209			●					
2,5	BY409			●					
2,5	BY476				●				
5	BY184	●							
50	BYX35							●	
200	BYX90		●						
200	BYX91								●

OPERATION AS RECTIFIER

Output voltages and currents of diodes in rectifier circuits based on the rated crest working reverse voltage and rated average forward current.



		Single phase half wave	Two phase half wave	Single phase full wave (Single phase bridge)	Three phase half wave (Three phase star)
		$I_O = I_{F(AV)}$	$I_O = 2\ I_{F(AV)}$	$I_O = 2\ I_{F(AV)}$	$I_O = 3\ I_{F(AV)}$
V_{RWMmax}	$V_{i(rms)}$	V_O	V_O	V_O	V_O
100	70	30	30	62	47
200	140	60	60	125	95
300	210	90	90	185	140
400	280	125	125	250	190
500	350	155	155	310	235
600	420	185	185	375	280
800	560	250	250	500	380
1000	700	315	315	635	475
1200	840	375	375	750	560
1600	1120	500	500	1000	760

These V_i and I_O figures are absolute max. values for resistive or inductive load; no source impedance is assumed. The equipment designer has to determine an average design such that these values will not be exceeded.

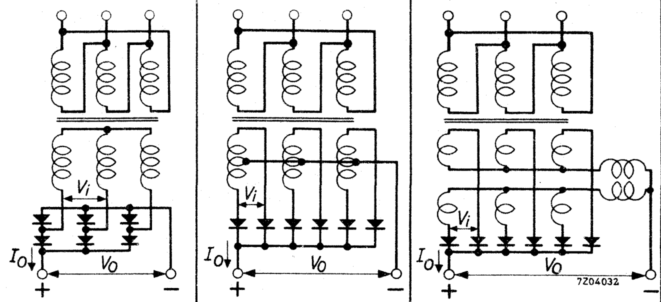
$V_{i(rms)}$ = transformer secondary r.m.s. voltage in V

I_O = average output current in A

V_O = average output voltage in V

OPERATION AS RECTIFIER

Output voltages and currents of diodes in rectifier circuits based on the rated crest working reverse voltage and rated average forward current.



		Three phase full wave (Three phase bridge)	Six phase half wave (Six phase star)	Three phase double Y with interphase transformer
		$I_O = 3\ I_{F(AV)}$	$I_O = 4.8\ I_{F(AV)}$	$I_O = 6\ I_{F(AV)}$
V_{RWMmax}	$V_{i(rms)}$	V_O	V_O	V_O
100	70	94	47	40
200	140	185	95	80
300	210	280	140	120
400	280	375	190	160
500	350	470	235	200
600	420	565	280	240
800	560	750	380	320
1000	700	940	475	400
1200	840	1120	560	480
1600	1120	1510	760	640

These V_i and I_O figures are absolute max. values for resistive or inductive load; no source impedance is assumed. The equipment designer has to determine an average design such that these values will not be exceeded.

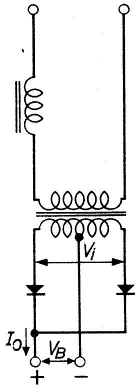
$V_{i(rms)}$ = transformer secondary r.m.s. voltage in V

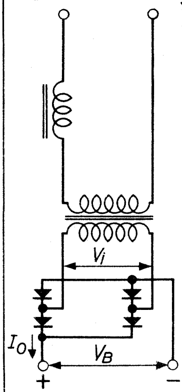
I_O = average output current in A

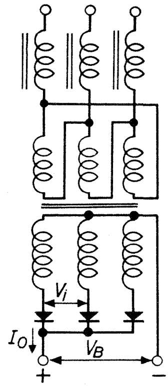
V_O = average output voltage in V

TYPICAL OPERATION FOR BATTERY CHARGING

Output voltages and currents of diodes in rectifier circuits based on the rated crest working reverse voltage and rated average forward current.







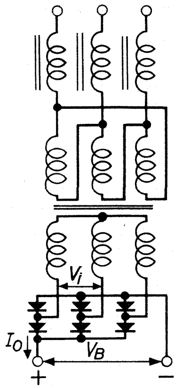
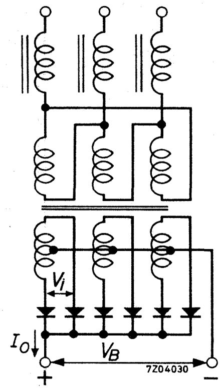
		Two phase half wave		Single phase full wave (Single phase bridge)		Three phase half wave (Three phase star)	
		$I_O = I_{F(AV)}$		$I_O = I_{F(AV)}$		$I_O = 1.5\ I_{F(AV)}$	
V_{RWMmax}	$V_{i(rms)}$	V_O	n	V_O	n	V_O	n
100	62	28	13	60	27	35	16
200	125	60	27	120	54	70	32
300	190	90	41	180	82	105	47
400	255	120	54	240	109	140	64
500	315	150	68	300	136	170	77
600	380	180	82	360	164	210	95
800	510	240	109	480	217	270	122
1000	640	300	136	600	272	340	154
1200	750	360	164	720	328	420	190

The above data are nominal values with battery load. The possibility of mains voltage fluctuations of max. 10% has been taken into account. For current limiting use is made of inductors in series with the primary of the mains transformer.

$V_{i(rms)}$ = transformer secondary r.m.s. voltage in V
I_O = average output current in A
V_B = battery voltage in V
n = maximum number of Pb cells in series (nominal voltage per cell is 2.2 V)

TYPICAL OPERATION FOR BATTERY CHARGING

Output voltages and currents of diodes in rectifier circuits based on the rated crest working reverse voltage and rated average forward current.

		Three phase full wave (Three phase bridge)		Six phase half wave (Six phase star)	
					
		I_O = 1,5 $I_{F(AV)}$		I_O = 3 $I_{F(AV)}$	
V_{RWMmax}	$V_{i(rms)}$	V_O	n	V_O	n
100	62	60	27	30	13
200	125	120	54	60	27
300	190	180	82	90	41
400	255	240	109	120	54
500	315	300	136	150	68
600	380	360	164	180	82
800	510	480	217	240	109
1000	640	600	272	300	136
1200	750	720	328	360	164

The above data are nominal values with battery load. The possibility of mains voltage fluctuations of max. 10% has been taken into account. For current limiting use is made of inductors in series with the primary of the mains transformer.

$V_{i(rms)}$ = transformer secondary r.m.s. voltage in V
I_O = average output current in A
V_B = battery voltage in V
n = maximum number of Pb cells in series (nominal voltage per cell is 2.2 V)

OPERATING NOTES

When there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage [1]), a damping circuit should be connected across the transformer.
Either a series RC circuit or a voltage dependent resistor may be used. Suitable component values for an RC circuit across the transformer primary or secondary may be calculated as follows:

$\frac{V_{RSM}}{V_{RWM}}$	RC across primary of transformer		RC across secondary of transformer	
	C (μF)	R (Ω)	C (μF)	R (Ω)
2.0	$200\frac{I_{mag}}{V_1}$	$\frac{150}{C}$	$225\frac{I_{mag}T^2}{V_1}$	$\frac{200}{C}$
1.5	$400\frac{I_{mag}}{V_1}$	$\frac{225}{C}$	$450\frac{I_{mag}T^2}{V_1}$	$\frac{275}{C}$
1.25	$550\frac{I_{mag}}{V_1}$	$\frac{260}{C}$	$620\frac{I_{mag}T^2}{V_1}$	$\frac{310}{C}$
1.0	$800\frac{I_{mag}}{V_1}$	$\frac{300}{C}$	$900\frac{I_{mag}T^2}{V_1}$	$\frac{350}{C}$

where I_{mag} = magnetising primary r.m.s. current (A)

V_1 = transformer primary r.m.s. voltage (V)

V_2 = transformer secondary r.m.s. voltage (V)

$T = V_1/V_2$

V_{RSM} = the transient voltage peak produced by the transformer

V_{RWM} = the actually applied crest working reverse voltage

The capacitance values calculated from the above table are minimum values; to allow for circuit variations and component tolerances, larger values should be used.

[1]) For controlled avalanche types read: non-repetitive peak reverse power.

RECTIFIER DIODES

REVERSE RECOVERY

When a semiconductor rectifier diode has been conducting in the forward direction sufficiently long to establish the steady state, there will be a charge due to minority carriers present. Before the device can block in the reverse direction this charge must be extracted. This extraction takes the form of a transient reverse current and this, together with the reverse bias voltage results in additional power dissipation which reduces the rectification efficiency. At sine-wave frequencies up to about 400 Hz these effects can often be ignored, but at higher frequencies and for square waves the switching losses must be considered.

Stored charge

The area under the I_R- time curve is known as the stored charge (Q_s) and is normally quoted in micro- or nanocoulombs. Low stored charge devices are preferred for fast switching applications.

Reverse recovery time

Another parameter which can be used to determine the speed of the rectifier is the reverse recovery time (t_{rr}). This is measured from the instant the current passes through zero (from forward to reverse) to the instant the current recovers to 10% of its peak reverse value. Low reverse recovery times are associated with low stored charge devices.

The conditions which need to be specified are:

a. Steady-state forward current (I_F); high currents increase recovery time.
b. Reverse bias voltage (V_R); low reverse voltage increases recovery time.
c. Rate of fall of anode current (dI_F/dt); high rates of fall reduce recovery time, but increase stored charge.
d. Junction temperature (T_j); high temperatures increase both recovery time and stored charge.

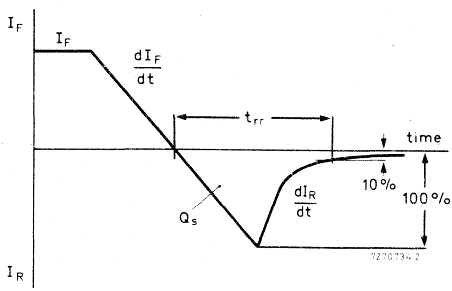


Fig. 1 Waveform showing the reverse recovery aspects.

REVERSE RECOVERY (continued)

Softness of recovery

In many switching circuits it is not just the magnitude but the shape of the reverse recovery characteristic that is important. If the positive-going edge of the characteristic has a fast rise time (as in a so-called 'snap-off' device) this edge may cause conducted or radiated r.f.i., or it may generate high voltages across inductors which may be in series with the rectifier. The maximum slope of the reverse recovery current (dI_R/dt) is quoted as a measure of the 'softness' of the characteristic. Low values are less liable to give r.f.i. problems. The measurement conditions which need to be specified are as above. When stored charges are very low, e.g. for very fast rectifiers this softness characteristic can be ignored.

Switching losses

The product of transient reverse current and reverse bias voltage is a power dissipation, most of which occurs during the fall time. In repetitive operation an average power can be calculated. This is then added to the forward dissipation to give the total power.

The conditions which need to be specified are:

a. Forward current (I_F); high currents increase switching losses.
b. Rate of fall of anode current (dI_F/dt); high rates of fall increase switching losses. This is particularly important in square-wave operation. Power losses in sine-wave operation for a given frequency are considerably less due to the much lower dI_F/dt.
c. Frequency (f); high frequency means high losses.
d. Reverse bias voltage (V_R); high reverse bias means high losses.
e. Junction temperature (T_j); high temperature means high losses.

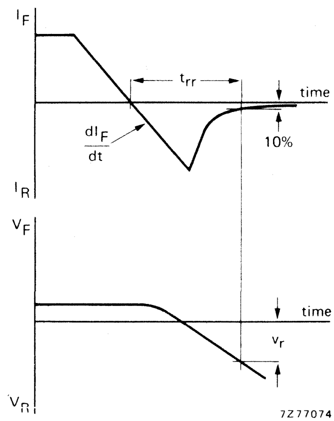


Fig. 2 Waveforms showing the reverse switching losses aspects.

REVERSE RECOVERY (continued)

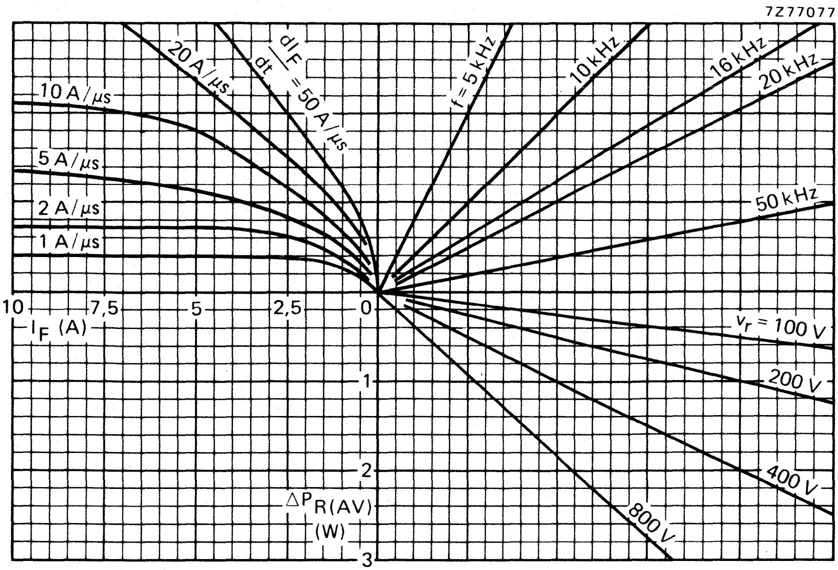


Fig. 3 **Nomogram** (example of reverse switching losses). Power loss $\Delta P_{R(AV)}$ due to switching only (to be added to steady-state power losses). I_F = forward current just before switching off; T_j = 150 °C.

FORWARD RECOVERY

At the instant a semiconductor rectifier diode is switched into forward conduction there are no carriers present at the junction, hence the forward voltage drop may be instantaneously of a high value. As the stored charge builds-up, conductivity modulation takes place and the forward voltage drop rapidly falls to the steady-state value. The peak value of forward voltage drop is known as the forward recovery voltage (V_{fr}). The time from the instant the current reaches 10% of its steady-state value to the time the forward voltage drop falls to within 10% of its final steady-state value is known as the forward recovery time (t_{fr}).

The conditions which need to be specified are:

a. Forward current (I_F); high currents give high recovery voltages.
b. Current pulse rise time (t_r); short rise times give high recovery voltages.
c. Junction temperature (T_j); the influence of temperature is slight.

For waveforms see Fig. 4.

FORWARD RECOVERY (continued)

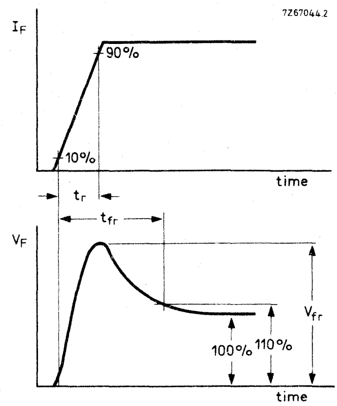


Fig. 4 Waveforms showing the forward recovery aspects.

DOUBLE-DIFFUSED RECTIFIER DIODES

A single-diffused diode with a two layer p-n structure cannot combine a high forward current density with a high reverse blocking voltage.

A way out of this dilemma is provided by the three layer double-diffused structure. A lightly doped silicon layer, called the base, is sandwiched between highly doped diffused p^+ and n^+ outer layers giving a p^+ –pn^+ or p^+ –nn^+ layer. Generally, the base gives the diode its high reverse voltage, and the two diffused regions give the high forward current rating.

Although double-diffused diodes are highly efficient, a slight compromise is still necessary. Generally, for a given silicon chip area, the thicker the base layer the higher the V_R and the lower the I_F. Reverse switching characteristics also determine the base design. Fast recovery diodes usually have n-type base regions to give 'soft' recovery. Other diodes have the base type, n or p, chosen to meet their specific requirements.

VERY FAST RECTIFIER DIODES

Very fast rectifier diodes, made by epitaxial technology, are intended for use in applications where low conduction and switching losses are of paramount importance and relatively low reverse blocking voltage (V_{RWM} = 150 V) is required: e.g., switched-mode power supplies operating at frequencies of about 50 kHz.

The use of epitaxial technology means that there is very close control over the almost ideal diffusion profile and base width giving very high carrier injection efficiencies leading to lower conduction losses than conventional technology permits. The well defined diffusion profile also allows a tight control of stored minority carriers in the base region, so that very fast turn-off times (35 ns) can be achieved. The range of devices also has a soft reverse recovery and a low forward recovery voltage.

HIGH-SPEED SILICON DIODE

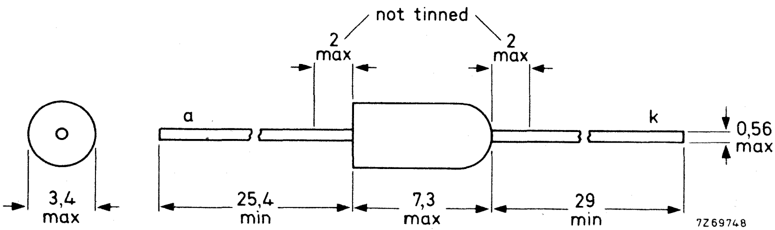
Double-diffused diode in a DO-14 plastic envelope. It is primarily intended for use in clamp circuits of colour difference amplifiers in television receivers.

QUICK REFERENCE DATA				
Repetitive peak reverse voltage	V_{RRM}	max.	350	V
Average forward current	$I_{F(AV)}$	max.	0,3	A
Non-repetitive peak forward current	I_{FSM}	max.	15	A
Reverse recovery charge	Q_s	<	0,4	nC

MECHANICAL DATA

Dimensions in mm

DO-14



The rounded end indicates the cathode

The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

FOR NEW DESIGN THE SUCCESSOR TYPE BY206 IS RECOMMENDED

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Crest working reverse voltage	V_{RWM}	max.	300	V
Repetitive peak reverse voltage ($\delta \leq 0.01$)	V_{RRM}	max.	350	V
Non-repetitive peak reverse voltage ($t \leq 1$ ms)	V_{RSM}	max.	350	V

Currents

Average forward current (averaged over any 20 ms period) with R load $V_{RWM} = V_{RWMmax}$	$I_{F(AV)}$	max.	0.3	A
Forward current d.c.	I_F	max.	0.3	A
Repetitive peak forward current	I_{FRM}	max.	2	A
Non-repetitive peak forward current ($t = 10$ ms; half sine wave) $T_j = 125\,^oC$ prior to surge	I_{FSM}	max.	15	A
Repetitive peak reverse current	I_{RRM}	max.	0.5	A

Temperatures

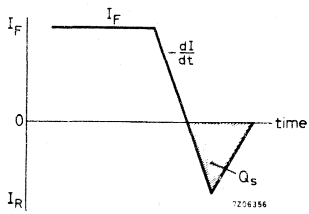
Storage temperature	T_{stg}		-65 to +125	^oC
Junction temperature	T_j	max.	125	^oC

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j\text{-}a}$	=	0.2 ^oC/mW

CHARACTERISTICS

Forward voltage				
$I_F = 100\,mA$; $T_j = 75\,^oC$	V_F	<	1.0	V [1]
Reverse current				
$V_R = 300\,V$; $T_j = 75\,^oC$	I_R	<	10	µA
$V_R = 300\,V$; $T_j = 25\,^oC$	I_R	<	2	µA
Capacitance at f = 1 MHz				
$V_R = 150\,V$; $T_j = 25$ to $125\,^oC$	C_d	typ.	4.0	pF
Reverse recovery charge when switched from $I_F = 10\,mA$ to $V_R = 2\,V$ with $-dI/dt = 5\,mA/\mu s$; $T_j = 25\,^oC$	Q_s	<	0.4	nC



SOLDERING AND MOUNTING NOTES

1. Soldered joints must be at least 5 mm from the seal.
2. A soldering iron must not be in contact with the joint for more than 3 seconds.
3. The maximum permissible temperature of the soldering bath is 300 °C; it must not be in contact with the joint for more than 3 seconds.
4. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 125 °C.

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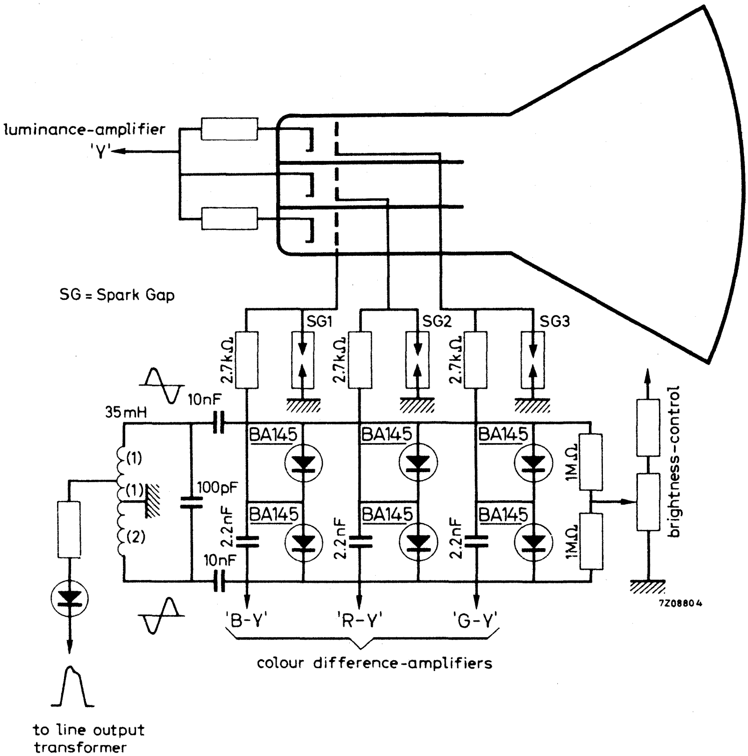
[1]) Measured under pulse conditions to avoid excessive dissipation.

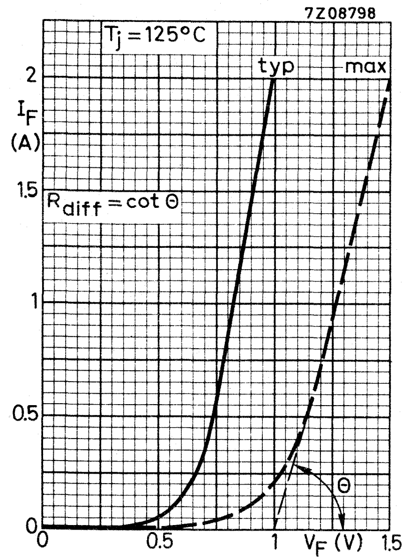
APPLICATION INFORMATION

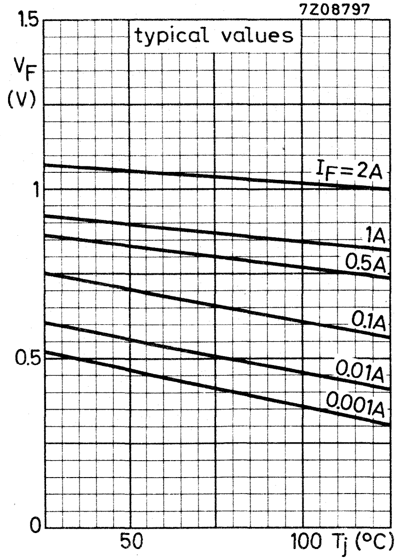
Clamp circuit for colour difference amplifiers in television receivers.

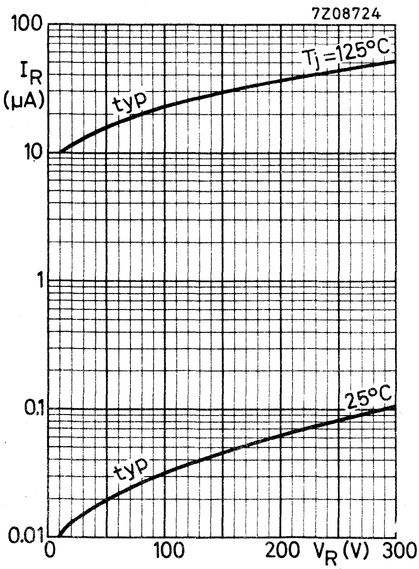


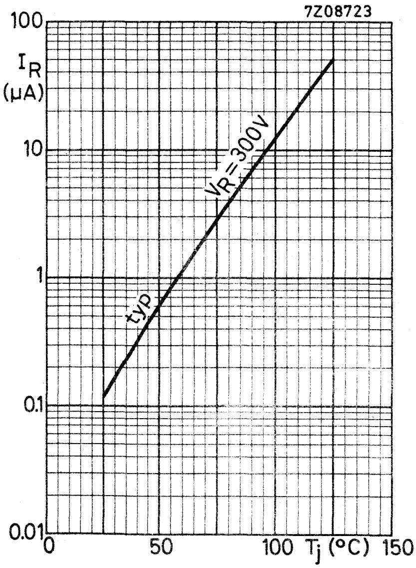
Up to $T_{amb} = 65^{o}C$ the differences in clamping levels in the circuit will be less than 1 V.

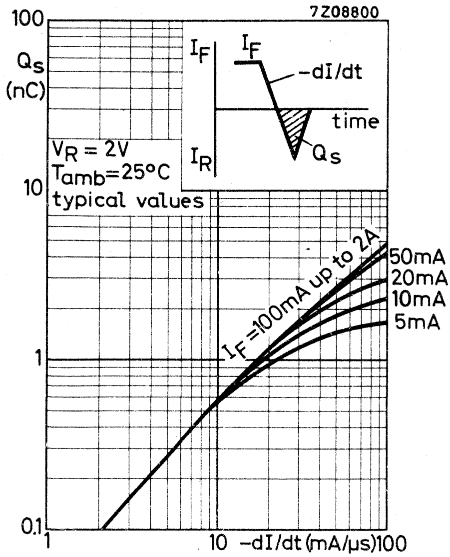
When in a picture tube flash-over occurs, it is possible that high voltage peaks appear at the control grid. These voltage peaks can damage the diodes in the clamp circuit. Protection of the diodes is obtained by means of a spark gap with breakover voltage of < 3000 V and a resistor of 2.7 kΩ.

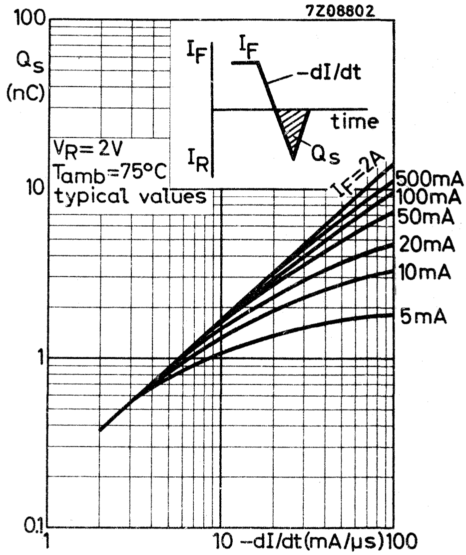

7Z08798
$T_j = 125°C$
typ
max
I_F (A)
$R_{diff} = \cot \Theta$
Θ
V_F (V)
0
0.5
1
1.5
2

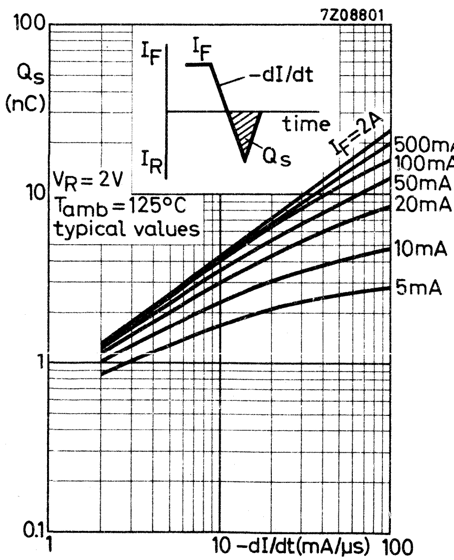

7Z08797
typical values
V_F (V)
$I_F = 2A$
1A
0.5A
0.1A
0.01A
0.001A
T_j (°C)
0
0.5
1
1.5
50
100

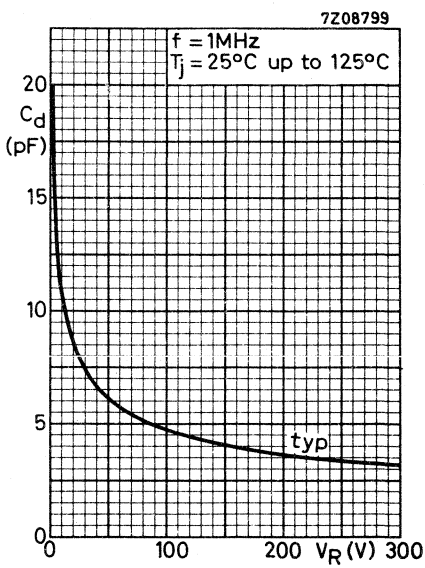

7Z08724
I_R (μA)
$T_j = 125°C$
typ
25°C
typ
V_R (V)
0.01
0.1
1
10
100
0
200
300


7Z08723
I_R (μA)
$V_R = 300V$
typ
T_j (°C)
0.01
0.1
1
10
100
0
50
100
150


7Z08800
Qs (nC)
VR = 2V
Tamb=25°C
typical values
IF
-dI/dt
time
Qs
IR
IF=100mA up to 2A
50mA
20mA
10mA
5mA
-dI/dt (mA/μs)
100
10
1
0.1


7Z08802
Qs (nC)
VR= 2V
Tamb=75°C
typical values
IF
-dI/dt
time
Qs
IR
IF=2A
500mA
100mA
50mA
20mA
10mA
5mA
-dI/dt (mA/μs)


7Z08801
Qs (nC)
VR = 2V
Tamb = 125°C
typical values
IF
-dI/dt
time
Qs
IR
IF=2A
500mA
100mA
50mA
20mA
10mA
5mA
-dI/dt(mA/μs)


7Z08799
f = 1MHz
Tj = 25°C up to 125°C
Cd (pF)
typ
VR (V)
0
100
200
300
5
10
15
20

FAST-RECOVERY SILICON DIODE

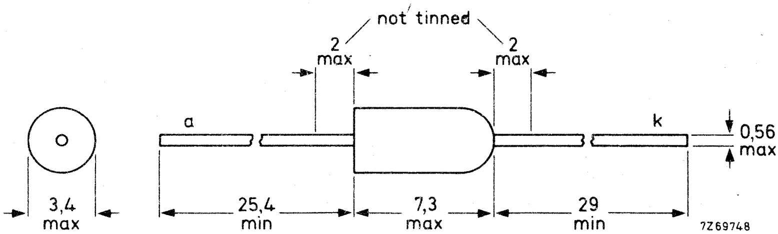
Double-diffused general purpose diode in a DO-14 plastic envelope. It is intended for use as line phase detector, scan rectifier for the supply of the small-signal parts in television receivers and other h.f. power supplies.

QUICK REFERENCE DATA				
Repetitive peak reverse voltage	V_{RRM}	max.	350	V
Average forward current	$I_{F(AV)}$	max.	0,5	A
Non-repetitive peak forward current	I_{FSM}	max.	15	A
Reverse recovery charge	Q_s	<	0,8	nC

MECHANICAL DATA

Dimensions in mm

DO-14



The rounded end indicates the cathode

The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

FOR NEW DESIGN THE SUCCESSOR TYPE BY206 IS RECOMMENDED

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Crest working reverse voltage	V_{RWM}	max.	300	V
Repetitive peak reverse voltage ($\delta \leq 0.01$)	V_{RRM}	max.	350	V
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	350	V

Currents

Average forward current (averaged over any 20 ms period) with R load $V_{RWM} = V_{RWMmax}$	$I_{F(AV)}$	max.	0.4	A
$V_{RWM} = 80$ V	$I_{F(AV)}$	max.	0.5	A
Repetitive peak forward current	I_{FRM}	max.	3.0	A
Repetitive peak forward current ($\delta \leq 0.03$; $f \geq 15$ kHz)	I_{FRM}	max.	5.0	A
Non-repetitive peak forward current ($t = 10$ ms; half sine wave) $T_j = 125\,^oC$ prior to surge	I_{FSM}	max.	15	A
Repetitive peak reverse current	I_{RRM}	max.	0.5	A

Temperatures

Storage temperature	T_{stg}		−65 to +125	^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE See page 3

CHARACTERISTICS

Forward voltage

$I_F = 2$ A; $T_j = 150\,^oC$	V_F	<	1.5	V [1]

Reverse current

$V_R = 300$ V; $T_j = 125\,^oC$	I_R	<	200	μA
$V_R = 300$ V; $T_j = 25\,^oC$	I_R	<	2	μA

Capacitance at f = 1 MHz

$V_R = 150$ V; $T_j = 25$ to $125\,^oC$	C_d	typ.	4.0	pF

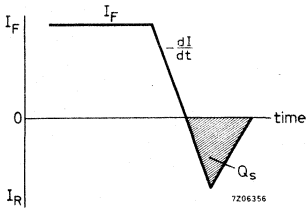
1) Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Reverse recovery charge when switched from.

I_F = 10 mA to V_R = 2 V with

$-\frac{dI}{dt}$ = 5 mA/µs; T_j = 25 °C | Q_s < 0.8 nC

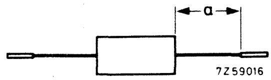


THERMAL RESISTANCE

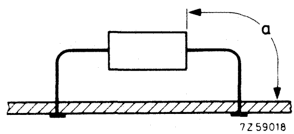
Effect of mounting on thermal resistance $R_{th\ j-a}$

The quoted values apply when no other leads run to the tie-points. If leads of other dissipating components share the same tie-points, the thermal resistance will be higher than that quoted.

1. Mounted to solder tags at a lead-length a = 10 mm. $R_{th\ j-a}$ = 150 °C/W

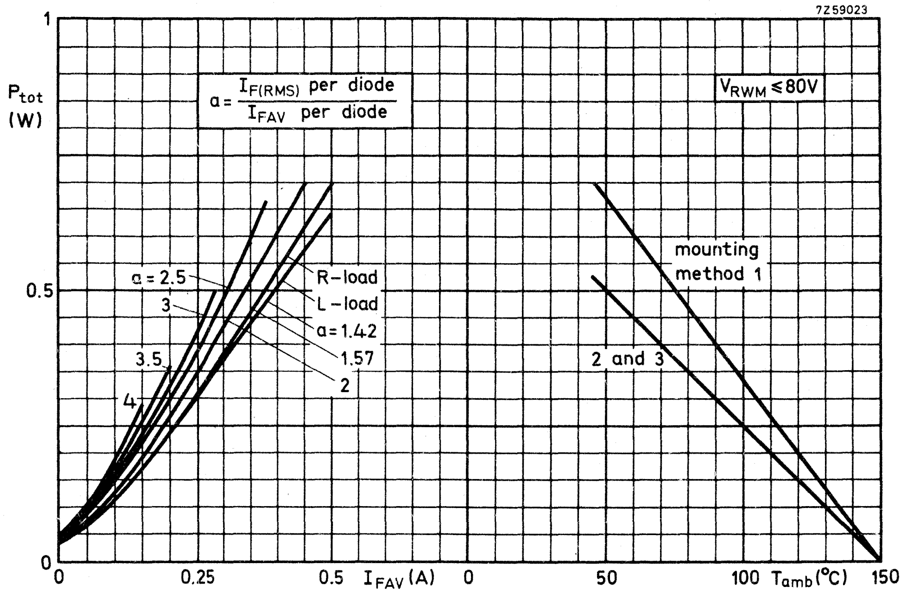


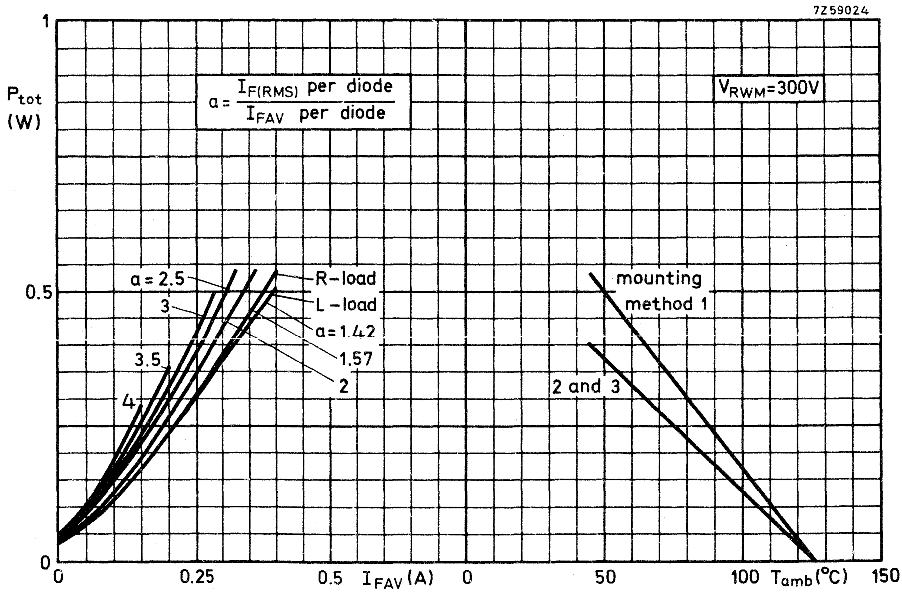
2. Mounted to solder tags at a = maximum lead-length. $R_{th\ j-a}$ = 200 °C/W
3. Mounted on printed-wiring board with a small area of copper at a lead-length a > 5 mm.
   $R_{th\ j-a}$ = 200 °C/W



SOLDERING AND MOUNTING NOTES

1. Soldered joints must be at least 5 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 300 °C; it must be in contact with the joint for no more than 3 seconds.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 125°C.


7Z59023
P_tot (W)
a = I_F(RMS) per diode / I_FAV per diode
V_RWM ≤ 80V
a = 2.5
3
3.5
4
R-load
L-load
a = 1.42
1.57
2
mounting method 1
2 and 3
1
0.5
0
0
0.25
0.5
I_FAV (A)
0
50
100
T_amb (°C)
150

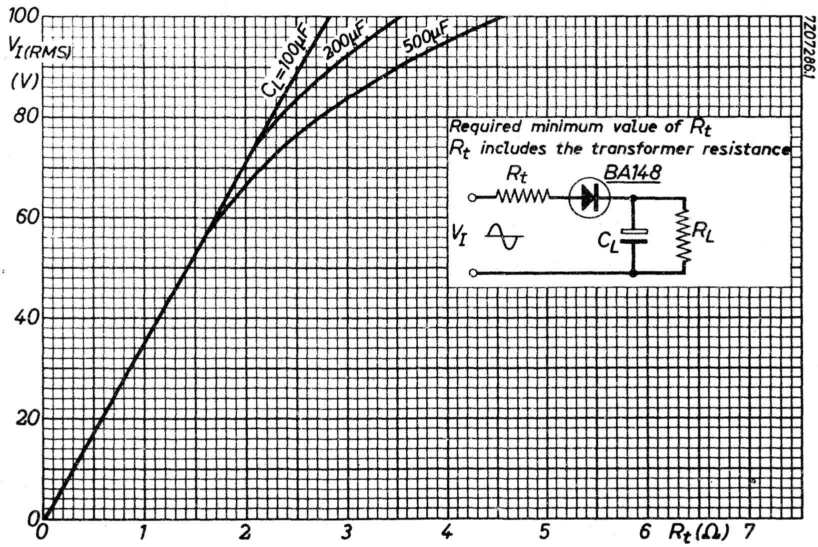

7Z59024
P_tot (W)
a = I_F(RMS) per diode / I_FAV per diode
V_RWM = 300V
a = 2.5
3
3.5
4
R-load
L-load
a = 1.42
1.57
2
mounting method 1
2 and 3
1
0.5
0
0
0.25
0.5
I_FAV (A)
0
50
100
T_amb (°C)
150

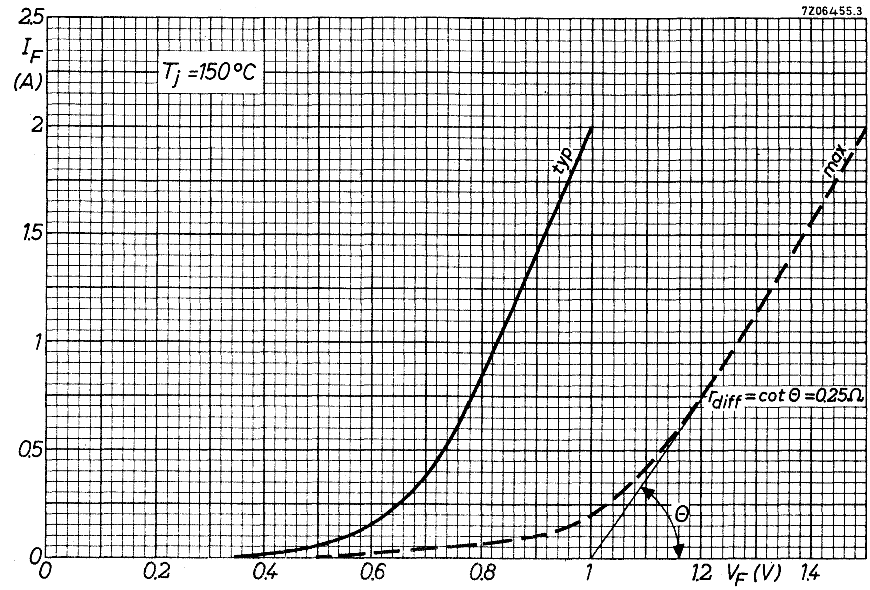
From the left hand graph the total power dissipation can be found as a function of the forward current.

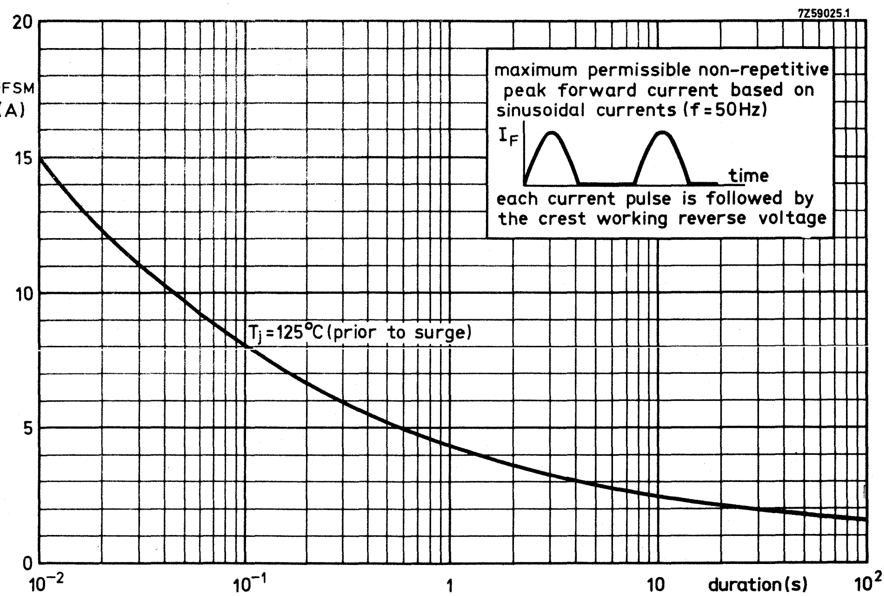
The parameter a = $\frac{I_{F(RMS)} \text{ per diode}}{I_{FAV} \text{ per diode}}$ depends on $\omega R_L C_L$ and $\frac{R_t + r_{diff.}}{R_L}$ and can be found from existing graphs.

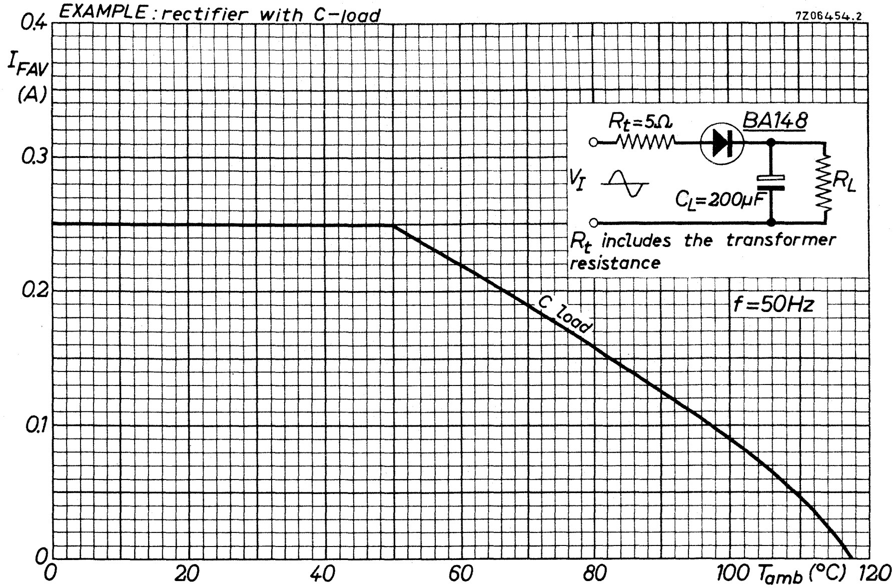
See Application Book: RECTIFIER DIODES
Once the power dissipation is known, the max. permissible ambient temperature follows from the right hand graph.

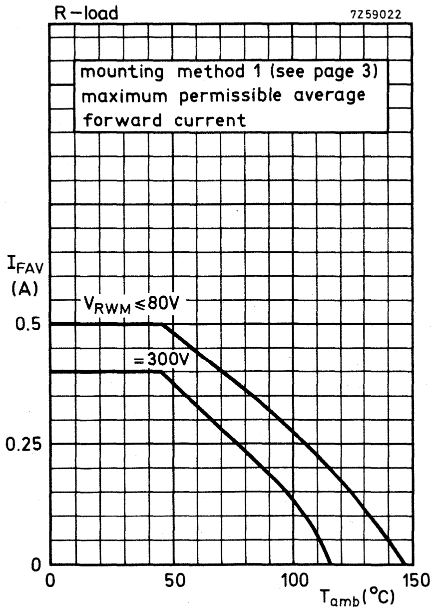
For the series resistance, added to limit the initial peak rectifier current, the required minimum value can be found from the graph below.
rdiff. is shown on page 6, upper figure.

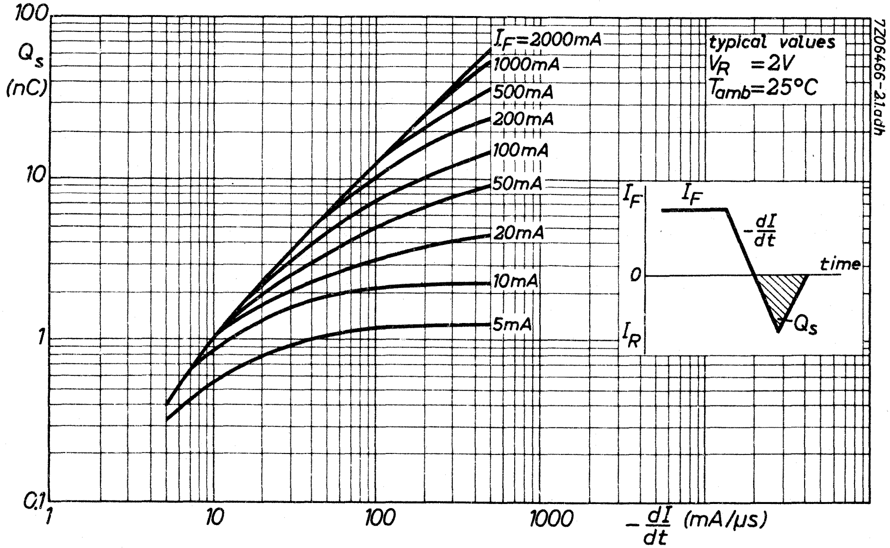


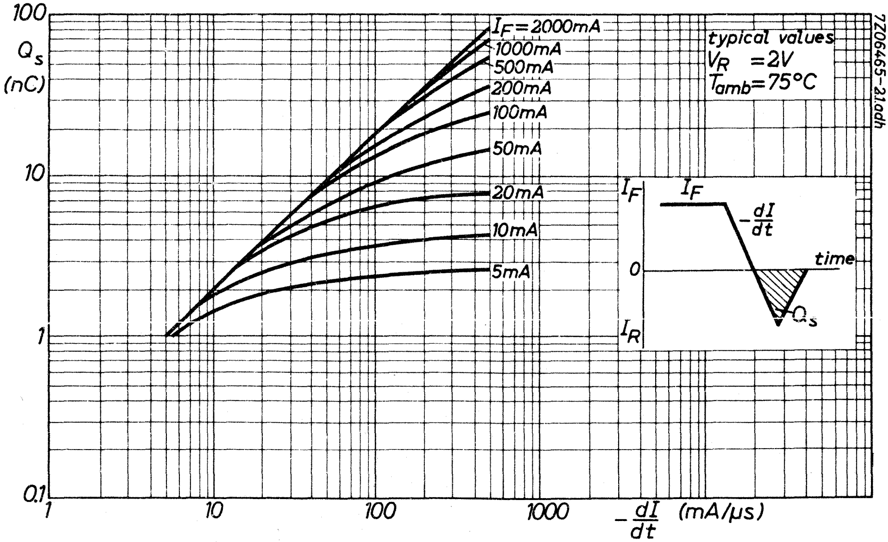

7Z06455.3
I_F (A)
T_j = 150 °C
typ
max
$r_{diff} = \cot\Theta = 0.25\Omega$
Θ
V_F (V)
0
0.5
1
1.5
2
2.5
0.2
0.4
0.6
0.8
1.2
1.4

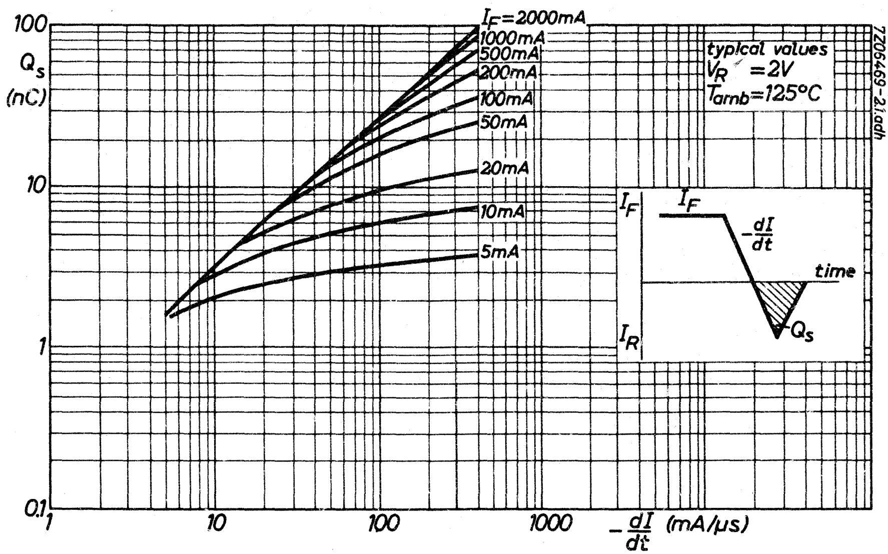

7Z59025.1
I_{FSM} (A)
maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50 Hz)
I_F
time
each current pulse is followed by the crest working reverse voltage
T_j = 125 °C (prior to surge)
duration (s)
0
5
10
15
20
10^{-2}
10^{-1}
1
10
10^2

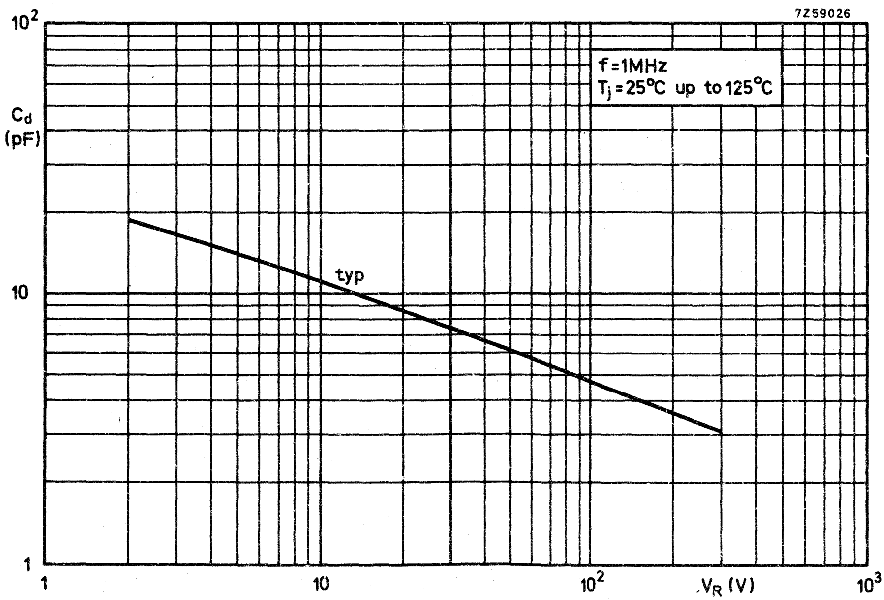

EXAMPLE : rectifier with C-load
7Z06454.2
I_{FAV} (A)
0.4
0.3
0.2
0.1
0
R_t=5Ω
BA148
V_I
C_L=200μF
R_L
R_t includes the transformer resistance
f=50Hz
C load
0
20
40
60
80
100
T_{amb} (°C)
120


R-load
7Z59022
mounting method 1 (see page 3)
maximum permissible average
forward current
I_{FAV} (A)
V_{RWM} ≤ 80V
= 300V
0.5
0.25
0
0
50
100
150
T_{amb} (°C)


100
Q_s
(nC)
10
1
0.1
1
10
100
1000
$-\frac{dI}{dt}$ (mA/µs)
I_F=2000mA
1000mA
500mA
200mA
100mA
50mA
20mA
10mA
5mA
typical values
V_R =2V
T_{amb}=25°C
I_F
I_F
$-\frac{dI}{dt}$
time
0
I_R
Q_s
7Z06466-2.1adh

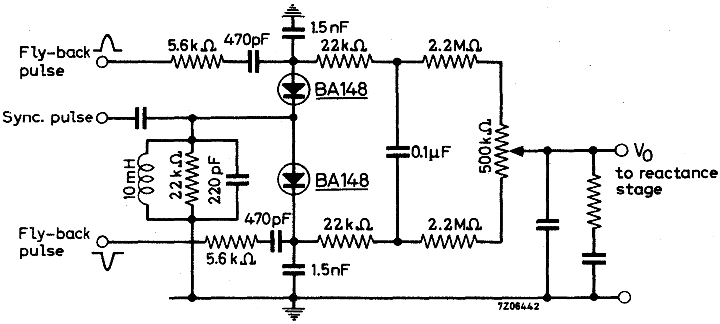

100
Q_s
(nC)
10
1
0.1
1
10
100
1000
$-\frac{dI}{dt}$ (mA/µs)
I_F=2000mA
1000mA
500mA
200mA
100mA
50mA
20mA
10mA
5mA
typical values
V_R =2V
T_{amb}=75°C
I_F
I_F
$-\frac{dI}{dt}$
time
0
I_R
Q_s
7Z06465-2.1adh


100
Q_s
(nC)
10
1
0.1
1
10
100
1000
$-\frac{dI}{dt}$ (mA/μs)
I_F=2000mA
1000mA
500mA
200mA
100mA
50mA
20mA
10mA
5mA
typical values
V_R =2V
T_{amb}=125°C
7Z05469-2.1adh
I_F
I_F
$-\frac{dI}{dt}$
time
I_R
Q_s


7Z59026
10^2
C_d
(pF)
10
1
1
10
10^2
V_R (V)
10^3
f=1MHz
T_j=25°C up to 125°C
typ

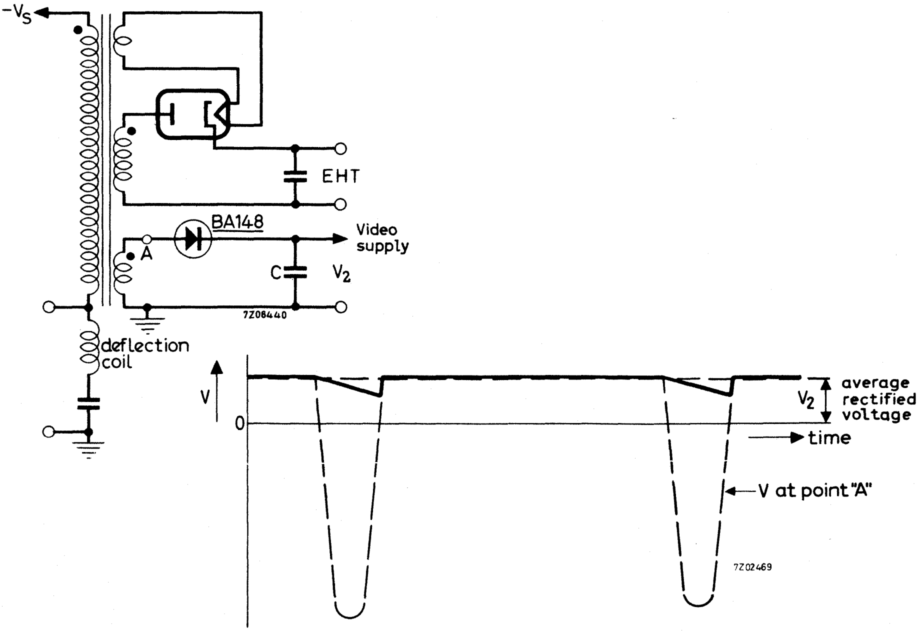
APPLICATION INFORMATION

Self catching line phase detector



The high speed and low leakage current of the BA148 make it particularly useful in the type of line phase detector shown above.

Low voltage supply from the line output stage of a television receiver.



An extra winding on the line output transformer in series with a BA148 can supply up to 30 V for the low voltage parts of a television receiver. Because the diode conducts during scan the source impedance is low and the output voltage stable.

FAST SOFT-RECOVERY RECTIFIER DIODES

Silicon double-diffused rectifier diodes in plastic envelopes. They are intended for use as clamp diode or scan rectifier in television receivers and also for use in inverter and converter applications. The devices feature non-snap-off characteristics.

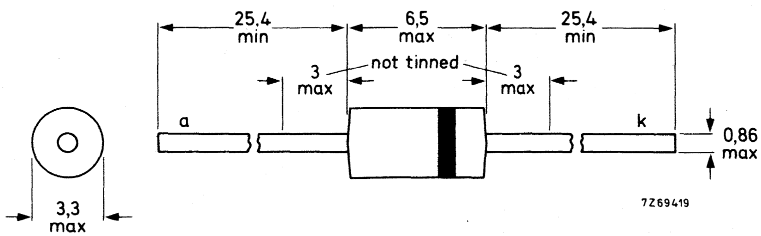
QUICK REFERENCE DATA

			BA157	BA158	BA159	
Repetitive peak reverse voltage	V_{RRM}	max.	400	600	1000	V
Average forward current	$I_{F(AV)}$	max.			0,4	A
Non-repetitive peak forward current	I_{FSM}	max.			15	A
Reverse recovery time	t_{rr}	<			300	ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-15 (SOD-40).



The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BA157	BA158	BA159	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	400	600	1000	V
Repetitive peak reverse voltage ($t \leq 12$ μs)	V_{RRM}	max.	400	600	1000	V

Average forward current (averaged over any 20 ms period); $T_{amb} = 45$ °C	$I_{F(AV)}$	max.	0,4	A
Repetitive peak forward current $\delta = 0{,}33$; $t \leq 1$ s; $T_{amb} = 25$ °C	I_{FRM}	max.	2	A
Non-repetitive peak forward current $t = 10$ ms; half sine-wave; $T_j = 150$ °C prior to surge	I_{FSM}	max.	15	A
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

Influence of mounting method

1. Thermal resistance from junction to tie-point at a lead length a = 10 mm — $R_{th\ j\text{-}tp}$ = 60 °C/W
2. Thermal resistance from junction to ambient when mounted to solder tags at a lead length a = 10 mm; Fig. 2 — $R_{th\ j\text{-}a}$ = 100 °C/W
3. Thermal resistance from junction to ambient when mounted on a printed-circuit board at any lead length a; Fig. 3 — $R_{th\ j\text{-}a}$ = 150 °C/W

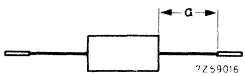


Fig. 2 Mounted to solder tags.

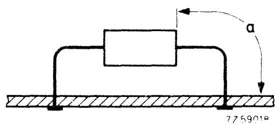


Fig. 3 Mounted on a printed-circuit board.

CHARACTERISTICS

Forward voltage			
I_F = 1 A; T_j = 25 °V	V_F	<	1,5 V*
Reverse current			
$V_R = V_{RRMmax}$; T_j = 25 °C	I_R	<	5 μA
Reverse recovery time when switched from			
I_F = 0,5 A to I_R = 1 A; measured at 0,25 A; Figs 4 and 5	t_{rr}	<	300 ns

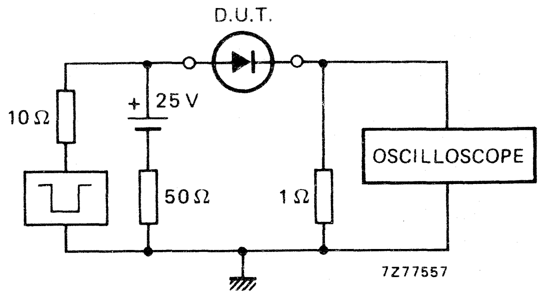


Fig. 4 Test circuit.
Input impedance oscilloscope 1 MΩ; 22 pF. Rise time ≤ 7 ns.
Source impedance 50 Ω. Rise time ≤ 15 ns.

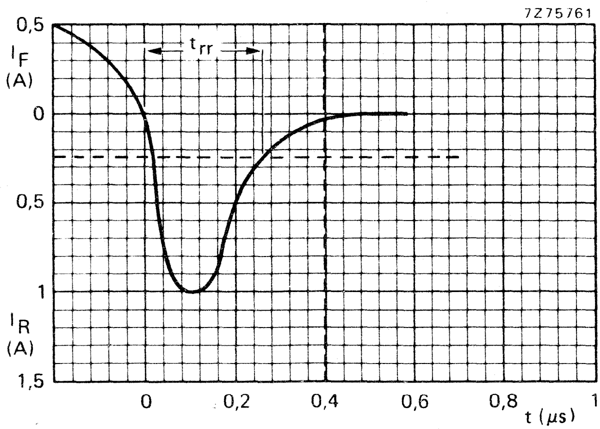
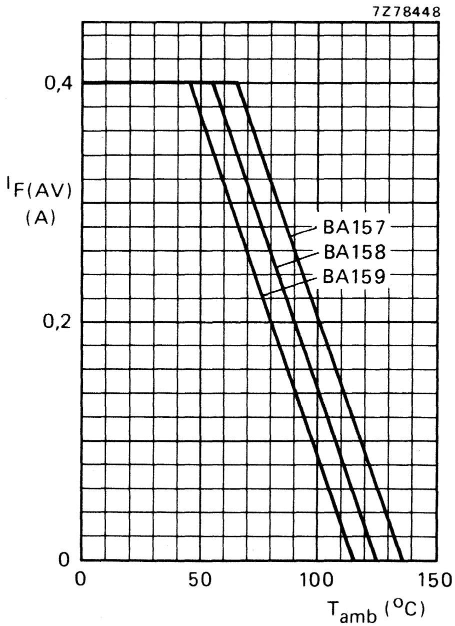


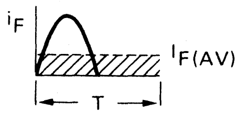
Fig. 5 Reverse recovery time characteristic.

* Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

1. Soldered joints must be at least 5 mm from the seal.
2. A soldering iron must not be in contact with the joint for more than 3 seconds.
3. The maximum permissible temperature of the soldering bath is 300 °C; it must not be in contact with the joint for more than 3 seconds.
4. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 °C.
5. Leads should not be bent less than 1,5 mm from the seal; exert no axial pull when bending.





T ⩽ 20 ms.

Fig. 6 Maximum permissible average rectified forward current as a function of ambient temperature.

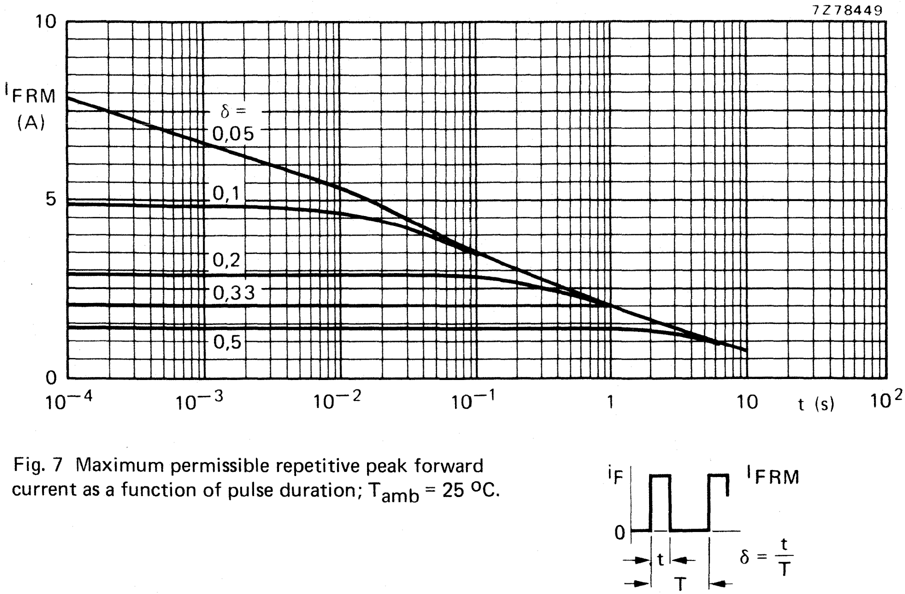


Fig. 7 Maximum permissible repetitive peak forward current as a function of pulse duration; T_{amb} = 25 °C.

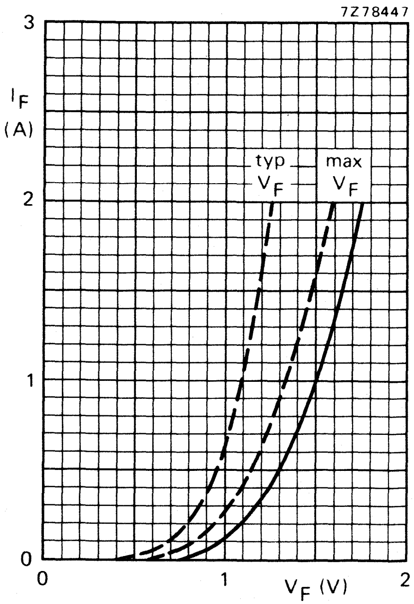


Fig. 8 ——— T_j = 25 °C; ----- T_j = 125 °C.

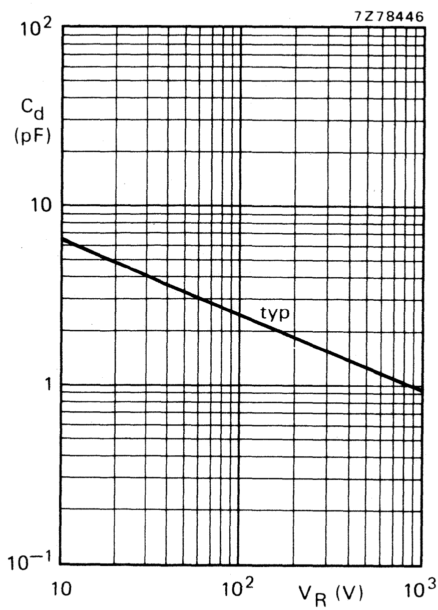


Fig. 9 f = 1 MHz; T_j = 25 to 125 °C.

VOLTAGE TRIPLER UNITS

Voltage tripler units for e.h.t. supply in colour television receivers.
Two types are available:
BG1895-541: for hybrid receivers.
BG1895-641: for all-transistor receivers.
The devices have a non-flammable encapsulation.

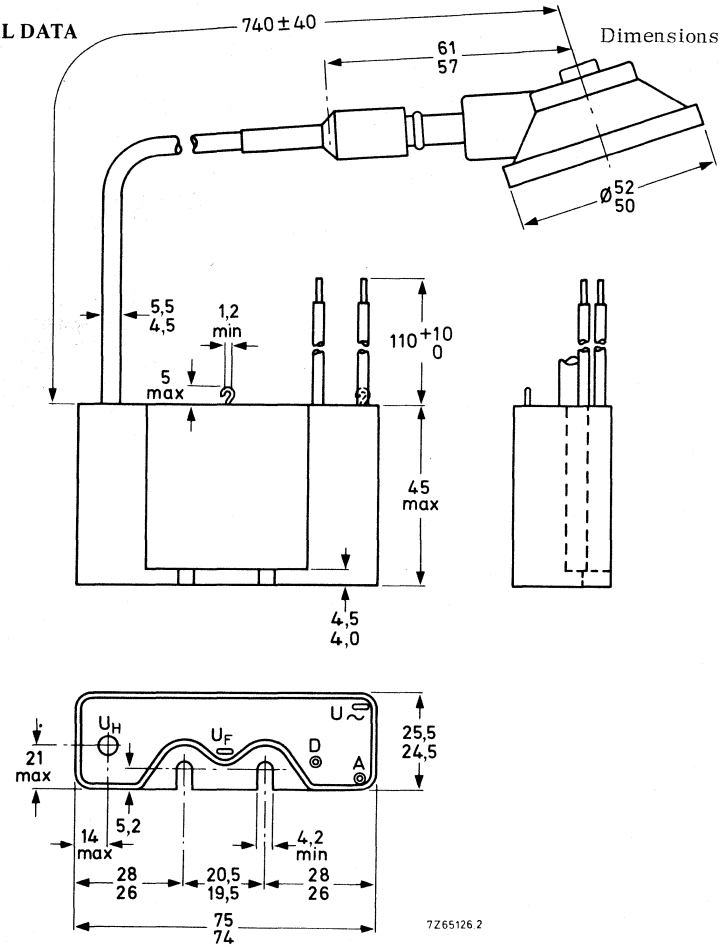
QUICK REFERENCE DATA

			BG1895-541	BG1895-641	
Number of diodes/capacitors + centre-base capacitor			5/4+1	6/4+1	
Input voltage (peak-to-peak value)	$V_{i(p-p)}$	typ.	9,1	8,6 *)	kV
Output voltage (d.c.) for e.h.t. supply	$V_{O(EHT)}$	typ.	25	25	kV
Output current (d.c.) for e.h.t. supply	$I_{O(EHT)}$	typ.	1,5	1,5	mA
Output current for focus supply	$I_{O(FOC)}$	typ.	300	300	μA
Input current of diode D6	$I_{I(D6)}$	typ.	–	3,5	mA
Ambient temperature	T_{amb}	max.		65	°C

MECHANICAL DATA See page 2

MECHANICAL DATA

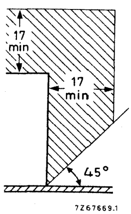
Dimensions in mm



NOTES

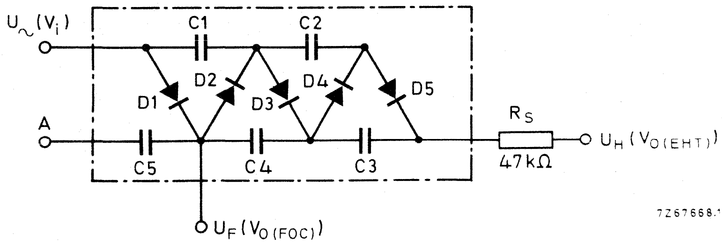
The encapsulation is of non-flammable material fulfilling IEC recommendation 65-14.4. Mounting on a metal chassis is permissible.

→ Above an angle of 45° from the base of the encapsulation at least 17 mm clearance on all sides must be allowed between the encapsulation and any other components (see drawing below).

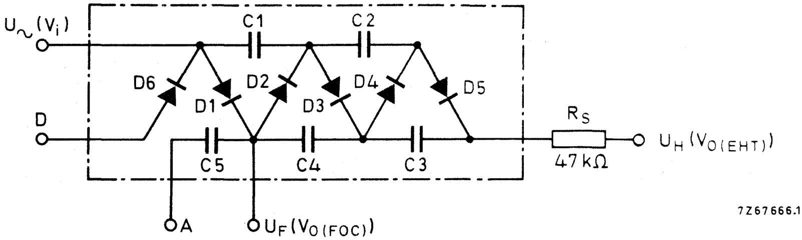


CIRCUIT DIAGRAMS

BG1895-541



BG1895-641



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Input voltage (peak-to-peak value)	$V_{i(p-p)}$	max.	10,0	kV
	$V_{i(p-p)}$	max.	10,5	kV [1])
Output voltage (d.c.) for e.h.t. supply (peak value)	$V_{OM(EHT)}$	max.	27,5	kV
	$V_{OM(EHT)}$	max.	30,0	kV [1])

Currents

Output current (d.c.) for e.h.t. supply	$I_{O(EHT)}$	max.	1,7	mA
Output current for focus supply	$I_{O(FOC)}$	max.	400	μA
Input current of diode D6 (for BG1895-641 only)	$I_{I(D6)}$	max.	4	mA

Temperatures

Ambient temperature	T_{amb}	max.	65	°C
Storage temperature	T_{stg}		−25 to +70	°C

1) Allowed only for a short period, e.g. during adjustment.

CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

Input voltage (peak-to-peak value)				
for $V_{O(EHT)}$ = 27,5 kV at $I_{O(EHT)}$ = 1,7 mA; $I_{O(FOC)}$ = 400 µA; $I_{I(D6)}$ = 4 mA [1]) measured in test circuits on page 5	$V_{i(p-p)}$	≤	10	kV
Input resistance				
$I_{O(EHT)}$ = 0,1 to 1,5 mA	R_i	typ.	500	kΩ
Input capacitance	C_i	≤	14	pF

EXAMPLE OF OPERATION at T_{amb} ≤ 65 °C

			BG1895-541	BG1895-641	
Input voltage (peak-to-peak value)	$V_{i(p-p)}$	typ.	9,1	8,6	kV [2])
Output voltage (d.c.) for e.h.t. supply	$V_{O(EHT)}$	typ.	25	25	kV
Output current (d.c.) for e.h.t. supply	$I_{O(EHT)}$	typ.	1,5	1,5	mA
Output current for focus supply	$I_{O(FOC)}$	typ.	300	300	µA
Input diode D6 current	$I_{I(D6)}$	typ.	–	3,5	mA
Resistor (R) current for V_{G2} voltage divider (see also page 6)	$I_{resistor}$	typ.	–	2,0	mA

Typical line-output circuits for hybrid and all-transistor colour television receivers are given on page 6.

→ The resistor (R_S) of 47 kΩ in the anode cap is essential for protection of the diodes in the tripler and the output power transistor in the horizontal deflection circuit; they also act to suppress radiation.
Their contribution to the e.h.t. source impedance is negligible.

In the all-transistor version, diode D6 can be used in conjunction with an RC circuit to clamp negative voltage pulses, and reduce the e.h.t. source impedance during periods of low beam current.
Separate connections for D6 and the capacitor C5 are provided in the interest of flexibility in circuit lay-out.

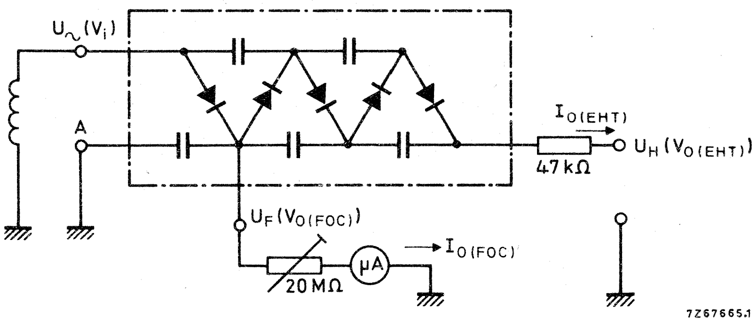
---

[1]) $I_{I(D6)}$ is for BG1895-641 only.

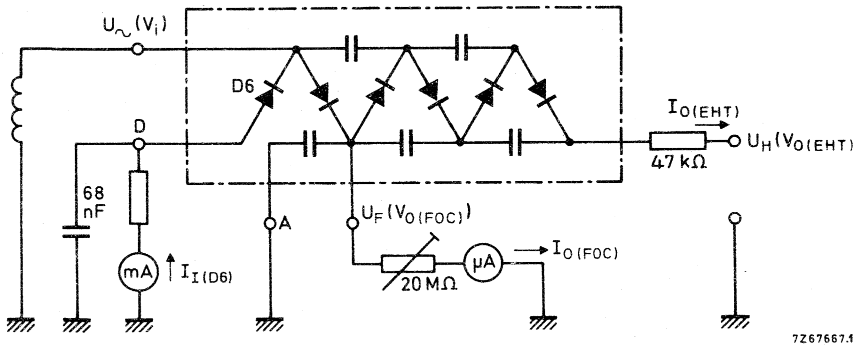
[2]) See also circuits on page 6.

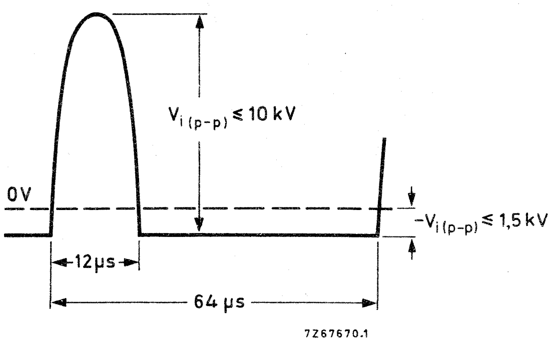
Test circuits (see characteristics on page 4)

BG1895-541

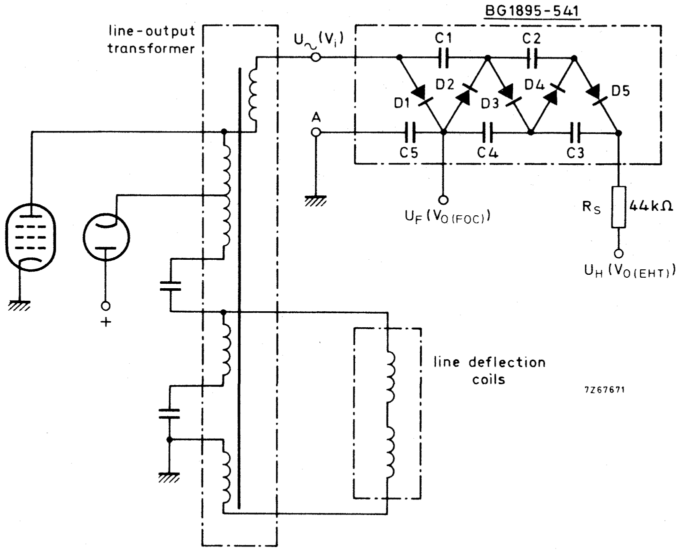


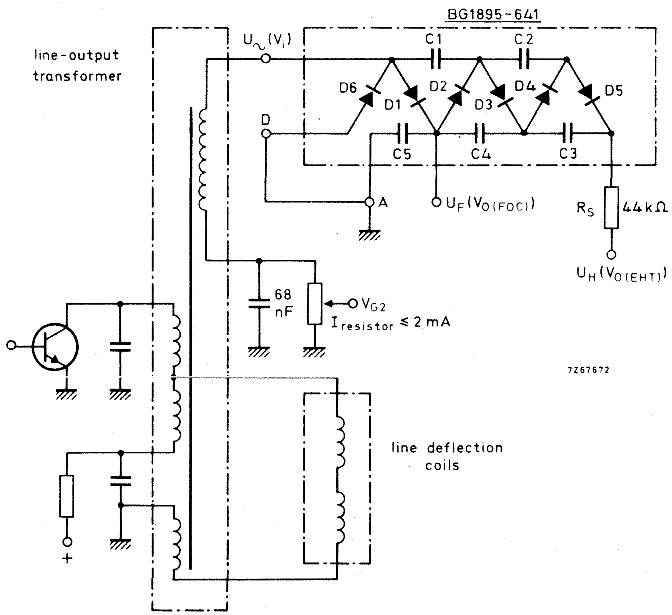
BG1895-641





APPLICATION INFORMATION





SILICON HIGH-VOLTAGE TRIPLER UNITS

Voltage tripler units for e.h.t. supply in colour television receivers with an integrated bleeder resistor and focus supply output. Devices with adjustable focus supply are also available.

Four types are available:

BG1897-541: without clipping diode D6; for use in thyristor or tube horizontal deflection circuits of CTV receivers.
BG1897-542: similar to BG1897-541, but with focus potentiometer.
BG1897-641: with clipping diode D6; for use in transistor horizontal deflection circuits of CTV receivers.
BG1897-642: similar to BG1897-641, but with focus potentiometer.

The devices have a non-flammable encapsulation.

QUICK REFERENCE DATA

			BG1897-541; 542	BG1897-641; 642	
Number of diodes/capacitors + centre-base capacitor			5/4 + 1	6/4 + 1	
Input voltage (peak-to-peak value)	$V_{i(p-p)}$	typ.	9,1	8,6	kV
Output voltage (d.c.) for e.h.t. supply	$V_{O(EHT)}$	typ.	25	25	kV
Adjustable focus output voltage range	$V_{O(FOC)}$		4,0 to 5,3	4,0 to 5,3	kV
Output current (d.c.) for e.h.t. supply	$I_{O(EHT)}$	typ.	1,5	1,5	mA
Current through bleeder resistor	I_B	typ.	85	85	μA
Input current of diode D6 *	$I_{I(D6)}$	typ.	–	3,7	mA

MECHANICAL DATA see Fig.1.

CIRCUIT DIAGRAMS see Figs 2 and 3.

* BG1897-641; 642 only.

MECHANICAL DATA

Dimensions in mm

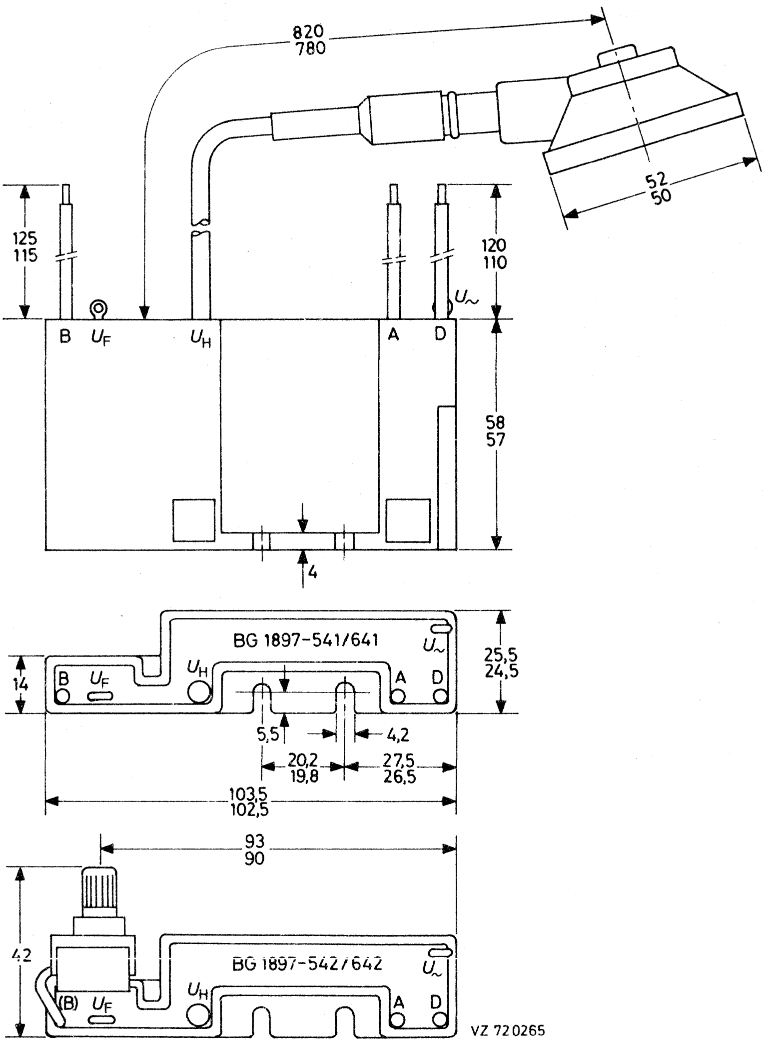


Fig. 1.

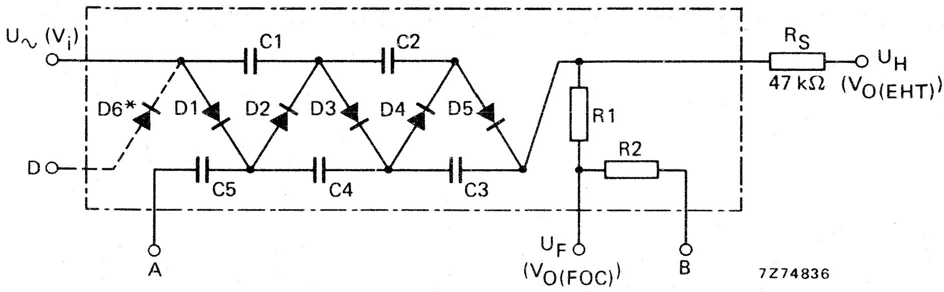


Fig.2 Circuit diagram for BG1897-541; 641.

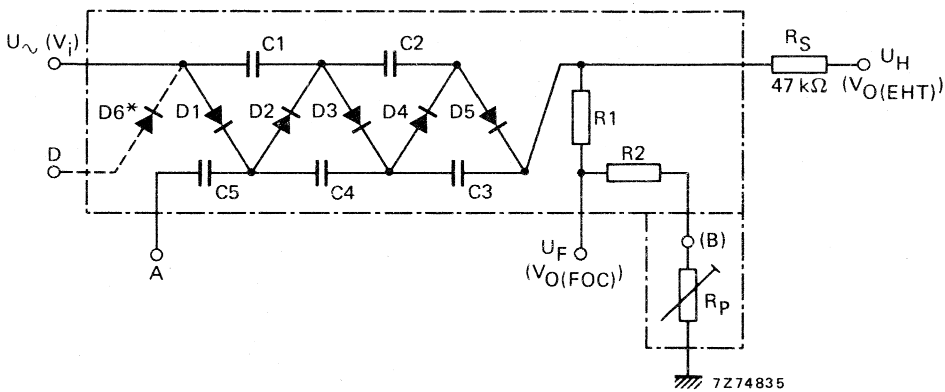


Fig.3 Circuit diagram for BG1897-542; 642.

NOTES

The encapsulation is of non-flammable material fulfilling IEC recommendation 65—14.4.
Mounting on a metal chassis is permissible.
Above an angle of 45° from the base of the encapsulation at least 17 mm clearance on all sides must be allowed between the encapsulation and any other components (see Fig.4).

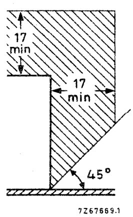


Fig.4.

RATINGS

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

Voltages			
Input voltage (peak-to-peak value)	$V_{i(p-p)}$	max.	10,0 kV
	$V_{i(p-p)}$	max.	10,5 kV *
Output voltage (d.c.) for e.h.t. supply (peak value)	$V_{OM(EHT)}$	max.	27,5 kV
	$V_{OM(EHT)}$	max.	30,0 kV *
Currents			
Output current (d.c.) for e.h.t. supply	$I_{O(EHT)}$	max.	1,7 mA
Input current of diode D6 (for BG1897-641; 642 only)	$I_{I(D6)}$	max.	4,0 mA
Temperatures			
Storage temperature	T_{stg}		−25 to +70 °C
Operating ambient temperature	T_{amb}	max.	65 °C

CHARACTERISTICS

T_{amb} = 25 °C

Input voltage (peak-to-peak value) for $V_{O(EHT)}$ = 27,5 V at $I_{O(EHT)}$ = 1,7 mA; $I_{I(D6)}$ = 4 mA**	$V_{i(p-p)}$	⩽	9,5 kV
Internal resistance $I_{O(EHT)}$ = 0,1 to 1,5 mA; $V_{i(p-p)}$ is constant	R_i	typ.	500 kΩ
Input capacitance	C_i	⩽	14 pF
Bleeder resistance	R_1	typ.	256 MΩ
	R_2	will be accommodated to the adjustment range of $V_{O(FOC)}$	
Value of focus adjusting potentiometer	R_P	typ.	30 MΩ ▲
Adjustable focus output voltage range	$V_{O(FOC)}$		4,0 to 5,3 kV

* Allowed only for a short period, e.g. during adjustment.
**BG1897-641; 642 only.
▲ For BG1897-541; 641 an external potentiometer of 30 MΩ ± 15% is necessary to realize the given adjustment range of $V_{O(FOC)}$.

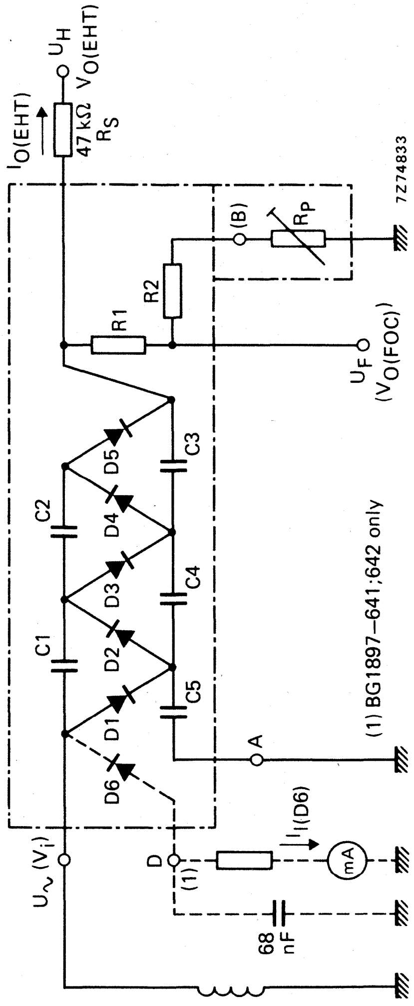


Fig.5 Test circuit.

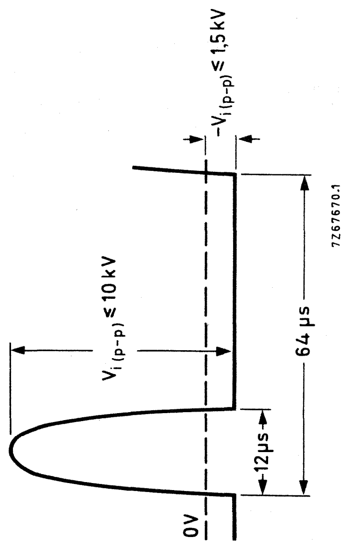


Fig.6 Input voltage pulse.

EXAMPLE OF OPERATION

$T_{amb} \leqslant 65$ °C; see also Figs. 7 and 8			BG1897-541; 542	BG1897-641; 642
Input voltage (peak-to-peak value)	$V_{i(p\text{-}p)}$	typ.	9,1	8,6 kV
Output voltage (d.c.) for e.h.t. supply	$V_{O(EHT)}$	typ.	25	25 kV
Output current (d.c.) for e.h.t. supply	$I_{O(EHT)}$	typ.	1,5	1,5 mA
Current through bleeder resistance	I_B	typ.	85	85 μA
Input current of diode D6	$I_{I(D6)}$	typ.	–	3,7 mA
Resistor (R) current for V_{G2} voltage divider (see Fig.8)	$I_{resistor}$	typ.	–	2,0 mA

The resistor (R_S) of 47 kΩ in the anode cap is essential for protection of the silicon diodes in the tripler and the output power transistor in the horizontal deflection circuit, it also acts to suppress radiation.

Its contribution to the e.h.t. source impedance is negligible.

In the BG1897-641; 642, diode D6 can be used in conjunction with an RC circuit to clamp negative voltage pulses, and reduce the e.h.t. source impedance during periods of low beam current.

Separate connections for D6 and the capacitor C5 are provided in the interest of flexibility in circuit layout.

APPLICATION INFORMATION

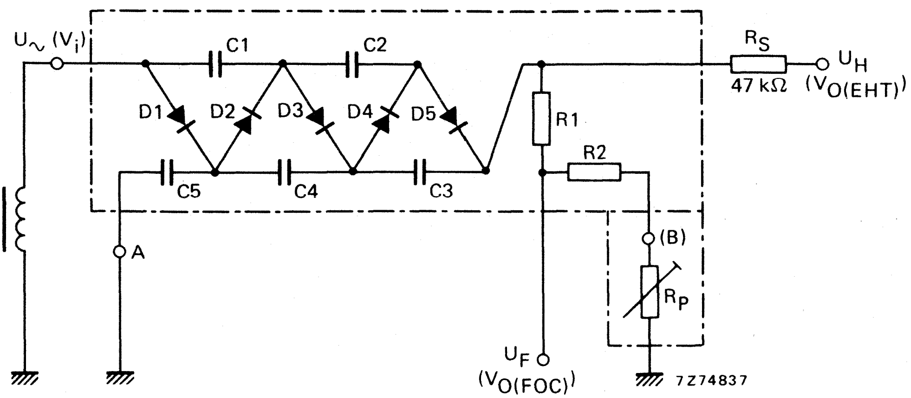


Fig.7 Circuit for BG1897-541; 542.

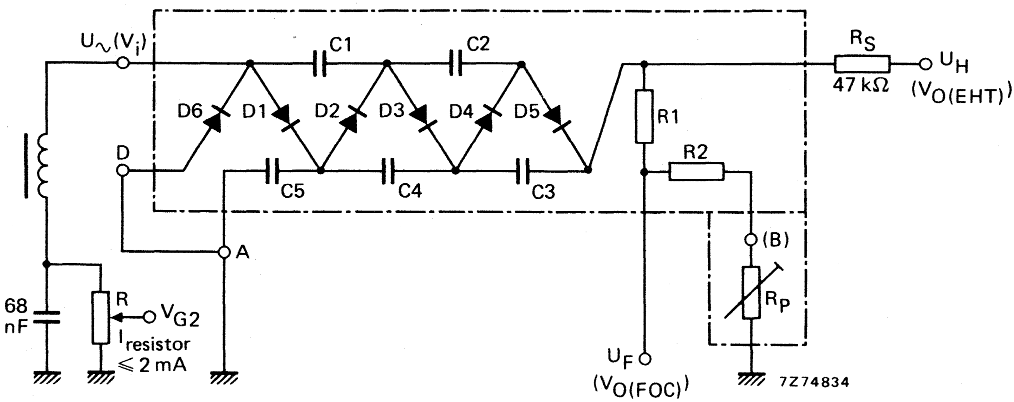


Fig.8 Circuit for BG1897-641; 642.

SILICON HIGH-VOLTAGE TRIPLER UNITS

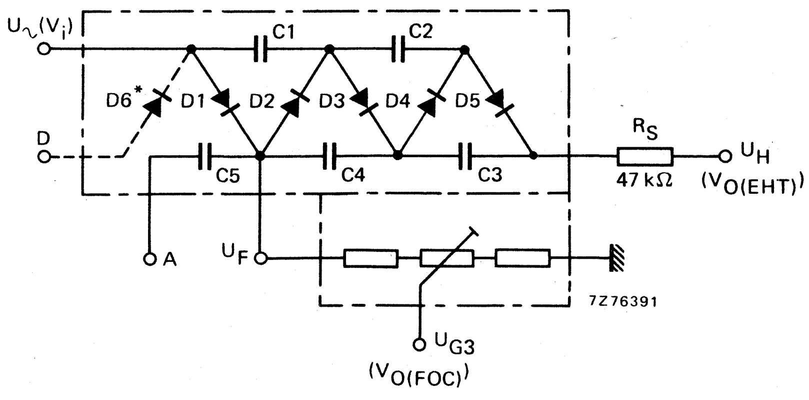
Voltage tripler units for e.h.t. supply in colour television receivers, provided with an adjustable focus supply output in thick-film technique.
Two types are available:
BG1898–541: without clipping diode D6.
BG1898–641: with clipping diode D6.
The devices have a non-flammable encapsulation.

QUICK REFERENCE DATA

			BG1898–541	BG1898–641	
Number of diodes/capacitors + centre-base capacitor			5/4 + 1	6/4 + 1	
Input voltage (peak-to-peak value)	$V_{i(p\text{-}p)}$	typ	9,1	8,6	kV
Output voltage (d.c.) for e.h.t. supply	$V_{O(EHT)}$	typ	25	25	kV
Adjustable focus output voltage range	$V_{O(FOC)}$		3,7 to 5,6	3,7 to 5,6	kV
Output current (d.c.) for e.h.t. supply	$I_{O(EHT)}$	typ	1,5	1,5	mA
Current through focus potentiometer	$I_{O(FOC)}$	typ	150	150	μA
Input current of diode D6 *	$I_{I(D6)}$	typ	–	3,7	mA

MECHANICAL DATA see page 2.

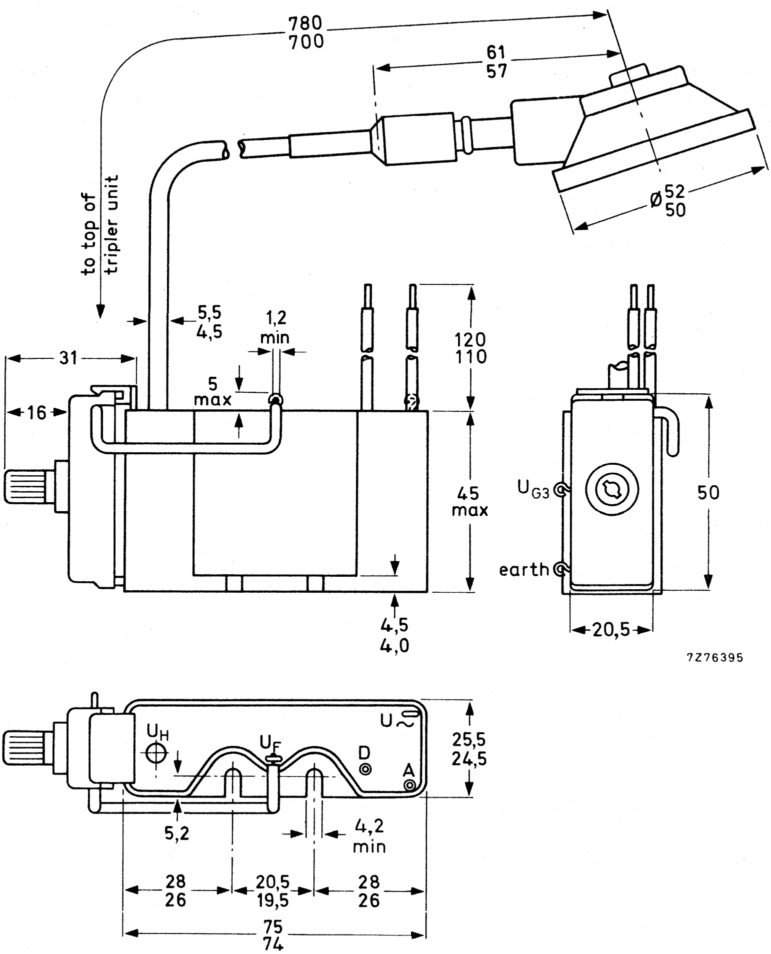
CIRCUIT DIAGRAM



* BG1898–641 only.

MECHANICAL DATA

Dimensions in mm

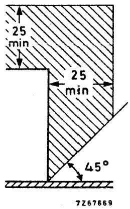


The adjustable focus supply unit may be placed on either narrow side of the high-voltage tripler unit.

Whenever service is necessary the high-voltage tripler unit and the adjustable focus voltage supply unit may be exchanged separately.

NOTES

The encapsulation is of non-flammable material fulfilling IEC recommendation 65—14.4.
Mounting on a metal chassis is permissible.
Above an angle of 45° from the base of the encapsulation at least 25 mm clearance on all sides must be allowed between the encapsulation and any other components (see drawing below).



RATINGS

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

Voltages

Input voltage (peak-to-peak value)	$V_{i(p-p)}$	max	10,0	kV
	$V_{i(p-p)}$	max	10,5	kV *
Output voltage (d.c.) for e.h.t. supply (peak value)	$V_{OM(EHT)}$	max	27,5	kV
	$V_{OM(EHT)}$	max	30,0	kV *

Currents

Output current (d.c.) for e.h.t. supply	$I_{O(EHT)}$	max	1,7	mA
Input current of diode D6 (for BG1898—641 only)	$I_{I(D6)}$	max	4,0	mA

Temperatures

Storage temperature	T_{stg}	—25 to +70		°C
Operating ambient temperature	T_{amb}	max	65	°C

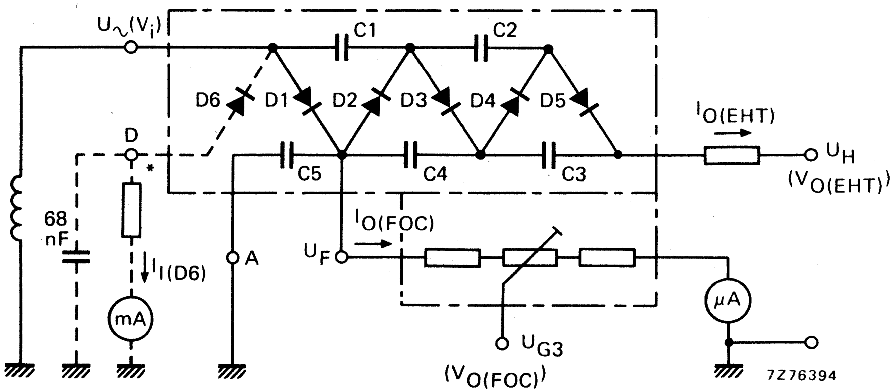
* Allowed only for a short period, e.g. during adjustment.

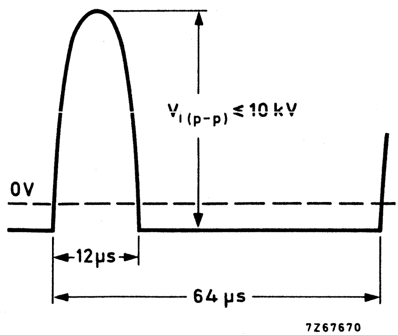
CHARACTERISTICS

T_{amb} = 25 °C

Input voltage (peak-to-peak value)			
for $V_{O(EHT)}$ = 27,5 kV at $I_{O(EHT)}$ = 1,7 mA; $I_{I(D6)}$ = 3,7 mA	$V_{i(p-p)}$	⩽	9,5 kV
Adjustable focus output voltage range			
$V_{O(EHT)}$ = 25 kV	$V_{O(FOC)}$		3,7 to 5,6 kV
Internal resistance			
$I_{O(EHT)}$ = 0,1 to 1,5 mA; $V_{i(p-p)}$ is constant	R_i	typ	450 kΩ
Input capacitance	C_i	⩽	14 pF

TEST CIRCUIT





* BG1898–641 only.

EXAMPLE OF OPERATION at $T_{amb} \leqslant 65\ ^{o}C$

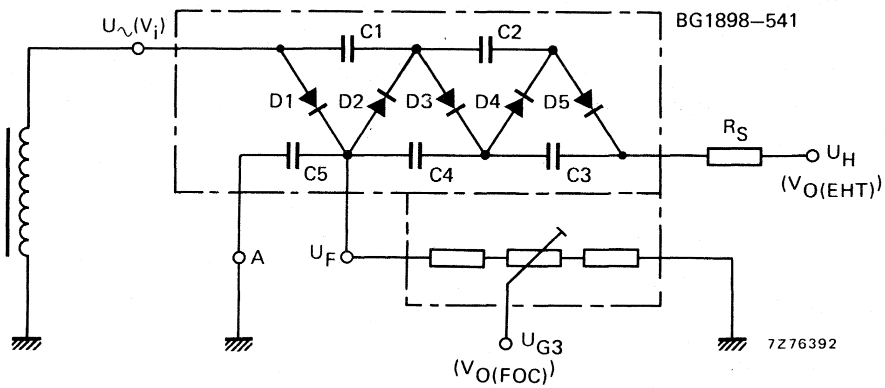
			BG1898–541	BG1898–641	
Input voltage (peak-to-peak value)	$V_{i(p-p)}$	typ	9,1	8,6	kV *
Output voltage (d.c.) for e.h.t. supply	$V_{O(EHT)}$	typ	25	25	kV
Focus output voltage	$V_{O(FOC)}$	typ	4,5	4,5	kV
Output current (d.c.) for e.h.t. supply	$I_{O(EHT)}$	typ	1,5	1,5	mA
Current through focus potentiometer	$I_{O(FOC)}$	typ	150	150	µA
Input current of diode D6	$I_{I(D6)}$	typ	–	3,7	mA
Resistor (R) current for V_{G2} voltage divider (see also page 6)	$I_{resistor}$	typ	–	2,0	mA

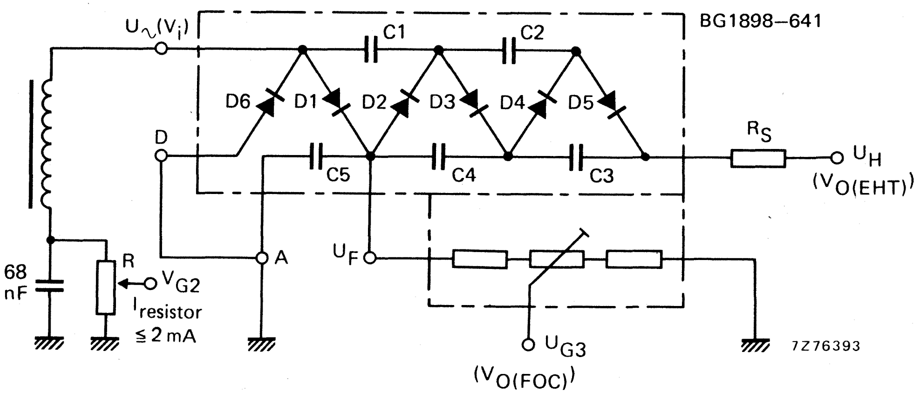
Typical circuits for colour television receivers are given on page 6.
The resistor (R_S) of 47 kΩ in the anode cap is essential for protection of the silicon diodes in the tripler and the output power transistor in the horizontal deflection circuit, it also acts to suppress radiation.
Its contribution to the e.h.t. source impedance is negligible.

In the 641 version, diode D6 can be used in conjunction with an RC circuit to clamp negative voltage pulses, and reduce the e.h.t. source impedance during periods of low beam current.
Separate connections for D6 and the capacitor C5 are provided in the interest of flexibility in circuit layout.

* See also circuits on page 6.

APPLICATION INFORMATION





SILICON RECTIFIER DIODES

Silicon double diffused rectifier diodes in a plastic envelope. They are intended for mains rectifier applications in television receivers.

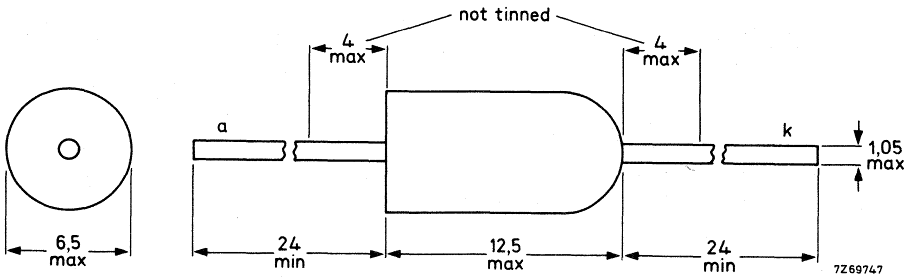
QUICK REFERENCE DATA

			BY126	BY127	
Crest working reverse voltage	V_{RWM}	max.	450	800	V
Repetitive peak reverse voltage	V_{RRM}	max.	650	1250	V
Average forward current with R load; $V_{RWM} = V_{RWMmax}$	$I_{F(AV)}$	max.	1,0		A
$V_{RWM} = 60$ V	$I_{F(AV)}$	max.	1,2		A
Non-repetitive peak forward current t = 10 ms; $T_j = 150$ °C prior to surge	I_{FSM}	max.	40		A
Junction temperature	T_j	max.	150		°C

MECHANICAL DATA

Dimensions in mm

SOD-18



The rounded end indicates the cathode.

The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

FOR NEW DESIGN THE SUCCESSOR TYPES BY226 AND BY227 ARE RECOMMENDED.

All information applies to frequencies up to 400 Hz.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BY126	BY127	
Crest working reverse voltage	V_{RWM}	max.	450	800	V
Repetitive peak reverse voltage ($\delta \leqslant 0{,}01$)	V_{RRM}	max.	650	1250	V
Non-repetitive peak reverse voltage ($t \leqslant 10$ ms)	V_{RSM}	max.	650	1250	V

Average forward current (averaged over any 20 ms period) with R load;				
$V_{RWM} = V_{RWMmax}$	$I_{F(AV)}$	max.	1,0	A
$V_{RWM} = 60$ V	$I_{F(AV)}$	max.	1,2	A
Repetitive peak forward current	I_{FRM}	max.	10	A
Non-repetitive peak forward current (t = 10 ms; half sine wave); $T_j = 150\ ^oC$ prior to surge	I_{FSM}	max.	40	A
Storage temperature	T_{stg}		−65 to +150	^oC
Junction temperature	T_j	max.	150	^oC

CHARACTERISTICS

Forward voltage $I_F = 5$ A; $T_j = 25\ ^oC$	V_F	<	1,5	V *
Peak reverse current $V_{RM} = V_{RRMmax}$	I_{RM}	<	10	μA

* Measured under pulse conditions to avoid excessive dissipation.

BRIDGE RECTIFIER ASSEMBLY

Plastic encapsulated bridge rectifier assembly comprising four silicon double diffused diodes. It is primarily intended for use in the power supplies of many types of transistorized equipment operating at frequencies up to 400 Hz.

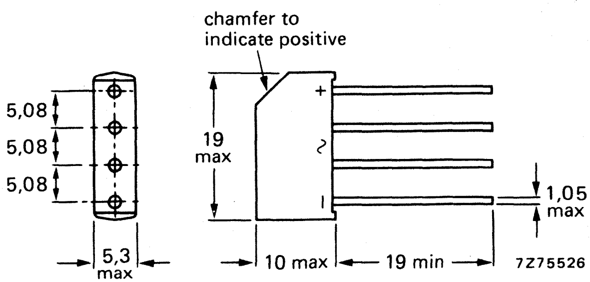
QUICK REFERENCE DATA

Input				
R.M.S. voltage	$V_{I(RMS)}$	max.	60	V
Repetitive peak voltage	V_{IRM}	max.	120	V
Output				
Continuous voltage				
with C load	V_O		85	V
with R load	V_O		54	V
Average current with R load				
$V_{I(RMS)} \leqslant 60$ V	I_O	max.	1,2	A
$V_{I(RMS)} \leqslant 42$ V	I_O	max.	1,4	A
Repetitive peak current	I_{ORM}	max.	5	A

MECHANICAL DATA

Dimensions in mm

SOD-28



The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

All information applies to mains frequencies up to 400 Hz.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Input

R.M.S. voltage	$V_{I(RMS)}$	max.	60	V
Crest working voltage	V_{IWM}	max.	85	V
Repetitive peak voltage	V_{IRM}	max.	120	V
Non repetitive peak voltage; $t \leq 10$ ms	V_{ISM}	max.	120	V
Non repetitive peak current (see also page 6)	I_{ISM}	max.	25	A

Output

Average current with C load	See pages 3, 4 and 5			
Average current with R and L load (see also page 6)				
$V_{I(RMS)} \leq 60$ V	I_O	max.	1.2	A
$V_{I(RMS)} \leq 42$ V	I_O	max.	1.4	A
Repetitive peak current	I_{ORM}	max.	5	A

Temperatures

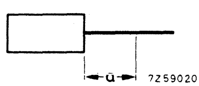
Storage temperature	T_{stg}	-55 to +125		^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE

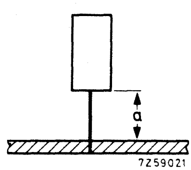
Effect of mounting on thermal resistance $R_{th\ j-a}$

The quoted values apply when no other leads run to the tie-points. If leads of other dissipating components share the same tie-points, the thermal resistance will be higher than that quoted.

1. Mounted to solder tags at a lead-length a > 5 mm. $R_{th\ j-a} = 40\ ^oC/W$



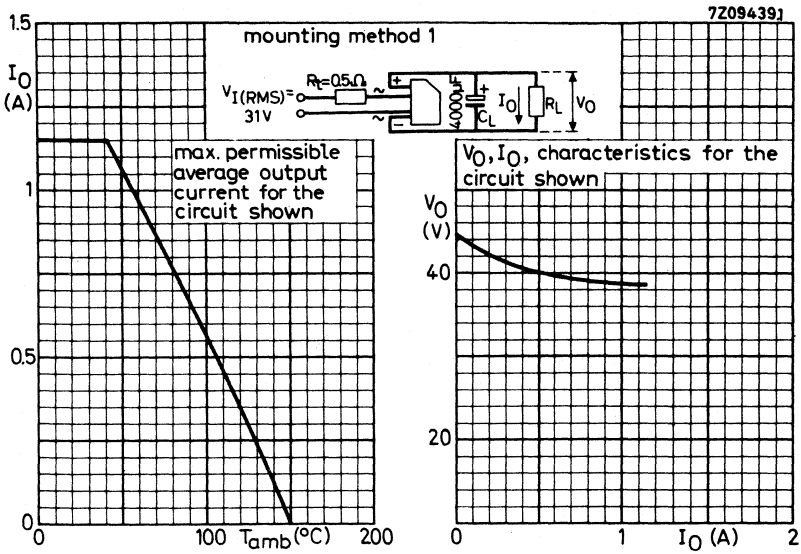
2. Mounted on printed-wiring board at a = maximum lead-length. $R_{th\ j-a} = 50\ ^oC/W$
3. Mounted on printed-wiring board at a lead-length a = 5 mm. $R_{th\ j-a} = 55\ ^oC/W$
4. Mounted on printed-wiring board at a lead-length a = 1.5 mm. $R_{th\ j-a} = 60\ ^oC/W$
(distance -a- is including printed-wiring board thickness)

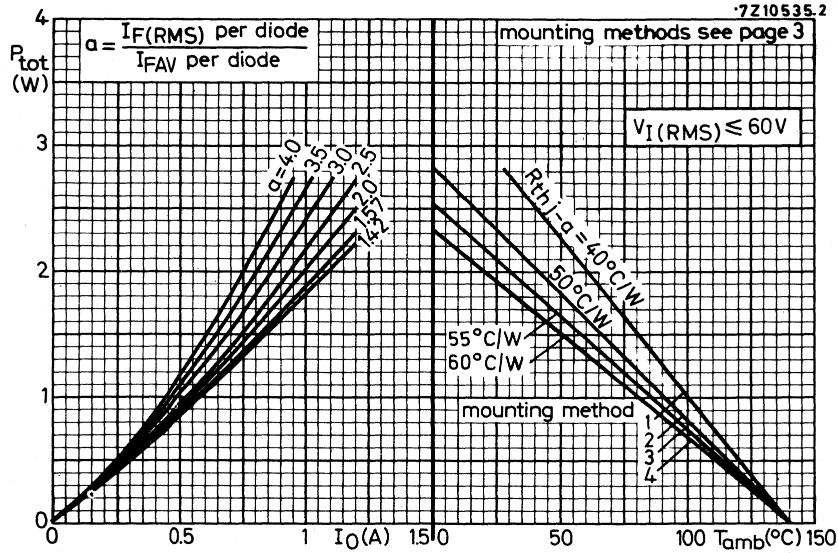


SOLDERING AND MOUNTING NOTES

1. The maximum permissible contact time for the soldering iron or bath is 3 seconds.
2. If the soldered joints are at least 5 mm from the seal, the maximum permissible temperature of the soldering iron or bath is 270 °C. If the joints are between 1.5 mm (min) and 5 mm from the seal, the maximum permissible temperature is 250 °C.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 °C.

EXAMPLE: Rectifier with C load





From the lefthand graph the total power dissipation can be found as a function of the average output current.

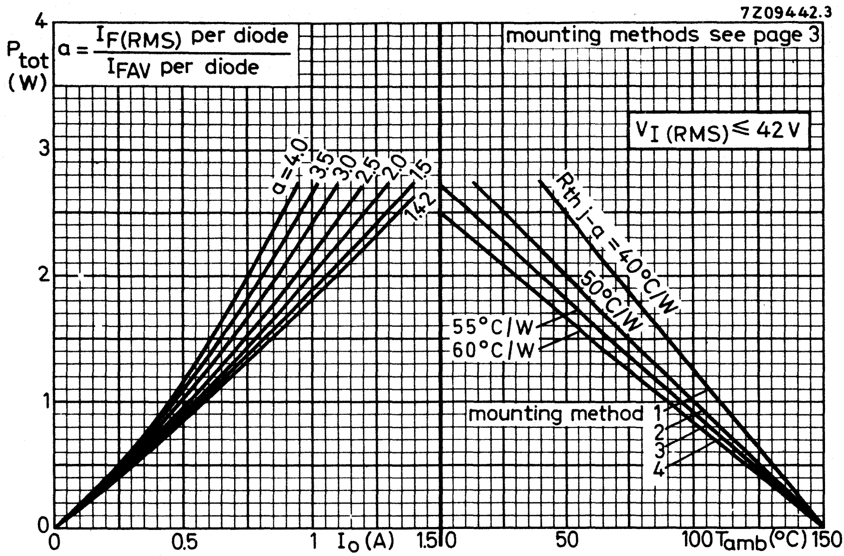
The parameter a = $\frac{I_{F(RMS)} \text{ per diode}}{I_{FAV} \text{ per diode}}$ depends on $\omega R_L C_L$ and $\frac{R_t + R_{diff}}{R_L}$ and can be found from existing graphs.

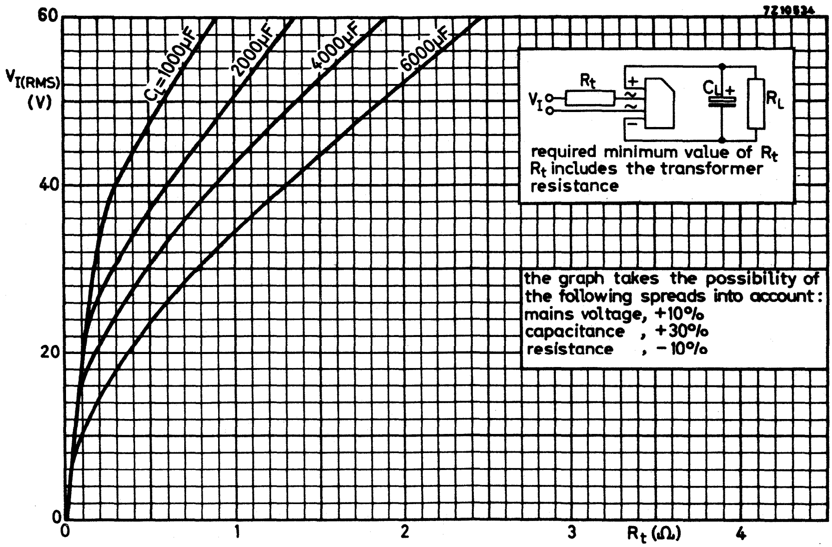
See Application Book: RECTIFIER DIODES.

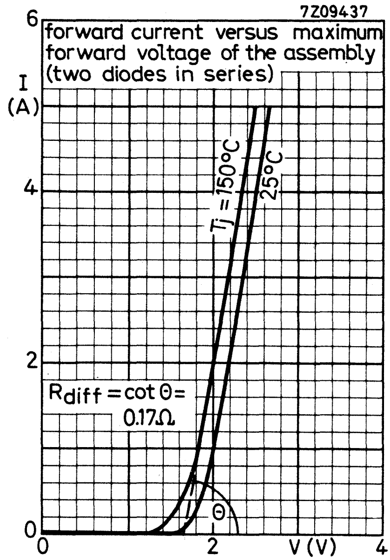
Once the power dissipation is known, the max. permissible ambient temperature follows from the right hand graph.

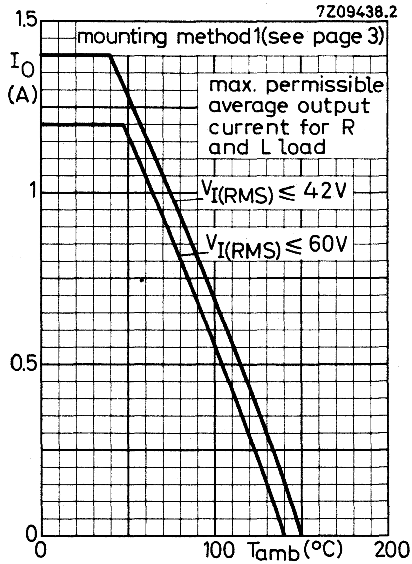
For the series resistance, added to limit the initial peak rectifier current, the required minimum value can be found from the lower graph on page 5.

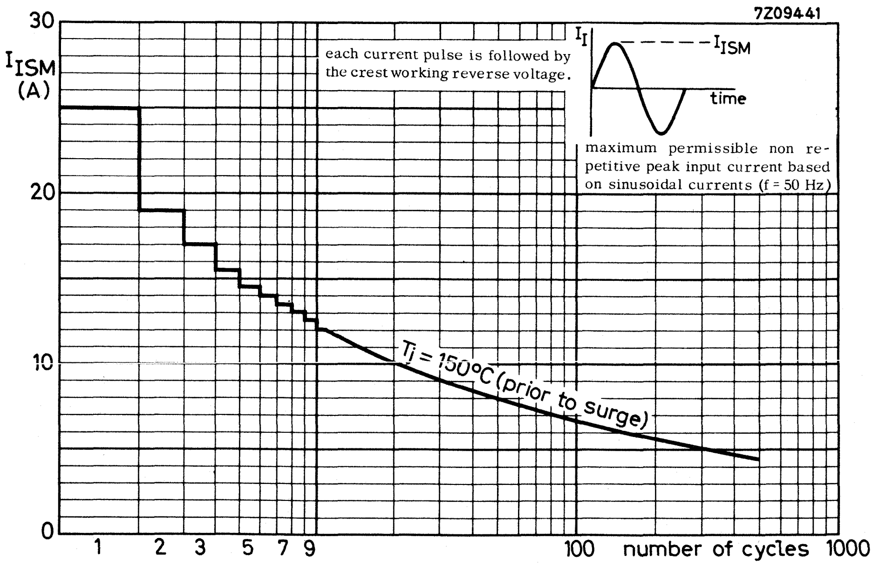
R_{diff} is shown on page 6, left hand upper figure.


7Z09442.3
P tot (W)
a = IF(RMS) per diode / IFAV per diode
mounting methods see page 3
VI (RMS) ≤ 42 V
a = 4.0
3.5
3.0
2.5
2.0
1.5
1.42
Rth j-a = 40°C/W
50°C/W
55°C/W
60°C/W
mounting method 1
2
3
4
Io (A)
Tamb (°C)


VI(RMS) (V)
CL=1000μF
2000μF
4000μF
6000μF
Rt
VI
CL
RL
required minimum value of Rt
Rt includes the transformer resistance
the graph takes the possibility of the following spreads into account:
mains voltage, +10%
capacitance , +30%
resistance , −10%
Rt (Ω)


7Z09437
forward current versus maximum forward voltage of the assembly (two diodes in series)
I
(A)
6
4
2
0
Tj = 150°C
25°C
Rdiff = cot Θ = 0.17Ω
Θ
0
2
V (V)
4


7Z09438.2
mounting method 1(see page 3)
1.5
IO
(A)
1
0.5
0
max. permissible average output current for R and L load
VI(RMS) ≤ 42V
VI(RMS) ≤ 60V
0
100
Tamb (°C)
200


7Z09441
30
IISM
(A)
20
10
0
each current pulse is followed by the crest working reverse voltage.
II
IISM
time
maximum permissible non repetitive peak input current based on sinusoidal currents (f = 50 Hz)
Tj = 150°C (prior to surge)
1
2
3
5
7
9
100
number of cycles
1000

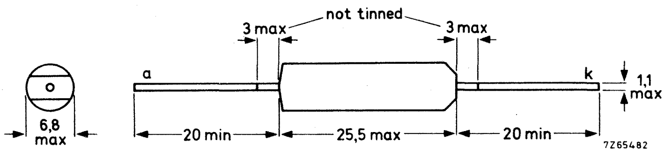
SILICON E.H.T. RECTIFIER DIODE

Rectifier diode in a plastic envelope. It is intended for use in tripler circuits, tiny vision receivers and focus rectifiers in colour television receivers.

QUICK REFERENCE DATA				
Crest working reverse voltage	V_{RWM}	max.	15	kV
Repetitive peak reverse voltage	V_{RRM}	max.	15	kV
Average forward current	$I_{F(AV)}$	max.	2,5	mA
Operating junction temperature	T_j	max.	95	^oC
Reverse recovery charge	Q_s	typ.	5	nC

MECHANICAL DATA Dimensions in mm

SOD-33



The chamfered end indicates the cathode

FOR NEW DESIGN THE SUCCESSOR TYPE BY476 IS RECOMMENDED

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

Voltages [1]

Crest working reverse voltage	V_{RWM}	max.	15	kV	
Repetitive peak reverse voltage	V_{RRM}	max.	15	kV	
Non repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	15	kV	

Currents

Average forward current (averaged over any 20 ms period)	I_{FAV}	max.	2.5	mA	
Repetitive peak forward current	I_{FRM}	max.	250	mA	[2]
Repetitive peak reverse current during switching off	I_{RRM}	max.	150	mA	

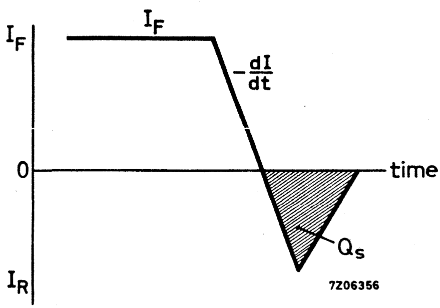
Temperatures

Storage temperature	T_{stg}	-55 to +100		^{o}C
Junction temperature	T_j	max.	95	^{o}C

THERMAL RESISTANCE from junction to ambient $R_{th\ j\text{-}amb}$ = 175 $^{o}C/W$

CHARACTERISTICS

Forward voltage at I_F = 100 mA; T_j = 95 ^{o}C	V_F	<	35	V
Reverse current at V_R = 15 kV; T_j = 75 ^{o}C	I_R	<	4	μA
Recoverd charge when switched from I_F = 200 mA to V_R = 100 V with $-\frac{dI}{dt}$ = 200 mA/μs; T_j = 25 ^{o}C	Q_s	typ.	5	nC



[1]) During initial line-up a reverse voltage of 17 kV is allowed at T_{amb} = 40 ^{o}C.
[2]) The rectifier can withstand flash-over currents in the picture tube.

BRIDGE RECTIFIER ASSEMBLY

Plastic encapsulated bridge rectifier assembly comprising four silicon double diffused diodes. It is primarily intended for equipment drawing its power from mains with frequencies up to 400 Hz.

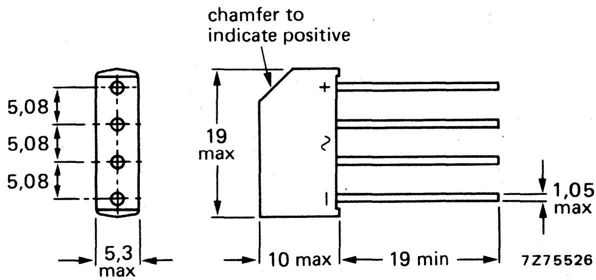
QUICK REFERENCE DATA

Input				
R.M.S. voltage	$V_{I(RMS)}$	max.	280	V
Repetitive peak voltage	V_{IRM}	max.	800	V
Output				
Continuous voltage				
with C load	V_O		400	V
with R load	V_O		255	V
Average current				
with R load up to T_{amb} = 40 °C	I_O	max.	1	A
Repetitive peak current	I_{ORM}	max.	5	A

MECHANICAL DATA

Dimensions in mm

SOD-28



The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

All information applies to mains frequencies up to 400 Hz.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Input

R.M.S. voltage	$V_{I(RMS)}$	max.	280	V
Crest working voltage	V_{IWM}	max.	400	V
Repetitive peak voltage	V_{IRM}	max.	800	V
Non repetitive peak voltage; $t \leq 10$ ms	V_{ISM}	max.	800	V
Non repetitive peak current (see also page 6)	I_{ISM}	max.	25	A

Output

Average current with C load	See pages 4 and 5			
Average current with R and L load up to T_{amb} = 40 ^{o}C (see also page 5)	I_O	max.	1	A
Repetitive peak current	I_{ORM}	max.	5	A

Temperatures

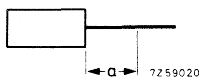
Storage temperature	T_{stg}	-55 to +125		^{o}C
Junction temperature	T_j	max.	125	^{o}C

THERMAL RESISTANCE

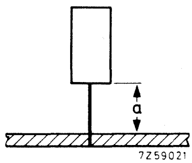
Effect of mounting on thermal resistance $R_{th\ j-a}$

The quoted values apply when no other leads run to the tie-points. If leads of other dissipating components share the same tie-points, the thermal resistance will be higher than that quoted.

1. Mounted to solder tags at a lead-length a > 5 mm. $R_{th\ j-a}$ = 40 ^{o}C/W

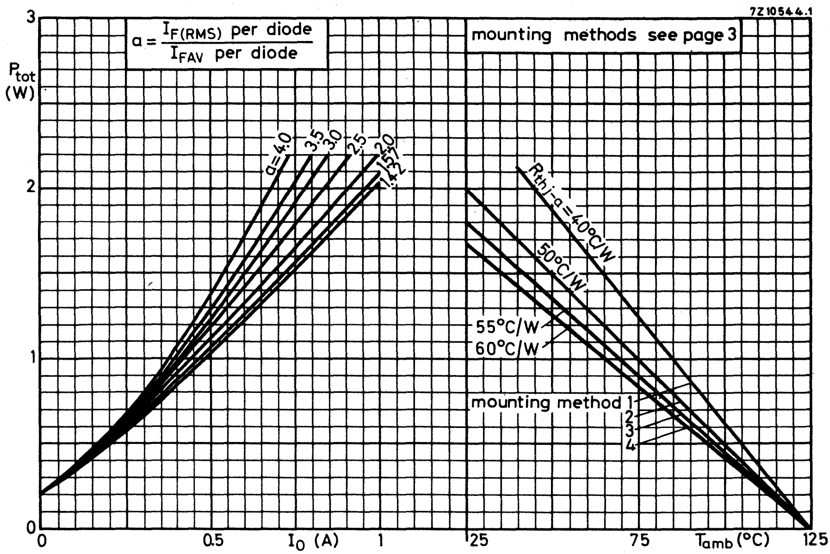


2. Mounted on printed-wiring board at a = maximum lead-length. $R_{th\ j-a}$ = 50 ^{o}C/W
3. Mounted on printed-wiring board at a lead-length a = 5 mm. $R_{th\ j-a}$ = 55 ^{o}C/W
4. Mounted on printed-wiring board at a lead length a = 1.5 mm. $R_{th\ j-a}$ = 60 ^{o}C/W (distance -a- including printed-wiring board thickness)



SOLDERING AND MOUNTING NOTES

1. The maximum permissible contact time for the soldering iron or bath is 3 seconds.
2. If the soldered joints are at least 5 mm from the seal, the maximum permissible temperature of the soldering iron or bath is 270 °C. If the joints are between 1.5 mm (min) and 5 mm from the seal, the maximum permissible temperature is 250 °C.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 °C.

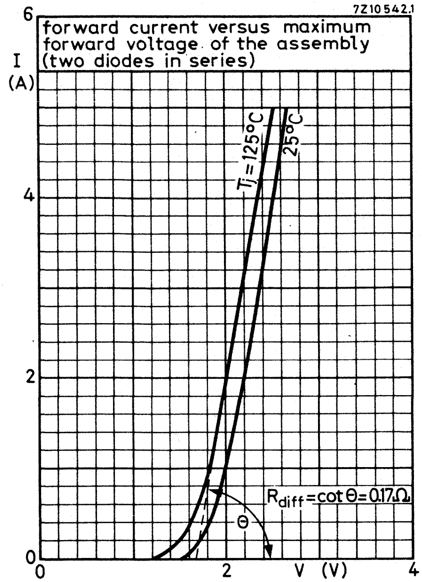


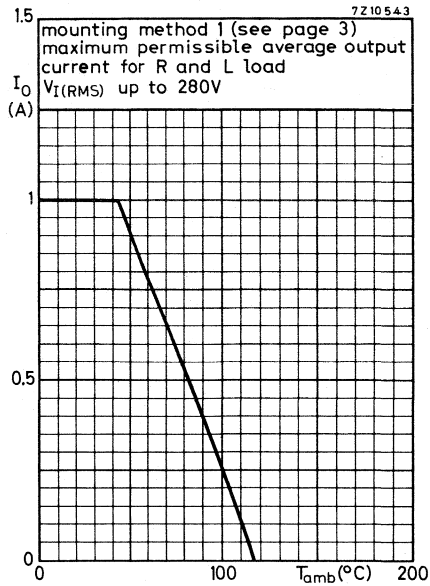
From the lefthand graph the total power dissipation can be found as a function of the average output current.

The parameter $a = \frac{I_{F(RMS)} \text{ per diode}}{I_{FAV} \text{ per diode}}$ depends on $\omega R_L C_L$ and $\frac{R_t + R_{diff}}{R_L}$ and can be found from existing graphs.

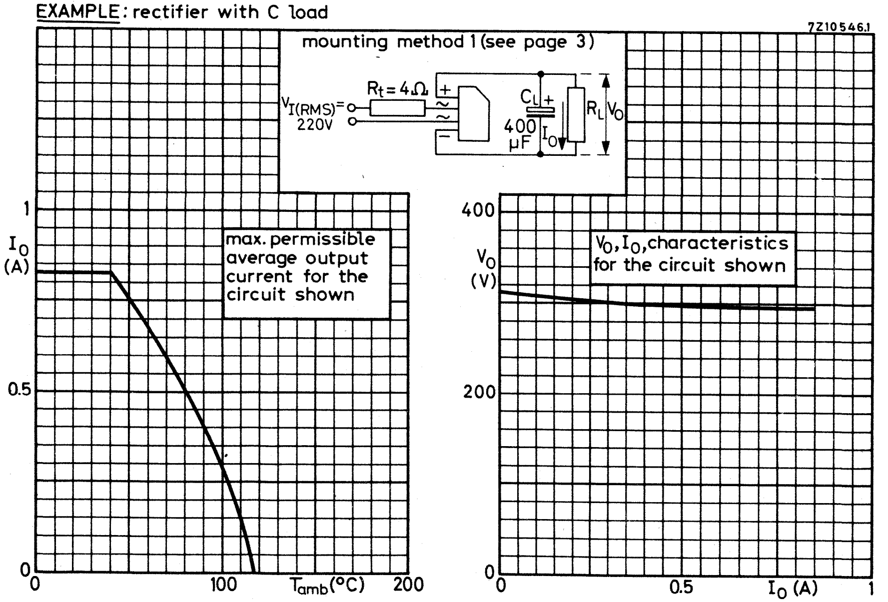
See Application Book: RECTIFIER DIODES.
Once the power dissipation is known, the max. permissible ambient temperature follows from the right hand graph.

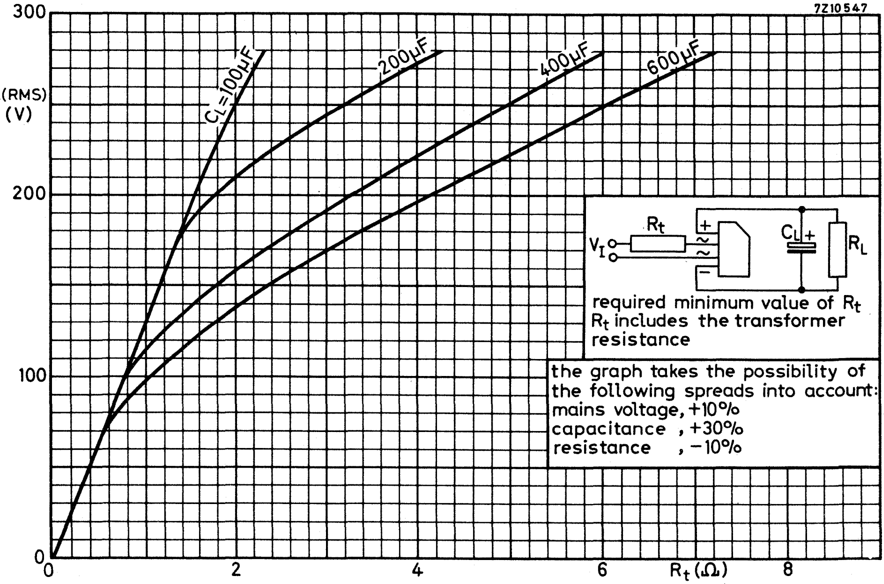
For the series resistance, added to limit the initial peak rectifier current, the required minimum value can be found from the upper graph on page 6.
R_{diff} is shown on page 5, left hand upper graph.

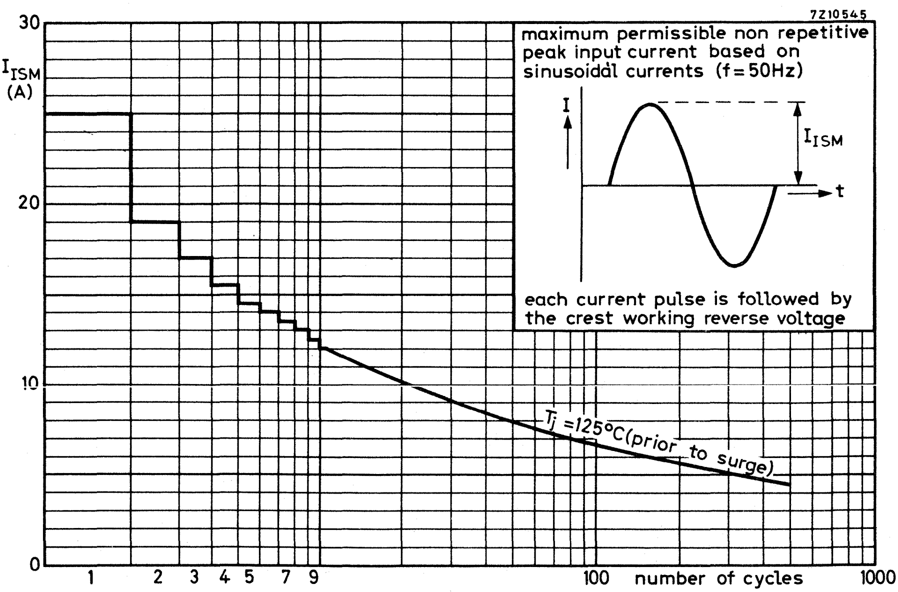




EXAMPLE: rectifier with C load




7Z10547
300
200
100
0
$V_{I(RMS)}$
(V)
C_L=100µF
200µF
400µF
600µF
R_t
V_I
C_L
R_L
required minimum value of R_t
R_t includes the transformer resistance
the graph takes the possibility of the following spreads into account:
mains voltage, +10%
capacitance , +30%
resistance , −10%
0
2
4
6
R_t (Ω)
8


7Z10545
30
20
10
0
I_{ISM}
(A)
maximum permissible non repetitive peak input current based on sinusoidal currents (f = 50Hz)
I
I_{ISM}
t
each current pulse is followed by the crest working reverse voltage
T_j = 125°C (prior to surge)
1
2
3
4
5
7
9
100
number of cycles
1000

SILICON HIGH-VOLTAGE DIODE

Diode in a plastic envelope. It is intended for use as V_{g2} supply in colour television receivers.

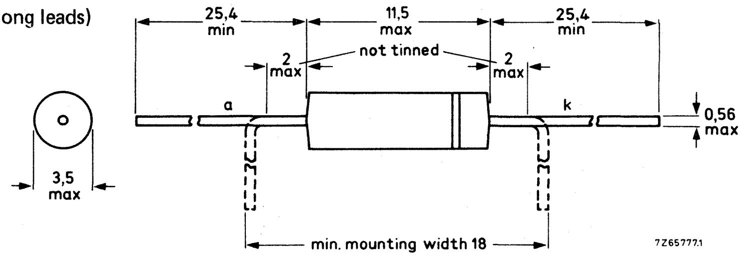
QUICK REFERENCE DATA

Crest working reverse voltage	V_{RWM}	max	1500	V
Repetitive peak reverse voltage	V_{RRM}	max	1800	V
Average forward current	$I_{F(AV)}$	max	5,0	mA
Repetitive peak forward current	I_{FRM}	max	400	mA
Operating junction temperature	T_j	max	85	°C
Reverse recovery charge	Q_s	typ	1	nC

MECHANICAL DATA

Dimensions in mm

SOD-34 (long leads)



The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Crest working reverse voltage	V_{RWM}	max	1500 V
Repetitive peak reverse voltage	V_{RRM}	max	1800 V
Non-repetitive peak reverse voltage ($t \leqslant 10$ ms)	V_{RSM}	max	1800 V

Currents

→ Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max	5,0 mA
Repetitive peak forward current	I_{FRM}	max	400 mA
Non-repetitive peak forward current ($t \leqslant 10$ ms)	I_{FSM}	max	5 A

Temperatures

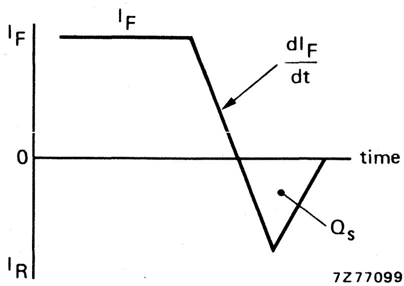
Storage temperature	T_{stg}	−65 to +100	°C
Operating junction temperature	T_j	max	85 °C

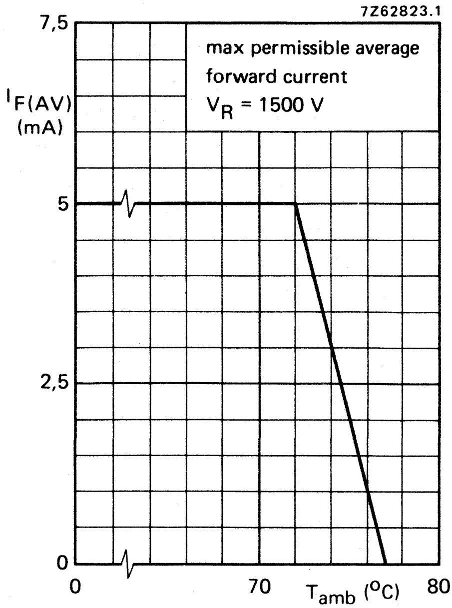
THERMAL RESISTANCE

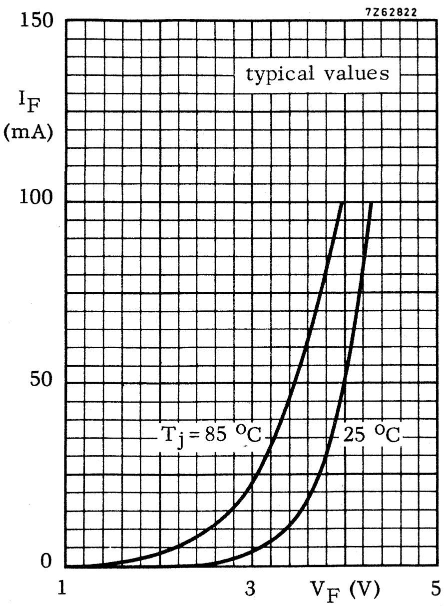
From junction to ambient in free air	$R_{th\,j\text{-}a}$	=	175 °C/W

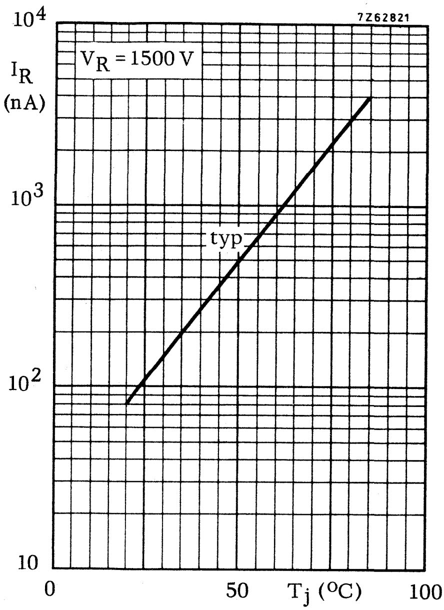
CHARACTERISTICS

Forward voltage at $I_F = 100$ mA; $T_j = 75$ °C	V_F	<	5 V
Reverse current at $V_R = 1500$ V; $T_j = 75$ °C	I_R	<	10 μA
Reverse recovery charge when switched from $I_F = 10$ mA to $V_R = 2$ V with $\frac{dI_F}{dt} = 5$ mA/μs; $T_j = 25$ °C	Q_s	typ	1 nC




7Z62823.1
max permissible average
forward current
V_R = 1500 V
$I_{F(AV)}$ (mA)
7,5
5
2,5
0
0
70
T_{amb} (°C)
80

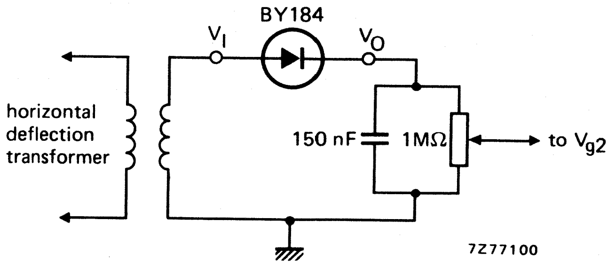

7Z62822
typical values
I_F (mA)
150
100
50
0
T_j = 85 °C
25 °C
1
3
V_F (V)
5

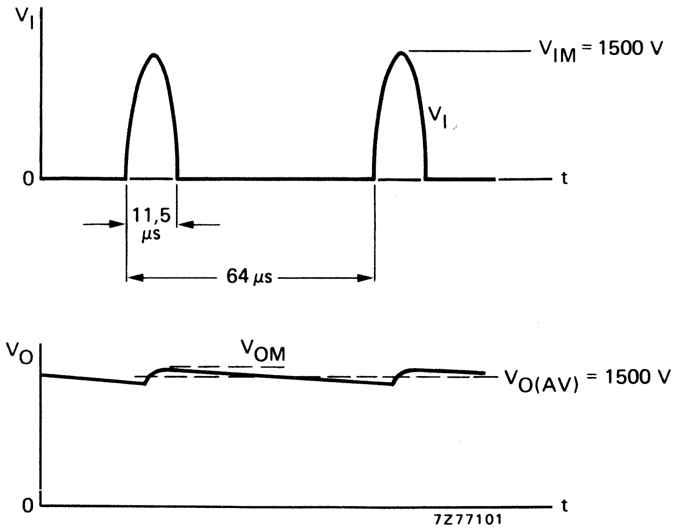

7Z62821
V_R = 1500 V
I_R (nA)
10^4
10^3
10^2
10
typ
0
50
T_j (°C)
100

APPLICATION INFORMATION

Basic circuit for V_{g2} supply in colour television receivers

Stable continuous operation is ensured at an ambient temperature up to 70 °C.





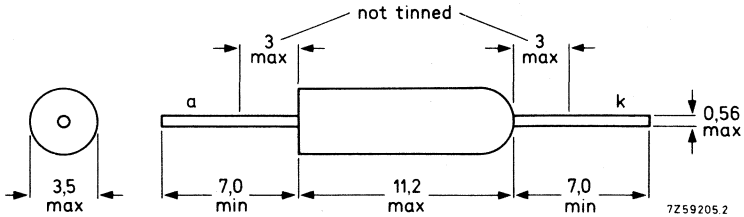
SILICON E.H.T. RECTIFIER DIODE

Rectifier diode in a plastic envelope. It is intended for use in tripler circuits and focus rectifiers in colour television receivers.
Because of the smallness of the envelope, the diode should be potted when used at voltages above 6 kV, see page 3.

QUICK REFERENCE DATA				
Working reverse voltage	V_{RW}	max.	11,5	kV
Repetitive peak reverse voltage	V_{RRM}	max.	12,5	kV
Average forward current	$I_{F(AV)}$	max.	2,5	mA
Junction temperature	T_j	max.	85	^oC
Reverse recovery:				
Recovery charge	Q_s	typ.	5	nC
Recovery time	t_{rr}	typ.	300	ns

MECHANICAL DATA Dimensions in mm

SOD-34 (short leads)



The rounded end indicates the cathode

FOR NEW DESIGN THE SUCCESSOR TYPE BY409 IS RECOMMENDED

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

Voltages

Working reverse voltage	V_{RW}	max.	11.5	kV
Repetitive peak reverse voltage	V_{RRM}	max.	12.5	kV
Non-repetitive peak reverse voltage ($t < 10$ ms)	V_{RSM}	max.	12.5	kV

Currents

Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	2.5	mA [1]
Repetitive peak forward current	I_{FRM}	max.	200	mA [2]
Repetitive peak forward current during 20% of vertical deflection period time	I_{FRM}	max.	500	mA [2]
Repetitive peak reverse current during switching off	I_{RRM}	max.	150	mA

Temperatures

Storage temperature	T_{stg}	-55 to +85		^oC
Junction temperature	T_j	max.	85	^oC

CHARACTERISTICS

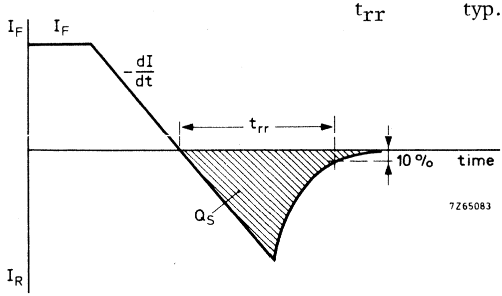
Forward voltage at $I_F = 100$ mA; $T_j = 75$ ^oC	V_F	<	26	V
Reverse current at $V_R = 10$ kV; $T_j = 75$ ^oC	I_R	<	4.0	μA

Reverse recovery: When switched from

$I_F = 200$ mA to $V_R = 100$ V with

$-\frac{dI}{dt} = 200$ mA/μs; $T_j = 25$ ^oC

Recovered charge	Q_s	typ.	5	nC
Recovery time	t_{rr}	typ.	300	ns



[1] $I_{F(AV)}$ can be max. 5 mA when used as scan rectifier in television circuits at $T_{amb} = 65$ ^oC and $V_{RW} = 11.5$ kV.

[2] The rectifier can withstand flash-over currents in the picture tube.

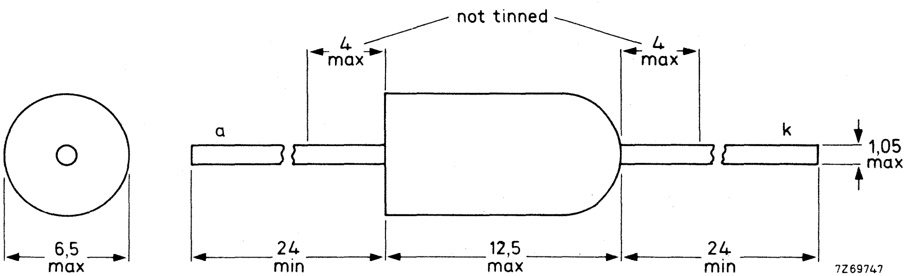
SILICON DIODES

Silicon double-diffused diodes in plastic envelopes. They are intended for use as efficiency diodes in horizontal deflection circuits between base and emitter terminals of the output transistor.

QUICK REFERENCE DATA					
Continuous reverse voltage	V_R	max.	25		V
Repetitive peak reverse voltage	V_{RRM}	max.	50		V
Average forward current with R load $V_R = V_{Rmax}$	$I_{F(AV)}$	max.	1,2		A
Repetitive peak forward current	I_{FRM}	max.	10		A
Junction temperature	T_j	max.	150		°C
			BY188A	BY188B	
Forward conduction delay	t_d	>	0	0,7	µs

MECHANICAL DATA Dimensions in mm

SOD-18



The rounded end indicates the cathode

The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Continuous reverse voltage	V_R	max.	25	V
Repetitive peak reverse voltage ($\delta \le 0,01$)	V_{RRM}	max.	50	V
Non-repetitive peak reverse voltage ($t \le 10$ ms)	V_{RSM}	max.	75	V

Currents

Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	1,2	A
Repetitive peak forward current	I_{FRM}	max.	10	A
Non-repetitive peak forward current (t = 10 ms; half sine-wave) T_j = 150 °C prior to surge	I_{FSM}	max.	40	A

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE See page 3

CHARACTERISTICS

Forward voltage

I_F = 5 A; T_j = 25 °C	V_F	<	1,3	V [1]

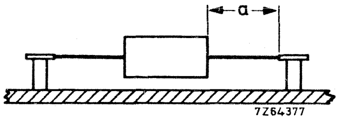
Forward conduction delay at T_j = 150 °C			BY188A	BY188B	
V_F = 4 V; see also page 5	t_d	>	0	−	µs
V_F = 6 V; see also page 5	t_d	>	−	0,7	µs

[1] Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE (influence of mounting method)

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no other leads run to the tie-points (see upper graph on page 4).

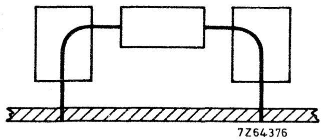
1. Mounted to ceramic solder tags at a lead-length a = 10 mm. $R_{th\ j\text{-}a}$ = 60 °C/W



2. Mounted on printed-wiring board at a = maximum lead length and heatsinks (0, 3 mm Cu) on leads.

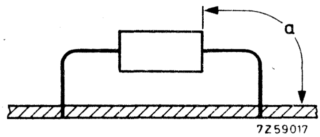
   a. Heatsink size 2 cm^2 (per side) $R_{th\ j\text{-}a}$ = 60 °C/W

   b. Heatsink size 1 cm^2 (per side) $R_{th\ j\text{-}a}$ = 70 °C/W



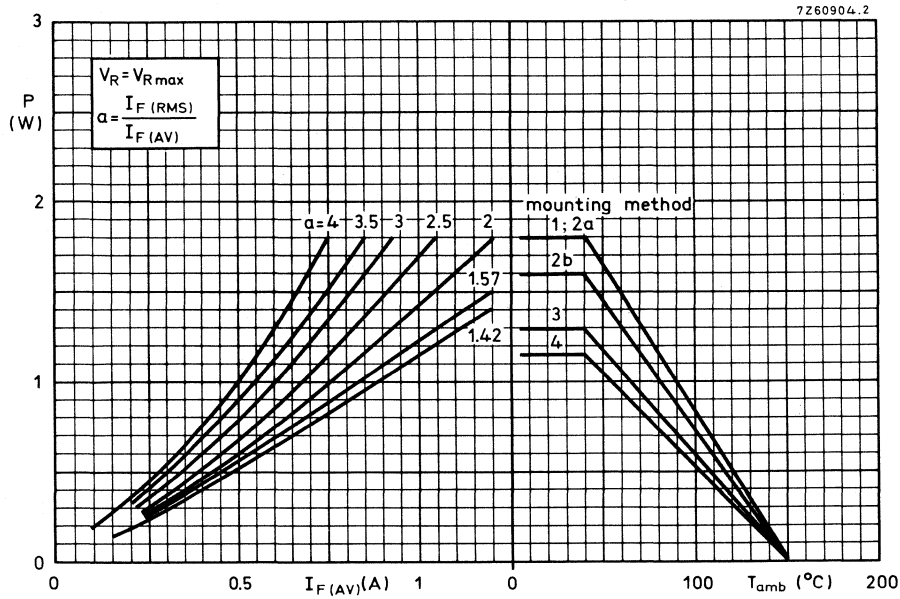
3. Mounted on printed-wiring board at a = maximum lead-length. $R_{th\ j\text{-}a}$ = 85 °C/W

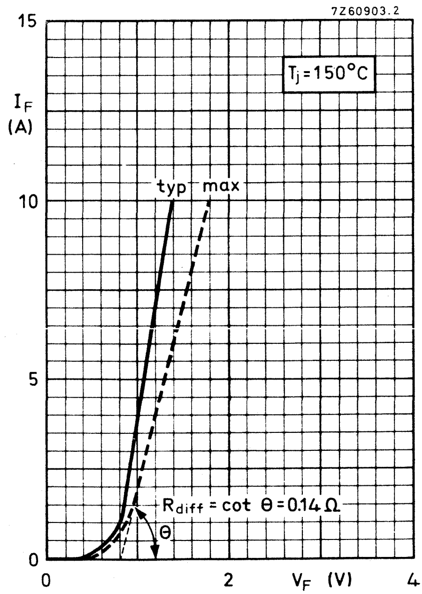
4. Mounted on printed-wiring board at a lead-length a= 10 mm. $R_{th\ j\text{-}a}$ = 95 °C/W



SOLDERING AND MOUNTING NOTES

1. Soldered joints must be at least 5 mm from the seal.
2. The maximum permissible temperature of the soldering bath is 300 °C; it must not be in contact with the joint for more than 3 seconds.
3. Avoid hot spots due to handling or mounting; the body and the device must not come into contact with or be exposed to a temperature higher than 150 °C.
4. Leads should not be bent less than 2 mm from the seal; exert no axial pull when bending.


7Z60904.2
P
(W)
$V_R = V_{R\,max}$
$a = \frac{I_{F\,(RMS)}}{I_{F\,(AV)}}$
a=4
3.5
3
2.5
2
1.57
1.42
mounting method
1; 2a
2b
3
4
$I_{F\,(AV)}$(A)
T_{amb} (°C)
0
0.5
1
100
200
1
2
3

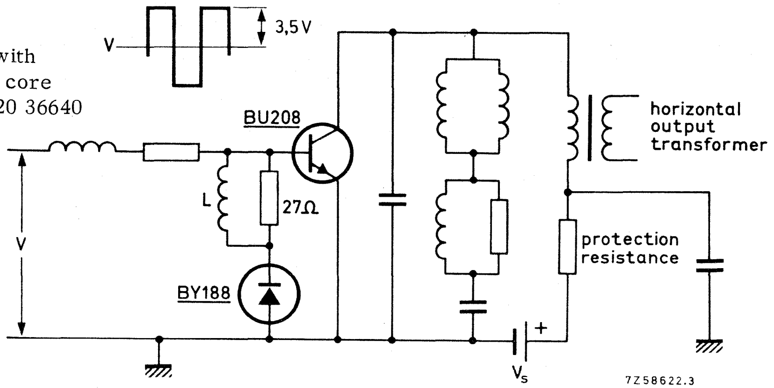

7Z60903.2
I_F
(A)
$T_j = 150$°C
typ
max
$R_{diff} = \cot\,\Theta = 0.14\,\Omega$
Θ
V_F (V)
0
2
4
5
10
15

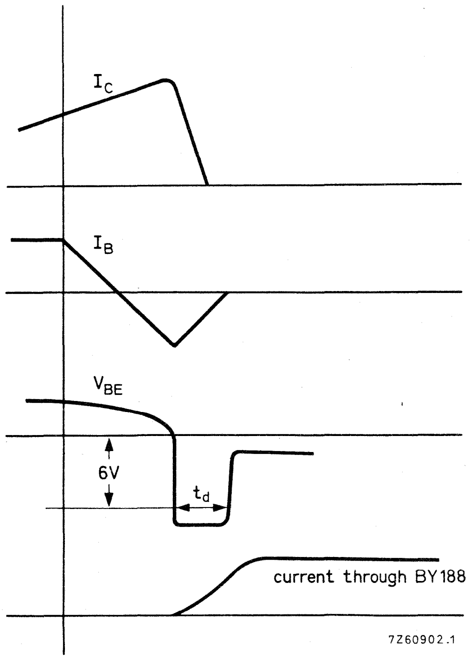
APPLICATION INFORMATION

In the horizontal deflection circuit shown below, the BY188 and the collector-base diode of the BU208 output transistor together fulfil the function of a parallel efficiency diode. During the forward conduction delay t_d of the BY188 (see waveforms below), the reverse bias between the base and emitter of the BU208 ensures fast turn-off of the collector current. The BU208 requires a delay time of minimum 1,5 μs, provided by the combined effects of the BY188 and coil L.

BY188A:
L = choke with ferrite core 4312 020 36640

BY188B:
L = 10 μH





Waveforms in the above circuit during current turn-off.

FAST SOFT-RECOVERY RECTIFIER DIODES

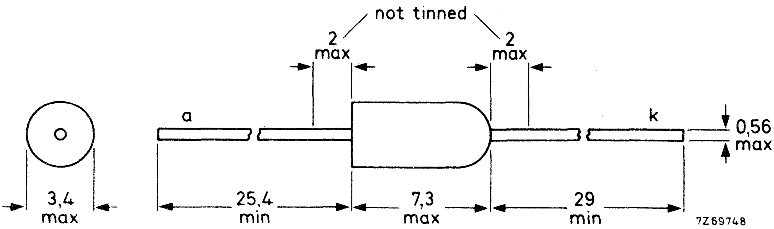
Silicon double-diffused rectifier diodes in plastic envelopes.
They are intended for use as top level detector, scan rectifier for the supply of small-signal parts in television and other h.f. power supplies. The devices feature non-snap-off characteristics.

QUICK REFERENCE DATA

			BY206	BY207	
Repetitive peak reverse voltage	V_{RRM}	max.	350	600	V
Average forward current	$I_{F(AV)}$	max.	0,5	0,5	A
Non-repetitive peak forward current	I_{FSM}	max.	15	15	A
Reverse recovery time	t_{rr}	<	300	300	ns

MECHANICAL DATA Dimensions in mm

DO-14



The rounded end indicates the cathode

The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages			BY206	BY207	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	350	600	V
Repetitive peak reverse voltage ($t \leq 12$ µs)	V_{RRM}	max.	350	600	V
Working reverse voltage	V_{RW}	max.	300	500	V
Continuous reverse voltage	V_R	max.	300	500	V

Currents

Average forward current (averaged over any 20 ms period; see also pages 4, 5, 7)				
$V_{RW} = V_{RWmax}$	$I_{F(AV)}$	max.	0,4	A
$V_{RW} \leq 80$ V	$I_{F(AV)}$	max.	0,5	A
Repetitive peak forward current	I_{FRM}	max.	3,0	A
Repetitive peak forward current ($\delta \leq 0,03$; $f \geq 15$ kHz)	I_{FRM}	max.	5,0	A
Non-repetitive peak forward current ($t = 10$ ms; half sine-wave) $T_j = 150$ °C prior to surge	I_{FSM}	max.	15	A

Temperatures

Storage temperature	T_{stg}		−65 to +125	°C
Operating junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE See page 3

CHARACTERISTICS

Forward voltage

$I_F = 2$ A; $T_j = 25$ °C	V_F	<	1,55	V [1]

Reverse current			BY206	BY207	
$V_R = V_{RWmax}$; $T_j = 125$ °C	I_R	<	200	125	µA
$T_j = 25$ °C	I_R	<	2	2	µA

Reverse recovery when switched from

$I_F = 0,4$ A to $V_R \geq 50$ V with
$-dI_F/dt = 0,4$ A/µs; $T_j = 25$ °C

Recovery charge	Q_s	<	60	nC
Recovery time	t_{rr}	<	1,0	µs
Fall time	t_f	>	60	ns

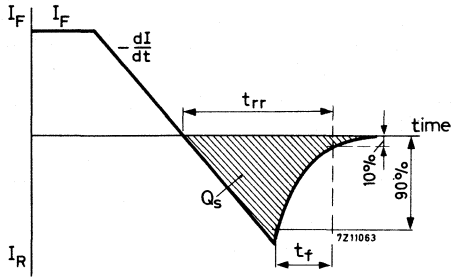
1) Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Reverse recovery when switched from

I_F = 10 mA to V_R ≥ 50 V with
$-dI/dt$ = 0,5 A/μs; T_j = 25 °C

Recovery time	t_{rr}	<	300	ns

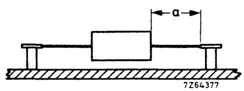


THERMAL RESISTANCE (influence of mounting method)

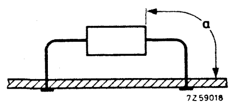
The quoted values of $R_{th\ j-a}$ should be used only when no other leads run to the tie-points. If leads of other dissipating components share the same tie-points, the thermal resistance will be higher than that quoted.

1. Mounted to solder tags at a lead-length a = 10 mm — $R_{th\ j-a}$ = 150 °C/W

2. Mounted to solder tags at a = maximum lead-length — $R_{th\ j-a}$ = 200 °C/W

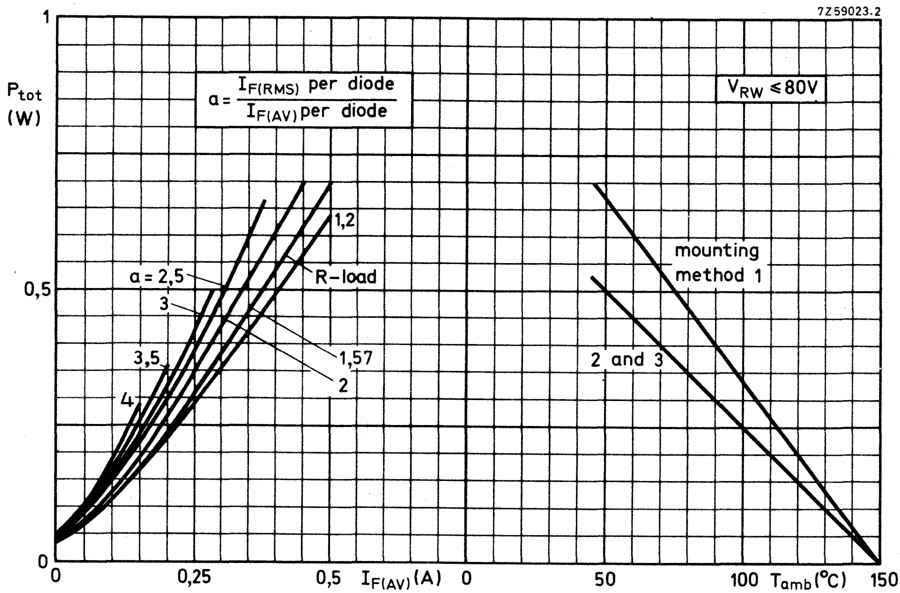


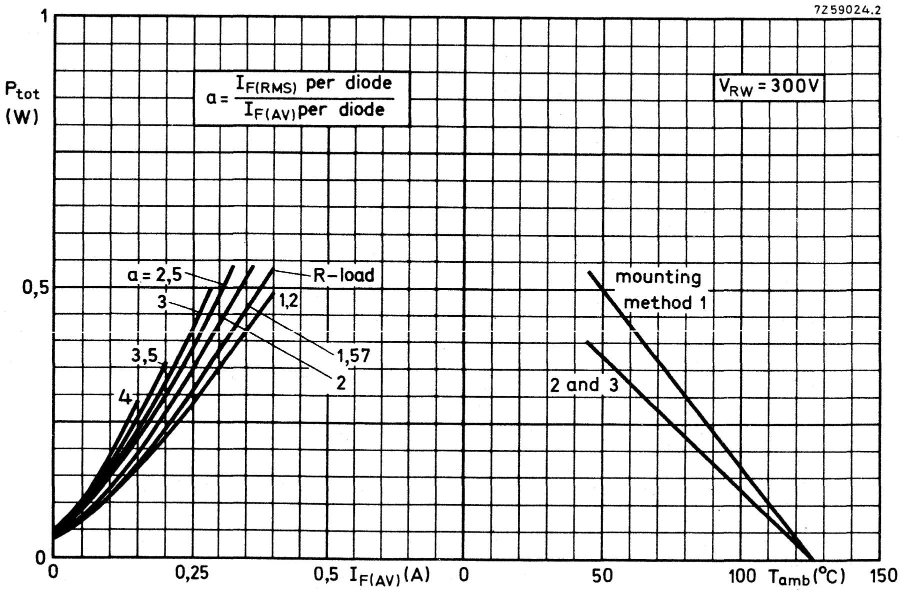
3. Mounted on printed-wiring board with a small area of copper at a lead-length a > 5 mm — $R_{th\ j-a}$ = 200 °C/W

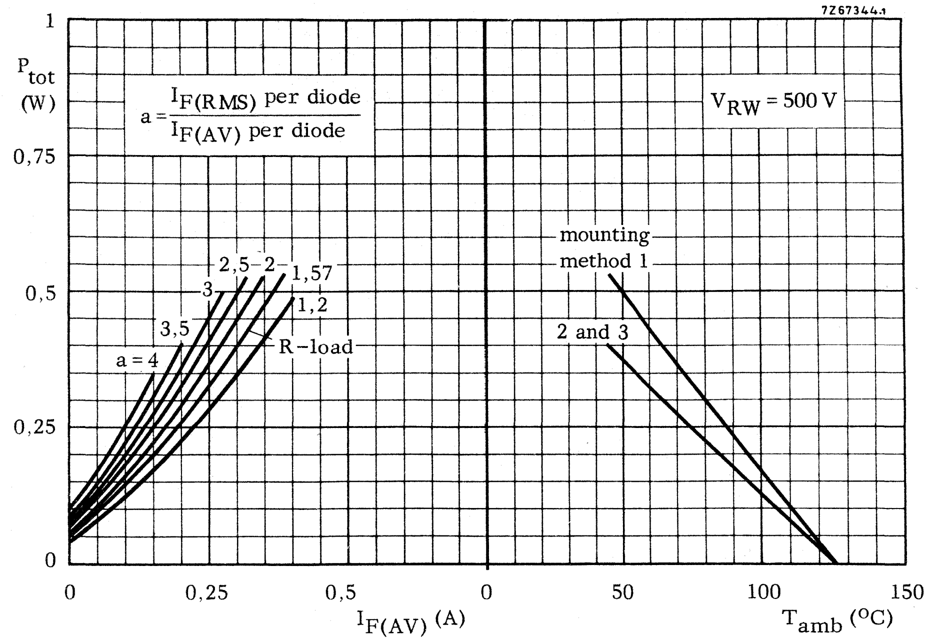


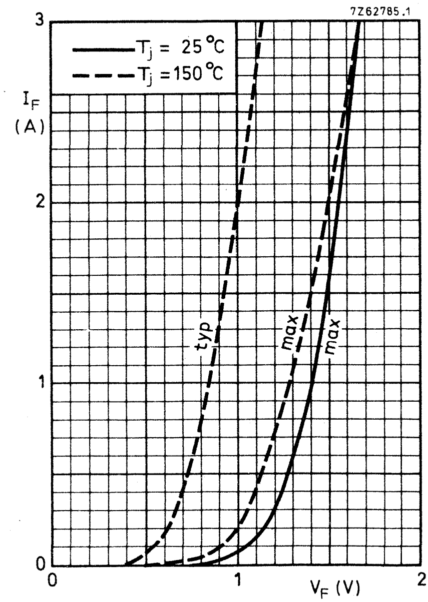
SOLDERING AND MOUNTING NOTES

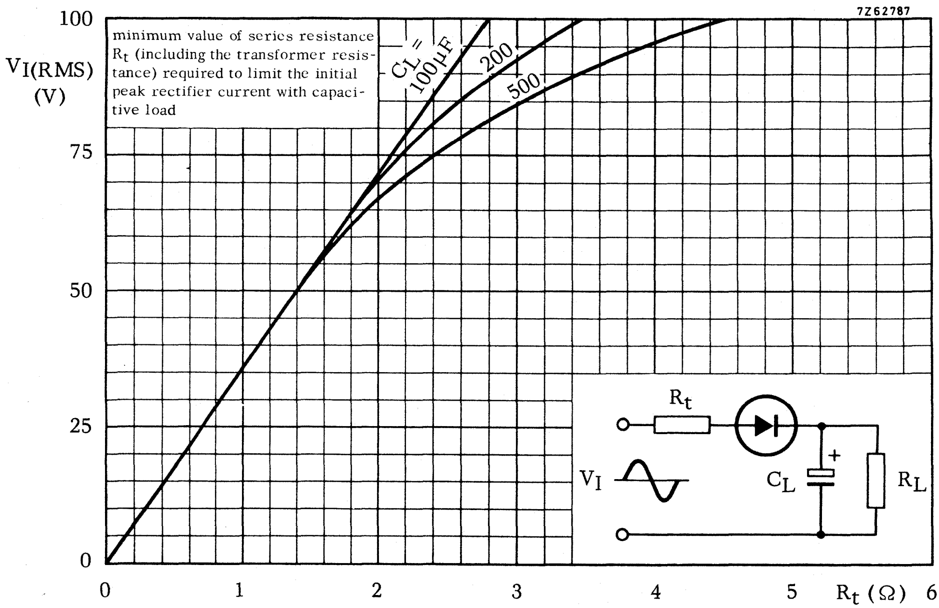
1. Soldered joints must be at least 5 mm from the seal.
2. The maximum permissible temperature of the soldering bath is 300 °C; it must not be in contact with the joint for more than 3 seconds.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 125 °C.

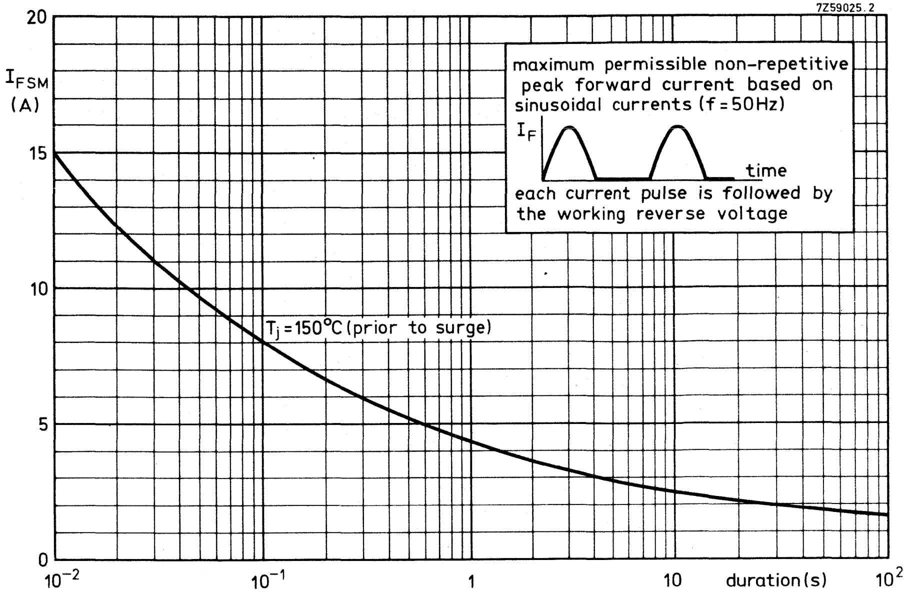

7Z59023.2
Ptot (W)
a = IF(RMS) per diode / IF(AV) per diode
VRW ≤ 80V
a = 2,5
3
3,5
4
1,2
R-load
1,57
2
mounting method 1
2 and 3
0
0,5
1
0
0,25
0,5 IF(AV) (A)
0
50
100 Tamb (°C)
150


7Z59024.2
Ptot (W)
a = IF(RMS) per diode / IF(AV) per diode
VRW = 300V
a = 2,5
3
3,5
4
R-load
1,2
1,57
2
mounting method 1
2 and 3
0
0,5
1
0
0,25
0,5 IF(AV) (A)
0
50
100 Tamb (°C)
150

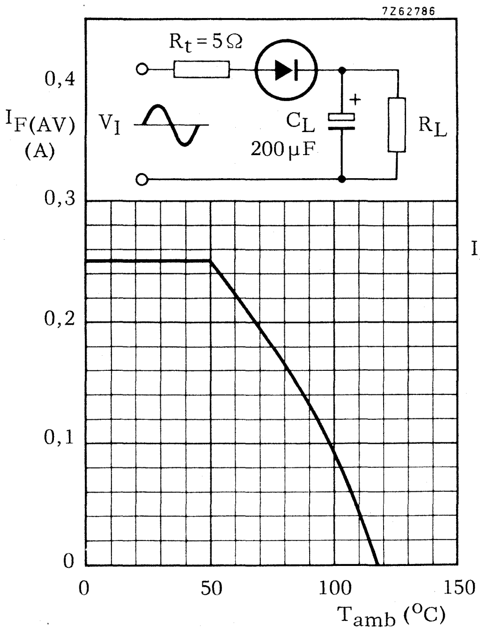

7Z67344.1
Ptot (W)
1
0,75
0,5
0,25
0
$a = \frac{I_{F(RMS)} \text{ per diode}}{I_{F(AV)} \text{ per diode}}$
a = 4
3,5
3
2,5
2
1,57
1,2
R-load
VRW = 500 V
mounting method 1
2 and 3
0
0,25
0,5
IF(AV) (A)
0
50
100
150
Tamb (°C)


7Z62785.1
Tj = 25 °C
Tj = 150 °C
IF (A)
3
2
1
0
typ
max
max
0
1
2
VF (V)

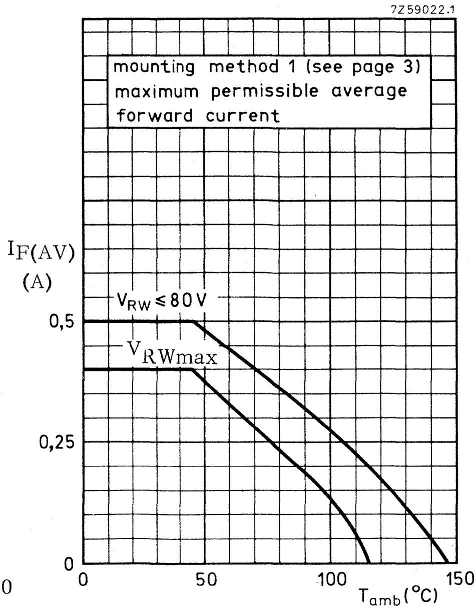

7Z62787
100
75
50
25
0
VI(RMS) (V)
minimum value of series resistance Rt (including the transformer resistance) required to limit the initial peak rectifier current with capacitive load
CL = 100µF
200
500
0
1
2
3
4
5
Rt (Ω)
6
Rt
VI
CL
RL
+

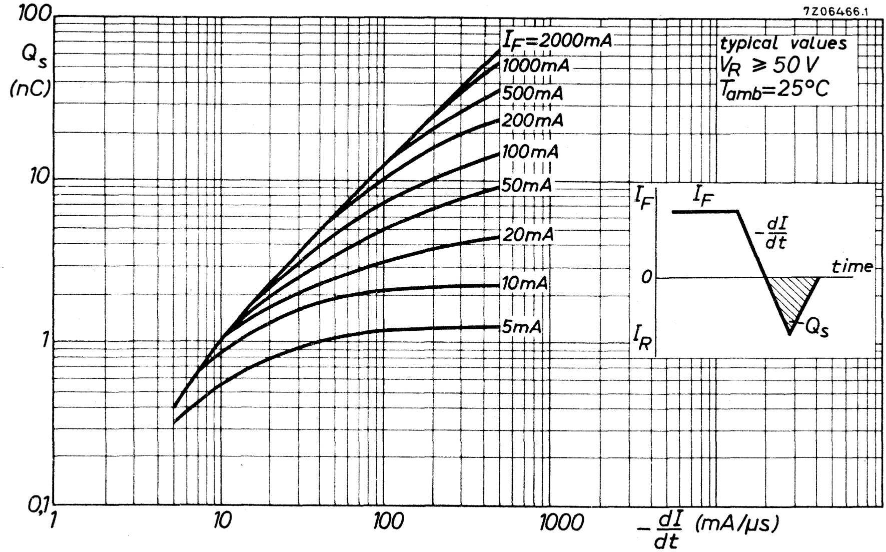


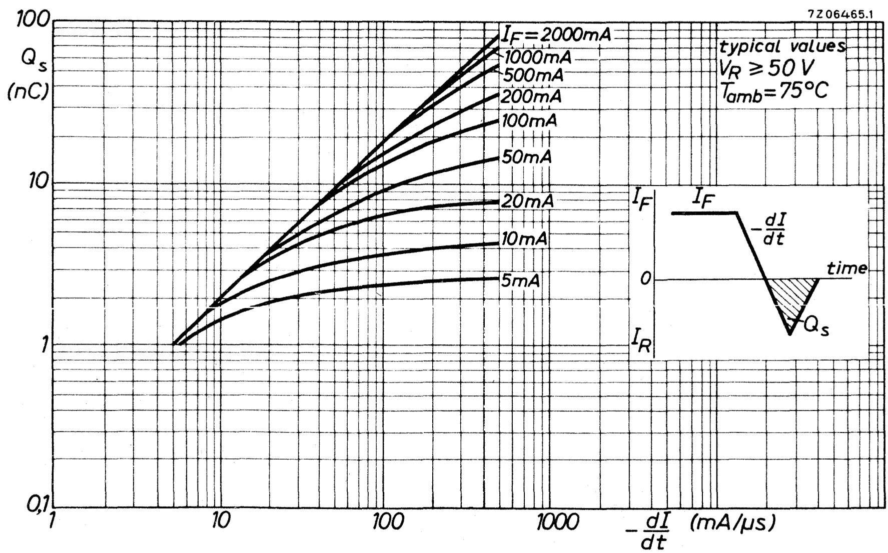
EXAMPLE OF OPERATION WITH C LOAD

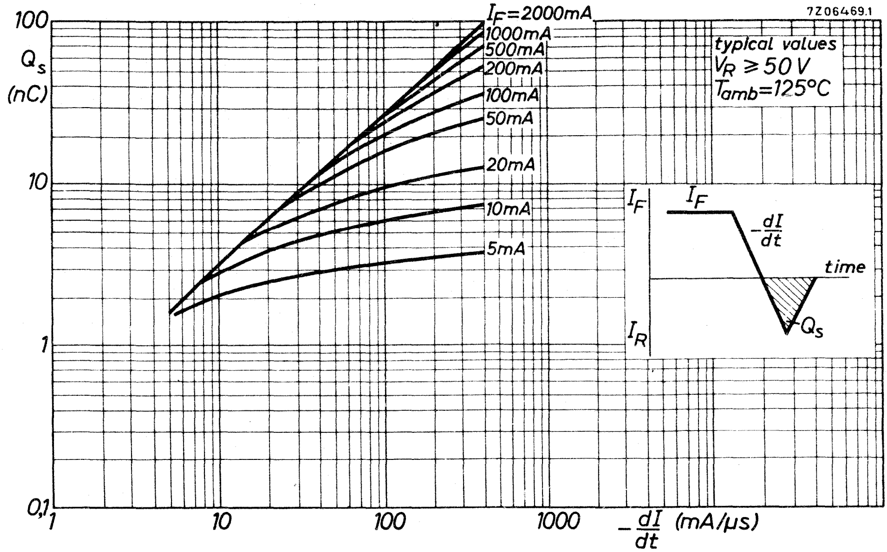


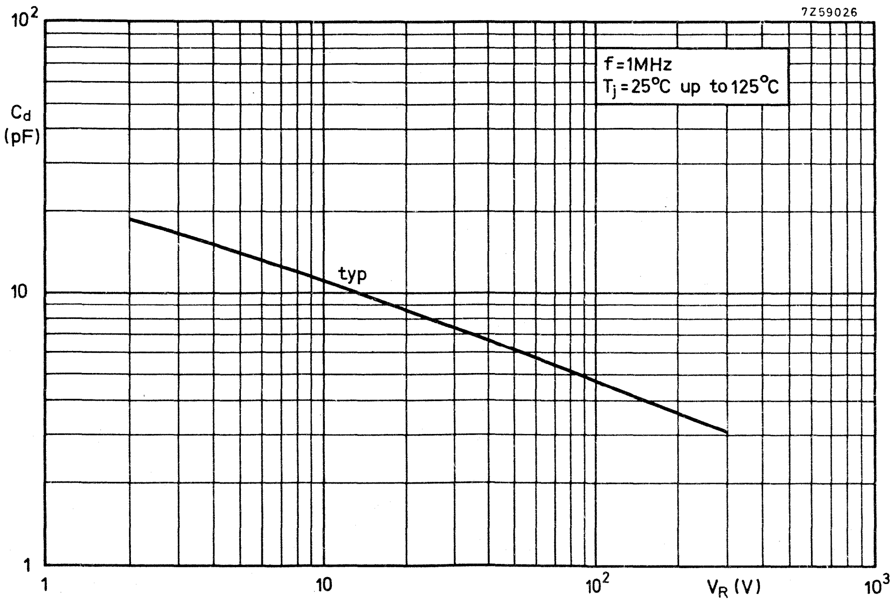
EXAMPLE OF OPERATION WITH R LOAD




7Z06466.1
100
Q_s
(nC)
10
1
0,1
1
10
100
1000
$-\frac{dI}{dt}$ (mA/μs)
I_F=2000mA
1000mA
500mA
200mA
100mA
50mA
20mA
10mA
5mA
typical values
$V_R \geq 50$ V
T_{amb}=25°C
I_F
I_F
$-\frac{dI}{dt}$
0
time
I_R
Q_s


7Z06465.1
100
Q_s
(nC)
10
1
0,1
1
10
100
1000
$-\frac{dI}{dt}$ (mA/μs)
I_F=2000mA
1000mA
500mA
200mA
100mA
50mA
20mA
10mA
5mA
typical values
$V_R \geq 50$ V
T_{amb}=75°C
I_F
I_F
$-\frac{dI}{dt}$
0
time
I_R
Q_s


7Z06469.1
100
Q_s
(nC)
10
1
0,1
1
10
100
1000
$-\frac{dI}{dt}$ (mA/μs)
I_F=2000mA
1000mA
500mA
200mA
100mA
50mA
20mA
10mA
5mA
typical values
$V_R \geq 50$ V
T_{amb}=125°C
I_F
I_R
$-\frac{dI}{dt}$
time
Q_s


7Z59026
10^2
C_d
(pF)
10
1
1
10
10^2
V_R (V)
10^3
f = 1MHz
T_j = 25°C up to 125°C
typ

FAST SOFT-RECOVERY RECTIFIER DIODES

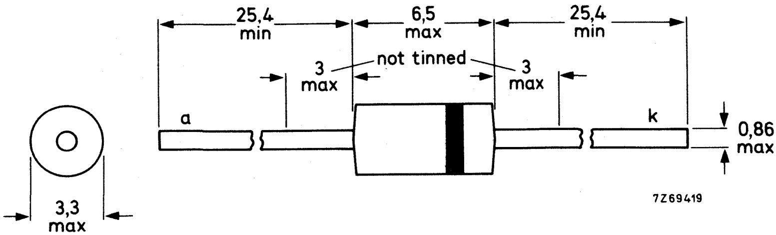
Silicon double-diffused rectifier diodes in plastic envelopes.
They are intended for use as clamp diode, dV/dt limiter and output rectifier diode in professional and consumer switched-mode power supply applications and as scan rectifier diode in television receivers. The devices feature non-snap-off characteristics and a very fast turn-on behaviour, which makes them extremely suitable for clamp and dV/dt limiting applications.

QUICK REFERENCE DATA

			BY208-600	-800	-1000	
Repetitive peak reverse voltage	V_{RRM}	max.	600	800	1000	V
Average forward current	$I_{F(AV)}$	max.	0,75	0,75	0,75	A
Non-repetitive peak forward current	I_{FSM}	max.	20	20	20	A
Reverse recovery time	t_{rr}	max.	350	350	350	ns

MECHANICAL DATA Dimensions in mm

DO-15 (SOD-40)



The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

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

→ Voltages

			BY208-600	-800	-1000	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	600	800	1000	V
Repetitive peak reverse voltage ($t \leq 12$ µs)	V_{RRM}	max.	600	800	1000	V
Working reverse voltage	V_{RW}	max.	400	600	800	V
Continuous reverse voltage	V_R	max.	400	600	800	V

Currents

Average forward current (averaged over any 20 ms period; see also pages 4 and 5)					
→ T_{lead} = 75 °C	$V_{RW} = V_{RWmax}$	$I_{F(AV)}$	max.	0,75	A
free air operation → at T_{amb} = 25 °C	$V_{RW} = V_{RWmax}$	$I_{F(AV)}$	max.	0,75	A
Repetitive peak forward current		I_{FRM}	max.	5	A
Non-repetitive peak forward current (t = 10 ms; half sine-wave) T_j = 125 °C prior to surge		I_{FSM}	max.	20	A

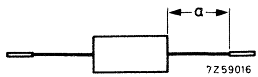
Temperatures

Storage temperature	T_{stg}		−65 to +125	°C
Junction temperature	T_j	max.	125	°C

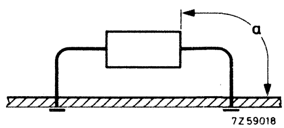
THERMAL RESISTANCE (influence of mounting method)

The quoted values of $R_{th\ j-a}$ should be used only when no leads of other dissipating components run to the same tie-points (see upper graphs on pages 4 and 5). Otherwise do not use the $R_{th\ j-a}$ values but refer to the lower graphs.

1. Mounted to solder tags at a lead-length a = 10 mm. $R_{th\ j-a}$ = 80 °C/W



2. Mounted to solder tags at a = maximum lead-length. $R_{th\ j-a}$ = 90 °C/W
3. Mounted on printed wiring board at any lead-length a. $R_{th\ j-a}$ = 120 °C/W



SOLDERING AND MOUNTING NOTES

1. Soldered joints must be at least 5 mm from the seal.
2. A soldering iron must not be in contact with the joint for more than 3 seconds.
3. The maximum permissible temperature of the soldering bath is 300 °C; it must not be in contact with the joint for more than 3 seconds.
4. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 125 °C.
5. Leads should not be bent less than 1,5 mm from the seal; exert no axial pull when bending.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage

I_F = 2 A	V_F	<	1,8 V [1]

Reverse current

$V_R = V_{RRMmax}$	I_R	<	10 µA
$V_R = V_{RWmax}$; T_j = 125 °C	I_R	<	80 µA

Reverse recovery time when switched from

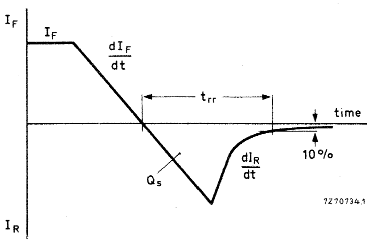
I_F = 400 mA to $V_R \geq$ 50 V; with $-dI_F/dt$ = 20 A/µs	t_{rr}	<	350 ns
I_F = 400 mA to $V_R \geq$ 50 V; with $-dI_F/dt$ = 400 mA/µs	t_{rr}	<	1,4 µs

Reverse recovery charge when switched from

I_F = 400 mA to $V_R \geq$ 50 V; with $-dI_F/dt$ = 400 mA/µs	Q_s	<	80 nC

Max. slope of reverse recovery current when switched from

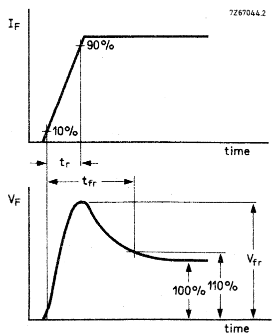
I_F = 400 mA to $V_R \geq$ 50 V; with $-dI_F/dt$ = 400 mA/µs	$\lvert dI_R/dt \rvert$	<	1,5 A/µs



Forward recovery when switched

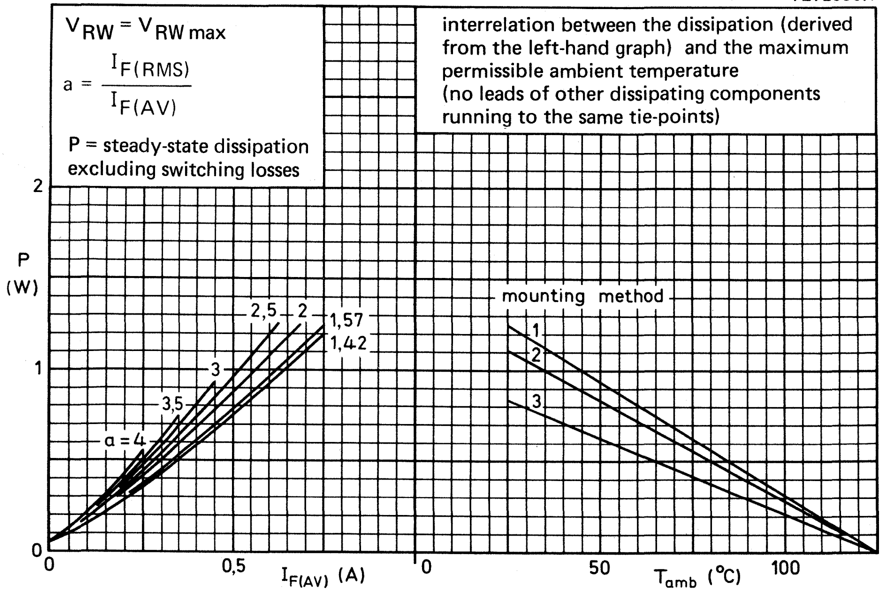
to I_F = 100 mA with t_r = 50 ns			
Recovery time	t_{fr}	<	800 ns
Recovery voltage	V_{fr}	<	10 V

Forward output waveform

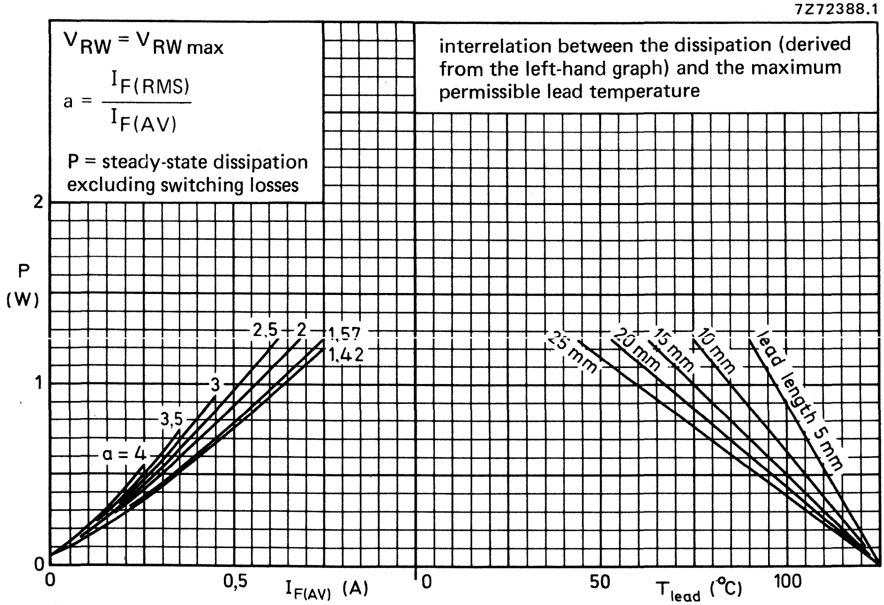


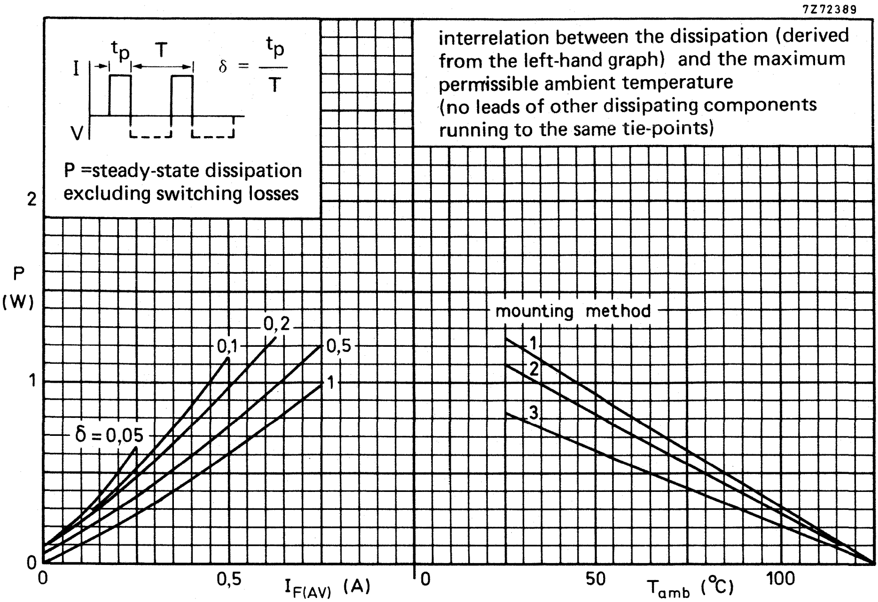
[1] Measured under pulse conditions to avoid excessive dissipation.

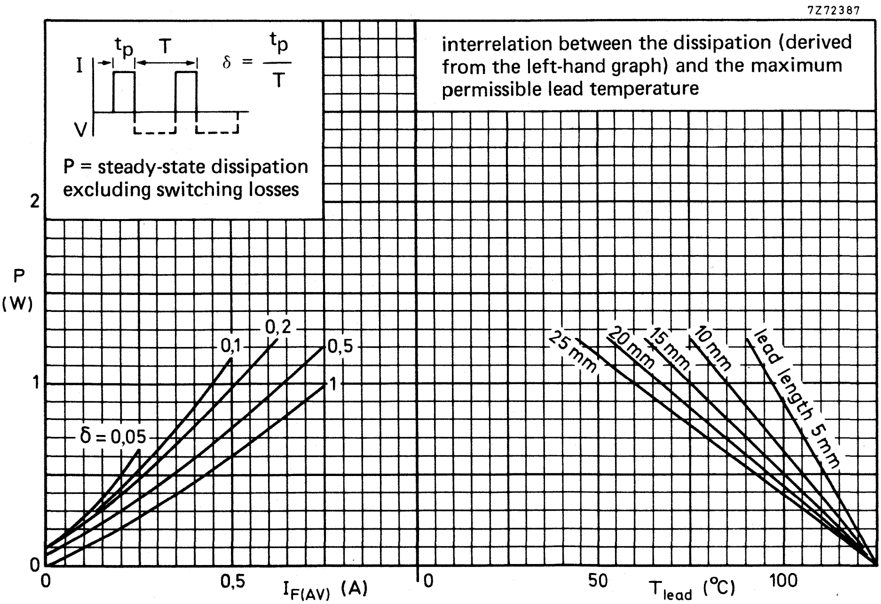
7Z72390.1

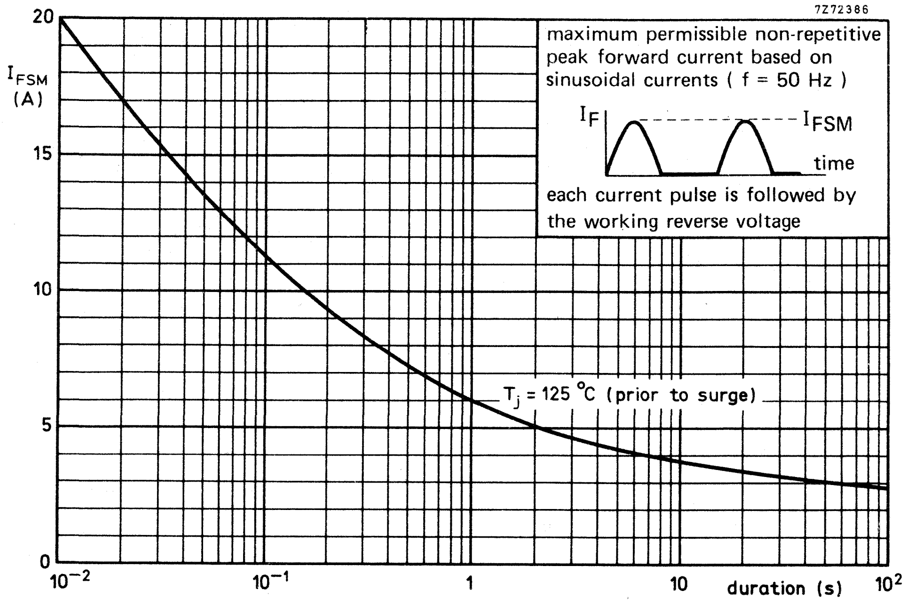


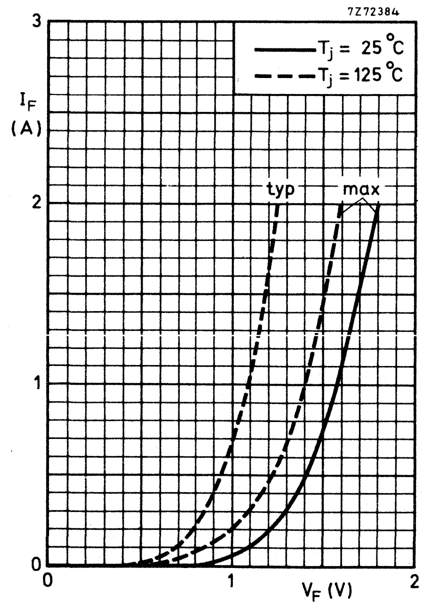
7Z72388.1

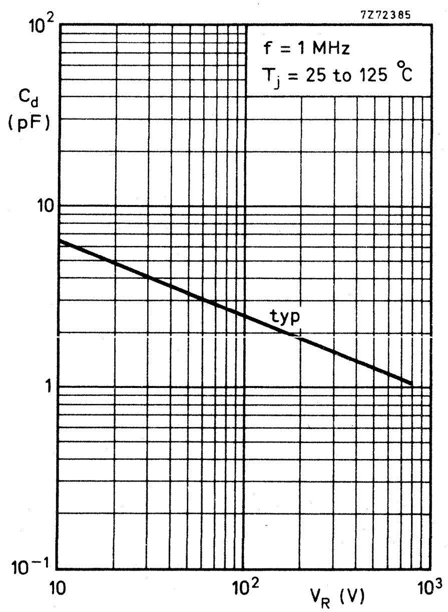



7Z72389
tp
T
I
V
δ = tp/T
P =steady-state dissipation excluding switching losses
interrelation between the dissipation (derived from the left-hand graph) and the maximum permissible ambient temperature (no leads of other dissipating components running to the same tie-points)
P (W)
2
1
0
δ = 0,05
0,1
0,2
0,5
1
0
0,5
I F(AV) (A)
mounting method
1
2
3
0
50
T amb (°C)
100


7Z72387
tp
T
I
V
δ = tp/T
P = steady-state dissipation excluding switching losses
interrelation between the dissipation (derived from the left-hand graph) and the maximum permissible lead temperature
P (W)
2
1
0
δ = 0,05
0,1
0,2
0,5
1
0
0,5
I F(AV) (A)
25 mm
20 mm
15 mm
10 mm
lead length 5 mm
0
50
T lead (°C)
100


7Z72386
maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_FSM
time
each current pulse is followed by the working reverse voltage
T_j = 125 °C (prior to surge)
I_FSM (A)
duration (s)
20
15
10
5
0
10^-2
10^-1
1
10
10^2


7Z72384
T_j = 25 °C
T_j = 125 °C
typ
max
I_F (A)
V_F (V)
3
2
1
0
0
1
2


7Z72385
f = 1 MHz
T_j = 25 to 125 °C
typ
C_d (pF)
V_R (V)
10^2
10
1
10^-1
10
10^2
10^3

SILICON E.H.T. SOFT-RECOVERY RECTIFIER DIODE

E.H.T. rectifier diode in a plastic envelope intended for tripler circuits and as focus rectifiers in colour television receivers. The device features non snap-off characteristics. Because of the smallness of the envelope, the diode should be potted when used at voltages above 6 kV, see page 4.

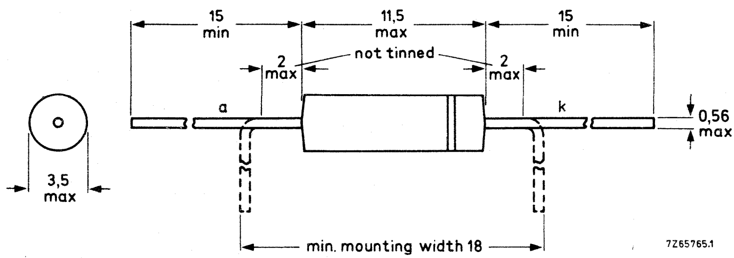
QUICK REFERENCE DATA

Working reverse voltage	V_{RW}	max.	11,5	kV
Repetitive peak reverse voltage	V_{RRM}	max.	12,5	kV
Average forward current	$I_{F(AV)}$	max.	2,5	mA
Junction temperature	T_j	max.	85	°C
Reverse recovery:				
Recovered charge	Q_s	typ.	15	nC
Recovery time	t_{rr}	typ.	1	μs

MECHANICAL DATA

Dimensions in mm

SOD-34



FOR NEW DESIGN THE SUCCESSOR TYPE BY409A IS RECOMMENDED.

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

Voltages

Working reverse voltage	V_{RW}	max.	11,5	kV
Repetitive peak reverse voltage	V_{RRM}	max.	12,5	kV
Non-repetitive peak reverse voltage ($t < 10$ ms)	V_{RSM}	max.	12,5	kV

Currents

Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	2,5	mA
Repetitive peak forward current	I_{FRM}	max.	200	mA [1]
Repetitive peak forward current during 20% of vertical deflection period time	I_{FRM}	max.	500	mA [1]

Temperatures

Storage temperature	T_{stg}		−55 to +85	°C
Junction temperature	T_j	max.	85	°C

CHARACTERISTICS

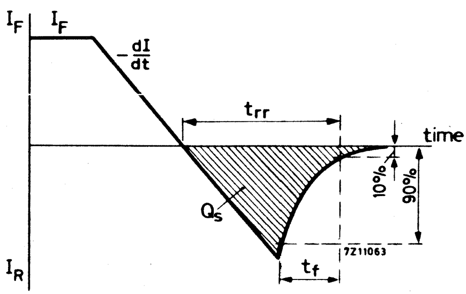
Forward voltage at I_F = 100 mA; T_j = 75 °C	V_F	<	23	V
Reverse current at V_R = 10 kV; T_j = 75 °C	I_R	<	4,0	µA

Reverse recovery: When switched from

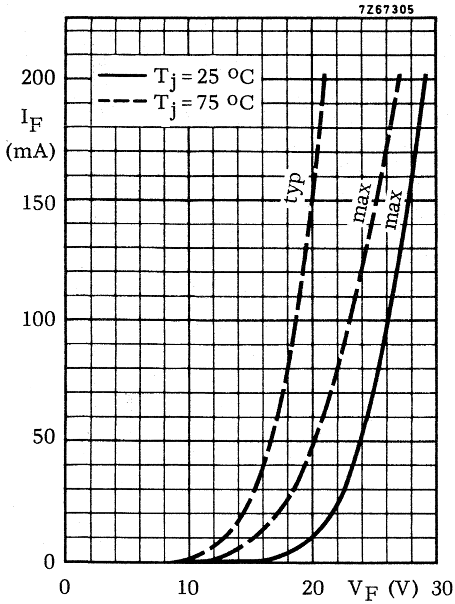
I_F = 200 mA to V_R = 100 V with

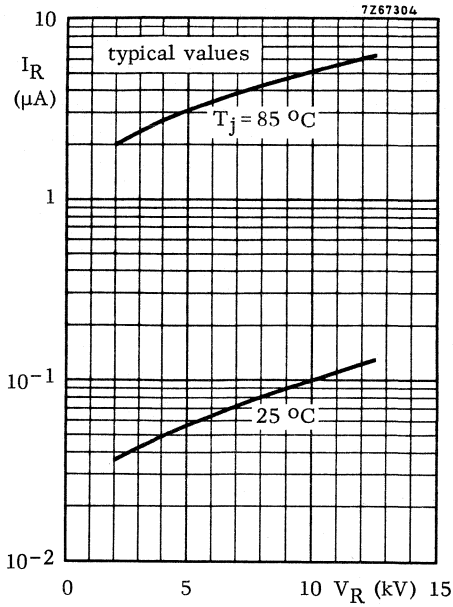
$-\frac{dI}{dt}$ = 200 mA/µs; T_j = 25 °C

Recovered charge	Q_s	typ.	15	nC
Recovery time	t_{rr}	typ.	1	µs
Fall time	t_f	typ.	0,8	µs

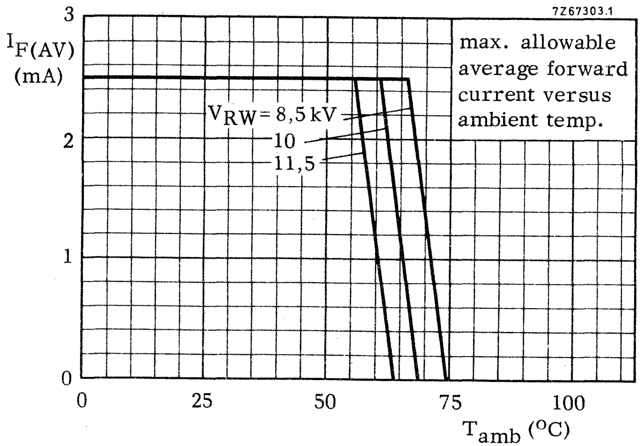


[1]) The rectifier can withstand flash-over currents in the picture tube.


7Z67305
$T_j = 25\ ^oC$
$T_j = 75\ ^oC$
I_F
(mA)
200
150
100
50
0
typ
max
max
0
10
20
V_F (V)
30

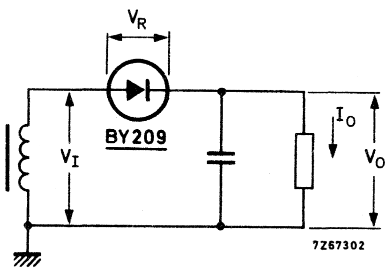

7Z67304
typical values
I_R
(μA)
10
1
10^{-1}
10^{-2}
$T_j = 85\ ^oC$
25 ^oC
0
5
10
V_R (kV)
15

APPLICATION INFORMATION

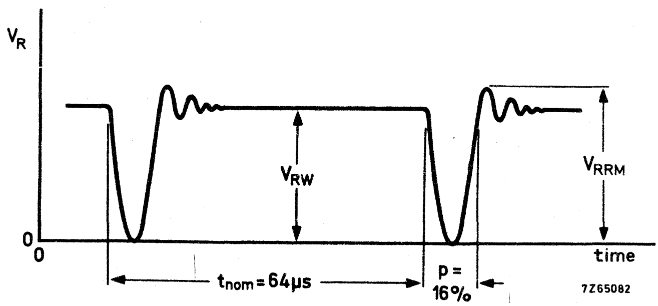


When used at voltages above 6 kV the diode should be potted in such a way that $R_{th\ j\text{-}a}$ is less than 120 °C/W.

Typical operating circuit



Typical applied voltage



PARALLEL EFFICIENCY DIODE

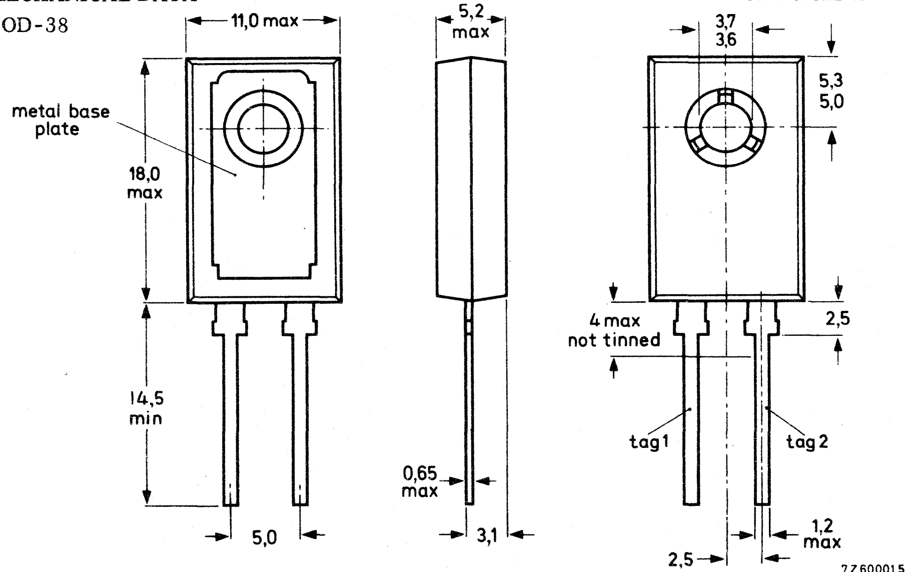
Silicon double-diffused rectifier diode in a plastic envelope, intended for use as efficiency diode in transistorized horizontal deflection circuits of colour television receivers.
The device features high reverse voltage capability together with controlled recovery time.

QUICK REFERENCE DATA				
Repetitive peak reverse voltage	V_{RRM}	max.	1500	V
Working peak forward current	I_{FWM}	max.	5	A
Repetitive peak forward current	I_{FRM}	max.	10	A
Total reverse recovery time	t_{tot}	<	20	µs

MECHANICAL DATA

Dimensions in mm

SOD-38



Polarity of connections: tag 1 = anode, tag 2 = cathode

The exposed metal base-plate is directly connected to tag 1.

Net mass: 2,5 g

Torque on screw: min. 0,95 Nm (9,5 kg cm)
max. 1,5 Nm (15 kg cm)

Accessories:
supplied with the device: washer
available on request : 56316 (mica insulating washer)

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

→ Transient rating (subsequent to flashover)	$V_{RM(flashover)}$	max.	1650	V
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	1500	V
Repetitive peak reverse voltage	V_{RRM}	max.	1500	V
Working reverse voltage [1]	V_{RW}	max.	1500	V
Working peak forward current	I_{FWM}	max.	5	A
Repetitive peak forward current	I_{FRM}	max.	10	A
Non-repetitive peak forward current ($t = 10$ ms; half sine-wave) $T_j = 125$ °C prior to surge; with reapplied V_{RWmax}	I_{FSM}	max.	20	A
Storage temperature	T_{stg}		−40 to +125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,5	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,3	°C/W

Influence of mounting method

1. Heatsink mounted

From mounting base to heatsink

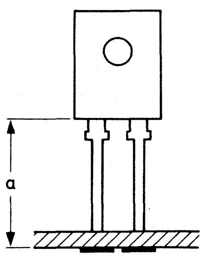
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	1,5	°C/W
b. with heatsink compound and 56316 mica washer	$R_{th\ mb\text{-}h}$	=	2,7	°C/W
c. without heatsink compound	$R_{th\ mb\text{-}h}$	=	2,7	°C/W
d. without heatsink compound; with 56316 mica washer	$R_{th\ mb\text{-}h}$	=	5	°C/W

2. Free air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-points.

From junction to ambient in free air mounted on a printed circuit board at a = maximum lead length and with a copper laminate

a. > 1 cm^2 — $R_{th\ j\text{-}a} = 50$ °C/W
b. < 1 cm^2 — $R_{th\ j\text{-}a} = 55$ °C/W



7Z62315.1

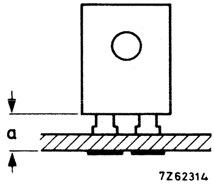
[1]) At $t_p \leq 20$ µs; $\delta = t_p/T \leq 0,25$; see page 5.

THERMAL RESISTANCE (continued)

at a lead length a = 3 mm
and with a copper laminate

c. > 1 cm^2 — $R_{th\ j\text{-}a}$ = 55 °C

d. < 1 cm^2 — $R_{th\ j\text{-}a}$ = 60 °C



SOLDERING AND MOUNTING NOTES

1. Soldered joints must be at least 2,5 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 270 °C; contact with the joint must not exceed 3 seconds.
3. The device should not be immersed in oil, and few potting resins are suitable for re-encapsulation. Advice on these materials is available on request.
4. Leads should not be bent less than 2,5 mm from the seal. Exert no axial pull when bending.
5. For good thermal contact, heatsink compound should be used between base-plate and heatsink.

CHARACTERISTICS

Forward voltage

I_F = 20 A; T_j = 25 °C	V_F	<	2,3	V [1]

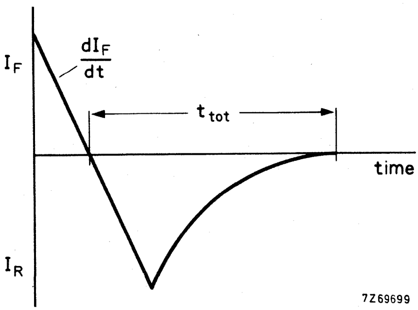
Reverse current

$V_R = V_{RWmax}$; T_j = 125 °C	I_R	<	0,6	mA

Reverse recovery when switched from

I_F = 4 A; $-dI_F/dt$ = 0,2 A/µs; T_j = 125 °C

total recovery time	t_{tot}	<	20	µs

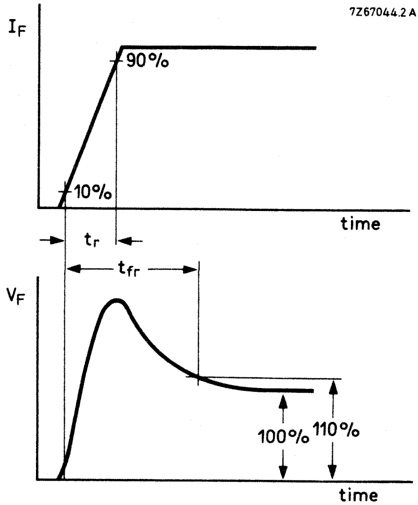


[1] Measured under pulse conditions to avoid excessive dissipation.

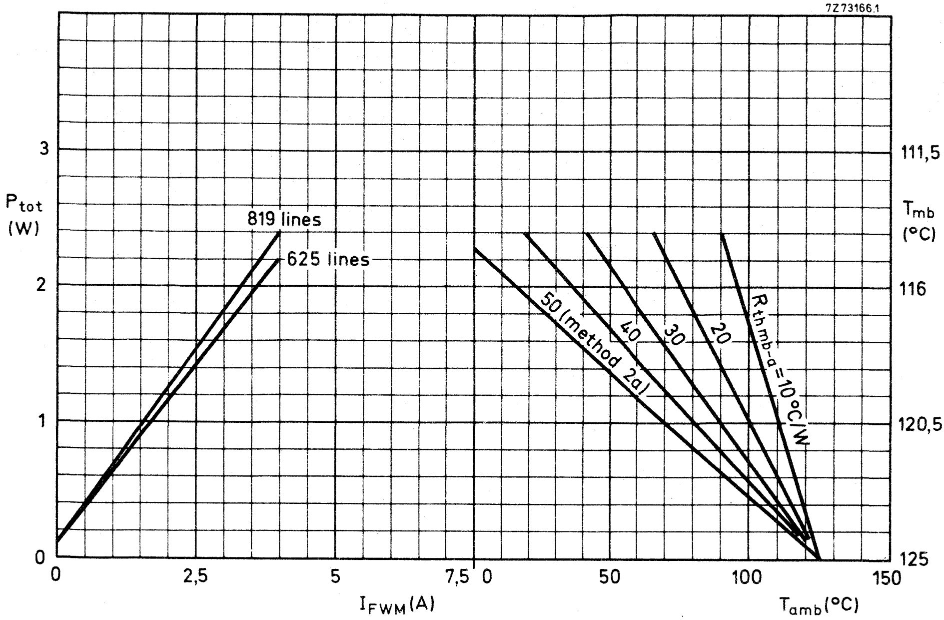
CHARACTERISTICS (continued)

Forward recovery time

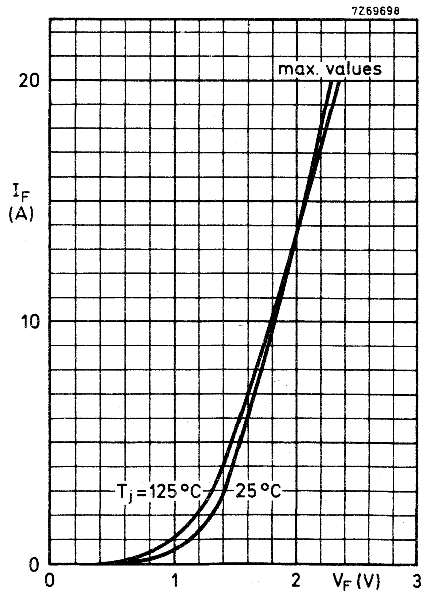
when switched to I_F = 5 A with t_r = 0, 1 μs;
T_j = 125 °C | t_{fr} < 1 μs

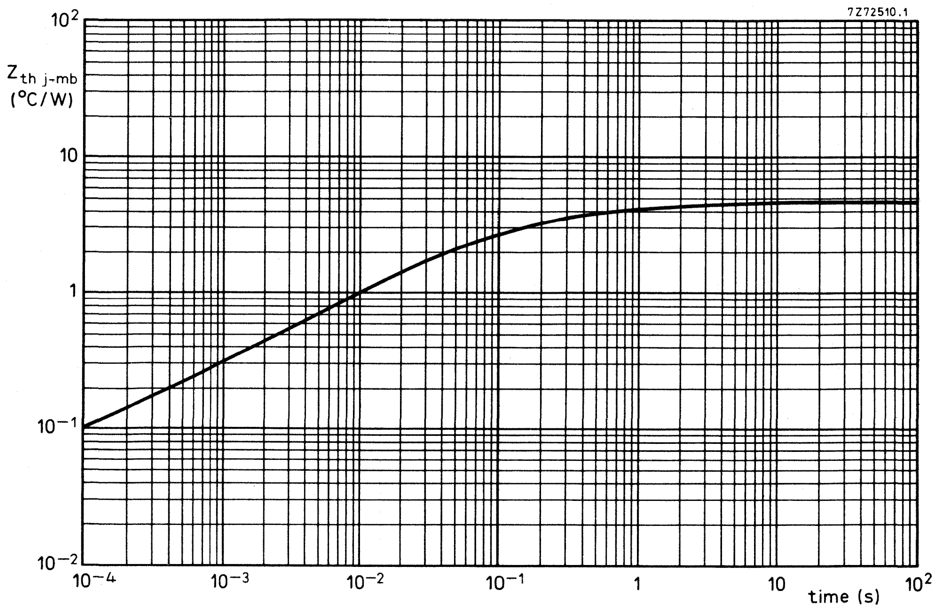


Forward output waveform

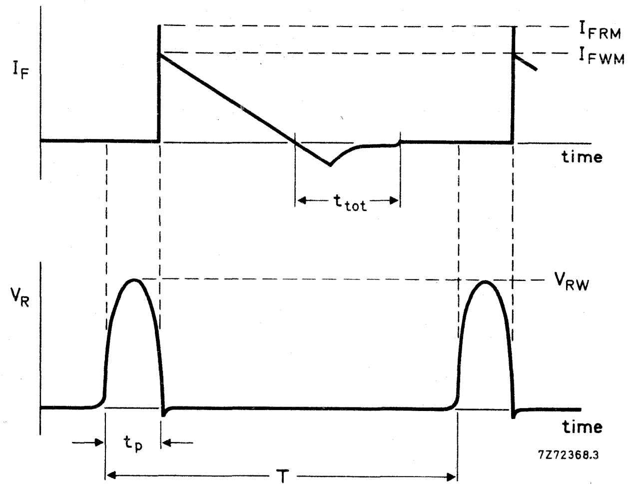


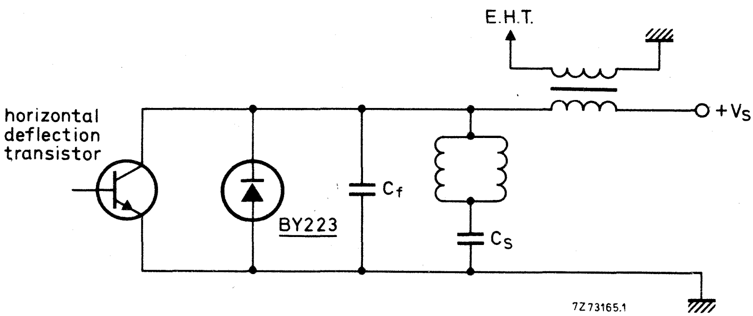
P_{tot} = power dissipation including switching losses.




7Z72510.1
$Z_{th\ j\text{-}mb}$ (°C/W)
10^2
10
1
10^{-1}
10^{-2}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
time (s)

APPLICATION INFORMATION





Basic circuit and waveforms

SILICON BRIDGE RECTIFIERS

Ready-for-use mains full-wave bridges, each consisting of four double-diffused silicon diodes, in a plastic encapsulation. The bridges are intended for use in equipment supplied from mains with r.m.s. voltages up to 280 V and are capable of delivering up to 1000 W into capacitive loads. They may be used in free air or clipped to a heatsink.

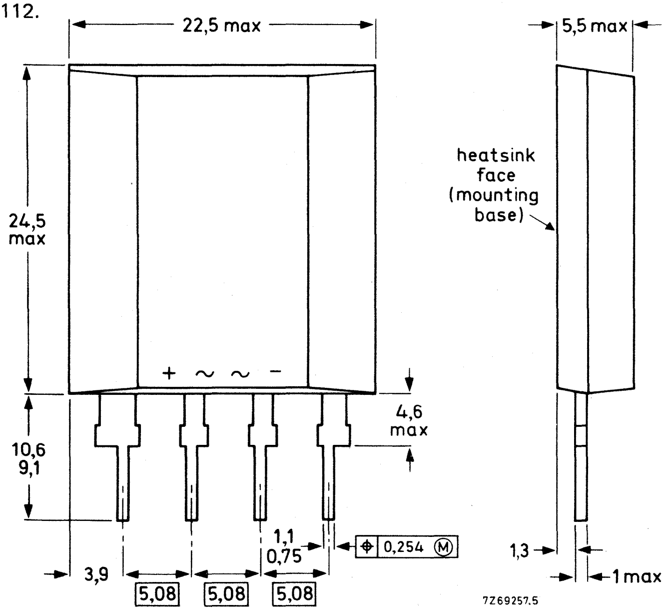
QUICK REFERENCE DATA

Input			BY224–400	600	V
R.M.S. voltage	$V_{I(RMS)}$	max.	220	280	V
Repetitive peak voltage	V_{IRM}	max.	400	600	V
Non-repetitive peak current	I_{ISM}	max.		100	A
Peak inrush current	I_{IIM}	max.		200	A
Output					
Average current	$I_{O(AV)}$	max.		4,8	A

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-112.



Net mass: 6,8 g

Accessories supplied on request: 56366 (clip); for mounting instructions see data 56366.

The sealing of the plastic withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BY224–400	600	
Input					
Non-repetitive peak voltage ($t \leq 10$ ms)	V_{ISM}	max.	400	600	V
Repetitive peak voltage	V_{IRM}	max.	400	600	V
Crest working voltage	V_{IWM}	max.	350	400	V
R.M.S. voltage (sine-wave)	$V_{I(RMS)}$	max.	220	280	V
Non-repetitive peak current half sine-wave; t = 20 ms; with reapplied V_{IWMmax}					
T_j = 25 °C prior to surge	I_{ISM}	max.		100	A
T_j = 125 °C prior to surge	I_{ISM}	max.		85	A
Peak inrush current (see Fig. 6)	I_{IIM}	max.		200	A
Output					
Average current (averaged over any 20 ms period; see Figs 2 and 3) heatsink operation up to T_{mb} = 90 °C	$I_{O(AV)}$	max.		4,8	A
free-air operation at T_{amb} = 45 °C; (mounting method 1a)	$I_{O(AV)}$	max.		2,5	A
Repetitive peak current	I_{ORM}	max.		50	A
Temperatures					
Storage temperature	T_{stg}			−40 to +125	°C
Junction temperature	T_j	max.		125	°C

THERMAL RESISTANCE

From junction to mounting base $R_{th\,j\text{-}mb}$ = 4,0 °C/W

Influence of mounting method

1. Free-air operation

The quoted values of $R_{th\,j\text{-}a}$ should be used only when no loads of other dissipating components run to the same tie-point (see Fig. 3).

Thermal resistance from junction to ambient in free air

a. Mounted on a printed-circuit board with 4 cm² of copper laminate to + and — leads	$R_{th\,j\text{-}a}$	=	19,5 °C/W
b. Mounted on a printed-circuit board with minimal copper laminate	$R_{th\,j\text{-}a}$	=	25 °C/W

2. Heatsink mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

a. With zinc-oxide heatsink compound	$R_{th\,mb\text{-}h}$	=	1,0 °C/W
b. Without heatsink compound	$R_{th\,mb\text{-}h}$	=	2,0 °C/W

MOUNTING INSTRUCTIONS

1. Soldered joints must be at least 4 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 270 °C; contact with the joint must not exceed 3 seconds.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 125 °C.
4. Leads should not be bent less than 4 mm from the seal. Exert no axial pull when bending.
5. Recommended force of clip on device is 120 N (12 kgf).
6. The heatsink should be in contact with the entire mounting base of the device and heatsink compound should be used.

CHARACTERISTICS

Forward voltage (2 diodes in series) I_F = 10 A; T_j = 25 °C	V_F	<	2,3 V*
Reverse current (2 diodes in parallel) $V_R = V_{IWMmax}$; T_j = 25 °C	I_R	<	200 μA

* Measured under pulse conditions to avoid excessive dissipation.

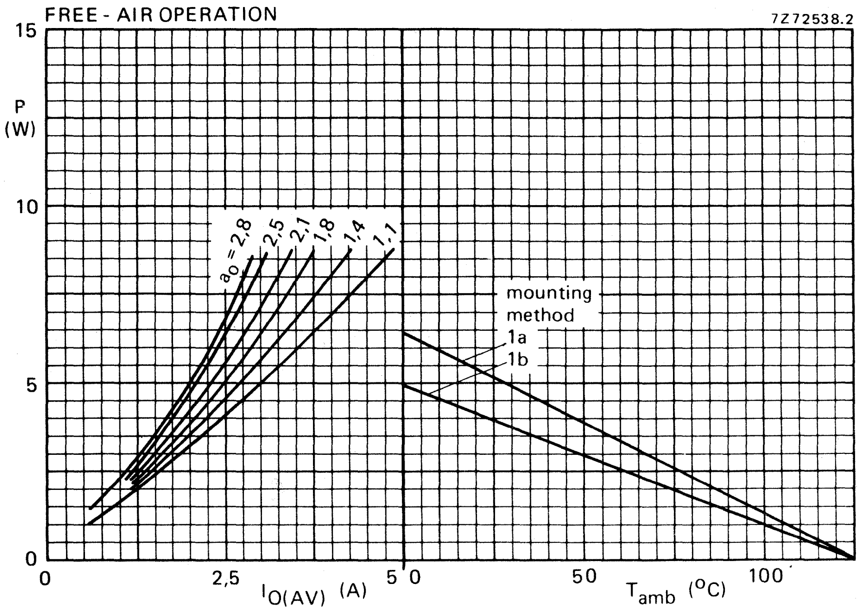


Fig. 2 The right-hand part shows the interrelationship between the power (derived from the left-hand graph) and the maximum permissible ambient temperature.

Output form factor $a_o = I_{O(RMS)}/I_{O(AV)} = 0,707 \times I_{F(RMS)}/I_{F(AV)}$ per diode.

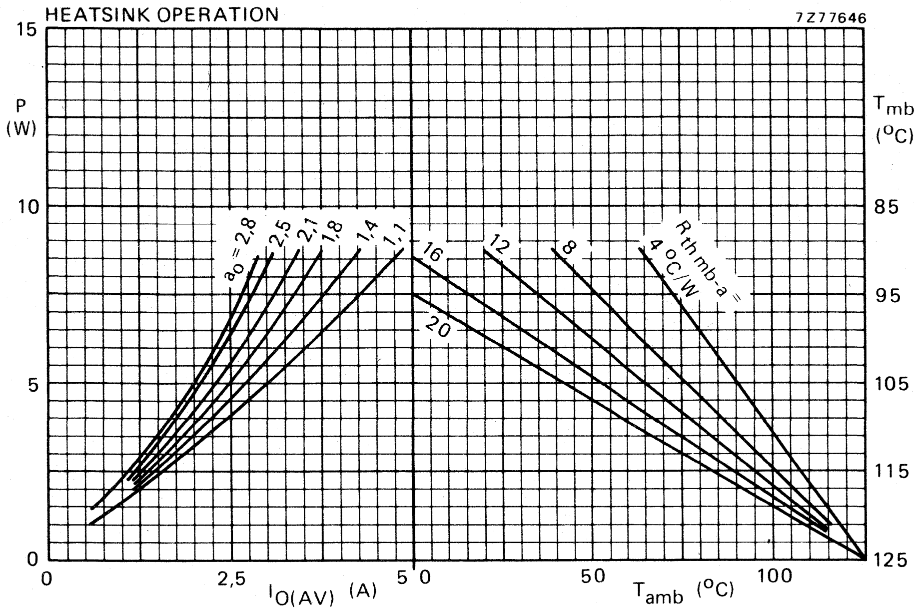


Fig. 3 The right-hand part shows the interrelationship between the power (derived from the left-hand graph) and the maximum permissible temperatures.

Output form factor $a_o = I_{O(RMS)}/I_{O(AV)} = 0{,}707 \times I_{F(RMS)}/I_{F(AV)}$ per diode.

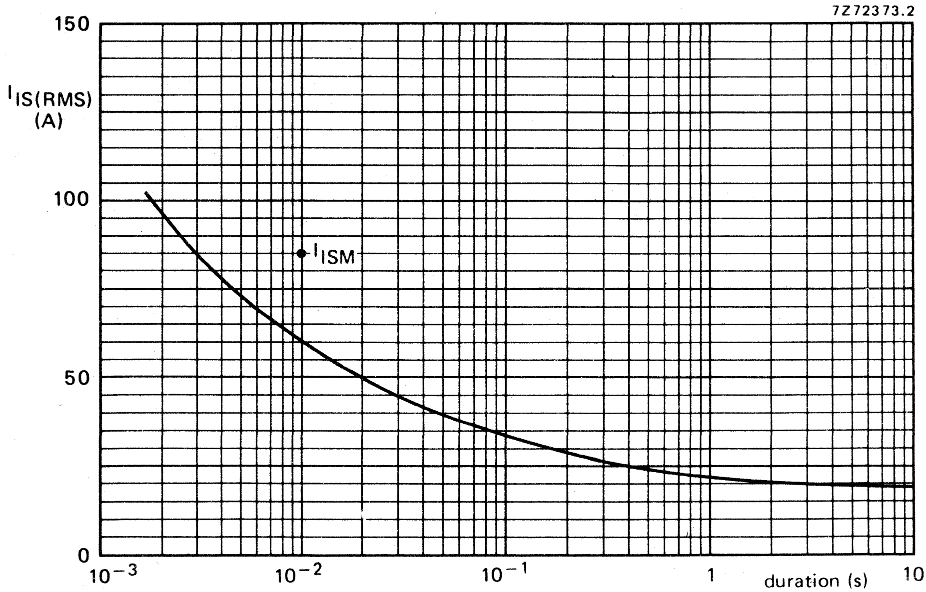
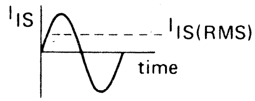


Fig. 4 Maximum permissible non-repetitive r.m.s. input current based on sinusoidal currents (f = 50 Hz); T_j = 125 °C prior to surge; with reapplied V_{IWMmax}.



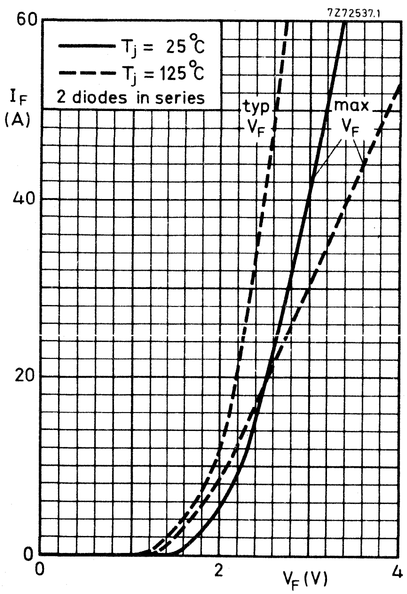
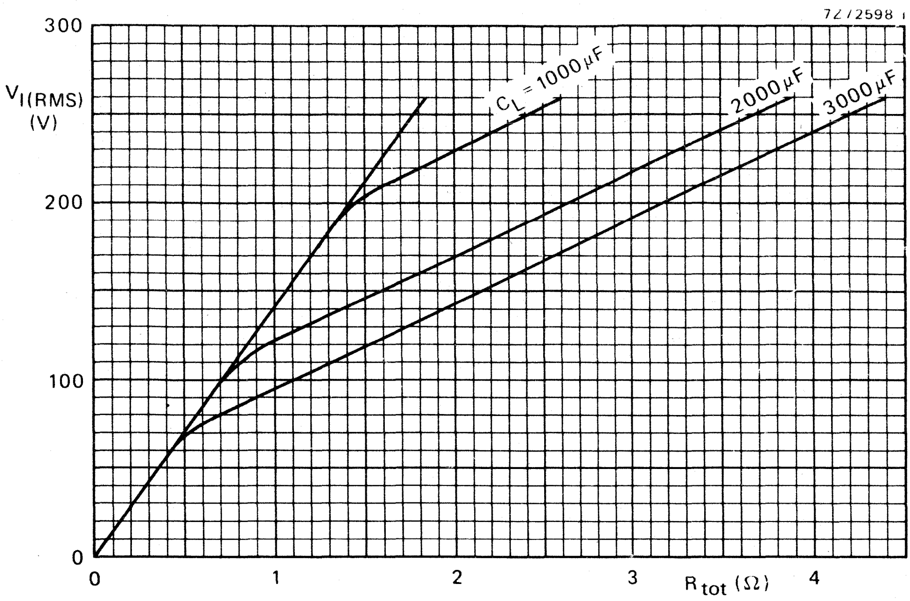
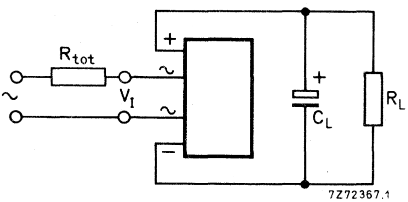


Fig. 5.



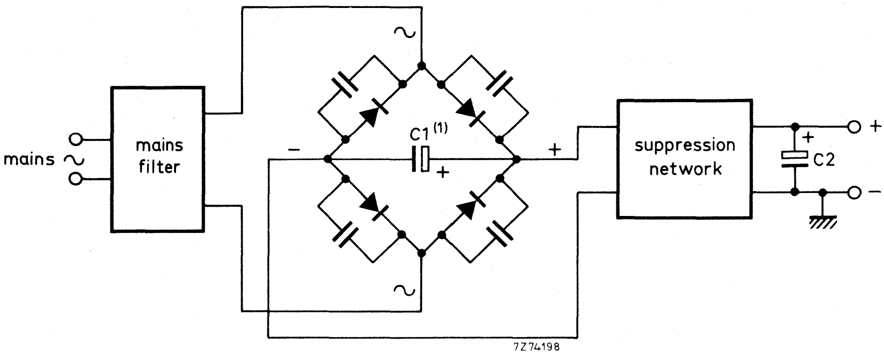


The graph takes the possibility of the following spreads into account:

mains voltage	+10%
capacitance	+50%
resistance	−10%

Fig. 6 Minimum value of the total series resistance R_{tot} (including the transformer resistance) required to limit the peak inrush current.

APPLICATION INFORMATION



(1) External capacitor.

Fig. 7 Because smoothing capacitor C2 is not always connected directly across the bridge (a suppression network may be sited between capacitor and bridge as shown), it is necessary to connect a capacitor of about 1 μF, C1, between the + and – terminals of the bridge. This capacitor should be as close to the bridge as possible, to give optimum suppression of mains transients.

SILICON BRIDGE RECTIFIERS

Ready-for-use full-wave bridge rectifiers in a plastic encapsulation. The bridges are intended for use in equipment supplied from a.c. with r.m.s. voltages up to 80 V and are capable of delivering output currents up to 4,8 A. They are also suitable for use in hi-fi audio equipments and low-voltage industrial power supplies. They may be used in free air or clipped to a heatsink.

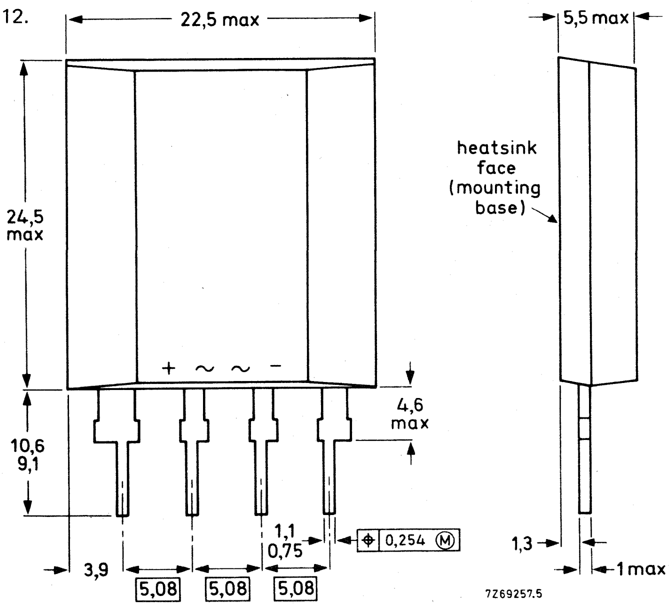
QUICK REFERENCE DATA

			BY225–100	200	
Input					
R.M.S. voltage	$V_{I(RMS)}$	max.	50	80	V
Repetitive peak voltage	V_{IRM}	max.	100	200	V
Non-repetitive peak current	I_{ISM}	max.		100	A
Peak inrush current	I_{IIM}	max.		200	A
Output					
Average current	$I_{O(AV)}$	max.		4,8	A

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-112.



Net mass: 6,8 g

Accessories supplied on request: 56366 (clip); for mounting instructions see data 56366.

The sealing of the plastic withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Input

			BY225–100	200	
Non-repetitive peak voltage ($t \leqslant 10$ ms)	V_{ISM}	max.	100	200	V
Repetitive peak voltage	V_{IRM}	max.	100	200	V
Crest working voltage	V_{IWM}	max.	70	112	V
R.M.S. voltage (sine-wave)	$V_{I(RMS)}$	max.	50	80	V
Non-repetitive peak current; half sine-wave; t = 20 ms; with reapplied V_{IWMmax}					
T_j = 25 °C prior to surge	I_{ISM}	max.		100	A
T_j = 150 °C prior to surge	I_{ISM}	max.		85	A
Peak inrush current (see Fig. 6)	I_{IIM}	max.		200	A

Output

Average current (averaged over any 20 ms period; see Figs 2 and 3)				
heatsink operation up to T_{mb} = 115 °C	$I_{O(AV)}$	max.	4,8	A
heatsink operation at T_{mb} = 125 °C	$I_{O(AV)}$	max.	3,6	A
free-air operation at T_{amb} = 45 °C; (mounting method 1a)	$I_{O(AV)}$	max.	3,2	A
Repetitive peak current	I_{ORM}	max.	50	A

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,0 °C/W

Influence of mounting method

1. Free-air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-point (see Fig. 2).

Thermal resistance from junction to ambient in free air

a. Mounted on a printed-circuit board with 4 cm^2 of copper laminate to + and — leads	$R_{th\ j\text{-}a}$	=	19,5 °C/W
b. Mounted on a printed-circuit board with minimal copper laminate	$R_{th\ j\text{-}a}$	=	25 °C/W

2. Heatsink mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

a. With zinc-oxide heatsink compound	$R_{th\ mb\text{-}h}$	=	1,0 °C/W
b. Without heatsink compound	$R_{th\ mb\text{-}h}$	=	2,0 °C/W

MOUNTING INSTRUCTIONS

1. Soldered joints must be at least 4 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 270 °C; contact with the joint must not exceed 3 seconds.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 °C.
4. Leads should not be bent less than 4 mm from the seal. Exert no axial pull when bending.
5. Recommended force of clip on device is 120 N (12 kgf).
6. The heatsink should be in contact with the entire mounting base of the device and heatsink compound should be used.

CHARACTERISTICS

Forward voltage (2 diodes in series) I_F = 10 A; T_j = 25 °C	V_F	<	2,3 V *
Reverse current (2 diodes in parallel) $V_R = V_{IWMmax}$; T_j = 25 °C	I_R	<	200 μA

* Measured under pulse conditions to avoid excessive dissipation.

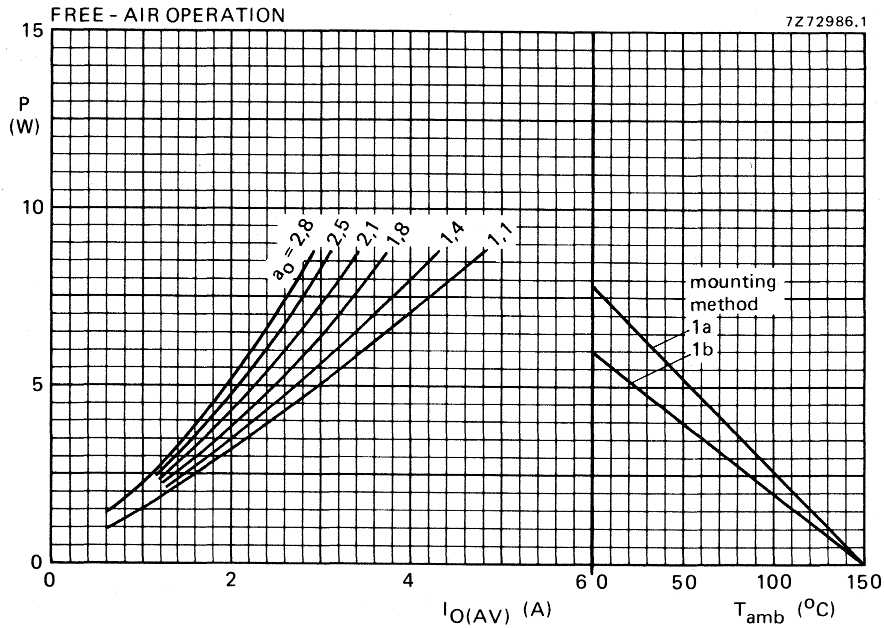


Fig. 2 The right-hand part shows the interrelationship between the power (derived from the left-hand graph) and the maximum permissible ambient temperature.

Output form factor $a_o = I_{O(RMS)}/I_{O(AV)} = 0{,}707 \times I_{F(RMS)}/I_{F(AV)}$ per diode.

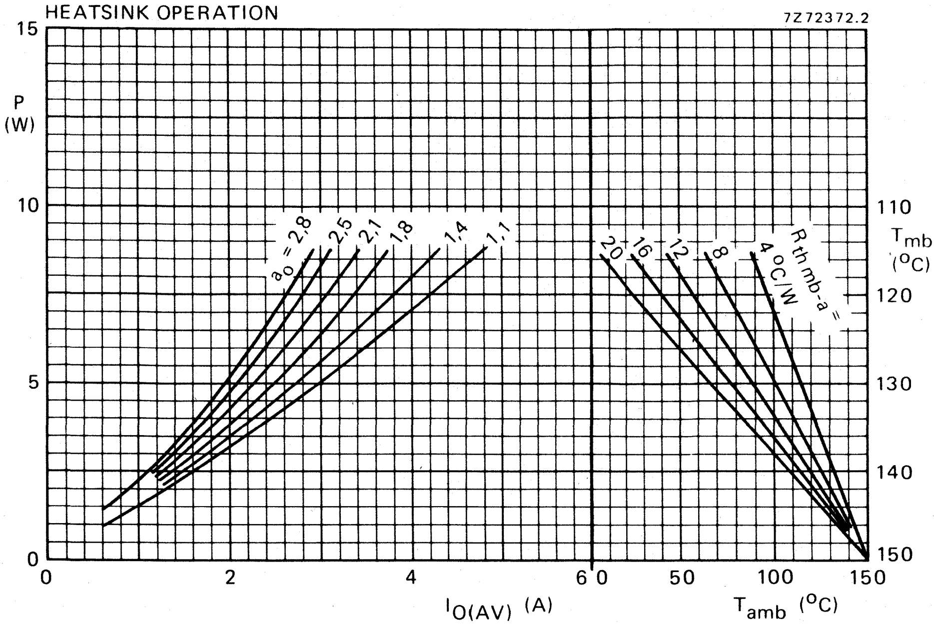


Fig. 3 The right-hand part shows the interrelationship between the power (derived from the left-hand graph) and the maximum permissible temperatures.

Output form factor $a_o = I_{O(RMS)}/I_{O(AV)} = 0{,}707 \times I_{F(RMS)}/I_{F(AV)}$ per diode.

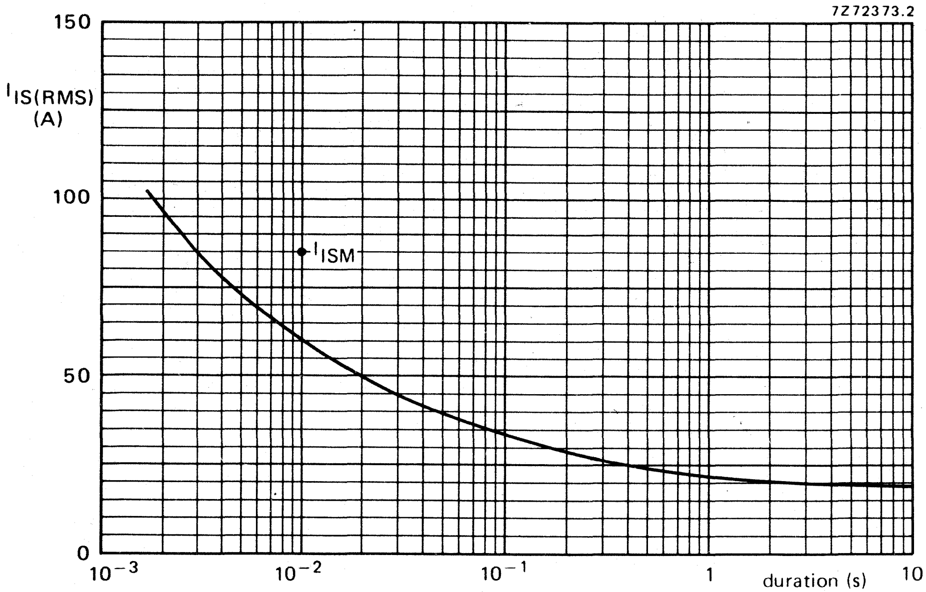


Fig. 4 Maximum permissible non-repetitive r.m.s. input current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge; with reapplied V_{IWMmax}.

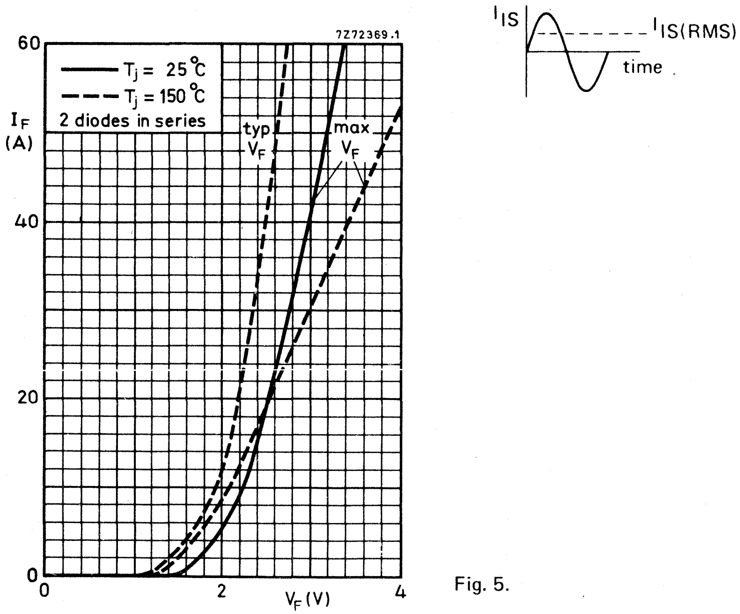
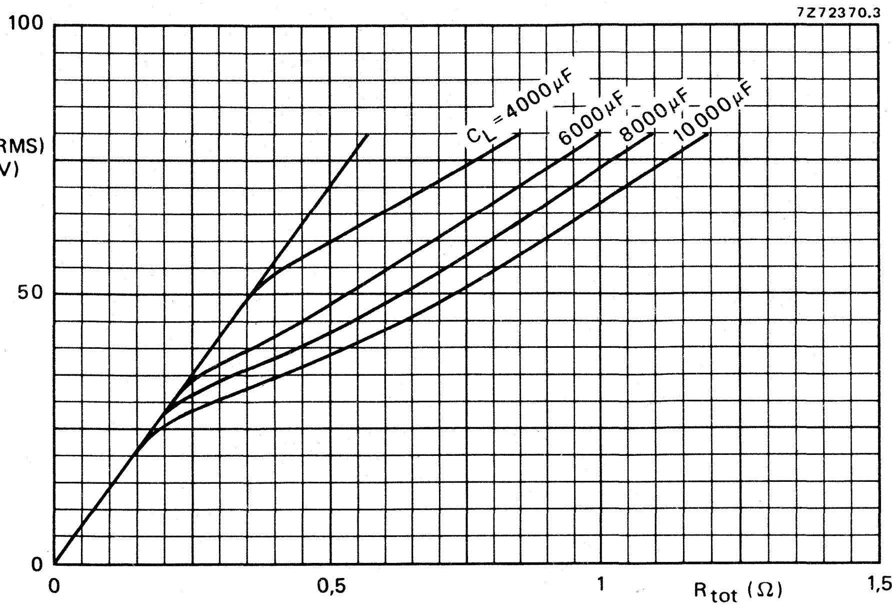
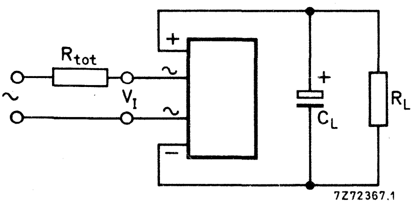


Fig. 5.





The graph takes the possibility of the following spreads into account:

input voltage	+10%
capacitance	+50%
resistance	−10%

Fig. 6 Minimum value of the total series resistance R_{tot} (including the transformer resistance) required to limit the peak inrush current.

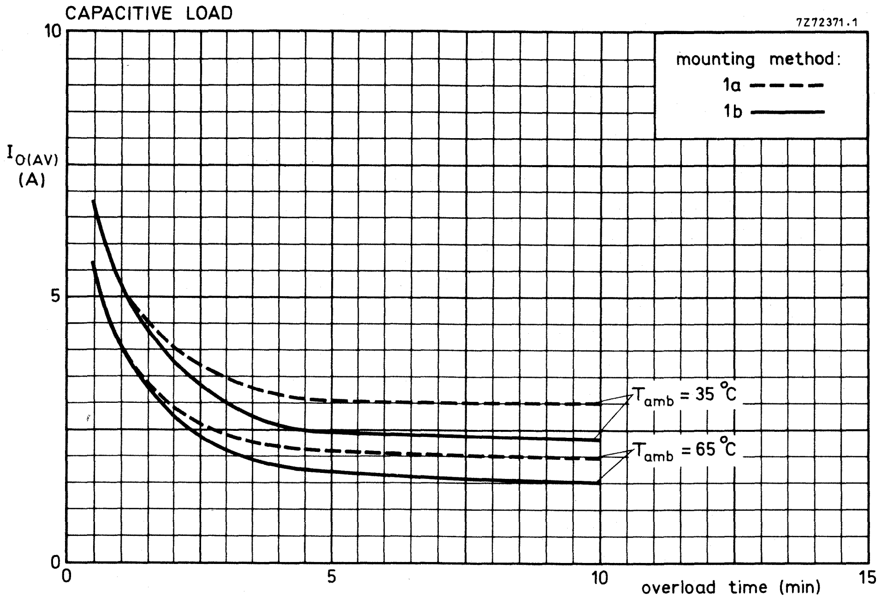

CAPACITIVE LOAD
7Z72371.1
mounting method:
1a
1b
$I_{O(AV)}$
(A)
10
5
0
0
5
10
15
overload time (min)
T_{amb} = 35 °C
T_{amb} = 65 °C

Fig. 7.

SILICON RECTIFIER DIODES

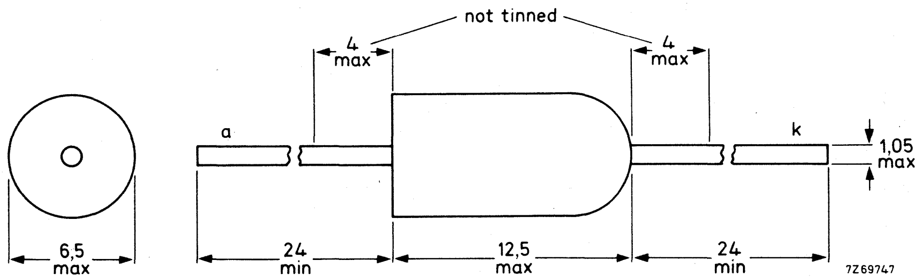
Double-diffused rectifier diodes in plastic envelopes.
They are intended for mains rectifier applications in television receivers.

QUICK REFERENCE DATA

			BY226	BY227	
Repetitive peak reverse voltage	V_{RRM}	max.	650	1250	V
Average forward current	$I_{F(AV)}$	max.	1,75	1,75	A
Non-repetitive peak forward current	I_{FSM}	max.	50	50	A

MECHANICAL DATA Dimensions in mm

SOD-18



The rounded end indicates the cathode

The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

All information applies to frequencies up to 400 Hz.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

			BY226	BY227	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	650	1250	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	650	1250	V
Crest working reverse voltage	V_{RWM}	max.	450	800	V

Currents

Average forward current (averaged over any 20 ms period; see also pages 4 to 7)				
$T_{lead} = 75\ ^oC$; $V_{RWM} \leq 60$ V	$I_{F(AV)}$	max.	1,75	A
free air operation at $T_{amb} = 25\ ^oC$; $V_{RWM} = V_{RWMmax}$	$I_{F(AV)}$	max.	1,33	A
free air operation at $T_{amb} = 25\ ^oC$; $V_{RWM} \leq 60$ V	$I_{F(AV)}$	max.	1,50	A
Repetitive peak forward current	I_{FRM}	max.	10	A
Non-repetitive peak forward current ($t = 10$ ms; half sine-wave) $T_j = 150\ ^oC$ prior to surge	I_{FSM}	max.	50	A

Temperatures

Storage temperature	T_{stg}		−65 to +150	^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE See page 3

CHARACTERISTICS

Forward voltage

$I_F = 5$ A; $T_j = 25\ ^oC$	V_F	<	1,5	V [1]

Reverse current

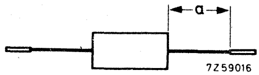
$V_R = V_{RRMmax}$; $T_j = 25\ ^oC$	I_R	<	10	μA
$V_R = V_{RWMmax}$; $T_j = 125\ ^oC$	I_R	<	200	μA

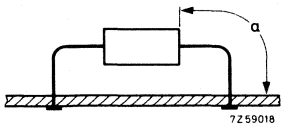
[1] Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE (influence of mounting method)

The quoted values of $R_{th\ j-a}$ should be used only when no leads of other dissipating components run to the same tie-points (see upper graphs on pages 4 and 5). Otherwise do not use the $R_{th\ j-a}$ values but refer to the lower graphs.

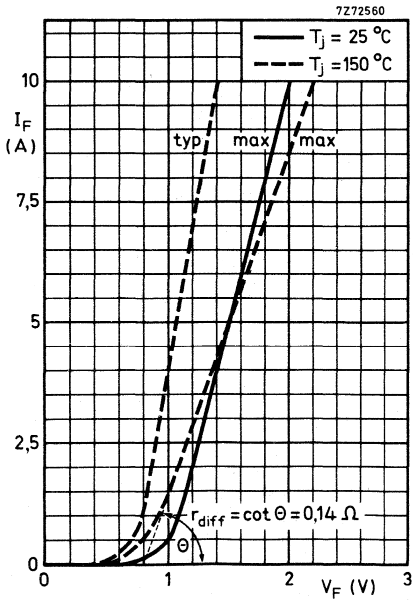
1. Mounted to solder tags at a lead length a = 10 mm. $R_{th\ j-a}$ = 60 °C/W
2. Mounted to solder tags at a = maximum lead length. $R_{th\ j-a}$ = 70 °C/W
3. Mounted on printed-wiring board at a = maximum lead length. $R_{th\ j-a}$ = 85 °C/W
4. Mounted on printed-wiring board at a lead length a = 10 mm. $R_{th\ j-a}$ = 95 °C/W

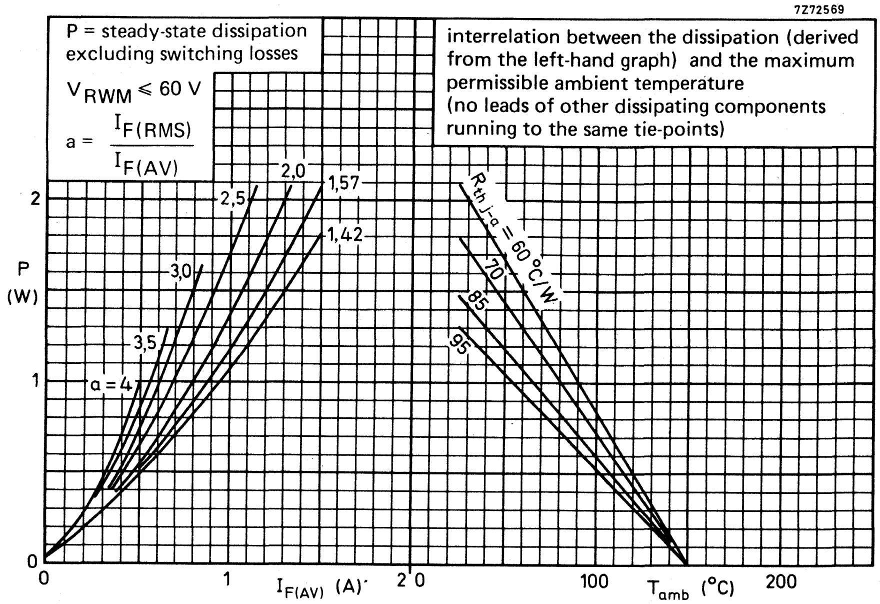


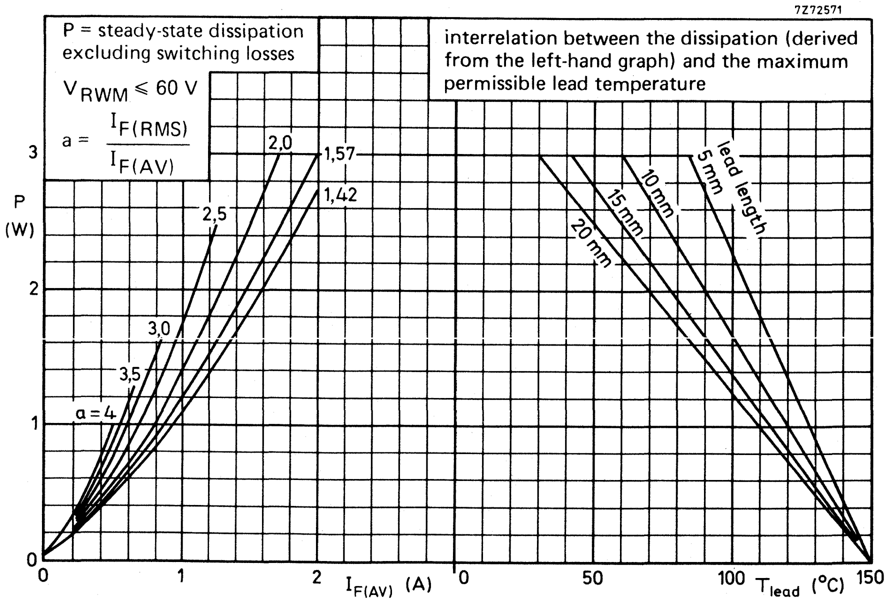


SOLDERING AND MOUNTING NOTES

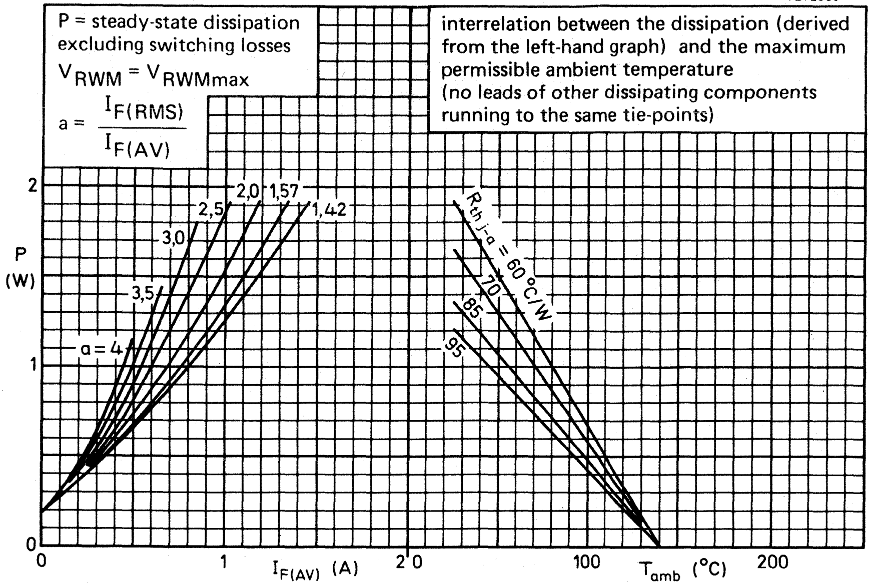
1. Soldered joints must be at least 5 mm from the seal.
2. The maximum permissible temperature of the soldering bath is 300 °C, it must not be in contact with the joint for more than 3 seconds.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 °C.



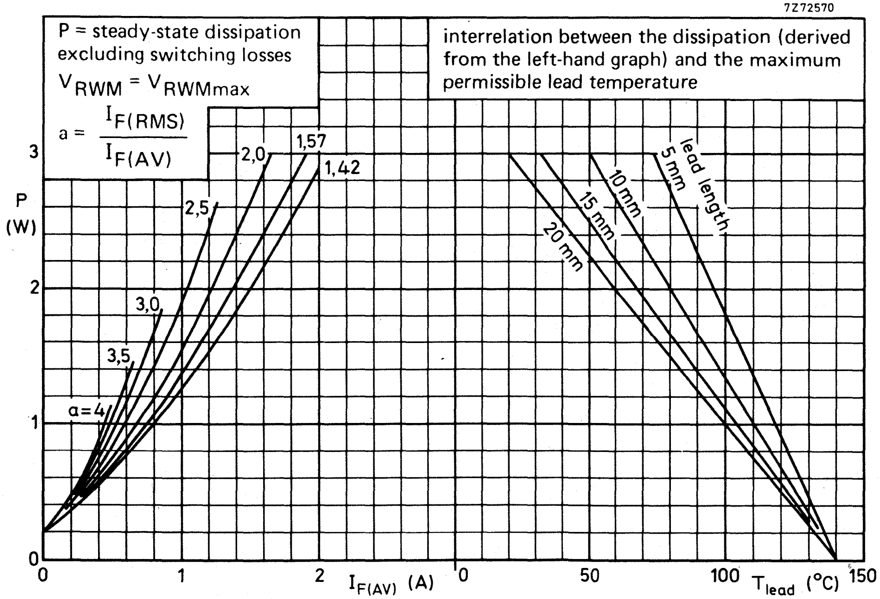

7Z72569
P = steady-state dissipation excluding switching losses
$V_{RWM} \leqslant 60$ V
$a = \frac{I_{F(RMS)}}{I_{F(AV)}}$
interrelation between the dissipation (derived from the left-hand graph) and the maximum permissible ambient temperature (no leads of other dissipating components running to the same tie-points)
P (W)
a = 4
3,5
3,0
2,5
2,0
1,57
1,42
$R_{th\,j\text{-}a}$ = 60 °C/W
70
85
95
$I_{F(AV)}$ (A)
T_{amb} (°C)
0
1
2
0
100
200


7Z72571
P = steady-state dissipation excluding switching losses
$V_{RWM} \leqslant 60$ V
$a = \frac{I_{F(RMS)}}{I_{F(AV)}}$
interrelation between the dissipation (derived from the left-hand graph) and the maximum permissible lead temperature
P (W)
a = 4
3,5
3,0
2,5
2,0
1,57
1,42
lead length
5 mm
10 mm
15 mm
20 mm
$I_{F(AV)}$ (A)
T_{lead} (°C)
0
1
2
3
0
50
100
150

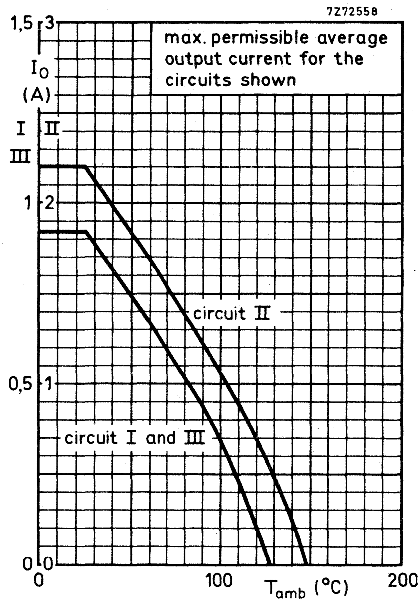
7Z72568

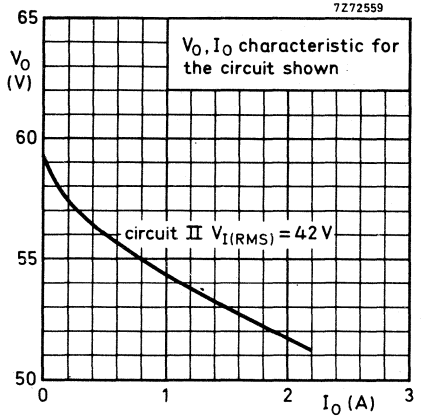


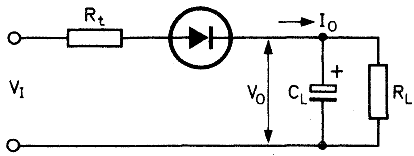
7Z72570



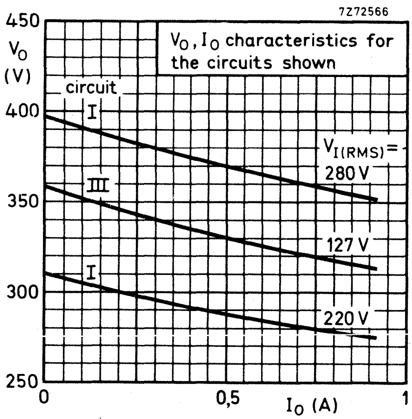
EXAMPLE: Rectifier with C load
mounting method 1 (see page 3)

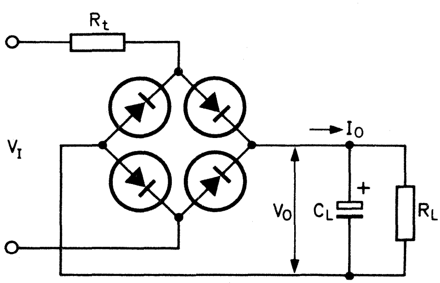




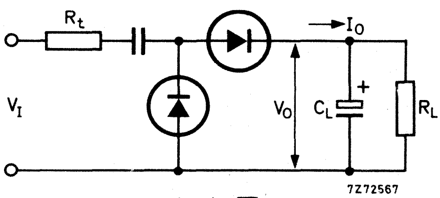


circuit I





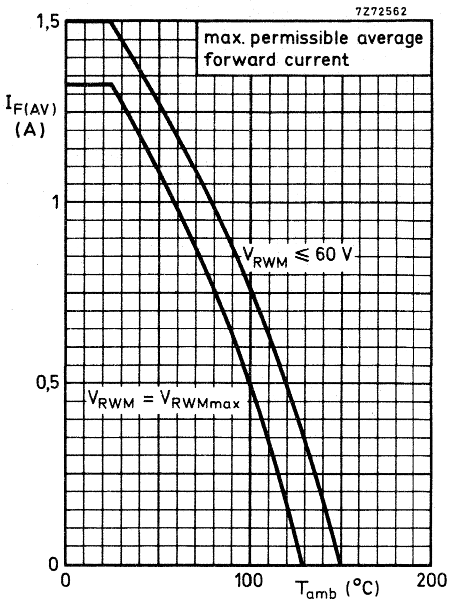
circuit II

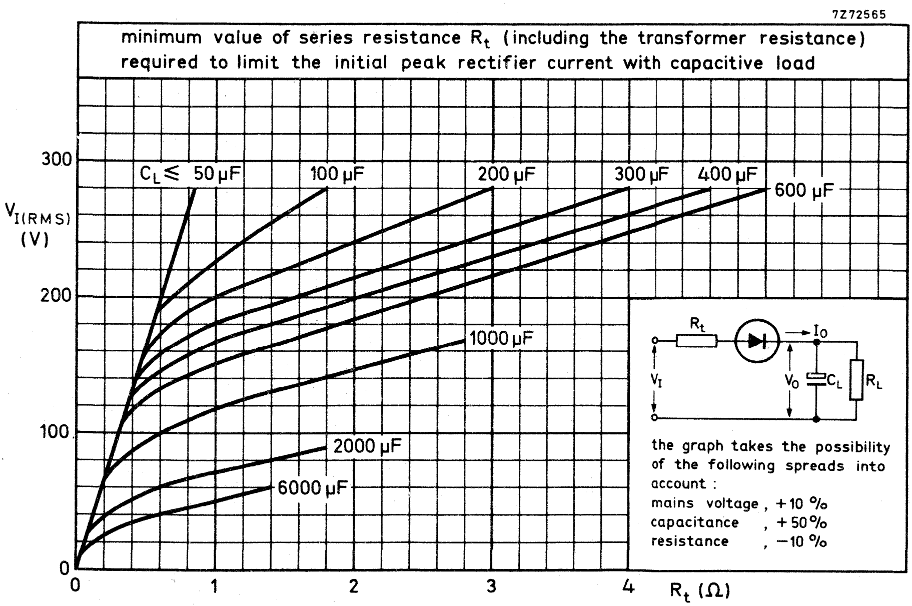


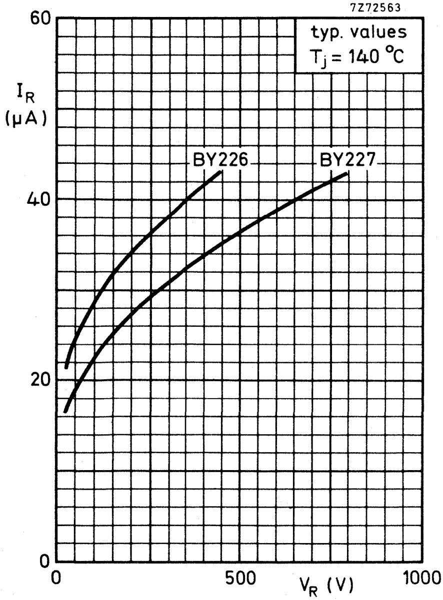
circuit III

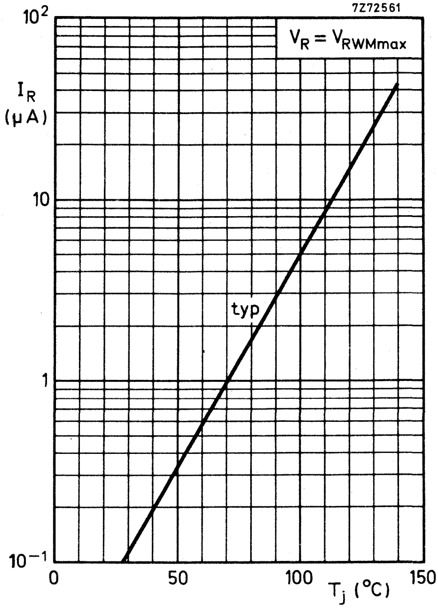
	$V_{I(RMS)}$	R_t	C_L
Circuit I	220 V	1,4 Ω	200 µF
	280 V	3,0 Ω	200 µF
Circuit II	42 V	0,72 Ω	6000 µF
Circuit III	127 V	0,4 Ω	400 µF

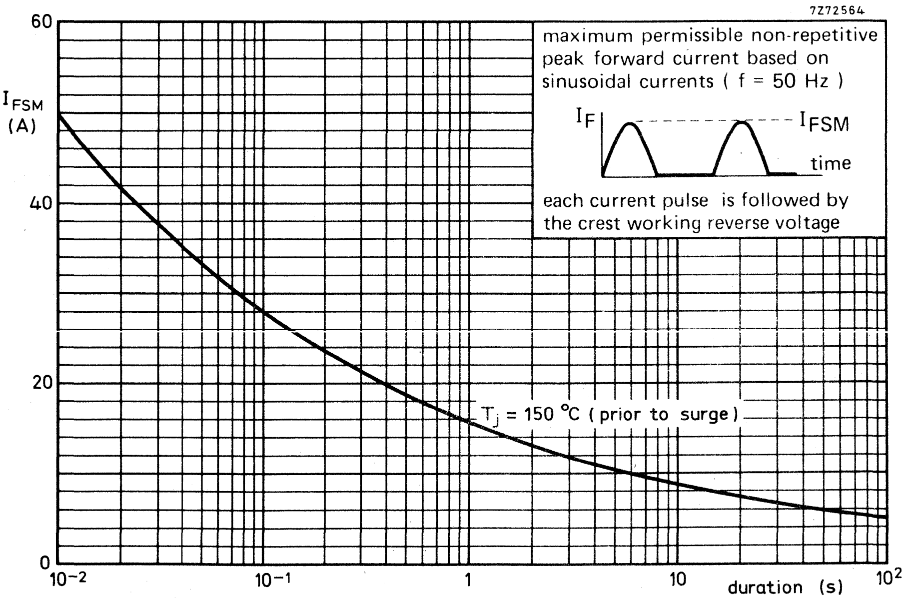
Rectifier with R load
mounting method 1 (see page 3)






7Z72563
typ. values
T_j = 140 °C
I_R (μA)
BY226
BY227
60
40
20
0
0
500
1000
V_R (V)


7Z72561
$V_R = V_{RWMmax}$
I_R (μA)
typ
10^2
10
1
10^{-1}
0
50
100
150
T_j (°C)


7Z72564
maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
time
each current pulse is followed by the crest working reverse voltage
T_j = 150 °C (prior to surge)
I_{FSM} (A)
60
40
20
0
10^{-2}
10^{-1}
1
10
10^2
duration (s)

PARALLEL EFFICIENCY DIODE

Double-diffused passivated rectifier diode in a hermetically sealed axial-leaded glass envelope, intended for use as efficiency diode in transistorized horizontal deflection circuits of television receivers. The device features high reverse voltage capability with controlled recovery time.

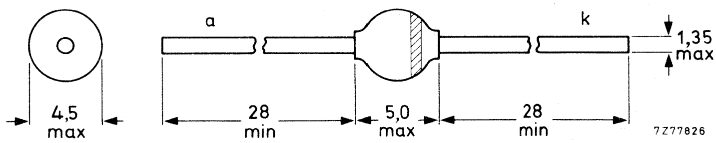
QUICK REFERENCE DATA

Repetitive peak reverse voltage	V_{RRM}	max.	1500	V
Working peak forward current	I_{FWM}	max.	5	A
Repetitive peak forward current	I_{FRM}	max.	10	A
Total reverse recovery time	t_{tot}	<	20	μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-64.



The marking band indicates the cathode.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Non-repetitive peak reverse voltage during flashover of picture tube	V_{RSM}	max.	1650	V
Repetitive peak reverse voltage	V_{RRM}	max.	1500	V
Working reverse voltage	V_{RW}	max.	1500	V
Working peak forward current	I_{FWM}	max.	5	A
Repetitive peak forward current	I_{FRM}	max.	10	A
Non-repetitive peak forward current $t = 10$ ms; half sine-wave; $T_j = 140$ °C prior to surge; with reapplied V_{RWmax}	I_{FSM}	max.	50	A
Storage temperature	T_{stg}		−65 to +175	°C
Junction temperature	T_j	max.	140	°C

THERMAL RESISTANCE

Influence of mounting method

The quoted value of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-points.

Thermal resistance from junction to ambient when mounted on a 1,5 mm thick epoxy-glass printed-circuit board; Cu-thickness ⩾ 40 μm; Fig. 2 — $R_{th\ j\text{-}a}$ = 75 °C/W

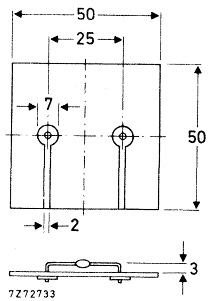


Fig. 2.

MOUNTING AND SOLDERING NOTES

Introduction

Excessive forces or temperatures applied to a diode may cause serious damage to the diode. To avoid damage when soldering and mounting, the following rules have to be followed.

Bending

During bending, the leads must be supported between body and bending point. Axial forces on the body during the bending process must not exceed 50 N. Perpendicular force on the body must be avoided as much as possible, however, if present, it shall not exceed 10 N. Bending the leads through 90° is allowed at any distance from the studs when it is possible to support the leads during the bending without contacting envelope or solder joints.

Twisting

Twisting the leads is allowed at any distance from the body if the lead is properly clamped between stud and twisting point. Without clamping, twisting is allowed only at a distance > 5 mm from the studs, the torque-angle must not exceed 30°.

Soldering

The minimum distance of soldering point to stud is 2 mm, the maximum allowed solder temperature is 300 °C, and the soldering time must not be longer than 10 seconds.

Prevent fast cooling after soldering.

When the device has to be mounted with straight or short-cropped leads, the leads should be soldered individually; bent leads may be soldered simultaneously. Do not correct the position of an already soldered device by pushing, pulling or twisting the body.

CHARACTERISTICS

Forward voltage			
I_F = 5 A; T_j = 25 °C	V_F	<	1,5 V*
Reverse current			
$V_R = V_{RWmax}$; T_j = 140 °C	I_R	<	200 μA
Total reverse recovery time when switched from			
I_F = 1 A; $-dI_F/dt$ = 0,05 A/μs; T_j = 140 °C	t_{tot}	<	20 μs

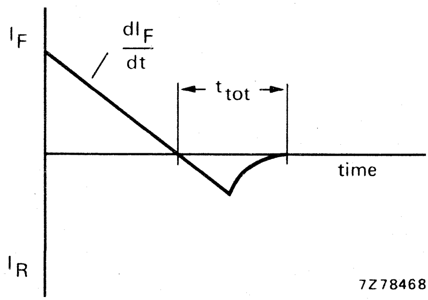


Fig. 3 Definition of t_{tot}.

* Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Forward recovery time when switched to
I_F = 5 A with t_r = 0,1 μs; T_j = 140 °C $\qquad t_{fr} \quad < \quad 1\ \mu s$

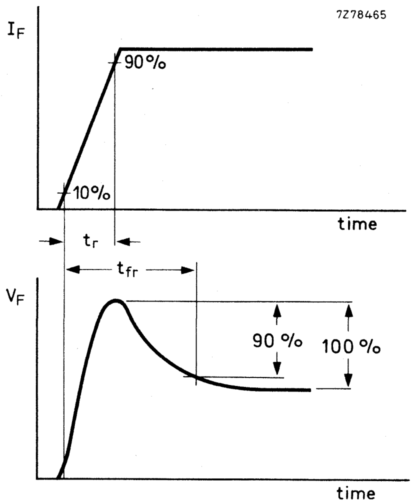


Fig. 4 Definition of t_{fr}.

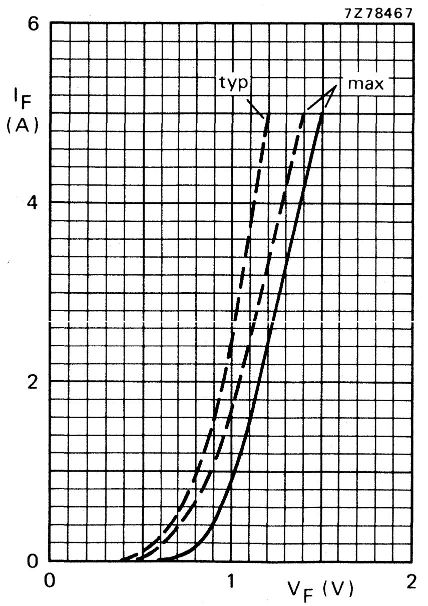


Fig. 5 —— T_j = 25 °C; – – – T_j = 140 °C.

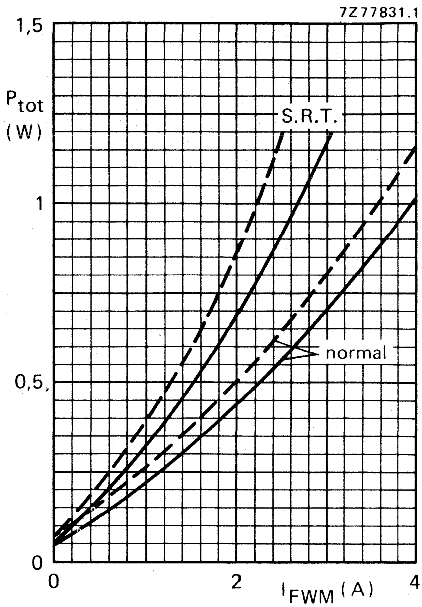


Fig. 6 P_{tot} = power dissipation including switching losses; --- 819 lines; —— 625 lines;
S.R.T. = self regulating time-base circuit; normal = conventional deflection circuit or high-voltage E–W modulator circuit; I_{FWM} is the **nominal** diode current, for tolerances and spreads 25% safety margin is taken into account.

APPLICATION INFORMATION

In designing horizontal deflection circuits, allowance has to be made for component and operating spreads, in order not to exceed any Absolute Maximum Rating.
Extensive analysis have shown that for the working peak forward current and reverse voltage the total allowance need not to be higher than 25%. For that reason the dissipation graph (Fig. 6) is based on the **nominal** I_{FWM}; 25% safety margin for tolerance and spreads is taken into account.

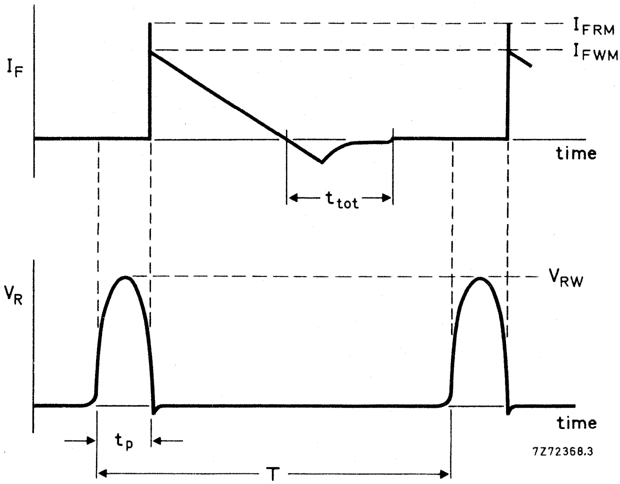


Fig. 7 Basic waveforms.

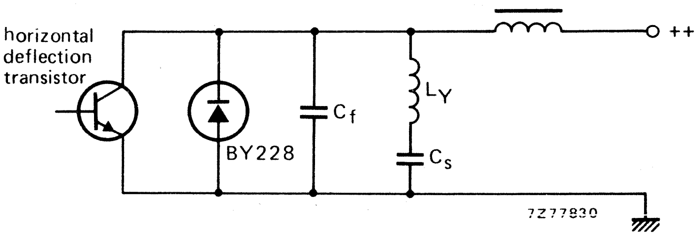


Fig. 8 Basic conventional horizontal deflection circuit.

APPLICATION INFORMATION (continued)

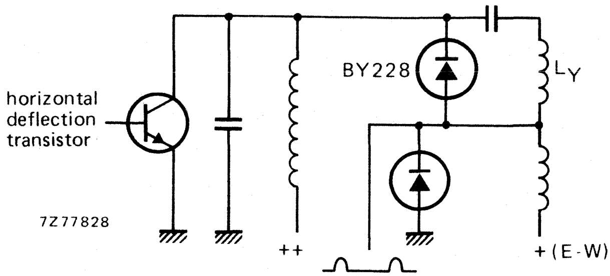


Fig. 9 Basic high-voltage E—W modulator circuit.

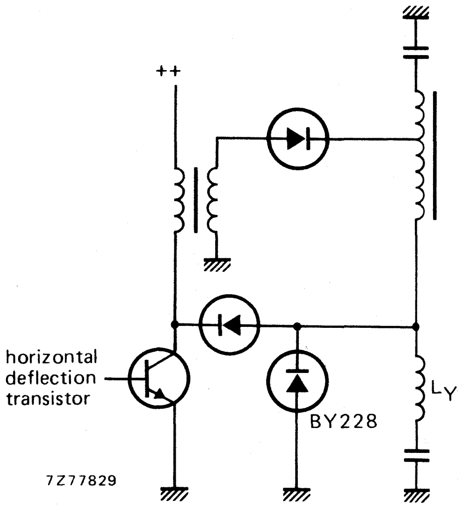
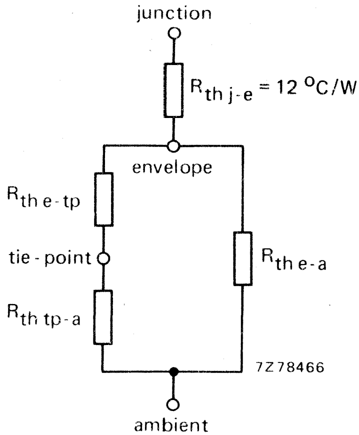


Fig. 10 Basic self-regulating time base circuit (S.R.T.).

OPERATING NOTES

The various components of junction temperature rise above ambient, for mounting with symmetrical lead length, are illustrated below.



The thermal resistances between envelope and tie-point, and between envelope and ambient depend on lead length.

lead length	5	10	15	20	25	mm
$R_{th\,e-tp}$	7,5	15	22,5	30	37,5	°C/W
$R_{th\,e-a}$	310	230	190	160	145	°C/W

The thermal resistance between tie-point and ambient depends on the mounting method; for mounting on a 1,5 mm thick epoxy-glass printed-circuit board with a copper-thickness ⩾ 40 μm, the following values apply:

1. Mounting similar to method given on page 2: $R_{th\,tp-a}$ = 72 °C/W .
2. Mounted on a printed-circuit board with a copper laminate of 1 cm^2: $R_{th\,tp-a}$ = 58 °C/W.

Note
Any temperature can be calculated by using the dissipation graph (Fig. 6) and the above thermal model.

PARALLEL EFFICIENCY DIODES

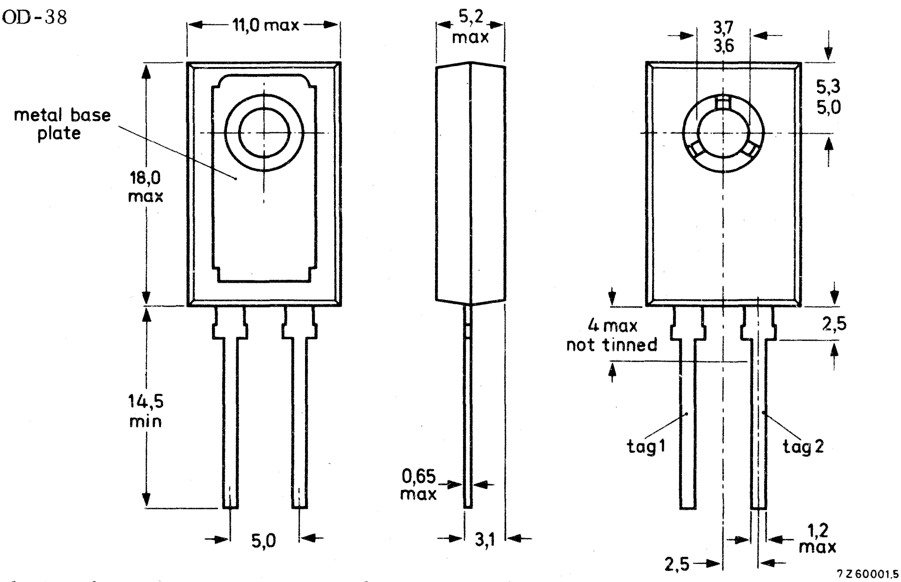
Silicon double-diffused rectifier diodes in plastic envelopes, intended for use as efficiency diode in thyristor horizontal deflection circuits of colour television receivers.
The devices feature low forward recovery voltage and non-snap-off characteristics which makes them particularly suitable for this application.

QUICK REFERENCE DATA

			BY277-600R	750R	
Repetitive peak reverse voltage	V_{RRM}	max.	600	750	V
Working peak forward current	I_{FWM}	max.		10	A
Repetitive peak forward current	I_{FRM}	max.		20	A
Reverse recovery time	t_{rr}	<		400	ns

MECHANICAL DATA (see also page 2) Dimensions in mm

SOD-38



Polarity of connections : tag 1 = anode, tag 2 = cathode.

The exposed metal base-plate is directly connected to tag 1.

MECHANICAL DATA (continued)

Net mass : 2,5 g

Recommended diameter of fixing screw : 3,5 mm

Torque on screw :

when using washer and heatsink compound : min. 0,95 Nm (9,5 kg cm)
max. 1,5 Nm (15 kg cm)

Accessories :

supplied with device : washer
available on request : 56316 (mica insulating washer)

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages			BY277-600R	750R	
Non-repetitive peak reverse voltage	V_{RSM}	max.	600	800	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	600	750	V
Working reverse voltage [1]	V_{RW}	max.	500	600	V

Currents				
R.M.S. forward current	$I_{F(RMS)}$	max.	3	A
Working peak forward current up to T_{mb} = 112 °C	I_{FWM}	max.	10	A
Repetitive peak forward current	I_{FRM}	max.	20	A
Non-repetitive peak forward current	I_{FSM}	max.	50	A

Temperatures				
Storage temperature	T_{stg}		−40 to +125	°C
Junction temperature	T_j	max.	125	°C

1) At $t_p \leq 20\ \mu s$; $\delta = t_p/T \leq 0,25$; see page 9.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,5	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,3	°C/W

Influence of mounting method

1. Heatsink mounted

From mounting base to heatsink

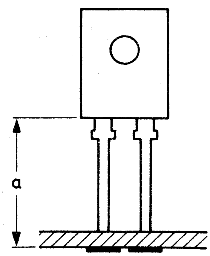
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	1,5	°C/W
b. with heatsink compound and 56316 mica washer	$R_{th\ mb\text{-}h}$	=	2,7	°C/W
c. without heatsink compound	$R_{th\ mb\text{-}h}$	=	2,7	°C/W
d. without heatsink compound; with 56316 mica washer	$R_{th\ mb\text{-}h}$	=	5	°C/W

2. Free air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-points.

From junction to ambient in free air mounted on a printed-circuit board at a = maximum lead length and with a copper laminate

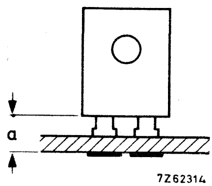
a. > 1 cm² $R_{th\ j\text{-}a}$ = 50 °C/W
b. < 1 cm² $R_{th\ j\text{-}a}$ = 55 °C/W



7Z62315.1

at a lead length a = 3 mm and with a copper laminate

c. > 1 cm² $R_{th\ j\text{-}a}$ = 55 °C
d. < 1 cm² $R_{th\ j\text{-}a}$ = 60 °C



7Z62314

CHARACTERISTICS

Forward voltage

I_F = 10 A; T_j = 25 °C	V_F	<	1,4	V [1]

Reverse current

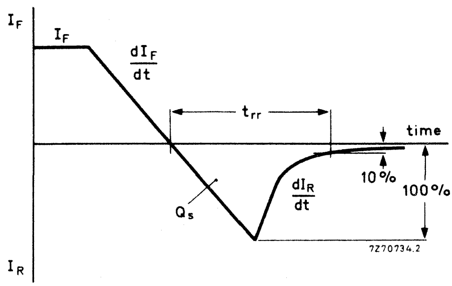
$V_R = V_{RWmax}$; T_j = 100 °C	I_R	<	0,2	mA

Reverse recovery when switched from

I_F = 2 A to $V_R \geqslant$ 30 V; $-dI_F/dt$ = 20 A/µs; T_j = 25 °C Recovery charge	Q_s	<	0,9	µC
I_F = 1 A to $V_R \geqslant$ 30 V; $-dI_F/dt$ = 20 A/µs; T_j = 25 °C Recovery time	t_{rr}	<	400	ns

Maximum slope of the reverse recovery current

(in horizontal deflection circuits) when switched from I_F = 5 A to $V_R \geqslant$ 30 V; with $-dI_F/dt$ = 1 A/µs; T_j = 25 °C	$\lvert dI_R/dt \rvert$	<	2	A/µs

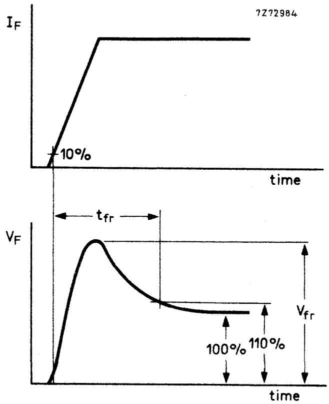


[1]) Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Forward recovery when switched to

I_F = 1 A; T_j = 25 °C				
Recovery time	t_{fr}	<	0,3	µs
Recovery voltage	V_{fr}	<	13	V
I_F = 20 mA; T_j = 25 °C				
Recovery time	t_{fr}	<	0,3	µs
Recovery voltage	V_{fr}	<	5	V



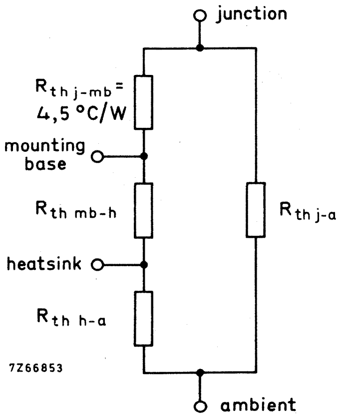
MOUNTING INSTRUCTIONS

1. Soldered joints must be at least 2, 5 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 270 °C; contact with the joint must not exceed 3 seconds.
3. The devices should not be immersed in oil, and few potting resins are suitable for re-encapsulation. Advice on these materials is available on request.
4. Leads should not be bent less than 2, 5 mm from the seal. Exert no axial pull when bending.
5. For good thermal contact heatsink compound should be used between base-plate and heatsink.

OPERATING NOTES

Dissipation and heatsink considerations :

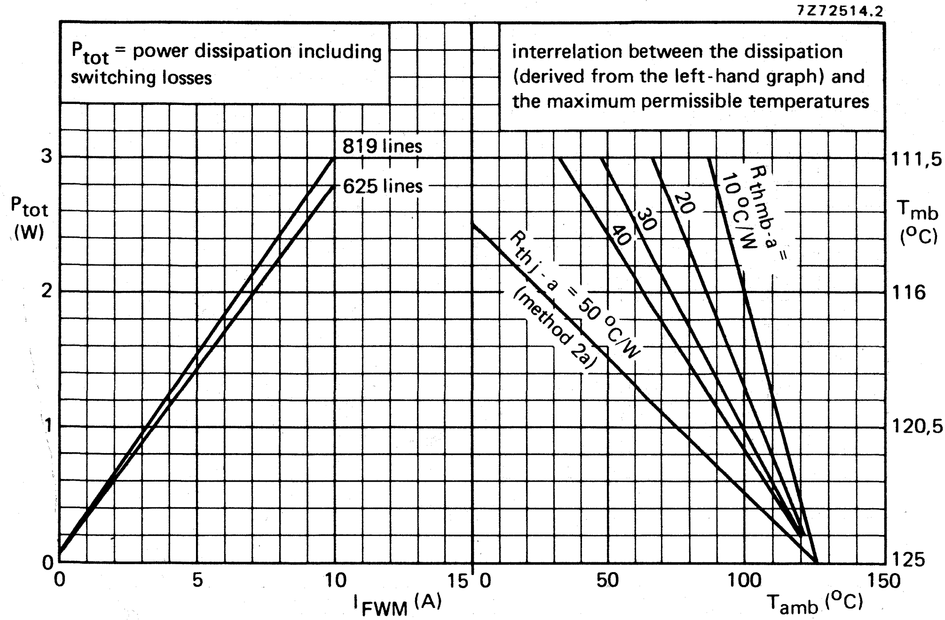
a. The various components of junction temperature rise above ambient are illustrated below :

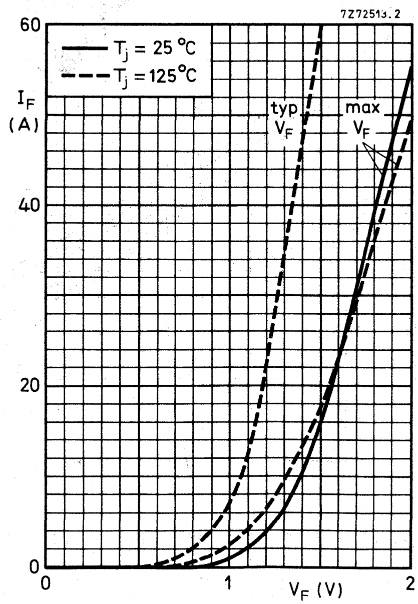


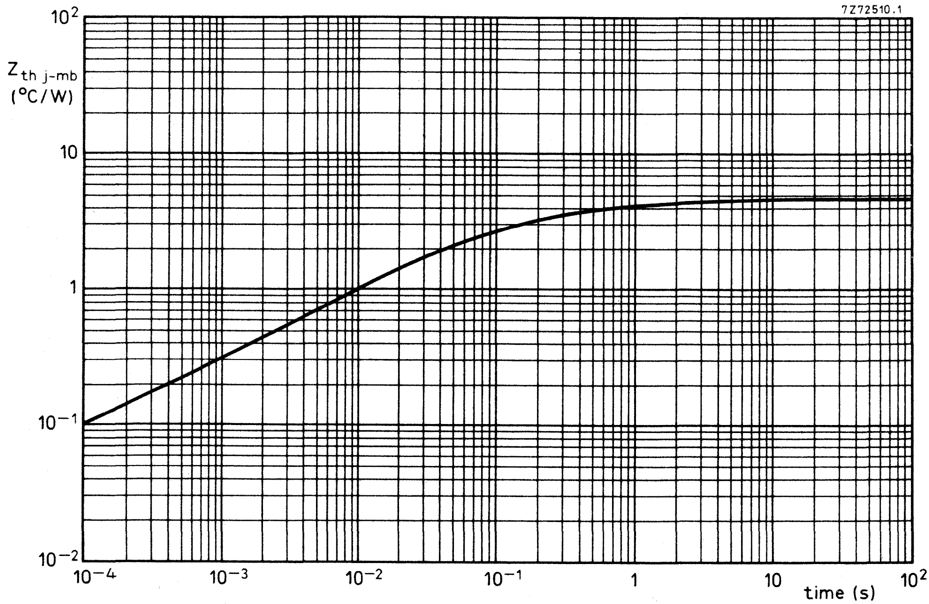
b. The method of using the graph on page 7 is as follows :
Starting with the required current on the I_{FWM} axis, trace upwards to meet the appropriate 625/819-curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb-a}$.
The heatsink thermal resistance value ($R_{th\ h-a}$) can now be calculated from :

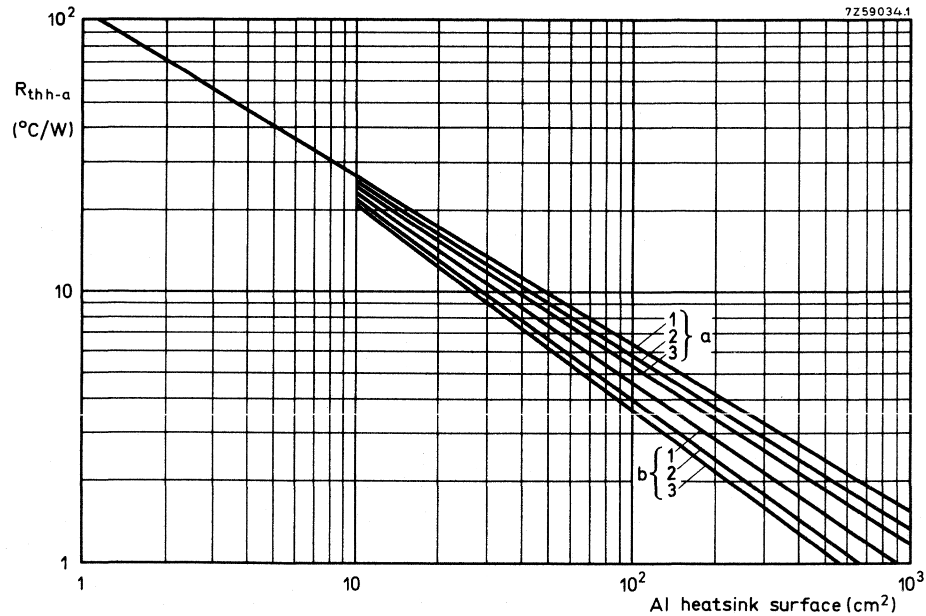
$$R_{th\ h-a} = R_{th\ mb-a} - R_{th\ mb-h}.$$

Any measurement of heatsink temperature should be made immediately adjacent to the device.


7Z72514.2
P_{tot} = power dissipation including switching losses
interrelation between the dissipation (derived from the left-hand graph) and the maximum permissible temperatures
819 lines
625 lines
P_{tot} (W)
3
2
1
0
0
5
10
15
I_{FWM} (A)
0
50
100
150
T_{amb} (°C)
T_{mb} (°C)
111,5
116
120,5
125
$R_{th\,mb\text{-}a}$ = 10 °C/W
20
30
40
$R_{th\,j\text{-}a}$ = 50 °C/W
(method 2a)

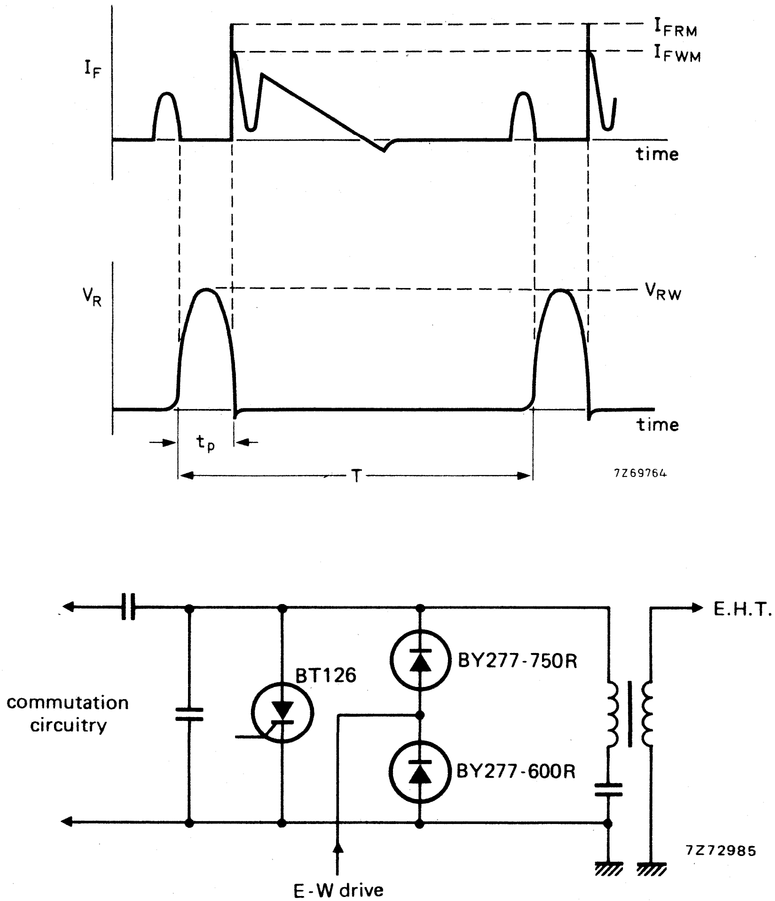

7Z72513.2
T_j = 25 °C
T_j = 125°C
I_F (A)
60
40
20
0
typ V_F
max V_F
0
1
2
V_F (V)





Thermal resistance $R_{th\,h\text{-}a}$ from aluminium heatsink to ambient (free air) versus heat-sink surface (one side). 1, 2 and 3 are thicknesses in mm, a is for a bright surface, b is for a black surface.

APPLICATION INFORMATION



Basic circuit and waveforms

FAST SOFT-RECOVERY RECTIFIER DIODES

Silicon double-diffused rectifier diodes in plastic envelopes. They are intended for use as top level detector, scan rectifier for the supply of small-signal parts in television and other h.f. power supplies. The devices feature non-snap-off characteristics and are flashover resistant.

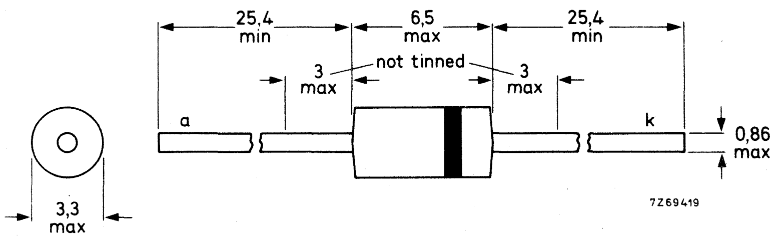
QUICK REFERENCE DATA

			BY406	BY407	
Repetitive peak reverse voltage	V_{RRM}	max.	350	600	V
Average forward current	$I_{F(AV)}$	max.	0,8		A
Non-repetitive peak forward current	I_{FSM}	max.	15		A
Reverse recovery time	t_{rr}	<	300		ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-15 (SOD-40).



The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BY406	BY407	
Non-repetitive peak reverse voltage ($t \leqslant 10$ ms)	V_{RSM}	max.	350	600	V
Repetitive peak reverse voltage ($t \leqslant 12\ \mu s$)	V_{RRM}	max.	350	600	V
Working reverse voltage	V_{RW}	max.	300	500	V
Continuous reverse voltage	V_R	max.	300	500	V

Average forward current (averaged over any 20 ms period); see also Figs 5, 6, 7 and 8				
$T_{lead} = 75\ ^oC$; $V_{RW} = 80$ V	$I_{F(AV)}$	max.	0,8	A
free air operation at $T_{amb} = 25\ ^oC$; $V_{RW} = V_{RWMmax}$	$I_{F(AV)}$	max.	0,65	A
free air operation at $T_{amb} = 25\ ^oC$; $V_{RW} = 80$ V	$I_{F(AV)}$	max.	0,8	A
Repetitive peak forward current	I_{FRM}	max.	5	A
Non-repetitive peak forward current $t = 10$ ms; half sine-wave; $T_j = 150\ ^oC$ prior to surge; with reapplied V_{RWmax}	I_{FSM}	max.	15	A
Storage temperature	T_{stg}		−65 to + 150	^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE

Thermal resistance from junction to tie-point at a lead length a = 10 mm — $R_{th\ j\text{-}tp}$ = 60 $^oC/W$

Influence of mounting method

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-points (see Figs 5 and 6). Otherwise, do not use the $R_{th\ j\text{-}a}$ values but refer to Figs 7 and 8.

1. Thermal resistance from junction to ambient when mounted to solder tags; Fig. 2
   a. at a lead length a = 10 mm — $R_{th\ j\text{-}a}$ = 100 $^oC/W$
   b. at a lead length a = maximum — $R_{th\ j\text{-}a}$ = 120 $^oC/W$
2. Thermal resistance from junction to ambient when mounted on a printed-circuit board at any lead length a; Fig. 3 — $R_{th\ j\text{-}a}$ = 150 $^oC/W$

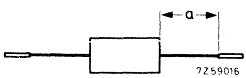


Fig. 2 Mounted to solder tags.

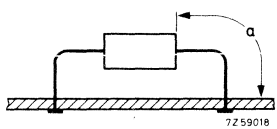


Fig. 3 Mounted on a printed-circuit board.

CHARACTERISTICS

Forward voltage					
I_F = 2 A; T_j = 25 °C	V_F	<	1,55		V *
			BY406	BY407	
Reverse current					
$V_R = V_{RWmax}$; T_j = 125 °C	I_R	<	200	125	μA
$V_R = V_{RWmax}$; T_j = 25 °C	I_R	<	2	2	μA
Reverse recovery when switched from I_F = 0,4 A to $V_R \geq$ 50 V with $-dI_F/dt$ = 0,4 A/μs; T_j = 25 °C					
recovered charge	Q_s	<	60		nC
recovery time	t_{rr}	<	1		μs
fall time	t_f	>	60		ns
Reverse recovery time when switched from I_F = 10 mA to $V_R \geq$ 50 V with $-dI_F/dt$ = 0,5 A/μs; T_j = 25 °C	t_{rr}	<	300		ns

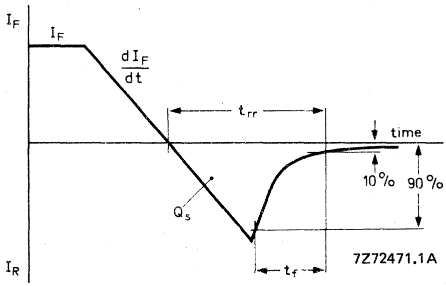


Fig. 4 Definitions of t_{rr}, Q_s and t_f.

MOUNTING INSTRUCTIONS

1. Soldered joints must be at least 5 mm from the seal.
2. A soldering iron must not be in contact with the joint for more than 3 seconds.
3. The maximum permissible temperature of the soldering bath is 300 °C; it must not be in contact with the joint for more than 3 seconds.
4. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 °C.
5. Leads should not be bent less than 1,5 mm from the seal; exert no axial pull when bending.

* Measured under pulse conditions to avoid excessive dissipation.

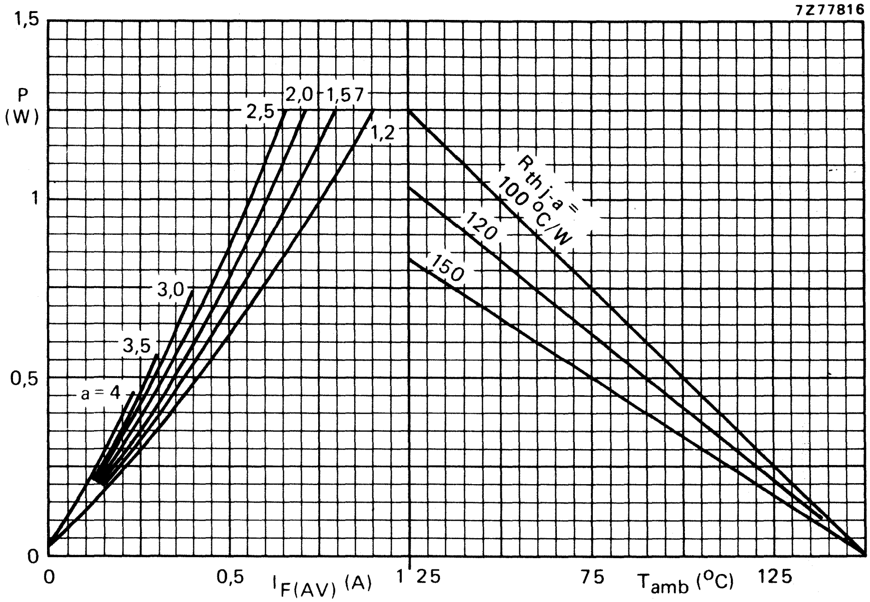


Fig. 5 Condition: V_{RW} = 80 V.

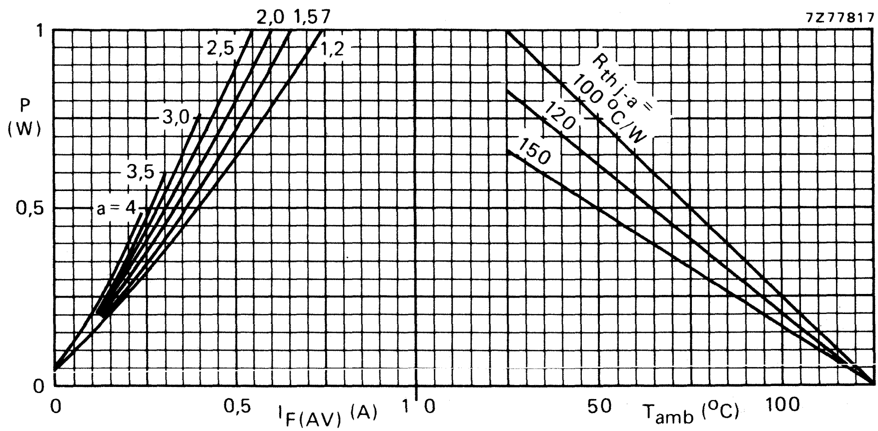


Fig. 6 Condition: $V_{RW} = V_{RWmax}$.

Note to Figs 5 and 6

The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible ambient temperature; no leads of other dissipating components running to the same tie-points.

P = steady-state power dissipation excluding switching losses; a = $I_{F(RMS)}/I_{F(AV)}$.

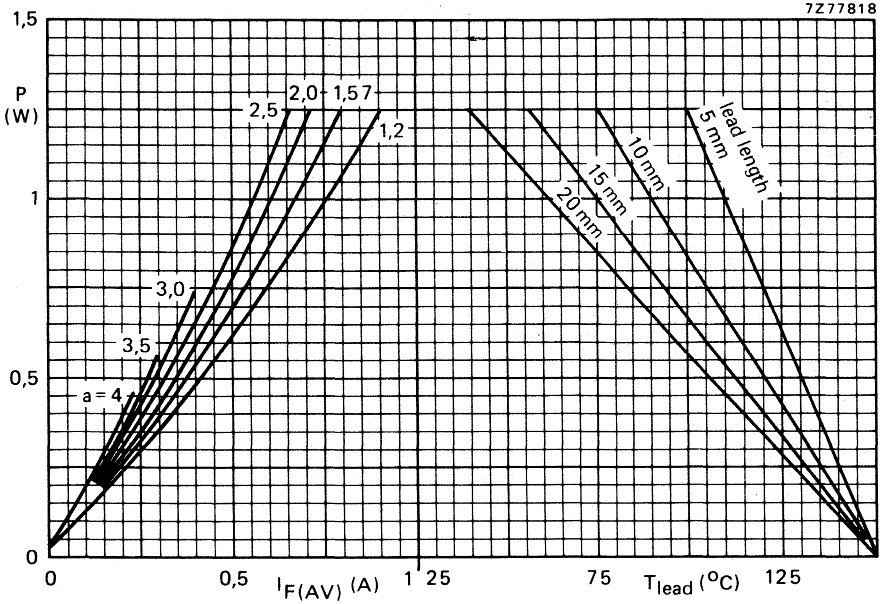


Fig. 7 Condition: V_{RW} = 80 V.

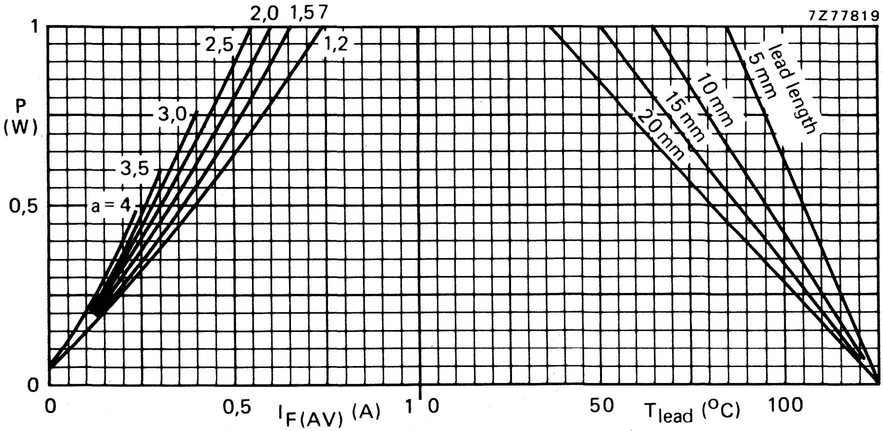


Fig. 8 Condition: $V_{RW} = V_{RWmax}$.

Note to Figs 7 and 8

The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible lead temperature.
P = steady-state power dissipation excluding switching losses; a = $I_{F(RMS)}/I_{F(AV)}$.

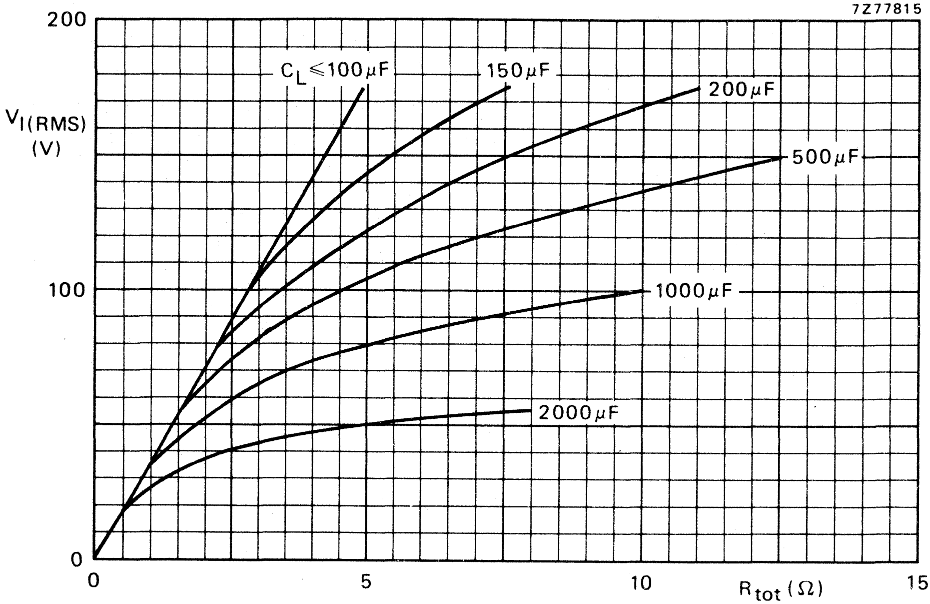
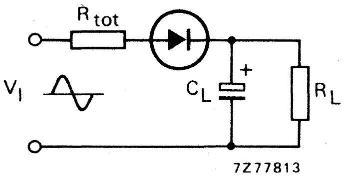


Fig. 9 Minimum value of the total series resistance R_{tot} (including the source resistance) required to limit the inrush current with capacitive load.



The graph takes the possibility of the following spreads into account:

mains voltage, + 10%
capacitance, + 50%
resistance, −10%

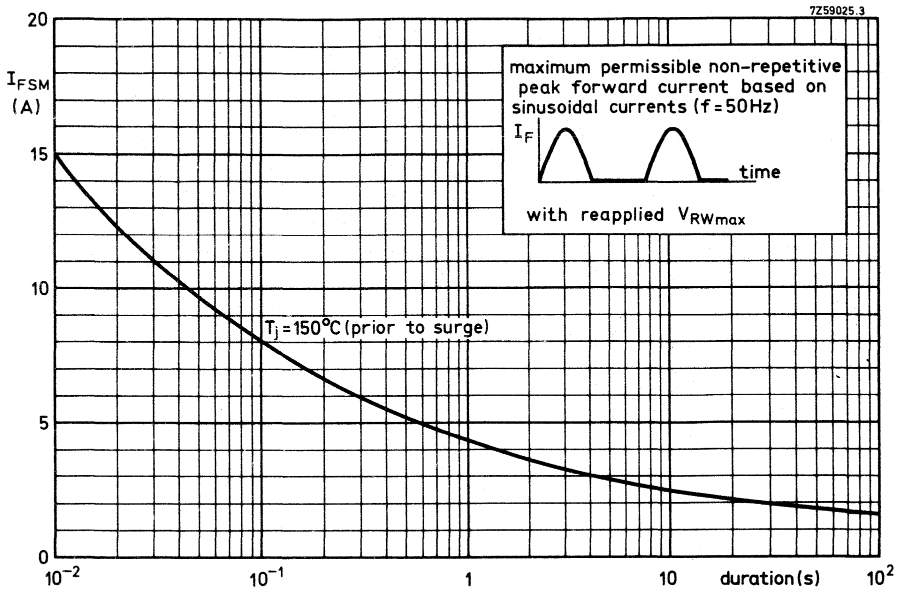


Fig. 10.

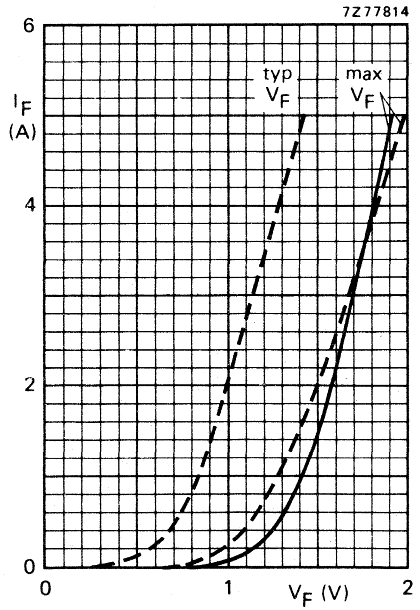
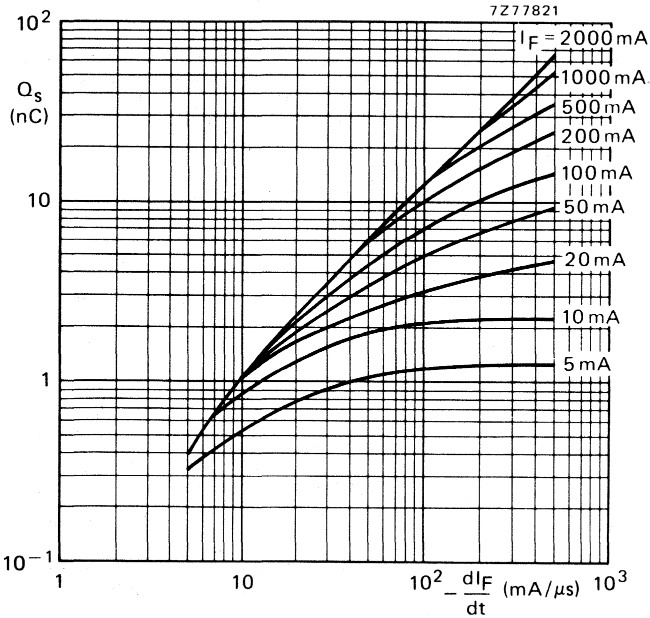


Fig. 11 —— T_j = 25 °C; – – – T_j = 150 °C.



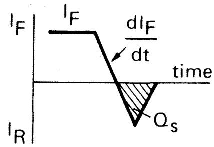
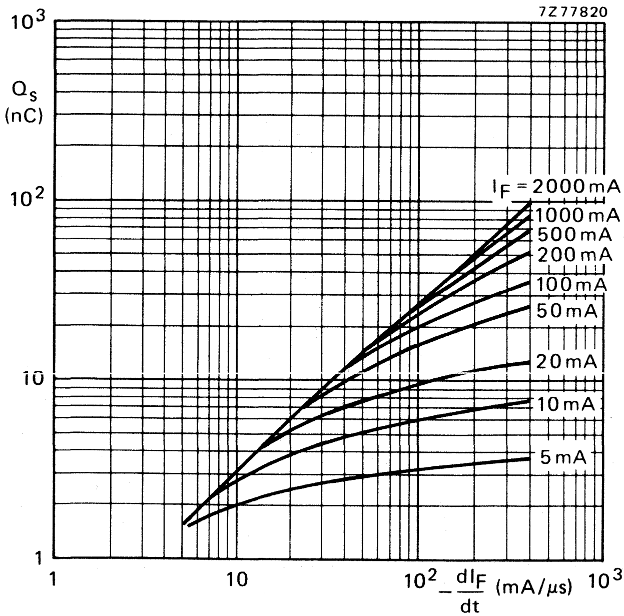


Fig. 12 Typical values; $V_R \geqslant 50$ V; T_j = 25 °C.



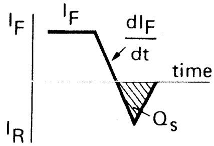


Fig. 13 Typical values; $V_R \geqslant 50$ V; T_j = 150 °C.

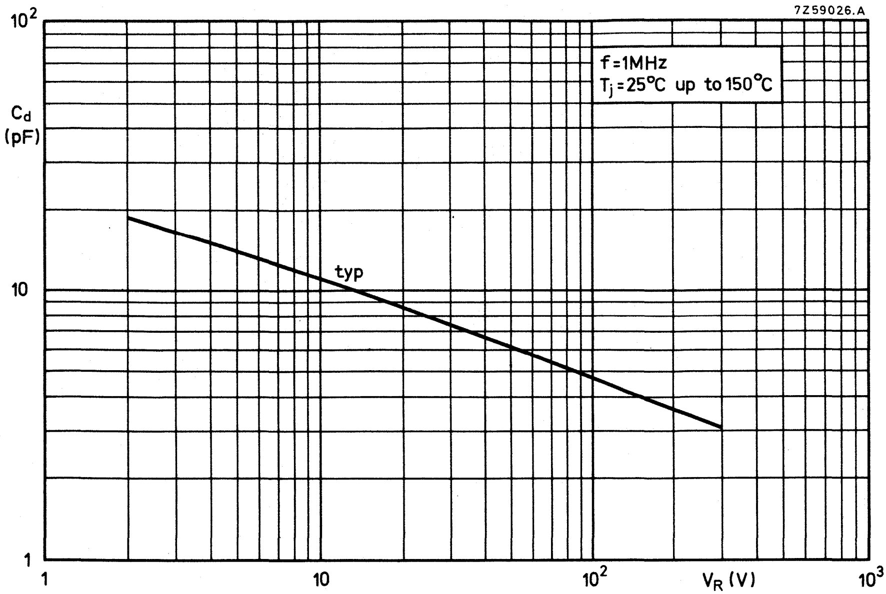

7Z59026.A
f = 1MHz
T_j = 25°C up to 150°C
C_d (pF)
typ
V_R (V)
10^2
10
1
1
10
10^2
10^3

Fig. 14.

SILICON E.H.T. SOFT-RECOVERY RECTIFIER DIODES

E.H.T. rectifier diodes in plastic envelopes intended for high-voltage multipliers (e.g. tripler circuits) and as focus rectifiers in colour television receivers. The device features non-snap-off characteristics. Because of the smallness of the envelope, the diodes should be potted when used at voltages above 6 kV, see page 3.

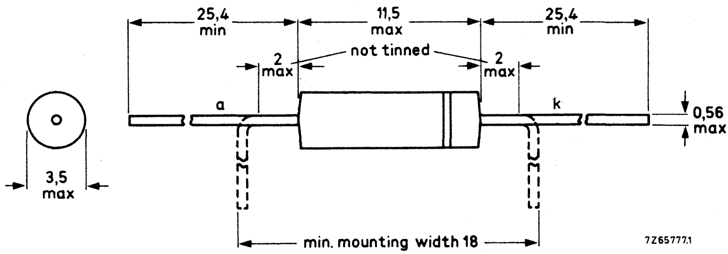
QUICK REFERENCE DATA

Working reverse voltage	V_{RW}	max	11,5	kV
Repetitive peak reverse voltage	V_{RRM}	max	12,5	kV
Average forward current	$I_{F(AV)}$	max	2,5	mA
Junction temperature	T_j	max	100	°C
Reverse recovery				
Recovery charge	Q_s	typ	2,5	nC
Recovery time	t_{rr}	typ	0,4	μs

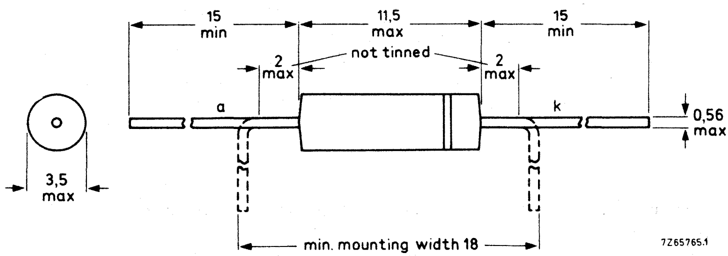
MECHANICAL DATA

Dimensions in mm

SOD-34 (long leads) **BY409**



SOD-34 (medium leads) **BY409A** ←



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Working reverse voltage	V_{RW}	max	11,5 kV
Repetitive peak reverse voltage	V_{RRM}	max	12,5 kV
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max	12,5 kV

Currents

Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max	2,5 mA *
Repetitive peak forward current	I_{FRM}	max	500 mA **

Temperatures

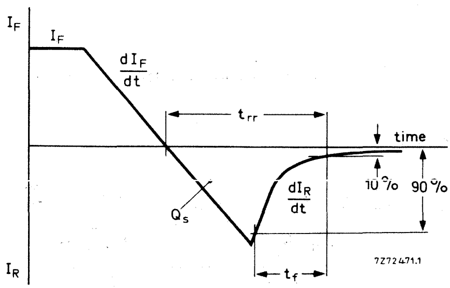
Storage temperature	T_{stg}		−65 to +100 °C
Junction temperature	T_j	max	100 °C

CHARACTERISTICS

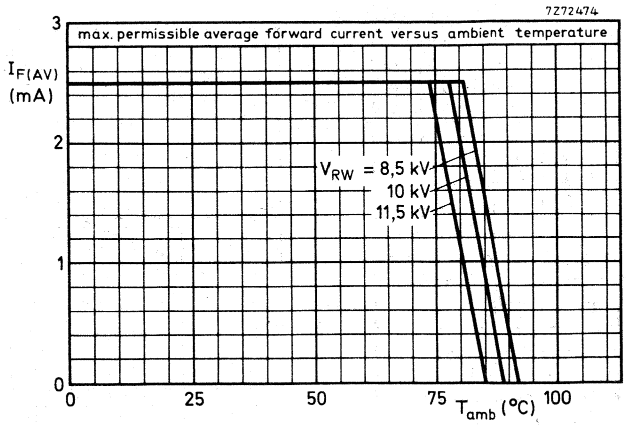
Forward voltage at $I_F = 100$ mA; $T_j = 100$ °C	V_F	<	36 V
Reverse current at $V_R = 10$ kV; $T_j = 100$ °C	I_R	<	5 μA

Reverse recovery when switched from
$I_F = 200$ mA to $V_R = 100$ V with
$-dI_F/dt = 200$ mA/μs; $T_j = 25$ °C

Recovery charge	Q_s	typ	2,5 nC
Recovery time	t_{rr}	typ	0,4 μs
Fall time	t_f	>	0,15 μs

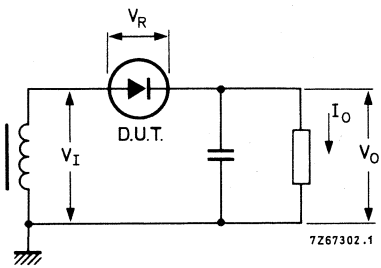


* For use as clamping diode in tripler circuits the maximum value for $I_{F(AV)} = 4$ mA up to $T_{amb} = 77$ °C.
** The rectifier can withstand peak currents occurring at flashover in the picture tube.

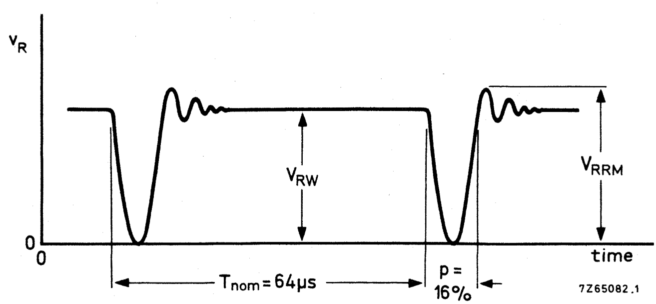


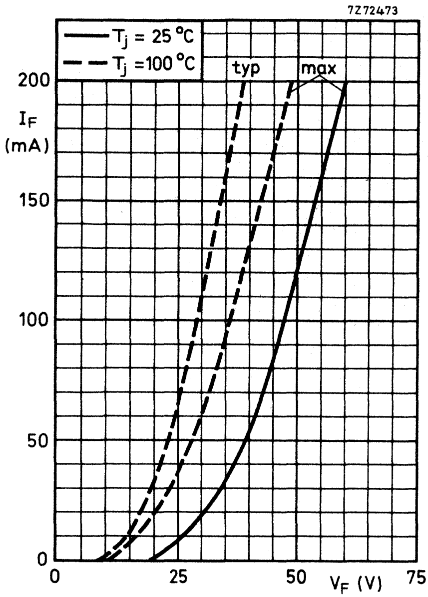
When used at voltages above 6 kV the diode should be potted in such a way that $R_{th\ j\text{-}a}$ is less than 120 °C/W.

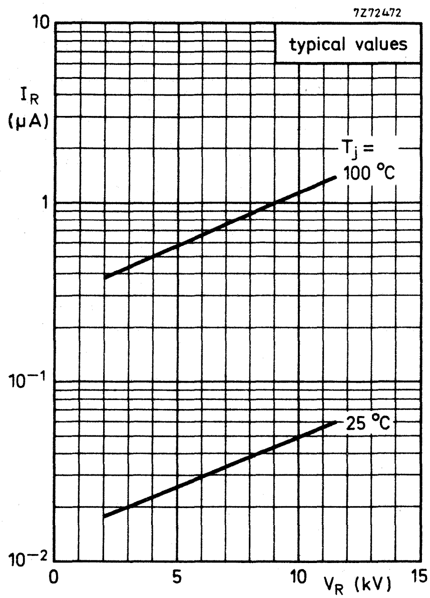
Typical operating circuit



Typical applied voltage




7Z72473
T_j = 25 °C
T_j =100 °C
typ
max
I_F
(mA)
200
150
100
50
0
0
25
50
V_F (V)
75


7Z72472
typical values
I_R
(μA)
10
1
10^{-1}
10^{-2}
T_j =
100 °C
25 °C
0
5
10
V_R (kV)
15

SILICON E.H.T. SOFT-RECOVERY RECTIFIER DIODES

E.H.T. rectifier diodes in plastic envelopes intended for high-voltage multipliers and for use in tiny vision black-and-white television receivers. Because of the smallness of the envelope, the diodes should be potted when used at voltages above 9 kV, see page 3.

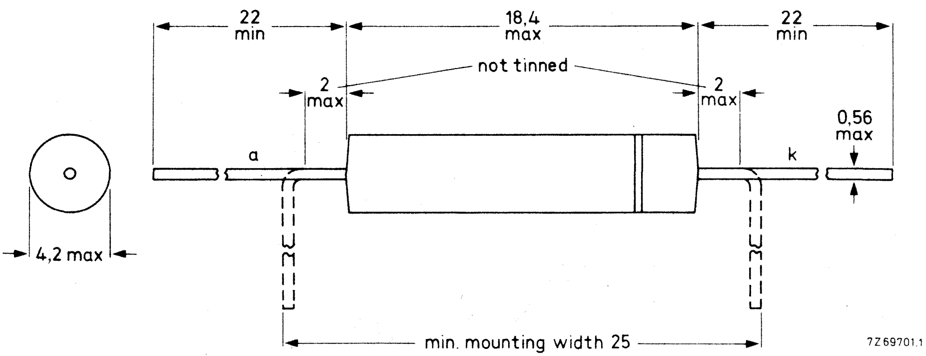
QUICK REFERENCE DATA

Working reverse voltage	V_{RW}	max	16	kV
Repetitive peak reverse voltage	V_{RRM}	max	18	kV
Average forward current	$I_{F(AV)}$	max	2,5	mA
Junction temperature	T_j	max	100	°C
Reverse recovery				
Recovery charge	Q_s	typ	2,5	nC
Recovery time	t_{rr}	typ	0,4	μs

MECHANICAL DATA

Dimensions in mm

SOD-56 (long leads) **BY476**



The **BY476A** has the same envelope except for the leads (min lead length 13 mm).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Working reverse voltage	V_{RW}	max	16	kV
Repetitive peak reverse voltage	V_{RRM}	max	18	kV
Non-repetitive peak reverse voltage ($t \leqslant 10$ ms)	V_{RSM}	max	21	kV

Currents

Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max	2,5	mA
Repetitive peak forward current	I_{FRM}	max	500	mA *

Temperatures

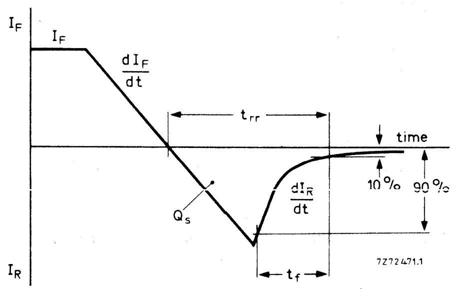
Storage temperature	T_{stg}		−65 to +100	°C
Junction temperature	T_j	max	100	°C

CHARACTERISTICS

Forward voltage at I_F = 100 mA; T_j = 100 °C	V_F	<	44	V
Reverse current at V_R = 15 kV; T_j = 100 °C	I_R	<	5	μA

Reverse recovery when switched from
I_F = 200 mA to V_R = 100 V with
$-dI_F/dt$ = 200 mA/μs; T_j = 25 °C

Recovery charge	Q_s	typ	2,5	nC
Recovery time	t_{rr}	typ	0,4	μs
Fall time	t_f	>	0,15	μs



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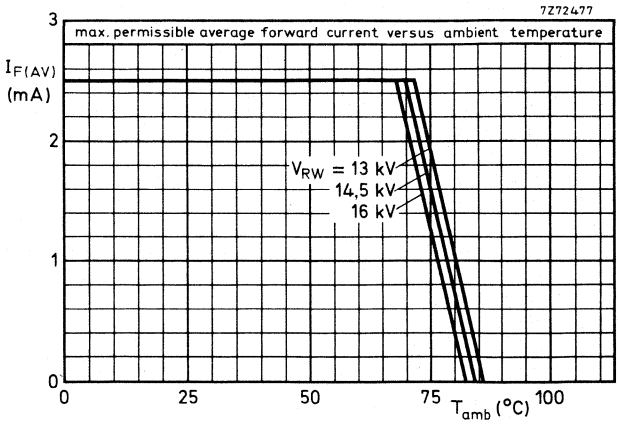
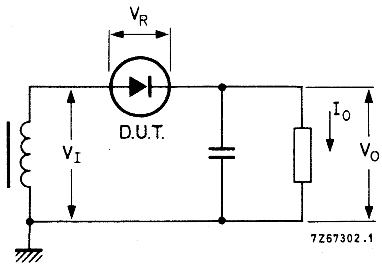
* The rectifier can withstand peak currents occurring at flashover in the picture tube.

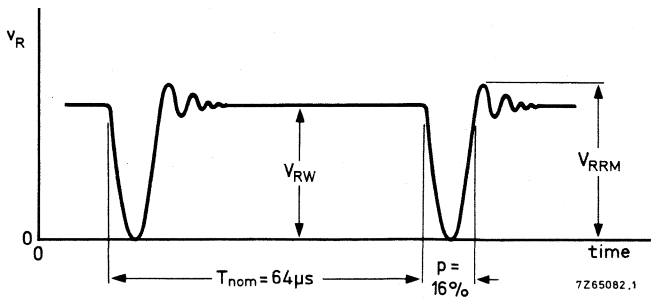


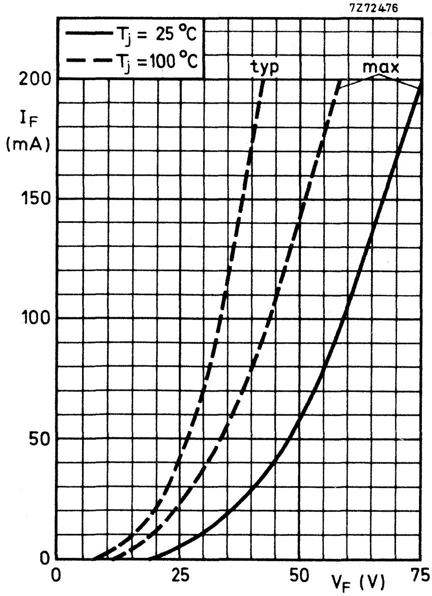
When used at voltages above 9 kV diode should be potted in such a way that $R_{th\ j\text{-}a}$ is less than 120 °C/W.

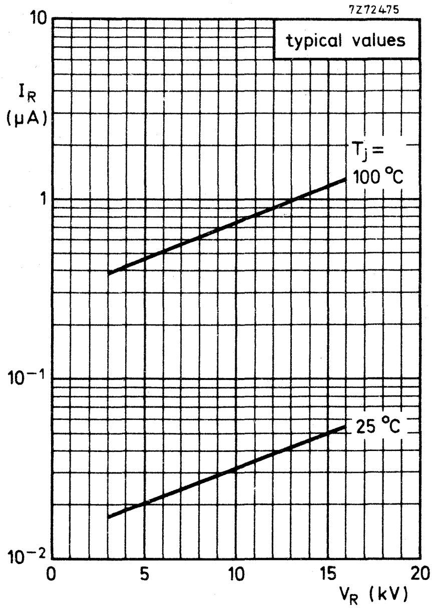
Typical operating circuit



Typical applied voltage




7Z72476
T_j = 25 °C
T_j = 100 °C
typ
max
200
150
100
50
0
I_F (mA)
0
25
50
75
V_F (V)


7Z72475
typical values
10
1
10^{-1}
10^{-2}
I_R (μA)
T_j = 100 °C
25 °C
0
5
10
15
20
V_R (kV)

SILICON E.H.T. SOFT-RECOVERY RECTIFIER DIODES

E.H.T. rectifier diodes in plastic envelopes intended as high-voltage rectifier in black-and-white television receivers. The devices feature non-snap-off characteristics.
Because of the smallness of the envelope, the diode should be potted when used at voltages above 9 kV.

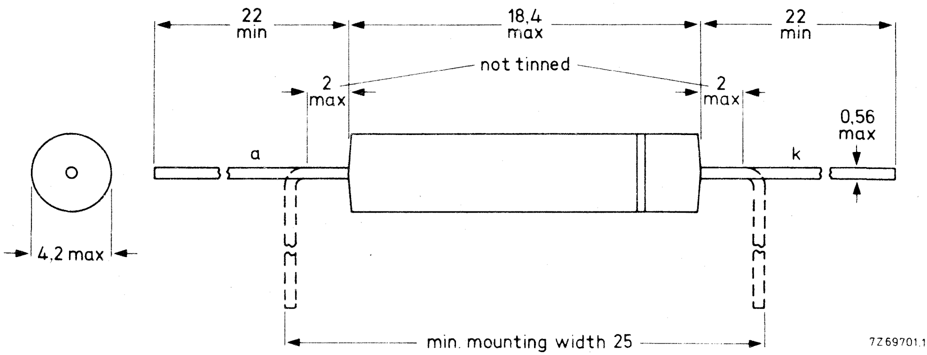
QUICK REFERENCE DATA

			BY477	BY478	
Non-repetitive peak reverse voltage	V_{RSM}	max.	27	32,0	kV
Repetitive peak reverse voltage	V_{RRM}	max.	23	27,5	kV
Average forward current	$I_{F(AV)}$	max.	2		mA
Reverse recovery time	t_{rr}	typ.	0,4		µs

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-56.



Cathode indicated by a coloured band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BY477	BY478	
Non-repetitive peak reverse voltage ($t \leqslant 10$ ms)	V_{RSM}	max.	27	32,0	kV
Repetitive peak reverse voltage	V_{RRM}	max.	23	27,5	kV
Working reverse voltage	V_{RW}	max.	21	25,0	kV

Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	2	mA
Repetitive peak forward current	I_{FRM}	max.	500	mA*
Storage temperature	T_{stg}		−65 to + 100	°C
Junction temperature	T_j	max.	100	°C

CHARACTERISTICS

Forward voltage $I_F = 100$ mA; $T_j = 100$ °C	V_F	<	50	V
Reverse current $V_R = V_{RWmax}$; $T_j = 100$ °C	I_R	<	3	μA
Reverse recovery when switched from $I_F = 200$ mA to $V_R = 100$ V with $-dI_F/dt = 200$ mA/μs; $T_j = 25$ °C				
Recovered charge	Q_s	typ.	2,0	nC
Recovery time	t_{rr}	typ.	0,4	μs
Fall time	t_f	>	0,15	μs

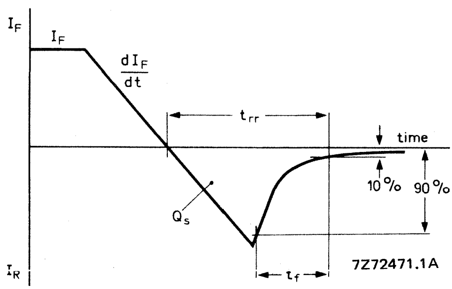


Fig. 2 Definitions of t_{rr}, t_f and Q_s.

* The rectifier can withstand peak currents occurring at flash-over in the picture tube.

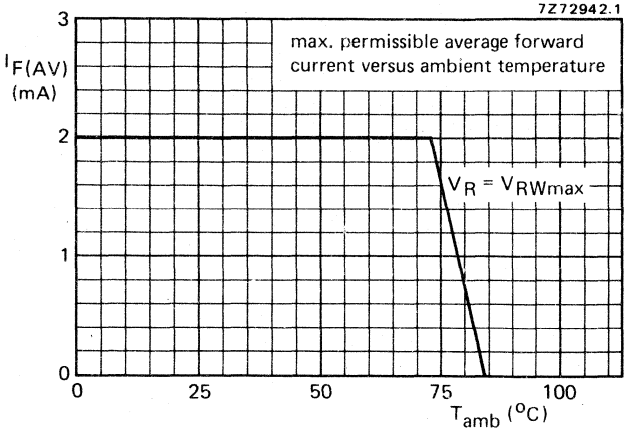


Fig. 3.

When used at voltages above 9 kV the diode should be potted in such a way that $R_{th\ j\text{-}a}$ is less than 120 °C/W.

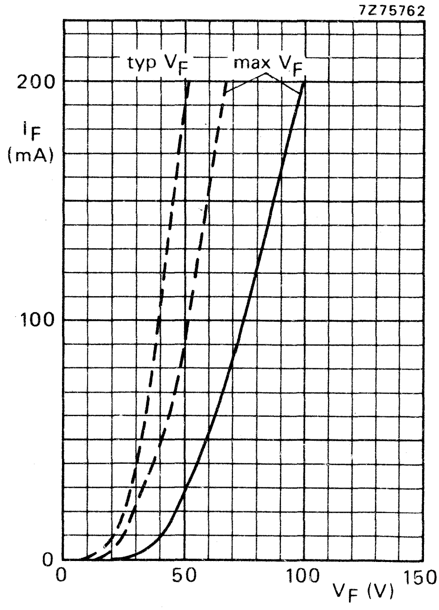


Fig. 4 —— T_j = 25 °C; – – – T_j = 100 °C.

FAST SOFT-RECOVERY RECTIFIER DIODES

Silicon double-diffused rectifier diodes in plastic envelopes. They are intended for use as clamp diode, dV/dt limiter and output rectifier diodes in professional and consumer switched-mode power supply applications and as scan rectifier diodes in television receivers. The devices feature non-snap-off characteristics and a very fast turn-on behaviour, which makes them extremely suitable for clamp and dV/dt limiting applications.

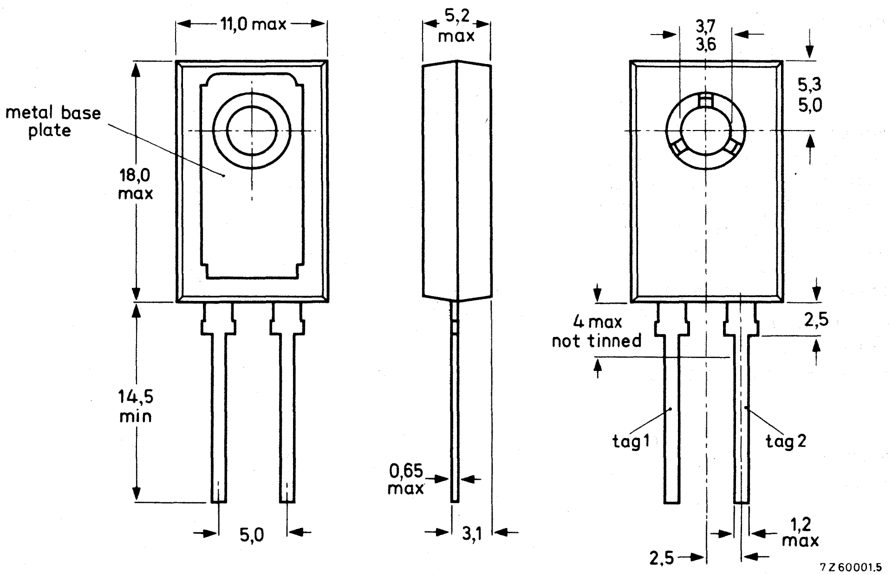
QUICK REFERENCE DATA

			BYW19-800(R)	1000(R)	
Repetitive peak reverse voltage	V_{RRM}	max	800	1000	V
Average forward current	$I_{F(AV)}$	max	7		A
Non-repetitive peak forward current	I_{FSM}	max	40		A
Reverse recovery time	t_{rr}	<	450		ns

MECHANICAL DATA (see also page 2)

Dimensions in mm

SOD-38



The exposed metal base-plate is directly connected to tag 1.

MECHANICAL DATA (continued)

Net mass: 2,5 g

Recommended diameter of fixing screw: 3,5 mm

Torque on screw
when using washer and heatsink compound: min 0,95 Nm (9,5 kg cm)
max 1,5 Nm (15 kg cm)

Accessories:
supplied with device: washer
available on request : 56316 (mica insulating washer)

POLARITY OF CONNECTIONS

	BYW19-800 and BYW19-1000	BYW19-800R and BYW19-1000R
Base-plate	cathode	anode
Tag 1	cathode	anode
Tag 2	anode	cathode

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages			BYW19-800(R)	1000(R)	
Non-repetitive peak reverse voltage	V_{RSM}	max	800	1000	V
Repetitive peak reverse voltage	V_{RRM}	max	800	1000	V
Working reverse voltage	V_{RW}	max	800	800	V
Continuous reverse voltage	V_R	max	800	800	V

Currents

Average forward current assuming zero switching losses (averaged over any 20 ms period; see page 7)

square-wave; δ = 0,5; up to T_{mb} = 98 °C	$I_{F(AV)}$	max	7	A
square-wave; δ = 0,5; at T_{mb} = 125 °C	$I_{F(AV)}$	max	4	A
sinusoidal; up to T_{mb} = 98 °C	$I_{F(AV)}$	max	7	A
sinusoidal; at T_{mb} = 125 °C	$I_{F(AV)}$	max	4	A
Repetitive peak forward current; t_p = 20 μs; $\delta \leqslant$ 0,02	I_{FRM}	max	75	A
Non-repetitive peak forward current square-wave; t = 10 ms; T_j = 150 °C prior to surge; with reapplied V_{RWmax}	I_{FSM}	max	40	A

Temperatures

Storage temperature	T_{stg}		−40 to +125	°C
Junction temperature	T_j	max	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,5 °C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,3 °C/W

Influence of mounting method

1. Heatsink mounted

Thermal resistance from mounting base to heatsink

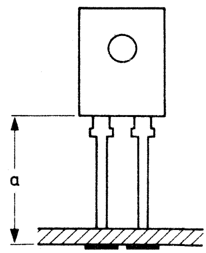
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	1,5 °C/W
b. with heatsink compound and 56316 mica washer	$R_{th\ mb\text{-}h}$	=	2,7 °C/W
c. without heatsink compound	$R_{th\ mb\text{-}h}$	=	2,7 °C/W
d. without heatsink compound with 56316 mica washer	$R_{th\ mb\text{-}h}$	=	5 °C/W

2. Free air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-points.

Thermal resistance from junction to ambient in free air:
mounted on a printed-circuit board at a = maximum lead length and with a copper laminate

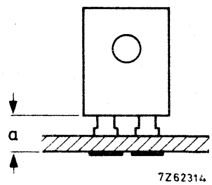
a. > 1 cm² $R_{th\ j\text{-}a}$ = 50 °C/W
b. < 1 cm² $R_{th\ j\text{-}a}$ = 55 °C/W



7Z62315.1

mounted on a printed-circuit board at a lead length a = 3 mm and with a copper laminate

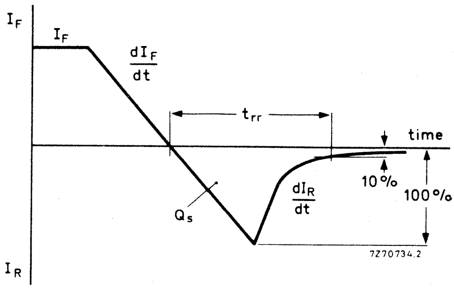
c. > 1 cm² $R_{th\ j\text{-}a}$ = 55 °C/W
d. < 1 cm² $R_{th\ j\text{-}a}$ = 60 °C/W



7Z62314

CHARACTERISTICS

Forward voltage			
I_F = 20 A; T_j = 25 °C	V_F	<	2,3 V *
Reverse current			
$V_R = V_{RWmax}$; T_j = 125 °C	I_R	<	0,6 mA
Reverse recovery when switched from			
I_F = 2 A to $V_R \geqslant$ 30 V; $-dI_F/dt$ = 20 A/μs; T_j = 25 °C			
Recovered charge	Q_s	<	0,7 μC
Recovery time	t_{rr}	<	450 ns
Maximum slope of the reverse recovery current			
when switched from I_F = 2 A to $V_R \geqslant$ 30 V;			
with $-dI_F/dt$ = 2 A/μs; T_j = 25 °C	$\lvert dI_R/dt \rvert$	<	5 A/μs



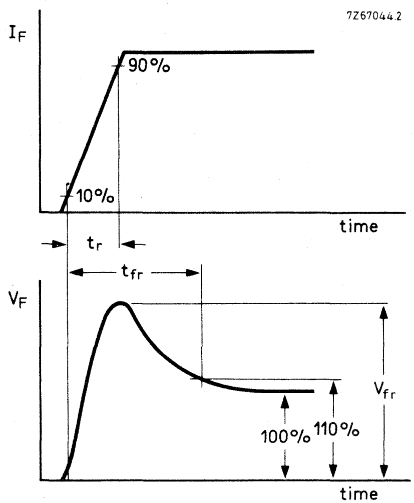
* Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Forward recovery when switched to

I_F = 10 A with t_r = 1 μs at T_j = 25 °C

Recovery time	t_{fr}	<	1	μs
Recovery voltage	V_{fr}	<	15	V



Forward output waveform

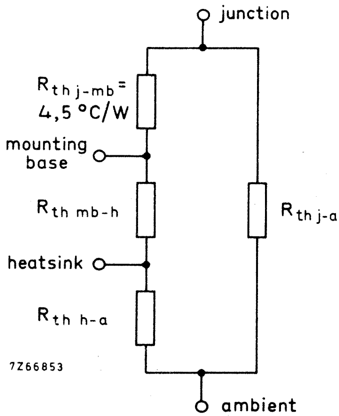
MOUNTING INSTRUCTIONS

1. Soldered joints must be at least 2,5 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 270 °C; contact with the joint must not exceed 3 seconds.
3. The devices should not be immersed in oil, and few potting resins are suitable for re-encapsulation. Advice on these materials is available on request.
4. Leads should not be bent less than 2,5 mm from the seal. Exert no axial pull when bending.
5. For good thermal contact heatsink compound should be used between base-plate and heatsink.

OPERATING NOTES

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated below:

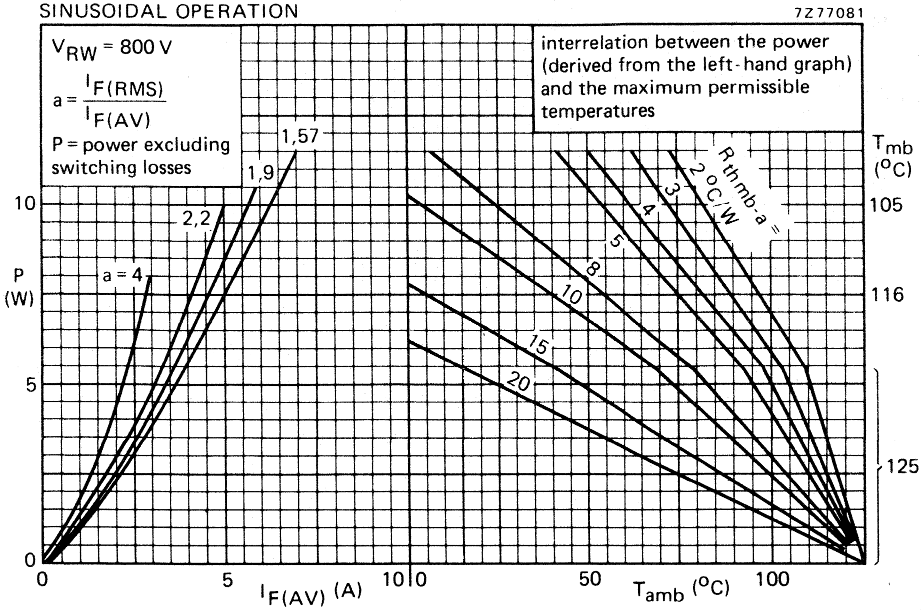


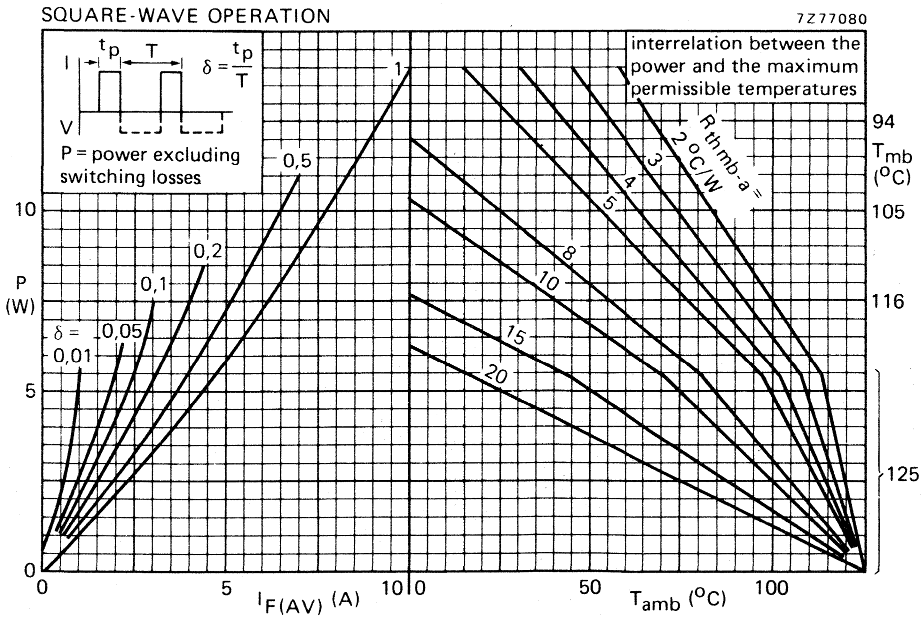
b. The method of using the graphs on page 7 is as follows:
Starting with the required current on the $I_{F(AV)}$ axis, trace upwards to meet the appropriate form factor curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can now be calculated from:

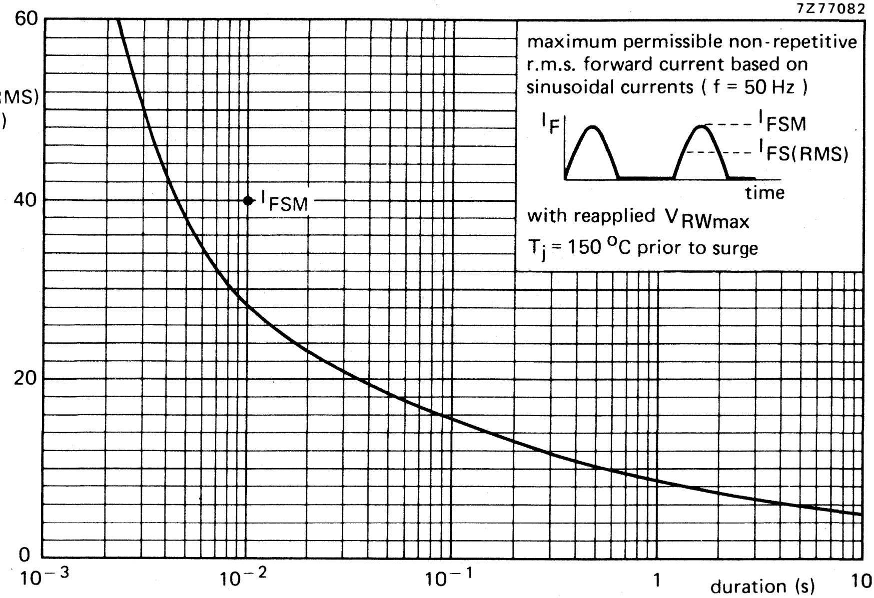
$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

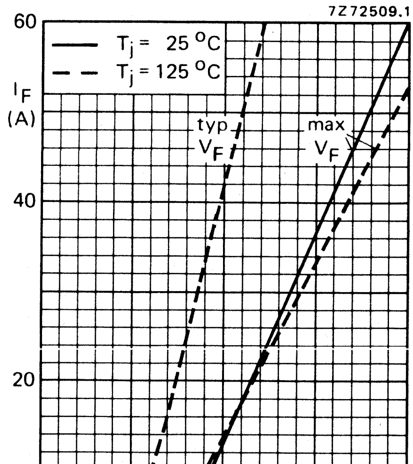
Any measurement of heatsink temperature should be made immediately adjacent to the device.

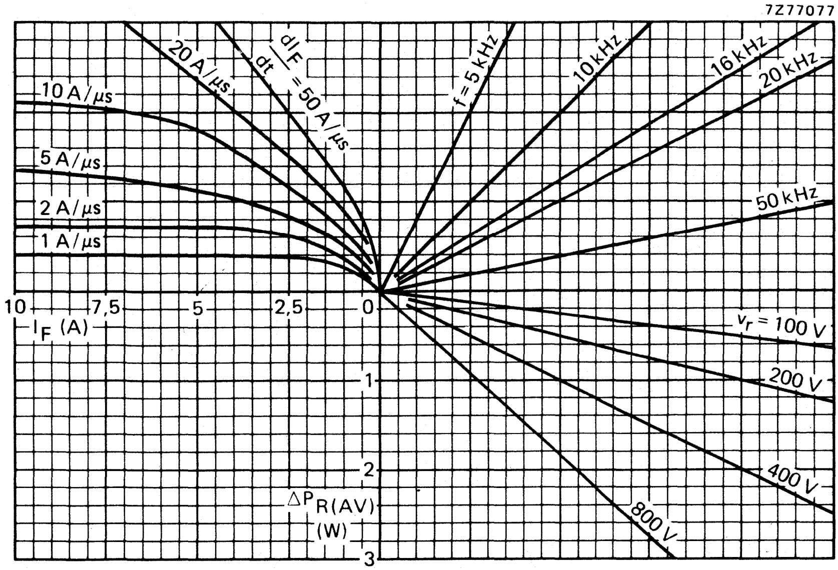
c. The heatsink curves are optimized to allow the junction temperature to run up to a maximum of 150 °C ($T_{j\ max}$) whilst limiting T_{mb} to 125 °C (or less).


SINUSOIDAL OPERATION
7Z77081
V_{RW} = 800 V
$a = \frac{I_{F(RMS)}}{I_{F(AV)}}$
P = power excluding switching losses
interrelation between the power (derived from the left-hand graph) and the maximum permissible temperatures
a = 4
2,2
1,9
1,57
P (W)
$I_{F(AV)}$ (A)
T_{amb} (°C)
T_{mb} (°C)
105
116
125
$R_{th\,mb\text{-}a}$ = 2 °C/W
3
4
5
8
10
15
20
0
5
10
50
100


SQUARE-WAVE OPERATION
7Z77080
I
V
t_p
T
$\delta = \frac{t_p}{T}$
P = power excluding switching losses
interrelation between the power and the maximum permissible temperatures
δ = 0,01
0,05
0,1
0,2
0,5
1
P (W)
$I_{F(AV)}$ (A)
T_{amb} (°C)
94
T_{mb} (°C)
105
116
125
$R_{th\,mb\text{-}a}$ = 2 °C/W
3
4
5
8
10
15
20
0
5
10
50
100


7Z77082
60
$I_{FS(RMS)}$
(A)
40
20
0
I_{FSM}
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_{RWmax}
T_j = 150 °C prior to surge
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10

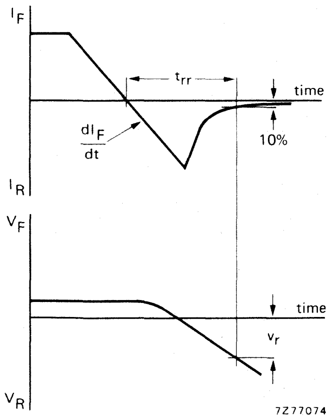

7Z72509.1
60
I_F
(A)
40
20
0
T_j = 25 °C
T_j = 125 °C
typ
V_F
max
V_F
0
2
V_F (V)
4

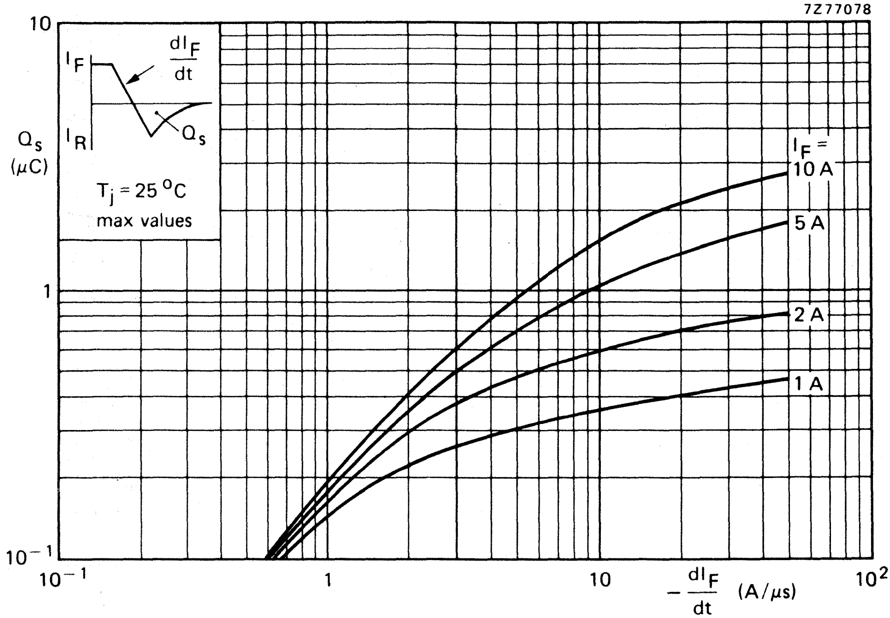


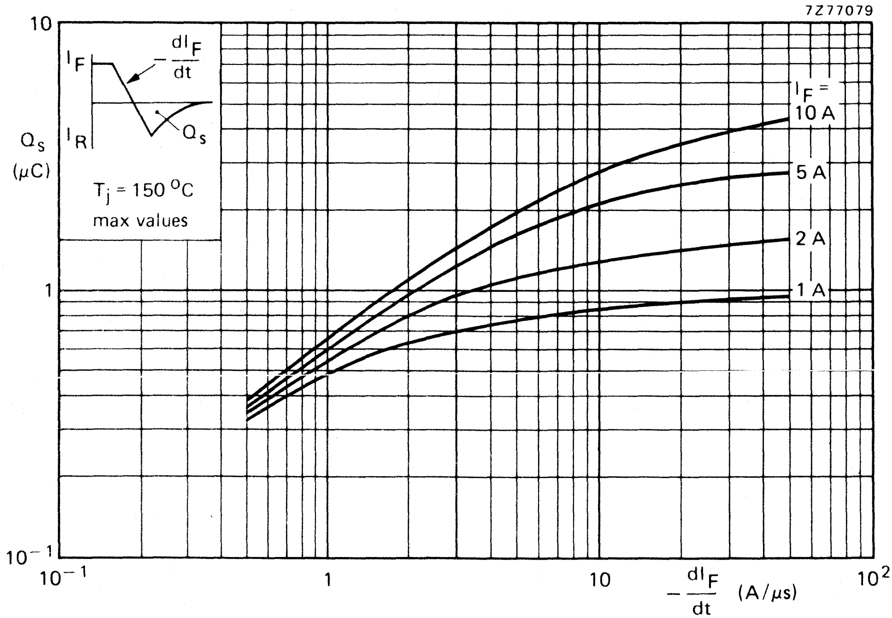
NOMOGRAM

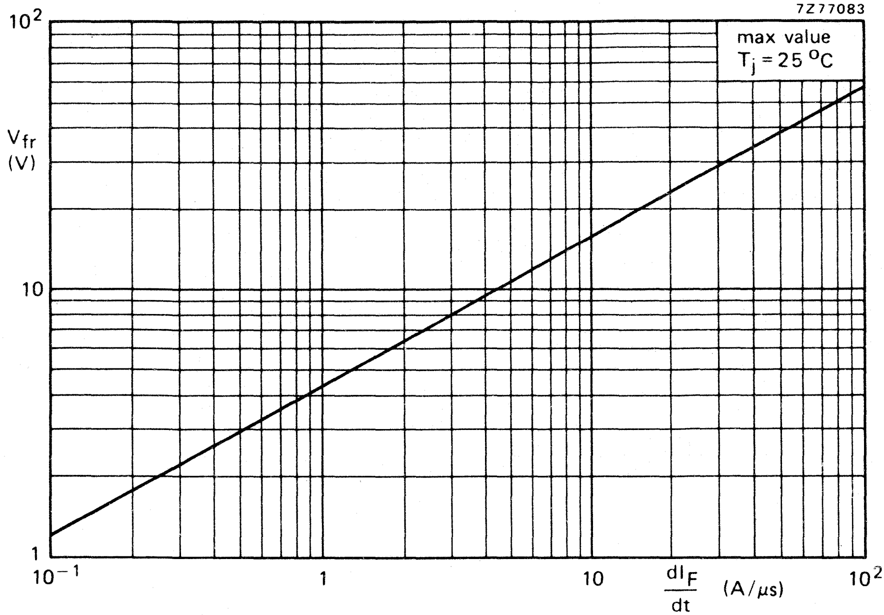
Power loss $\Delta P_{R(AV)}$ due to switching only (to be added to steady state power losses).

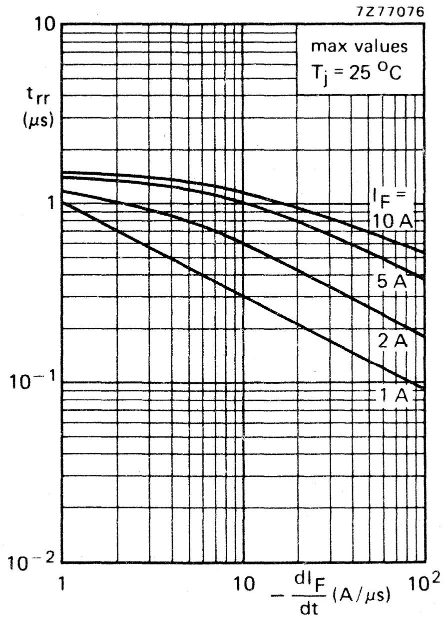
I_F = forward current just before switching off; T_j = 150 °C

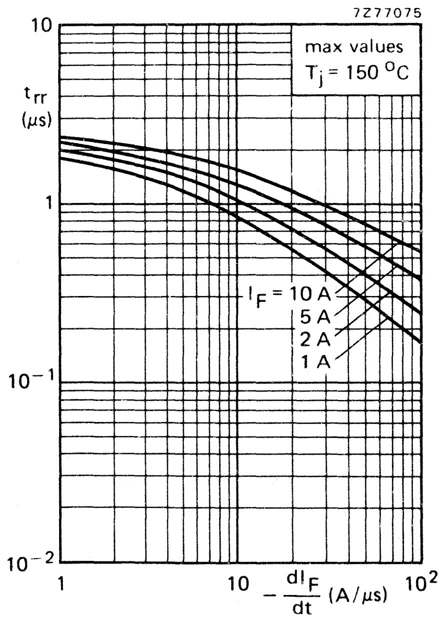


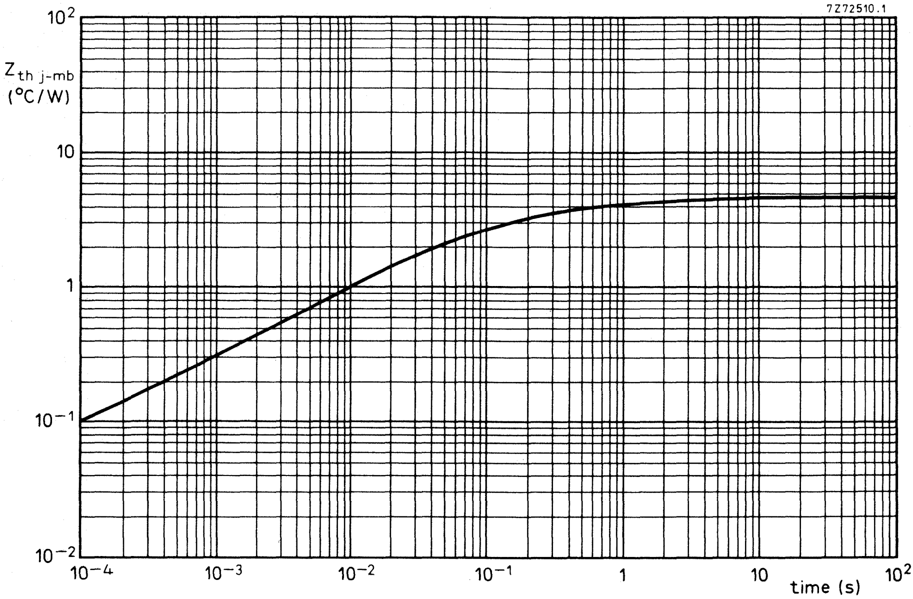

7Z77078
I_F
$\frac{dI_F}{dt}$
I_R
Q_s
$T_j = 25\ ^oC$
max values
Q_s (μC)
I_F =
10 A
5 A
2 A
1 A
10
1
10^{-1}
10^{-1}
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)


7Z77079
I_F
$-\frac{dI_F}{dt}$
I_R
Q_s
$T_j = 150\ ^oC$
max values
Q_s (μC)
I_F =
10 A
5 A
2 A
1 A
10
1
10^{-1}
10^{-1}
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)


7Z77083
max value
$T_j = 25\ ^oC$
10^2
V_{fr}
(V)
10
1
10^{-1}
1
10
$\frac{dI_F}{dt}$ (A/μs)
10^2


7Z77076
max values
$T_j = 25\ ^oC$
10
t_{rr}
(μs)
1
10^{-1}
10^{-2}
$I_F =$
10 A
5 A
2 A
1 A
1
10
$-\frac{dI_F}{dt}$ (A/μs)
10^2


7Z77075
max values
$T_j = 150\ ^oC$
10
t_{rr}
(μs)
1
10^{-1}
10^{-2}
$I_F = 10$ A
5 A
2 A
1 A
1
10
$-\frac{dI_F}{dt}$ (A/μs)
10^2


7Z72510.1
10^2
$Z_{th\ j\text{-}mb}$
(°C/W)
10
1
10^{-1}
10^{-2}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
time (s)

VERY FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency, eutectically-bonded rectifier diodes in plastic envelopes, featuring low forward voltage drop, very fast reverse recovery times, very low stored charge and non-snap-off. They are intended for use in switched-mode power supplies, and high-frequency circuits in general, where low conduction and switching losses are essential. The series consists of normal polarity (cathode to mounting base) types.

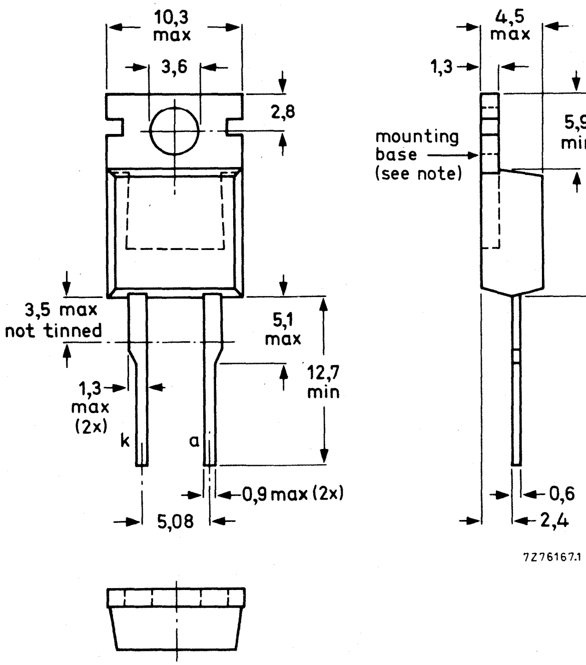
QUICK REFERENCE DATA

			BYW29–50	100	150	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	V
Average forward current	$I_{F(AV)}$	max.		7		A
Forward voltage	V_F	<		0,85		V
Reverse recovery time	t_{rr}	<		35		ns

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Note: The exposed metal mounting base is directly connected to the cathode.

Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages*			BYW29–50	100	150	
Non-repetitive peak reverse voltage	V_{RSM}	max.	50	100	150	V
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	V
Crest working reverse voltage	V_{RWM}	max.	50	100	150	V
Continuous reverse voltage	V_R	max.	50	100	150	V

Currents

Average forward current; switching losses negligible up to 500 kHz				
sinusoidal; up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	7	A
square-wave; δ = 0,5; up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	7,6	A
R.M.S. forward current	$I_{F(RMS)}$	max.	12	A
Repetitive peak forward current	I_{FRM}	max.	80	A
Non-repetitive peak forward current; t = 10 ms; half sine-wave; T_j = 150 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	80	A
I^2t for fusing (t = 10 ms)	I^2t	max.	32	A^2s

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

* To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant 16$ °C/W (continuous reverse voltage).

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2,7 °C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,26 °C/W

Influence of mounting method

1. Heatsink mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,3 °C/W
b. with heatsink compound and 0,06 mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1,4 °C/W
c. with heatsink compound and 0,1 mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2,2 °C/W
d. with heatsink compound and 0,25 mm maximum alumina insulator (56367)	$R_{th\ mb\text{-}h}$	=	0,8 °C/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1,4 °C/W

2. Free-air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-point.
Thermal resistance from junction to ambient in free air:
mounted on a printed-circuit board at a = any lead length and with copper laminate — $R_{th\ j\text{-}a}$ = 60 °C/W

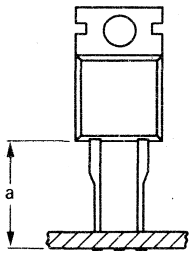


Fig. 2.

CHARACTERISTICS

Forward voltage			
I_F = 5 A; T_j = 100 °C	V_F	<	0,85 V*
I_F = 20 A; T_j = 25 °C	V_F	<	1,3 V*
Reverse current			
$V_R = V_{RWMmax}$; T_j = 100 °C	I_R	<	0,6 mA
Reverse recovery when switched from			
I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 50 A/µs; T_j = 25 °C			
Recovery time	t_{rr}	<	35 ns
I_F = 2 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/µs; T_j = 25 °C			
Recovered charge	Q_s	<	15 nC
Recovery time	t_{rr}	<	50 ns
Forward recovery when switched to I_F = 1 A with dI_F/dt = 10 A/µs			
Recovery voltage	V_{fr}	typ.	1,0 V

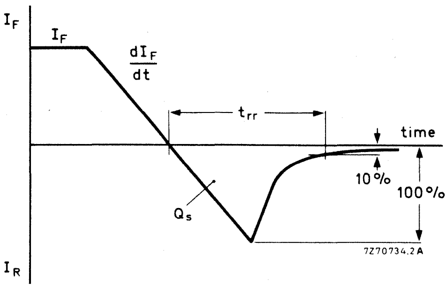


Fig. 3 Definitions of t_{rr} and Q_s.

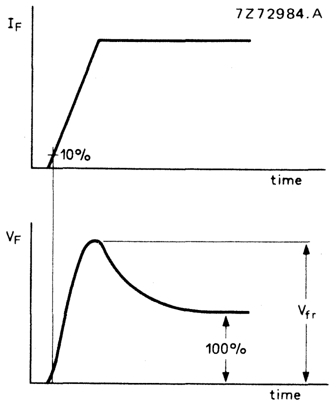


Fig. 4 Definition of V_{fr}.

* Measured under pulse conditions to avoid excessive dissipation.

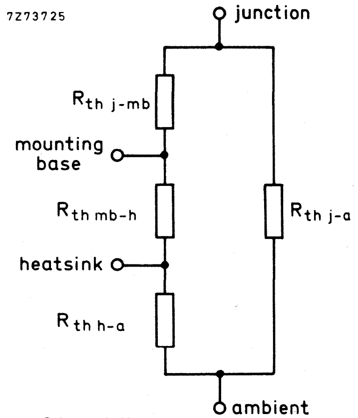
MOUNTING INSTRUCTIONS

1. The device may be soldered directly into the circuit, but the maximum permissible temperature of the soldering iron or bath is 275 °C; it must not be in contact with the joint for more than 5 seconds. Soldered joints must be at least 4,7 mm from the seal.
2. The leads should not be bent less than 2,4 mm from the seal, and should be supported during bending.
3. It is recommended that the circuit connection be made to the cathode tag, rather than direct to the heatsink.
4. Mounting by means of a spring clip is the best mounting method because it offers:
   a. a good thermal contact under the crystal area and slightly lower $R_{th\ mb\text{-}h}$ values than screw mounting.
   b. safe isolation for mains operation.
   However, if a screw is used, it should be M3 cross-recess pan head. Care should be taken to avoid damage to the plastic body.
5. For good thermal contact heatsink compound should be used between base-plate and heatsink. Values of $R_{th\ mb\text{-}h}$ given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
6. The device should not be pop-rivetted to the heatsink. However, it is permissible to press-rivet providing that rivets of soft material are used, and the press forces are slowly and carefully controlled so as to avoid shock and deformation of either heatsink or mounting tab.

OPERATING NOTES

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated below:



b. The method of using Figs 5 and 6 is as follows:
   Starting with the required current on the $I_{F(AV)}$ axis, trace upwards to meet the appropriate form factor or duty factor curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can now be calculated from:

   $$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

c. Any measurement of heatsink temperature should be made immediately adjacent to the device.

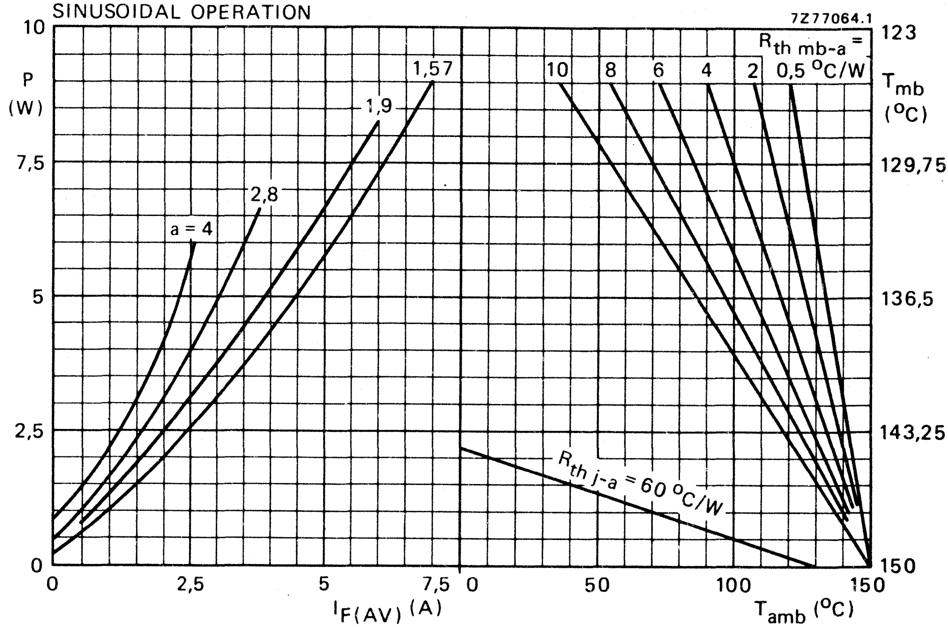


Fig. 5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses and switching losses up to f = 500 kHz.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

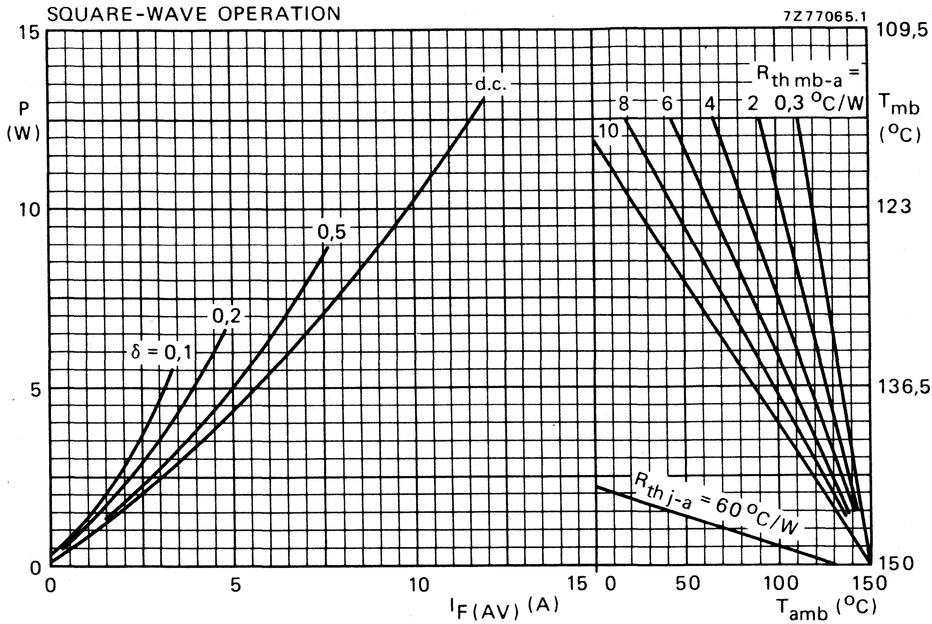
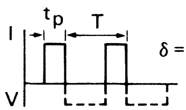


Fig. 6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses and switching losses up to f = 500 kHz.



$$\delta = \frac{t_p}{T}$$

$$I_{F(AV)} = I_{F(RMS)} \times \sqrt{\delta}$$

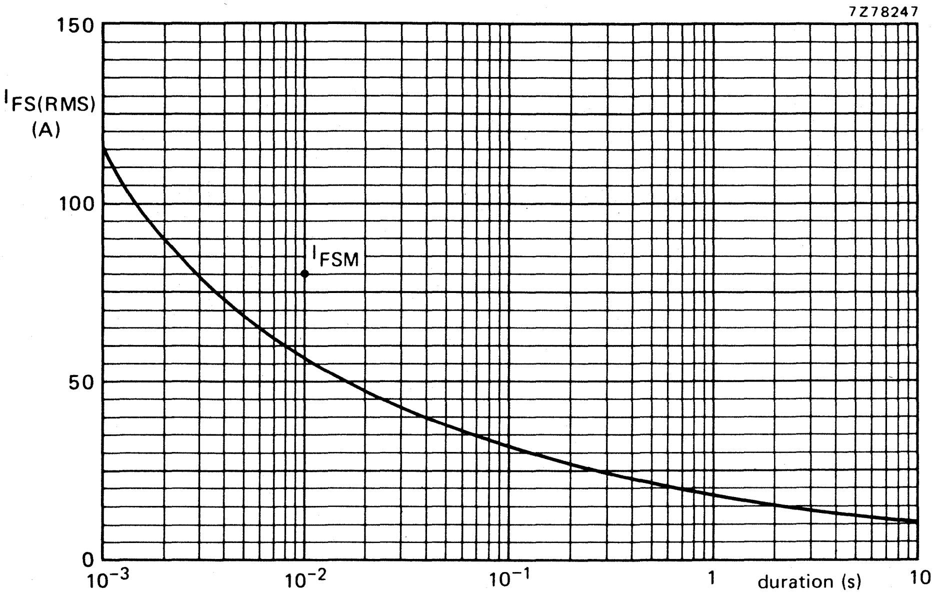
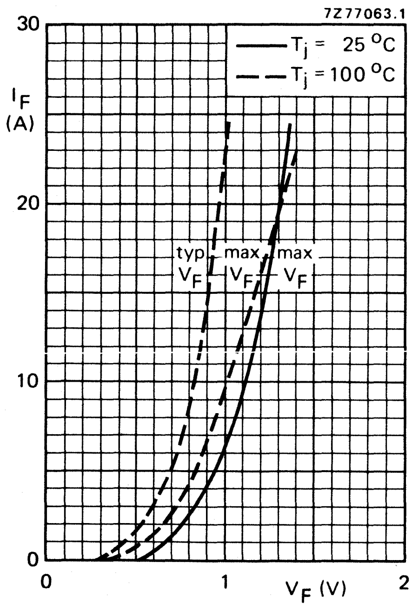


Fig. 7 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge; with reapplied V_{RWMmax}.



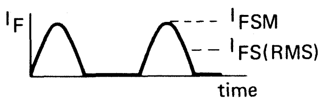


Fig. 8.

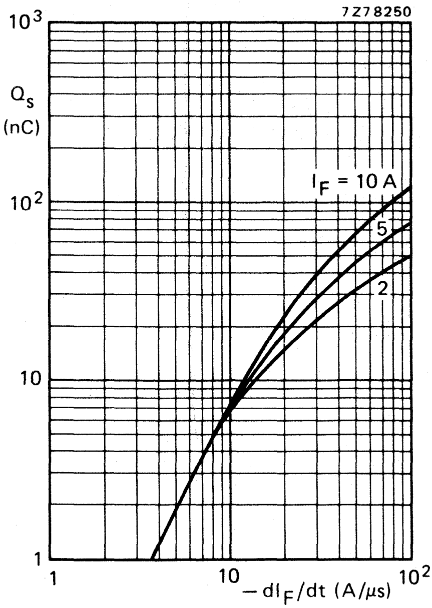


Fig. 9 T_j = 25 °C; maximum values.

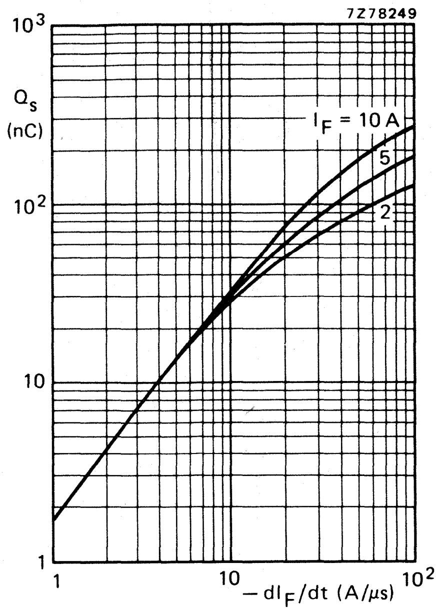
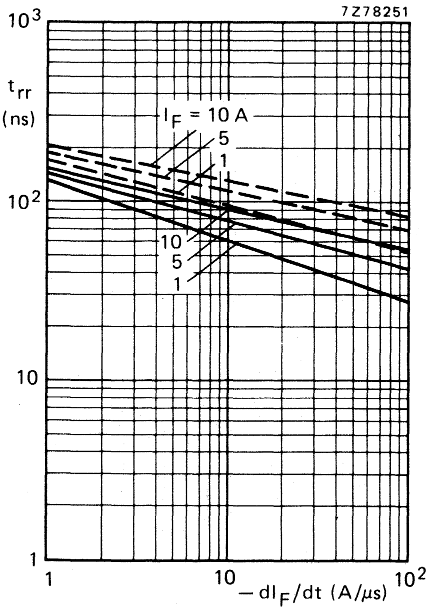
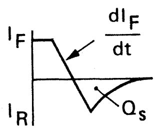


Fig. 10 T_j = 100 °C; maximum values.





Definition of Q_s in Figs 9 and 10.

Fig. 11 Maximum values; ——— T_j = 25 °C; - - - - T_j = 100 °C.

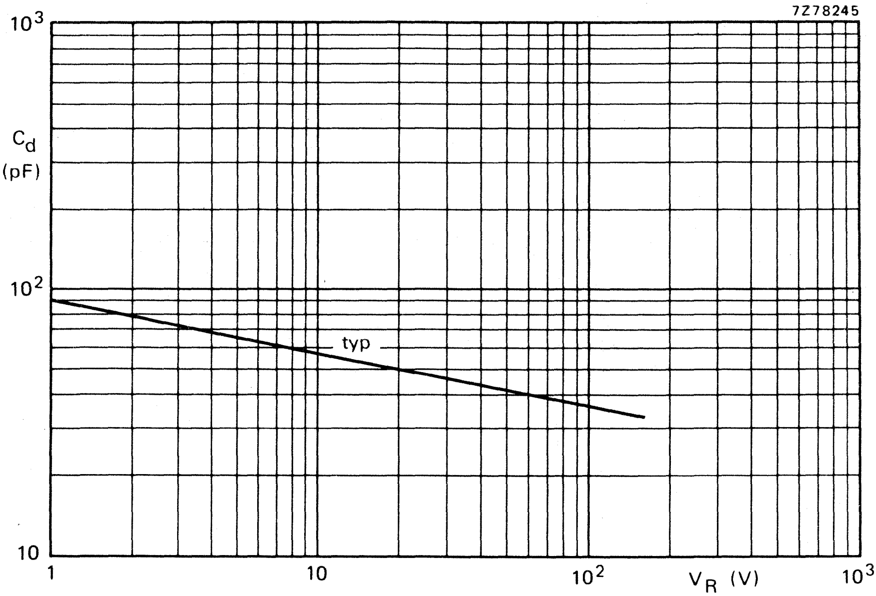


Fig. 12 f = 1 MHz; T_j = 25 °C.

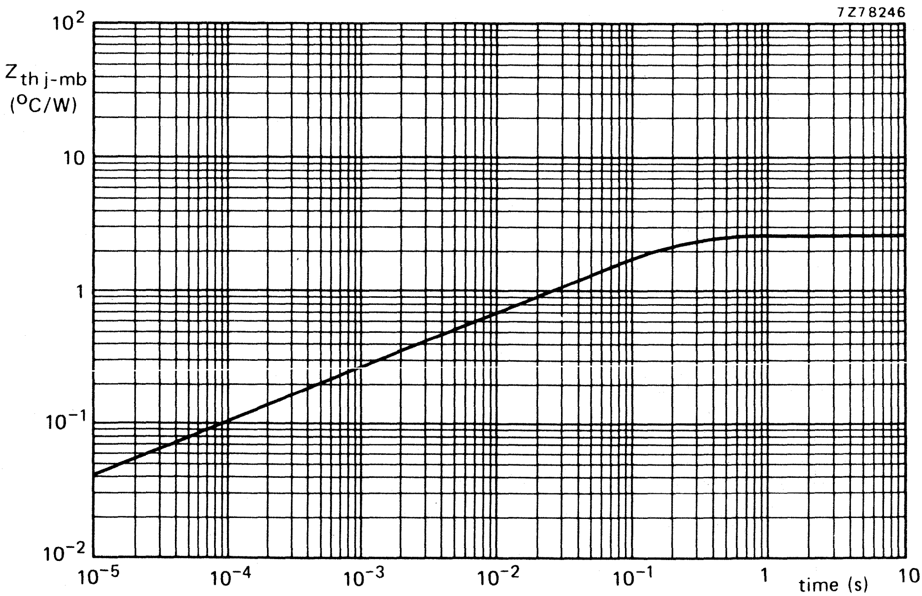


Fig. 13.

VERY FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency rectifier diodes in DO-4 metal envelopes, featuring low forward voltage drop, very fast reverse recovery times, very low stored charge and non-snap-off. They are intended for use in switched-mode power supplies, and high-frequency circuits in general, where low conduction and switching losses are essential. The series consists of normal polarity (cathode to stud) types.

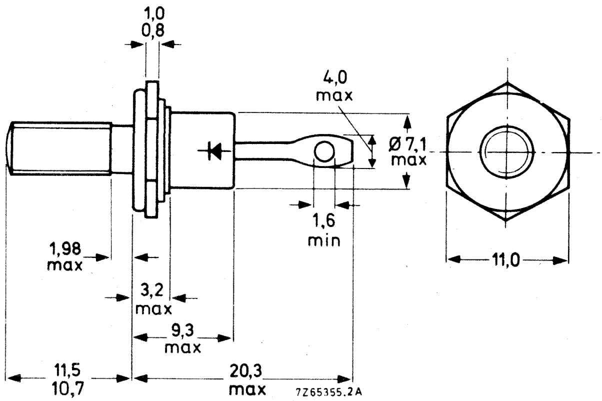
QUICK REFERENCE DATA

			BYW30–50	100	150	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	V
Average forward current	$I_{F(AV)}$	max.		12		A
Forward voltage	V_F	<		0,85		V
Reverse recovery time	t_{rr}	<		35		ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-4: with metric M5 stud (ϕ5 mm); e.g. BYW30-50.
with 10-32 UNF stud (ϕ4,83 mm); e.g. BYW30-50U.



Net mass: 6 g

Diameter of clearance hole: max. 5,2 mm

Accessories supplied on request: 56295
(PTFE bush, 2 mica washers, plain washer, tag)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats; M5: 8,0 mm
10-32 UNF: 9,5 mm

Torque on nut: min. 0,9 Nm (9 kg cm)
max. 1,7 Nm (17 kg cm)

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages*			BYW30-50	100	150	
Non-repetitive peak reverse voltage	V_{RSM}	max.	50	100	150	V
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	V
Crest working reverse voltage	V_{RWM}	max.	50	100	150	V
Continuous reverse voltage	V_R	max.	50	100	150	V

Currents

Average forward current; switching losses negligible up to 500 kHz				
sinusoidal; up to T_{mb} = 120 °C	$I_{F(AV)}$	max.	12	A
sinusoidal; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	10	A
square-wave; δ = 0,5; up to T_{mb} = 114 °C	$I_{F(AV)}$	max.	14	A
square-wave; δ = 0,5; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	10	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current	I_{FRM}	max.	200	A
Non-repetitive peak forward current t = 10 ms; half sine-wave; T_j = 150 °C prior to surge with reapplied V_{RWMmax}	I_{FSM}	max.	200	A
I^2t for fusing (t = 10 ms)	I^2t	max.	200	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2,2	°C/W
From mounting base to heatsink				
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
b. without heatsink compound	$R_{th\ mb\text{-}h}$	=	0,6	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,3	°C/W

MOUNTING INSTRUCTIONS

The top connector should neither be bent nor twisted; 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.

* To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant 8{,}2$ °C/W (continuous reverse voltage).

CHARACTERISTICS

Forward voltage				
I_F = 10 A; T_j = 100 °C	V_F	<	0,85	V*
I_F = 50 A; T_j = 25 °C	V_F	<	1,3	V*
Reverse current				
$V_R = V_{RWMmax}$; T_j = 100 °C	I_R	<	1,3	mA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/µs; T_j = 25 °C				
Recovery time	t_{rr}	<	**35**	**ns**
I_F = 2 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/µs; T_j = 25 °C				
Recovery charge	Q_s	<	15	nC
Recovery time	t_{rr}	<	50	ns
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/µs	V_{fr}	typ.	1,0	V

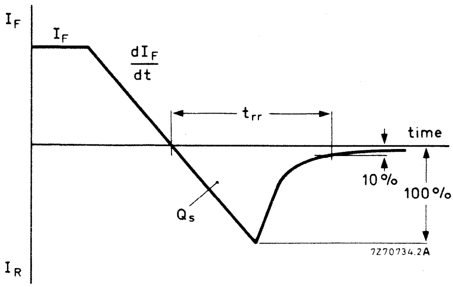


Fig. 2 Definitions of t_{rr} and Q_s.

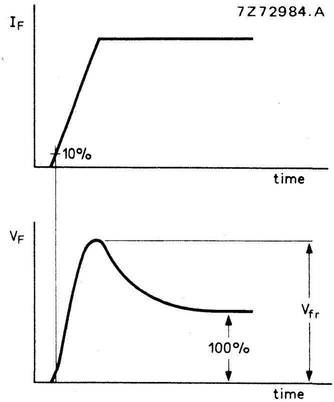


Fig. 3 Definition of V_{fr}.

* Measured under pulse conditions to avoid excessive dissipation.

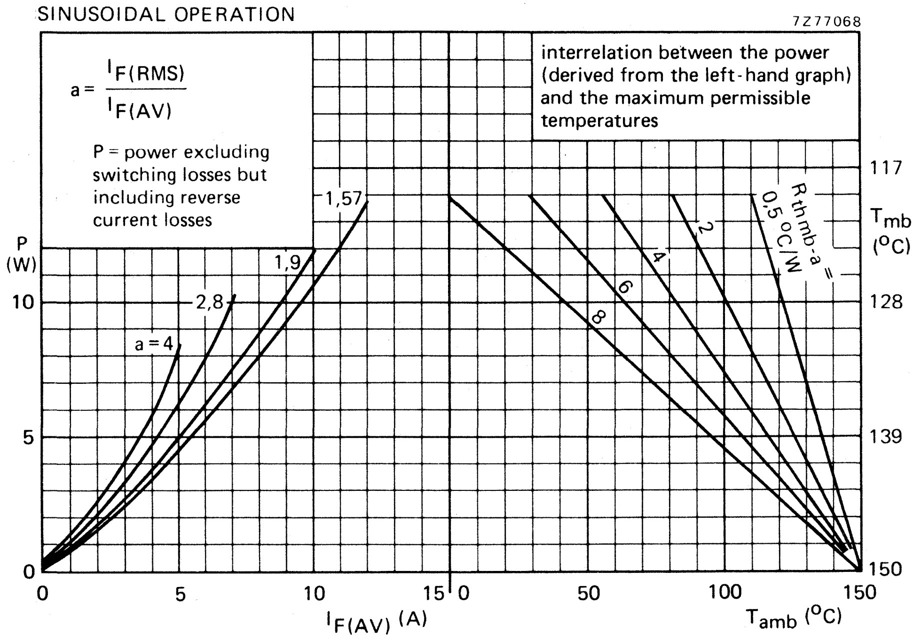

SINUSOIDAL OPERATION
7Z77068
a = I_F(RMS) / I_F(AV)
P = power excluding switching losses but including reverse current losses
interrelation between the power (derived from the left-hand graph) and the maximum permissible temperatures
P (W)
0
5
10
a = 4
2,8
1,9
1,57
0
5
10
15
I_F(AV) (A)
0
50
100
150
T_amb (°C)
R_thmb-a = 0,5 °C/W
2
4
6
8
117
T_mb (°C)
128
139
150

Fig. 4.

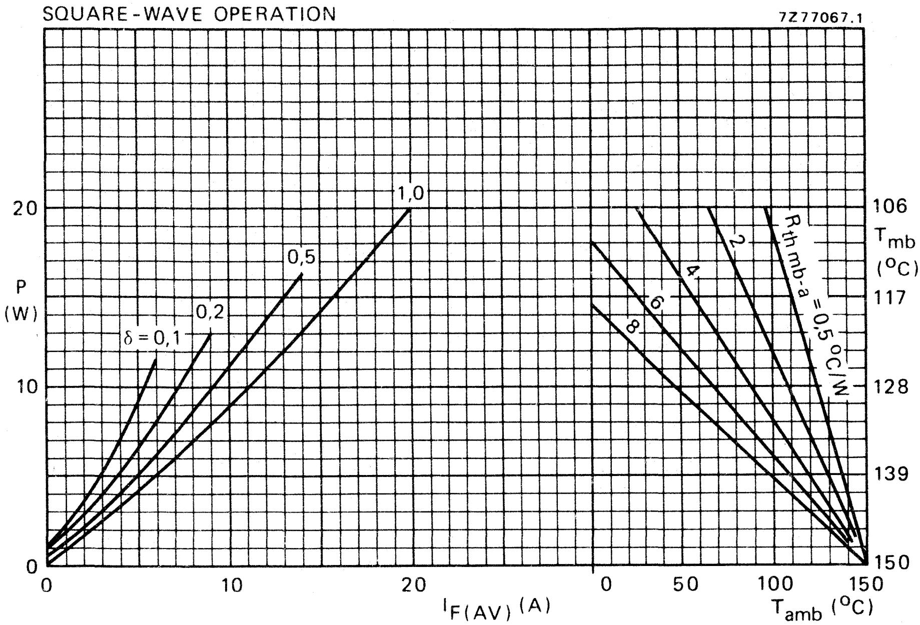
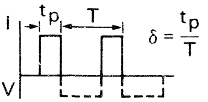


Fig. 5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses and switching losses up to f = 500 kHz.



$I_{F(AV)} = I_{F(RMS)} \times \sqrt{\delta}$

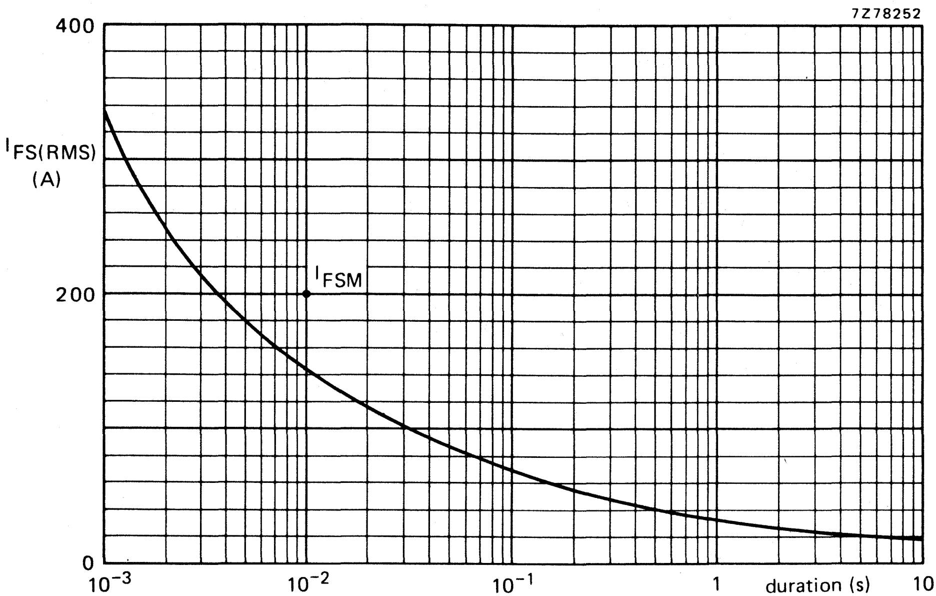
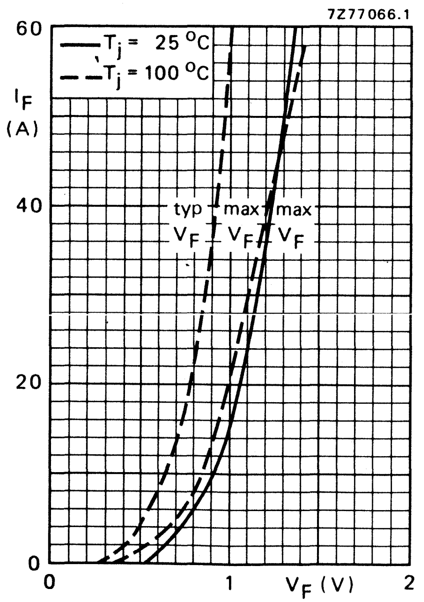


Fig. 6 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge; with reapplied V_{RWMmax}.



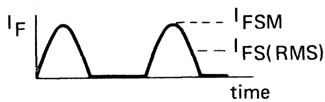


Fig. 7.

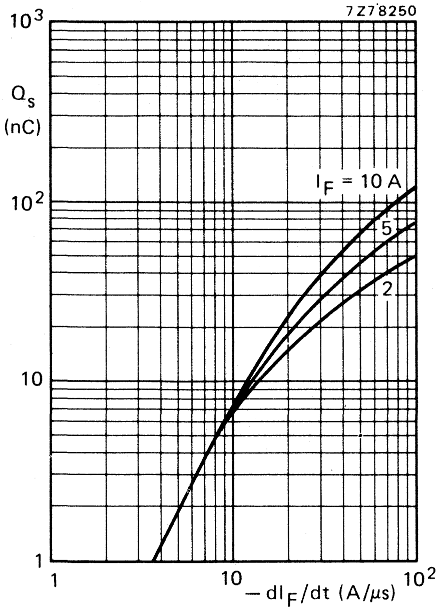


Fig. 8 T_j = 25 °C; maximum values.

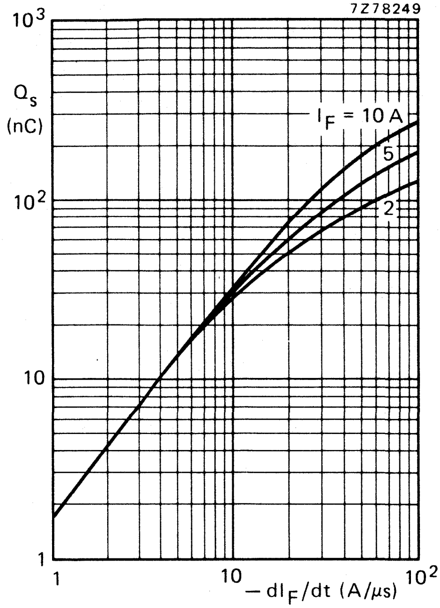
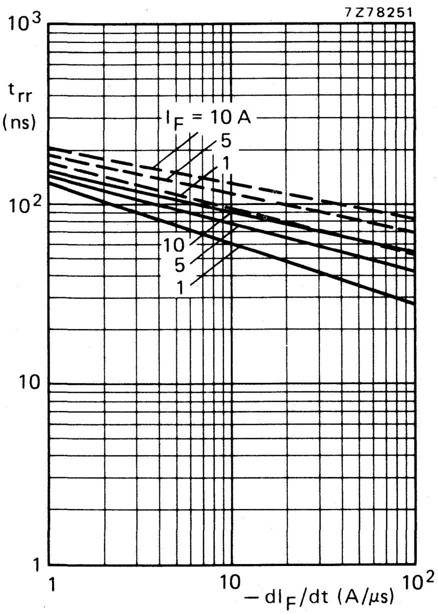
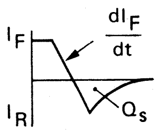


Fig. 9 T_j = 100 °C; maximum values.





Definition of Q_s in Figs 8 and 9.

Fig. 10 Maximum values; —— T_j = 25 °C; – – – T_j = 100 °C.

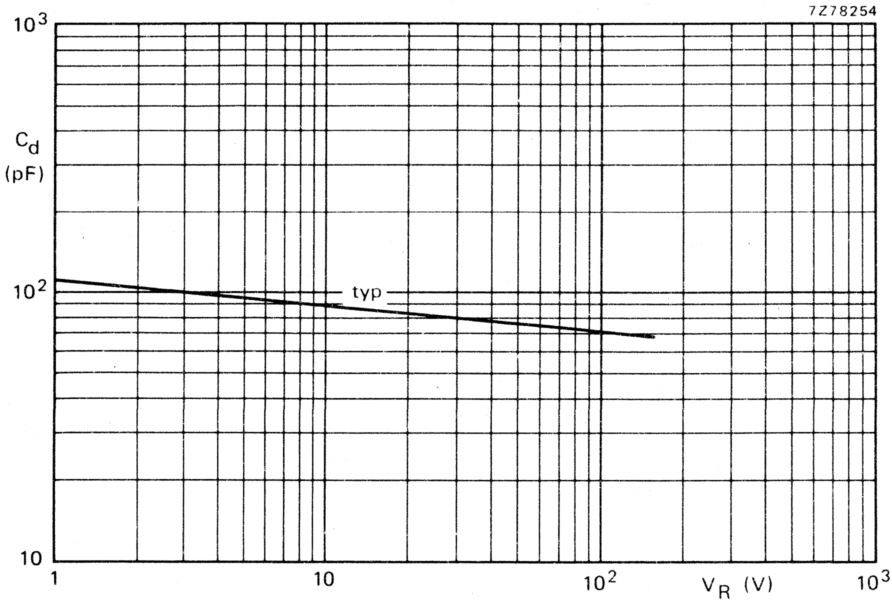


Fig. 11 f = 1 MHz; T_j = 25 ^oC.

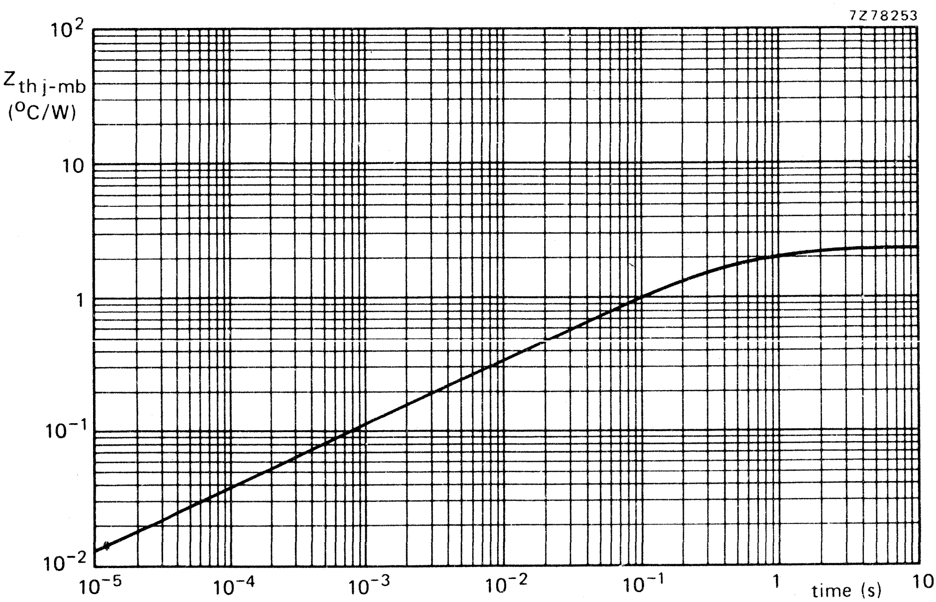


Fig. 12.

VERY FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency rectifier diodes in DO-4 metal envelopes, featuring low forward voltage drop, very fast reverse recovery times, very low stored charge and non-snap-off. They are intended for use in switched-mode power supplies, and high frequency circuits in general, where low conduction and switching losses are essential. The series consists of normal polarity (cathode to stud) types.

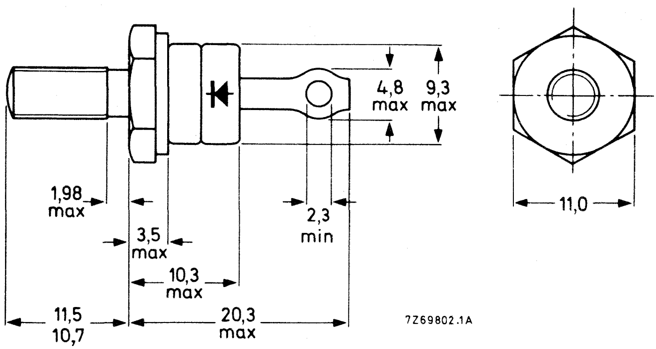
QUICK REFERENCE DATA

			BYW31–50	100	150	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	V
Average forward current	$I_{F(AV)}$	max.		25		A
Forward voltage	V_F	<		0,85		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-4: with metric M5 stud (ϕ5 mm); e.g. BYW31-50.
with 10-32 UNF stud (ϕ4,83 mm); e.g. BYW31-50U.



Net mass: 7 g

Diameter of clearance hole: max. 5,2 mm

Accessories supplied on request: 56295
(PTFE bush, 2 mica washers, plain washer, tag)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats; M5: 8,0 mm
10-32 UNF: 9,5 mm

Torque on nut: min. 0,9 (9 kg cm)
max. 1,7 (17 kg cm)

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages *

			BYW31–50	100	150	
Non-repetitive peak reverse voltage	V_{RSM}	max.	50	100	150	V
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	V
Crest working reverse voltage	V_{RWM}	max.	50	100	150	V
Continuous reverse voltage	V_R	max.	50	100	150	V

Currents

Average forward current; switching losses negligible up to 500 kHz				
sinusoidal; up to T_{mb} = 120 °C	$I_{F(AV)}$	max.	25	A
sinusoidal; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	23	A
square-wave; δ = 0,5; up to T_{mb} = 119 °C	$I_{F(AV)}$	max.	28	A
square-wave; δ = 0,5; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	23	A
R.M.S. forward current	$I_{F(RMS)}$	max.	40	A
Repetitive peak forward current	I_{FRM}	max.	320	A
Non-repetitive peak forward current t = 10 ms; half sine-wave; T_j = 150 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	320	A
I^2t for fusing (t = 10 ms)	I^2t	max.	500	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,0	°C/W
From mounting base to heatsink				
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,3	°C/W
b. without heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
Transient thermal impedance: t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,2	°C/W

MOUNTING INSTRUCTIONS

The top connector should neither be bent nor twisted; 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.

* To ensure thermal stability: $R_{th\ j\text{-}a} \leq 6$ °C/W (continuous reverse voltage).

CHARACTERISTICS

Forward voltage			
I_F = 20 A; T_j = 100 °C	V_F	<	0,85 V*
I_F = 100 A; T_j = 25 °C	V_F	<	1,3 V*
Reverse current			
$V_R = V_{RWMmax}$; T_j = 100 °C	I_R	<	2,5 mA
Reverse recovery when switched from			
I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 25 °C			
Recovery time	t_{rr}	<	50 ns
I_F = 2 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C			
Recovered charge	Q_s	<	20 nC
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs			
Recovery voltage	V_{fr}	typ.	1,0 V

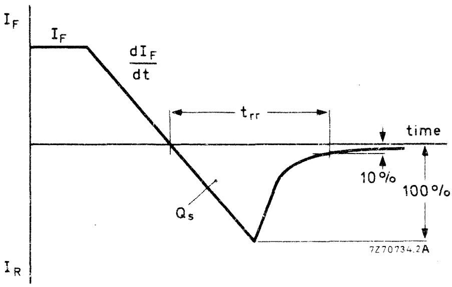


Fig. 2 Definitions of t_{rr} and Q_s.

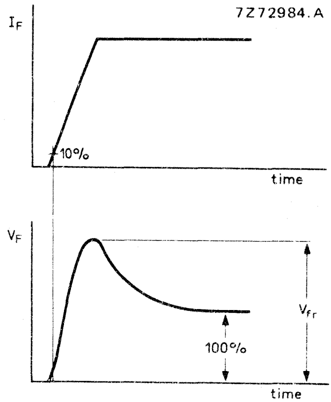


Fig. 3 Definition of V_{fr}.

* Measured under pulse conditions to avoid excessive dissipation.

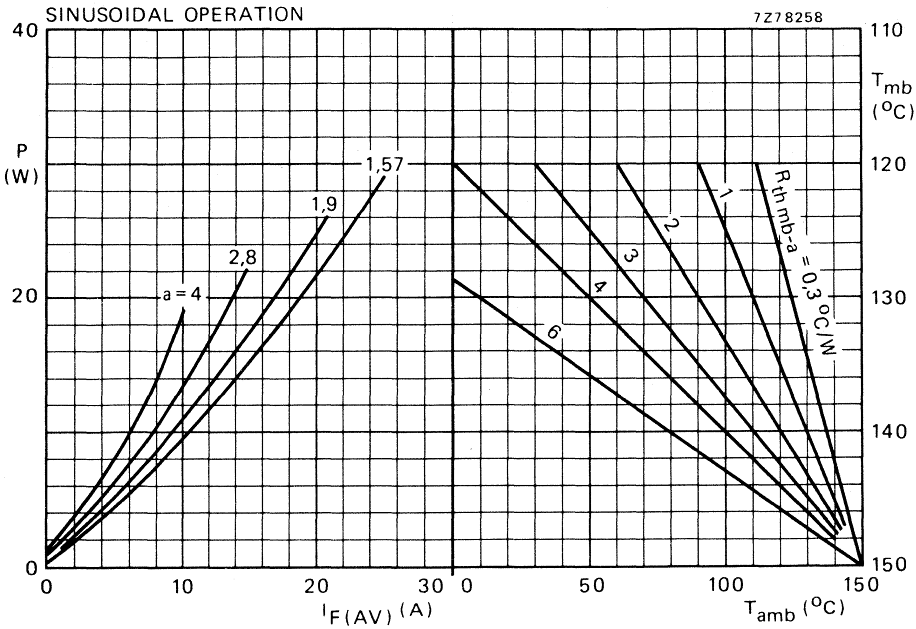


Fig. 4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses and switching losses up to f = 500 kHz.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

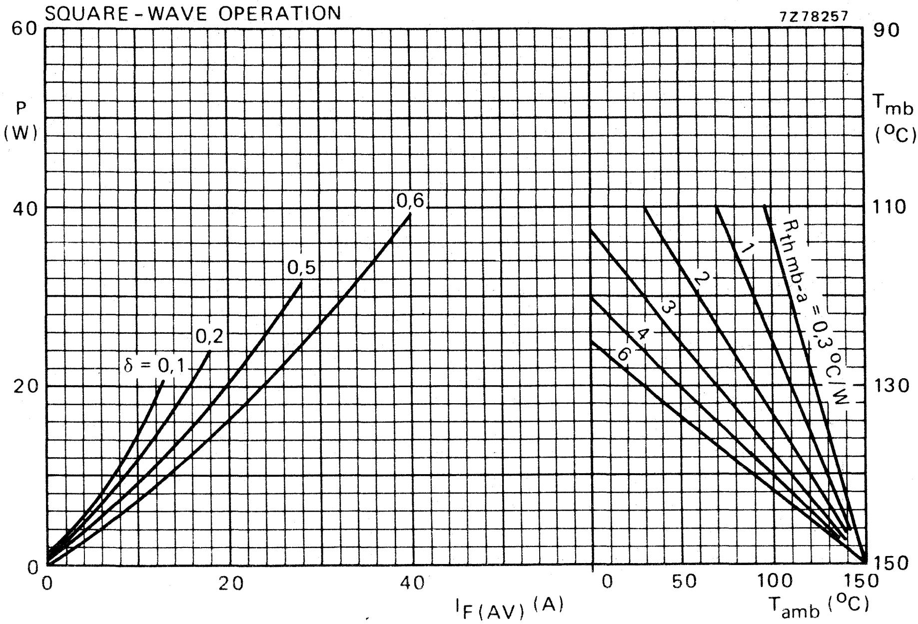
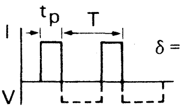


Fig. 5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses and switching losses up to f = 500 kHz.



$$\delta = \frac{t_p}{T}$$

$$I_{F(AV)} = I_{F(RMS)} \times \sqrt{\delta}$$

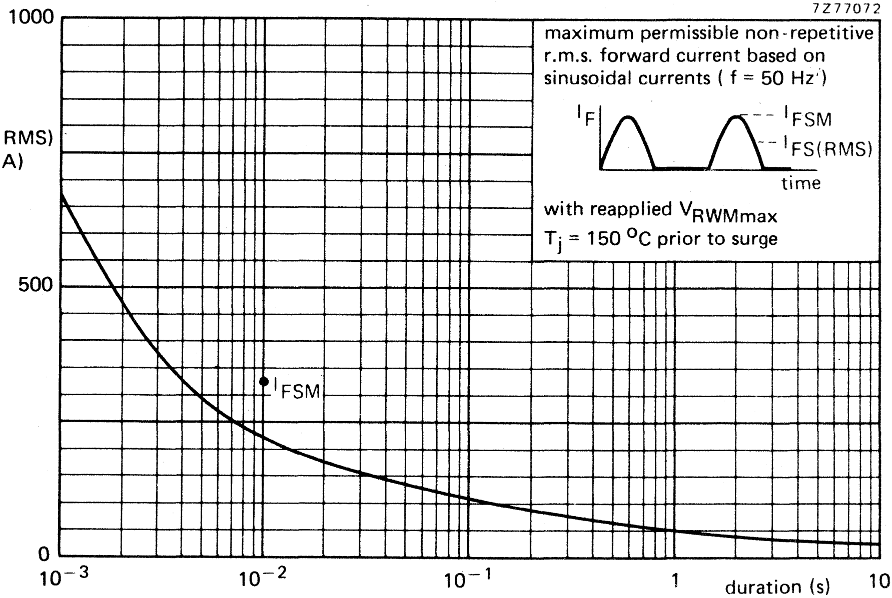


Fig. 6.

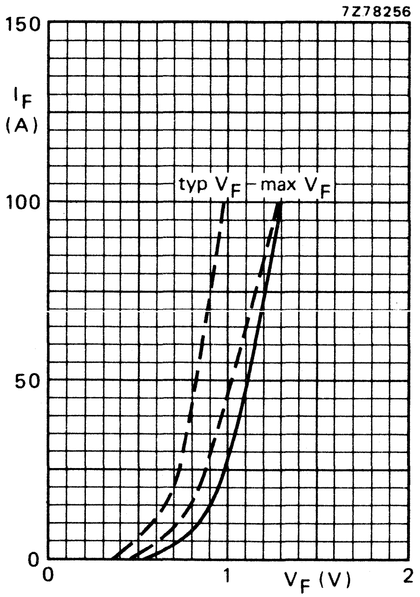


Fig. 7 ——— T_j = 25 °C; – – – T_j = 100 °C.

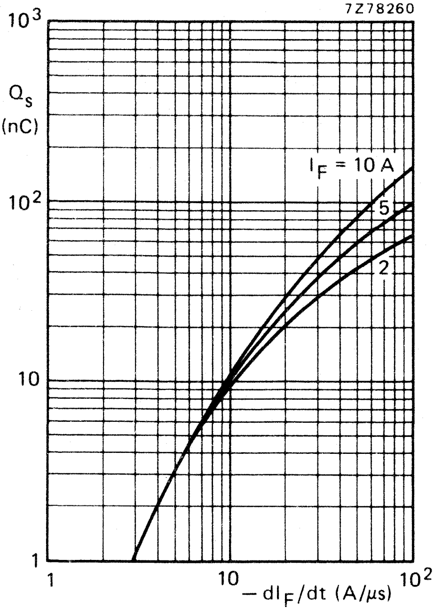


Fig. 8 T_j = 25 °C; maximum values.

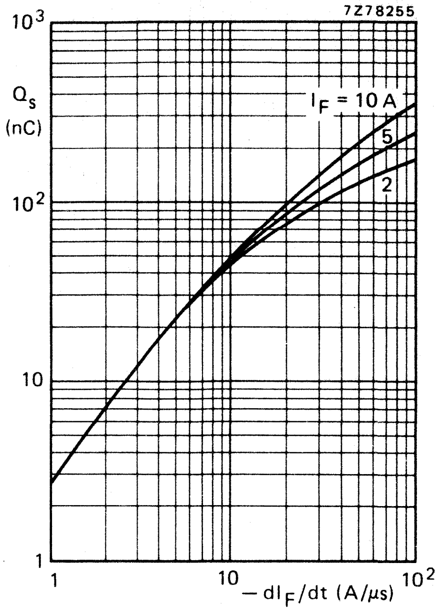
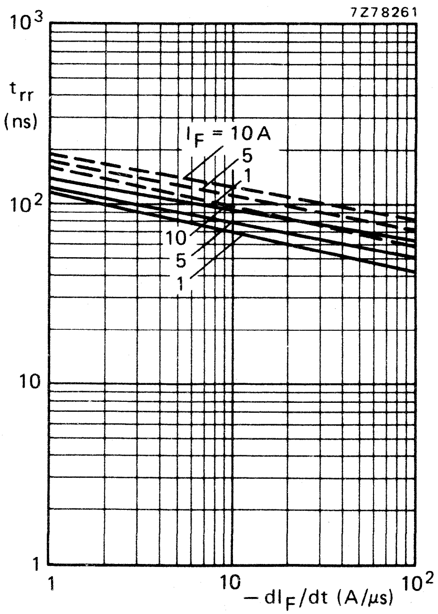
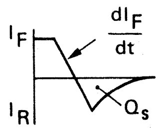


Fig. 9 T_j = 100 °C; maximum values.





Definition of Q_s in Figs 8 and 9.

Fig. 10 Maximum values; ——— T_j = 25 °C; ---- T_j = 100 °C.

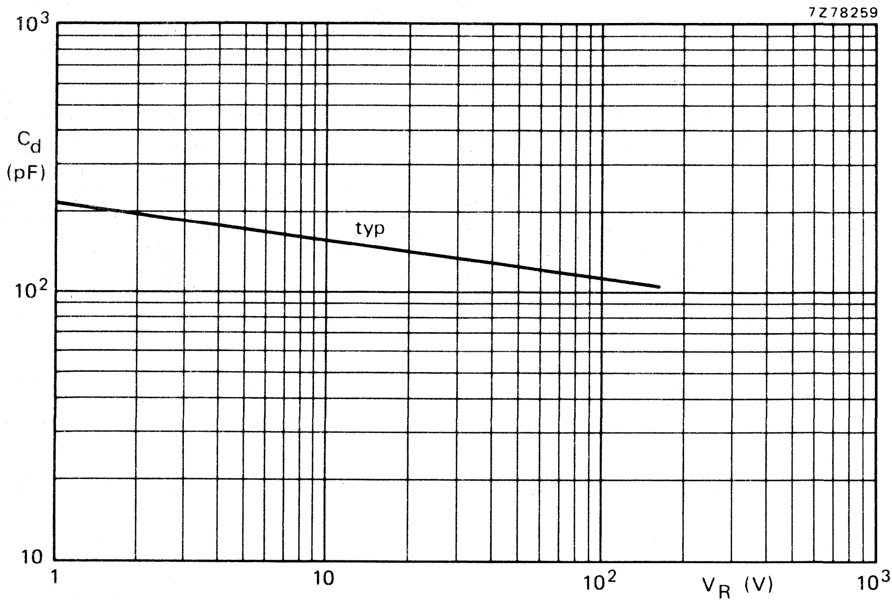


Fig. 11 f = 1 MHz; T_j = 25 °C.

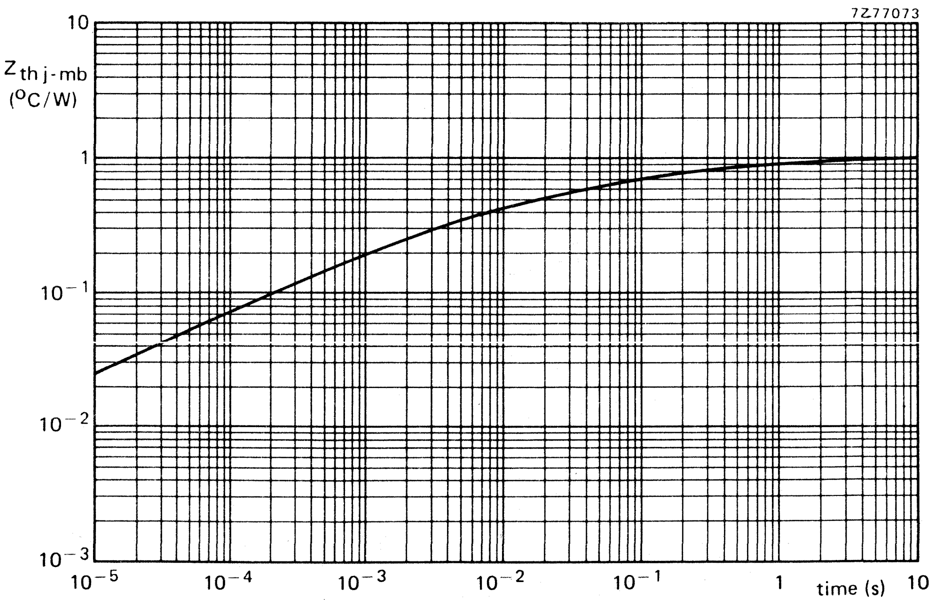


Fig. 12.

CONTROLLED AVALANCHE RECTIFIER DIODES

Double-diffused solid-glass passivated rectifier diodes in hermetically sealed axial-leaded glass envelopes, capable of absorbing reverse transients.

They are intended for rectifier applications in colour television circuits as well as general purpose applications in telephony equipment.

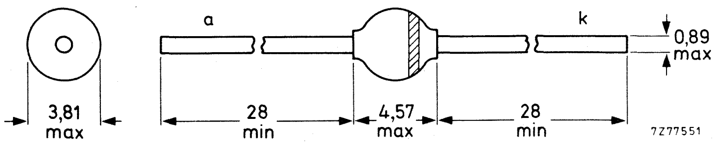
QUICK REFERENCE DATA

			BYW54	BYW55	BYW56	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	650	900	1100	V
		<	1000	1300	1600	V
Average forward current	$I_{F(AV)}$	max.	2	2	2	A
Non-repetitive peak forward current	I_{FSM}	max.		50		A
Non-repetitive peak reverse power dissipation	P_{RSM}	max.		1		kW
Junction temperature	T_j	max.		165		°C

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-57.



The marking band indicates the cathode.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BYW54	BYW55	BYW56	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	V
Continuous reverse voltage *	V_R	max.	600	800	1000	V
Average forward current (averaged over any 20 ms period); T_{lead} = 25 °C; $R_{th\ j\text{-}tp}$ = 50 °C/W (mounting method 1)	$I_{F(AV)}$	max.		2		A
T_{amb} = 75 °C; $R_{th\ j\text{-}a}$ = 100 °C/W (mounting method 3)	$I_{F(AV)}$	max.		0,8		A
Repetitive peak forward current	I_{FRM}	max.		12		A
Non-repetitive peak forward current ** (t = 10 ms; half sine-wave) $T_j = T_{j\,max}$ prior to surge; V_R = 0	I_{FSM}	max.		50		A
Non-repetitive peak reverse power dissipation (t = 20 μs; half sine-wave); $T_j = T_{j\,max}$ prior to surge	P_{RSM}	max.		1		kW
Non-repetitive peak reverse avalanche mode pulse energy; I_R = 1 A; $T_j = T_{j\,max}$ prior to surge; with inductive load switched off	E_{RSM}	max.		20		mJ
Storage temperature	T_{stg}			−65 to +175		°C
Junction temperature *	T_j	max.		165		°C

Notes

* See also Fig. 12.

** The device is capable of withstanding inrush currents when a 200 μF capacitor is connected to a 220 V mains with a series resistance of 2,4 Ω.

THERMAL RESISTANCE

Influence of mounting method

1. Thermal resistance from junction to tie-point at a lead length a = 10 mm; Fig. 2 — $R_{th\ j\text{-}tp}$ = 50 °C/W
2. Thermal resistance from junction to ambient when mounted to solder tags at a lead length a = 10 mm; Fig. 3 — $R_{th\ j\text{-}a}$ = 80 °C/W
3. Thermal resistance from junction to ambient when mounted on a 1,5 mm thick epoxy-glass printed-circuit board; Cu-thickness ≥ 40 μm; Fig. 4 — $R_{th\ j\text{-}a}$ = 100 °C/W

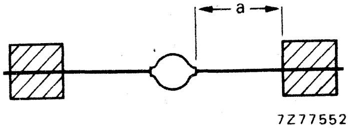


Fig. 2 Mounting method 1.

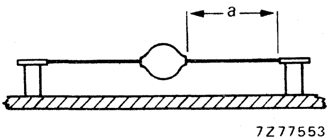


Fig. 3 Mounting method 2.

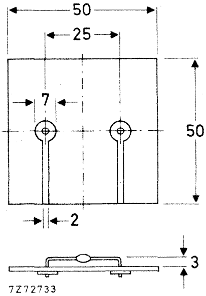


Fig. 4 Mounting method 3.

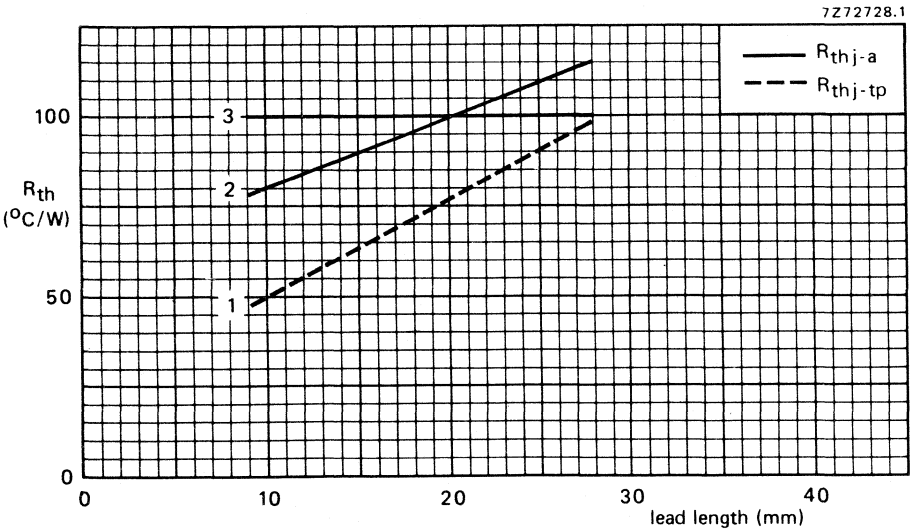


Fig. 5 Thermal resistance as a function of lead length for mounting methods 1, 2 and 3.

CHARACTERISTICS

			BYW54	BYW55	BYW56	
Forward voltage; $T_j = 25\ ^oC$ *						
$I_F = 1$ A	V_F	<	1	1	1	V
$I_F = 10$ A	V_F	<	1,65	1,65	1,65	V
Reverse avalanche breakdown voltage						
$I_R = 0,1$ mA; $T_j = 25\ ^oC$	$V_{(BR)R}$	>	650	900	1100	V
		<	1000	1300	1600	V
Reverse current						
$V_R = V_{RWM\,max}$; $T_j = 25\ ^oC$**	I_R	<		1,0		μA
$V_R = V_{RWM\,max}$; $T_j = 100\ ^oC$	I_R	<		10		μA
Reverse recovery charge when switched from $I_F = 1$ A to $V_R \geq 50$ V with $-dI_F/dt = 5$ A/μs; $T_j = 25\ ^oC$	Q_s	typ.		3		μC
Reverse recovery time when switched from $I_F = 1$ A to $V_R \geq 50$ V at $i_{rr} = 10\%$ of I_R with $-dI_F/dt = 5$ A/μs; $T_j = 25\ ^oC$	t_{rr}	typ.		2,5		μs

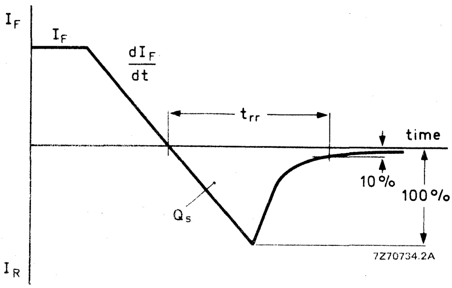


Fig. 6 Definitions of t_{rr} and Q_s.

Diode capacitance				
$V_R = 0$ V; f = 1 MHz; $T_j = 25\ ^oC$	C_d	typ.	50	pF

* Measured under pulse conditions to avoid excessive dissipation.

** Illuminance ≤ 500 lux (daylight); relative humidity < 65%.

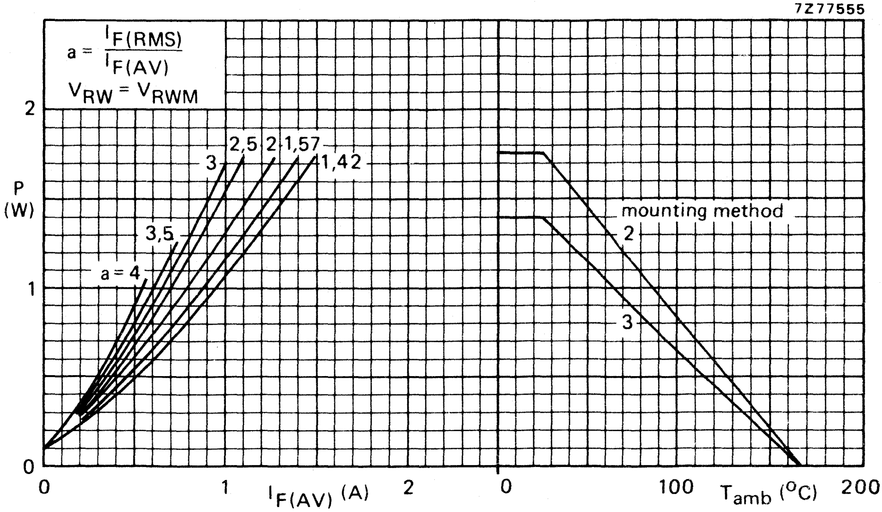


Fig. 7 Interrelation between the steady-state power dissipation excluding power in avalanche region (left-hand graph), and the maximum permissible ambient temperature (no leads of other dissipating components running to the same tie-points) in accordance with the mounting methods mentioned in Figs 3 and 4.

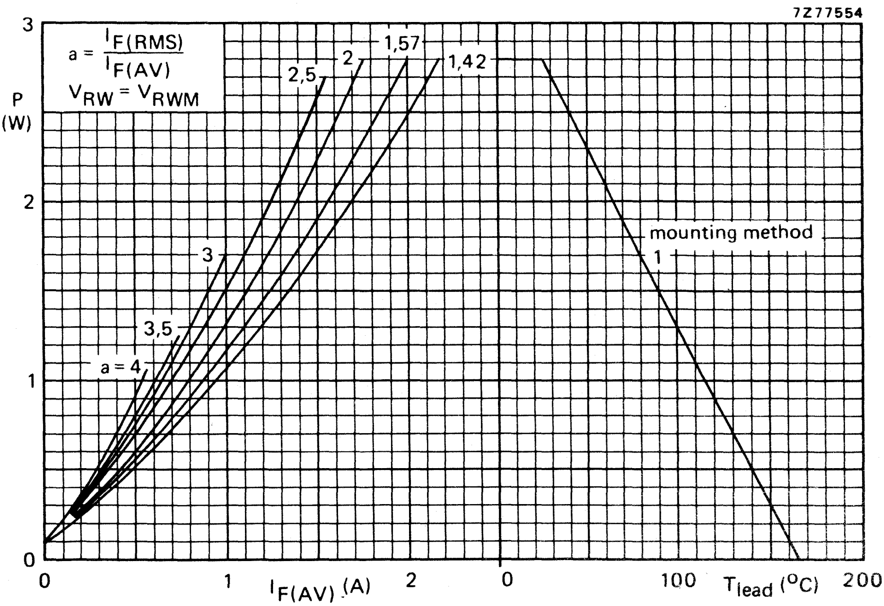


Fig. 8 Interrelation between the steady-state power dissipation excluding power in avalanche region (left-hand graph) and the maximum permissible lead temperature.

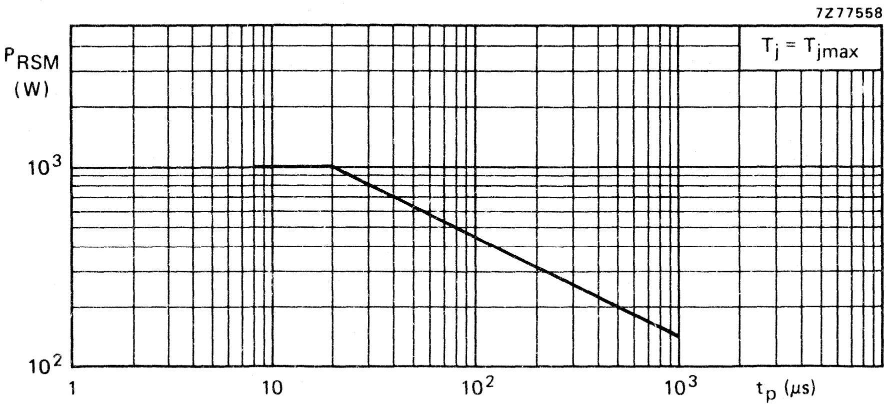
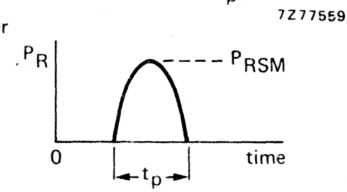


Fig. 9 Maximum permissible non-repetitive peak reverse power dissipation in the avalanche region.



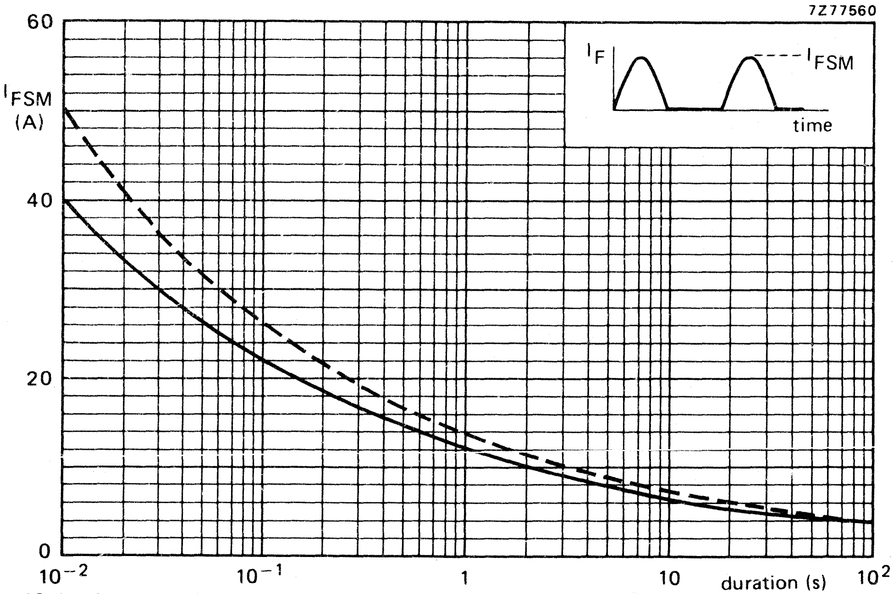


Fig. 10 Maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50 Hz).

– – – – – $T_j = T_{j\,max}$ prior to surge; $V_R = 0$

———— $T_j = 25\ ^{o}C$; $V_R = V_{RWM\,max}$

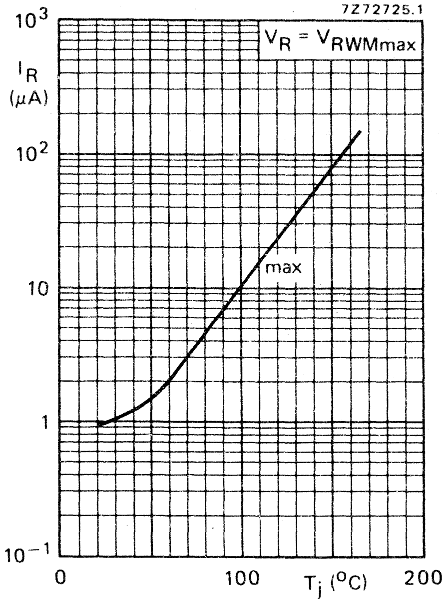


Fig. 11.

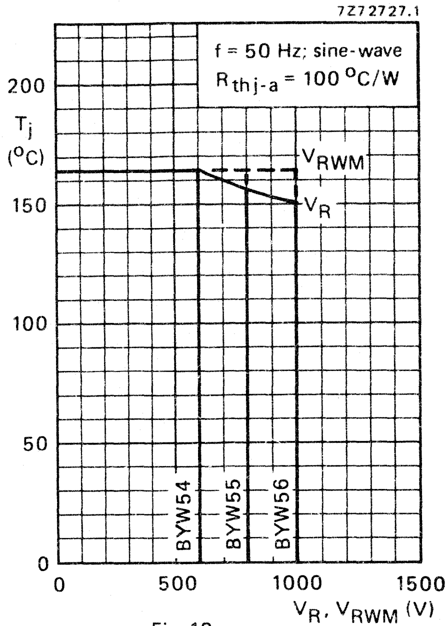


Fig. 12.

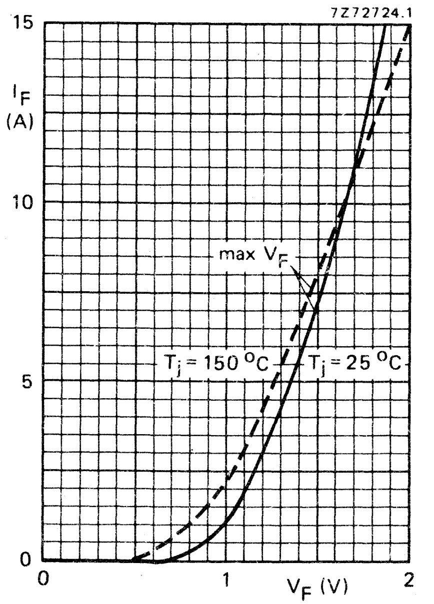


Fig. 13.

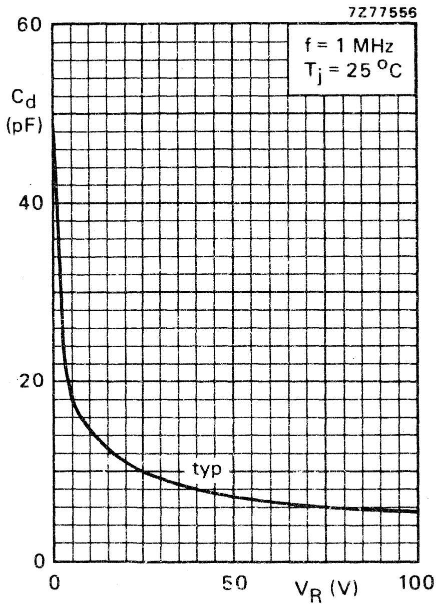


Fig. 14.

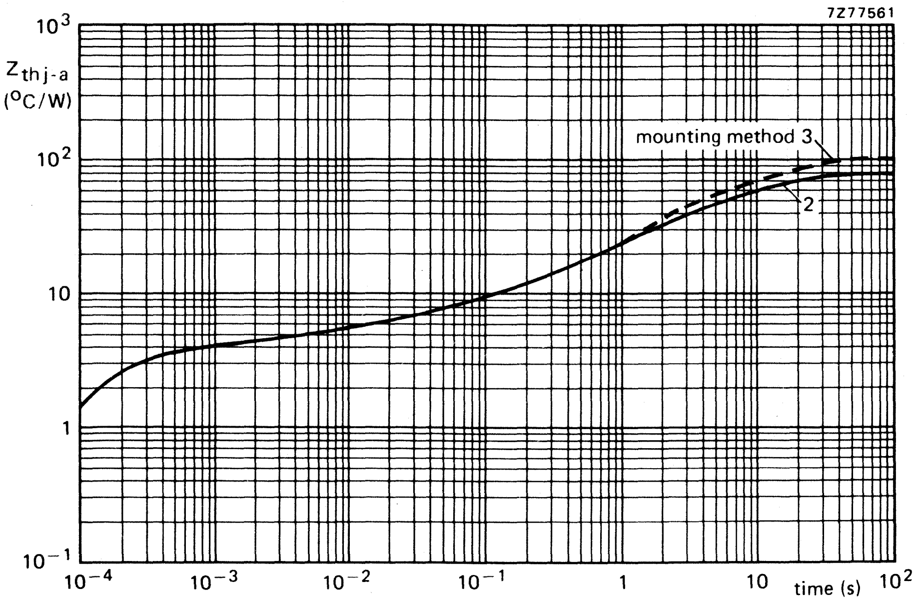

7Z77561
10^3
$Z_{th\,j\text{-}a}$ ($^oC/W$)
10^2
10
1
10^{-1}
mounting method 3
2
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
time (s)
10^2

Fig. 15.

VERY FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency rectifier diodes in DO-5 metal envelopes, featuring low forward voltage drop, very fast reverse recovery times, very low stored charge and non-snap-off. They are intended for use in switched-mode power supplies and high-frequency inverter circuits in general, where low conduction and switching losses are essential. The series consists of normal polarity (cathode-to-stud) types.

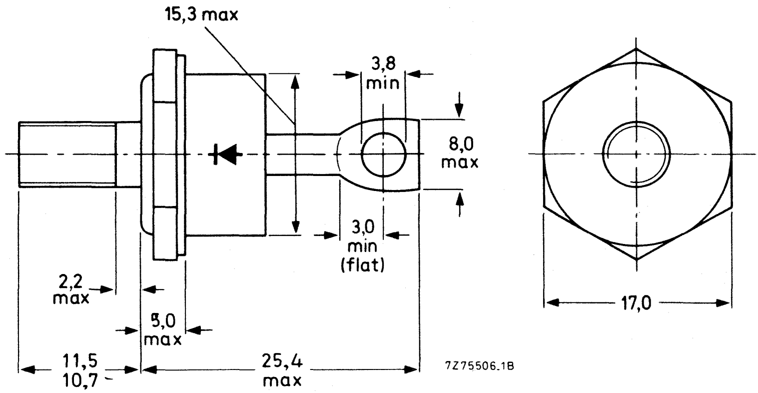
QUICK REFERENCE DATA

			BYW92-50	100	150	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	V
Average forward current	$I_{F(AV)}$	max.		35		A
Forward voltage	V_F	$<$		0,95		V
Reverse recovery time	t_{rr}	$<$		50		ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-5: with metric M6 stud (ϕ 6 mm); e.g. BYW92-50.
with ¼ in x 28UNF stud (ϕ 6,35mm); e.g. BYW92-50U.



Net mass: 22 g
Diameter of clearance hole: max. 6,5 mm
Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats;
M6: 10 mm
¼ in x 28UNF: 11,1 mm
Supplied on request: accessories 56264A
(mica washer, insulating ring, tag)

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages*

			BYW92-50	100	150	
Non-repetitive peak reverse voltage	V_{RSM}	max.	50	100	150	V
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	V
Crest working reverse voltage	V_{RWM}	max.	50	100	150	V
Continuous reverse voltage	V_R	max.	50	100	150	V

Currents

Average forward current; switching losses negligible up to 500 kHz				
sinusoidal; up to T_{mb} = 105 °C	$I_{F(AV)}$	max.	35	A
sinusoidal; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	23	A
square wave; δ = 0,5; up to T_{mb} = 102 °C	$I_{F(AV)}$	max.	40	A
square wave; δ = 0,5; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	23	A
R.M.S. forward current	$I_{F(RMS)}$	max.	55	A
Repetitive peak forward current	I_{FRM}	max.	500	A
Non-repetitive peak forward current; t = 10 ms; half sine-wave; T_j = 150 °C prior to surge; with re-applied V_{RWMmax}	I_{FSM}	max.	500	A
I^2t for fusing (t = 10 ms)	I^2t	max.	1250	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,0	°C/W
From mounting base to heatsink				
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,3	°C/W
b. without heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,2	°C/W

MOUNTING INSTRUCTIONS

The top connector should neither be bent nor twisted; 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.

* To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant 6$ °C/W (continuous reverse voltage).

CHARACTERISTICS

Forward voltage			
I_F = 35 A; T_j = 100 °C	V_F	<	0,95 V*
I_F = 100 A; T_j = 25 °C	V_F	<	1,3 V*
Reverse current			
$V_R = V_{RWMmax}$; T_j = 100 °C	I_R	<	2,5 mA
Reverse recovery when switched from			
I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 50 A/µs; T_j = 25 °C			
Recovery time	t_{rr}	<	50 ns
I_F = 2 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/µs; T_j = 25 °C			
Recovered charge	Q_s	<	20 nC
Forward recovery when switched to I_F = 10 A			
with dI_F/dt = 10 A/µs			
Recovery voltage	V_{fr}	typ.	1,0 V

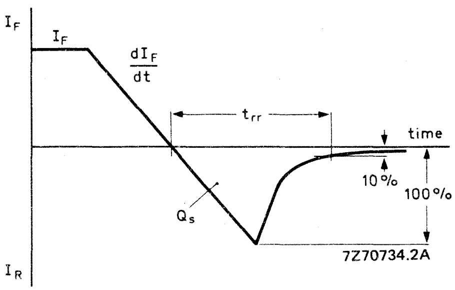


Fig. 2 Definitions of t_{rr} and Q_s.

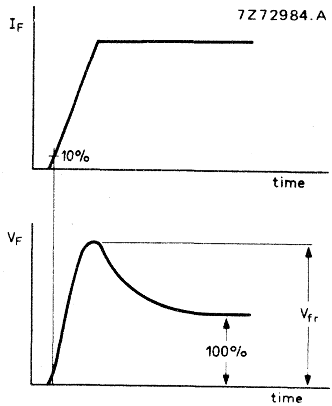


Fig. 3 Definition of V_{fr}.

* Measured under pulse conditions to avoid excessive dissipation.

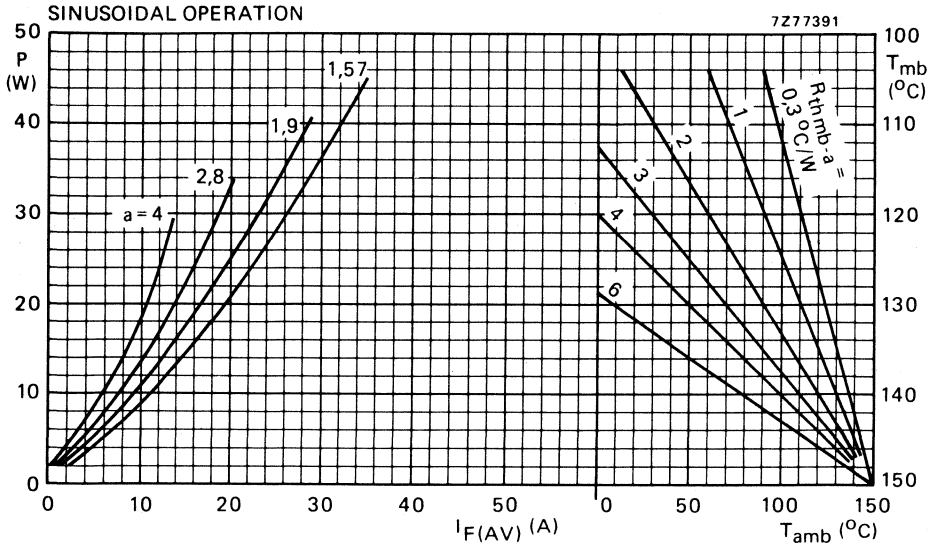


Fig. 4 P = power including reverse current losses and switching losses up to f = 500 kHz.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

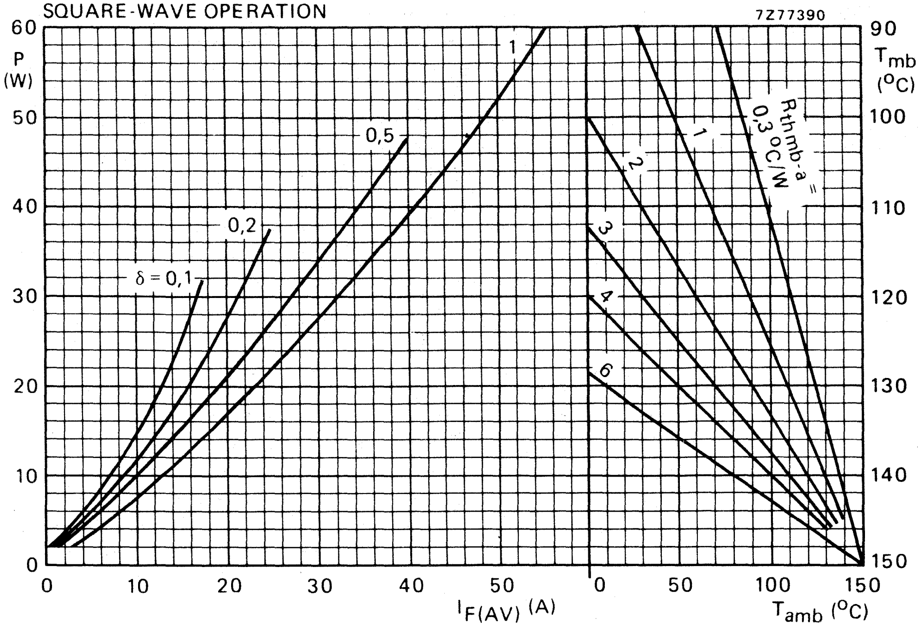
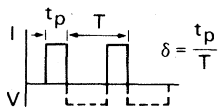


Fig. 5 P = power including reverse current losses and switching losses up to f = 500 kHz.



$I_{F(AV)} = I_{F(RMS)} \times \sqrt{\delta}$

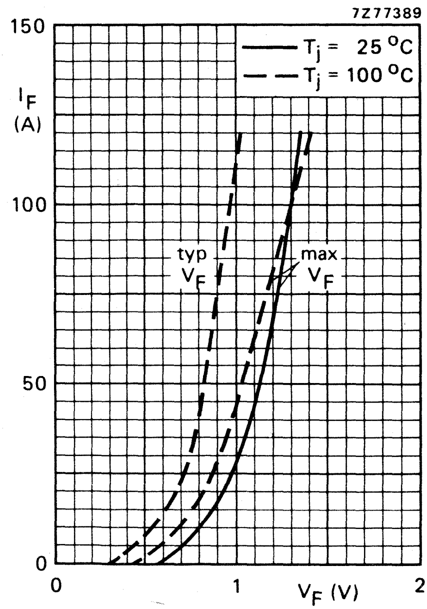


Fig. 6.

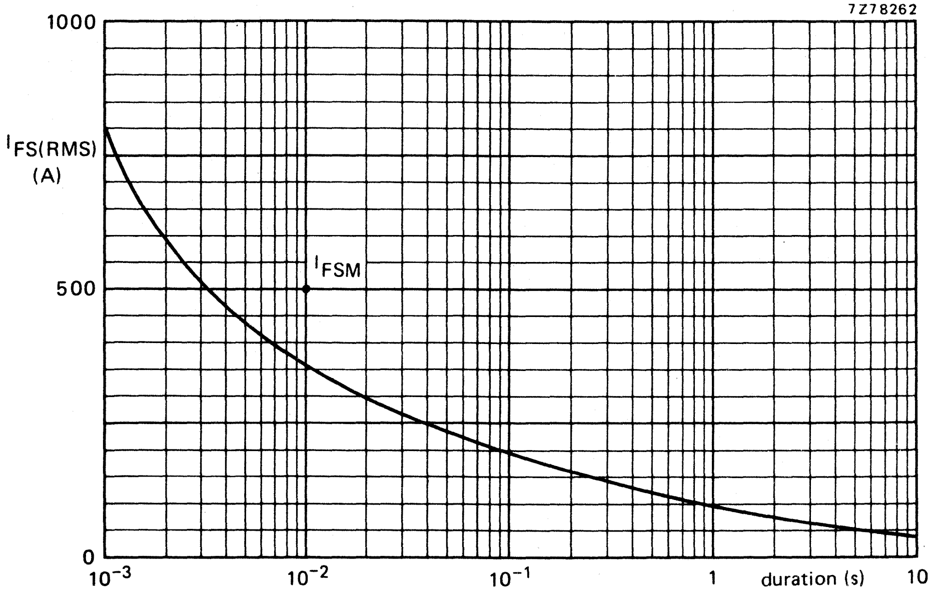
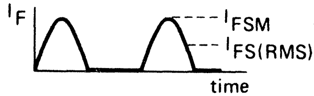


Fig. 7 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge; with reapplied V_{RWMmax}.



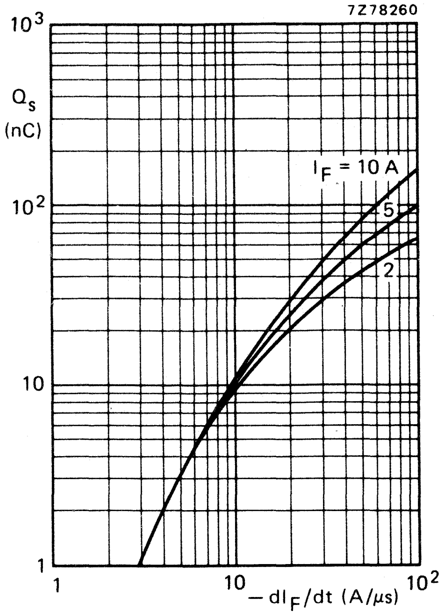


Fig. 8 $T_j = 25\ ^oC$; maximum values.

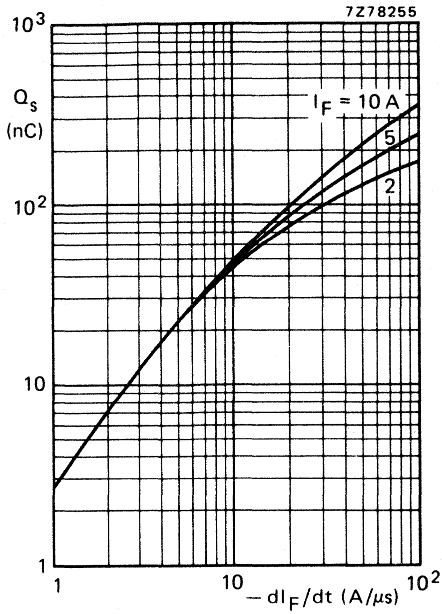
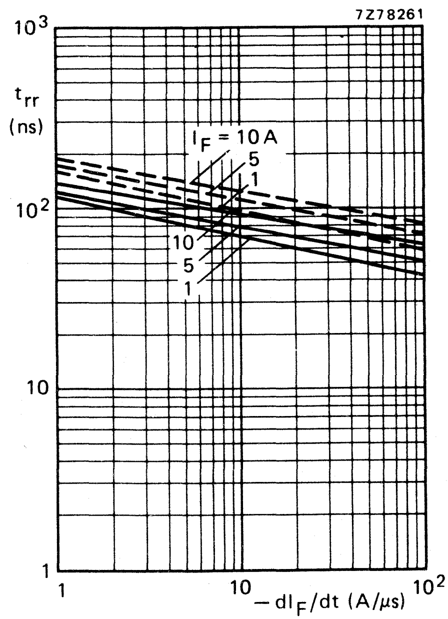
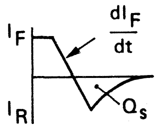


Fig. 9 $T_j = 100\ ^oC$; maximum values.





Definition of Q_s in Figs 8 and 9.

Fig. 10 Maximum values; —— $T_j = 25\ ^oC$; ----- $T_j = 100\ ^oC$.

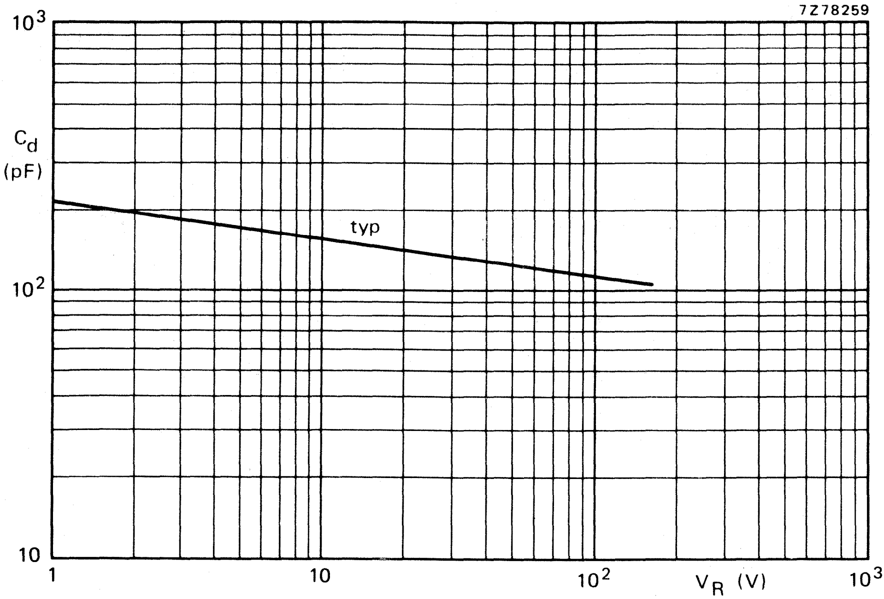


Fig. 11 f = 1 MHz; T_j = 25 °C.

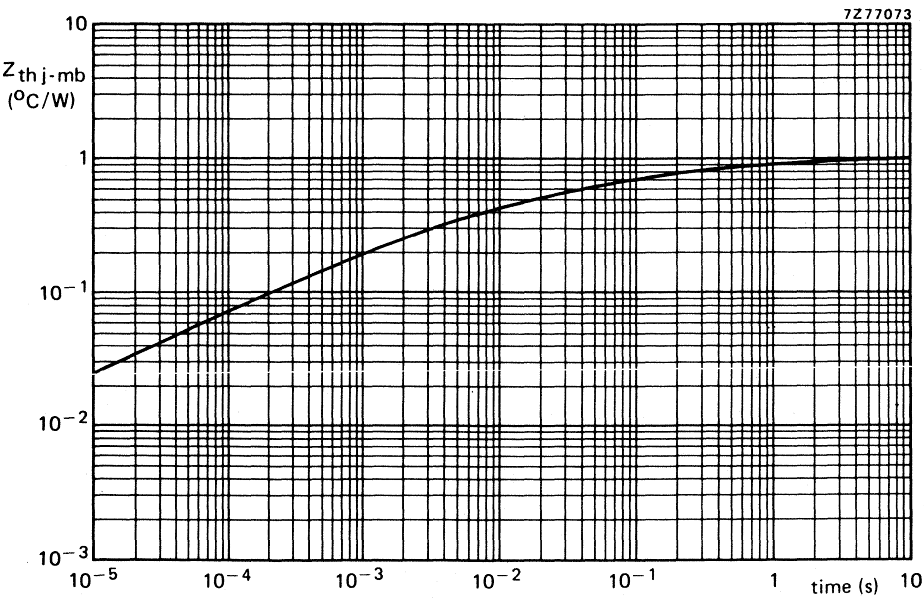


Fig. 12.

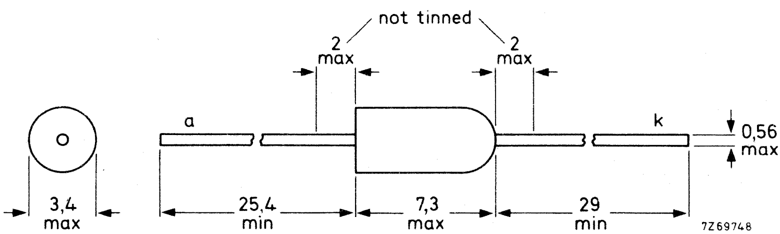
SILICON RECTIFIER DIODE

Double-diffused silicon diode in a DO-14 plastic envelope.
It is intended for low current rectifier applications.

QUICK REFERENCE DATA				
Repetitive peak reverse voltage	V_{RRM}	max.	1600	V
Average forward current	$I_{F(AV)}$	max.	0,5	A
Non-repetitive peak forward current	I_{FSM}	max.	15	A

MECHANICAL DATA Dimensions in mm

DO-14



The rounded end indicates the cathode

The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

MOUNTING METHODS see page 3.

All information applies to frequencies up to 400 Hz.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Crest working reverse voltage	V_{RWM}	max.	800	V
Repetitive peak reverse voltage ($\delta \leq 0.01$)	V_{RRM}	max.	1600	V
Non-repetitive peak reverse voltage ($t < 10$ ms)	V_{RSM}	max.	1600	V

Currents

Average forward current (averaged over any 20 ms period)				
with R load; $V_{RWM} = V_{RWMmax}$	$I_{F(AV)}$	max.	0.36	A
$V_{RWM} = 60$ V	$I_{F(AV)}$	max.	0.5	A
for capacitive load		see page 4		
Repetitive peak forward current	I_{FRM}	max.	3	A
Non-repetitive peak forward current ($t = 10$ ms; half-sine wave) $T_j = 150\ ^oC$ prior to surge	I_{FSM}	max.	15	A

Temperatures

Storage temperature	T_{stg}		-65 to +150	^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE See page 3

CHARACTERISTICS

Forward voltage

$I_F = 2$ A; $T_j = 25\ ^oC$	V_F	<	1.6	V	1)

Reverse current

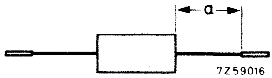
$V_R = 800$ V; $T_j = 125\ ^oC$	I_R	<	50	μA
$V_R = 800$ V; $T_j = 25\ ^oC$	I_R	<	1	μA

1) Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE (influence of mounting method)

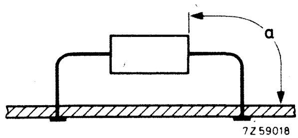
The quoted values apply when no other leads run to the tie-points. If leads of other dissipating components share the same tie-points, the thermal resistance will be higher than that quoted.

1. Mounted to solder tags at a lead-length a = 10 mm. $R_{th\ j\text{-}a} = 150\ ^{o}C/W$



2. Mounted to solder tags at a = maximum lead-length. $R_{th\ j\text{-}a} = 200\ ^{o}C/W$

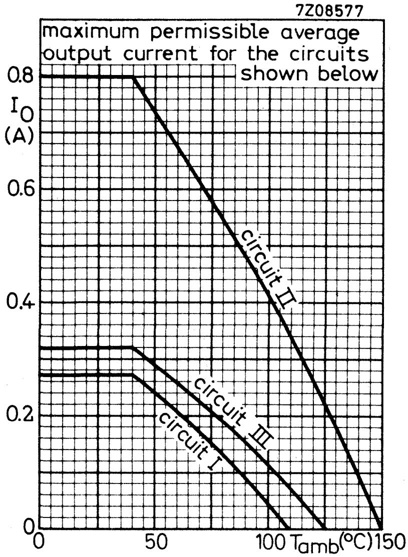
3. Mounted on printed-wiring with a small area of copper at any lead-length a. $R_{th\ j\text{-}a} = 200\ ^{o}C/W$

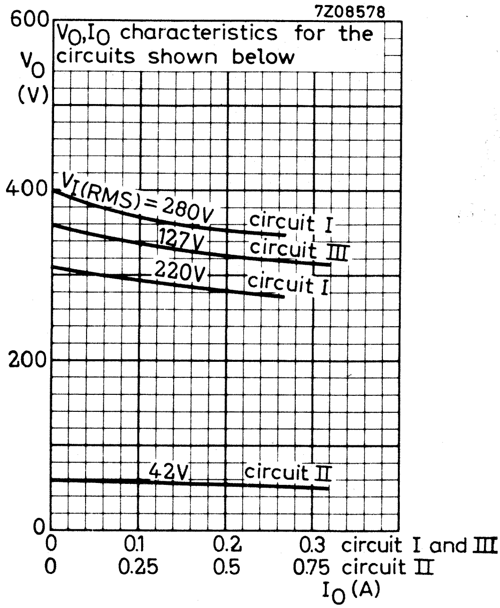


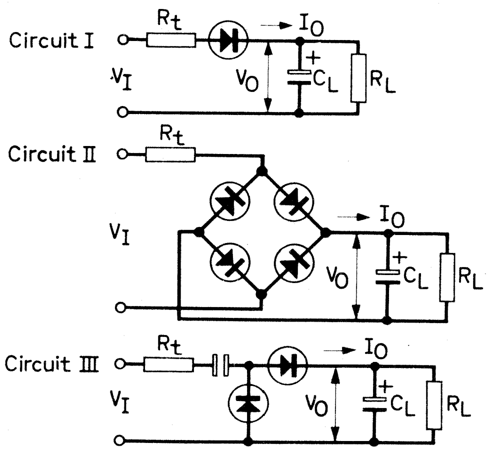
SOLDERING AND MOUNTING NOTES

1. Soldered joints must be at least 5 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 300 ^{o}C; it must be in contact with the joint for no more than 3 seconds.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 ^{o}C.

EXAMPLE: Rectifier with C-load
mounting method 1 (see page 3)

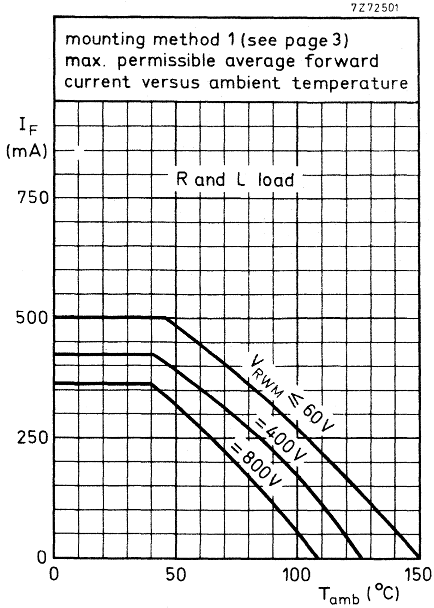


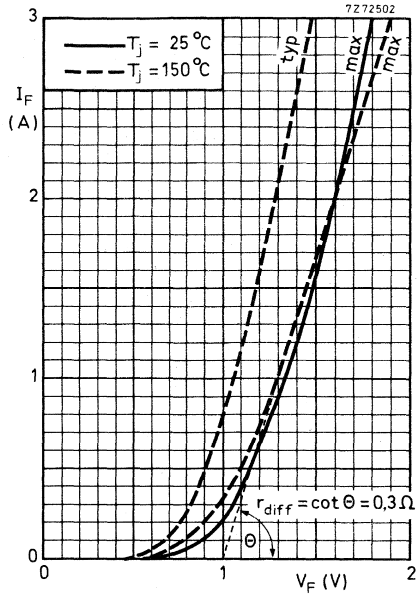


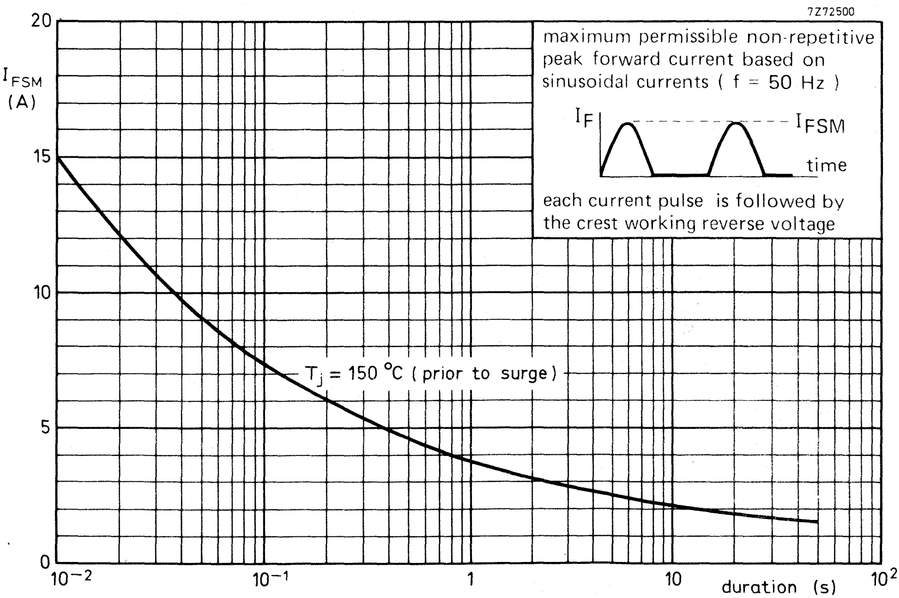


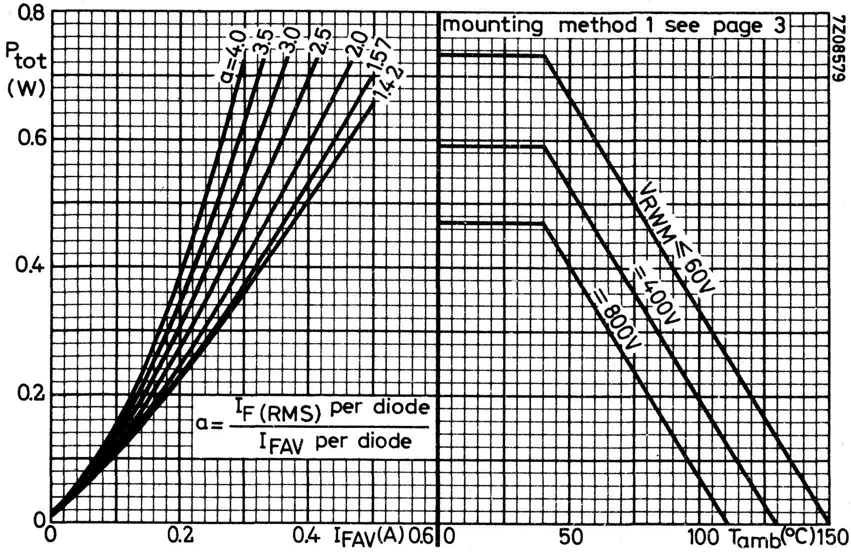
	$V_{I(RMS)}$	R_t	C_L
Circuit I	220V	8.2 Ω	100 µF
	280V	15 Ω	100 µF
Circuit II	42V	1.5 Ω	1500 µF
Circuit III	127V	5.6 Ω	200 µF

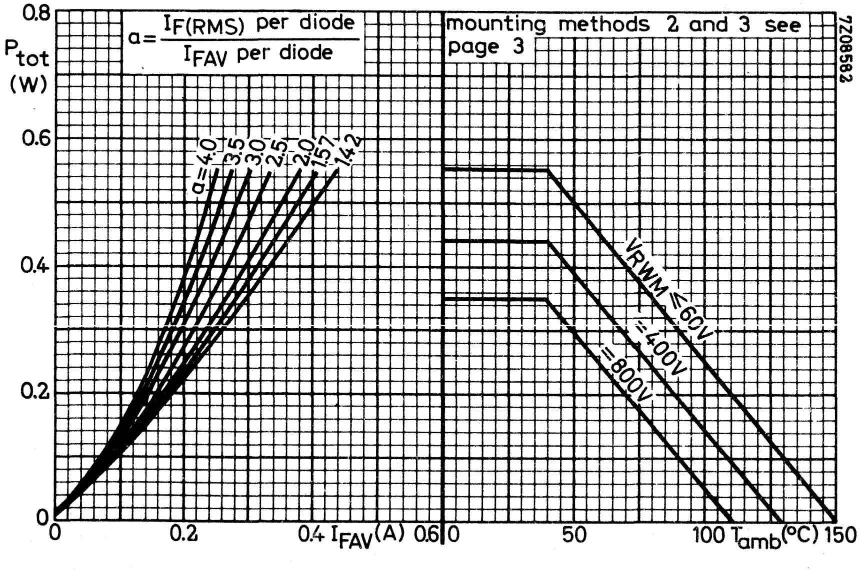
7Z08584

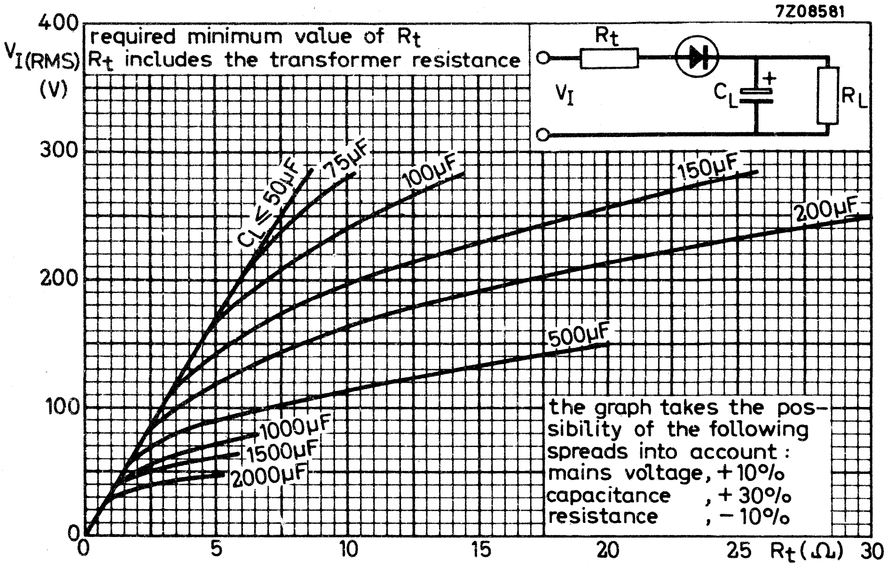

7Z72501
mounting method 1 (see page 3)
max. permissible average forward current versus ambient temperature
I_F (mA)
R and L load
750
500
250
0
$V_{RWM} \leq 60$ V
= 400 V
= 800 V
0
50
100
150
T_{amb} (°C)


7Z72502
T_j = 25 °C
T_j = 150 °C
typ
max
max
I_F (A)
3
2
1
0
$r_{diff} = \cot\Theta = 0{,}3\,\Omega$
Θ
0
1
2
V_F (V)


7Z72500
maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
time
each current pulse is followed by the crest working reverse voltage
I_{FSM} (A)
20
15
10
5
0
T_j = 150 °C (prior to surge)
10^{-2}
10^{-1}
1
10
10^2
duration (s)


0.8
Ptot
(W)
0.6
0.4
0.2
0
a=4.0
3.5
3.0
2.5
2.0
1.57
1.42
a = IF(RMS) per diode / IFAV per diode
0
0.2
0.4 IFAV(A) 0.6
mounting method 1 see page 3
7Z08579
VRWM ≤ 60V
≤ 400V
≤ 800V
0
50
100 Tamb(°C) 150


0.8
Ptot
(W)
0.6
0.4
0.2
0
a = IF(RMS) per diode / IFAV per diode
a=4.0
3.5
3.0
2.5
2.0
1.57
1.42
0
0.2
0.4 IFAV(A) 0.6
mounting methods 2 and 3 see page 3
7Z08582
VRWM ≤ 60V
≤ 400V
≤ 800V
0
50
100 Tamb(°C) 150



From the left hand graph on page 6 the total power dissipation can be found as a function of the average output current.

The parameter $a = \frac{I_{F(RMS)} \text{ per diode}}{I_{FAV} \text{ per diode}}$ depends on $n\omega R_L C_L$ and $\frac{R_t + R_{diff}}{nR_L}$ and can be found from existing graphs.

See Application Book: RECTIFIER DIODES

Once the power dissipation is known, the max. permissible ambient temperature follows from the right hand graph.

For the series resistance, added to limit the initial peak rectifier current, the required minimum value can be found from the upper graph.

R_{diff} is shown on page 5 upper figure.

SILICON RECTIFIER DIODES

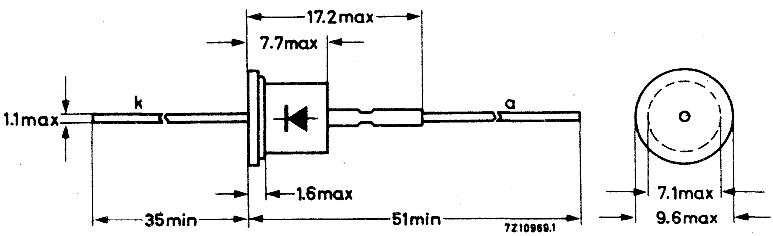
The BYX22-600 and BYX22-1200 are silicon diodes in a metal DO-1 envelope, intended for power rectifier applications up to 1.4 A.

QUICK REFERENCE DATA

		BYX22-600	1200	
Crest working reverse voltage	V_{RWM}	max. 400	800	V
Repetitive peak reverse voltage	V_{RRM}	max. 600	1200	V
Average forward current	I_{FAV}	max. 1.4		A
Non-repetitive peak forward current t = 10 ms; T_j = 150 °C	I_{FSM}	max. 40		A
Junction temperature	T_j	max. 150		°C
Thermal resistance from junction to ambient	$R_{th\ j-a}$	= 60		°C/W

MECHANICAL DATA Dimensions in mm

DO-1



MOUNTING METHODS see page 3

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

All information applies to frequencies up to 400Hz

Voltages

		BYX22-600		1200	
Crest working reverse voltage	V_{RWM}	max.	400	800	V
Repetitive peak reverse voltage ($d \leq 1\%$)	V_{RRM}	max.	600	1200	V
Non repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	600	1200	V

Currents

Average forward current (averaged over any 20 ms period) for R-load up to $T_{amb} = 30\ ^{o}C$	I_{FAV}	max.	1.4	A
Forward current (d.c.) up to $T_{amb} = 30\ ^{o}C$	I_F	max.	1.6	A
Repetitive peak forward current	I_{FRM}	max.	15	A
Non repetitive peak forward current $t = 10$ ms; $T_j = 150\ ^{o}C$ (see page 6)	I_{FSM}	max.	40	A

Temperatures

Storage temperature	T_{stg}		-65 to +150	^{o}C
Ambient temperature	T_{amb}	max.	150	^{o}C

THERMAL RESISTANCE

From junction to ambient $R_{th\ j-a}$ See page 3

CHARACTERISTICS

Forward voltage at $I_F = 5A$; $T_{amb} = 25\ ^{o}C$	V_F	<	1.5	V [1]
Reverse current at $V_R = V_{RWMmax}$; $T_{amb} = 125\ ^{o}C$	I_R	<	120	μA

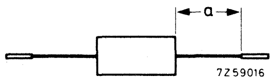
[1]) Measured under pulsed conditions to avoid excessive dissipation.

THERMAL RESISTANCE

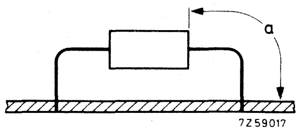
Effect of mounting on thermal resistance $R_{th\ j-a}$

The quoted values apply when no other leads run to the tie-points. If leads of other dissipating components share the same tie-points, the thermal resistance will be higher than that quoted.

1. Mounted to solder tags at a lead-length a = 10 mm. $R_{th\ j-a}$ = 60 °C/W
2. Mounted to solder tags at a = maximum lead-length. $R_{th\ j-a}$ = 70 °C/W

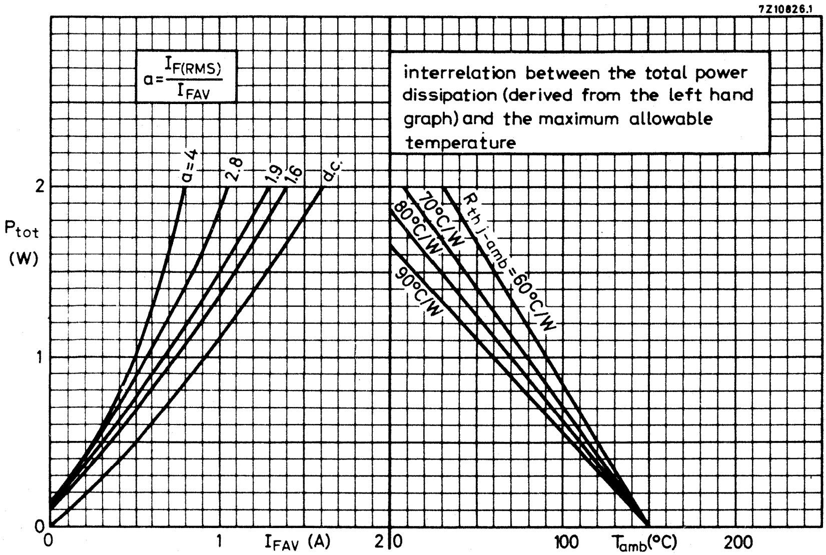


3. Mounted on printed-wiring board at a = maximum lead-length. $R_{th\ j-a}$ = 80 °C/W
4. Mounted on printed-wiring board at a lead-length a = 10 mm. $R_{th\ j-a}$ = 90 °C/W



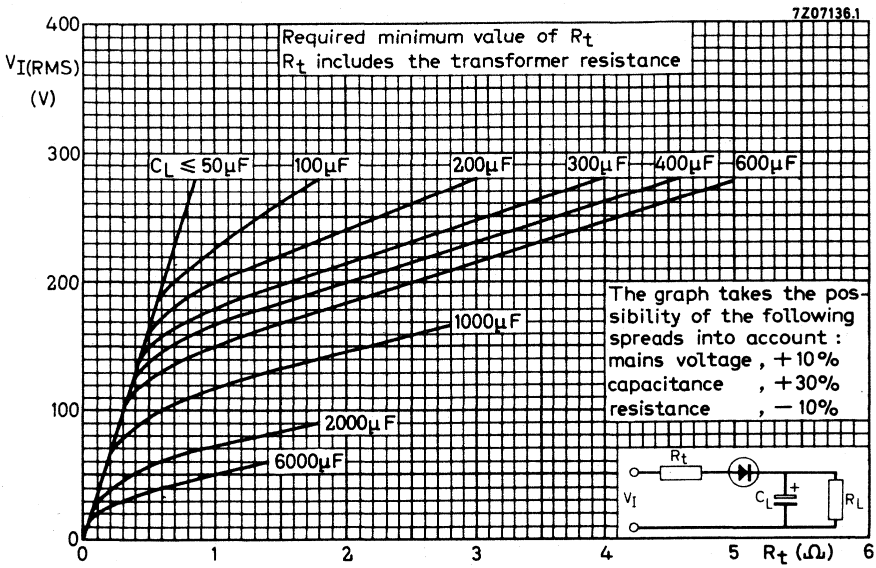
SOLDERING AND MOUNTING NOTES

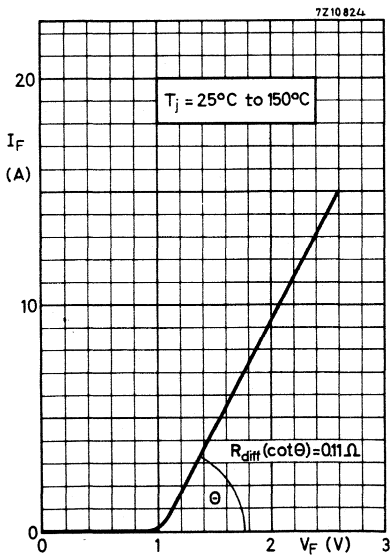
1. At a soldering iron or bath temperature of up to 245 °C, the maximum permissible soldering time is 10 s if the joint is 5 mm from the seal, 3 s if it is 1.5 mm from the seal.
2. At a temperature between 245 °C and 400 °C (max.), the joint must be more than 5 mm from the seal and soldering time must not exceed 5 s.
3. Leads should not be bent less than 1.5 mm from the seal; excert no axial pull when bending.

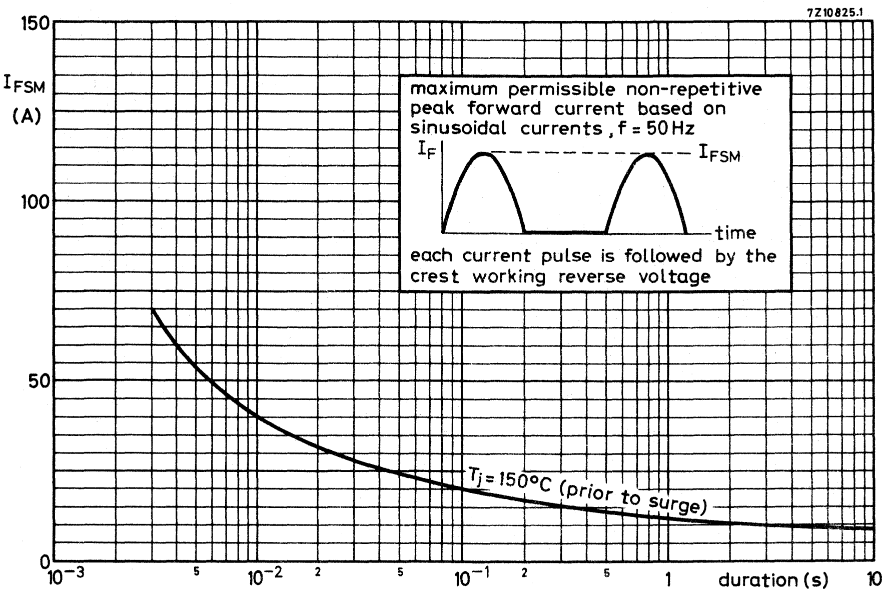


The form factor $a = \frac{I_{F(RMS)} \text{ per diode}}{I_{FAV} \text{ per diode}}$ depends on $n\omega R_L C_L$ and $\frac{R_t + R_{diff}}{nR_L}$ and can be found from existing graphs.

See Application Book: RECTIFIER DIODES.


7Z07136.1
Required minimum value of R_t
R_t includes the transformer resistance
400
$V_{I(RMS)}$
(V)
300
200
100
0
$C_L \leq 50\mu F$
100µF
200µF
300µF
400µF
600µF
1000µF
2000µF
6000µF
The graph takes the possibility of the following spreads into account :
mains voltage , + 10 %
capacitance , + 30%
resistance , − 10%
R_t
V_I
C_L
R_L
0
1
2
3
4
5
R_t (Ω)
6


7Z10824
20
I_F
(A)
10
0
T_j = 25°C to 150°C
R_{diff} (cotΘ) = 0.11 Ω
Θ
0
1
2
V_F (V)
3


7Z10825.1
I_{FSM}
(A)
150
100
50
0
maximum permissible non-repetitive peak forward current based on sinusoidal currents, f = 50 Hz
I_F
I_{FSM}
time
each current pulse is followed by the crest working reverse voltage
T_j = 150°C (prior to surge)
10^{-3}
5
10^{-2}
2
5
10^{-1}
2
5
1
duration (s)
10

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 1000.
Reverse polarity (anode to stud): BYX25-600R to 1000R.

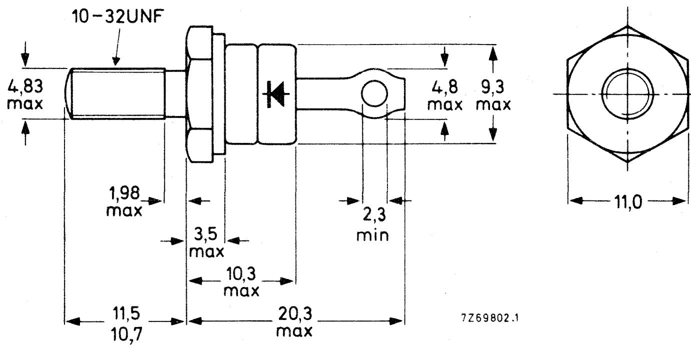
QUICK REFERENCE DATA

			BYX25-600(R)	800(R)	1000(R)	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	750	1000	1250	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

DO-4



Net mass: 7 g

Diameter of clearance hole: max. 5,2 mm

Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)
56262A (mica washer, insulating ring, plain washer)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 9,5 mm

The mark shown applies to the normal polarity types.

Torque on nut: min. 0,9 Nm
(9 kg cm)
max. 1,7 Nm
(17 kg cm)

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages [1]			BYX25-600(R)	800(R)	1000(R)	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	V
Continuous reverse voltage	V_R	max.	600	800	1000	V

Currents

Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	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

[1]) To ensure thermal stability: $R_{th\ j-a} < 2,5$ °C/W (continuous reverse voltage) or < 5 °C/W (a.c.).
For smaller heatsinks $T_{j\,max}$ should be derated. For a.c. see page 5.
For continuous reverse voltage: if $R_{th\ j-a}$ = 5 °C/W, then $T_{j\,max}$ = 135 °C,
if $R_{th\ j-a}$ = 10 °C/W, then $T_{j\,max}$ = 129 °C.

THERMAL RESISTANCE

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

CHARACTERISTICS

			BYX25-600(R)	800(R)	1000(R)	
Forward voltage						
I_F = 50 A; T_j = 25 °C	V_F	<	1.8	1.8	1.8	V [1]
Reverse avalanche breakdown voltage						
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	750	1000	1250	V
		<	2000	2000	2000	V
Peak reverse current						
$V_{RM} = V_{RWM\,max}$; T_j = 125 °C	I_{RM}	<	1.0	0.8	0.6	mA

APPLICATION INFORMATION

See general pages at the beginning of this section

[1]) Measured under pulsed conditions to avoid excessive dissipation.

OPERATING NOTES (See also general pages at the beginning of this section.)

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: $P_{RAV} = 0.002 \times 2\ kW = 4\ W$

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

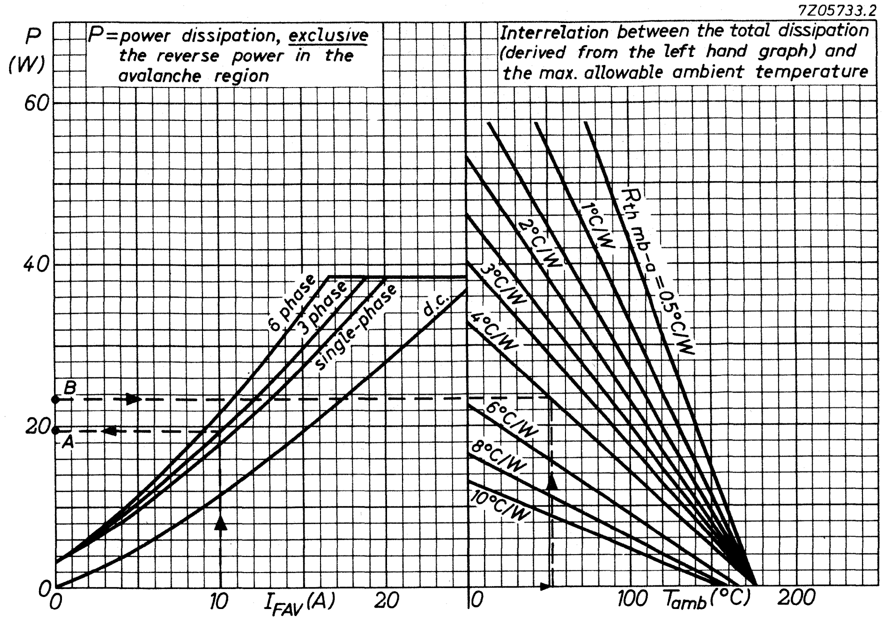
$$R_{th\ mb-a} \approx 4\ °C/W$$

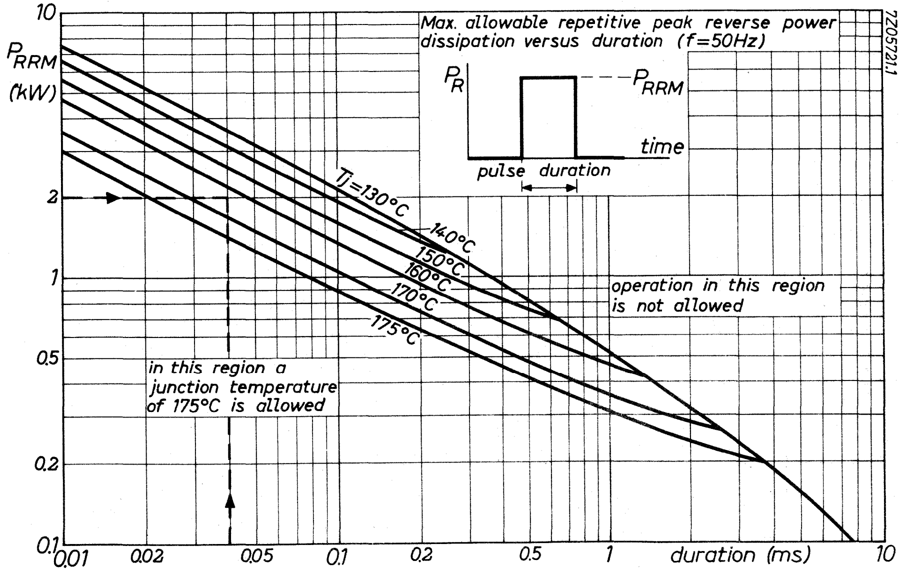
The contact thermal resistance $R_{th\ mb-h} = 0.5\ °C/W$

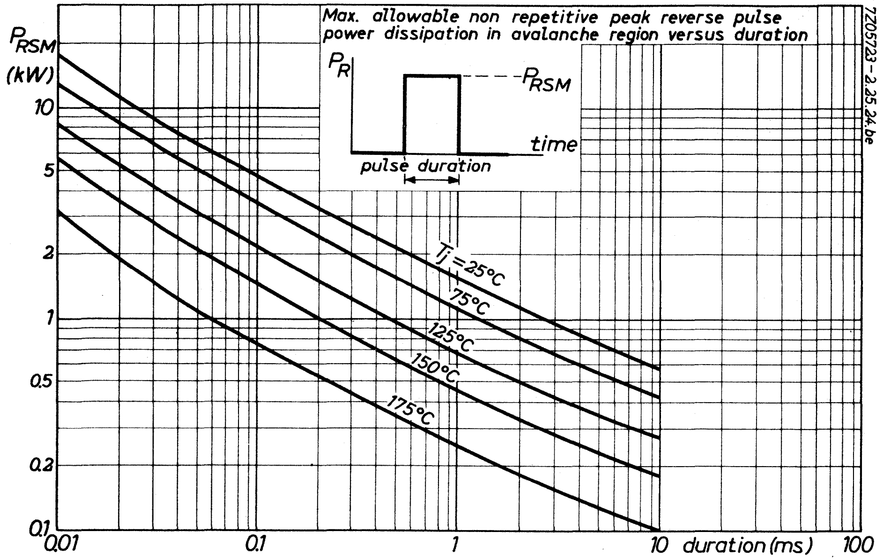
Hence the heatsink thermal resistance should be:

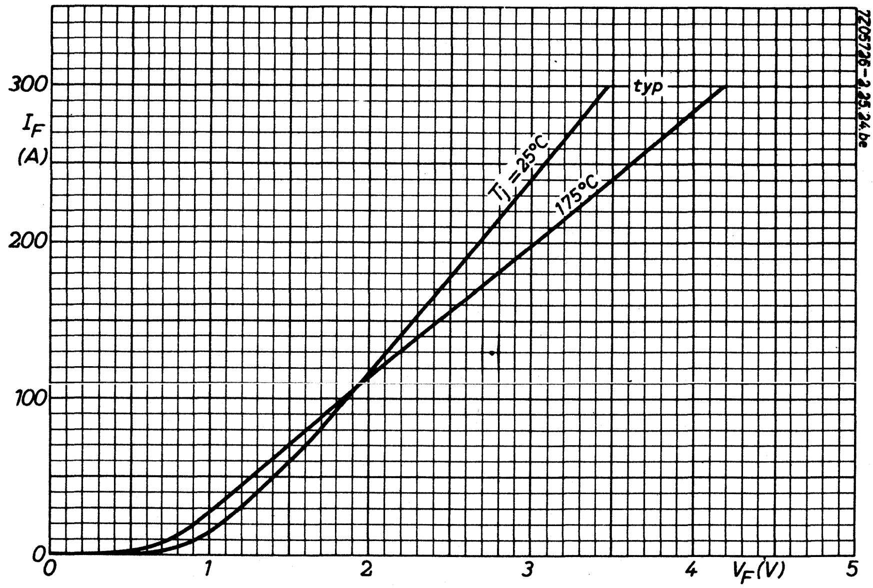
$$R_{th\ h-a} = R_{th\ mb-a} - R_{th\ mb-h} = (4 - 0.5)\ °C/W = 3.5\ °C/W$$

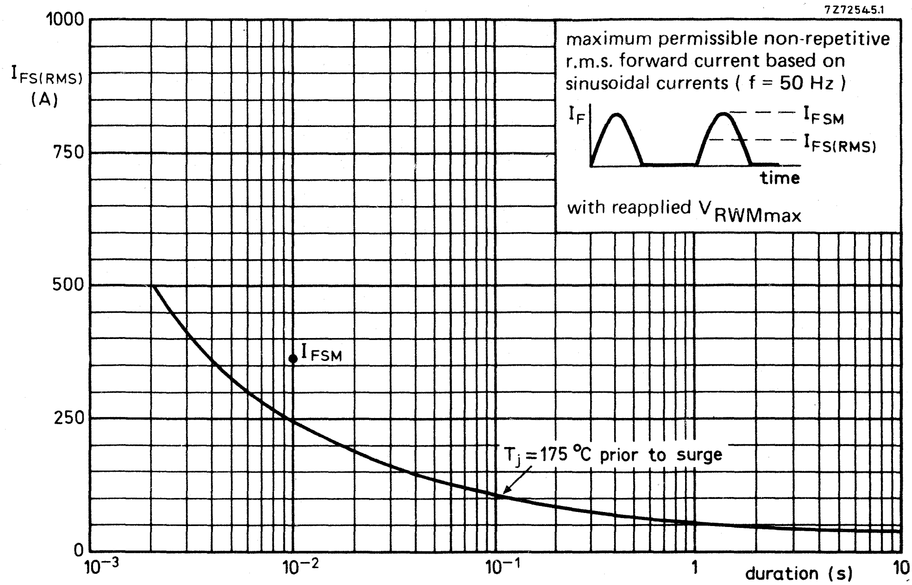
The applicable heatsink(s) may then be found in the Section HEATSINKS.


7Z05733.2
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
P
(W)
60
40
20
0
6 phase
3 phase
single-phase
d.c.
B
A
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
0
10
I FAV (A)
20
0
100
T amb (°C)
200


7Z05721.1
Max. allowable repetitive peak reverse power dissipation versus duration (f=50Hz)
P R
P RRM
time
pulse duration
P RRM
(kW)
10
2
1
0.5
0.2
0.1
Tj=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
0.01
0.02
0.05
0.1
0.2
0.5
1
duration (ms)
10


Max. allowable non repetitive peak reverse pulse power dissipation in avalanche region versus duration
P_{RSM} (kW)
P_R
P_{RSM}
time
pulse duration
T_j = 25°C
75°C
125°C
150°C
175°C
duration (ms)
0.01
0.1
1
10
100
10
5
2
1
0.5
0.2
0.1
7Z05723-2.25.24.be


I_F (A)
300
200
100
0
typ
T_j = 25°C
175°C
V_F (V)
0
1
2
3
4
5
7Z05726-2.25.24.be


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

CONTROLLED-AVALANCHE HIGH-VOLTAGE DIODES

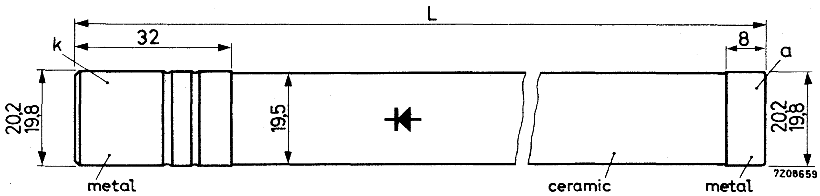
Silicon diodes in ceramic envelopes with metal connectors capable of absorbing transients and primarily intended for high-voltage rectifier circuits in X-ray applications.
The series consists of the following types:
BYX29-75 000; BYX29-100 000; BYX29-125 000 and BYX29-150 000.

QUICK REFERENCE DATA

			BYX29-75 000	100 000	125 000	150 000	
Crest working reverse voltage	V_{RWM}	max.	75	100	125	150	kV
Average forward current	$I_{F(AV)}$	max.	50	50	50	50	mA
Non-repetitive peak forward current	I_{FSM}	max.	5000	5000	5000	5000	mA
Junction temperature	T_j	max.	125	125	125	125	°C
Thermal resistance from junction to cooling oil	$R_{th\ j-o}$	=	3,2	2,7	1,6	1,6	°C/W

MECHANICAL DATA

Dimensions in mm



BYX29- 75 000	L: 141 to 143 mm	Weight: 135 g
BYX29-100 000	L: 169 to 171 mm	Weight: 165 g
BYX29-125 000	L: 229 to 231 mm	Weight: 225 g
BYX29-150 000	L: 229 to 231 mm	Weight: 225 g

FOR NEW DESIGN THE SUCCESSOR TYPE BYX91 SERIES IS RECOMMENDED

All information applies to frequencies up to 400 Hz

RATINGS (Limiting values) [1])

Voltages		BYX29-75000	100000	125000	150000	
Crest working reverse voltage	V_{RWM}	max. 75	100	125	150	kV

Currents

Average forward current
(averaged over any 20 ms period)

continuous operation	I_{FAV}	max.	50	mA
intermittent operation ($t \leq 1$ s, once every 20 s)	I_{FAV}	max.	750	mA

Repetitive peak forward current

continuous operation	I_{FRM}	max.	250	mA
intermittent operation (at an average forward current I_{FAV} = 750 mA; $t \leq 1$ s, once every 20 s)	I_{FRM}	max.	2500	mA
Non repetitive peak forward current (t = 10 ms)	I_{FSM}	max.	5000	mA

Non repetitive peak reverse current

$t < 10\ \mu s$; T_j = 25 °C	I_{RSM}	max.	500	mA
T_j = 125 °C	I_{RSM}	max.	400	mA

Temperatures

Storage temperature	T_{stg}	−30 to +125	°C
Junction temperature	T_j	max. 125	°C

THERMAL RESISTANCE

		BYX29-75000	100000	125000	150000	
From junction to cooling oil	$R_{th\ j\text{-}o}$ =	3.2	2.7	1.6	1.6	°C/W

CHARACTERISTICS

Voltages at T_j = 25 °C						
Forward voltage at I_F = 50 mA	V_F	< 88	116	145	175	V
Reverse breakdown voltage I_R = 1 mA	$V_{(BR)R}$	> 100	135	165	200	kV
Currents at T_j = 125 °C						
Reverse current at $V_R = V_{RWMmax}$	I_R	< 33	33	33	33	μA

[1]) Limiting values according to the Absolute Maximum System as defined in IEC publication 134.

FAST SOFT-RECOVERY RECTIFIER DIODES

- **With controlled avalanche**

Diffused silicon diodes in DO-4 metal envelopes, capable of absorbing transients. They are primarily intended for use in high-frequency power supplies, thyristor inverters and multi-phase power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX30-200 to BYX30-600
Reverse polarity (anode to stud): BYX30-200R to BYX30-600R.

QUICK REFERENCE DATA

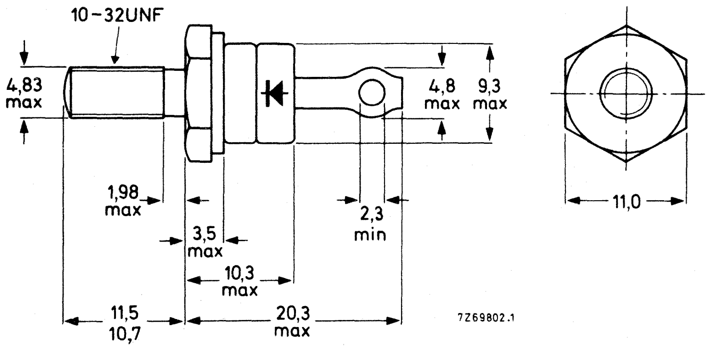
			BYX30-200(R)	300(R)	400(R)	500(R)	600(R)	
Crest working reverse voltage	V_{RWM}	max.	200	300	400	500	600	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	250	375	500	625	750	V

Average forward current	$I_{F(AV)}$	max.	14	A
Non-repetitive peak forward current	I_{FSM}	max.	250	A
Non-repetitive peak reverse power	P_{RSM}	max.	18	kW
Reverse recovery time	t_{rr}	<	200	ns

MECHANICAL DATA

Dimensions in mm

DO-4; Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 9.5 mm



Net mass: 7 g
Diameter of clearance hole: max. 5.2 mm
Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)

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

The mark shown applies to the normal polarity types.

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

Voltages [1]		BYX30-200(R)	300(R)	400(R)	500(R)	600(R)	
Crest working reverse voltage	V_{RWM}	max. 200	300	400	500	600	V
Continuous reverse voltage	V_R	max. 200	300	400	500	600	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 100 °C	$I_{F(AV)}$	max.	14	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	7.5	A
R.M.S. forward current	$I_{F(RMS)}$	max.	22	A
Repetitive peak forward current	I_{FRM}	max.	310	A
Non-repetitive peak forward current (t = 10 ms; half-sinewave) T_j = 150 °C prior to surge; with reapplied V_{RWM}max.	I_{FSM}	max.	250	A
I^2t for fusing (t = 10 ms)	I^2t	max.	312	A^2s

Reverse power dissipation

Repetitive peak reverse power dissipation t = 10 μs (square wave; f = 50 Hz) T_j = 150 °C	P_{RRM}	max.	5.5	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 = 150 °C prior to surge	P_{RSM}	max.	5.5	kW

Temperatures

Storage temperature	T_{stg}	-55 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

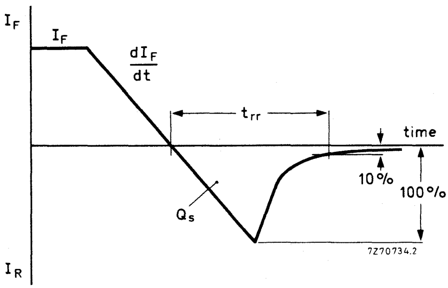
From junction to ambient in free air	$R_{th\ j-a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	1.3	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.5	°C/W

[1]) To ensure thermal stability: $R_{th\ j-a}$ < 2.5 °C/W (continuous reverse voltage) or < 5 °C/W (a.c.).
For smaller heatsinks T_j max should be derated. For a.c. see page 5.
For continuous reverse voltage: if $R_{th\ j-a}$ = 5 °C/W, then T_j max = 135 °C.
if $R_{th\ j-a}$ = 10 °C/W, then T_j max = 120 °C.

CHARACTERISTICS

			BYX30-200(R)	300(R)	400(R)	500(R)	600(R)	
Forward voltage								
$I_F = 50$ A; $T_j = 25\ ^oC$	V_F	<	3.2	3.2	3.2	3.2	3.2	V [1]
Reverse breakdown voltage								
$I_R = 5$ mA; $T_j = 25\ ^oC$	$V_{(BR)R}$	>	250	375	500	625	750	V
		<	1050	1050	1050	1050	1050	V
Reverse current								
$V_R = V_{RWMmax}$; $T_j = 125\ ^oC$	I_R	<	4.0	4.0	4.0	4.0	4.0	mA

Reverse recovery charge when switched from				
$I_F = 2$ A to $V_R \geq 30$ V; with $-dI_F/dt = 100$ A/μs; $T_j = 25\ ^oC$	Q_s	<	0.70	μC
Reverse recovery time when switched from				
$I_F = 1$ A to $V_R \geq 30$ V; $-dI_F/dt = 50$ A/μs; $T_j = 25\ ^oC$	t_{rr}	<	200	ns



OPERATING NOTES

1. Square-wave operation

When I_F has been flowing sufficiently long for the steady state to be established, there will be a charge due to minority carriers present. Before the device can block in the reverse direction this charge must be extracted. This extraction takes the form of a reverse transient (see figure above). The majority of the power dissipation due to the reverse transient occurs during fall time as the rectifier gradually becomes reverse biased, and the mean power will be proportional to the operating frequency. The mean value of this power loss can be derived from the graphs on page 10.

[1]) Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTES (continued)

2. Sine wave operation

Power loss in sine wave operation will be considerably less owing to the much slower rate of change of the applied voltage (and consequently lower values of I_{RRM}), so that power loss due to reverse recovery may be safely ignored for frequencies up to 20 kHz.

3. Determination of the heatsink thermal resistance

Example:
Assume a diode, used in an inverter.

frequency	f	=	20	kHz
duty cycle	δ	=	0.5	
ambient temperature	T_{amb}	=	45	°C
switched from	I_F	=	12	A
to	V_R	=	400	V
at a rate	$-\frac{dI}{dt}$	=	20	A/µs

At a duty cycle $\delta = 0.5$ the average forward current $I_{FAV} = 6$ A.
From the upper graph on page 5 it follows, that at $I_{FAV} = 6$ A the average forward power + average leakage power = 15 W (point A).
The additional power losses due to switching-off can be read from the nomogram on page 10 (the example being based on optimum use, i.e. $T_j = 150$ °C). Starting from $I_F = 12$ A on the horizontal scale trace upwards until the appropriate line $-\frac{dI}{dt} = 20$ A/µs. From the intersection trace horizontally to the right until the line for f = 20 kHz. Then trace downwards to the line $V_R = 400$ V and ultimately trace horizontally to the left and on the vertical axis read the additional average power dissipation $P_{RAV} = 4$ W.
Therefore the total power dissipation $P_{tot} = 15\text{ W} + 4\text{ W} = 19$ W (point B of the upper graph on page 5). From the right hand part follows the thermal resistance, required at $T_{amb} = 45$ °C.

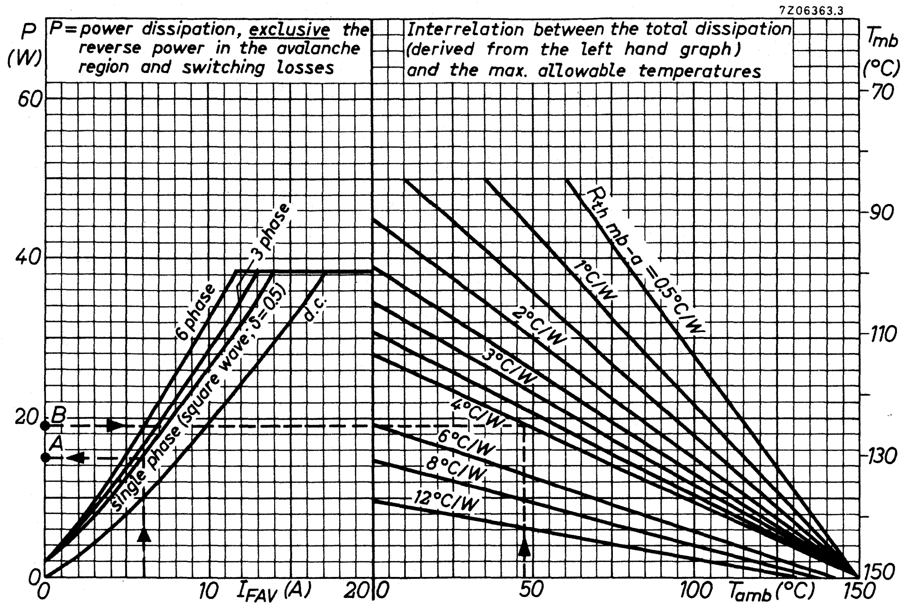
$$R_{th\ mb\text{-}a} \approx 4\ ^{\circ}\text{C/W}$$

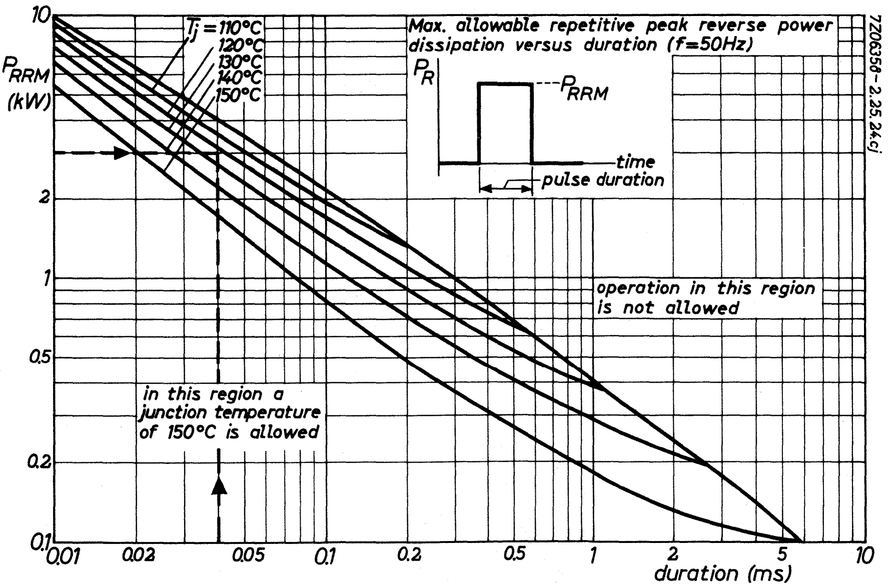
The contact thermal resistance $R_{th\ mb\text{-}h} = 0.5$ °C/W.

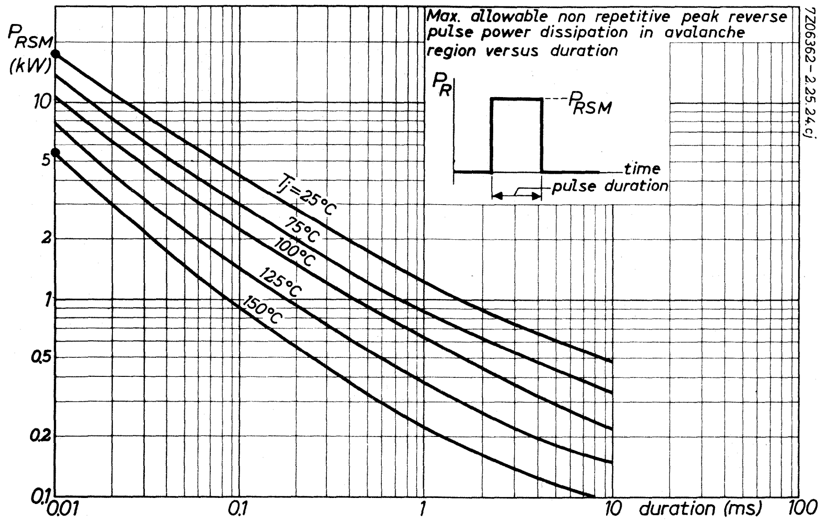
Hence the heatsink thermal resistance should be:

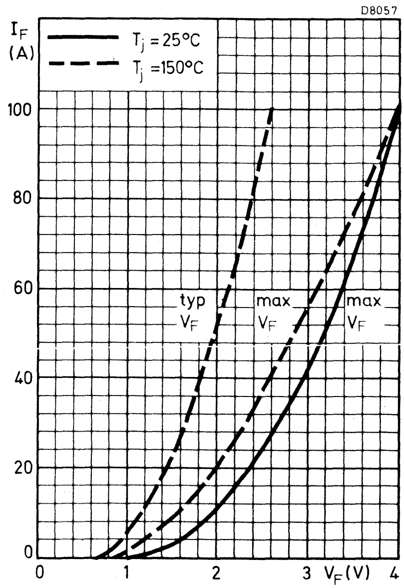
$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h} = (4 - 0.5)\ ^{\circ}\text{C/W} = 3.5\ ^{\circ}\text{C/W}.$$

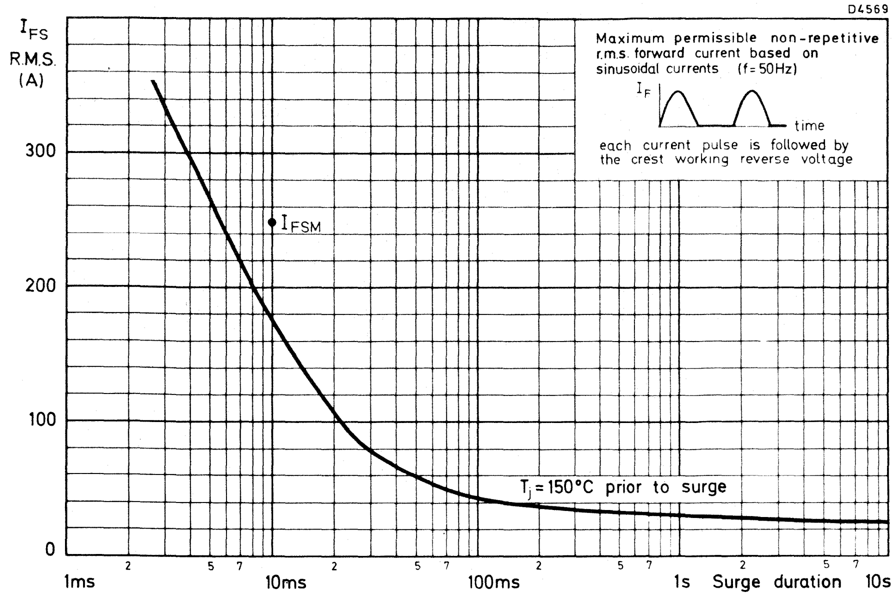
The applicable heatsink(s) may then be found in the Section HEATSINKS.

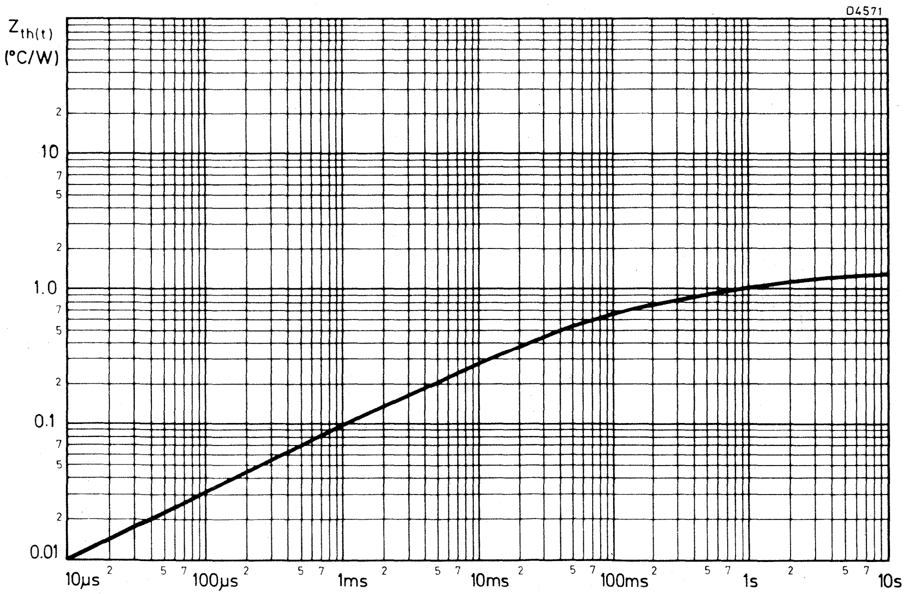

7Z06363.3
P (W)
P = power dissipation, exclusive the reverse power in the avalanche region and switching losses
Interrelation between the total dissipation (derived from the left hand graph) and the max. allowable temperatures
T_{mb} (°C)
6 phase
3 phase
single phase (square wave; δ=0.5)
d.c.
B
A
$R_{th\ mb-a}$ = 0.5°C/W
1°C/W
2°C/W
3°C/W
4°C/W
6°C/W
8°C/W
12°C/W
I_{FAV} (A)
T_{amb} (°C)

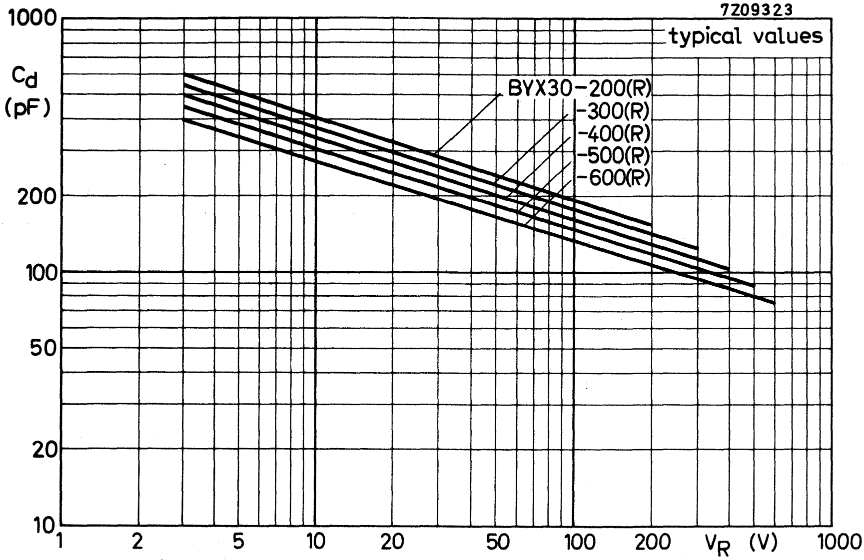

7Z06356-2.25.24.cj
P_{RRM} (kW)
T_j = 110°C
120°C
130°C
140°C
150°C
Max. allowable repetitive peak reverse power dissipation versus duration (f=50Hz)
P_R
P_{RRM}
time
pulse duration
operation in this region is not allowed
in this region a junction temperature of 150°C is allowed
duration (ms)

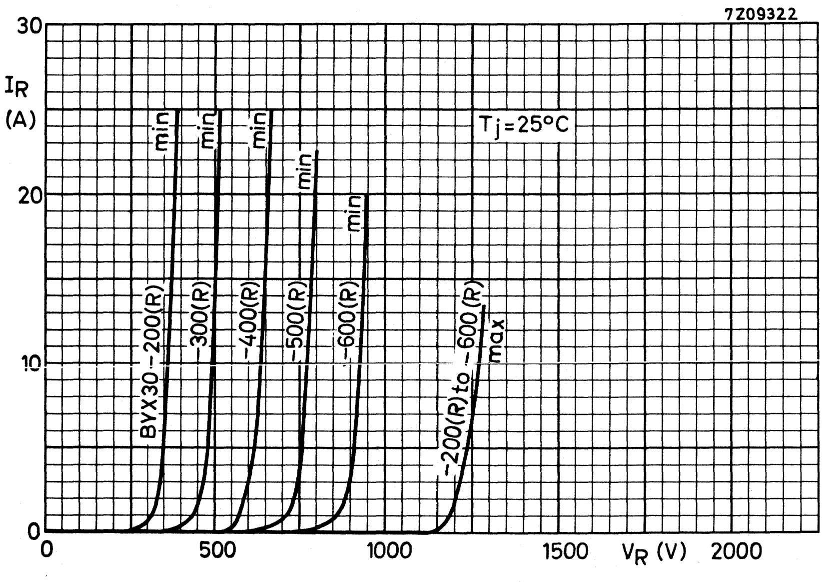

Max. allowable non repetitive peak reverse pulse power dissipation in avalanche region versus duration
7Z06362-2.25.24.cj
P_{RSM} (kW)
10
5
2
1
0.5
0.2
0.1
0.01
0.1
1
10
duration (ms)
100
T_j=25°C
75°C
100°C
125°C
150°C
P_R
P_{RSM}
time
pulse duration

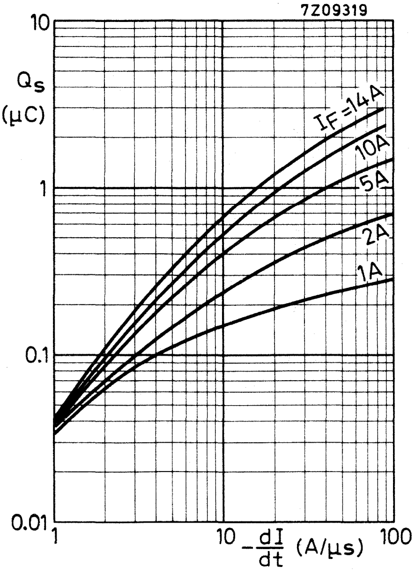

D8057
I_F (A)
T_j = 25°C
T_j = 150°C
100
80
60
40
20
0
0
1
2
3
V_F(V)
4
typ V_F
max V_F
max V_F


D4569
I_{FS} R.M.S. (A)
300
200
100
0
Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50Hz)
I_F
time
each current pulse is followed by the crest working reverse voltage
I_{FSM}
T_j = 150°C prior to surge
1ms
10ms
100ms
1s
Surge duration
10s

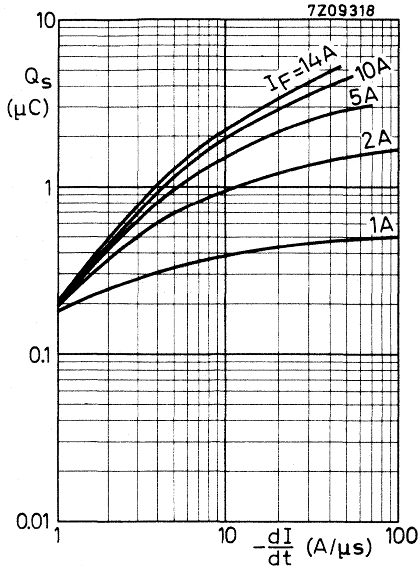

D4571
$Z_{th(t)}$ (°C/W)
10
1.0
0.1
0.01
10µs
100µs
1ms
10ms
100ms
1s
10s


7Z09323
typical values
C_d (pF)
1000
200
100
50
20
10
BYX30-200(R)
-300(R)
-400(R)
-500(R)
-600(R)
1
2
5
10
20
50
100
200
V_R (V)
1000

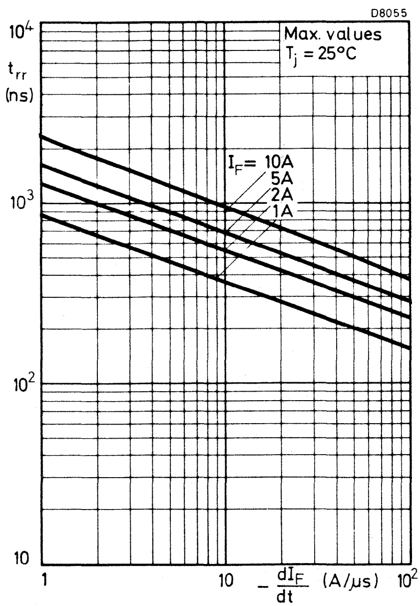

7Z09322
I_R (A)
30
20
10
0
$T_j = 25°C$
min
min
min
min
min
BYX30-200(R)
-300(R)
-400(R)
-500(R)
-600(R)
-200(R) to -600(R)
max
0
500
1000
1500
V_R (V)
2000

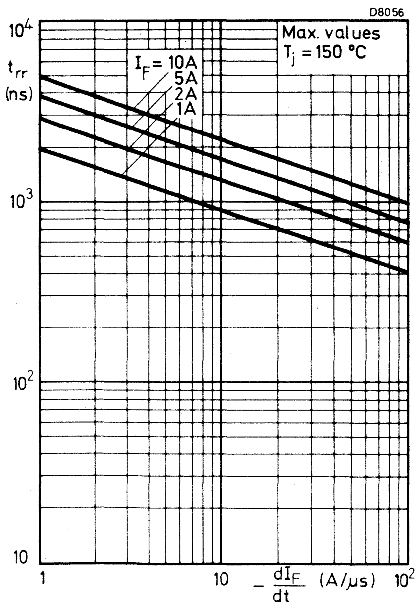


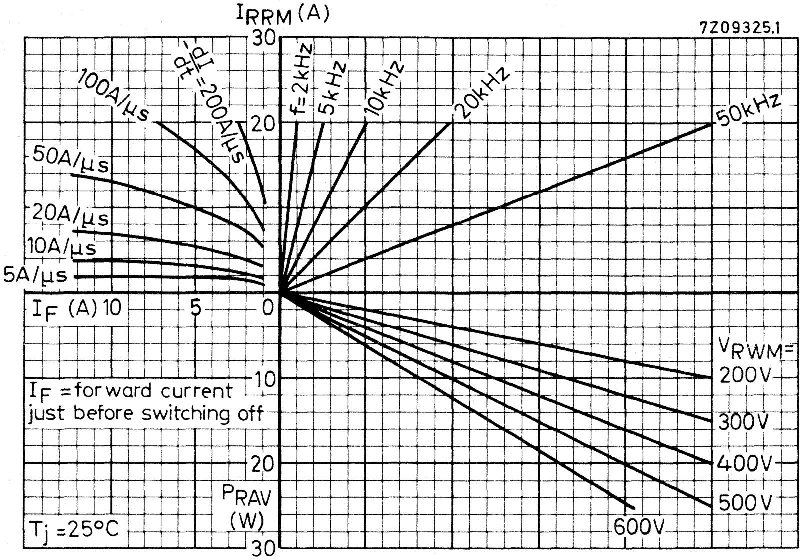
Maximum values; T_j = 25 °C; switched from I_F to $V_R \geqslant 30$ V.

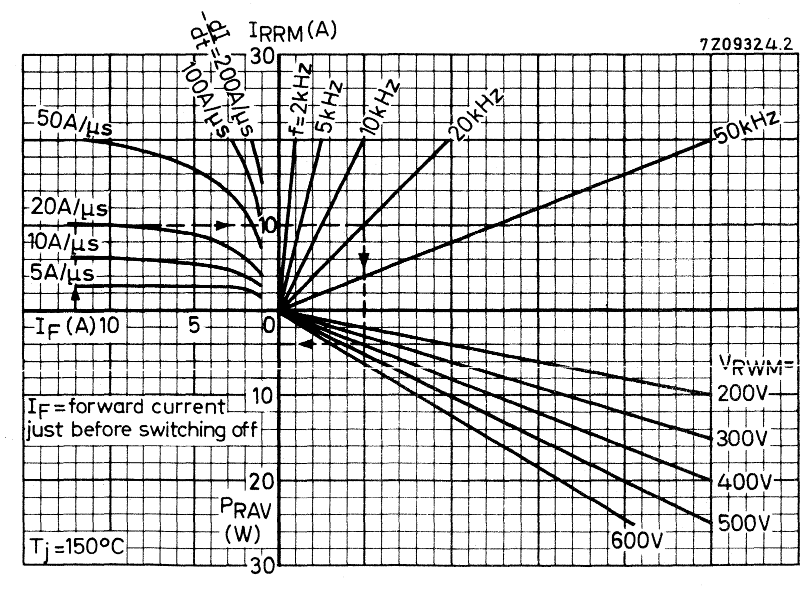


Maximum values; T_j = 150 °C; switched from I_F to $V_R \geqslant 30$ V.









Nomogram: Power loss P_{RAV} due to switching only (square wave operation)

SILICON RECTIFIER DIODES

Diffused silicon diodes in metal envelopes with ceramic insulation, intended for power rectifier application. The series consists of the following types:
Normal polarity (cathode to stud): BYX32-600 to BYX32-1600
Reverse polarity (anode to stud): BYX32-600R to BYX32-1600R

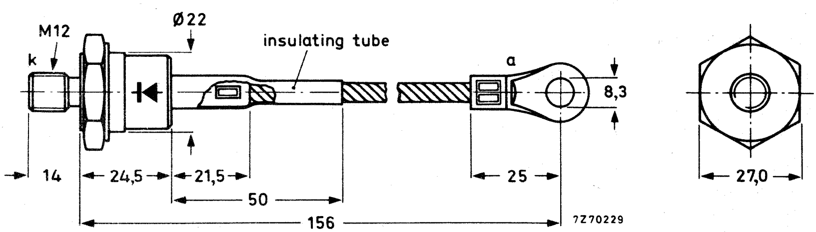
QUICK REFERENCE DATA

			600	800	1000	1200	1600	
	BYX32 -		600R	800R	1000R	1200R	1600R	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	1200	1200	V
Repetitive peak reverse voltage	V_{RRM}	max.	600	800	1000	1200	1600	V

Average forward current up to T_{mb} = 100 °C	$I_{F(AV)}$	max.	150	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	115	A
Non-repetitive peak forward current t = 10 ms; T_j = 190 °C prior to surge	I_{FSM}	max.	1600	A
Operating junction temperature	T_j	max.	190	°C

MECHANICAL DATA

dimensions in mm



Normal polarity (⊣◀⊢): blue cable. Reverse polarity (⊣▶⊢): red cable.

Net weight : 115 g

Diameter of clearance hole : max. 13,0 mm

Torque on nut : min. 10 Nm (100 kg cm)
max. 25 Nm (250 kg cm)

All information applies to frequencies up to 400 Hz.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages [1]			BYX32-	600 600R	800 800R	1000 1000R	1200 1200R	1600 1600R	
Continuous reverse voltage	V_R	max.		600	800	1000	1200	1200	V
Crest working reverse voltage	V_{RWM}	max.		600	800	1000	1200	1200	V
Repetitive peak reverse voltage	V_{RRM}	max.		600	800	1000	1200	1600	V
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.		650	900	1100	1300	1600	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 100 °C	$I_{F(AV)}$	max.	150 A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	115 A
Forward current (d. c.)	I_F	max.	240 A
R. M. S. forward current	$I_{F(RMS)}$	max.	240 A
Repetitive peak forward current	I_{FRM}	max.	750 A
Non-repetitive peak forward current (t = 10 ms; half sine wave) T_j = 190 °C prior to surge	I_{FSM}	max.	1600 A
I squared t for fusing (t = 10 ms)	I^2t	max.	12800 A^2s

Temperatures

Storage temperature	T_{stg}		-55 to +200 °C
Operating junction temperature	T_j	max.	190 °C

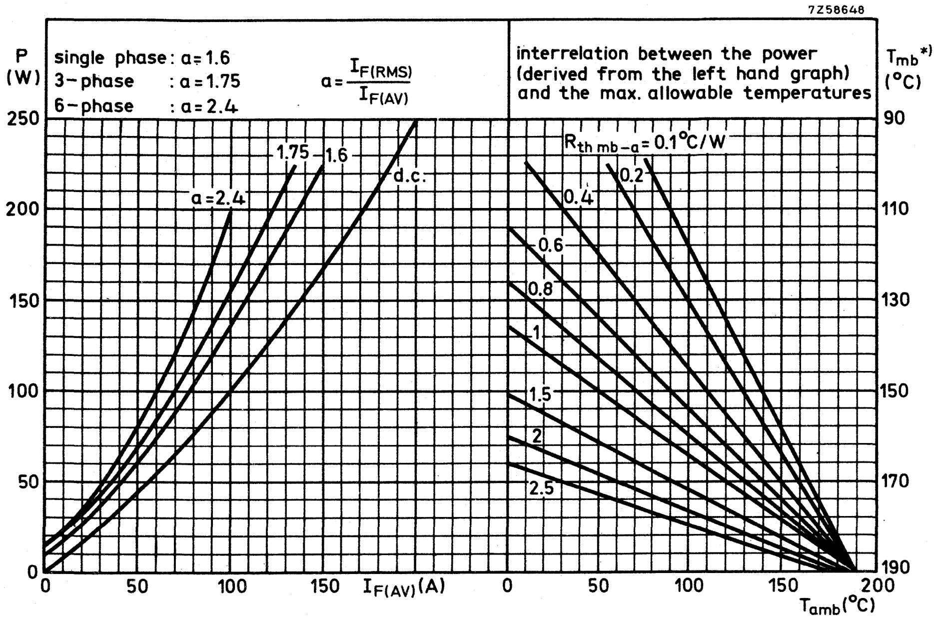
THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0.4 °C/W
From mounting base to heatsink without heatsink compound	$R_{th\ mb\text{-}h}$	=	0.1 °C/W
From mounting base to heatsink with heatsink compound (Dow Corning 340)	$R_{th\ mb\text{-}h}$	=	0.04 °C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.025 °C/W

[1]) **To ensure thermal stability:** $R_{th\ j\text{-}a}$ < 0.75 °C/W **(continuous reverse voltage) or < 1.5 °C/W (a.c.)**
For smaller heatsinks T_j should be derated. For a.c. see **graph on page 3.**
For continuous reverse voltage: $R_{th\ j\text{-}a}$ = 1 °C/W, then T_{jmax} = 184 °C
$R_{th\ j\text{-}a}$ = 1.2 °C/W, then T_{jmax} = 180 °C
$R_{th\ j\text{-}a}$ = 1.5 °C/W, then T_{jmax} = 175 °C

CHARACTERISTICS

			BYX32- 600(R)	800(R)	1000(R)	1200(R)	1600(R)	
Forward voltage I_F = 500 A; T_j = 25 °C	V_F	<	1,6	1,6	1,6	1,6	1,6	V [1]
Peak reverse current $V_{RM} = V_{RWMmax}$ T_j = 175 °C	I_{RM}	<	24	18	15	12	12	mA

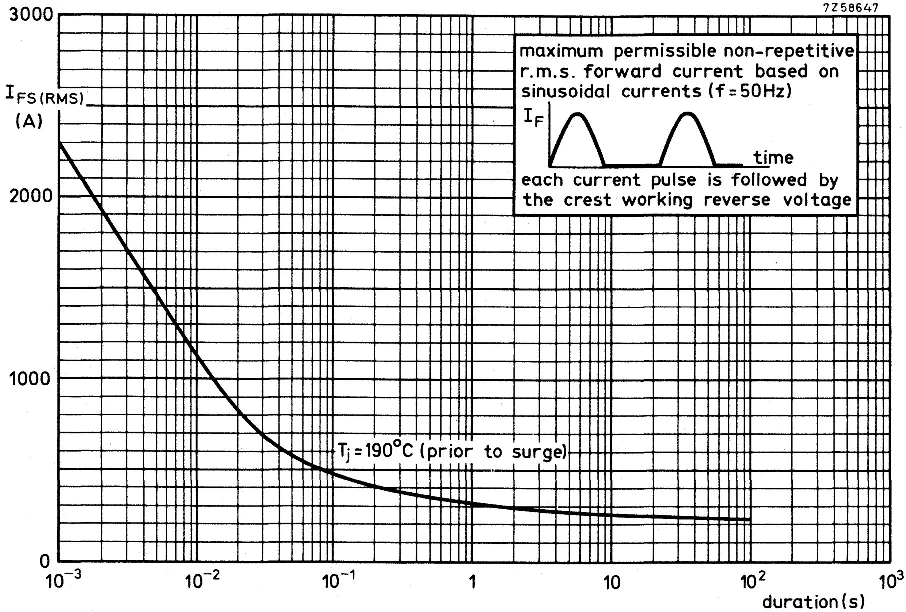


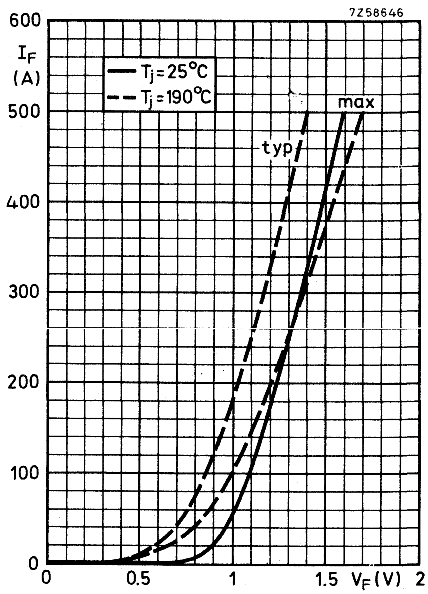
*) T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb\text{-}a} \leq 1.1$ °C/W

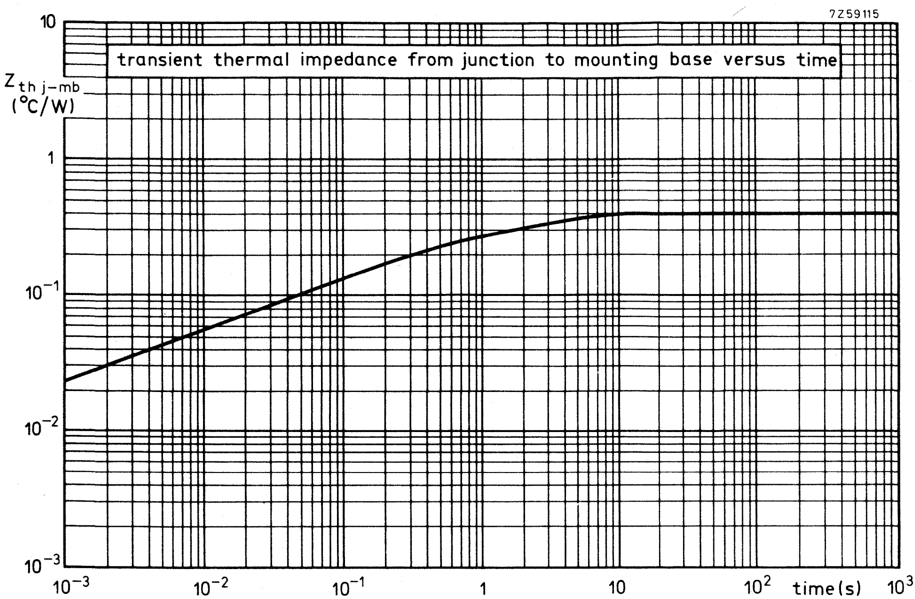
APPLICATION INFORMATION AND OPERATING NOTES

See general pages at the beginning of this section.

[1]) Measured under pulse conditions to avoid excessive dissipation.


7Z58647
3000
$I_{FS(RMS)}$
(A)
2000
1000
0
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50Hz)
I_F
time
each current pulse is followed by the crest working reverse voltage
T_j = 190°C (prior to surge)
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
10^3
duration (s)


7Z58646
600
I_F
(A)
500
400
300
200
100
0
T_j = 25°C
T_j = 190°C
typ
max
0
0.5
1
1.5
V_F (V)
2


7Z59115
transient thermal impedance from junction to mounting base versus time
Z th j-mb
(°C/W)
10
1
10^-1
10^-2
10^-3
10^-3
10^-2
10^-1
1
10
10^2
time(s)
10^3

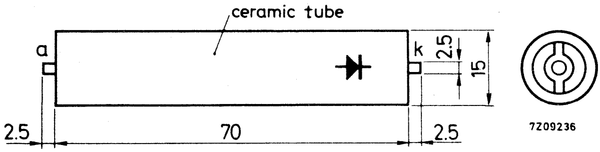
SILICON HIGH VOLTAGE DIODE

The BYX35 is primarily intended for the high voltage power supply of X-ray, electron microscope and LASER equipment.
The device is in a ceramic tube and must be immersed in oil for cooling and insulating.
The diodes can be connected in series, without voltage equalizing elements, for higher voltage applications.

QUICK REFERENCE DATA				
Crest working reverse voltage	V_{RWM}	max.	25	kV
Repetitive peak reverse voltage	V_{RRM}	max.	37.5	kV
Average forward current	I_{FAV}	max.	0.05	A
Non repetitive peak forward current t = 10 ms	I_{FSM}	max.	15	A

MECHANICAL DATA

Dimensions in mm



Net weight : 42 g
With accessories: 44 g

For mounting instructions see page 3.

All information applies to frequencies from 40 up to 400 Hz.

RATINGS (Limiting values) [1])

Voltages

Crest working reverse voltage	V_{RWM}	max.	25	kV
Repetitive peak reverse voltage	V_{RRM}	max.	37.5	kV
Non repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	40	kV

Currents

Continuous operation				
Average forward current (averaged over any 20 ms period) $T_{oil} \leq 50\,^{o}C$	I_{FAV}	max.	0.05	A
Repetitive peak forward current	I_{FRM}	max.	0.16	A
Non repetitive peak forward current ($t = 10$ ms)	I_{FSM}	max.	15	A
Intermittent operation				
Average forward current (averaged over any 20 ms period) $T_{oil} \leq 50\,^{o}C$ ($t \leq 0.5$ s once every 18 s)	I_{FAV}	max.	0.5	A
Repetitive peak forward current ($t \leq 0.5$ s once every 18 s)	I_{FRM}	max.	1.6	A

Temperatures

Storage temperature	T_{stg}	-65 to +125		^{o}C
Junction temperature	T_j	max.	125	^{o}C

THERMAL RESISTANCE

From junction to cooling oil	$R_{th\ j-o}$	=	8	$^{o}C/W$

CHARACTERISTICS

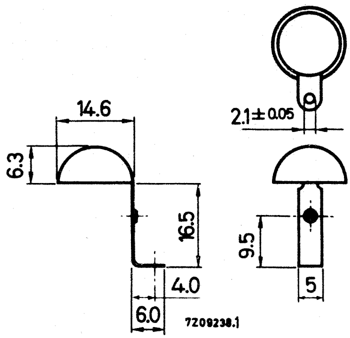
Forward voltage at $I_F = 10$ mA; $T_j = 25\,^{o}C$	V_F	typ.	25	V
Diode capacitance at $T_j = 25\,^{o}C$	C_d	typ.	45	pF

[1]) Limiting values according to the Absolute Maximum System as defined in IEC publication 134.

MOUNTING INSTRUCTIONS

Dimensions in mm

Each diode is supplied with 2 anti-corona caps.



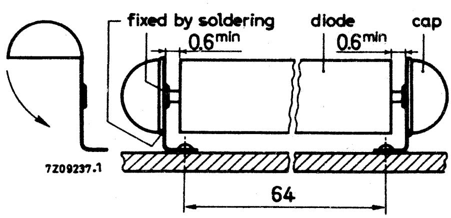
1. Mount clip on board.
2. Solder diode into fixing hole. Solder temperature: max. 300 °C; duration: max. 5 s.
3. Bend anti-corona cap down in direction of arrow and solder into position.

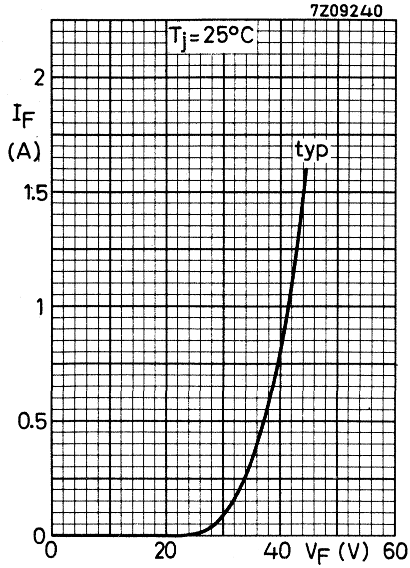
Notes:

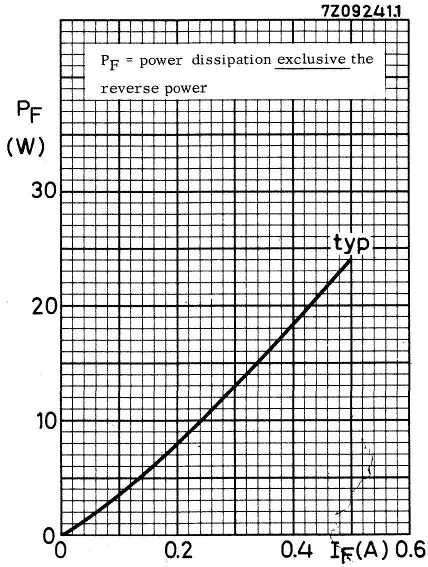
a. For good heat transfer and insulation, the devices must be immersed in oil.

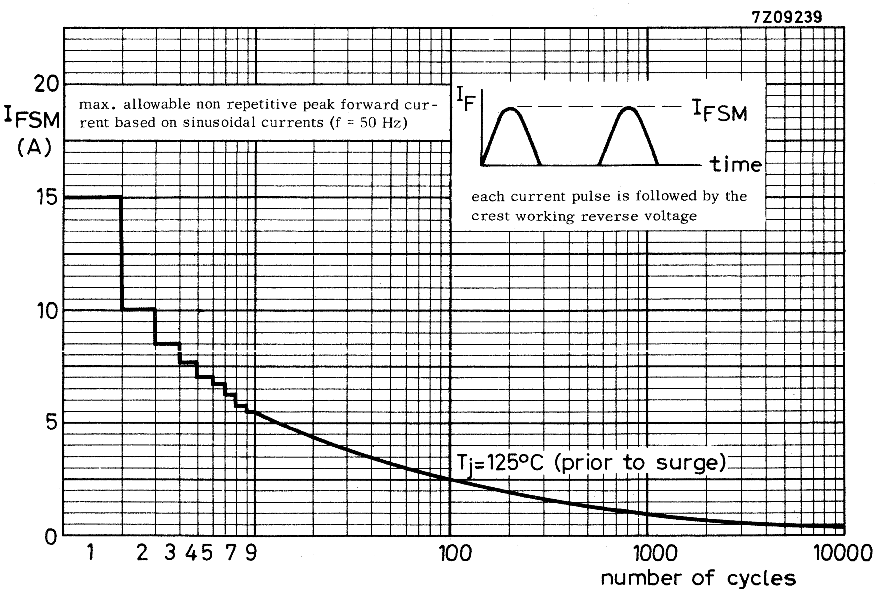
b. Any mounting position can be used.

c. Use acid free soldering flux.




7Z09240
Tj = 25°C
IF
(A)
typ
VF (V)
0
0.5
1
1.5
2
0
20
40
60


7Z09241.1
PF = power dissipation exclusive the reverse power
PF
(W)
typ
IF (A)
0
10
20
30
0
0.2
0.4
0.6


7Z09239
IFSM
(A)
max. allowable non repetitive peak forward current based on sinusoidal currents (f = 50 Hz)
IF
IFSM
time
each current pulse is followed by the crest working reverse voltage
Tj=125°C (prior to surge)
number of cycles
0
5
10
15
20
1
2
3
4
5
7
9
100
1000
10000

SILICON RECTIFIER DIODES

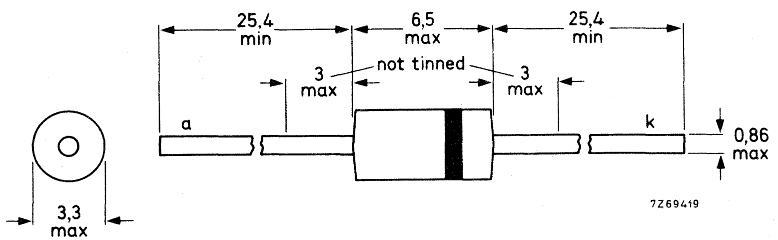
Diffused silicon rectifier diodes in DO-15 plastic envelopes for general purposes.
The series consists of the following types: BYX36-150, BYX36-300, BYX36-600.

QUICK REFERENCE DATA

			BYX36-150	300	600	
Crest working reverse voltage	V_{RWM}	max.	100	200	400	V
Repetitive peak reverse voltage	V_{RRM}	max.	150	300	600	V
Average forward current with R load up to T_{amb} = 40 °C	$I_{F(AV)}$	max.		0,8		A
Non-repetitive peak forward current t = 10 ms; T_j = 125 °C prior to surge	I_{FSM}	max.		30		A
Junction temperature	T_j	max.		125		°C

MECHANICAL DATA Dimensions in mm

DO-15 (SOD-40)



The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

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

Voltages			BYX36-150	300	600	
Continuous reverse voltage	V_R	max.	100	200	400	V
Crest working reverse voltage	V_{RWM}	max.	100	200	400	V
Repetitive peak reverse voltage ($\delta \leq 0.01$)	V_{RRM}	max.	150	300	600	V
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	150	300	600	V

Currents				
Average forward current (averaged over any 20 ms period) for R-load up to T_{amb} = 40 °C	$I_{F(AV)}$	max.	0.8	A
Forward current (d.c.) up to T_{amb} = 40 °C	I_F	max.	0.9	A
Repetitive peak forward current	I_{FRM}	max.	5	A
Non-repetitive peak forward current t = 10 ms; half sine wave T_j = 125 °C prior to surge	I_{FSM}	max.	30	A

Temperatures				
Storage temperature	T_{stg}		−55 to +125	°C
Junction temperature	T_j	max.	125	°C

CHARACTERISTICS

Forward voltage				
I_F = 1 A; T_j = 25 °C	V_F	typ.	0.9	V 1)
		<	1.2	V 1)
I_F = 5 A; T_j = 25 °C	V_F	typ.	1.1	V 1)

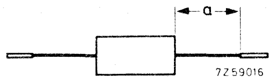
Peak reverse current				
$V_{RM} = V_{RWMmax}$; T_j = 125 °C	I_{RM}	<	120	µA

1) Measured under pulsed conditions to avoid excessive dissipation

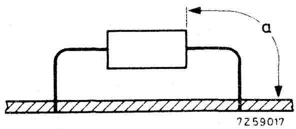
MOUNTING METHODS

The upper graph on page 4 applies when no other leads run to the tie-points. If leads of other dissipating components share the same tie-points, refer to the lower graph.

1. Mounted to solder tags at a lead-length a = 10 mm.
2. Mounted to solder tags at a = maximum lead-length.

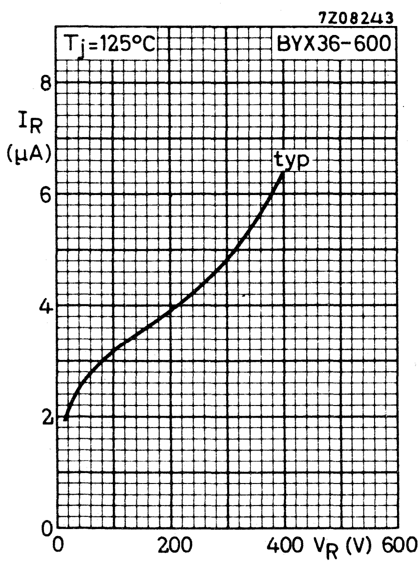


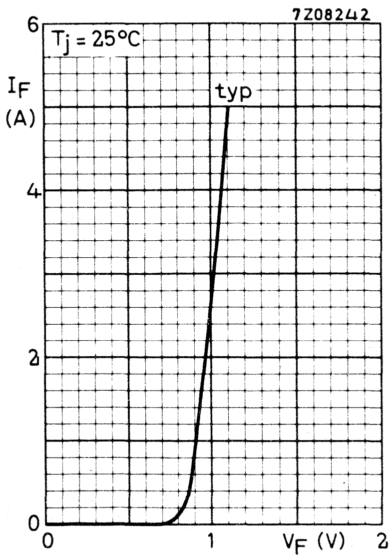
3. Mounted on printed-wiring board at a = maximum lead-length.
4. Mounted on printed-wiring board at a lead-length a = 10 mm.

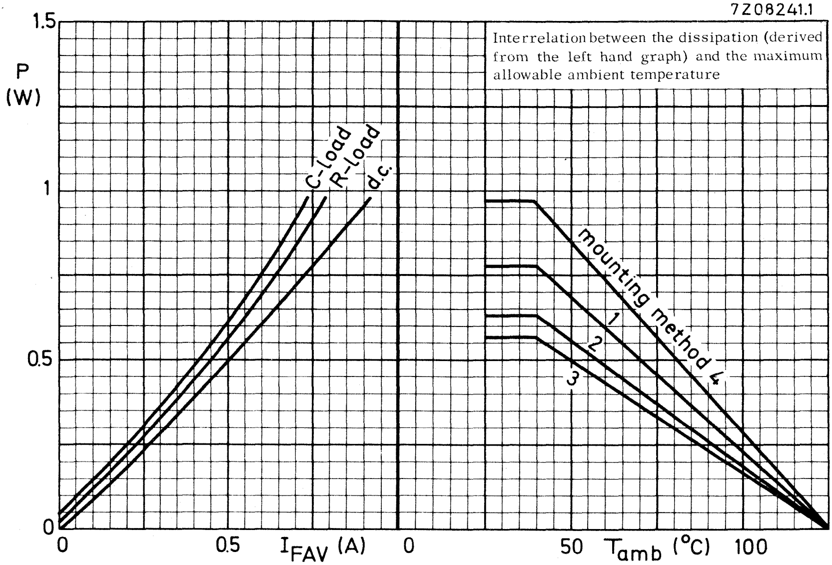


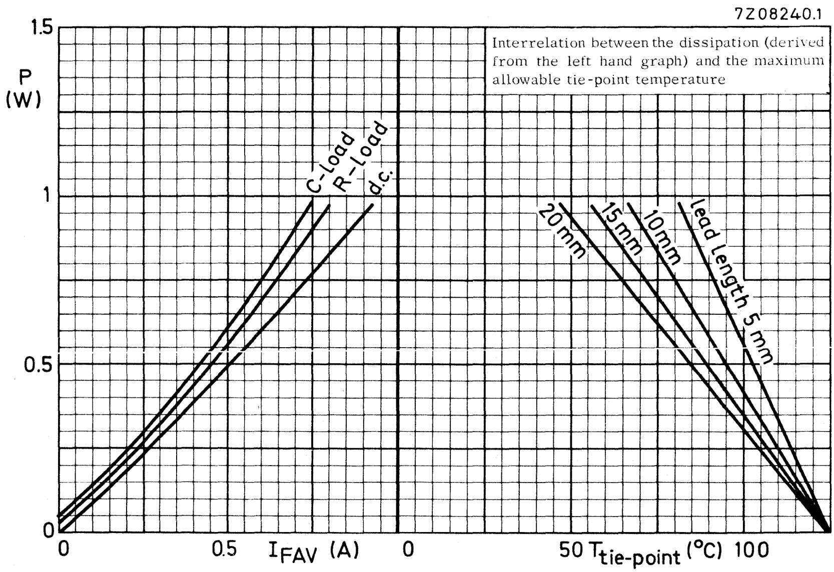
SOLDERING AND MOUNTING NOTES

1. Soldered joints must be at least 5 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 300 °C; it must be in contact with the joint for no more than 3 seconds.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 °C.






7Z08241.1
Interrelation between the dissipation (derived from the left hand graph) and the maximum allowable ambient temperature
1.5
P
(W)
1
0.5
0
0
0.5
I_{FAV} (A)
0
50
T_{amb} (°C)
100
C-Load
R-Load
d.c.
mounting method 4
1
2
3


7Z08240.1
Interrelation between the dissipation (derived from the left hand graph) and the maximum allowable tie-point temperature
1.5
P
(W)
1
0.5
0
0
0.5
I_{FAV} (A)
0
50
$T_{tie-point}$ (°C)
100
C-Load
R-Load
d.c.
20mm
15mm
10mm
lead length 5 mm

SILICON RECTIFIER DIODES

Silicon rectifier diodes in DO-4 metal envelopes, intended for use in power rectifier applications. The series consists of the following types:
Normal polarity (cathode to stud): BYX38-300 to 1200.
Reverse polarity (anode to stud): BYX38-300R to 1200R.

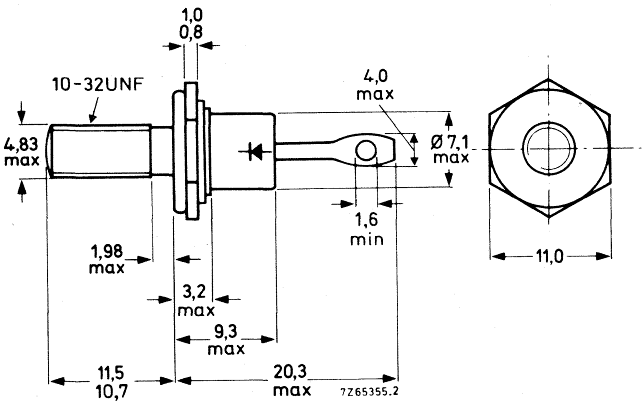
QUICK REFERENCE DATA

			BYX38-300(R)	600(R)	1200(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	V
Average forward current	$I_{F(AV)}$	max.		6		A
Non-repetitive peak forward current	I_{FSM}	max.		50		A

MECHANICAL DATA

Dimensions in mm

DO-4



Net mass: 6 g

Diameter of clearance hole: max. 5,2 mm

Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)
56262A (mica washer, insulating ring, plain washer)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 9,5 mm

The mark shown applies to normal polarity types.

Torque on nut: min. 0,9 Nm
(9 kg cm)
max. 1,7 Nm
(17 kg cm)

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

→ Voltages

			BYX38-300(R)	600(R)	1200(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	V
Continuous reverse voltage	V_R	max.	200	400	800	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 110 °C	$I_{F(AV)}$	max.	6	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	4	A
R.M.S. forward current	$I_{F(RMS)}$	max.	10	A
Repetitive peak forward current	I_{FRM}	max.	50	A
Non-repetitive peak forward current (t = 10 ms; half sine-wave) T_j = 150 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	50	A
I^2t for fusing (t = 10 ms)	I^2t	max.	13	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
without heatsink compound	$R_{th\ mb\text{-}h}$	=	0,6	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,3	°C/W

CHARACTERISTICS

Forward voltage

$I_F = 20\ A; T_j = 25\ ^oC$	V_F	<	1,7	V [1]

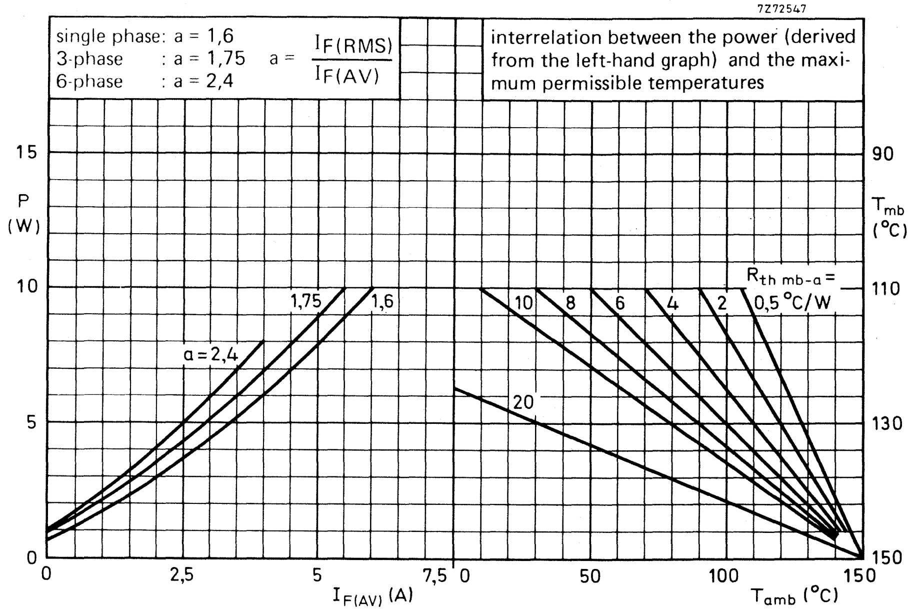
Reverse current

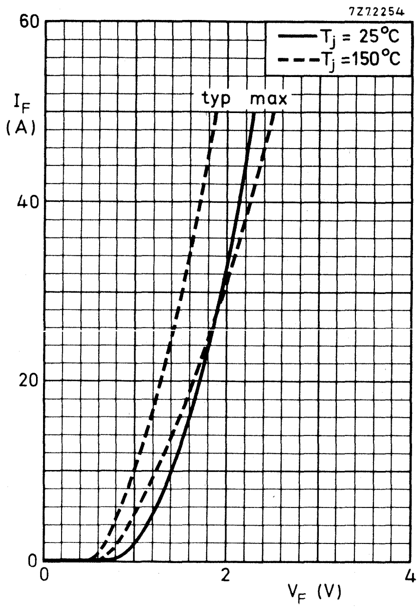
$V_R = V_{RWMmax}; T_j = 125\ ^oC$	I_R	<	200	μA

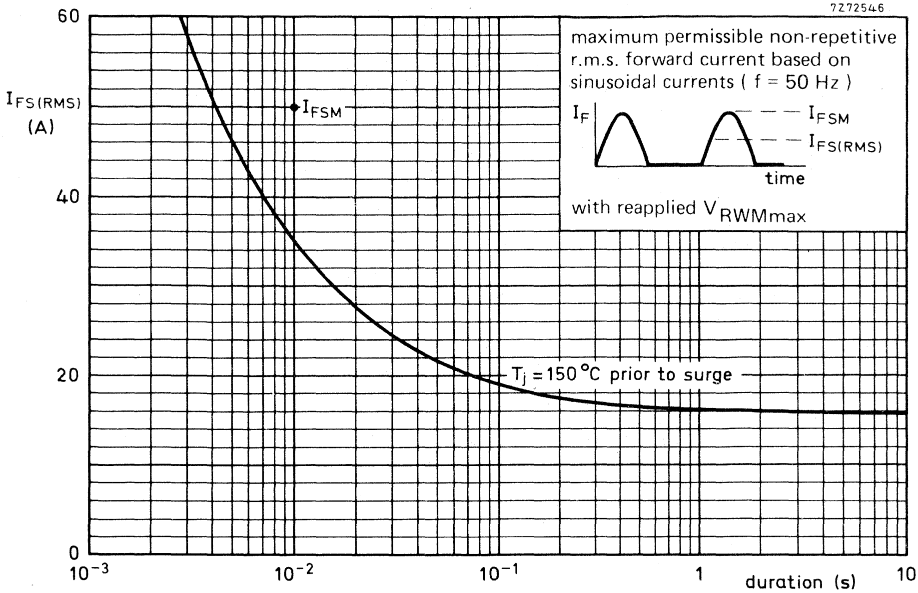
OPERATING NOTES

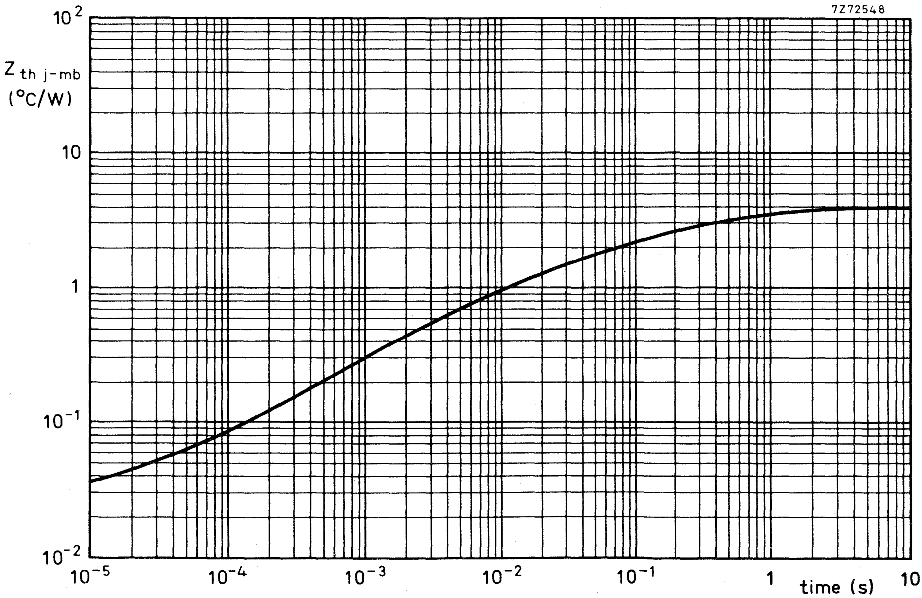
1. The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
During soldering the heat conduction to the junction should be kept to a minimum.
2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits in Data Handbook Part SC 1a.

[1]) Measured under pulse conductions to avoid excessive dissipation.


7Z72547
single phase: a = 1,6
3-phase : a = 1,75
6-phase : a = 2,4
a = IF(RMS) / IF(AV)
interrelation between the power (derived from the left-hand graph) and the maximum permissible temperatures
P (W)
15
10
5
0
a = 2,4
1,75
1,6
0
2,5
5
7,5
IF(AV) (A)
10
8
6
4
2
0,5 °C/W
Rth mb-a =
20
0
50
100
150
Tamb (°C)
Tmb (°C)
90
110
130
150


7Z72254
Tj = 25°C
Tj =150°C
typ
max
IF (A)
60
40
20
0
0
2
4
VF (V)


7Z72546
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}
$I_{FS(RMS)}$ (A)
60
40
20
0
I_{FSM}
$T_j = 150\,^\circ C$ prior to surge
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10


7Z72548
$Z_{th\ j\text{-}mb}$ (°C/W)
10^2
10
1
10^{-1}
10^{-2}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10

CONTROLLED AVALANCHE RECTIFIER DIODES

Silicon diodes in a DO-4 metal envelope, capable of absorbing transients and intended for use in power rectifier application.
The series consists of the following types:
Normal polarity (cathode to stud): BYX39-600; BYX39-800; BYX39-1000
Reverse polarity (anode to stud): BYX39-600R; BYX39-800R ; BYX39-1000R

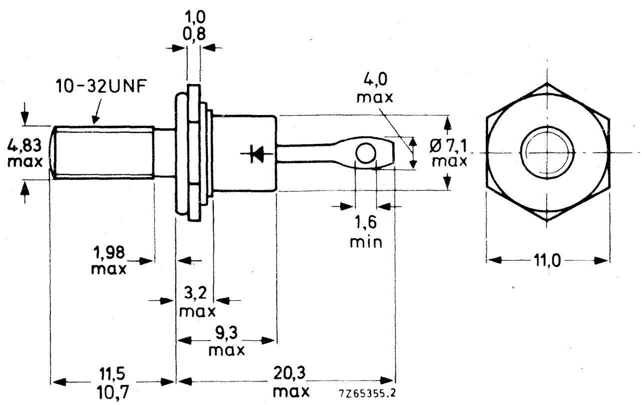
QUICK REFERENCE DATA

			BYX39-600(R)	800(R)	1000(R)	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	750	1000	1250	V

Average forward current	$I_{F(AV)}$	max.	9.5	A
Non-repetitive peak forward current	I_{FSM}	max.	125	A
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	4	kW

MECHANICAL DATA Dimensions in mm

DO-4; Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 9.5 mm



Net mass: 6 g
Diameter of clearance hole: max. 5.2 mm
Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)

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

The mark shown applies to normal polarity types.

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

Voltages*			BYX39-600(R)	800(R)	1000(R)	
Continuous reverse voltage	V_R	max.	600	800	1000	V
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{F(AV)}$	max.	9.5	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	6.0	A
Forward current (d.c.)	I_F	max.	6.8	A
R.M.S. forward current	$I_{F(RMS)}$	max.	15	A
Repetitive peak forward current	I_{FRM}	max.	100	A
Non-repetitive peak forward current (t = 10 ms; half-sinewave) with reapplied V_{RWMmax}; T_j = 175 °C prior to surge	I_{FSM}	max.	125	A
I^2t for fusing (t = 10 ms)	I^2t	max.	78	A^2s

Reverse power dissipation

Average reverse power dissipation (averaged over any 20 ms period) T_j = 125 °C	$P_{R(AV)}$	max.	10	W
Repetitive peak reverse power dissipation t = 10 μs (square wave; f = 50 Hz) T_j = 125 °C	P_{RRM}	max.	2	kW
Non-repetitive peak reverse power dissipation t = 10 μs (square wave) T_j = 25 °C prior to surge	P_{RSM}	max.	4	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	0.8	kW

Temperatures

Storage temperature	T_{stg}		-55 to +175	°C
Junction temperature	T_j	max.	175	°C

* To ensure thermal stability: $R_{th\ j-a} \leq 10$ °C/W (continuous reverse voltage) or ≤ 20 °C/W (a.c.)
For smaller heatsinks T_{jmax} should be derated.
For continuous reverse voltage: if $R_{th\ j-a}$ = 15 °C/W, then T_{jmax} = 140 °C
if $R_{th\ j-a}$ = 20 °C/W, then T_{jmax} = 135 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4.5	°C/W
From mounting base to heatsink				
without heatsink compound	$R_{th\ mb\text{-}h}$	=	1.0	°C/W
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.5	°C/W
with mica washer	$R_{th\ mb\text{-}h}$	=	2.0	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.35	°C/W

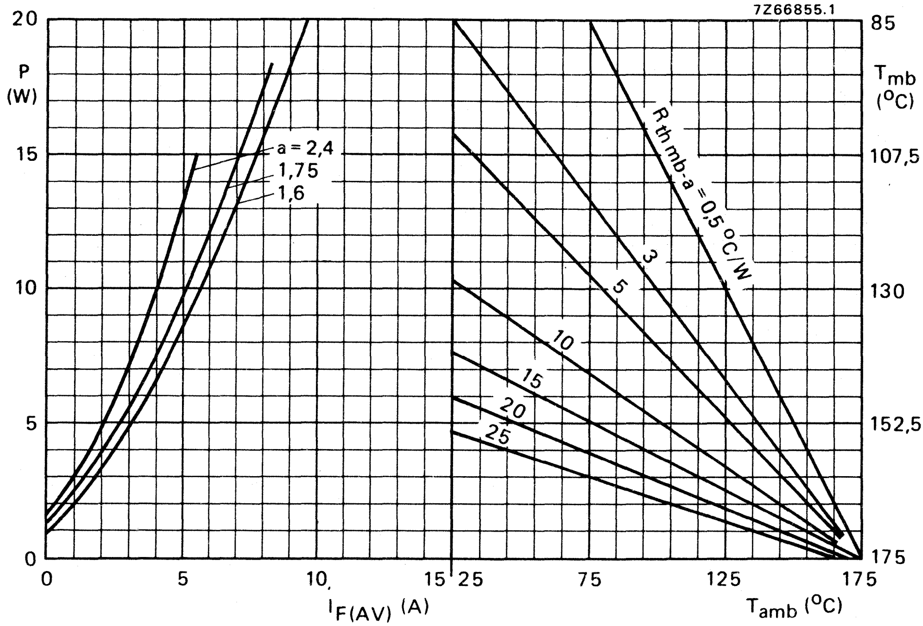
CHARACTERISTICS

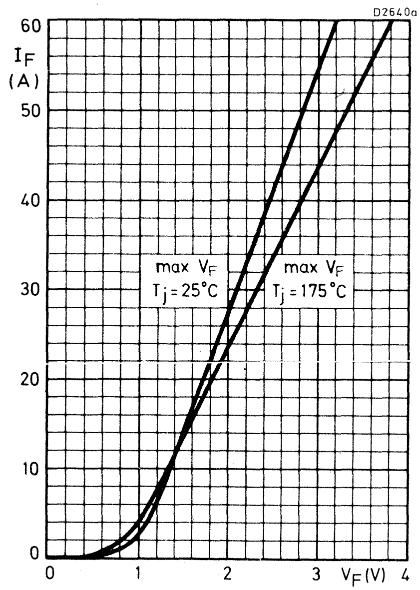
			BYX39-600(R)	800(R)	1000(R)	
Forward voltage*						
I_F = 20 A; T_j = 25 °C	V_F	<	1.7	1.7	1.7	V
Reverse avalanche breakdown voltage						
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	750	1000	1250	V
		<	2000	2000	2000	V
Reverse current						
$V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	200	200	200	μA

OPERATING NOTES

The top connector should neither be bent nor twisted; 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.

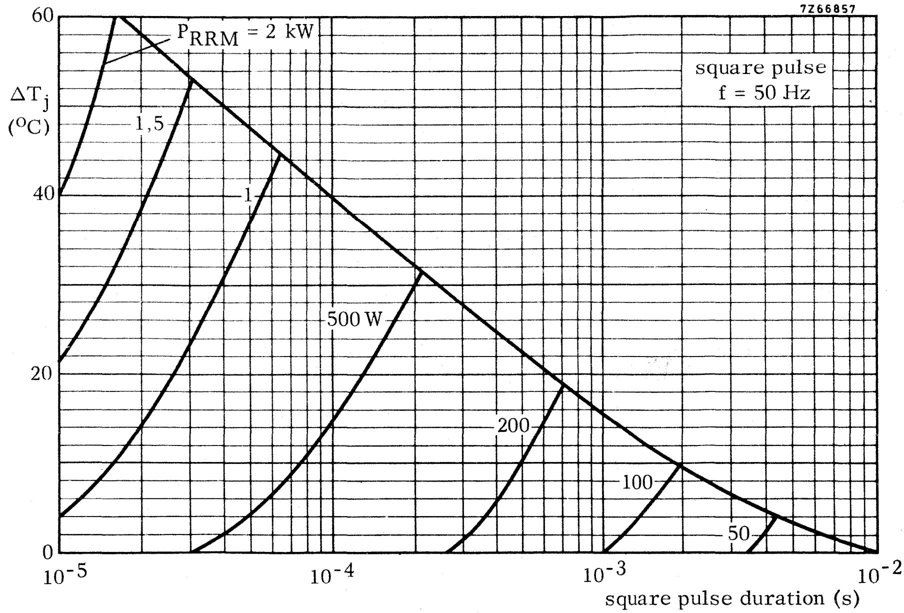
* Measured under pulse conditions to avoid excessive dissipation.

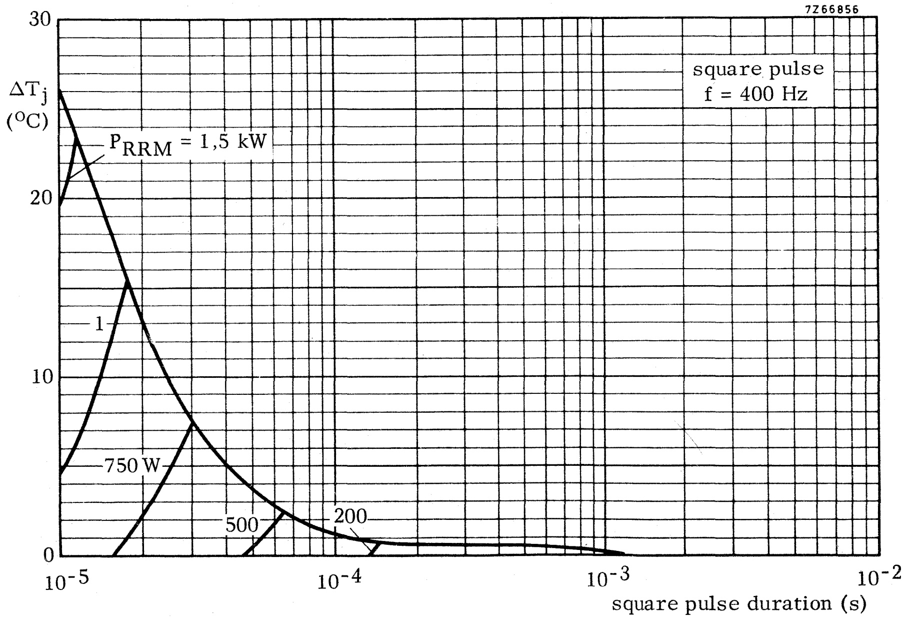


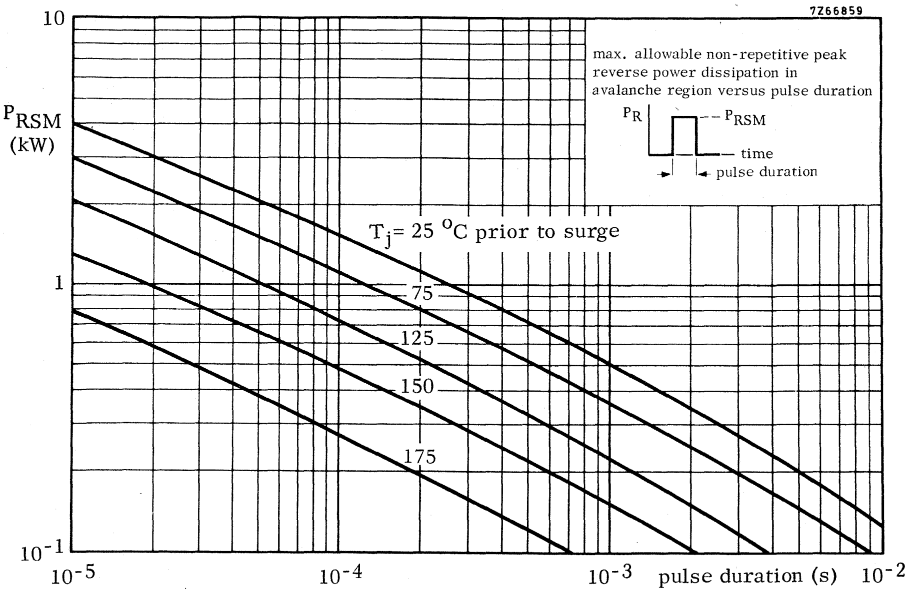


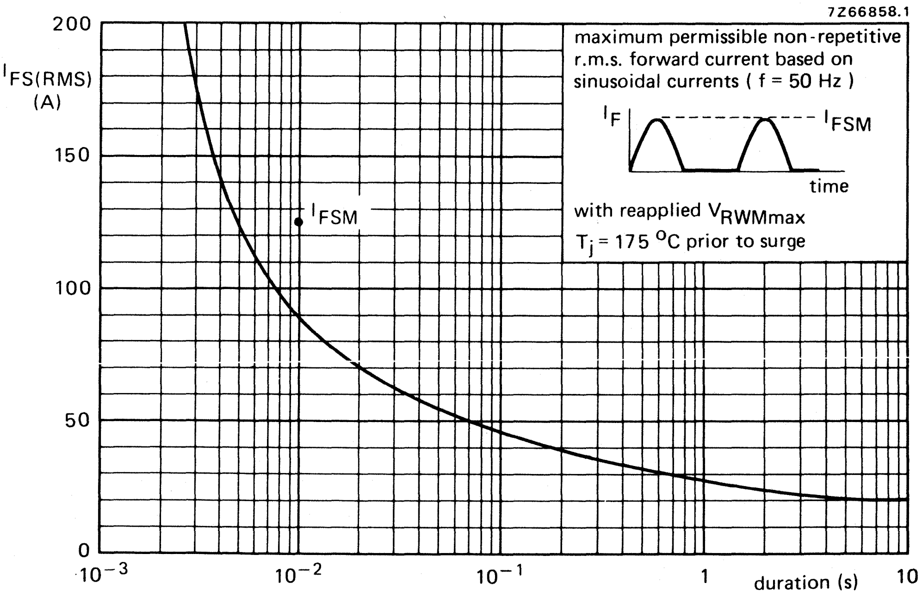
The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = dissipation excluding power in the avalanche region.
single phase: a = 1,6
3-phase : a = 1,75
6-phase : a = 2,4

$a = I_{F(RMS)}/I_{F(AV)}$


7Z66857
P_{RRM} = 2 kW
1,5
1
500 W
200
100
50
square pulse
f = 50 Hz
ΔT_j
(^oC)
60
40
20
0
10^{-5}
10^{-4}
10^{-3}
10^{-2}
square pulse duration (s)


7Z66856
P_{RRM} = 1,5 kW
1
750 W
500
200
square pulse
f = 400 Hz
ΔT_j
(^oC)
30
20
10
0
10^{-5}
10^{-4}
10^{-3}
10^{-2}
square pulse duration (s)


7Z66859
max. allowable non-repetitive peak reverse power dissipation in avalanche region versus pulse duration
P_R
P_{RSM}
time
pulse duration
P_{RSM} (kW)
T_j = 25 °C prior to surge
75
125
150
175
10
1
10^{-1}
10^{-5}
10^{-4}
10^{-3}
pulse duration (s)
10^{-2}


7Z66858.1
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
time
with reapplied V_{RWMmax}
T_j = 175 °C prior to surge
$I_{FS(RMS)}$ (A)
I_{FSM}
200
150
100
50
0
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10

SILICON RECTIFIER DIODES

Diffused silicon rectifier diodes in DO-4 metal envelopes, intended for power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX42-300 to 1200.
Reserve polarity (anode to stud): BYX42-300R to 1200R.

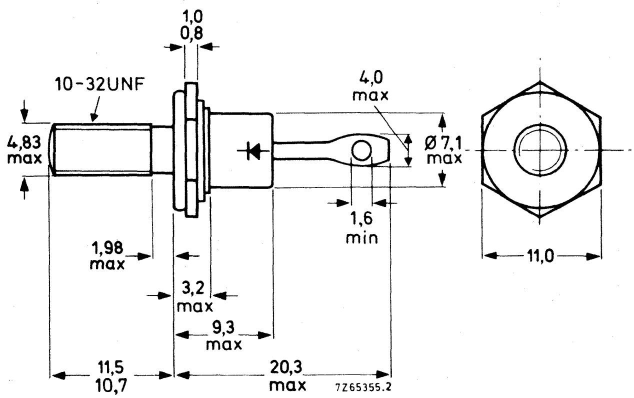
QUICK REFERENCE DATA

			BYX42-300(R)	600(R)	1200(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	V
Average forward current	$I_{F(AV)}$	max.		12		A
Non-repetitive peak forward current	I_{FSM}	max.		125		A

MECHANICAL DATA

Dimensions in mm

DO-4



Net mass: 6 g

Diameter of clearance hole: 5,2 mm

Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)
56262A (mica washer, insulating ring, plain washer)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions accross the flats: 9,5 mm

The mark shown applies to normal polarity types.

Torque on nut: min. 0,9 Nm
(9 kg cm)
max. 1,7 Nm
(17 kg cm)

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

→ Voltages

			BYX42-300(R)	600(R)	1200(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	V
Continuous reverse voltage	V_R	max.	200	400	800	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 115 °C	$I_{F(AV)}$	max.	12	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	10	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current	I_{FRM}	max.	60	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.	125	A

Temperatures

Storage temperature	T_{stg}		−55 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	3	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,5	°C/W

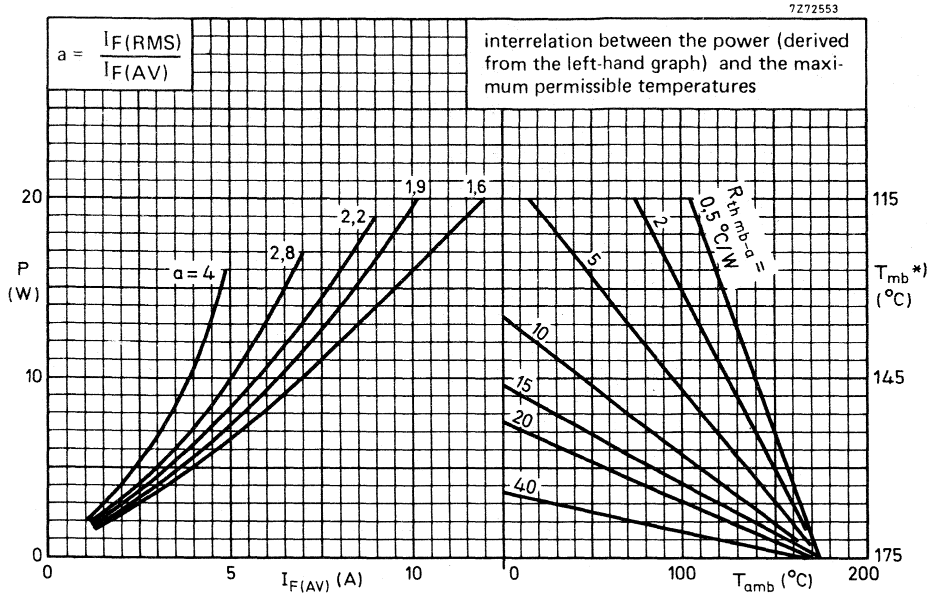
CHARACTERISTICS

Forward voltage at I_F = 15 A; T_j = 25 °C	V_F	<	1,4	V [1]
Reverse current at $V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	200	µA

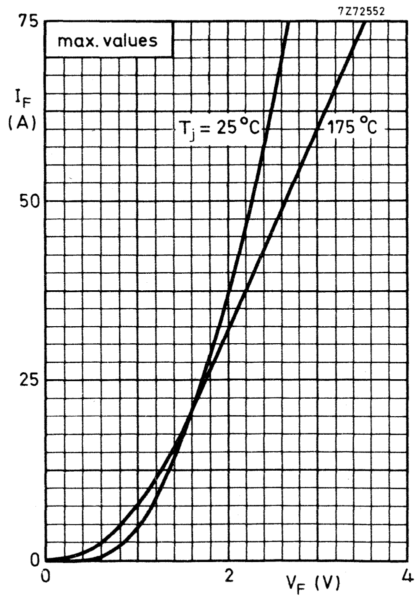
MOUNTING INSTRUCTIONS

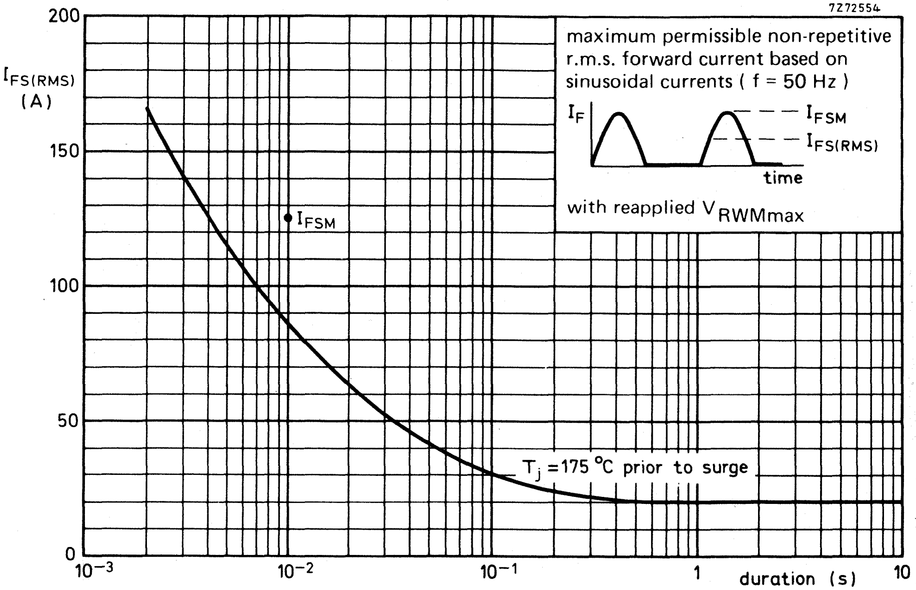
The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
During soldering the heat conduction to the junction should be kept to a minimum.

[1]) Measured under pulse conditions to avoid excessive dissipation.



*) T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb\text{-}a} \leq 22\ ^{o}C/W$




7Z72554
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_FS(RMS) (A)
200
150
100
50
0
I_FSM
T_j = 175 °C prior to surge
10^-3
10^-2
10^-1
1
10
duration (s)

CONTROLLED AVALANCHE RECTIFIER DIODES

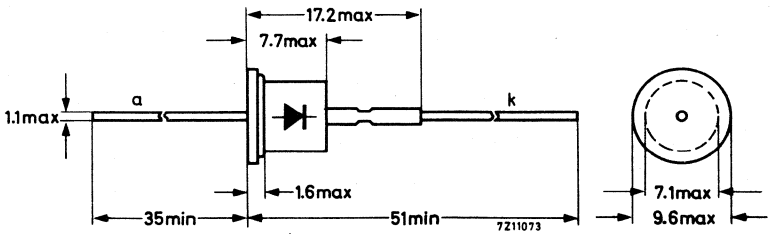
Diffused silicon diodes in a DO-1 metal envelope, capable of absorbing transients. They are intended for rectifier applications and particularly suited for series operation.
The series consists of the following reverse polarity types (anode to case): BYX45-600R, BYX45-800R, BYX45-1000R.

QUICK REFERENCE DATA

			BYX45-600R	800R	1000R	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	V
Reverse breakdown voltage	$V_{(BR)R}$	>	750	1000	1250	V
Average forward current	I_{FAV}	max.		1.5		A
Non repetitive peak forward current t = 10 ms; T_j = 150 °C (prior to surge)	I_{FSM}	max.		40		A
Non repetitive peak reverse power t = 10 μs; T_j = 25 °C	P_{RSM}	max.		2.5		kW
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA Dimensions in mm

DO-1



All information applies to frequencies up to 400 Hz

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

			BYX45-600R	800R	1000R	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	V

Currents

Average forward current (averaged over any 20 ms period) (see also **page 5**)	I_{FAV}	max.	1.5	A
Forward current (d.c.)	I_F	max.	2.0	A
R.M.S. forward current	$I_{F(RMS)}$	max.	2.4	A
Repetitive peak forward current	I_{FRM}	max.	15	A
Non repetitive peak forward current t = 10 ms; T_j = 150 °C (prior to surge)	I_{FSM}	max.	40	A
I squared t for fusing (t = 10 ms)	I^2t	max.	8	A^2s

Reverse power dissipation

Repetitive peak reverse power dissipation (square wave) f = 50 Hz; t = 10 μs; T_j = 125 °C	P_{RRM}	max.	800	W
Non repetitive peak reverse power dissipation (square wave) t = 10 μs; T_j = 25 °C (prior to surge)	P_{RSM}	max.	2.5	kW
t = 10 μs; T_j = 150 °C (prior to surge)	P_{RSM}	max.	800	W

Temperatures

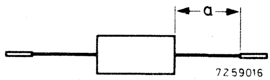
Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

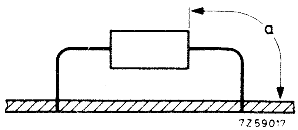
Effect of mounting on thermal resistance $R_{th\ j-a}$

The quoted values apply when no other leads run to the tie-points. If leads of other dissipating components share the same tie-points, the thermal resistance will be higher than that quoted.

1. Mounted to solder tags at a lead-length a = 10 mm. $R_{th\ j-a}$ = 60 °C/W
2. Mounted to solder tags at a = maximum lead-length. $R_{th\ j-a}$ = 70 °C/W



3. Mounted on printed-wiring board at a = maximum lead-length. $R_{th\ j-a}$ = 80 °C/W
4. Mounted on printed-wiring board at a lead-length a = 10 mm. $R_{th\ j-a}$ = 90 °C/W



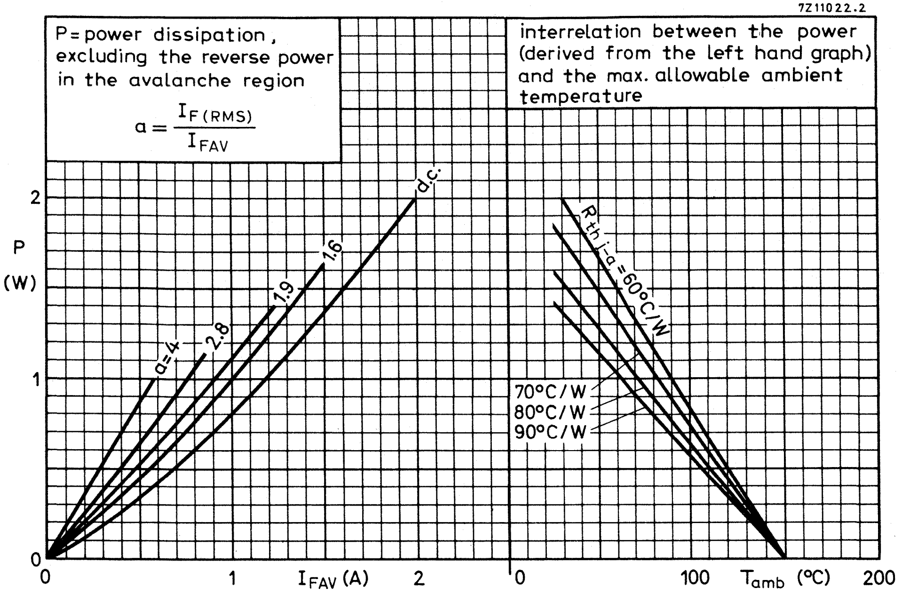
SOLDERING AND MOUNTING NOTES

1. At a soldering iron or bath temperature of up to 245 °C, the maximum permissible soldering time is 10 s if the joint is 5 mm from the seal, 3 s if it is 1.5 mm from the seal.
2. At a temperature between 245 °C and 400 °C (max.), the joint must be more than 5 mm from the seal and soldering time must not exceed 5 s.
3. Leads should not be bent less than 1.5 mm from the seal; excert no axial pull when bending.

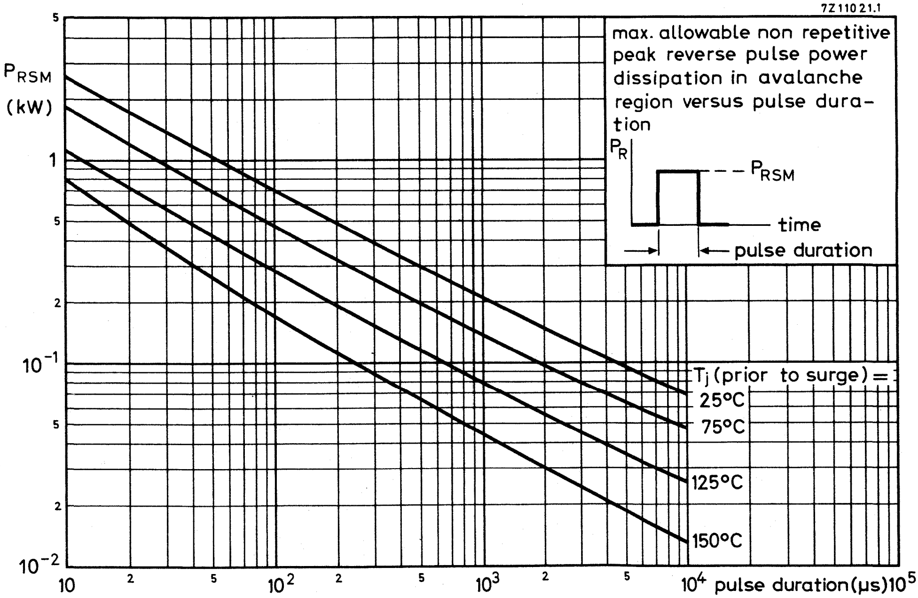
CHARACTERISTICS

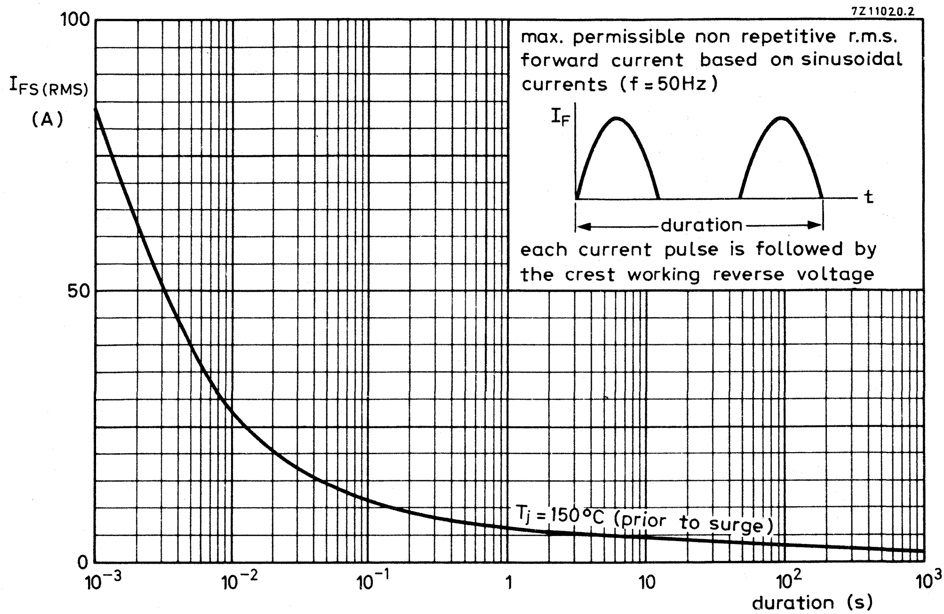
Voltages			BYX45-600R	800R	1000R	
Forward voltage at $I_F = 5$ A; $T_j = 25\ ^oC$	V_F	<	1.45	1.45	1.45	V
Reverse avalanche breakdown voltage $I_R = 1$ mA; $T_j = 25\ ^oC$	$V_{(BR)R}$	>	750	1000	1250	V
		<	2000	2000	2000	V
Current						
Peak reverse current at $T_j = 125\ ^oC$ $V_R = V_{RWMmax}$	I_{RM}	<	100	100	100	µA

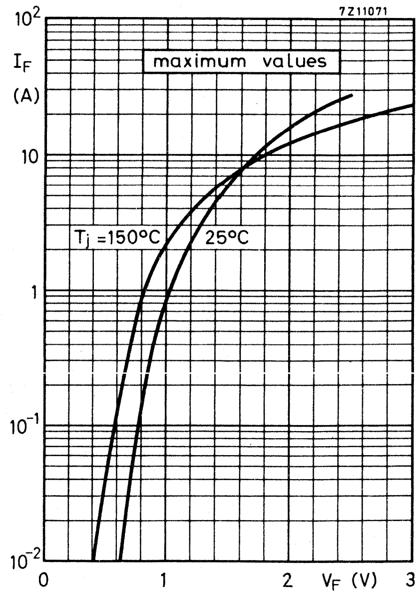
7Z11022.2



7Z11021.1




7Z11020.2
100
50
0
$I_{FS(RMS)}$
(A)
max. permissible non repetitive r.m.s. forward current based on sinusoidal currents (f = 50Hz)
I_F
t
duration
each current pulse is followed by the crest working reverse voltage
T_j = 150 °C (prior to surge)
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
10^3
duration (s)


7Z11071
10^2
I_F
(A)
10
1
10^{-1}
10^{-2}
maximum values
T_j =150°C
25°C
0
1
2
V_F (V)
3

FAST SOFT-RECOVERY RECTIFIER DIODES

- With controlled avalanche

Diffused silicon diodes in DO-4 metal envelopes, capable of absorbing transients. They are primarily intended for use in high-frequency power supplies, thyristor inverters and multi-phase power rectifier applications.

The series consists of the following types:
Normal polarity (cathode to stud): BYX46-200 to BYX46-600.
Reverse polarity (anode to stud): BYX46-200R to BYX46-600R

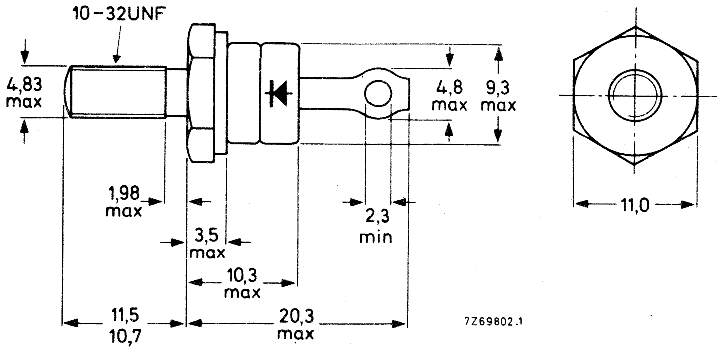
QUICK REFERENCE DATA

			BYX46-200(R)	300(R)	400(R)	500(R)	600(R)	
Crest working reverse voltage	V_{RWM}	max.	200	300	400	500	600	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	250	375	500	625	750	V
Average forward current	$I_{F(AV)}$	max.			22			A
Non-repetitive peak forward current	I_{FSM}	max.			300			A
Non-repetitive peak reverse power	P_{RSM}	max.			18			kW
Reverse recovery time	t_{rr}	<			200			ns

MECHANICAL DATA

Dimensions in mm

DO-4 Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 9,5 mm



Net mass: 7 g
Diameter of clearance hole: max. 5,2 mm
Accessories supplied on request: 56295
(PTFE bush, 2 mica washers, plain washer, tag)

Torque on nut: min. 0,9 Nm
(9 kg cm)
max. 1,7 Nm
(17 kg cm)

The mark shown applies to the normal polarity types.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages *			BYX46-200(R)	300(R)	400(R)	500(R)	600(R)	
Crest working reverse voltage	V_{RWM}	max.	200	300	400	500	600	V
Continuous reverse voltage	V_R	max.	200	300	400	500	600	V

Currents				
Average forward current (averaged over any 20 ms period)				
up to T_{mb} = 100 °C	$I_{F(AV)}$	max.	22	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	15	A
R.M.S. forward current	$I_{F(RMS)}$	max.	35	A
Repetitive peak forward current	I_{FRM}	max.	400	A
Non-repetitive peak forward current (t = 10 ms; half-sinewave) T_j = 165 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	300	A
I^2t for fusing (t = 10 ms)	I^2t	max.	450	A^2s
Reverse power dissipation				
Repetitive peak reverse power dissipation t = 10 μs (square wave; f = 50 Hz) T_j = 100 °C	P_{RRM}	max.	9,5	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 = 165 °C prior to surge	P_{RSM}	max.	4	kW
Temperatures				
Storage temperature	T_{stg}		−55 to +165	°C
Junction temperature	T_j	max.	165	°C

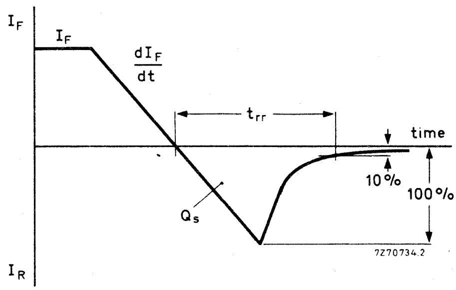
THERMAL RESISTANCE

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

* To ensure thermal stability: $R_{th\ j\text{-}a} < 2{,}5$ °C/W (continuous reverse voltage) or < 5 °C/W (a.c.). For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see page 5. For continuous reverse voltage: if $R_{th\ j\text{-}a}$ = 5 °C/W, then $T_{j\ max}$ = 135 °C; if $R_{th\ j\text{-}a}$ = 10 °C/W, then $T_{j\ max}$ = 125 °C.

CHARACTERISTICS

			BYX46-200(R)	300(R)	400(R)	500(R)	600(R)	
Forward voltage								
I_F = 50 A; T_j = 25 °C	V_F	<	2,0	2,0	2,0	2,0	2,0	V *
Reverse breakdown voltage								
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	250	375	500	625	750	V
		<	1050	1050	1050	1050	1050	V
Reverse current								
$V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	4,0	4,0	4,0	4,0	4,0	mA
Reverse recovery charge when switched from I_F = 2 A to $V_R \geqslant$ 30 V; $-dI_F/dt$ = 100 A/µs; T_j = 25 °C	Q_s	<			0,70			µC
Reverse recovery time when switched from I_F = 1 A to $V_R \geqslant$ 30 V; $-dI_F/dt$ = 50 A/µs; T_j = 25 °C	t_{rr}	<			200			ns ←



OPERATING NOTES

1. Square-wave operation

When I_F has been flowing sufficiently long for the steady state to be established, there will be a charge due to minority carriers present. Before the device can block in the reverse direction this charge must be extracted. This extraction takes the form of a reverse transient (see figure above). The majority of the power dissipation due to the reverse transient occurs during fall time as the rectifier gradually becomes reverse biased, and the mean power will be proportional to the operating frequency. The mean value of this power loss can be derived from the graphs on page 10.

* Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTES (continued)

2. Sine wave operation

Power loss in sine wave operation will be considerably less owing to the much slower rate of change of the applied voltage (and consequently lower values of I_{RRM}), so that power loss due to reverse recovery may be safely ignored for frequencies up to 50 kHz.

3. Determination of the heatsink thermal resistance

Example:

Assume a diode, used in an inverter.

frequency	f	=	20	kHz
duty cycle	δ	=	0.5	
ambient temperature	T_{amb}	=	40	°C
switched from	I_F	=	12	A
to	V_R	=	300	V
at a rate	$-\frac{dI}{dt}$	=	50	A/µs

At a duty cycle $\delta = 0.5$ the average forward current $I_{FAV} = 6$ A.
From the upper graph on page 5 it follows, that at $I_{FAV} = 6$ A the average forward power + average leakage power = 13 W (point A).
The additional power losses due to switching-off can be read from the nomogram on page 10 (the example being based on optimum use, i.e. $T_j = 165$ °C). Starting from $I_F = 12$ A on the horizontal scale trace upwards until the appropriate line $-\frac{dI}{dt} = 50$ A/µs. From the intersection trace horizontally to the right until the line for $f = 20$ kHz. Then trace downwards to the line $V_R = 300$ V and ultimately trace horizontally to the left and on the vertical axis read the additional average power dissipation $P_{RAV} = 6$ W.
Therefore the total power dissipation $P_{tot} = 13\ W + 6\ W = 19\ W$ (point B of the upper graph on page 5).

From the right hand part of the upper graph on page 5 follows the thermal resistance, required at $T_{amb} = 40$ °C.

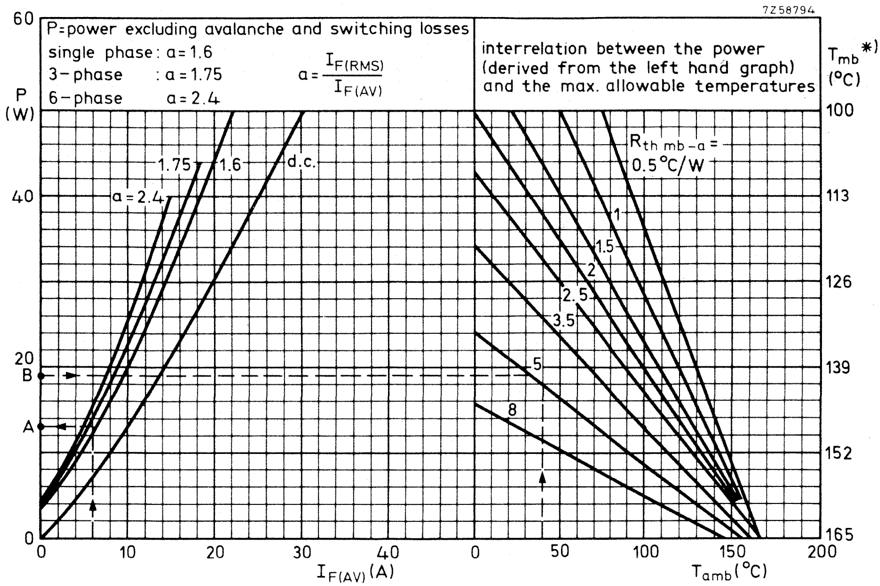
$$R_{th\ mb-a} \approx 5\ °C/W$$

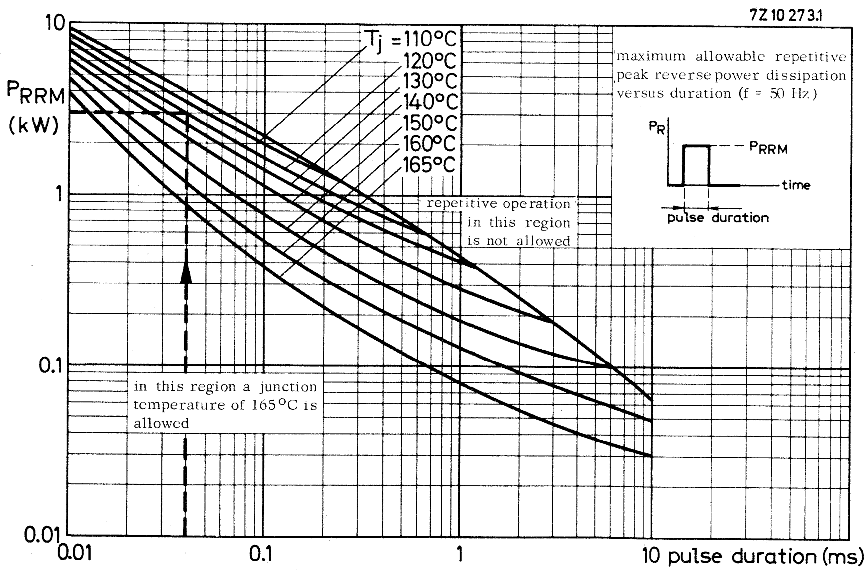
The contact thermal resistance $R_{th\ mb-h} = 0.5$ °C/W.

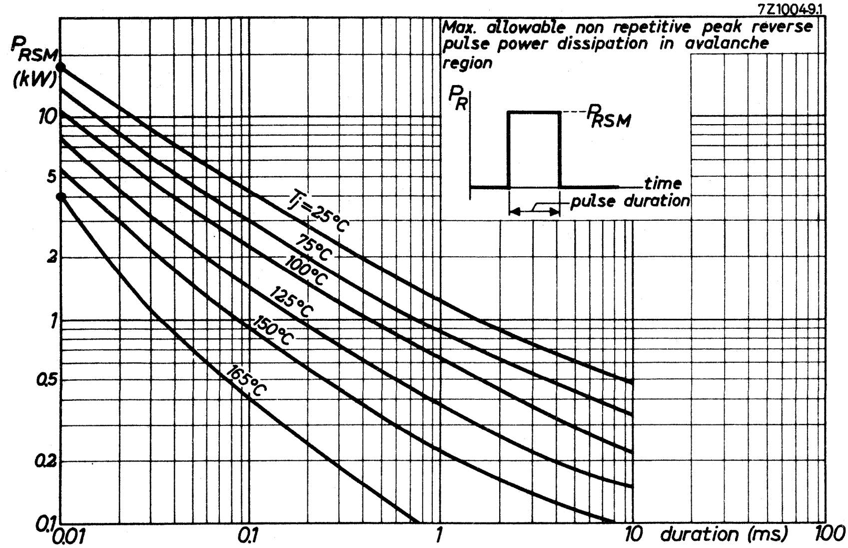
Hence the heatsink thermal resistance should be:

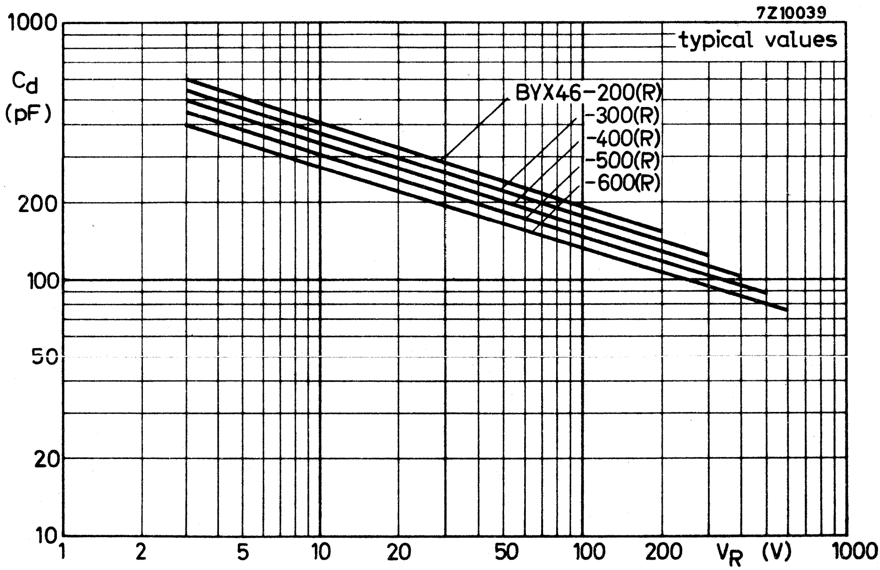
$$R_{th\ h-a} = R_{th\ mb-a} - R_{th\ mb-h} = (5 - 0.5)\ °C/W = 4.5\ °C/W.$$

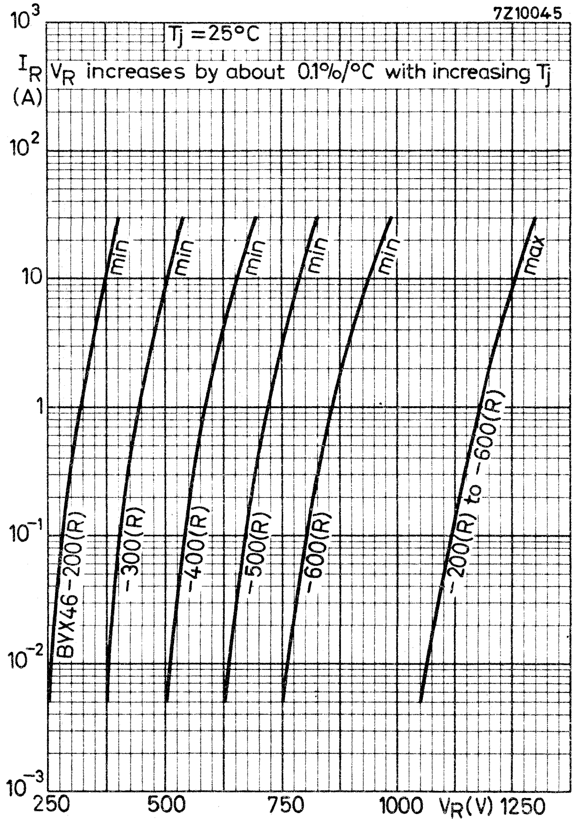
The applicable heatsink(s) may then be found in the Section HEATSINKS.

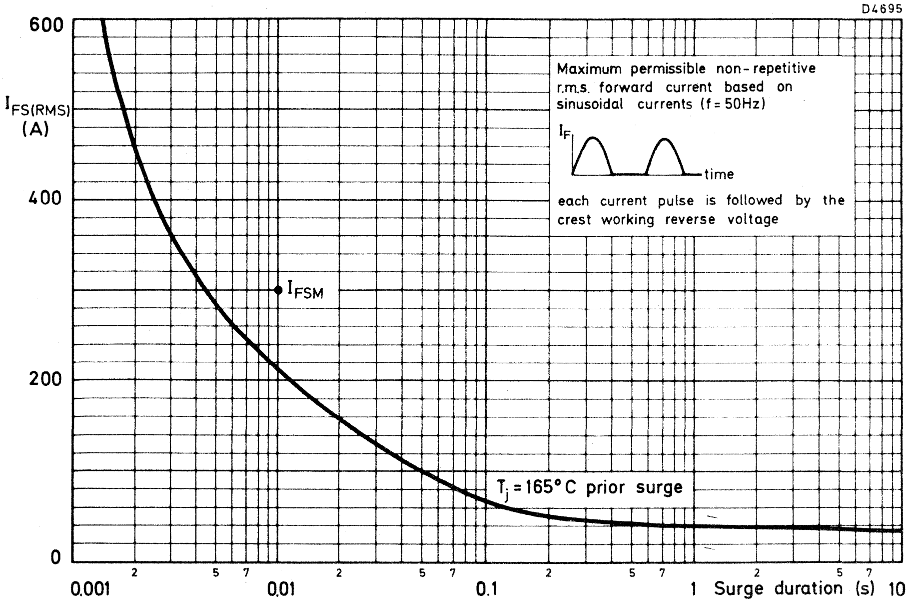

7Z58794
P=power excluding avalanche and switching losses
single phase: a = 1.6
3-phase : a = 1.75
6-phase a = 2.4
a = I_F(RMS) / I_F(AV)
interrelation between the power
(derived from the left hand graph)
and the max. allowable temperatures
P (W)
T_mb *) (°C)
a = 2.4
1.75
1.6
d.c.
R_th mb-a = 0.5 °C/W
1
1.5
2
2.5
3.5
5
8
B
A
I_F(AV) (A)
T_amb (°C)

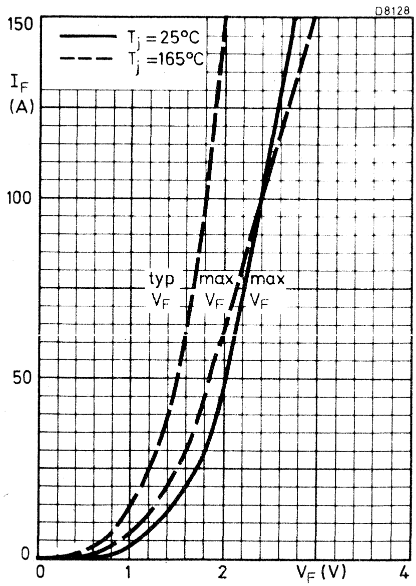

7Z10273.1
P_RRM (kW)
Tj = 110°C
120°C
130°C
140°C
150°C
160°C
165°C
maximum allowable repetitive peak reverse power dissipation versus duration (f = 50 Hz)
P_R
P_RRM
time
pulse duration
repetitive operation in this region is not allowed
in this region a junction temperature of 165°C is allowed
pulse duration (ms)

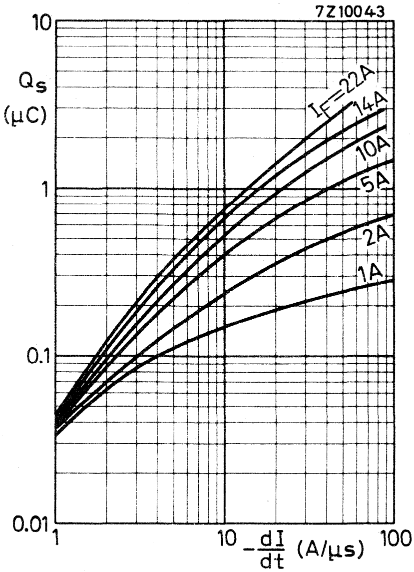

7Z10049.1
Max. allowable non repetitive peak reverse pulse power dissipation in avalanche region
P_{RSM} (kW)
P_R
P_{RSM}
time
pulse duration
T_j=25°C
75°C
100°C
125°C
150°C
165°C
10
5
2
1
0.5
0.2
0.1
0.01
0.1
1
10
duration (ms)
100

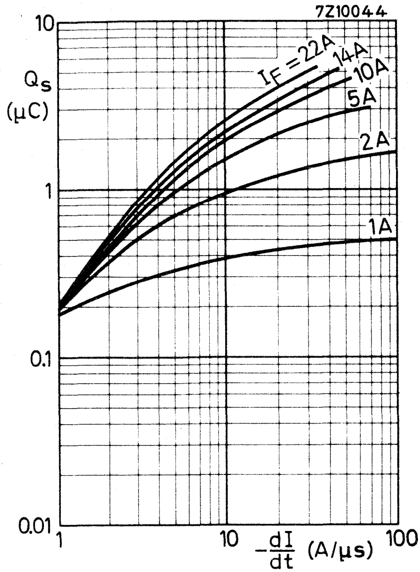

7Z10039
typical values
C_d (pF)
BYX46-200(R)
-300(R)
-400(R)
-500(R)
-600(R)
1000
200
100
50
20
10
1
2
5
10
20
50
100
200
V_R (V)
1000

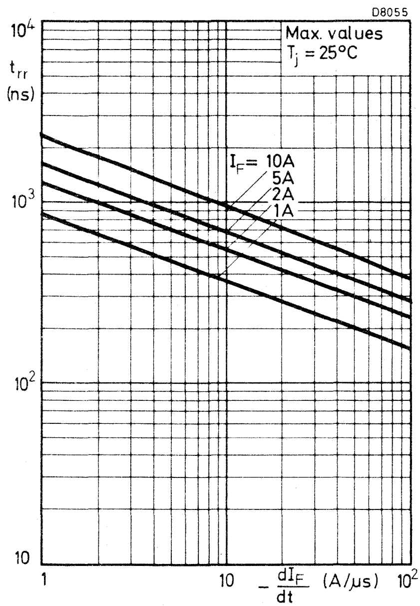

7Z10045
T_j = 25°C
V_R increases by about 0.1%/°C with increasing T_j
I_R (A)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
min
min
min
min
min
max
BYX46-200(R)
-300(R)
-400(R)
-500(R)
-600(R)
-200(R) to -600(R)
250
500
750
1000
V_R(V)
1250

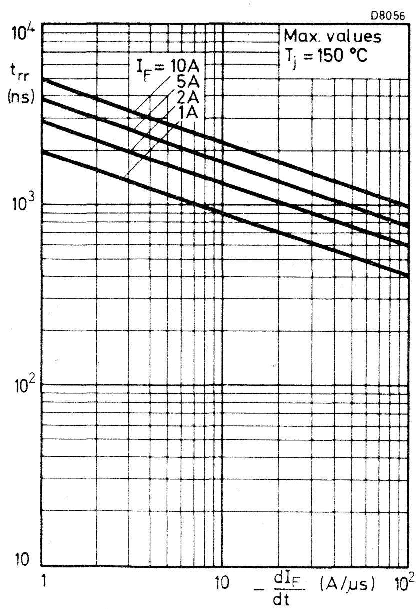

D4695
600
400
200
0
$I_{FS(RMS)}$
(A)
Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50Hz)
I_F
time
each current pulse is followed by the crest working reverse voltage
I_{FSM}
T_j = 165°C prior surge
0.001
2
5
7
0.01
0.1
1
Surge duration (s)
10

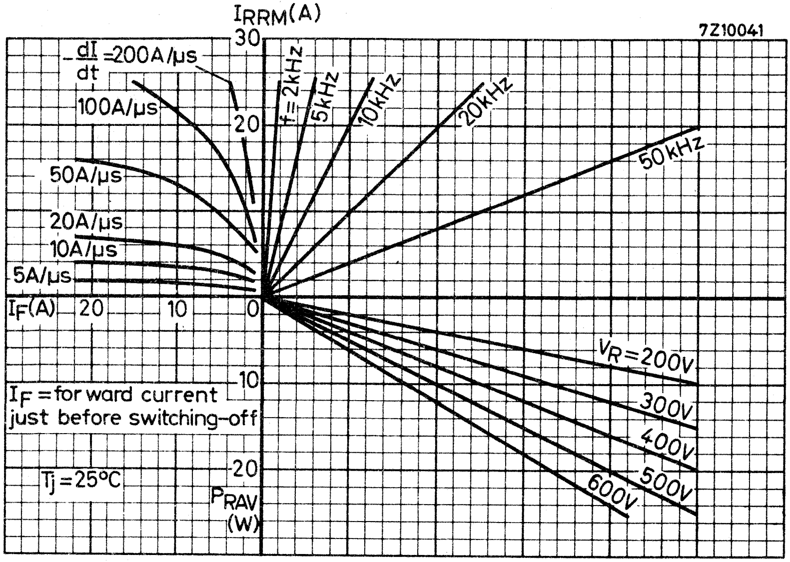

D8128
150
100
50
0
I_F
(A)
T_j = 25°C
T_j = 165°C
typ V_F
max V_F
max V_F
0
1
2
V_F (V)
4

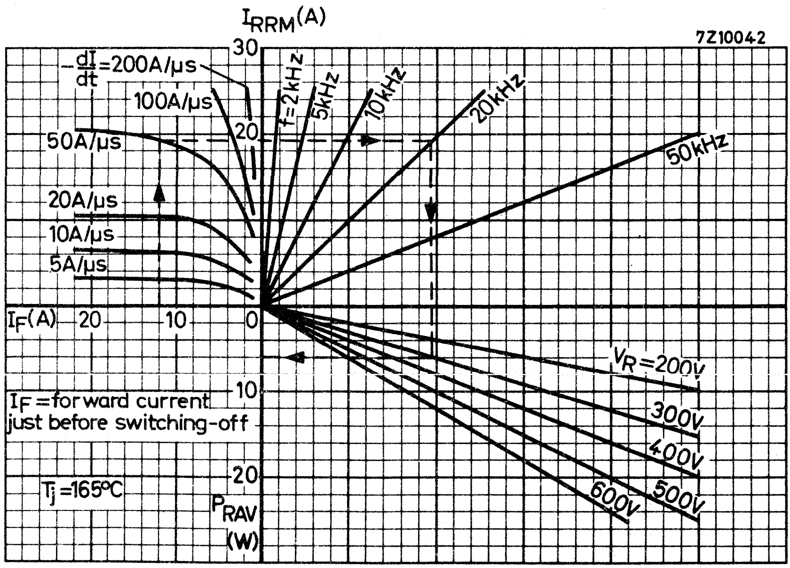

7Z10043
Q_s
(μC)
10
1
0.1
0.01
1
10
100
$-\frac{dI}{dt}$ (A/μs)
I_F=22A
14A
10A
5A
2A
1A


7Z10044
Q_s
(μC)
10
1
0.1
0.01
1
10
100
$-\frac{dI}{dt}$ (A/μs)
I_F=22A
14A
10A
5A
2A
1A

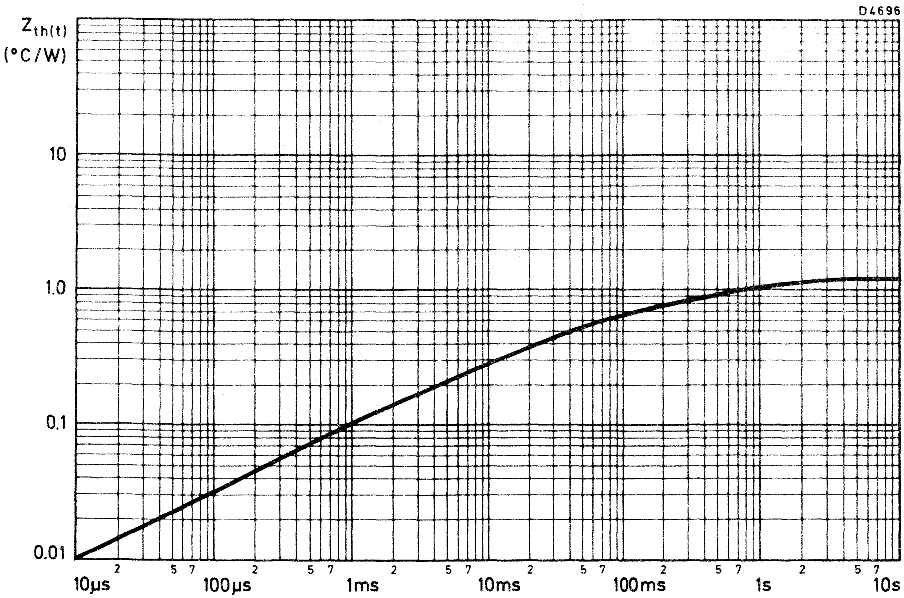

D8055
Max. values
T_j = 25°C
t_{rr}
(ns)
10^4
10^3
10^2
10
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)
I_F= 10A
5A
2A
1A


D8056
Max. values
T_j = 150 °C
t_{rr}
(ns)
10^4
10^3
10^2
10
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)
I_F= 10A
5A
2A
1A





Nomogram: Power loss P_{RAV} due to switching only (square wave operation)


D4696
$Z_{th(t)}$
(°C/W)
10
1.0
0.1
0.01
10µs
100µs
1ms
10ms
100ms
1s
10s

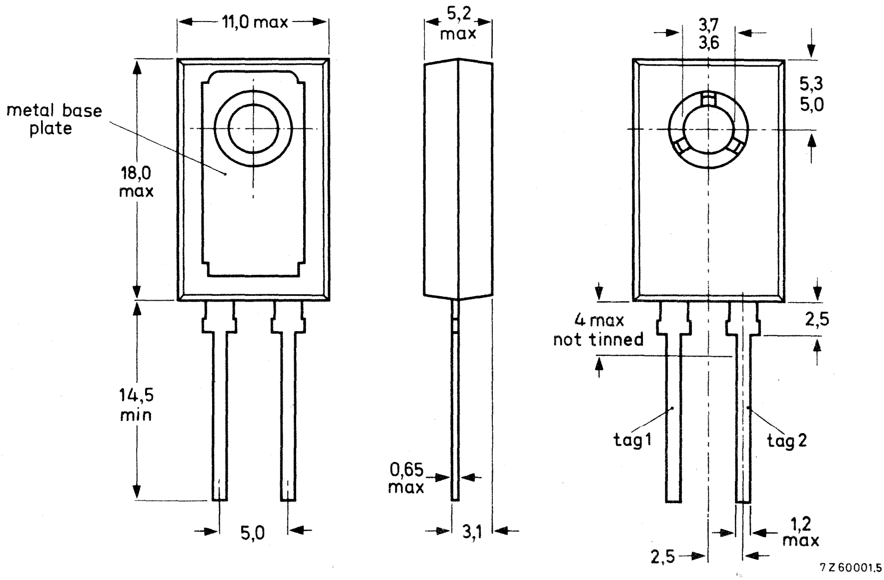
SILICON RECTIFIER DIODES

Plastic-encapsulated rectifier diodes intended for power rectifier applications.
Normal and reverse polarity types are available.

QUICK REFERENCE DATA						
			BYX49-300(R)	600(R)	1200(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	V
Average forward current	$I_{F(AV)}$	max.		6		A
Non-repetitive peak forward current	I_{FSM}	max.		40		A

MECHANICAL DATA (see also page 2) Dimensions in mm

SOD-38



The exposed metal base-plate is directly connected to tag 1.

MECHANICAL DATA (continued)

Net mass: 2,5 g

Recommended diameter of fixing screw: 3,5 mm

Torque on screw
when using washer and heatsink compound: min. 0,95 Nm (9,5 kg cm)
max. 1,5 Nm (15 kg cm)

Accessories:
supplied with device: washer
available on request: 56316 (mica insulating washer)

POLARITY OF CONNECTIONS

	BYX 49-300 to BYX 49-1200	BYX 49-300R to BYX 49-1200R
Base-plate:	cathode	anode
Tag 1 :	cathode	anode
Tag 2 :	anode	cathode

All information applies to frequencies up to 400 Hz.

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

Voltages			BYX49-300(R)	600(R)	1200(R)	
Continuous reverse voltage	V_R	max.	200	400	800	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	V
Repetitive peak reverse voltage (δ = 0,01)	V_{RRM}	max.	300	600	1200	V
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{F(AV)}$	max.	6,0	A
at T_{mb} = 120 °C	$I_{F(AV)}$	max.	3,0	A
without heatsink; at T_{amb} = 50 °C	$I_{F(AV)}$	max.	1,1	A
Forward current (d.c.)	I_F	max.	9,5	A
R.M.S. forward current	$I_{F(RMS)}$	max.	9,5	A
Repetitive peak forward current	I_{FRM}	max.	20	A
Non-repetitive peak forward current (t = 10 ms; half sine wave) T_j = 150 °C prior to surge	I_{FSM}	max.	40	A
I^2t for fusing (t = 10 ms)	I^2t	max.	8,0	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +125	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,5	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,3	°C/W

Influence of mounting method

1. Heatsink mounted

From mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	1,5	°C/W
b. with heatsink compound and 56316 mica washer	$R_{th\ mb\text{-}h}$	=	2,7	°C/W
c. without heatsink compound	$R_{th\ mb\text{-}h}$	=	2,7	°C/W
d. without heatsink compound; with 56316 mica washer	$R_{th\ mb\text{-}h}$	=	5	°C/W

2. Free air operation

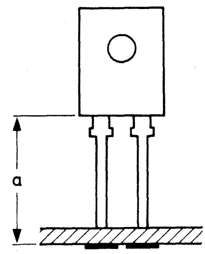
The quoted values of $R_{th\ j\text{-}a}$ should be used only when no other leads run to the tie-points.

From junction to ambient in free air mounted on a printed circuit board

at a = maximum lead length and with a copper laminate

a. > 1 cm^2 — $R_{th\ j\text{-}a}$ = 50 °C/W

b. < 1 cm^2 — $R_{th\ j\text{-}a}$ = 55 °C/W

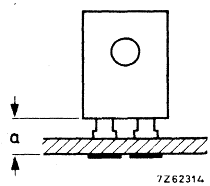


7Z62315.1

at a lead-length a = 3 mm and with a copper laminate

c. > 1 cm^2 — $R_{th\ j\text{-}a}$ = 55 °C/W

d. < 1 cm^2 — $R_{th\ j\text{-}a}$ = 60 °C/W



7Z62314

CHARACTERISTICS

Forward voltage

I_F = 20 A; T_j = 25 °C	V_F	<	2,3	V [1]

Reverse current

V_R = V_{RWMmax}; T_j = 125 °C	I_R	<	200	μA

SOLDERING AND MOUNTING NOTES

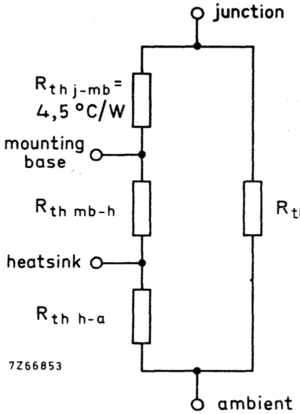
1. Soldered joints must be at least 2,5 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 270 °C; contact with the joint must not exceed 3 seconds.
3. The devices should not be immersed in oil, and few potting resins are suitable for re-encapsulation. Advice on these materials is available on request.
4. Leads should not be bent less than 2,5 mm from the seal; exert no axial pull when bending.
5. For good thermal contact heatsink compound should be used between base-plate and heatsink.

[1]) Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTES

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated below:

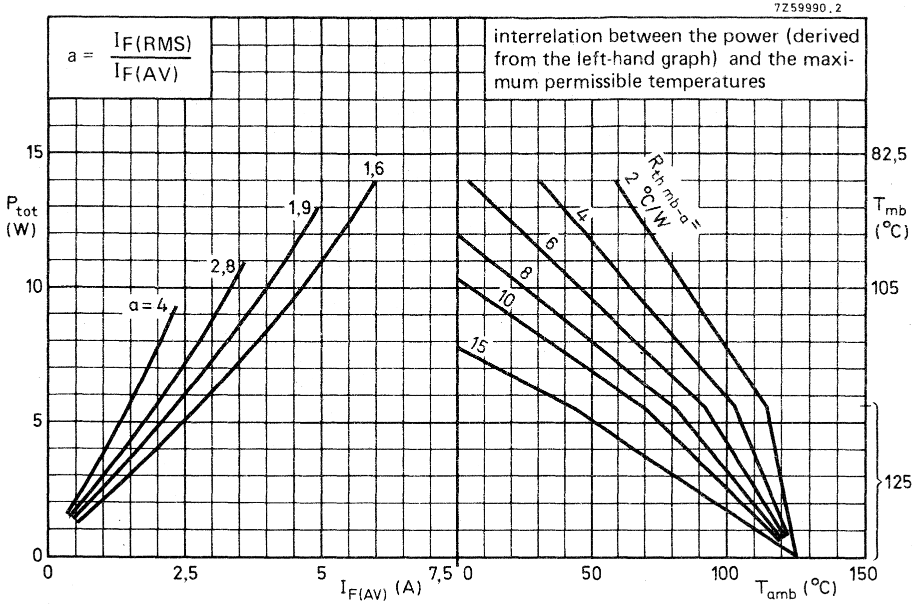


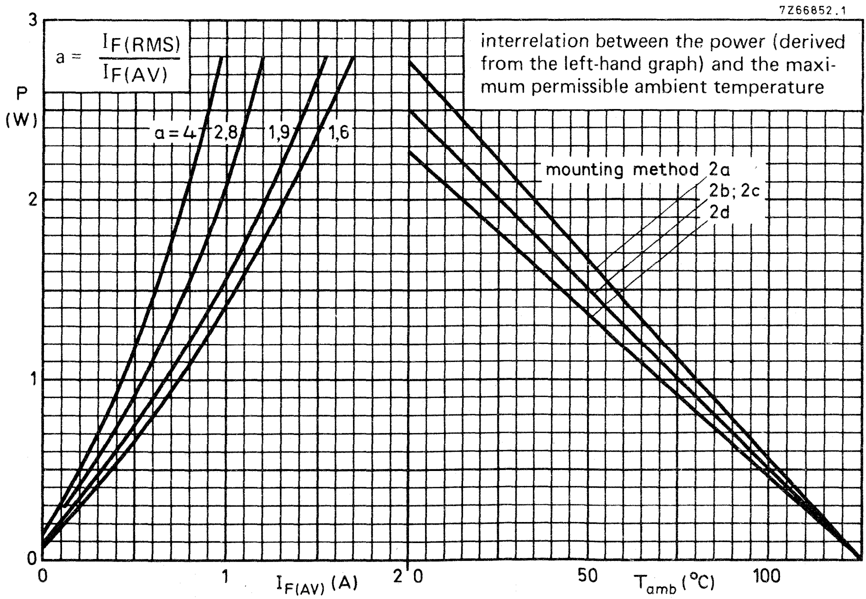
b. The method of using the graph on page 7 is as follows:
Starting with the curve of maximum dissipation as a function of $I_{F(AV)}$, for a particular current value trace upwards to meet the appropriate form factor curve. Trace horizontally until the $R_{th\ mb-a}$ curve is reached.
Finally trace upwards from the T_{amb} scale. The intersection determines the $R_{th\ mb-a}$ required.
The heatsink thermal resistance value ($R_{th\ h-a}$) can now be calculated from:

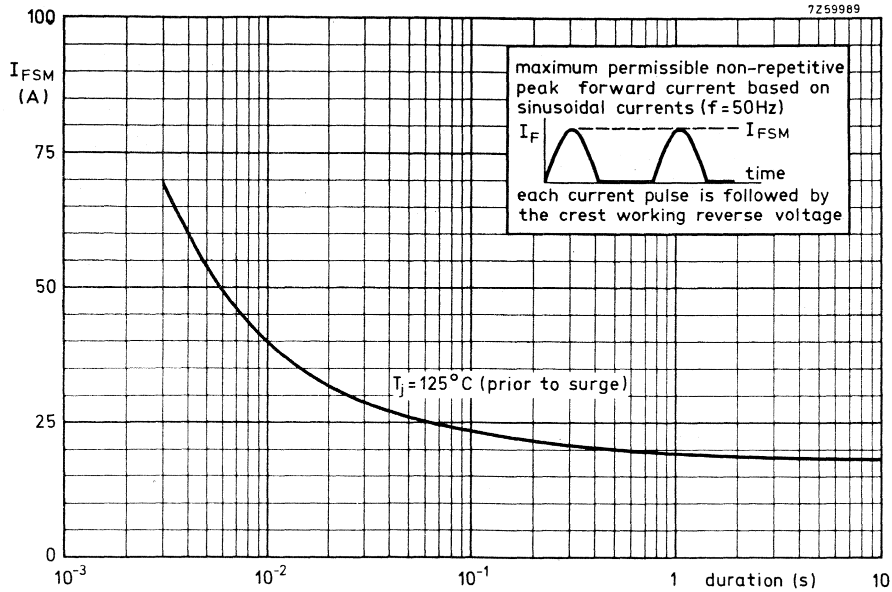
$$R_{th\ h-a} = R_{th\ mb-a} - R_{th\ mb-h}$$

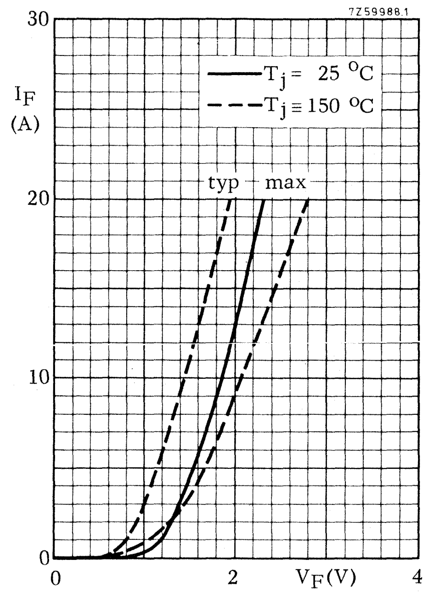
Any measurement of heatsink temperature should be made immediately adjacent to the device.

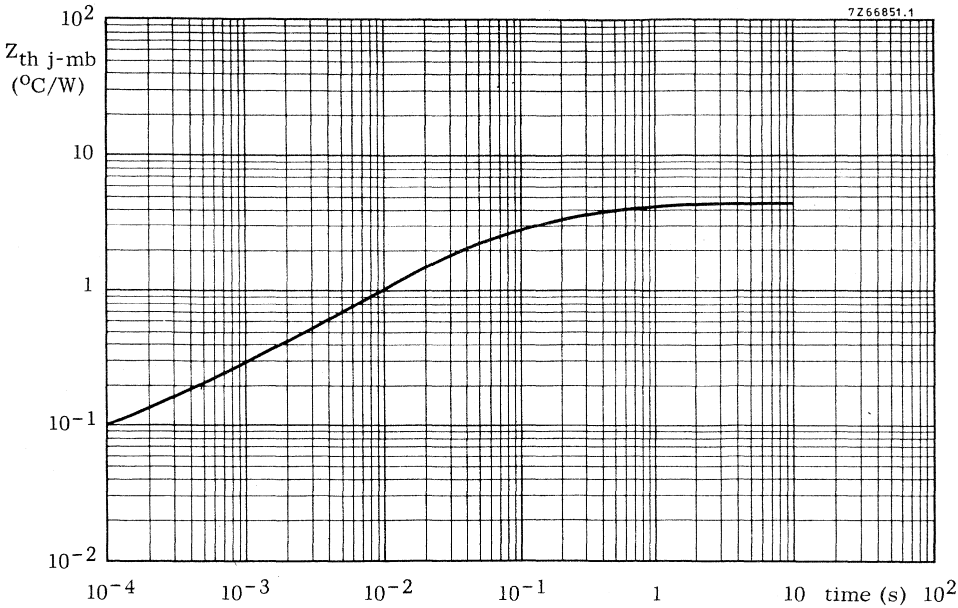
c. The heatsink curves are optimised to allow the junction temperature to run up to 150 °C ($T_{j\,max}$) whilst limiting T_{mb} to 125 °C (or less).


7Z59990.2
a = IF(RMS) / IF(AV)
interrelation between the power (derived from the left-hand graph) and the maximum permissible temperatures
Ptot (W)
15
10
5
0
a = 4
2,8
1,9
1,6
0
2,5
5
7,5
IF(AV) (A)
Rth mb-a = 2 °C/W
4
6
8
10
15
0
50
100
150
Tamb (°C)
82,5
Tmb (°C)
105
125


7Z66852.1
a = IF(RMS) / IF(AV)
interrelation between the power (derived from the left-hand graph) and the maximum permissible ambient temperature
P (W)
3
2
1
0
a = 4
2,8
1,9
1,6
0
1
2
IF(AV) (A)
mounting method 2a
2b; 2c
2d
0
50
100
Tamb (°C)


7Z59989
100
I_{FSM}
(A)
75
50
25
0
maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50Hz)
I_F
I_{FSM}
time
each current pulse is followed by the crest working reverse voltage
T_j = 125°C (prior to surge)
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10


7Z59988.1
30
I_F
(A)
20
10
0
T_j = 25 °C
T_j = 150 °C
typ
max
0
2
V_F(V)
4


7Z66851.1
$Z_{th\ j\text{-}mb}$
(°C/W)
10^2
10
1
10^{-1}
10^{-2}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
time (s)
10^2

FAST SOFT-RECOVERY RECTIFIER DIODES

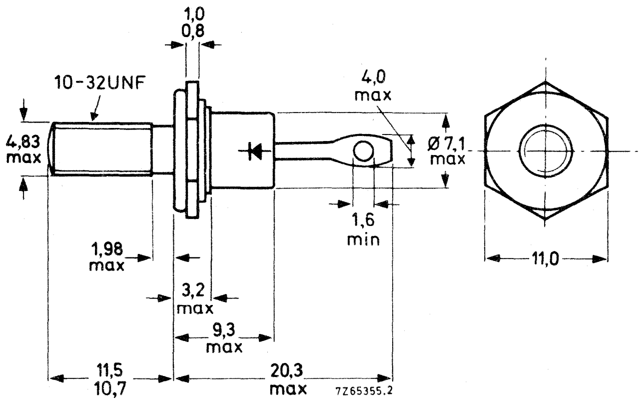
Silicon diodes in DO-4 metal envelopes, intended for use in high-frequency power supplies, thyristor inverters and multi-phase power rectifier applications. The series consists of the following types:
Normal polarity (cathode to stud): BYX50-200, 300
Reverse polarity (anode to stud): BYX50-200R, 300R
These devices feature non-snap-off characteristics.

QUICK REFERENCE DATA

			BYX50-200(R)	300(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	200	300	V
Average forward current	$I_{F(AV)}$	max.	7		A
Non-repetitive peak forward current	I_{FSM}	max.	80		A
Reverse recovery time	t_{rr}	<	100		ns

MECHANICAL DATA Dimensions in mm

DO-4, Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 9.5 mm



Net mass: 6 g
Diameter of clearance hole: max. 5.2 mm
Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)

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

The mark shown applies to the normal polarity types.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

			BYX50-200(R)	300(R)	
Non-repetitive peak reverse voltage; $t \leq 10$ ms	V_{RSM}	max.	250	350	V
Repetitive peak reverse voltage	V_{RRM}	max.	200	300	V
Crest working reverse voltage	V_{RWM}	max.	200	300	V
Continuous reverse voltage	V_R	max.	200	300	V

Currents

Average on-state current assuming zero switching losses (averaged over any 20 ms period) up to T_{mb} = 103 °C	$I_{F(AV)}$	max.	7	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	4	A
R.M.S. forward current	$I_{F(RMS)}$	max.	11	A
Repetitive peak forward current	I_{FRM}	max.	80	A
Non-repetitive peak forward current t = 10 ms; T_j = 150 °C prior to surge with reapplied V_{RWMmax}	I_{FSM}	max.	80	A
I^2t for fusing (t = 10 ms)	I^2t	max.	32	A^2s
Rate of change of commutation current	See nomogram on page 5			

Temperatures

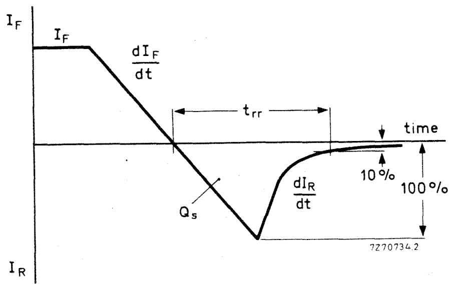
Storage temperature	T_{stg}	−55 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

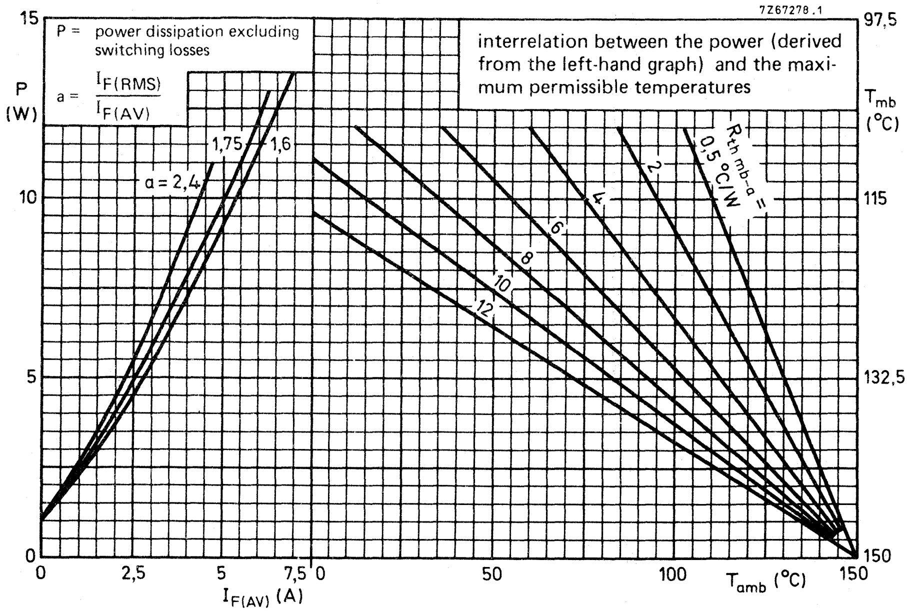
From junction to ambient in free air	$R_{th\ j-a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	3,5	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,5	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j-mb}$	=	1	°C/W

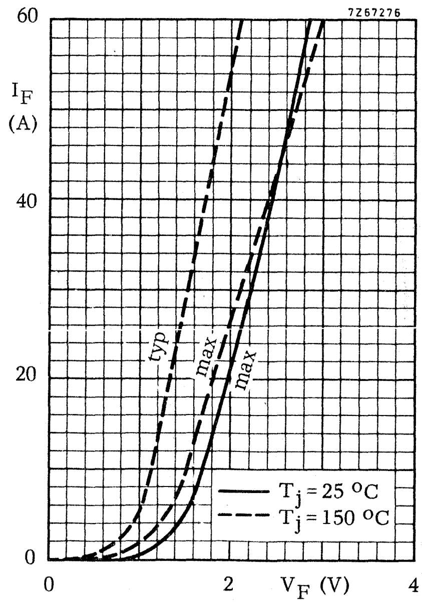
CHARACTERISTICS

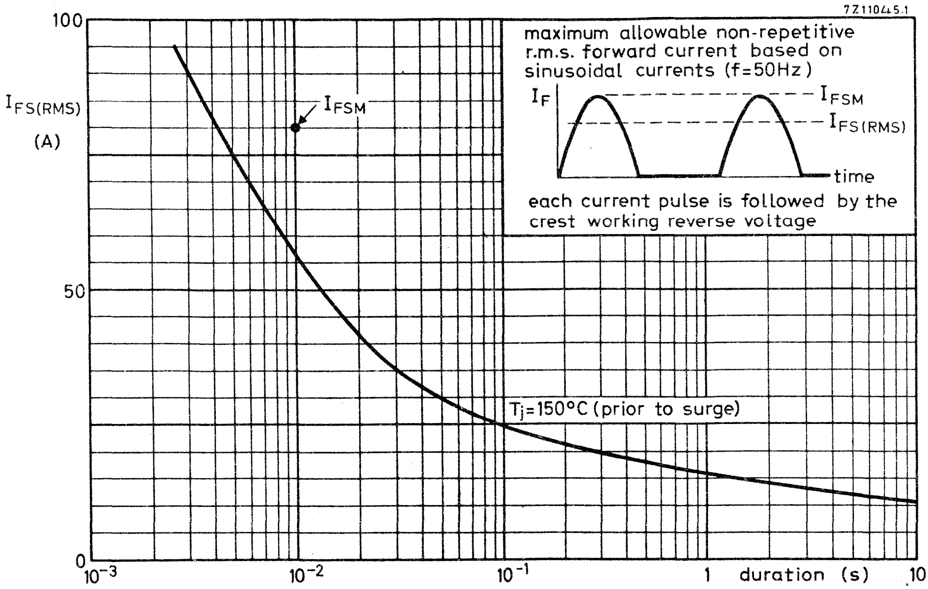
Forward voltage				
I_F = 20 A; T_j = 25 °C	V_F	<	1,95	V [1]
Reverse current				
V_R = V_{RWMmax}; T_j = 125 °C	I_R	<	3	mA
Reverse recovery when switched from				
I_F = 1 A to V_R = 30 V; $-dI_F/dt$ = 100 A/µs; T_j = 25 °C Recovery time	t_{rr}	<	100	ns
I_F = 1 A to V_R = 30 V; $-dI_F/dt$ = 35 A/µs; T_j = 25 °C Recovery time	t_{rr}	<	150	ns
I_F = 2 A to V_R = 30 V; $-dI_F/dt$ = 20 A/µs; T_j = 25 °C Recovered charge	Q_s	<	250	nC
I_F = 2 A to V_R = 50 V; $-dI_F/dt$ = 2 A/µs; T_j = 25 °C Max. slope of the reverse recovery current	$\|dI_R/dt\|$	<	5	A/µs

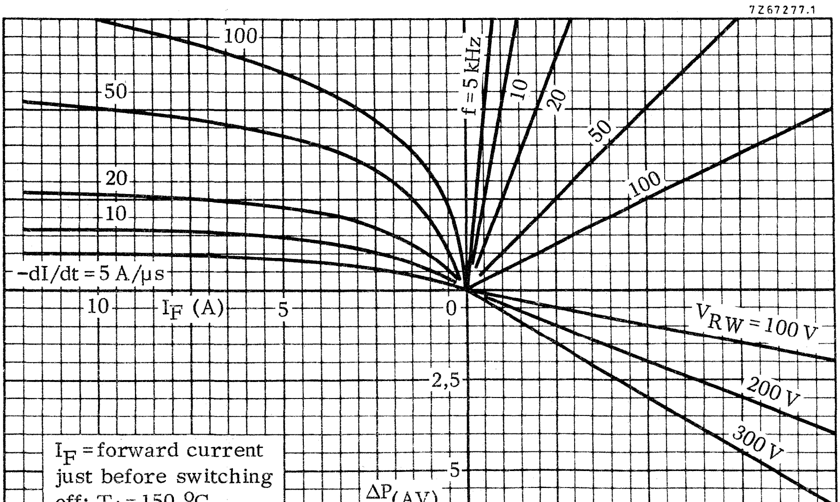


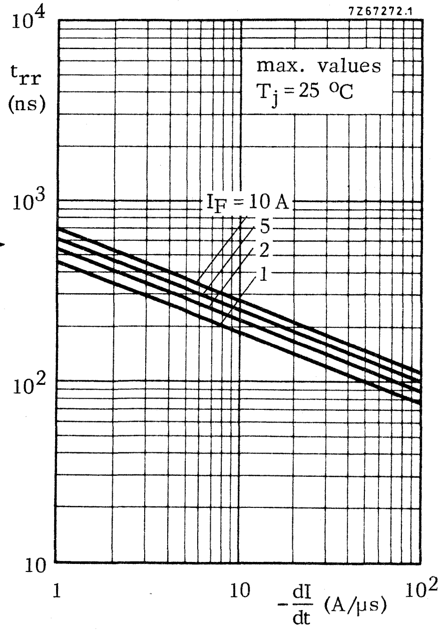
[1]) Measured under pulse conditions to avoid excessive dissipation.

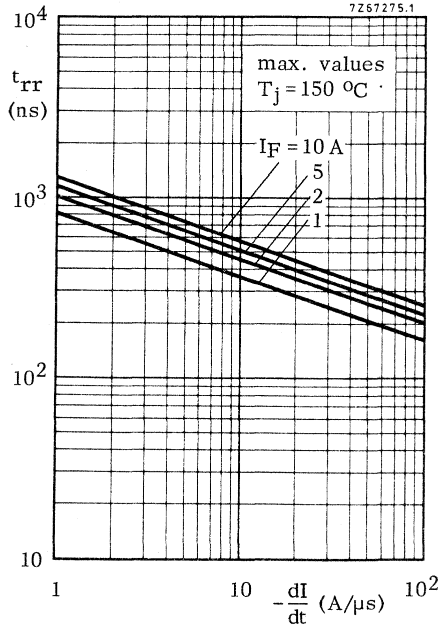

7Z67278.1
P = power dissipation excluding switching losses
a = $\frac{I_{F(RMS)}}{I_{F(AV)}}$
P (W)
15
10
5
0
a = 2,4
1,75
1,6
0
2,5
5
7,5
$I_{F(AV)}$ (A)
interrelation between the power (derived from the left-hand graph) and the maximum permissible temperatures
$R_{th\ mb-a}$ = 0,5 °C/W
2
4
6
8
10
12
0
50
100
150
T_{amb} (°C)
97,5
115
132,5
150
T_{mb} (°C)

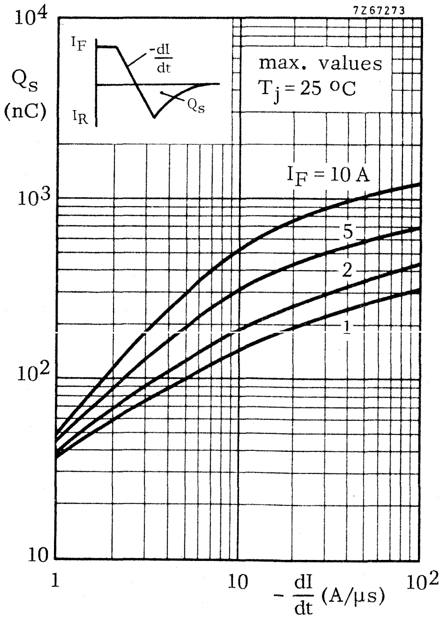

7Z67276
I_F (A)
60
40
20
0
0
2
4
V_F (V)
typ
max
max
T_j = 25 °C
T_j = 150 °C

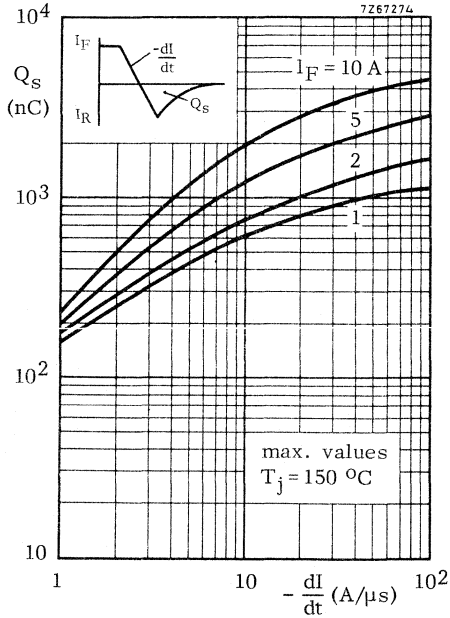

7Z11045.1
maximum allowable non-repetitive r.m.s. forward current based on sinusoidal currents (f=50Hz)
I_F
I_{FSM}
$I_{FS(RMS)}$
time
each current pulse is followed by the crest working reverse voltage
$I_{FS(RMS)}$ (A)
100
50
0
I_{FSM}
T_j=150°C (prior to surge)
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10

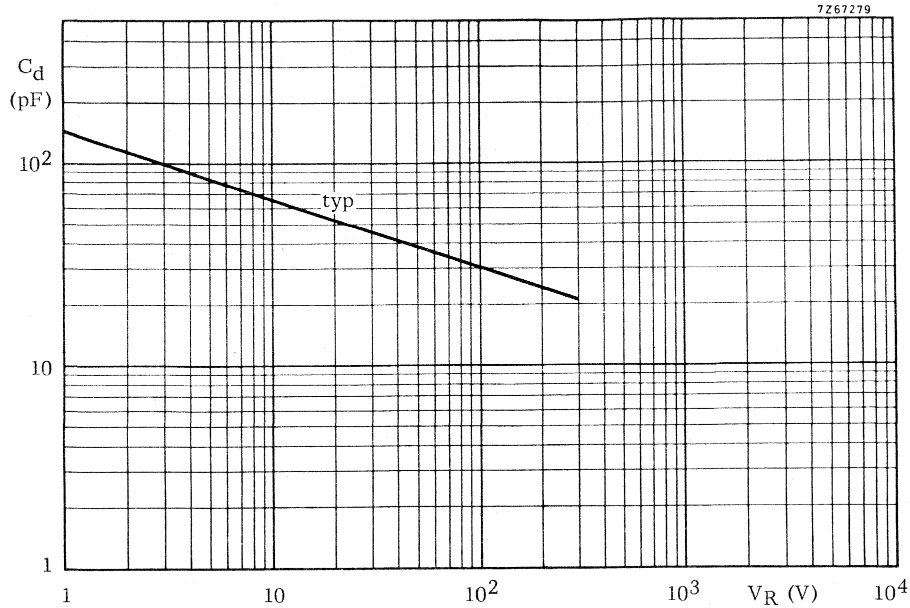

7Z67277.1
100
50
20
10
−dI/dt = 5 A/μs
f = 5 kHz
10
20
50
100
10
I_F (A)
5
0
V_{RW} = 100 V
200 V
300 V
−2,5
−5
−7,5
$\Delta P_{(AV)}$ (W)
I_F = forward current just before switching off; T_j = 150 °C

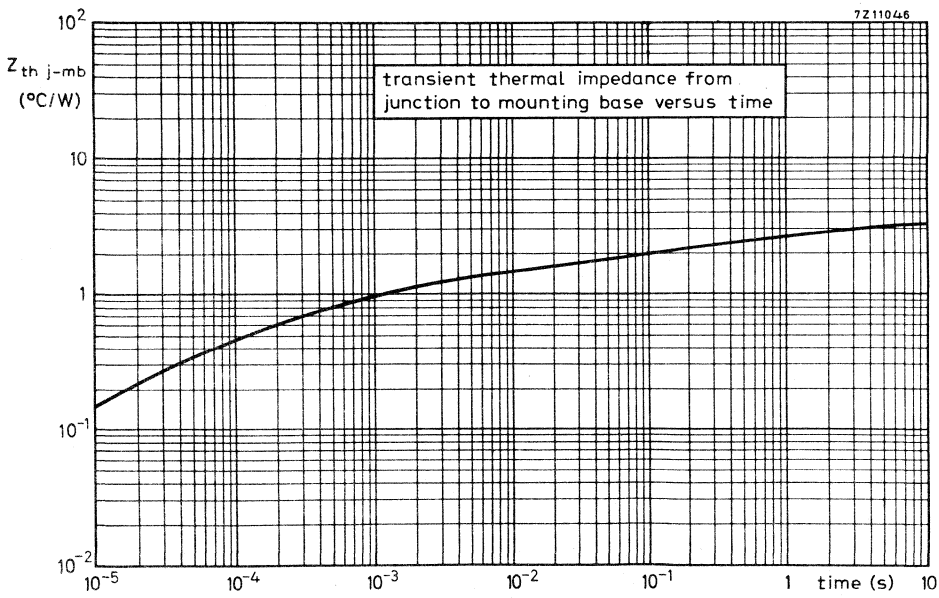

7Z67272.1
max. values
Tj = 25 °C
trr
(ns)
IF = 10 A
5
2
1
10^4
10^3
10^2
10
1
10
10^2
- dI/dt (A/μs)


7Z67275.1
max. values
Tj = 150 °C
trr
(ns)
IF = 10 A
5
2
1
10^4
10^3
10^2
10
1
10
10^2
- dI/dt (A/μs)


7Z67273
Qs
(nC)
IF
IR
-dI/dt
Qs
max. values
Tj = 25 °C
IF = 10 A
5
2
1
10^4
10^3
10^2
10
1
10
10^2
- dI/dt (A/μs)


7Z67274
Qs
(nC)
IF
IR
-dI/dt
Qs
IF = 10 A
5
2
1
max. values
Tj = 150 °C
10^4
10^3
10^2
10
1
10
10^2
- dI/dt (A/μs)


7Z67279
C_d
(pF)
10^2
typ
10
1
1
10
10^2
10^3
V_R (V)
10^4


7Z11046
10^2
$Z_{th\ j\text{-}mb}$
(°C/W)
transient thermal impedance from junction to mounting base versus time
10
1
10^{-1}
10^{-2}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10

RECTIFIER DIODES

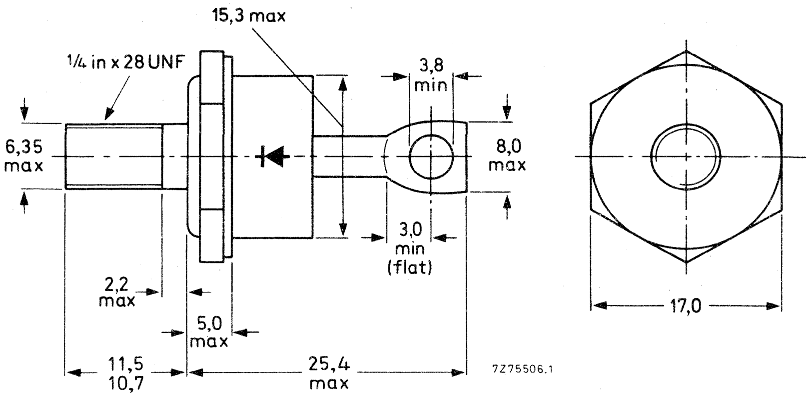
Silicon rectifier diodes in DO-5 metal envelopes, intended for use in power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX52-300, BYX52-600, BYX52-1200.
Reverse polarity (anode to stud): BYX52-300R, BYX52-600R, BYX52-1200R.

QUICK REFERENCE DATA

			BYX52-300(R)	600(R)	1200(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	V
Average forward current	$I_{F(AV)}$	max.	48			A
Non-repetitive peak forward current	I_{FSM}	max.	800			A

MECHANICAL DATA Dimensions in mm

DO-5; Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 11,1 mm



Net mass: 22 g
Diameter of clearance hole: max. 6,5 mm
Accessories supplied on request:
56264A (mica washer, insulating ring, tag)

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)

The mark shown applies to the normal polarity types.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

→ Voltages

			BYX52-300(R)	600(R)	1200(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	V
Repetitive peak reverse voltage ($\delta = 0.01$)	V_{RRM}	max.	300	600	1200	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	V

Currents

Average forward current (averaged over any 20 ms period) up to $T_{mb} = 112\,^{o}C$	$I_{F(AV)}$	max.	48	A
at $T_{mb} = 125\,^{o}C$	$I_{F(AV)}$	max.	40	A
R.M.S. forward current	$I_{F(RMS)}$	max.	75	A
Repetitive peak forward current	I_{FRM}	max.	450	A
Non-repetitive peak forward current ($t = 10$ ms; half-sinewave) $T_j = 175\,^{o}C$ prior to surge	I_{FSM}	max.	800	A
I^2t for fusing ($t = 10$ ms)	I^2t	max.	3200	A^2s

Temperatures

Storage temperature	T_{stg}	-55 to +175		^{o}C
Junction temperature	T_j	max.	175	^{o}C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0.8	$^{o}C/W$
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.2	$^{o}C/W$

CHARACTERISTICS

Forward voltage

$I_F = 150$ A; $T_j = 25\,^{o}C$	V_F	<	1.8	V [1]

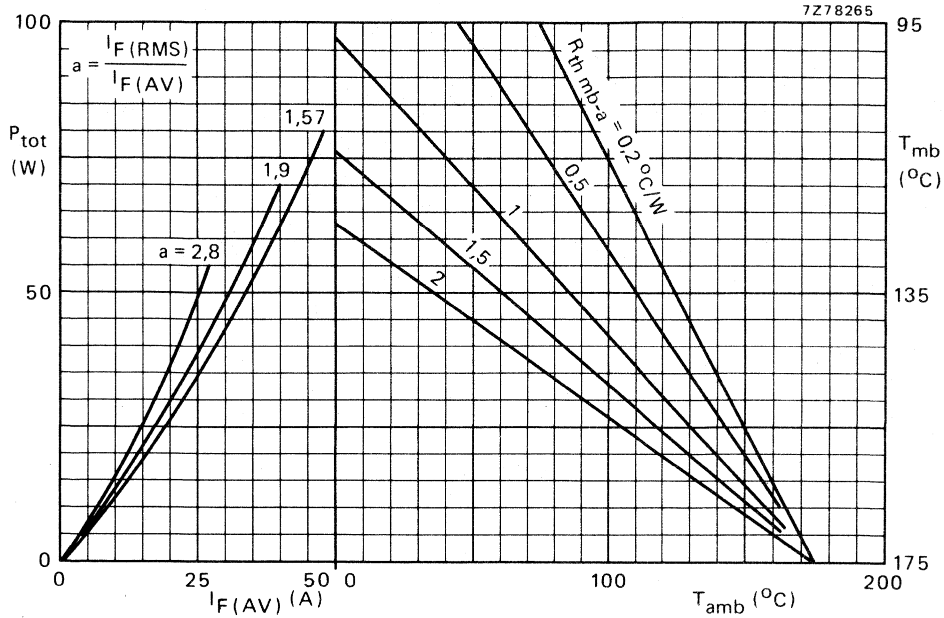
Reverse current

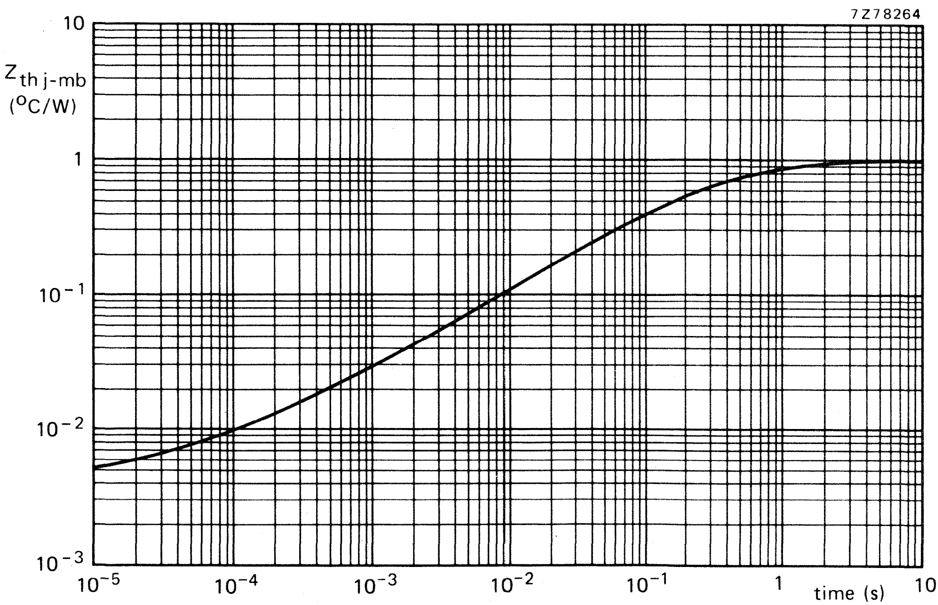
$V_R = V_{RWM}$max; $T_j = 125\,^{o}C$	I_R	<	1.6	mA

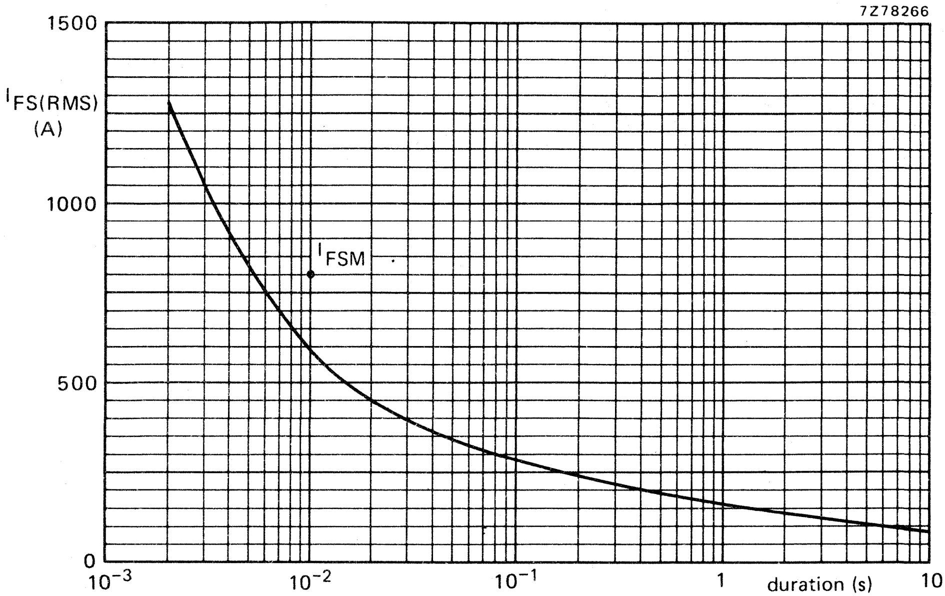
OPERATING NOTES

The top connector should neither be bent nor twisted; it should be soldered into the circuit so there is no strain on it.

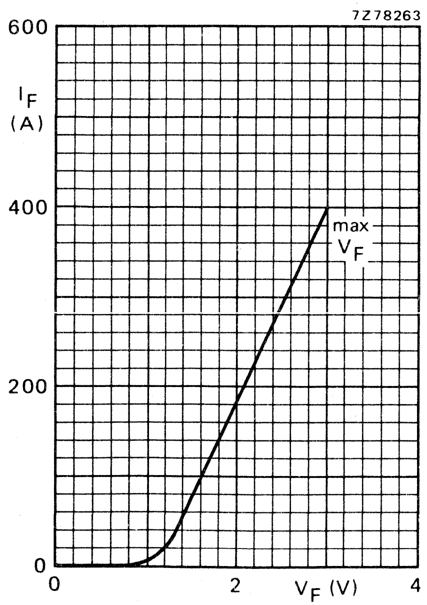
[1]) Measured under pulse conditions to avoid excessive dissipation.

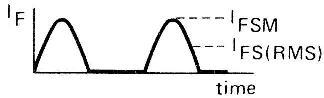

7Z78265
$a = \frac{I_{F(RMS)}}{I_{F(AV)}}$
P_{tot} (W)
100
50
0
0
25
50
$I_{F(AV)}$ (A)
1,57
1,9
a = 2,8
$R_{th\ mb\text{-}a}$ = 0,2 °C/W
0,5
1
1,5
2
0
100
200
T_{amb} (°C)
T_{mb} (°C)
95
135
175


7Z78264
$Z_{th\ j\text{-}mb}$ (°C/W)
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
time (s)



Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 175 °C prior to surge; with reapplied V_{RWMmax}.





FAST SOFT-RECOVERY RECTIFIER DIODES

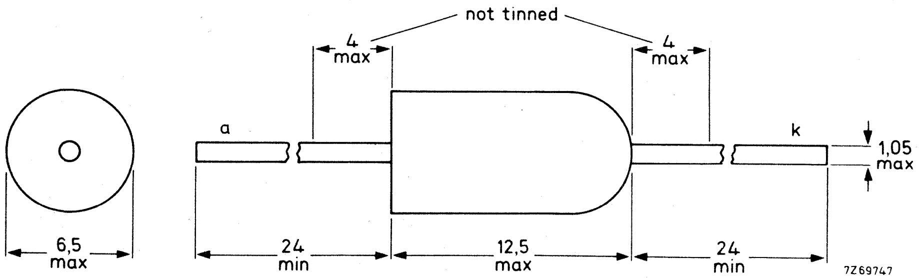
Silicon double-diffused rectifier diodes in plastic envelopes.
They are intended for use in inverter and converter applications, and in switched-mode power supplies, scan rectifiers in television receivers and other h.f. power supplies.
The devices feature non-snap-off characteristics.

QUICK REFERENCE DATA

			BYX55-350	600	
Working reverse voltage	V_{RW}	max.	300	500	V
Repetitive peak reverse voltage	V_{RRM}	max.	350	600	V
Average forward current	$I_{F(AV)}$	max.	1,2		A
Non-repetitive peak forward current t = 10 ms; T_j = 125 °C prior to surge	I_{FSM}	max.	40		A
Junction temperature	T_j	max.	125		°C
Reverse recovery charge when switched from I_F = 1 A to $V_R \geq 50$ V with $-dI/dt$ = 1 A/µs; T_j = 25 °C	Q_s	<	120		nC

MECHANICAL DATA Dimensions in mm

SOD-18



The rounded end indicates the cathode

The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

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

Voltages			BYX55 -350	-600	
Continuous reverse voltage	V_R	max.	300	500	V
Working reverse voltage	V_{RW}	max.	300	500	V
Repetitive peak reverse voltage ($t \leq 10\ \mu s$)	V_{RRM}	max.	350	600	V
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	350	600	V

Currents				
Average forward current (averaged over any 20 ms period), see also pages 4 and 5	$I_{F(AV)}$	max.	1.2	A
Repetitive peak forward current	I_{FRM}	max.	8	A
→ **Repetitive peak forward current ($\delta \leq 0.04$; $f > 15$ kHz)**	I_{FRM}	**max.**	**15**	**A**
Non-repetitive peak forward current ($t = 10$ ms; half sine wave) $T_j = 125\ ^oC$ prior to surge	I_{FSM}	max.	40	A
Rate of change of commutation current See also nomogram on page 6	$-\frac{dI}{dt}$	max.	20	A/µs

Temperatures				
Storage temperature	T_{stg}		−40 to +125	^oC
Junction temperature	T_j	max.	125	^oC

THERMAL RESISTANCE See page 3

CHARACTERISTICS

Forward voltage				
$I_F = 5$ A; $T_j = 25\ ^oC$	V_F	<	1.25	V[1]

Reverse current				
$V_R = V_{RWmax}$; $T_j = 125\ ^oC$	I_R	<	0.75	mA
$V_R = V_{RWmax}$; $T_j = 25\ ^oC$	I_R	<	10	µA

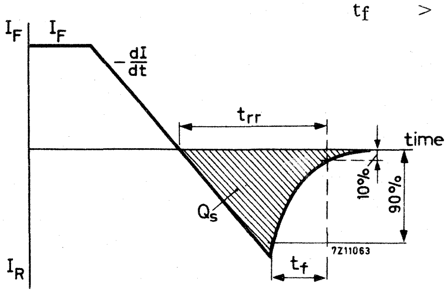
Capacitance at f = 1 MHz				
$V_R = 250$ V; $T_j = 25$ to $125\ ^oC$	C_d	typ.	8	pF

[1]) Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Reverse recovery when switched from
I_F = 1 A to $V_R \geq$ 50 V with −dI/dt =
T_j = 25 °C

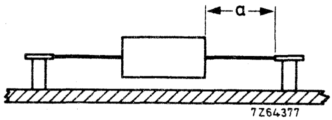
			1	20	A/µs
Recovery charge	Q_s	<	120	400	nC
Recovery time	t_{rr}	<	750	350	ns
Fall time	t_f	>	120	100	ns



THERMAL RESISTANCE (influence of mounting method)

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no other leads run to the tie-points. If the leads of other dissipating components share the same tie-points, the thermal resistance will be higher than that quoted.

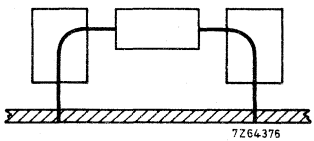
1. Mounted on solder tags at a lead-length: a = 10 mm — $R_{th\ j\text{-}a}$ = 60 °C/W
   a = max. lead length — $R_{th\ j\text{-}a}$ = 70 °C/W



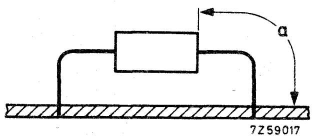
2. Mounted on printed-wiring board at a = maximum lead-length and heatsinks (0, 3 mm Cu) on leads.

   Heatsink size 2 cm^2 (per side) — $R_{th\ j\text{-}a}$ = 60 °C/W

   Heatsink size 1 cm^2 (per side) — $R_{th\ j\text{-}a}$ = 70 °C/W



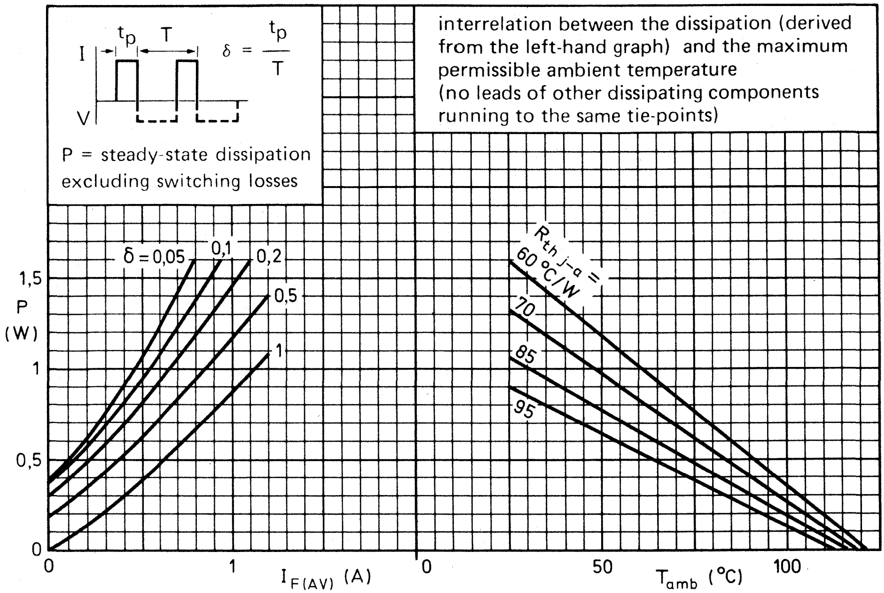
3. Mounted on printed-wiring board at a = maximum lead-length. — $R_{th\ j\text{-}a}$ = 85 °C/W
4. Mounted on printed-wiring board at a lead-length a = 10 mm. — $R_{th\ j\text{-}a}$ = 95 °C/W



SOLDERING AND MOUNTING NOTES

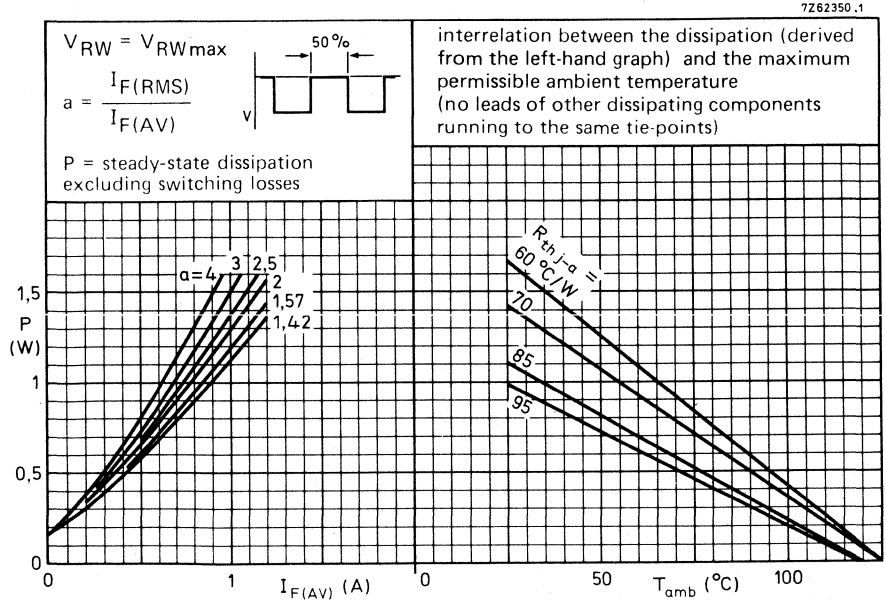
1. Soldered joints must be at least 5 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 300 °C; it must be in contact with the joint for no more than 3 seconds.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 °C.

7Z62352.2

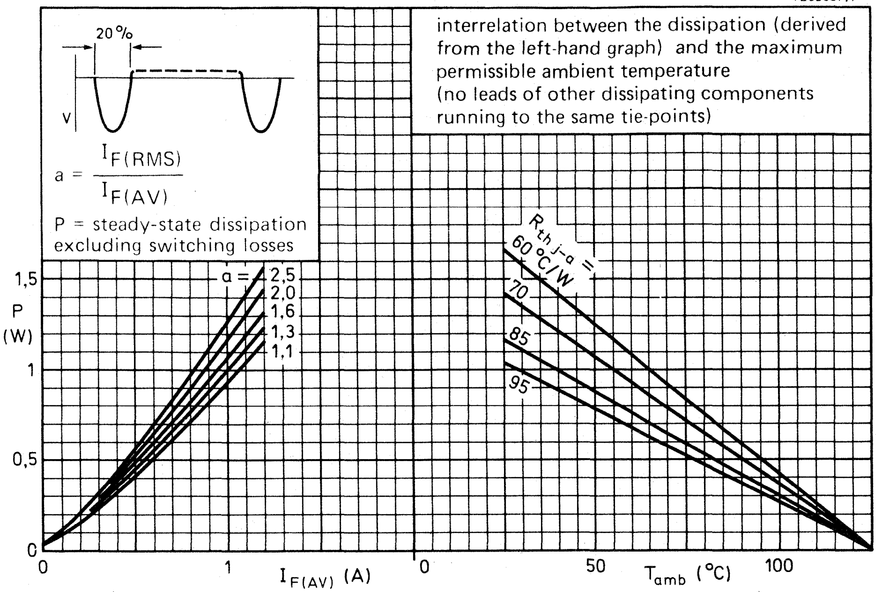


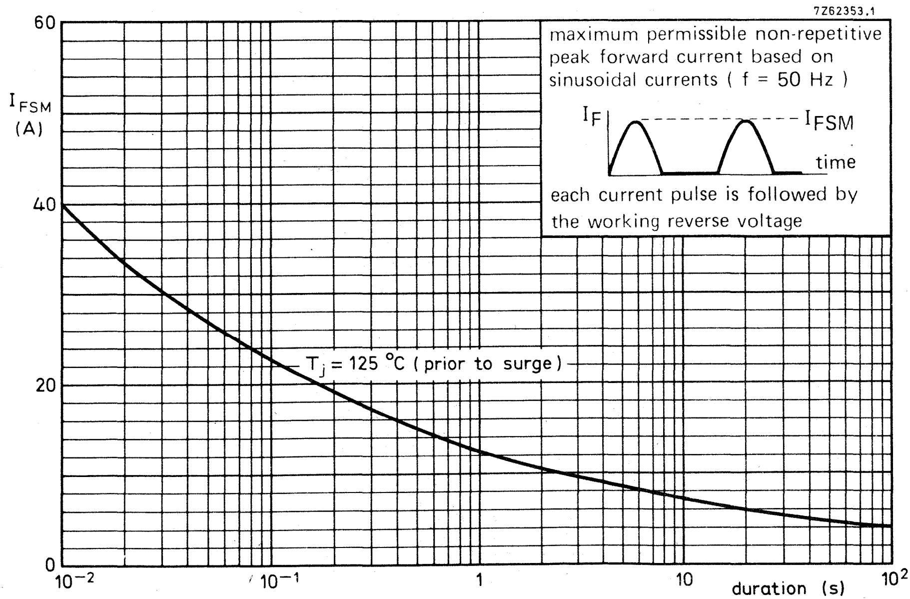
SWITCHED-MODE APPLICATION

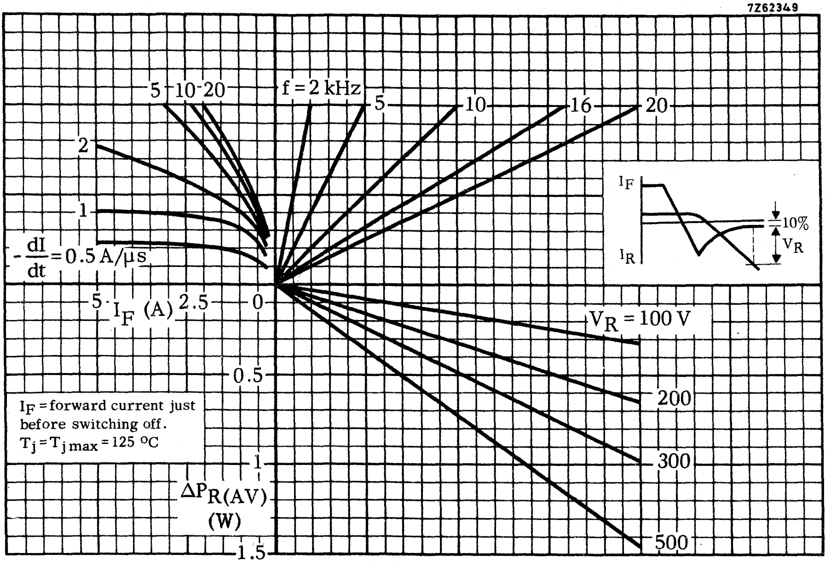
7Z62350.1



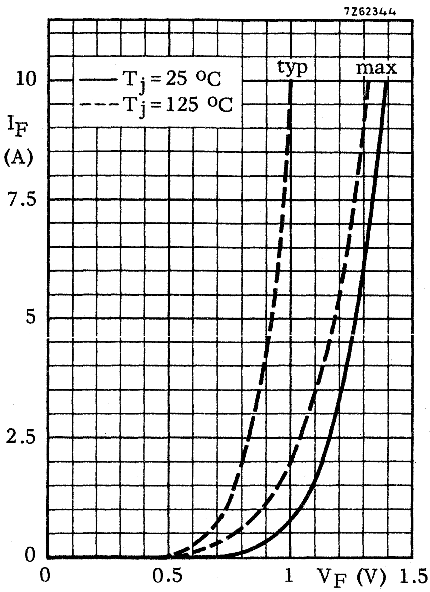
SCAN RECTIFICATION

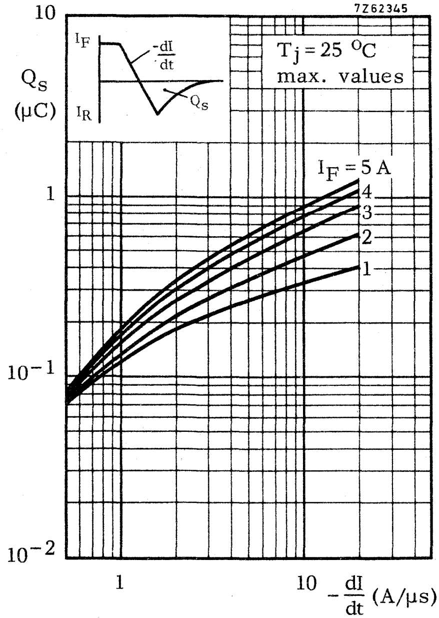


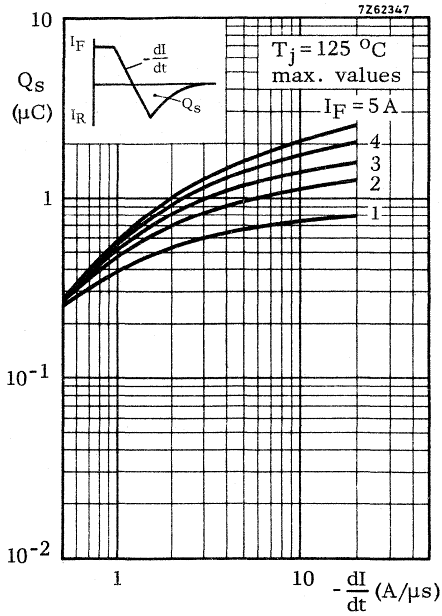


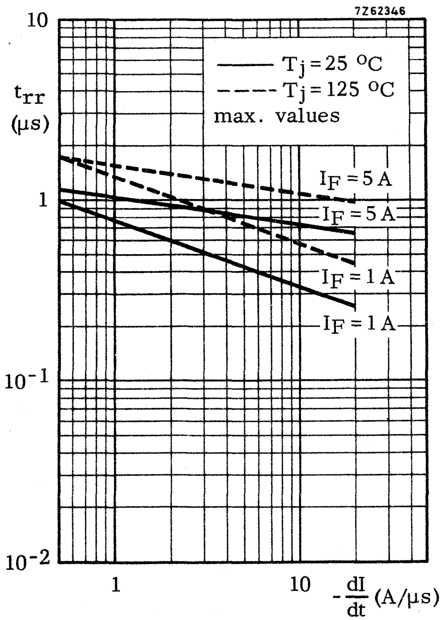


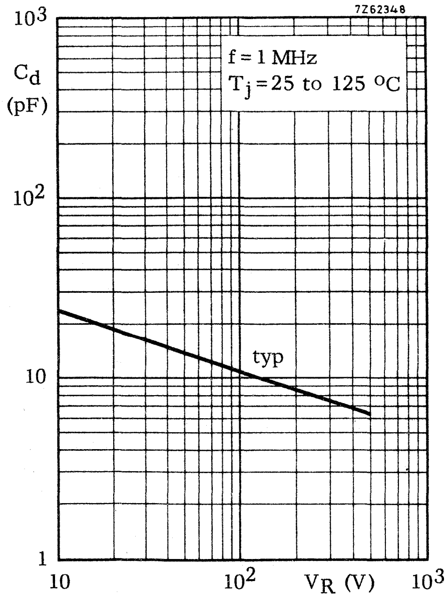
nomogram: power loss $\Delta P_{R(AV)}$ due to switching only (to be added to forward and reverse power losses)




7Z62345
Qs (μC)
$T_j = 25\ ^oC$
max. values
I_F
$-\frac{dI}{dt}$
I_R
Q_s
$I_F = 5\ A$
4
3
2
1
10
1
10^{-1}
10^{-2}
1
10
$-\frac{dI}{dt}$ (A/μs)


7Z62347
Qs (μC)
$T_j = 125\ ^oC$
max. values
I_F
$-\frac{dI}{dt}$
I_R
Q_s
$I_F = 5\ A$
4
3
2
1
10
1
10^{-1}
10^{-2}
1
10
$-\frac{dI}{dt}$ (A/μs)


7Z62346
t_{rr} (μs)
$T_j = 25\ ^oC$
$T_j = 125\ ^oC$
max. values
$I_F = 5\ A$
$I_F = 5\ A$
$I_F = 1\ A$
$I_F = 1\ A$
10
1
10^{-1}
10^{-2}
1
10
$-\frac{dI}{dt}$ (A/μs)


7Z62348
C_d (pF)
f = 1 MHz
$T_j = 25$ to $125\ ^oC$
typ
10^3
10^2
10
1
10
10^2
V_R (V)
10^3

CONTROLLED AVALANCHE RECTIFIER DIODES

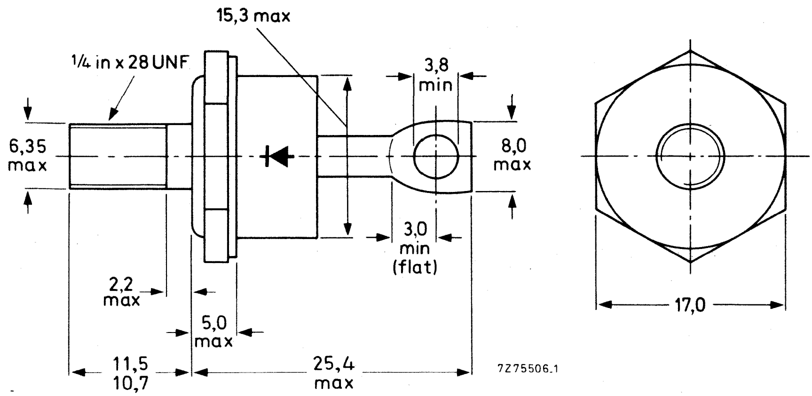
Silicon diodes in a DO-5 metal envelope, capable of absorbing transients and intended for use in power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX56-600, BYX56-800, BYX56-1000.
Reverse polarity (anode to stud): BYX56-600R, BYX56-800R, BYX56-1000R.

QUICK REFERENCE DATA

			BYX56-600(R)	800(R)	1000(R)	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	<	750	1000	1250	V
Average forward current	$I_{F(AV)}$	max.	48			A
Non-repetitive peak forward current	I_{FSM}	max.	800			A
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	40			kW

MECHANICAL DATA Dimensions in mm

DO-5; Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 11,1 mm



Net weight: 22 g
Diameter of clearance hole: 6,5 mm
Accessories supplied on request:
56264A (mica washer, insulating ring, tag)

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)

The mark shown applies to normal polarity types.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

			BYX56-600(R)	800(R)	1000(R)	
Continuous reverse voltage	V_R	max.	600	800	1000	V
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	V

Currents

Average forward current (averaged over any 20 ms period)				
up to T_{mb} = 112 °C	$I_{F(AV)}$	max.	48	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	40	A
R.M.S. forward current	$I_{F(RMS)}$	max.	75	A
Repetitive peak forward current	I_{FRM}	max.	450	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.	800	A
I^2t for fusing ($t \leqslant 10$ ms)	I^2t	max.	3200	A^2s

Reverse power dissipation

Repetitive peak reverse power dissipation t = 10 µs (square-wave; f = 50 Hz); T_j = 175 °C	P_{RRM}	max.	6,5	kW
Non-repetitive peak reverse power dissipation t = 10 µs (square-wave)				
T_j = 25 °C prior to surge	P_{RSM}	max.	40	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	6,5	kW

Temperatures

Storage temperature	T_{stg}		−55 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

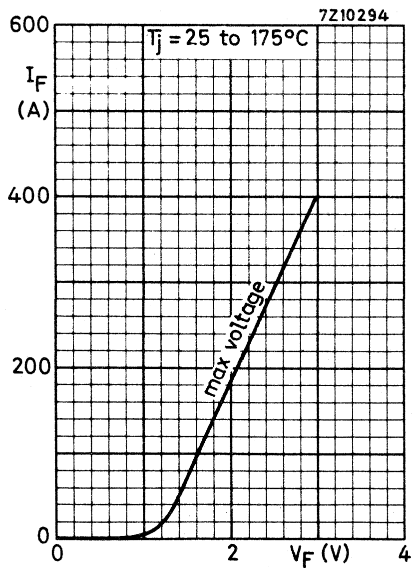
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0,8	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}h}$	=	0,03	°C/W

CHARACTERISTICS

		BYX56-600(R)	800(R)	1000(R)	
Forward voltage at I_F = 150 A; T_j = 25 °C	V_F	< 1.8	1.8	1.8	V [1]
Reverse avalanche breakdown voltage					
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	> 750	1000	1250	V
		< 2000	2000	2000	V
Peak reverse current					
$V_{RM} = V_{RWMmax}$; T_j = 125 °C	I_{RM}	< 1.6	1.6	1.6	mA

OPERATING NOTES (see general pages at the beginning of this section)

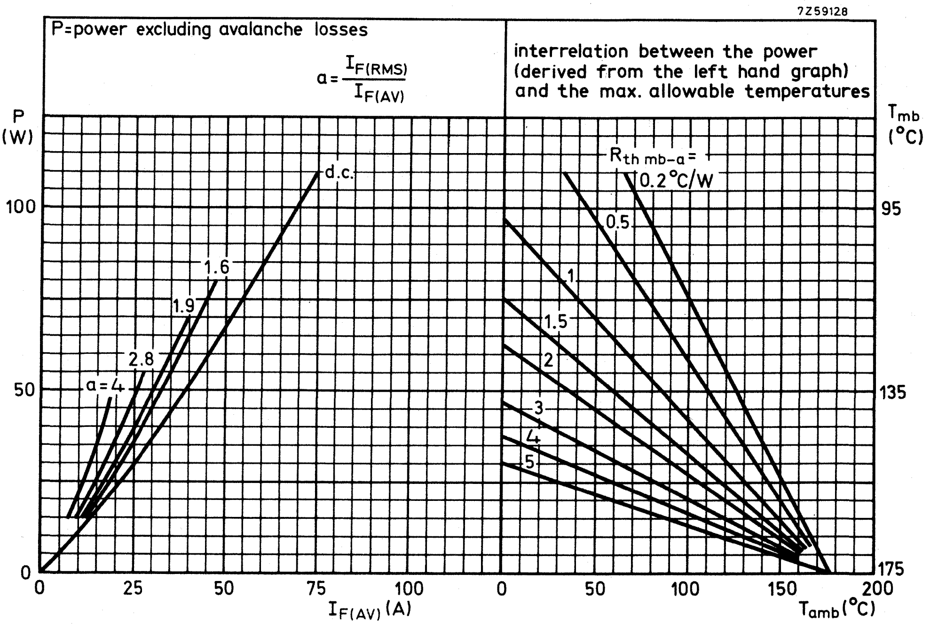
The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
During soldering the heat conduction to the junction should be kept to a minimum by using a thermal shunt.

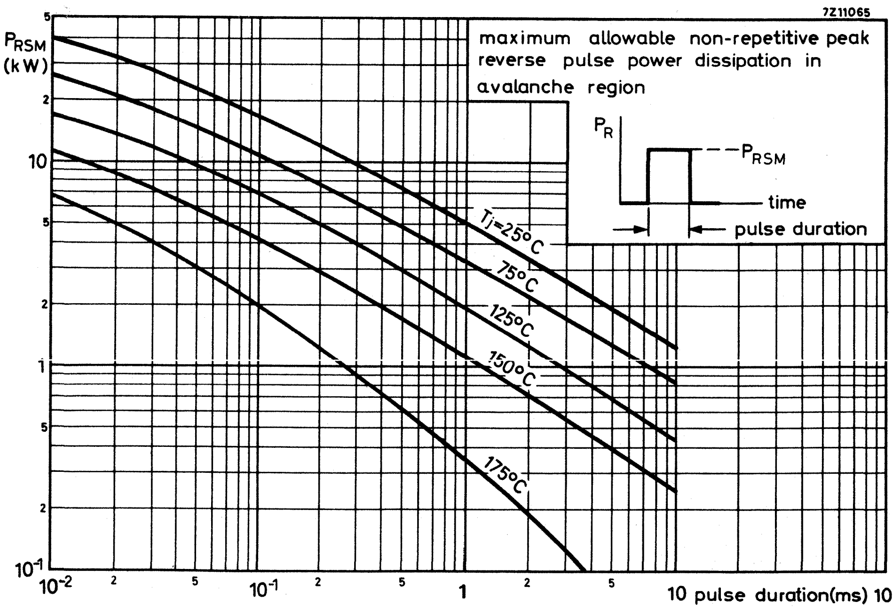


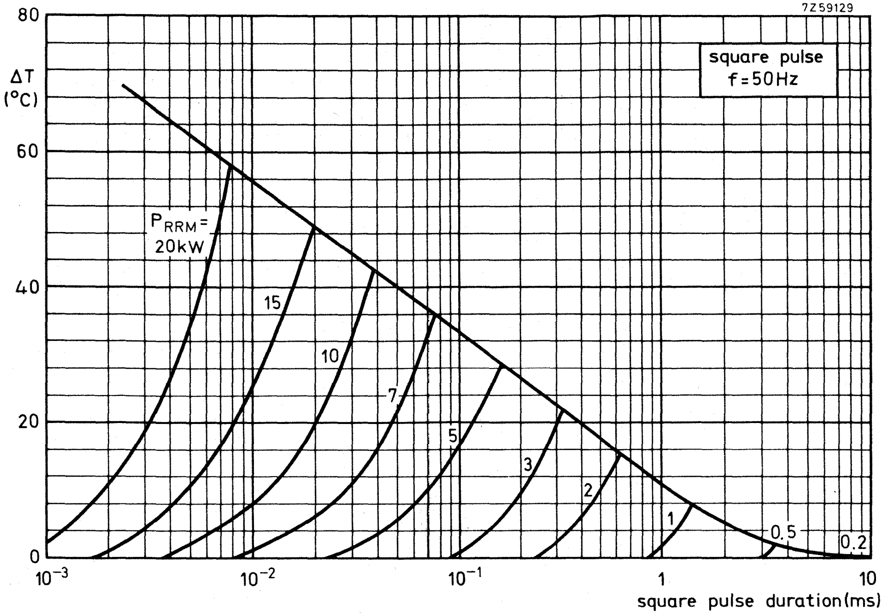
APPLICATION INFORMATION

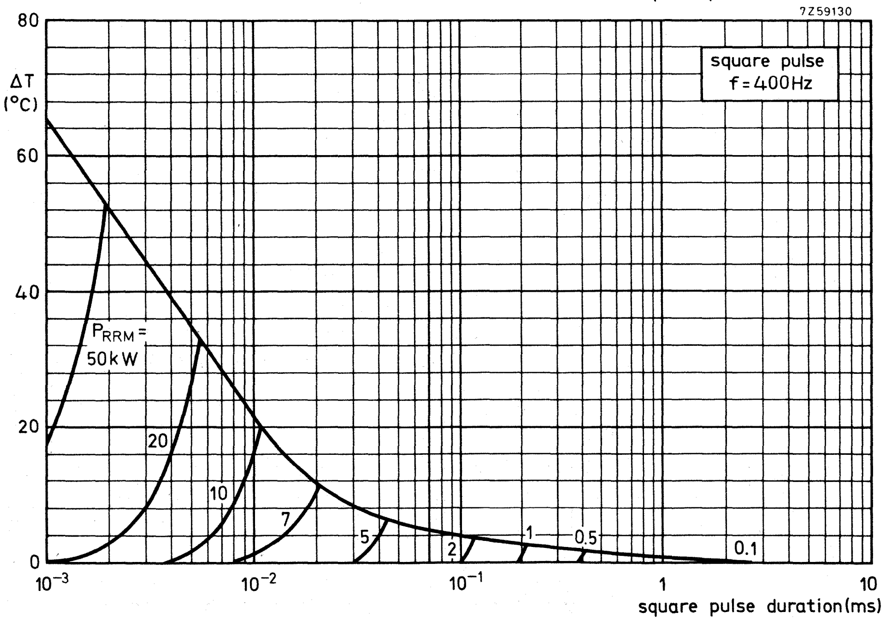
See general pages at the beginning of this section

[1]) Measured under pulsed conditions to avoid excessive dissipation.

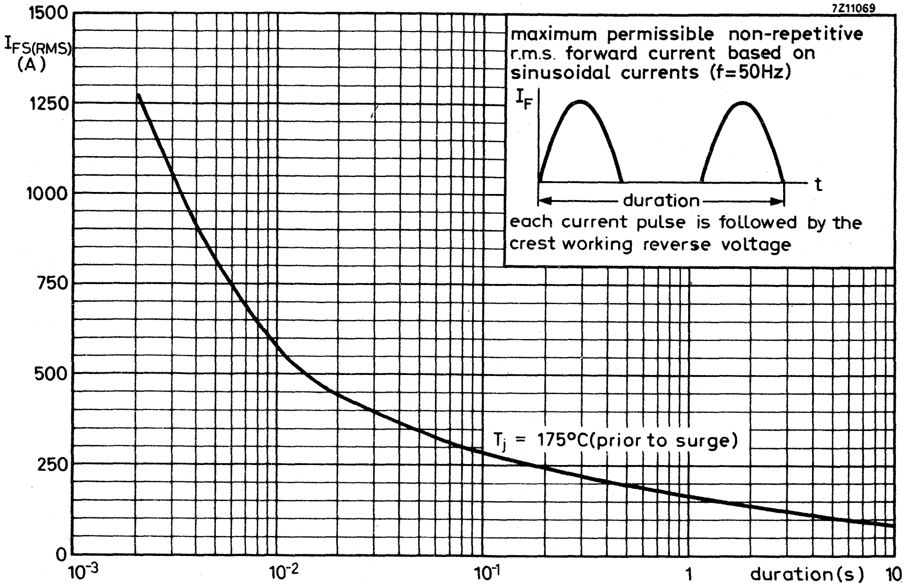

7Z59128
P=power excluding avalanche losses
a = I F(RMS) / I F(AV)
interrelation between the power (derived from the left hand graph) and the max. allowable temperatures
P (W)
100
50
0
d.c.
1.6
1.9
2.8
a=4
0
25
50
75
100
I F(AV) (A)
T mb (°C)
95
135
175
R th mb-a = 0.2 °C/W
0.5
1
1.5
2
3
4
5
0
50
100
150
200
T amb (°C)

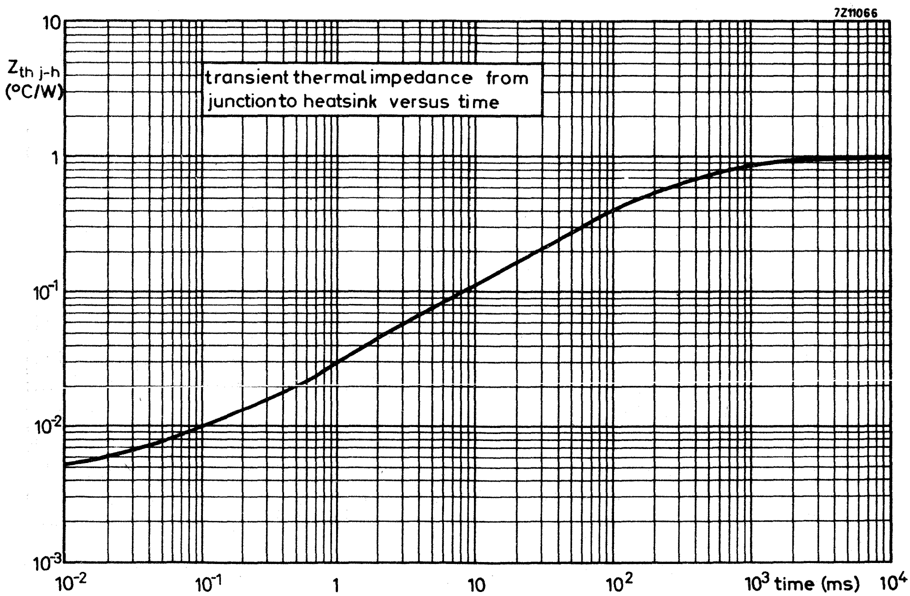

7Z11065
maximum allowable non-repetitive peak reverse pulse power dissipation in avalanche region
P RSM (kW)
10
1
10-1
P R
P RSM
time
pulse duration
Tj=25°C
75°C
125°C
150°C
175°C
10-2
10-1
1
10 pulse duration(ms) 10





ΔT = neccessary derating of $T_{j\,max}$ to accommodate repetitive transients in the reverse direction. Allowance can be made for this by assuming the ambient temperature ΔT higher.


7Z11069
1500
$I_{FS(RMS)}$
(A)
1250
1000
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=50Hz)
I_F
t
duration
each current pulse is followed by the crest working reverse voltage
T_j = 175°C (prior to surge)


7Z11066
10
$Z_{th\ j-h}$
(°C/W)
1
10^{-1}
10^{-2}
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
10^3 time (ms)
10^4
transient thermal impedance from junction to heatsink versus time

FAST SOFT-RECOVERY RECTIFIER DIODES

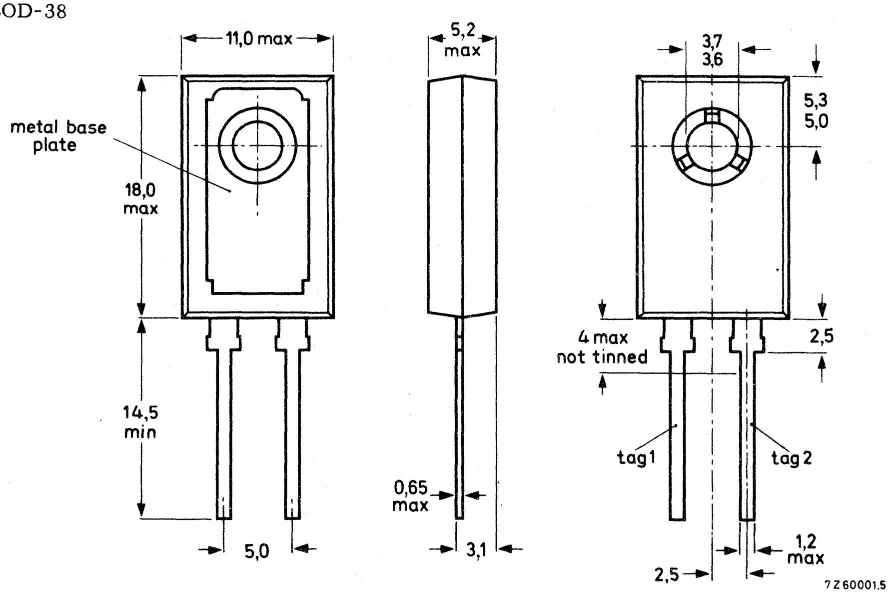
Silicon double-diffused rectifier diodes in plastic envelopes. They are intended for use in chopper applications as well as in switched-mode power supplies, as efficiency diodes and scan rectifiers in television receivers. The devices feature non-snap-off characteristics. Normal and reverse polarity types are available.

QUICK REFERENCE DATA

			BYX71-350(R)	600(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	350	600	V
Average forward current	$I_{F(AV)}$	max.	7		A
Non-repetitive peak forward current	I_{FSM}	max.	60		A
Reverse recovery time	t_{rr}	<	450		ns

MECHANICAL DATA (see also page 2) Dimensions in mm

SOD-38



The exposed metal base-plate is directly connected to tag 1.

MECHANICAL DATA (continued)

Net mass: 2,5 g

Recommended diameter of fixing screw: 3,5 mm

Torque on screw
when using washer and heatsink compound: min. 0,95 Nm (9,5 kg cm)
max. 1,5 Nm (15 kg cm)

Accessories:
supplied with the device: 56355 (washer)
available on request: 56316 (mica insulating washer)

POLARITY OF CONNECTIONS

	BYX71-350 and BYX71-600	BYX71-350R and BYX71-600R
Base-plate:	cathode	anode
Tag 1 :	cathode	anode
Tag 2 :	anode	cathode

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

Voltages			BYX71-350(R)	600(R)	
Continuous reverse voltage	V_R	max.	300	500	V
Working reverse voltage	V_{RW}	max.	300	500	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	350	600	V
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	350	600	V

Currents

Average on-state current assuming zero switching losses (averaged over any 20 ms period)				
square wave: $\delta = 0,5$; up to $T_{mb} = 85\ ^oC$	$I_{F(AV)}$	max.	7	A
without heatsink at $T_{amb} = 50\ ^oC$	$I_{F(AV)}$	max.	1,4	A
sinusoidal: at $T_{mb} = 85\ ^oC$	$I_{F(AV)}$	max.	6,5	A
R.M.S. forward current	$I_{F(RMS)}$	max.	10	A
Repetitive peak forward current	I_{FRM}	max.	25	A
Non-repetitive peak forward current				
half sine wave; t = 10 ms; $T_j = 150\ ^oC$ prior to surge	I_{FSM}	max.	60	A
square pulse; t = 5 ms; $T_j = 150\ ^oC$ prior to surge	I_{FSM}	max.	60	A
Rate of change of commutation current	$-\frac{dI}{dt}$	max.	50	A/µs

Temperatures

Storage temperature	T_{stg}		−55 to +125	^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	6,5 °C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,3 °C/W

Influence of mounting method

1. Heatsink mounted

From mounting base to heatsink

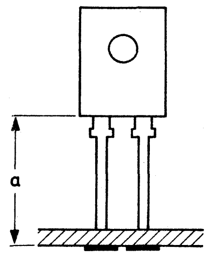
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	1,5 °C/W
b. with heatsink compound and 56316 mica washer	$R_{th\ mb\text{-}h}$	=	2,7 °C/W
c. without heatsink compound	$R_{th\ mb\text{-}h}$	=	2,7 °C/W
d. without heatsink compound; with 56316 mica washer	$R_{th\ mb\text{-}h}$	=	5 °C/W

2. Free air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no other leads run to the tie-points.

From junction to ambient in free air mounted on a printed circuit board at a = maximum lead length and with a copper laminate

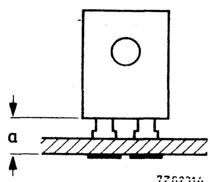
a. > 1 cm^2 — $R_{th\ j\text{-}a}$ = 50 °C/W
b. < 1 cm^2 — $R_{th\ j\text{-}a}$ = 55 °C/W



7Z62315.1

at a lead-length a = 3 mm and with a copper laminate

c. > 1 cm^2 — $R_{th\ j\text{-}a}$ = 55 °C/W
d. < 1 cm^2 — $R_{th\ j\text{-}a}$ = 60 °C/W



7Z62314

SOLDERING AND MOUNTING NOTES

1. Soldered joints must be at least 2,5 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 270 °C; contact with the joint must not exceed 3 seconds.
3. The device should not be immersed in oil, and few potting resins are suitable for re-encapsulation. Advice on these materials is available on request.
4. Leads should not be bent less than 2,5 mm from the seal; exert no axial pull when bending.
5. For good thermal contact heatsink compound should be used between base-plate and heatsink.

CHARACTERISTICS

Forward voltage

I_F = 5 A; T_j = 25 °C	V_F	<	1,25	V [1]

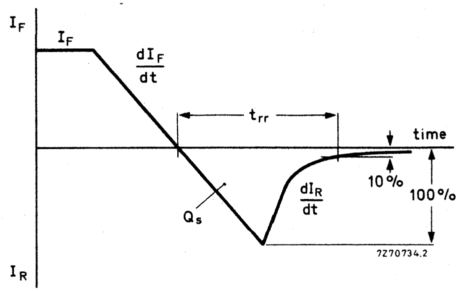
Reverse current

$V_R = V_{RWmax}$; T_j = 125 °C	I_R	<	0,4	mA

Reverse recovery when switched from

I_F = 2 A to V_R = 30 V with
$-dI_F/dt$ = 20 A/µs; T_j = 25 °C

Recovery charge	Q_s	<	700	nC
Recovery time	t_{rr}	<	450	ns
Max. slope of the reverse recovery current with $-dI_F/dt$ = 2 A/µs	$\|dI_R/dt\|$	<	5	A/µs



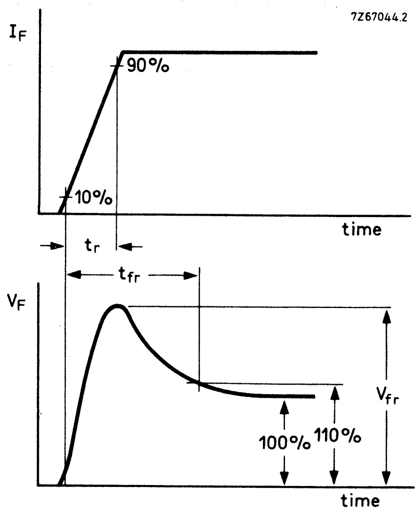
[1]) Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Forward recovery when switched to

I_F = 25 A with t_r = 0,5 μs at T_j = 25 °C

Recovery time	t_{fr}	<	0,8	μs
Recovery voltage	V_{fr}	<	3,5	V

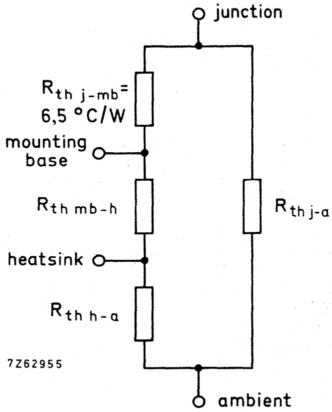


Forward output waveform

OPERATING NOTES

Dissipation and heatsink **considerations:**

a. The various components of junction temperature rise above ambient are illustrated below:



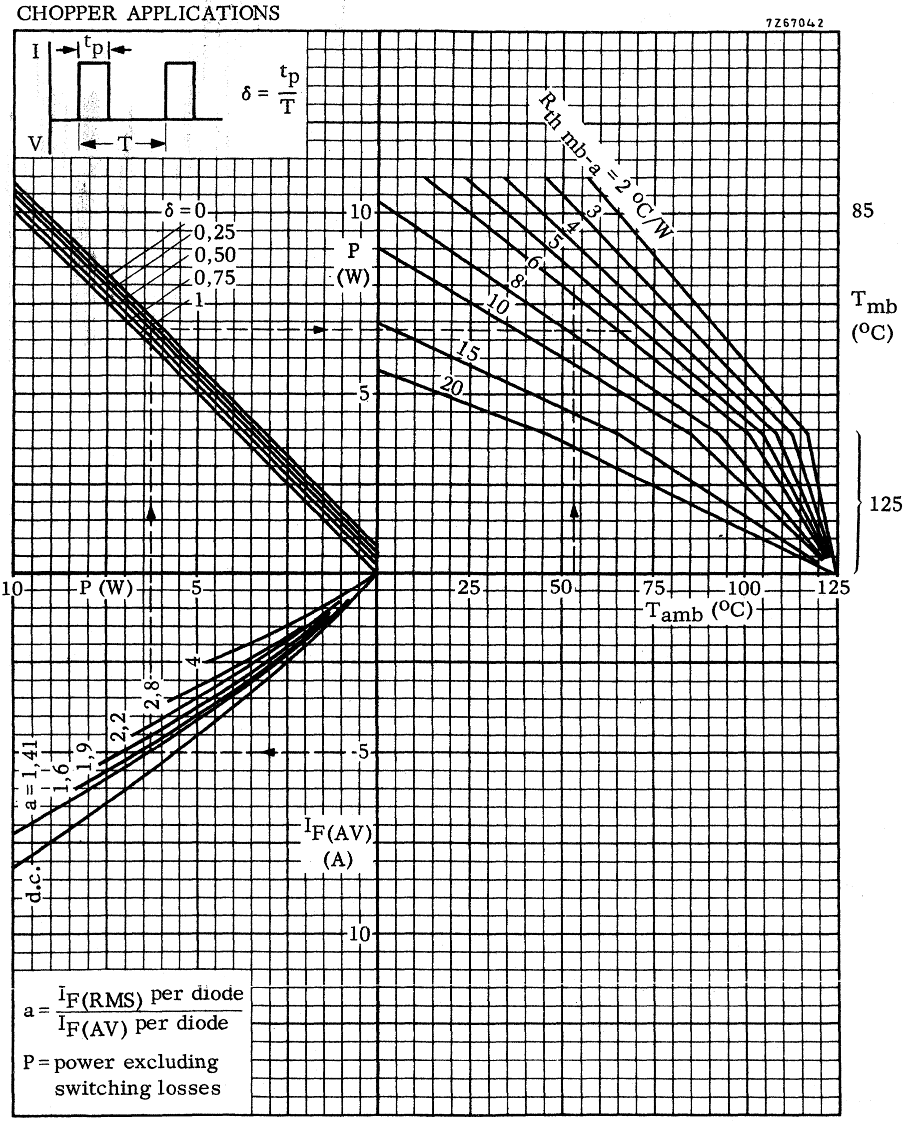
b. The method of using the graph on page 8 is as follows:
Starting with the curve of maximum dissipation as a function of $I_{F(AV)}$, for a particular current trace horizontally to meet the appropriate form factor; upwards to the operating duty cycle (δ) line; horizontally until the $R_{th\ mb-a}$ curve is reached. Finally trace upwards from the T_{amb} scale. The intersection determines the $R_{th\ mb-a}$ required.
The heatsink thermal resistance value ($R_{th\ h-a}$) can now be calculated from:

$$R_{th\ h-a} = R_{th\ mb-a} - R_{th\ mb-h}$$

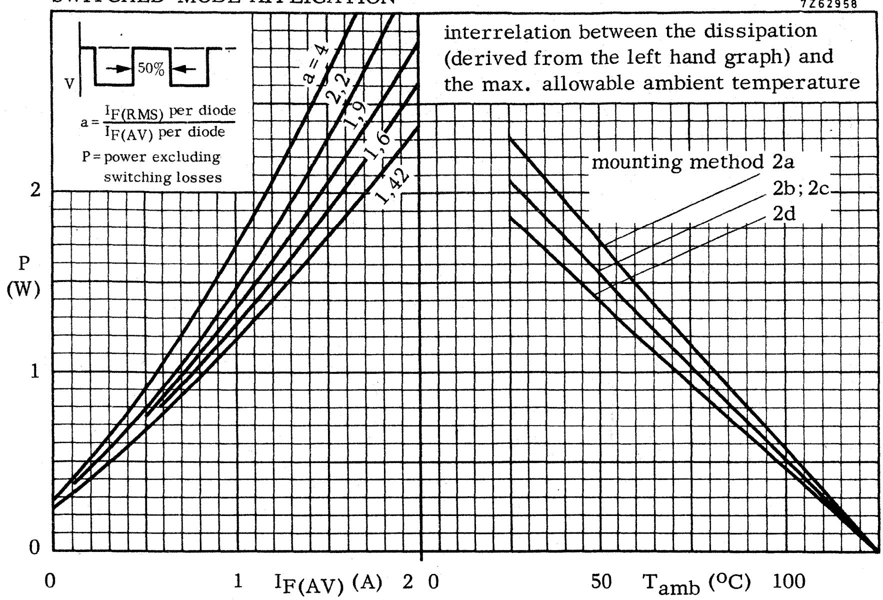
Any measurement of heatsink temperature should be made immediately adjacent to the device.

c. The heatsink curves are optimised to allow the junction temperature to run up to 150 °C ($T_{j\ max}$) whilst limiting T_{mb} to 125 °C (or less).

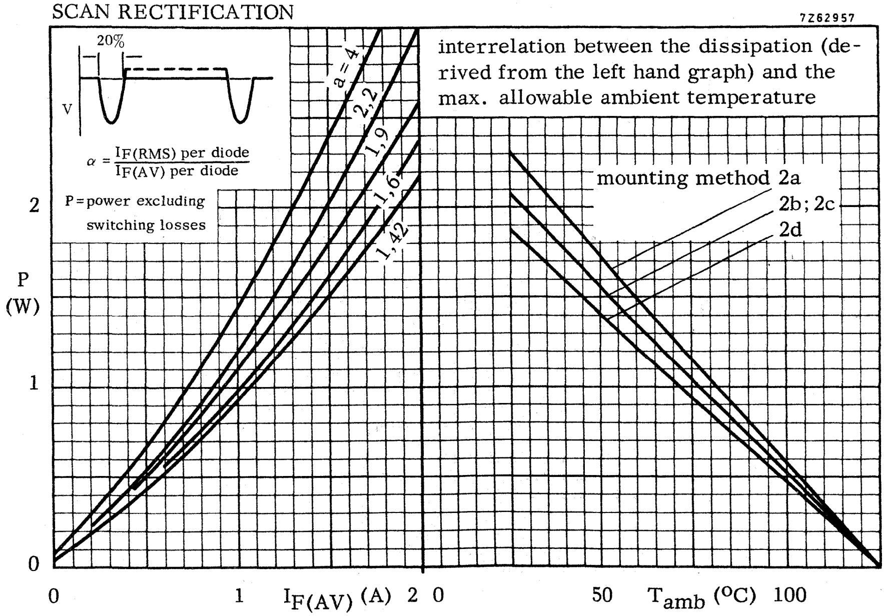
CHOPPER APPLICATIONS

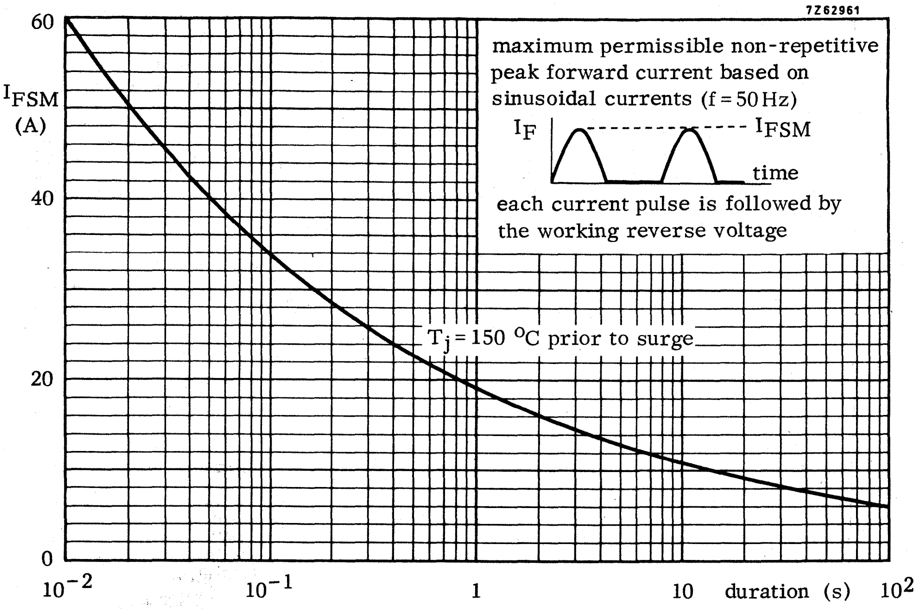


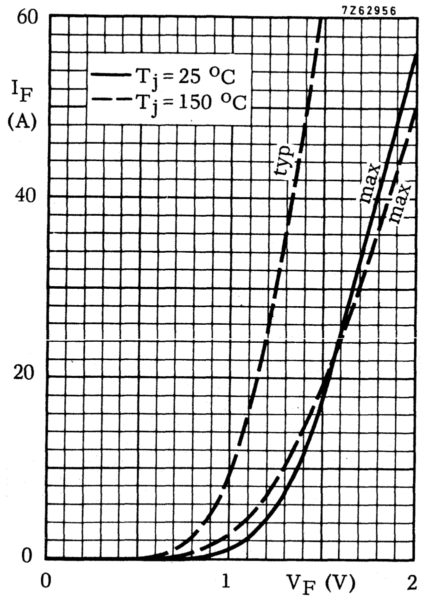
SWITCHED-MODE APPLICATION

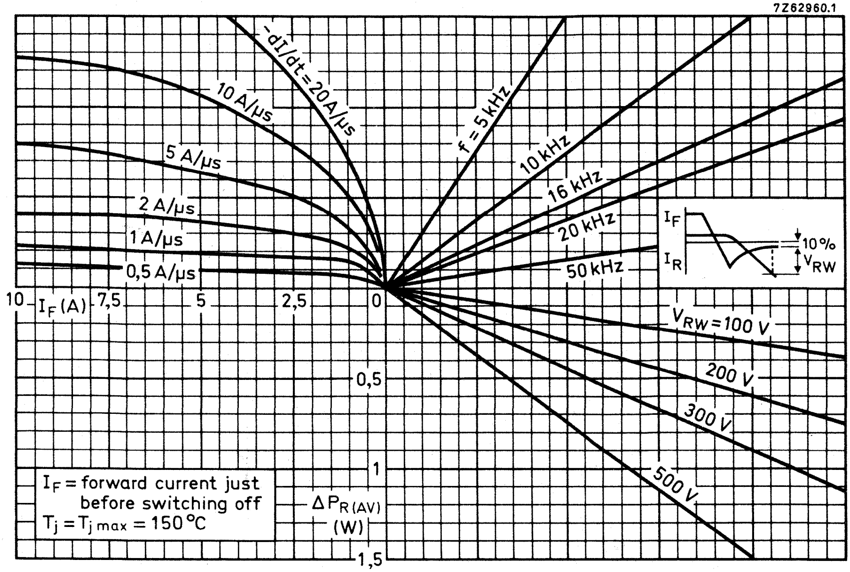


SCAN RECTIFICATION

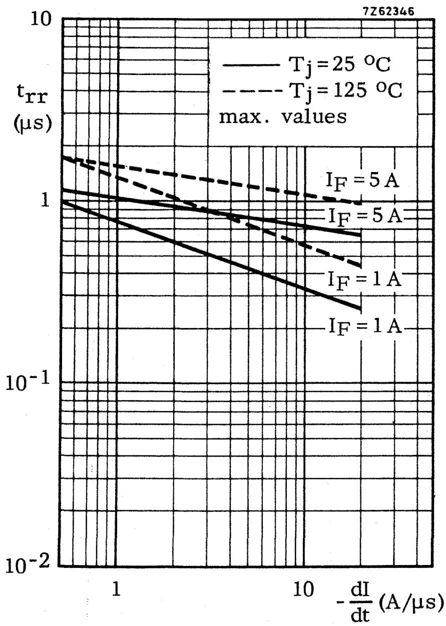


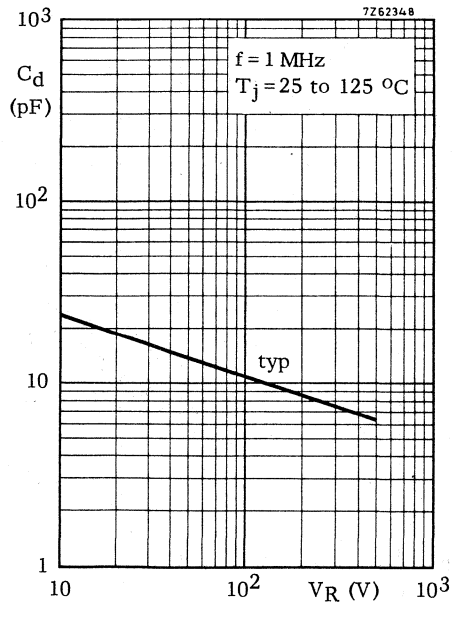

7Z62961
maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_FSM
time
each current pulse is followed by the working reverse voltage
T_j = 150 °C prior to surge
I_FSM (A)
60
40
20
0
10^-2
10^-1
1
10
duration (s)
10^2

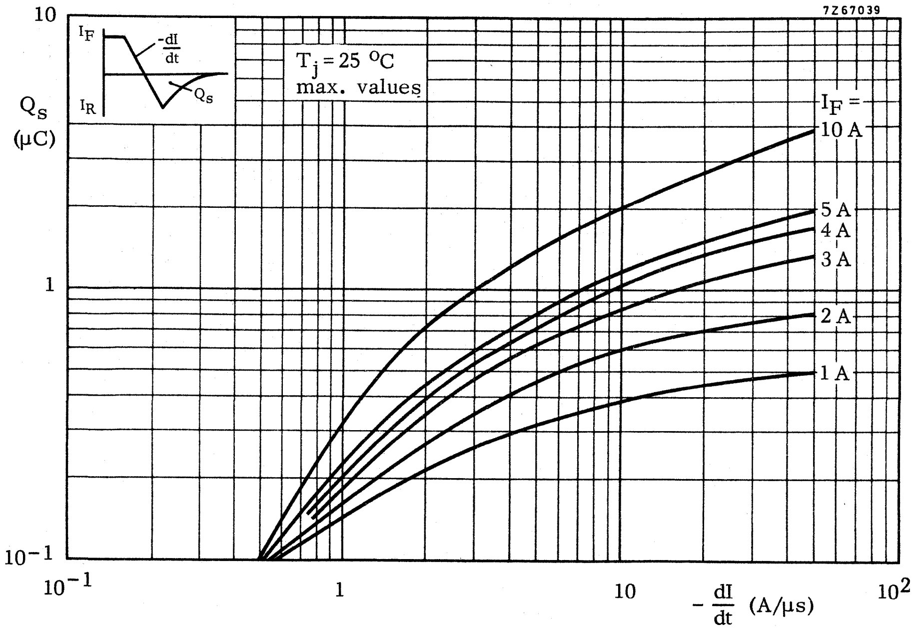

7Z62956
T_j = 25 °C
T_j = 150 °C
typ
max
max
I_F (A)
60
40
20
0
0
1
V_F (V)
2

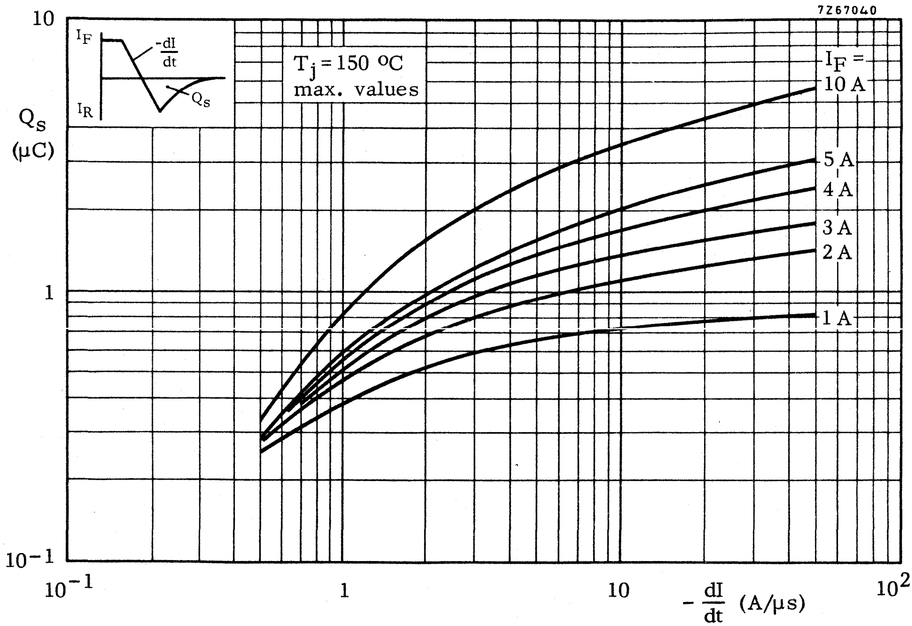


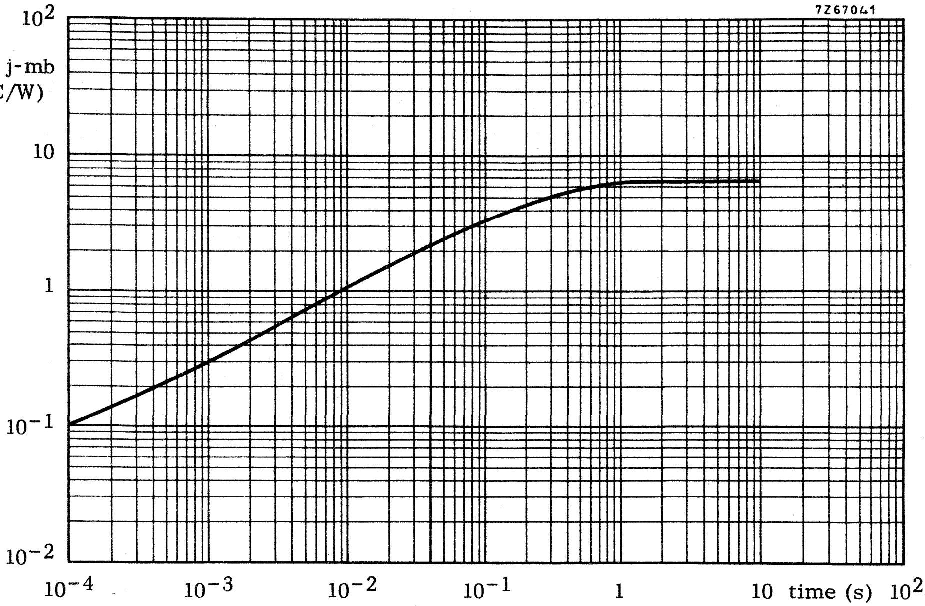
Nomogram: power loss $\Delta P_{R(AV)}$ due to switching only (to be added to forward and reverse power losses).






7Z67039
I_F
$-\frac{dI}{dt}$
I_R
Q_s
$T_j = 25\ ^oC$
max. values
Q_s
(μC)
$I_F =$
10 A
5 A
4 A
3 A
2 A
1 A
10
1
10^{-1}
1
10
10^2
$-\frac{dI}{dt}$ (A/μs)


7Z67040
I_F
$-\frac{dI}{dt}$
I_R
Q_s
$T_j = 150\ ^oC$
max. values
Q_s
(μC)
$I_F =$
10 A
5 A
4 A
3 A
2 A
1 A
10
1
10^{-1}
1
10
10^2
$-\frac{dI}{dt}$ (A/μs)


7Z67041
10^2
$Z_{th\ j\text{-}mb}$
(°C/W)
10
1
10^{-1}
10^{-2}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
time (s)
10^2

SILICON E.H.T. RECTIFIER DIODE

The BYX90 is a 6 kV silicon diode in a plastic envelope, only intended as subassembly for very high voltage stacks in X-ray equipment (in oil).

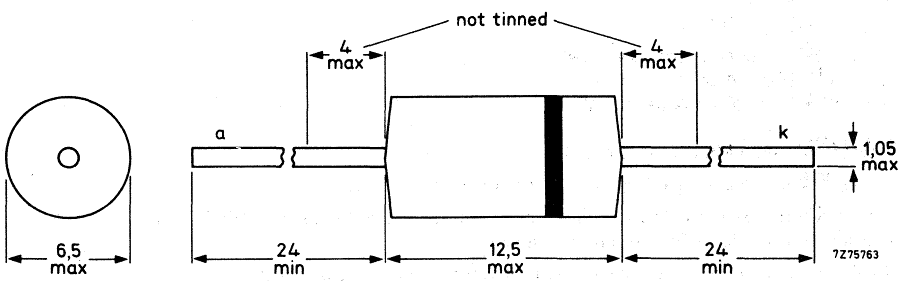
QUICK REFERENCE DATA

Crest working reverse voltage	V_{RWM}	max.	6	kV
Repetitive peak reverse voltage	V_{RRM}	max.	7,5	kV
Average forward current up to T_{oil} = 50 °C	$I_{F(AV)}$	max.	200	mA
Non-repetitive peak forward current t = 10 ms; T_j = 125 °C prior to surge	I_{FSM}	max.	25	A
Junction temperature	T_j	max.	125	°C

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-18B.



All information applies to frequencies from 40 Hz to 400 Hz

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Crest working reverse voltage	V_{RWM}	max.	6	kV
Repetitive peak reverse voltage ($\delta \leqslant 0{,}01$)	V_{RRM}	max.	7,5	kV
Non-repetitive peak reverse voltage ($t \leqslant 10$ ms)	V_{RSM}	max.	8	kV
Average forward current (averaged over any 20 ms period) up to T_{oil} = 55 °C (stirring oil) continuous operation	$I_{F(AV)}$	max.	200	mA
Repetitive peak forward current	I_{FRM}	max.	3	A
intermittent operation	see application information Figs 6 and 7			
Non-repetitive peak forward current (t = 10 ms; half sine wave) T_j = 125 °C prior to surge	I_{FSM}	max.	25	A
Storage temperature	T_{stg}	−40 to + 125		°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to cooling oil (in stirring oil)	$R_{th\ j\text{-}o}$	=	30	°C/W

CHARACTERISTICS

Forward voltage I_F = 2 A; T_j = 25 °C	V_F	<	15	V
Peak reverse current V_R = 6 kV; T_j = 100 °C	I_R	<	10	μA
Reverse recovery charge when switched from I_F = 200 mA to $V_R \geqslant 50$ V with $-dI_F/dt$ = 200 mA/μs; T_j = 25 °C	Q_s	<	125	nC

SOLDERING AND MOUNTING NOTES

1. Soldered joints must be at least 5 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 300 °C; it must not be in contact with the joint for more than 3 seconds.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 °C.

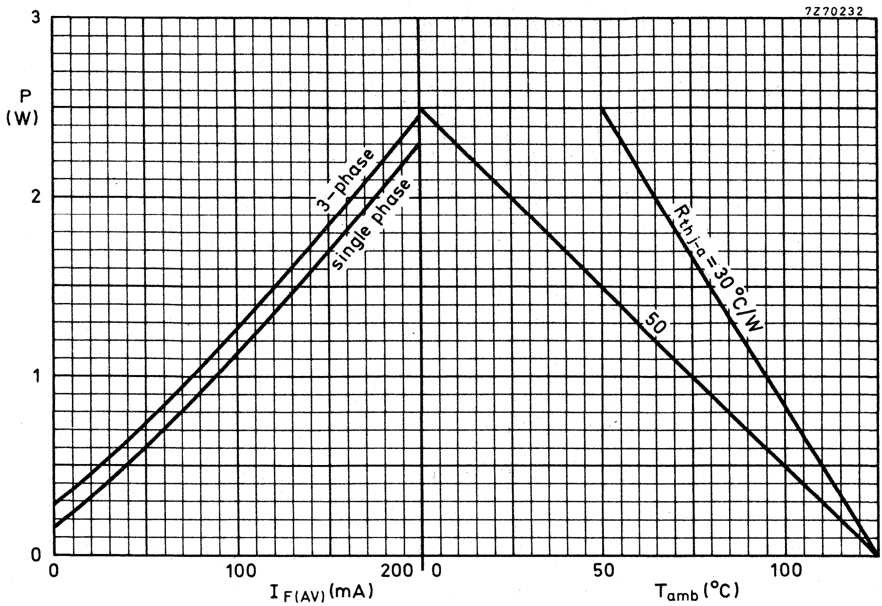

7Z70232
P
(W)
3-phase
single phase
$R_{th\ j-a}$ = 30 °C/W
50
$I_{F(AV)}$ (mA)
T_{amb} (°C)

Fig. 2.

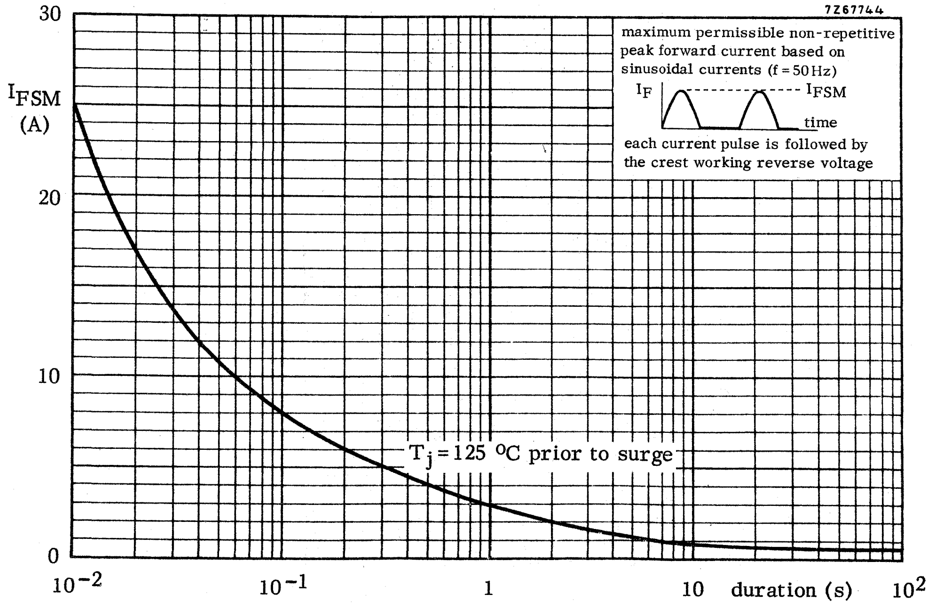

7Z67744
I_{FSM}
(A)
maximum permissible non-repetitive
peak forward current based on
sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
time
each current pulse is followed by
the crest working reverse voltage
T_j = 125 °C prior to surge
duration (s)

Fig. 3.

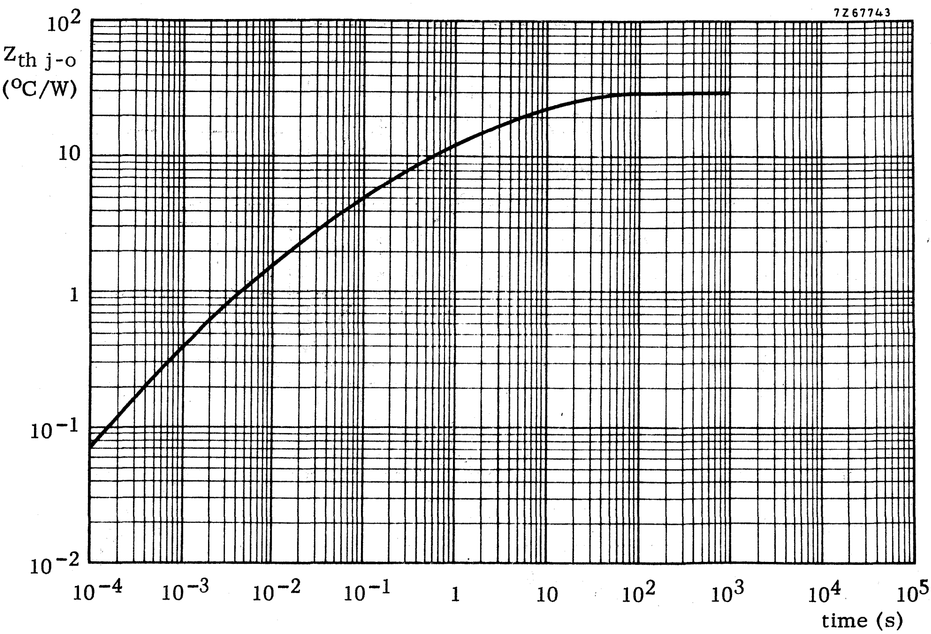

7Z67743
10^2
$Z_{th\ j\text{-}o}$
($^oC/W$)
10
1
10^{-1}
10^{-2}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
10^3
10^4
10^5
time (s)

Fig. 4.

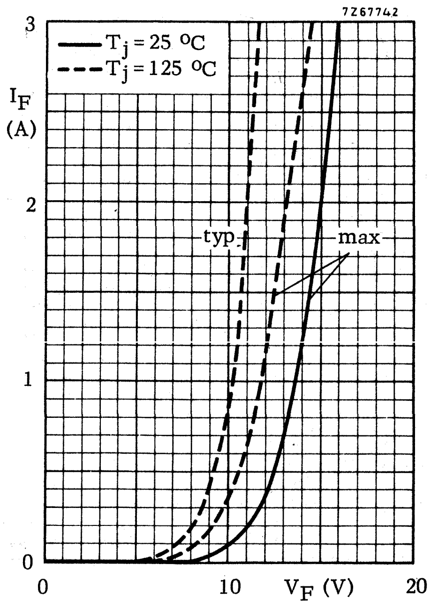

7Z67742
$T_j = 25\ ^oC$
$T_j = 125\ ^oC$
I_F
(A)
3
2
1
0
typ
max
0
10
V_F (V)
20

Fig. 5.

APPLICATION INFORMATION

The BYX90 used in very high voltage stacks applied in X-ray equipment.

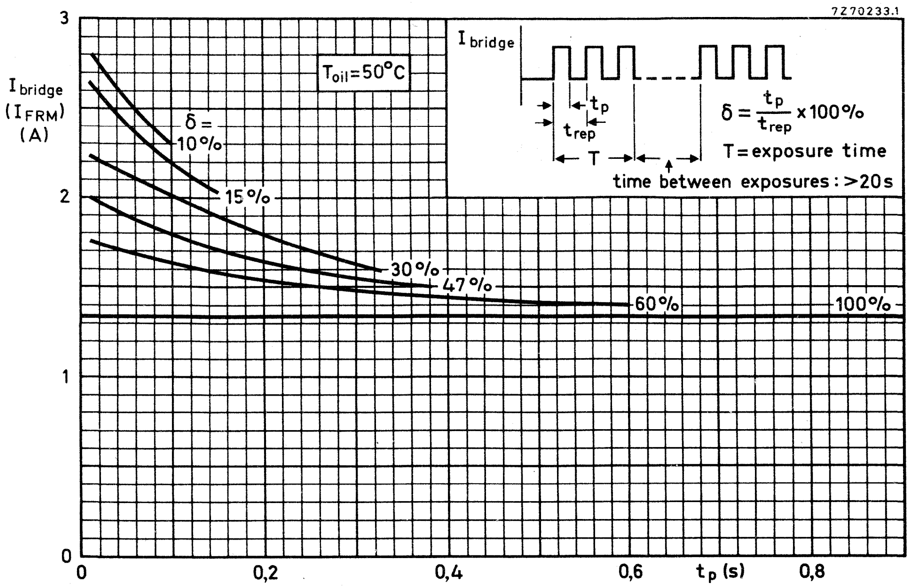


Fig. 6 Maximum current through a 3-phase rectifier bridge as a function of pulse duration.
The exposure time T = 1 s.

APPLICATION INFORMATION (continued)

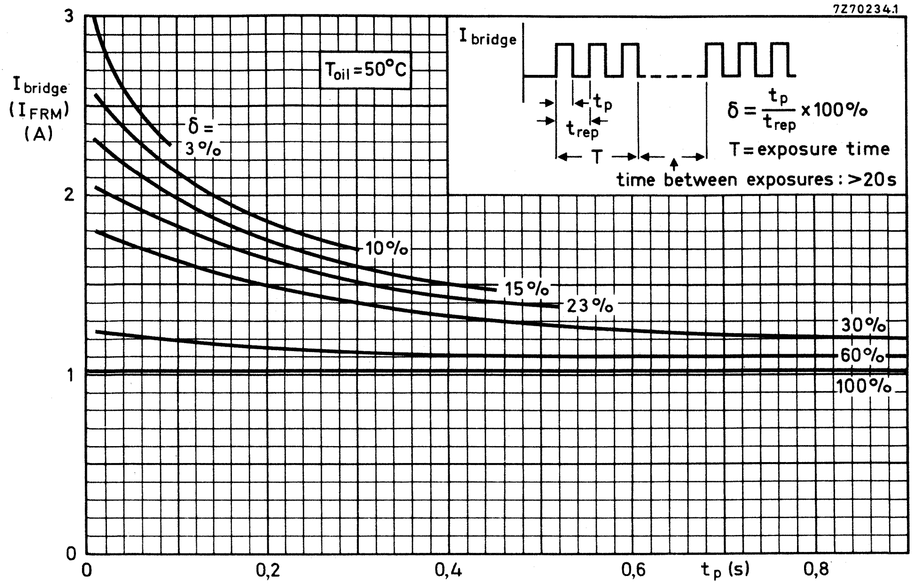


Fig. 7 Maximum current through a 3-phase rectifier bridge as a function of pulse duration.
The exposure time T = 3 s.

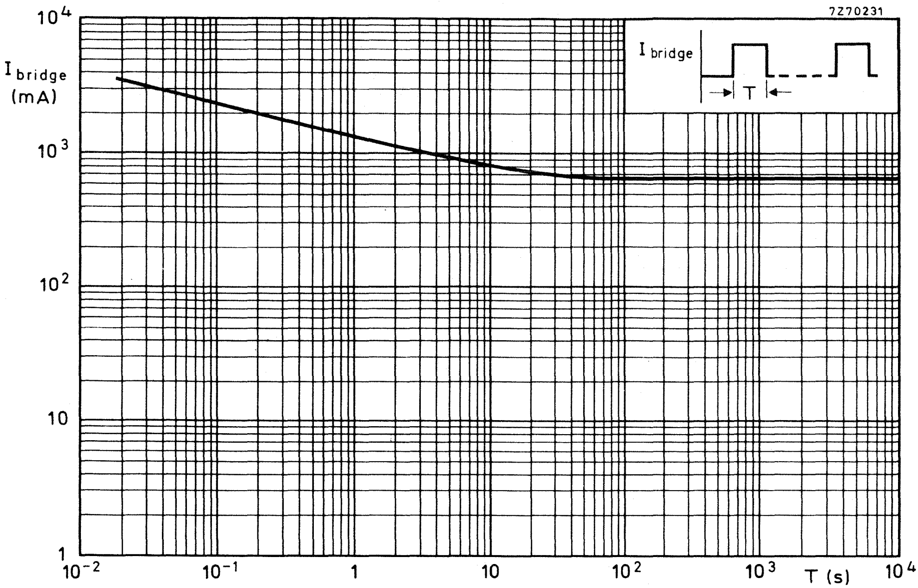


Fig. 8 Maximum permissible output current in a 3-phase rectifier bridge with a minimum time between exposures of 20 s.

SILICON E.H.T. RECTIFIER DIODES

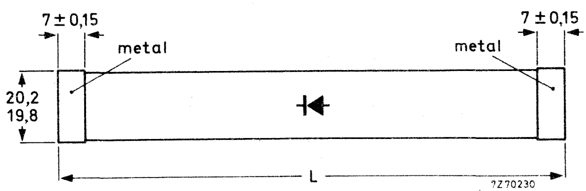
The BYX91 series are silicon high-voltage rectifiers capable of absorbing transients. They are primarily intended for X-ray applications. This series is a direct replacement of the BYX29 series. Each rectifier consists of an appropriate number of diodes encapsulated in a synthetic resin-bonded paper tube.
For cooling and insulation reasons, the devices can only be used when immersed in oil.
The series consists of the following types:

BYX91- 90K (replaces BYX29- 75 000); BYX91-150K (replaces BYX29-125 000);
BYX91-120K (replaces BYX29-100 000); BYX91-180K (replaces BYX29-150 000).

QUICK REFERENCE DATA

			BYX91-90K	120K	150K	180K	
Crest working reverse voltage	V_{RWM}	max.	90	120	150	180	kV
Average forward current	$I_{F(AV)}$	max.	200	200	200	200	mA
Non-repetitive peak forward current; t = 10 ms	I_{FSM}	max.	25	25	25	25	A
Junction temperature	T_j	max.	125	125	125	125	°C
Thermal resistance from junction to cooling oil	$R_{th\ j-o}$	=	2	1,5	1,2	1	°C/W

MECHANICAL DATA Dimensions in mm



BYX91- 90K	L: 141 to 143 mm	Weight: 47 g
BYX91-120K	L: 169 to 171 mm	Weight: 54 g
BYX91-150K	L: 229 to 231 mm	Weight: 65 g
BYX91-180K	L: 229 to 231 mm	Weight: 70 g

All information applies to frequencies up to 400 Hz

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

Voltages			BYX91-90K	120K	150K	180K	
Crest working reverse voltage	V_{RWM}	max.	90	120	150	180	kV
Crest working reverse voltage; t ≤ 10 min	V_{RWM}	max.	100	130	165	195	kV
Repetitive peak reverse voltage; δ ≤ 0,01	V_{RRM}	max.	115	150	190	225	kV
Non-repetitive peak reverse voltage; t = 10 ms	V_{RSM}	max.	120	160	200	240	kV

Currents

Average forward current (averaged over any 20 ms period) at T_{oil} = 50 °C

continuous operation	$I_{F(AV)}$	max.	200	mA
intermittent operation (t ≤ 0,1 s, once every 20 s)	$I_{F(AV)}$	max.	800	mA

Repetitive peak forward current

continuous operation	I_{FRM}	max.	600	mA
intermittent operation ($I_{F(AV)}$ = 800 mA; t ≤ 0,1 s once every 20 s)	I_{FRM}	max.	2400	mA
Non-repetitive peak forward current; t = 10 ms	I_{FSM}	max.	25	A

Temperatures

Storage temperature	T_{stg}		−30 to +125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

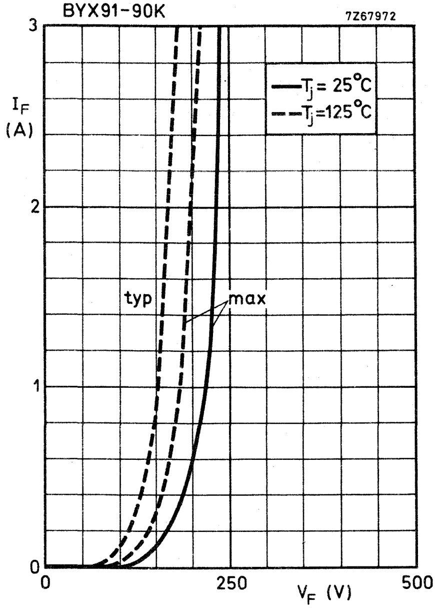
		BYX91-90K	120K	150K	180K	
From junction to cooling oil (stirring oil)	$R_{th\,j-o}$ =	2	1,5	1,2	1	°C/W

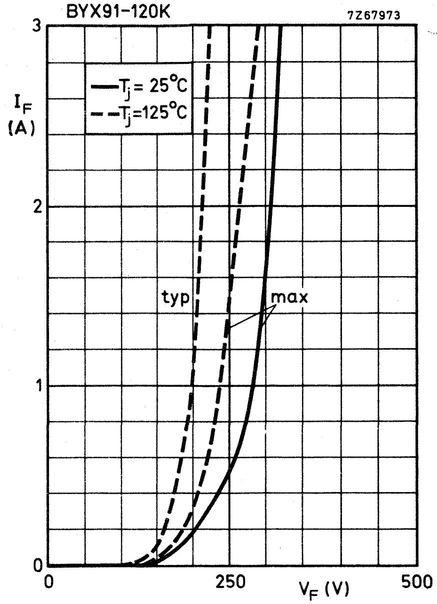
CHARACTERISTICS

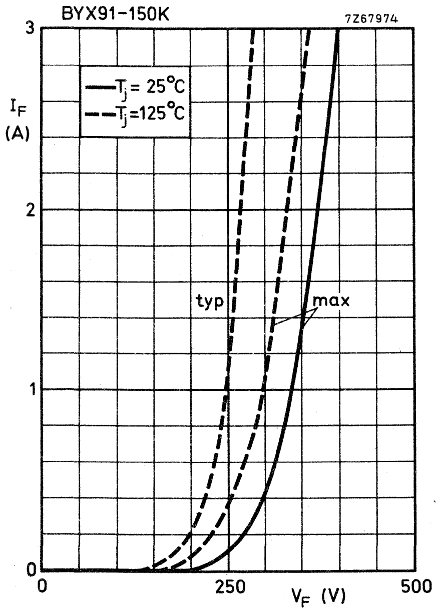
Forward voltage		BYX91-90K	120K	150K	180K	
I_F = 2 A; T_j = 25 °C	V_F <	225	300	375	450	V
Peak reverse current at T_j = 125 °C						
V_{RM} = V_{WRMmax} at t = 10 min	I_{RM} <	10	10	10	10	µA

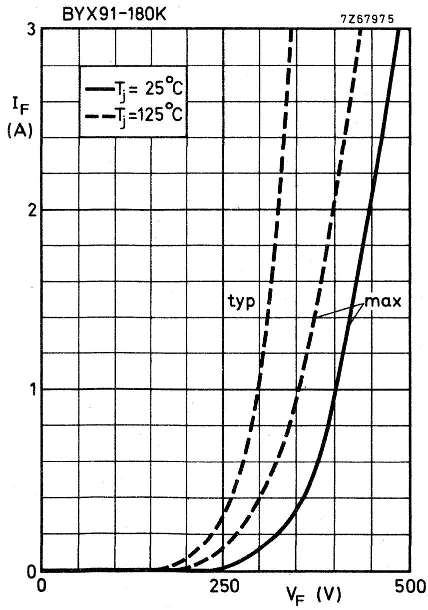
MOUNTING NOTES

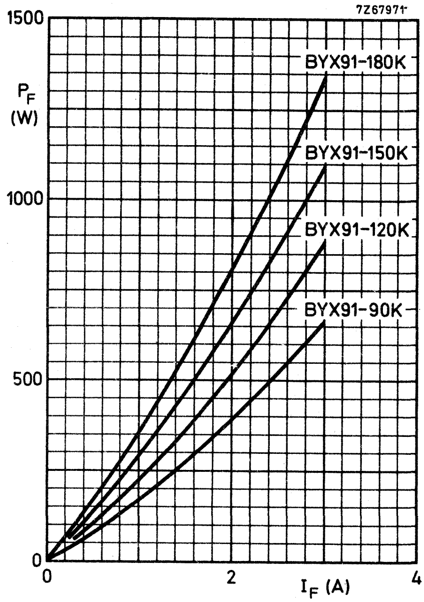
1. The rectifier stack shall be used in cooling (insulating) oil.
2. It should be made possible that the oil can circulate freely through the stacks.
3. Horizontal mounting should be avoided.

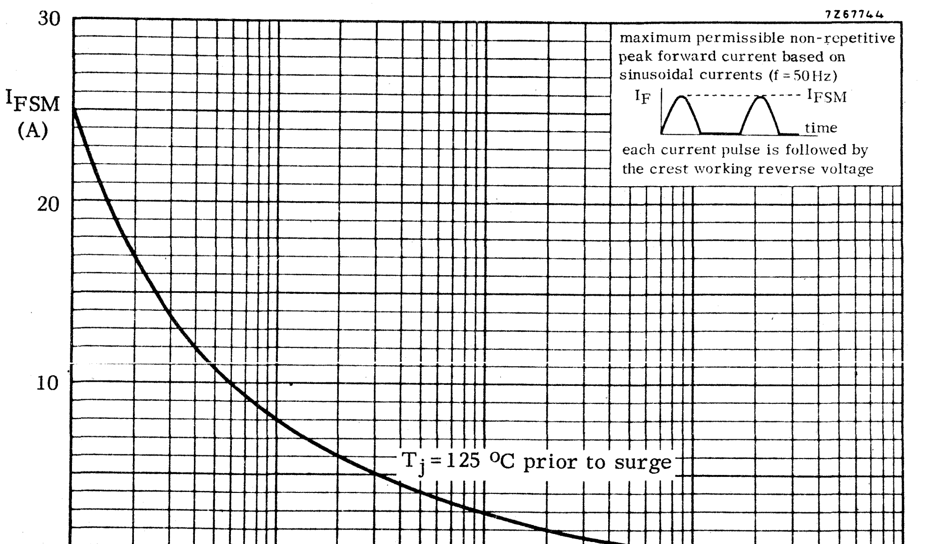

BYX91-90K
7Z67972
I_F (A)
V_F (V)
0
1
2
3
250
500
T_j = 25°C
T_j = 125°C
typ
max

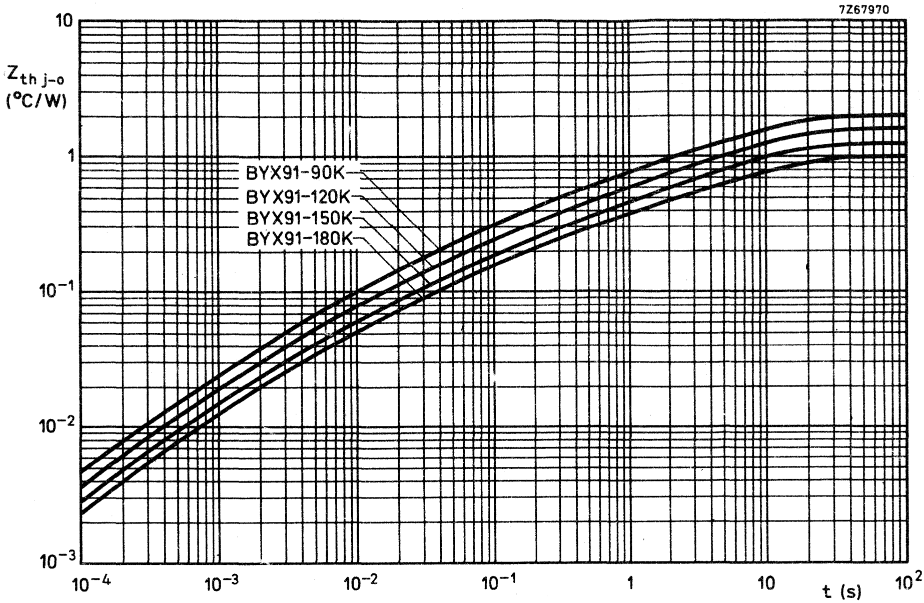

BYX91-120K
7Z67973
I_F (A)
V_F (V)
0
1
2
3
250
500
T_j = 25°C
T_j = 125°C
typ
max


BYX91-150K
7Z67974
I_F (A)
V_F (V)
0
1
2
3
250
500
T_j = 25°C
T_j = 125°C
typ
max


BYX91-180K
7Z67975
I_F (A)
V_F (V)
0
1
2
3
250
500
T_j = 25°C
T_j = 125°C
typ
max


7Z67971
1500
P_F
(W)
1000
500
0
BYX91-180K
BYX91-150K
BYX91-120K
BYX91-90K
0
2
I_F (A)
4


7Z67744
30
I_{FSM}
(A)
20
10
0
maximum permissible non-repetitive
peak forward current based on
sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
time
each current pulse is followed by
the crest working reverse voltage
T_j = 125 °C prior to surge
10^{-2}
10^{-1}
1
10
duration (s)
10^2


7Z67970
$Z_{th\ j\text{-}o}$ (°C/W)
10
1
10^{-1}
10^{-2}
10^{-3}
BYX91-90K
BYX91-120K
BYX91-150K
BYX91-180K
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
t (s)
10^{2}

RECTIFIER DIODES

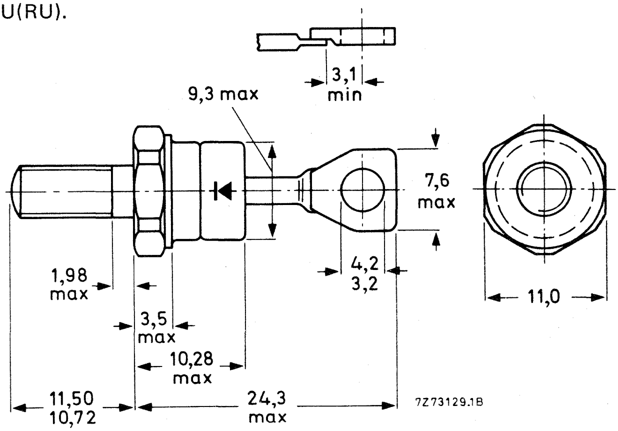
Silicon rectifier diodes in metal envelopes similar to DO-4, intended for use in power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX96-300 to 1600.
Reverse polarity (anode to stud): BYX96-300R to 1600R.

QUICK REFERENCE DATA

			BYX96-300 BYX96-300R	600 600R	1200 1200R	1600 1600R	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	1600	V
Average forward current	$I_{F(AV)}$	max.				30	A
Non-repetitive peak forward current	I_{FSM}	max.				400	A

MECHANICAL DATA Dimensions in mm

Fig. 1 DO-4: with metric M5 stud (ϕ 5 mm); e.g. BYX96-300(R).
Types with 10-32 UNF stud (ϕ 4,83 mm) are available on request. These are indicated by the suffix U; e.g. BYX96-300U(RU).



Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats, M5 thread: 8 mm, 10-32 UNF thread: 9.5 mm

Net mass: 7 g
Diameter of clearance hole: max. 5.2 mm
Supplied on request: accessories 56295
(PTFE bush, 2 mica washers, plain washer, tag)
a version with insulated flying leads
The mark shown applies to normal polarity types

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

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

→ Voltages [1]

			BYX96-300(R)	600(R)	1200(R)	1600(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	1600	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	1600	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	800	V
Continuous reverse voltage	V_R	max.	200	400	800	800	V

Currents

Average forward current (averaged over any 20 ms period) up to $T_{mb} = 125\ ^oC$	$I_{F(AV)}$	max.	30	A
R.M.S. forward current	$I_{F(RMS)}$	max.	48	A
Repetitive peak forward current	I_{FRM}	max.	400	A
Non-repetitive peak forward current ($t = 10$ ms; half sine-wave) $T_j = 175\ ^oC$ prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	400	A
I^2t for fusing ($t = 10$ ms)	I^2t	max.	800	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +175	^oC
Junction temperature	T_j	max.	175	^oC

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,0	$^oC/W$
From mounting base to heatsink without heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	$^oC/W$
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,3	$^oC/W$
Transient thermal impedance; $t = 1$ ms	$Z_{th\ j\text{-}mb}$	=	0,2	$^oC/W$

[1] To ensure thermal stability: $R_{th\ j\text{-}a} \leq 2\ ^oC/W$ (continuous reverse voltage) or $\leq 8\ ^oC/W$ (a.c.)
For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see page 4.
For continuous reverse voltage: if $R_{th\ j\text{-}a} = 4\ ^oC/W$, then $T_{j\ max} = 138\ ^oC$,
if $R_{th\ j\text{-}a} = 6\ ^oC/W$, then $T_{j\ max} = 125\ ^oC$.

CHARACTERISTICS

Forward voltage

$I_F = 100$ A; $T_j = 25$ °C	V_F	<	1,7	V	[1]

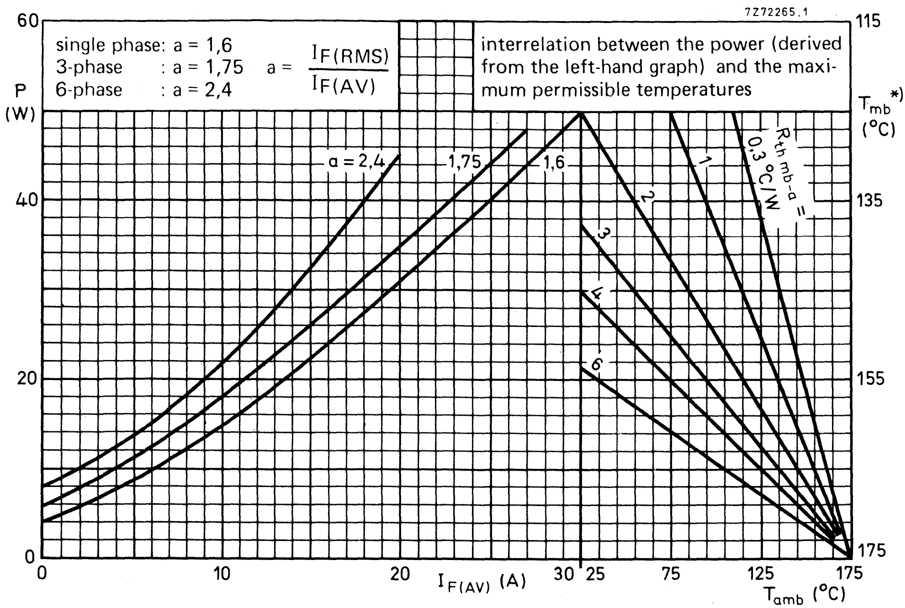
Reverse current

$V_R = V_{RWMmax}$; $T_j = 125$ °C	I_R	<	1	mA

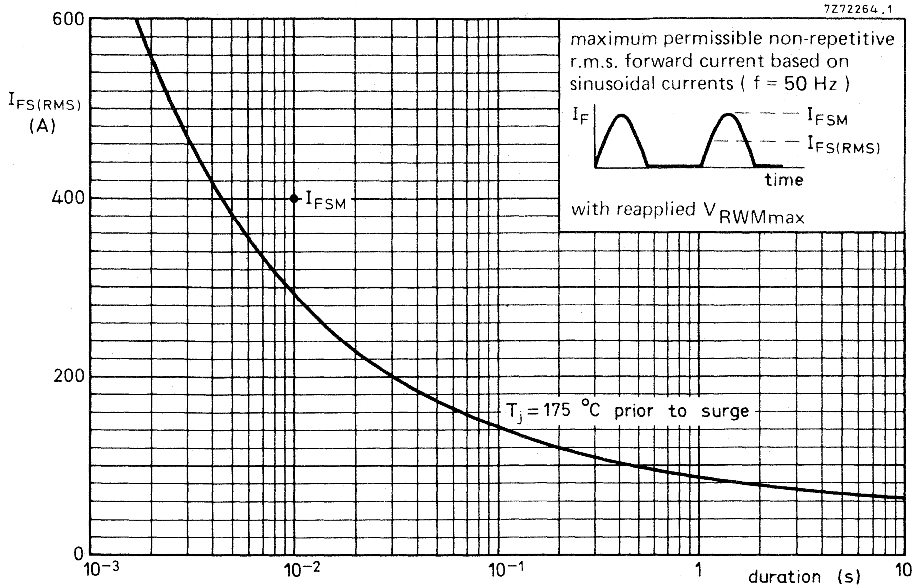
OPERATING NOTES

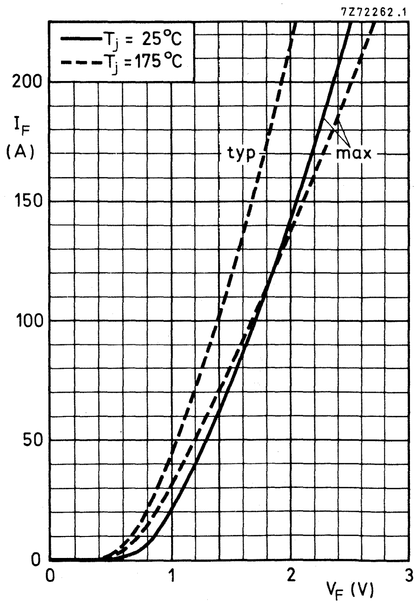
1. The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits in Data Handbook Part SC 1a.

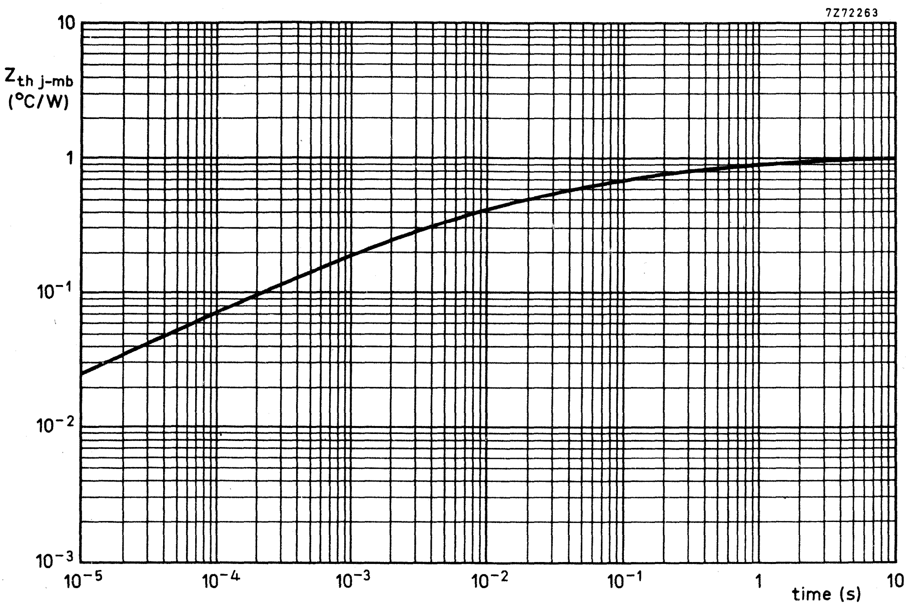
[1] Measured under pulse conditions to avoid excessive dissipation.



*) T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb\text{-}a} \leq 6{,}5$ °C/W


7Z72264.1
600
400
200
0
$I_{FS(RMS)}$
(A)
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
10^{-3}
10^{-2}
10^{-1}
1
10
duration (s)


7Z72262.1
T_j = 25°C
T_j = 175 °C
200
150
100
50
0
I_F
(A)
typ
max
0
1
2
3
V_F (V)


7Z72263
10
$Z_{th\ j\text{-}mb}$
(°C/W)
1
10^{-1}
10^{-2}
10^{-3}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10

RECTIFIER DIODES

Silicon rectifier diodes in metal envelopes similar to DO-5, intended for use in power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX97-300 to 1600.
Reverse polarity (anode to stud): BYX97-300R to 1600R.

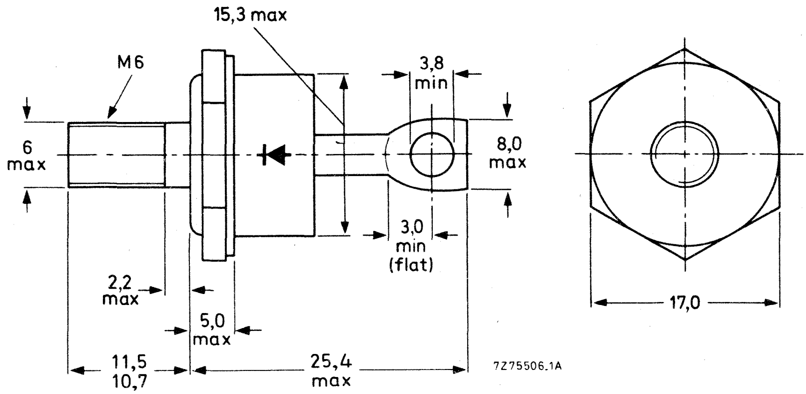
QUICK REFERENCE DATA

			BYX97-300 BYX97-300R	600 600R	1200 1200R	1600 1600R	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	1600	V
Average forward current	$I_{F(AV)}$	max.	47				A
Non-repetitive peak forward current	I_{FSM}	max.	800				A

MECHANICAL DATA

Dimensions in mm

DO-5 (except for M6 stud); Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 10 mm



Net mass: 22 g
Diameter of clearance hole: max. 6.5 mm
Supplied on request: accessories 56264A
(mica washer, insulating ring, tag)
a version with insulated flying leads
The mark shown applies to normal polarity types

Torque on nut: min. 1.7 Nm (17 kg cm)
max. 3.5 Nm (35 kg cm)

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages 1)

			BYX97-300(R)	600(R)	1200(R)	1600(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	1600	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	1600	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	800	V
Continuous reverse voltage	V_R	max.	200	400	800	800	V

Currents

Average forward current (averaged over any 20 ms period) up to $T_{mb} = 120$ °C	$I_{F(AV)}$	max.	47	A
at $T_{mb} = 125$ °C	$I_{F(AV)}$	max.	40	A
R.M.S. forward current	$I_{F(RMS)}$	max.	75	A
Repetitive peak forward current	I_{FRM}	max.	550	A
Non-repetitive peak forward current ($t = 10$ ms; half sine-wave) $T_j = 150$ °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	800	A
I^2t for fusing ($t = 10$ ms)	I^2t	max.	3200	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0,6	°C/W
From mounting base to heatsink without heatsink compound	$R_{th\ mb\text{-}h}$	=	0,3	°C/W
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance; $t = 1$ ms	$Z_{th\ j\text{-}mb}$	=	0,1	°C/W

1) To ensure thermal stability: $R_{th\ j\text{-}a} \leq 1$ °C/W (continuous reverse voltage) or ≤ 4 °C/W (a.c.)
For smaller heatsinks $T_{j\,max}$ should be derated. For a.c. see page 4.
For continuous reverse voltage: if $R_{th\ j\text{-}a} = 2$ °C/W, then $T_{j\,max} = 138$ °C,
if $R_{th\ j\text{-}a} = 3$ °C/W, then $T_{j\,max} = 125$ °C.

CHARACTERISTICS

Forward voltage

I_F = 150 A; T_j = 25 °C	V_F	<	1,45	V [1]

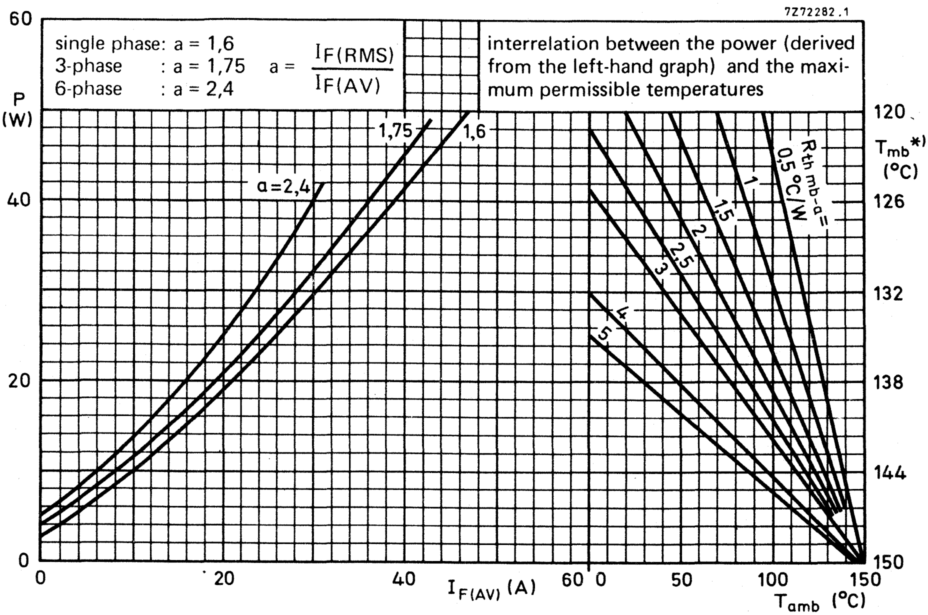
Reverse current

$V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	4	mA

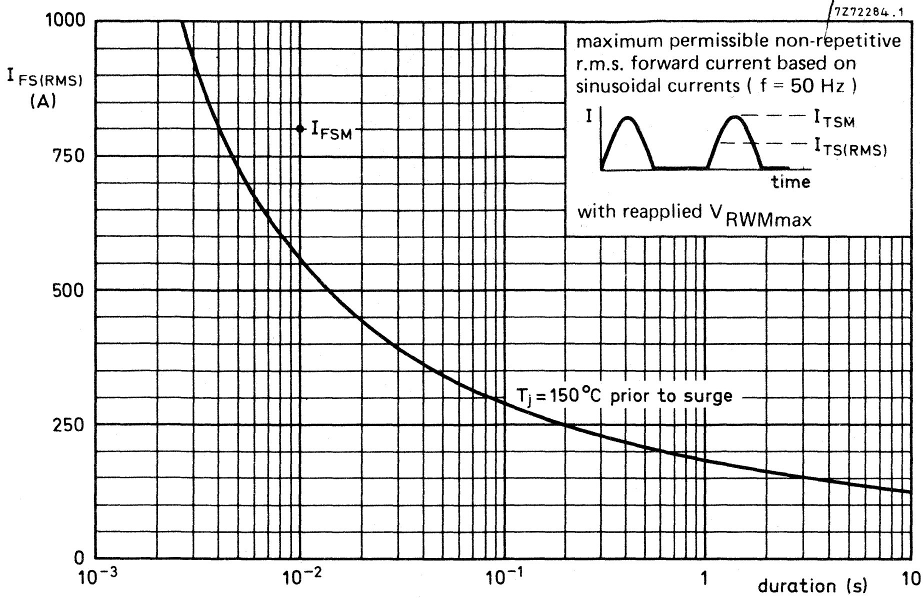
OPERATING NOTES

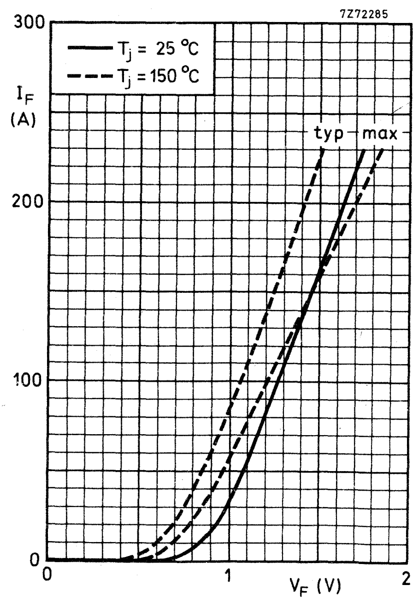
1. The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits in Data Handbook Part SC1a.

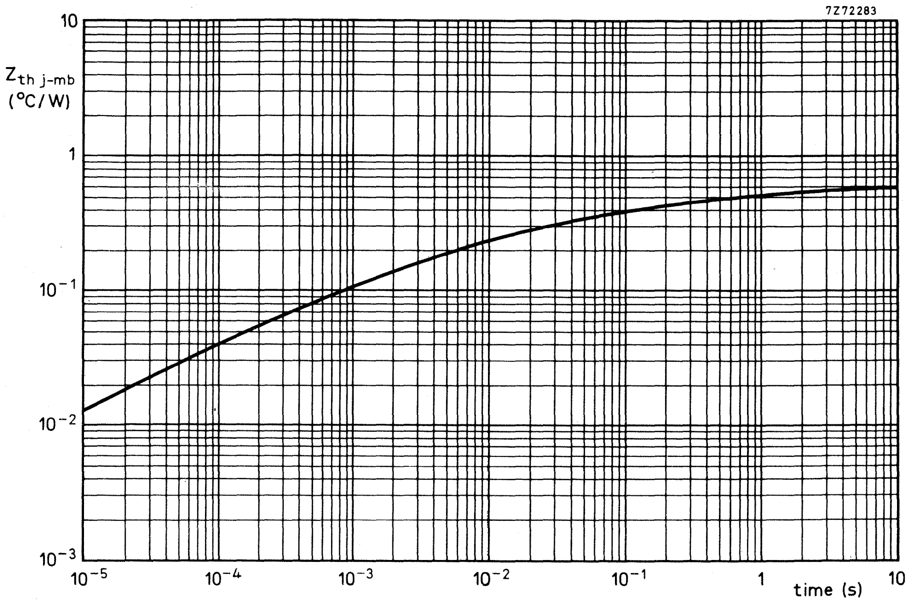
[1] Measured under pulse conditions to avoid excessive dissipation.



*) T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leq 3{,}4\ ^{o}C/W$


7Z72284.1
1000
$I_{FS(RMS)}$
(A)
750
500
250
0
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10
I_{FSM}
maximum permissible non-repetitive
r.m.s. forward current based on
sinusoidal currents (f = 50 Hz)
I
I_{TSM}
$I_{TS(RMS)}$
time
with reapplied V_{RWMmax}
$T_j = 150\,°C$ prior to surge


7Z72285
300
200
100
0
I_F
(A)
$T_j = 25\,°C$
$T_j = 150\,°C$
typ
max
0
1
2
V_F (V)


7Z72283
10
$Z_{th\ j\text{-}mb}$
(°C/W)
1
10^{-1}
10^{-2}
10^{-3}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10

RECTIFIER DIODES

Silicon rectifier diodes in DO-4 metal envelopes, intended for use in power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX98-300 to 1200.
Reverse polarity (anode to stud): BYX98-300R to 1200R.

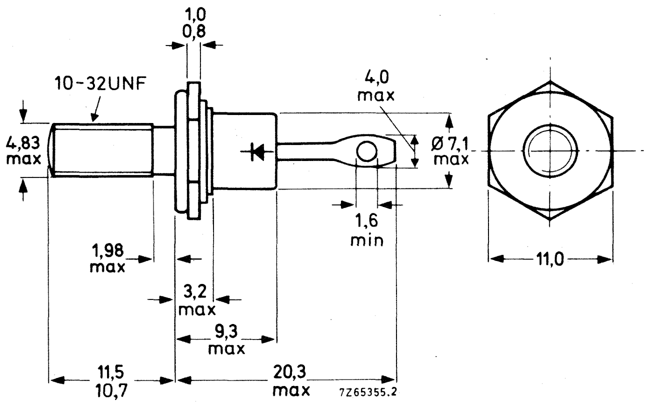
QUICK REFERENCE DATA

			BYX98-300 BYX98-300R	600 600R	1200 1200R	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	V
Average forward current	$I_{F(AV)}$	max.	10			A
Non-repetitive peak forward current	I_{FSM}	max.	75			A

MECHANICAL DATA

Dimensions in mm

DO-4; Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 9.5 mm



Net mass: 6 g
Diameter of clearance hole: max. 5.2 mm
Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)
The mark shown applies to the normal polarity types.

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

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

→ Voltages

			BYX98-300(R)	600(R)	1200(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	V
Continuous reverse voltage	V_R	max.	200	400	800	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 97 °C	$I_{F(AV)}$	max.	10	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	6	A
R.M.S. forward current	$I_{F(RMS)}$	max.	16	A
Repetitive peak forward current	I_{FRM}	max.	75	A
Non-repetitive peak forward current (t = 10 ms; half sine-wave) T_j = 150 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	75	A
I^2t for fusing (t = 10 ms)	I^2t	max.	28	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	3	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb-h}$	=	0,5	°C/W
without heatsink compound	$R_{th\ mb-h}$	=	0,6	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j-mb}$	=	0,3	°C/W

CHARACTERISTICS

Forward voltage

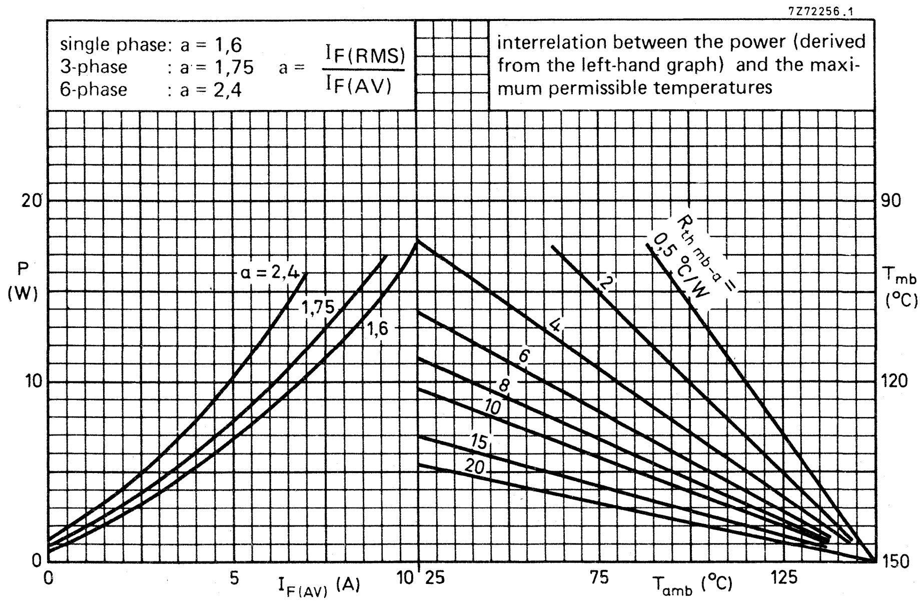
I_F = 20 A; T_j = 25 °C	V_F	<	1,7	V	1)

Reverse current

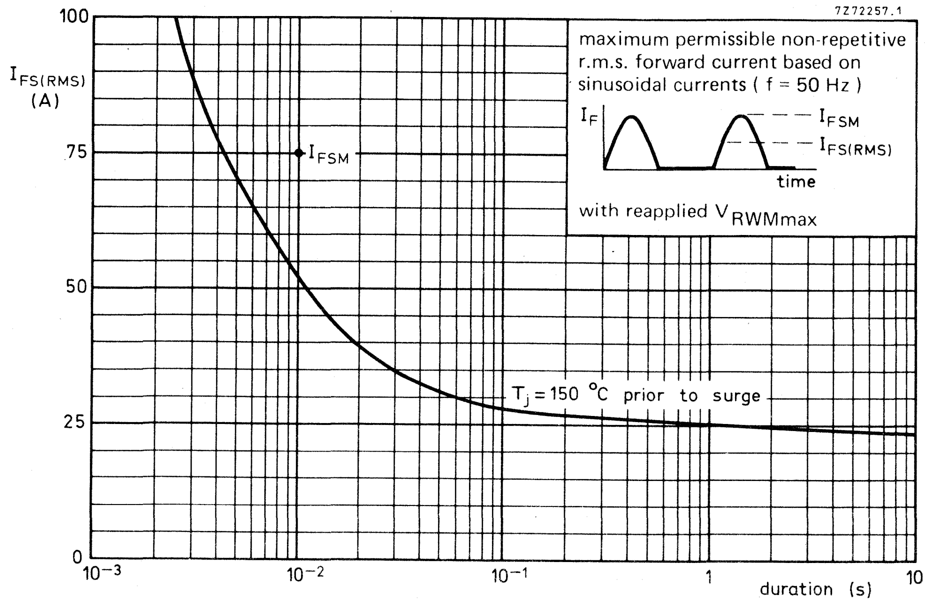
V_R = V_{RWMmax}; T_j = 125 °C	I_R	<	200	μA

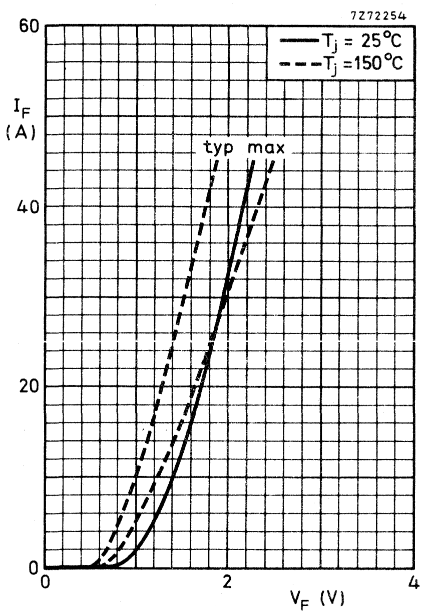
OPERATING NOTES

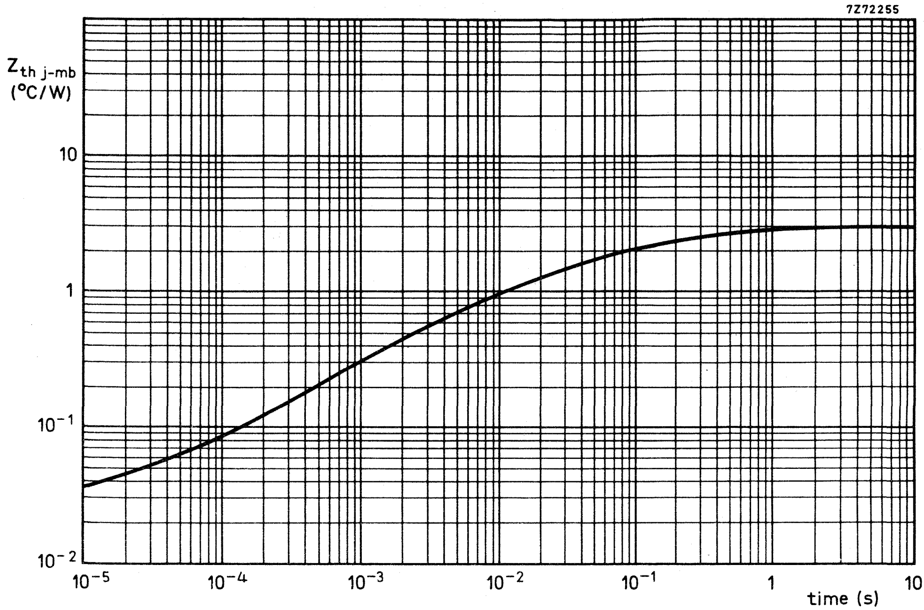
1. The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits in Data Handbook Part SC1a.



1) Measured under pulse conditions to avoid excessive dissipation.


7Z72257.1
100
75
50
25
0
$I_{FS(RMS)}$
(A)
I_{FSM}
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}
$T_j = 150\ ^{\circ}C$ prior to surge
10^{-3}
10^{-2}
10^{-1}
1
10
duration (s)


7Z72254
60
40
20
0
I_F
(A)
$T_j = 25^{\circ}C$
$T_j = 150^{\circ}C$
typ
max
0
2
4
V_F (V)


7Z72255
$Z_{th\ j\text{-}mb}$ (°C/W)
10
1
10^{-1}
10^{-2}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
time (s)

RECTIFIER DIODES

Silicon rectifier diodes in DO-4 metal envelopes, intended for use in power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX99-300 to 1200.
Reverse polarity (anode to stud): BYX99-300R to 1200R.

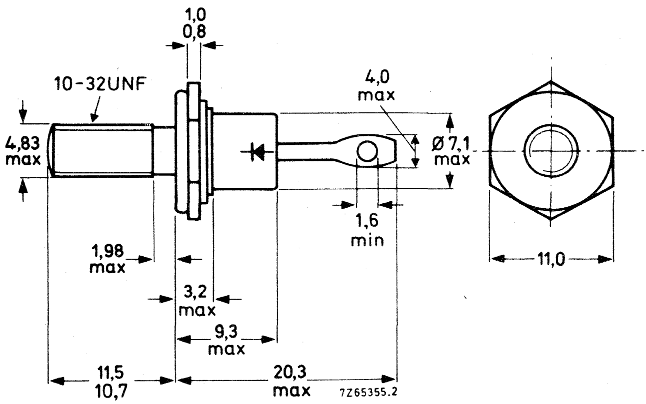
QUICK REFERENCE DATA

			BYX99-300 BYX99-300R	600 600R	1200 1200R	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	V
Average forward current	$I_{F(AV)}$	max.		15		A
Non-repetitive peak forward current	I_{FSM}	max.		180		A

MECHANICAL DATA

Dimensions in mm

DO-4; Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 9.5 mm



Net mass: 6 g
Diameter of clearance hole: 5.2 mm
Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)

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

The mark shown applies to the normal polarity types

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

→ Voltages

			BYX99-300(R)	600(R)	1200(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	V
Continuous reverse voltage	V_R	max.	200	400	800	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 129 °C	$I_{F(AV)}$	max.	15	A
R.M.S. forward current	$I_{F(RMS)}$	max.	24	A
Repetitive peak forward current	I_{FRM}	max.	180	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.	180	A
I^2t for fusing (t = 10 ms)	I^2t	max.	162	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	2,3	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb-h}$	=	0,5	°C/W
without heatsink compound	$R_{th\ mb-h}$	=	0,6	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j-mb}$	=	0,13	°C/W

CHARACTERISTICS

Forward voltage

I_F = 50 A; T_j = 25 °C	V_F	<	1,55	V [1]

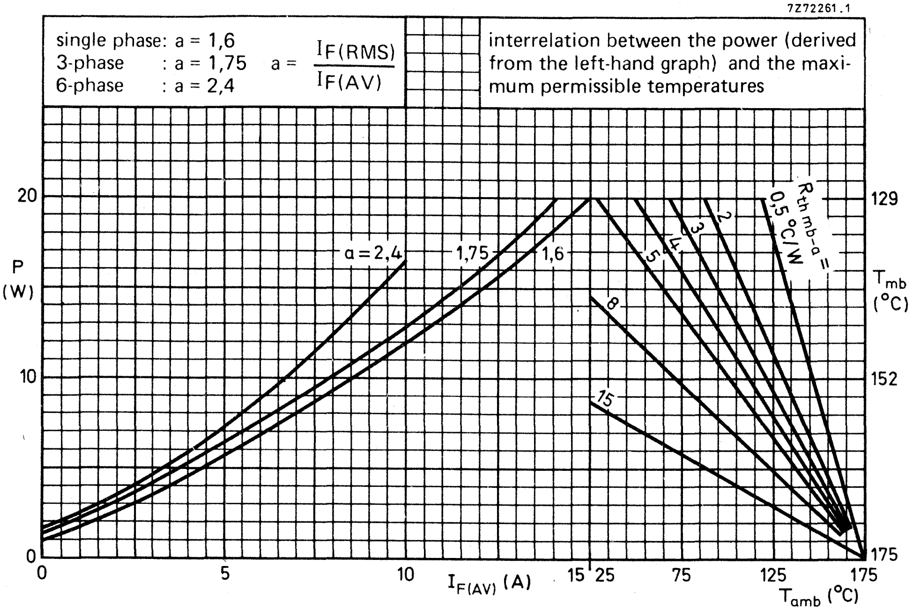
Reverse current

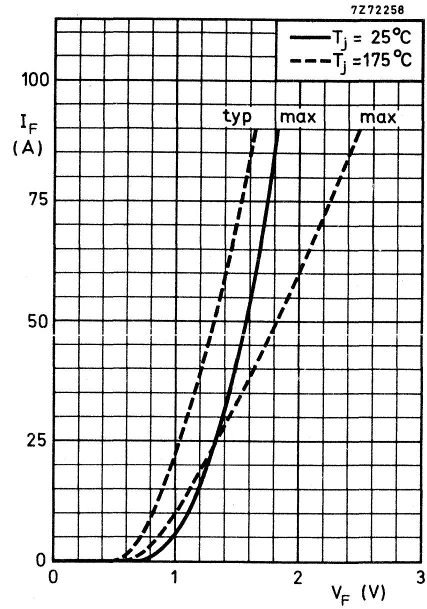
$V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	200	µA

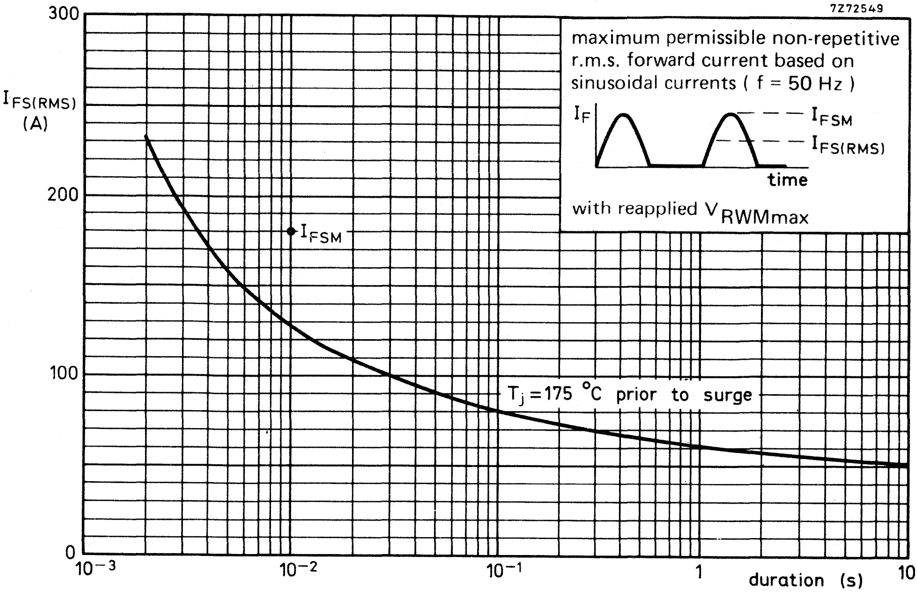
OPERATING NOTES

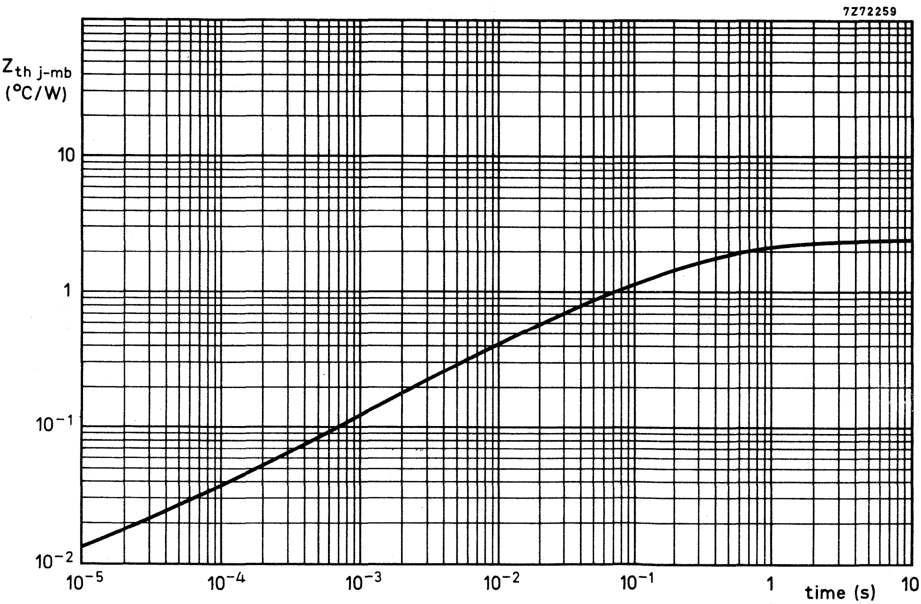
1. The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits in Data Handbook Part SC1a.

[1] Measured under pulse conductions to avoid excessive dissipation.


7Z72261.1
single phase: a = 1,6
3-phase : a = 1,75
6-phase : a = 2,4
a = IF(RMS) / IF(AV)
interrelation between the power (derived from the left-hand graph) and the maximum permissible temperatures
P (W)
20
10
0
a = 2,4
1,75
1,6
0
5
10
15
IF(AV) (A)
Rth mb-a = 0,5 °C/W
2
3
4
5
8
15
25
75
125
175
Tamb (°C)
129
152
175
Tmb (°C)


7Z72258
Tj = 25 °C
Tj = 175 °C
IF (A)
100
75
50
25
0
typ
max
max
0
1
2
3
VF (V)


7Z72549
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}
$I_{FS(RMS)}$ (A)
300
200
100
0
I_{FSM}
$T_j = 175$ °C prior to surge
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10


7Z72259
$Z_{th\ j\text{-}mb}$ (°C/W)
10
1
10^{-1}
10^{-2}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10

FAST SOFT-RECOVERY RECTIFIER DIODES

Silicon diodes, each in a DO-4 metal envelope, featuring non-snap-off characteristics, and intended for use in high-frequency power supplies, thyristor inverters and multi-phase power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): 1N3879, 1N3880, 1N3881 and 1N3882.
Reverse polarity (anode to stud): 1N3879R, 1N3880R, 1N3881R and 1N3882R.

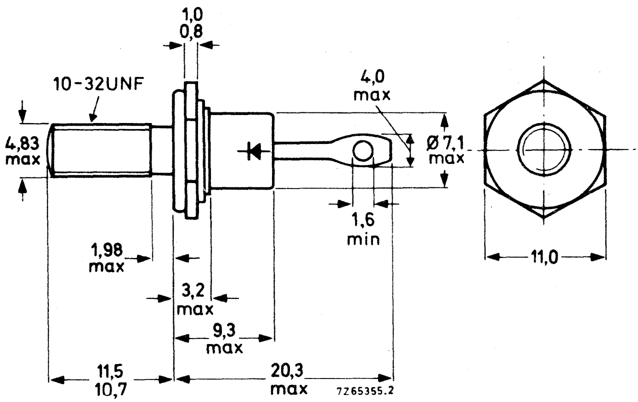
QUICK REFERENCE DATA

			1N3879(R)	1N3880(R)	1N3881(R)	1N3882(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	200	300	V
Average forward current				$I_{F(AV)}$	max.	6	A
Non-repetitive peak forward current				I_{FSM}	max.	80	A
Reverse recovery time				t_{rr}	<	200	ns

MECHANICAL DATA

Dimensions in mm

DO-4



Net mass: 6 g

Diameter of clearance hole: max. 5,2 mm

Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 9,5 mm

The mark shown applies to the normal polarity types.

Torque on nut: min. 0,9 Nm (9 kg cm)
max. 1,7 Nm (17 kg cm)

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

			1N3879(R)	1N3880(R)	1N3881(R)	1N3882(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	100	150	250	350	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	50	100	200	300	V
Crest working reverse voltage	V_{RWM}	max.	50	100	200	300	V

Currents

Average on-state current assuming zero switching losses (averaged over any 20 ms period)				
up to T_{mb} = 100 °C	$I_{F(AV)}$	max.	6	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	3,5	A
R.M.S. forward current	$I_{F(RMS)}$	max.	10	A
Repetitive peak forward current	I_{FRM}	max.	75	A
Non-repetitive peak forward current T_j = 150 °C prior to surge; half sine-wave with reapplied V_{RWMmax};				
t = 10 ms	I_{FSM}	max.	75	A
t = 8,3 ms	I_{FSM}	max.	80	A
I^2t for fusing (t = 10 ms)	I^2t	max.	28	A^2s

Temperatures

Storage temperature	T_{stg}		−65 to +175	°C
Operating junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,4	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
Transient thermal impedance; t = 1 ms; δ = 0	$Z_{th\ j\text{-}mb}$	=	1	°C/W

CHARACTERISTICS

Forward voltage [1]

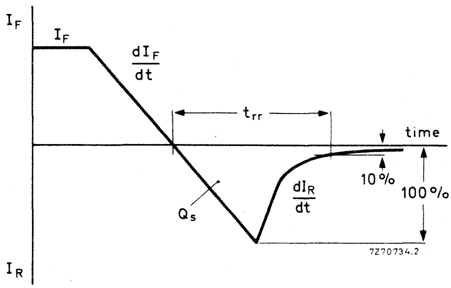
I_F = 6 A; T_j = 25 °C	V_F	<	1,4	V

Reverse current

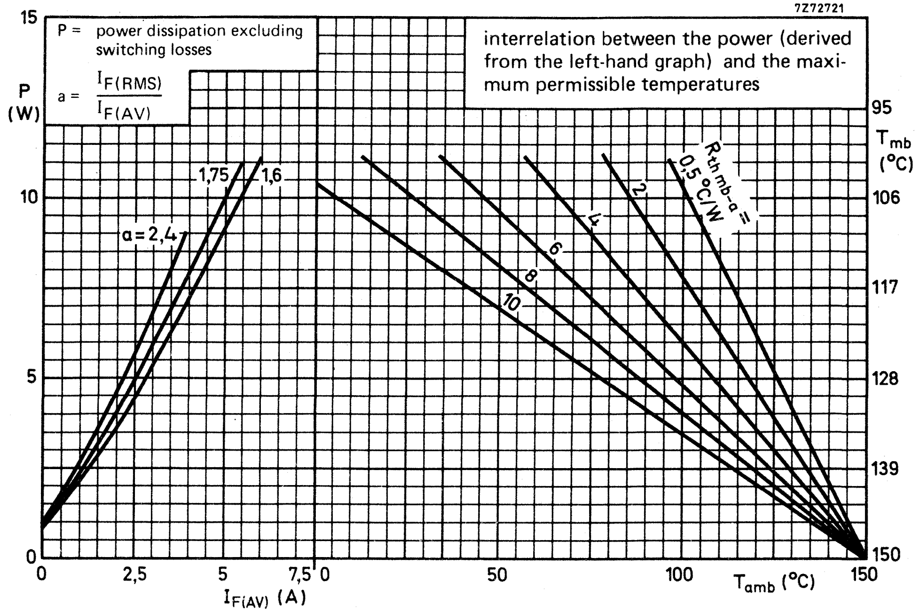
$V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	3	mA

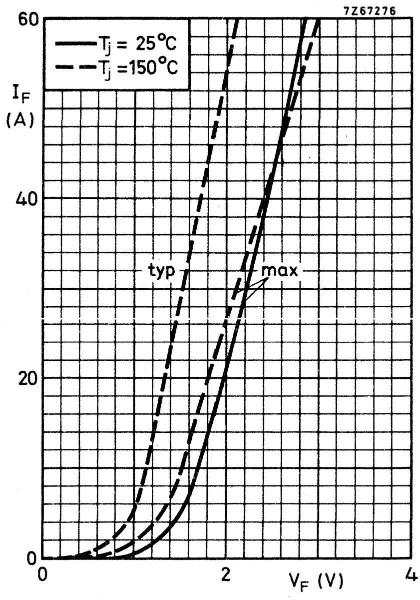
Reverse recovery when switched from

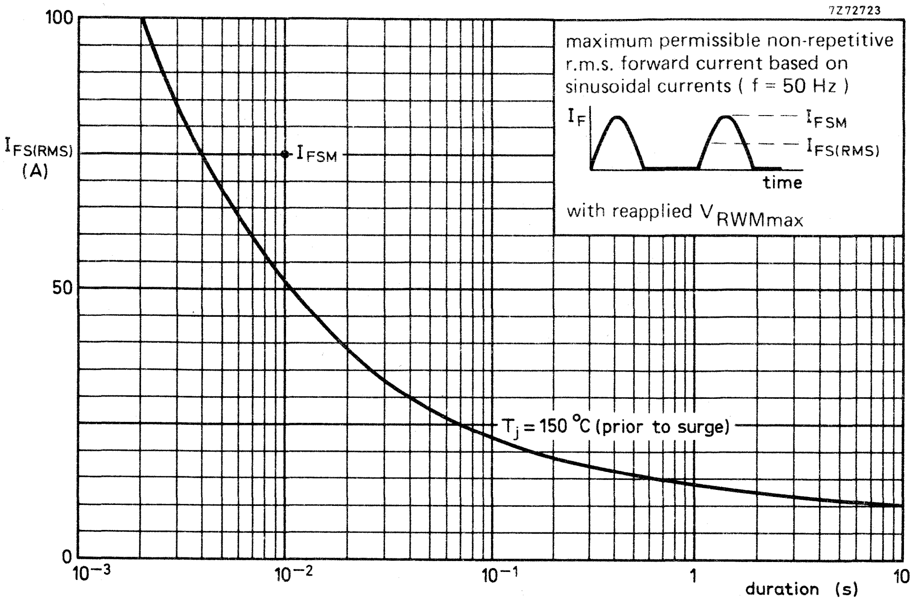
I_F = 1 A to V_R = 30 V; $-dI_F/dt$ = 35 A/µs; T_j = 25 °C Recovery time	t_{rr}	<	200	ns
I_F = 2 A to V_R = 30 V; $-dI_F/dt$ = 20 A/µs; T_j = 25 °C Recovery charge	Q_s	<	250	nC
I_F = 1 A to V_R = 30 V; $-dI_F/dt$ = 2 A/µs; T_j = 25 °C Max. slope of the reverse recovery current	$\|dI_R/dt\|$	<	5	A/µs

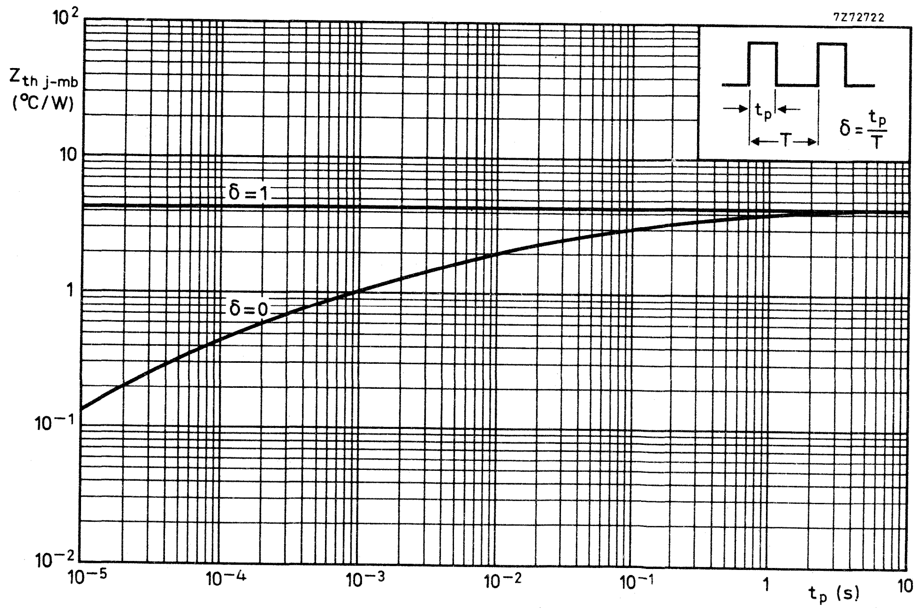


[1]) Measured under pulse conditions to avoid excessive dissipation.


7Z72721
P = power dissipation excluding switching losses
a = I F(RMS) / I F(AV)
P (W)
15
10
5
0
a=2,4
1,75
1,6
0
2,5
5
7,5
I F(AV) (A)
interrelation between the power (derived from the left-hand graph) and the maximum permissible temperatures
R th mb-a = 0,5 °C/W
2
4
6
8
10
0
50
100
150
T amb (°C)
T mb (°C)
95
106
117
128
139
150


7Z67276
T j = 25°C
T j =150°C
I F (A)
60
40
20
0
typ
max
0
2
4
V F (V)


7Z72723
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_FS(RMS) (A)
100
50
0
I_FSM
T_j = 150 °C (prior to surge)
10^-3
10^-2
10^-1
1
10
duration (s)


7Z72722
Z_th j-mb (°C/W)
t_p
T
δ = t_p/T
10^2
10
1
10^-1
10^-2
δ = 1
δ = 0
10^-5
10^-4
10^-3
10^-2
10^-1
1
10
t_p (s)

FAST SOFT-RECOVERY RECTIFIER DIODES

Silicon diodes, each in a DO-4 metal envelope, featuring non-snap-off characteristics, and intended for use in high-frequency power supplies, thyristor inverters and multi-phase power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): 1N3889, 1N3890, 1N3891 and 1N3892.
Reverse polarity (anode to stud): 1N3889R, 1N3890R, 1N3891R and 1N3892R.

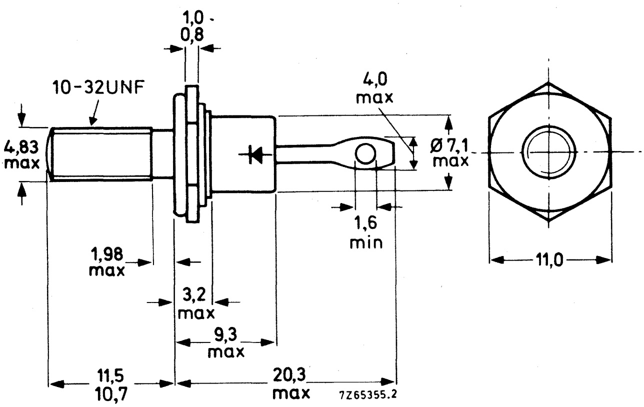
QUICK REFERENCE DATA

			1N3889(R)	1N3890(R)	1N3891(R)	1N3892(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	200	300	V
Average forward current				$I_{F(AV)}$	max.	12	A
Non-repetitive peak forward current				I_{FSM}	max.	150	A
Reverse recovery time				t_{rr}	<	200	ns

MECHANICAL DATA

Dimensions in mm

DO-4



Net mass: 6 g
Diameter of clearance hole: max. 5,2 mm

Torque on nut: min. 0,9 Nm (9 kg cm)
max. 1,7 Nm (17 kg cm)

Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 9,5 mm

The mark shown applies to the normal polarity types.

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

Voltages

			1N3889(R)	1N3890(R)	1N3891(R)	1N3892(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	100	150	250	350	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	50	100	200	300	V
Crest working reverse voltage	V_{RWM}	max.	50	100	200	300	V

Currents

Average on-state current assuming zero switching losses (averaged over any 20 ms period)				
up to T_{mb} = 100 °C	$I_{F(AV)}$	max.	12	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	7	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current	I_{FRM}	max.	140	A
Non-repetitive peak forward current T_j = 150 °C prior to surge; half sine-wave with reapplied V_{RWMmax};				
t = 10 ms	I_{FSM}	max.	140	A
t = 8,3 ms	I_{FSM}	max.	150	A
I^2t for fusing (t = 10 ms)	I^2t	max.	100	A^2s

Temperatures

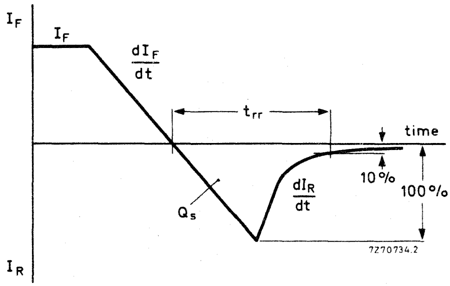
Storage temperature	T_{stg}		−65 to +175	°C
Operating junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

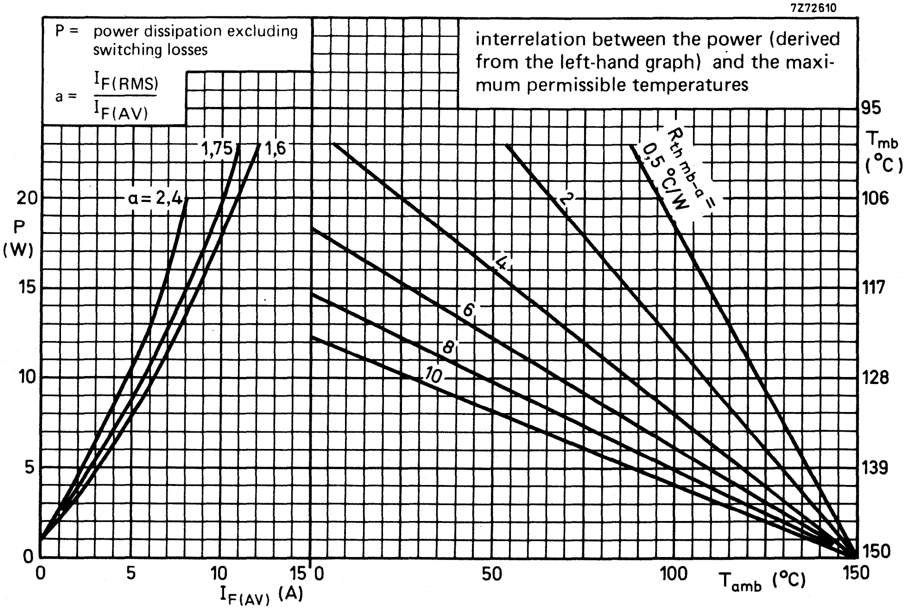
From junction to ambient in free air	$R_{th\ j-a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	2,2	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,5	°C/W
Transient thermal impedance; t = 1 ms; δ = 0	$Z_{th\ j-mb}$	=	0,8	°C/W

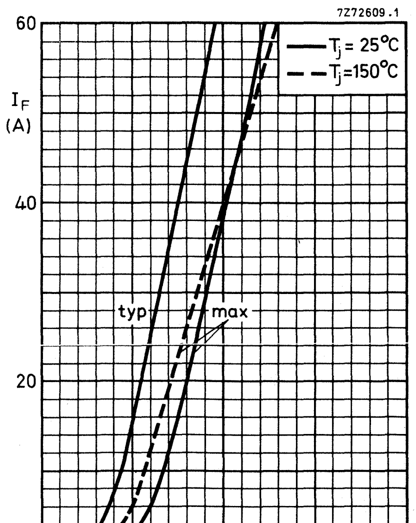
CHARACTERISTICS

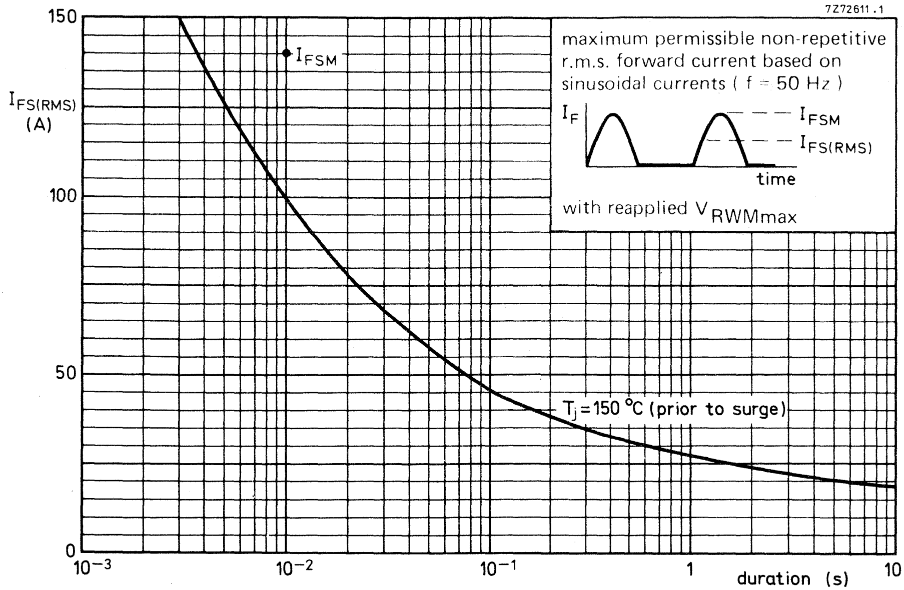
Forward voltage [1]				
I_F = 12 A; T_j = 25 °C	V_F	<	1, 4	V
Reverse current				
$V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	3	mA
Reverse recovery when switched from				
I_F = 1 A to V_R = 30 V; $-dI_F/dt$ = 35 A/µs; T_j = 25 °C Recovery time	t_{rr}	<	200	ns
I_F = 2 A to V_R = 30 V; $-dI_F/dt$ = 20 A/µs; T_j = 25 °C Recovery charge	Q_s	<	250	nC
I_F = 1 A to V_R = 30 V; $-dI_F/dt$ = 2 A/µs; T_j = 25 °C Max. slope of the reverse recovery current	$\lvert dI_R/dt \rvert$	<	5	A/µs

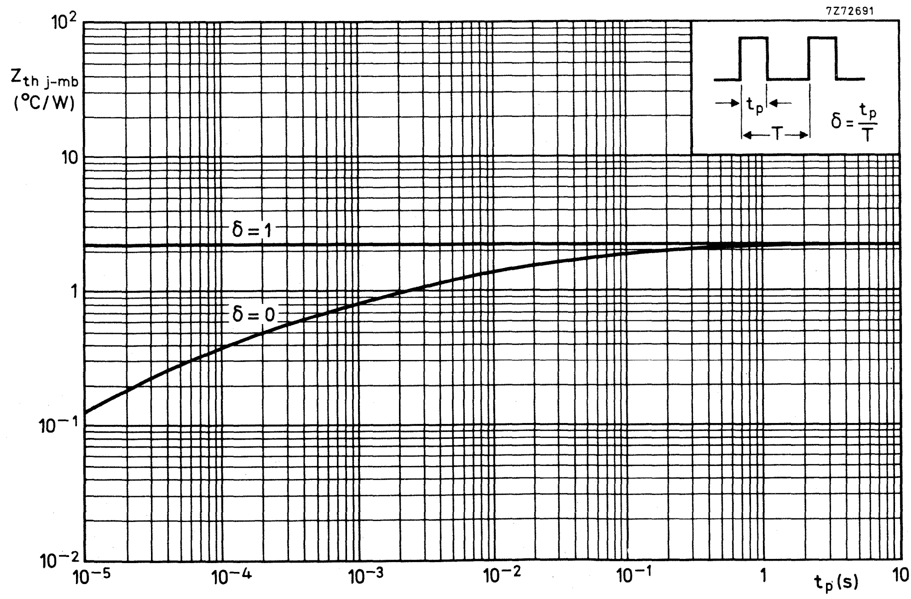


[1] Measured under pulse conditions to avoid excessive dissipation.


7Z72610
P = power dissipation excluding switching losses
a = I_F(RMS) / I_F(AV)
interrelation between the power (derived from the left-hand graph) and the maximum permissible temperatures
a = 2,4
1,75
1,6
P (W)
I_F(AV) (A)
R_th mb-a = 0,5 °C/W
2
4
6
8
10
T_mb (°C)
T_amb (°C)
95
106
117
128
139
150


7Z72609.1
T_j = 25°C
T_j = 150°C
I_F (A)
typ
max
V_F (V)


7Z72611.1
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_FS(RMS)
(A)
150
100
50
0
I_FSM
T_j = 150 °C (prior to surge)
10^-3
10^-2
10^-1
1
10
duration (s)


7Z72691
t_p
T
δ = t_p/T
Z_th j-mb
(°C/W)
10^2
10
1
10^-1
10^-2
δ = 1
δ = 0
10^-5
10^-4
10^-3
10^-2
10^-1
1
10
t_p (s)

CONTROLLED AVALANCHE RECTIFIER DIODES

Double-diffused solid-glass passivated rectifier diodes in hermetically sealed axial-leaded glass envelopes, capable of absorbing reverse transients.

They are intended for rectifier applications as well as general purpose applications in television and communication equipment.

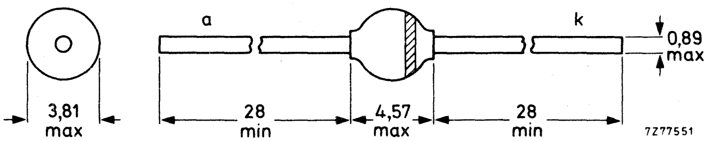
QUICK REFERENCE DATA

			1N5060	1N5061	1N5062	
Crest working reverse voltage	V_{RWM}	max.	400	600	800	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	450	650	900	V
		<	1600	1600	1600	V
Average forward current	$I_{F(AV)}$	max.		2,0		A
Non-repetitive peak forward current	I_{FSM}	max.		50		A
Non-repetitive peak reverse power dissipation	P_{RSM}	max.		1		kW
Junction temperature	T_j	max.		165		°C

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-57.



The marking band indicates the cathode.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			1N5060	1N5061	1N5062	
Crest working reverse voltage	V_{RWM}	max.	400	600	800	V
Continuous reverse voltage	V_R	max.	400	600	800	V
Average forward current (averaged over any 20 ms period)						
T_{lead} = 25 °C (mounting method 1)	$I_{F(AV)}$	max.		2,0		A
T_{amb} = 75 °C (mounting method 3)	$I_{F(AV)}$	max.		0,8		A
Repetitive peak forward current	I_{FRM}	max.		12		A
Non-repetitive peak forward current * t = 10 ms (half sine-wave);						
$T_j = T_{j\,max}$ prior to surge; (V_R = 0)	I_{FSM}	max.		50		A
Non-repetitive peak reverse power dissipation						
t = 20 μs (half sine-wave) $T_j = T_{j\,max}$ prior to surge	P_{RSM}	max.		1		kW
t = 100 μs (half sine-wave) $T_j = T_{j\,max}$ prior to surge	P_{RSM}	max.		450		W
Storage temperature	T_{stg}			−65 to + 175		°C
Junction temperature	T_j	max.		165		°C

* The device is capable of withstanding inrush currents when a 200 μF capacitor is connected to a 220 V mains with a series resistance of 2,4 Ω.

THERMAL RESISTANCE

Influence of mounting method

1. Thermal resistance from junction to tie-point at a lead length a = 10 mm; Fig. 2 — $R_{th\ j\text{-}tp}$ = 50 °C/W
2. Thermal resistance from junction to ambient when mounted to solder tags at a lead length a = 10 mm; Fig. 3 — $R_{th\ j\text{-}a}$ = 80 °C/W
3. Thermal resistance from junction to ambient when mounted on a 1,5 mm thick epoxy-glass printed-circuit board; Cu-thickness ⩾ 40 μm; Fig. 4 — $R_{th\ j\text{-}a}$ = 100 °C/W

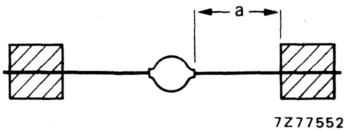


Fig. 2 Mounting method 1.

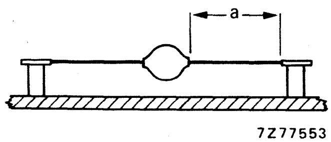


Fig. 3 Mounting method 2.

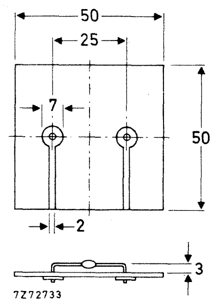


Fig. 4 Mounting method 3.

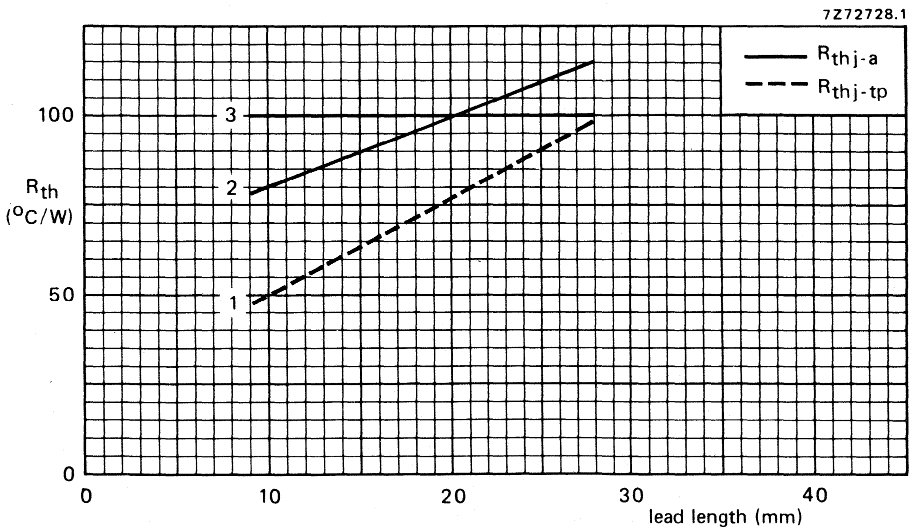


Fig. 5 Thermal resistance as a function of lead length for mounting methods 1, 2 and 3.

CHARACTERISTICS

			1N5060	1N5061	1N5062	
Forward voltage; T_j = 25 °C *						
I_F = 1 A	V_F	<	1	1	1	V
I_F = 2,5 A	V_F	<	1,15	1,15	1,15	V
Reverse avalanche breakdown voltage		>	450	650	900	V
I_R = 0,1 mA; T_j = 25 °C	$V_{(BR)R}$	<	1600	1600	1600	V
Reverse current						
$V_R = V_{RWMmax}$; T_j = 25 °C **	I_R	<	1,0	1,0	1,0	μA
$V_R = V_{RWMmax}$; T_j = 100 °C	I_R	<	10	10	10	μA
$V_R = V_{RWMmax}$; T_j = 165°C	I_R	<	150	150	150	μA
Reverse recovery time when switched from I_F = 0,5 A to I_R = 1 A at i_{rr} = 0,25 A	t_{rr}	<		6		μs
		typ.		3		μs

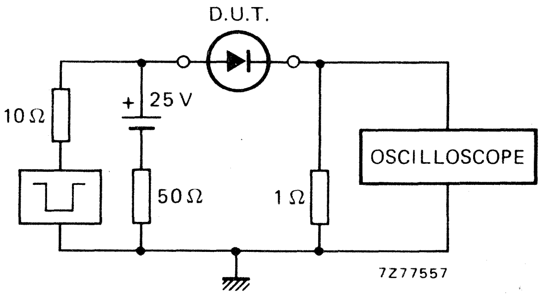


Fig. 6 Test circuit.
Input impedance oscilloscope 1 MΩ; 22 pF. Rise time ⩽ 7 ns.
Source impedance 50 Ω. Rise time ⩽ 15 ns.

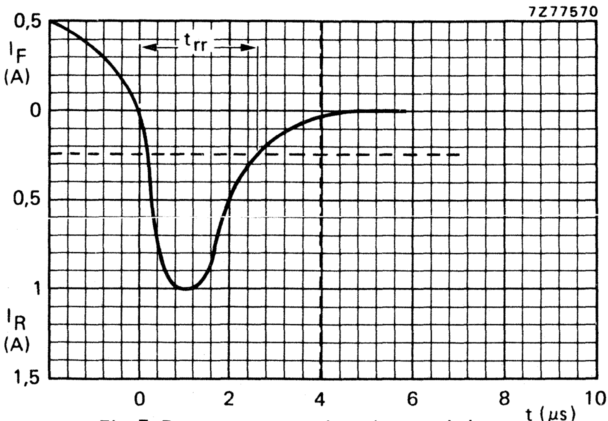


Fig. 7 Reverse recovery time characteristic.

* Measured under pulse conditions to avoid excessive dissipation.
** Illuminance ⩽ 500 lux (daylight); relative humidity < 65%.

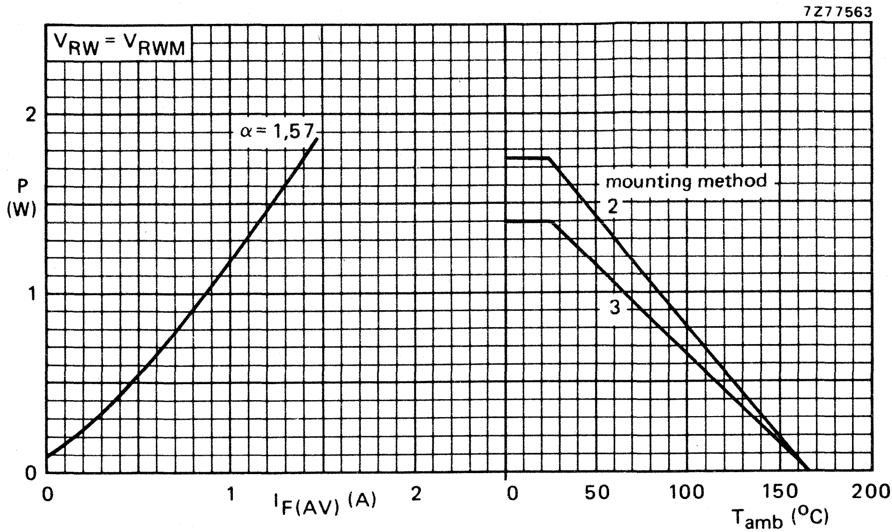


Fig. 8 Interrelation between the steady-state dissipation excluding power in avalanche region (left-hand graph) and the maximum permissible ambient temperature (no leads of other dissipating components running to the same tie-points) in accordance with the mounting methods mentioned in Figs 3 and 4.

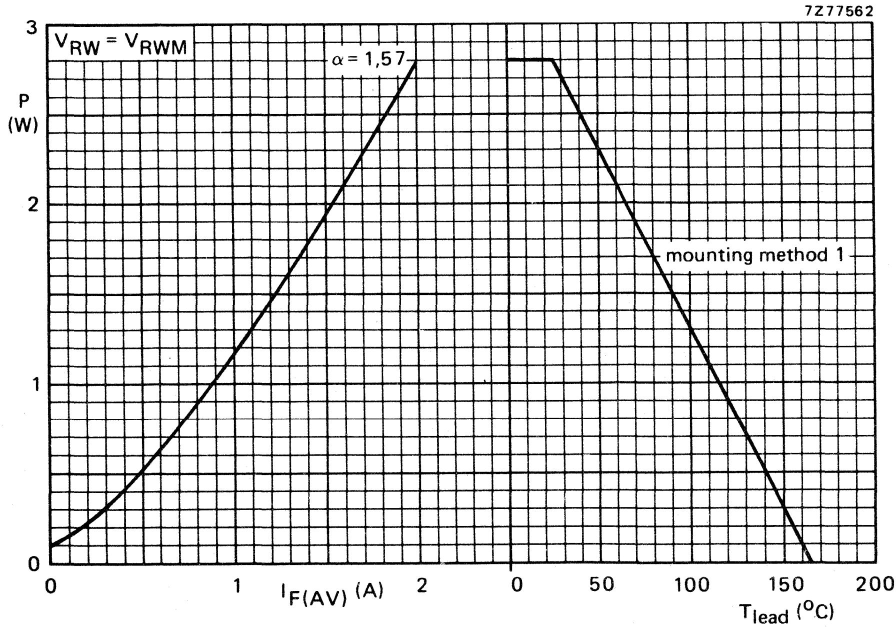


Fig. 9 Interrelation between the steady-state dissipation excluding power in avalanche region (left-hand graph) and the maximum permissible lead temperature.

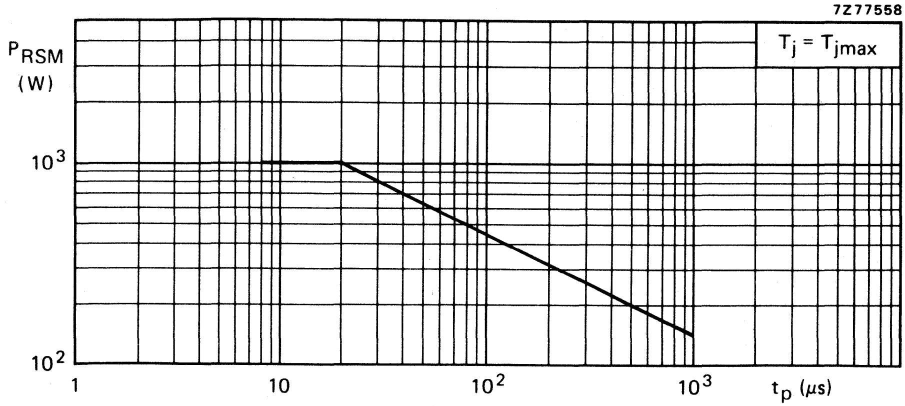
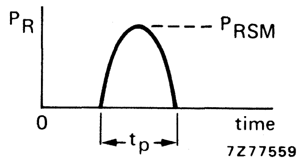


Fig. 10 Maximum permissible non-repetitive peak reverse power dissipation in the avalanche region.



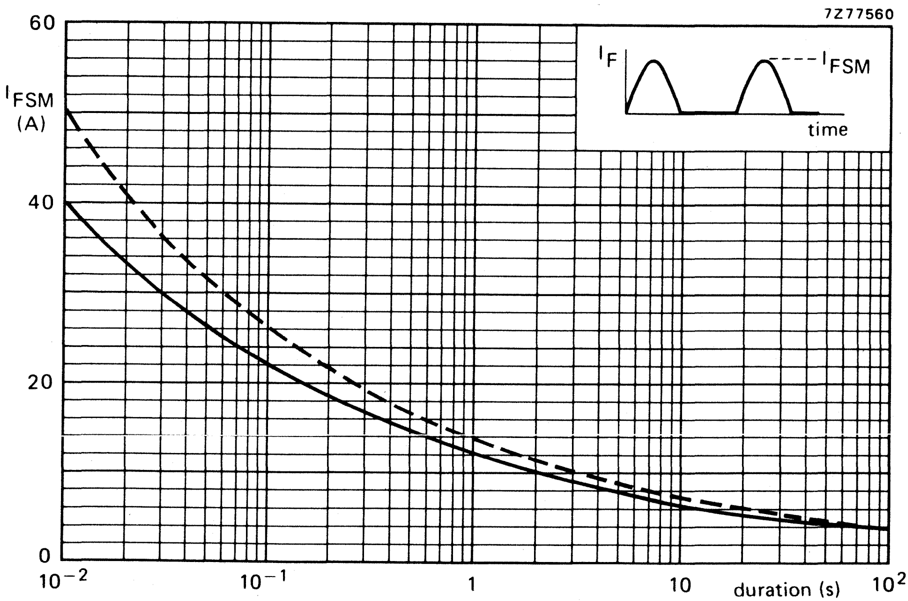


Fig. 11 Maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50 Hz).
– – – $T_j = T_{j\,max}$ prior to surge; $V_R = 0$
—— $T_j = 25\ ^oC$; $V_R = V_{RWMmax}$

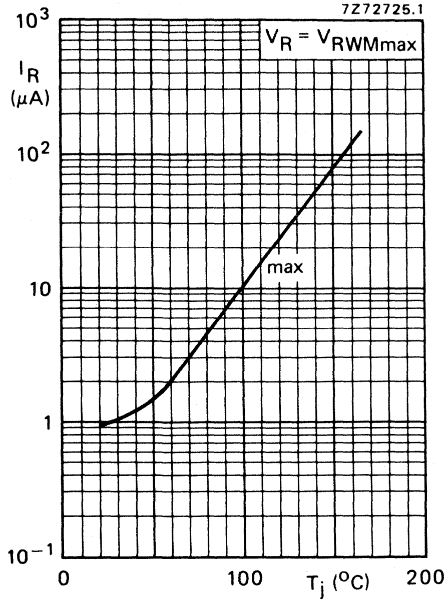


Fig. 12.

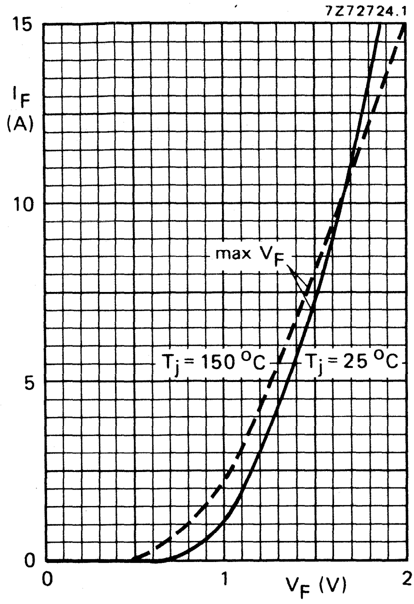


Fig. 13.

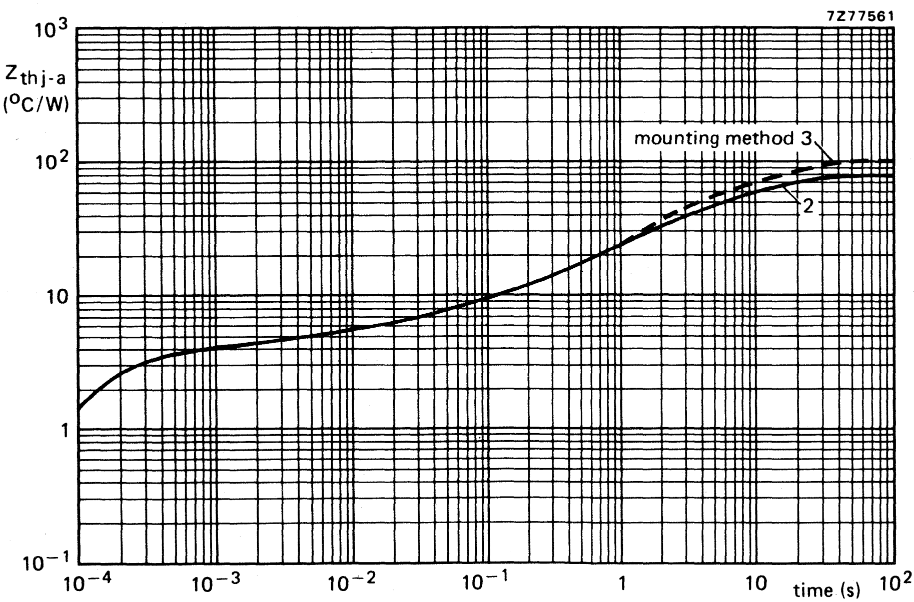


Fig. 14.

VOLTAGE REGULATOR DIODES

LOW POWER (Handbook SC1b)

Series number / Nominal voltage (5% tolerance)	1N75 . A	1N9 . . B	1N57 . . .	BZX55– . . .	* BZX79– . . .
2,4				C2V4	C2V4
2,7				C2V7	C2V7
3,0				C3V0	C3V0
3,3				C3V3	C3V3
3,6				C3V6	C3V6
3,9				C3V9	C3V9
4,3				C4V3	C4V3
4,7				C4V7	C4V7
5,1	751A		5729B	C5V1	C5V1
5,6	752A		30B	C5V6	C5V6
6,2	753A		31B	C6V2	C6V2
6,8	754A	18,5 957B	32B	C6V8	C6V8
7,5	20 755A	958B	33B	C7V5	5 C7V5
8,2	756A	959B	10 34B	C8V2	C8V2
9,1	757A	960B	35B	C9V1	C9V1
10	758A	961B	36B	5 C10	C10
11		11,5 962B	37B	C11	C11
12	759A	10,5 963B	38B	C12	C12
13		964B	39B	C13	C13
15		965B	40B	C15	C15
16		966B	5 41B	C16	C16
18		967B	42B	C18	C18
20		6,2 968B	43B	C20	C20
22		5,6 969B	44B	C22	C22
24		970B	45B	C24	C24
27		971B	46B	C27	C27
30		972B	47B	C30	C30
33		973B	48B	C33	C33
36		3,4 974B	49B	C36	C36
39		3,2 975B	50B	C39	C39
43		976B	2 51B	C43	2 C43
47		977B	52B	C47	C47
51		978B	53B	C51	C51
56		979B	54B	2,5 C56	C56
62		2,0 980B	55B	C62	C62
68		1,8 981B	56B	C68	C68
75		1,7 982B	5757B	C75	C75
82					
91					
100					
110					
120					
130					

current in mA at which nominal voltage is specified

* 4,7 to 75 V (suffixes B4V7 to B75) available with 2% tolerance.

LOW POWER (Handbook SC1b)

Series number Nominal voltage (5% tolerance)	BZY88–... mA	BZY88–...	BZX85–... mA	BZX85–...	BZX61–... mA	BZX61–...	BZX87–... mA	BZX87–...
2,4								
2,7								
3,0								
3,3		C3V3						
3,6		C3V6						
3,9		C3V9						
4,3		C4V3						
4,7		C4V7						
5,1		C5V1	45	C5V1				C5V1
5,6		C5V6		C5V6			50	C5V6
6,2		C6V2		C6V2				C6V2
6,8		C6V8	35	C6V8				C6V8
7,5		C7V5		C7V5		C7V5		C7V5
8,2		C8V2		C8V2		C8V2		C8V2
9,1	5	C9V1	25	C9V1		C9V1		C9V1
10		C10		C10	20	C10	20	C10
11		C11		C11		C11		C11
12		C12	20	C12		C12		C12
13		C13		C13		C13		C13
15		C15		C15		C15		C15
16		C16	15	C16		C16		C16
18		C18		C18		C18		C18
20		C20		C20		C20		C20
22		C22	10	C22		C22		C22
24		C24		C24	10	C24	10	C24
27		C27		C27		C27		C27
30		C30	8	C30		C30		C30
33				C33		C33		C33
36				C36		C36		C36
39			6	C39		C39		C39
43				C43		C43		C43
47				C47		C47		C47
51				C51		C51	5	C51
56				C56		C56		C56
62			4	C62		C62		C62
68				C68	5	C68		C68
75				C75		C75		C75
82						C82		
91						C91		
100						C100		
110						C110		
120						C120		
130						C130		

current in mA at which nominal voltage is specified

MEDIUM TO HIGH POWER (Handbook SC1a)

Series number / Nominal voltage	BZY96–...	BZY95–...	BZX70–...	BZV15–...(R)	BZY93–...(R)	BZY91–...(R)
3,9						
4,3						
4,7	C4V7					
5,1	C5V1					
5,6	100 C5V6					
6,2	C6V2					
6,8	C6V8					
7,5	C7V5		C7V5		2A C7V5	5A C7V5
8,2	50 C8V2		C8V2		C8V2	C8V2
9,1	C9V1		C9V1		C9V1	C9V1
10		C10	50 C10	C10	C10	C10
11		C11	C11	C11	C11	C11
12		50 C12	C12	1A C12	1A C12	2A C12
13		C13	C13	C13	C13	C13
15		C15	C15	C15	C15	C15
16		C16	C16	C16	C16	C16
18		C18	C18	C18	C18	C18
20		C20	C20	C20	C20	C20
22		20 C22	C22	500 C22	500 C22	C22
24		C24	20 C24	C24	C24	C24
27		C27	C27	C27	C27	1A C27
30		C30	C30	C30	C30	C30
33		C33	C33	C33	C33	C33
36		C36	C36	C36	C36	C36
39		C39	C39	C39	C39	C39
43		C43	C43	C43	C43	C43
47		C47	C47	200 C47	200 C47	C47
51		10 C51	10 C51	C51	C51	500 C51
56		C56	C56	C56	C56	C56
62		C62	C62	C62	C62	C62
68		C68	C68	C68	C68	C68
75		C75	C75	C75	C75	C75
82						
91						
100						

current in mA (< 1 A) or A (≥ 1 A) at which nominal voltage is specified

Normal polarity (cathode to stud)	no end-letter
Reverse polarity (anode to stud)	R
Both polarities available	(R)

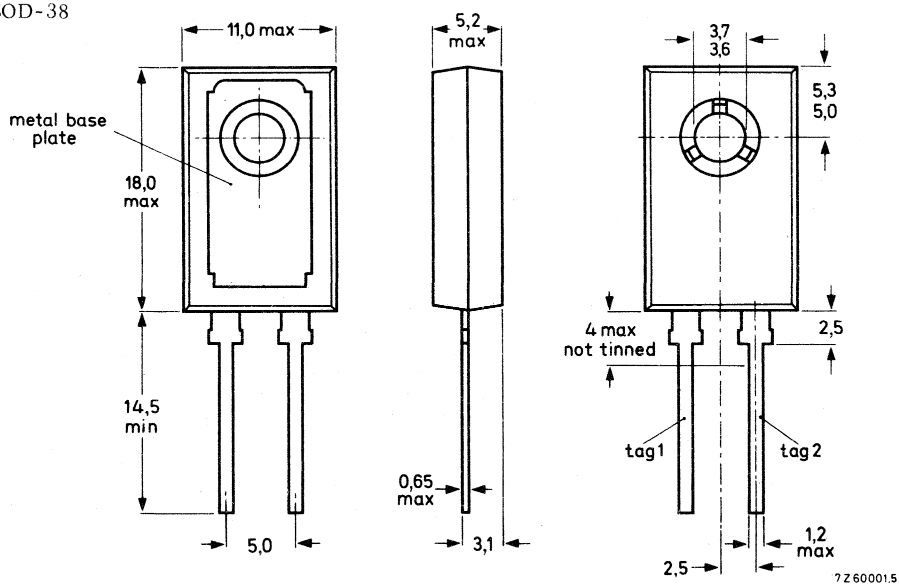
VOLTAGE REGULATOR DIODES

A range of voltage regulator diodes in plastic envelopes intended for use as voltage stabilizers in power supply circuits.
Normal and reverse polarity types are available: BZV15-C10(R) to C75(R).

QUICK REFERENCE DATA				
Working voltage range (5% range)	V_Z	nom.	10 to 75	V
Total power dissipation at T_{amb} = 25 °C	P_{tot}	max.	2,2	W
at T_{mb} = 82 °C	P_{tot}	max.	15	W
Junction temperature	T_j	max.	150	°C

MECHANICAL DATA Dimensions in mm

SOD-38



Net mass; 2,5 g
Accessories:
supplied with device : washer
available on request : 56316 (mica insulating washer)

Torque on screw: min. 0,95 Nm (9,5 kg cm)
max. 1,5 Nm (15 kg cm)

Tag 1 is connected to the metal base-plate, which should be mounted in contact with the heatsink used.

POLARITY OF CONNECTIONS

	BZV15-C10 to C75	BZV15-C10R to C75R
Base-plate:	cathode	anode
Tag 1 :	cathode	anode
Tag 2 :	anode	cathode

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Currents

Average forward current (averaged over any 20 ms period) at T_{mb} = 82 °C	$I_{F(AV)}$	max.	7,5	A
Repetitive peak forward current	I_{FRM}	max.	50	A

Power dissipation

Total power dissipation at T_{amb} = 25 °C (method a)	P_{tot}	max.	2,2	W
at T_{mb} = 82 °C	P_{tot}	max.	15	W
Non-repetitive peak reverse power dissipation T_{amb} = 25 °C; t = 1 ms (square pulse)	P_{ZSM}	max.	400	W

Temperatures

Storage temperature	T_{stg}		−55 to +125	°C
Junction temperature	T_j	max.	150	°C

SOLDERING AND MOUNTING NOTES

1. The devices may be soldered directly into the circuit.
2. The maximum permissible temperature of the soldering iron or bath is 270 °C; contact with the joint must not exceed 3 seconds.
3. The devices should not be immersed in oil, and few potting resins are suitable for re-encapsulation. Advice on these materials is available on request.
4. Leads should not be bent less than 2,5 mm from the seal; exert no axial pull when bending.
5. Soldered joints must be at least 2,5 mm from the seal.
6. For good thermal contact heatsink compound should be used between base-plate and heatsink.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,5	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,3	°C/W

Influence of mounting method

1. Heatsink operation

From mounting base to heatsink

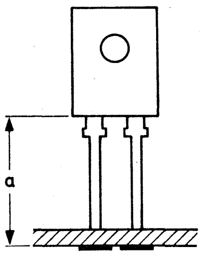
a. With heatsink compound	$R_{th\ mb\text{-}h}$	=	1,5	°C/W
b. With heatsink compound and 56316 mica washer	$R_{th\ mb\text{-}h}$	=	2,7	°C/W
c. Without heatsink compound	$R_{th\ mb\text{-}h}$	=	2,7	°C/W
d. Without heatsink compound with 56316 mica washer	$R_{th\ mb\text{-}h}$	=	5	°C/W

2. Free air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no other leads run to the tie-points.

From junction to ambient in free air mounted on a printed circuit board at a = maximum lead length and with a copper laminate

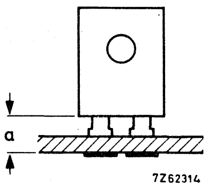
a. > 1 cm^2 — $R_{th\ j\text{-}a}$ = 50 °C/W
b. < 1 cm^2 — $R_{th\ j\text{-}a}$ = 55 °C/W



7Z62315.1

at a lead-length a = 3 mm and with a copper laminate

c. > 1 cm^2 — $R_{th\ j\text{-}a}$ = 55 °C/W
d. < 1 cm^2 — $R_{th\ j\text{-}a}$ = 60 °C/W



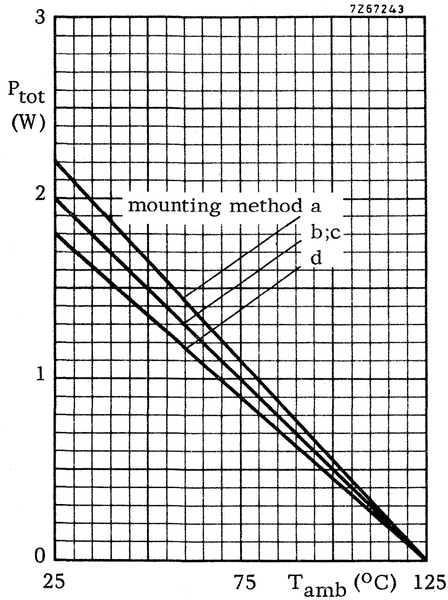
7Z62314

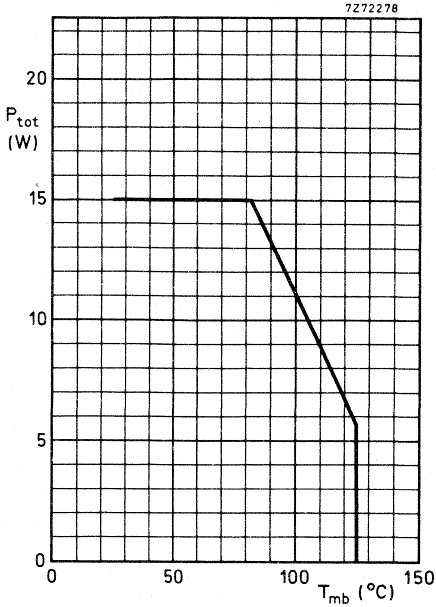
CHARACTERISTICS T_j = 25 °C unless otherwise specified

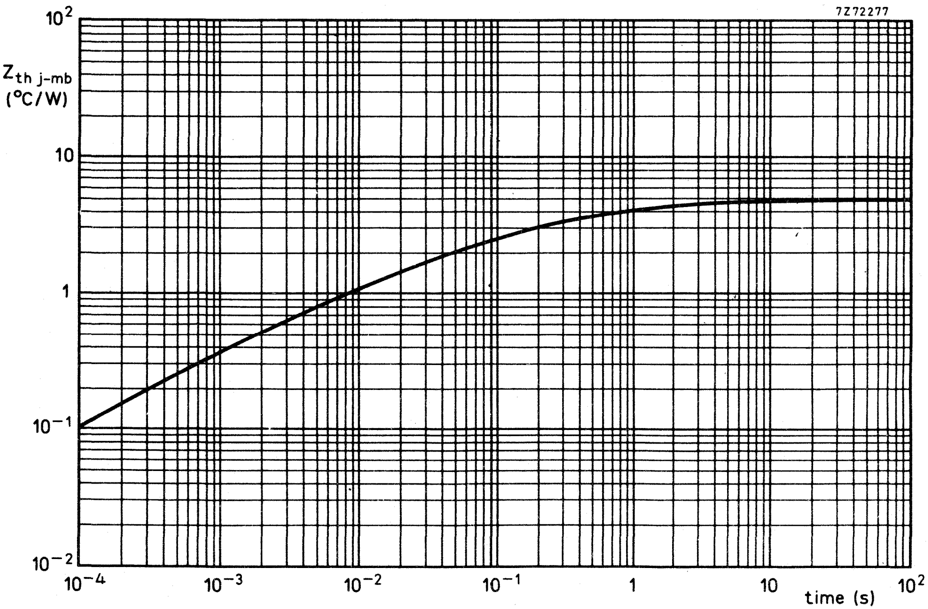
Forward voltage at I_F = 10 A	V_F	< 1,5	V
Reverse current at $V_R = \frac{2}{3} V_{Znom}$	I_R	< 50	μA

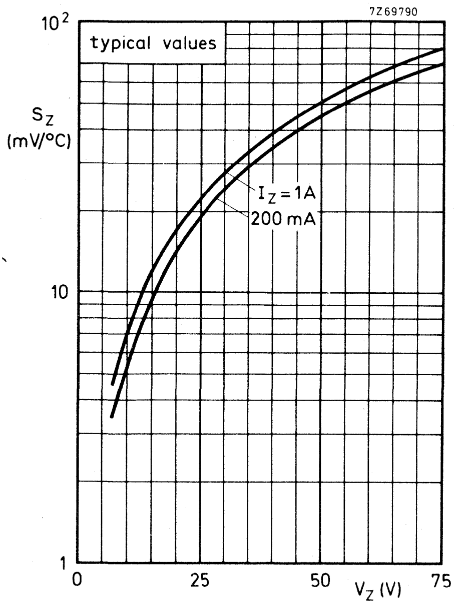
BZV15-..	Working voltage V_Z (V) 1)		Differential resistance r_{diff} (Ω) 1)	Temperature coefficient S_Z (mV/°C) 1)
	at I_Z = 1 A		**at I_Z = 1 A**	**at I_Z = 1 A**
	min.	max.	max.	typ.
C10(R)	9,4	10,6	0,5	9
C11(R)	10,4	11,6	1,0	9,9
C12(R)	11,4	12,7	1,0	10,8
C13(R)	12,4	14,1	1,0	11,7
C15(R)	13,8	15,6	1,2	13,5
	at I_Z = 0,5 A		**at I_Z = 0,5 A**	**at I_Z = 0,5 A**
C16(R)	15,3	17,1	1,2	14,4
C18(R)	16,8	19,1	1,5	16,2
C20(R)	18,8	21,2	1,5	15
C22(R)	20,8	23,3	1,8	16,5
C24(R)	22,7	25,9	2,0	19,2
C27(R)	25,1	28,9	2,0	22,1
C30(R)	28	32	2,5	25,5
C33(R)	31	35	3,0	29
	at I_Z = 0,2 A		**at I_Z = 0,2 A**	**at I_Z = 0,2 A**
C36(R)	34	38	4,0	32,4
C39(R)	37	41	5,0	35,1
C43(R)	40	46	6,5	39,6
C47(R)	44	50	7,0	43,7
C51(R)	48	54	7,5	47,4
C56(R)	52	60	8,0	52,6
C62(R)	58	66	9,0	58,3
C68(R)	64	72	10,0	63,9
C75(R)	70	79	10,5	71,3

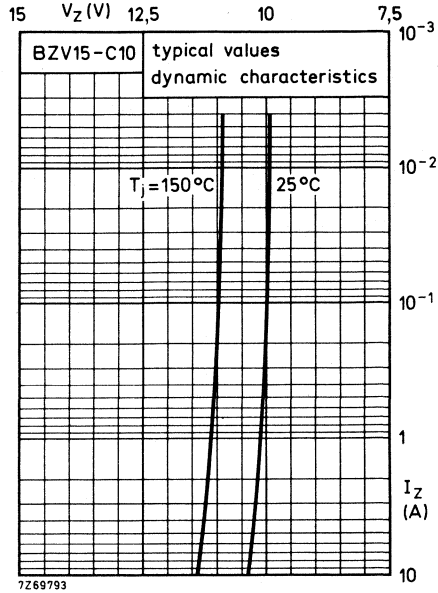
1) Measured by a pulse method with $t_p \leq 100$ μs, duty cycle $\delta \leq 0,001$ and $T_j \approx 25$ °C.

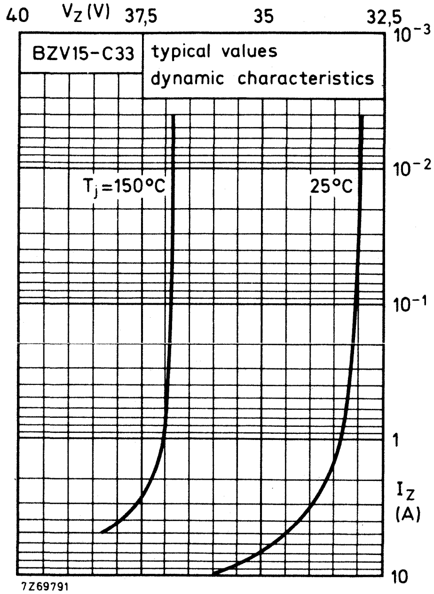

7Z67243
P_{tot}
(W)
3
2
1
0
mounting method a
b;c
d
25
75
T_{amb} (°C)
125

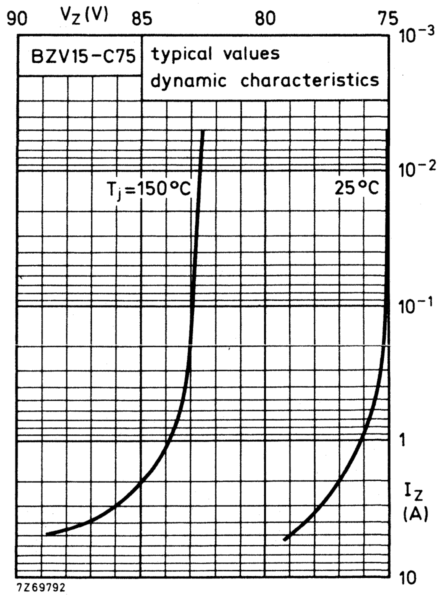

7Z72278
P_{tot}
(W)
20
15
10
5
0
0
50
100
T_{mb} (°C)
150


7Z72277
$Z_{th\ j-mb}$
(°C/W)
10^2
10
1
10^{-1}
10^{-2}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
time (s)
10^2


7Z69790
typical values
S_Z
(mV/°C)
10^2
10
1
$I_Z = 1A$
200 mA
0
25
50
75
V_Z (V)


15
V_Z (V)
12,5
10
7,5
BZV15-C10
typical values
dynamic characteristics
$T_j = 150°C$
25°C
10^{-3}
10^{-2}
10^{-1}
1
I_Z
(A)
10
7Z69793


40
V_Z (V)
37,5
35
32,5
BZV15-C33
typical values
dynamic characteristics
$T_j = 150°C$
25°C
10^{-3}
10^{-2}
10^{-1}
1
I_Z
(A)
10
7Z69791


90
V_Z (V)
85
80
75
BZV15-C75
typical values
dynamic characteristics
$T_j = 150°C$
25°C
10^{-3}
10^{-2}
10^{-1}
1
I_Z
(A)
10
7Z69792

REGULATOR DIODES

A range of diffused silicon diodes in plastic envelopes, intended for use as voltage regulator and transient suppressor diodes in medium power regulators and transient suppression circuits.

The series consists of the following types: BZX70-C7V5 to BZX70-C75.

QUICK REFERENCE DATA

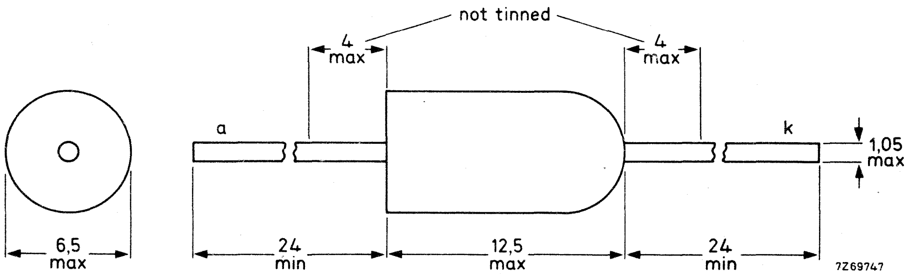
			voltage regulator	transient suppressor	
Working voltage (5% range)	V_Z	nom.	7,5 to 75	–	V
Stand-off voltage	V_R		–	5,6 to 56	V
Total power dissipation	P_{tot}	max.	2,5	–	W
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	–	700	W

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-18.

The rounded end indicates the cathode.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Peak working current	I_{ZM}	max.	5 A
Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	1 A
Non-repetitive peak reverse current T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse); BZX70-C7V5 to BZX70-C75	I_{RSM}	max.	44 to 6 A
Total power dissipation at T_{amb} = 25 °C; with 10 mm tie-points; Fig. 5	P_{tot}	max.	2,5 W
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse)	P_{RSM}	max.	700 W

Maximum recommended stand-off voltage (V_R)

	V_R (V)		V_R (V)		V_R (V)		V_R (V)		V_R (V)
BZX70-C7V5	5,6	-C12	9,1	-C20	15	-C33	24	-C51	39
-C8V2	6,2	-C13	10	-C22	16	-C36	27	-C56	43
-C9V1	6,8	-C15	11	-C24	18	-C39	30	-C62	47
-C10	7,5	-C16	12	-C27	20	-C43	33	-C68	51
-C11	8,2	-C18	13	-C30	22	-C47	36	-C75	56

Storage temperature	T_{stg}		−55 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air — see Figs 4 and 5

CHARACTERISTICS

Forward voltage I_F = 1 A; T_{amb} = 25 °C	V_F	<	1,5 V

CHARACTERISTICS

T_{amb} = 25 °C

BZX70-. . .	working voltage V_Z (V) *		differential resistance r_Z (Ω) *		temperature coefficient S_Z (mV/°C) *	V_Z, r_Z, S_Z at I_Z (mA)
	min.	max.	typ.	max.	typ.	
C7V5	7,0	7,9	0,45	3,5	3,0	50
C8V2	7,7	8,7	0,45	3,5	4,0	50
C9V1	8,5	9,6	0,55	4,0	5,5	50
C10	9,4	10,6	0,75	4,0	7,0	50
C11	10,4	11,6	0,8	4,5	7,5	50
C12	11,4	12,7	0,85	5,0	8,0	50
C13	12,4	14,1	0,9	6,0	8,5	50
C15	13,8	15,6	1,0	8,0	10	50
C16	15,3	17,1	2,4	9,0	11	20
C18	16,8	19,1	2,5	11	12	20
C20	18,8	21,2	2,8	12	14	20
C22	20,8	23,3	3,0	13	16	20
C24	22,7	25,9	3,4	14	18	20
C27	25,1	28,9	3,8	18	20	20
C30	28	32	4,5	22	25	20
C33	31	35	5,0	25	30	20
C36	34	38	5,5	30	32	20
C39	37	41	12	35	35	10
C43	40	46	13	40	40	10
C47	44	50	14	50	45	10
C51	48	54	15	55	50	10
C56	52	60	17	63	55	10
C62	58	66	18	75	60	10
C68	64	72	18	90	65	10
C75	70	79	20	100	70	10

* Measured using a pulse method with $t_p \leq 100\ \mu s$ and $\delta \leq 0{,}001$ so that the values correspond to a T_j of approximately 25 °C.

CHARACTERISTICS (continued)

reverse current	at reverse voltage	clamping voltage at t_p = 500 μs; exp. pulse		non-repetitive peak reverse current	BZW70 types have 15% tolerance — they may be replaced by 5% BZX70 types if required	
I_R (μA)	V_R (V)	$V_{(CL)}$ (V)		I_{RSM} (A)	BZX70-	BZW70-
max.		typ.	max.			
50	2,0	9	10	20	C7V5	5V6
20	5,6	10	11,2	20	C8V2	6V2
10	6,2	11	12,5	20	C9V1	6V8
10	6,8	12	14	20	C10	7V5
10	7,5	13,5	15,5	20	C11	8V2
10	8,2	15	17,5	20	C12	9V1
10	9,1	17	19	20	C13	10
10	10	19	21	20	C15	11
10	11	21	23	20	C16	12
10	12	23	26	20	C18	13
10	13	22	26	10	C20	15
10	15	25	29	10	C22	16
10	16	28	33	10	C24	18
10	18	32	38	10	C27	20
10	20	36	43	10	C30	22
10	22	41	48	10	C33	24
10	24	47	54	10	C36	27
10	27	44	52	5	C39	30
10	30	49	58	5	C43	33
10	33	56	65	5	C47	36
10	36	63	72	5	C51	39
10	39	71	82	5	C56	43
10	43	80	93	5	C62	47
10	47	89	104	5	C68	51
10	51	98	116	5	C75	56

OPERATION AS A VOLTAGE REGULATOR

Dissipation and heatsink considerations

a. Steady-state conditions

The maximum permissible steady-state dissipation $P_{s\,max}$ is given by the relationship

$$P_{s\,max} = \frac{T_{j\,max} - T_{amb}}{R_{th\,j\text{-}a}}$$

where: $T_{j\,max}$ is the maximum permissible operating junction temperature
T_{amb} is the ambient temperature
$R_{th\,j\text{-}a}$ is the total thermal resistance from junction to ambient

b. Pulse conditions (see Fig. 2)

The maximum permissible pulse power $P_{p\,max}$ is given by the formula

$$P_{p\,max} = \frac{(T_{j\,max} - T_{amb}) - (P_s \cdot R_{th\,j\text{-}a})}{R_{th\,t}}$$

where: P_s is any steady-state dissipation excluding that in pulses
$R_{th\,t}$ is the effective transient thermal resistance of the device between junction and ambient. It is a function of the pulse duration t_p and duty factor δ.
δ is the duty factor (t_p/T)

The steady-state power P_s when biased in the zener direction at a given zener current can be found from Fig. 3. With the additional pulse power dissipation $P_{p\,max}$ calculated from the above expression, the total peak zener power dissipation $P_{tot} = P_{ZRM} = P_s + P_p$. From Fig. 3 the corresponding maximum repetitive peak zener current at P_{tot} can now be read. This repetitive peak zener current is subject to the absolute maximum rating. For pulse durations longer than the temperature stabilization time of the diode t_{stab}, the maximum permissible repetitive peak dissipation P_{ZRM} is equal to the steady-state power P_s. The temperature stabilization time for the BZX70 is 100 seconds (see Figs 17 and 18).

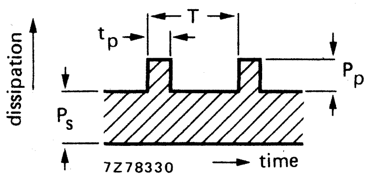


Fig. 2.

NOTES WHEN OPERATING AS A TRANSIENT SUPPRESSOR

1. Recommended stand-off voltage is defined as being the maximum reverse voltage to be applied without causing conduction in the avalanche mode or significant reverse dissipation.
2. Maximum clamping voltage is the maximum reverse avalanche breakdown voltage which will appear across the diode at the specified pulse duration and junction temperature. For square pulses see Figs 19 and 20, for exponential pulses see Figs 21 and 22.
3. Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that energy content does not continue beyond twice this time.

SOLDERING AND MOUNTING INSTRUCTIONS

1. When using a soldering iron, diodes may be soldered directly into the circuit, but heat conducted to the junction should be kept to a minimum.
2. Diodes may be dip-soldered at a solder temperature of 245 ^{o}C for a maximum soldering time of 5 seconds. The case temperature during dip-soldering must not at any time exceed the maximum storage temperature. These recommendations apply to a diode with the anode end mounted flush on a printed-circuit board having punched-through holes. For mounting the anode end onto a printed-circuit board, the diode must be spaced at least 5 mm from the underside of the printed-circuit board having punched-through holes, or 5 mm from the top of the printed circuit board having plated-through holes.
3. Care should be taken not to bend the leads nearer than 1,5 mm from the seal; exert no axial pull when bending.

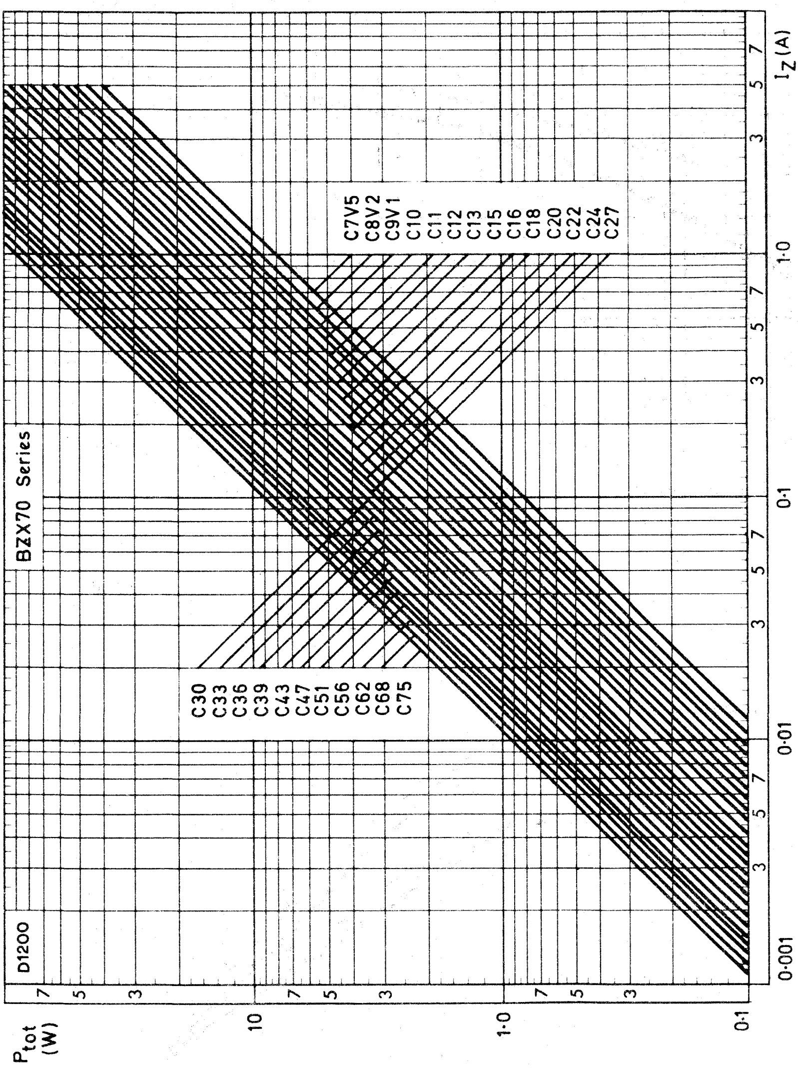


Fig. 3 Maximum permissible repetitive peak dissipation ($P_{tot} = P_{ZRM}$).

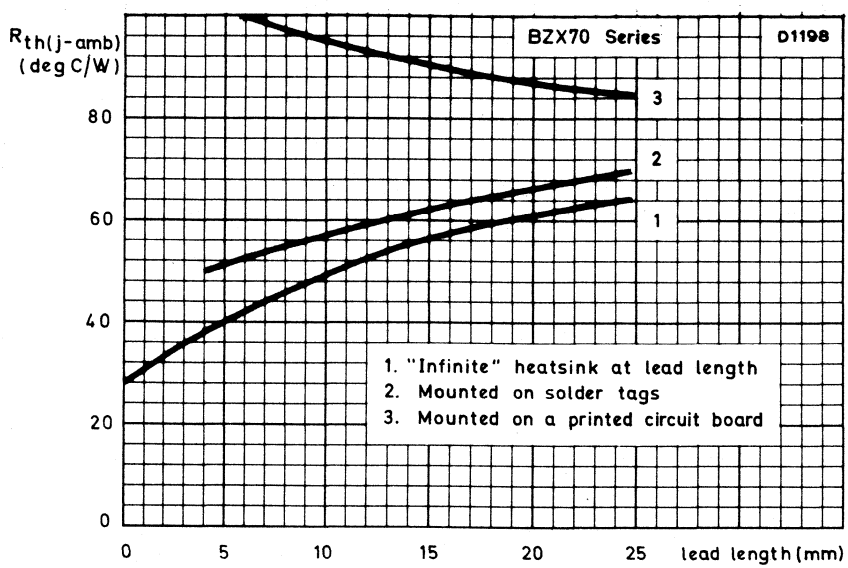


Fig. 4 Thermal resistance as a function of lead length under various mounting conditions.

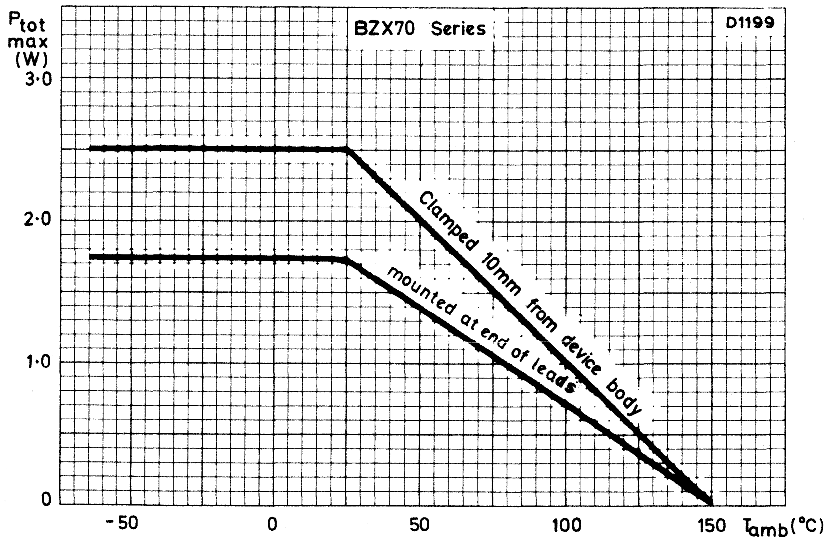


Fig. 5 Maximum permissible power dissipation; the top curve is for mounting method 1 from Fig. 4 at 10 mm lead length.

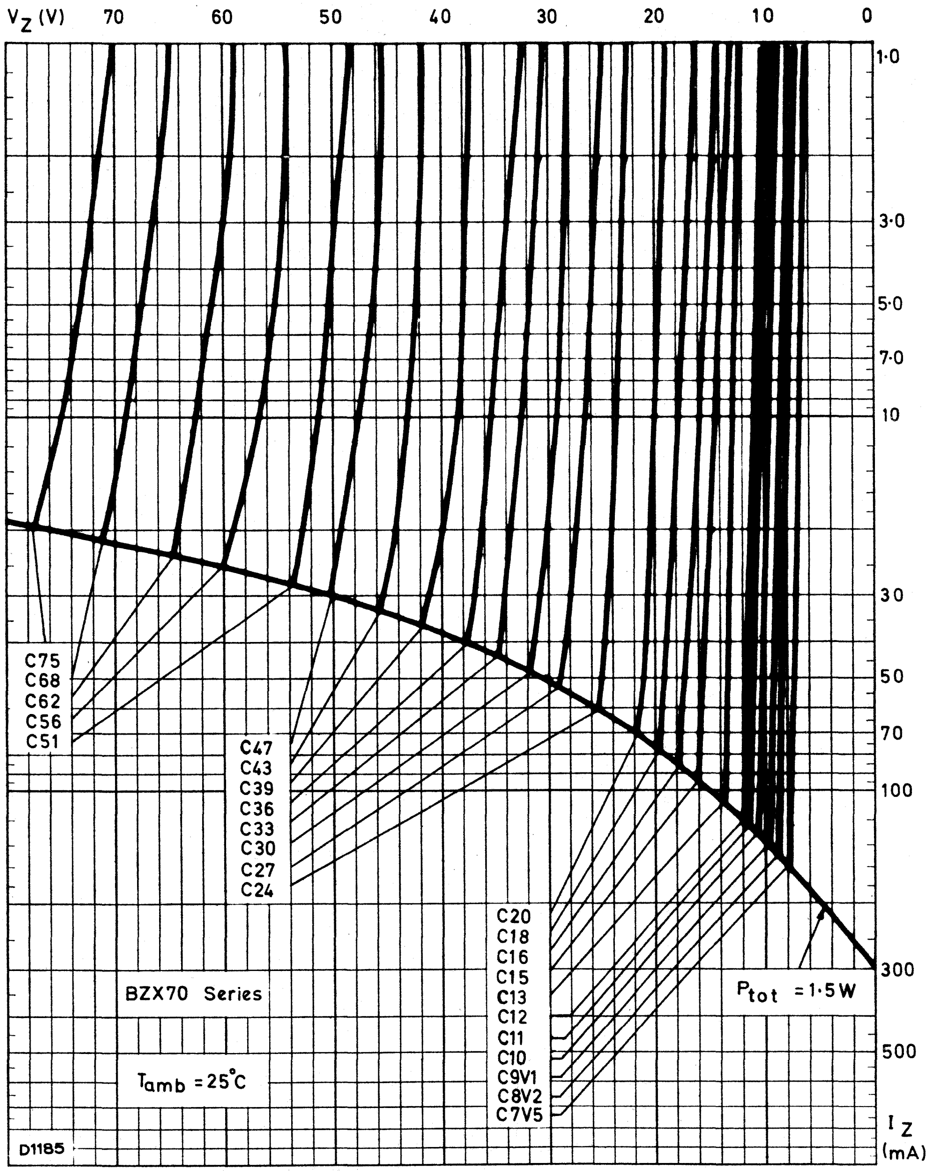


Fig. 6 Typical static zener characteristics.

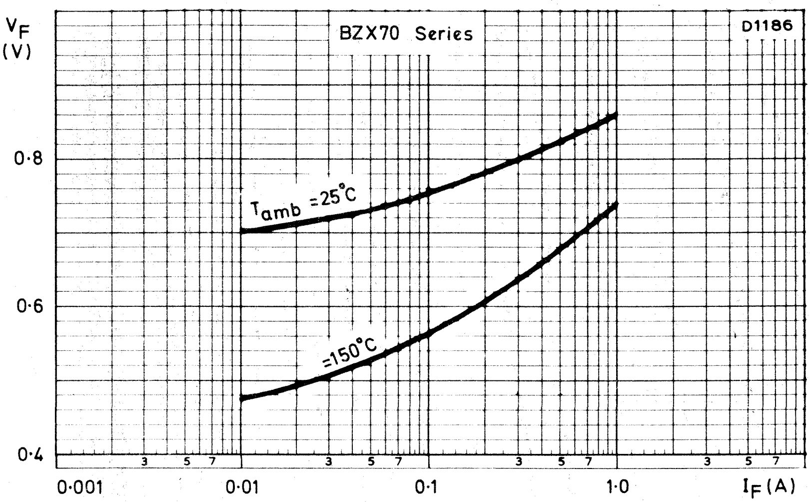


Fig. 7.

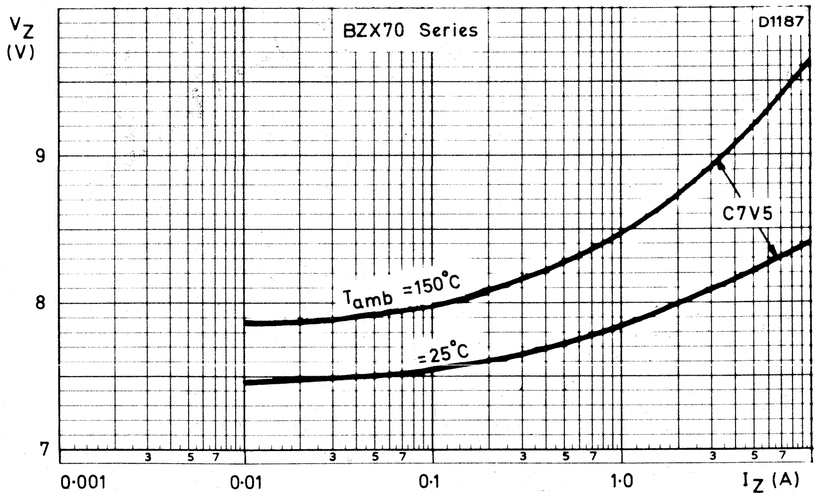


Fig. 8 Typical dynamic zener characteristics for BZX70-C7V5.

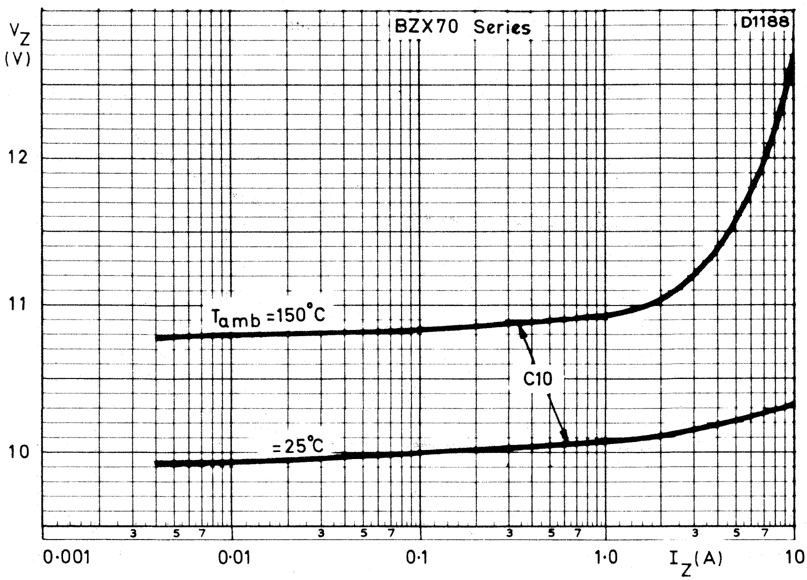


Fig. 9 Typical dynamic zener characteristics for BZX70-C10.

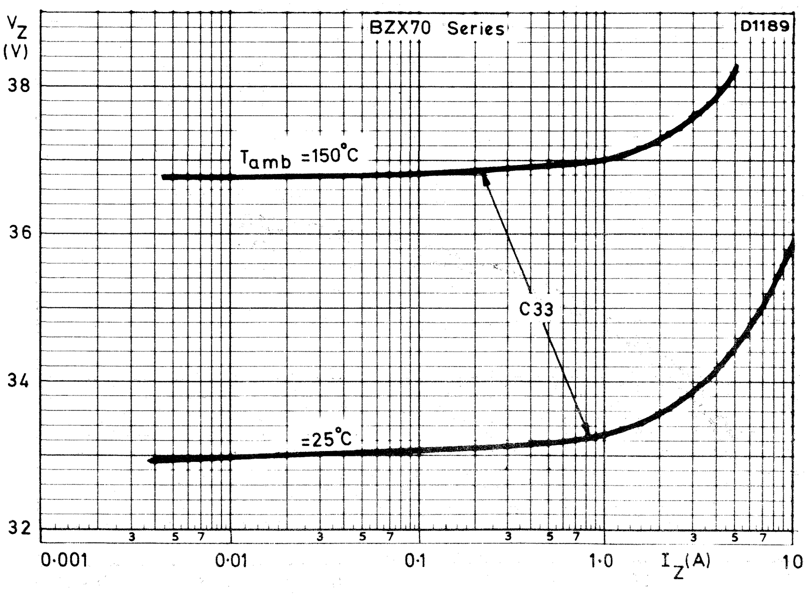


Fig. 10 Typical dynamic zener characteristics for BZX70-C33.

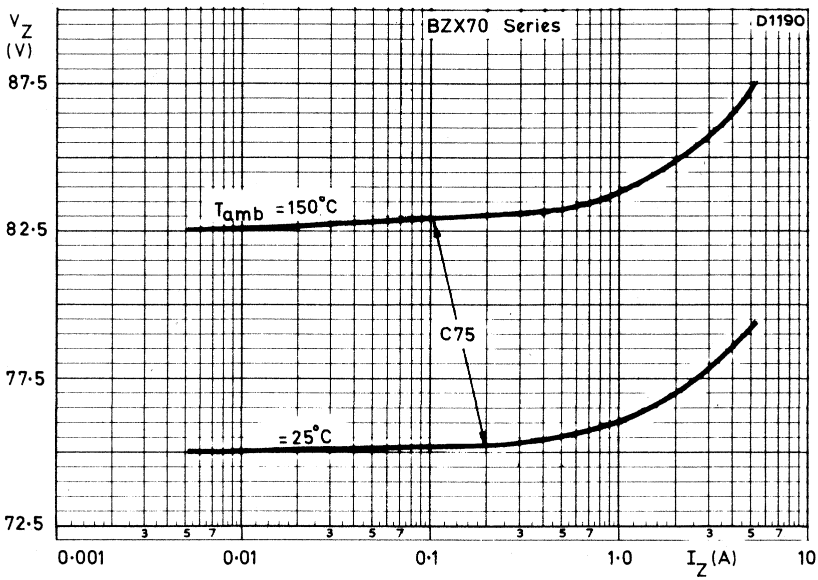


Fig. 11 Typical dynamic zener characteristics for BZX70-C75.

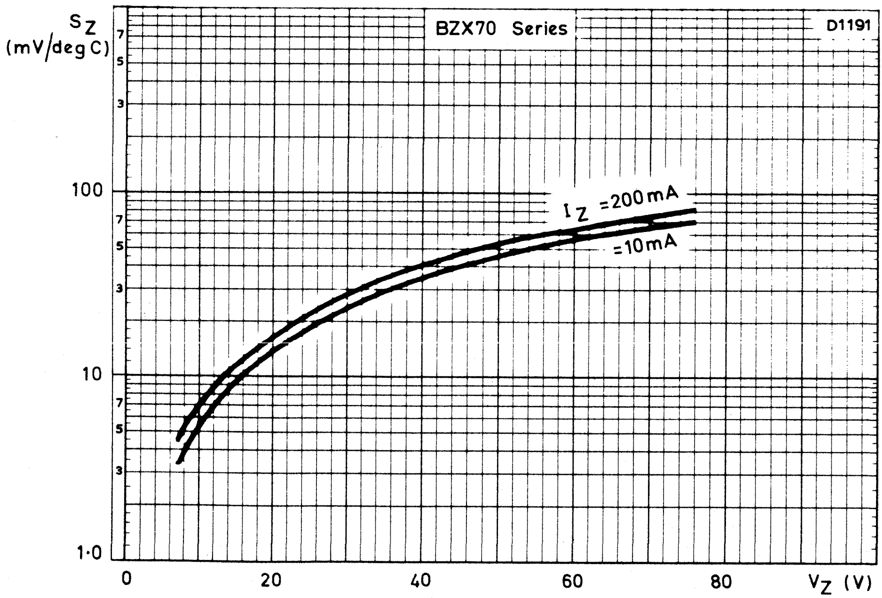


Fig. 12.

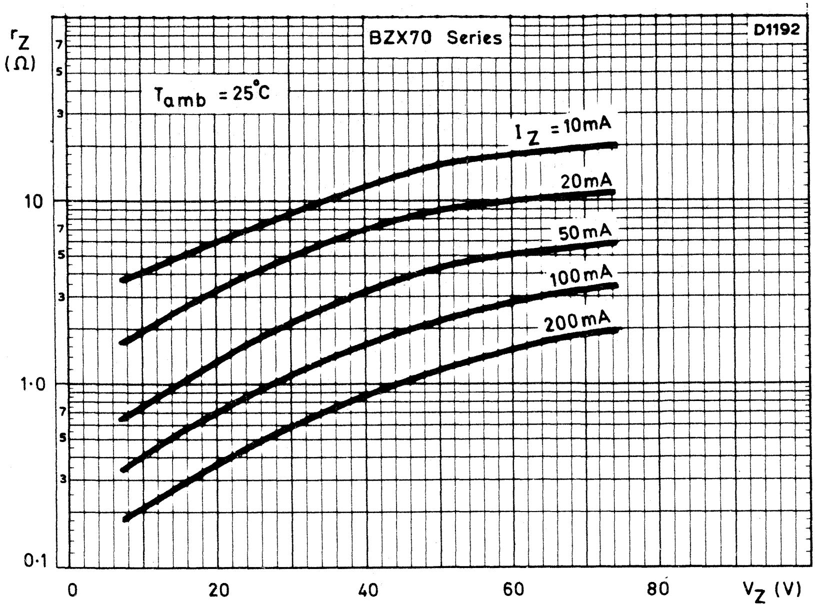

BZX70 Series
D1192
T_{amb} = 25°C
r_Z (Ω)
I_Z = 10mA
20mA
50mA
100mA
200mA
10
1·0
0·1
0
20
40
60
80
V_Z (V)

Fig. 13.

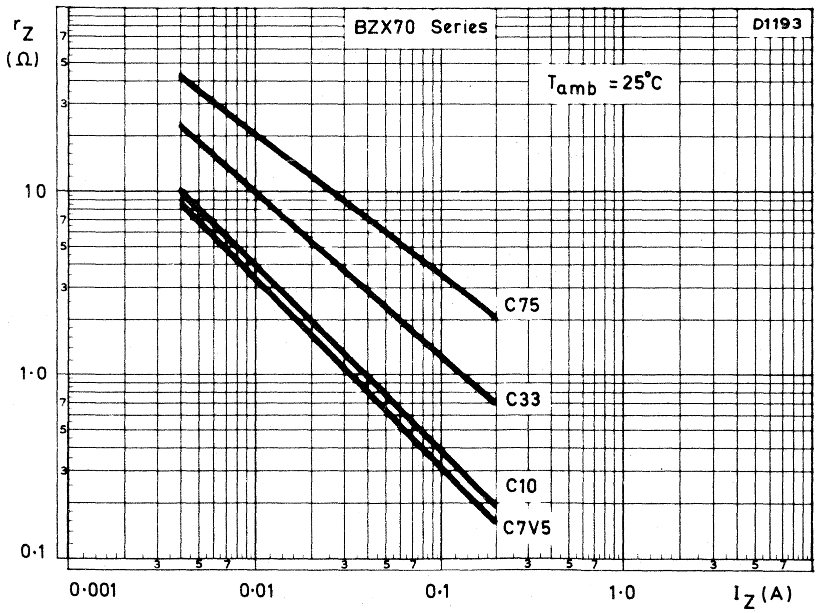

BZX70 Series
D1193
T_{amb} = 25°C
r_Z (Ω)
C75
C33
C10
C7V5
10
1·0
0·1
0·001
0·01
0·1
1·0
I_Z (A)

Fig. 14.

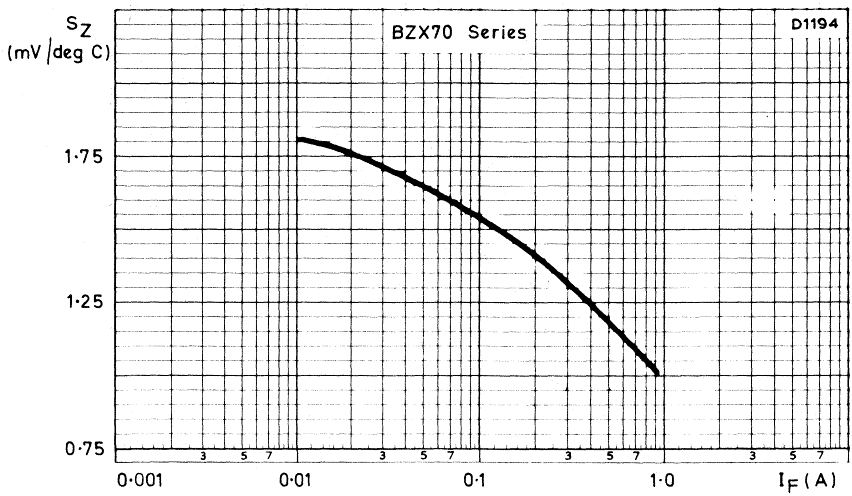


Fig. 15 Typical values.

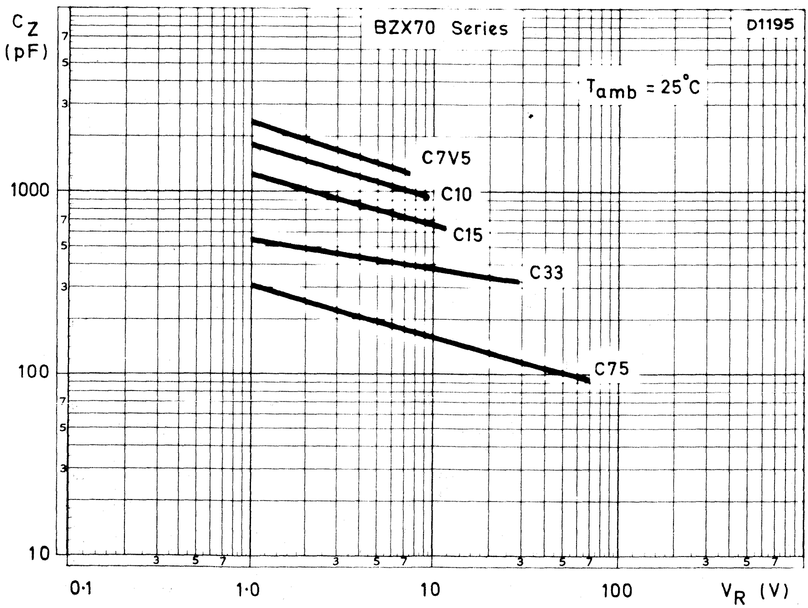


Fig. 16 Typical values.

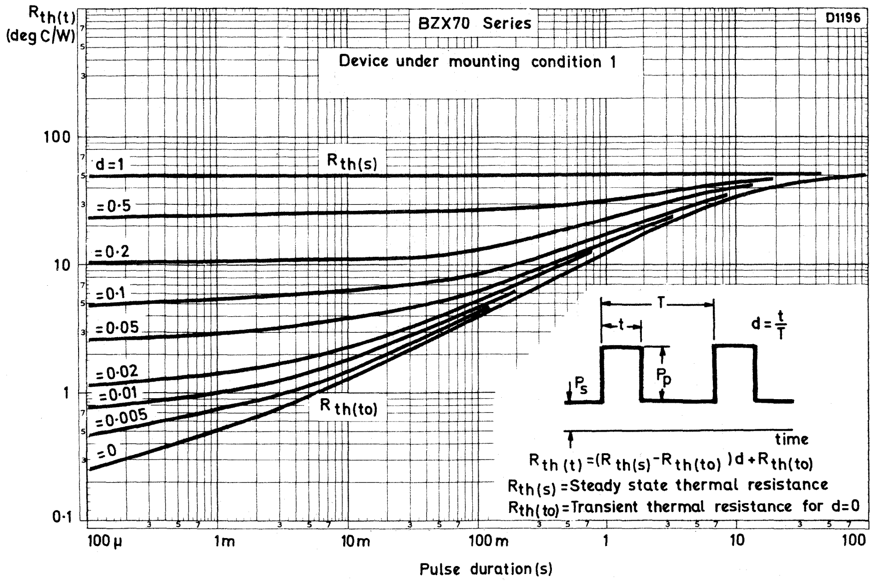


Fig. 17 Device under mounting condition 1 (infinite heatsink); see Fig. 4.

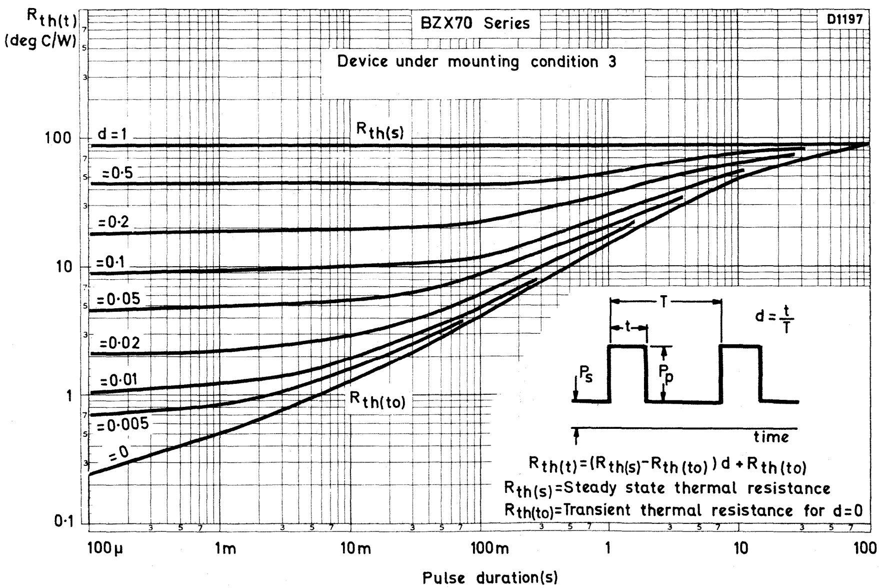


Fig. 18 Device under mounting method 3 (mounted on a printed-circuit board); see Fig. 4.

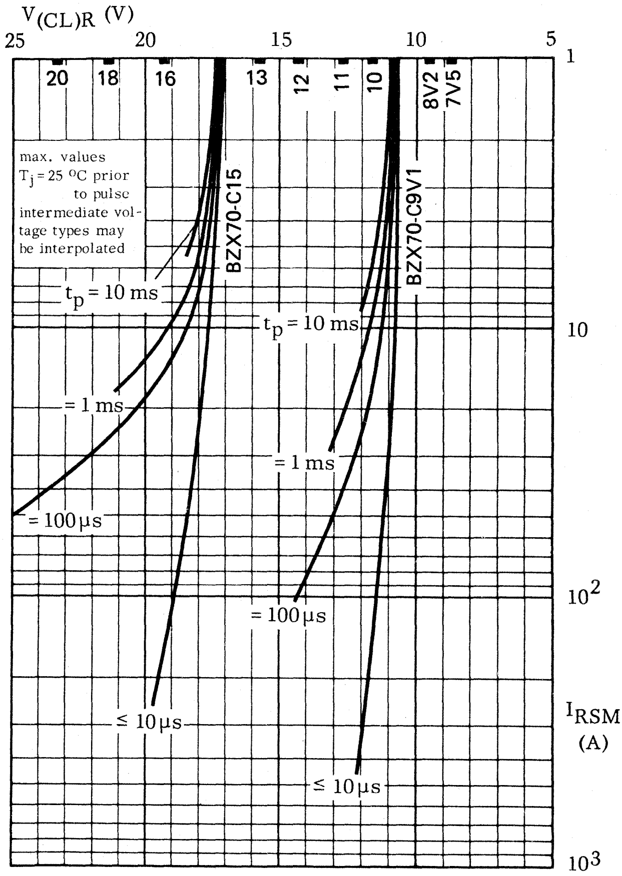


Fig. 19 Square pulses.

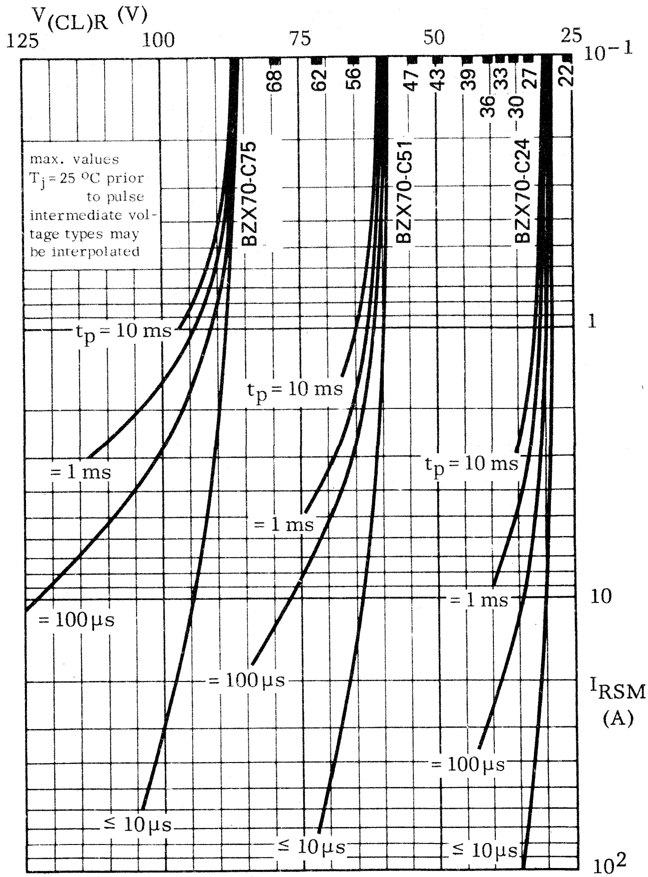


Fig. 20 Square pulses.

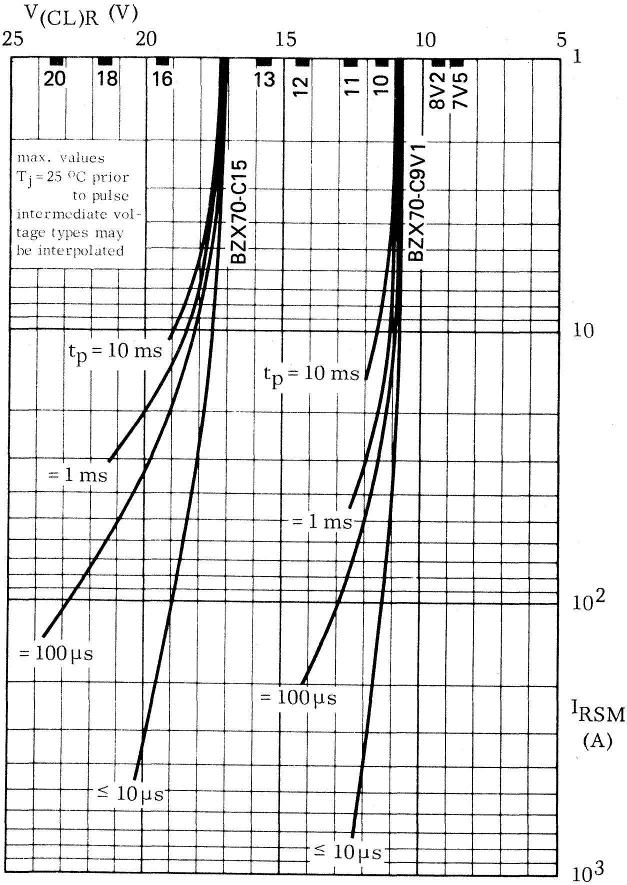


Fig. 21 Exponential pulses.

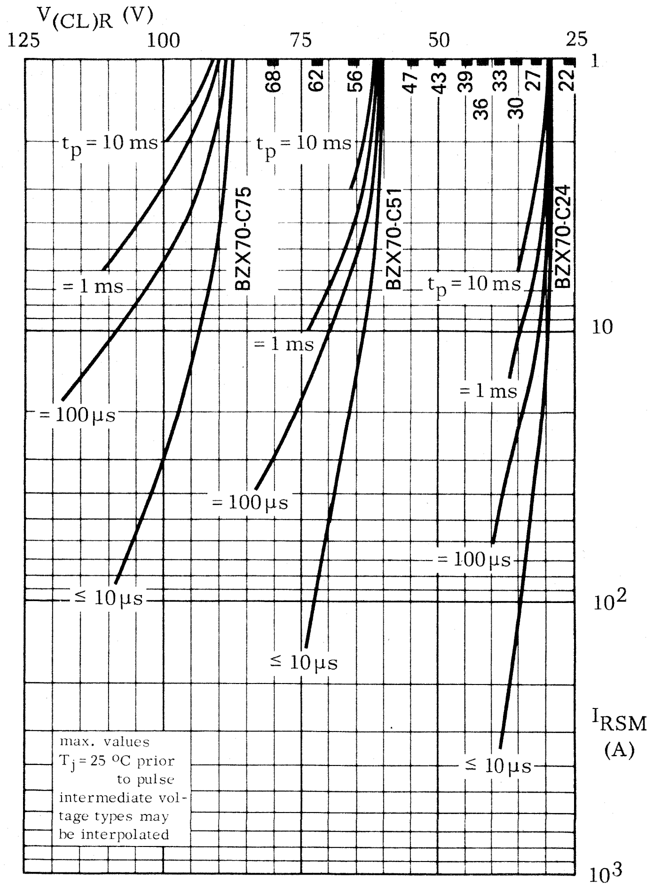


Fig. 22 Exponential pulses.

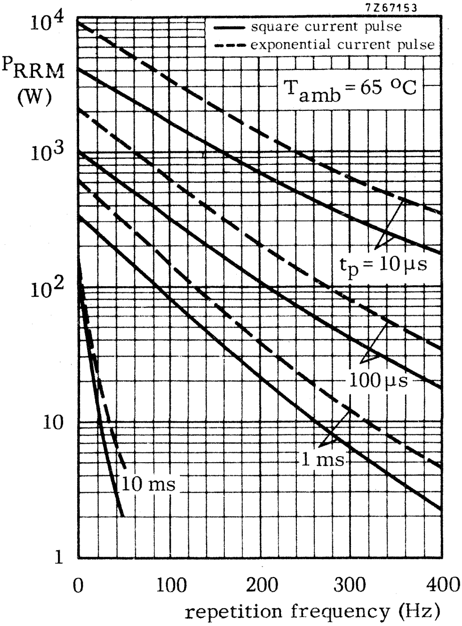


Fig. 23.

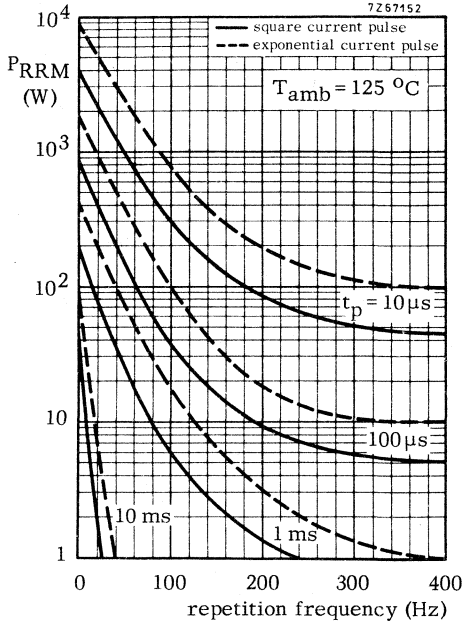


Fig. 24.

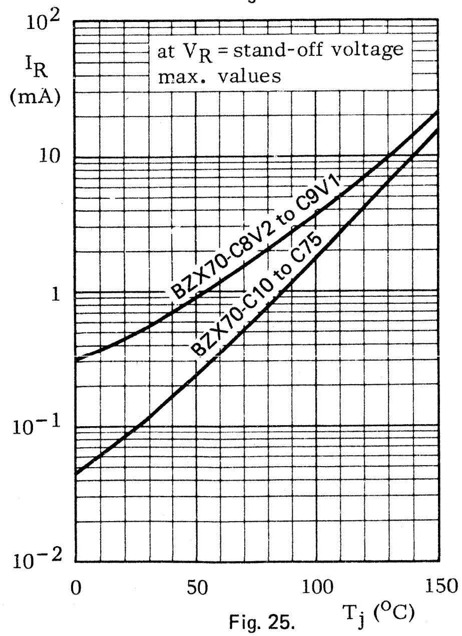


Fig. 25.

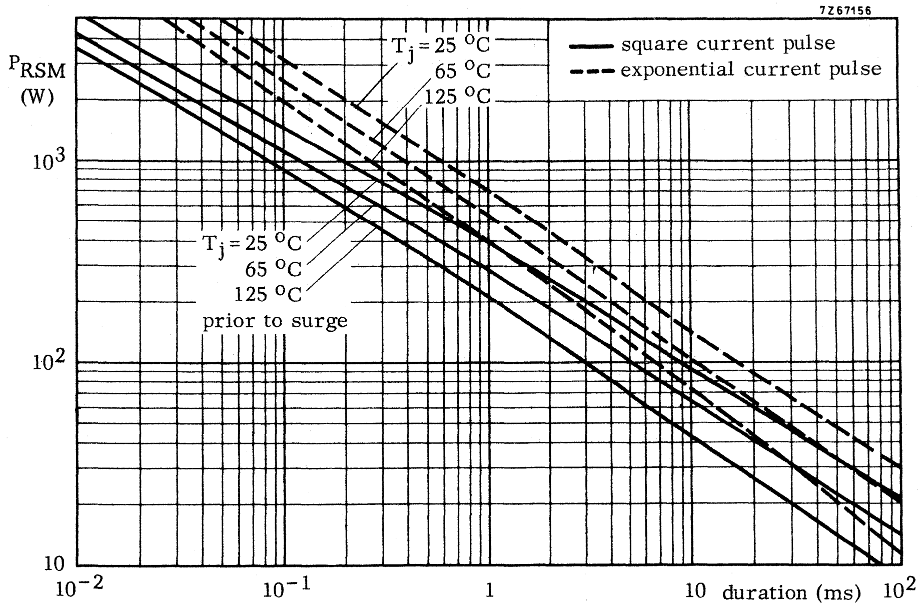

7Z67156
P_{RSM} (W)
10^3
10^2
10
10^{-2}
10^{-1}
1
10
duration (ms)
10^2
square current pulse
exponential current pulse
T_j = 25 °C
65 °C
125 °C
T_j = 25 °C
65 °C
125 °C
prior to surge

Fig. 26.

REGULATOR DIODES

A range of diffused silicon diodes in DO-5 metal envelopes, intended for use as voltage regulator and transient suppressor diodes in power stabilization and transient suppression circuits.

The series consists of the following types:
Normal polarity (cathode to stud): BZY91-C7V5 to BZY91-C75.
Reverse polarity (anode to stud): BZY91-C7V5R to BZY91-C75R.

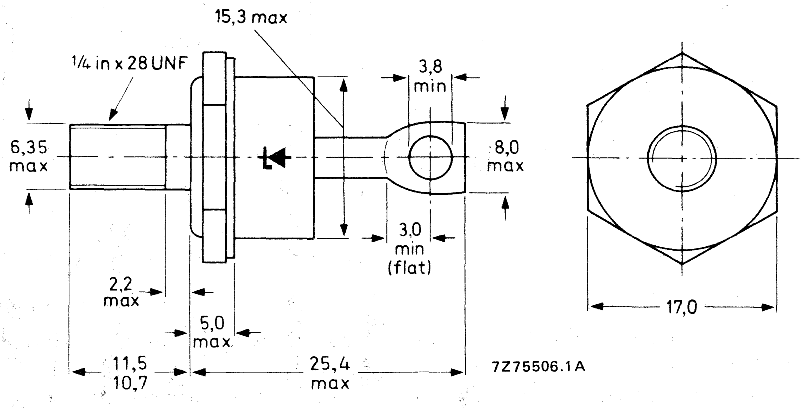
QUICK REFERENCE DATA

			voltage regulator	transient suppressor	
Working voltage (5% range)	V_Z	nom.	7,5 to 75	–	V
Stand-off voltage	V_R		–	5,6 to 56	V
Total power dissipation	P_{tot}	max.	100	–	W
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	–	9,5	kW

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-5.



Net mass: 22 g

Diameter of clearance hole: max. 6,5 mm

Accessories supplied on request: 56264A
(mica washer, insulating ring, tag)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 11,1 mm

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Peak working current	I_{ZM}	max.	400	A
Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	20	A
Non-repetitive peak reverse current T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse); BZY91-C7V5(R) to BZY91-C75(R)	I_{RSM}	max.	1000 to 85	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	100	W
at T_{mb} = 65 °C	P_{tot}	max.	75	W
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse)	P_{RSM}	max.	9,5	kW

Maximum recommended stand-off voltage (V_R)

	V_R (V)		V_R (V)		V_R (V)		V_R (V)		V_R (V)
BZY91-C7V5	5,6	-C12	9,1	-C20	15	-C33	24	-C51	39
-C8V2	6,2	-C13	10	-C22	16	-C36	27	-C56	43
-C9V1	6,8	-C15	11	-C24	18	-C39	30	-C62	47
-C10	7,5	-C16	12	-C27	20	-C43	33	-C68	51
-C11	8,2	-C18	13	-C30	22	-C47	36	-C75	56

Storage temperature	T_{stg}		−55 to + 175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,5	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	°C/W

CHARACTERISTICS

Forward voltage I_F = 10 A; T_{mb} = 25 °C	V_F	<	1,5	V

MOUNTING INSTRUCTIONS

The top connector should neither be bent not twisted; 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.

CHARACTERISTICS

$T_{mb} = 25\ ^oC$

BZY91-. . .	working voltage V_Z (V) *		differential resistance r_Z (Ω) *	temperature coefficient S_Z (%/^oC) *	V_Z; r_Z; S_Z at I_Z (A)
	min.	max.	max.	typ.	
C7V5(R)	7,0	7,9	0,2	0,09	5,0
C8V2(R)	7,7	8,7	0,3	0,09	5,0
C9V1(R)	8,5	9,6	0,4	0,07	2,0
C10(R)	9,4	10,6	0,4	0,07	2,0
C11(R)	10,4	11,6	0,4	0,07	2,0
C12(R)	11,4	12,7	0,5	0,07	2,0
C13(R)	12,4	14,1	0,5	0,07	2,0
C15(R)	13,8	15,6	0,6	0,075	2,0
C16(R)	15,3	17,1	0,6	0,075	2,0
C18(R)	16,8	19,1	0,7	0,075	2,0
C20(R)	18,8	21,2	0,8	0,075	1,0
C22(R)	20,8	23,3	0,8	0,075	1,0
C24(R)	22,7	25,9	0,9	0,08	1,0
C27(R)	25,1	28,9	1,0	0,082	1,0
C30(R)	28	32	1,1	0,085	1,0
C33(R)	31	35	1,2	0,088	1,0
C36(R)	34	38	1,3	0,09	1,0
C39(R)	37	41	1,4	0,09	0,5
C43(R)	40	46	1,5	0,092	0,5
C47(R)	44	50	1,7	0,093	0,5
C51(R)	48	54	1,8	0,093	0,5
C56(R)	52	60	2,0	0,094	0,5
C62(R)	58	66	2,2	0,094	0,5
C68(R)	64	72	2,4	0,094	0,5
C75(R)	70	79	2,6	0,095	0,5

* Measured using a pulse method with $t_p \leqslant 100\ \mu s$ and $\delta \leqslant 0,001$ so that the values correspond to a T_j of approximately 25 ^oC.

CHARACTERISTICS (continued)

reverse current at	reverse voltage	clamping voltage t_p = 500 μs; exp. pulse		at non-repetitive peak reverse current	BZW91 types have 15% tolerance — they may be replaced by 5% BZY91 types if required	
I_R (mA)	V_R (V)	$V_{(CL)R}$ (V)		I_{RSM} (A)	BZY91-	BZW91-
max.		typ.	max.			
5,0	2,0	—	—	—	C7V5	—
5,0	5,6	9,5	10,5	150	C8V2	6V2
5,0	6,2	10	11	150	C9V1	6V8
1,0	6,8	11	12,5	150	C10	7V5
1,0	7,5	12	13,5	150	C11	8V2
1,0	8,2	13	15	150	C12	9V1
1,0	9,1	14,5	17	150	C13	10
1,0	10	16	19	150	C15	11
1,0	11	17,5	22	150	C16	12
1,0	12	19	26	150	C18	13
1,0	13	22	28	100	C20	15
1,0	15	24	31	100	C22	16
1,0	16	26	34	100	C24	18
1,0	18	28	37	100	C27	20
1,0	20	31	40	100	C30	22
1,0	22	34	44	100	C33	24
1,0	24	38	48	100	C36	27
1,0	27	40	52	50	C39	30
1,0	30	44	56	50	C43	33
1,0	33	49	61	50	C47	36
1,0	36	54	66	50	C51	39
1,0	39	60	72	50	C56	43
1,0	43	66	79	50	C62	47
1,0	47	72	87	50	C68	51
1,0	51	79	97	50	C75	56

OPERATION AS A VOLTAGE REGULATOR

Dissipation and heatsink considerations

a. Steady-state conditions

The maximum permissible steady-state dissipation $P_{s\,max}$ is given by the relationship

$$P_{s\,max} = \frac{T_{j\,max} - T_{amb}}{R_{th\,j\text{-}a}}$$

where: $T_{j\,max}$ is the maximum permissible operating junction temperature
T_{amb} is the ambient temperature
$R_{th\,j\text{-}a}$ is the total thermal resistance from junction to ambient

$$R_{th\,j\text{-}a} = R_{th\,j\text{-}mb} + R_{th\,mb\text{-}h} + R_{th\,h\text{-}a}$$

$R_{th\,mb\text{-}h}$ is the thermal resistance from mounting base to heatsink, that is, 0,2 °C/W.
$R_{th\,h\text{-}a}$ is the thermal resistance of the heatsink.

b. Pulse conditions (see Fig. 2)

The heating effect of repetitive power pulses can be found from the curves in Figs 5 and 6 which are given for operation as a transient suppressor at 50 Hz and 400 Hz respectively. This value ΔT is in addition to the mean heating effect. The value of ΔT found from the curves for the particular operating condition should be added to the known value for ambient temperature used in calculating the required heatsink.
The value of the peak power for a given peak zener current is found from the curves in Figs 3 and 4. The required heatsink is calculated as follows:

$$R_{th\,j\text{-}a} = \frac{T_{j\,max} - T_{amb} - \Delta T}{P_s + \delta \cdot P_p}$$

where: $T_{j\,max}$ = 175 °C
T_{amb} = ambient temperature
ΔT = from Fig. 5 or 6
P_s = any steady-state dissipation excluding that in pulses
P_p = peak pulse power
δ = duty factor (t_p/T)
$R_{th\,j\text{-}a} = R_{th\,j\text{-}mb} + R_{th\,mb\text{-}h} + R_{th\,h\text{-}a} = 1{,}5 + 0{,}2 + R_{th\,h\text{-}a}$ °C/W.

Thus $R_{th\,h\text{-}a}$ can be found.

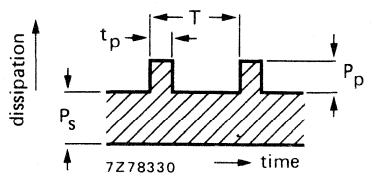


Fig. 2.

OPERATION AS A TRANSIENT SUPPRESSOR

Heatsink considerations

a. For non-repetitive transients, the device may be used without a heatsink for pulses up to 10 ms in duration.

b. For repetitive transients which fall within the permitted operating range shown in Figs 26 and 27 the required heatsink is found as follows:

$$R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a} = \frac{T_{j\ max} - T_{amb}}{P_s + \delta \cdot P_{RRM}}$$

where: $T_{j\ max}$ = 175 °C
T_{amb} = ambient temperature
P_s = any steady-state dissipation excluding that in pulses
δ = duty factor (t_p/T)
$R_{th\ j\text{-}mb}$ = 1,5 °C/W
$R_{th\ mb\text{-}h}$ = 0,2 °C/W

Thus $R_{th\ h\text{-}a}$ can be found.

Notes

1. The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.
2. The maximum clamping voltage is the maximum reverse voltage which appears across the diode at the specified pulse duration and junction temperature. For square pulses see Figs 22 and 23, for exponential pulses see Figs 24 and 25.
3. Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that the energy content does not continue beyond twice this time.

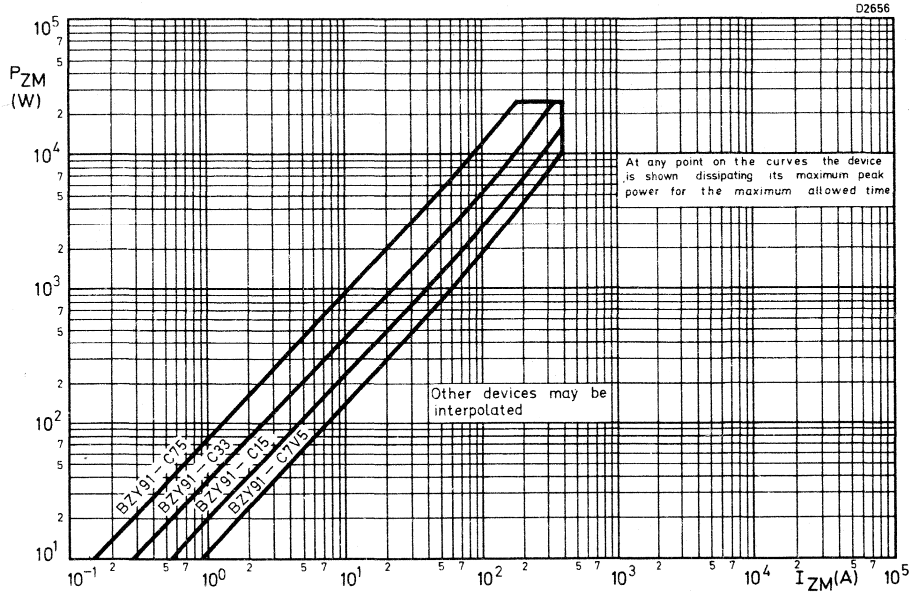

D2656
P_{ZM} (W)
At any point on the curves the device is shown dissipating its maximum peak power for the maximum allowed time
Other devices may be interpolated
BZY91 – C75
BZY91 – C33
BZY91 – C15
BZY91 – C7V5
I_{ZM}(A)

Fig. 3.

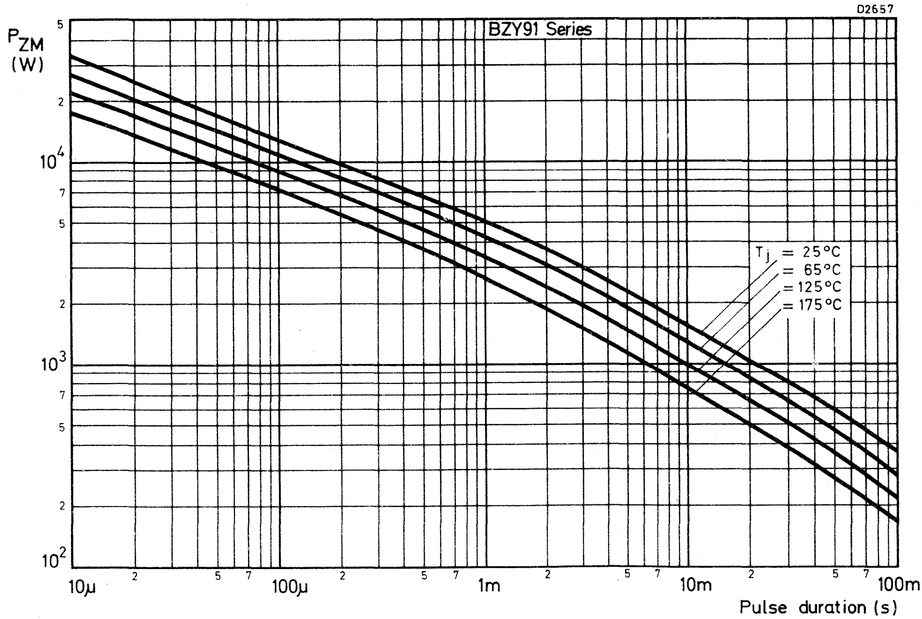

D2657
P_{ZM} (W)
BZY91 Series
T_j = 25 °C
= 65 °C
= 125 °C
= 175 °C
Pulse duration (s)

Fig. 4.

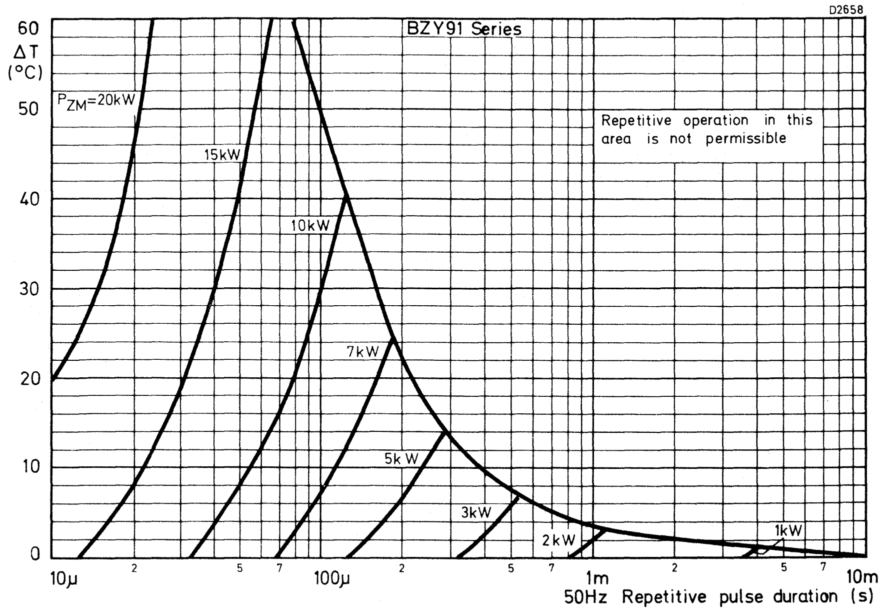

D2658
BZY91 Series
ΔT (°C)
60
50
40
30
20
10
0
P_{ZM}=20kW
15kW
10kW
7kW
5kW
3kW
2kW
1kW
Repetitive operation in this area is not permissible
10µ
2
5
7
100µ
2
5
7
1m
2
5
7
10m
50Hz Repetitive pulse duration (s)

Fig. 5.

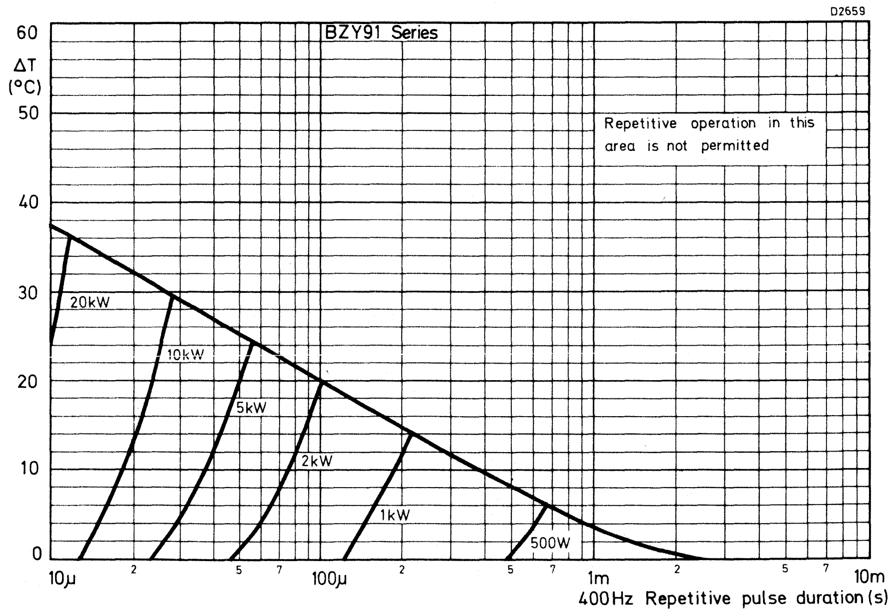

D2659
BZY91 Series
ΔT (°C)
60
50
40
30
20
10
0
20kW
10kW
5kW
2kW
1kW
500W
Repetitive operation in this area is not permitted
10µ
2
5
7
100µ
2
5
7
1m
2
5
7
10m
400Hz Repetitive pulse duration (s)

Fig. 6.

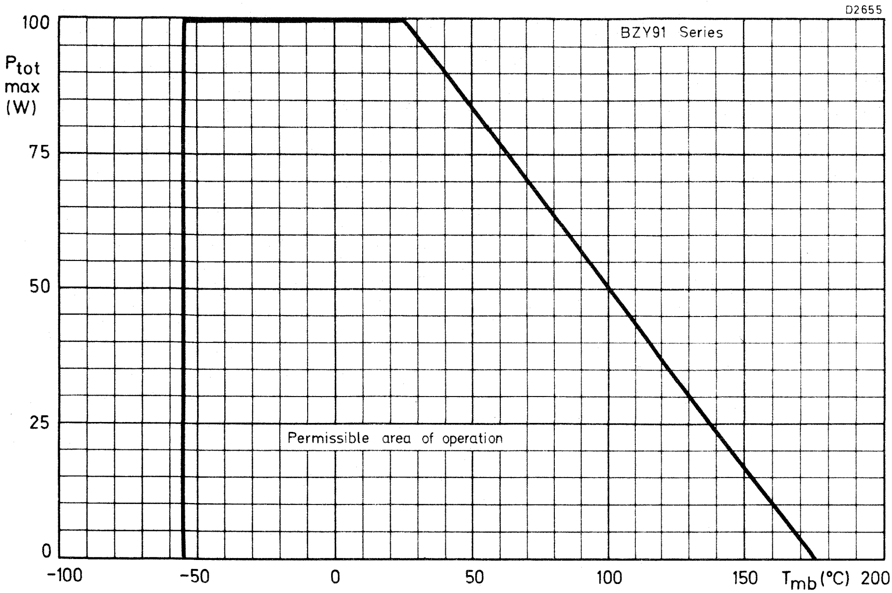


Fig. 7.

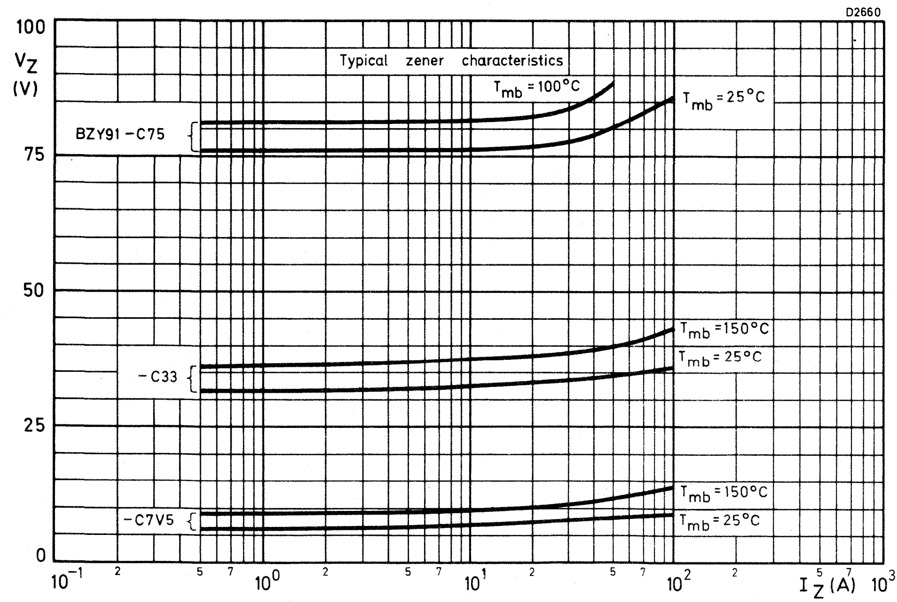


Fig. 8 Typical dynamic zener characteristics.

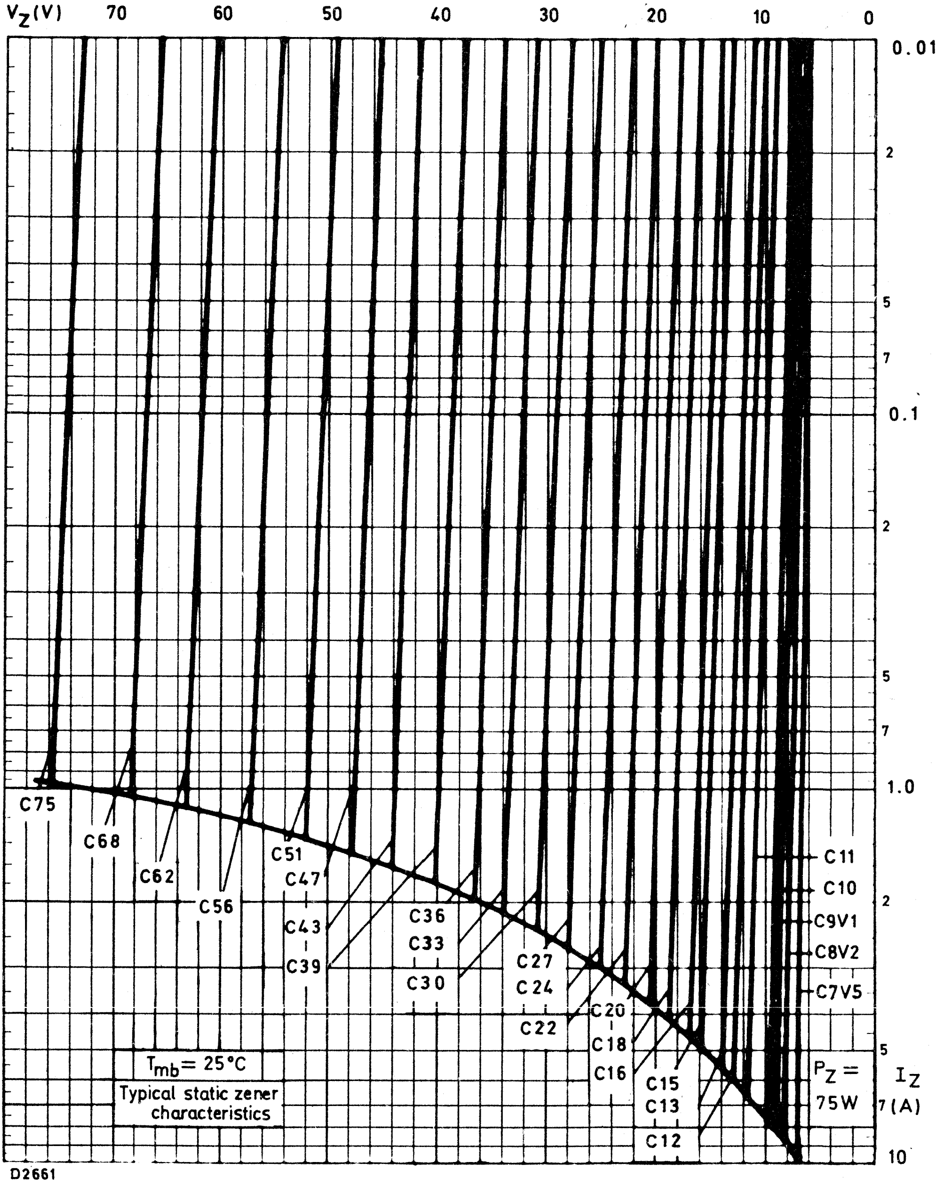


Fig. 9 Typical static zener characteristics.

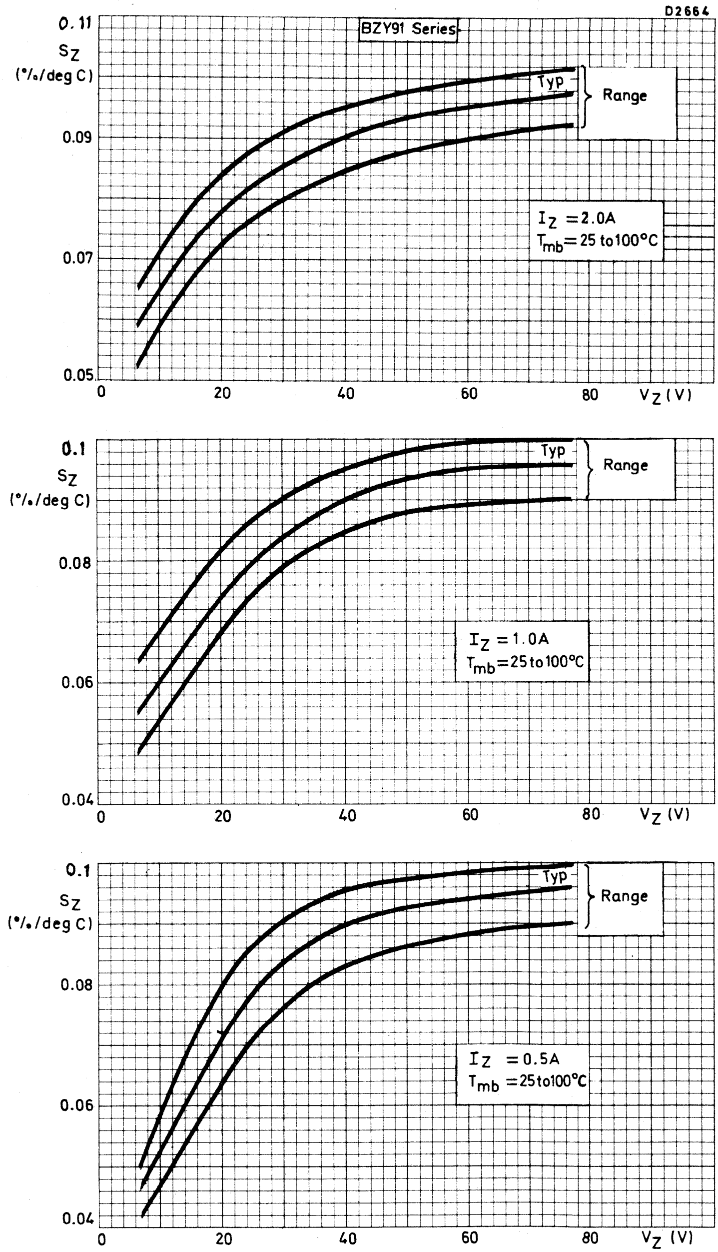

D2664
BZY91 Series
0.11
S_Z
(%/deg C)
0.09
0.07
0.05
0
20
40
60
80
V_Z (V)
Typ
Range
I_Z = 2.0A
T_{mb} = 25 to 100°C
0.1
0.08
0.06
0.04
I_Z = 1.0A
T_{mb} = 25 to 100°C
I_Z = 0.5A
T_{mb} = 25 to 100°C

Fig. 10.

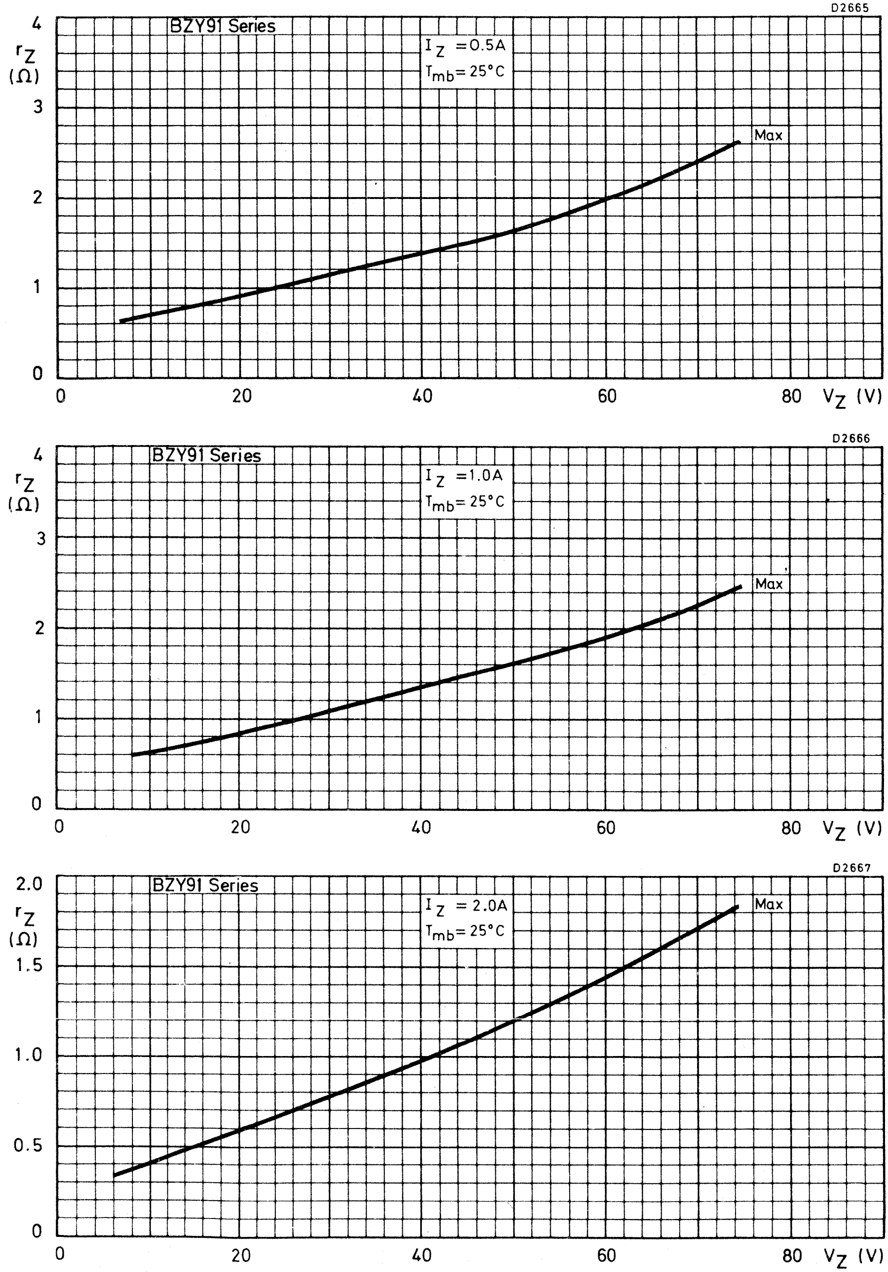

D2665
BZY91 Series
I_Z = 0.5A
T_{mb} = 25°C
Max
r_Z (Ω)
4
3
2
1
0
0
20
40
60
80
V_Z (V)
D2666
BZY91 Series
I_Z = 1.0A
T_{mb} = 25°C
Max
r_Z (Ω)
4
3
2
1
0
0
20
40
60
80
V_Z (V)
D2667
BZY91 Series
I_Z = 2.0A
T_{mb} = 25°C
Max
r_Z (Ω)
2.0
1.5
1.0
0.5
0
0
20
40
60
80
V_Z (V)

Fig. 11.

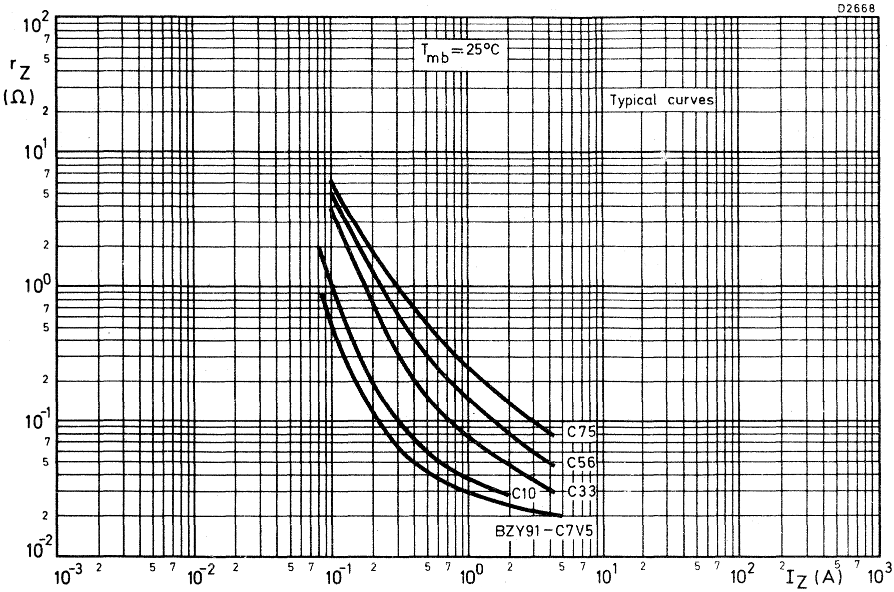

D2668
r_Z (Ω)
$T_{mb} = 25°C$
Typical curves
C75
C56
C33
C10
BZY91 − C7V5
I_Z (A)

Fig. 12.

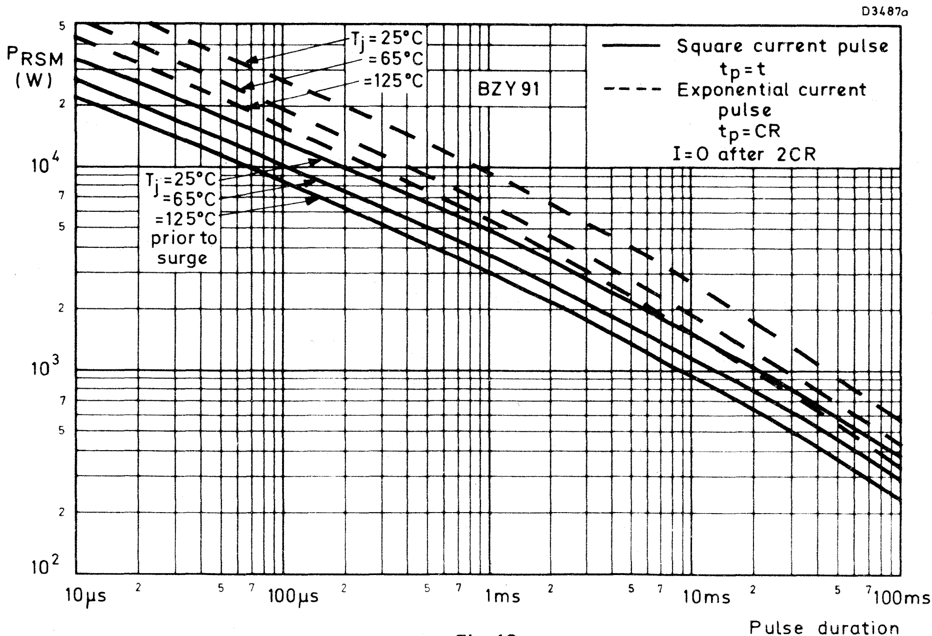

D3487a
P_{RSM} (W)
$T_j = 25°C$
= 65°C
= 125°C
BZY 91
Square current pulse
$t_p = t$
Exponential current pulse
$t_p = CR$
I = 0 after 2CR
$T_j = 25°C$
= 65°C
= 125°C
prior to surge
Pulse duration

Fig. 13.

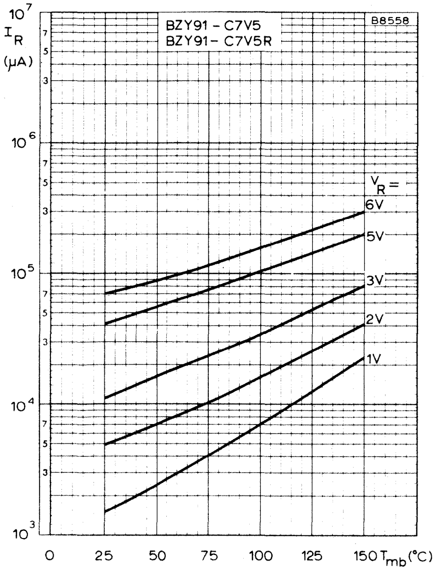


Fig. 14.

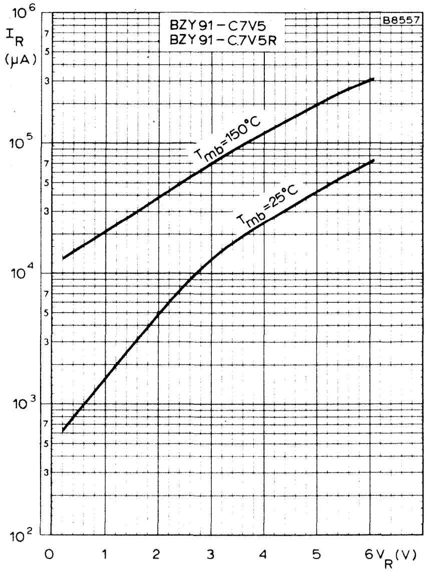


Fig. 15.

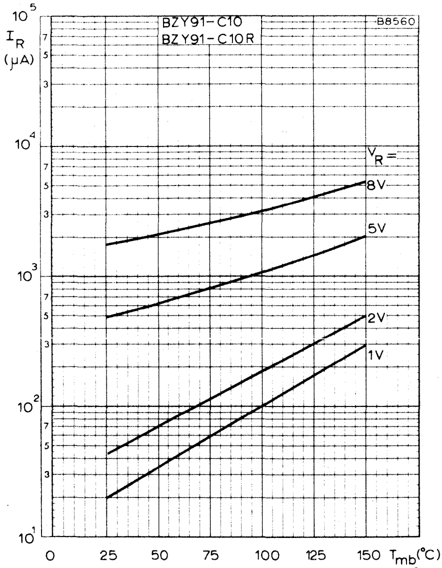


Fig. 16.

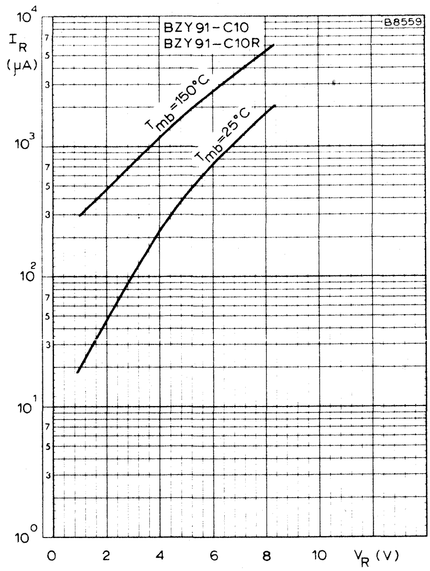


Fig. 17.

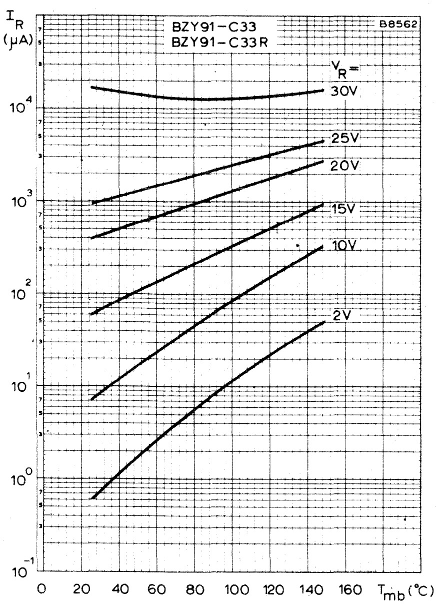


Fig. 18.

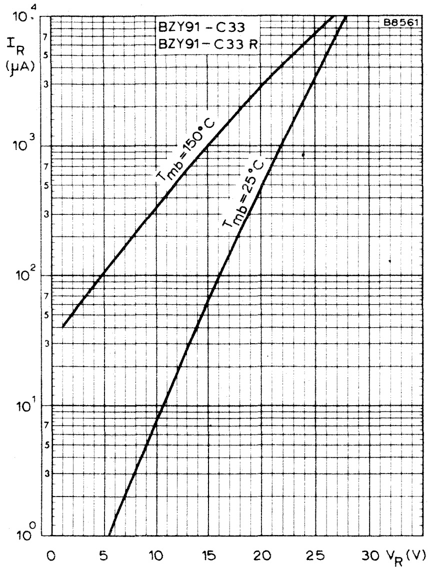


Fig. 19.

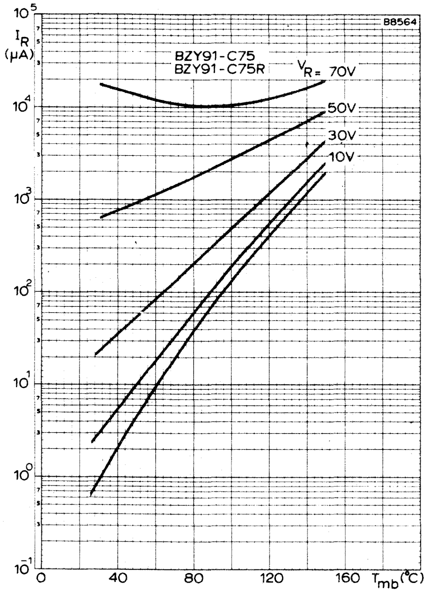


Fig. 20.

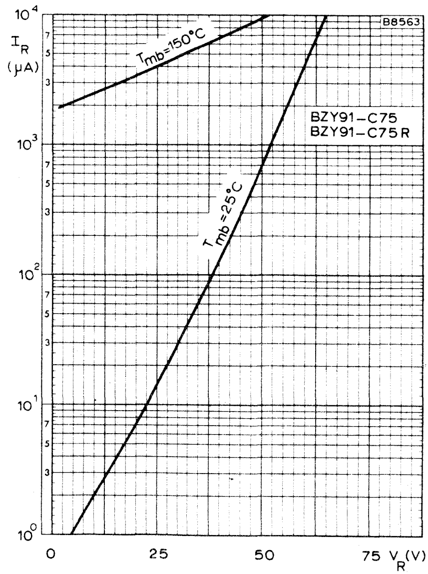


Fig. 21.

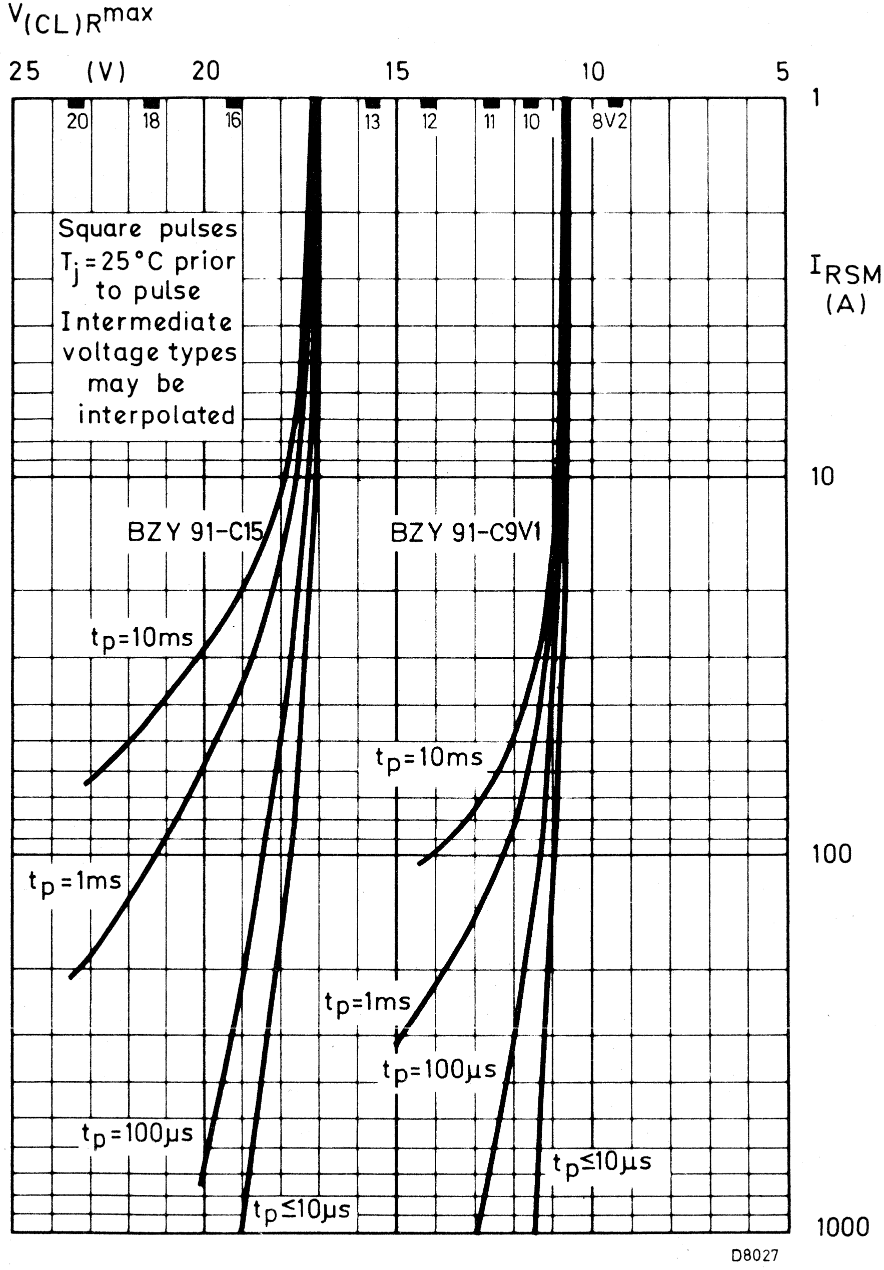

V(CL)R max
25
(V)
20
15
10
5
20
18
16
13
12
11
10
8V2
Square pulses
Tj = 25 °C prior to pulse
Intermediate voltage types may be interpolated
1
10
100
1000
IRSM (A)
BZY 91-C15
BZY 91-C9V1
tp=10ms
tp=1ms
tp=100µs
tp≤10µs
tp=10ms
tp=1ms
tp=100µs
tp≤10µs
D8027

Fig. 22.

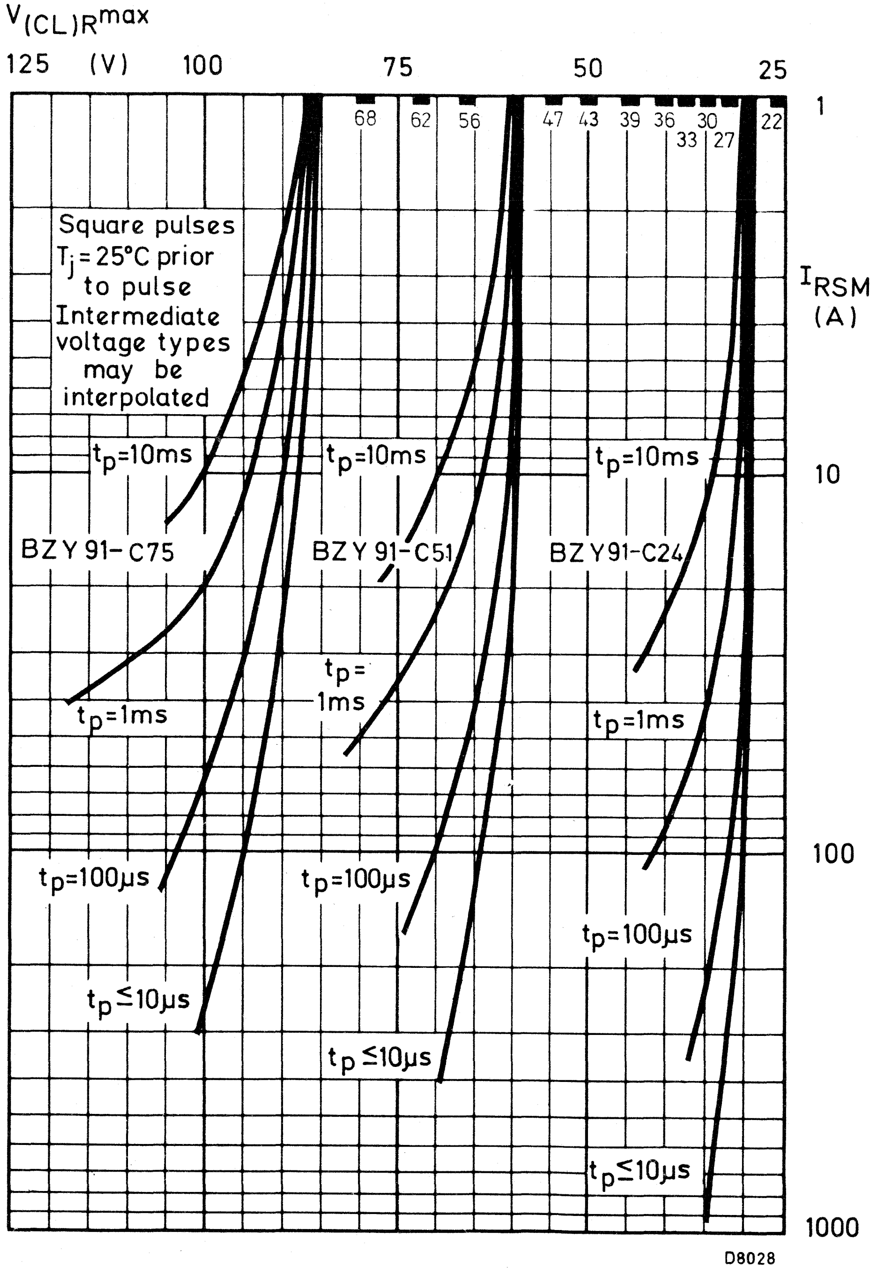
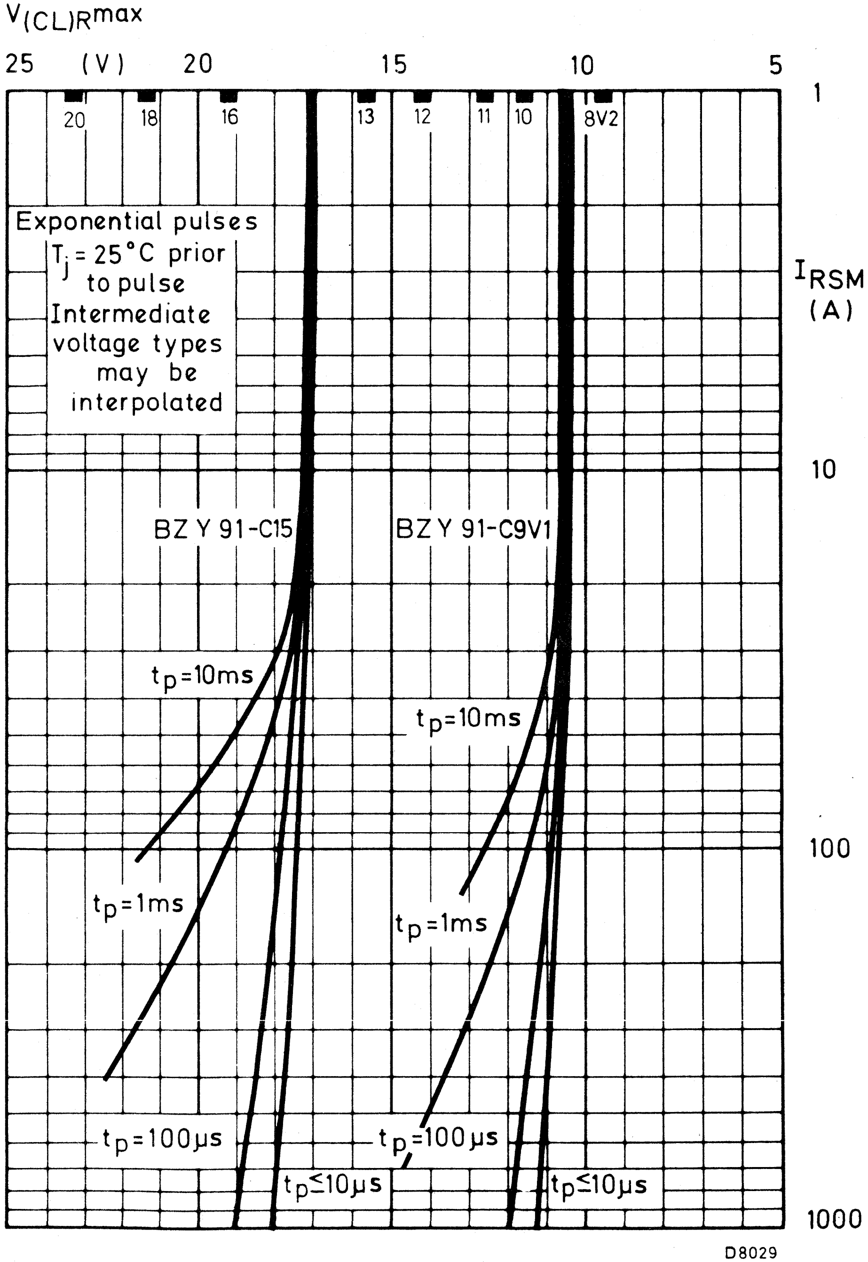

$V_{(CL)R}$max
125 (V) 100 75 50 25
68 62 56 47 43 39 36 30 33 27 22
1
10
100
1000
I_{RSM}
(A)
Square pulses
T_j = 25°C prior to pulse
Intermediate voltage types may be interpolated
t_p=10ms
t_p=10ms
t_p=10ms
BZY 91-C75
BZY 91-C51
BZY91-C24
t_p=1ms
t_p= 1ms
t_p=1ms
t_p=100µs
t_p=100µs
t_p=100µs
t_p≤10µs
t_p≤10µs
t_p≤10µs
D8028

Fig. 23.



V(CL)Rmax
25
(V)
20
15
10
5
20
18
16
13
12
11
10
8V2
1
10
100
1000
IRSM
(A)
Exponential pulses
Tj = 25°C prior to pulse
Intermediate voltage types may be interpolated
BZ Y 91-C15
BZ Y 91-C9V1
tp=10ms
tp=1ms
tp=100µs
tp≤10µs
D8029

Fig. 24.

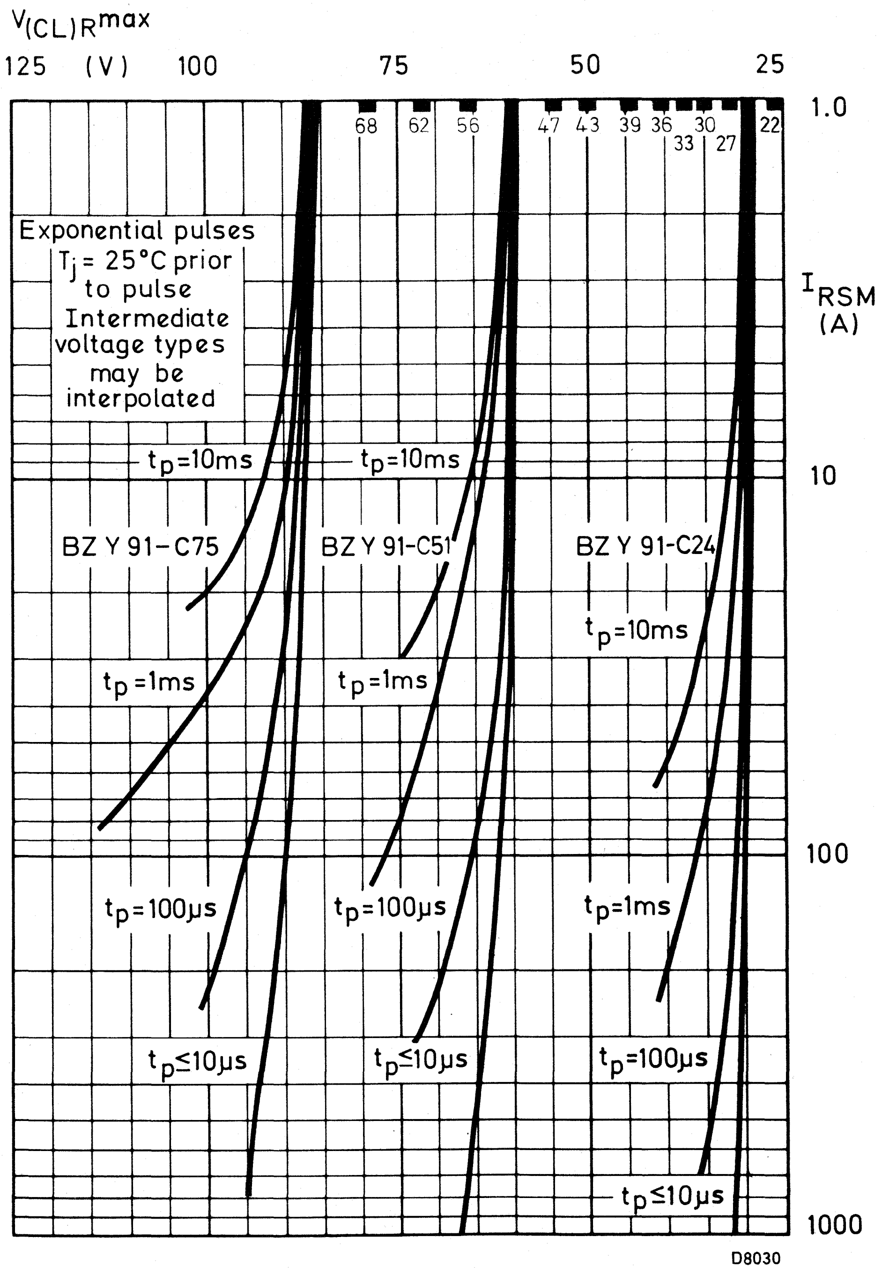

V(CL)R max
125 (V) 100 75 50 25
68 62 56 47 43 39 36 30 22
33 27
1.0
10
100
1000
I RSM (A)
Exponential pulses
Tj = 25°C prior to pulse
Intermediate voltage types may be interpolated
tp=10ms
tp=10ms
BZ Y 91–C75
BZ Y 91-C51
BZ Y 91-C24
tp=10ms
tp =1ms
tp =1ms
tp=100µs
tp=100µs
tp=1ms
tp≤10µs
tp≤10µs
tp=100µs
tp≤10µs
D8030

Fig. 25.

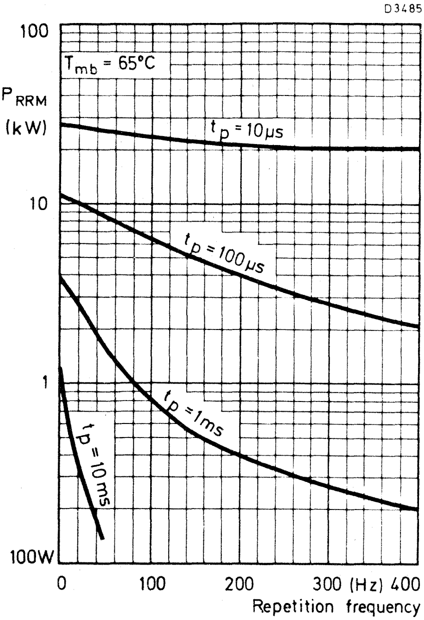


Fig. 26.

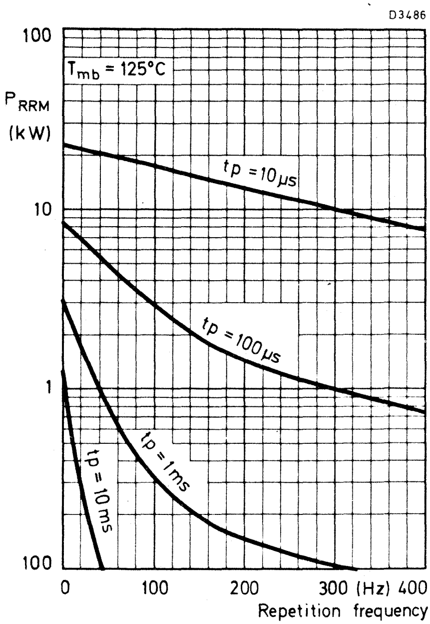


Fig. 27.

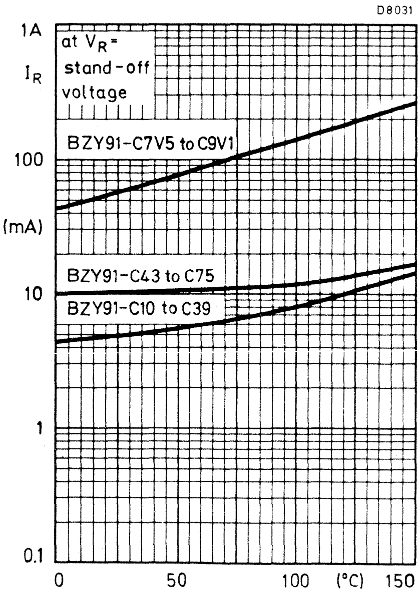


Fig. 28.

REGULATOR DIODES

A range of diffused silicon diodes in DO-4 metal envelopes, intended for use as voltage regulator and transient suppressor diodes in power stabilization and transient suppression circuits.

The series consists of the following types:
Normal polarity (cathode to stud): BZY93-C7V5 to BZY93-C75.
Reverse polarity (anode to stud): BZY93-C7V5R to BZY93-C75R.

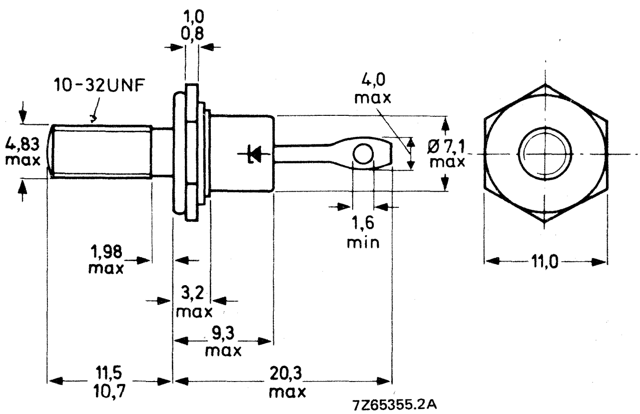
QUICK REFERENCE DATA

			voltage regulator	transient suppressor	
Working voltage (5% range)	V_Z	nom.	7,5 to 75	—	V
Stand-off voltage	V_R		—	5,6 to 56	V
Total power dissipation	P_{tot}	max.	20	—	W
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	—	700	W

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-4.



Net mass: 6 g

Diameter of clearance hole: max. 5,2 mm

Accessories supplied on request: 56295
(PTFE bush, 2 mica washers, plain washer, tag)

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)

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Peak working current	I_{ZM}	max.	20 A
Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	5 A
Non-repetitive peak reverse current T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse); BZY93-C7V5(R) to BZY93-C75(R)	I_{RSM}	max.	55 to 6 A
Total power dissipation up to T_{mb} = 75 °C	P_{tot}	max.	20 W
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse)	P_{RSM}	max.	700 W

Maximum recommended stand-off voltage (V_R)

	V_R (V)		V_R (V)		V_R (V)		V_R (V)		V_R (V)
BZY93-C7V5	5,6	-C12	9,1	-C20	15	-C33	24	-C51	39
-C8V2	6,2	-C13	10	-C22	16	-C36	27	-C56	43
-C9V1	6,8	-C15	11	-C24	18	-C39	30	-C62	47
-C10	7,5	-C16	12	-C27	20	-C43	33	-C68	51
-C11	8,2	-C18	13	-C30	22	-C47	36	-C75	56

Storage temperature	T_{stg}		−55 to + 175 °C
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	5 °C/W
From junction to ambient	$R_{th\ j\text{-}a}$	=	50 °C/W
From mounting base to heatsink (minimum torque: 0,9 Nm)	$R_{th\ mb\text{-}h}$	=	0,6 °C/W

CHARACTERISTICS

Forward voltage I_F = 5 A; T_{mb} = 25 °C	V_F	$<$	1,5 V

MOUNTING INSTRUCTIONS

The top connector should neither be bent nor twisted; 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.

CHARACTERISTICS

T_{mb} = 25 °C

BZY93-. . .	working voltage V_Z (V) *		differential resistance r_Z (Ω) *		temperature coefficient S_Z (mV/°C) *	V_Z; r_Z; S_Z at I_Z (A)
	min.	max.	typ.	max.	typ.	
C7V5(R)	7,0	7,9	0,04	0,3	3,0	2,0
C8V2(R)	7,7	8,7	0,05	0,3	4,0	2,0
C9V1(R)	8,5	9,6	0,07	0,5	5,0	1,0
C10(R)	9,4	10,6	0,07	0,5	7,0	1,0
C11(R)	10,4	11,6	0,08	1,0	7,5	1,0
C12(R)	11,4	12,7	0,08	1,0	8,0	1,0
C13(R)	12,4	14,1	0,08	1,0	8,5	1,0
C15(R)	13,8	15,6	0,10	1,2	10	1,0
C16(R)	15,3	17,1	0,18	1,2	11	0,5
C18(R)	16,8	19,1	0,20	1,5	12	0,5
C20(R)	18,8	21,2	0,20	1,5	14	0,5
C22(R)	20,8	23,3	0,21	1,8	16	0,5
C24(R)	22,7	25,9	0,22	2,0	18	0,5
C27(R)	25,1	28,9	0,25	2,0	21	0,5
C30(R)	28	32	0,30	2,5	25	0,5
C33(R)	31	35	0,32	3,0	30	0,5
C36(R)	34	38	0,75	4,0	32	0,2
C39(R)	37	41	0,85	5,0	35	0,2
C43(R)	40	46	0,90	6,5	40	0,2
C47(R)	44	50	1,0	7,0	45	0,2
C51(R)	48	54	1,2	7,5	50	0,2
C56(R)	52	60	1,3	8,0	55	0,2
C62(R)	58	66	1,5	9,0	60	0,2
C68(R)	64	72	1,8	10,0	65	0,2
C75(R)	70	79	2,0	10,5	70	0,2

* Measured using a pulse method with $t_p \leqslant 100\ \mu s$ and $\delta \leqslant 0{,}001$ so that the values correspond to a T_j of approximately 25 °C.

CHARACTERISTICS

reverse current at	reverse voltage	clamping voltage t_p = 500 μs; exp. pulse at		non-repetitive peak reverse current	BZW93 types have 15% tolerance — they may be replaced by 5% BZY93 types if required	
I_R (μA)	V_R (V)	$V_{(CL)R}$ (V)		I_{RSM} (A)	BZY93-	BZW93-
max.		typ.	max.			
100	2,0	8	9,2	20	C7V5	5V6
100	5,6	9	10,2	20	C8V2	6V2
50	6,2	10	11,5	20	C9V1	6V8
50	6,8	11	12,5	20	C10	7V5
50	7,5	12,3	14	20	C11	8V2
50	8,2	14	16	20	C12	9V1
50	9,1	15,3	17,5	20	C13	10
50	10	17	19,5	20	C15	11
50	11	19,3	22	20	C16	12
50	12	21	24	20	C18	13
50	13	23	27	10	C20	15
50	15	26	30	10	C22	16
50	16	29	34	10	C24	18
50	18	33	39	10	C27	20
50	20	38	44	10	C30	22
50	22	42	50	10	C33	24
50	24	47	56	10	C36	27
50	27	40	47	5	C39	30
50	30	45	52	5	C43	33
50	33	51	59	5	C47	36
50	36	57	66	5	C51	39
50	39	64	75	5	C56	43
50	43	73	85	5	C62	47
50	47	81	94	5	C68	51
50	51	90	105	5	C75	56

OPERATION AS A VOLTAGE REGULATOR

Dissipation and heatsink considerations

a. Steady-state conditions

The maximum permissible steady-state dissipation $P_{s\,max}$ is given by the relationship

$$P_{s\,max} = \frac{T_{j\,max} - T_{amb}}{R_{th\,j\text{-}a}}$$

where: $T_{j\,max}$ is the maximum permissible operating junction temperature
T_{amb} is the ambient temperature
$R_{th\,j\text{-}a}$ is the total thermal resistance from junction to ambient

$$R_{th\,j\text{-}a} = R_{th\,j\text{-}mb} + R_{th\,mb\text{-}h} + R_{th\,h\text{-}a}$$

$R_{th\,mb\text{-}h}$ is the thermal resistance from mounting base to heatsink, that is, 0,6 ^{o}C/W.
$R_{th\,h\text{-}a}$ is the thermal resistance of the heatsink.

b. Pulse conditions (see Fig. 2)

The maximum permissible pulse power $P_{p\,max}$ is given by the formula

$$P_{p\,max} = \frac{(T_{j\,max} - T_{amb}) - (P_s \cdot R_{th\,j\text{-}a})}{R_{th\,t} + \delta \cdot R_{th\,mb\text{-}a}}$$

where: P_s is any steady-state dissipation excluding that in pulses
$R_{th\,t}$ is the effective transient thermal resistance of the device between junction and mounting base. It is a function of the pulse duration t_p and duty factor δ.
δ is duty factor (t_p/T)
$R_{th\,mb\text{-}a}$ is the total thermal resistance between the mounting base and ambient ($R_{th\,mb\text{-}a} = R_{th\,mb\text{-}h} + R_{th\,h\text{-}a}$).

The steady-state power P_s when biased in the zener direction at a given zener current can be found from Fig. 14. With the additional pulse power dissipation $P_{p\,max}$ calculated from the above expression, the total peak zener power dissipation $P_{tot} = P_{ZRM} = P_s + P_p$. From Fig. 14 the corresponding maximum repetitive peak zener current at P_{ZRM} can now be read. This repetitive peak zener current is subject to the absolute maximum rating. For pulse durations larger than the temperature stabilization time of the diode t_{stab}, the maximum permissible repetitive peak dissipation P_{ZRM} is equal to the steady-state power P_s. The temperature stabilization time for the BZY93 is 5 seconds (see Fig. 9).

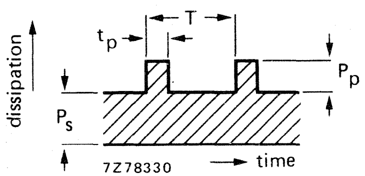


Fig. 2.

OPERATION AS A TRANSIENT SUPPRESSOR

Heatsink considerations

a. For non-repetitive transients, the device may be used without a heatsink for pulses up to 10 ms in duration.

b. For repetitive transients which fall within the permitted operating range shown in Figs 19 and 20 the required heatsink is found as follows:

$$R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a} = \frac{T_{j\ max} - T_{amb}}{P_s + \delta \cdot P_{RRM}}$$

where: $T_{j\ max}$ = 175 ^oC
T_{amb} = ambient temperature
P_s = any steady-state dissipation excluding that in pulses
δ = duty factor (t_p/T)
$R_{th\ j\text{-}mb}$ = 5 $^oC/W$
$R_{th\ mb\text{-}h}$ = 0,6 $^oC/W$

Thus $R_{th\ h\text{-}a}$ can be found.

Notes

1. The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.
2. The maximum clamping voltage is the maximum reverse voltage which appears across the diode at the specified pulse duration and junction temperature. For square pulses see Figs 15 and 16, for exponential pulses see Figs 17 and 18.
3. Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that the energy content does not continue beyond twice this time.

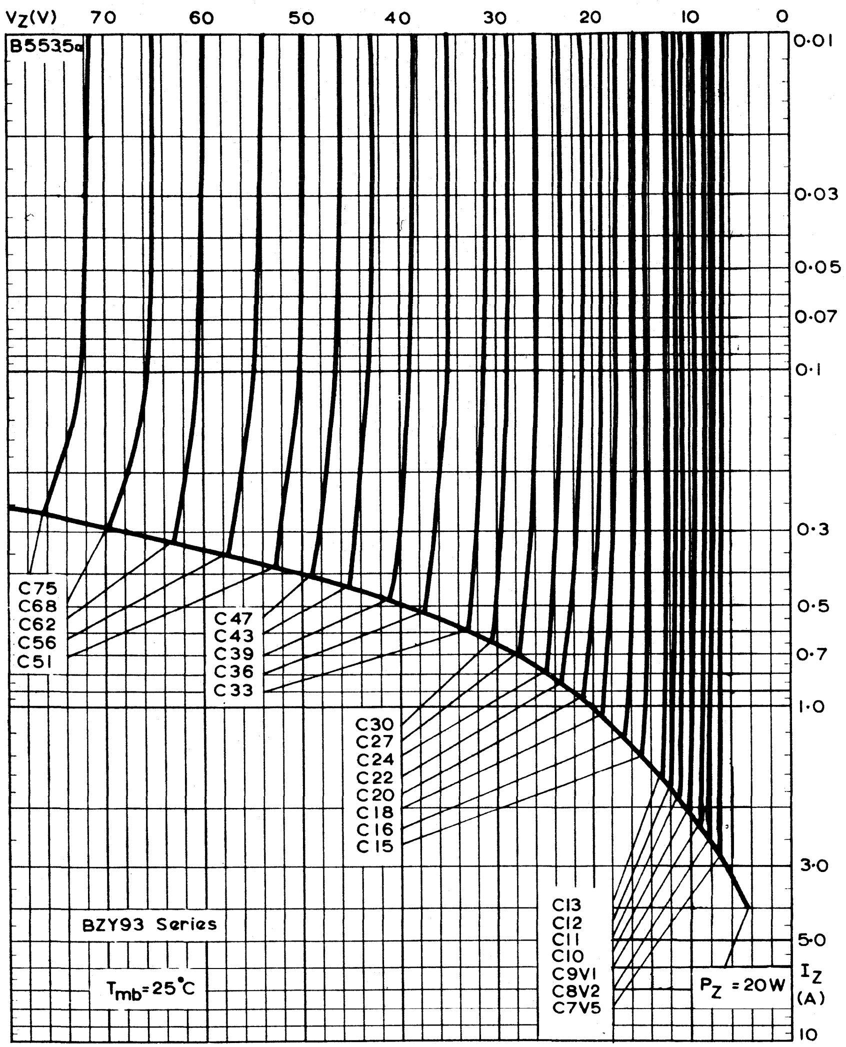


Fig. 3 Typical static zener characteristics.

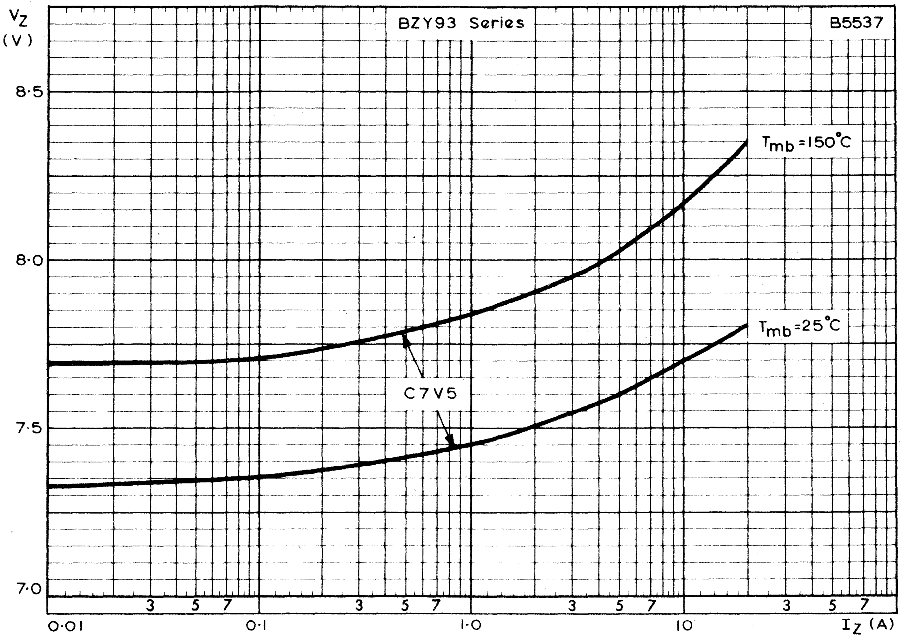


Fig. 4 Typical dynamic zener characteristics for BZY93-C7V5.

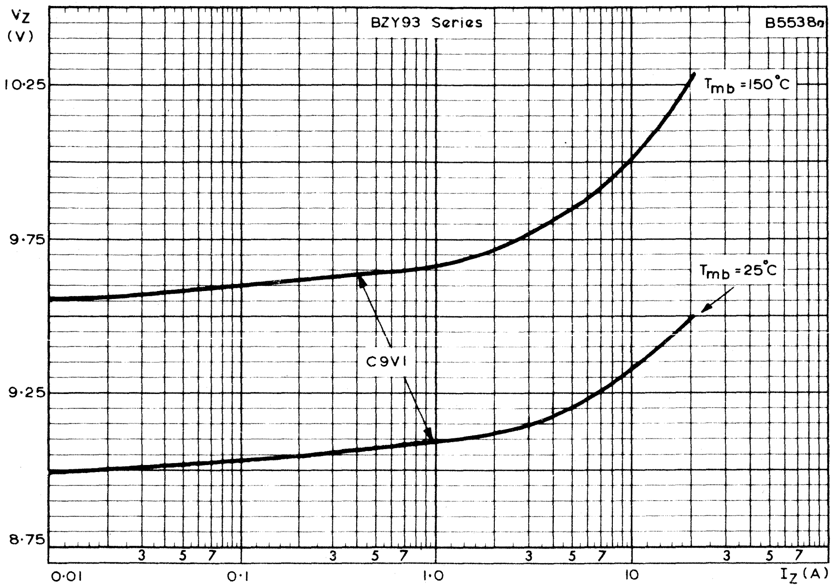


Fig. 5 Typical dynamic zener characteristics for BZY93-C9V1.

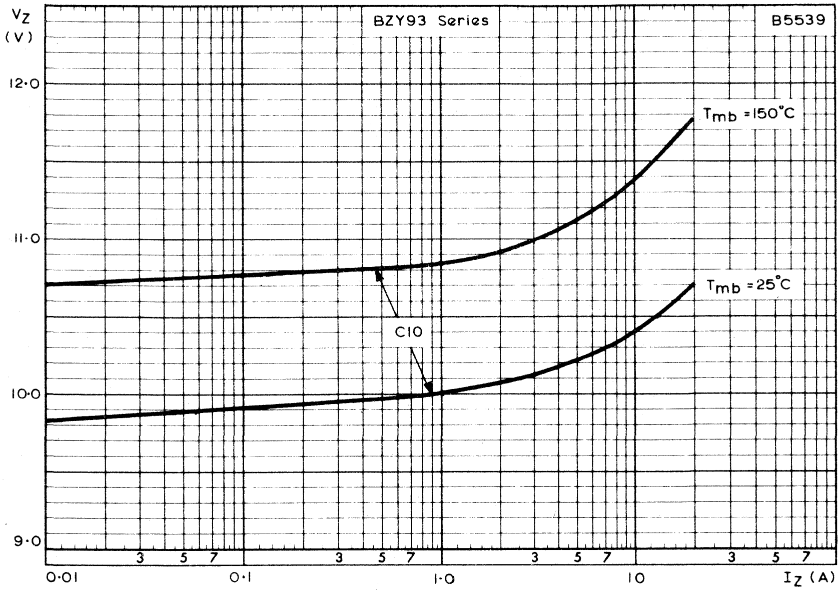


Fig. 6 Typical dynamic zener characteristics for BZY93-C10.

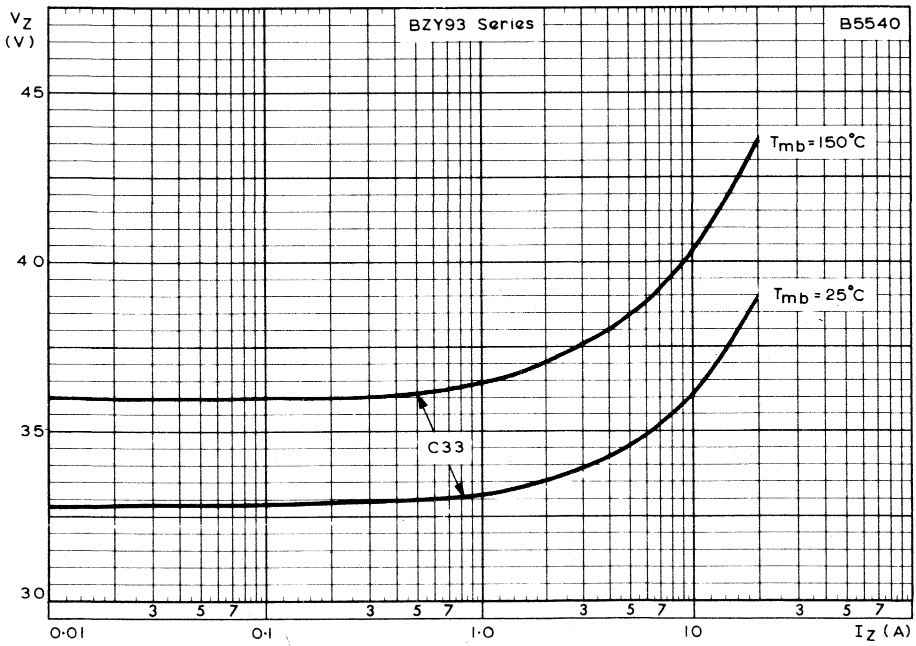


Fig. 7 Typical dynamic zener characteristics for BZY93-C33.

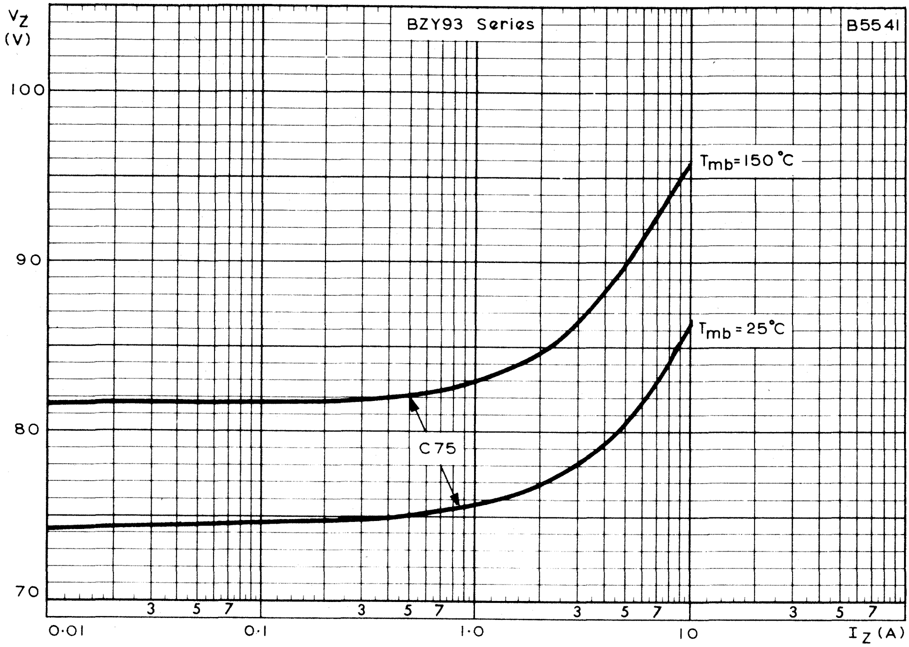


Fig. 8 Typical dynamic zener characteristics for BZY93-C75.

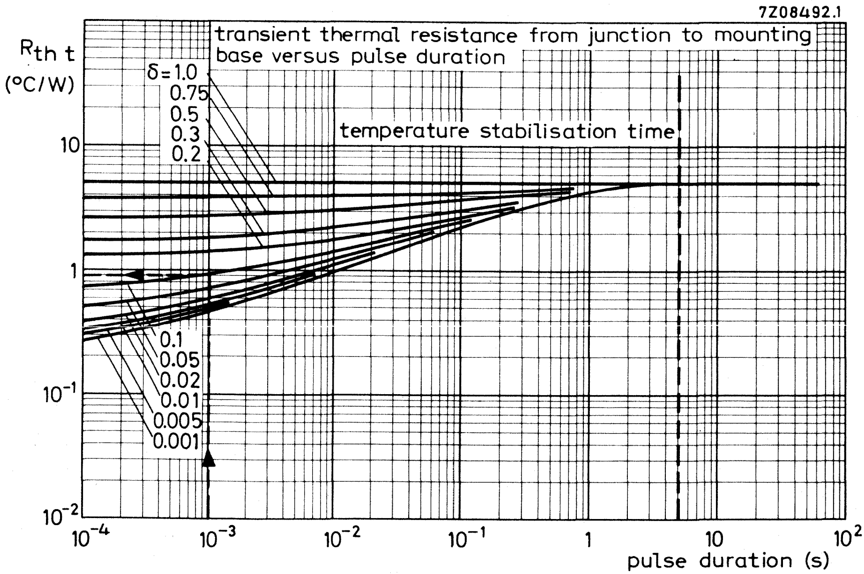


Fig. 9.

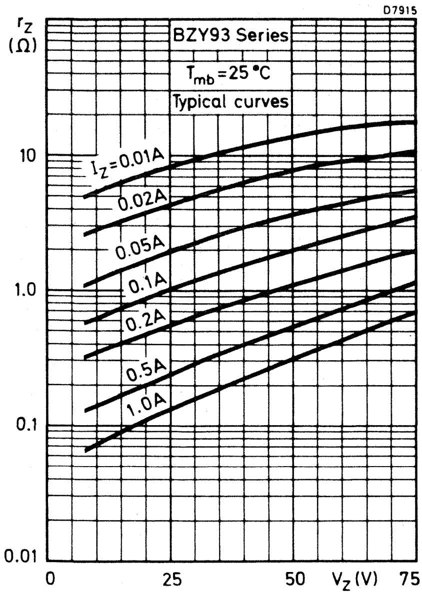


Fig. 10.

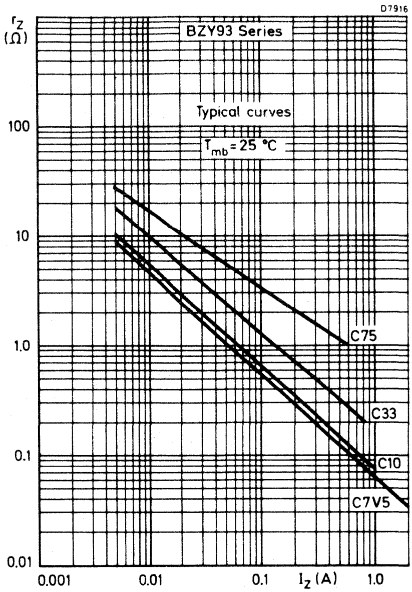


Fig. 11.

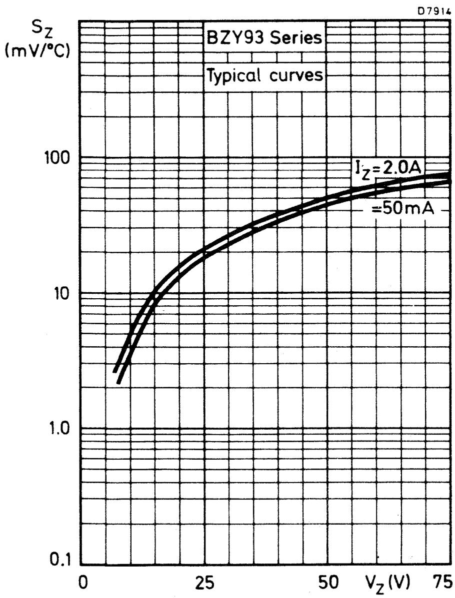


Fig. 12.

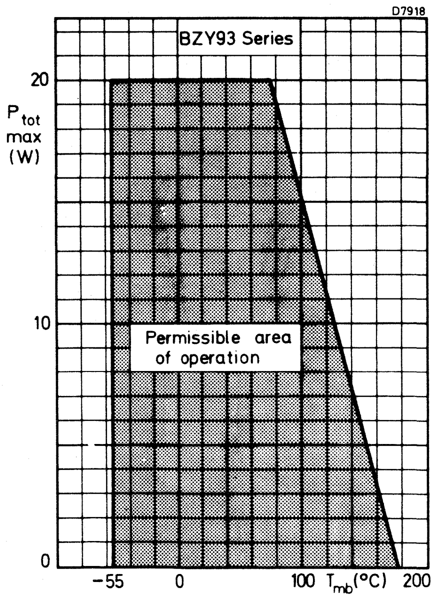


Fig. 13.

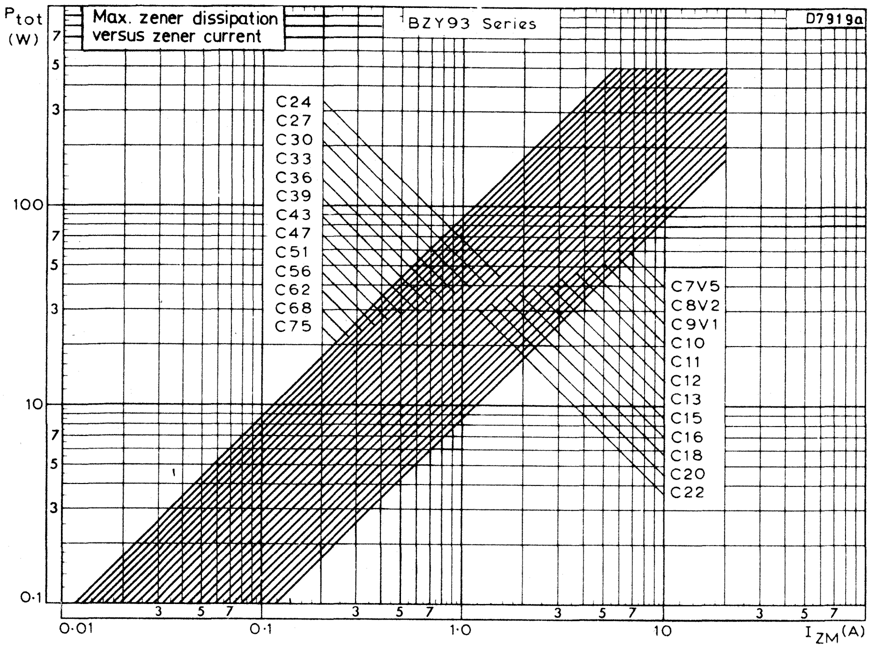


Fig. 14 Maximum permissible repetitive peak dissipation ($P_{tot} = P_{ZRM}$).

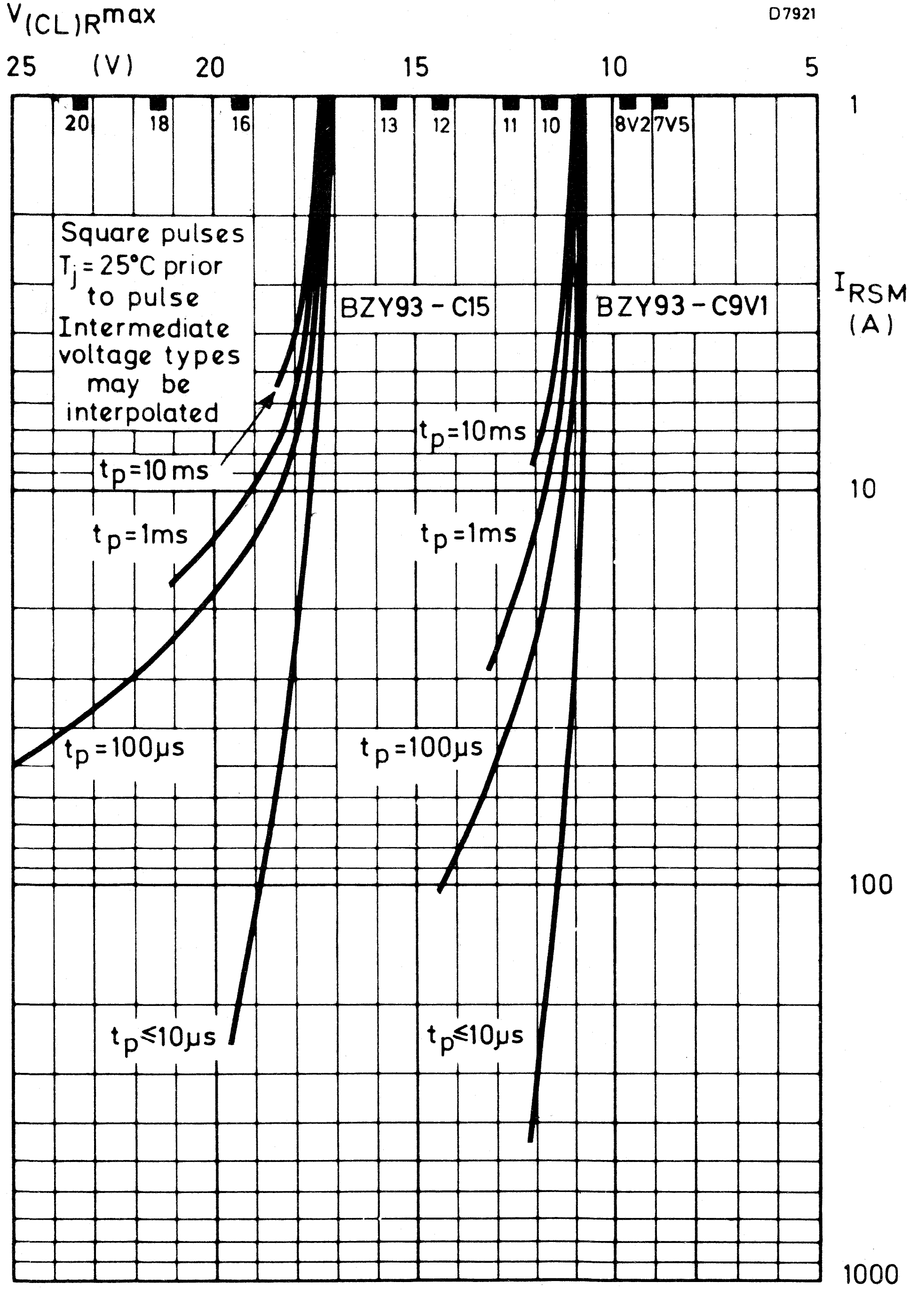

D7921
$V_{(CL)R}$max
(V)
25
20
15
10
5
20
18
16
13
12
11
10
8V2
7V5
1
10
100
1000
I_{RSM}
(A)
Square pulses
T_j = 25°C prior to pulse
Intermediate voltage types may be interpolated
BZY93 - C15
BZY93 - C9V1
t_p=10 ms
t_p=1ms
t_p=100µs
t_p≤10µs
t_p=10ms
t_p=1ms
t_p=100µs
t_p≤10µs

Fig. 15.

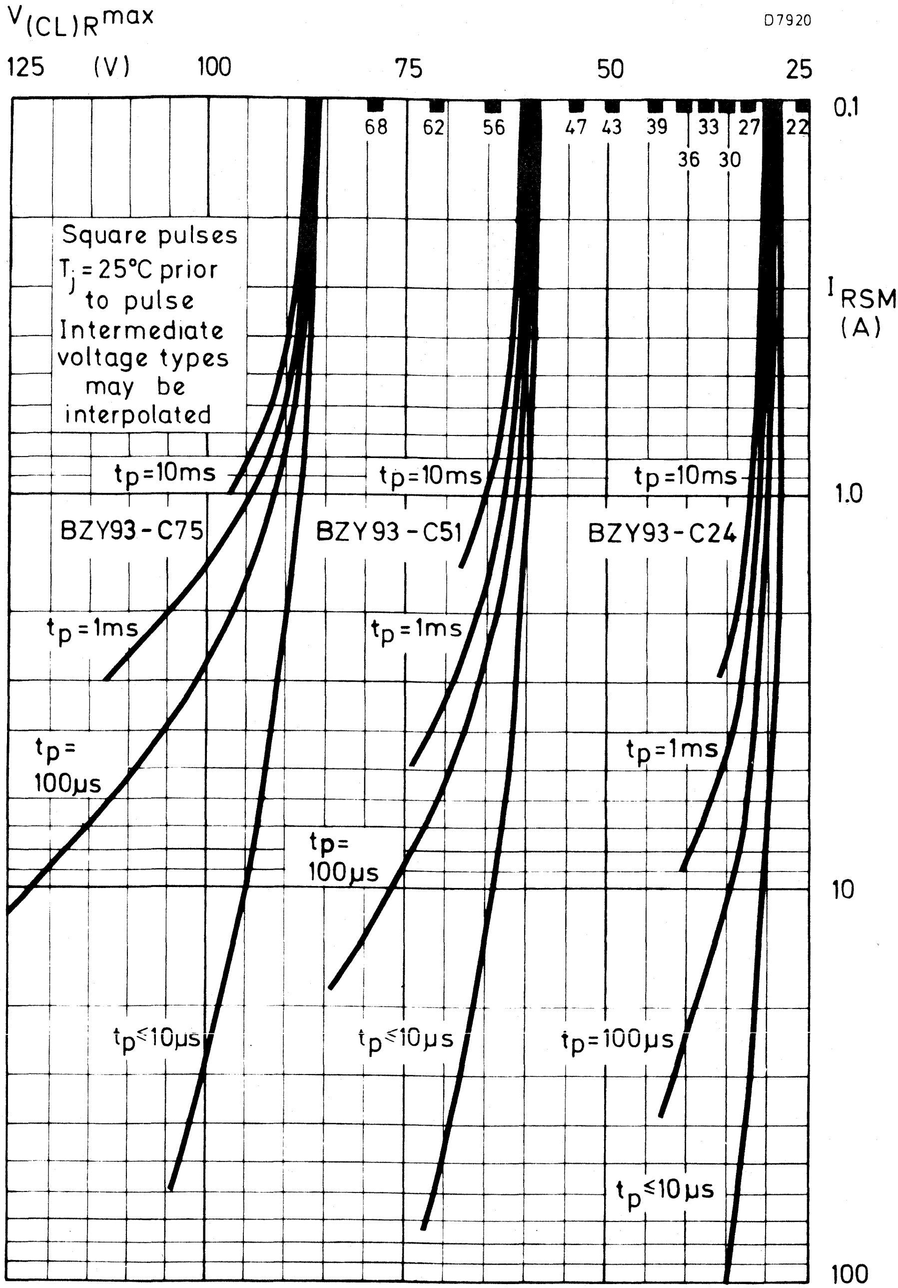

D7920
$V_{(CL)R}$max
(V)
125
100
75
50
25
68
62
56
47
43
39
33
27
22
36
30
0.1
1.0
10
100
I_{RSM}
(A)
Square pulses
T_j = 25°C prior to pulse
Intermediate voltage types may be interpolated
tp=10ms
tp=10ms
tp=10ms
BZY93-C75
BZY93-C51
BZY93-C24
tp=1ms
tp=1ms
tp=1ms
tp= 100µs
tp= 100µs
tp=100µs
tp≤10µs
tp≤10µs
tp≤10µs

Fig. 16.

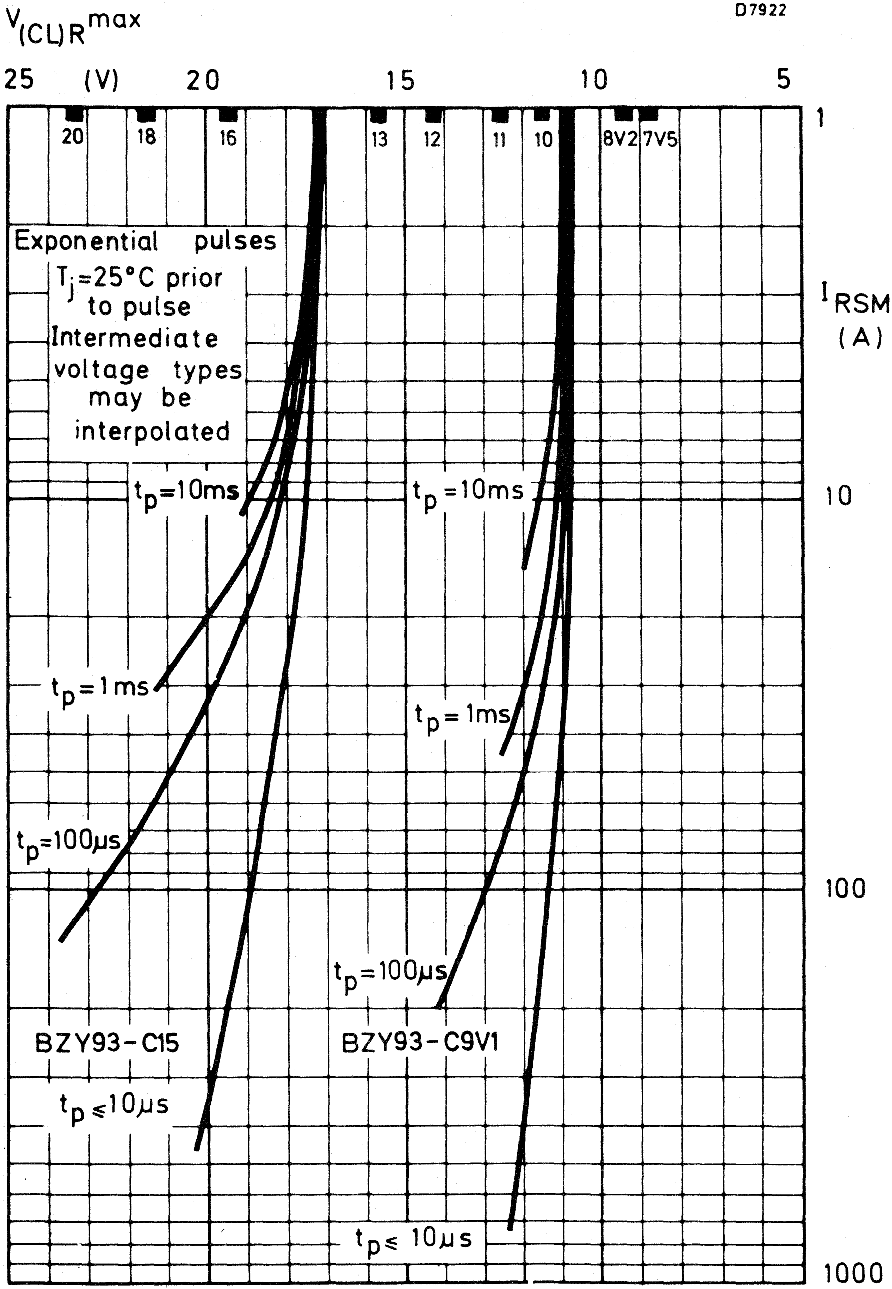

D7922
$V_{(CL)R}$ max
25 (V) 20 15 10 5
20 18 16 13 12 11 10 8V2 7V5
Exponential pulses
T_j=25°C prior to pulse
Intermediate voltage types may be interpolated
t_p=10ms
t_p=1ms
t_p=100µs
t_p≤10µs
BZY93-C15
BZY93-C9V1
I_{RSM} (A)
1
10
100
1000

Fig. 17.

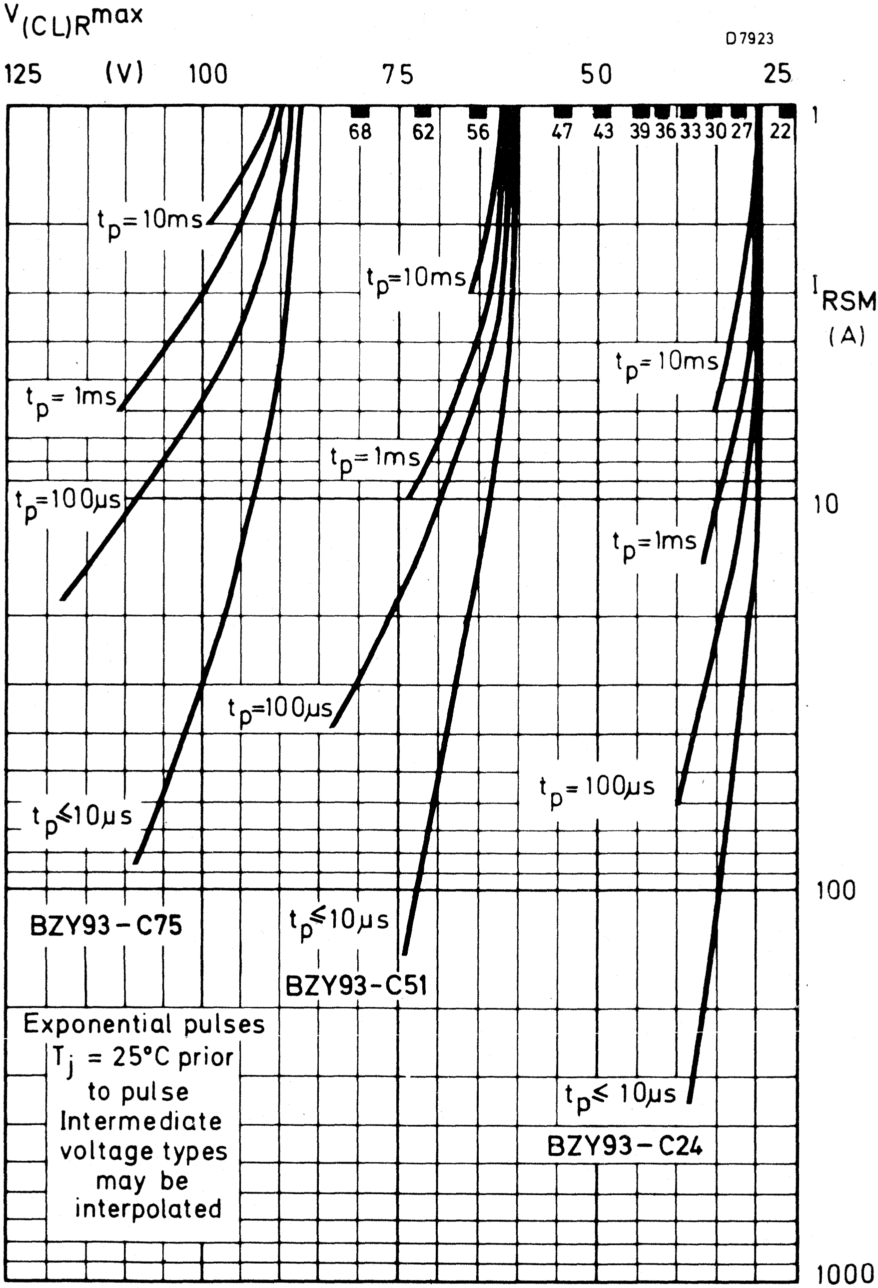

V(CL)Rmax
D7923
125
(V)
100
75
50
25
68
62
56
47
43
39
36
33
30
27
22
1
10
100
1000
IRSM
(A)
tp=10ms
tp= 1ms
tp=100μs
tp≤10μs
BZY93-C75
tp=10ms
tp=1ms
tp=100μs
tp≤10μs
BZY93-C51
tp= 10ms
tp=1ms
tp= 100μs
tp≤ 10μs
BZY93-C24
Exponential pulses
Tj = 25°C prior to pulse
Intermediate voltage types may be interpolated

Fig. 18.

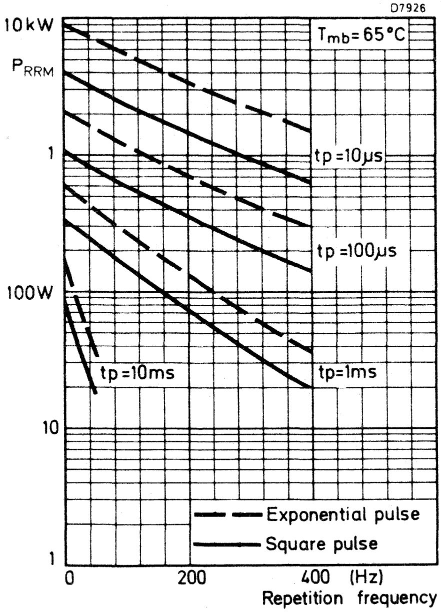


Fig. 19.

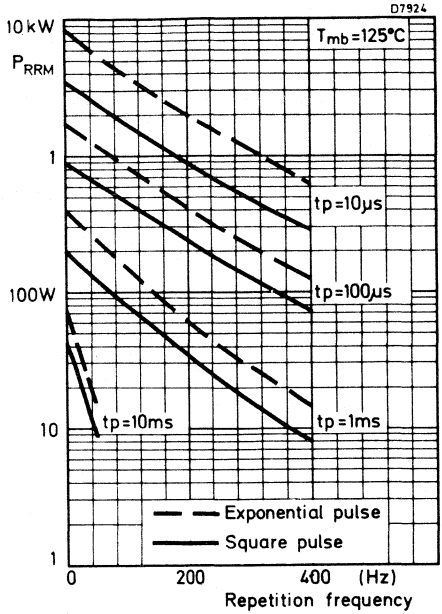


Fig. 20.

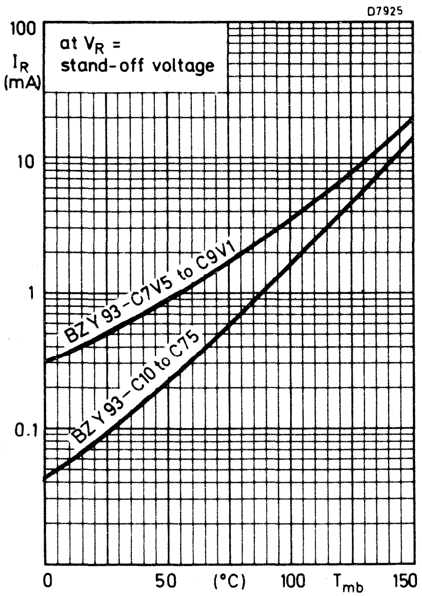


Fig. 21.

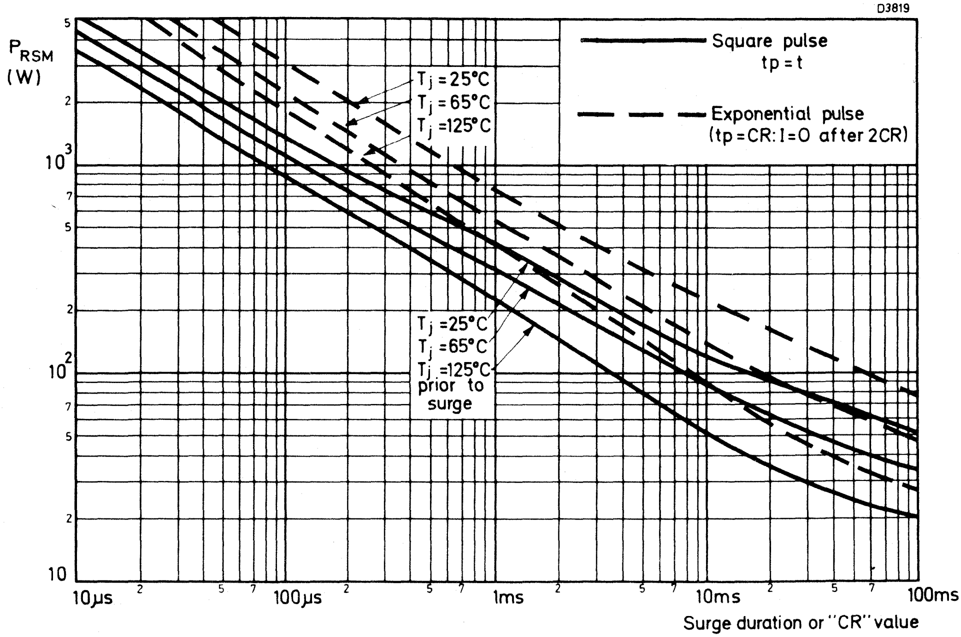

D3819
P_{RSM} (W)
5
2
10^3
7
5
2
10^2
7
5
2
10
10μs
2
5
7
100μs
2
5
7
1ms
2
5
7
10ms
2
5
7
100ms
Surge duration or "CR" value
Square pulse tp = t
Exponential pulse (tp = CR: I = 0 after 2CR)
T_j = 25°C
T_j = 65°C
T_j = 125°C
T_j = 25°C
T_j = 65°C
T_j = 125°C prior to surge

Fig. 22.

REGULATOR DIODES

A range of diffused silicon diodes in DO-1 envelopes, intended for use as voltage regulator and transient suppressor diodes in medium power regulators and transient suppression circuits.

The series consists of the following types: BZY95-C10 to BZY95-C75.

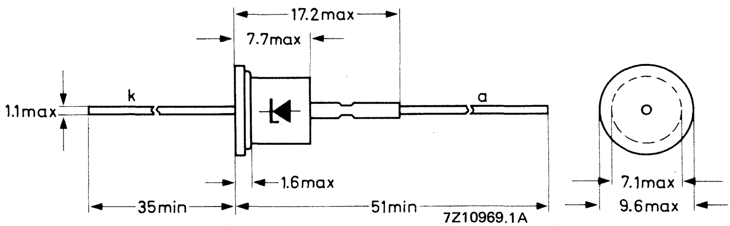
QUICK REFERENCE DATA

			voltage regulator	transient suppressor	
Working voltage (5% range)	V_Z	nom.	10 to 75	—	V
Stand-off voltage	V_R		—	7,5 to 56	V
Total power dissipation	P_{tot}	max.	1,5	—	W
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	—	700	W

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-1.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Peak working current	I_{ZM}	max.	5 A
Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	1 A
Non-repetitive peak reverse current T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse); BZY95-C10 to BZY95-C75	I_{RSM}	max.	70 to 5 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5 W
at T_{amb} = 75 °C	P_{tot}	max.	1 W
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse)	P_{RSM}	max.	700 W

Maximum recommended stand-off voltage (V_R)

	V_R (V)		V_R (V)		V_R (V)		V_R (V)		V_R (V)
BZY95-C10	7,5	-C16	12	-C27	20	-C43	33	-C68	51
-C11	8,2	-C18	13	-C30	22	-C47	36	-C75	56
-C12	9,1	-C20	15	-C33	24	-C51	39		
-C13	10	-C22	16	-C36	27	-C56	43		
-C15	11	-C24	18	-C39	30	-C62	47		

Storage temperature	T_{stg}		−65 to + 175 °C
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-points.

Thermal resistance from junction to ambient in free air:

mounted on soldering tags

at lead length a = 10 mm $R_{th\ j\text{-}a}$ = 60 °C/W

at lead length a = maximum $R_{th\ j\text{-}a}$ = 70 °C/W

mounted on a printed-circuit board

at lead length a = maximum $R_{th\ j\text{-}a}$ = 80 °C/W

at lead length a = 10 mm $R_{th\ j\text{-}a}$ = 90 °C/W

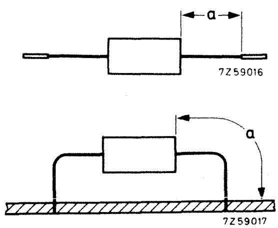


Fig. 2.

CHARACTERISTICS

Forward voltage

I_F = 1 A; T_{amb} = 25 °C V_F < 1,5 V

CHARACTERISTICS

T_{amb} = 25 °C

BZY95-. . .	working voltage V_Z (V) *		differential resistance r_Z (Ω) *		temperature coefficient S_Z (mV/°C) *	V_Z, r_Z, S_Z at I_Z (mA)
	min.	max.	typ.	max.	typ.	
C10	9,4	10,6	0,75	4,0	7,0	50
C11	10,4	11,6	0,80	4,5	7,5	50
C12	11,4	12,7	0,85	5,0	8,0	50
C13	12,4	14,1	0,90	6,0	8,5	50
C15	13,8	15,6	1,0	8,0	10	50
C16	15,3	17,1	2,4	9	11	20
C18	16,8	19,1	2,5	11	12	20
C20	18,8	21,2	2,8	12	14	20
C22	20,8	23,3	3,0	13	16	20
C24	22,7	25,9	3,4	14	18	20
C27	25,1	28,9	3,8	18	20	20
C30	28	32	4,5	22	25	20
C33	31	35	5,0	25	30	20
C36	34	38	5,5	30	32	20
C39	37	41	12	35	35	10
C43	40	46	13	40	40	10
C47	44	50	14	50	45	10
C51	48	54	15	55	50	10
C56	52	60	17	63	55	10
C62	58	66	18	75	60	10
C68	64	72	18	90	65	10
C75	70	79	20	100	70	10

* Measured using a pulse method with $t_p \leqslant 100\ \mu s$ and $\delta \leqslant 0{,}001$ so that the values correspond to a T_j of approximately 25 °C.

CHARACTERISTICS

reverse current at	reverse voltage	clamping voltage at t_p = 500 µs; exp. pulse		non-repetitive peak reverse current	BZW95 types have 15% tolerance — they may be replaced by 5% BZY95 types if required	
I_R (µA)	V_R (V)	$V_{(CL)R}$ (V)		I_{RSM} (A)	BZY95-	BZW95-
max.		typ.	max.			
10	6,8	11	12,5	20	C10	7V5
10	7,5	12,3	14	20	C11	8V2
10	8,2	14	16	20	C12	9V1
10	9,1	15,3	17,5	20	C13	10
10	10	17	19,5	20	C15	11
10	11	19,3	22	20	C16	12
10	12	21	24	20	C18	13
10	13	23	27	10	C20	15
10	15	26	30	10	C22	16
10	16	29	34	10	C24	18
10	18	33	39	10	C27	20
10	20	38	44	10	C30	22
10	22	42	50	10	C33	24
10	24	47	56	10	C36	27
10	27	40	47	5	C39	30
10	30	45	52	5	C43	33
10	33	51	59	5	C47	36
10	36	57	66	5	C51	39
10	39	64	75	5	C56	43
10	43	73	85	5	C62	47
10	47	81	94	5	C68	51
10	51	90	105	5	C75	56

OPERATION AS A VOLTAGE REGULATOR

Dissipation and heatsink considerations

a. Steady-state conditions

The maximum permissible steady-state dissipation $P_{s\,max}$ is given by the relationship

$$P_{s\,max} = \frac{T_{j\,max} - T_{amb}}{R_{th\,j\text{-}a}}$$

where: $T_{j\,max}$ is the maximum permissible operating junction temperature
T_{amb} is the ambient temperature
$R_{th\,j\text{-}a}$ is the total thermal resistance from junction to ambient

b. Pulse conditions (see Fig. 3)

The maximum permissible pulse power $P_{p\,max}$ is given by the formula

$$P_{p\,max} = \frac{(T_{j\,max} - T_{amb}) - (P_s \cdot R_{th\,j\text{-}a})}{R_{th\,t}}$$

where: P_s is any steady-state dissipation excluding that in pulses.
$R_{th\,t}$ is the effective transient thermal resistance of the device between junction and ambient. It is a function of the pulse duration t_p and duty factor δ.
δ is the duty factor (t_p/T).

The steady-state power P_s when biased in the zener direction at a given zener current can be found from Fig. 4. With the additional pulse power dissipation $P_{p\,max}$ calculated from the above expression, the total peak zener power dissipation $P_{tot} = P_{ZRM} = P_s + P_p$. From Fig. 4 the corresponding maximum repetitive peak zener current at P_{tot} can now be read. This repetitive peak zener current is subject to the absolute maximum rating. For pulse durations longer than the temperature stabilization time of the diode t_{stab}, the maximum permissible repetitive peak dissipation P_{ZRM} is equal to the steady-state power P_s. The temperature stabilization time for the BZY95 is 100 seconds (see Fig. 10).

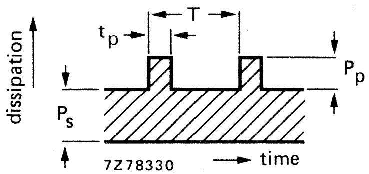


Fig. 3.

NOTES WHEN OPERATING AS A TRANSIENT SUPPRESSOR

1. The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.
2. The maximum clamping voltage is the maximum reverse voltage which appears across the diode at the specified pulse duration and junction temperature. For square pulses see Figs 14 and 15, for exponential pulses see Figs 16 and 17.
3. Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that the energy content does not continue beyond twice this time.

SOLDERING AND MOUNTING INSTRUCTIONS

1. When using a soldering iron, diodes may be soldered directly into the circuit, but heat conducted to the junction should be kept to a minimum.
2. Diodes may be dip-soldered at a solder temperature of 245 ^{o}C for a maximum soldering time of 5 seconds. The case temperature during dip-soldering must not at any time exceed the maximum storage temperature. These recommendations apply to a diode with the anode end mounted flush on a printed-circuit board having punched-through holes. For mounting the anode end onto a printed-circuit board, the diode must be spaced at least 5 mm from the underside of the printed-circuit board having punched-through holes, or 5 mm from the top of the printed-circuit board having plated-through holes.
3. Care should be taken not to bend the leads nearer than 1,5 mm from the seal; exert no axial pull when bending.

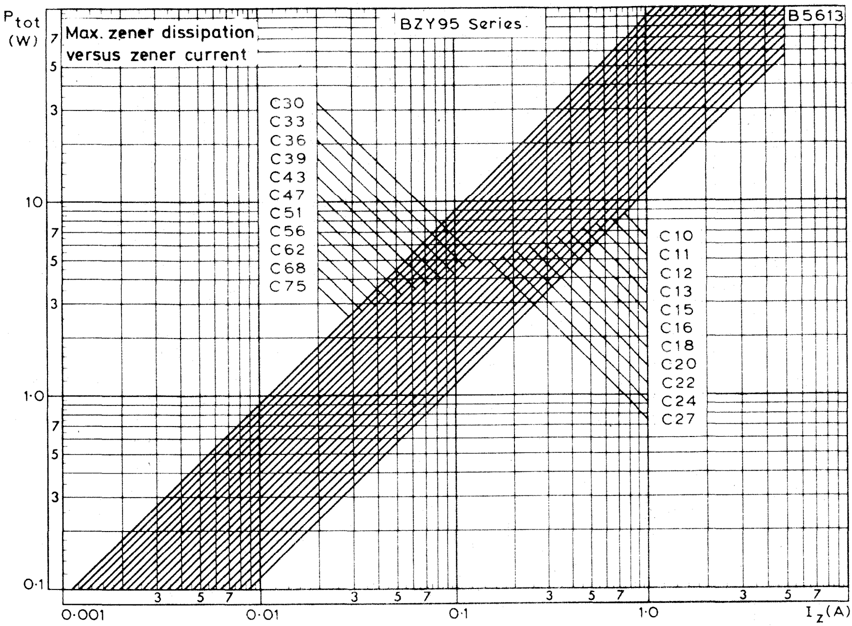


Fig. 4 Maximum permissible repetitive peak dissipation ($P_{tot} = P_{ZRM}$).

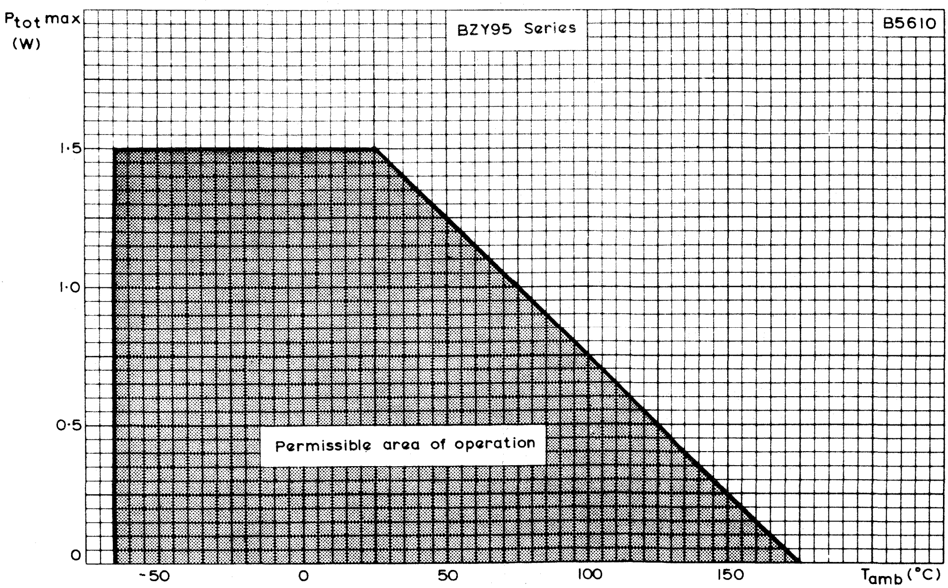


Fig. 5 Maximum permissible total power dissipation versus ambient temperature.

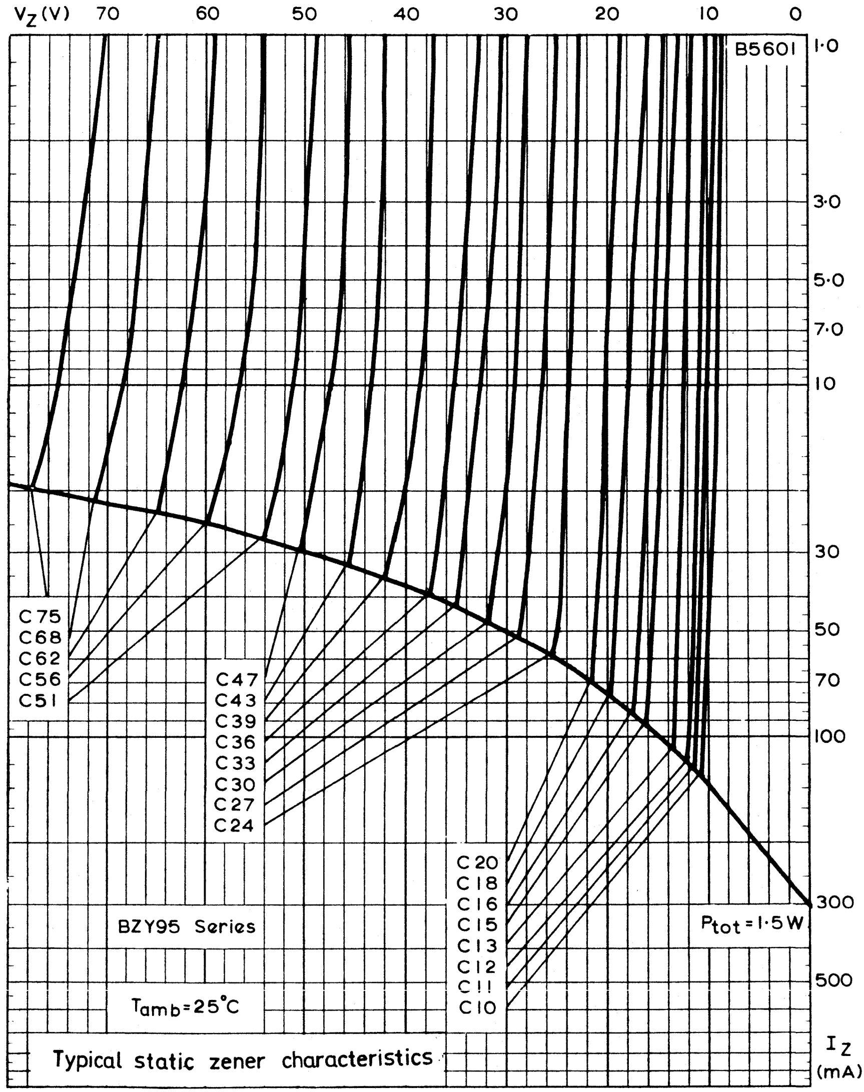


Fig. 6 Typical static zener characteristics.

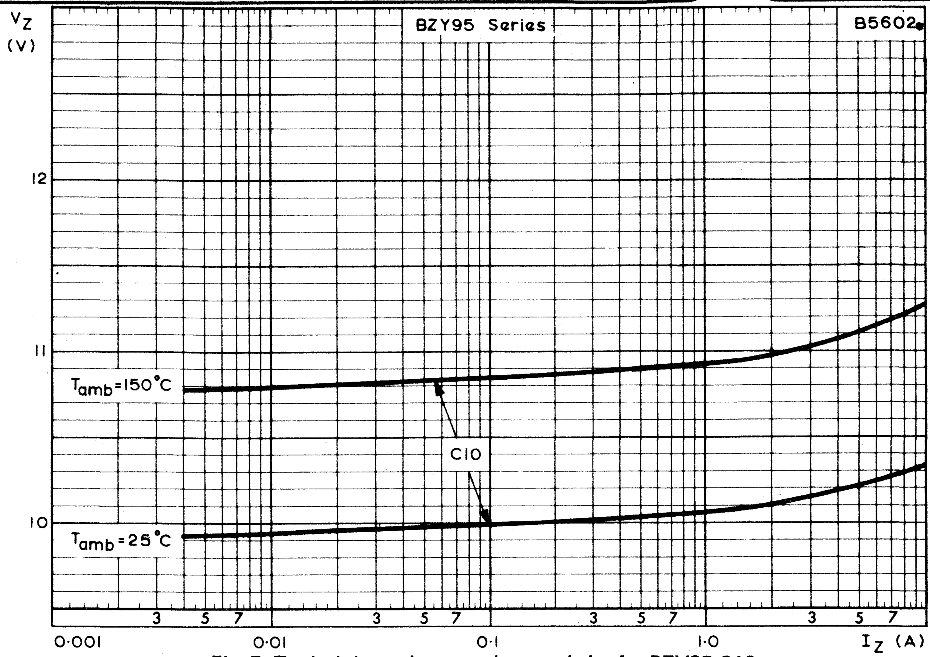


Fig. 7 Typical dynamic zener characteristics for BZY95-C10.

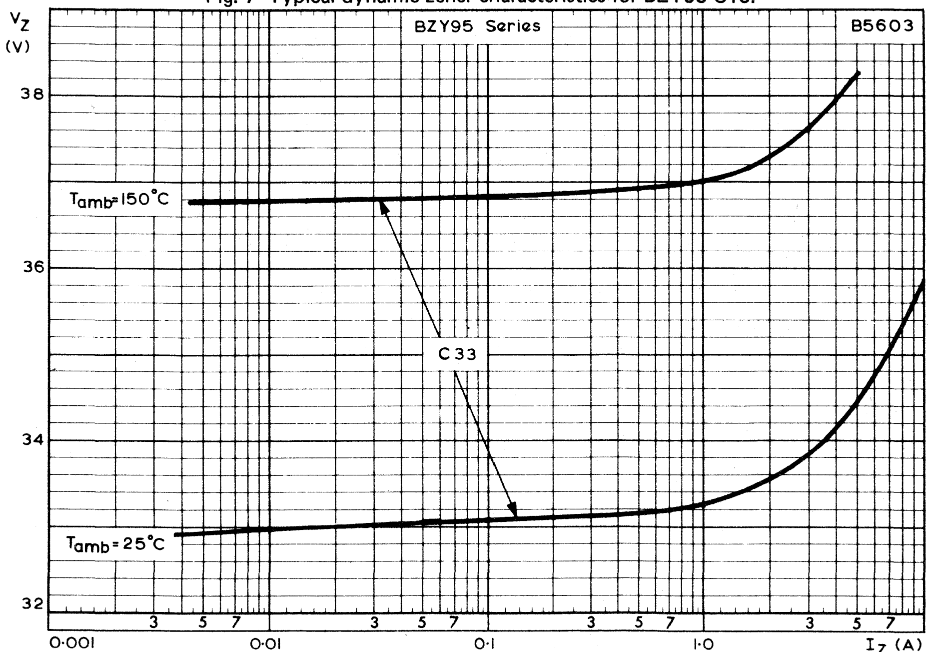


Fig. 8 Typical dynamic zener characteristics for BZY95-C33.

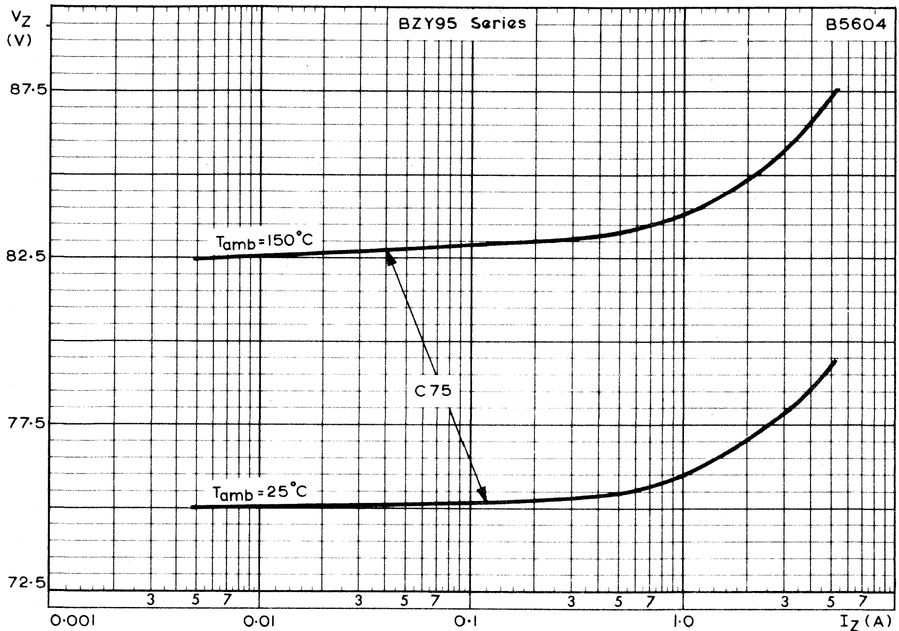


Fig. 9 Typical dynamic zener characteristics for BZY95-C75.

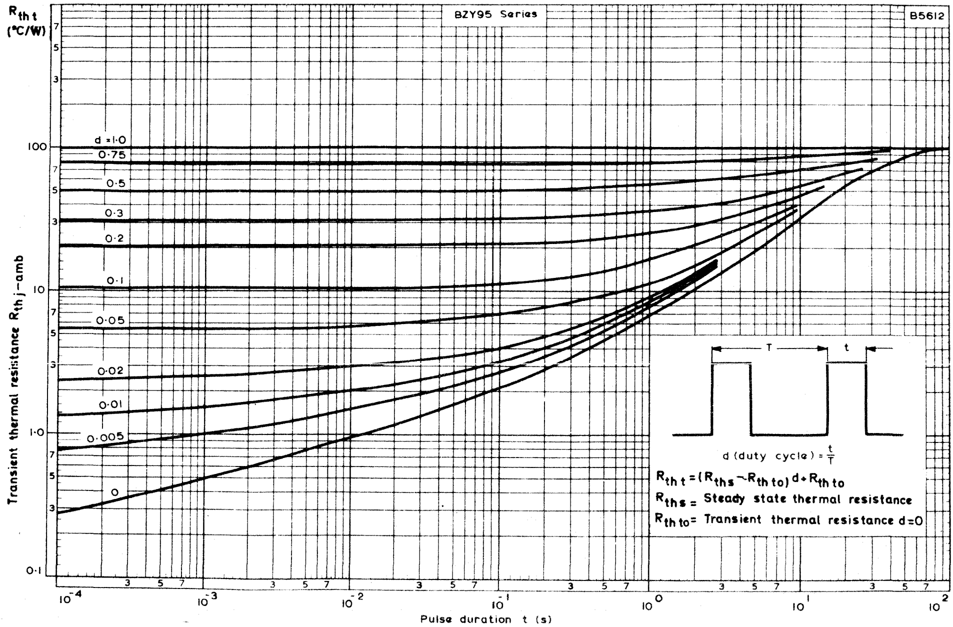


Fig. 10.

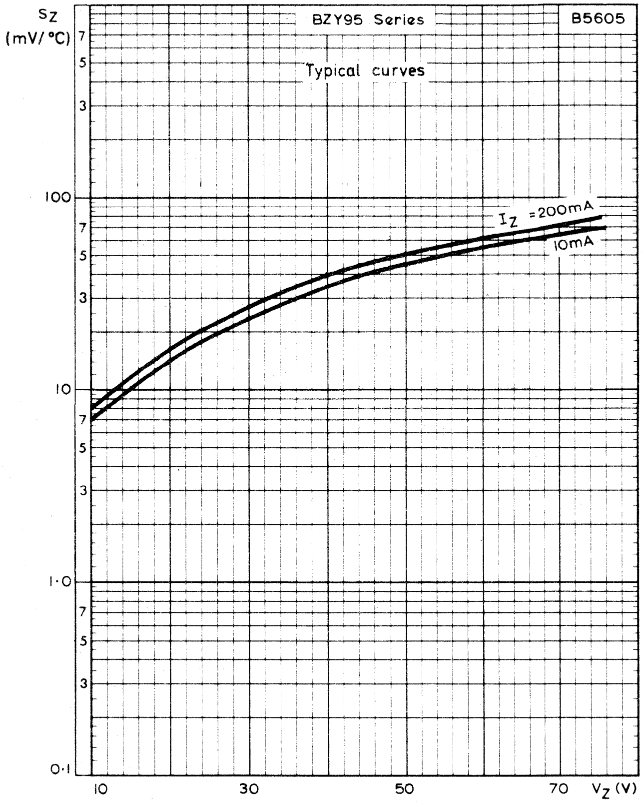

BZY95 Series
B5605
Typical curves
S_Z (mV/°C)
I_Z =200mA
10mA
100
10
1·0
0·1
7
5
3
10
30
50
70
V_Z (V)

Fig. 11.

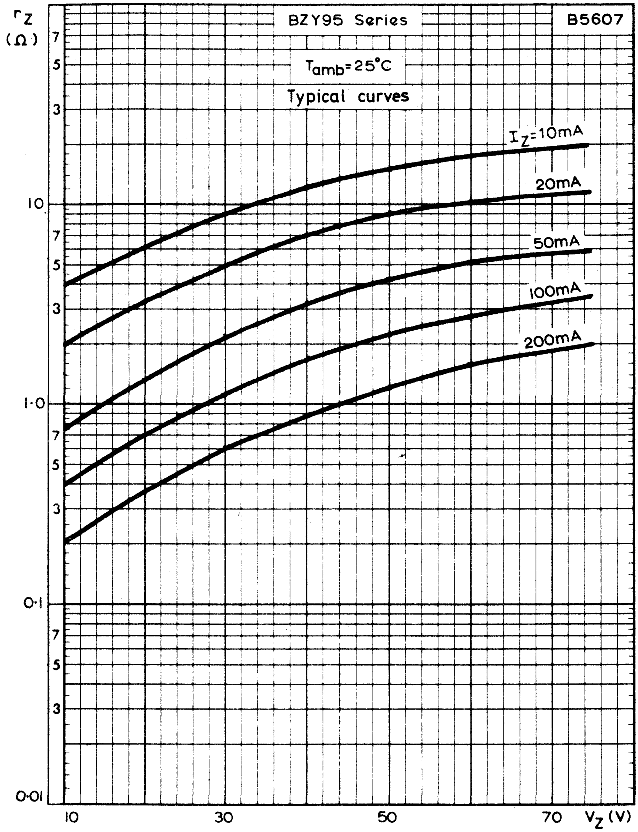

BZY95 Series
B5607
T_{amb}=25°C
Typical curves
I_Z=10mA
20mA
50mA
100mA
200mA
r_Z (Ω)
10
1·0
0·1
0·01
7
5
3
10
30
50
70
V_Z (V)

Fig. 12.

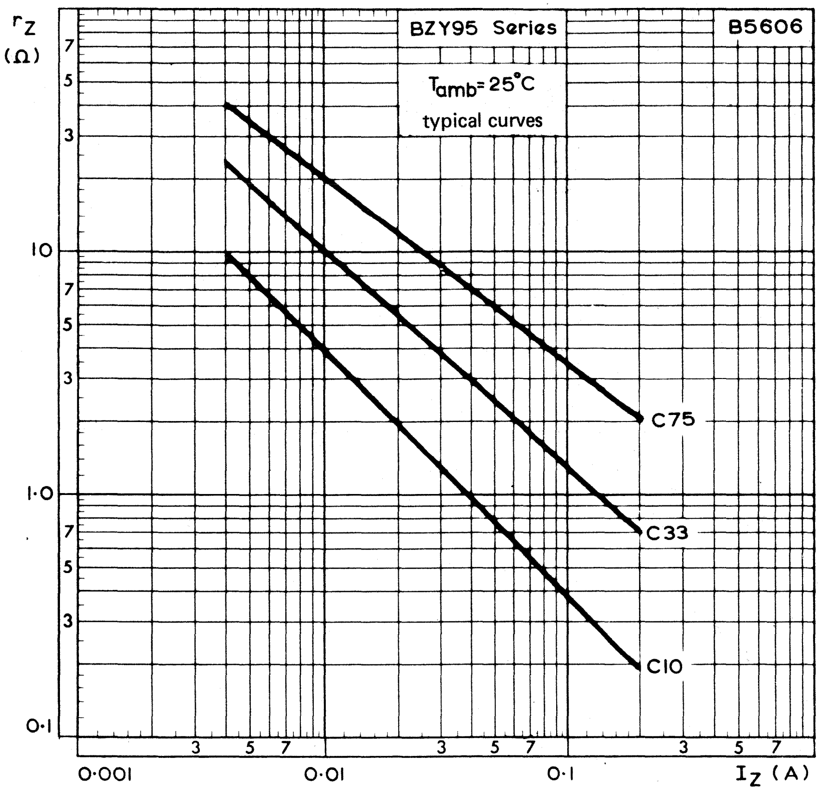

BZY95 Series
B5606
T_{amb} = 25°C
typical curves
r_Z (Ω)
10
1·0
0·1
7
5
3
C75
C33
C10
0·001
0·01
0·1
I_Z (A)

Fig. 13.

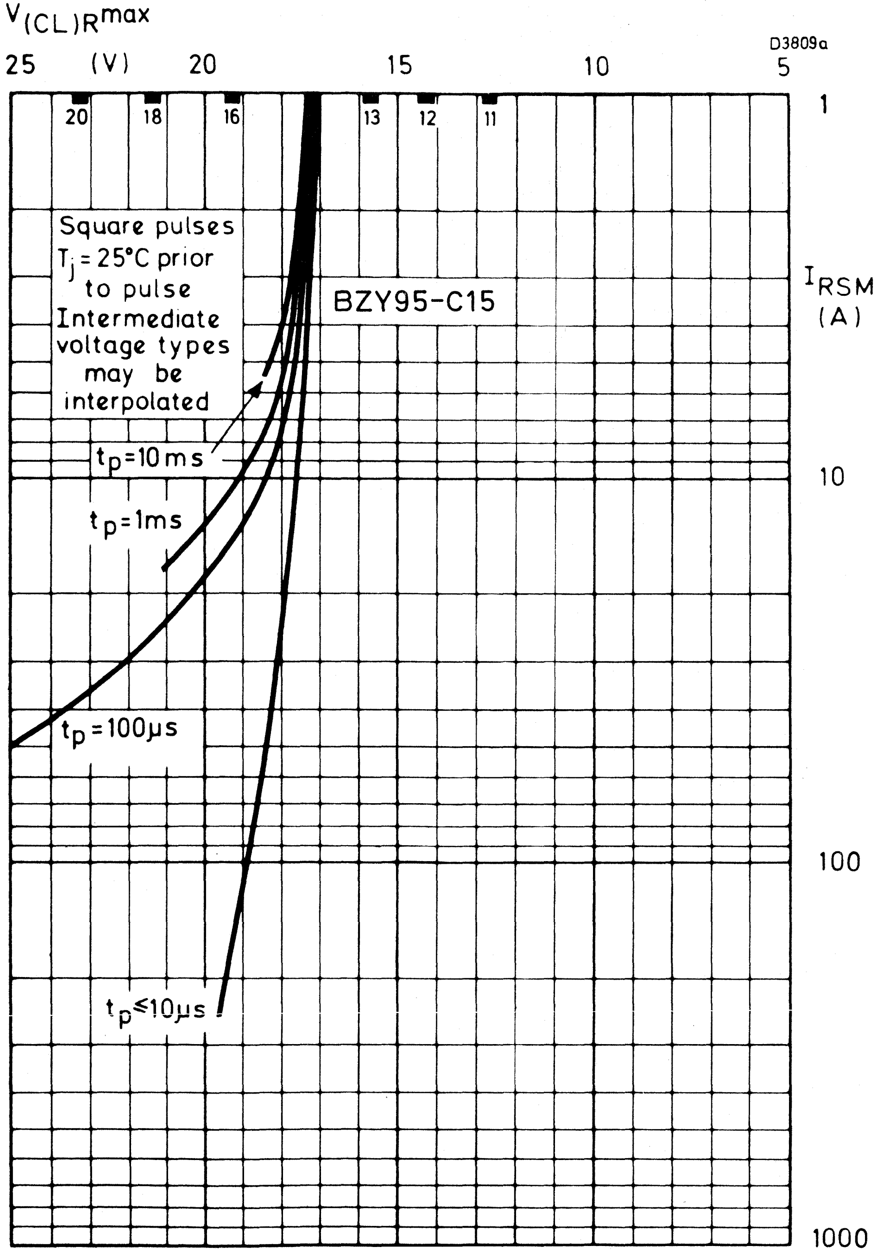

V(CL)R max
(V)
25
20
15
10
5
D3809a
20
18
16
13
12
11
1
10
100
1000
IRSM
(A)
Square pulses
Tj = 25°C prior
to pulse
Intermediate
voltage types
may be
interpolated
BZY95-C15
tp=10ms
tp=1ms
tp=100μs
tp≤10μs

Fig. 14.

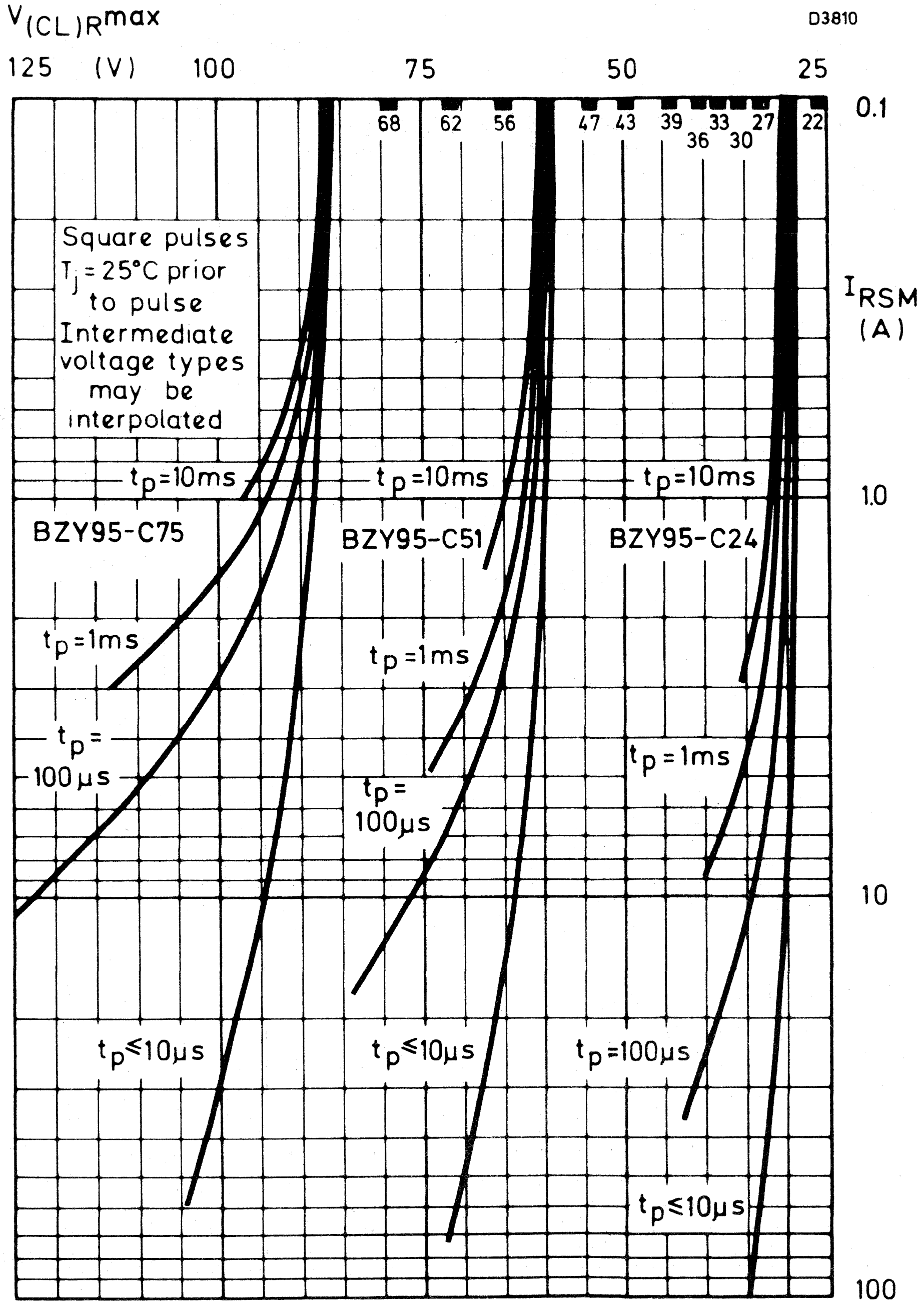

$V_{(CL)R}max$
D3810
125 (V) 100 75 50 25
68 62 56 47 43 39 36 33 30 27 22
0.1
1.0
10
100
I_{RSM} (A)
Square pulses T_j = 25°C prior to pulse Intermediate voltage types may be interpolated
t_p=10ms
t_p=10ms
t_p=10ms
BZY95-C75
BZY95-C51
BZY95-C24
t_p=1ms
t_p=1ms
t_p=1ms
t_p= 100µs
t_p= 100µs
t_p=100µs
t_p≤10µs
t_p≤10µs
t_p≤10µs

Fig. 15.

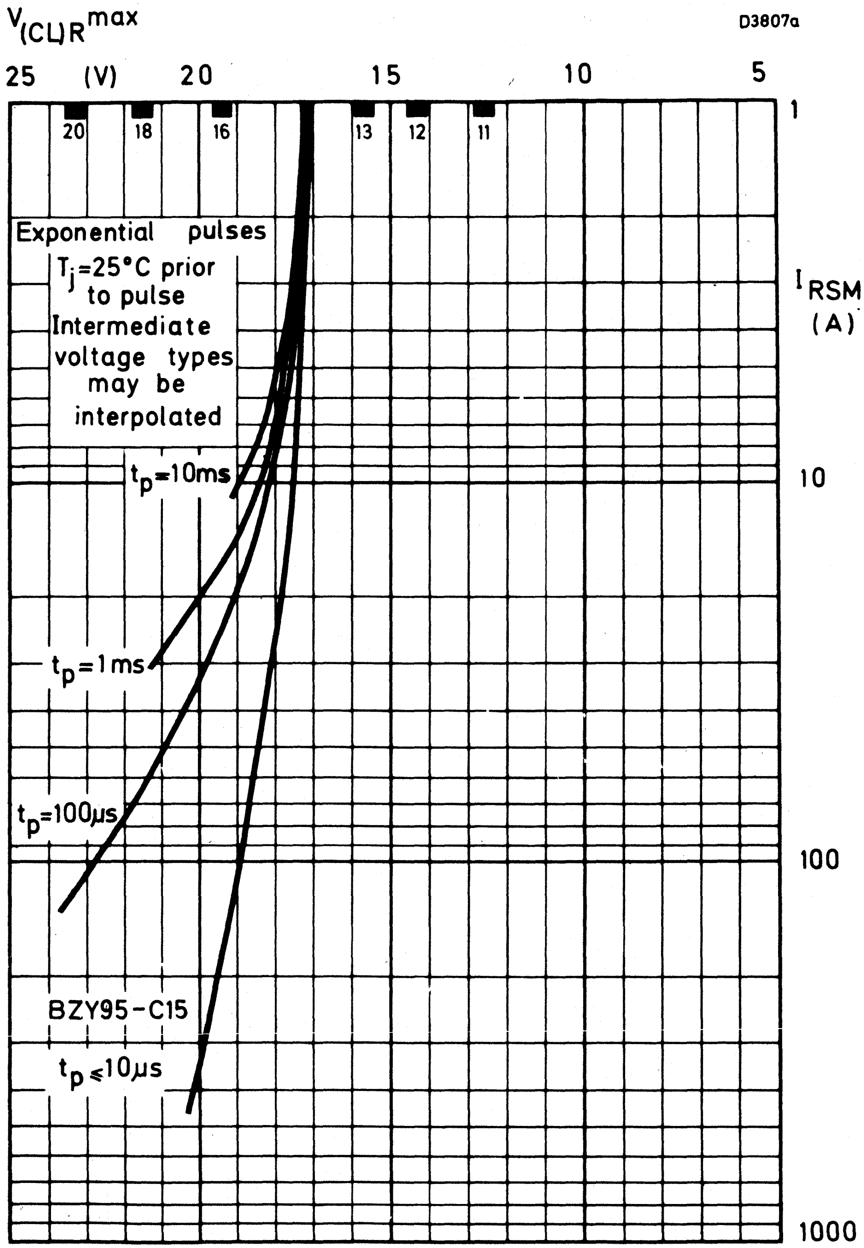

D3807a
$V_{(CL)R}$max
25 (V) 20 15 10 5
20
18
16
13
12
11
Exponential pulses
T_j=25°C prior to pulse
Intermediate voltage types may be interpolated
t_p=10ms
t_p=1ms
t_p=100µs
BZY95-C15
t_p≤10µs
1
10
100
1000
I_{RSM} (A)

Fig. 16.

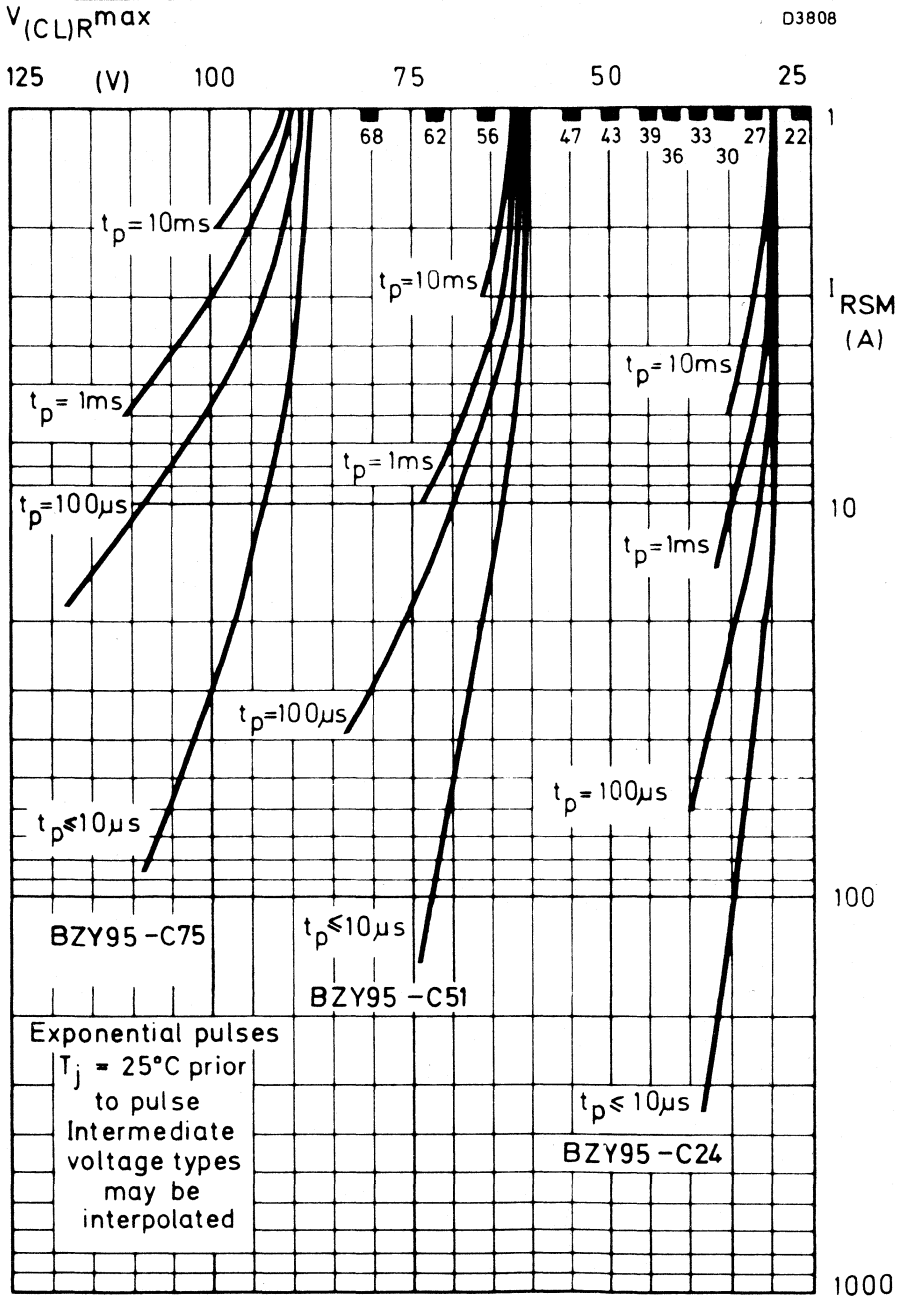

D3808
V(CL)Rmax
125 (V) 100 75 50 25
68 62 56 47 43 39 36 33 30 27 22
1
10
100
1000
IRSM (A)
tp=10ms
tp= 1ms
tp=100µs
tp≤10µs
BZY95-C75
BZY95-C51
BZY95-C24
Exponential pulses
Tj = 25°C prior to pulse
Intermediate voltage types may be interpolated

Fig. 17.

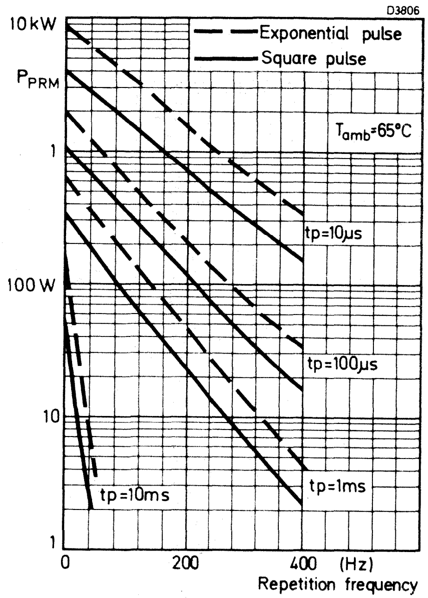


Fig. 18.

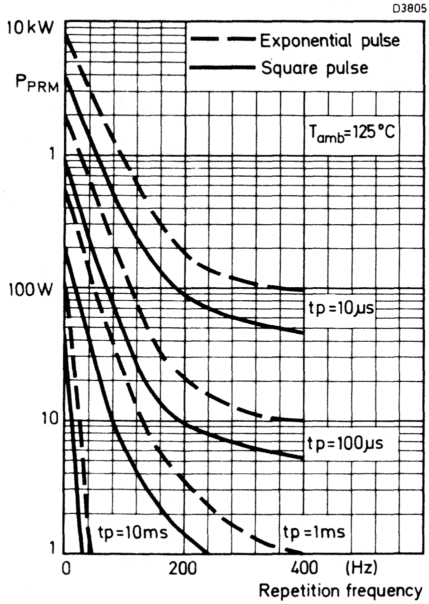


Fig. 19.

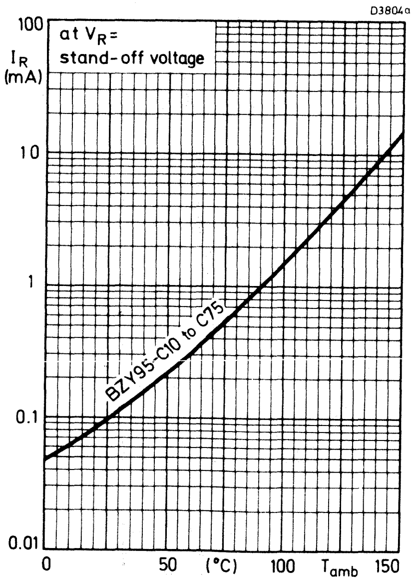


Fig. 20.

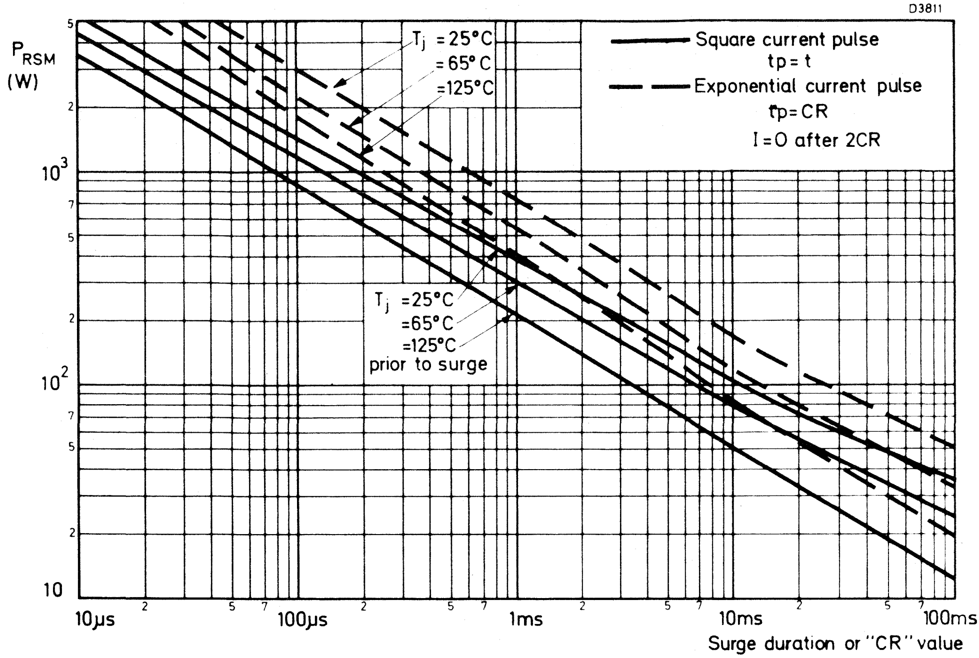

D3811
P_{RSM} (W)
5
2
10^3
7
5
2
10^2
7
5
2
10
T_j = 25°C
= 65°C
= 125°C
Square current pulse
tp = t
Exponential current pulse
tp = CR
I = 0 after 2CR
T_j = 25°C
= 65°C
= 125°C
prior to surge
10µs
2
5
7
100µs
2
5
7
1ms
2
5
7
10ms
2
5
7
100ms
Surge duration or "CR" value

Fig. 21.

REGULATOR DIODES

A range of alloyed silicon diodes in DO-1 envelopes, intended for use as voltage regulator and transient suppressor diodes in medium power regulators and transient suppression circuits.

The series consists of the following types: BZY96-C4V7 to BZY96-C9V1.

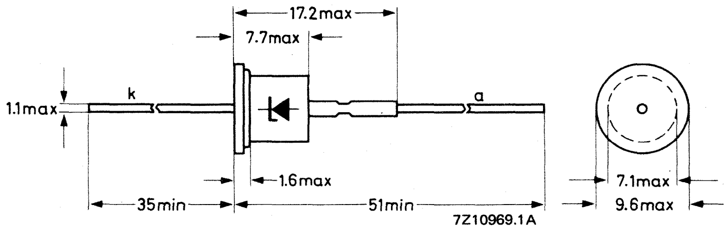
QUICK REFERENCE DATA

			voltage regulator	transient suppressor	
Working voltage (5% range)	V_Z	nom.	4,7 to 9,1	–	V
Stand-off voltage	V_R		–	3,6 to 6,8	V
Total power dissipation	P_{tot}	max.	1,5	–	W
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	–	190	W

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-1.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Peak working current	I_{ZM}	max.	3,5 A
Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	1 A
Non-repetitive peak reverse current T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse); BZY96-C4V7 to BZY96-C9V1	I_{RSM}	max.	22 to 12 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5 W
at T_{amb} = 75 °C	P_{tot}	max.	1 W
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse)	P_{RSM}	max.	190 W

Maximum recommended stand-off voltage (V_R)

	V_R (V)		V_R (V)
BZY96-C4V7	3,6	-C7V5	5,6
-C5V1	3,9	-C8V2	6,2
-C5V6	4,3	-C9V1	6,8
-C6V2	4,7		
-C6V8	5,1		

Storage temperature	T_{stg}		−65 to + 175 °C
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-points.

Thermal resistance from junction to ambient in free air:

mounted on soldering tags
- at lead length a = 10 mm — $R_{th\ j\text{-}a}$ = 60 °C/W
- at lead length a = maximum — $R_{th\ j\text{-}a}$ = 70 °C/W

mounted on a printed-circuit board
- at lead length a = maximum — $R_{th\ j\text{-}a}$ = 80 °C/W
- at lead length a = 10 mm — $R_{th\ j\text{-}a}$ = 90 °C/W

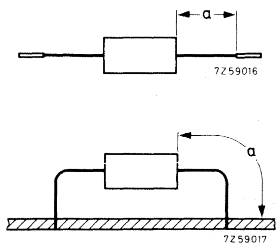


Fig. 2.

CHARACTERISTICS

Forward voltage I_F = 1 A; T_{amb} = 25 °C	V_F	<	1,5 V

CHARACTERISTICS

T_{amb} = 25 °C

BZY96-. . .	working voltage V_Z (V) *		differential resistance r_Z (Ω) *		temperature coefficient S_Z (mV/°C) *	V_Z, r_Z, S_Z at I_Z (mA)
	min.	max.	typ.	max.	typ.	
C4V7	4,4	5,0	2,5	10	–0,6	100
C5V1	4,8	5,4	1,0	5	–0,4	100
C5V6	5,2	6,0	0,7	4	+ 1,0	100
C6V2	5,8	6,6	0,6	3	+ 2,0	100
C6V8	6,4	7,2	0,6	3	+ 3,0	100
C7V5	7,0	7,9	1,0	3,5	+ 4,0	50
C8V2	7,7	8,7	1,2	3,5	+ 5,0	50
C9V1	8,5	9,6	1,8	4,5	+ 6,4	50

reverse current at	reverse voltage	clamping voltage t_p = 500 μs; exp. pulse at		non-repetitive peak reverse current	BZW96 types have 15% tolerance — they may be replaced by 5% BZY96 types if required	
I_R (μA)	V_R (V)	$V_{(CL)R}$ (V)		I_{RSM} (A)	BZY96-	BZW96-
max.		typ.	max.			
20	1,0	6,5	7,8	10	C4V7	—
20	1,0	7,0	8,2	10	C5V1	3V9
20	1,0	7,5	8,8	10	C5V6	4V3
20	2,0	8,0	9,4	10	C6V2	4V7
20	2,0	8,5	10	10	C6V8	5V1
20	3,0	9,5	11	10	C7V5	5V6
20	5,6	11	13	10	C8V2	6V2
20	6,2	13	15	10	C9V1	6V8

* Measured using a pulse method with $t_p \leqslant 100\ \mu s$ and $\delta \leqslant 0{,}001$ so that the values correspond to a T_j of approximately 25 °C.

OPERATION AS A VOLTAGE REGULATOR

Dissipation and heatsink considerations

a. Steady-state conditions

The maximum permissible steady-state dissipation $P_{s\,max}$ is given by the relationship

$$P_{s\,max} = \frac{T_{j\,max} - T_{amb}}{R_{th\,j\text{-}a}}$$

where: $T_{j\,max}$ is the maximum permissible operating junction temperature
T_{amb} is the ambient temperature
$R_{th\,j\text{-}a}$ is the total thermal resistance from junction to ambient

b. Pulse conditions (see Fig. 3)

The maximum permissible pulse power $P_{p\,max}$ is given by the formula

$$P_{p\,max} = \frac{(T_{j\,max} - T_{amb}) - (P_s \cdot R_{th\,j\text{-}a})}{R_{th\,t}}$$

Where: P_s is any steady-state dissipation excluding that in pulses
$R_{th\,t}$ is the effective transient thermal resistance of the device between junction and ambient. It is a function of the pulse duration t_p and duty factor δ.
δ is the duty factor (t_p/T)

The steady-state power P_s when biased in the zener direction at a given zener current can be found from Fig. 4. With the additional pulse power dissipation $P_{p\,max}$ calculated from the above expression, the total peak zener power dissipation $P_{tot} = P_{ZRM} = P_s + P_p$. From Fig. 4 the corresponding maximum repetitive peak zener current at P_{tot} can now be read. This repetitive peak zener current is subject to the absolute maximum rating. For pulse durations longer than the temperature stabilization time of the diode t_{stab}, the maximum permissible repetitive peak dissipation P_{ZRM} is equal to the steady-state power P_s. The temperature stabilization time for the BZY96 is 100 seconds (see Fig. 10).

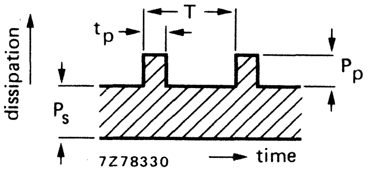


Fig. 3.

NOTES WHEN OPERATING AS A TRANSIENT SUPPRESSOR

1. The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.
2. The maximum clamping voltage is the maximum reverse voltage which appears across the diode at the specified pulse duration and junction temperature. For square pulses see Fig. 13 and for exponential pulses see Fig. 14.
3. Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that the energy content does not continue beyond twice this time.

SOLDERING AND MOUNTING INSTRUCTIONS

1. When using a soldering iron, diodes may be soldered directly into the circuit, but heat conducted to the junction should be kept to a minimum.
2. Diodes may be dip-soldered at a solder temperature of 245 °C for a maximum soldering time of 5 seconds. The case temperature during dip-soldering must not at any time exceed the maximum storage temperature. These recommendations apply to a diode with the anode end mounted flush on a printed-circuit board having punched-through holes. For mounting the anode end onto a printed-circuit board, the diode must be spaced at least 5 mm from the underside of the printed-circuit board having punched-through holes, or 5 mm from the top of the printed-circuit board having plated-through holes.
3. Care should be taken not to bend the leads nearer than 1,5 mm from the seal; exert no axial pull when bending.

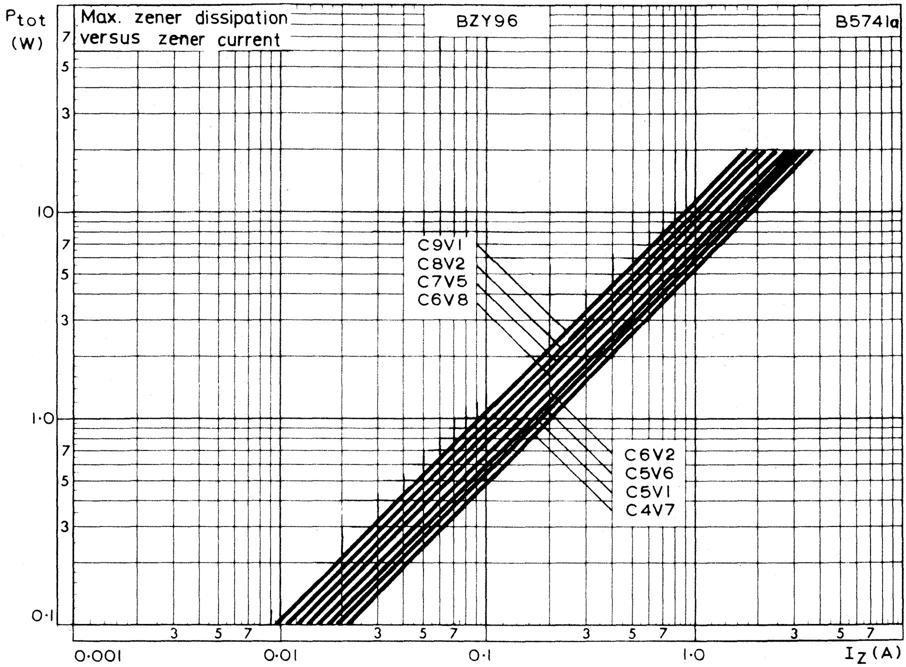


Fig. 4 Maximum permissible repetitive peak dissipation ($P_{tot} = P_{ZRM}$).

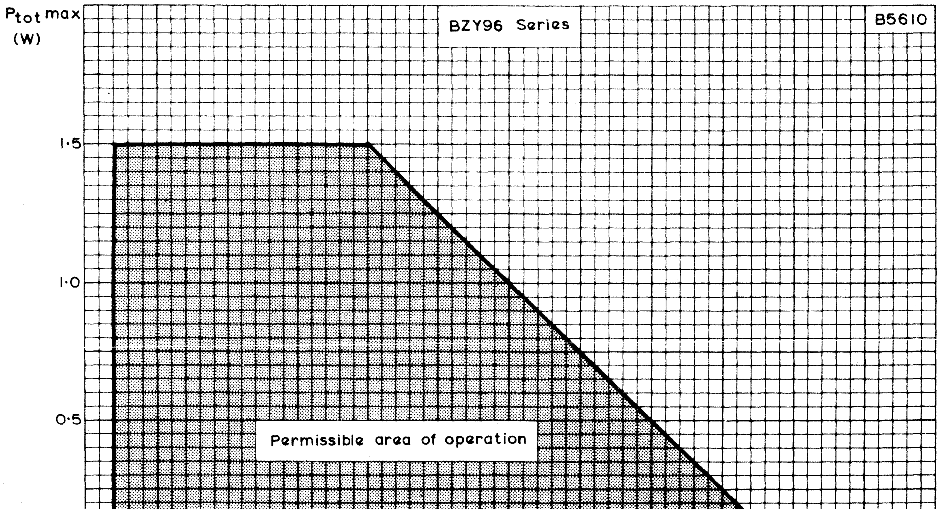


Fig. 5 Maximum permissible total power dissipation versus ambient temperature.

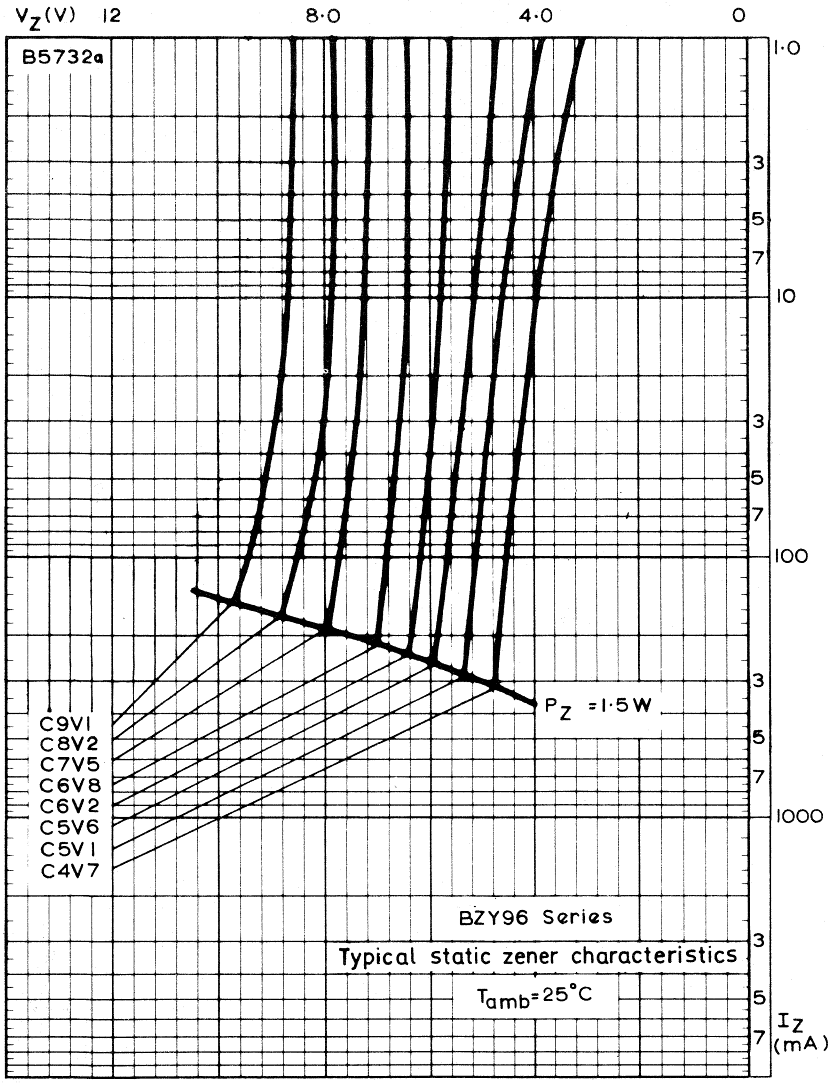


Fig. 6 Typical static zener characteristics.

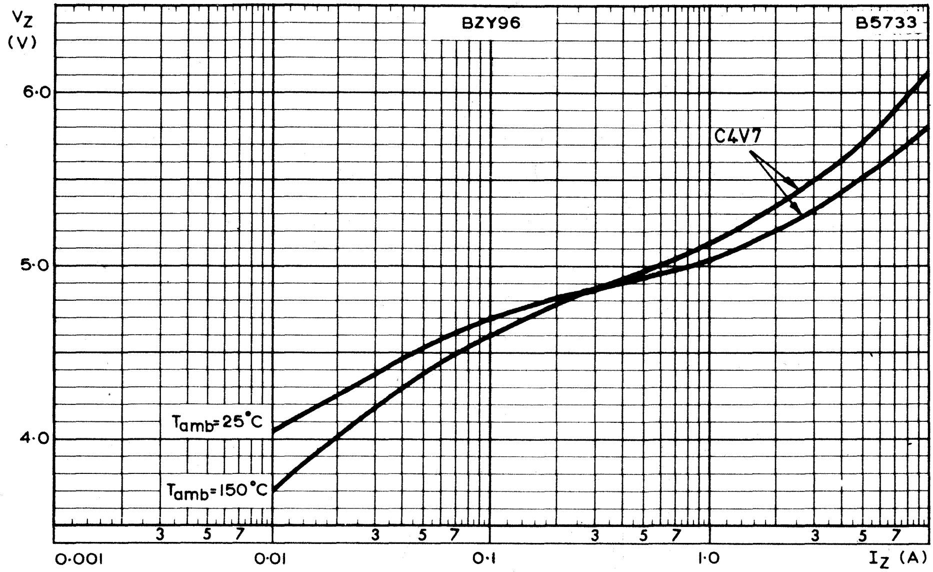


Fig. 7 Typical dynamic zener characteristics for BZY96-C4V7.

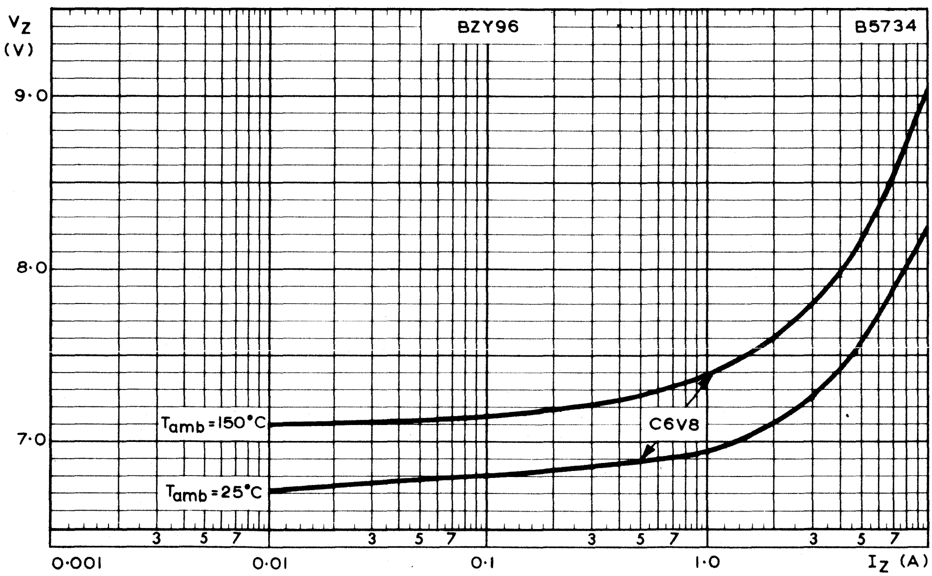


Fig. 8 Typical dynamic zener characteristics for BZY96-C6V8.

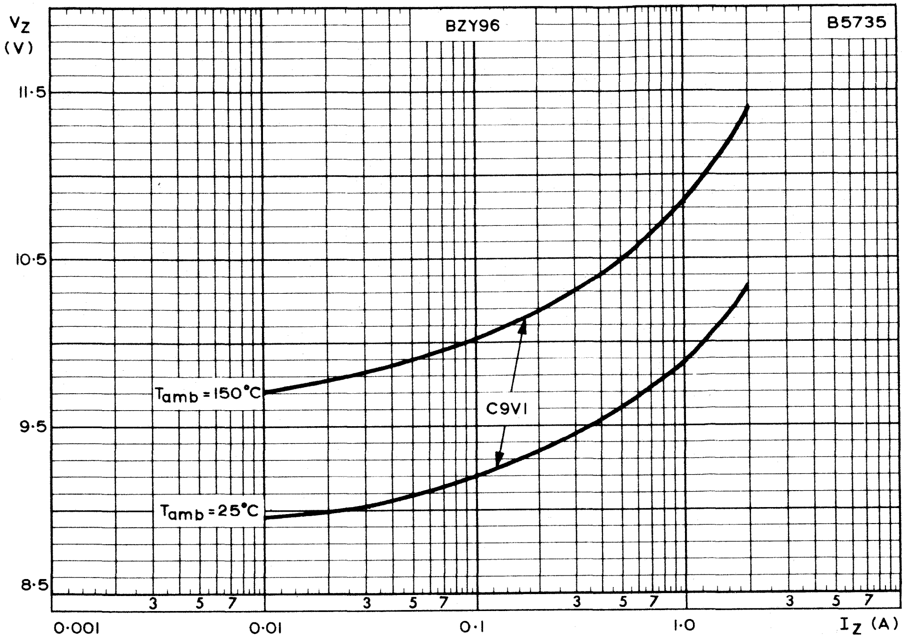


Fig. 9 Typical dynamic zener characteristics for BZY96-C9V1.

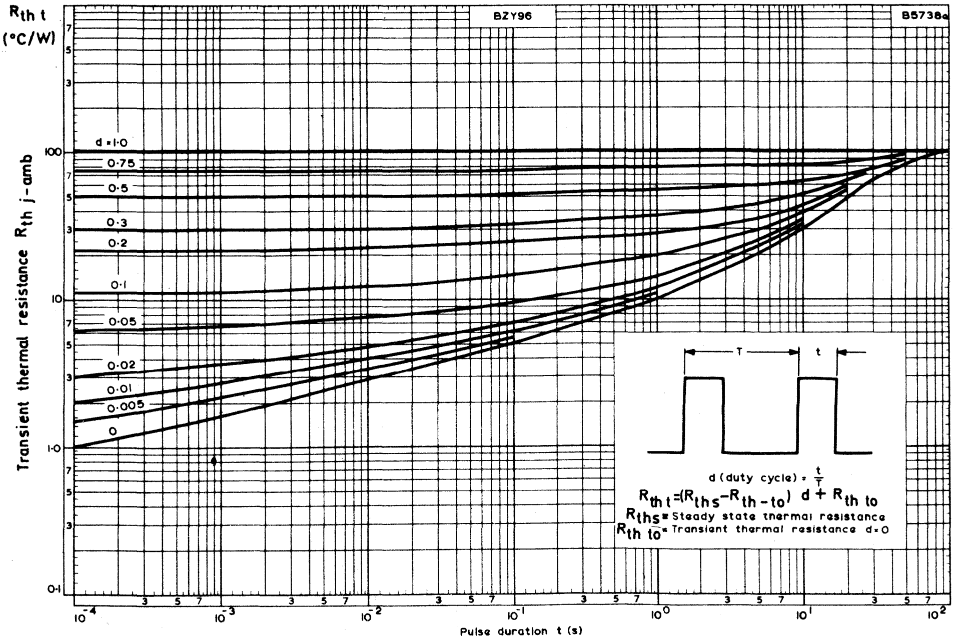


Fig. 10.

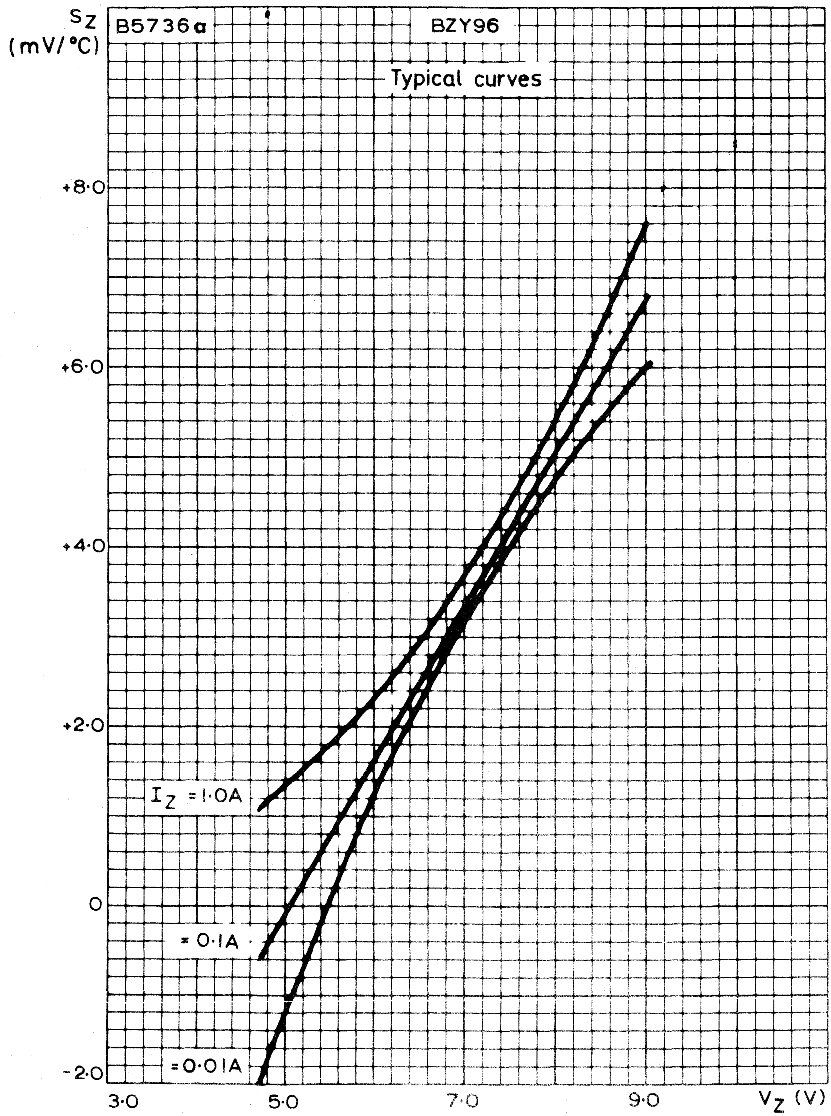

B5736a
BZY96
Typical curves
S_Z (mV/°C)
+8·0
+6·0
+4·0
+2·0
0
-2·0
I_Z = 1·0A
= 0·1A
= 0·01A
3·0
5·0
7·0
9·0
V_Z (V)

Fig. 11.

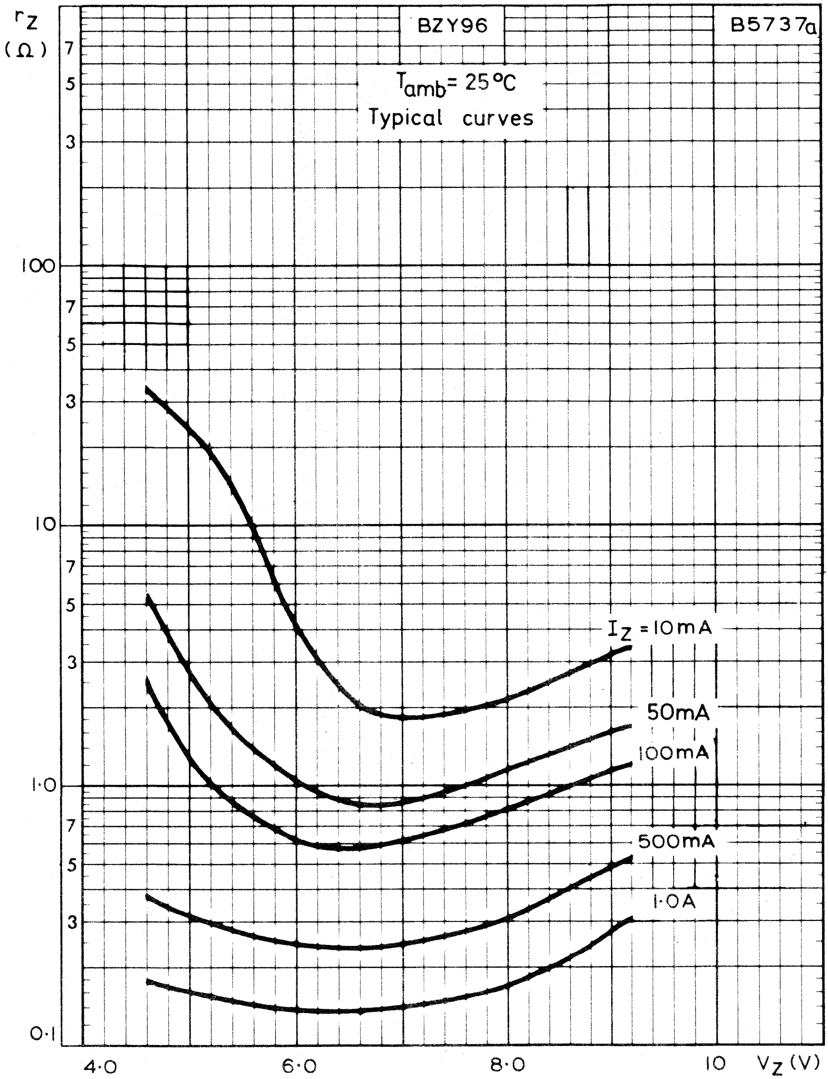
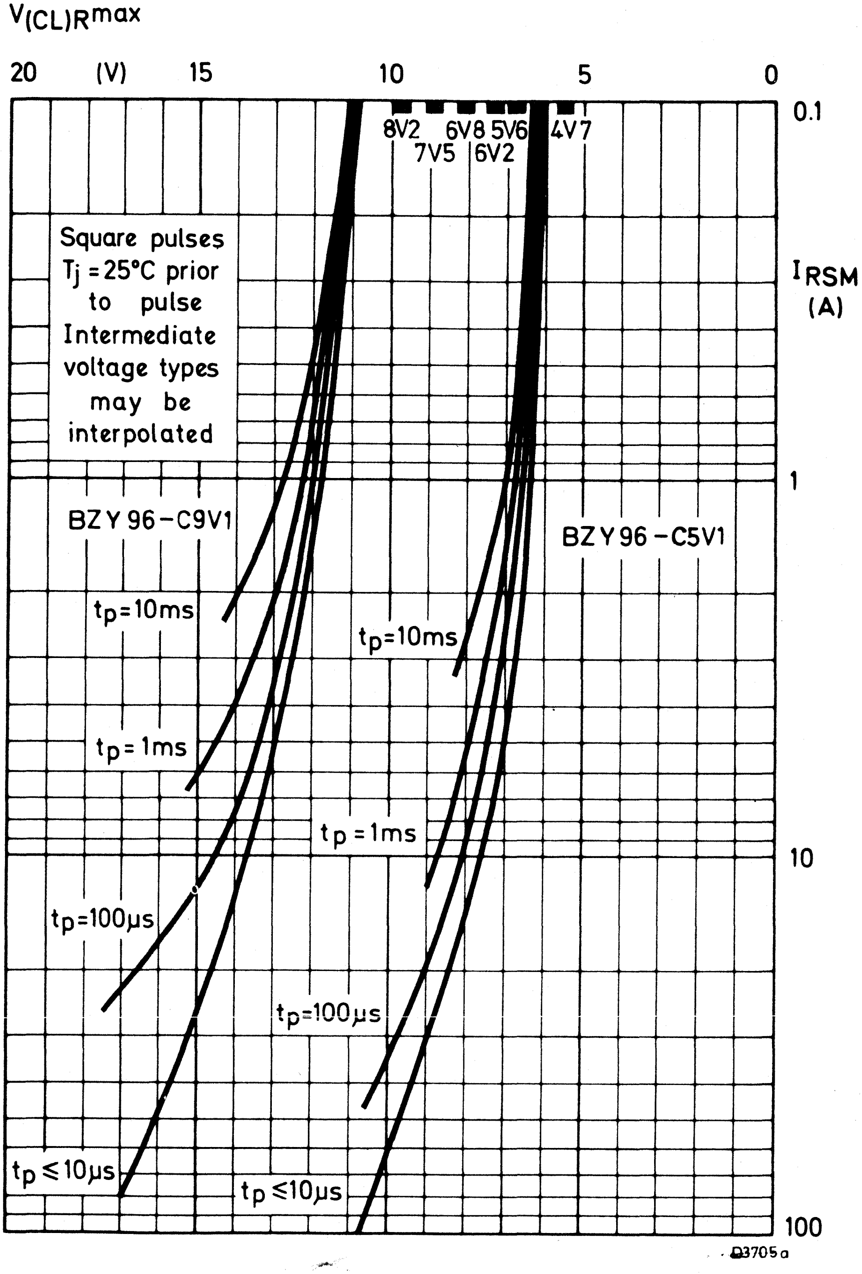

BZY96
B5737a
T_{amb} = 25 °C
Typical curves
r_Z (Ω)
I_Z = 10 mA
50mA
100mA
500mA
1·0A
100
10
1·0
0·1
4·0
6·0
8·0
10
V_Z (V)

Fig. 12.



$V_{(CL)R}max$
20 (V) 15 10 5 0
8V2 7V5 6V8 6V2 5V6 4V7
0.1
I_{RSM} (A)
1
10
100
Square pulses
T_j = 25°C prior to pulse
Intermediate voltage types may be interpolated
BZY96-C9V1
BZY96-C5V1
t_p=10ms
t_p=1ms
t_p=100µs
t_p≤10µs
t_p=10ms
t_p=1ms
t_p=100µs
t_p≤10µs
D3705a

Fig. 13.

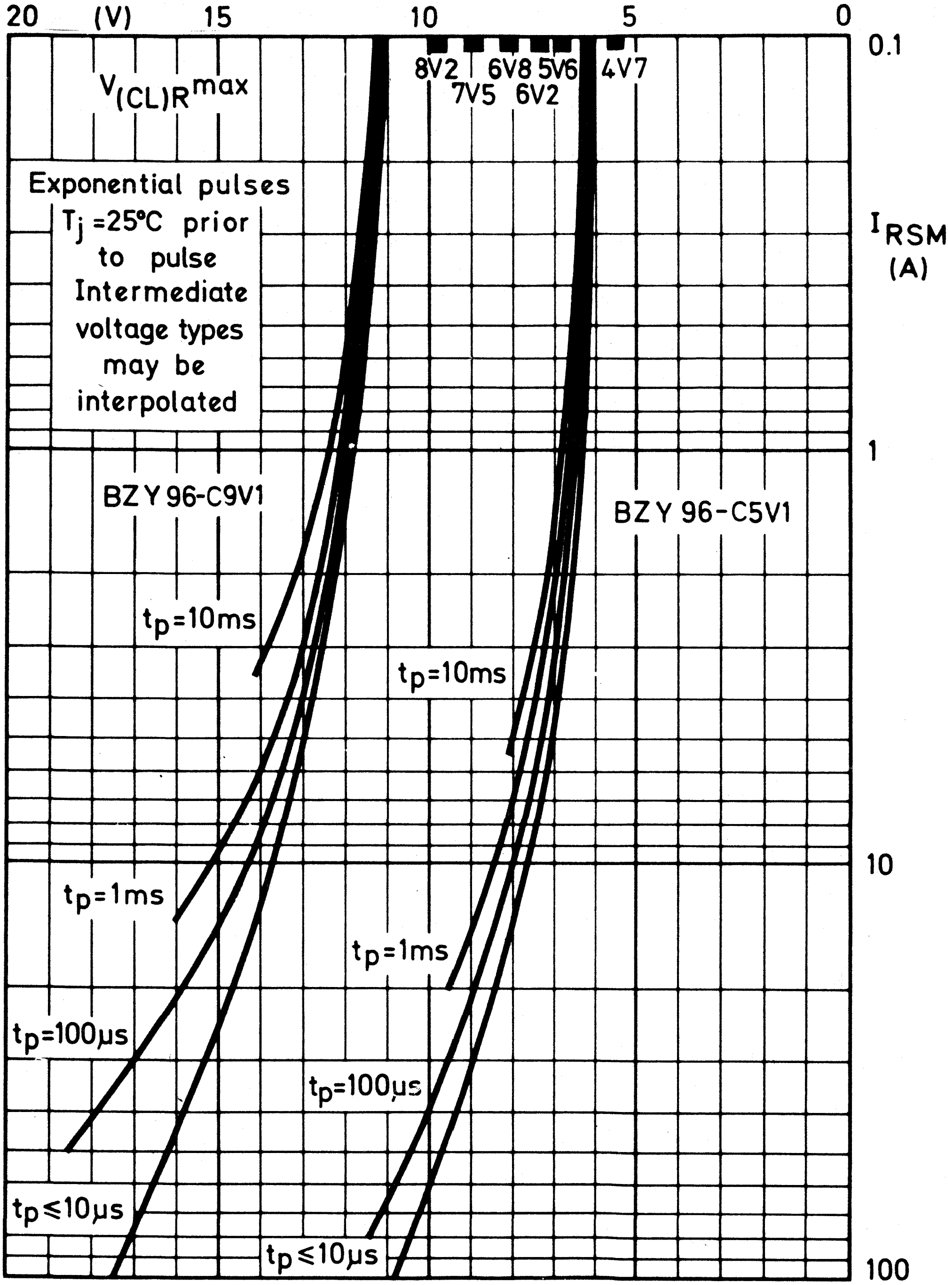


Fig. 14.

D3704a

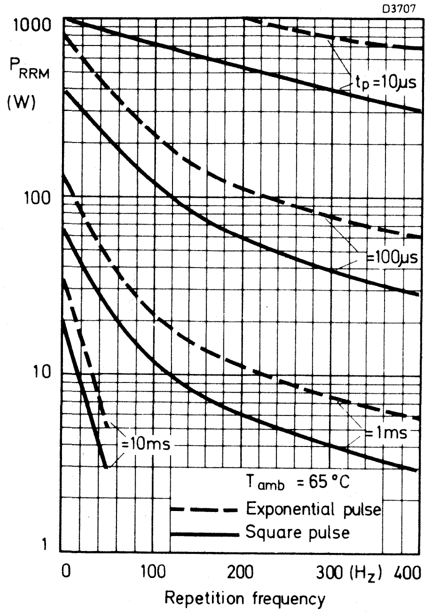


Fig. 15.

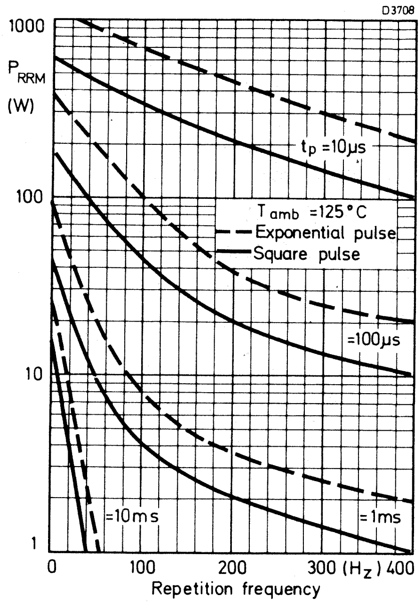


Fig. 16.

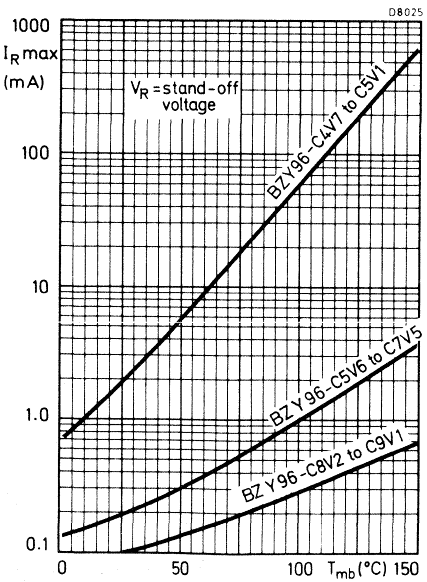


Fig. 17.

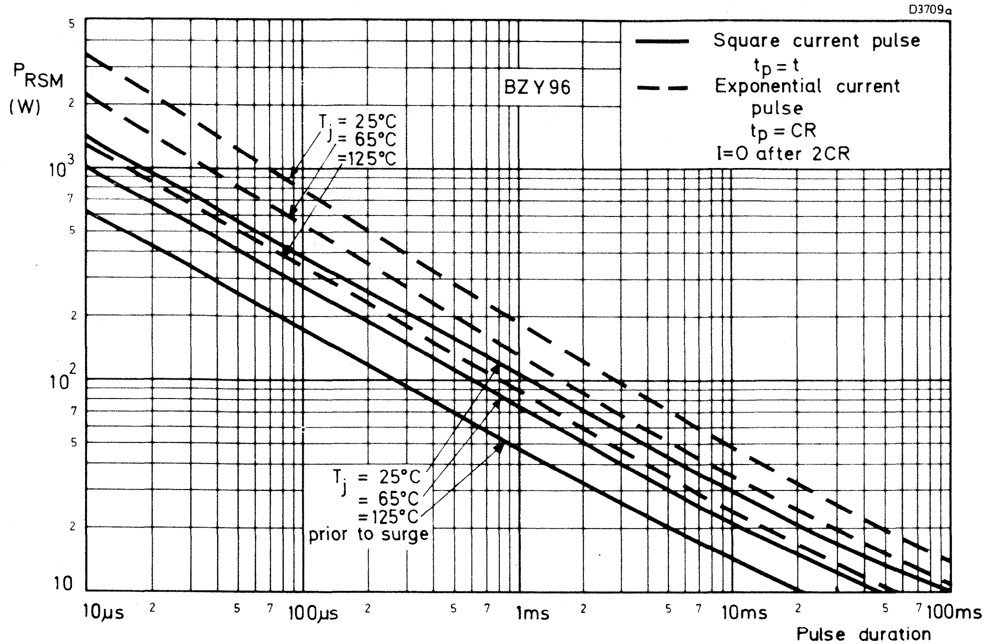

D3709a
P_{RSM} (W)
BZY96
Square current pulse
$t_p = t$
Exponential current pulse
$t_p = CR$
I=0 after 2CR
T_j = 25°C
= 65°C
=125°C
T_j = 25°C
= 65°C
=125°C
prior to surge
10µs
100µs
1ms
10ms
100ms
Pulse duration

Fig. 18.

MEDIUM POWER VOLTAGE REGULATORS

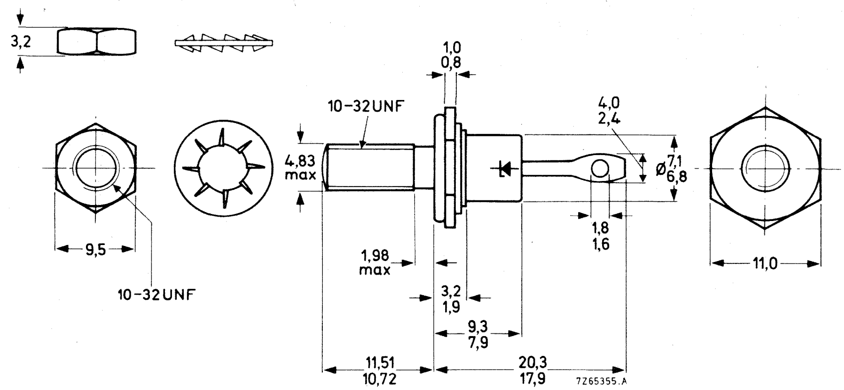
Alloyed silicon diodes in a DO-4 metal envelope for use as medium-current voltage stabilisers or voltage references.
Zener voltage range from 5.6 to 24 V with a tolerance of ±5%.

QUICK REFERENCE DATA				
Zener voltage range (tolerance ±5%)		nom.	5.6 to 24	V
Repetitive peak zener current	I_{ZRM}	max.	7	A
Total power dissipation up to T_{mb} = 50 °C	P_{tot}	max.	10	W
Non repetitive peak reverse power dissipation	P_{ZSM}	max.	45	W
Junction temperature	T_j	max.	150	°C
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	=	10	°C/W

MECHANICAL DATA

Dimensions in mm

DO-4



Net weight : 4.3 g
With accessories: 6.5 g
Diameter of hole in heatsink: max. 5.2 mm
Accessories available for insulated mounting:
56295 (56262A)

Mounting torque: min. 0.8 Nm
(8 kg cm)
max. 1.7 Nm
(17 kg cm)

RATINGS (Limiting values) [1])

Currents

Average forward current (averaged over any 20 ms period)	I_{FAV}	max.	0.5	A
Repetitive peak forward current	I_{FRM}	max.	7	A
Repetitive peak zener current	I_{ZRM}	max.	7	A

Power dissipation

Total power dissipation up to T_{mb} = 50 °C	P_{tot}	max.	10	W
Non repetitive peak reverse power ($t < 100\ \mu s$)	P_{ZSM}	max.	45	W

Temperatures

Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	70	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	10	°C/W

CHARACTERISTICS T_{mb} = 25 °C unless otherwise specified

Forward voltage

I_F = 200 mA	V_F	<	1.0	V

Reverse current

BZZ14	V_R = 2 V	I_R	<	500	nA
BZZ15	V_R = 2 V	I_R	<	500	nA
BZZ16	V_R = 3 V	I_R	<	500	nA
BZZ17	V_R = 3 V	I_R	<	500	nA
BZZ18	V_R = 3 V	I_R	<	400	nA
BZZ19	V_R = 5 V	I_R	<	400	nA
BZZ20	V_R = 5 V	I_R	<	400	nA
BZZ21 to 29	V_R = 5 V	I_R	<	50	nA

[1]) Limiting values according to the Absolute Maximum System as defined in IEC publication 134.

CHARACTERISTICS (continued) T_{mb} = 25 °C unless otherwise specified

Diode capacitance

BZZ14	V_R = 3 V	C_d	typ.	575	pF
BZZ15	V_R = 3 V	C_d	typ.	475	pF
BZZ16	V_R = 3 V	C_d	typ.	375	pF
BZZ17	V_R = 2 V	C_d	typ.	350	pF
BZZ18	V_R = 2 V	C_d	typ.	300	pF
BZZ19	V_R = 2 V	C_d	typ.	250	pF
BZZ20	V_R = 2 V	C_d	typ.	250	pF
BZZ21	V_R = 3 V	C_d	typ.	340	pF
BZZ22	V_R = 3 V	C_d	typ.	280	pF
BZZ23	V_R = 3 V	C_d	typ.	260	pF
BZZ24	V_R = 3 V	C_d	typ.	240	pF
BZZ25	V_R = 3 V	C_d	typ.	210	pF
BZZ26	V_R = 3 V	C_d	typ.	200	pF
BZZ27	V_R = 3 V	C_d	typ.	155	pF
BZZ28	V_R = 3 V	C_d	typ.	135	pF
BZZ29	V_R = 3 V	C_d	typ.	130	pF

	Zener voltage V_Z (V) at I_Z = 20 mA			Temperature coefficient S_Z (mV/°C) at I_Z = 20 mA			Differential resistance r_z (Ω) at I_Z = 20 mA	
	min.	nom.	max.	min.	typ.	max.	typ.	max.
BZZ14	5.3	5.6	6.0	−0.4	+0.7	+2.5	4.5	15
BZZ15	5.8	6.2	6.6	+1.0	+2.1	+3.5	2.2	6.0
BZZ16	6.4	6.8	7.2	+2.0	+2.9	+4.0	2.07	5.0
BZZ17	7.0	7.5	7.9	+3.0	+3.75	+4.5	2.3	7.5
BZZ18	7.7	8.2	8.7	+4.0	+4.7	+6.0	2.6	10
BZZ19	8.5	9.1	9.6	+3.5	+5.8	+6.5	3.18	10
BZZ20	9.4	10	10.6	+6.0	+7.0	+8.0	3.8	17
BZZ21	10.4	11	11.6		+7.5		4.4	25
BZZ22	11.4	12	12.7		+8.8		5.25	28
BZZ23	12.4	13	14.1		+10		6.3	33
BZZ24	13.8	15	15.6		+12.6		8.9	39
BZZ25	15.3	16	17.1		+13.8		10.5	48
BZZ26	16.8	18	19.1		+16.4		14.5	54
BZZ27	18.8	20	21.2		+19		19.5	58
BZZ28	20.8	22	23.3		+21.6		26	63
BZZ29	22.7	24	25.9		+24.2		33.5	70

CHARACTERISTICS (continued) T_{mb} = 25 °C unless otherwise specified

	Zener voltage V_Z (V)			Temperature coefficient S_Z (mV/°C)			Differential resistance r_Z (Ω)	
	at I_Z = 100 mA			at I_Z = 100 mA			at I_Z = 100 mA	
	min.	nom.	max.	min.	typ.	max.	typ.	max.
BZZ14	5.5	5.72	6.3	+0.5	+1.6	+3.0	1.47	4.0
BZZ15	5.8	6.3	6.8	+2.0	+2.45	+4.0	1.12	2.5
BZZ16	6.4	6.9	7.4	+2.5	+3.15	+4.0	1.1	2.5
BZZ17	7.2	7.6	8.2	+3.0	+4.05	+5.0	1.2	3.5
BZZ18	7.8	8.35	9.0	+3.0	+4.9	+6.1	1.38	5.0
BZZ19	8.8	9.3	10	+4.0	+6.1	+7.0	1.65	5.0
BZZ20	9.6	10.3	11	+3.0	+7.25	+11	2.05	5.0
BZZ21		11.3			+9.5		2.0	8.0
BZZ22		12.3			+11		2.5	10
BZZ23		13.4			+12		3.0	13
BZZ24		15.5			+14.8		4.2	16
BZZ25		16.7			+16		5.0	20
BZZ26		18.8			+18.7		7.0	20
BZZ27		21.5			+21.2		9.2	20
BZZ28		23.6			+23.8		12.2	25
BZZ29		26.1			+26.5		16	28

	at I_Z = 500 mA			at I_Z = 500 mA			at I_Z = 500 mA	
	min.	nom.	max.	min.	typ.	max.	typ.	max.
BZZ14	5.5	5.97	6.5	0	+2.15	+3.0	0.54	1.0
BZZ15	6.0	6.6	7.4	+1.5	+2.9	+4.0	0.53	2.0
BZZ16	6.6	7.12	7.9	+2.5	+3.7	+4.0	0.57	2.5
BZZ17	7.1	7.82	8.5	+3.0	+4.6	+7.0	0.62	3.0
BZZ18	8.0	8.57	9.5	+3.5	+5.5	+6.8	0.68	3.0
BZZ19	8.8	9.55	10.2	+4.5	+6.65	+7.5	0.81	3.0
BZZ20	10	10.72	11.6	+3.0	+7.8	+11	0.97	3.0

TRANSIENT SUPPRESSOR DIODES

Reverse breakdown voltage in volts at T_j = 25 °C

Series number / Type number suffix (is stand-off voltage)	BZW70– . . . current	BZW70– . . .	BZW93– . . . (R) current	BZW93– . . . (R)	BZW91– . . . (R) current	BZW91– . . . (R)	BZW86– . . . (R) current	BZW86– . . . (R)
5V6		6,4		6,4				
6V2		7,0	2A	7,0	5A	7,0		
6V8		7,7		7,7		7,7		
7V5		8,5		8,5		8,5		8,5
8V2	50	9,4		9,4		9,4		9,4
9V1		10,4	1A	10,4		10,4		10,4
10		11,4		11,4		11,4		11,4
11		12,4		12,4	2A	12,4	10A	12,4
12		13,8		13,8		13,8		13,8
13		15,3		15,3		15,3		15,3
15		16,8		16,8		16,8		16,8
16		18,8		18,8		18,8		18,8
18	20	20,8	500	20,8		20,8		20,8
20		22,8		22,8		22,8		22,8
22		25,1		25,1	1A	25,1	5A	25,1
24		28		28		28		28
27		31		31		31		31
30		34		34		34		34
33		37		37		37		37
36		40		40		40		40
39		44		44		44		44
43	10	48	200	48	500	48	2A	48
47		52		52		52		52
51		58		58		58		58
56		64		64		64		64
62		70		70		70		

current in mA (< 1 A) or A (⩾ 1 A) at which breakdown voltage is specified

Transient suppressor bridge

type	V_I V	$V_{O(CL)}$ V	$I_{(CL)SM}$ A
BZW10	12	30	50

Normal polarity (cathode to stud)	**no end-letter**
Reverse polarity (anode to stud)	**R**
Both polarities available	**(R)**

TRANSIENT SUPPRESSOR BRIDGE

Plastic encapsulated bridge assembly comprising four silicon double diffused transient suppressor diodes. It is specifically intended for use as line polarity guard and transient protection element in telephony equipment, and as suppressor element in electrical and electronic equipment in general.

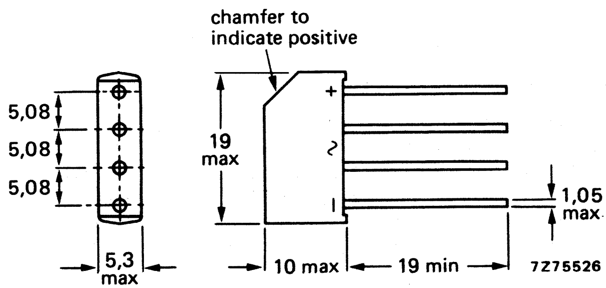
QUICK REFERENCE DATA

Input stand-off voltage	V_I	max.	12 V
Output clamping voltage	$V_{O(CL)}$	<	30 V
Non-repetitive peak clamping current	$I_{(CL)SM}$	max.	50 A
Output voltage	V_O	>	10 V

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD–28.



The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68–2 (test D, severity IV, 6 cycles).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Input stand-off voltage (see note 1)	V_I	max.	12	V
Average output current (averaged over any 20 ms period)	$I_{O(AV)}$	max.	150	mA
Non-repetitive peak clamping current full load prior to surge (see note 2)	$I_{(CL)SM}$	max.	50	A
Storage temperature	T_{stg}	−55 to + 125		°C
Operating ambient temperature	T_{amb}	−25 to + 70		°C

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j\text{-}a}$	=	60	°C/W

CHARACTERISTICS

T_{amb} = −25 to + 70 °C

Output voltage V_I = 12 V; I_O = 10 mA	V_O	>	10	V
Output clamping voltage at $I_{(CL)SM}$ at rated load conditions	$V_{O(CL)}$	<	30	V
Leakage current V_I = 12 V; at rated load conditions	I_R	<	40	μA

MOUNTING INSTRUCTIONS

1. The maximum permissible temperature of the soldering iron or bath is 270 °C; it must not be in contact with the joint for more than 3 seconds.
2. Soldered joints must be at least 5 mm from the seal. If the joints are between 1,5 mm (minimum) and 5 mm from the seal, the maximum permissible temperature is 250 °C.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 °C.

Notes
1. The stand-off voltage is the maximum bridge input voltage permitted for continuous operation.
2. In accordance with F.T.Z. requirement 10/700 with 2 kV test voltage (see also page 3).

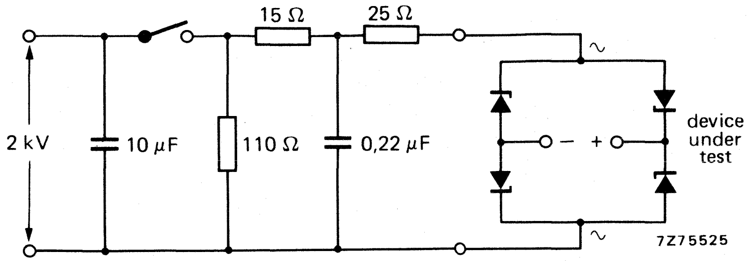


Fig. 2 Test set-up in accordance with F.T.Z. 10/700.

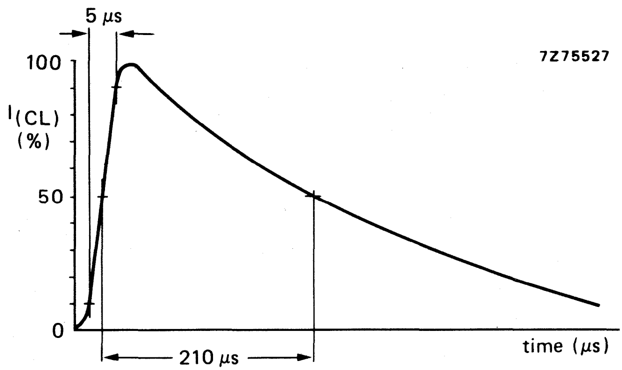


Fig. 3 Output clamping current as a function of time.

TRANSIENT SUPPRESSOR DIODES

A range of diffused silicon diodes in a plastic envelope intended for use in the protection of electrical and electronic equipment against voltage transients.
The series consists of the following types: BZW70-5V6 to BZW70-62.

QUICK REFERENCE DATA

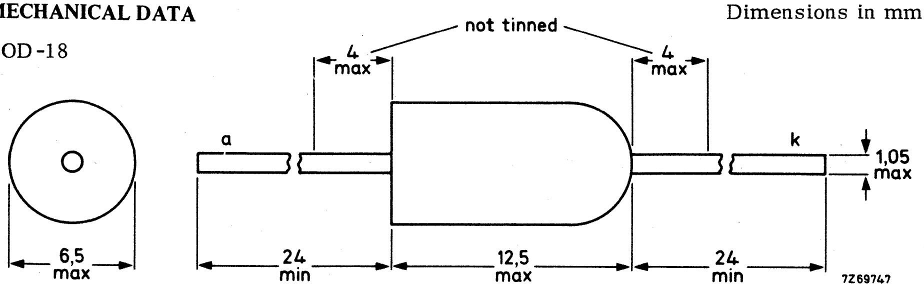
Stand-off voltage (15% range) *	V_R	5,6 to 62	V
Reverse breakdown voltage	$V_{(BR)R}$	6,4 to 70	V
Non-repetitive peak reverse power dissipation; exponential pulse	P_{RSM}	max. 700	W

* The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.

MECHANICAL DATA

Dimensions in mm

SOD-18



The rounded end indicates the cathode

The sealing of the plastic envelope withstands the accelerated damp heat test of IEC recommendation 68-2 (test D, severity IV, 6 cycles).

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

Stand-off voltage [1]	V_R	equal to type number suffix		
Currents				
Non-repetitive peak reverse current				
T_j = 25 °C prior to surge				
t_p = 10 μs; square pulse				
BZW70-6V8	I_{RSM}	max.	420	A
BZW70-11	I_{RSM}	max.	250	A
BZW70-18	I_{RSM}	max.	140	A
BZW70-39	I_{RSM}	max.	70	A
BZW70-62	I_{RSM}	max.	50	A
t_p = 1 ms; exponential pulse				
BZW70-6V8	I_{RSM}	max.	45	A
BZW70-11	I_{RSM}	max.	30	A
BZW70-18	I_{RSM}	max.	16	A
BZW70-39	I_{RSM}	max.	10	A
BZW70-62	I_{RSM}	max.	6	A
Power dissipation				
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; exponential pulse; see also graph on page 5;				
t_p = 100 μs	P_{RSM}	max.	3	kW
t_p = 1 ms	P_{RSM}	max.	700	W
Temperatures				
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE (see also page 4)

From junction to ambient (mounting method 1)	$R_{th\,j-a}$	=	60	°C/W

CHARACTERISTICS

Forward voltage				
I_F = 1 A at T_j = 25 °C	V_F	<	1,5	V [2]

[1] The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.
[2] Measured under pulse conditions.

CHARACTERISTICS (continued)

	Clamping voltage (exp. pulse at T_j = 25 °C prior to surge; t_p = 500 μs) $V_{(CL)R}$ (V)			Reverse breakdown voltage at T_j = 25 °C $V_{(BR)R}$ (V)	
	typ.	max.		min.	
BZW70-5V6	9	10	I_R = 20 A	6, 4	I_R = 50 mA
-6V2	10	11, 2		7, 0	
-6V8	11	12, 5		7, 7	
-7V5	12	14		8, 5	
-8V2	13, 5	15, 5		9, 4	
-9V1	15	17, 5		10, 4	
-10	17	19		11, 4	
-11	19	21		12, 4	
-12	21	23		13, 8	
-13	23	26		15, 3	I_R = 20 mA
-15	22	26	I_R = 10 A	16, 8	
-16	25	29		18, 8	
-18	28	33		20, 8	
-20	32	38		22, 8	
-22	36	43		25, 1	
-24	41	48		28	
-27	47	54		31	
-30	44	52	I_R = 5 A	34	
-33	49	58		37	I_R = 10 mA
-36	56	65		40	
-39	63	72		44	
-43	71	82		48	
-47	80	93		52	
-51	89	104		58	
-56	98	116		64	
-62	104	116		70	

The maximum clamping voltage is the maximum reverse voltage which appear across the diode at the specified pulse duration and junction temperature.
See curves on pages 6 and 7 for square pulses and pages 8 and 9 for exponential pulses.

CHARACTERISTICS (continued)

Peak reverse current

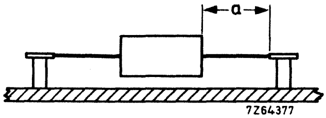
V_{RM} = recommended stand-off voltage

BZW70-5V6 to BZW70-6V8	I_{RM}	<	500	μA
BZW70-7V5 to BZW70-62	I_{RM}	<	100	μA
Temperature coefficient of clamping voltage	S	typ.	+0,1	%/°C

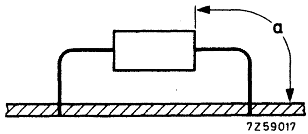
THERMAL RESISTANCE (influence of mounting method)

The quoted values of $R_{th\,j-a}$ should be used only when no other leads run to the tie-points.

1. Mounted on solder tags at a lead-length: a = 10 mm — $R_{th\,j-a}$ = 60 °C/W
   a = max. lead length — $R_{th\,j-a}$ = 70 °C/W

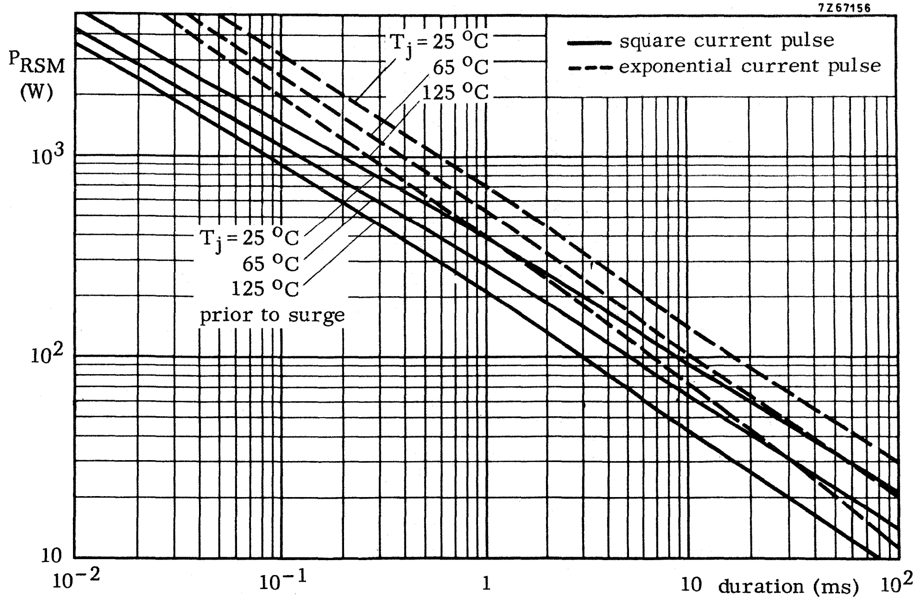


2. Mounted on printed-wiring board at a = maximum lead-length — $R_{th\,j-a}$ = 85 °C/W
3. Mounted on printed-wiring board at a lead-length a = 10 mm — $R_{th\,j-a}$ = 95 °C/W

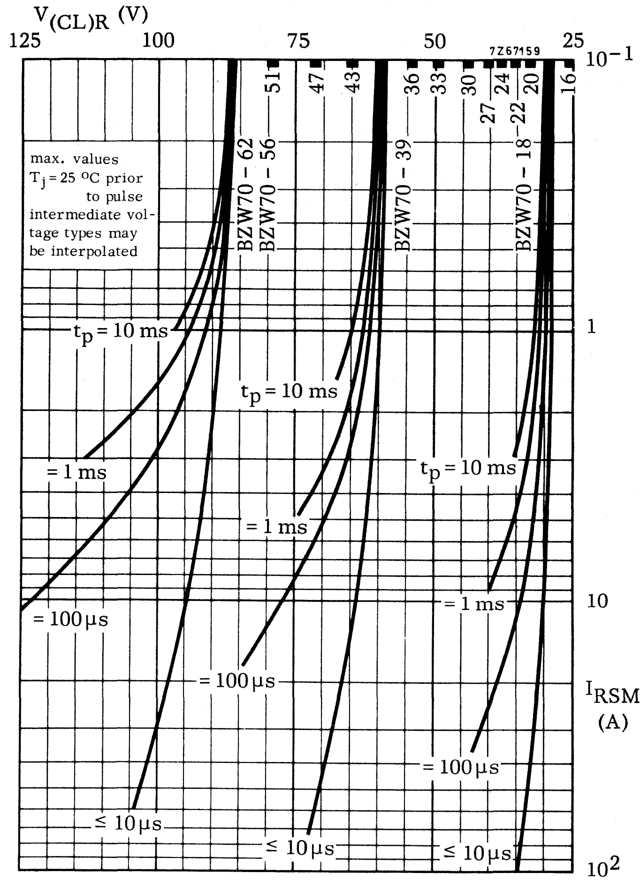


SOLDERING AND MOUNTING NOTES

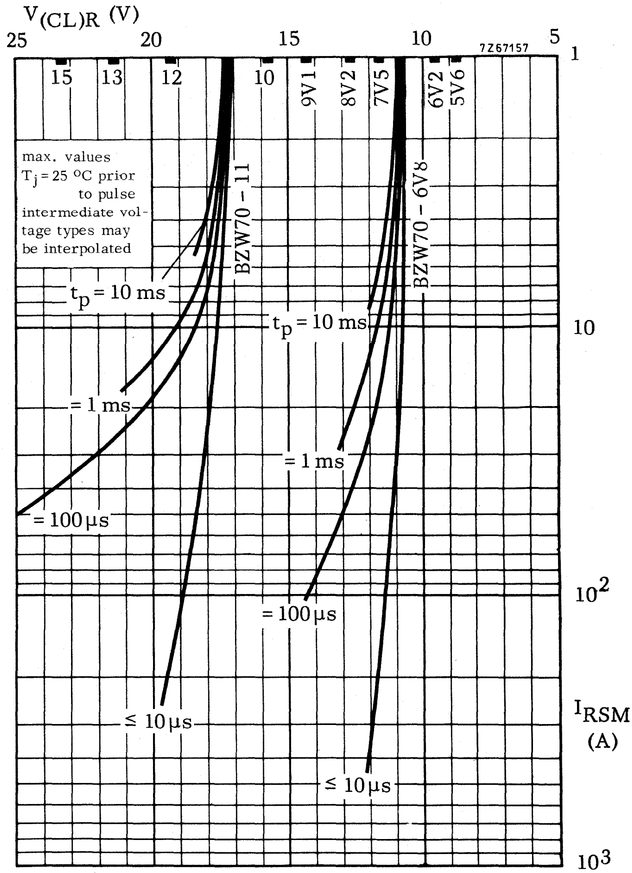
1. Soldered joints must be at least 5 mm from the seal.
2. The maximum permissible temperature of the soldering iron or bath is 300 °C; it must be in contact with the joint for no more than 3 seconds.
3. Avoid hot spots due to handling or mounting; the body of the device must not come into contact with or be exposed to a temperature higher than 150 °C.



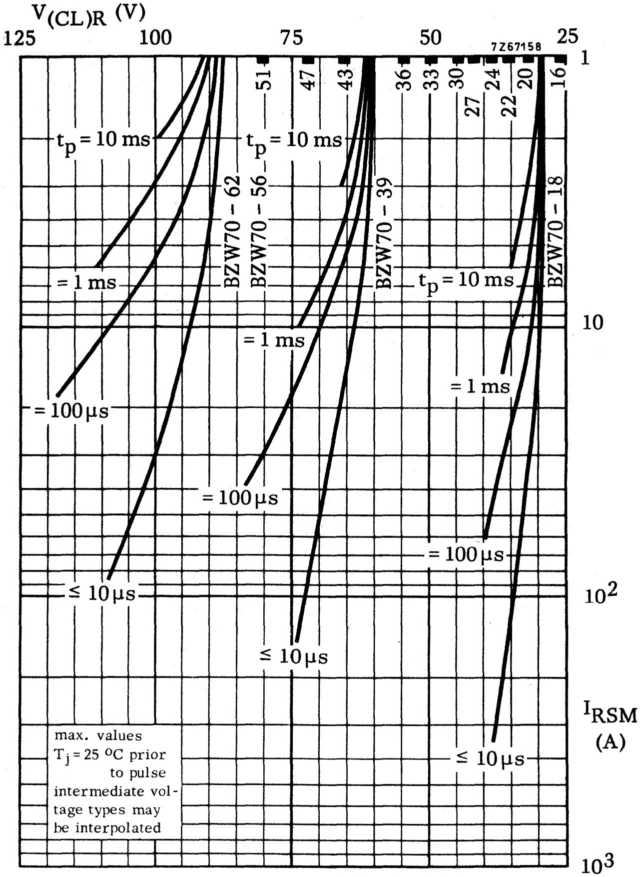
Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that the energy content does not continue beyond twice this time.



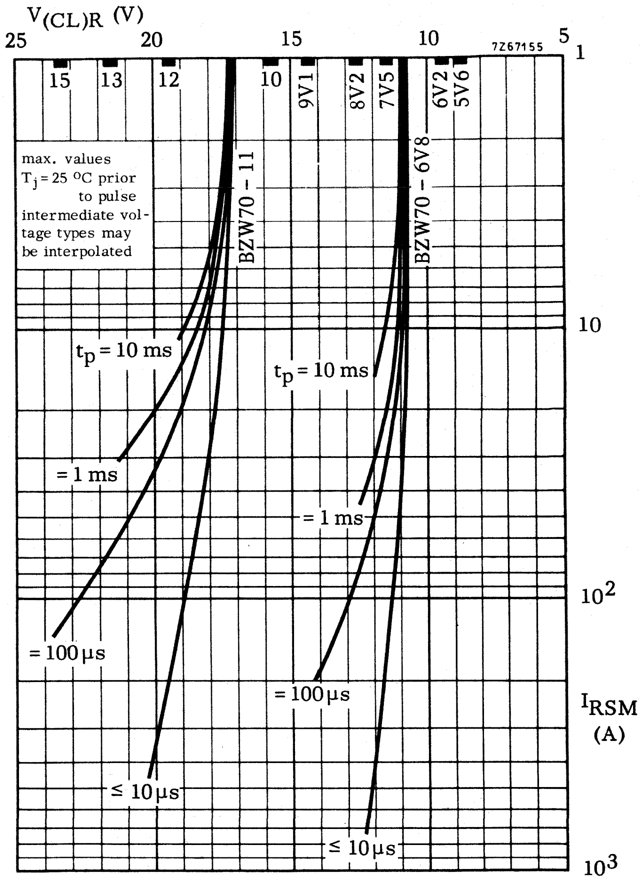
square pulses



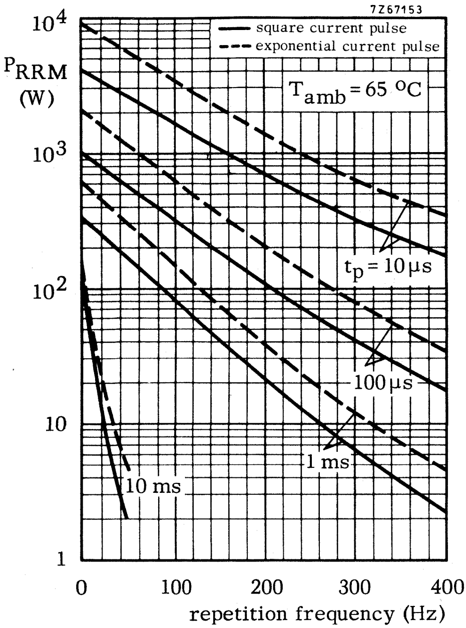
square pulses

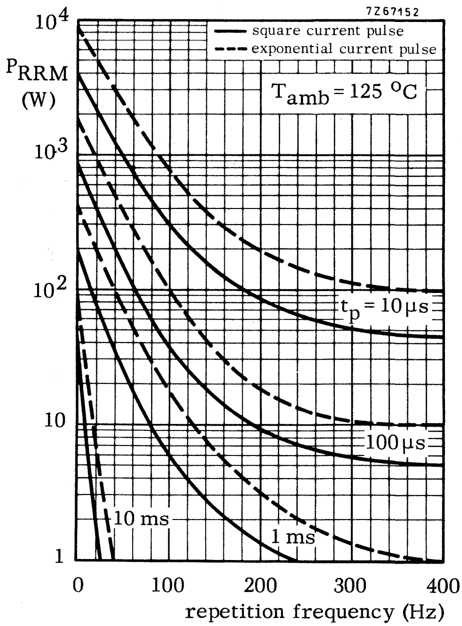


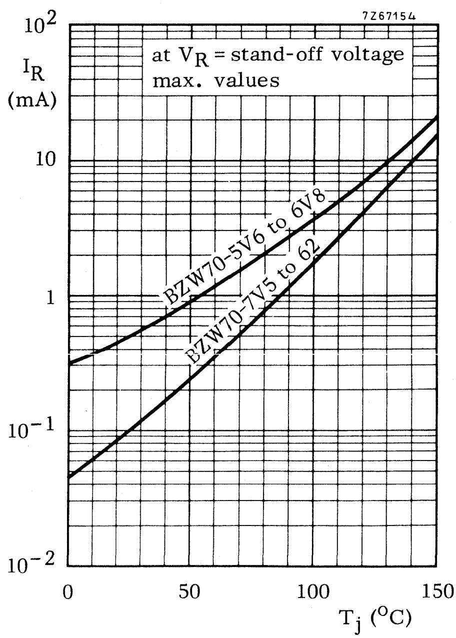
exponential pulses



exponential pulses


7Z67153
square current pulse
exponential current pulse
$T_{amb} = 65\ ^oC$
P_{RRM} (W)
10^4
10^3
10^2
10
1
$t_p = 10\ \mu s$
$100\ \mu s$
1 ms
10 ms
0
100
200
300
400
repetition frequency (Hz)


7Z67152
square current pulse
exponential current pulse
$T_{amb} = 125\ ^oC$
P_{RRM} (W)
10^4
10^3
10^2
10
1
$t_p = 10\ \mu s$
$100\ \mu s$
1 ms
10 ms
0
100
200
300
400
repetition frequency (Hz)


7Z67154
at V_R = stand-off voltage
max. values
I_R (mA)
10^2
10
1
10^{-1}
10^{-2}
BZW70-5V6 to 6V8
BZW70-7V5 to 62
0
50
100
150
T_j (^oC)

TRANSIENT SUPPRESSOR DIODES

A range of diffused silicon diodes in a DO-30 metal envelope intended for use in the protection of the electrical and electronic equipment against voltage transients.
The series consists of the following types:
Normal polarity (cathode to stud): BZW86-7V5 to 56
Reverse polarity (anode to stud) : BZW86-7V5R to 56R

QUICK REFERENCE DATA

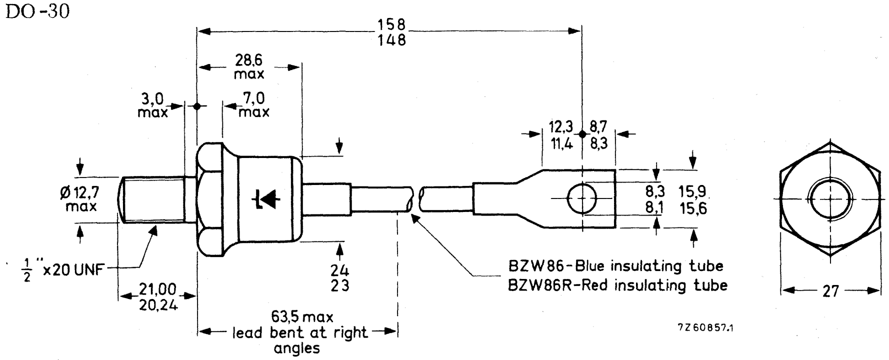
Stand-off voltage (15% range) *	V_R		7,5 to 56	V
Reverse breakdown voltage	$V_{(BR)R}$		9,4 to 64	V
Non-repetitive peak reverse power dissipation; exponential pulse	P_{RSM}	max.	25	kW

* The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.

MECHANICAL DATA

Dimensions in mm

DO-30



Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 19 mm

Diameter of clearance hole: max. 13 mm
Net weight: 123 g
The mark shown applies to the normal polarity types.

Torque on nut: min. 9 Nm (90 kgcm)
max. 17,5 Nm (175 kgcm)

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

Stand-off voltage *	V_R	equal to type number suffix		
Currents				
Non-repetitive peak reverse current				
T_j = 25 °C prior to surge				
t_p = 10 μs; square pulse				
BZW86-9V1(R)	I_{RSM}	max.	3700	A
BZW86-27(R)	I_{RSM}	max.	1200	A
BZW86-56(R)	I_{RSM}	max.	700	A
t_p = 1 ms; exponential pulse				
BZW86-9V1(R)	I_{RSM}	max.	1200	A
BZW86-27(R)	I_{RSM}	max.	400	A
BZW86-56(R)	I_{RSM}	max.	250	A
Power dissipation				
Repetitive peak reverse power dissipation T_{mb} = 65 °C; f = 50 Hz; t_p = 10 μs (square pulse; see also graphs on page 6)	P_{RRM}	max.	50	kW
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; exponential pulse: see also graph on page 5				
t_p = 100 μs	P_{RSM}	max.	60	kW
t_p = 1 ms	P_{RSM}	max.	25	kW
Temperatures				
Storage temperature	T_{stg}		−55 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0,3	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,1	°C/W

CHARACTERISTICS

Forward voltage

I_F = 500 A at T_j = 25 °C	V_F	<	1,5	V **

* The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.

** Measured under pulse condition.

CHARACTERISTICS (continued)

	Clamping voltages (exp. pulse) at T_j = 25 °C prior to surge; t_p = 500 μs $V_{(CL)R}$ (V)			Reverse breakdown voltage at T_j = 25 °C $V_{(BR)R}$ (V)	
	typ.	max.		min.	
BZW86 -7V5(R)	12	14	I_R = 1000 A	8,5	I_R = 10 A
-8V2(R)	13	15,5	I_R = 1000 A	9,4	I_R = 10 A
-9V1(R)	14	17	I_R = 1000 A	10,4	I_R = 10 A
-10(R)	15,5	18,5	I_R = 1000 A	11,4	I_R = 10 A
-11(R)	17	20	I_R = 1000 A	12,4	I_R = 10 A
-12(R)	18,5	22	I_R = 1000 A	13,8	I_R = 10 A
-13(R)	20	24	I_R = 1000 A	15,3	I_R = 10 A
-15(R)	23	27		16,8	I_R = 10 A
-16(R)	27	32	I_R = 500 A	18,8	I_R = 5 A
-18(R)	31	36	I_R = 500 A	20,8	I_R = 5 A
-20(R)	34	40	I_R = 500 A	22,8	I_R = 5 A
-22(R)	37	43	I_R = 500 A	25,1	I_R = 5 A
-24(R)	40	47	I_R = 500 A	28	I_R = 5 A
-27(R)	44	52	I_R = 500 A	31	I_R = 5 A
-30(R)	47	55	I_R = 250 A	34	I_R = 5 A
-33(R)	51	60	I_R = 250 A	37	I_R = 2 A
-36(R)	55	65	I_R = 250 A	40	I_R = 2 A
-39(R)	60	70	I_R = 250 A	44	I_R = 2 A
-43(R)	66	77	I_R = 250 A	48	I_R = 2 A
-47(R)	72	84	I_R = 250 A	52	I_R = 2 A
-51(R)	78	92	I_R = 250 A	58	I_R = 2 A
-56(R)	85	102	I_R = 250 A	64	I_R = 2 A

The maximum clamping voltage is the maximum reverse voltage which appear across the diode at the specified pulse duration and junction temperature.
See curves on pages 8 and 9 for square pulses and pages 10 and 11 for exponential pulses.

CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Peak reverse current

V_{RM} = recommended stand-off voltage	I_{RM}	<	2	mA
Temperature coefficient of clamping voltage	S	typ.	+0, 1	%/°C

OPERATING NOTES

Heatsink considerations

(a) For non-repetitive transients, the device may be used without a heatsink for pulses up to 10 ms in duration.

(b) For repetitive transients which fall within the permitted operating range shown in the curves on page 6 the required heatsink is found as follows:

$$R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a} = \frac{T_{j\ max} - T_{amb}}{P_S + \delta .\ P_{RRM}}$$

where $T_{j\ max}$ = 175 °C

T_{amb} = ambient temperature

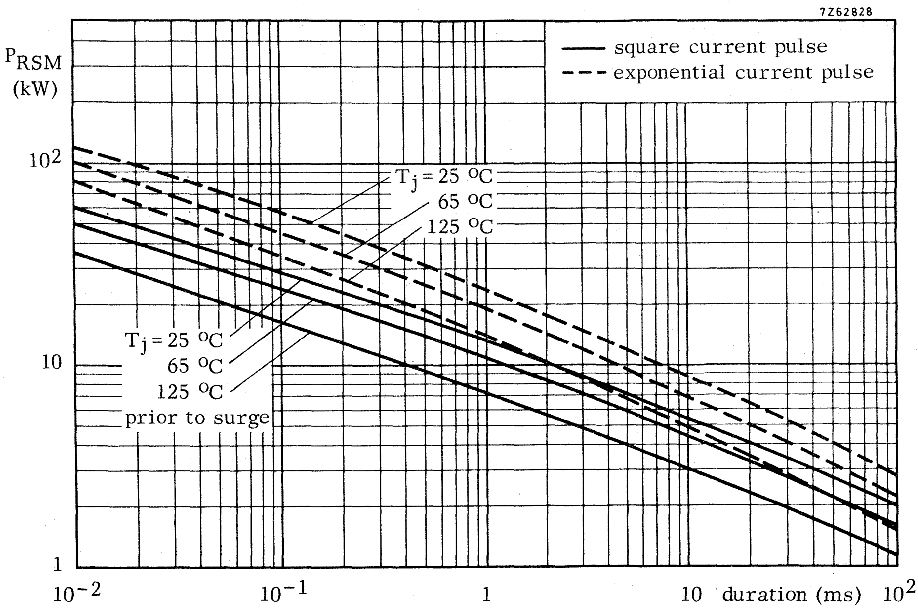
P_S = any steady state dissipation excluding that in pulses

δ = duty factor (t_p/T)

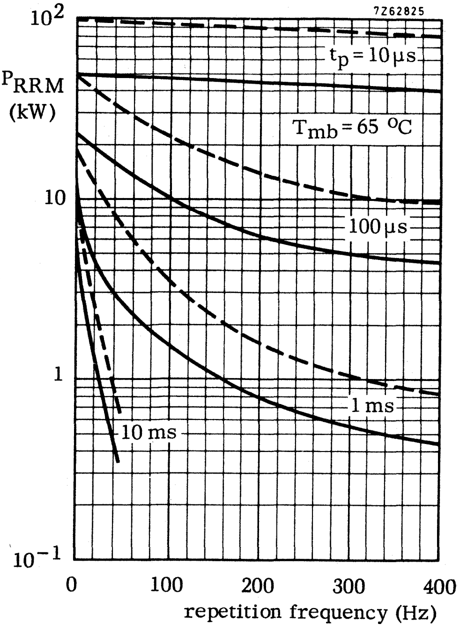
$R_{th\ j\text{-}mb}$ = 0, 3 °C/W

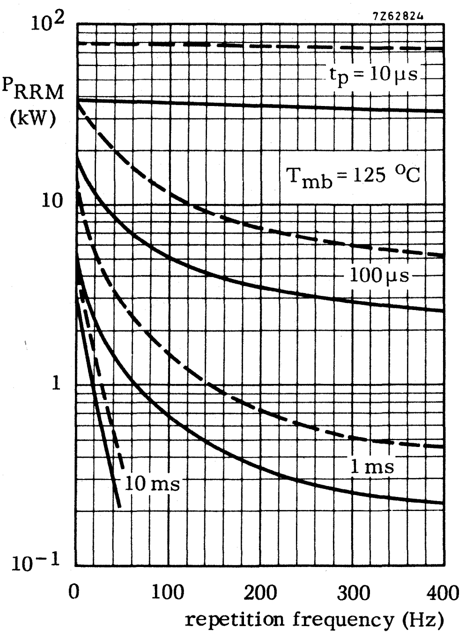
$R_{th\ mb\text{-}h}$ = 0, 1 °C/W

thus $R_{th\ h\text{-}a}$ can be found.



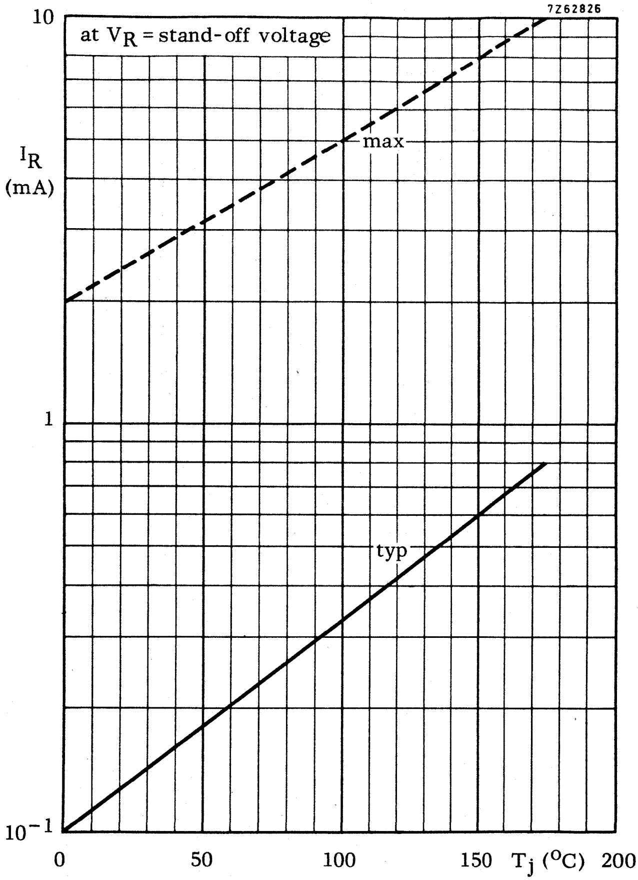
Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that the energy content does not continue beyond twice this time.

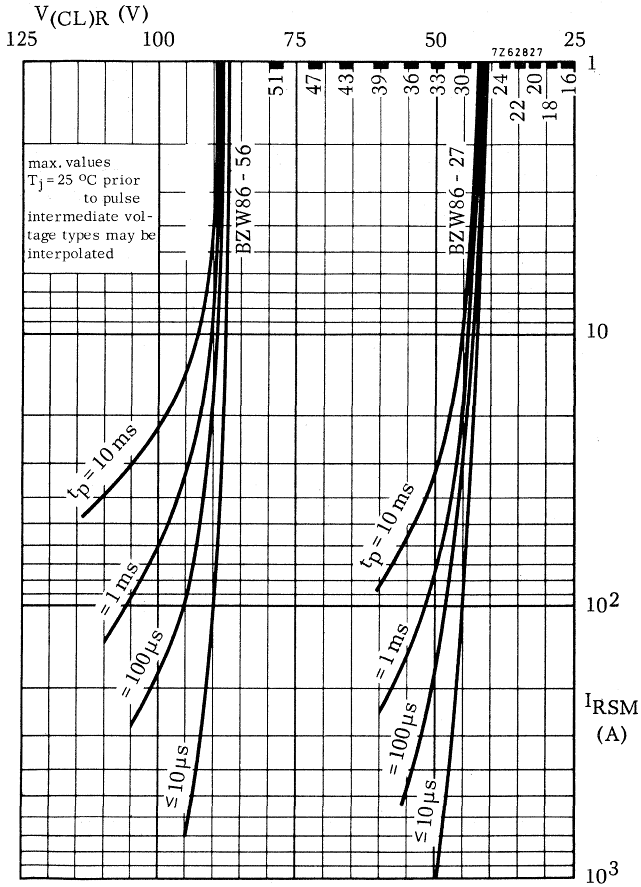




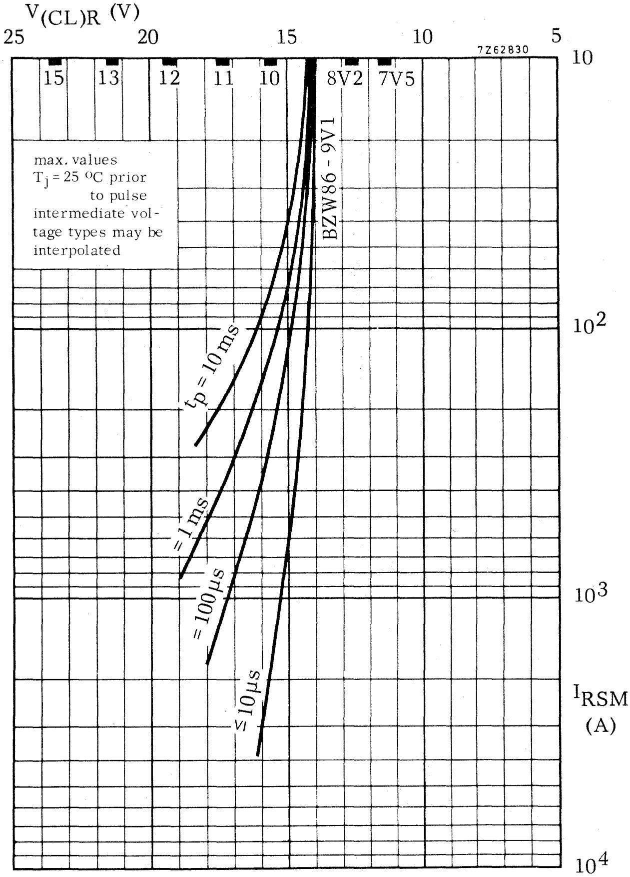
——— square current pulses

– – – exponential current pulses

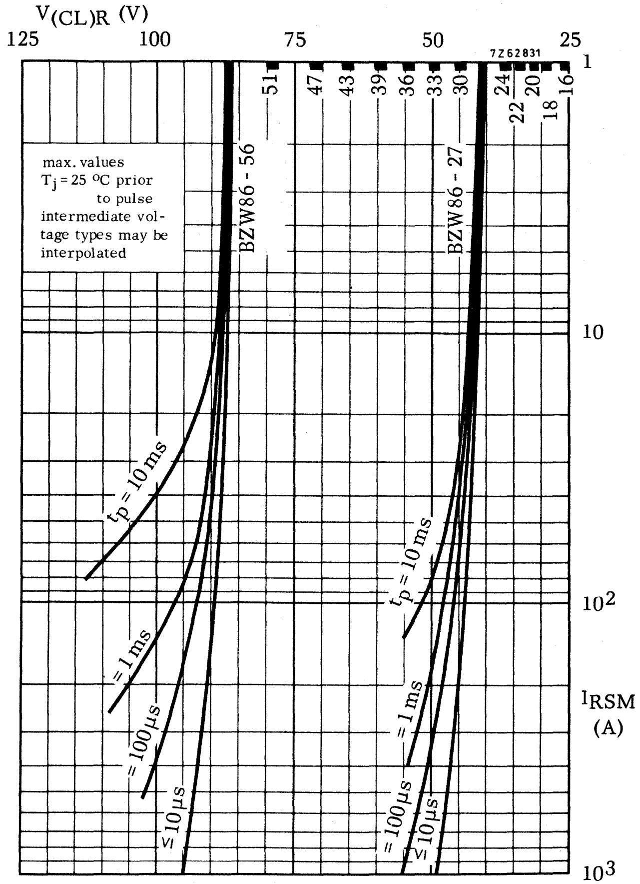

7Z62826
at V_R = stand-off voltage
10
1
10^{-1}
I_R (mA)
max
typ
0
50
100
150
200
T_j (°C)



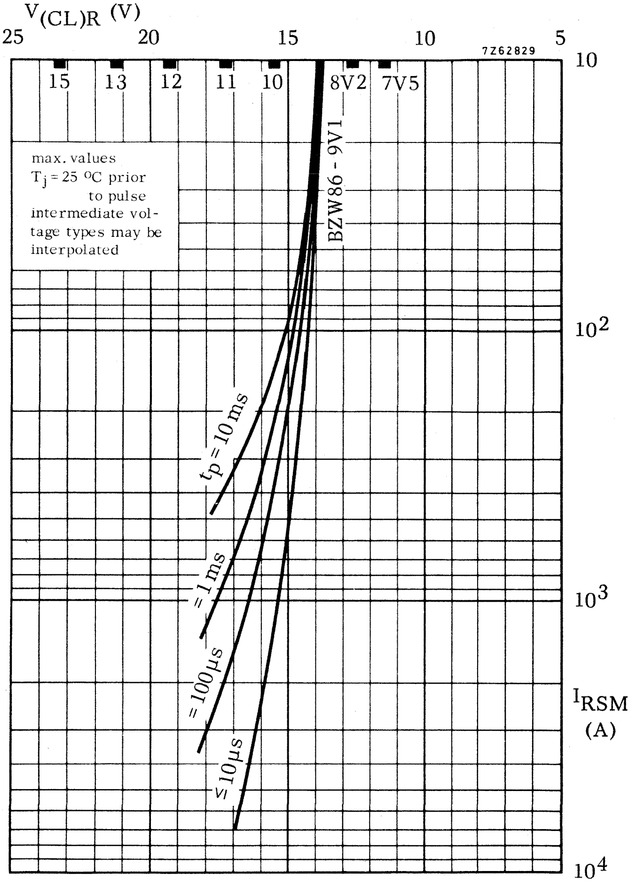
square pulses



square pulses



exponential pulses



exponential pulses

TRANSIENT SUPPRESSOR DIODES

A range of diffused silicon diodes in a DO-5 metal envelope intended for use in the protection of the electrical and electronic equipment against voltage transients.
The series consists of the following types:
Normal polarity (cathode to stuf): BZW91 - 6V2 to 62
Reverse polarity (anode to stud) : BZW91 - 6V2R to 62R

QUICK REFERENCE DATA

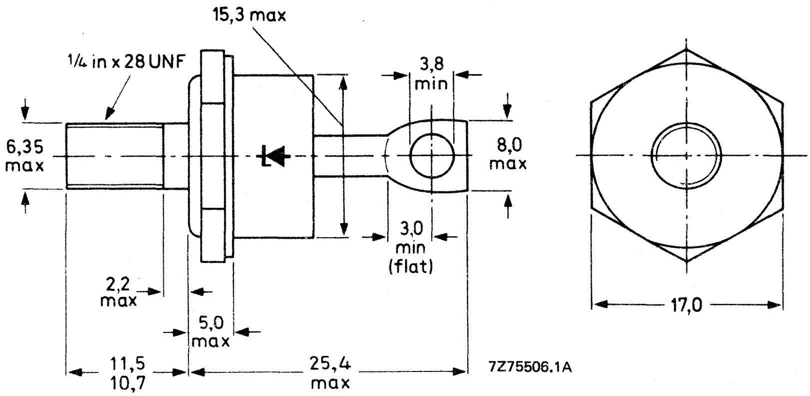
Stand-off voltage (15% range)*	V_R		6, 2 to 62	V
Reverse breakdown voltage	$V_{(BR)R}$		7, 0 to 70	V
Non-repetitive peak reverse power dissipation; T_j = 25 °C prior to surge; t_p = 100 μs (exponential pulse)	P_{RSM}	max.	27	kW

* The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.

MECHANICAL DATA

Dimensions in mm

DO-5



Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 11, 1 mm
Diameter of clearance hole: max. 6, 5 mm
Net mass: 16, 5 kg
Accessories available: 56264A; 56309B; 56309R
The mark shown applies to the normal polarity types.

Torque on nut: min. 1, 7 Nm (17 kgcm)
max. 3, 5 Nm (35 kgcm)

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

Stand-off voltage [1]	V_R	equal to type number suffix		
Currents				
Non-repetitive peak reverse current T_j = 25 °C prior to surge				
t_p = 10 µs; square pulse				
BZW91-6V8(R)	I_{RSM}	max.	2800	A
BZW91-11(R)	I_{RSM}	max.	1700	A
BZW91-18(R)	I_{RSM}	max.	1000	A
BZW91-39(R)	I_{RSM}	max.	480	A
BZW91-62(R)	I_{RSM}	max.	350	A
t_p = 1 ms; exponential pulse				
BZW91-6V8(R)	I_{RSM}	max.	660	A
BZW91-11(R)	I_{RSM}	max.	430	A
BZW91-18(R)	I_{RSM}	max.	240	A
BZW91-39(R)	I_{RSM}	max.	120	A
BZW91-62(R)	I_{RSM}	max.	85	A
Power dissipation				
Repetitive peak reverse power dissipation T_{mb} = 65 °C; f = 50 Hz; t_p = 10 µs (square pulse; see also graphs on page 6)	P_{RRM}	max.	25	kW
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; t_p = 100 µs (exponetial pulse; see also graph on page 5)	P_{RSM}	max.	27	kW
Temperatures				
Storage temperature	T_{stg}		-55 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j-a}$	=	25	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	1,5	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,2	°C/W

CHARACTERISTICS

Forward voltage

I_F = 10 A at T_j = 25 °C	V_F	<	1,5	V [2]

1) The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.
2) Measured under pulse conditions.

CHARACTERISTICS (continued)

	Clamping voltages (exp. pulse) at T_j = 25 °C prior to pulse; t_p = 500 µs $V_{(CL)R}$ (V) typ.	max.		Reverse breakdown voltage at T_j = 25 °C $V_{(BR)R}$ (V) min.	
BZW91 -6V2(R)	9,5	10,5	I_R = 150 A	7,0	I_R = 5 A
-6V8(R)	10	11,5		7,7	
-7V5(R)	11	12,5		8,5	I_R = 2 A
-8V2(R)	12	13,5		9,4	
-9V1(R)	13	15		10,4	
-10(R)	14,5	17		11,4	
-11(R)	16	19		12,4	
-12(R)	17,5	22		13,8	
-13(R)	19	26		15,3	
-15(R)	22	28	I_R = 100 A	16,8	
-16(R)	24	31		18,8	I_R = 1 A
-18(R)	26	34		20,8	
-20(R)	28	37		22,8	
-22(R)	31	40		25,1	
-24(R)	34	44		28	
-27(R)	38	48		31	
-30(R)	40	52	I_R = 50 A	34	
-33(R)	44	56		37	I_R = 0,5 A
-36(R)	49	61		40	
-39(R)	54	66		44	
-43(R)	60	72		48	
-47(R)	66	79		52	
-51(R)	72	87		58	
-56(R)	79	97		64	
-62(R)	86	97		70	

The maximum clamping voltage is the maximum reverse voltage which appear across the diode at the specified pulse duration and junction temperature.
See curves on pages 8 and 9 for square pulses and pages 10 and 11 for exponential pulses.

CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Peak reverse current

V_{RM} = recommended stand-off voltage

BZW91-5V6 to BZW91-6V8	I_{RM}	<	60	mA
BZW91-7V5 to BZW91-30	I_{RM}	<	5	mA
BZW91-33 to BZW91-62	I_{RM}	<	10	mA
Temperature coefficient of clamping voltage	S	typ.	+0,1	%/°C

OPERATING NOTES

Heatsink considerations

(a) For non-repetitive transients, the device may be used without a heatsink for pulses up to 10 ms in duration.

(b) For repetitive transients which fall within the permitted operating range shown in the curves on page 6 the required heatsink is found as follows:

$$R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a} = \frac{T_{j\ max} - T_{amb}}{P_S + \delta .\ P_{RRM}}$$

where $T_{j\ max}$ = 175 °C

T_{amb} = ambient temperature

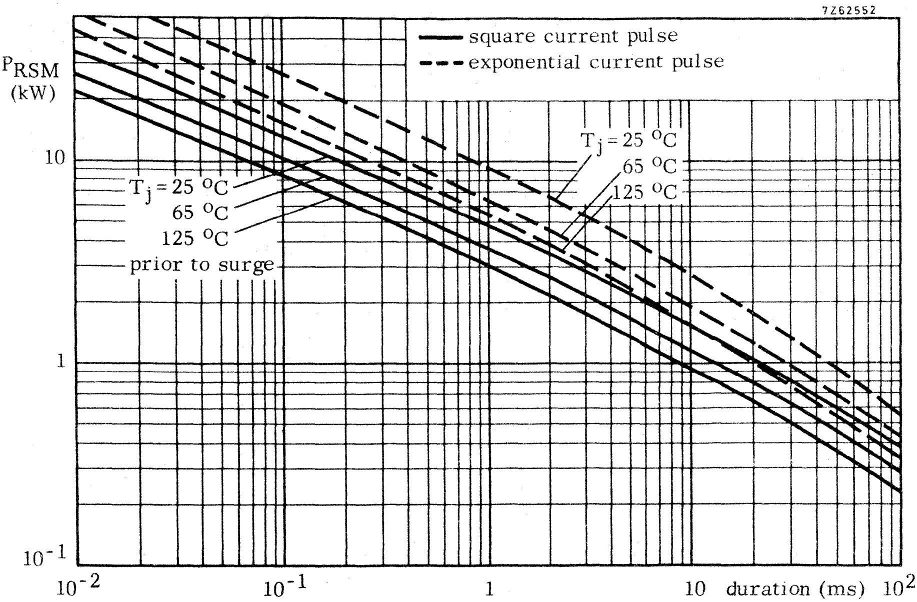
P_S = any steady state dissipation exluding that in pulses

δ = duty factor (t_p/T)

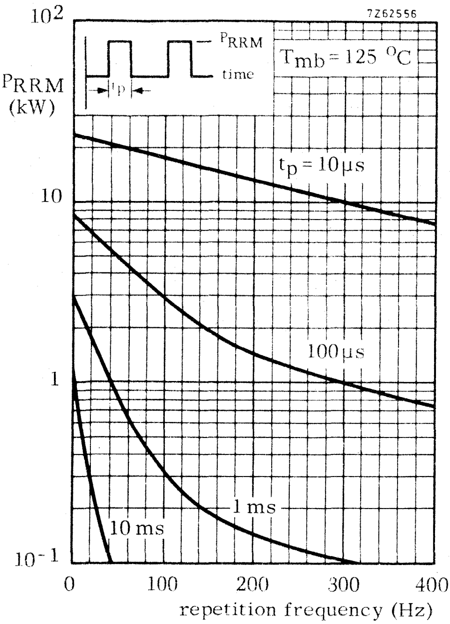
$R_{th\ j\text{-}mb}$ = 1,5 °C/W

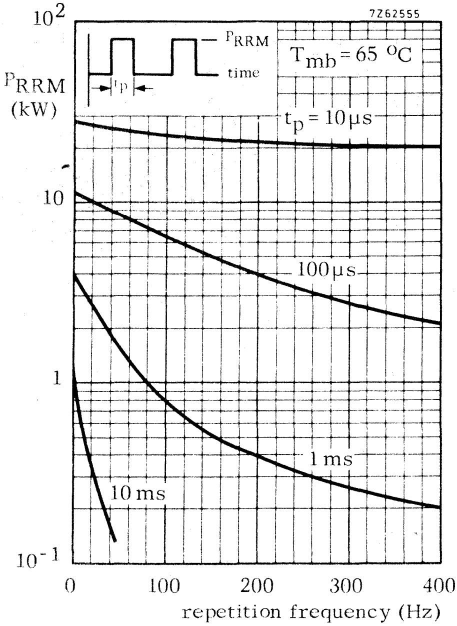
$R_{th\ mb\text{-}h}$ = 0 2 °C/W

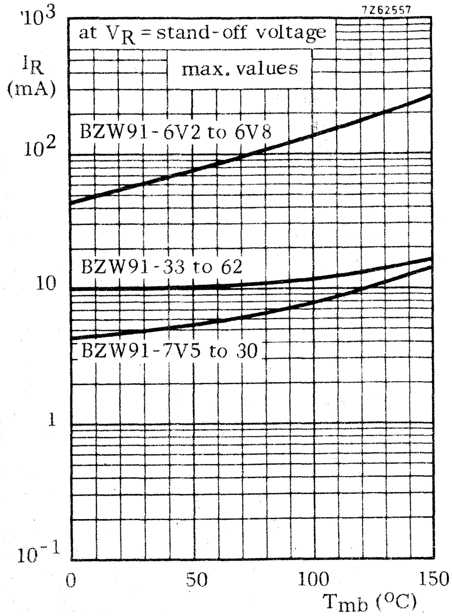
thus $R_{th\ h\text{-}a}$ can be found.

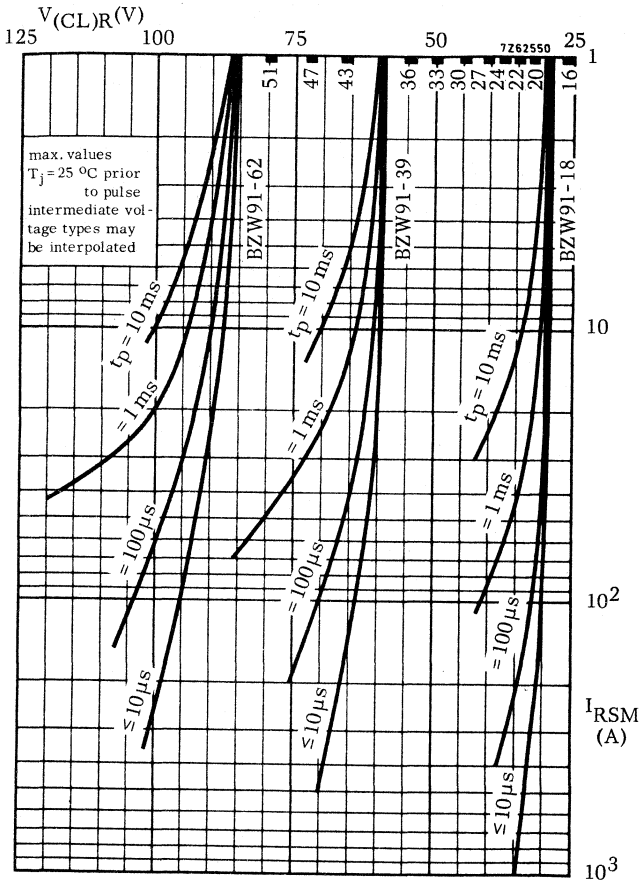


Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that the energy content does not continue beyond twice this time.

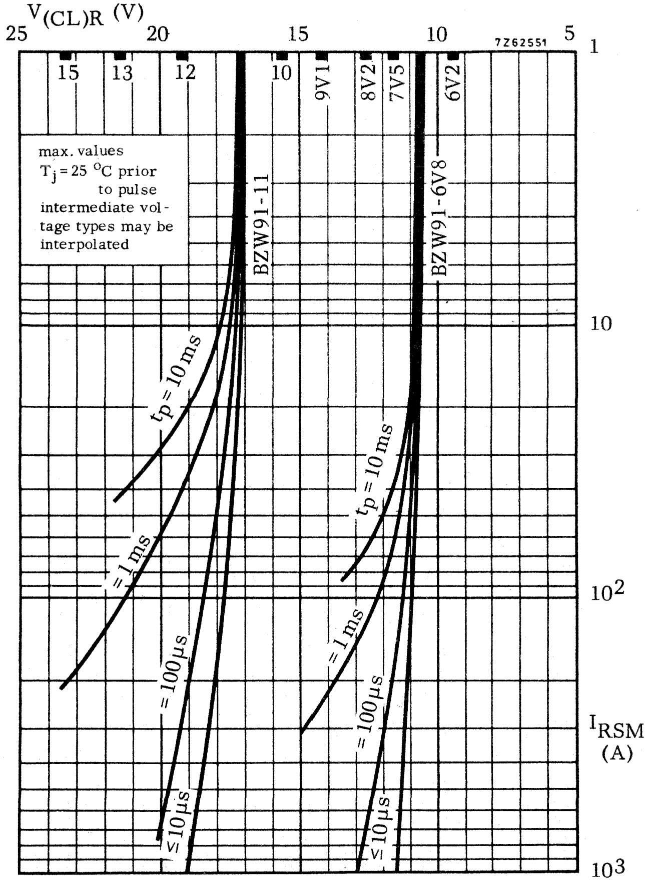

7Z62556
10^2
P_{RRM}
(kW)
10
1
10^{-1}
P_{RRM}
time
t_p
T_{mb} = 125 °C
t_p = 10 μs
100 μs
1 ms
10 ms
0
100
200
300
400
repetition frequency (Hz)


7Z62555
10^2
P_{RRM}
(kW)
10
1
10^{-1}
P_{RRM}
time
t_p
T_{mb} = 65 °C
t_p = 10 μs
100 μs
1 ms
10 ms
0
100
200
300
400
repetition frequency (Hz)

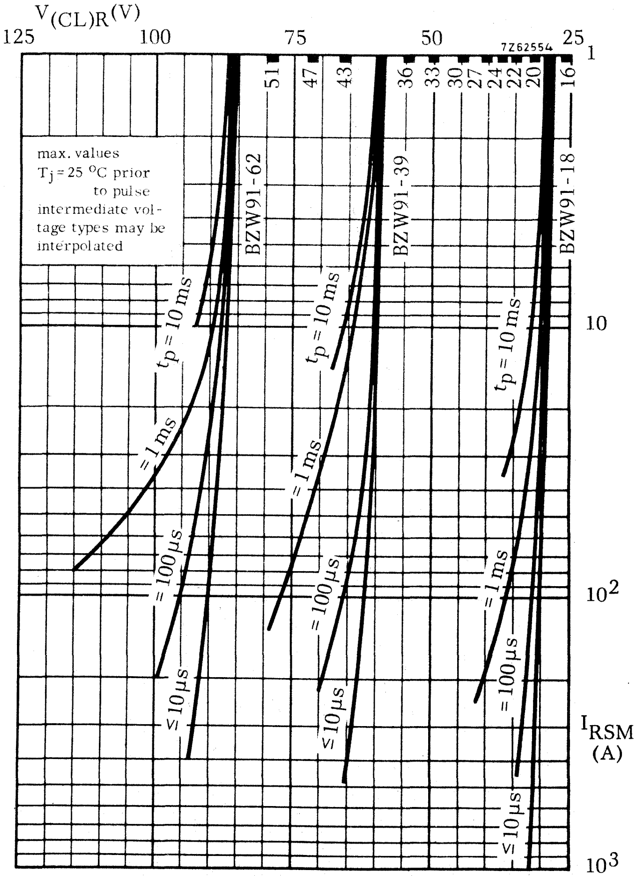

7Z62557
at V_R = stand-off voltage
max. values
I_R
(mA)
BZW91-6V2 to 6V8
BZW91-33 to 62
BZW91-7V5 to 30
10^3
10^2
10
1
10^-1
0
50
100
150
T_mb (°C)



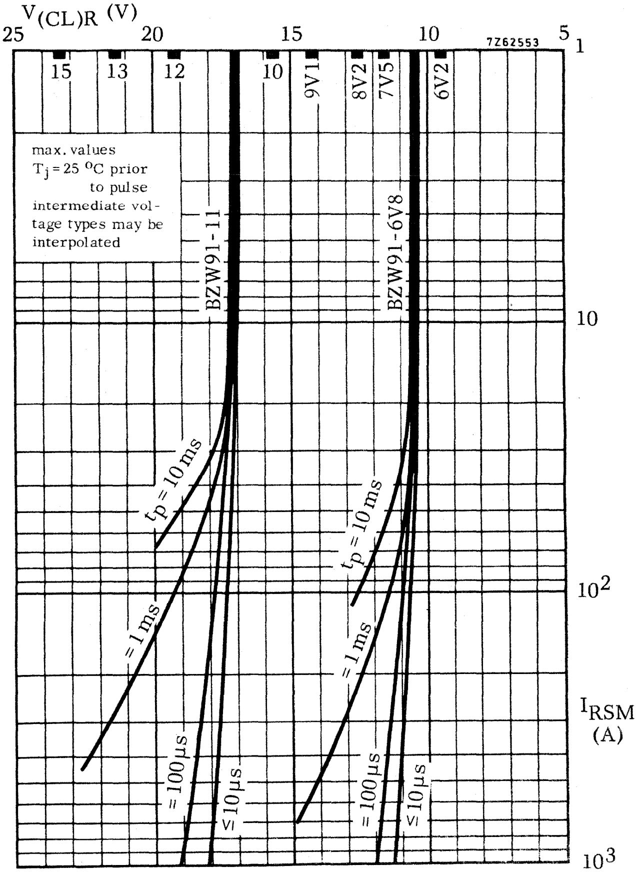
square pulses



square pulses



exponential pulses



exponential pulses

TRANSIENT SUPPRESSOR DIODES

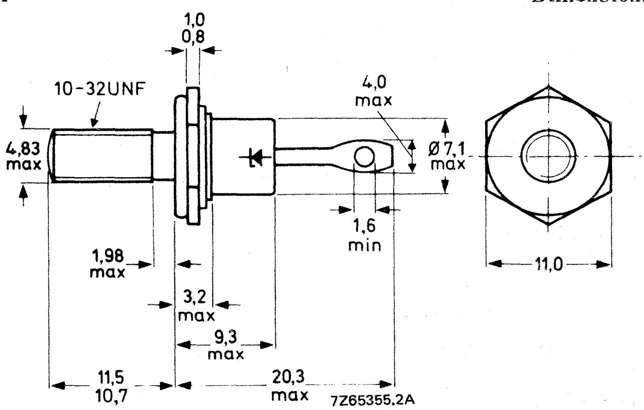
A range of diffused silicon diodes in a DO-4 metal envelope intended for use in the protection of the electrical and electronic equipment against voltage transients.
The series consists of the following types:
Normal polarity (cathode to stud): BZW93-5V6 to 62
Reverse polarity (anode to stud) : BZW93-5V6R to 62R

QUICK REFERENCE DATA				
Stand-off voltage (15% range)*	V_R		5,6 to 62	V
Reverse breakdown voltage	$V_{(BR)R}$		6,4 to 70	V
Non-repetitive peak reverse power dissipation; exponential pulse	P_{RSM}	max.	3	kW

* The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.

MECHANICAL DATA Dimensions in mm

DO-4



Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 9,5 mm
Diameter of clearance hole: max. 5,2 mm
Net mass: 6 g
The mark shown applies to the normal polarity types.

Torque on nut: min. 0,9 Nm (9 kgcm)
max. 1,7 Nm (17 kgcm)

FOR NEW DESIGN THE SUCCESSOR TYPE BZY93 SERIES IS RECOMMENDED

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

Stand-off voltage [1]	V_R	equal to type number suffix		
Currents				
Non-repetitive peak reverse current				
T_j = 25 °C prior to surge				
t_p = 10 μs; square pulse				
BZW93-6V8(R)	I_{RSM}	max.	300	A
BZW93-11(R)	I_{RSM}	max.	180	A
BZW93-18(R)	I_{RSM}	max.	100	A
BZW93-39(R)	I_{RSM}	max.	50	A
BZW93-62(R)	I_{RSM}	max.	33	A
t_p = 1 ms; exponential pulse				
BZW93-6V8(R)	I_{RSM}	max.	58	A
BZW93-11(R)	I_{RSM}	max.	33	A
BZW93-18(R)	I_{RSM}	max.	20	A
BZW93-39(R)	I_{RSM}	max.	10	A
BZW93-62(R)	I_{RSM}	max.	6,5	A
Power dissipation				
Repetitive peak reverse power dissipation T_{mb} = 65 °C; f = 50 Hz; t_p = 10 μs (square pulse; see also graphs on page 6)	P_{RRM}	max.	3	kW
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; t_p = 100 μs (exponential pulse; see also graph on page 5)	P_{RSM}	max.	3	kW
Temperatures				
Storage temperature	T_{stg}		−55 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j\text{-}a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	5,0	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	°C/W

CHARACTERISTICS

Forward voltage

I_F = 10 A at T_j = 25 °C	V_F	<	1	1,5	V [2]

1) The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.
2) Measured under pulse conditions.

CHARACTERISTICS (continued)

	Clamping voltages (exp. pulse) at T_j = 25 °C prior to pulse; t_p = 500 µs $V_{(CL)R}$ (V)			Reverse breakdown voltage at T_j = 25 °C $V_{(BR)R}$ (V)	
	typ.	max.		min.	
BZW93 -5V6(R)	9	10	I_R = 20 A	6,4	I_R = 2 A
-6V2(R)	10	11,2	I_R = 20 A	7,0	I_R = 2 A
-6V8(R)	11	12,5	I_R = 20 A	7,7	I_R = 2 A
-7V5(R)	12	14	I_R = 20 A	8,5	I_R = 1 A
-8V2(R)	13,5	15,5	I_R = 20 A	9,4	I_R = 1 A
-9V1(R)	15	17,5	I_R = 20 A	10,4	I_R = 1 A
-10(R)	17	19	I_R = 20 A	11,4	I_R = 1 A
-11(R)	19	21	I_R = 20 A	12,4	I_R = 1 A
-12(R)	21	23	I_R = 20 A	13,8	I_R = 1 A
-13(R)	23	26	I_R = 20 A	15,3	I_R = 0,5 A
-15(R)	22	26	I_R = 20 A	16,8	I_R = 0,5 A
-16(R)	25	29	I_R = 10 A	18,8	I_R = 0,5 A
-18(R)	28	33	I_R = 10 A	20,8	I_R = 0,5 A
-20(R)	32	38	I_R = 10 A	22,8	I_R = 0,5 A
-22(R)	36	43	I_R = 10 A	25,1	I_R = 0,5 A
-24(R)	41	48	I_R = 10 A	28	I_R = 0,5 A
-27(R)	47	54	I_R = 10 A	31	I_R = 0,5 A
-30(R)	44	52	I_R = 5 A	34	I_R = 0,2 A
-33(R)	49	58	I_R = 5 A	37	I_R = 0,2 A
-36(R)	56	65	I_R = 5 A	40	I_R = 0,2 A
-39(R)	63	72	I_R = 5 A	44	I_R = 0,2 A
-43(R)	71	82	I_R = 5 A	48	I_R = 0,2 A
-47(R)	80	93	I_R = 5 A	52	I_R = 0,2 A
-51(R)	89	104	I_R = 5 A	58	I_R = 0,2 A
-56(R)	98	116	I_R = 5 A	64	I_R = 0,2 A
-62(R)	104	116	I_R = 5 A	70	I_R = 0,2 A

The maximum clamping voltage is the maximum reverse voltage which appear across the diode at the specified pulse duration and junction temperature.
See curves on pages 8 and 9 for square pulses and pages 10 and 11 for exponential pulses.

CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Peak reverse current

V_{RM} = recommended stand-off voltage				
BZW93-5V6 to BZW93-6V8	I_{RM}	<	0,5	mA
BZW93-7V5 to BZW93-62	I_{RM}	<	0,1	mA
Temperature coefficient of clamping voltage	S	typ.	+0,1	%/°C

OPERATING NOTES

Heatsink considerations

(a) For non-repetitive transients, the device may be used without a heatsink for pulses up to 10 ms in duration.

(b) For repetitive transients which fall within the permitted operating range shown in the curves on page 6 the required heatsink is found as follows:

$$R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a} = \frac{T_{j\ max} - T_{amb}}{P_S + \delta .\ P_{RRM}}$$

where $T_{j\ max}$ = 175 °C

T_{amb} = ambient temperature

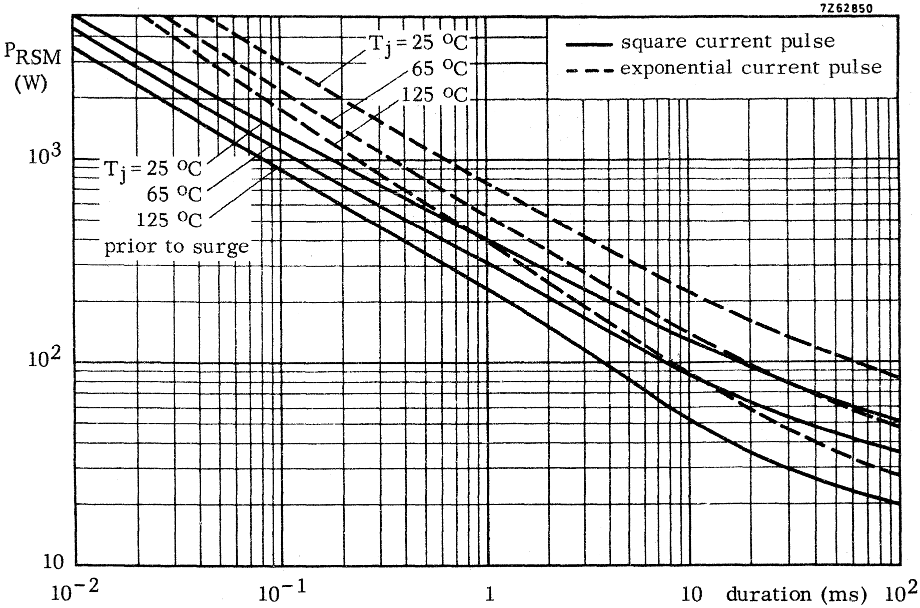
P_S = any steady state dissipation excluding that in pulses

δ = duty factor (t_p/T)

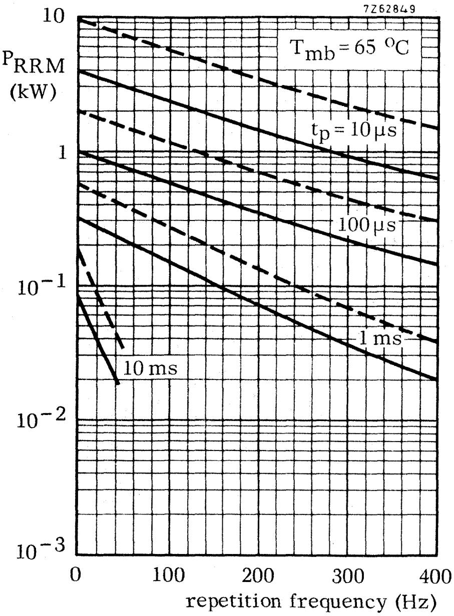
$R_{th\ j\text{-}mb}$ = 5,0 °C/W

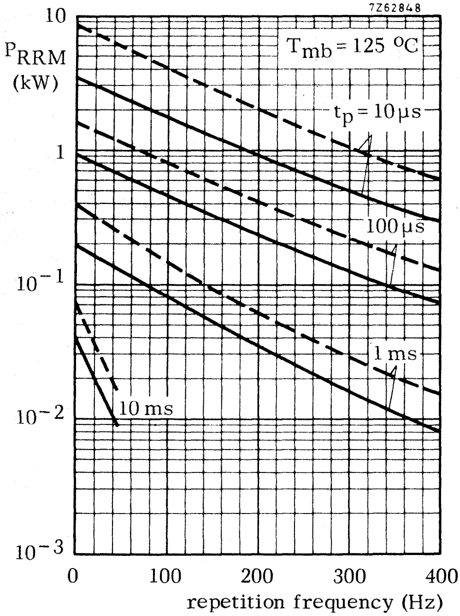
$R_{th\ mb\text{-}h}$ = 0,6 °C/W

thus $R_{th\ h\text{-}a}$ can be found.



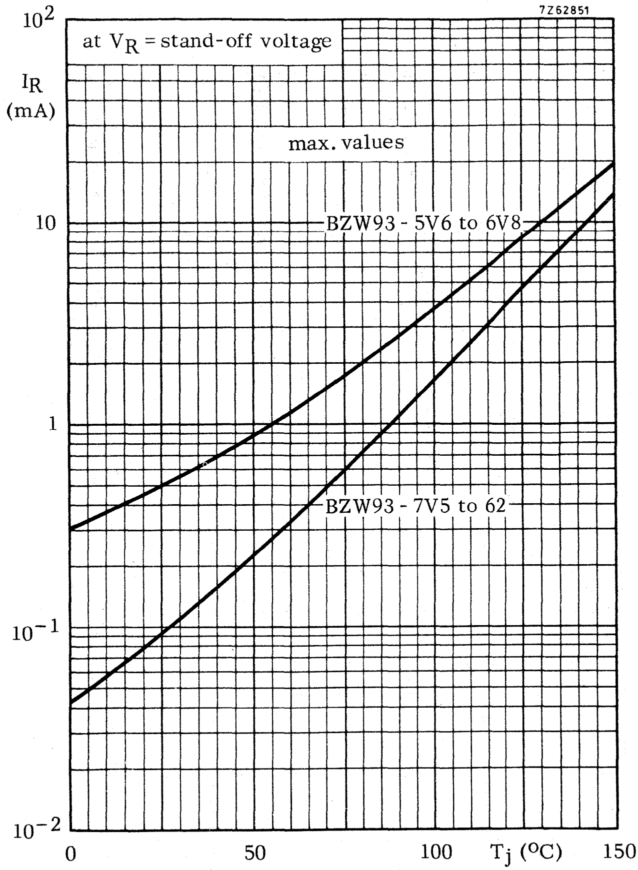
Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that the energy content does not continue beyond twice this time.

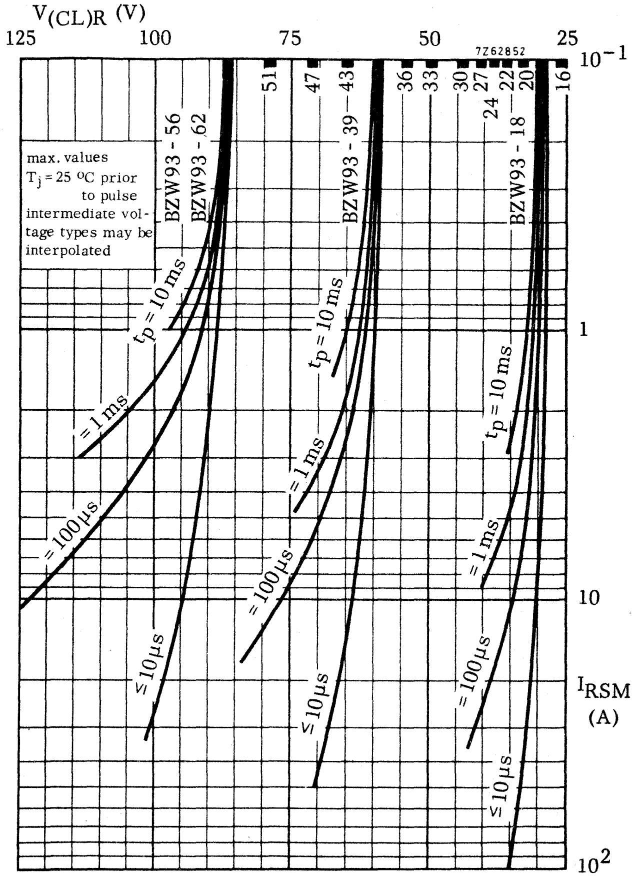




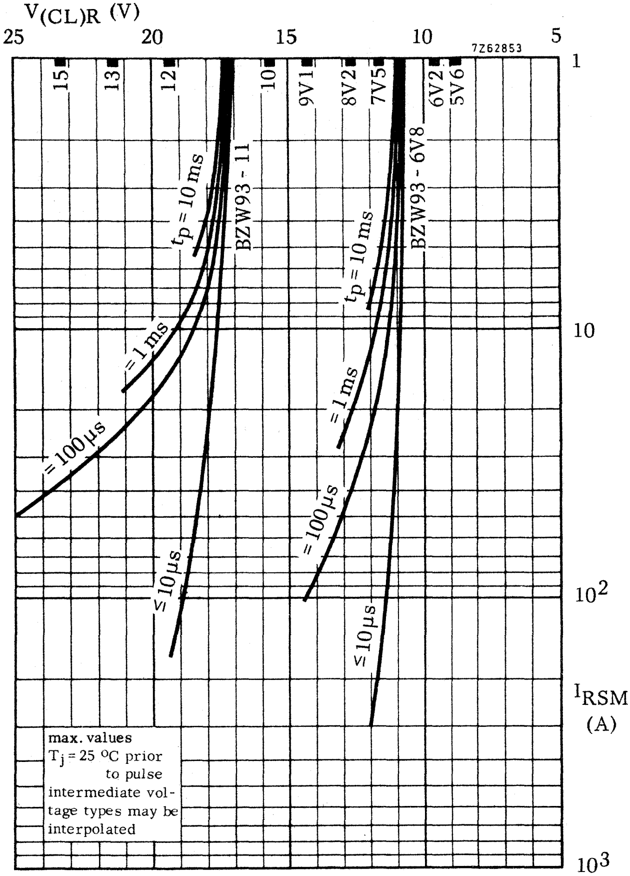
——— square current pulses

– – – exponential current pulses

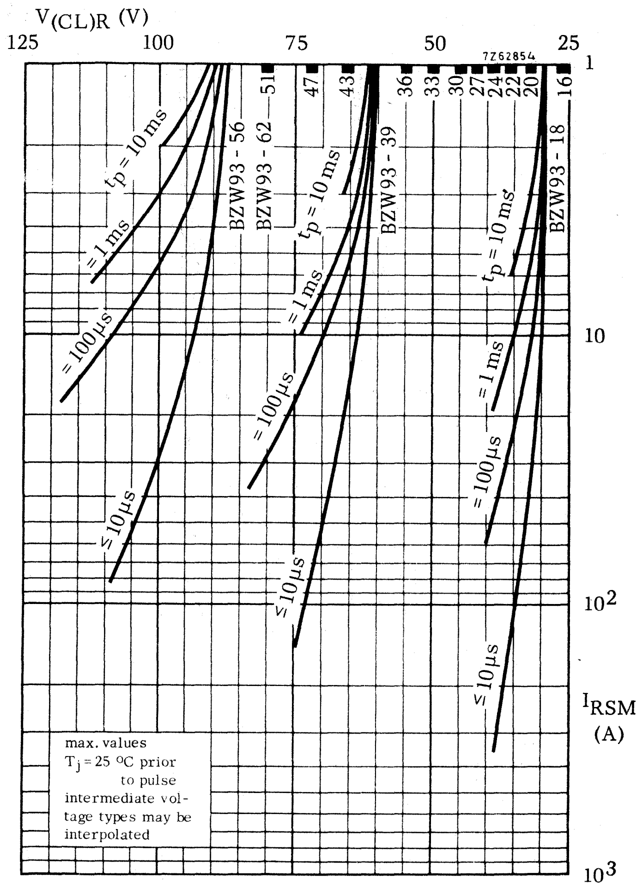

7Z62851
at V_R = stand-off voltage
I_R
(mA)
max. values
10^2
10
1
10^{-1}
10^{-2}
BZW93 - 5V6 to 6V8
BZW93 - 7V5 to 62
0
50
100
T_j (°C)
150



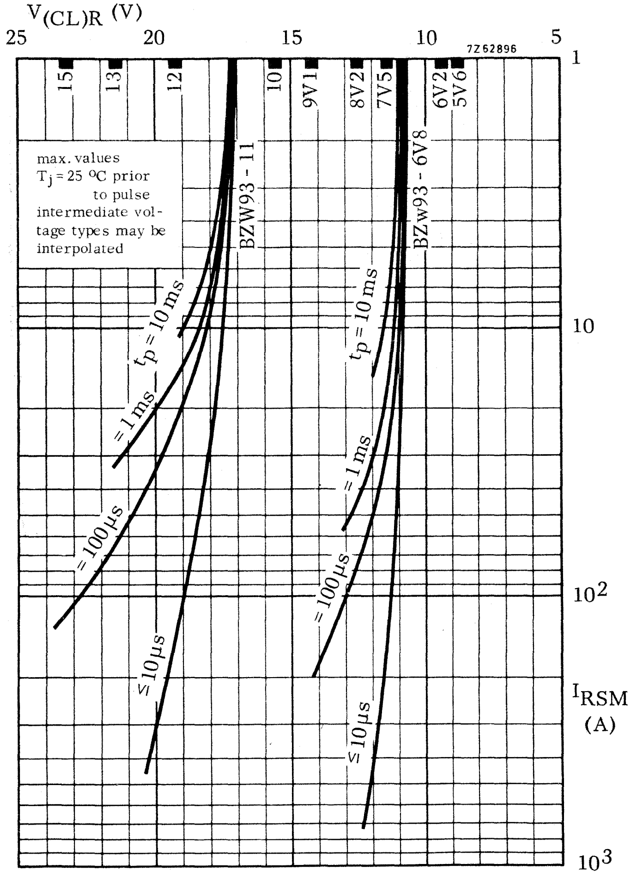
square pulses



square pulses



exponential pulses



exponential pulses

TRANSIENT SUPPRESSOR DIODES

A range of diffused silicon diodes in DO-1 envelopes, intended for use in protection of electrical and electronic equipment against voltage transients.
The series consists of the following types: BZW95-8V2 to 62.

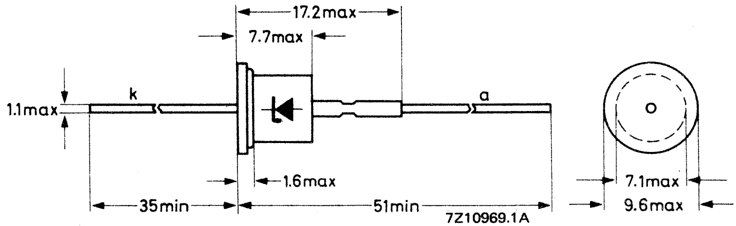
QUICK REFERENCE DATA

Stand-off voltage (15% range)*	V_R		8,2 to 62 V
Reverse breakdown voltage	$V_{(BR)R}$		9,4 to 70 V
Non-repetitive peak reverse power dissipation; exponential pulse	P_{RSM}	max.	700 W

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-1.



* The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.

FOR NEW DESIGN THE SUCCESSOR TYPE BZY95 SERIES IS RECOMMENDED.

TRANSIENT SUPPRESSOR DIODES

A range of diffused silicon diodes in DO-1 envelopes, intended for use in protection of electrical and electronic equipment against voltage transients.
The series consists of the following types: BZW96-3V9 to 7V5.

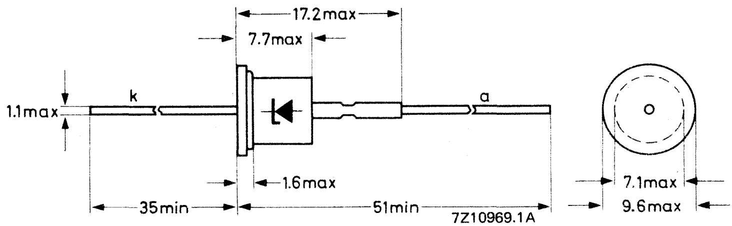
QUICK REFERENCE DATA

Stand-off voltage (15% range)*	V_R		3,9 to 7,5 V
Reverse breakdown voltage	$V_{(BR)R}$		4,4 to 8,6 V
Non-repetitive peak reverse power dissipation; exponential pulse	P_{RSM}	max.	190 W

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-1.

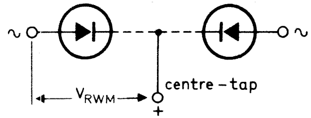
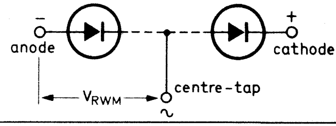
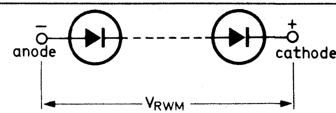


* The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.

FOR NEW DESIGN THE SUCCESSOR TYPE BZY96 SERIES IS RECOMMENDED.

RECTIFIER STACKS

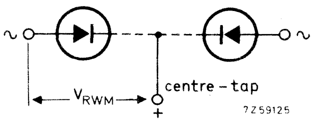
TYPE SELECTION CHART

Type number		OSB9110	OSB9210	OSB9310	OSB9410	OSM9110	OSM9210	OSM9310	OSM9410	OSS9110	OSS9210	OSS9310	OSS9410
Number of diodes		4. 6. . . 28. 30				4. 6. . . 28. 30				3. 4. . . . 29. 30			
Circuit													
Crest working reverse voltage		2. 3. . . 14. 15 kV				2. 3. . . 14. 15 kV				3. 4. . . . 29. 30 kV			
	T_{amb} = 35 °C	3. 5 A	5 A	4 A	10 A	3. 5 A	5 A	4 A	10 A	3. 5 A	5 A	4 A	10 A
Average forward current per diode at:	T_{oil} = 30 °C		20 A				20 A				20 A		
	T_{oil} = 35 °C				30 A				30 A				30 A
	T_{oil} = 65 °C			12 A				12 A				12 A	
	T_{oil} = 100 °C	6 A				6A				6 A			
Non-repetitive peak forward current		85 A	360 A	180 A	800 A	85 A	360 A	180 A	800 A	85 A	360 A	180 A	800 A
Base		A = **M6-studs at the ends** B = 4 pin Super Jumbo (B4D) C = Goliath E = 4 pin Jumbo (B4F) F = A3-20											

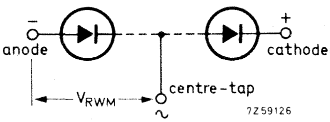
HIGH VOLTAGE RECTIFIER STACKS

The OSB9110, OSM9110 and OSS9110series are ranges of high voltage rectifier assemblies, incorporating controlled avalanche diodes mounted on fire proof triangular formers. The OSB9110series is intended for application in two phase half wave rectifier circuits. The OSM9110series is intended for application in single phase or three phase bridges or in voltage doubler circuits.
The OSS9110series is intended for all kinds of high voltage rectification. The assemblies are supplied with **M6 studs or with standard valve bases.** The OSB9110-series and OSM9110series are supplied with a centre tap (8-32UNC). The maximum crest working voltages of the OSB9110 and OSM9110series cover the range from 2 kV to 15 kV, and of the OSS9110series the range from 3 kV to 30 kV, in 1 kV steps.

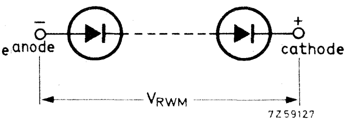
CIRCUIT OSB 9110



CIRCUIT OSM9110



CIRCUIT OSS9110



QUICK REFERENCE DATA

		OSB9110	−4	−6	. . .	−28	−30		
		OSM9110	−4	−6	. . .	−28	−30		
Crest working reverse voltage from centre tap to end	V_{RWM}	max.	2	3	. . .	14	15	kV	
		OSS9110	−3	−4	. . .	−29	−30		
Crest working reverse voltage	V_{RWM}	max.	3	4	. . .	29	30	kV	
Average forward current with R and L load (averaged over any 20 ms period)									
in free air up to T_{amb} = 35 °C					$I_{F(AV)}$	max.		3.5	A
in oil up to T_{oil} = 100 °C					$I_{F(AV)}$	max.		6	A
Non-repetitive peak forward current t = 10 ms; half sine wave; T_j = 175 °C prior to surge					I_{FSM}	max.		125	A

MECHANICAL DATA see pages 4 and 5.

All information applies to frequencies up to 400 Hz

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

			OSB9110 -4 / OSM9110-4	-6 / -6	...	-28 / -28	-30 / -30	
Crest working reverse voltage	V_{RWM}	max.	2	3	...	14	15	kV

			OSS9110 -3	-4	...	-29	-30	
Crest working reverse voltage	V_{RWM}	max.	3	4	...	29	30	kV

Currents

Average forward current (averaged over any 20 ms period)				
in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	3.5	A
in oil up to T_{oil} = 100 °C	$I_{F(AV)}$	max.	6	A
Repetitive peak forward current	I_{FRM}	max.	120	A
→ Non-repetitive peak forward current t = 10 ms; half sine wave; T_j = 175 °C prior to surge	I_{FSM}	max.	**125**	A

Reverse power dissipation

			OSB9110 -4 / OSM9110-4	-6 / -6	...	-28 / -28	-30 / -30	
Repetitive peak reverse power t = 10 µs (square wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.	1.2	1.8	...	8.4	9	kW
Non-repetitive peak reverse power t = 10 µs (square wave)								
T_j = 25 °C prior to surge	P_{RSM}	max.	6	9	...	42	45	kW
T_j=125 °C prior to surge	P_{RSM}	max.	1.2	1.8	...	8.4	9	kW

			OSS9110 -3	-4	...	-29	-30	
Repetitive peak reverse power dissipation t = 10 µs (square wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.	1.8	2.4	...	17.4	18	kW
Non-repetitive peak reverse power dissipation t = 10 µs (square wave)								
T_j = 25 °C prior to surge	P_{RSM}	max.	9	12	...	87	90	kW
T_j =175 °C prior to surge	P_{RSM}	max.	1.8	2.4		17.4	18	kW

Temperatures

Storage temperature	T_{stg}		-55 to +175	°C
Junction temperature	T_j	max.	175	°C

CHARACTERISTICS (See note 1)

			OSB9110-4 / OSM9110-4	-6	...	-28	-30	
Forward voltage								
I_F = 20 A; T_j = 25 °C	V_F	<	4	6	...	28	30	V
Reverse avalanche breakdown voltage [1]								
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	2.5	3.75	...	17.5	18.75	kV
		<	3.76	5.64	...	26.32	28.2	kV

			OSS9110 -3	-4	...	-29	-30	
Forward voltage								
I_F = 20 A; T_j = 25 °C	V_F	<	6	8	...	58	60	V
Reverse avalanche breakdown voltage [1]								
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	3.75	5.0	...	36.25	37.5	kV
		<	5.64	7.52	...	54.52	56.4	kV

Reverse current				
$V_{RM} = V_{RWMmax}$; T_j = 125 °C	I_{RM}	<	0.6	mA

NOTES

1. The Ratings and Characteristics given apply from centre tap to end. (Not for OSS9110series)
2. Type number suffix

   The suffix consists of a figure indicating the total number of diodes, followed by a letter indicating the base.
   A = M6 studs at the ends
   B = 4 pin Super Jumbo (B4D)
   C = Goliath
   E = 4 pin Jumbo (B4F)
   F = A3-20
3. Operating position

   The rectifier units can be operated at their maximum ratings when mounted in any position.

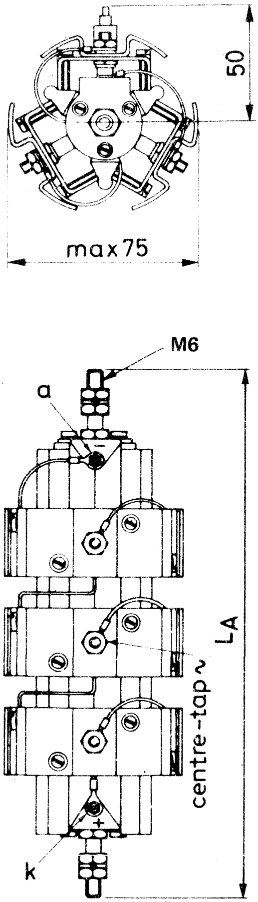
[1]) The breakdown voltage increases by approximately 0.1 % per °C with increasing junction temperature.

MECHANICAL DATA

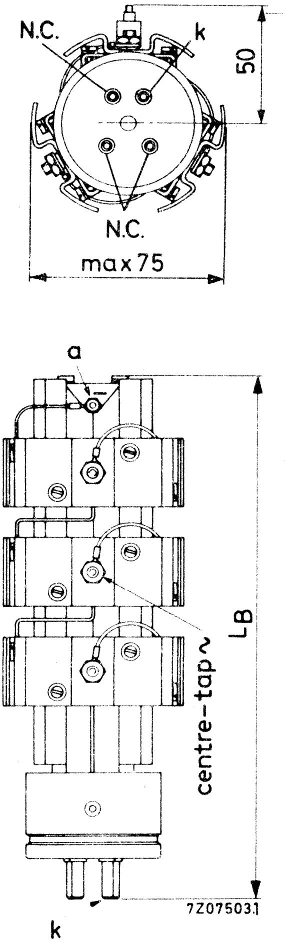
Dimensions in mm

n = total number of diodes

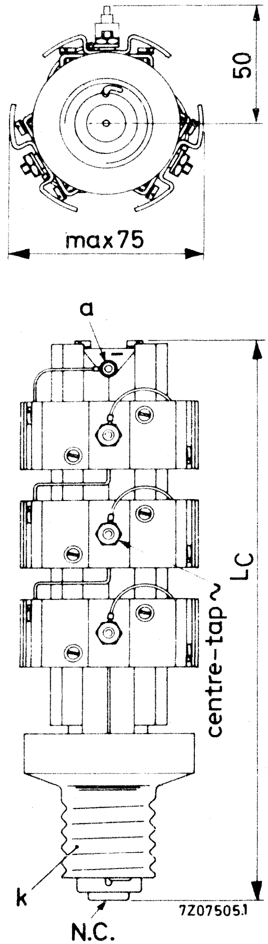
OSM9110-nA



OSM9110-nB



OSM9110-nC



The drawings show the OSM9110series; the OSB9110 and OSS9110series differ in the following respects:

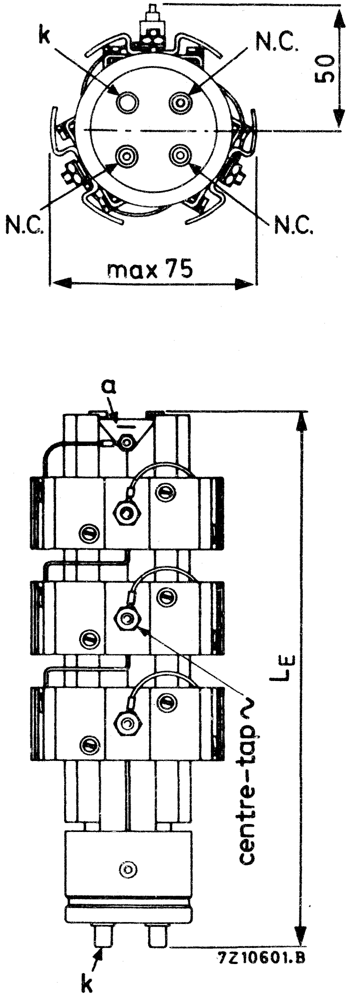
OSB9110series – terminals marked a(-) and k(+) in the drawings are both marked ∿ ; the centre-tap is marked + (instead of ∿ as in the drawings).

OSS9110series – has no centre-tap.

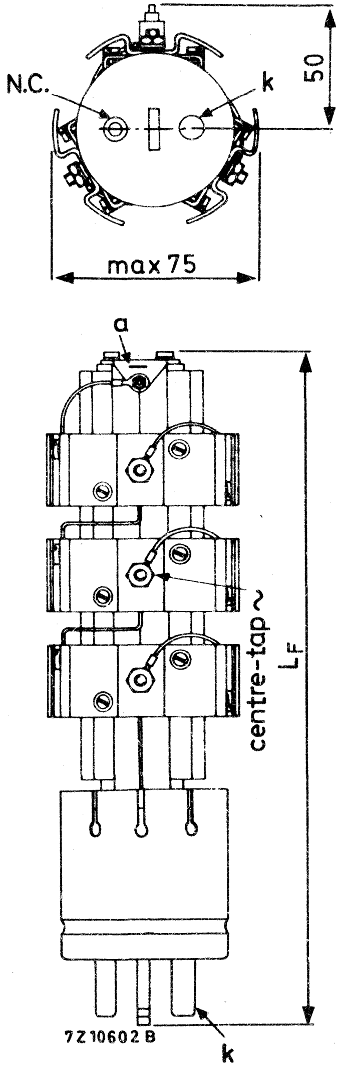
MECHANICAL DATA (continued)

n = total number of diodes.

OSM9110-nE



OSM9110-nF

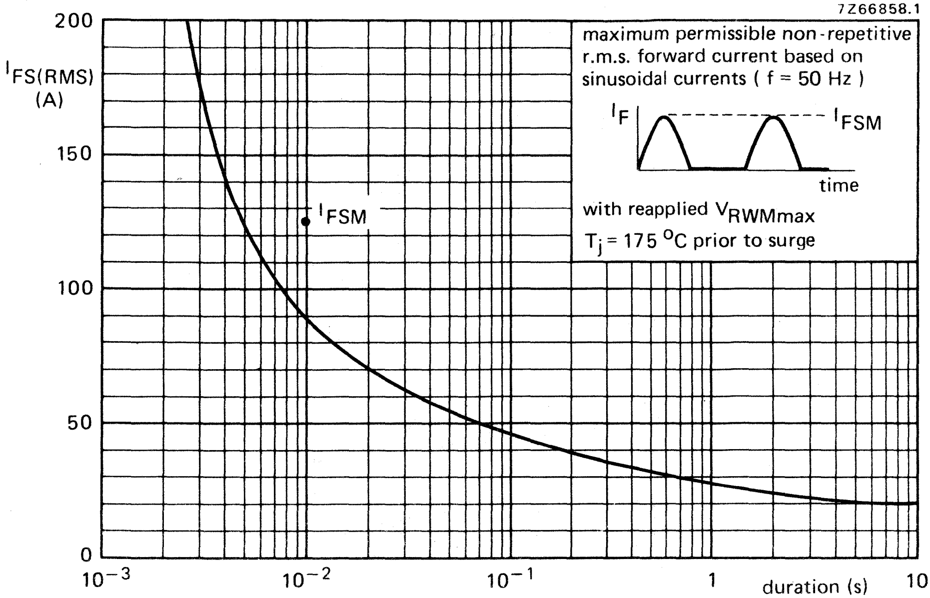


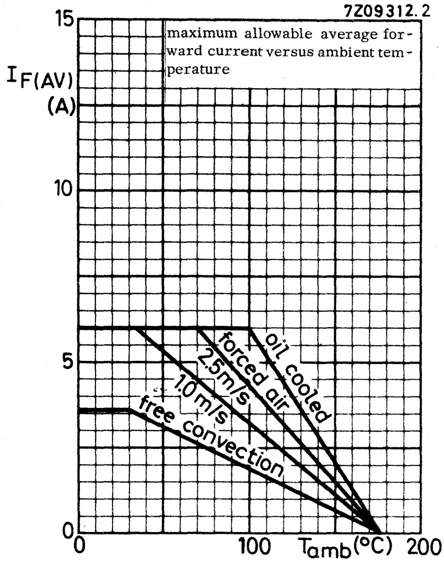
For lengths and weights see table on page 6.

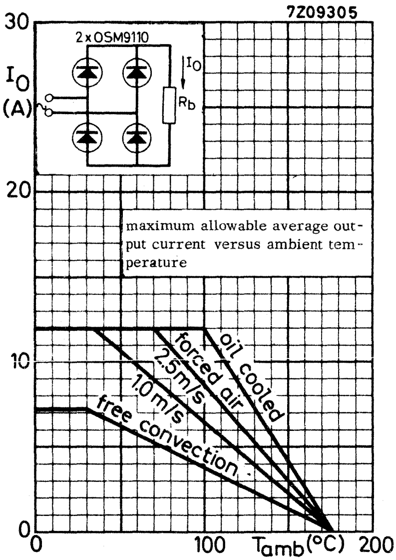
Table of lengths and weights (mm and g)

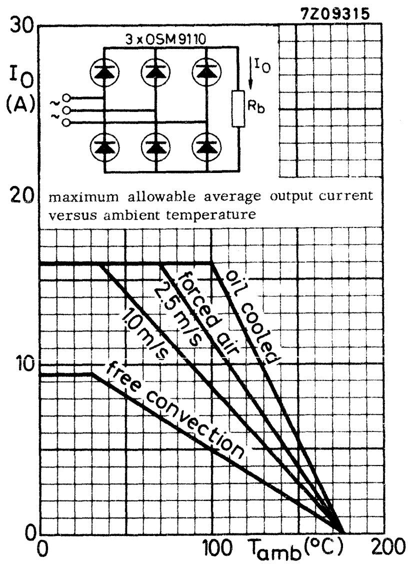
number of diodes	n	3	4 to 6	7 to 9	10 to 12	13 to 15
maximum lengths	L_A	143	184	224	264	305
	L_B	147	188	228	268	309
	L_C	159	199	239	279	320
	L_E	132	173	213	253	294
	L_F	184	225	265	305	346
weights	W_A	153	286	419	552	685
W_B = W_C =	W_E	218	351	484	617	750
	W_F	379	512	645	778	911

number of diodes	n	16 to 18	19 to 21	22 to 24	25 to 27	28 to 30
maximum lengths	L_A	345	385	426	466	506
	L_B	349	389	430	470	510
	L_C	360	400	441	481	521
	L_E	334	374	415	455	495
	L_F	386	426	467	507	547
weights	W_A	818	951	1048	1217	1350
W_B = W_C =	W_E	883	1016	1149	1282	1415
	W_F	1044	1177	1310	1443	1576


7Z66858.1
200
$I_{FS(RMS)}$ (A)
150
100
50
0
I_{FSM}
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
time
with reapplied V_{RWMmax}
T_j = 175 °C prior to surge
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10

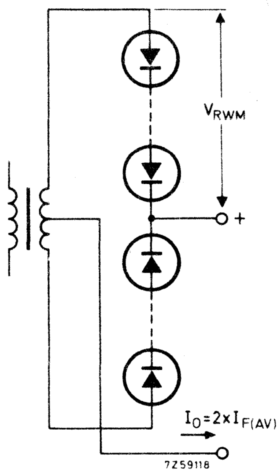

7Z09312.2
maximum allowable average forward current versus ambient temperature
$I_{F(AV)}$ (A)
15
10
5
0
oil cooled
forced air
2.5 m/s
1.0 m/s
free convection
0
100
T_{amb} (°C)
200


7Z09305
2 x OSM9110
I_O
R_b
I_O (A)
30
20
10
0
maximum allowable average output current versus ambient temperature
oil cooled
forced air
2.5 m/s
1.0 m/s
free convection
0
100
T_{amb} (°C)
200

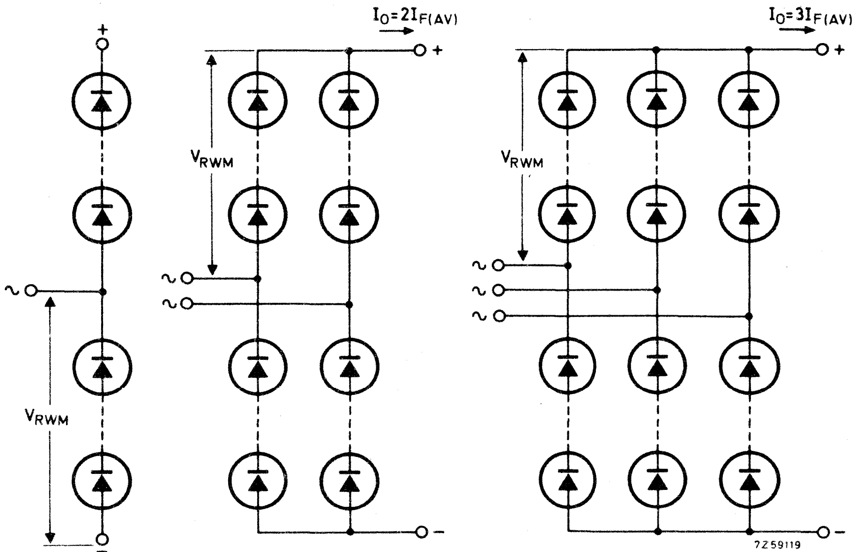

7Z09315
3 x OSM9110
I_O
R_b
I_O (A)
30
20
10
0
maximum allowable average output current versus ambient temperature
oil cooled
forced air
2.5 m/s
1.0 m/s
free convection
0
100
T_{amb} (°C)
200

APPLICATION INFORMATION

OSB9110-4



OSM9110series



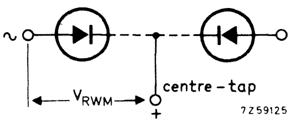
voltage doubler
1x OSM 9110

rectifier circuits with respectively
2x OSM 9110 and 3x OSM9110

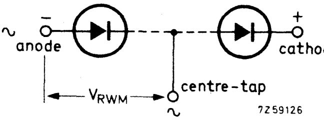
HIGH VOLTAGE RECTIFIER STACKS

The OSB9210, OSM9210 and OSS9210series are ranges of high voltage rectifier assemblies, incorporating controlled avalanche diodes mounted on fire proof triangular formers. The OSB9210series is intended for application in two phase half wave rectifier circuits. The OSM9210series is intended for application in single phase or three phase bridges or in voltage doubler circuits.
The OSS9210series is intended for all kinds of high voltage rectification. The assemblies are supplied with M6 studs or with standard valve bases. The OSB9210-series and OSM9210series are supplied with a centre tap (8-32UNC). The maximum crest working voltages of the OSB9210 and OSM9210series cover the range from 2 kV to 15 kV, and of the OSS9210series the range from 3 kV to 30 kV, in 1 kV steps. ←

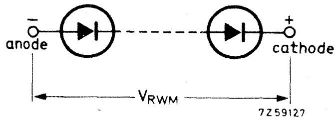
CIRCUIT OSB9210



CIRCUIT OSM9210



CIRCUIT OSS9210



QUICK REFERENCE DATA

			OSB9210 −4	−6	...	−28	−30	
			OSM9210−4	−6	...	−28	−30	
Crest working reverse voltage from centre tap to end	V_{RWM}	max.	2	3	...	14	15	kV
			OSS9210 −3	−4	...	−29	−30	
Crest working reverse voltage	V_{RWM}	max.	3	4	...	29	30	kV

Average forward current with R and L load (averaged over any 20 ms period)				
in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	5	A
in oil up to T_{oil} = 30 °C	$I_{F(AV)}$	max.	20	A
Non-repetitive peak forward current t = 10 ms; half sine wave; T_j = 175 °C prior to surge	I_{FSM}	max.	360	A

MECHANICAL DATA see page 4 and 5

All information applies to frequencies up to 400 Hz

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

		OSB9210	-4	-6	...	-28	-30	
		OSM9210	-4	-6	...	-28	-30	
Crest working reverse voltage	V_{RWM}	max.	2	3	...	14	15	kV
		OSS9210	-3	-4	...	-29	-30	
Crest working reverse voltage	V_{RWM}	max.	3	**4**	...	29	30	kV

Currents

Average forward current (averaged over any 20 ms period) in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	5	A
in oil up to T_{oil} = 30 °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	I_{FSM}	max.	360	A

Reverse power dissipation

		OSB9210	-4	-6	...	-28	-30	
		OSM9210	-4	-6	...	-28	-30	
Repetitive peak reverse power t = 10 µs (square wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.	4	6	...	28	30	kW
Non-repetitive peak reverse power t = 10 µs (square wave) T_j = 25 °C prior to surge	P_{RSM}	max.	26	39	...	182	195	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	4	6	...	28	30	kW
		OSS9210	-3	-4	...	-29	-30	kW
Repetitive peak reverse power dissipation t = 10 µs (square wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.	6	8	...	58	60	kW
Non-repetitive peak reverse power dissipation t = 10 µs (square wave) T_j = 25 °C prior to surge	P_{RSM}	max.	39	52	...	377	390	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	6	8		58	60	kW

Temperatures

Storage temperature	T_{stg}		-55 to +175	°C
Junction temperature	T_j	max.	175	°C

CHARACTERISTICS (See note 1)

			OSB9210 -4	-6	...	-28	-30	
			OSM9210-4	-6	...	-28	-30	
Forward voltage								
I_F = 50 A; T_j = 25 °C	V_F	<	3.6	5.4	...	25.2	27	V
Reverse breakdown voltage [1]								
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	2.5	3.75	...	17.5	18.75	kV
		<	3.76	5.64	...	26.32	28.2	kV

			OSS9210 -3	-4	...	-29	-30	
Forward voltage								
I_F = 50 A; T_j = 25 °C	V_F	<	5.4	7.2	...	52.2	54	V
Reverse breakdown voltage [1]								
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	3.75	5.0	...	36.25	37.5	kV
		<	5.64	7.52	...	54.52	56.4	kV

Reverse current

$V_{RM} = V_{RWM\,max}$; T_j = 125 °C $\quad I_{RM}$ < 0.6 mA

NOTES

1. The Ratings and Characteristics given apply from centre tap to end. (Not for OSS9210series).
2. Type number suffix

   The suffix sonsists of a figure indicating the total number of diodes, followed by a letter indicating the base.
   A = M6 studs at the ends
   B = 4 pin Super Jumbo (B4D)
   C = Goliath
   E = 4 pin Jumbo (B4F)
   F = A3-20
3. Operating position

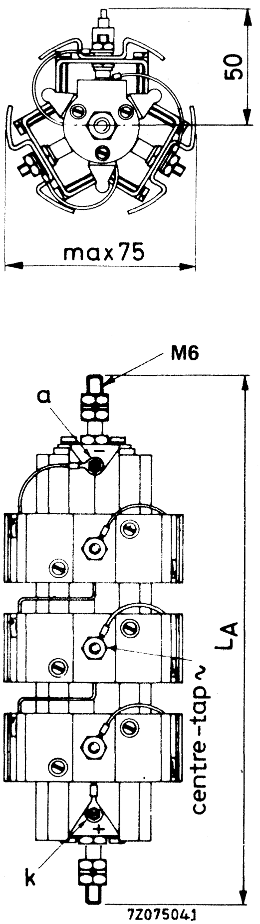
   The rectifier units can be operated at their maximum ratings when mounted in any position.

[1]) The breakdown voltage increases by approximately 0.1% per °C with increasing junction temperature.

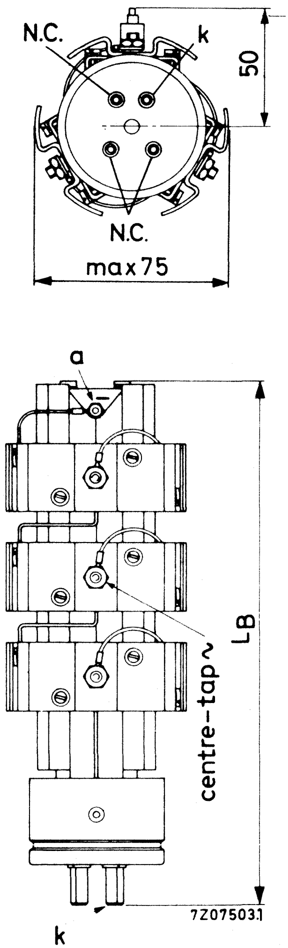
MECHANICAL DATA Dimensions in mm

n = total number of diodes

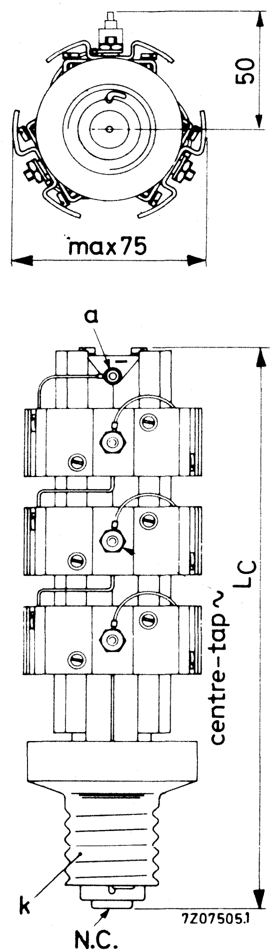
OSM9210-nA



OSM9210-nB



OSM9210-nC



The drawings show the OSM9210series; the OSB9210 and OSS9210series differ in the following respects:

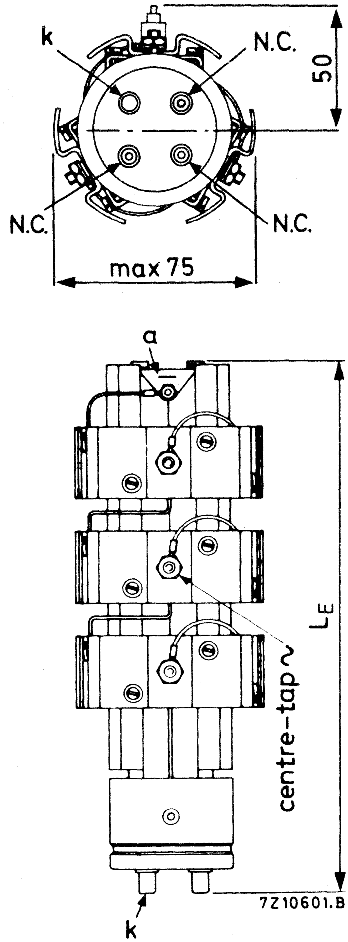
OSB9210series – terminals marked a(-) and k(+) in the drawings are both marked ∿; the centre-tap is marked + (instead of ∿ as in the drawings).

OSS9210series – has no centre-tap.

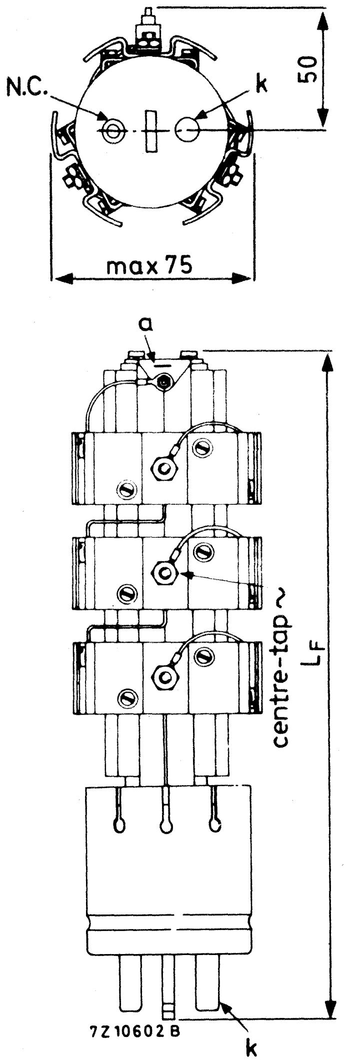
MECHANICAL DATA

n = total number of diodes.

OSM9210-nE



OSM9210-nF

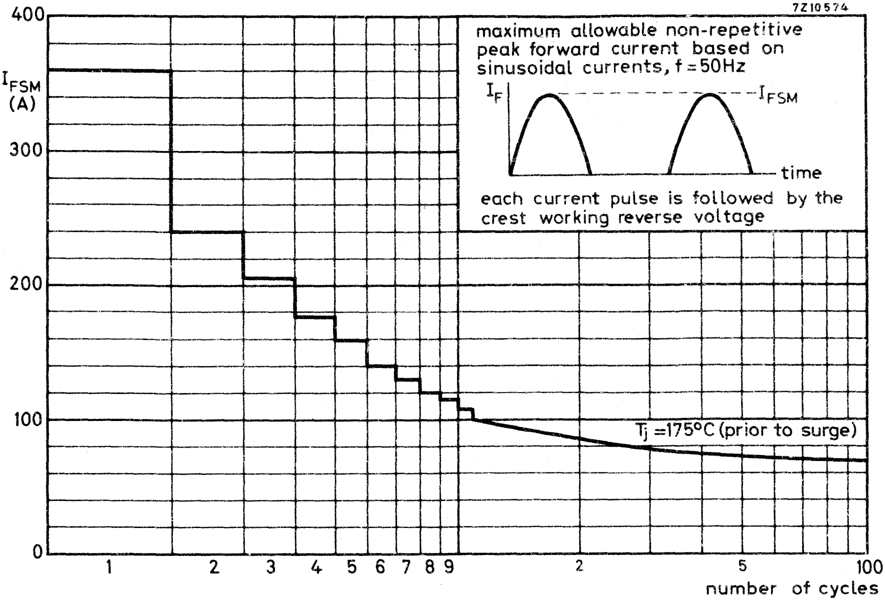


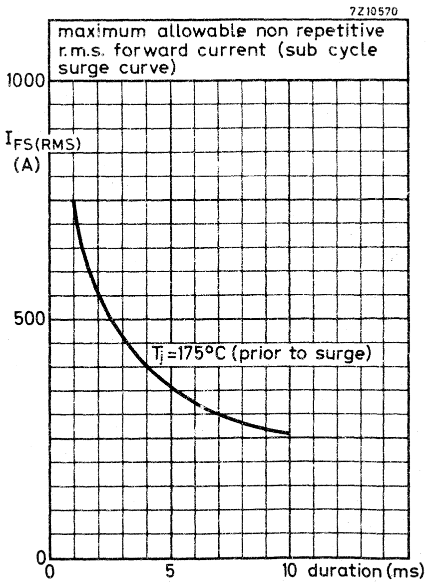
For lengths and weights see table on page 6.

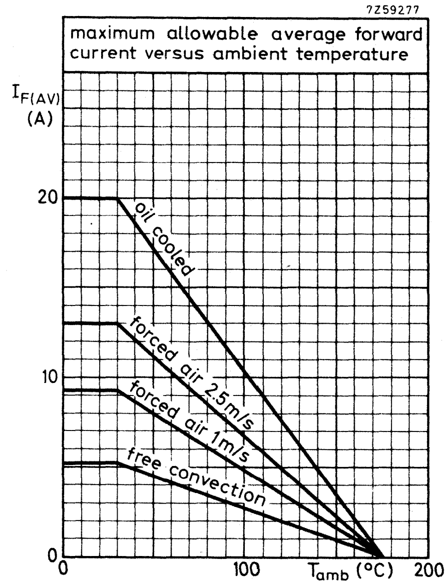
Table of lengths and weights (mm and g)

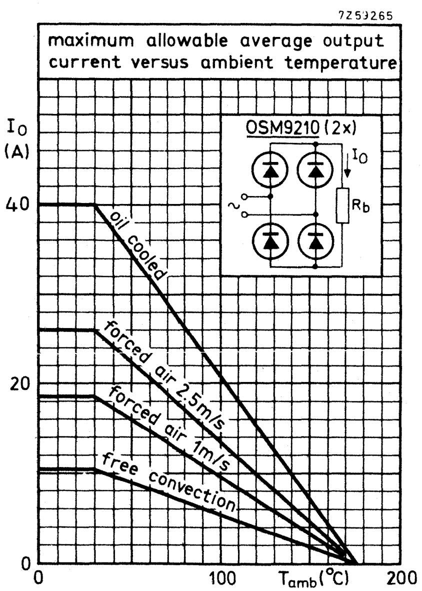
number of diodes	n	3	4 to 6	7 to 9	10 to 12	13 to 15
maximum lengths	L_A	143	184	224	264	305
	L_B	147	188	228	268	309
	L_C	159	199	239	279	320
	L_E	132	173	213	253	294
	L_F	184	225	265	305	346
weight	W_A	153	286	419	552	685
$W_B = W_C =$	W_E	218	351	484	617	750
	W_F	379	512	645	778	911

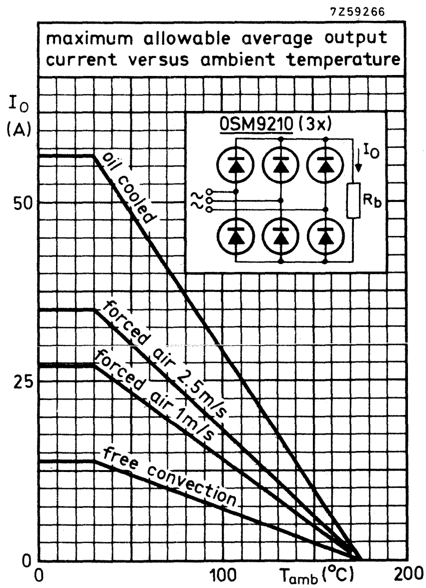
number of diodes	n	16 to 18	19 to 21	22 to 24	25 to 27	28 to 30
maximum lengths	L_A	345	385	426	466	506
	L_B	349	389	430	470	510
	L_C	360	400	441	481	521
	L_E	334	374	415	455	495
	L_F	386	426	467	507	547
weights	W_A	818	951	1084	1217	1350
$W_B = W_C =$	W_E	883	1016	1149	1282	1415
	W_F	1044	1177	1310	1443	1576


7Z10574
maximum allowable non-repetitive peak forward current based on sinusoidal currents, f = 50Hz
I_F
I_{FSM}
time
each current pulse is followed by the crest working reverse voltage
I_{FSM} (A)
400
300
200
100
0
T_j = 175°C (prior to surge)
1
2
3
4
5
6
7
8
9
2
5
100
number of cycles


7Z10570
maximum allowable non repetitive r.m.s. forward current (sub cycle surge curve)
$I_{FS(RMS)}$ (A)
1000
500
0
T_j = 175°C (prior to surge)
0
5
10
duration (ms)

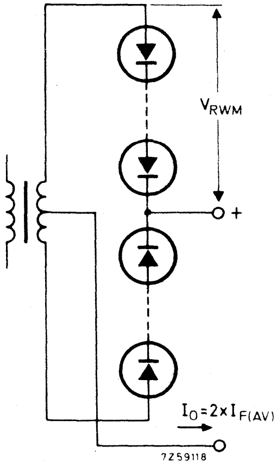

7Z59277
maximum allowable average forward current versus ambient temperature
$I_{F(AV)}$ (A)
20
10
0
oil cooled
forced air 2.5m/s
forced air 1m/s
free convection
0
100
T_{amb} (°C)
200


7Z59265
maximum allowable average output current versus ambient temperature
I_O (A)
40
20
0
OSM9210 (2x)
I_O
R_b
oil cooled
forced air 2.5m/s
forced air 1m/s
free convection
0
100
T_{amb} (°C)
200

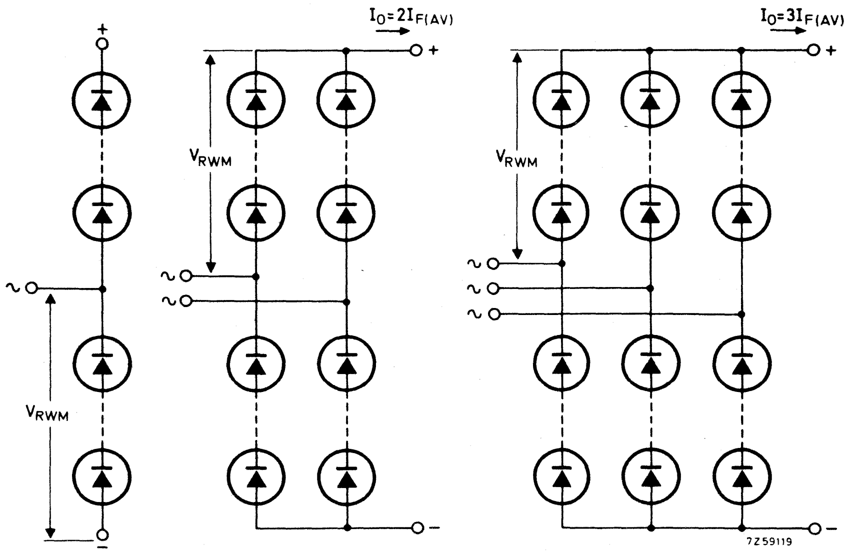

7Z59266
maximum allowable average output current versus ambient temperature
I_O (A)
50
25
0
OSM9210 (3x)
I_O
R_b
oil cooled
forced air 2.5m/s
forced air 1m/s
free convection
0
100
T_{amb} (°C)
200

APPLICATION INFORMATION

OSB9210-4



OSM9210series



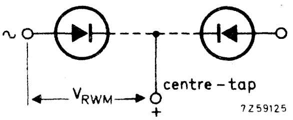
voltage doubler
1x OSM9210

rectifier circuits with respectively
2x OSM9210 and 3x OSM9210

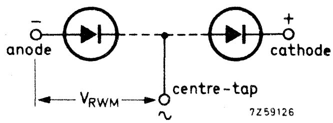
HIGH VOLTAGE RECTIFIER STACKS

The OSB9310, OSM9310 and OSS9310 series are ranges of high voltage rectifier assemblies, incorporating controlled avalanche diodes mounted on fire proof triangular formers. The OSB9310 series is intended for application in two phase half wave rectifier circuits. The OSM9310 series is intended for application in single phase or three phase bridges or in voltage doubler circuits.
The OSS9310 series is intended for all kinds of high voltage rectification. The assemblies are supplied with M6 studs or with standard valve bases. The OSB9310 series and OSM9310 series are supplied with a centre tap (8-32UNC). The maximum crest working voltages of the OSB9310 and OSM9310 series cover the range from 2 kV to 15 kV, and of the OSS9310 series the range from 3 kV to 30 kV, in 1 kV steps.

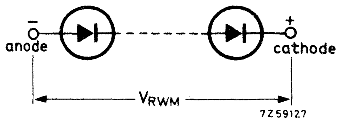
circuit OSB 9310



circuit OSM 9310



circuit OSS 9310



QUICK REFERENCE DATA

			OSB9310 / OSM9310	-4	-6	...	-28	-30	
Crest working reverse voltage from centre tap to end	V_{RWM}	max.		2	3	...	14	15	kV
			OSS9310	-3	-4	...	-29	-30	
Crest working reverse voltage	V_{RWM}	max.		3	4	...	29	30	kV

Average forward current with R and L load (averaged over any 20 ms period)				
in free air up to $T_{amb} = 35^oC$	$I_{F(AV)}$	max.	4	A
in oil up to $T_{oil} = 65^oC$	$I_{F(AV)}$	max.	12	A
Non-repetitive peak forward current $t = 10$ ms: half sine wave; $T_j = 175^oC$ prior to surge	I_{FSM}	max.	180	A

MECHANICAL DATA see page 4 and 5

All information applies to frequencies up to 400 Hz

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

			OSB9310	-4	-6	...	-28	-30	
			OSM9310	-4	-6	...	-28	-30	
Crest working reverse voltage	V_{RWM}	max.		2	3	...	14	15	kV
			OSS9310	-3	-4	...	-29	-30	
Crest working reverse voltage	V_{RWM}	max.		3	4	...	29	30	kV

Currents

Average forward current (averaged over any 20 ms period)

in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	4	A
in oil up to T_{oil} = 65 °C	$I_{F(AV)}$	max.	12	A
Repetitive peak forward current	I_{FRM}	max.	250	A
Non-repetitive peak forward current t = 10 ms; half sine wave; T_j = 175 °C prior to surge	I_{FSM}	max.	180	A

Reverse power dissipation

			OSB9310	-4	-6	...	-28	-30	
			OSM9310	-4	-6	...	-28	-30	
Repetitive peak reverse power dissipation t = 10 μs (square wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.		2	3	...	14	15	kW
Non-repetitive peak reverse power dissipation t = 10 μs (square wave) T_j = 25 °C prior to surge	P_{RSM}	max.		12	18	...	84	90	kW
T_j = 175 °C prior to surge	P_{RSM}	max.		2	3	...	14	15	kW
			OSS9310	-3	-4		-29	-30	
Repetitive peak reverse power dissipation t = 10 μs (square wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.		3	4	...	29	30	kW
Non-repetitive peak reverse power dissipation t = 10 μs (square wave) T_j = 25 °C prior to surge	P_{RSM}	max.		18	24	...	174	180	kW
T_j = 175 °C prior to surge	P_{RSM}	max.		3	4		29	30	kW

Temperatures

Storage temperature	T_{stg}		-55 to +175	°C
Junction temperature	T_j	max.	175	°C

CHARACTERISTICS (See note 1)

			OSB9310 -4	-6	...	-28	-30	
			OSM9310 -4	-6	...	-28	-30	
Forward voltage								
I_F = 50 A; T_j = 25 °C	V_F	<	5	7.5	...	35	37.5	V
Reverse breakdown voltage [1]								
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	2.5	3.75	...	17.5	18.75	kV
		<	4	6	...	28	30	kV
			OSS9310 -3	-4	...	-29	-30	
Forward voltage								
I_F = 50 A; T_j = 25 °C	V_F	<	7.5	10	...	72.5	75	V
Reverse breakdown voltage [1]								
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	3.75	5	...	36.25	37.5	kV
		<	6	8	...	58	60	kV

Reverse current

$V_{RM} = V_{RWMmax}$; T_j = 125 °C $\quad I_{RM}$ < 0.3 mA

NOTES

1. The Ratings and Characteristics given apply from centre tap to end. (Not for OSS9310series).

2. Type number suffix

   The suffix consists of a figure indicating the total number of diodes, followed by a letter indicating the base.
   A = M6 studs at the ends
   B = 4 pin Super Jumbo (B4D)
   C = Goliath
   E = 4 pin Jumbo (B4F)
   F = A3-20

3. Operating position

   The rectifier units can be operated at their maximum ratings when mounted in any position.

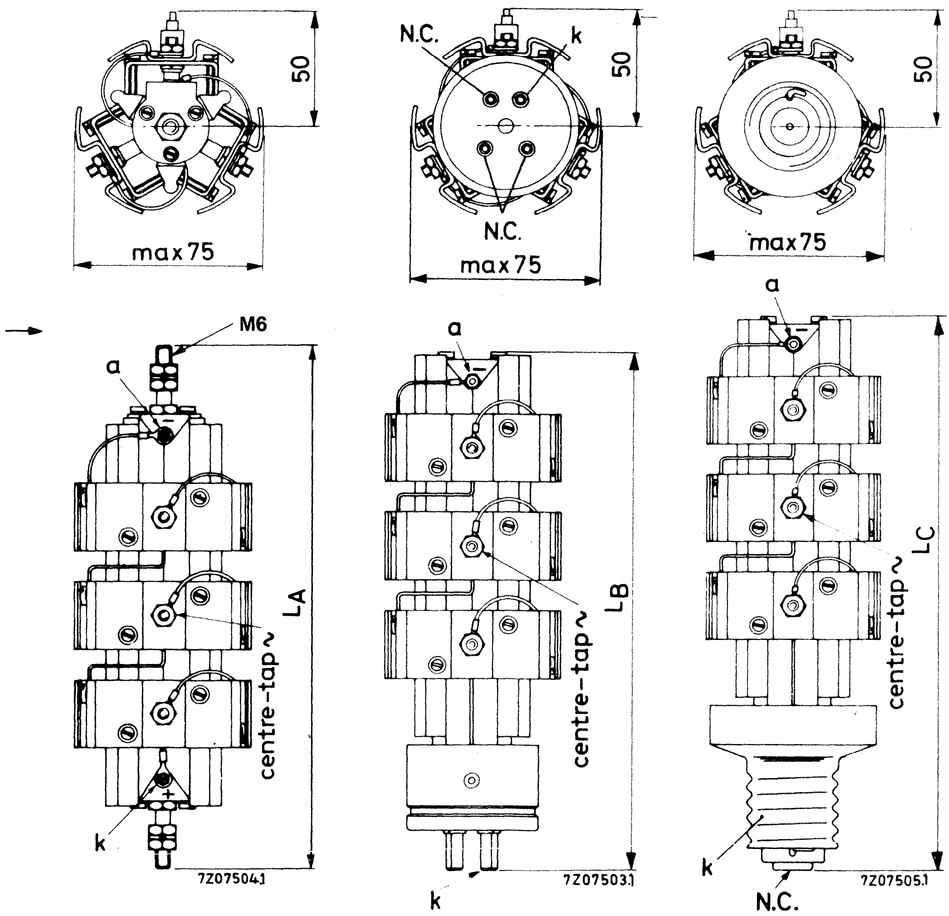
[1] The breakdown voltage increases by approximately 0.1% per °C with increasing junction temperature.

MECHANICAL DATA

Dimensions in mm

n = total number of diodes

OSM9310-nA OSM9310-nB OSM9310-nC



The drawings show the OSM9310series; the OSB9310 and OSS9310series differ in the following respects:

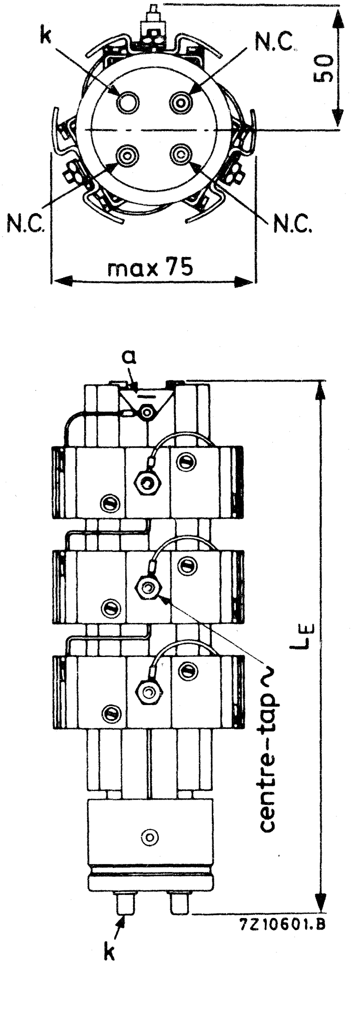
OSB9310series - terminals marked a(-) and k(+) in the drawings are both marked ∿; the centre-tap is marked + (instead of ∿ as in the drawings).

OSS9310series - has no centre-tap.

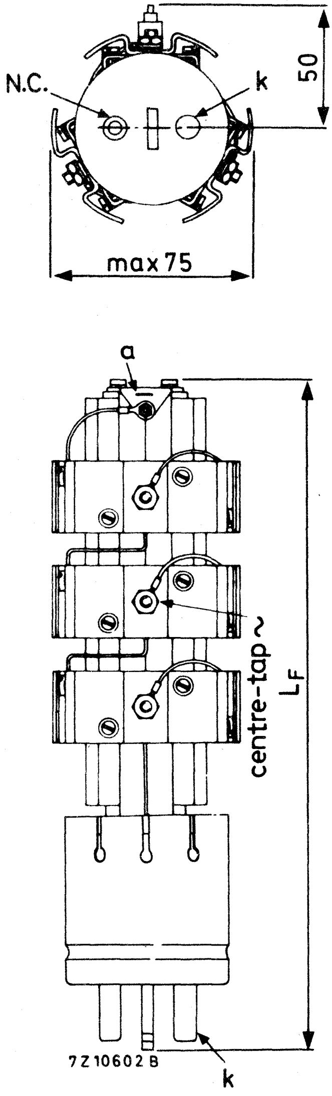
MECHANICAL DATA

n = total number of diodes

OSM9310-nE



OSM9310-nF

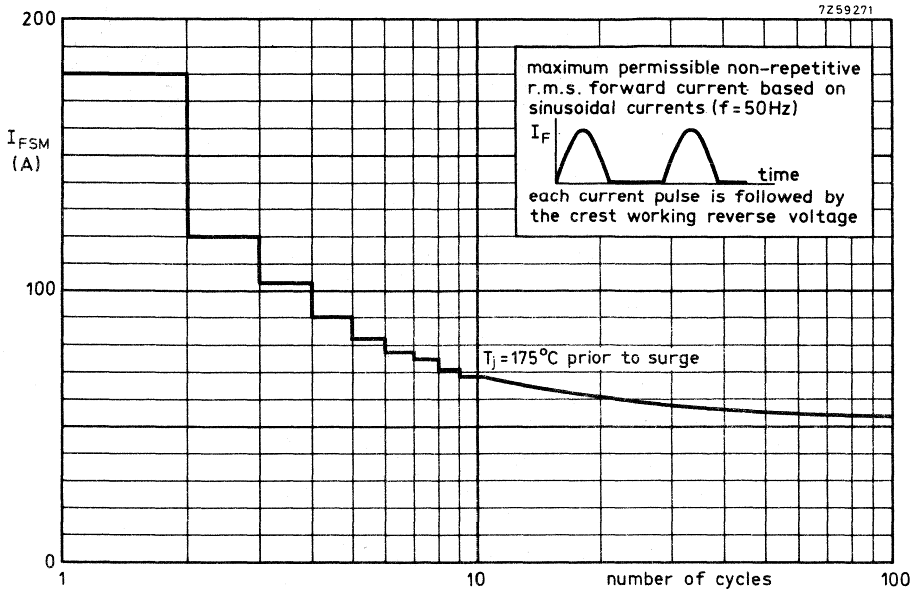


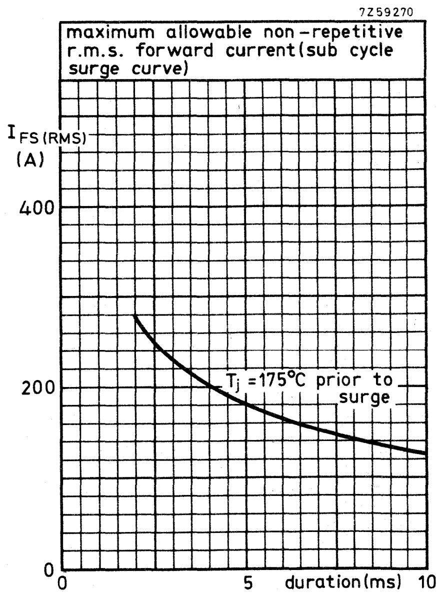
For lengths and weights see table on page 6.

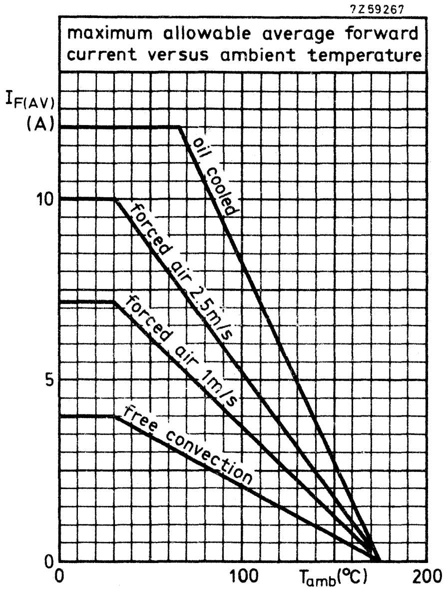
Table of lengths and weights (mm and g)

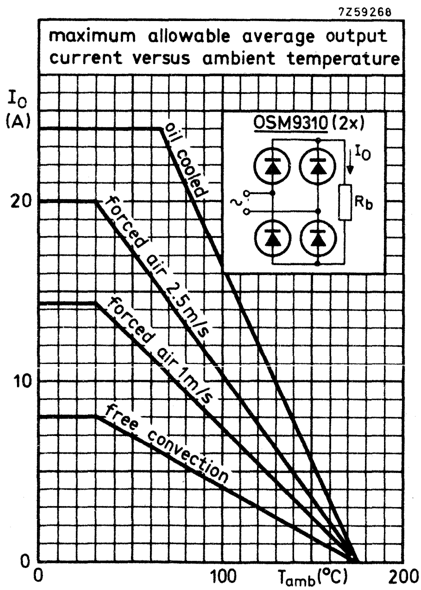
number of diodes	n	3	4 to 6	7 to 9	10 to 12	13 to 15
maximum lengths	L_A	143	184	224	264	305
	L_B	147	188	228	268	309
	L_C	159	199	239	279	320
	L_E	132	173	213	253	294
	L_F	184	225	265	305	346
weight	W_A	153	286	419	552	685
$W_B = W_C =$	W_E	218	351	484	617	750
	W_F	379	512	645	778	911

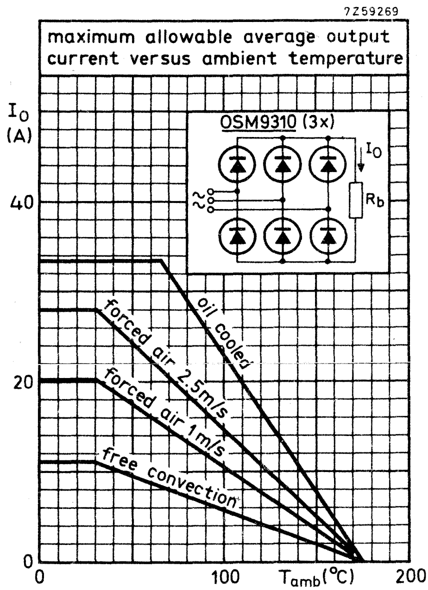
number of diodes	n	16 to 18	19 to 21	22 to 24	25 to 27	28 to 30
maximum lengths	L_A	345	385	426	466	506
	L_B	349	389	430	470	510
	L_C	360	400	441	481	521
	L_E	334	374	415	455	495
	L_F	386	426	467	507	547
weights	W_A	818	951	1084	1217	1350
$W_B = W_C =$	W_E	883	1016	1149	1282	1415
	W_F	1044	1177	1310	1443	1576


7Z59271
200
100
0
I_{FSM}
(A)
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50Hz)
I_F
time
each current pulse is followed by the crest working reverse voltage
T_j = 175°C prior to surge
1
10
number of cycles
100


7Z59270
maximum allowable non-repetitive r.m.s. forward current (sub cycle surge curve)
$I_{FS(RMS)}$
(A)
400
200
0
T_j = 175°C prior to surge
0
5
duration (ms)
10

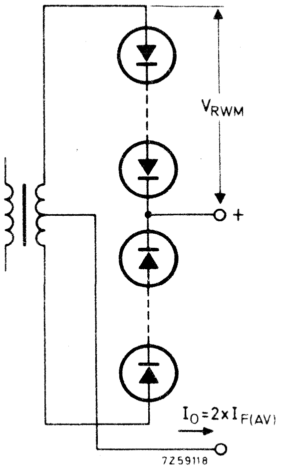

7Z59267
maximum allowable average forward current versus ambient temperature
$I_{F(AV)}$ (A)
10
5
0
0
100
200
T_{amb}(°C)
oil cooled
forced air 2.5m/s
forced air 1m/s
free convection


7Z59268
maximum allowable average output current versus ambient temperature
I_O (A)
20
10
0
0
100
200
T_{amb}(°C)
OSM9310 (2x)
I_O
R_b
oil cooled
forced air 2.5m/s
forced air 1m/s
free convection

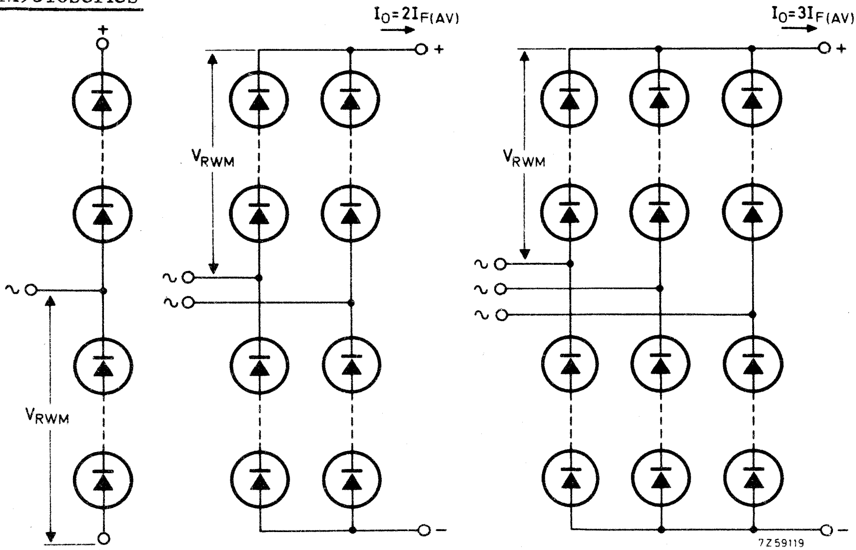

7Z59269
maximum allowable average output current versus ambient temperature
I_O (A)
40
20
0
0
100
200
T_{amb}(°C)
OSM9310 (3x)
I_O
R_b
oil cooled
forced air 2.5m/s
forced air 1m/s
free convection

APPLICATION INFORMATION

OSB9310series



OSM9310series

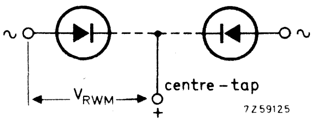


voltage doubler 1x OSM9310 — rectifier circuits with respectively 2x OSM9310 and 3x OSM9310

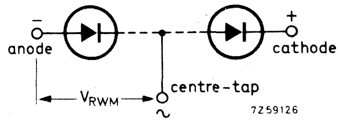
HIGH VOLTAGE RECTIFIER STACKS

Ranges of high voltage rectifier assemblies, incorporating controlled avalanche diodes mounted on fire proof triangular formers. They are supplied with **M6 studs**.
The OSB9410series is intended for application in two phase half wave rectifier circuits.
The OSM9410series is intended for application in single phase or three phase bridges or in voltage doubler circuits.
The OSS9410series is intended for all kinds of high voltage rectification.
The OSB9410series and OSM9410series are supplied with a centre tap (8-32UNC).
The maximum crest working voltages of the OSB9410 and OSM9410series cover the range from 2 kV to 15 kV, and of the OSS9410series the range from 3 kV to 30 kV, in 1 kV steps.

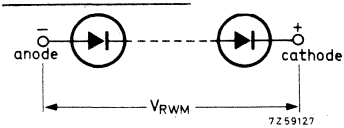
CIRCUIT OSB9410



CIRCUIT OSM9410



CIRCUIT OSS9410



QUICK REFERENCE DATA

		OSB9410	−4	−6	...	−28	−30	
		OSM9410	−4	−6	...	−28	−30	
Crest working reverse voltage from centre tap to end	V_{RWM}	max.	2	3		14	15	kV
		OSS9410	−3	−4	...	−29	−30	
Crest working reverse voltage	V_{RWM}	max.	3	4	...	29	30	kV

Average forward current with R and L load (averaged over any 20 ms period)

in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	10	A
in oil up to T_{oil} = 35 °C	$I_{F(AV)}$	max.	30	A
Non-repetitive peak forward current t = 10 ms; half sine wave; T_j = 175 °C prior to surge	I_{FSM}	max.	800	A

MECHANICAL DATA see page 4

All information applies to frequencies up to 400 Hz

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

			OSB9410	-4	-6	...	-28	-30	
			OSM9410	-4	-6		-28	-30	
Crest working reverse voltage	V_{RWM}	max.		2	3	...	14	15	kV
			OSS9410	-3	-4	...	-29	-30	
Crest working reverse voltage	V_{RWM}	max.		3	4	...	29	30	kV

Currents

Average forward current (averaged over any 20 ms period)				
in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	10	A
in oil up to T_{oil} = 35 °C	$I_{F(AV)}$	max.	30	A
Repetitive peak forward current	I_{FRM}	max.	450	A
Non-repetitive peak forward current t = 10 ms; half sine wave; T_j = 175 °C prior to surge	I_{FSM}	max.	800	A

Reverse power dissipation

			OSB9410	-4	-6	...	-28	-30	
Repetitive peak reverse power dissipation			OSM9410	-4	-6	...	-28	-30	
t = 10 μs (square wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.		9	13.5	...	63	67.5	kW
Non-repetitive peak reverse power dissipation t = 10 μs (square wave)									
T_j = 25 °C prior to surge	P_{RSM}	max.		55	80	...	375	400	kW
T_j = 175 °C prior to surge	P_{RSM}	max.		8.5	13	...	60.5	65	kW
Repetitive peak reverse			OSS9410	-3	-4	...	-29	-30	
power dissipation t = 10 μs (square wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.		13.5	18	...	130.5	135	kW
Non-repetitive peak reverse power dissipation t = 10 μs (square wave)									
T_j = 25 °C prior to surge	P_{RSM}	max.		80	105	...	775	800	kW
T_j = 175 °C prior to surge	P_{RSM}	max.		13	17	...	126	130	kW

Temperatures

Storage temperature	T_{stg}	- 55 to + 175	°C
Junction temperature	T_j	max. 175	°C

CHARACTERISTICS (See note 1)

			OSB9410 -4	-6	...	-28	-30
			OSM9410 -4	-6	...	-28	-30
Forward voltage							
I_F = 150 A; T_j = 25 °C	V_F	<	3.6	5.4	...	25.2	27 V
Reverse avalanche breakdown voltage [1]							
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	2.5	3.75	...	17.5	18.75 kV
		<	4	6	...	28	30 kV

			OSS9410 -3	-4	...	-29	-30
Forward voltage							
I_F = 150 A; T_j = 25 °C	V_F	<	5.4	7.2	...	52.2	54 V
Reverse avalanche breakdown voltage [1]							
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	3.75	5	...	36.25	37.5 kV
		<	6	8	...	58	60 kV

Reverse current

$V_{RM} = V_{RWMmax}$; T_j = 125 °C $\quad I_{RM}$ < 1.6 mA

NOTES

1. The Ratings and Characteristics given apply from centre tap to end. (Not for OSS9410series).
2. Type number suffix
   The suffix consists of a figure indicating the total number of diodes, followed by a letter indicating the base.
   A = M6 studs at the ends.
3. Operating position
   The rectifier units can be operated at their maximum ratings when mounted in any position.

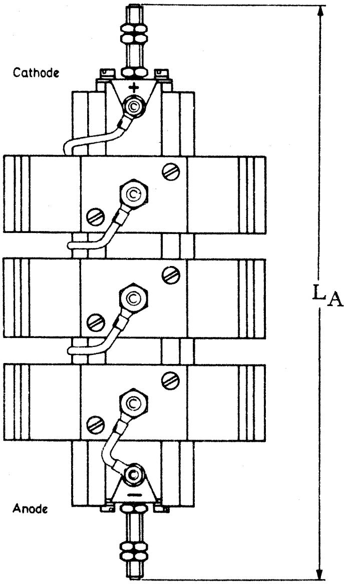
[1] The breakdown voltage increases, by approximately 0.1% per °C with increasing junction temperature.

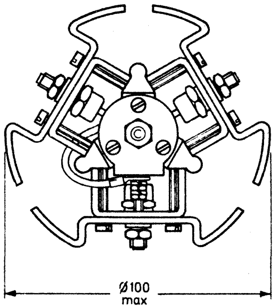
MECHANICAL DATA

Dimensions in mm

n = total number of diodes.

OSS9410-nA





The drawing shows the OSS9410series.
The OSB9410 and OSM9410series differ in the following respects:

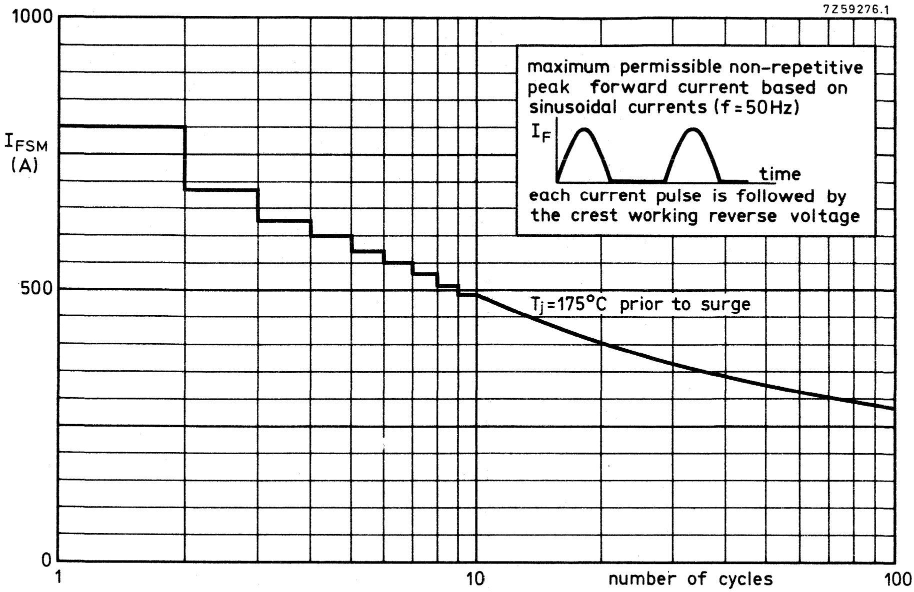
OSB9410 series – has a centre tap marked +; anode and cathode terminals are both marked ∿.

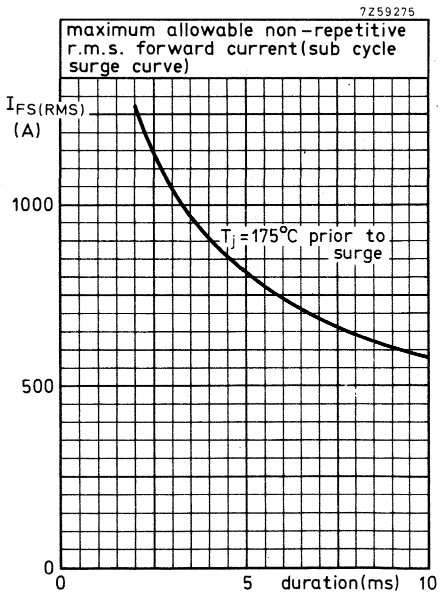
OSM9410series – has a centre tap marked ∿.

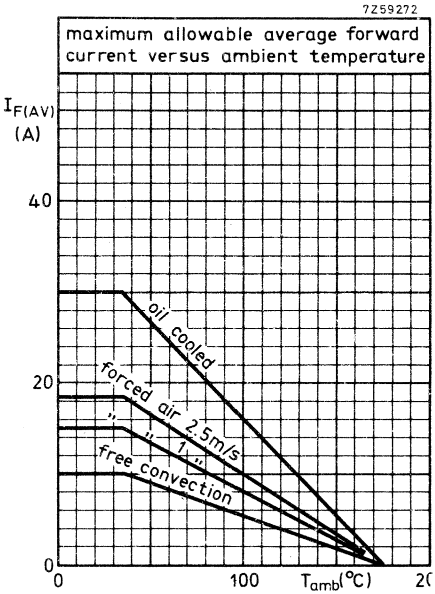
Table of lengths and weights (mm and g)

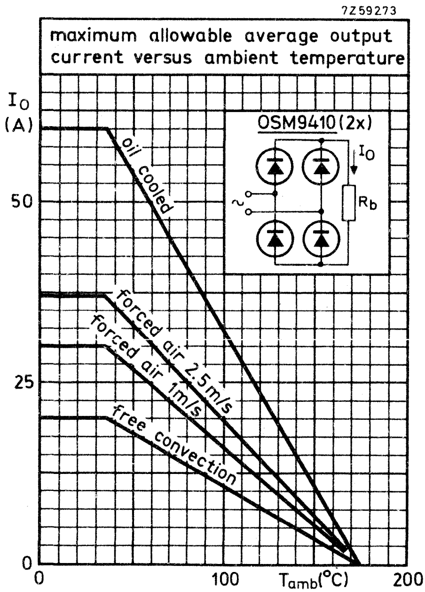
number of diodes n	3	4 to 6	7 to 9	10 to 12	13 to 15
maximum lengths L_A	143	184	224	264	305
weights W_A	215	413	611	809	1007

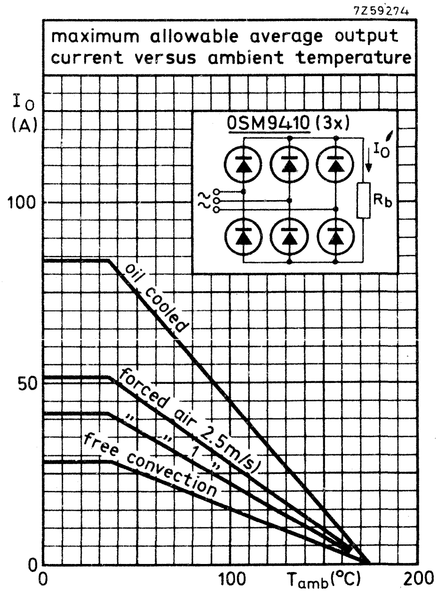
number of diodes n	16 to 18	19 to 21	22 to 24	25 to 27	28 to 30
maximum lengths L_A	345	385	426	466	506
weights W_A	1208	1406	1604	1802	2000


7Z59276.1
1000
500
0
I_{FSM}
(A)
1
10
100
number of cycles
maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50Hz)
I_F
time
each current pulse is followed by the crest working reverse voltage
T_j = 175°C prior to surge


7Z59275
maximum allowable non-repetitive r.m.s. forward current (sub cycle surge curve)
$I_{FS(RMS)}$
(A)
1000
500
0
0
5
duration (ms)
10
T_j = 175°C prior to surge

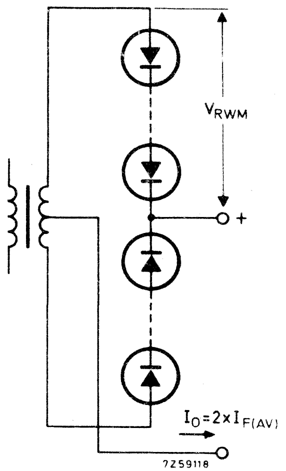

7Z59272
maximum allowable average forward current versus ambient temperature
$I_{F(AV)}$ (A)
40
20
0
0
100
T_{amb} (°C)
oil cooled
forced air 2.5m/s
" " 1 "
free convection


7Z59273
maximum allowable average output current versus ambient temperature
I_O (A)
50
25
0
0
100
T_{amb} (°C)
200
OSM9410 (2x)
I_O
R_b
~
oil cooled
forced air 2.5m/s
forced air 1m/s
free convection

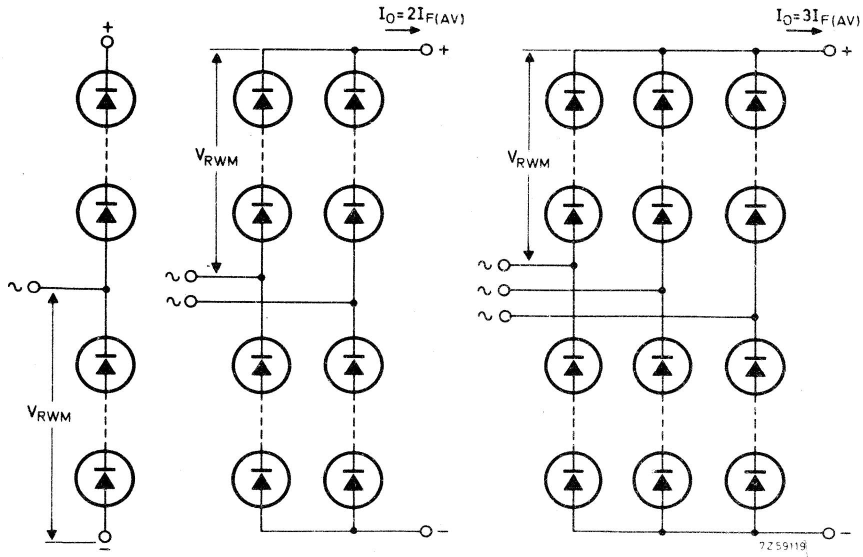

7Z59274
maximum allowable average output current versus ambient temperature
I_O (A)
100
50
0
0
100
T_{amb} (°C)
200
OSM9410 (3x)
I_O
R_b
oil cooled
forced air 2.5m/s
" " 1 "
free convection

APPLICATION INFORMATION

OSB9410series



OSM9410series



voltage doubler
1x OSM9410

rectifier circuits with respectively
2x OSM9410 and 3x OSM9410

THYRISTORS

General purpose thyristors

$I_{T(AV)max}$ (A)	Type	100	200	300	400	500	600	650	800	1000	1200	1400	1600
		V_{RRMmax} (V)											
1	BTX18	•	•	•	•	•							
7,5	BT151					•		•					
10	BTY79				•	•	•		•	•			
10	BTW38						•		•	•	•		
10	BTW42						•		•	•	•		
16	BTW45				•		•		•	•	•		
16	BTW47								•	•	•	•	•
16	BTY87				•	•	•		•				
16	BTY91				•	•	•		•				
20	BTW40				•		•		•				
20	BTW92								•	•	•	•	•
35	BTW24						•		•	•	•	•	•
90	BTW23						•		•	•	•	•	•

Fast turn-off thyristors

$I_{T(AV)max}$ (A)	Type	800	1000	1200	1400	1600
		V_{DRMmax} (V)				
16	BTW30S	•	•	•		
22	BTW31W	•	•	•		
80	BTW33	•	•	•		

Thyristor tetrode BRY39 V_{RRMmax} = 70 V; I_{Tmax} = 250 mA

OPERATING NOTES

When there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage [1]), a damping circuit should be connected across the transformer.
Either a series RC circuit or a voltage dependent resistor may be used. Suitable component values for an RC circuit across the transformer primary or secondary may be calculated as follows:

$\frac{V_{RSM}}{V_{RWM}}$	RC across primary of transformer		RC across secondary of transformer	
	C (μF)	R (Ω)	C (μF)	R (Ω)
2.0	$200\frac{I_{mag}}{V_1}$	$\frac{150}{C}$	$225\frac{I_{mag}T^2}{V_1}$	$\frac{200}{C}$
1.5	$400\frac{I_{mag}}{V_1}$	$\frac{225}{C}$	$450\frac{I_{mag}T^2}{V_1}$	$\frac{275}{C}$
1.25	$550\frac{I_{mag}}{V_1}$	$\frac{260}{C}$	$620\frac{I_{mag}T^2}{V_1}$	$\frac{310}{C}$
1.0	$800\frac{I_{mag}}{V_1}$	$\frac{300}{C}$	$900\frac{I_{mag}T^2}{V_1}$	$\frac{350}{C}$

where I_{mag} = magnetising primary r.m.s. current (A)

V_1 = transformer primary r.m.s. voltage (V)

V_2 = transformer secondary r.m.s. voltage (V)

T = V_1/V_2

V_{RSM} = the transient voltage peak produced by the transformer

V_{RWM} = the actually applied crest working reverse voltage

The capacitance values calculated from the above table are minimum values; to allow for circuit variations and component tolerances, larger values should be used.

---

[1]) For controlled avalanche types read: non-repetitive peak reverse power.

SILICON BI-DIRECTIONAL TRIGGER DEVICE

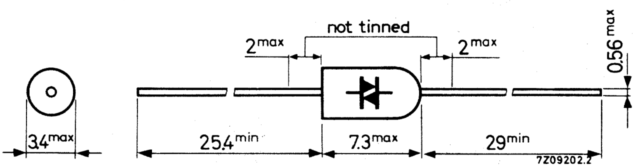
Silicon bi-directional trigger device in a DO-14 plastic envelope intended for use in triac and thyristor trigger circuits.

QUICK REFERENCE DATA				
Breakover voltage	$V_{(BO)}$	28 to 36		V
Breakback voltage at I_F = 10 mA	ΔV	>	6	V
Repetitive peak current ($t \leq 20\ \mu s$)	I_{FRM}	max.	2	A

MECHANICAL DATA

Dimensions in mm

DO-14



Devices may be supplied in an alternitive (smaller) envelope.
The envelope fulfils the accelerated damp heat test described in I.E.C. publication 68.2 (test D, severity IV, 6 cycles).

RATINGS (Limiting values) [1])

Total power dissipation up to T_{amb} = 70 °C	P_{tot}	max.	150	mW
Repetitive peak current ($t \leq 20\ \mu s$)	I_{FRM}	max.	2	A
Storage temperature	T_{stg}	−65 to +100		°C
Junction temperature	T_j	max.	100	°C

THERMAL RESISTANCE

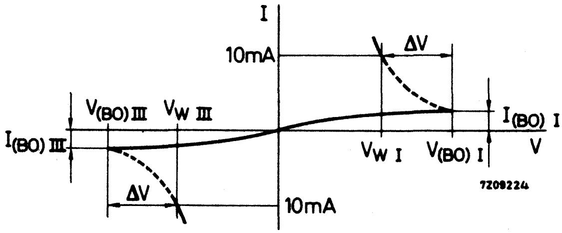
From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0.2	°C/mW

[1]) Limiting values according to the Absolute Maximum System as defined in IEC publication 134.

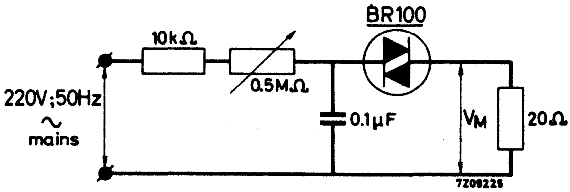
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakover voltage at $\frac{dV}{dt}$ = 10 V/ms	$V_{(BO)}$		28 to 36	V
Breakover voltage symmetry	$\lvert V_{(BO)I} - V_{(BO)III} \rvert$	<	3	V
Breakback voltage I_F = 10 mA; $\frac{dV}{dt}$ = 10 V/ms	$\Delta V = V_{(BO)} - V_W$	>	6	V
Breakover current at V = 0,98 $V_{(BO)}$	$I_{(BO)}$	<	20	μA



Test circuit for peak output voltage



V_M measured across a resistor of 20 Ω (instead of a thyristor) will be > 5 V.

THYRISTOR TETRODE

The BRY39 is a planar p-n-p-n trigger device in a TO-72 metal envelope, intended for use in switching applications such as relay and lamp drivers, sensing network for temperature, etc.
For the applications of the BRY39 as SCS see Handbook Part 3, section SWITCHING TRANSISTORS and as PROGRAMMABLE UNIJUNCTION TRANSISTOR see Handbook Part 3, section SWITCHING TRANSISTORS.

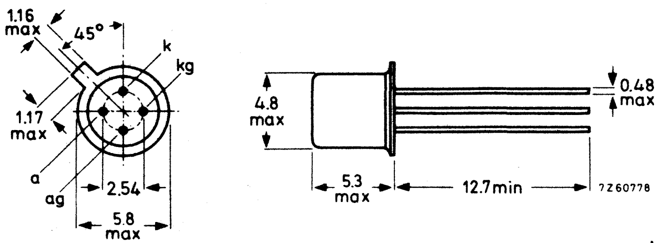
QUICK REFERENCE DATA					
Continuous voltages	$V_D = V_R$		max.	70	V
Repetitive peak voltages	$V_{DRM} = V_{RRM}$		max.	70	V
On-state current up to T_{case} = 85 °C		I_T	max.	250	mA
Non-repetitive peak on-state current t = 10 µs; T_j = 150 °C prior to surge		I_{TSM}	max.	3	A
Junction temperature		T_j	max.	150	°C
Rate of rise of on-state current		$\frac{dI_T}{dt}$	max.	20	A/µs

MECHANICAL DATA

Dimensions in mm

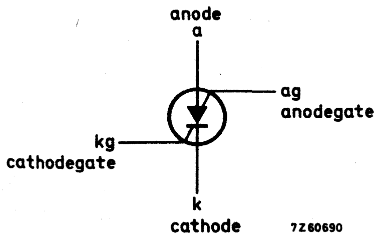
Anodegate connected to case

TO-72



Accessories supplied on request: 56246; 56263

MEANING OF SYMBOLS



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

ANODE TO CATHODE

~~Voltages~~ Voltage [1])

Continuous voltages	$V_D = V_R$	max.	70	V
Repetitive peak voltages	$V_{DRM} = V_{RRM}$	max.	70	V
Non-repetitive peak voltages	$V_{DSM} = V_{RSM}$	max.	70	V

Currents

On-state current (d.c.) up to T_{case} = 85 °C	I_T	max.	250	mA
up to T_{amb} = 25 °C	I_T	max.	175	mA
Repetitive peak on-state current t = 10 µs; δ = 0.01	I_{TRM}	max.	2.5	A
Non-repetitive peak on-state current t = 10 µs; T_j = 150 °C prior to surge	I_{TSM}	max.	3	A
Rate of rise of on-state current after triggering to I_T = 2.5 A	$\frac{dI_T}{dt}$	max.	20	A/µs

CATHODEGATE TO CATHODE

Voltage

Reverse peak voltage	V_{RGKM}	max.	5	V

Current

Forward peak current	I_{FGKM}	max.	100	mA

ANODEGATE TO ANODE

Voltage

Reverse peak voltage	V_{RGAM}	max.	70	V

Current

Forward peak current	I_{FGAM}	max.	100	mA

TEMPERATURES

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\,j\text{-}a}$	=	0.45	°C/mW
From junction to case	$R_{th\,j\text{-}c}$	=	0.15	°C/mW

[1]) These ratings apply for zero or negative bias on the cathodegate with respect to the cathode, and when a resistor R ≤ 10 kΩ is connected between cathodegate and cathode.

CHARACTERISTICS

ANODE TO CATHODE

Voltages

On-state voltage I_T = 100 mA; T_j = 25 °C	V_T	<	1.4	V
Rate of rise of off-state voltage that will not trigger any device [1]	$\frac{dV_D}{dt}$ [1]			

Currents

Peak reverse current V_{RM} = 70 V; T_j = 25 °C	I_{RM}	typ.	1	nA
		<	100	nA
T_j = 150 °C	I_{RM}	<	2	µA
Peak off-state current V_{DM} = 70 V; T_j = 25 °C	I_{DM}	typ.	1	nA
		<	100	nA
T_j = 150 °C	I_{DM}	<	2	µA
Holding current; R_{GK} = 10 kΩ; R_{GA} = 220 kΩ; T_j = 25 °C	I_H	<	250	µA

CATHODEGATE TO CATHODE

Voltages

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	V_{GKT}	>	0.5	V

Current

Current that will trigger all devices V_D = 6 V; T_j = 25 °C	I_{GKT}	>	1	µA

ANODEGATE TO ANODE

Voltages

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	$-V_{GAT}$	>	1	V

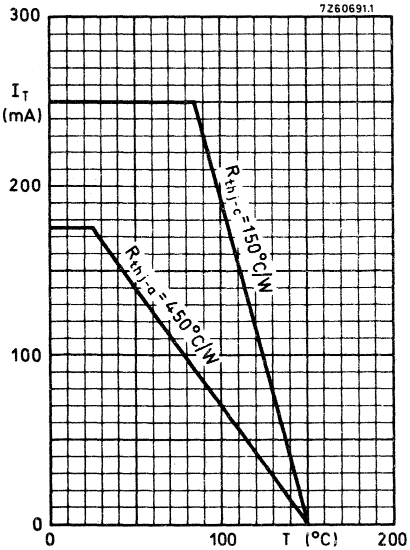
Current

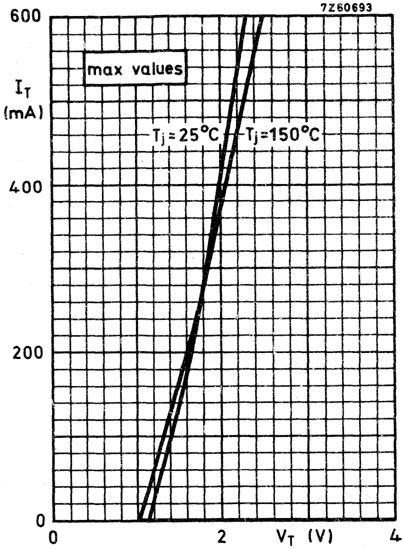
Current that will trigger all devices V_D = 6 V; R_{GK} = 10 kΩ; T_j = 25 °C	$-I_{GAT}$	>	100	µA

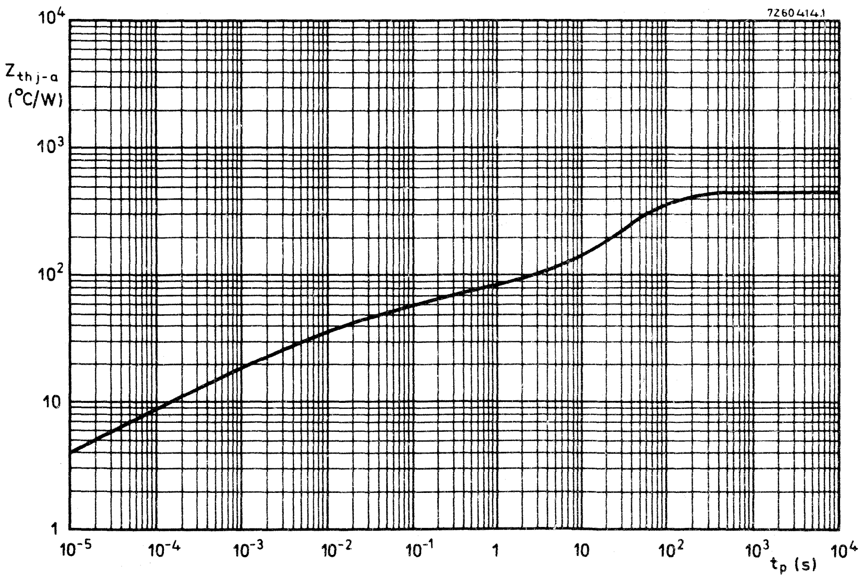
[1]) The dV_D/dt is unlimited when the anodegate lead is returned to the anode supply voltage through a current limiting resistor.

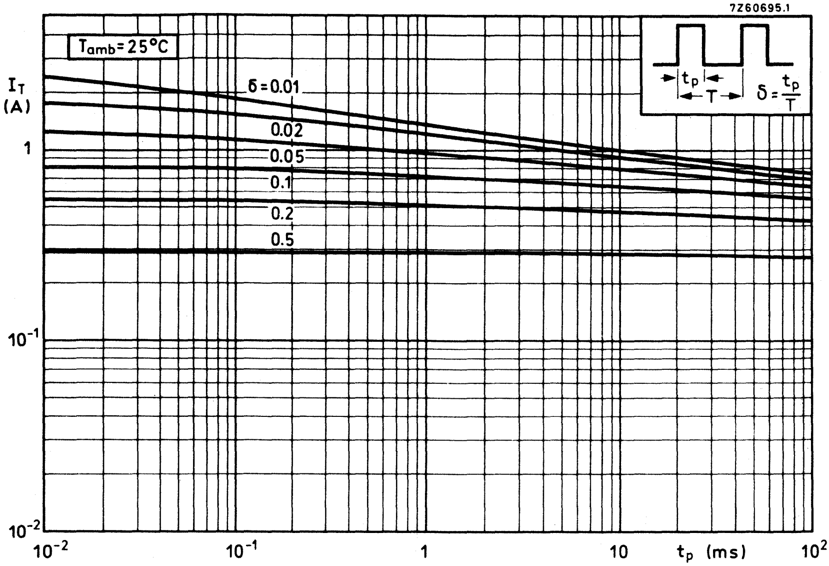
SWITCHING CHARACTERISTICS

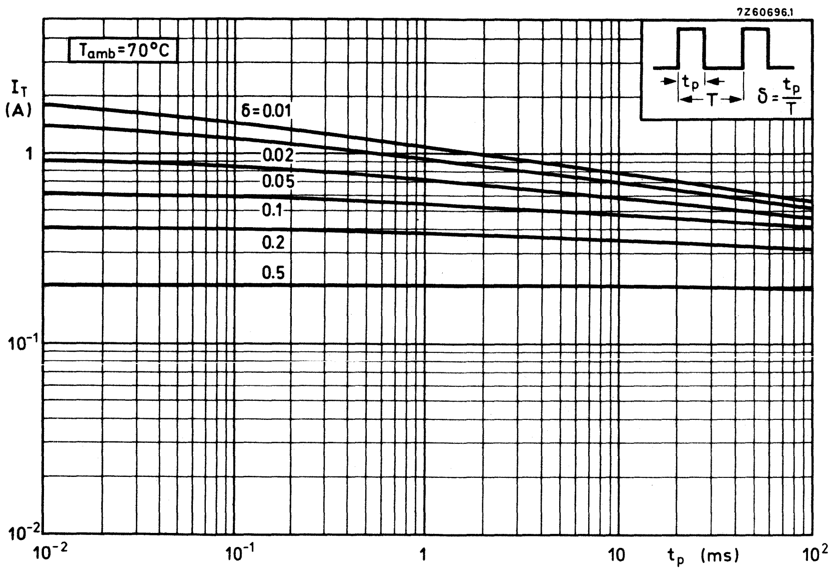
Turn-on time ($t_{on} = t_d + t_r$)				
V_D = 15 V; I_T = 150 mA				
R_{GK} = 10 kΩ; T_j = 25 °C	t_{on}	<	300	ns
Circuit-commutated turn-off time				
$V_D = V_R$ = 15 V; I_T = 150 mA				
R_{GK} = 10 kΩ; T_j = 25 °C	t_{off}	<	3	μs

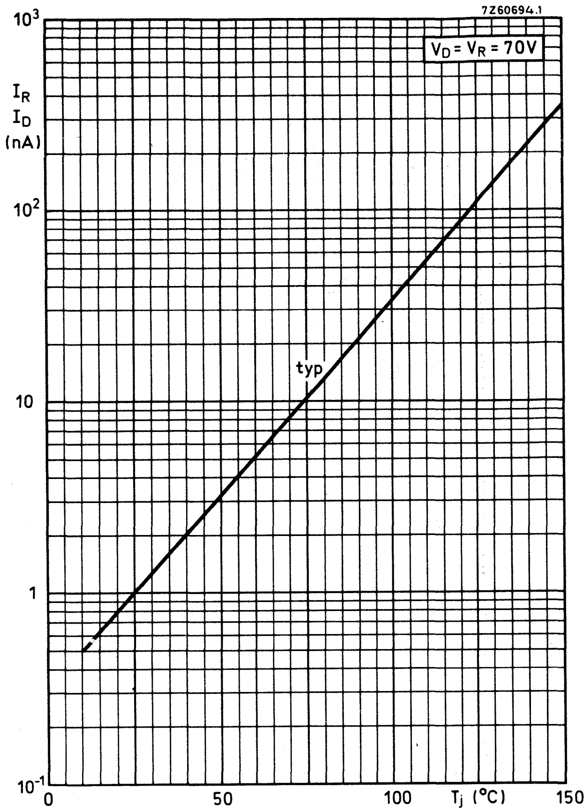

7Z60691.1
300
200
100
0
I_T (mA)
$R_{th\,j\text{-}c}$ = 150 °C/W
$R_{th\,j\text{-}a}$ = 450 °C/W
0
100
T (°C)
200


7Z60693
600
400
200
0
I_T (mA)
max values
T_j = 25 °C
T_j = 150 °C
0
2
V_T (V)
4


7Z60414.1
10^4
10^3
10^2
10
1
$Z_{th\,j\text{-}a}$ (°C/W)
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
10^3
10^4
t_p (s)

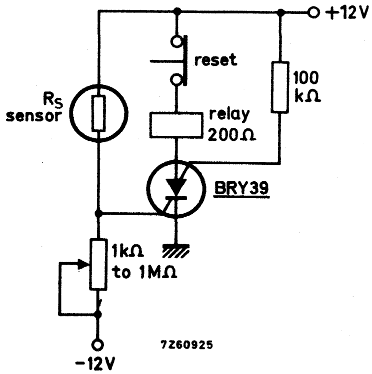

7Z60695.1
T_{amb} = 25°C
I_T
(A)
δ = 0.01
0.02
0.05
0.1
0.2
0.5
1
10^{-1}
10^{-2}
10^{-2}
10^{-1}
1
10
t_p (ms)
10^2
t_p
T
$\delta = \frac{t_p}{T}$


7Z60696.1
T_{amb} = 70°C
I_T
(A)
δ = 0.01
0.02
0.05
0.1
0.2
0.5
1
10^{-1}
10^{-2}
10^{-2}
10^{-1}
1
10
t_p (ms)
10^2
t_p
T
$\delta = \frac{t_p}{T}$


7Z60694.1
$V_D = V_R = 70V$
I_R
I_D
(nA)
10^3
10^2
10
1
10^{-1}
typ
0
50
100
T_j (°C)
150

APPLICATION INFORMATION

Sensing network



R_S must be chosen in accordance with the light, temperature, or radiation intensity to be sensed; its resistance should be of the same order as that of the potentiometer.

In the arrangement shown, a decline in resistance of R_S triggers the thyristor, closing the relay that activates the warning system. If the positions of R_S and the potentiometer are interchanged, an increase in the resistance of R_S triggers the thyristor.

FAST TURN-OFF THYRISTOR

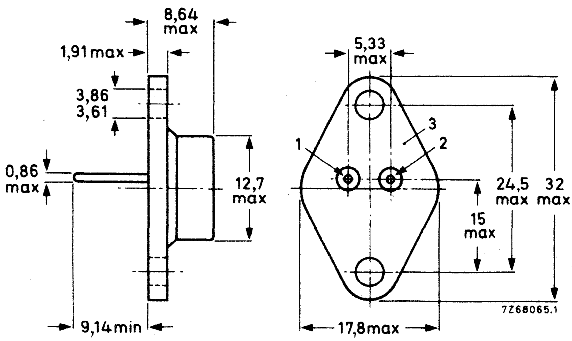
Thyristor in a TO-66 envelope intended for use as trace switch in thyristor horizontal deflection circuits of colour television receivers.

QUICK REFERENCE DATA				
Repetitive peak off-state voltage	V_{DRM}	max.	750	V
Working peak on-state current	I_{TWM}	max.	10	A
Repetitive peak on-state current	I_{TRM}	max.	30	A
Non-repetitive peak on-state current	I_{TSM}	max.	50	A
Circuit-commutated turn-off time	t_q	<	2,4	µs

MECHANICAL DATA

Dimensions in mm

TO-66



1. Gate
2. Cathode
3. Anode

Accessories supplied on request: 56337 (mica insulating washer and 2 insulating bushes).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

Voltages

Non-repetitive peak off-state voltage $t \leq 10$ ms	V_{DSM}	max.	800	V	
Repetitive peak off-state voltage	V_{DRM}	max.	750	V	
Working off-state voltage	V_{DW}	max.	600	V	1)

Currents

R.M.S. on-state current	$I_{T(RMS)}$	max.	5	A
Working peak on-state current	I_{TWM}	max.	10	A
Repetitive peak on-state current	I_{TRM}	max.	30	A
Non-repetitive peak on-state current (t = 10 ms; half sine-wave) $T_j = 110\ ^oC$ prior to surge	I_{TSM}	max.	50	A
Rate of rise of on-state current after triggering up to f = 20 kHz	dI_T/dt	max.	60	A/µs

Gate to cathode

Peak power dissipation at t = 10 µs	P_{GM}	max.	25	W

Temperatures

Storage temperature	T_{stg}		−40 to +125	^oC
Operating junction temperature	T_j	max.	110	^oC

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,0	$^oC/W$
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	$^oC/W$
From mounting base to heatsink with 56337 mica washer and heatsink compound	$R_{th\ mb\text{-}h}$	=	1,5	$^oC/W$

1) At $t_p \leq 20$ µs; $\delta = t_p/T \leq 0,25$; see page 6.

CHARACTERISTICS

Anode to cathode

Voltages

On-state voltage I_T = 20 A; T_j = 25 ^oC	V_T	<	3	V [1]
Rate of rise of off-state voltage that will not trigger any device (exp. method; V_D = 2/3 V_{DRMmax}); $-V_{GG}$ = 25 V; R_{tot} = 62 Ω (see note 2); up to T_j = 110 ^oC	dV_D/dt	<	200	V/μs

Current

Off-state current V_D = V_{DRMmax}; T_j = 110 ^oC	I_D	<	1,5	mA

Gate to cathode

Voltage

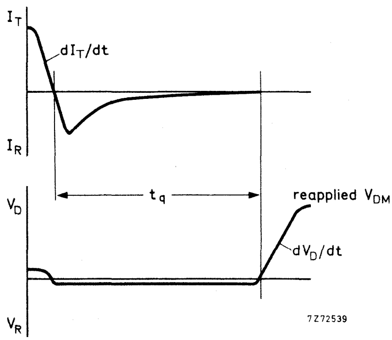
Voltage that will trigger all devices V_D = 6 V; T_j = 25 ^oC	V_{GT}	>	4	V

Current

Current that will trigger all devices V_D = 6 V; T_j = 25 ^oC	I_{GT}	>	40	mA

Switching characteristics

Circuit-commutated turn-off time (in horizontal deflection trace switch) when switched from I_T = 8 A to V_R = 0,8 V with $-dI_T/dt$ = 10 A/μs; dV_D/dt = 200 V/μs; V_{DM} = 700 V; $-V_{GG}$ = 25 V from R_{tot} = 62 Ω (see note 2); T_{mb} = 80 ^oC	t_q	<	2,4	μs



[1] Measured under pulse conditions to avoid excessive dissipation.
[2] R_{tot} is the total series resistance including source resistance.

HIGH SPEED THYRISTORS WITH INTEGRATED DIODE

Thyristor-diode combinations in a TO-66 envelope intended for use as trace (BT129) and commutation (BT128) switch in television line deflection circuits.

QUICK REFERENCE DATA

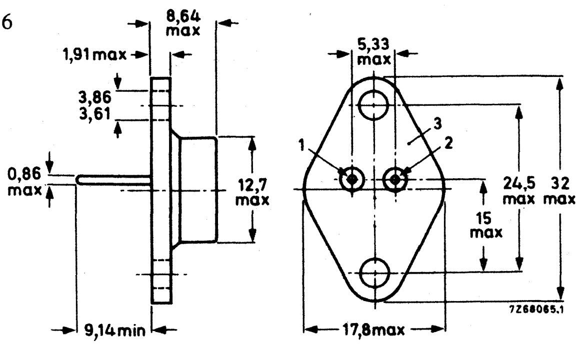
			BT128-700R	BT129-600R	BT129-750R	
Repetitive peak off-state voltage	V_{DRM}	max.	700	600	750	V
Non-repetitive peak off-state voltage ($t \leq 10$ ms)	V_{DSM}	max.	750	650	800	V

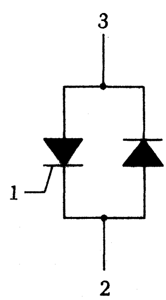
Average currents either on-state (thyristor) or forward (diode)	$I_{T(AV)}$ $I_{F(AV)}$	max.	3,2	A
R.M.S. currents: either on-state (thyristor) or forward (diode)	$I_{T(RMS)}$ $I_{F(RMS)}$	max.	5	A
Non-repetitive peak currents either on-state (thyristor) or forward (diode)	I_{TSM} I_{FSM}	max.	50	A
Rate of rise of on-state current after triggering	dI_T/dt	max.	60	A/µs
Junction temperature: thyristor	T_j	max.	110	°C
Junction temperature: diode	T_j	max.	150	°C
Circuit-commutated turn-off time BT128series	t_q	<	4,5	µs
Circuit-commutated turn-off time BT129series	t_q	<	2,4	µs

MECHANICAL DATA

Dimensions in mm

TO-66





Accessories supplied on request: 56337 (mica insulating washer and 2 insulating bushes)

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

Voltages			BT128-700R	BT129-600R	BT129-750R	
Repetitive peak off-state voltage	V_{DRM}	max.	700	600	750	V
Non-repetitive peak off-state voltage ($t \leq 10$ ms)	V_{DSM}	max.	750	650	800	V

Currents

Average currents at T_{mb} = 85 °C: either on-state (thyristor) or forward (diode)	$I_{T(AV)}$ $I_{F(AV)}$	max.	3,2	A
R.M.S. currents: either on-state (thyristor) or forward (diode)	$I_{T(RMS)}$ $I_{F(RMS)}$	max.	5	A
Repetitive peak currents: either on-state (thyristor) or forward (diode)	I_{TRM} I_{FRM}	max.	30	A
Non-repetitive peak currents (t = 10 ms; half sine wave) T_j = 110 °C prior to surge either on-state (thyristor) or forward (diode)	I_{TSM} I_{FSM}	max.	50	A
Rate of rise of on-state current after triggering (gate)	dI_T/dt	max.	60	A/µs

Gate to cathode

Peak power dissipation at t = 10 µs (forward or reverse)	P_{GM}	max.	25	W

Temperatures

Storage temperature	T_{stg}		−40 to +125	°C
Junction temperature: thyristor	T_j	max.	110	°C
diode	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base (thyristor or diode)	$R_{th\ j-mb}$	=	4,0	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,5	°C/W
From mounting base to heatsink with 56337 (mica washer)	$R_{th\ mb-h}$	=	1,5	°C/W

CHARACTERISTICS

Voltages

On-state voltage (thyristor) I_T = 20 A; T_j = 25 °C	V_T	$<$	3	V	1)
Forward voltage (diode) I_F = 5 A; T_j = 25 °C	V_F	$<$	1,65	V	1)
Rate of rise of off-state voltage that will not trigger any device up to T_j = 110 °C					
$-V_{GG}$ = 3 V ; R_{tot} = 62 Ω; BT128series	dV_D/dt	$<$	800	V/µs	2)
$-V_{GG}$ = 25 V ; R_{tot} = 62 Ω; BT129series	dV_D/dt	$<$	200	V/µs	2)

Current

Off-state current (thyristor) $V_D = V_{DRMmax}$; T_j = 110 °C	I_D	$<$	1,5	mA

Gate to cathode

Voltage

Voltage that will trigger all devices at T_j = 25 °C	V_{GT}	$>$	4	V

Current

Current that will trigger all devices at T_j = 25 °C	I_{GT}	$>$	40	mA

1) Measured under pulse conditions to avoid excessive dissipation.

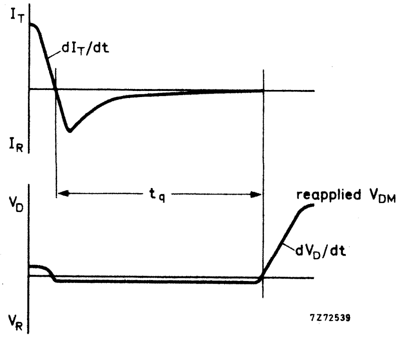
2) R_{tot} is the total series resistance including source resistance.

CHARACTERISTICS (continued)

Switching characteristics

Circuit-commutated turn-off time when switched

from I_T = 18 A to V_R = 0,8 V with $-dI_T/dt$ = 8 A/μs; dV_D/dt = 400 V/μs; V_{DM} = 100 V; $-V_{GG}$ = 3 V from R_{tot} = 62 Ω (see note 1); T_j = 110 °C	BT128series	t_q	<	4,5	μs
I_T = 8 A to V_R = 0,8 V with $-dI_T/dt$ = 10 A/μs; dV_D/dt = 200V/μs; V_{DM} = 700 V; $-V_{GG}$ = 25 V from R_{tot} = 62 Ω (see note 1); T_j = 110 °C	BT129series	t_q	<	2,4	μs



1) R_{tot} is the total series resistance including source resistance.

THYRISTORS

Glass-passivated thyristors in TO-220AB envelopes, featuring eutectic bonding, thus being particularly suitable in situations creating high fatigue stresses involved in thermal cycling and repeated switching. Applications include temperature control, motor control, regulators in transformerless power supply applications, relay and coil pulsing and power supply crowbar protection circuits.

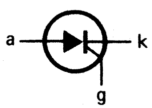
QUICK REFERENCE DATA

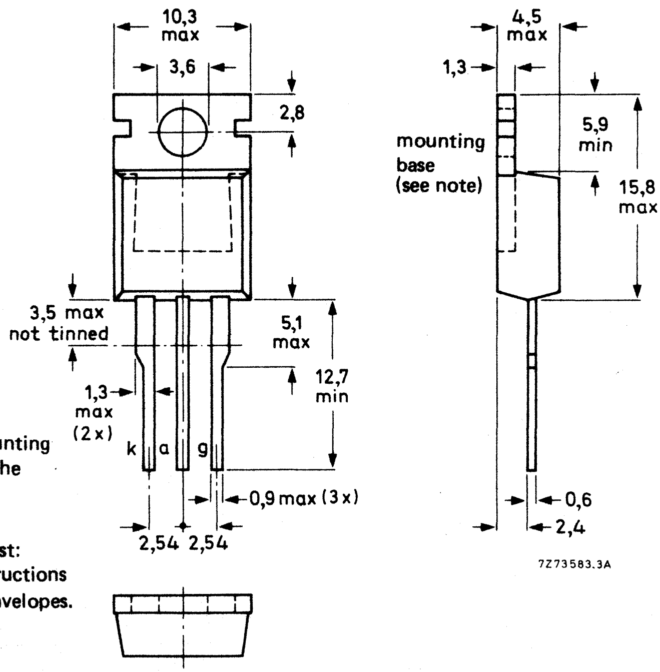
			BT151-500R	650R	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	500	650	V
Average on-state current	$I_{T(AV)}$	max.	7,5		A
R.M.S. on-state current	$I_{T(RMS)}$	max.	12		A
Non-repetitive peak on-state current	I_{TSM}	max.	100		A

MECHANICAL DATA

Fig. 1 TO-220AB.

Dimensions in mm





Net mass: 2 g

Note: The exposed metal mounting base is directly connected to the anode.

Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BT151-500R	650R	
Non-repetitive peak voltages ($t \leqslant 10$ ms)	V_{DSM}/V_{RSM}	max.	500	650	V*
Repetitive peak voltages ($\delta \leqslant 0{,}01$)	V_{DRM}/V_{RRM}	max.	500	650	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	400	400	V
Continuous voltages	V_D/V_R	max.	400	400	V
Average on-state current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{T(AV)}$	max.		7,5	A
R.M.S. on-state current	$I_{T(RMS)}$	max.		12	A
→ Repetitive peak on-state current	I_{TRM}	max.		65	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 100 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.		100	A
I^2t for fusing (t = 10 ms)	I^2t	max.		50	A^2s
Rate of rise of on-state current after triggering with I_G = 50 mA to I_T = 20 A; dI_G/dt = 50 mA/μs	dI_T/dt	max.		50	A/μs

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	5	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0,5	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−40 to +125	°C
Operating junction temperature	T_j	max.	100	°C

* Although not recommended, higher off-state voltages may be applied without damage, but the thyristor may switch into the on-state. The rate of rise of on-state current should not exceed 15 A/μs.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,3 °C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,2 °C/W

Influence of mounting method

1. Heatsink mounted with clip (see mounting instructions)

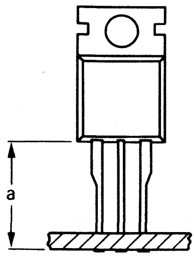
Thermal resistance from mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,3 °C/W
b. with heatsink compound and 0,06 mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1,4 °C/W
c. with heatsink compound and 0,1 mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2,2 °C/W
d. with heatsink compound and 0,25 mm max. alumina insulator (56367)	$R_{th\ mb\text{-}h}$	=	0,8 °C/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1,4 °C/W

2. Free-air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-point.

Thermal resistance from junction to ambient in free air:
mounted on a printed-circuit board at a = any lead length
and with copper laminate $R_{th\ j\text{-}a}$ = 60 °C/W



7Z75493 Fig. 2.

CHARACTERISTICS

Anode to cathode

On-state voltage			
$I_T = 23$ A; $T_j = 25$ °C	V_T	<	1,75 V*
Rate of rise of off-state voltage that will not trigger any device; $T_j = 100$ °C; see Fig. 10			
R_{GK} = open circuit	dV_D/dt	<	50 V/μs
$R_{GK} = 100\ \Omega$	dV_D/dt	<	200 V/μs
Reverse current			
$V_R = V_{RWMmax}$; $T_j = 100$ °C	I_R	<	0,5 mA
Off-state current			
$V_D = V_{DWMmax}$; $T_j = 100$ °C	I_D	<	0,5 mA
Latching current; $T_j = 25$ °C	I_L	<	40 mA
Holding current; $T_j = 25$ °C	I_H	<	20 mA

Gate to cathode

Voltage that will trigger all devices			
$V_D = 6$ V; $T_j = 25$ °C	V_{GT}	>	1,5 V
$V_D = 6$ V; $T_j = -40$ °C	V_{GT}	>	2,3 V
Voltage that will not trigger any device			
$V_D = V_{DRMmax}$; $T_j = 100$ °C	V_{GD}	<	250 mV
Current that will trigger all devices			
$V_D = 6$ V; $T_j = 25$ °C	I_{GT}	>	15 mA
$V_D = 6$ V; $T_j = -40$ °C	I_{GT}	>	20 mA

* Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

1. The device may be soldered directly into the circuit, but the maximum permissible temperature of the soldering iron or bath is 275 °C; it must not be in contact with the joint for more than 5 seconds. Soldered joints must be at least 4,7 mm from the seal.
2. The leads should not be bent less than 2,4 mm from the seal, and should be supported during bending.
3. It is recommended that the circuit connection be made to the anode tag, rather than direct to the heatsink.
4. Mounting by means of a spring clip is the best mounting method because it offers:
   a. a good thermal contact under the crystal area and slightly lower $R_{th\ mb\text{-}h}$ values than screw mounting.
   b. safe isolation for mains operation.
   However, if a screw is used, it should be M3 cross-recess pan-head. Care should be taken to avoid damage to the plastic body.
5. For good thermal contact heatsink compound should be used between mounting base and heatsink. Values of $R_{th\ mb\text{-}h}$ given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
6. The device should not be pop-rivetted to the heatsink. However, it is permissible to press-rivet providing that rivets of soft material are used, and the press forces are slowly and carefully controlled so as to avoid shock and deformation of either heatsink or mounting tab.

OPERATING NOTES

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated in Fig. 3.

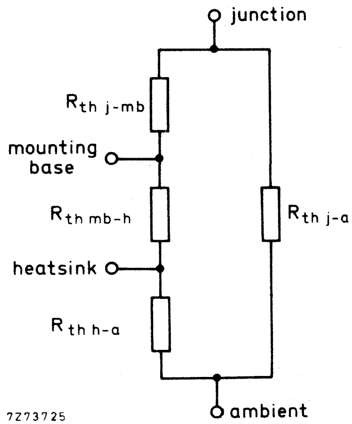


Fig. 3.

b. The method of using Fig. 4 is as follows:
Starting with the required current on the $I_{T(AV)}$ axis, trace upwards to meet the appropriate form factor curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can now be calculated from:

$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

c. Any measurement of heatsink temperature should be made immediately adjacent to the device.

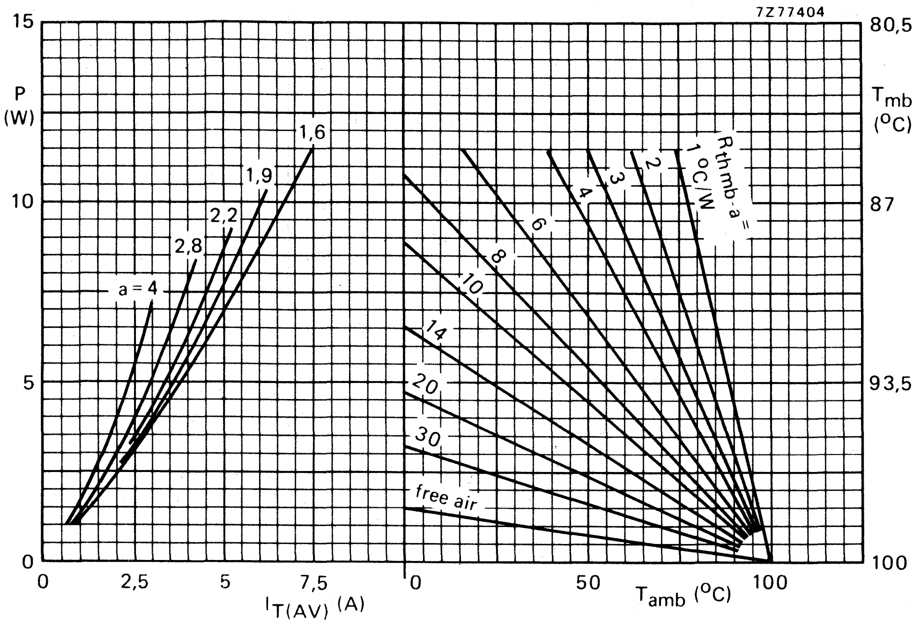
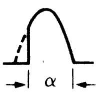


Fig. 4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.



α = conduction angle per half cycle

a = form factor = $\frac{I_{T(RMS)}}{I_{T(AV)}}$

α	a
30°	4
60°	2,8
90°	2,2
120°	1,9
180°	1,57

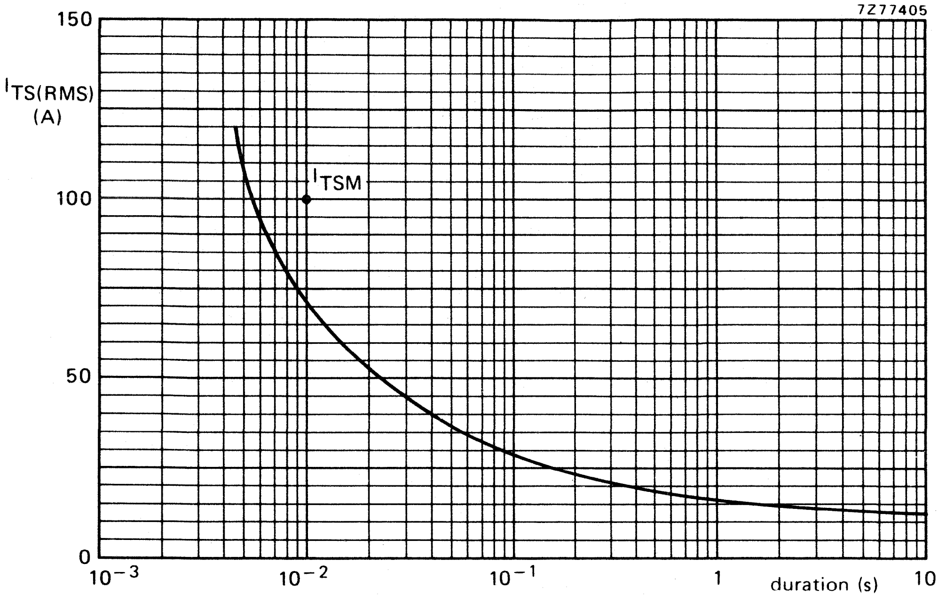
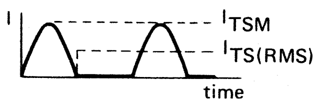


Fig. 5 Maximum permissible non-repetitive r.m.s. on-state current based on sinusoidal currents (f = 50 Hz); T_j = 100 °C prior to surge; with reapplied V_{RWMmax}.



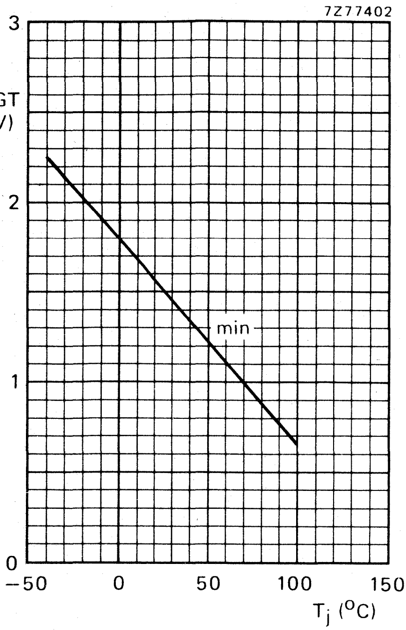


Fig. 6 Minimum gate voltage that will trigger all devices as a function of junction temperature.

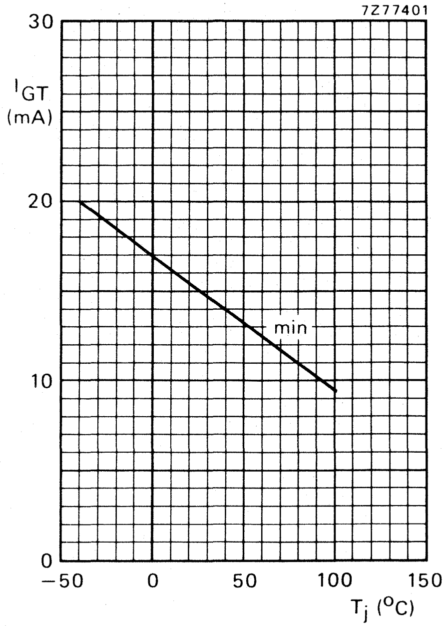


Fig. 7 Minimum gate current that will trigger all devices as a function of junction temperature.

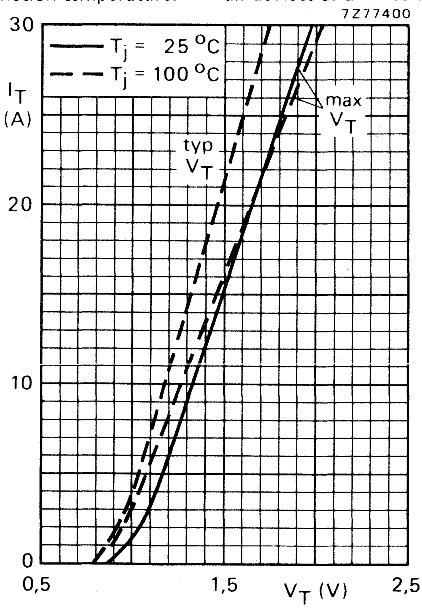


Fig. 8.

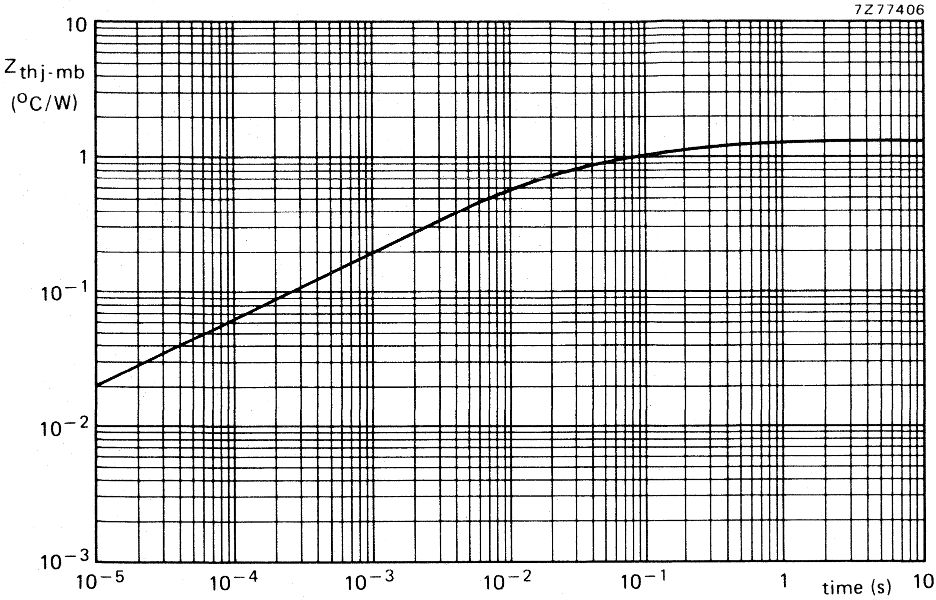


Fig. 9.

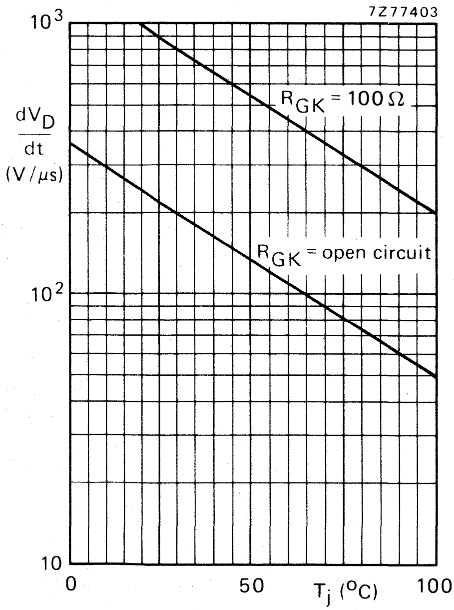


Fig. 10 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of junction temperature.

THYRISTORS

Silicon thyristors in metal envelopes, intended for general purpose single-phase or three-phase mains operation.
The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTW23-600R to 1600R.

QUICK REFERENCE DATA

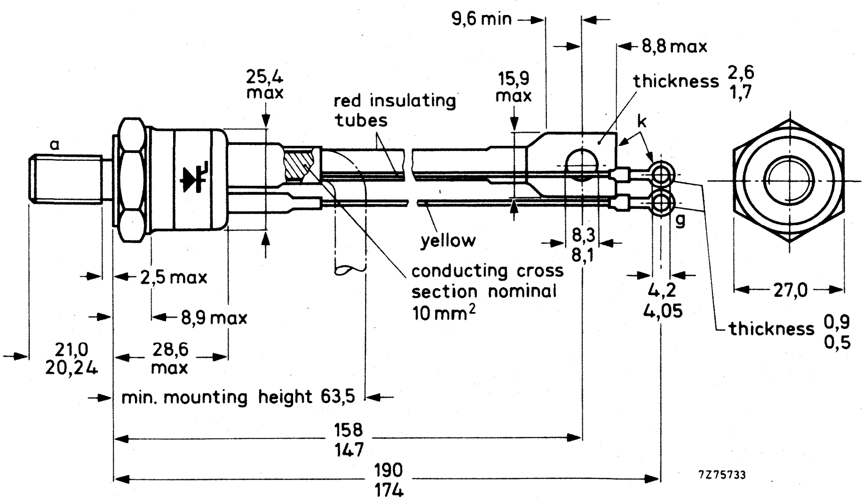
		BTW23-600R	800R	1000R	1200R	1400R	1600R	
Repetitive peak voltages $V_{DRM} = V_{RRM}$	max.	600	800	1000	1200	1400	1600	V

Average on-state current	$I_{T(AV)}$	max.	90	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	140	A
Non-repetitive peak on-state current	I_{TSM}	max.	2000	A
Rate of rise of off-state voltage that will not trigger any device	dV_D/dt	<	200	V/μs
On request (see ordering note on page 4)	dV_D/dt	<	1000	V/μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-94: with metric M12 stud (Ø 12 mm); e.g. BTW23-600R.
Types with ½ in x 20 UNF stud (Ø 12,7 mm) are available on request. These are indicated by the suffix U: e.g. BTW23-600RU.



Net mass: 134 g
Diameter of clearance hole: max. 13,0 mm
Torque on nut: min. 9 Nm (90 kg cm)
max. 17,5 Nm (175 kg cm)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats;
M12 : 19 mm
½ in x 20 UNF: 19 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTW23-600R	800R	1000R	1200R	1400R	1600R	
Non-repetitive peak voltages ($t \leq 10$ ms)	V_{DSM}/V_{RSM}	max.	600	800	1000	1200	1400	1600	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	600	800	1000	1200	1400	1600	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	400	600	700	800	800	800	V*

Average on-state current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{T(AV)}$	max.	90	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	140	A
Repetitive peak on-state current	I_{TRM}	max.	1250	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 125 °C prior to surge; with reapplied $V_{RWM\,max}$	I_{TSM}	max.	2000	A
I^2t for fusing (t = 10 ms)	I^2t	max.	20 000	A^2s
Rate of rise of on-state current after triggering with I_G = 750 mA to I_T = 300 A; dI_G/dt = 1 A/µs	dI_T/dt	max.	300	A/µs
Rate of change of commutation current	see Fig. 14			

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	10	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	2	W
Peak power dissipation	P_{GM}	max.	10	W

Temperatures

Storage temperature	T_{stg}		−55 to + 125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\,j\text{-}mb}$	=	0,3	°C/W
From mounting base to heatsink	$R_{th\,mb\text{-}h}$	=	0,1	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\,j\text{-}mb}$	=	0,015	°C/W

* To ensure thermal stability: $R_{th\,j\text{-}a}$ < 0,75 °C/W (d.c. blocking) or < 1,5 °C/W (a.c.). For smaller heatsinks $T_{j\,max}$ should be derated. For a.c. see Fig. 4.

CHARACTERISTICS

Anode to cathode

On-state voltage I_T = 500 A; T_j = 25 °C	V_T	<	2,2 V*
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 $V_{DRM\,max}$; T_j = 125 °C	dV_D/dt	<	200 V/μs
Reverse current $V_R = V_{RWM\,max}$; T_j = 125 °C	I_R	<	15 mA
Off-state current $V_D = V_{DWM\,max}$; T_j = 125 °C	I_D	<	15 mA
Holding current; T_j = 25 °C	I_H	<	200 mA

Gate to cathode

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	V_{GT}	>	2,5 V
Voltage that will not trigger any device $V_D = V_{DRM\,max}$; T_j = 125 °C	V_{GD}	<	250 mV
Current that will trigger any device V_D = 6 V; T_j = 25 °C	I_{GT}	>	150 mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from $V_D = V_{DWM\,max}$ to I_T = 100 A; I_{GT} = 200 mA; dI_G/dt = 1 A/μs; T_j = 25 °C	t_{gt}	<	2,5 μs
	t_r	typ.	1 μs

* Measured under pulse conditions to avoid excessive dissipation.

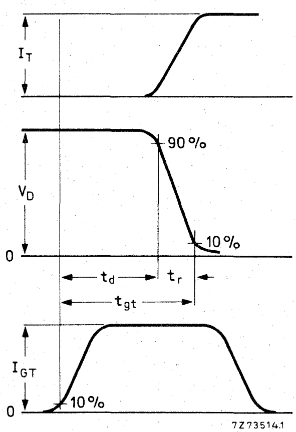


Fig. 2 Gate-controlled turn-on time definitions.

CHARACTERISTICS (continued)

Circuit-commutated turn-off when switched
from I_T = 50 A to $V_R \geqslant$ 50 V with $-dI_T/dt$ = 50 A/μs;
dV_D/dt = 200 V/μs;

T_j = 125 °C	t_q	typ.	100 μs
		<	200 μs
T_j = 25 °C	t_q	typ.	60 μs
		<	120 μs

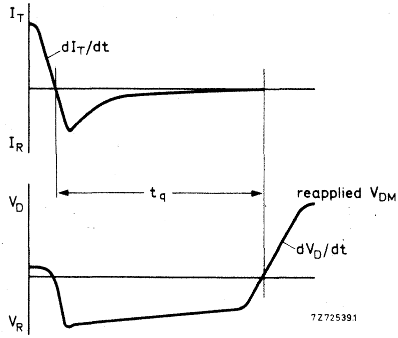


Fig. 3 Circuit-commutated turn-off time definition.

OPERATING NOTE

Switching losses in commutation

For applications in which the thyristor is forced to switch from an on-state current I_{TRM} to a high reverse voltage at a high commutation rate ($-dI_T/dt$), consult Fig. 14 (nomogram) to find the increase in total average power. This increase must be added to the loss from the curves in Fig. 4.

ORDERING NOTE

Types with dV_D/dt of 1000 V/μs are available on request. Add suffix C to the type number when ordering; e.g. BTW23-600RC.

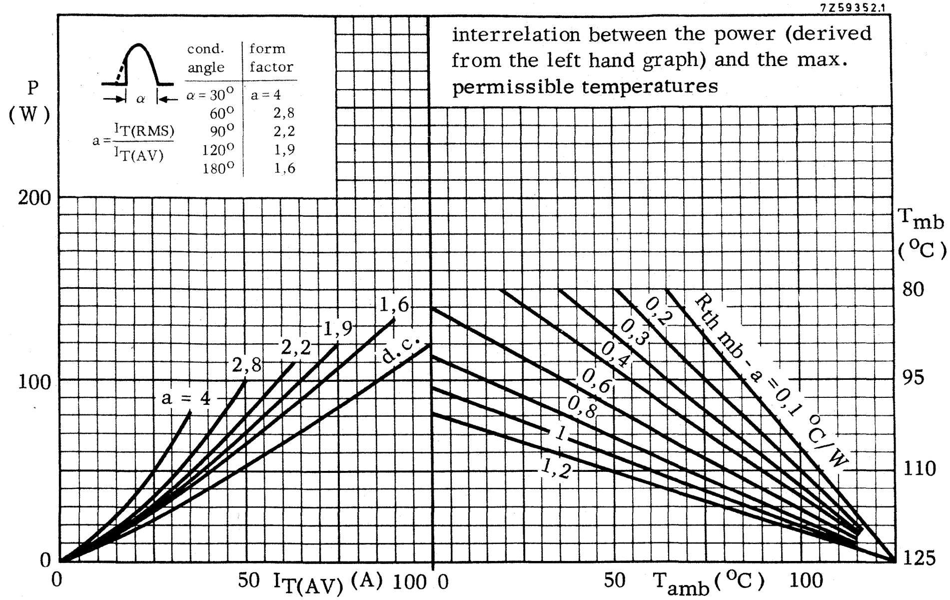

7Z59352.1
interrelation between the power (derived from the left hand graph) and the max. permissible temperatures
P (W)
200
100
0
cond. angle
form factor
α = 30° a = 4
60° 2,8
90° 2,2
120° 1,9
180° 1,6
a = I_T(RMS) / I_T(AV)
α
a = 4
2,8
2,2
1,9
1,6
d.c.
0
50
I_T(AV) (A)
100
T_mb (°C)
80
95
110
125
R_th mb - a = 0,1 °C/W
0,2
0,3
0,4
0,6
0,8
1
1,2
0
50
T_amb (°C)
100

Fig. 4.

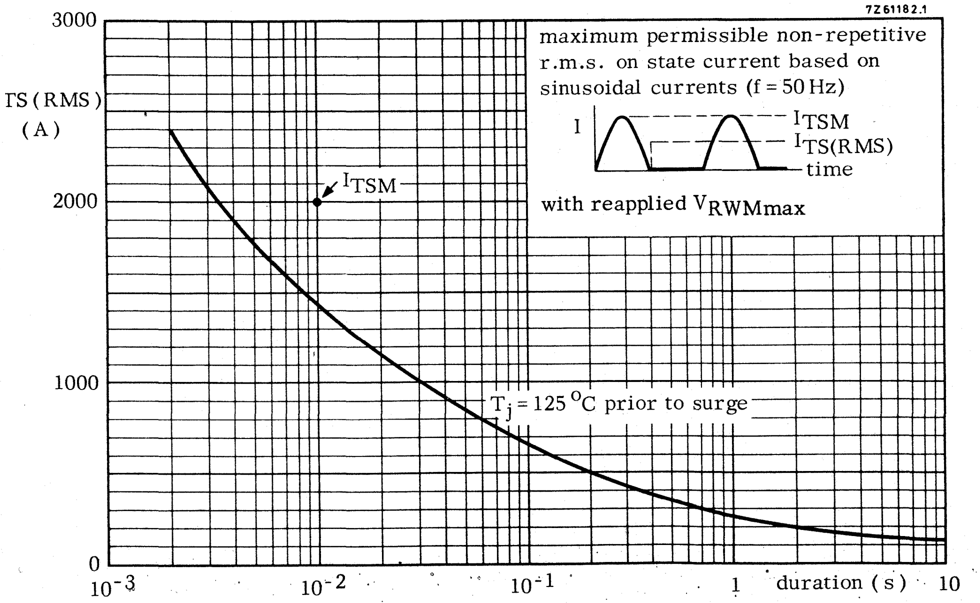

7Z61182.1
maximum permissible non-repetitive r.m.s. on state current based on sinusoidal currents (f = 50 Hz)
I
I_TSM
I_TS(RMS)
time
with reapplied V_RWMmax
I_TS(RMS) (A)
3000
2000
1000
0
I_TSM
T_j = 125 °C prior to surge
10^-3
10^-2
10^-1
1
duration (s)
10

Fig. 5.

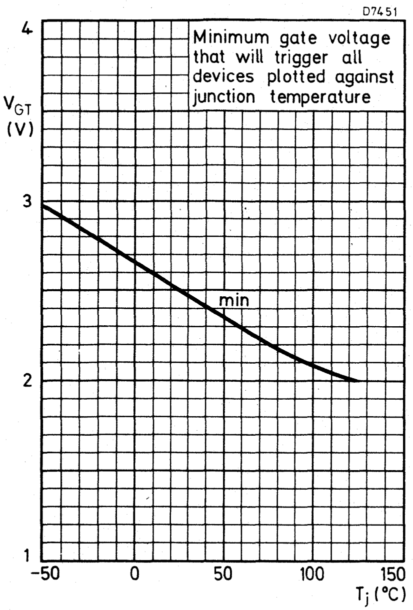


Fig. 6.

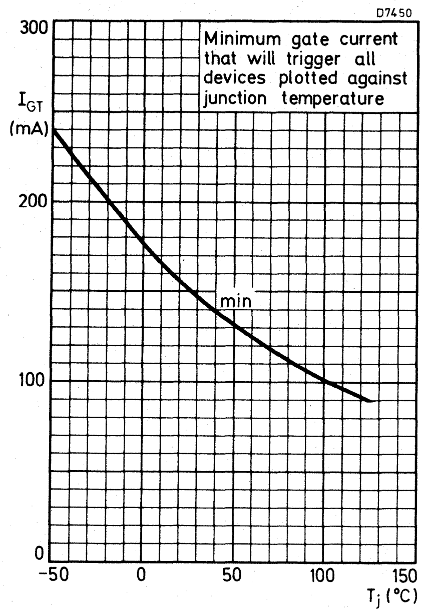


Fig. 7.

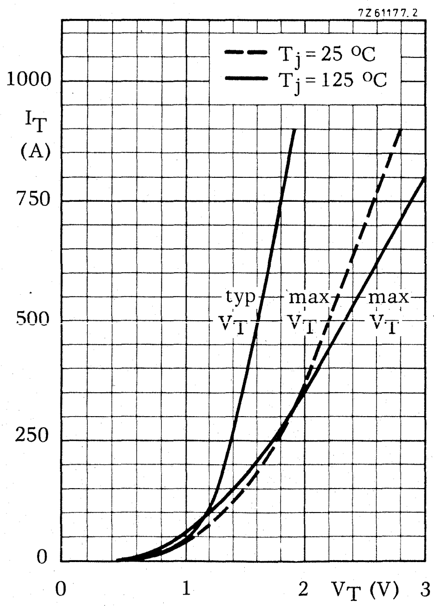


Fig. 8.

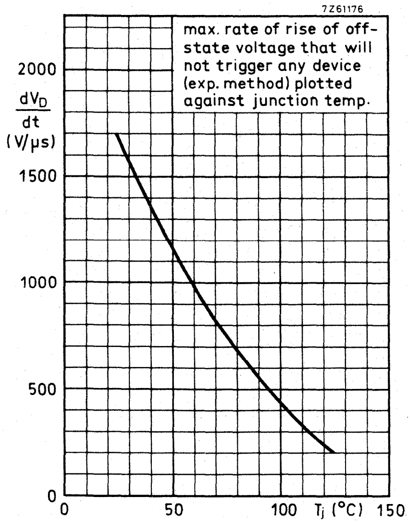


Fig. 9.

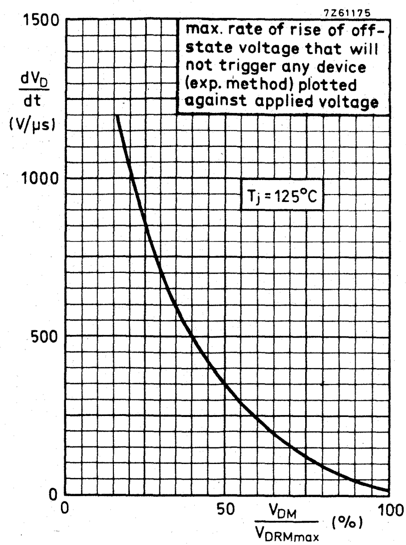


Fig. 10.

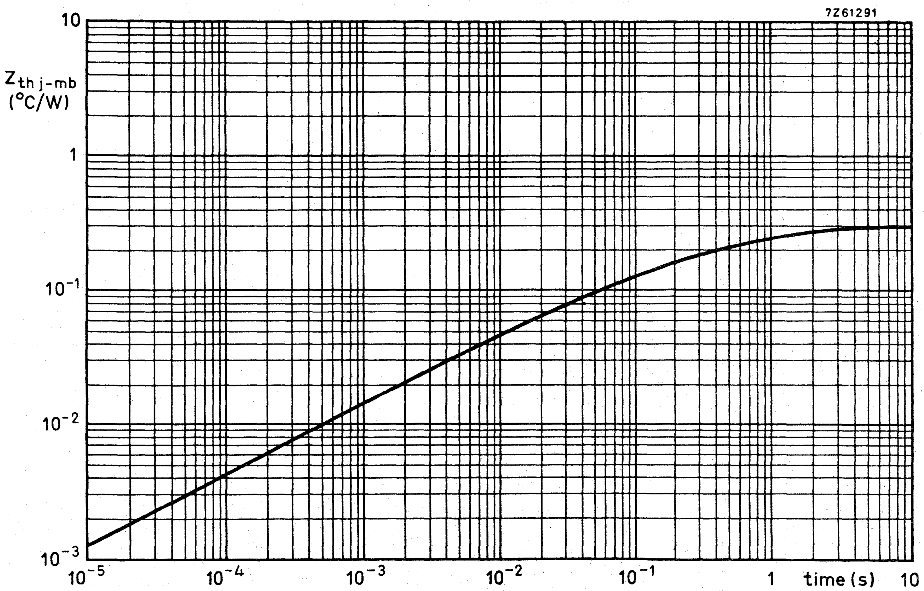
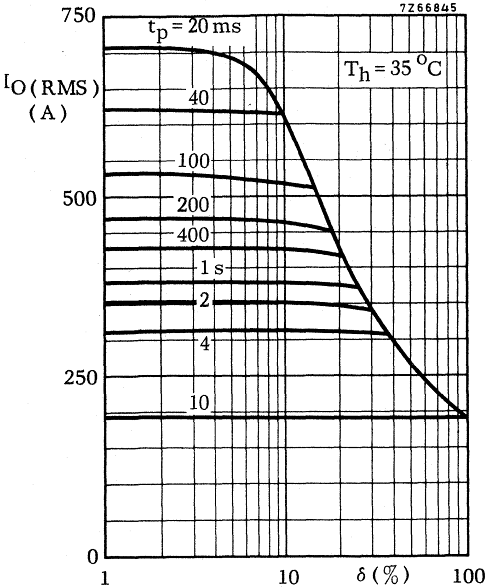
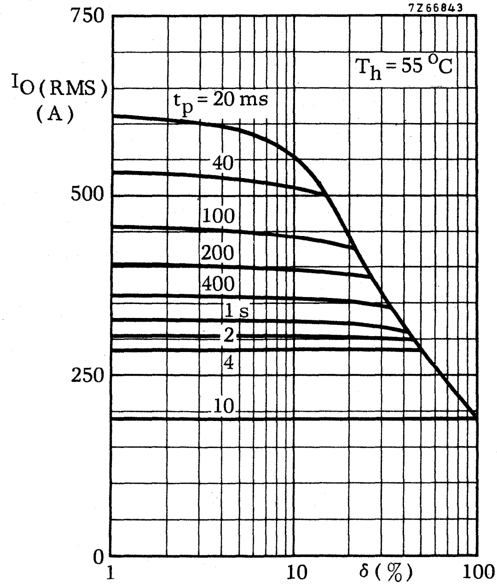
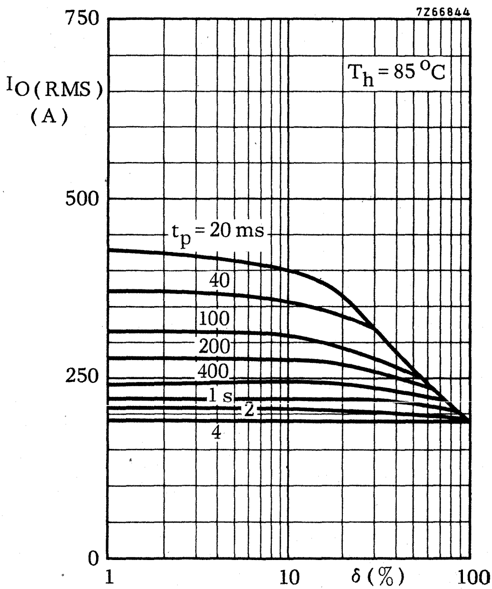
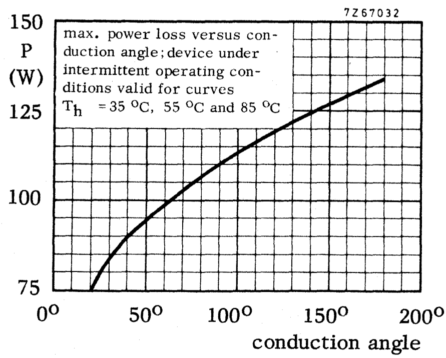


Fig. 11.









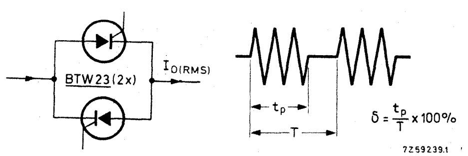


Fig. 12 Intermittent overload capability of two BTW23 thyristors in anti-parallel connection in a single phase a.c. control circuit (e.g. welding); conduction angle 360°.

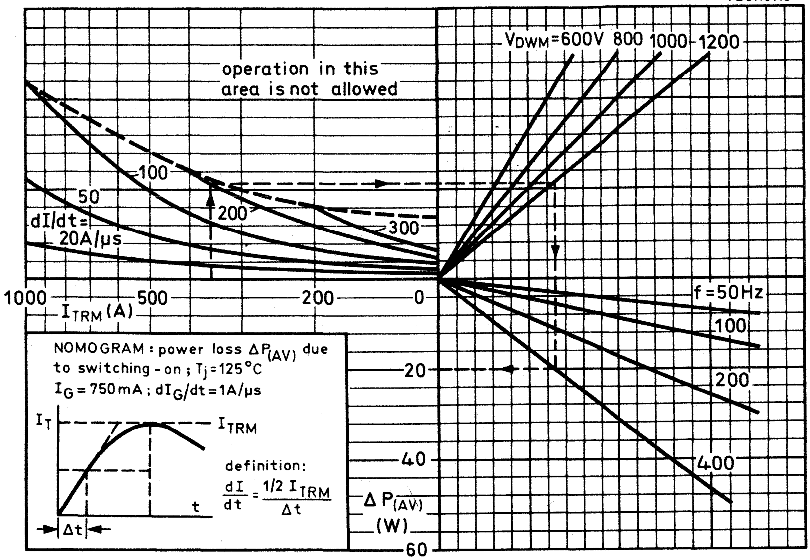

7Z61181.2
operation in this area is not allowed
V_{DWM}=600V
800
1000
1200
100
50
dI/dt=
20A/μs
200
300
1000
500
200
0
I_{TRM} (A)
f=50Hz
100
200
400
20
40
60
ΔP(AV)
(W)
NOMOGRAM: power loss ΔP(AV) due to switching-on; Tj=125°C
IG=750 mA; dIG/dt=1A/μs
IT
ITRM
definition:
dI/dt = 1/2 ITRM / Δt
t
Δt

Fig. 13.

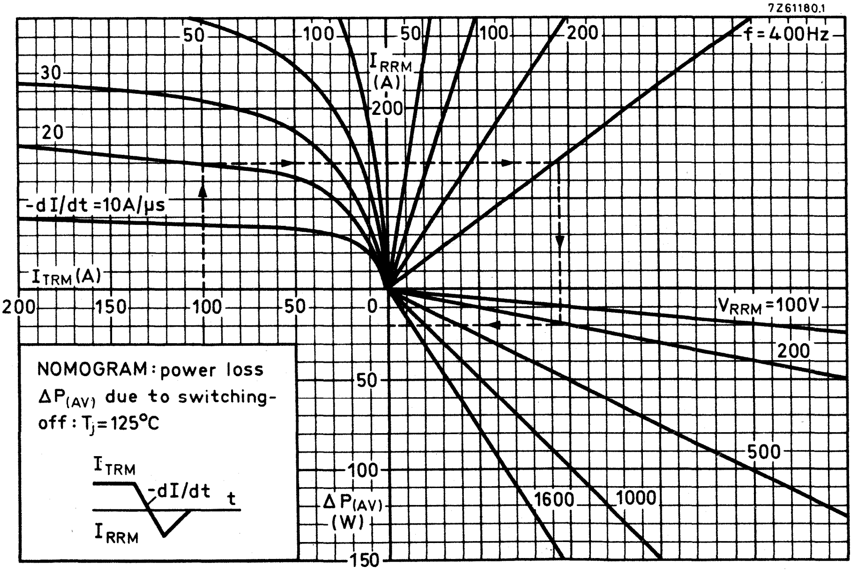
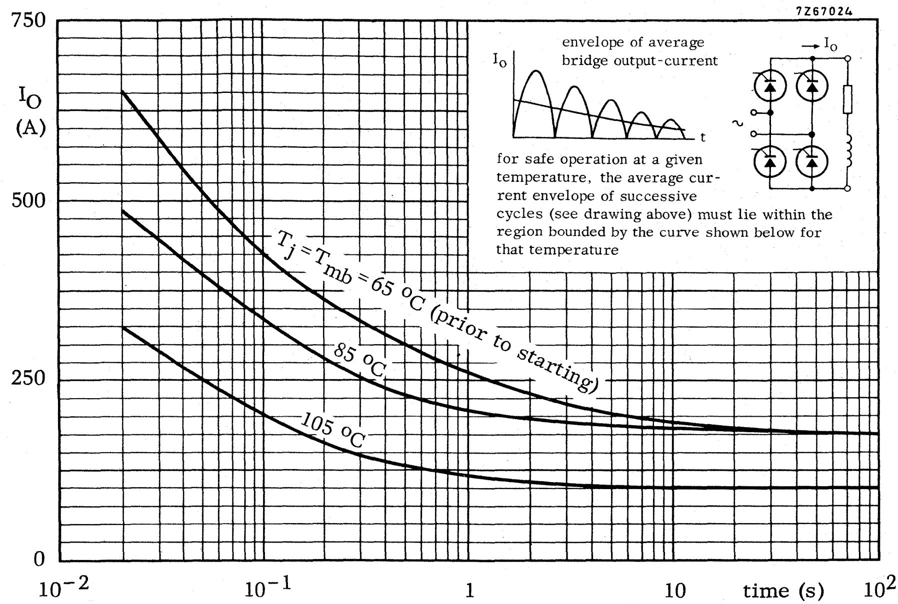

7Z61180.1
50
100
50
100
200
f=400Hz
30
20
IRRM
(A)
200
-dI/dt=10A/μs
ITRM (A)
200
150
100
50
0
VRRM=100V
200
500
1600
1000
50
100
150
ΔP(AV)
(W)
NOMOGRAM: power loss ΔP(AV) due to switching-off: Tj=125°C
ITRM
-dI/dt
t
IRRM

Fig. 14.



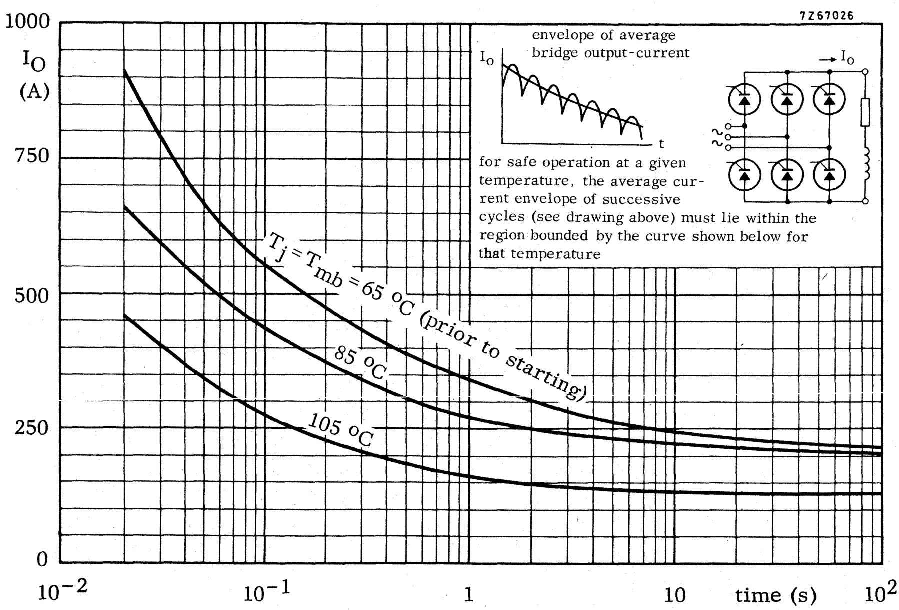


Fig. 15 Limits for starting or inrush currents.

THYRISTORS

Silicon thyristors in metal envelopes, intended for general purpose single-phase or three-phase mains operation.
The series consists of reverse polarity types (anode to stud) identified by a suffix R:
BTW24-600R to 1600R.

QUICK REFERENCE DATA

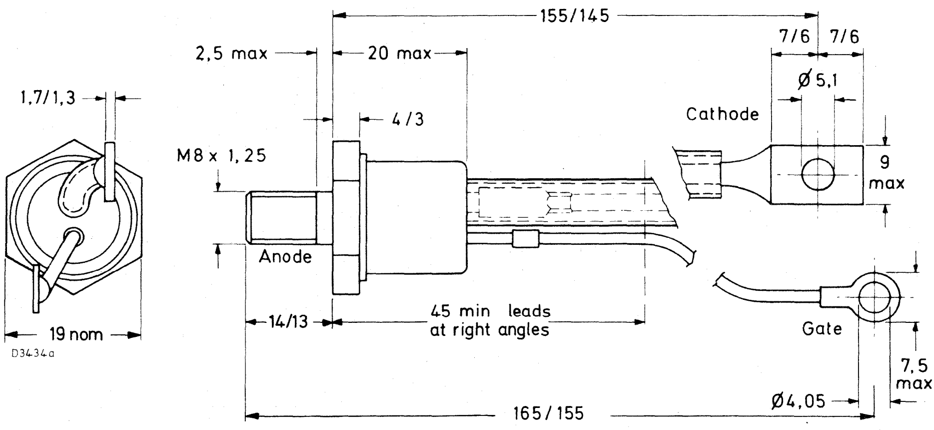
		BTW24-600R	800R	1000R	1200R	1400R	1600R	
Repetitive peak voltages $V_{DRM} = V_{RRM}$	max.	600	800	1000	1200	1400	1600	V

Average on-state current	$I_{T(AV)}$	max.	35	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	55	A
Non-repetitive peak on-state current	I_{TSM}	max.	800	A
Rate of rise of off-state voltage that will not trigger any device	dV_D/dt	<	200	V/μs
On request (see ordering note on page 4)	dV_D/dt	<	1000	V/μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-103.



Net mass: 46 g
Diameter of clearance hole: 8,5 mm
Torque on nut: min. 4 Nm (40 kg cm)
max. 6 Nm (60 kg cm)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 13 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTW24-600R	800R	1000R	1200R	1400R	1600R	
Non-repetitive peak voltages ($t \leqslant 10$ ms)	V_{DSM}/V_{RSM}	max.	600	800	1000	1200	1400	1600	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	600	800	1000	1200	1400	1600	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	400	600	700	800	800	800	V *

Average on-state current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{T(AV)}$	max.	35	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	55	A
Repetitive peak on-state current	I_{TRM}	max.	450	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 125 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.	800	A
I^2t for fusing (t = 10 ms)	I^2t	max.	3200	A^2s
Rate of rise of on-state current after triggering with I_G = 500 mA to I_T = 100 A; dI_G/dt = 1 A/μs	dI_T/dt	max.	300	A/μs
Rate of change of commutation current	see Fig. 14			

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	10	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	1	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}	−55 to + 125		°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0,6	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,04	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a} < 1$ °C/W (d.c. blocking) or < 2 °C/W (a.c.). For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see Fig. 4.

CHARACTERISTICS

Anode to cathode

On-state voltage I_T = 100 A; T_j = 25 °C	V_T	<	1,9 V *
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 V_{DRMmax}; T_j = 125 °C	dV_D/dt	<	200 V/µs
Reverse current $V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	10 mA
Off-state current $V_D = V_{DWMmax}$; T_j = 125 °C	I_D	<	10 mA
Latching current; T_j = 25 °C	I_L	<	300 mA
Holding current; T_j = 25 °C	I_H	<	200 mA

Gate to cathode

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	V_{GT}	>	2,5 V
Voltage that will not trigger any device $V_D = V_{DRMmax}$; T_j = 125 °C	V_{GD}	<	200 mV
Current that will trigger all devices V_D = 6 V; T_j = 25 °C	I_{GT}	>	100 mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from $V_D = V_{DWMmax}$ to I_T = 100 A; I_{GT} = 150 mA; dI_G/dt = 1 A/µs; T_j = 25 °C	t_{gt} t_r	typ. typ.	2 µs 1 µs

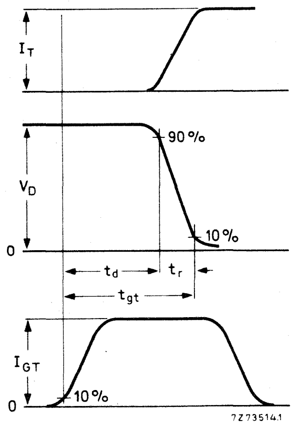


Fig. 2 Gate-controlled turn-on time definitions.

* Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Circuit-commutated turn-off time when switched from I_T = 30 A to $V_R \geqslant$ 50 V with $-dI_T/dt$ = 30 A/μs; dV_D/dt = 100 V/μs; T_j = 125 °C	t_q	typ. <	140 μs 200 μs
T_j = 25 °C	t_q	<	100 μs

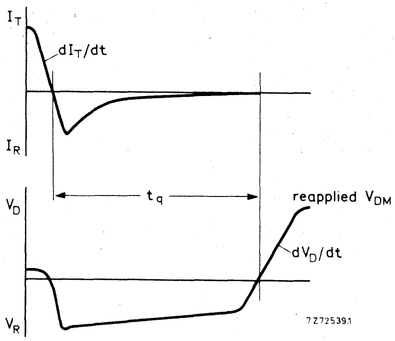


Fig. 3 Circuit-commutated turn-off time definition.

OPERATING NOTE

Switching losses in commutation

For applications in which the thyristor is forced to switch from an on-state current I_{TRM} to a high reverse voltage at a high commutation rate ($-dI_T/dt$), consult Fig. 14 (nomogram) to find the increase in total average power. This increase must be added to the loss from the curves in Fig. 4.

ORDERING NOTE

Types with dV_D/dt of 1000 V/μs are available on request. Add suffix C to the type number when ordering; e.g. BTW24-600RC.

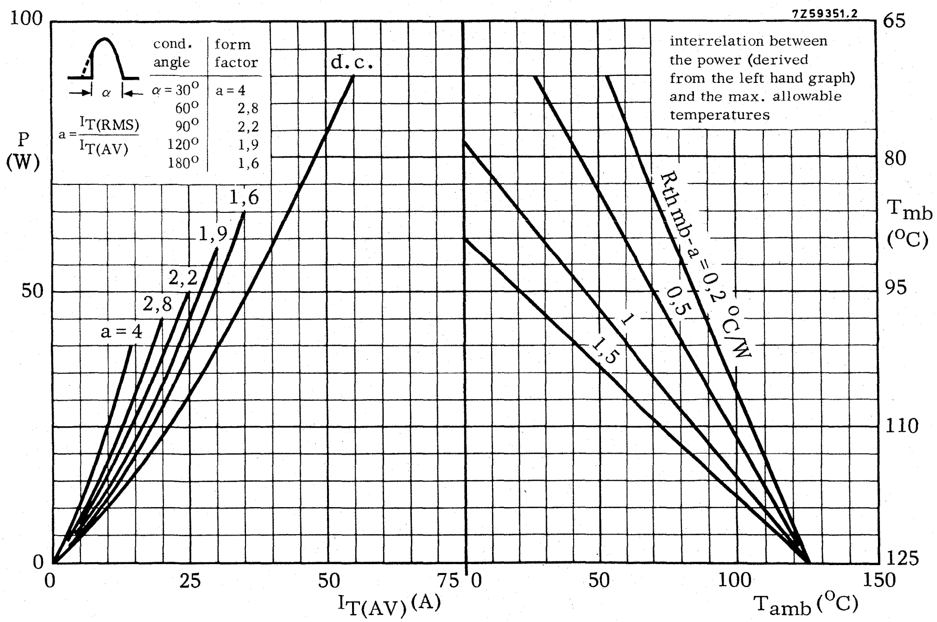

7Z59351.2
cond. angle
form factor
α = 30° a = 4
60° 2,8
90° 2,2
120° 1,9
180° 1,6
a = $I_{T(RMS)}$ / $I_{T(AV)}$
d.c.
1,6
1,9
2,2
2,8
a = 4
P (W)
$I_{T(AV)}$ (A)
interrelation between the power (derived from the left hand graph) and the max. allowable temperatures
$R_{th\ mb-a}$ = 0,2 °C/W
0,5
1
1,5
T_{mb} (°C)
T_{amb} (°C)

Fig. 4.

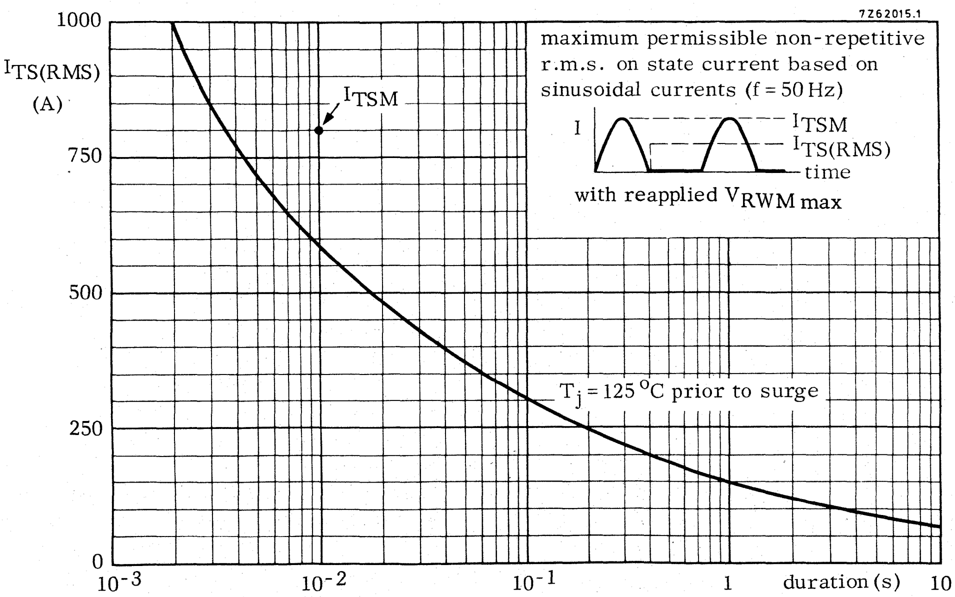

7Z62015.1
$I_{TS(RMS)}$ (A)
I_{TSM}
maximum permissible non-repetitive r.m.s. on state current based on sinusoidal currents (f = 50 Hz)
I
I_{TSM}
$I_{TS(RMS)}$
time
with reapplied $V_{RWM\ max}$
T_j = 125 °C prior to surge
duration (s)

Fig. 5.

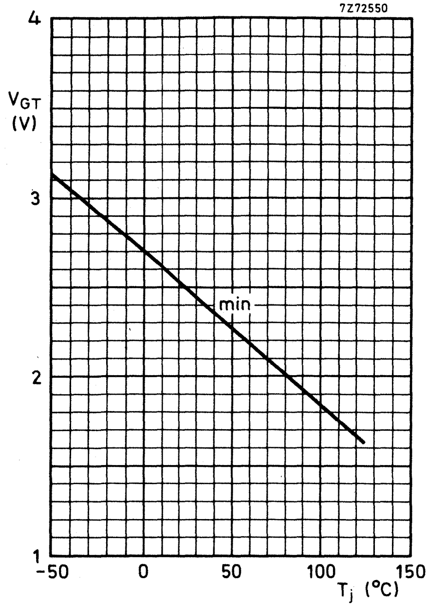


Fig. 6 Minimum gate voltage that will trigger all devices plotted against junction temperature.

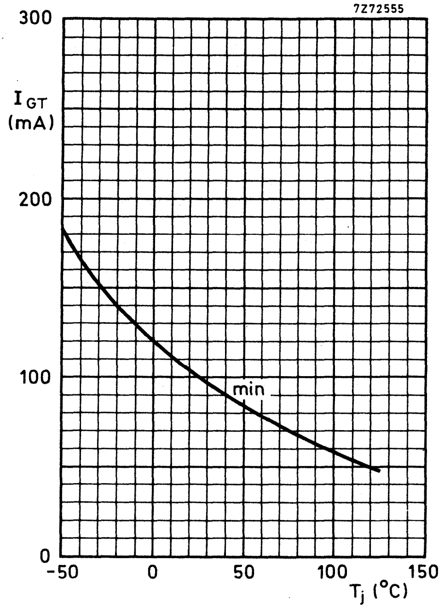


Fig. 7 Minimum gate current that will trigger all devices plotted against junction temperature.

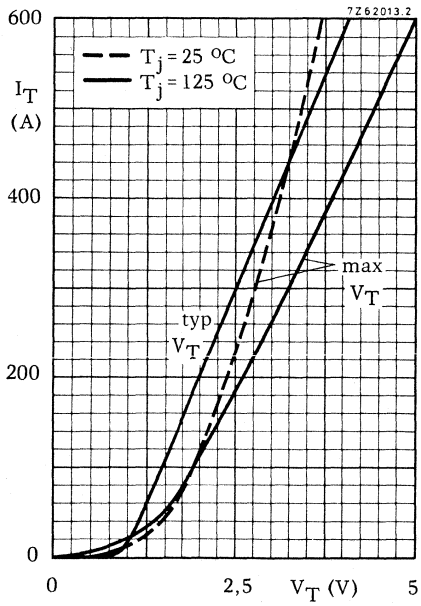


Fig. 8.

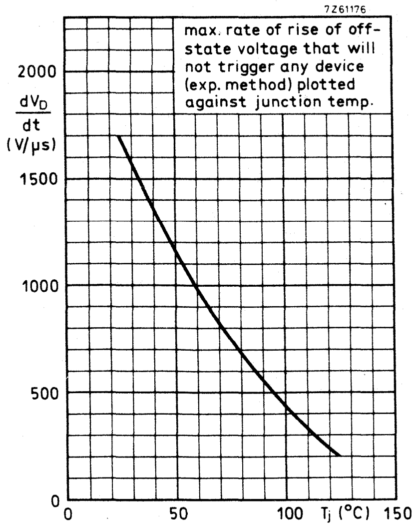


Fig. 9.

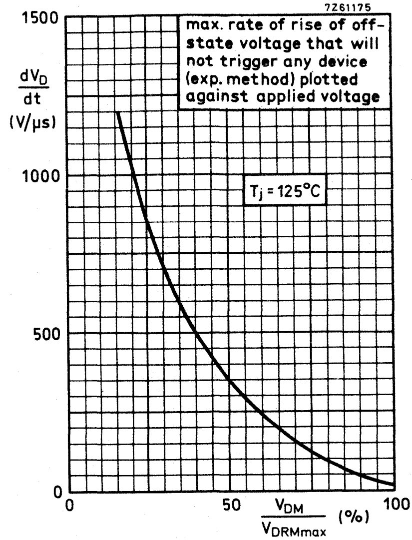


Fig. 10.

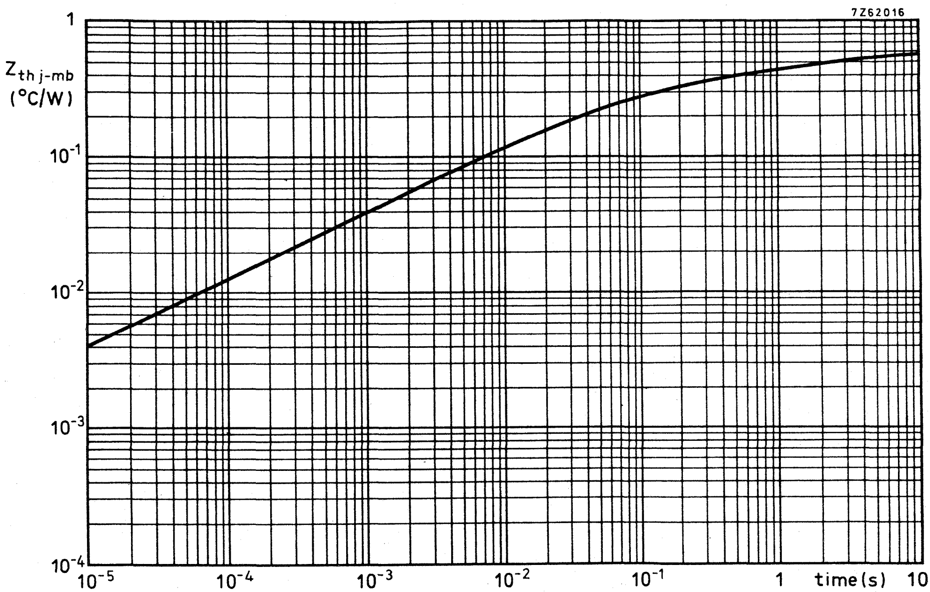


Fig. 11.

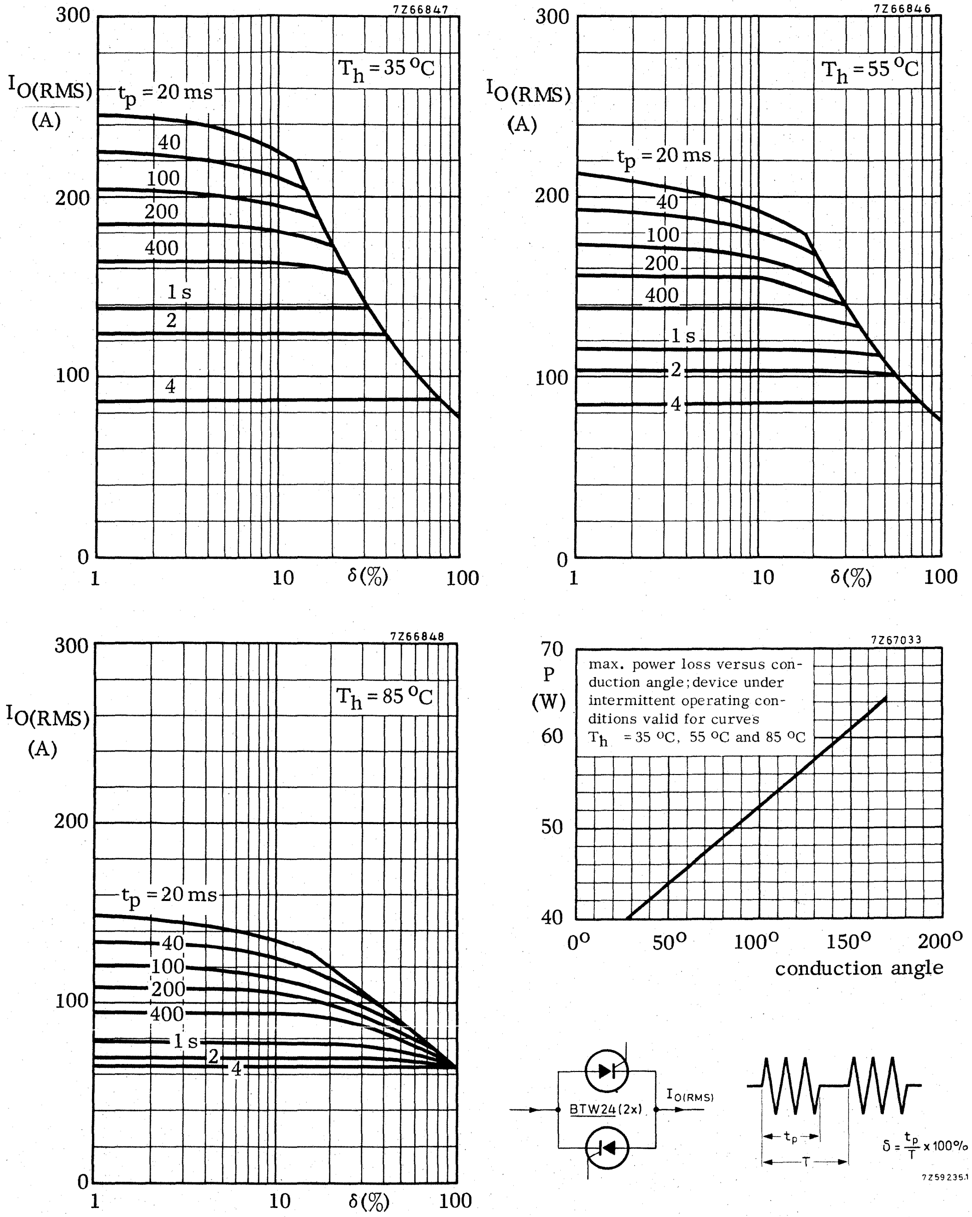


Fig. 12 Intermittent overload capability of two BTW24 thyristors in anti-parallel connection in a single phase a.c. control circuit (e.g. welding); conduction angle: 360°.

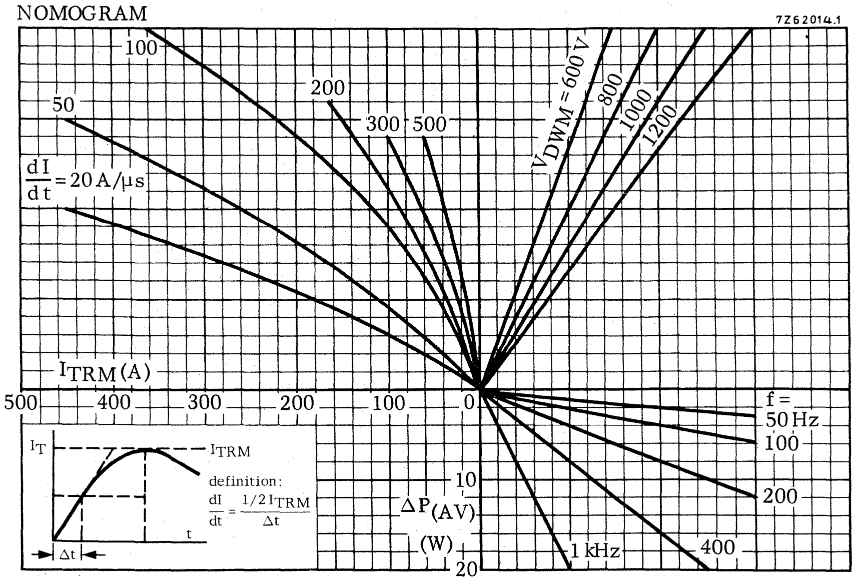


Fig. 13 Power loss $\Delta P_{(AV)}$ due to switching-on; T_j = 125 °C; I_G = 500 mA; dI_G/dt = 1 A/µs.

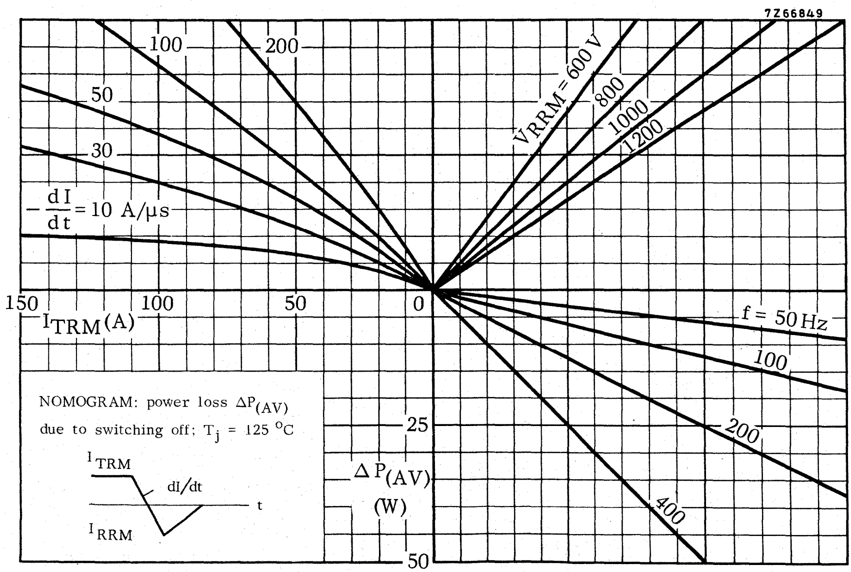
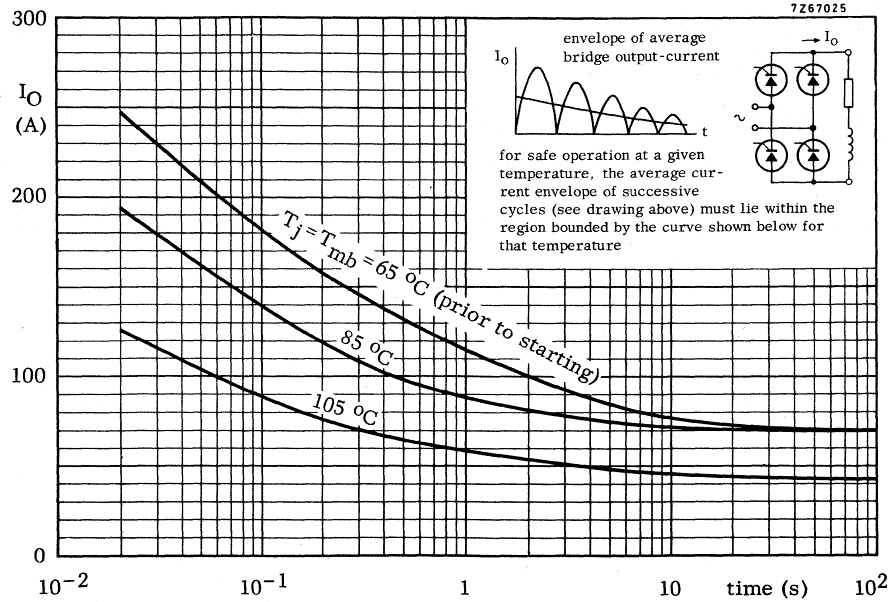


Fig. 14.



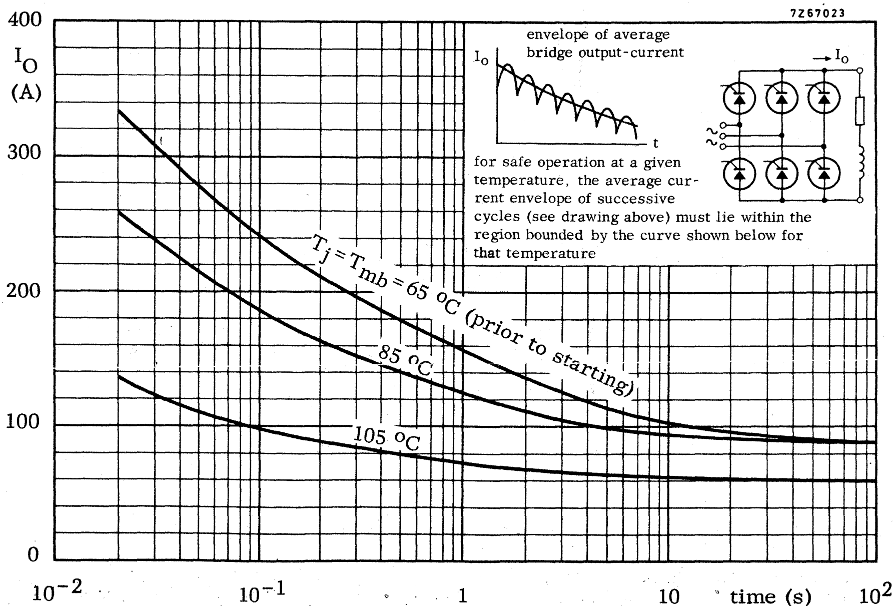


Fig. 15 Limits for starting or inrush currents.

FAST TURN-OFF THYRISTORS

A range of medium current fast turn-off thyristors in metal envelopes, intended for use in inverter applications.
The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTW30-800RS to 1200RS.

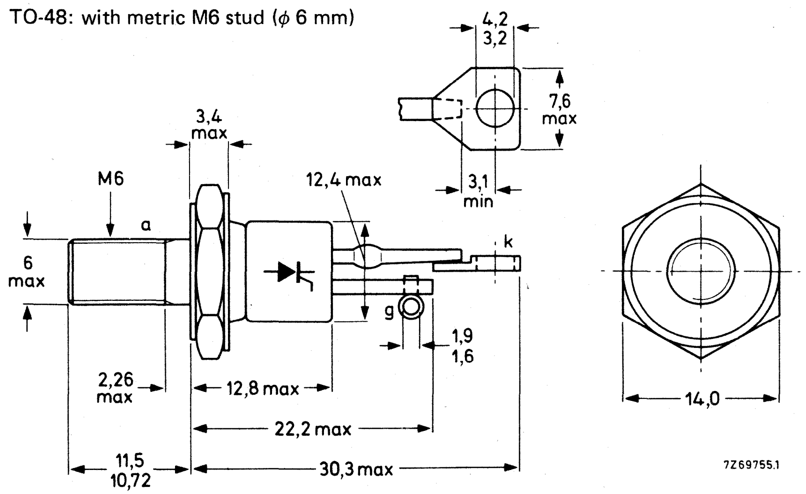
QUICK REFERENCE DATA

			BTW30-800RS	1000RS	1200RS	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	800	1000	1200	V
Average on-state current	$I_{T(AV)}$	max.			16	A
R.M.S. on-state current	$I_{T(RMS)}$	max.			24	A
Non-repetitive peak on-state current	I_{TSM}	max.			150	A
Rate of rise of on-state current	dI_T/dt	max.			100	A/µs
Rate of rise of off-state voltage that will not trigger any device	dV_D/dt	$<$			200	V/µs
Circuit-commutated turn-off time	t_q	$<$			15	µs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-48: with metric M6 stud (ϕ 6 mm)



Net mass: 14 g
Diameter of clearance hole: max. 6,5 mm
Accessories supplied on request: 56264A
(mica washer, insulating ring, soldering tag)

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)
Supplied with device:
1 nut, 1 lock washer
Nut dimensions across the flats: 10 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTW30-800RS	1000RS	1200RS	
Non-repetitive peak voltages (t ⩽ 10 ms)	V_{DSM}**/V_{RSM}	max.	800	1000	1200	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	800	1000	1200	V▲
Crest working off-state voltage square-wave; δ = 0,5	V_{DWM}	max.	600	800	1000	V*

Average on-state current assuming zero switching losses (averaged over any 20 ms period)				
square-wave; δ = 0,5; up to T_{mb} = 65 °C	$I_{T(AV)}$	max.	16	A
square-wave; δ = 0,5; at T_{mb} = 85 °C	$I_{T(AV)}$	max.	12	A
sinusoidal; at T_{mb} = 85 °C	$I_{T(AV)}$	max.	10	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	24	A
Repetitive peak on-state current	I_{TRM}	max.	150	A
Non-repetitive peak on-state current T_j = 125 °C prior to surge (see Fig. 6)				
t = 10 ms; half sine-wave	I_{TSM}	max.	150	A
t = 5 ms; square pulse	I_{TSM}	max.	150	A
I^2t for fusing (t = 10 ms)	I^2t	max.	115	A^2s
Rate of rise of on-state current after triggering with I_G = 1 A to I_T = 50 A; dI_G/dt = 1 A/μs	dI_T/dt	max.	100	A/μs

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	10	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	1	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−55 to + 125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,06	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a}$ < 3 °C/W (d.c. blocking) or < 6 °C/W (square-wave; δ = 0,5). For smaller heatsinks $T_{j\ max}$ should be derated. For square-wave see Fig. 5.

** Although not recommended, higher off-state voltages may be applied without damage, but the thyristor may switch into the on-state. The rate of rise of on-state current should not exceed 30 A/μs.

▲ Thermal stability at higher voltage ratings is dependent on duty factor. See Figs 15 and 16.

CHARACTERISTICS

Anode to cathode

On-state voltage $I_T = 20$ A; $T_j = 25$ °C	V_T	<	3,5 V*
Rate of rise of off-state voltage that will not trigger any device; exponential method; $V_D = 2/3\ V_{DRM\,max}$; $T_j = 125$ °C	dV_D/dt	<	200 V/μs
Off-state current $V_D = V_{DWM\,max}$; $T_j = 125$ °C	I_D	<	7 mA
Holding current; $T_j = 25$ °C	I_H	<	200 mA

Gate to cathode

Voltage that will trigger all devices $V_D = 6$ V; $T_j = 25$ °C	V_{GT}	>	2,5 V
Voltage that will not trigger any device $V_D = V_{DRM\,max}$; $T_j = 125$ °C	V_{GD}	<	0,2 V
Current that will trigger all devices $V_D = 6$ V; $T_j = 25$ °C	I_{GT}	>	200 mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from $V_D = V_{DWM\,max}$ to $I_T = 50$ A; $I_{GT} = 200$ mA; $dI_G/dt = 1$ A/μs; $T_j = 25$ °C	t_d	<	1 μs
	t_r	<	1 μs

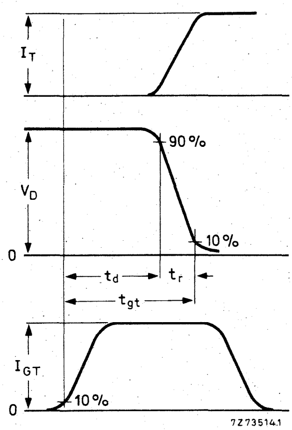


Fig. 2 Gate-controlled turn-on time definitions.

* Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Circuit-commutated turn-off time when switched
from I_T = 10 A to $V_R \geqslant 50$ V with $-dI_T/dt$ = 10 A/μs;
dV_D/dt = 50 V/μs; T_j = 125 °C — t_q < 15 μs

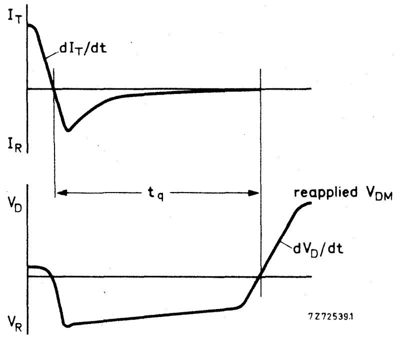
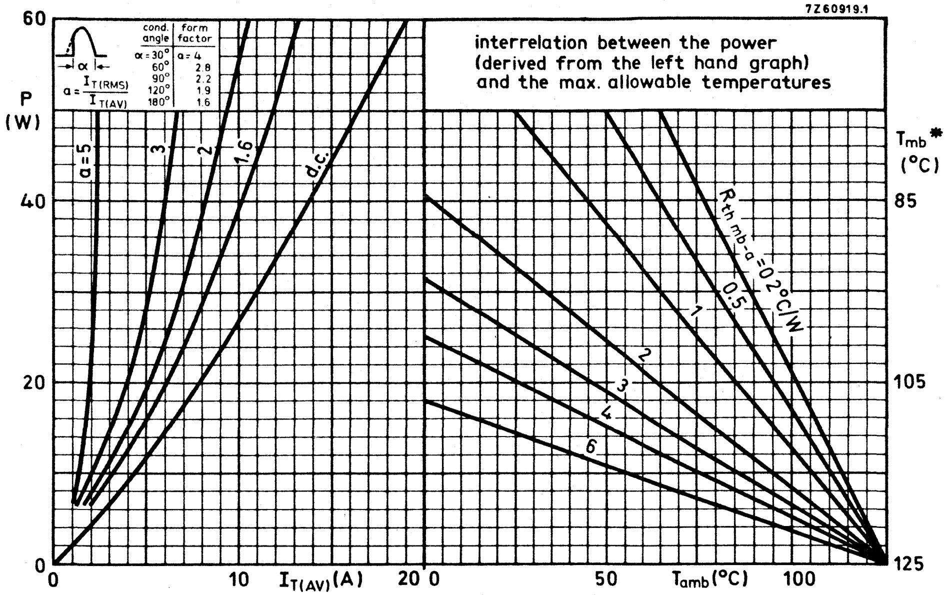


Fig. 3 Circuit-commutated turn-off time definitions.

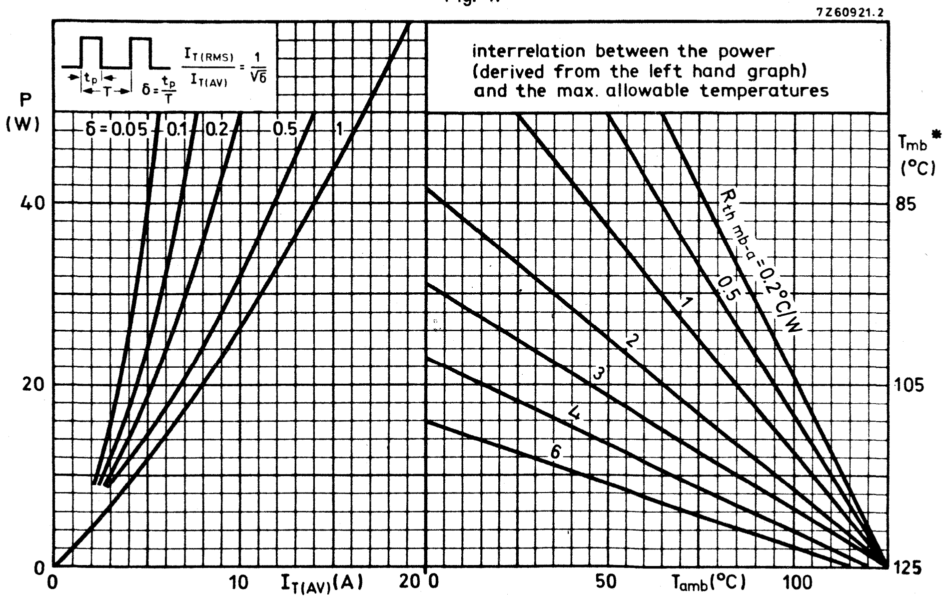
OPERATING NOTES

1. The terminals should neither be bent nor twisted; they should be soldered into the circuit so that there is no strain on them.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. High frequency operation.
   a. The curves in Figs 13 and 14 show the additional average power losses due to turning on and turning off the thyristor in square pulse operation. This power should be added to that derived from the curves in Fig. 5.
   b. Power loss due to turn-off may be discounted if an inverse parallel diode is connected across the thyristor to clip any reverse voltage which may occur following commutation. Note should be taken of the consequent increase in turn-off time (see Fig. 11).



* T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leq 6$°C/W

Fig. 4.



* T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leq 2$°C/W

Fig. 5.

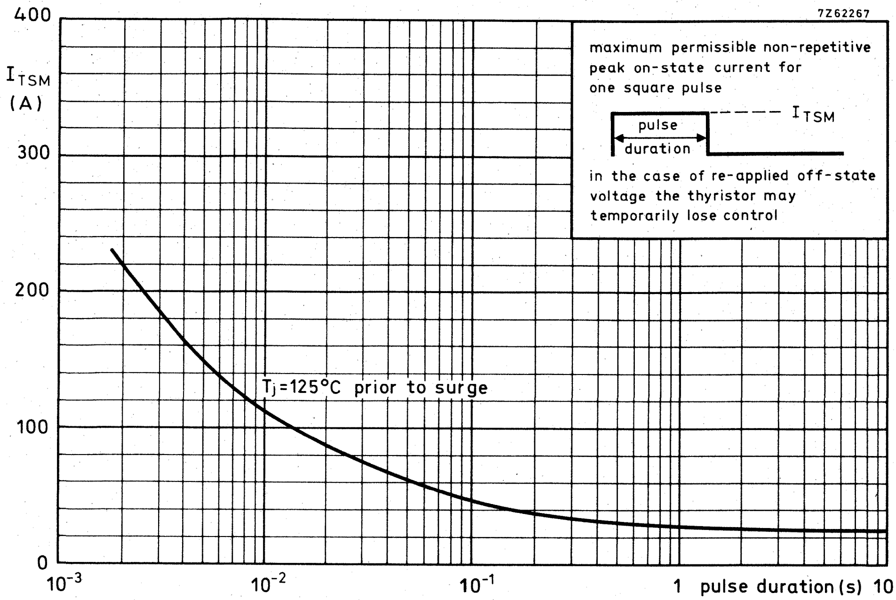


Fig. 6.

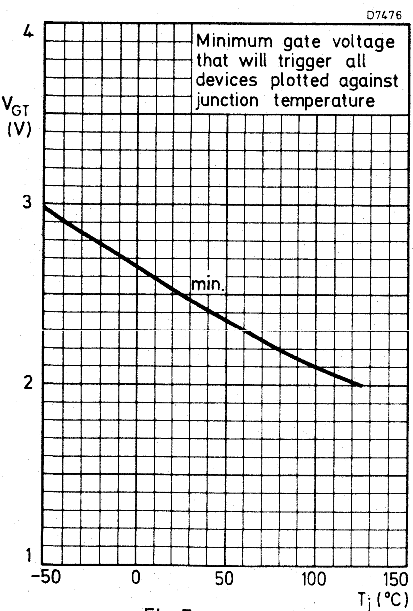


Fig. 7.

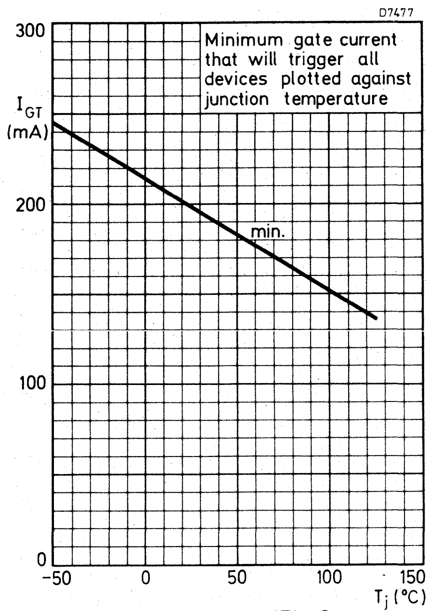


Fig. 8.

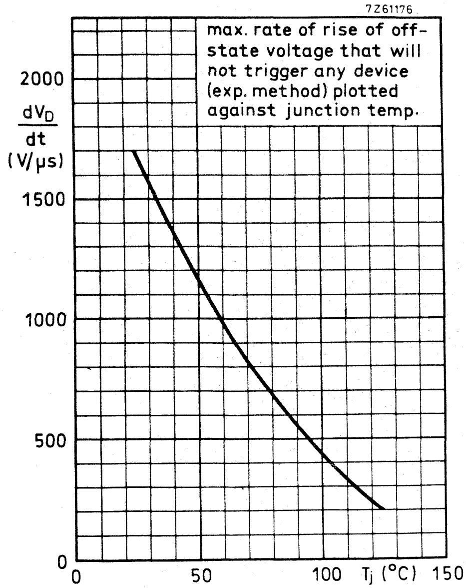


Fig. 9.

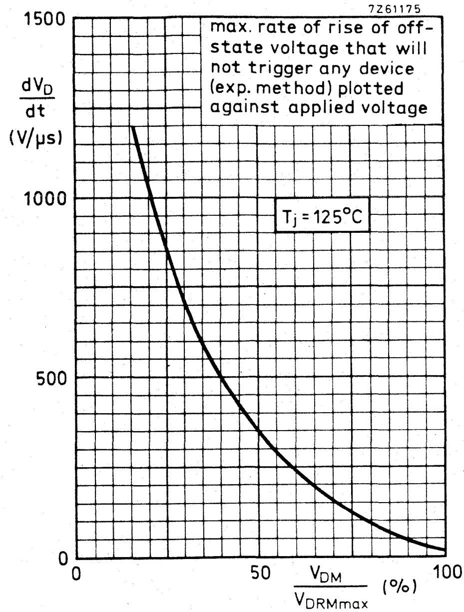


Fig. 10.

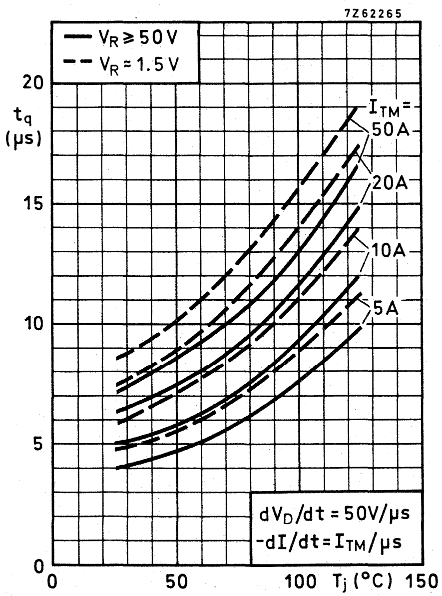


Fig. 11.

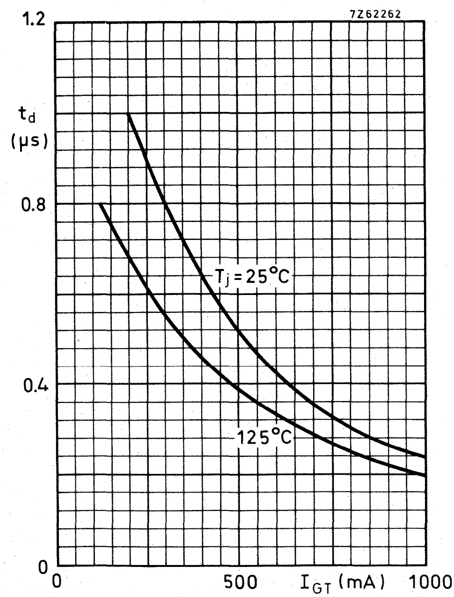


Fig. 12.

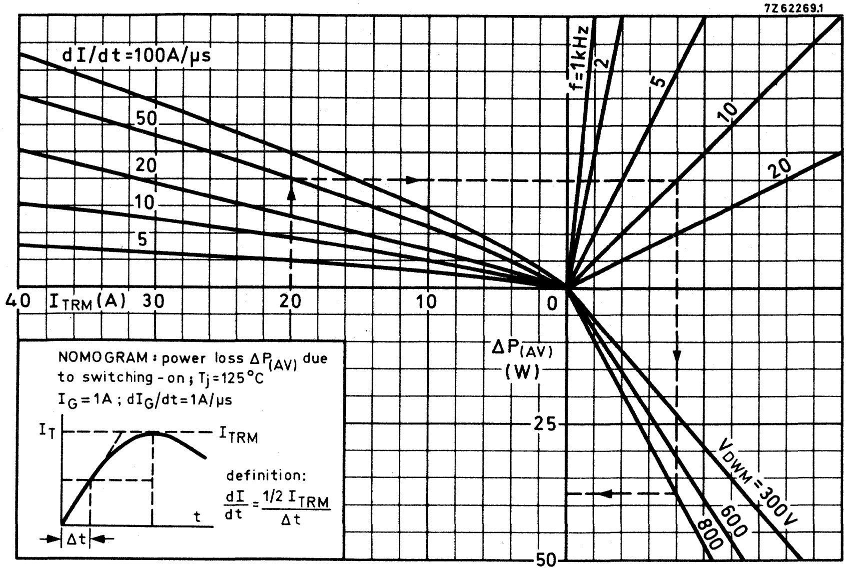

7Z62269.1
dI/dt=100A/μs
50
20
10
5
f=1kHz
2
5
10
20
40
I_{TRM}(A)
30
20
10
0
ΔP(AV)
(W)
25
50
NOMOGRAM: power loss ΔP(AV) due to switching-on; Tj=125°C
IG=1A; dIG/dt=1A/μs
IT
ITRM
t
Δt
definition:
dI/dt = 1/2 ITRM / Δt
VDWM=300V
600
800

Fig. 13.

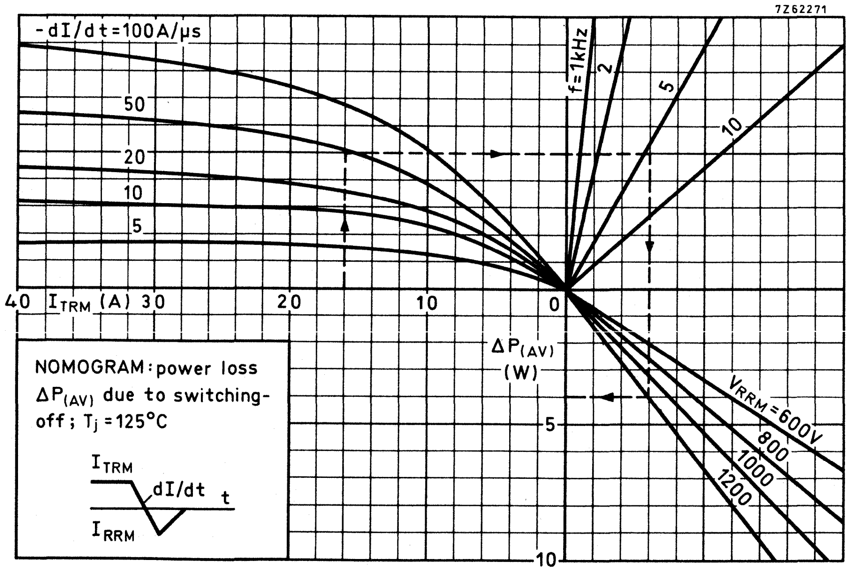

7Z62271
-dI/dt=100A/μs
50
20
10
5
f=1kHz
2
5
10
40
ITRM (A)
30
20
10
0
ΔP(AV)
(W)
5
10
NOMOGRAM: power loss ΔP(AV) due to switching-off; Tj=125°C
ITRM
dI/dt
t
IRRM
VRRM=600V
800
1000
1200

Fig. 14.

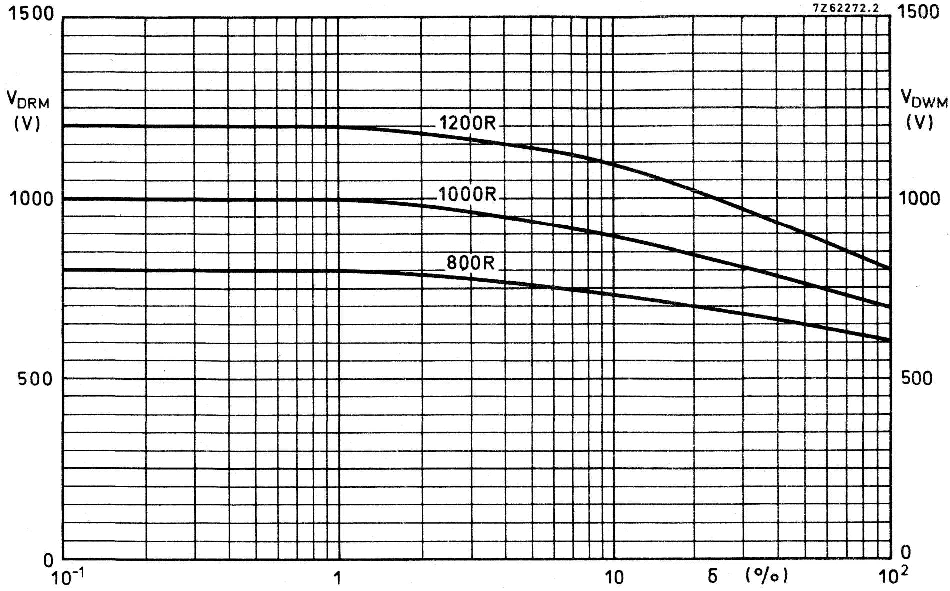

7Z62272.2
1500
1000
500
0
V_{DRM}
(V)
V_{DWM}
(V)
1200R
1000R
800R
10^{-1}
1
10
δ (%)
10^2

Fig. 15.

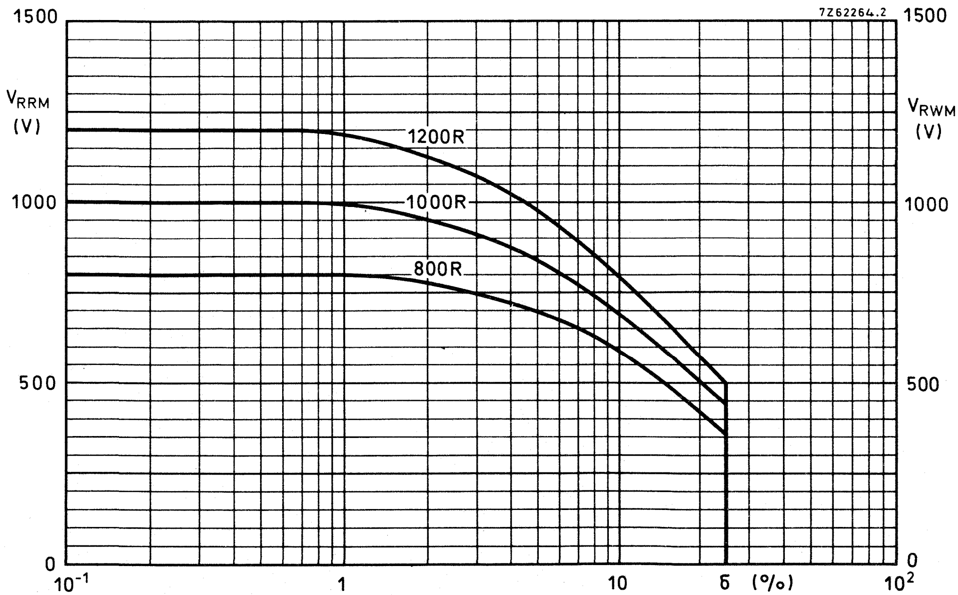

7Z62264.2
1500
1000
500
0
V_{RRM}
(V)
V_{RWM}
(V)
1200R
1000R
800R
10^{-1}
1
10
δ (%)
10^2

Fig. 16.

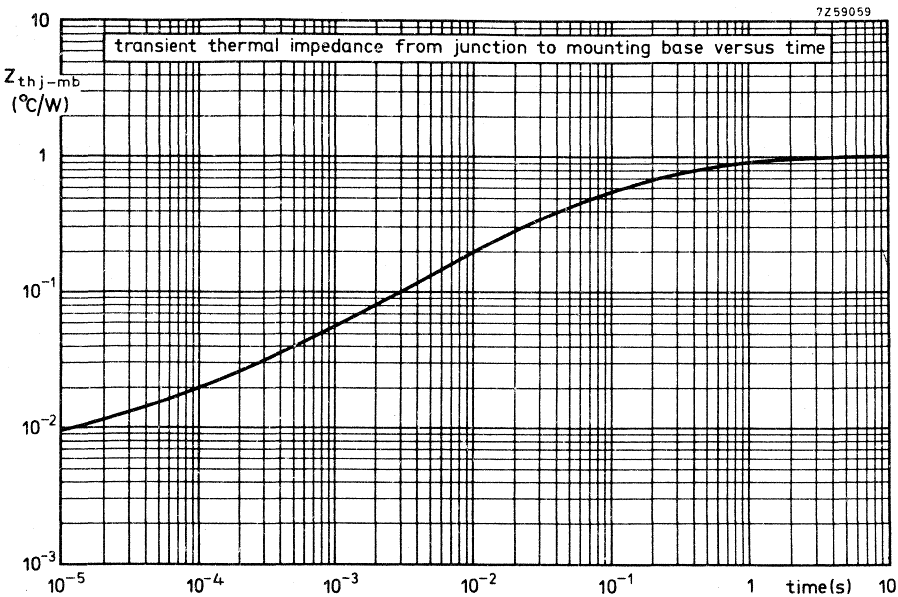

7Z59059
transient thermal impedance from junction to mounting base versus time
$Z_{th\,j-mb}$ (°C/W)
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time(s)
10

Fig. 17.

FAST TURN-OFF THYRISTORS

A range of medium current fast turn-off thyristors in metal envelopes, intended for use in inverter applications.
The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTW31-800RW to 1200RW.

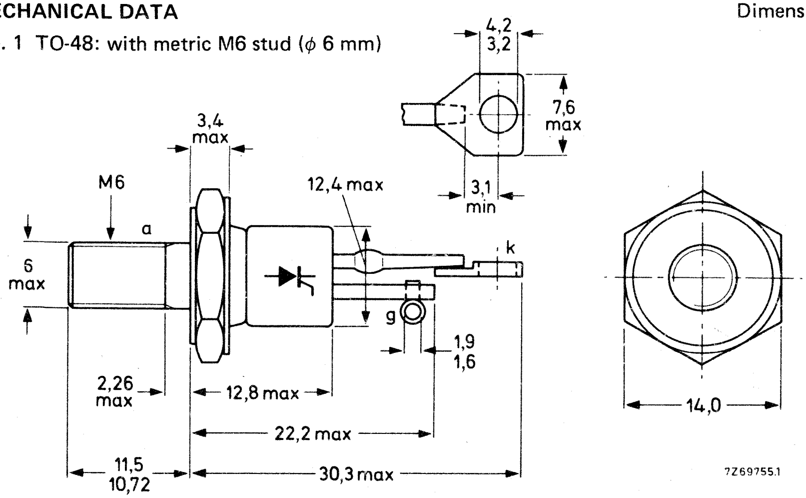
QUICK REFERENCE DATA

			BTW31-800RW	1000RW	1200RW	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	800	1000	1200	V
Average on-state current	$I_{T(AV)}$	max.		22		A
R.M.S. on-state current	$I_{T(RMS)}$	max.		31		A
Non-repetitive peak on-state current	I_{TSM}	max.		240		A
Rate of rise of on-state current	dI_T/dt	max.		100		A/µs
Rate of rise of off-state voltage that will not trigger any device	dV_D/dt	<		200		V/µs
Circuit-commutated turn-off time	t_q	<		20		µs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-48: with metric M6 stud (ϕ 6 mm)



Net mass: 14 g
Diameter of clearance hole: max. 6,5 mm
Accessories supplied on request: 56264A
(mica washer, insulating ring, soldering tag)

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)
Supplied with device:
1 nut, 1 lock washer
Nut dimensions across the flats: 10 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTW31-800RW	1000RW	1200RW	
Non-repetitive peak voltages (t ⩽ 10 ms)	V_{DSM}**/V_{RSM}	max.	800	1000	1200	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	800	1000	1200	V▲
Crest working off-state voltage square-wave; δ = 0,5	V_{DWM}	max.	600	800	1000	V *

Average on-state current assuming zero switching losses (averaged over any 20 ms period)				
square-wave; δ = 0,5; up to T_{mb} = 65 °C	$I_{T(AV)}$	max.	22	A
square-wave; δ = 0,5; at T_{mb} = 85 °C	$I_{T(AV)}$	max.	16	A
sinusoidal; at T_{mb} = 85 °C	$I_{T(AV)}$	max.	15	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	31	A
Repetitive peak on-state current	I_{TRM}	max.	240	A
Non-repetitive peak on-state current T_j = 125 °C prior to surge (see Fig. 6)				
t = 10 ms; half sine-wave	I_{TSM}	max.	240	A
t = 5 ms; square pulse	I_{TSM}	max.	240	A
I^2t for fusing (t = 10 ms)	I^2t	max.	290	A^2s
Rate of rise of on-state current after triggering with I_G = 1 A to I_T = 50 A; dI_G/dt = 1 A/µs	dI_T/dt	max.	100	A/µs

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	10	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	1	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−55 to +125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,06	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a} < 3$ °C/W (d.c. blocking) or < 6 °C/W (square-wave; δ = 0,5). For smaller heatsinks $T_{j\ max}$ should be derated. For square-wave see Fig. 5.

** Although not recommended, higher off-state voltages may be applied without damage, but the thyristor may switch into the on-state. The rate of rise of on-state current should not exceed 30 A/µs.

▲ Thermal stability at higher voltage ratings is dependent on duty factor. See Figs 15 and 16.

CHARACTERISTICS

Anode to cathode

On-state voltage I_T = 50 A; T_j = 25 °C	V_T	<	2,9 V *
Rate of rise of off-state voltage that will not trigger any device; exponential method; $V_D = 2/3 V_{DRMmax}$; T_j = 125 °C	dV_D/dt	<	200 V/µs
Off-state current $V_D = V_{DWMmax}$; T_j = 125 °C	I_D	<	7 mA
Holding current; T_j = 25 °C	I_H	<	200 mA

Gate to cathode

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	V_{GT}	>	2,5 V
Voltage that will not trigger any device $V_D = V_{DRMmax}$; T_j = 125 °C	V_{GD}	<	0,2 V
Current that will trigger all devices V_D = 6 V; T_j = 25 °C	I_{GT}	>	200 mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from $V_D = V_{DWMmax}$ to I_T = 50 A; I_{GT} = 200 mA; dI_G/dt = 1 A/µs; T_j = 25 °C	t_d t_r	< <	1 µs 0,7 µs

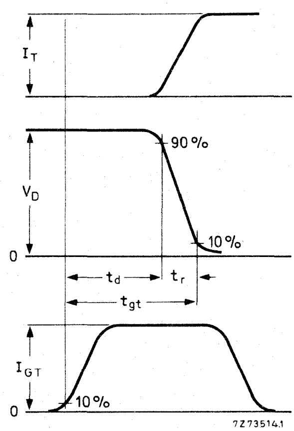


Fig. 2 Gate-controlled turn-on time definitions.

* Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Circuit-commutated turn-off time when switched from I_T = 10 A to $V_R \geqslant$ 50 V with $-dI_T/dt$ = 10 A/µs; dV_D/dt = 50 V/µs; T_j = 125 °C	t_q	<	20 µs

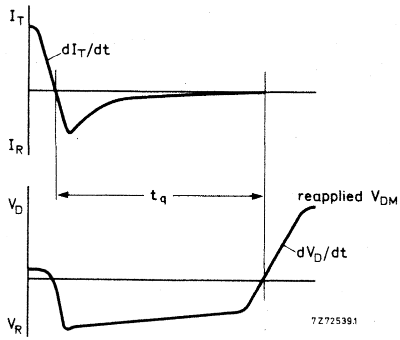
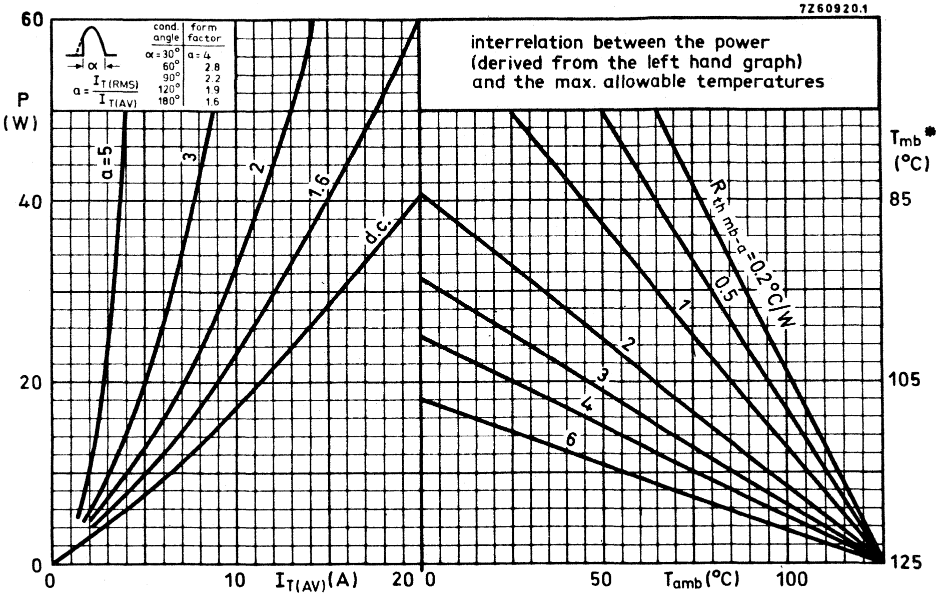


Fig. 3 Circuit-commutated turn-off time definitions.

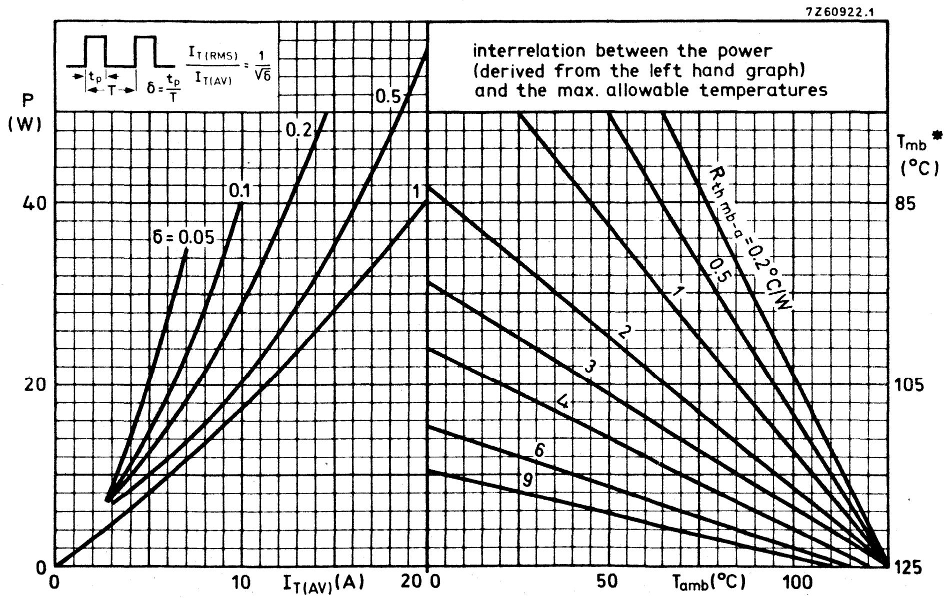
OPERATING NOTES

1. The terminals should neither be bent nor twisted; they should be soldered into the circuit so that there is no strain on them.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. High frequency operation.
   a. The curves in Figs 13 and 14 show the additional average power losses due to turning on and turning off the thyristor in square pulse operation. This power should be added to that derived from the curves in Fig. 5.
   b. Power loss due to turn-off may be discounted if an inverse parallel diode is connected across the thyristor to clip any reverse voltage which may occur following commutation. Note should be taken of the consequent increase in turn-off time (see Fig. 11).



* T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leq 6$ °C/W

Fig. 4.



* T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leq 2$ °C/W

Fig. 5.

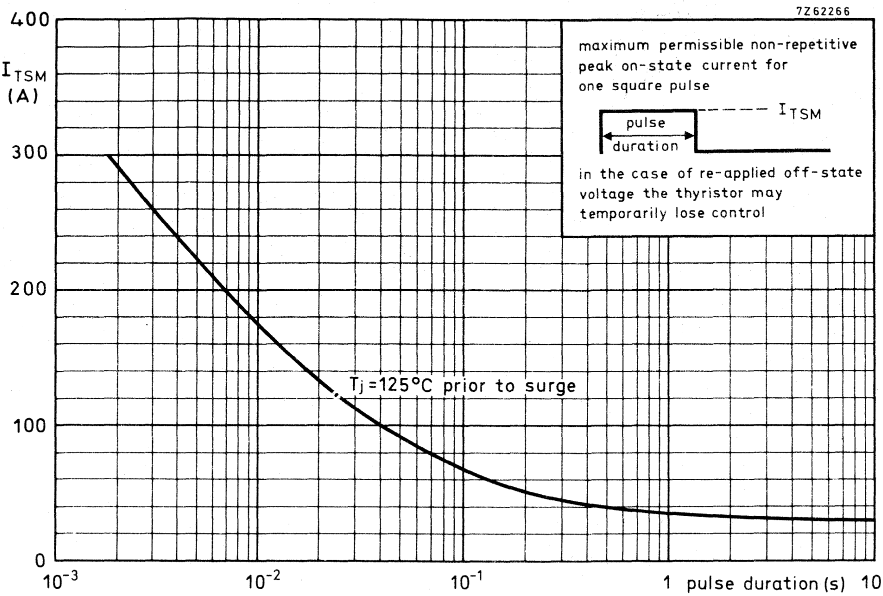


Fig. 6.

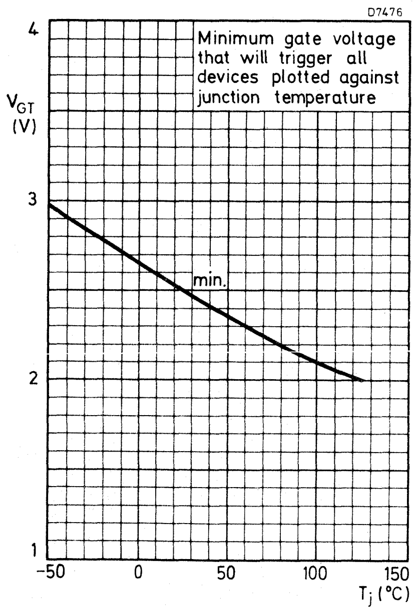


Fig. 7.

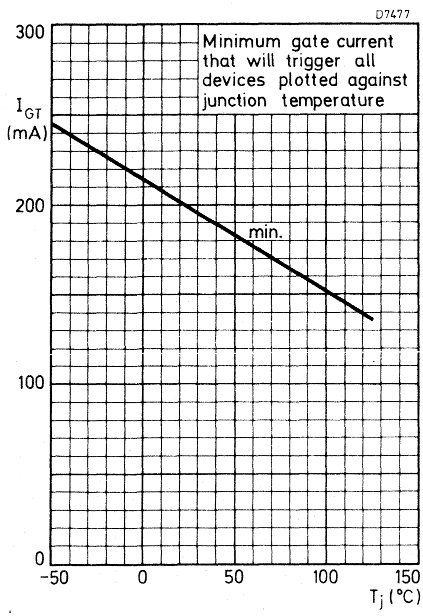


Fig. 8.

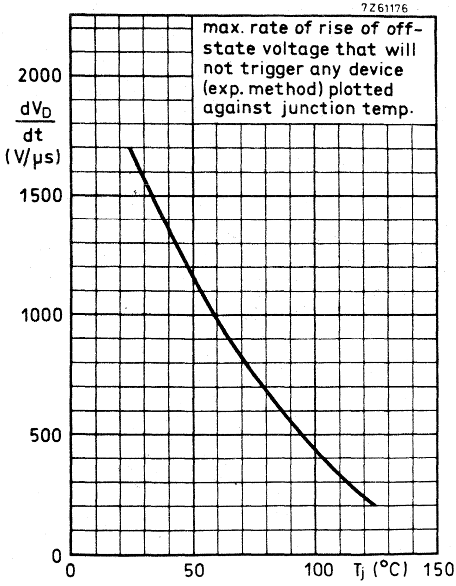


Fig. 9.

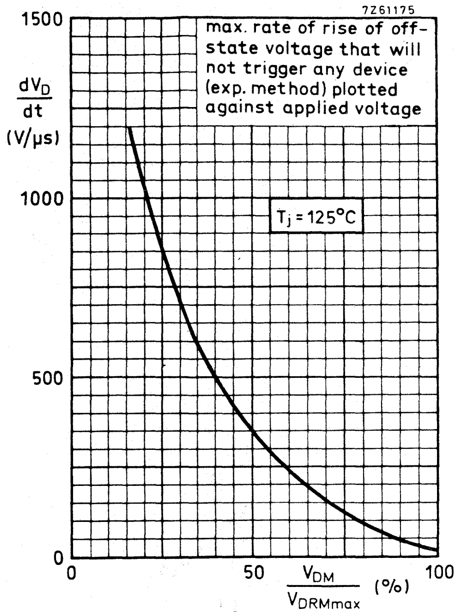


Fig. 10.

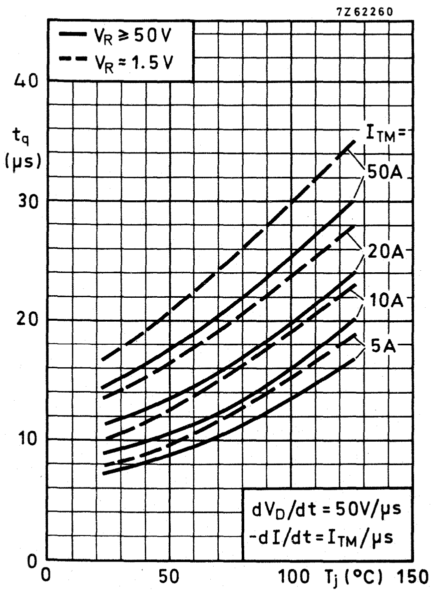


Fig. 11.

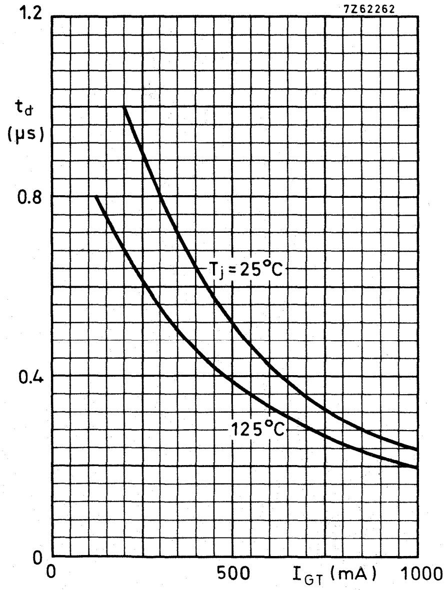


Fig. 12.

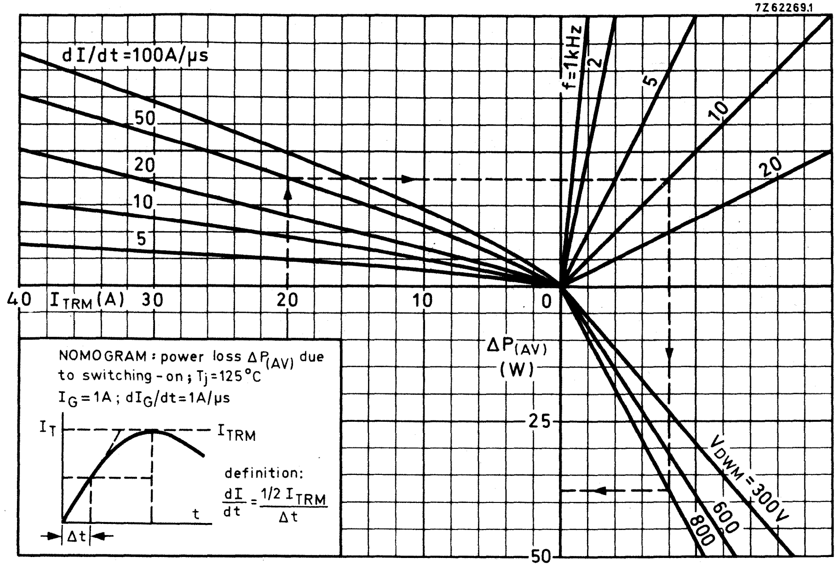

7Z62269.1
dI/dt = 100A/μs
50
20
10
5
f=1kHz
2
5
10
20
40 I_TRM (A) 30
20
10
0
ΔP(AV)
(W)
25
50
VDWM = 300V
600
800
NOMOGRAM: power loss ΔP(AV) due to switching-on; Tj = 125°C
IG = 1A; dIG/dt = 1A/μs
IT
ITRM
t
Δt
definition:
dI/dt = 1/2 ITRM / Δt

Fig. 13.

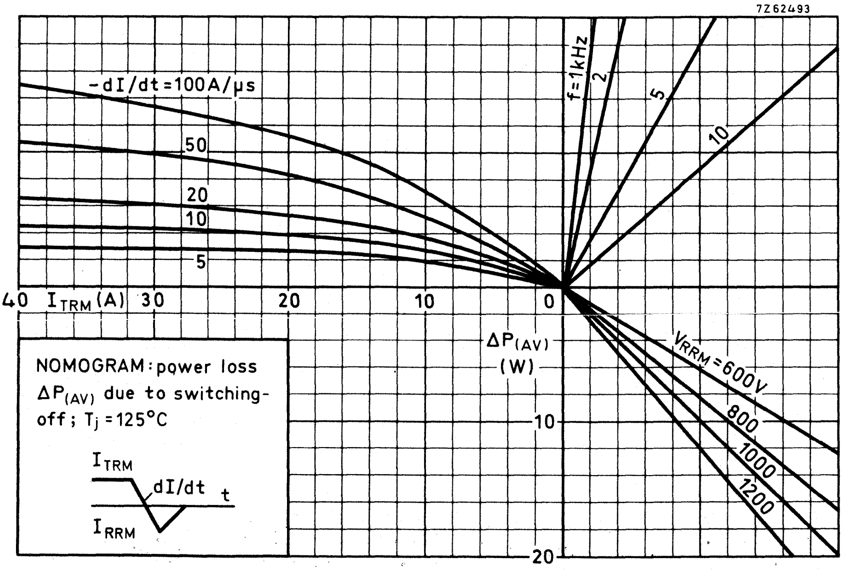

7Z62493
-dI/dt = 100A/μs
50
20
10
5
f=1kHz
2
5
10
40 ITRM (A) 30
20
10
0
ΔP(AV)
(W)
10
20
VRRM = 600V
800
1000
1200
NOMOGRAM: power loss ΔP(AV) due to switching-off; Tj = 125°C
ITRM
dI/dt
t
IRRM

Fig. 14.

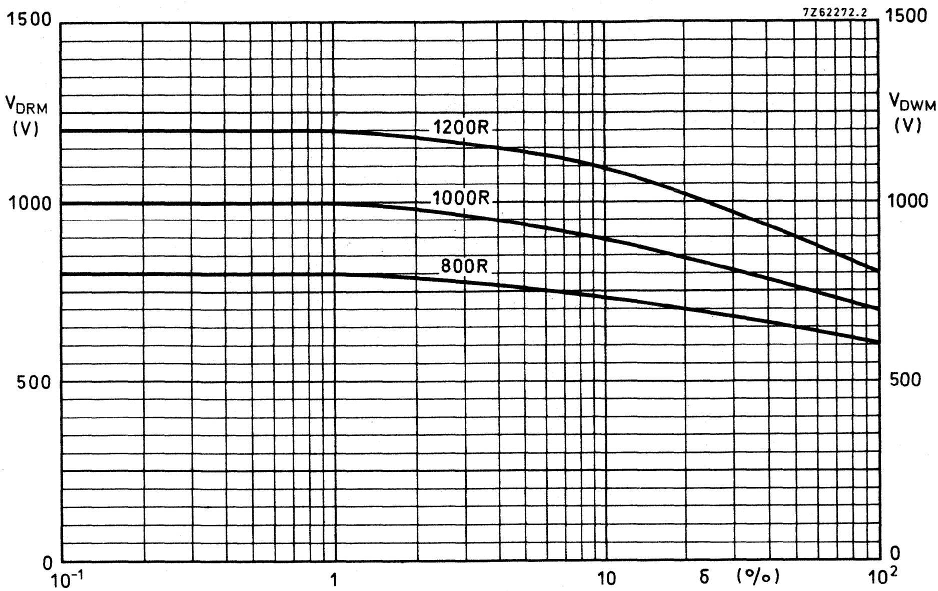

7Z62272.2
1500
V_DRM
(V)
1000
500
0
1200R
1000R
800R
1500
V_DWM
(V)
1000
500
0
10^-1
1
10
δ (%)
10^2

Fig. 15.

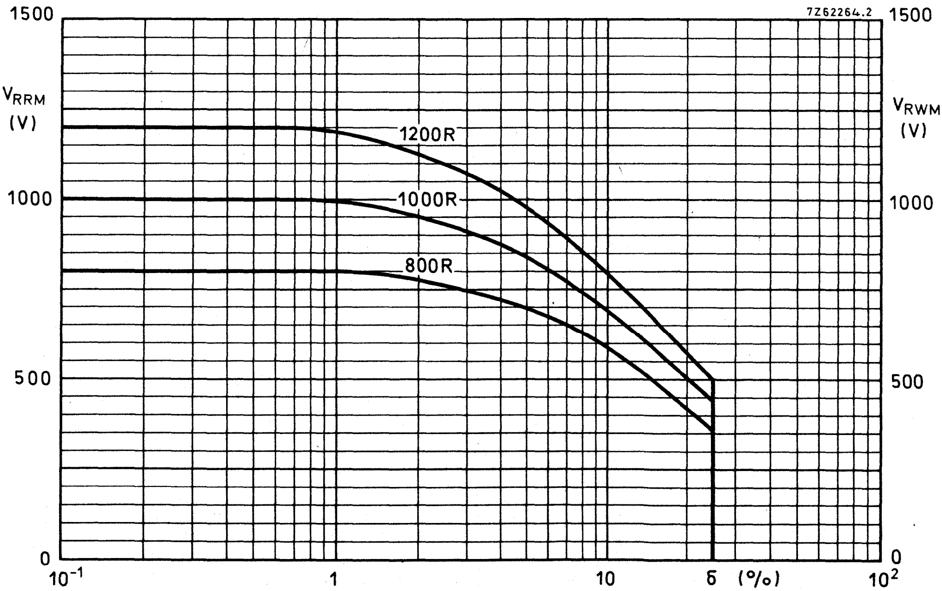

7Z62264.2
1500
V_RRM
(V)
1000
500
0
1200R
1000R
800R
1500
V_RWM
(V)
1000
500
0
10^-1
1
10
δ (%)
10^2

Fig. 16.

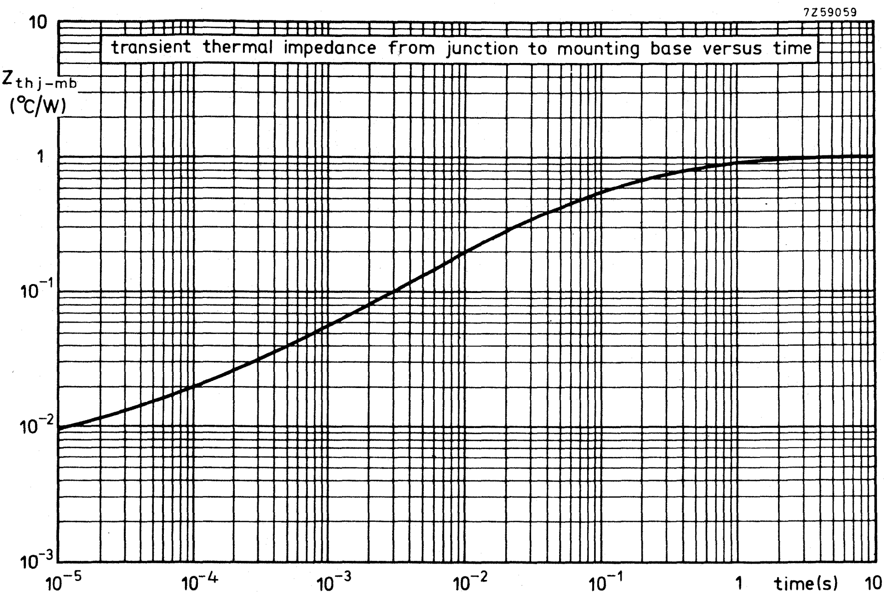

7Z59059
transient thermal impedance from junction to mounting base versus time
$Z_{th\,j-mb}$ (°C/W)
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time(s)
10

Fig. 17.

FAST TURN-OFF THYRISTORS

A range of fast turn-off thyristors in metal envelopes, intended for use in inverter applications.
The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTW33-800R to 1200R.

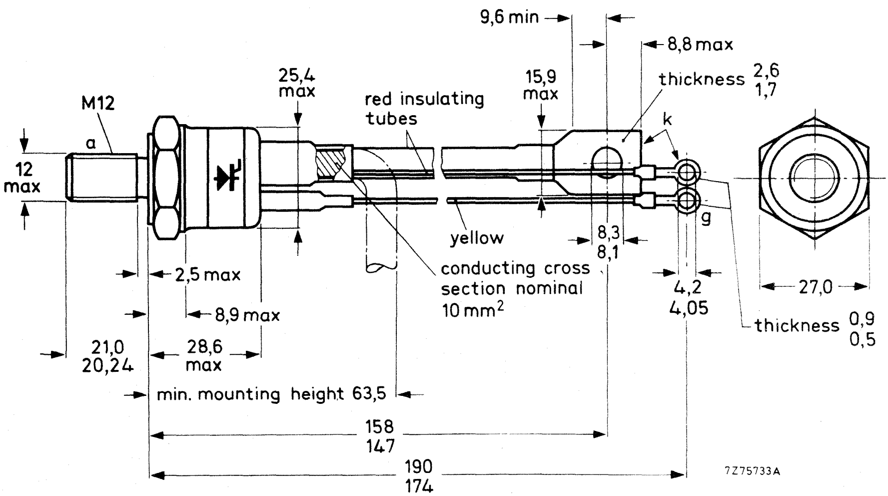
QUICK REFERENCE DATA

			BTW33-800R	1000R	1200R	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	800	1000	1200	V
Average on-state current	$I_{T(AV)}$	max.			80	A
R.M.S. on-state current	$I_{T(RMS)}$	max.			110	A
Non-repetitive peak on-state current	I_{TSM}	max.			1500	A
Circuit-commutated turn-off time	t_q	<			25	μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-94; with metric M12 stud (ϕ 12 mm)



Net mass: 108 g
Diameter of clearance hole: max. 13,0 mm
Torque on nut: min. 9 Nm (90 kg cm)
max. 17,5 Nm (175 kg cm)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats;
M12: 19 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTW33-800R	1000R	1200R	
Non-repetitive peak voltages ($t \leqslant 10$ ms)	V_{DSM}**/V_{RSM}	max.	800	1000	1200	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	800	1000	1200	V▲
Crest working off-state voltage square-wave; $\delta = 0{,}5$	V_{DWM}	max.	600	800	1000	V *

Average on-state current assuming zero switching losses (averaged over any 20 ms period)				
square-wave; $\delta = 0{,}5$; up to $T_{mb} = 70$ °C	$I_{T(AV)}$	max.	80	A
square-wave; $\delta = 0{,}5$; at $T_{mb} = 85$ °C	$I_{T(AV)}$	max.	65	A
sinusoidal; at $T_{mb} = 85$ °C	$I_{T(AV)}$	max.	60	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	110	A
Repetitive peak on-state current	I_{TRM}	max.	750	A
Non-repetitive peak on-state current $T_j = 125$ °C prior to surge				
t = 10 ms; half sine-wave (see Fig. 8)	I_{TSM}	max.	1500	A
t = 5 ms; square pulse (see Fig. 7)	I_{TSM}	max.	1500	A
I^2t for fusing (t = 10 ms)	I^2t	max.	11 250	A^2s
Rate of rise of on-state current after triggering with $I_G = 750$ mA to $I_T = 200$ A; $dI_G/dt = 1$ A/μs	dI_T/dt	max.	100	A/μs

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	10	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	2	W
Peak power dissipation	P_{GM}	max.	10	W
	T_{stg}		−55 to + 125	°C

Temperatures

Storage temperature	T_{stg}		−55 to + 125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0,3	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,1	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,015	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a} < 0{,}75$ °C/W (d.c. blocking) or $< 1{,}5$ °C/W (square-wave; $\delta = 0{,}5$). For smaller heatsinks $T_{j\ max}$ should be derated. For square-wave see Fig. 6.

** Although not recommended, higher off-state voltages may be applied without damage, but the thyristor may switch into the on-state. The rate of rise of on-state current should not exceed 20 A/μs.

▲ Thermal stability at higher voltage ratings is dependent on duty factor. See Figs 19 and 20.

CHARACTERISTICS

Anode to cathode

On-state voltage I_T = 200 A; T_j = 25 °C	V_T	<	3 V *
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 V_{DRMmax}; T_j = 125 °C	dV_D/dt	<	200 V/μs
Off-state current V_D = V_{DWMmax}; T_j = 125 °C	I_D	<	25 mA
Holding current; T_j = 25 °C	I_H	<	200 mA
Latching current; T_j = 25 °C	I_L	<	400 mA

Gate to cathode

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	V_{GT}	>	2,5 V
Voltage that will not trigger any device V_D = V_{DRMmax}; T_j = 125 °C	V_{GD}	<	0,2 V
Current that will trigger all devices V_D = 6 V; T_j = 25 °C	I_{GT}	>	150 mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from V_D = V_{DWMmax} to I_T = 200 A; I_{GT} = 200 mA; dI_G/dt = 1 A/μs; T_j = 25 °C	t_d	<	2 μs
	t_r	<	2 μs

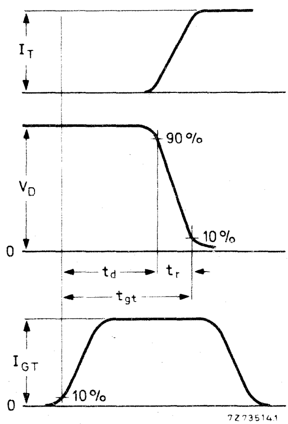


Fig. 2 Gate-controlled turn-on time definitions.

* Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Circuit-commutated turn-off time when switched from I_T = 50 A to $V_R \geqslant$ 50 V with $-dI_T/dt$ = 50 A/μs; dV_D/dt = 25 V/μs; T_j = 125 °C — t_q < 25 μs

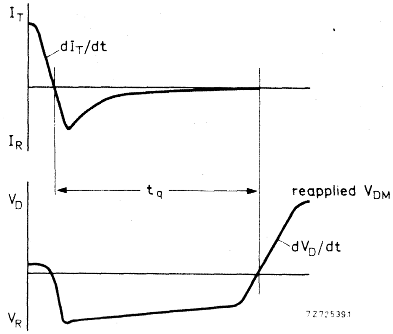


Fig. 3 Circuit-commutated turn-off time definitions.

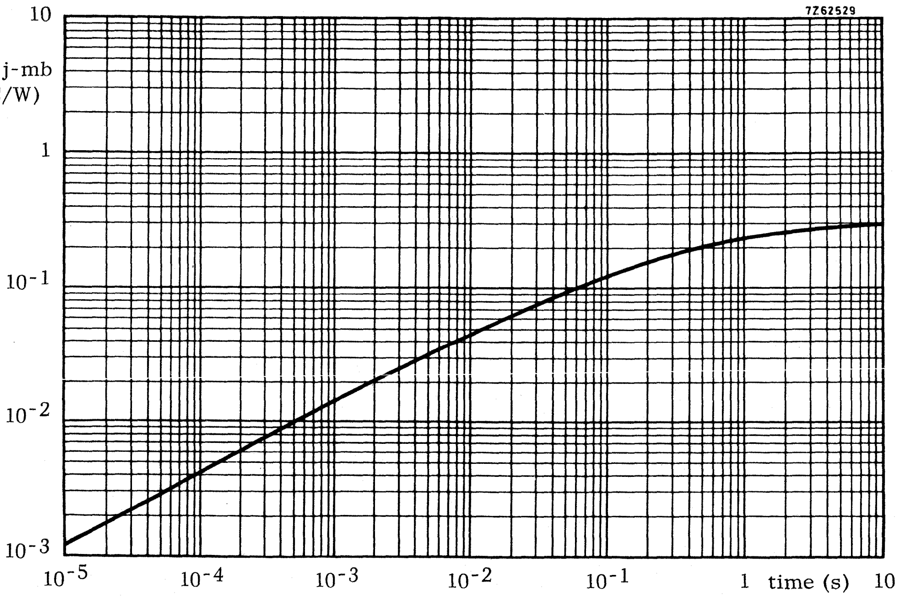


Fig. 4.

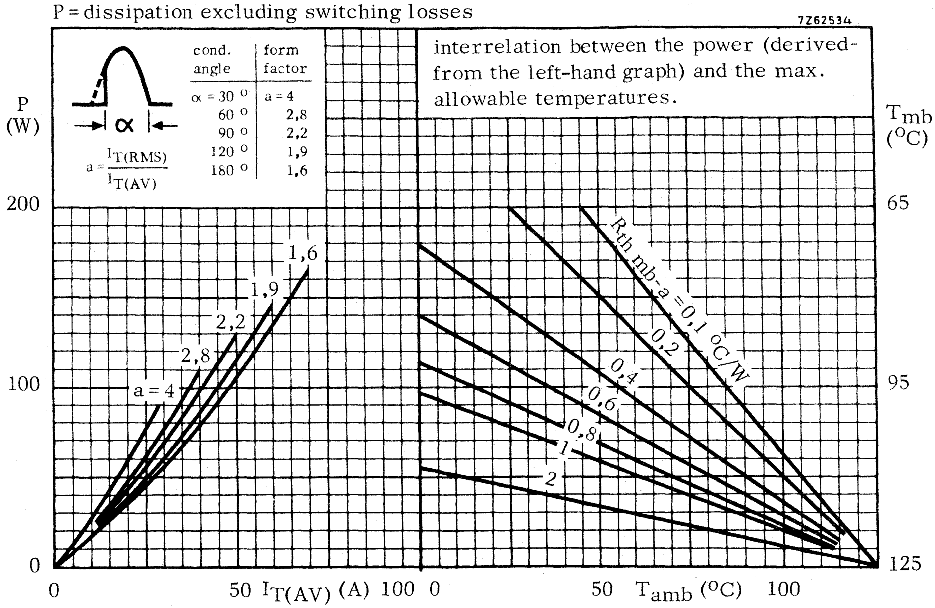
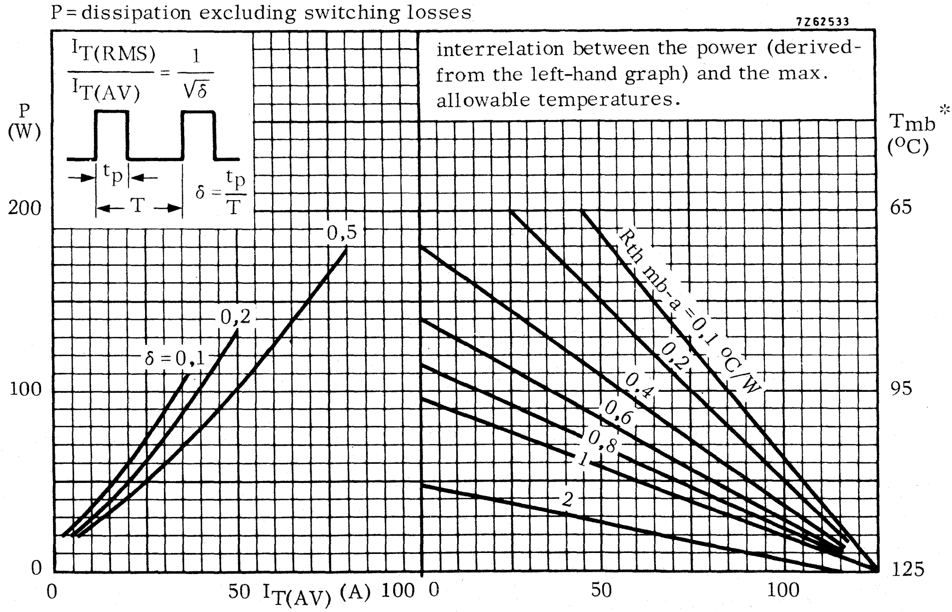


Fig. 5.



* T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb\text{-}a} \leq 1,0$ °C/W.

Fig. 6.

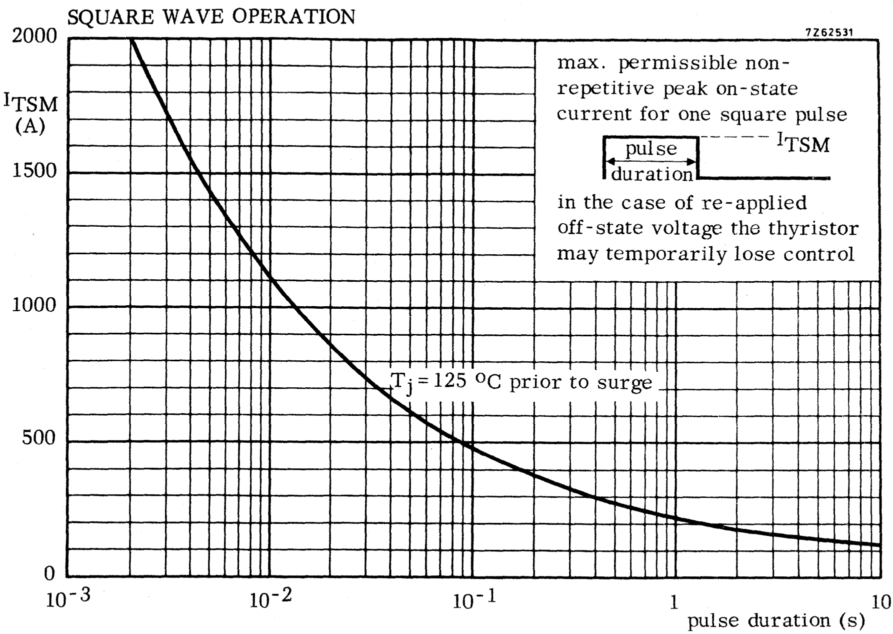

SQUARE WAVE OPERATION
7Z62531
2000
1500
1000
500
0
I_{TSM}
(A)
max. permissible non-repetitive peak on-state current for one square pulse
pulse
duration
I_{TSM}
in the case of re-applied off-state voltage the thyristor may temporarily lose control
$T_j = 125\ ^oC$ prior to surge
10^{-3}
10^{-2}
10^{-1}
1
10
pulse duration (s)

Fig. 7.

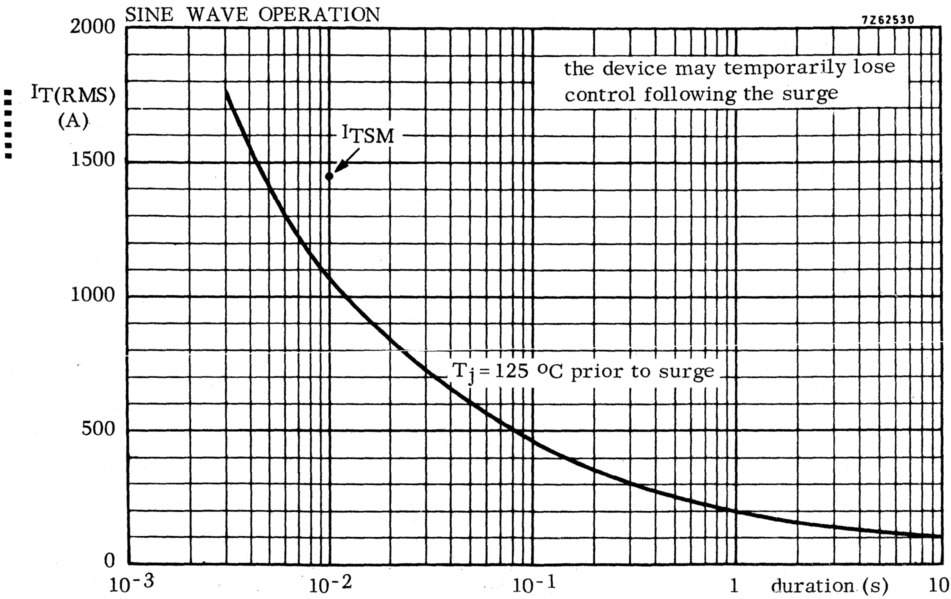

SINE WAVE OPERATION
7Z62530
2000
1500
1000
500
0
$I_{T(RMS)}$
(A)
the device may temporarily lose control following the surge
I_{TSM}
$T_j = 125\ ^oC$ prior to surge
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10

Fig. 8.

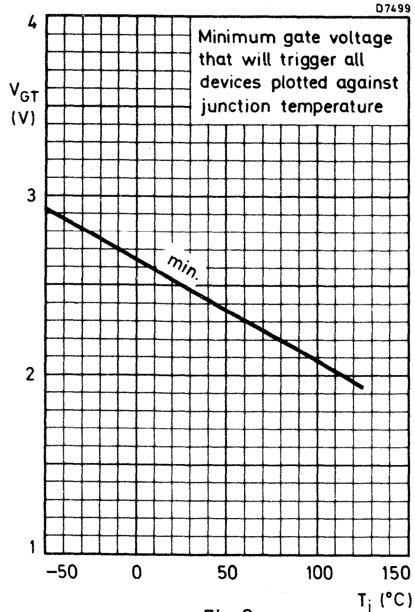


Fig. 9.

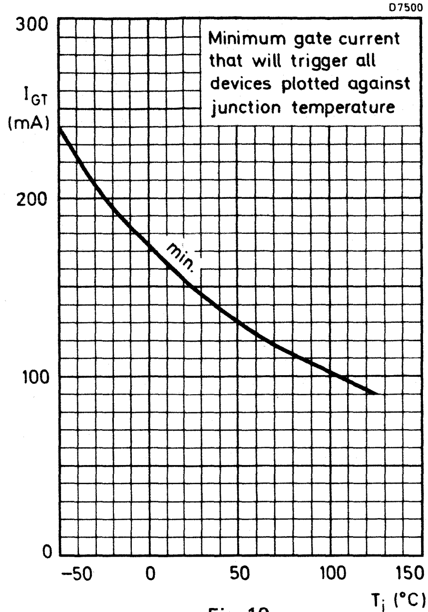


Fig. 10.

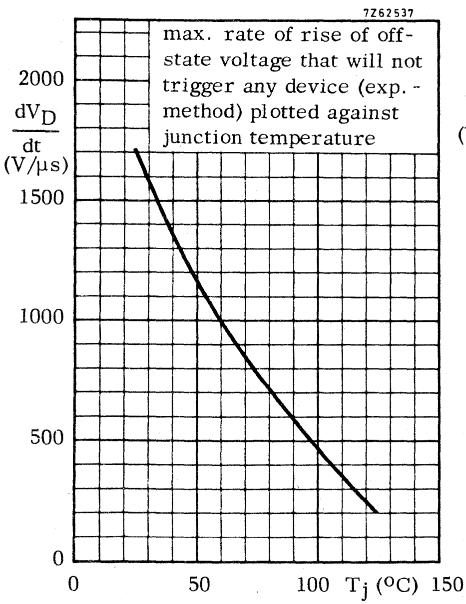


Fig. 11.

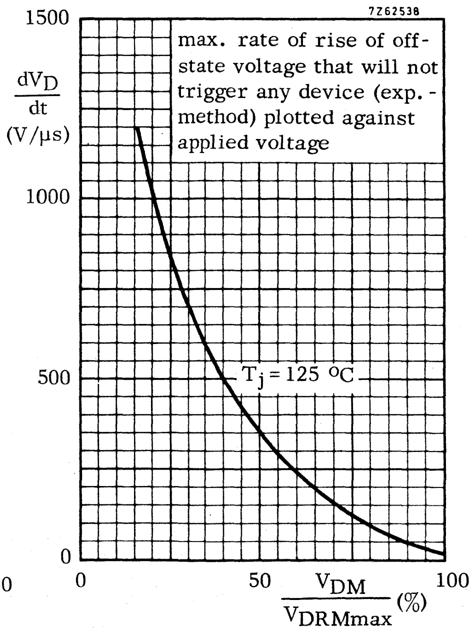


Fig. 12.

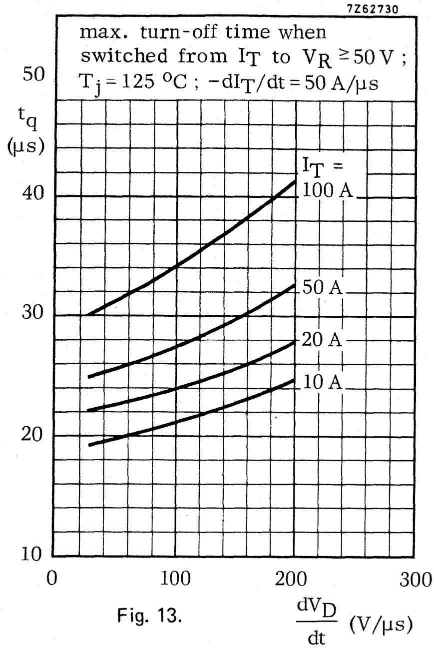


Fig. 13.

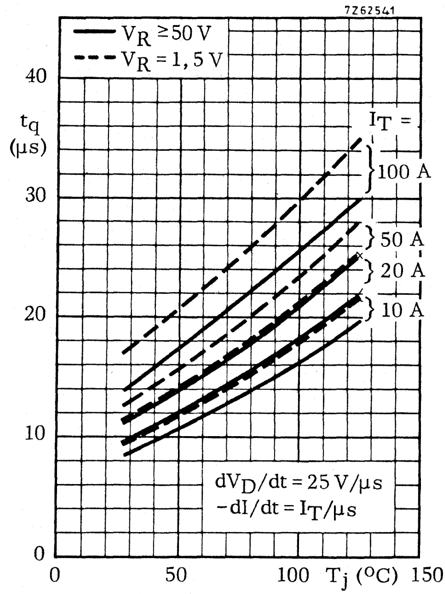


Fig. 14.

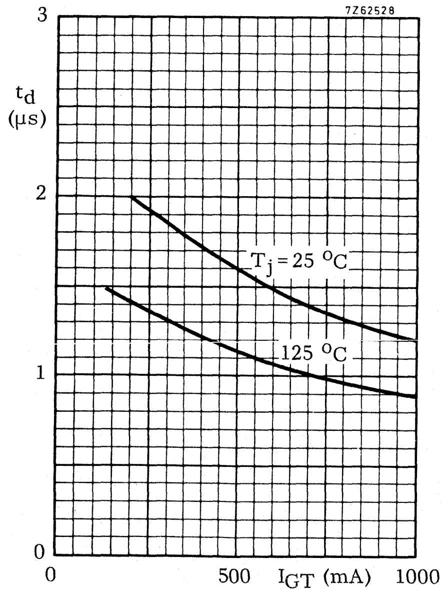


Fig. 15.

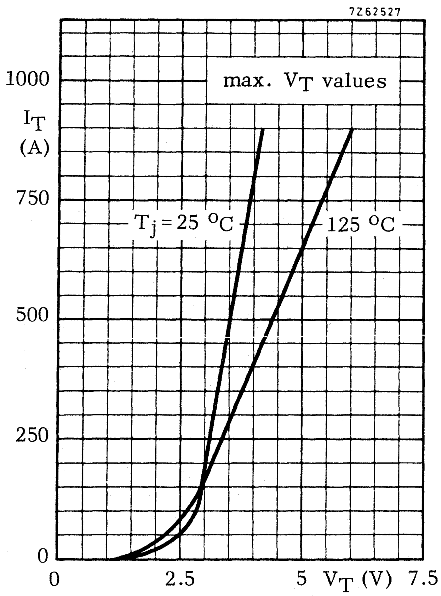


Fig. 16.

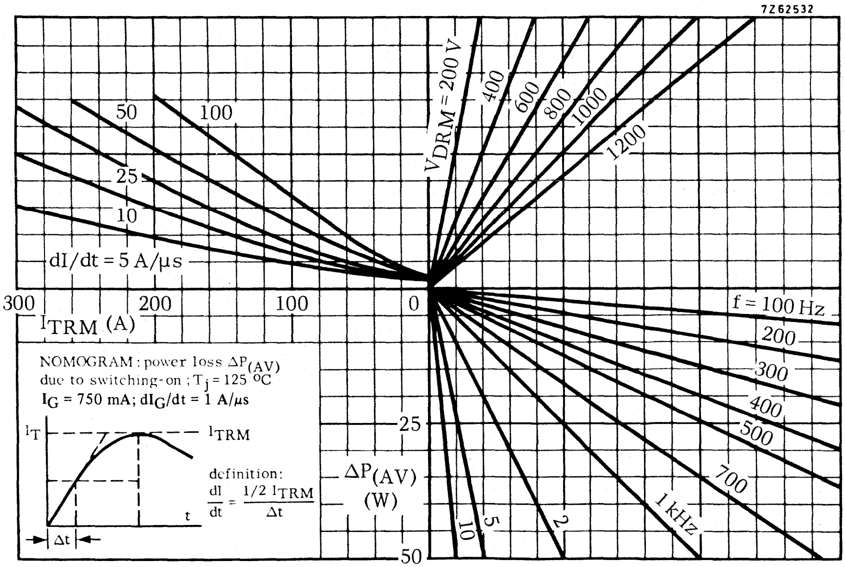

7Z62532
V_{DRM} = 200 V
400
600
800
1000
1200
50
100
25
10
dI/dt = 5 A/µs
300
200
100
0
I_{TRM} (A)
f = 100 Hz
200
300
400
500
700
1 kHz
2
5
10
NOMOGRAM : power loss $\Delta P_{(AV)}$
due to switching-on ; T_j = 125 °C
I_G = 750 mA; dI_G/dt = 1 A/µs
I_T
I_{TRM}
t
Δt
definition:
$\frac{dI}{dt} = \frac{1/2\ I_{TRM}}{\Delta t}$
25
$\Delta P_{(AV)}$
(W)
50

Fig. 17.

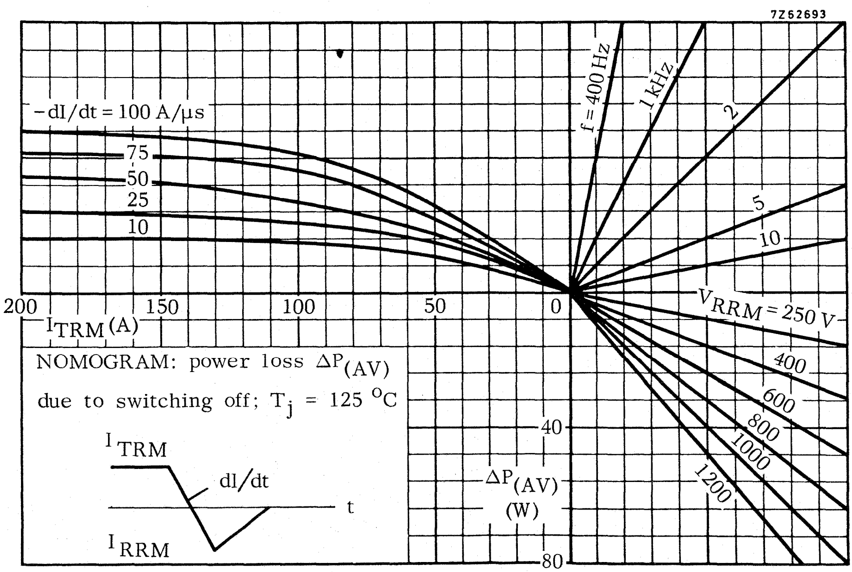

7Z62693
f = 400 Hz
1 kHz
2
5
10
−dI/dt = 100 A/µs
75
50
25
10
200
150
100
50
0
I_{TRM} (A)
V_{RRM} = 250 V
400
600
800
1000
1200
NOMOGRAM: power loss $\Delta P_{(AV)}$
due to switching off; T_j = 125 °C
I_{TRM}
dI/dt
t
I_{RRM}
40
$\Delta P_{(AV)}$
(W)
80

Fig. 18.

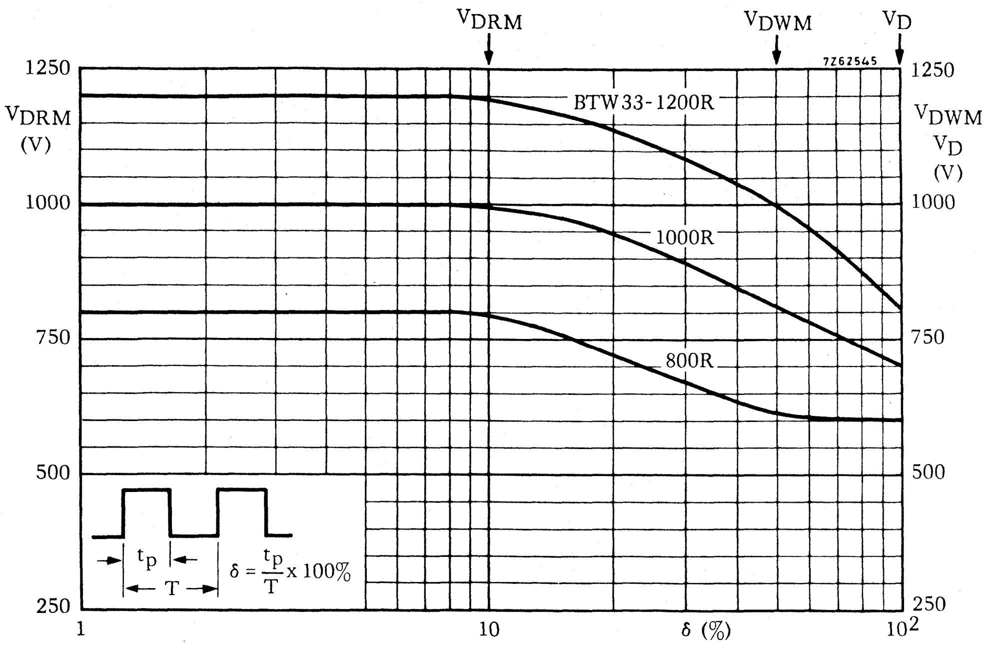

VDRM
VDWM
VD
7Z62545
1250
1000
750
500
250
VDRM (V)
VDWM VD (V)
BTW33-1200R
1000R
800R
tp
T
δ = tp/T x 100%
1
10
δ (%)
10²

Fig. 19.

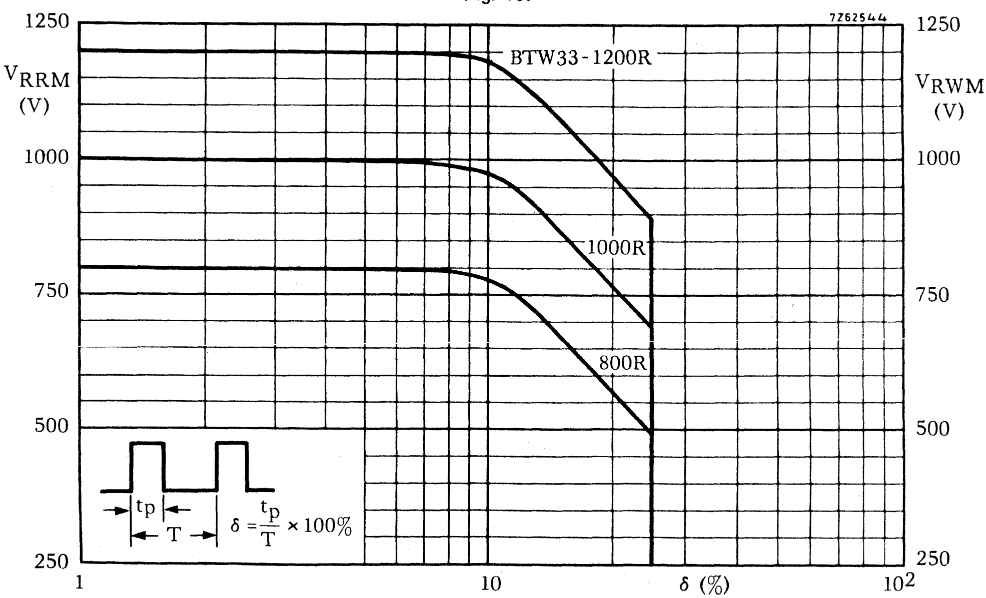

7Z62544
1250
1000
750
500
250
VRRM (V)
VRWM (V)
BTW33-1200R
1000R
800R
tp
T
δ = tp/T × 100%
1
10
δ (%)
10²

Fig. 20.

THYRISTORS

Also available to BS9341-F082

Silicon thyristors in metal envelopes, intended for use in power control circuits (e.g. light and motor control) and power switching systems.
The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTW38-600R to 1200R.

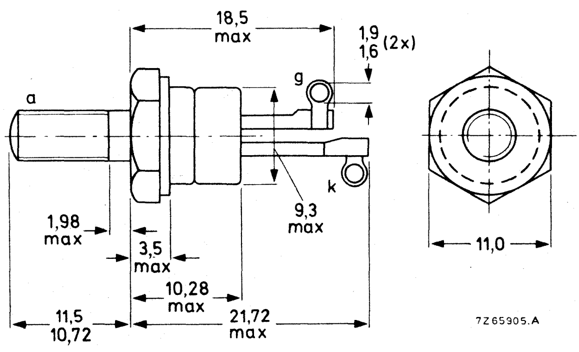
QUICK REFERENCE DATA

			BTW38-600R	800R	1000R	1200R	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	600	800	1000	1200	V
Average on-state current	$I_{T(AV)}$	max.				10	A
R.M.S. on-state current	$I_{T(RMS)}$	max.				16	A
Non-repetitive peak on-state current	I_{TSM}	max.				150	A

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-64: with metric M5 stud (ϕ 5 mm); e.g. BTW38-600R.
Types with 10-32UNF stud (ϕ 4,83 mm) are available on request. These are indicated by the suffix U: e.g. BTW38-600RU.



Net mass: 7 g
Diameter of clearance hole: max. 5,2 mm
Accessories supplied on request:
- 56295 (PTFE bush, 2 mica washers, plain washer, tag)
- 56262A (mica washer, insulating ring, plain washer)

Torque on nut: min. 0,9 Nm (9 kg cm)
max. 1,7 Nm (17 kg cm)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions: across the flats; M5: 8,0 mm
10-32UNF: 9,5 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTW38-600R	800R	1000R	1200R	
Non-repetitive peak voltages (t ⩽ 10 ms)	V_{DSM}/V_{RSM}	max.	600	800	1000	1200	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	600	800	1000	1200	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	400	600	700	800	V *

Average on-state current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{T(AV)}$	max.	10	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	16	A
Repetitive peak on-state current	I_{TRM}	max.	75	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 125 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.	150	A
I^2t for fusing (t = 10 ms)	I^2t	max.	112	A^2s
Rate of rise of on-state current after triggering with I_G = 250 mA to I_T = 25 A; dI_G/dt = 0,25 A/µs	dI_T/dt	max.	50	A/µs

Gate to cathode

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0,5	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−55 to +125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,8	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	45	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,1	°C/W

OPERATING NOTE

The terminals should neither be bent nor twisted; they should be soldered into the circuit so that there is no strain on them.
During soldering the heat conduction to the junction should be kept to a minimum.

* To ensure thermal stability: $R_{th\ j\text{-}a} < 4$ °C/W (d.c. blocking) or < 8 °C/W (a.c.). For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see Fig. 3.

CHARACTERISTICS

Anode to cathode

On-state voltage I_T = 20 A; T_j = 25 °C	V_T	<	2	V *
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 V_{DRMmax}; T_j = 125 °C	dV_D/dt	<	50	V/μs
Reverse current V_R = V_{RWMmax}; T_j = 125 °C	I_R	<	3	mA
Off-state current V_D = V_{DWMmax}; T_j = 125 °C	I_D	<	3	mA
Latching current; T_j = 25 °C	I_L	<	150	mA
Holding current; T_j = 25 °C	I_H	<	75	mA

Gate to cathode

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	V_{GT}	>	1,5	V
Voltage that will not trigger any device V_D = V_{DRMmax}; T_j = 125 °C	V_{GD}	<	200	mV
Current that will trigger all devices V_D = 6 V; T_j = 25 °C	I_{GT}	>	50	mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from V_D = 800 V to I_T = 25 A; I_{GT} = 250 mA; dI_G/dt = 0,25 A/μs; T_j = 25 °C	t_{gt}	<	1,5	μs
	t_r	typ.	0,2	μs

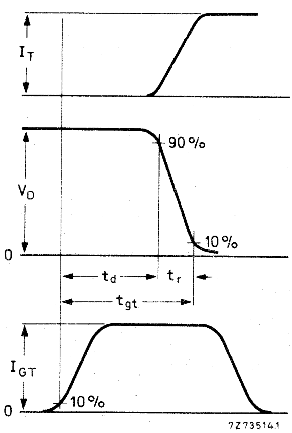


Fig. 2 Gate-controlled turn-on time definitions.

* Measured under pulse conditions to avoid excessive dissipation.

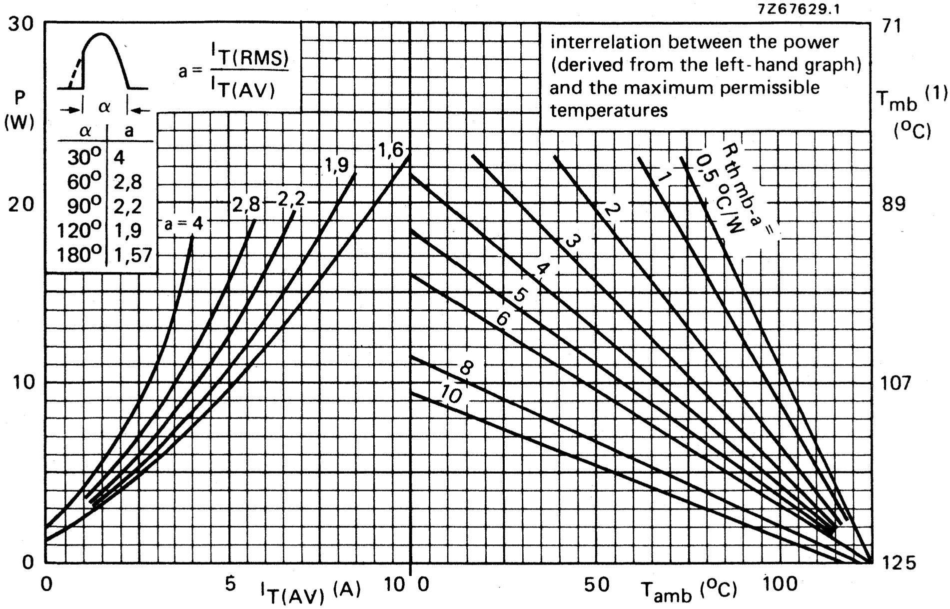


Fig. 3 (1) T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\,mb\text{-}a} \leqslant 6$ °C/W.

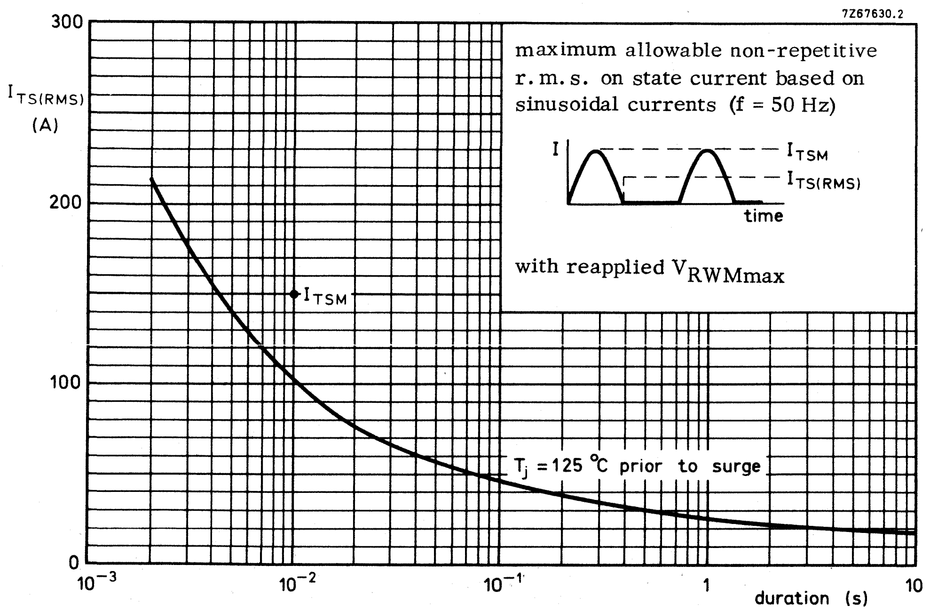


Fig. 4.

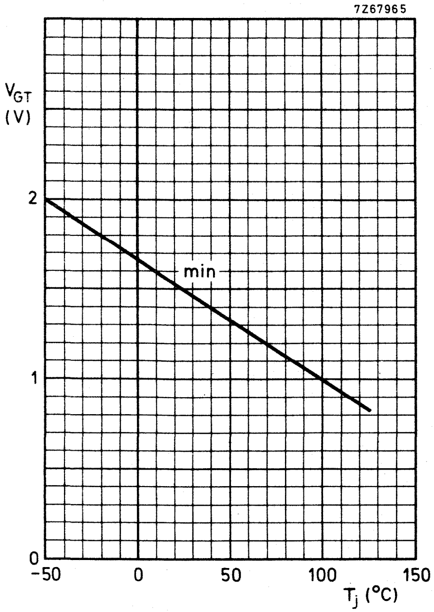


Fig. 5 Minimum gate voltage that will trigger all devices as a function of T_j.

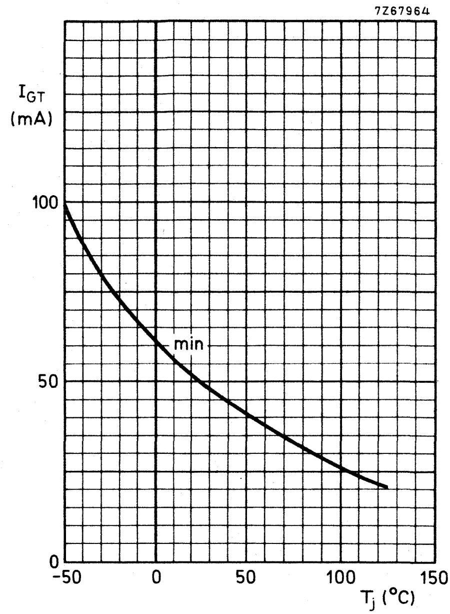


Fig. 6 Minimum gate current that will trigger all devices as a function of T_j.

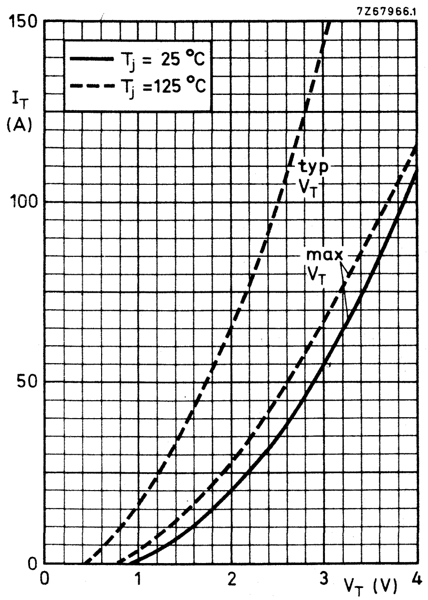


Fig. 7.

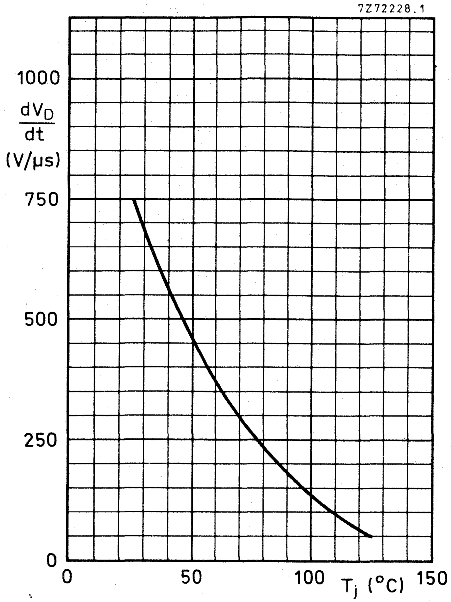


Fig. 8 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of T_j.

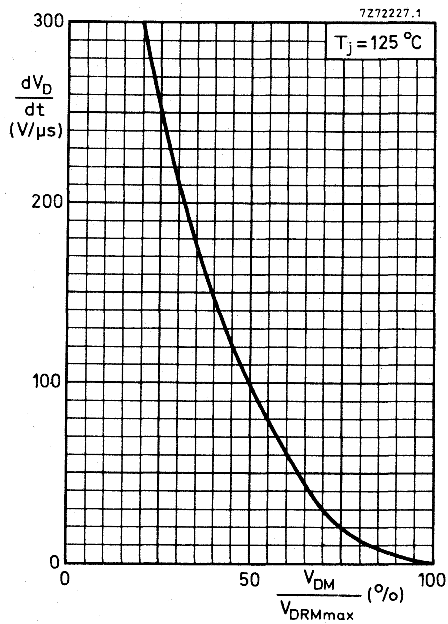
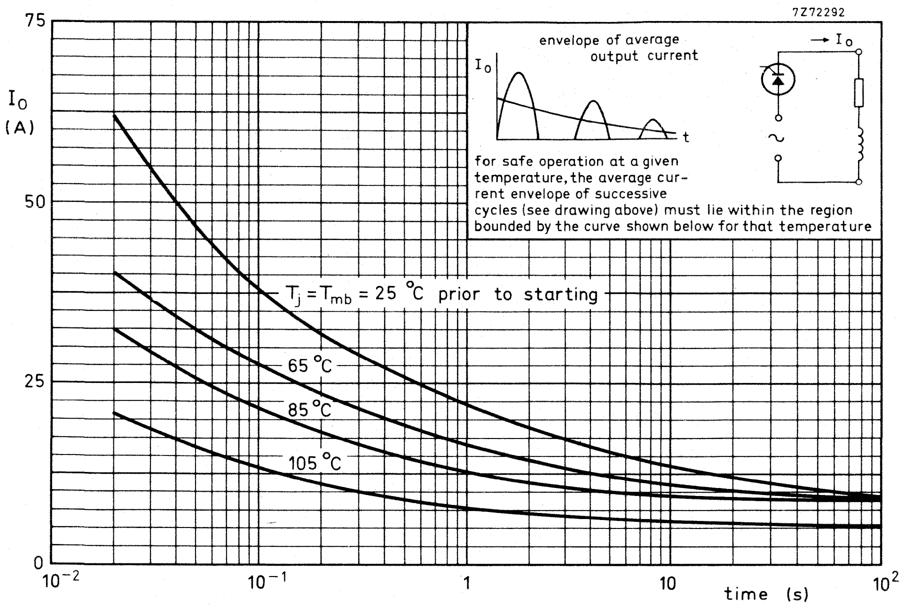


Fig. 9 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of applied voltage.



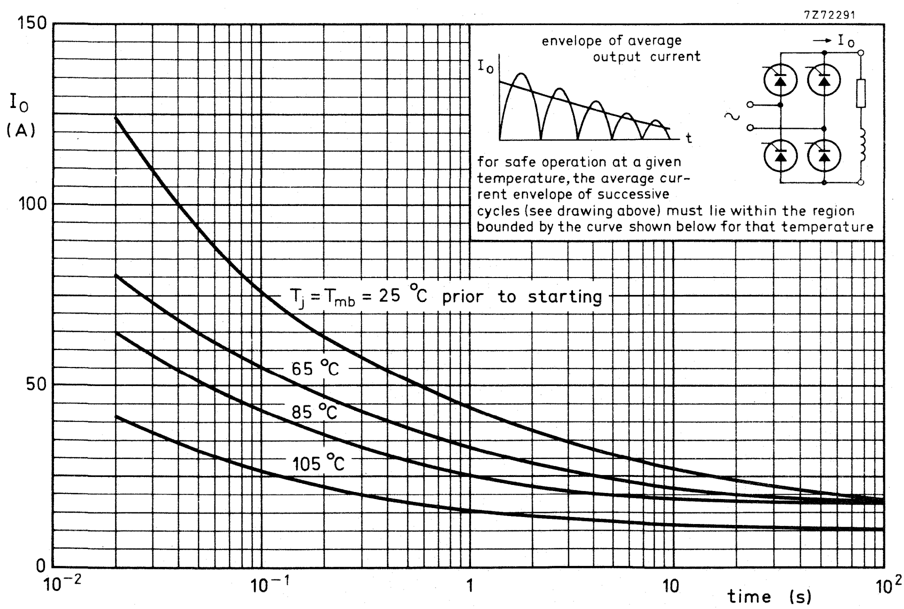


Fig. 10 Limits for starting or inrush currents.

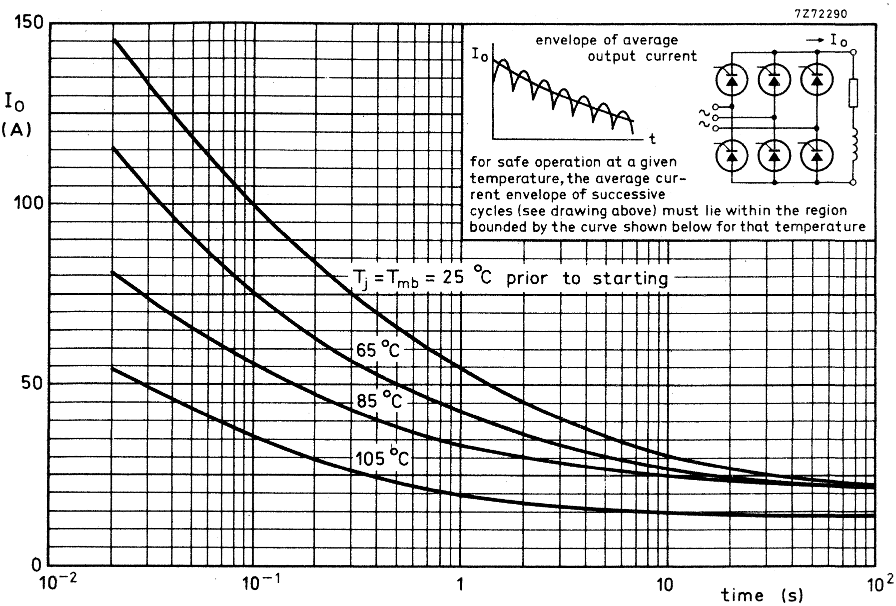


Fig. 11 Limits for starting or inrush currents.

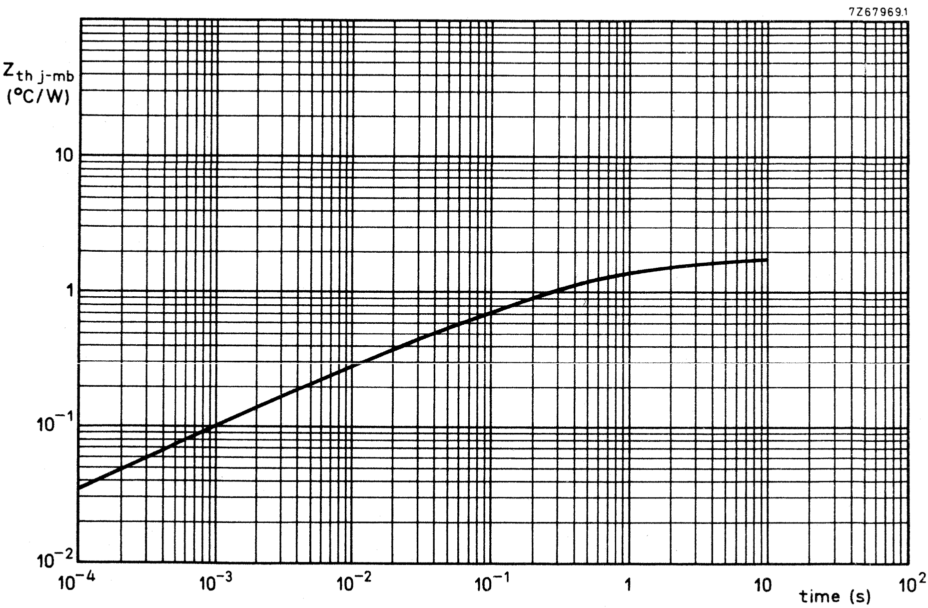


Fig. 12.

THYRISTORS

Also available to BS9341-F083

Silicon thyristors in metal envelopes, intended for use in power control applications in general, and lighting control (in a.c. controller circuit) up to 2,5 kW in particular. A feature of the thyristors is their high surge rating.
The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTW40-400R to 800R.

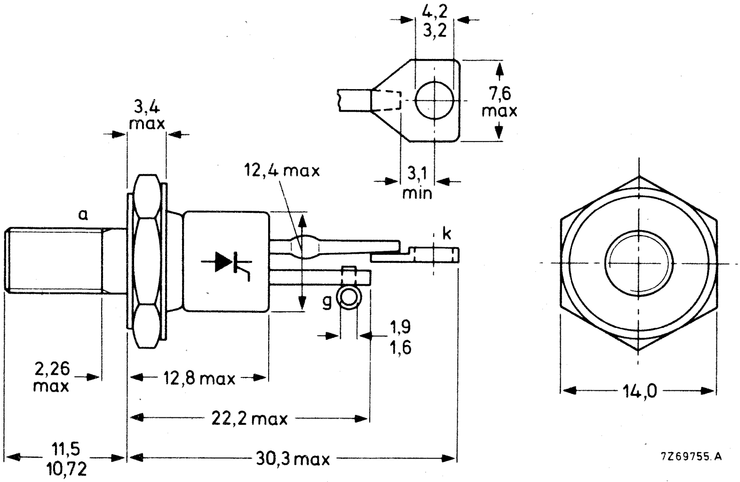
QUICK REFERENCE DATA

			BTW40-400R	600R	800R	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	400	600	800	V
Average on-state current	$I_{T(AV)}$	max.			20	A
R.M.S. on-state current	$I_{T(RMS)}$	max.			32	A
Non-repetitive peak on-state current	I_{TSM}	max.			400	A

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-48: with metric M6 stud (ϕ 6 mm); e.g. BTW40-400R.
Types with ¼ in x 28 UNF stud (ϕ 6,35 mm) are available on request. These are indicated by the suffix U: e.g. BTW40-400RU.



Net mass: 14 g
Diameter of clearance hole: max. 6,5 mm
Accessories supplied on request: 56264A
(mica washer, insulating ring, soldering tag)

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)
Supplied with the device:
1 nut, 1 lock washer
Nut dimensions across the flats;
M6: 10 mm
¼ in x 28 UNF: 11,1 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTW40-400R	600R	800R	
Non-repetitive peak voltages ($t \leqslant 10$ ms)	V_{DSM}/V_{RSM}	max.	400	600	800	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	400	600	800	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	300	400	600	V *

Average on-state current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{T(AV)}$	max.	20	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	32	A
Repetitive peak on-state current	I_{TRM}	max.	200	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 125 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.	400	A
I^2t for fusing (t = 10 ms)	I^2t	max.	800	A^2s
Rate of rise of on-state current after triggering with I_G = 400 mA to I_T = 60 A; dI_G/dt = 0,4 A/µs	dI_T/dt	max.	100	A/µs

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	10	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	1	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−55 to + 125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,1	°C/W

OPERATING NOTE

The terminals should neither be bent not twisted; they should be soldered into the circuit so that there is no strain on them.
During soldering the heat conduction to the junction should be kept to a minimum.

* To ensure thermal stability: $R_{th\ j\text{-}a} < 6,5$ °C/W (d.c. blocking) or < 13 °C/W (a.c.). For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see Fig. 3.

CHARACTERISTICS

Anode to cathode

On-state voltage I_T = 50 A; T_j = 25 °C	V_T	<	2,1 V *
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 V_{DRMmax}; T_j = 125 °C	dV_D/dt	<	100 V/μs
Reverse current $V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	3 mA
Off-state current $V_D = V_{DWMmax}$; T_j = 125 °C	I_D	<	3 mA
Latching current; T_j = 25 °C	I_L	<	150 mA
Holding current; T_j = 25 °C	I_H	<	75 mA

Gate to cathode

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	V_{GT}	>	1,5 V
Voltage that will not trigger any device $V_D = V_{DRMmax}$; T_j = 125 °C	V_{GD}	<	200 mV
Current that will trigger all devices V_D = 6 V; T_j = 25 °C	I_{GT}	>	75 mA

* Measured under pulse conditions to avoid excessive dissipation.

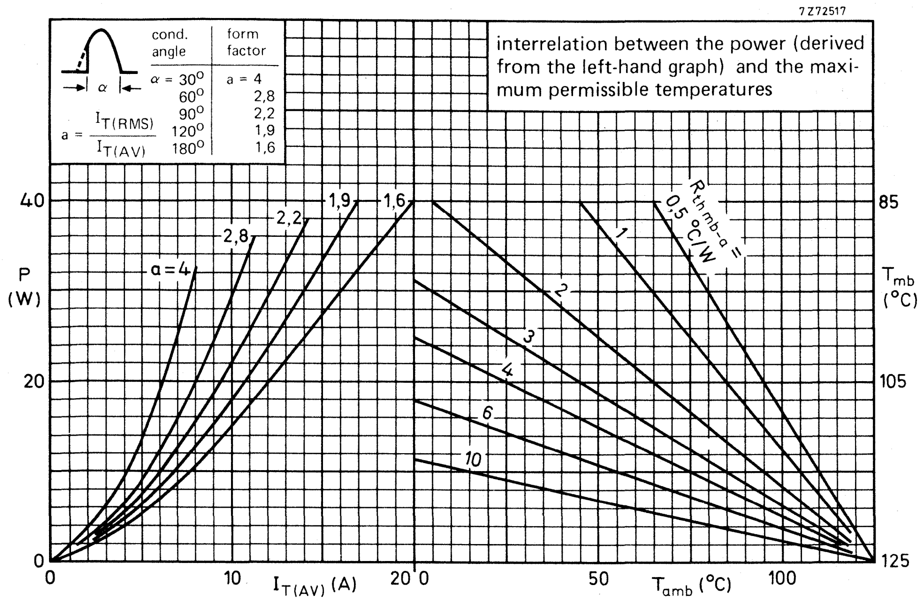

7Z72517
cond. angle
form factor
α = 30° a = 4
60° 2,8
90° 2,2
120° 1,9
180° 1,6
a = I_T(RMS) / I_T(AV)
interrelation between the power (derived from the left-hand graph) and the maximum permissible temperatures
P (W)
a=4
2,8
2,2
1,9
1,6
I_T(AV) (A)
T_amb (°C)
T_mb (°C)
R_th mb-a = 0,5 °C/W
1
2
3
4
6
10
85
105
125

Fig. 2.

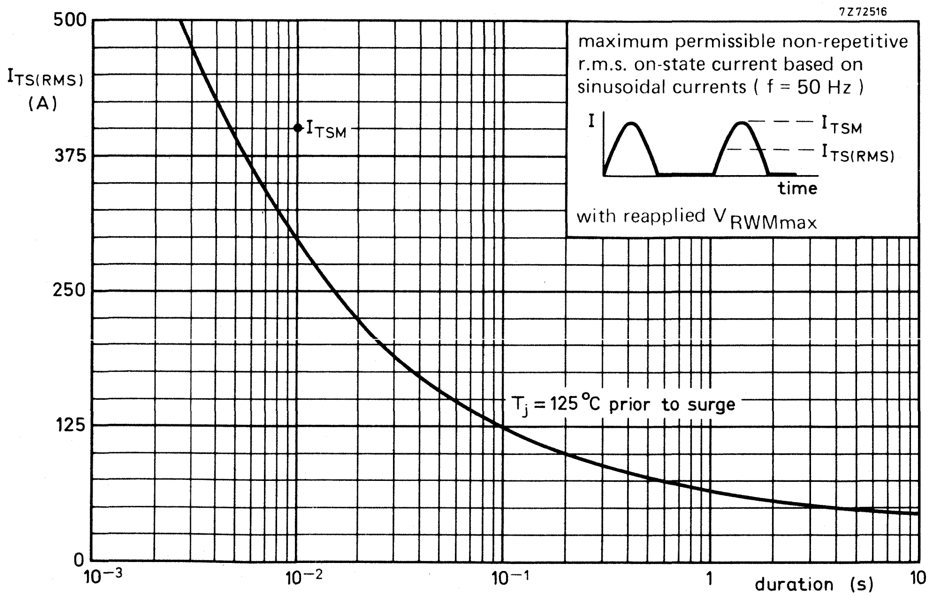

7Z72516
I_TS(RMS) (A)
maximum permissible non-repetitive r.m.s. on-state current based on sinusoidal currents (f = 50 Hz)
I_TSM
I_TS(RMS)
time
with reapplied V_RWMmax
T_j = 125 °C prior to surge
duration (s)

Fig. 3.

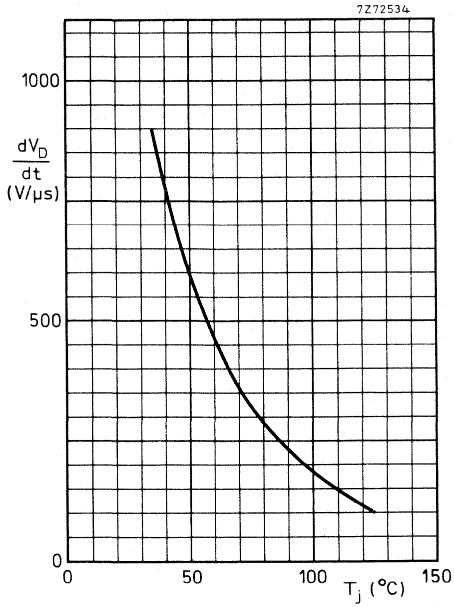


Fig. 4 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of T_j.

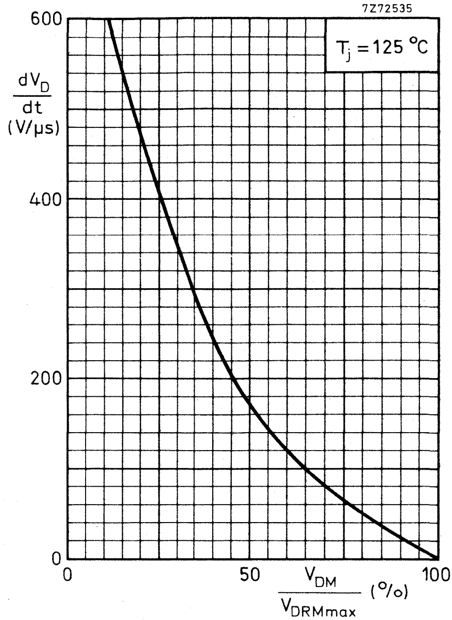


Fig. 5 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of applied voltage.

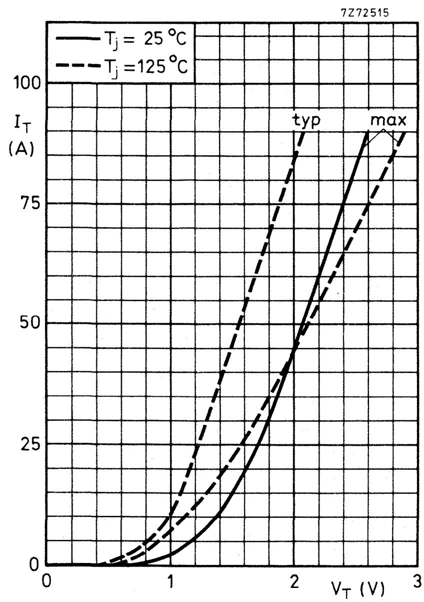


Fig. 6.

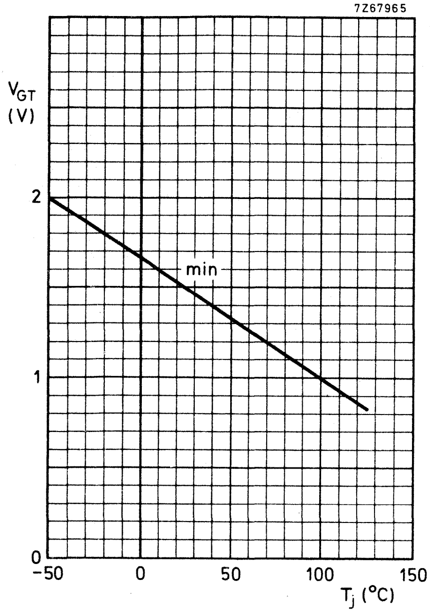


Fig. 7 Minimum gate voltage that will trigger all devices as a function of T_j.

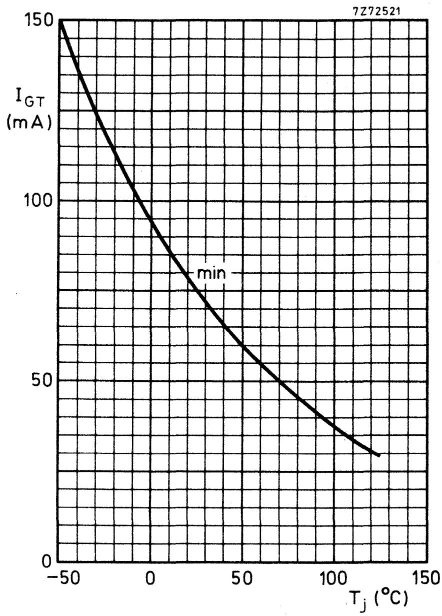


Fig. 8 Minimum gate current that will trigger all devices as a function of T_j.

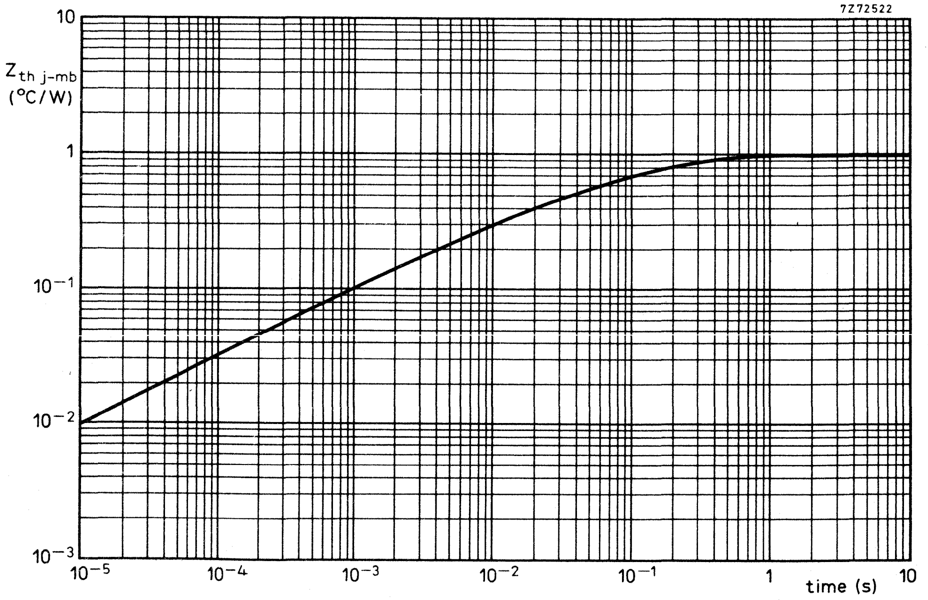


Fig. 9.

THYRISTORS

Also available to BS9341-F084

Silicon thyristors in metal envelopes with high dV_D/dt capabilities. They are intended for use in power control circuits and switching systems where high transients can occur (e.g. phase control in three-phase systems).

The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTW42-600R to 1200R.

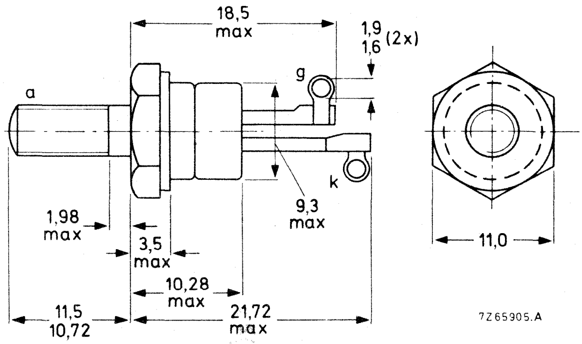
QUICK REFERENCE DATA

			BTW42-600R	800R	1000R	1200R	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	600	800	1000	1200	V
Average on-state current			$I_{T(AV)}$		max.	10	A
R.M.S. on-state current			$I_{T(RMS)}$		max.	16	A
Non-repetitive peak on-state current			I_{TSM}		max.	150	A
Rate of rise of off-state voltage that will not trigger any device			dV_D/dt		<	200	V/μs
On request (see ordering note on page 2)			dV_D/dt		<	1000	V/μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-64: with metric M5 stud (ϕ5 mm); e.g. BTW42-600R.
Types with 10-32UNF stud (ϕ4,83 mm) are available on request. These are indicated by the suffix U: e.g. BTW42-600RU.



Net mass: 7 g
Diameter of clearance hole: max. 5,2 mm
Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)
56262A (mica washer, insulating ring, plain washer)

Torque on nut: min. 0,9 Nm (9 kg cm)
max. 1,7 Nm (17 kg cm)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats; M5: 8,0 mm
10-32UNF: 9,5 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTW42-600R	800R	1000R	1200R	
Non-repetitive peak voltages ($t \leqslant 10$ ms)	V_{DSM}/V_{RSM}	max.	600	800	1000	1200	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	600	800	1000	1200	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	400	600	700	800	V *

Average on-state current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{T(AV)}$	max.	10	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	16	A
Repetitive peak on-state current	I_{TRM}	max.	75	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 125 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.	150	A
I^2t for fusing (t = 10 ms)	I^2t	max.	112	A^2s
Rate of rise of on-state current after triggering with I_G = 250 mA to I_T = 25 A; dI_G/dt = 0,25 A/µs	dI_T/dt	max.	50	A/µs

Gate to cathode

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0,5	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−55 to + 125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,8	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	45	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,1	°C/W

OPERATING NOTE

The terminals should neither be bent nor twisted; they should be soldered into the circuit so that there is no strain on them.
During soldering the heat conduction to the junction should be kept to a minimum.

ORDERING NOTE

Types with dV_D/dt of 1000 V/µs are available on request. Add suffix C to the type number when ordering; e.g. BTW42-600RC.

* To ensure thermal stability: $R_{th\ j\text{-}a} < 4$ °C/W (d.c. blocking) or < 8 °C/W (a.c.). For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see Fig. 3.

CHARACTERISTICS

Anode to cathode

On-state voltage I_T = 20 A; T_j = 25 °C	V_T	<	2 V *
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 V_{DRMmax}; T_j = 125 °C	dV_D/dt	<	200 V/μs
Reverse current $V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	3 mA
Off-state current $V_D = V_{DWMmax}$; T_j = 125 °C	I_D	<	3 mA
Latching current; T_j = 25 °C	I_L	<	150 mA
Holding current; T_j = 25 °C	I_H	<	75 mA

Gate to cathode

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	V_{GT}	>	1,5 V
Voltage that will not trigger any device $V_D = V_{DRMmax}$; T_j = 125 °C	V_{GD}	<	200 mV
Current that will trigger all devices V_D = 6 V; T_j = 25 °C	I_{GT}	>	50 mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from V_D = 800 V to I_T = 25 A; I_{GT} = 250 mA; dI_G/dt = 0,25 A/μs; T_j = 25 °C	t_{gt}	<	1,5 μs
	t_r	typ.	0,2 μs

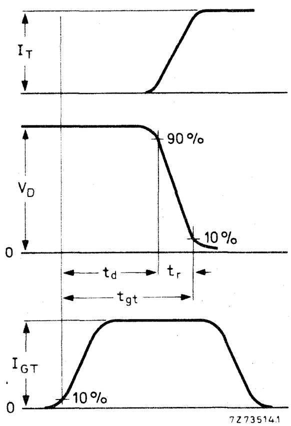


Fig. 2 Gate-controlled turn-on time definitions.

* Measured under pulse conditions to avoid excessive dissipation.

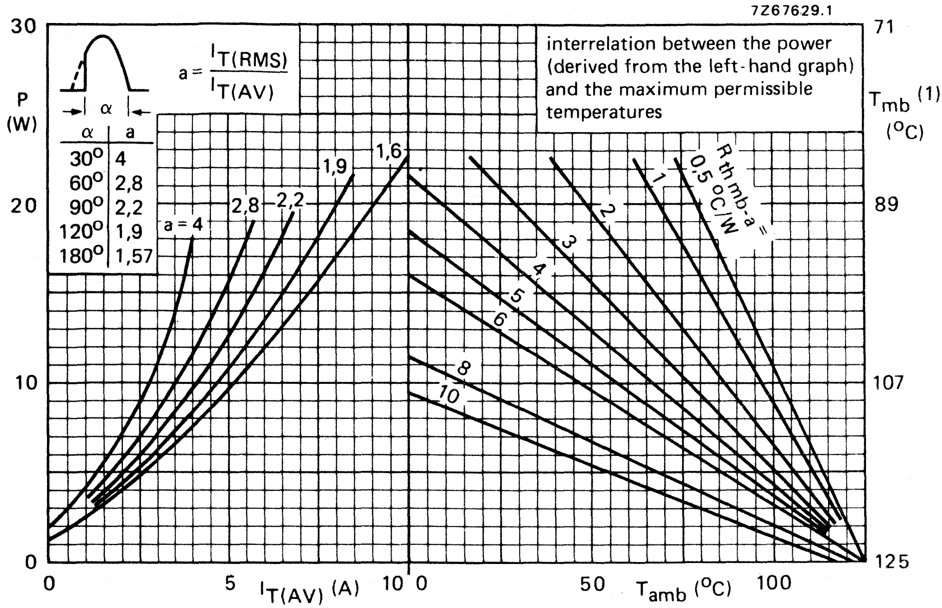


Fig. 3 (1) T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leqslant 6$ °C/W.

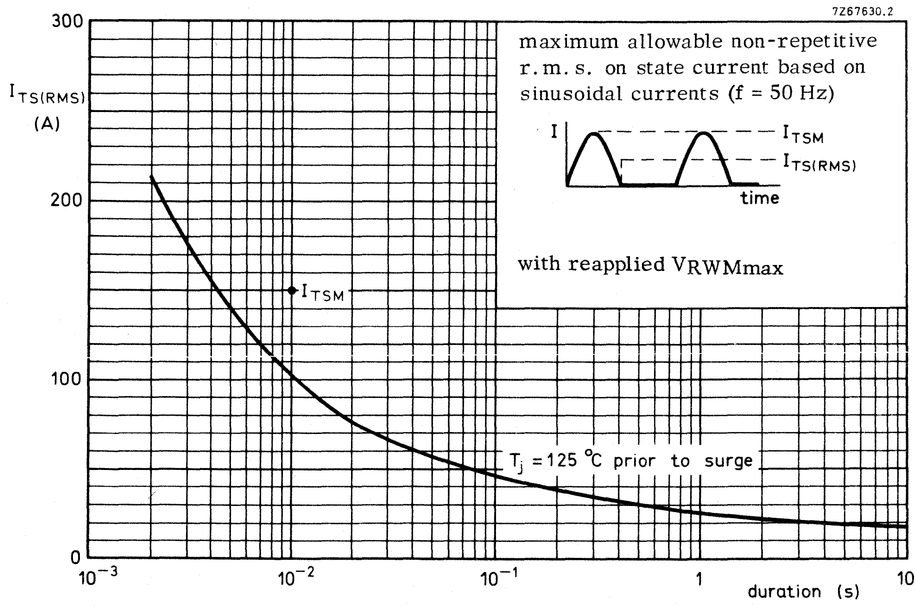


Fig. 4.

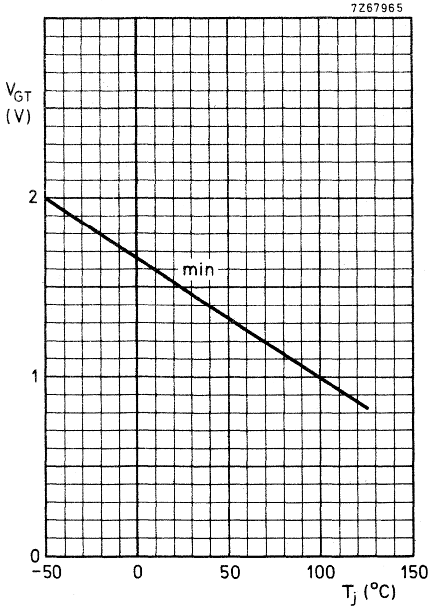


Fig. 5 Minimum gate voltage that will trigger all devices as a function of T_j.

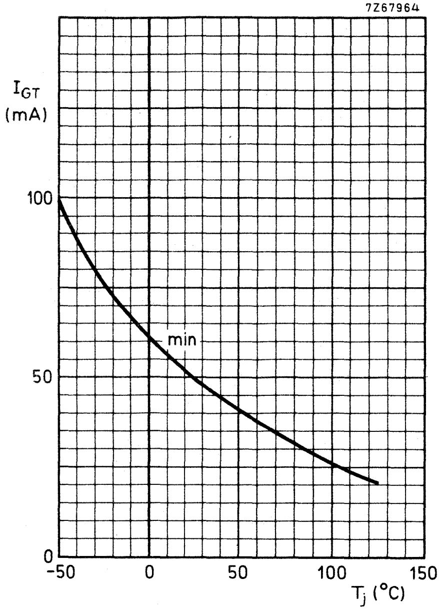


Fig. 6 Minimum gate current that will trigger all devices as a function of T_j.

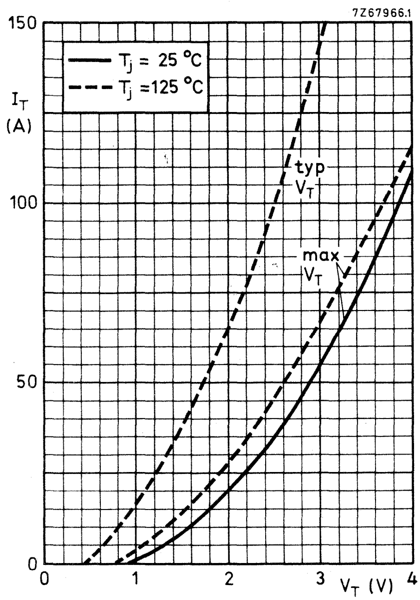


Fig. 7.

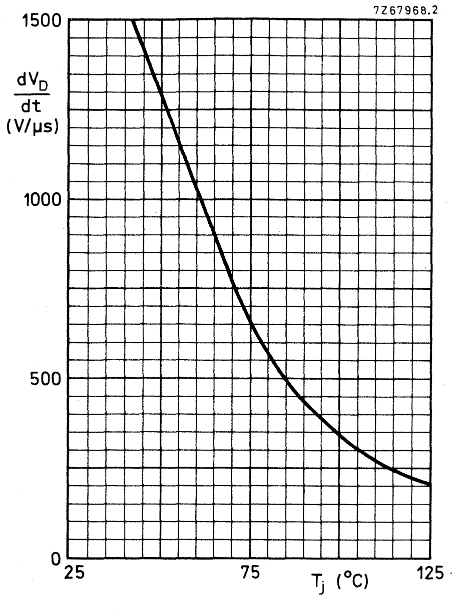


Fig. 8 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of T_j.

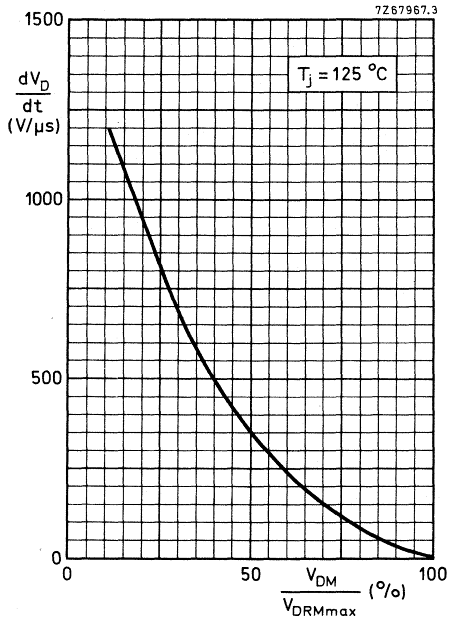
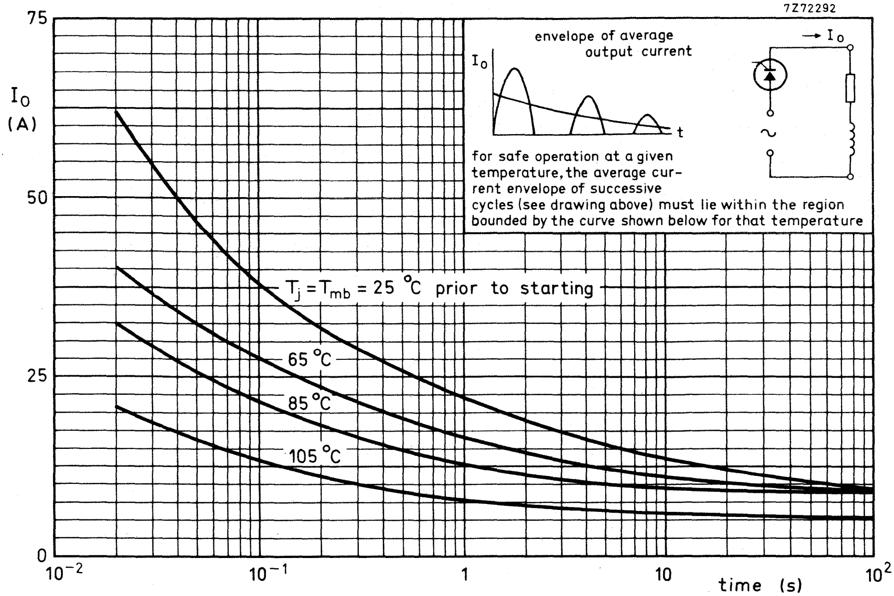


Fig. 9 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of applied voltage.



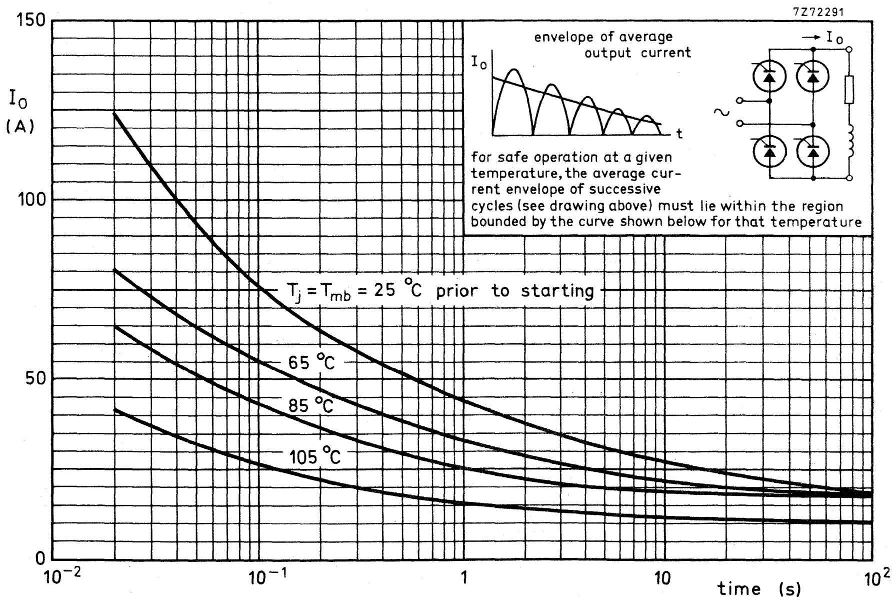


Fig. 10 Limits for starting or inrush currents.

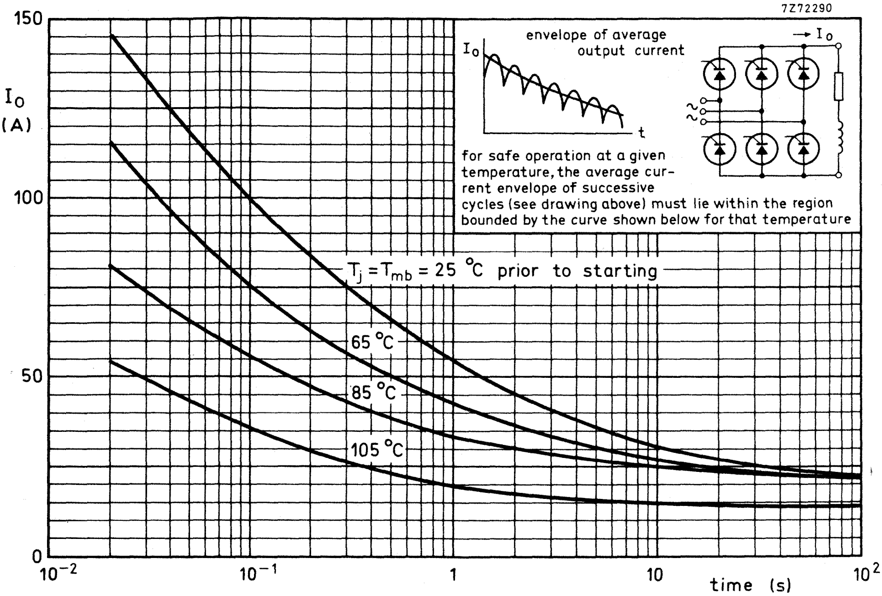


Fig. 11 Limits for starting or inrush currents.

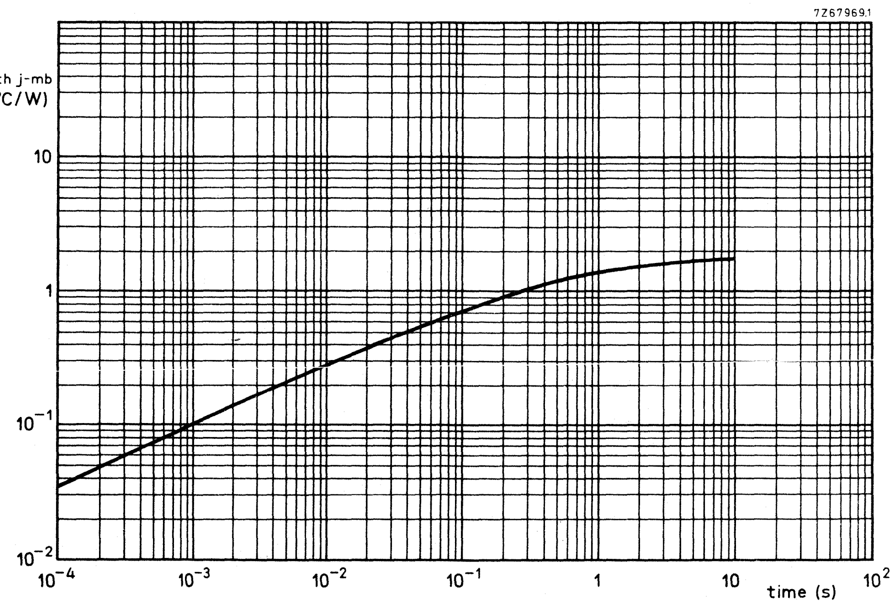


Fig. 12.

THYRISTORS

Silicon thyristors in metal envelopes, intended for power control applications.

The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTW45-400R to 1200R.

QUICK REFERENCE DATA

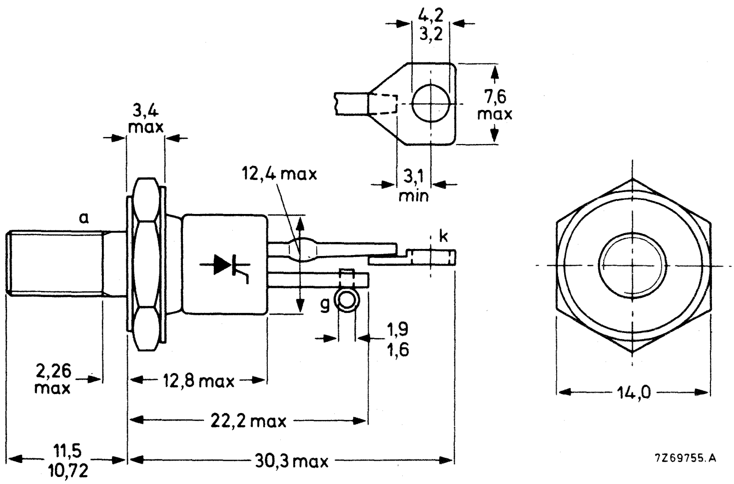
			BTW45-400R	600R	800R	1000R	1200R	
Repetitive peak voltages $V_{DRM} = V_{RRM}$		max.	400	600	800	1000	1200	V

Average on-state current	$I_{T(AV)}$	max.	16	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	25	A
Non-repetitive peak on-state current	I_{TSM}	max.	300	A
Rate of rise of off-state voltage that will not trigger any device	dV_D/dt	$<$	200	V/μs
On request (see ordering note on page 3)	dV_D/dt	$<$	1000	V/μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-48: with metric M6 stud (ϕ 6 mm); e.g. BTW45-400R.
Types with ¼ in x 28 UNF stud (ϕ 6,35 mm) are available on request. These are indicated by the suffix U: BTW45-400RU.



Net mass: 14 g
Diameter of clearance hole: max. 6,5 mm
Accessories supplied on request: 56264A
(mica washer, insulating ring, soldering tag)

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)
Supplied with the device:
1 nut, 1 lock washer
Nut dimensions across the flats;
M6: 10 mm
¼ in x 28 UNF: 11,1 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTW45-400R	600R	800R	1000R	1200R	
Non-repetitive peak voltages ($t \leq 10$ ms)	V_{DSM}/V_{RSM}	max.	400	600	800	1000	1200	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	400	600	800	1000	1200	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	300	400	600	700	800	V*

Average on-state current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{T(AV)}$	max.	16	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	25	A
Repetitive peak on-state current	I_{TRM}	max.	200	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 125 °C prior to surge; with reapplied $V_{RWM\,max}$	I_{TSM}	max.	300	A
I^2t for fusing (t = 10 ms)	I^2t	max.	450	A^2s
Rate of rise of on-state current after triggering with I_G = 400 mA to I_T = 60 A; dI_G/dt = 0,4 A/µs	dI_T/dt	max.	100	A/µs

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	10	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	1	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−55 to + 125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\,j\text{-}mb}$	=	1,33	°C/W
From mounting base to heatsink; with heatsink compound	$R_{th\,mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\,j\text{-}mb}$	=	0,1	°C/W

* To ensure thermal stability: $R_{th\,j\text{-}a} < 6,5$ °C/W (d.c. blocking) or < 13 °C/W (a.c.). For smaller heatsinks $T_{j\,max}$ should be derated. For a.c. see Fig. 2.

CHARACTERISTICS

Anode to cathode

On-state voltage $I_T = 50$ A; $T_j = 25$ °C	V_T	<	2	V*
Rate of rise of off-state voltage that will not trigger any device; exponential method; $V_D = 2/3\ V_{DRM\,max}$; $T_j = 125$ °C	dV_D/dt	<	200	V/µs
Reverse current $V_R = V_{RWM\,max}$; $T_j = 125$ °C	I_R	<	3	mA
Off-state current $V_D = V_{DWM\,max}$; $T_j = 125$ °C	I_D	<	3	mA
Latching current; $T_j = 25$ °C	I_L	<	150	mA
Holding current; $T_j = 25$ °C	I_H	<	75	mA

Gate to cathode

Voltage that will trigger all devices $V_D = 6$ V; $T_j = 25$ °C	V_{GT}	>	1,5	V
Voltage that will not trigger any device $V_D = V_{DRM\,max}$; $T_j = 125$ °C	V_{GD}	<	200	mV
Current that will trigger all devices $V_D = 6$ V; $T_j = 25$ °C	I_{GT}	>	75	mA

OPERATING NOTE

The terminals should neither be bent nor twisted; they should be soldered into the circuit so that there is no strain on them.
During soldering the heat conduction to the junction should be kept to a minimum.

ORDERING NOTE

Types with dV_D/dt of 1000 V/µs are available on request. Add suffix C to the type number when ordering; e.g. BTW45-400RC.

* Measured under pulse conditions to avoid excessive dissipation.

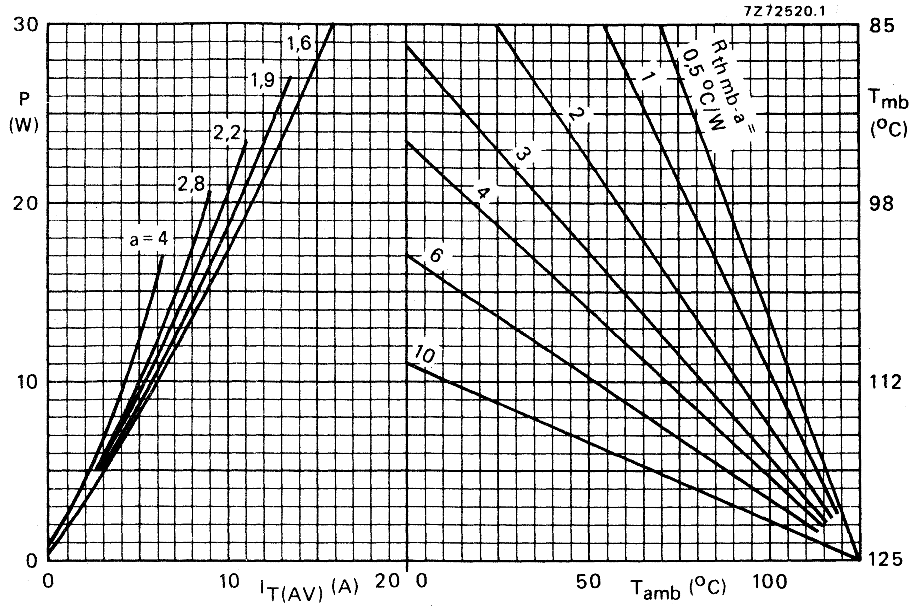

7Z72520.1
P
(W)
30
20
10
0
a = 4
2,8
2,2
1,9
1,6
0
10
$I_{T(AV)}$ (A)
20
0
50
T_{amb} (°C)
100
$R_{th\,mb-a}$ =
0,5 °C/W
1
2
3
4
6
10
T_{mb}
(°C)
85
98
112
125

Fig. 2.

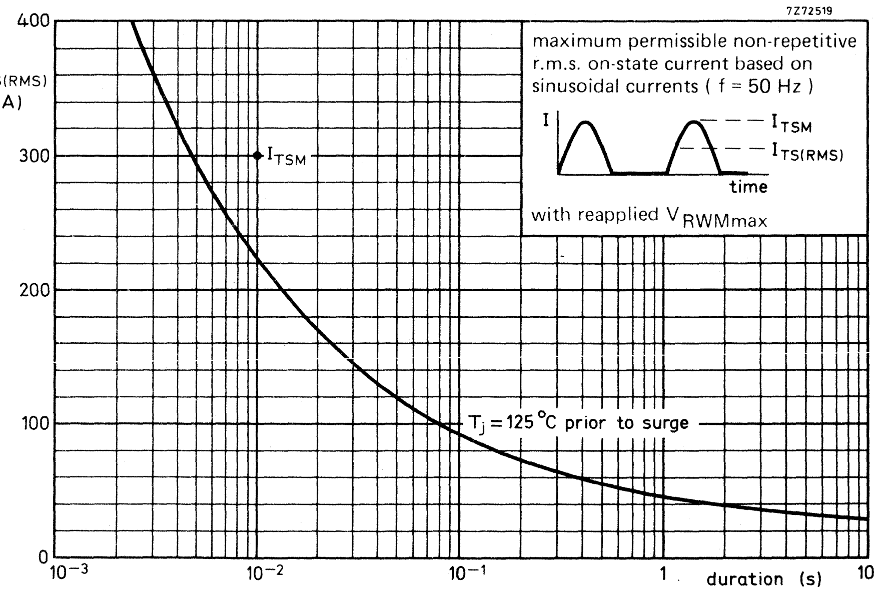

7Z72519
$I_{TS(RMS)}$
(A)
400
300
200
100
0
I_{TSM}
maximum permissible non-repetitive
r.m.s. on-state current based on
sinusoidal currents (f = 50 Hz)
I
I_{TSM}
$I_{TS(RMS)}$
time
with reapplied V_{RWMmax}
T_j = 125 °C prior to surge
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10

Fig. 3.

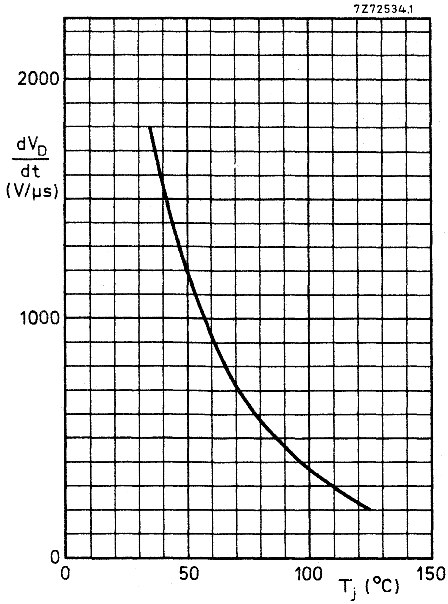


Fig. 4 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of T_j.

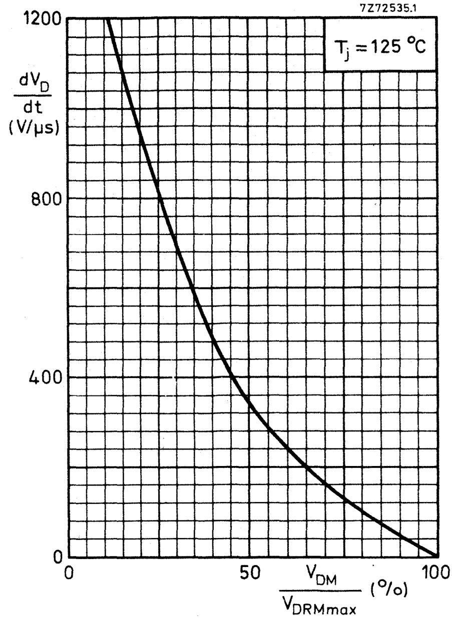


Fig. 5 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of applied voltage.

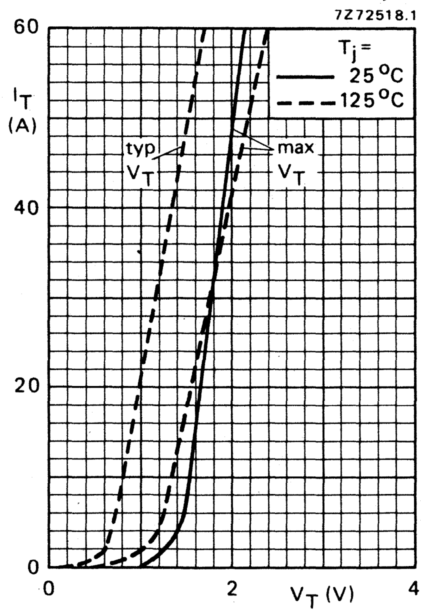


Fig. 6.

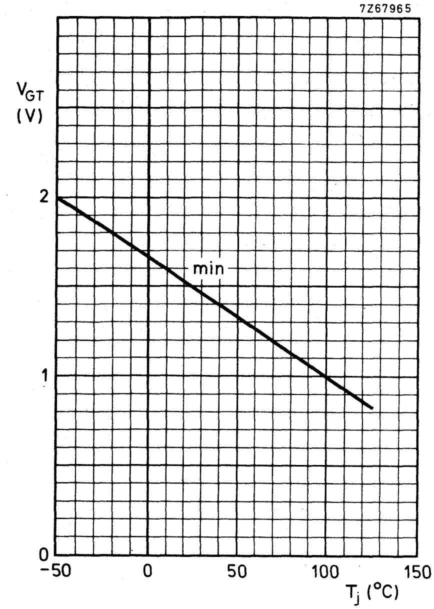


Fig. 7 Minimum gate voltage that will trigger all devices as a function of T_j.

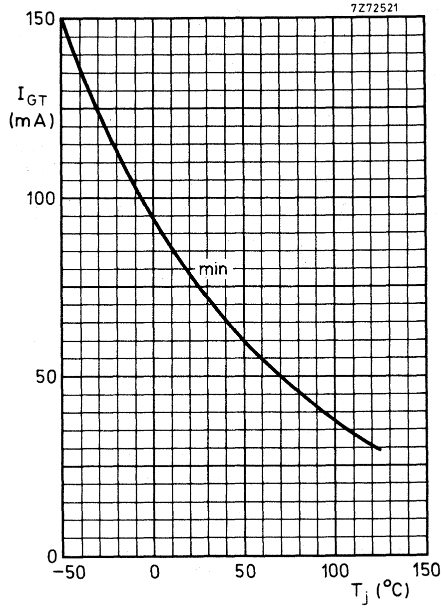


Fig. 8 Minimum gate current that will trigger all devices as a function of T_j.

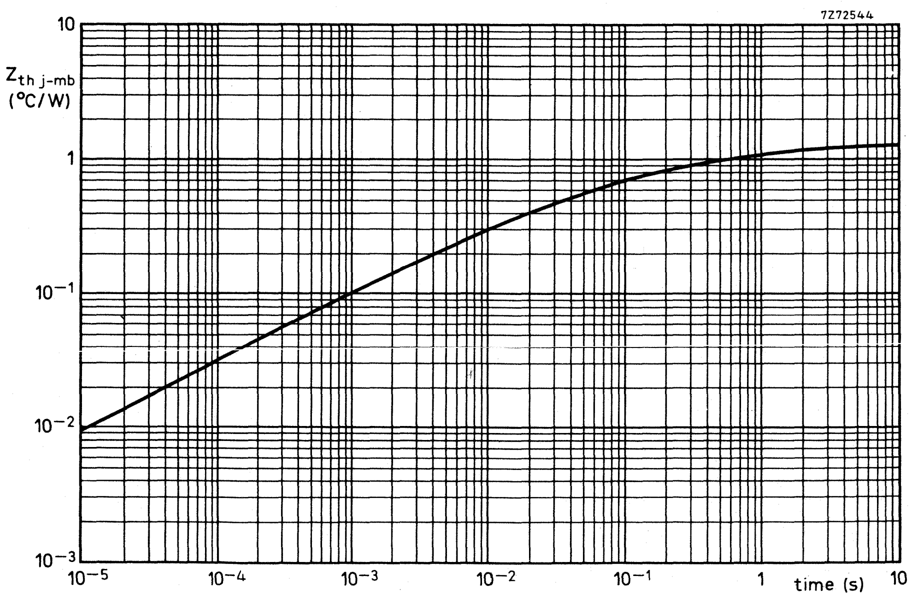


Fig. 9.

THYRISTORS

Silicon thyristors in metal envelopes, primarily intended for three-phase mains operation. The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTW47-800R to 1600R.

QUICK REFERENCE DATA

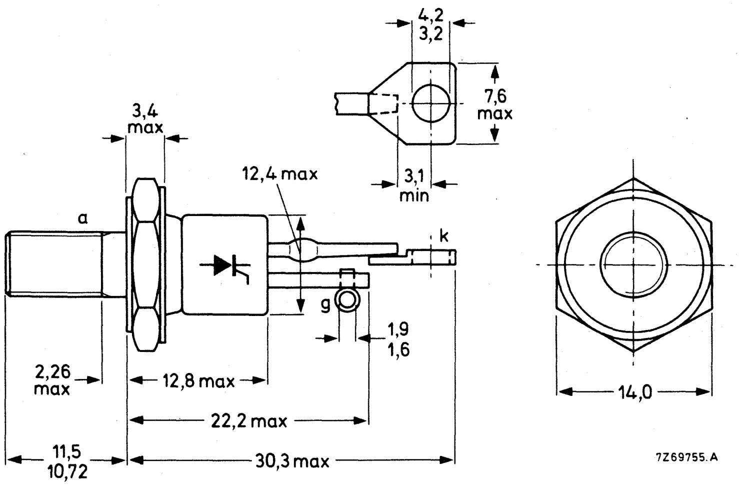
		BTW47-800R	1000R	1200R	1400R	1600R	
Repetitive peak voltages $V_{DRM} = V_{RRM}$	max.	800	1000	1200	1400	1600	V

Average on-state current	$I_{T(AV)}$	max.	16	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	25	A
Non-repetitive peak on-state current	I_{TSM}	max.	300	A
Rate of rise of off-state voltage that will not trigger any device	dV_D/dt	<	300	V/μs
On request (see ordering note on page 4)	dV_D/dt	<	1000	V/μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-48: with metric M6 stud (ϕ 6 mm); e.g. BTW47-800R.
Types with ¼ in x 28UNF stud (ϕ 6,35 mm) are available on request. These are indicated by the suffix U: BTW47-800RU.



Net mass: 14 g
Diameter of clearance hole: max. 6,5 mm
Accessories supplied on request: 56264A
(mica washer, insulating ring, soldering tag)

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)
Supplied with the device:
1 nut, 1 lock washer
Nut dimensions across the flats;
M6: 10 mm
¼ in x 28 UNF: 11,1 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTW47-800R	1000R	1200R	1400R	1600R	
Non-repetitive peak voltages (t ⩽ 10 ms)	V_{DSM}/V_{RSM}	max.	800	1000	1200	1400	1600	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	800	1000	1200	1400	1600	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	600	700	800	800	800	V*

Average on-state current (averaged over any 20 ms period) up to T_{mb} = 77 °C	$I_{T(AV)}$	max.	16	A
at T_{mb} = 85 °C	$I_{T(AV)}$	max.	14	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	25	A
Repetitive peak on-state current	I_{TRM}	max.	150	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 125 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.	300	A
I^2t for fusing (t = 10 ms)	I^2t	max.	450	A^2s
Rate of rise of on-state current after triggering with I_G = 500 mA to I_T = 50 A	dI_T/dt	max.	200	A/µs
Rate of change of commutation current	see Fig. 9			

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	10	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	1	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−55 to +125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,06	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a}$ < 1,5 °C/W (d.c. blocking) or < 3 °C/W (a.c.). For smaller heat-sinks $T_{j\ max}$ should be derated. For a.c. see Fig. 3.

CHARACTERISTICS

Anode to cathode

On-state voltage I_T = 50 A; T_j = 25 °C	V_T	<	3 V*
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 V_{DRMmax}; T_j = 125 °C	dV_D/dt	<	300 V/μs
Reverse current $V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	5 mA
Off-state current $V_D = V_{DWMmax}$; T_j = 125 °C	I_D	<	5 mA
Latching current; T_j = 25 °C	I_L	<	200 mA
Holding current; T_j = 25 °C	I_H	<	200 mA

Gate to cathode

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	V_{GT}	>	3,5 V
Voltage that will not trigger any device $V_D = V_{DRMmax}$; T_j = 125 °C	V_{GD}	<	200 mV
Current that will trigger all devices V_D = 6 V; T_j = 25 °C	I_{GT}	>	100 mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from $V_D = V_{DWMmax}$ to I_T = 10 A; I_{GT} = 150 mA; dI_G/dt = 1 A/μs; T_j = 25 °C	t_{gt} t_r	typ. typ.	2 μs 1,2 μs

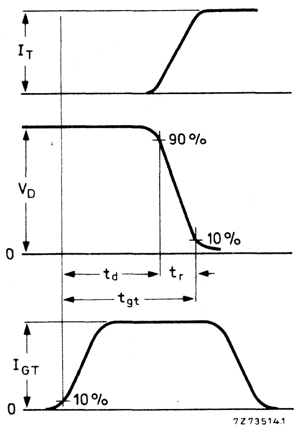


Fig. 2 Gate-controlled turn-on time definitions.

* Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTES

1. The terminals should neither be bent nor twisted; they should be soldered into the circuit so that there is no strain on them.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. Switching losses in commutation
   For applications in which the thyristor is forced to switch from an on-state current I_{TRM} to a high reverse voltage at a high commutation rate ($-dI_T/dt$), consult Fig. 9 (nomogram) to find the increase in total average power. This increase must be added to the loss from the curves in Fig. 3.

ORDERING NOTE

Types with dV_D/dt of 1000 V/μs are available on request. Add suffix C to the type number when ordering; e.g. BTW47-800RC.

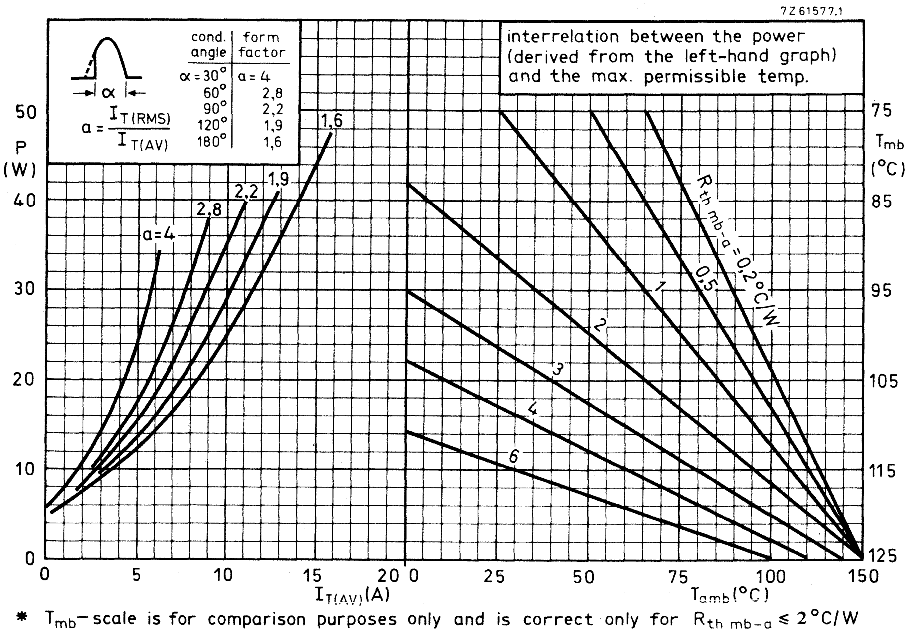


Fig. 3.

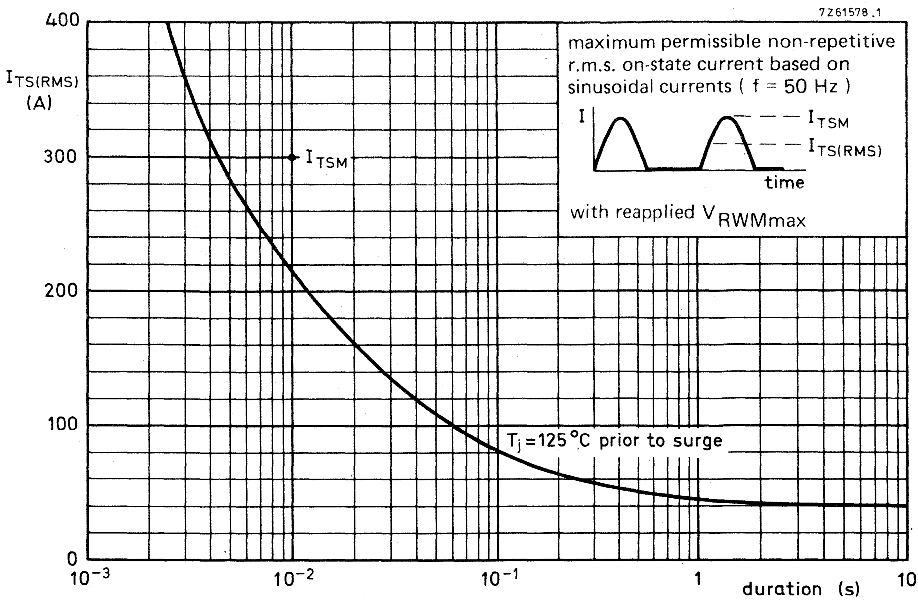


Fig. 4.

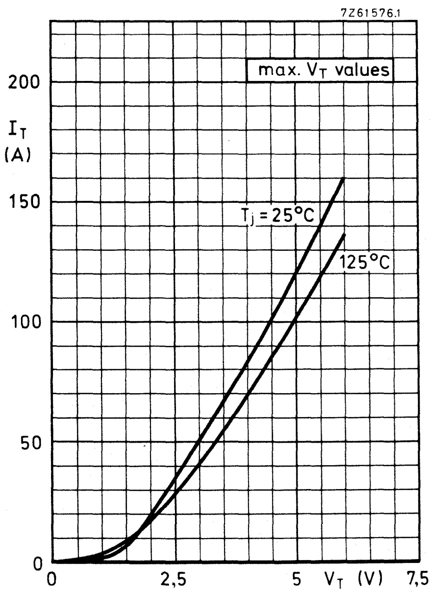


Fig. 5.

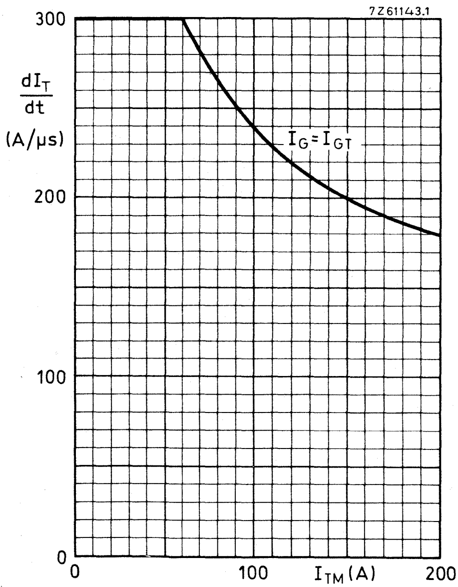


Fig. 6.

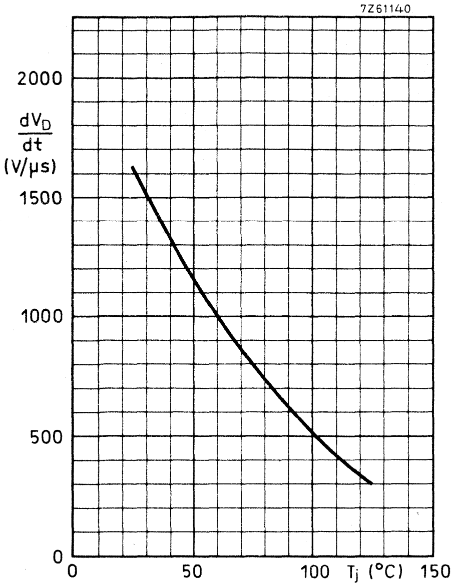


Fig. 7 Maximum rate of rise of off-state voltage that with not trigger any device (exponential method) as a function of T_j.

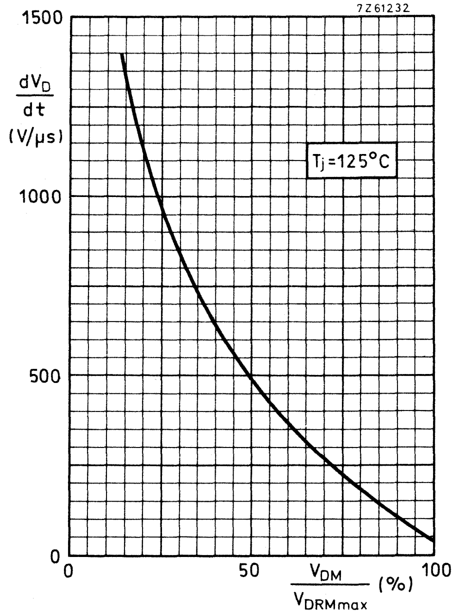


Fig. 8 Maximum rate of rise of off-state voltage that with not trigger any device (exponential method) as a function of applied voltage.

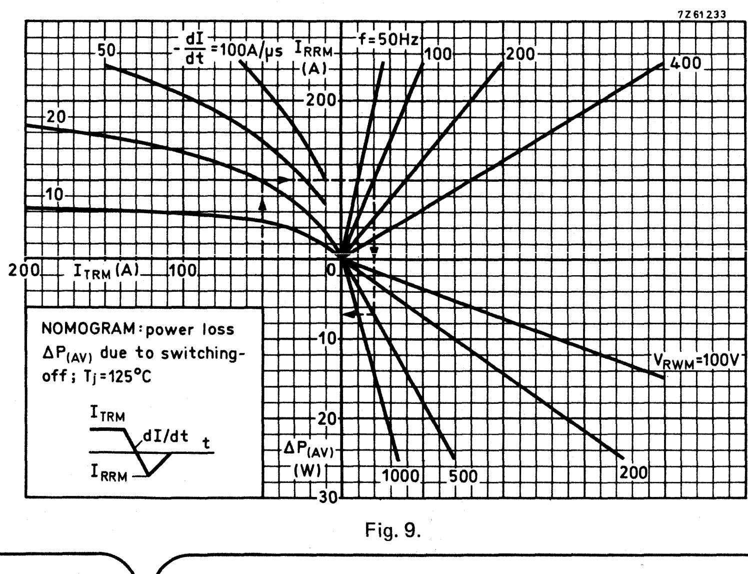


Fig. 9.

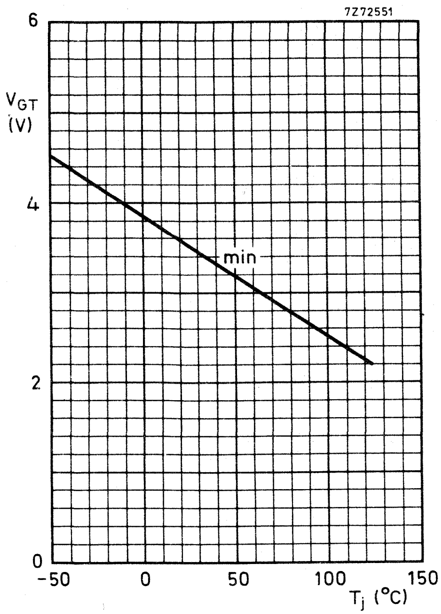


Fig. 10 Minimum gate voltage that will trigger all devices as a function of T_j.

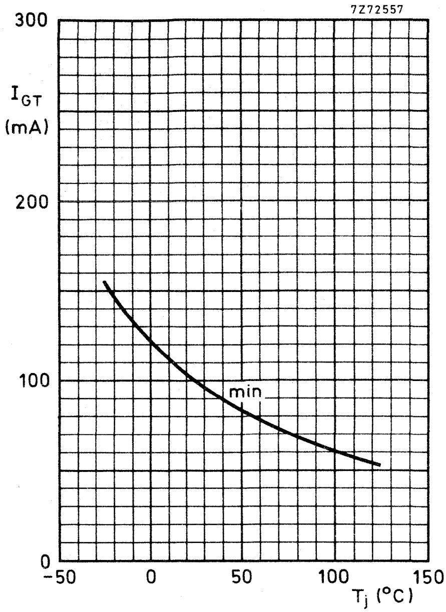


Fig. 11 Minimum gate current that will trigger all devices as a function of T_j.

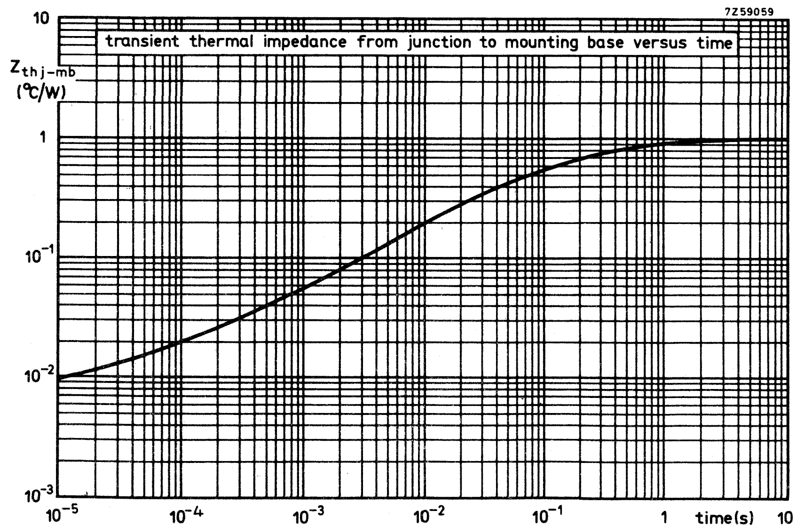
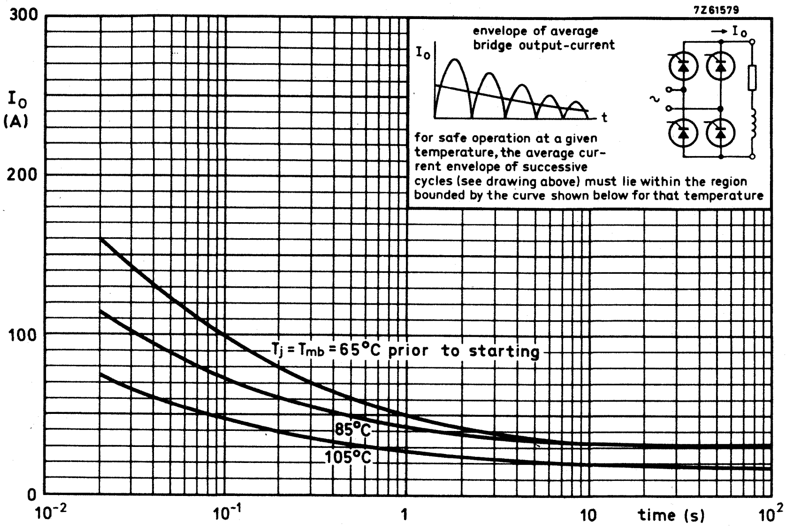


Fig. 12.



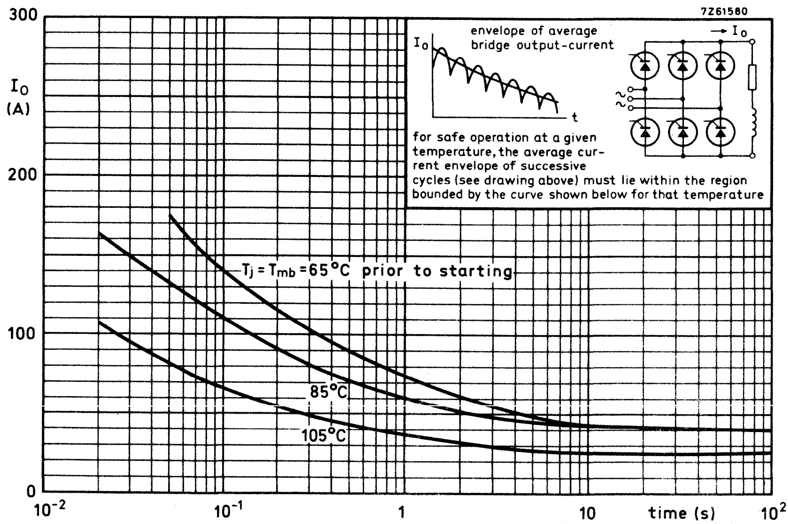


Fig. 13 Limits for starting or inrush currents.

THYRISTORS

Also available to BS9341-F039

Silicon thyristors in metal envelopes, intended for use in general purpose three-phase power control circuits.

The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTW92-800R to 1600R.

QUICK REFERENCE DATA

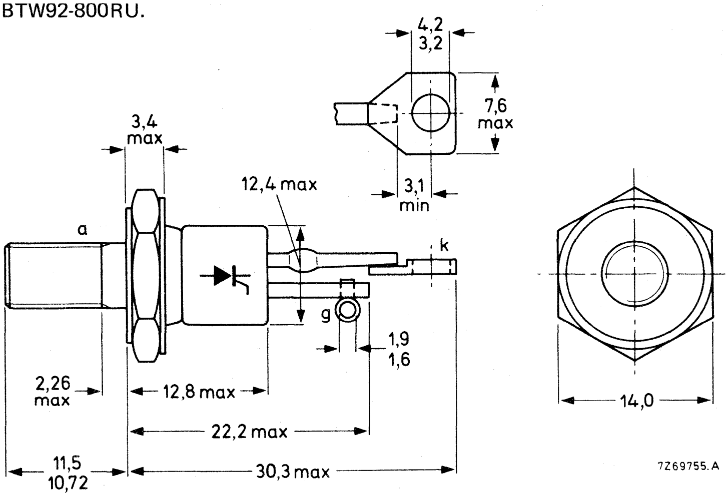
			BTW92-800R	1000R	1200R	1400R	1600R	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	800	1000	1200	1400	1600	V

Average on-state current	$I_{T(AV)}$	max.	20	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	31	A
Non-repetitive peak on-state current	I_{TSM}	max.	400	A
Rate of rise of off-state voltage that will not trigger any device	dV_D/dt	<	300	V/μs
On request (see ordering note on page 4)	dV_D/dt	<	1000	V/μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-48: with metric M6 stud (ϕ 6 mm); e.g. BTW92-800R.
Types with ¼ in x 28 UNF stud (ϕ 6,35 mm) are available on request. These are indicated by the suffix U: BTW92-800RU.



Net mass: 14 g
Diameter of clearance hole: max. 6,5 mm
Accessories supplied on request: 56264A
(mica washer, insulating ring, soldering tag)

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)
Supplied with the device:
1 nut, 1 lock washer
Nut dimensions across the flats;
M6: 10 mm
¼ in x 28 UNF: 11,1 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTW92-800R	1000R	1200R	1400R	1600R	
Non-repetitive peak voltages (t ⩽ 10 ms)	V_{DSM}/V_{RSM}	max.	800	1000	1200	1400	1600	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	800	1000	1200	1400	1600	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	600	700	800	800	800	V *

Average on-state current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{T(AV)}$	max.	20	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	31	A
Repetitive peak on-state current	I_{TRM}	max.	200	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 125 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.	400	A
I^2t for fusing (t = 10 ms)	I^2t	max.	800	A^2s
Rate of rise of on-state current after triggering with I_G = 500 mA to I_T = 60 A	dI_T/dt	max.	300	A/µs
Rate of change of commutation current	see Fig. 9			

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	10	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	1	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}	−55 to + 125		°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,06	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a}$ < 1,5 °C/W (d.c. blocking) or < 3 °C/W (a.c.). For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see Fig. 3.

CHARACTERISTICS

Anode to cathode

On-state voltage I_T = 50 A; T_j = 25 °C	V_T	<	2,3 V *
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 V_{DRMmax}; T_j = 125 °C	dV_D/dt	<	300 V/µs
Reverse current V_R = V_{RWMmax}; T_j = 125 °C	I_R	<	5 mA
Off-state current V_D = V_{DWMmax}; T_j = 125 °C	I_D	<	5 mA
Latching current; T_j = 25 °C	I_L	<	200 mA
Holding current; T_j = 25 °C	I_H	<	200 mA

Gate to cathode

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	V_{GT}	>	3,5 V
Voltage that will not trigger any device V_D = V_{DRMmax}; T_j = 125 °C	V_{GD}	<	200 mV
Current that will trigger all devices V_D = 6 V; T_j = 25 °C	I_{GT}	>	100 mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from V_D = V_{DWMmax} to I_T = 10 A; I_{GT} = 150 mA; dI_G/dt = 1 A/µs; T_j = 25 °C	t_{gt} t_r	typ. typ.	2 µs 1,2 µs

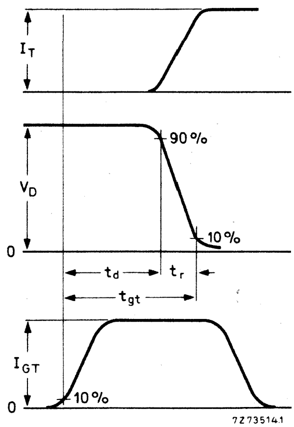


Fig. 2 Gate-controlled turn-on time definitions.

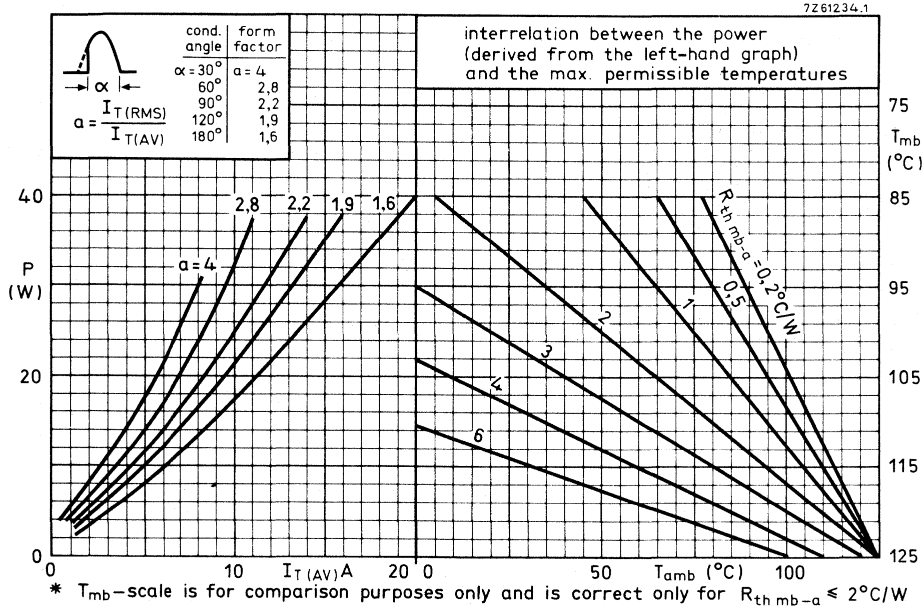
* Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTES

1. The terminals should neither be bent nor twisted; they should be soldered into the circuit so that there is no strain on them.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. Switching losses in commutation.
   For applications in which the thyristor is forced to switch from an on-state current I_{TRM} to a high reverse voltage at a high commutation rate ($-dI_T/dt$), consult Fig. 9 (nomogram) to find the increase in total average power. This increase must be added to the loss from the curves in Fig. 3.

ORDERING NOTE

Types with dV_D/dt of 1000 V/μs are available on request. Add suffix C to the type number when ordering; e.g. BTW92-800RC.



* T_{mb}–scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leq 2$ °C/W

Fig. 3.

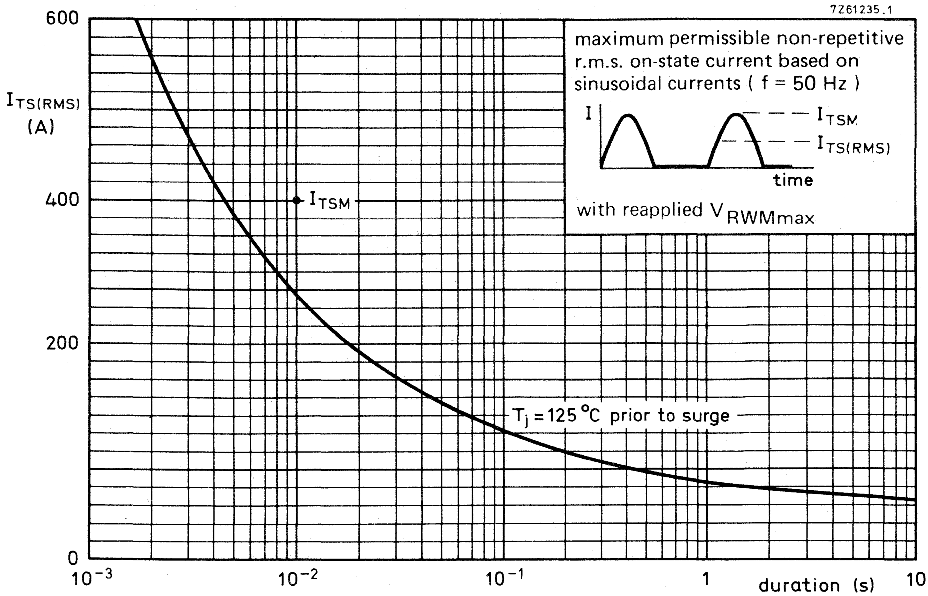


Fig. 4.

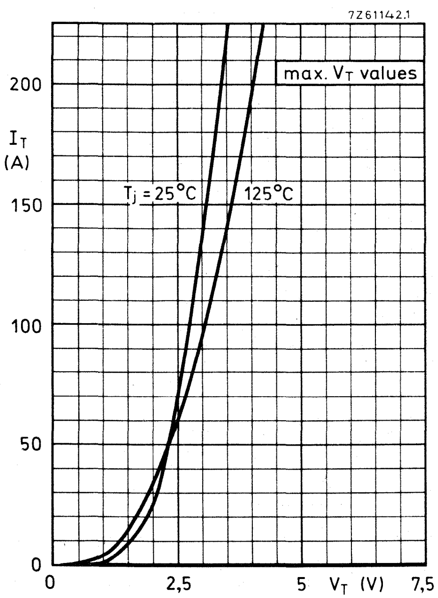


Fig. 5.

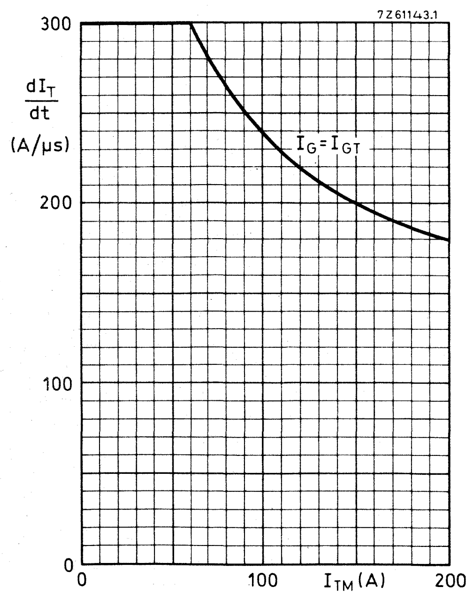


Fig. 6.

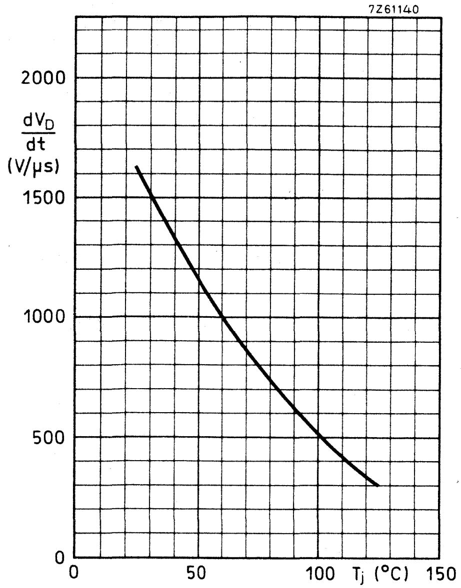


Fig. 7 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of T_j.

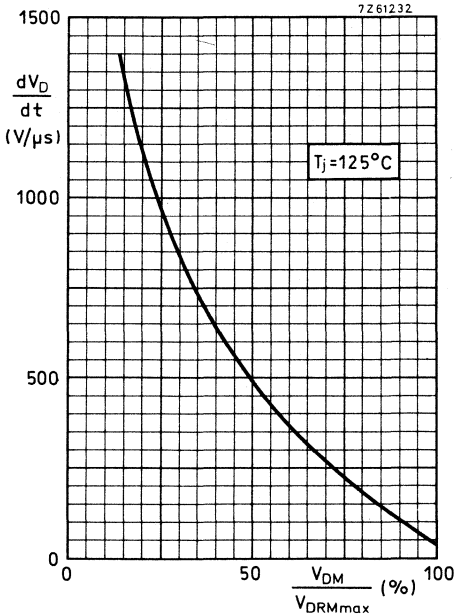


Fig. 8 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of applied voltage.

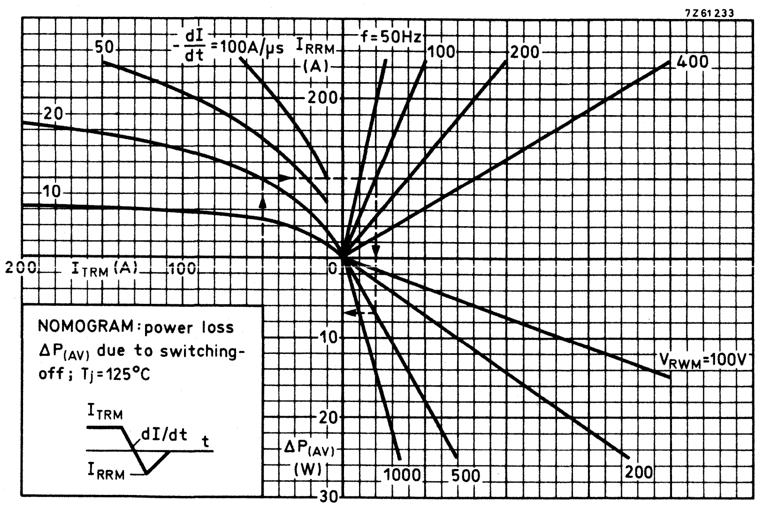


Fig. 9.

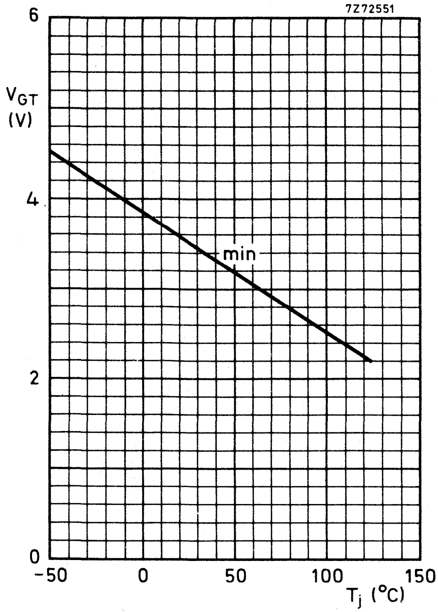


Fig. 10 Minimum gate voltage that will trigger all devices as a function of T_j.

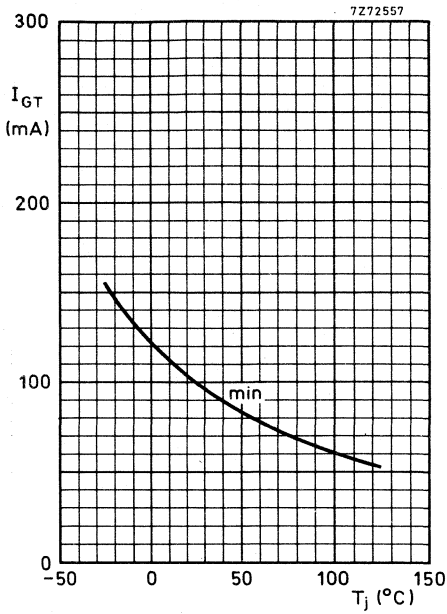


Fig. 11 Minimum gate current that will trigger all devices as a function of T_j.

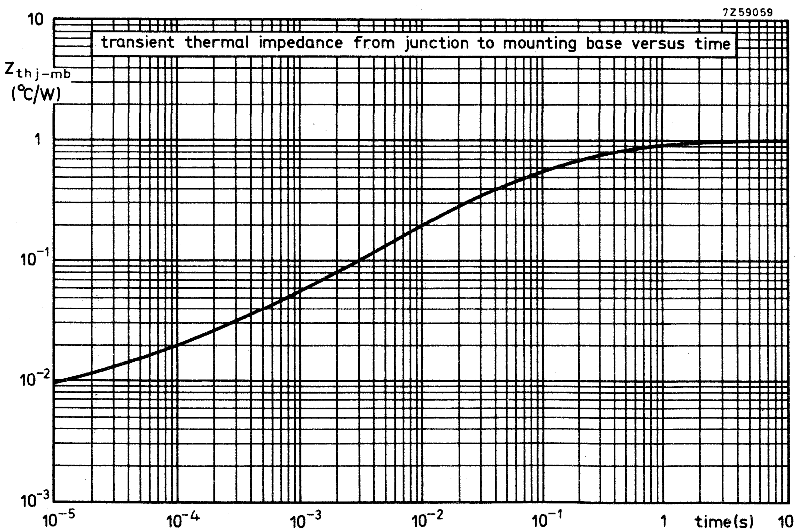
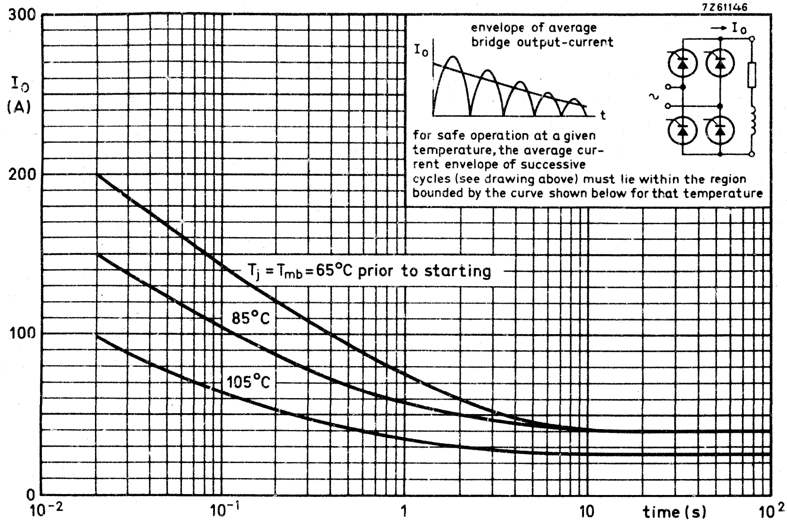


Fig. 12.



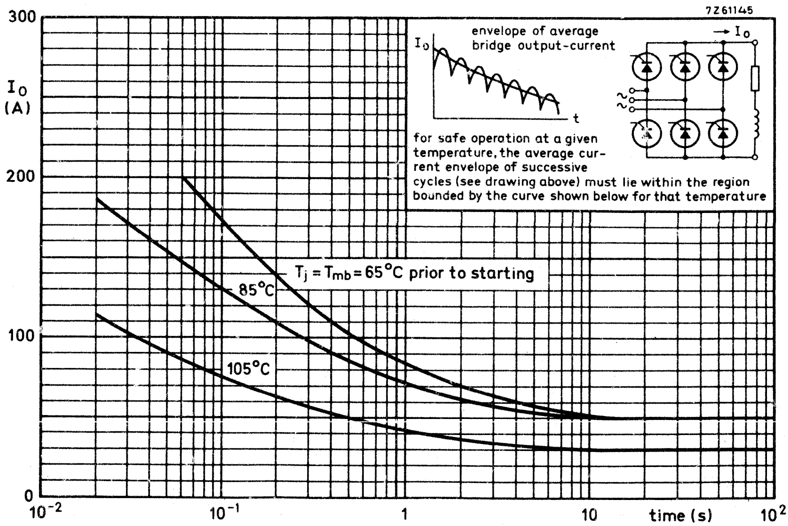


Fig. 13 Limits for starting or inrush currents.

SILICON THYRISTORS

The BTX18series is a range of p-gate reverse blocking thyristors, in a TO-5 metal envelope, intended for use in general low power applications up to 1 A average on-state current

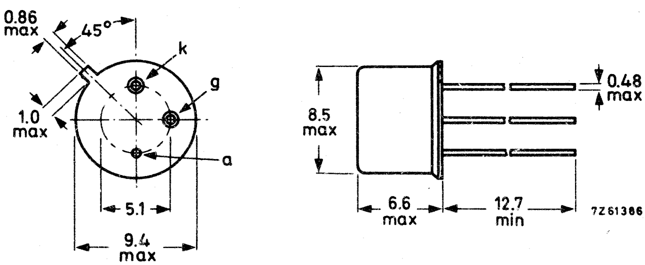
QUICK REFERENCE DATA

			BTX18-100	200	300	400	500	
Crest working reverse voltage	V_{RWM}	max.	100	200	300	400	500	V
Crest working off-state voltage	V_{DWM}	max.	100	200	300	400	500	V
Average on-state current up to T_{case} = 105 °C	$I_{T(AV)}$	max.	1.0					A
T_{amb} = 60 °C; in free air	$I_{T(AV)}$	max.	250					mA
Non-repetitive peak on-state current t = 10 ms; T_j = 125 °C prior to surge	I_{TSM}	max.	10					A
Junction temperature	T_j	max.	125					°C

MECHANICAL DATA Dimensions in mm

Anode connected to the case

TO-39



Accessories supplied on request: 56218; 56245.

All information applies to frequencies up to 400 Hz

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

ANODE TO CATHODE

Voltages [1]			BTX18-100	200	300	400	500	
Continuous reverse voltage	V_R	max.	100	200	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	100	200	300	400	500	V
Repetitive peak reverse voltage (δ = 0.01; f = 50 Hz)	V_{RRM}	max.	120	240	350	500	600	V
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	120	240	350	500	600	V
Continuous off-state voltage	V_D	max.	100	200	300	400	500	V
Crest working off-state voltage	V_{DWM}	max.	100	200	300	400	500	V
Repetitive peak off-state voltage (δ = 0.01; f = 50 Hz)	V_{DRM}	max.	120	240	350	500	600	V [2]
Non-repetitive peak off-state voltage ($t \leq 10$ ms)	V_{DSM}	max.	120	240	350	500	600	V [2]

Currents

Average on-state current (averaged over any 20 ms period) up to T_{case} = 105 °C	$I_{T(AV)}$	max.	1.0	A
at T_{amb} = 60 °C	$I_{T(AV)}$	max.	250	mA
On-state current (d.c.) T_{case} = 100 °C	I_T	max.	1.6	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	1.6	A
Repetitive peak on-state current	I_{TRM}	max.	10	A
Non-repetitive peak on-state current (t = 10 ms, half sinewave)	I_{TSM}	max.	10	A

[1]) These ratings apply for zero or negative bias on the gate with respect to the cathode, and when a resistor $R \leq 1$ kΩ is connected between gate and cathode.

[2]) The device is not suitable for operation in the forward breakover mode.

RATINGS

GATE TO CATHODE (with 1 kΩ resistor between gate and cathode)

Voltages

Forward peak voltage	V_{FGM}	max.	10	V
Reverse peak voltage	V_{RGM}	max.	5	V

Current

Forward peak current	I_{FGM}	max.	0.2	A

Power dissipation

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0.05	W
Peak power dissipation	P_{GM}	max.	0.5	W

TEMPERATURES

Storage temperature	T_{stg}		-55 to +125	^{o}C
Junction temperature	T_j	max.	125	^{o}C

THERMAL RESISTANCE

From junction to case	$R_{th\ j-c}$	=	10	$^{o}C/W$
From junction to ambient	$R_{th\ j-a}$	=	200	$^{o}C/W$
Transient thermal resistance (t = 10 ms)	$Z_{th\ j-c}$	=	2.5	$^{o}C/W$

CHARACTERISTICS

ANODE TO CATHODE

Voltages

			BTX18-100	200	300	400	500	
On-state voltage I_T = 1.0 A; T_j = 25 ^{o}C	V_T	<	1.5	1.5	1.5	1.5	1.5	V 1)
Rate of rise of off-state voltage that will not trigger any device R_{GK} = 1 kΩ; T_j = 125 ^{o}C	$\frac{dV_D}{dt}$		See page 6					

Currents

Peak reverse current $V_{RM} = V_{RWMmax}$; T_j = 125 ^{o}C	I_{RM}	<	800	400	275	200	160	µA
Peak off-state current $V_{DM} = V_{DWMmax}$; T_j = 125 ^{o}C	I_{DM}	<	800	400	275	200	160	µA

1) V_T is measured along the leads at 1 cm from the case.

CHARACTERISTICS (continued)

Latching current; T_j = 125 °C	I_L	typ.	10	mA
Holding current; T_j = 25 °C	I_H	<	5.0	mA [1)]

GATE TO CATHODE

Voltages

Voltage that will trigger all devices; T_j = 25 °C	V_{GT}	>	2.0	V
Voltage that will not trigger any device; T_j = 125 °C	V_{GD}	<	200	mV

Current

Current that will trigger all devices; T_j = 25 °C	I_{GT}	>	5.0	mA

SWITCHING CHARACTERISTICS

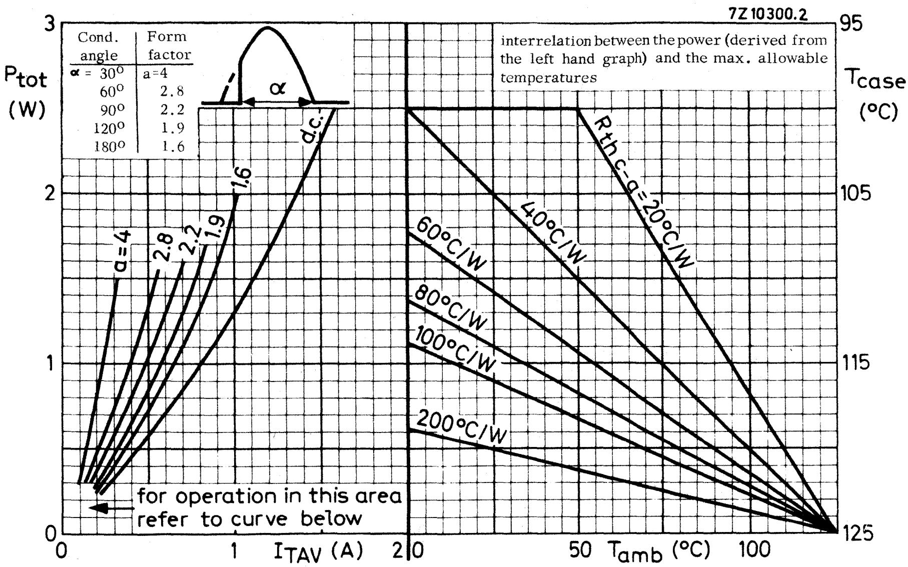
Turn off time when switched from

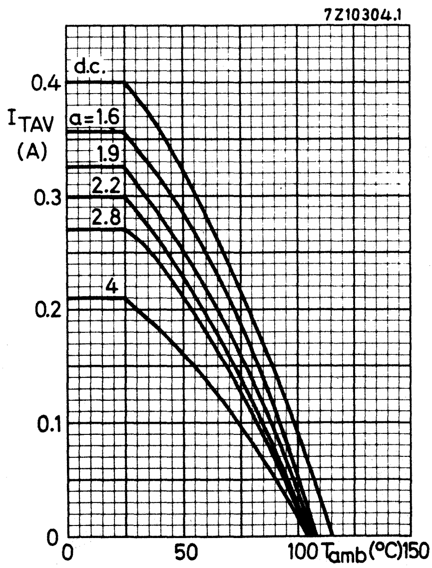
I_T = 300 mA to I_R = 175 mA; T_j = 25 °C	t_q	typ.	20	µs
T_j = 125 °C	t_q	typ.	35	µs

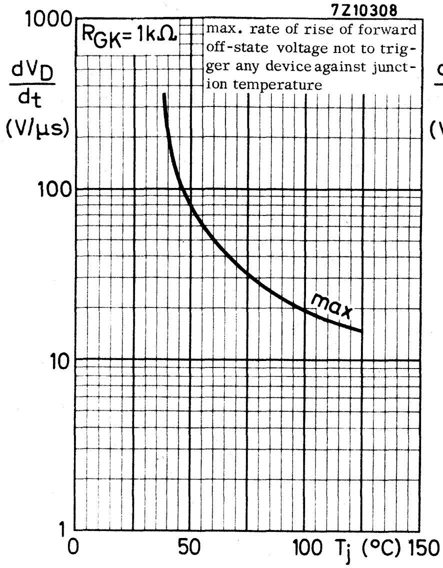
NOTES

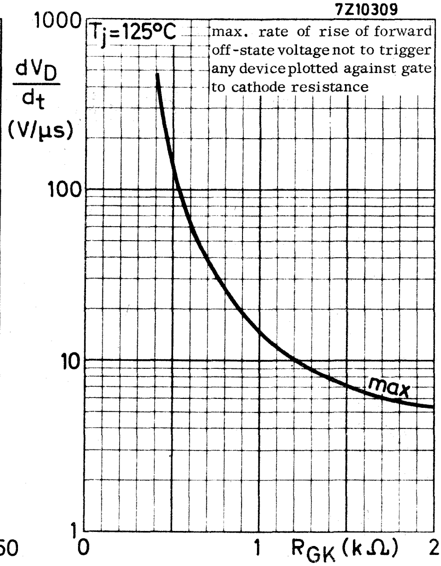
1. When using a soldering iron the thyristor may be soldered directly into the circuit, but the heat conduction to the junction should be kept to a minimum by using a thermal shunt.
2. Thyristors may be dip soldered at a solder temperature of 245 °C, for a maximum soldering time of 5 seconds. The case temperature during dip soldering must not at any time exceed the maximum storage temperature. These recommendations apply to a thyristor mounted flush on a board with punched-through holes, or spaced 1.5 mm above a board having plated-through holes.
3. Care should be taken not to bend the leads nearer than 1.5 mm from the seal.

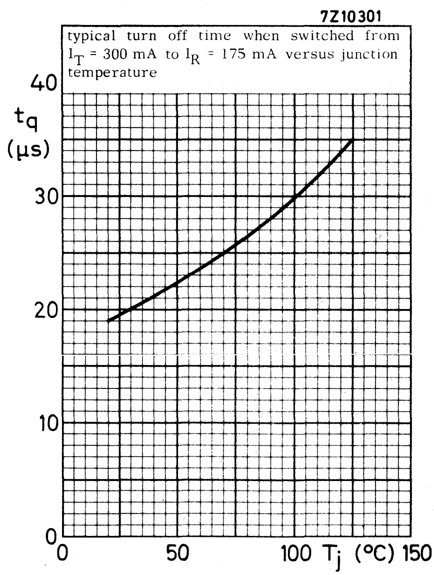
1) Measured under the following conditions: Anode supply voltage = +6.0 V.
Initial on-state current after gate triggering = 50 mA.
The current is reduced until the device turns of.

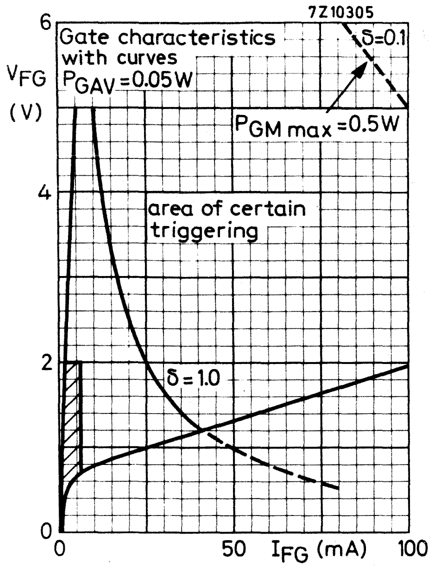

7Z10300.2
Cond. angle
Form factor
α = 30° a=4
60° 2.8
90° 2.2
120° 1.9
180° 1.6
α
Ptot (W)
d.c.
1.6
1.9
2.2
2.8
a=4
for operation in this area refer to curve below
ITAV (A)
interrelation between the power (derived from the left hand graph) and the max. allowable temperatures
Tcase (°C)
Rth c-a=20°C/W
40°C/W
60°C/W
80°C/W
100°C/W
200°C/W
Tamb (°C)

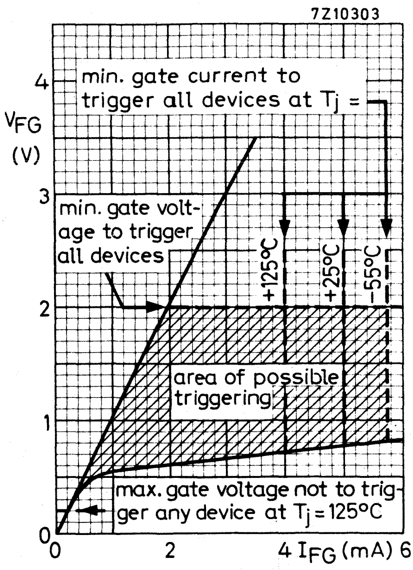

7Z10304.1
ITAV (A)
d.c.
a=1.6
1.9
2.2
2.8
4
Tamb (°C)

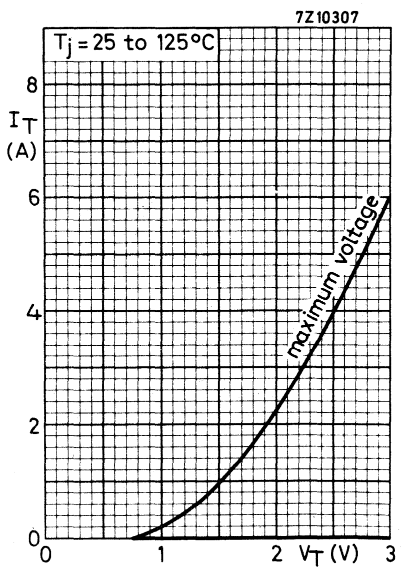

7Z10308
1000
100
10
1
$\frac{dV_D}{dt}$
(V/µs)
R_{GK} = 1kΩ
max. rate of rise of forward off-state voltage not to trigger any device against junction temperature
max
0
50
100
T_j (°C)
150

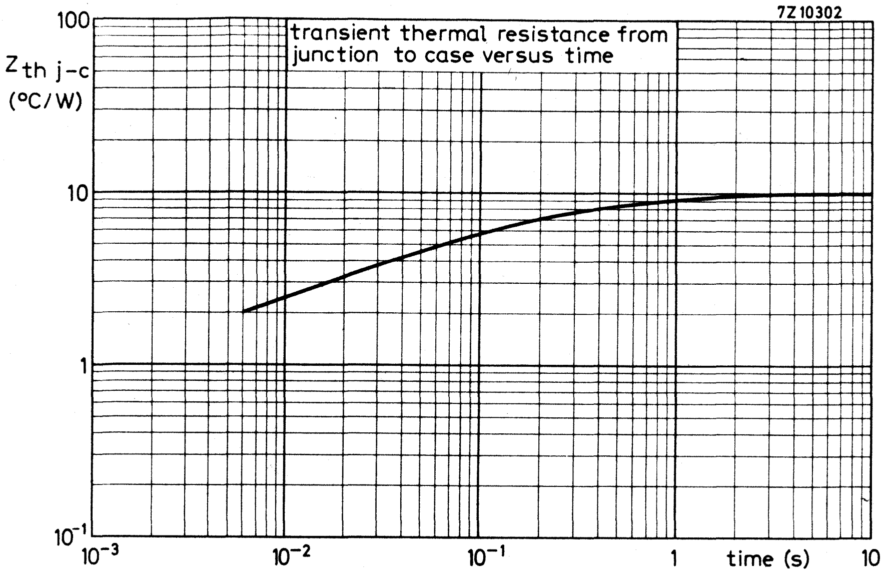

7Z10309
1000
100
10
1
$\frac{dV_D}{dt}$
(V/µs)
T_j = 125°C
max. rate of rise of forward off-state voltage not to trigger any device plotted against gate to cathode resistance
max
0
1
R_{GK} (kΩ)
2

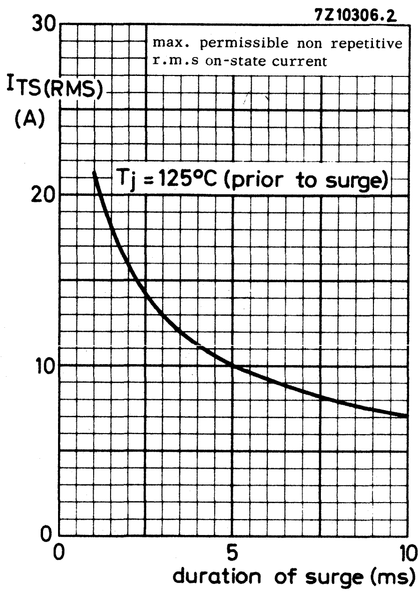

7Z10301
typical turn off time when switched from I_T = 300 mA to I_R = 175 mA versus junction temperature
40
30
20
10
0
t_q
(µs)
0
50
100
T_j (°C)
150


7Z10305
Gate characteristics
with curves
P_{GAV} = 0.05 W
δ = 0.1
$P_{GM\,max}$ = 0.5 W
area of certain
triggering
δ = 1.0
V_{FG}
(V)
6
4
2
0
0
50
I_{FG} (mA)
100


7Z10303
min. gate current to
trigger all devices at T_j =
min. gate volt-
age to trigger
all devices
+125°C
+25°C
−55°C
area of possible
triggering
max. gate voltage not to trig-
ger any device at T_j = 125°C
V_{FG}
(V)
4
3
2
1
0
0
2
4 I_{FG} (mA) 6


7Z10307
T_j = 25 to 125°C
maximum voltage
I_T
(A)
8
6
4
2
0
0
1
2 V_T (V)
3


7Z10302
transient thermal resistance from junction to case versus time
Z th j-c (°C/W)
100
10
1
10⁻¹
10⁻³
10⁻²
10⁻¹
1
time (s)
10


7Z10306.2
max. permissible non repetitive r.m.s on-state current
ITS(RMS) (A)
Tj = 125°C (prior to surge)
30
20
10
0
0
5
10
duration of surge (ms)

THYRISTORS

Also available to BS9341-F001 to F009

Silicon thyristors in metal envelopes, intended for use in power control circuits (e.g. light and motor control) and power switching systems.
The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTY79-400R to 1000R.

QUICK REFERENCE DATA

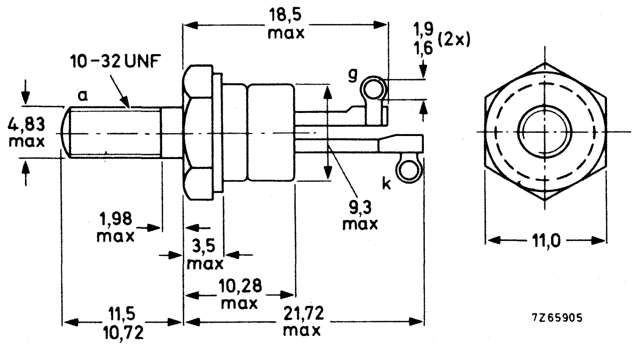
		BTY79-400R	500R	600R	800R	1000R	
Repetitive peak voltages V_{DRM}/V_{RRM}	max.	400	500	600	800	1000	V

Average on-state current	$I_{T(AV)}$	max.	10	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	16	A
Non-repetitive peak on-state current	I_{TSM}	max.	150	A

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-64: with 10-32 UNF stud (ϕ 4,83 mm).



Net mass: 7 g
Diameter of clearance hole: max. 5,2 mm
Accessories supplied on request:
56295 (PTFE bush, 2 mica washers, plain washer, tag)
56262A (mica washer, insulating ring, plain washer)

Torque on nut: min. 0,9 Nm (9 kg cm)
max. 1,7 Nm (17 kg cm)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions: across the flats: 9,5 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTY79–400R	500R	600R	800R	1000R	
Non-repetitive peak off-state voltage (t ⩽ 10 ms)	V_{DSM}**	max.	500	1100	1100	1100	1100	V
Non-repetitive peak reverse voltage (t ⩽ 5 ms)	V_{RSM}	max.	500	600	720	960	1100	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	400	500	600	800	1000	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	400	500	600	800	1000	V*

Average on-state current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{T(AV)}$	max.	10	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	16	A
Repetitive peak on-state current	I_{TRM}	max.	75	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 125 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.	150	A
I^2t for fusing (t = 10 ms)	I^2t	max.	112	A^2s
Rate of rise of on-state current after triggering with I_G = 150 mA to I_T = 30 A; dI_G/dt = 0,25 A/µs	dI_T/dt	max.	50	A/µs

Gate to cathode

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0,5	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−55 to +125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,8	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	45	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,1	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a} < 4$ °C/W (d.c. blocking) or < 8 °C/W (a.c.). For smaller heat-sinks $T_{j\ max}$ should be derated. For a.c. see Fig. 3.

** Although not recommended, higher off-state voltages may be applied without damage, but the thyristor may switch into the on-state. The rate of rise of on-state current should not exceed 100 A/µs.

CHARACTERISTICS

Anode to cathode

On-state voltage $I_T = 20$ A; $T_j = 25$ °C	V_T	<	2 V*
Rate of rise of off-state voltage that will not trigger any device; exponential method; $V_D = 2/3\ V_{DRMmax}$; $T_j = 125$ °C	dV_D/dt	<	50 V/μs
Reverse current $V_R = V_{RWMmax}$; $T_j = 125$ °C	I_R	<	3 mA
Off-state current $V_D = V_{DWMmax}$; $T_j = 125$ °C	I_D	<	3 mA
Latching current; $T_j = 25$ °C	I_L	<	150 mA
Holding current; $T_j = 25$ °C	I_H	<	75 mA

Gate to cathode

Voltage that will trigger all devices $V_D = 6$ V; $T_j = 25$°C	V_{GT}	>	1,5 V
Voltage that will not trigger any device $V_D = V_{DRMmax}$; $T_j = 125$ °C	V_{GD}	<	200 mV
Current that will trigger all devices $V_D = 6$ V; $T_j = 25$ °C	I_{GT}	>	30 mA
On request (see ordering note on page 4)	I_{GT}	>	20 mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from $V_D = 800$ V to $I_T = 25$ A; $I_{GT} = 250$ mA; $dI_G/dt = 0,25$ A/μs; $T_j = 25$ °C	t_{gt}	<	1,5 μs
	t_r	typ.	0,2 μs

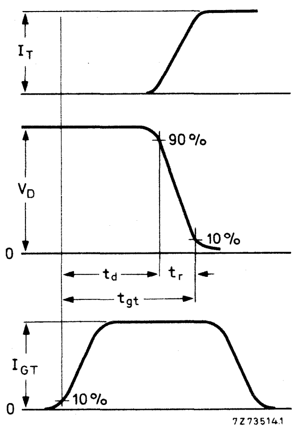


Fig. 2 Gate-controlled turn-on time definitions.

* Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTE

The terminals should neither be bent nor twisted; they should be soldered into the circuit so that there is no strain on them.
During soldering the heat conduction to the junction should be kept to a minimum.

ORDERING NOTE

Types with low gate trigger current, $I_{GT} > 20$ mA, are available on request. Add suffix A to the type number when ordering: e.g. BTY79A-400R.

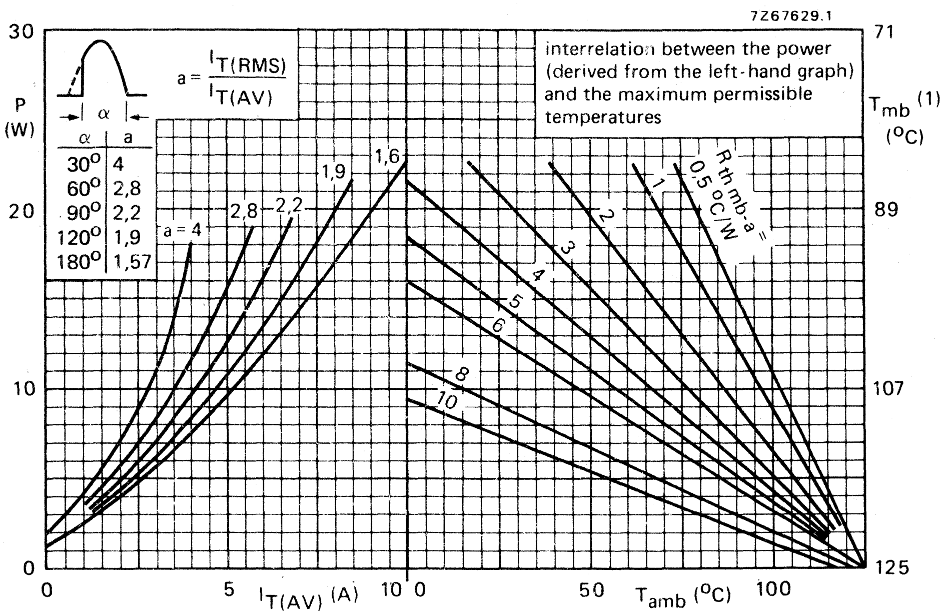


Fig. 3 (1) T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leqslant 6$ °C/W.

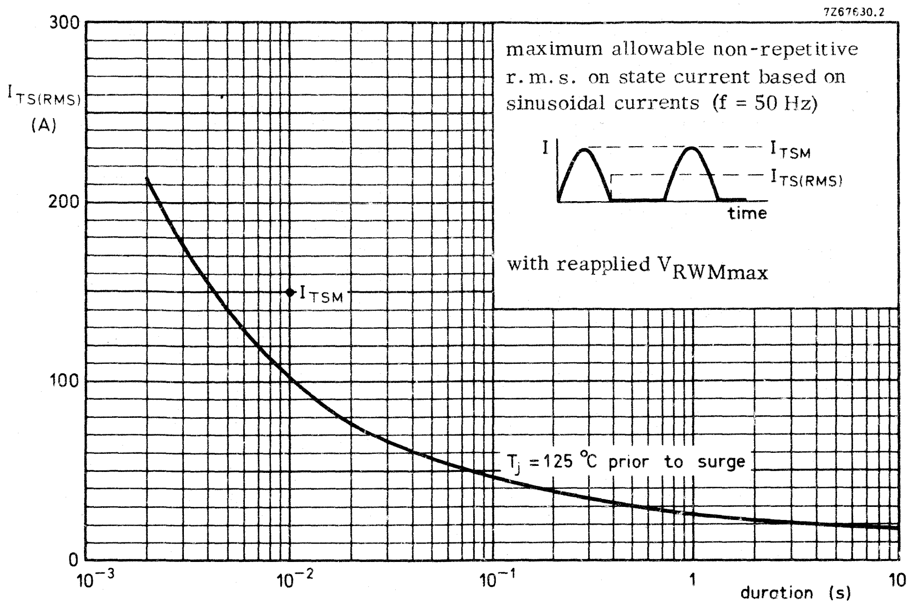

7Z67630.2
maximum allowable non-repetitive r.m.s. on state current based on sinusoidal currents (f = 50 Hz)
I
I_{TSM}
$I_{TS(RMS)}$
time
with reapplied V_{RWMmax}
$I_{TS(RMS)}$ (A)
I_{TSM}
T_j = 125 °C prior to surge
duration (s)
300
200
100
0
10^{-3}
10^{-2}
10^{-1}
1
10

Fig. 4.

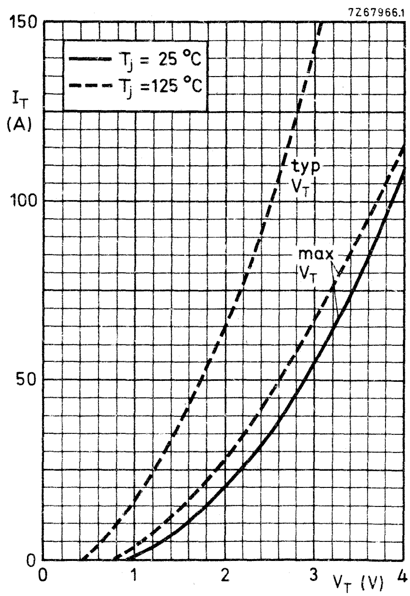

7Z67966.1
T_j = 25 °C
T_j =125 °C
I_T (A)
typ V_T
max V_T
V_T (V)
150
100
50
0
0
1
2
3
4

Fig. 5.

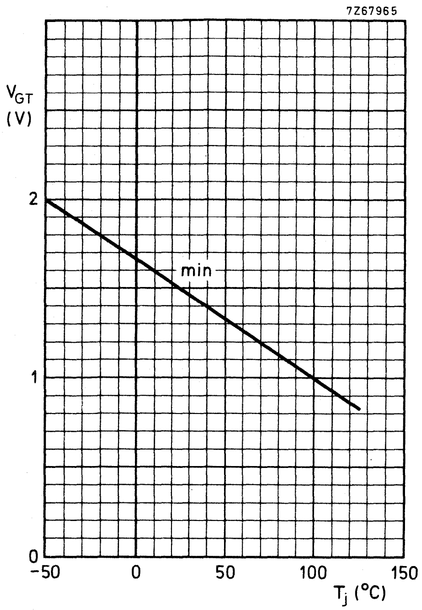


Fig. 6 Minimum gate voltage that will trigger all devices as a function of T_j.

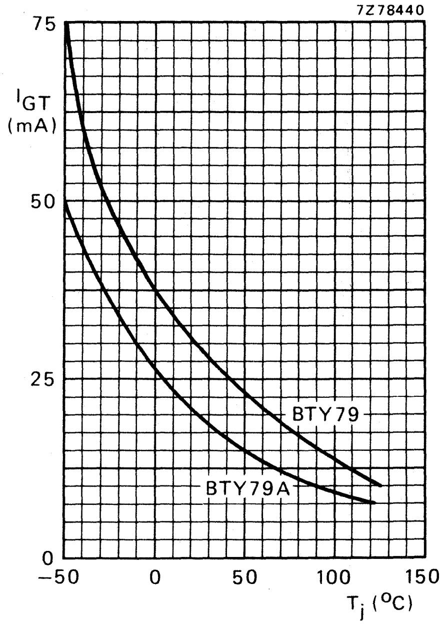


Fig. 7 Minimum gate current that will trigger all devices as a function of T_j.

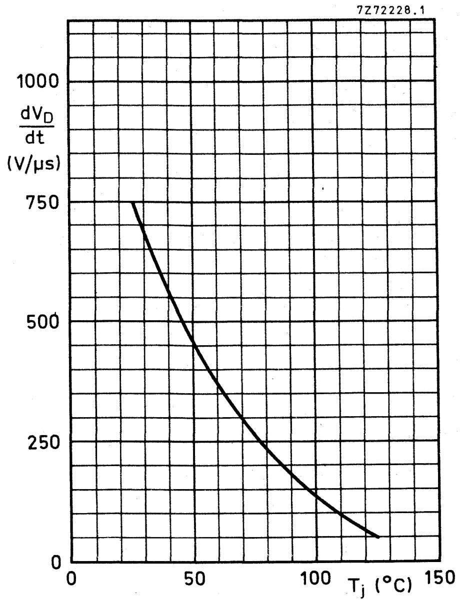


Fig. 8 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of T_j.

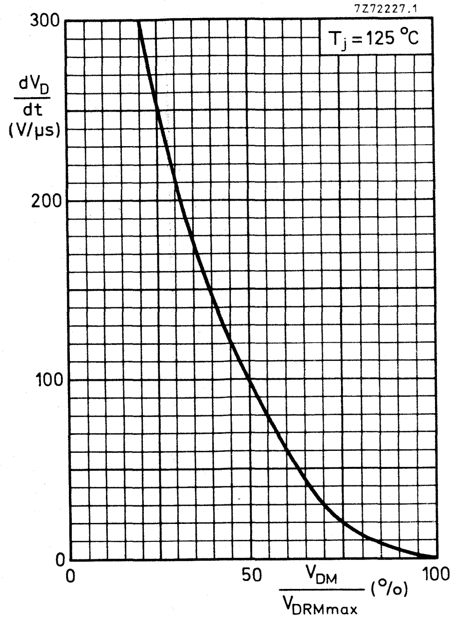
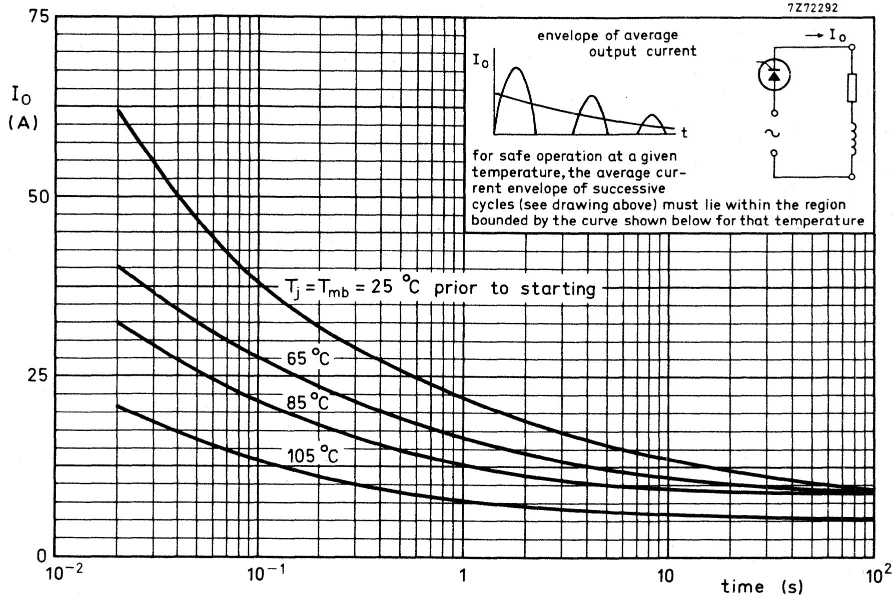


Fig. 9 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of applied voltage.



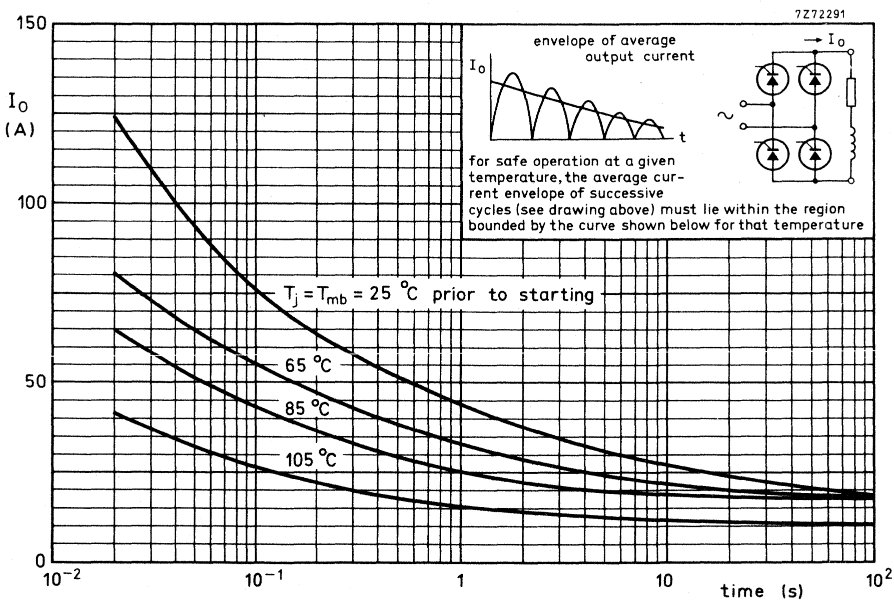


Fig. 10 Limits for starting or inrush currents.

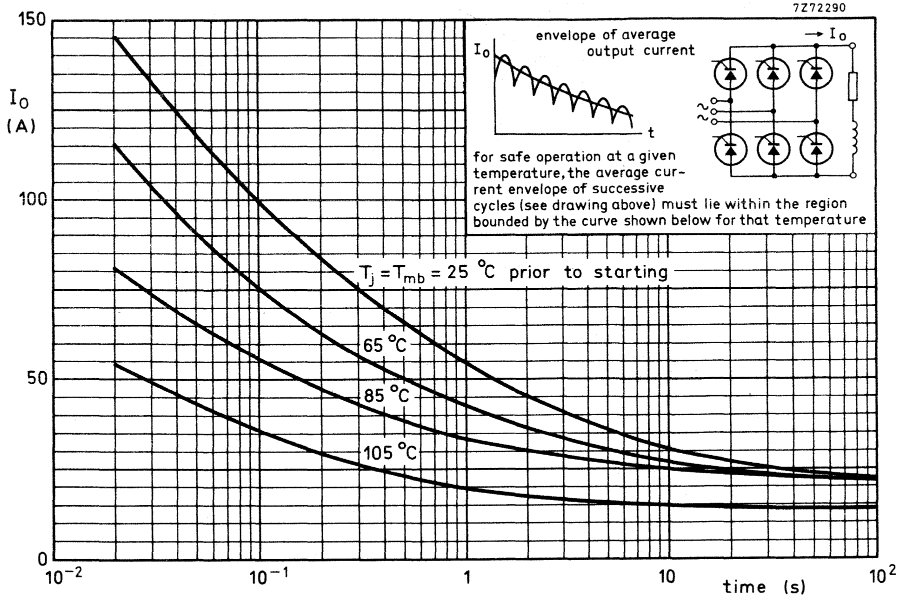


Fig. 11 Limits for starting or inrush currents.

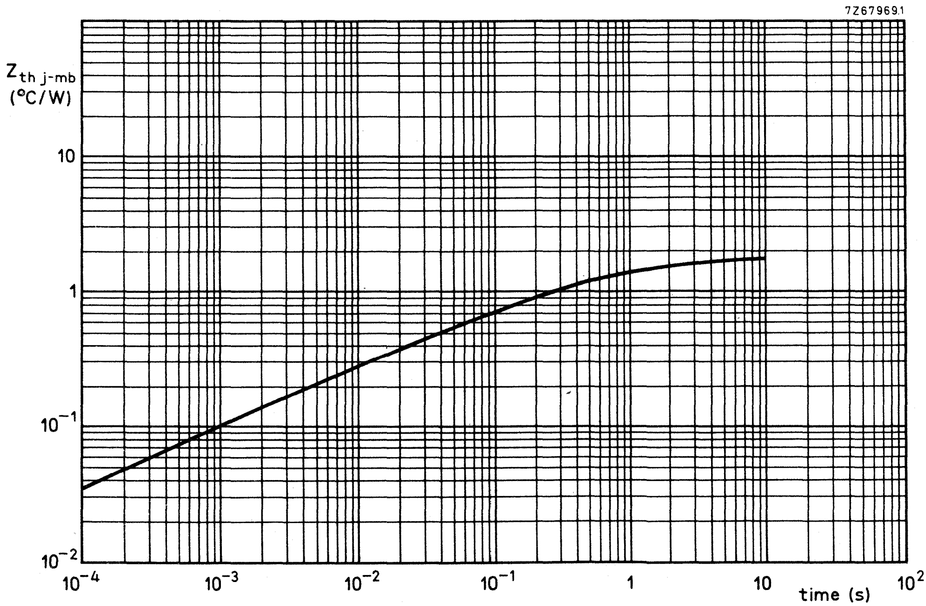


Fig. 12.

THYRISTORS

Silicon thyristors in metal envelopes, intended for power control and power switching applications. The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTY87-400R to 800R.

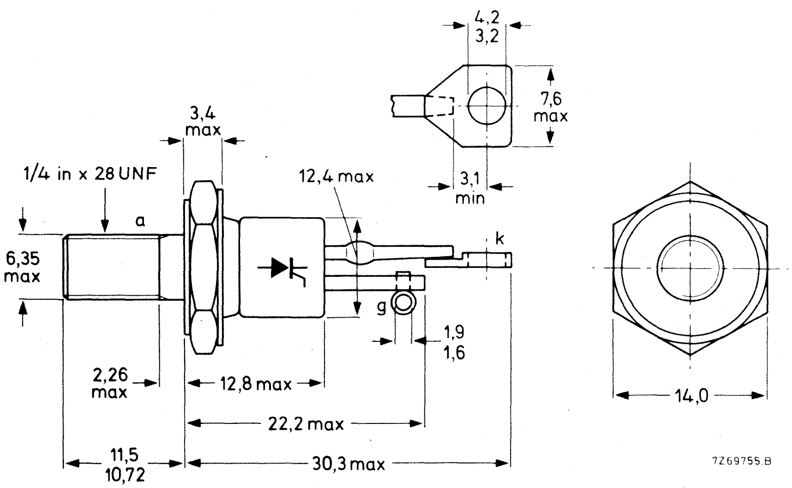
QUICK REFERENCE DATA

			BTY87-400R	500R	600R	800R	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	400	500	600	800	V
Average on-state current	$I_{T(AV)}$	max.				16	A
R.M.S. on-state current	$I_{T(RMS)}$	max.				25	A
Non-repetitive peak on-state current	I_{TSM}	max.				140	A

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-48: with ¼ in x 28 UNF stud (ϕ 6,35 mm).



Net mass: 14 g
Diameter of clearance hole: max. 6,5 mm
Accessories supplied on request: 56264A
(mica washer, insulating ring, soldering tag)

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)
Supplied with the device:
1 nut, 1 lock washer
Nut dimensions across the flats: 11,1 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTY87-400R	500R	600R	800R	
Non-repetitive peak off-state voltage ($t \leq 10$ ms)	V_{DSM}	max.	500	850	850	850	V
Non-repetitive peak reverse voltage ($t \leq 5$ ms)	V_{RSM}	max.	500	600	850	960	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	400	500	600	800	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	400	500	600	800	V *

Average on-state current (averaged over any 20 ms period) up to T_{mb} = 52 °C	$I_{T(AV)}$	max.	16	A
at T_{mb} = 85 °C	$I_{T(AV)}$	max.	10	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	25	A
Repetitive peak on-state current	I_{TRM}	max.	140	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 125 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.	140	A
I^2t for fusing (t = 10 ms)	I^2t	max.	100	A^2s
Rate of rise of on-state current after triggering with I_G = 325 mA to I_T = 50 A	dI_T/dt	max.	20	A/µs

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	5	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0,5	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−55 to + 125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,6	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,09	°C/W

OPERATING NOTE

The terminals should neither be bent nor twisted; they should be soldered into the circuit so that there is no strain on them.
During soldering the heat conduction to the junction should be kept to a minimum.

* To ensure thermal stability: $R_{th\ j\text{-}a} < 4,5$ °C/W (d.c. blocking) or < 9 °C/W (a.c.). For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see Fig. 3.

CHARACTERISTICS

Anode to cathode

On-state voltage $I_T = 50$ A; $T_j = 25$ °C	V_T	<	3 V *
Rate of rise of off-state voltage that will not trigger any device; exponential method; $V_D = 2/3\ V_{DRMmax}$; $T_j = 125$ °C	dV_D/dt	<	20 V/μs
Reverse current $V_R = V_{RWMmax}$; $T_j = 125$ °C	I_R	<	3 mA
Off-state current $V_D = V_{DWMmax}$; $T_j = 125$ °C	I_D	<	3 mA
Latching current; $T_j = 25$ °C	I_L	typ.	20 mA
Holding current; $T_j = 25$ °C	I_H	typ.	10 mA

Gate to cathode

Voltage that will trigger all devices $V_D = 6$ V; $T_j = 25$ °C	V_{GT}	>	3,5 V
Voltage that will not trigger any device $V_D = V_{DRMmax}$; $T_j = 125$ °C	V_{GD}	<	200 mV
Current that will trigger all devices $V_D = 6$ V; $T_j = 25$ °C	I_{GT}	>	65 mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from $V_D = 400$ V to $I_T = 50$ A; $I_{GT} = 200$ mA; $T_j = 25$ °C	t_{gt}	typ.	2 μs

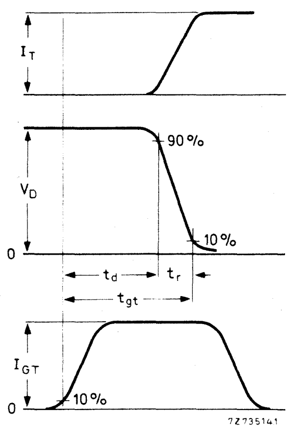


Fig. 2 Gate-controlled turn-on time definitions.

* Measured under pulse conditions to avoid excessive dissipation.

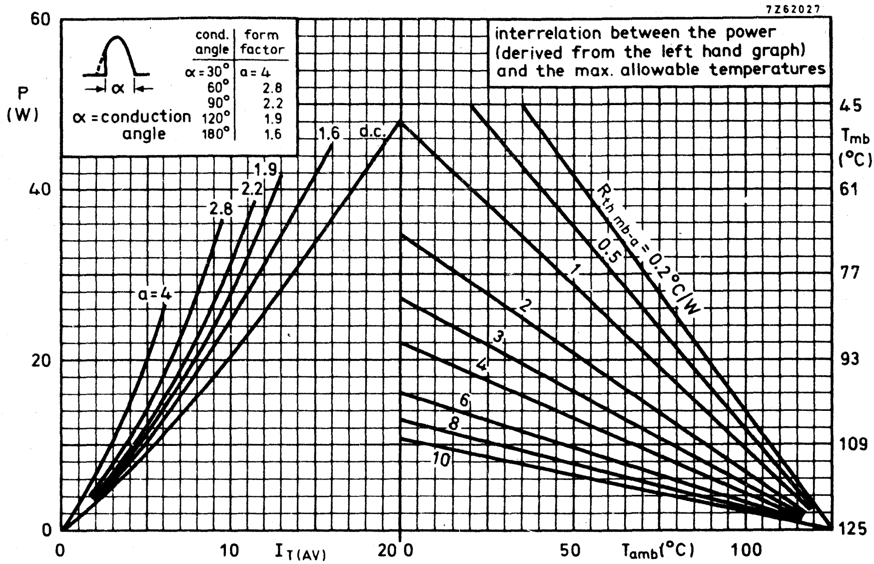

7Z62027
60
40
20
0
P
(W)
cond. angle
form factor
α = 30°
a = 4
60°
2.8
90°
2.2
120°
1.9
180°
1.6
α = conduction angle
a=4
2.8
2.2
1.9
1.6
d.c.
interrelation between the power
(derived from the left hand graph)
and the max. allowable temperatures
45
T_{mb}
(°C)
61
77
93
109
125
$R_{th\ mb-a}$ = 0.2°C/W
0.5
1
2
3
4
6
8
10
0
10
$I_{T(AV)}$
20
0
50
T_{amb}(°C)
100

Fig. 3.

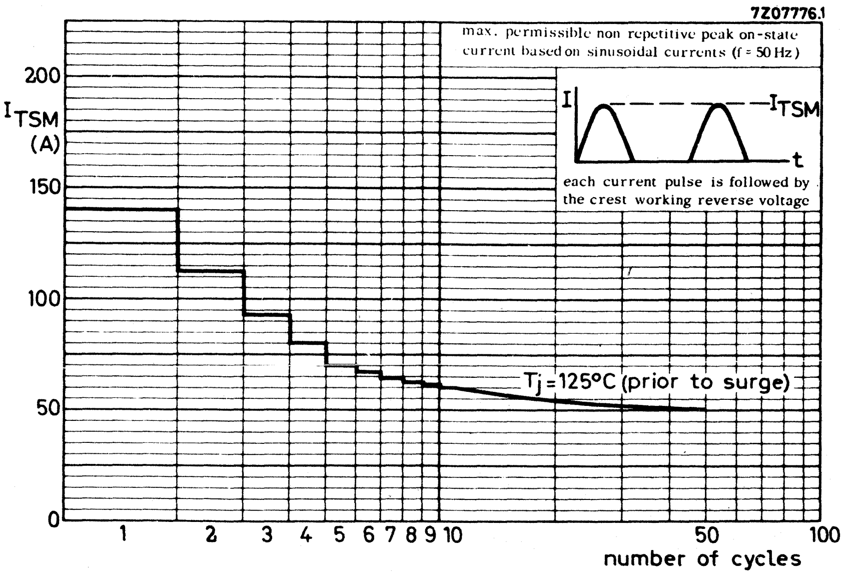

7Z07776.1
max. permissible non repetitive peak on-state current based on sinusoidal currents (f = 50 Hz)
I
I_{TSM}
t
each current pulse is followed by the crest working reverse voltage
200
I_{TSM}
(A)
150
100
50
0
T_j = 125°C (prior to surge)
1
2
3
4
5
6
7
8
9
10
50
100
number of cycles

Fig. 4.

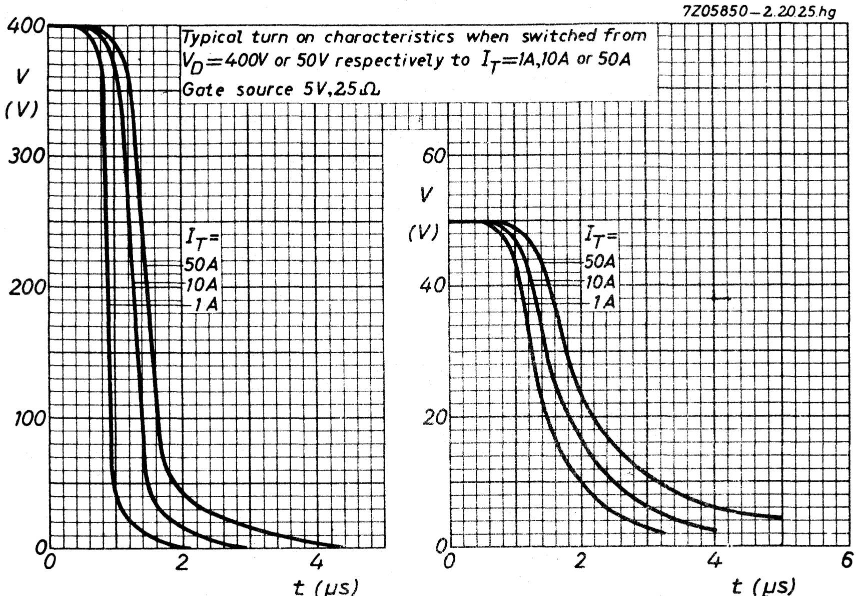

7Z05850—2.20.25.hg
Typical turn on characteristics when switched from V_D=400V or 50V respectively to I_T=1A,10A or 50A
Gate source 5V,25Ω
400
V
(V)
300
200
100
0
I_T=
50A
10A
1A
0
2
4
t (μs)
60
V
(V)
40
20
0
I_T=
50A
10A
1A
0
2
4
6
t (μs)

Fig. 5.

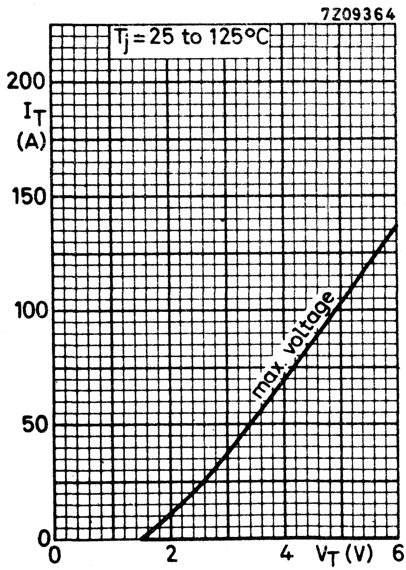

7Z09364
T_j=25 to 125°C
200
I_T
(A)
150
100
50
0
max. voltage
0
2
4
V_T (V)
6

Fig. 6.

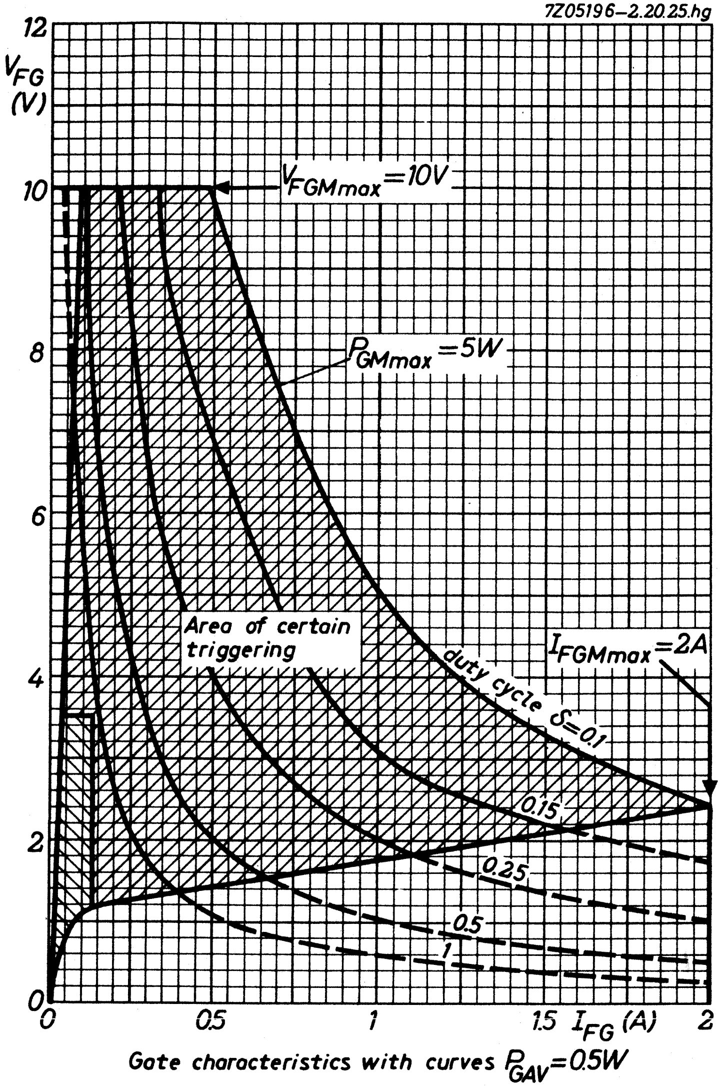

7Z05196-2.20.25.hg
V_{FG} (V)
V_{FGMmax}=10V
P_{GMmax}=5W
Area of certain triggering
I_{FGMmax}=2A
duty cycle δ=0.1
0.15
0.25
0.5
1
I_{FG} (A)
0
0.5
1
1.5
2
2
4
6
8
10
12
Gate characteristics with curves P_{GAV}=0.5W

Fig. 7.

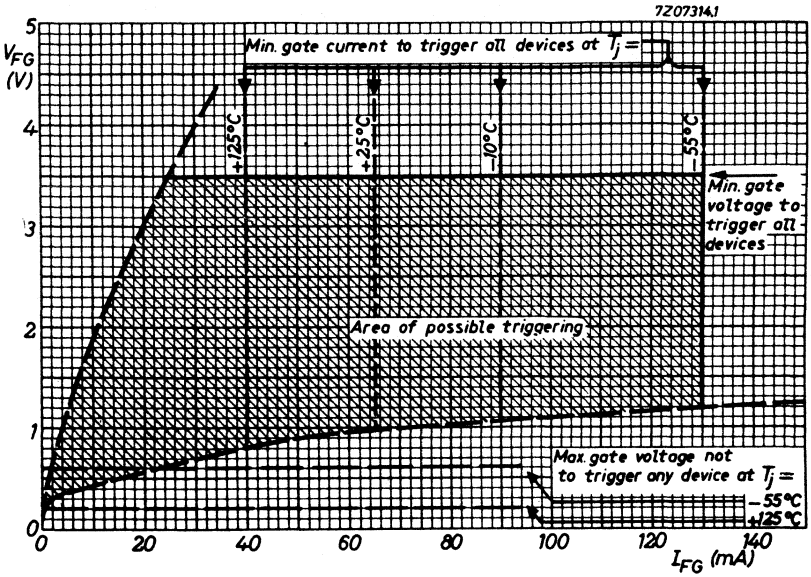

7Z07314.1
V_{FG} (V)
Min. gate current to trigger all devices at T_j =
+125°C
+25°C
−10°C
−55°C
Min. gate voltage to trigger all devices
Area of possible triggering
Max. gate voltage not to trigger any device at T_j =
−55°C
+125°C
I_{FG} (mA)
0
20
40
60
80
100
120
140
0
1
2
3
4
5

Fig. 8.

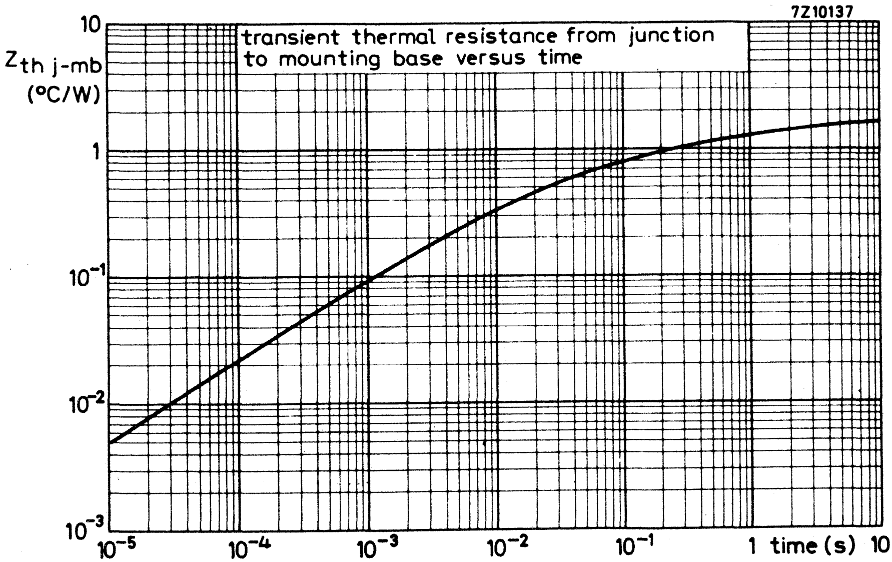

7Z10137
transient thermal resistance from junction to mounting base versus time
$Z_{th\ j\text{-}mb}$ (°C/W)
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10

Fig. 9.

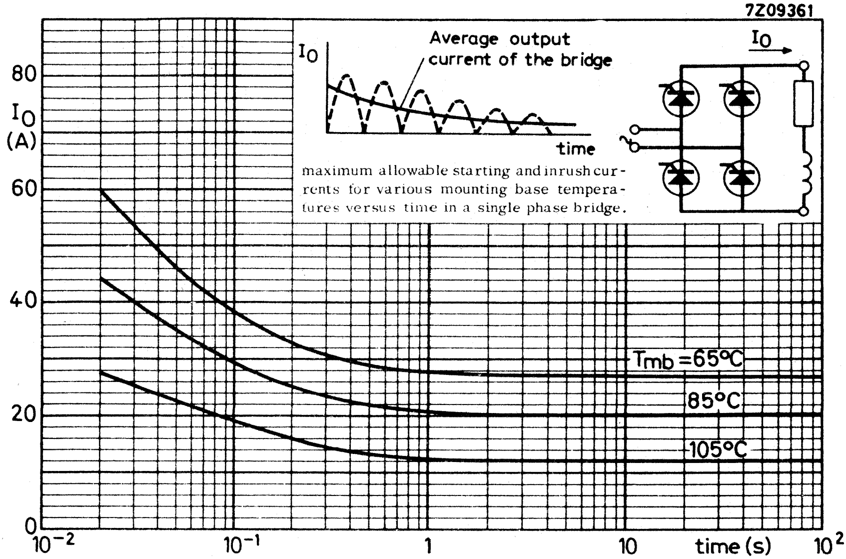

7Z09361
Average output current of the bridge
I_O
time
maximum allowable starting and inrush currents for various mounting base temperatures versus time in a single phase bridge.
80
I_O
(A)
60
40
20
0
T_{mb} = 65°C
85°C
105°C
10^{-2}
10^{-1}
1
10
time (s)
10^2

Fig. 10.

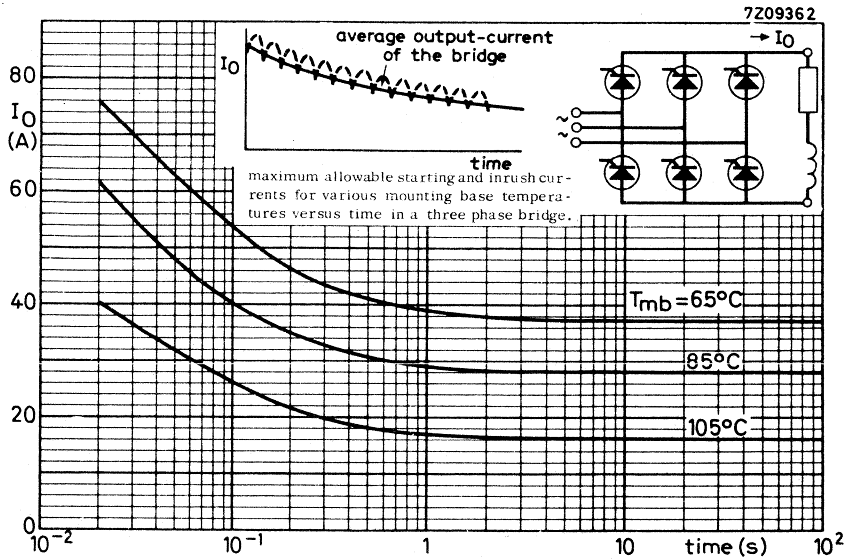

7Z09362
average output-current of the bridge
I_O
time
maximum allowable starting and inrush currents for various mounting base temperatures versus time in a three phase bridge.
80
I_O
(A)
60
40
20
0
T_{mb} = 65°C
85°C
105°C
10^{-2}
10^{-1}
1
10
time (s)
10^2

Fig. 11.

THYRISTORS

Silicon thyristors in metal envelopes, intended for power control and power switching applications. The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTY91-400R to 800R.

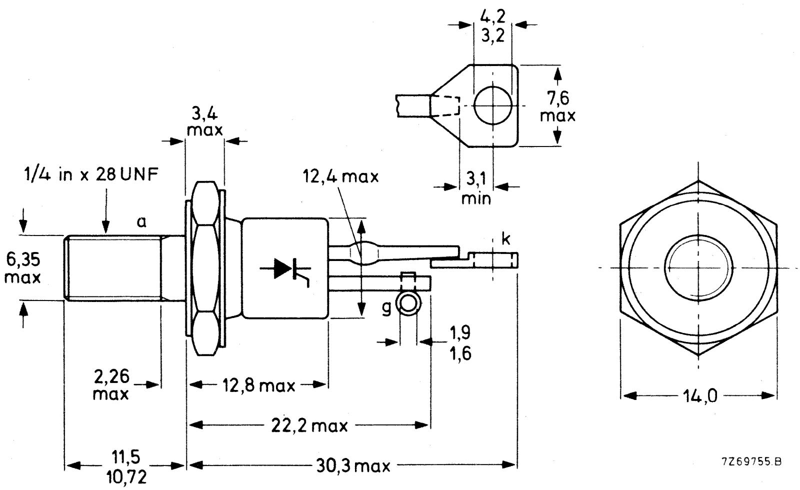
QUICK REFERENCE DATA

			BTY91-400R	500R	600R	800R	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	400	500	600	800	V
Average on-state current	$I_{T(AV)}$	max.				16	A
R.M.S. on-state current	$I_{T(RMS)}$	max.				25	A
Non-repetitive peak on-state current	I_{TSM}	max.				200	A

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-48: with ¼ in x 28 UNF stud (ϕ 6,35 mm).



Net mass: 14 g
Diameter of clearance hole: max. 6,5 mm
Accessories supplied on request: 56264A
(mica washer, insulating ring, soldering tag)

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)
Supplied with the device:
1 nut, 1 lock washer
Nut dimensions across the flats: 11,1 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Anode to cathode

			BTY91-400R	500R	600R	800R	
Non-repetitive peak off-state voltage ($t \leq 10$ ms)	V_{DSM}	max.	500	850	850	850	V
Non-repetitive peak reverse voltage ($t \leq 5$ ms)	V_{RSM}	max.	500	600	720	960	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	400	500	600	800	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	400	500	600	800	V *

Average on-state current (averaged over any 20 ms period) up to T_{mb} = 77 °C	$I_{T(AV)}$	max.	16	A
at T_{mb} = 85 °C	$I_{T(AV)}$	max.	14	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	25	A
Repetitive peak on-state current	I_{TRM}	max.	200	A
Non-repetitive peak on-state current; t = 10 ms; half sine-wave; T_j = 125 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.	200	A
I^2t for fusing (t = 10 ms)	I^2t	max.	200	A^2s
Rate of rise of on-state current after triggering with I_G = 200 mA to I_T = 50 A	dI_T/dt	max.	20	A/μs

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	5	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0,5	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}	−55 to + 125		°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,6	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0,09	°C/W

OPERATING NOTE

The terminals should neither be bent nor twisted; they should be soldered into the circuit so that there is no strain on them.
During soldering the heat conduction to the junction should be kept to a minimum.

* To ensure thermal stability: $R_{th\ j\text{-}a} < 4,5$ °C/W (d.c. blocking) or < 9 °C/W (a.c.). For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see Fig. 3.

CHARACTERISTICS

Anode to cathode

On-state voltage			
I_T = 50 A; T_j = 25 °C	V_T	<	2 V *
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 V_{DRMmax}; T_j = 125 °C	dV_D/dt	<	20 V/µs
Reverse current			
V_R = V_{RWMmax}; T_j = 125 °C	I_R	<	3 mA
Off-state current			
V_D = V_{DWMmax}; T_j = 125 °C	I_D	<	3 mA
Latching current; T_j = 25 °C	I_L	typ.	20 mA
Holding current; T_j = 25 °C	I_H	typ.	10 mA

Gate to cathode

Voltage that will trigger all devices			
V_D = 6 V; T_j = 25 °C	V_{GT}	>	3 V
Voltage that will not trigger any device			
V_D = V_{DRMmax}; T_j = 125 °C	V_{GD}	<	200 mV
Current that will trigger all devices			
V_D = 6 V; T_j = 25 °C	I_{GT}	>	40 mA

Switching characteristics

Gate-controlled turn-on time (t_{gt} = t_d + t_r) when switched from V_D = 400 V to I_T = 10 A; I_{GT} = 200 mA; T_j = 25 °C	t_{gt}	typ.	2 µs

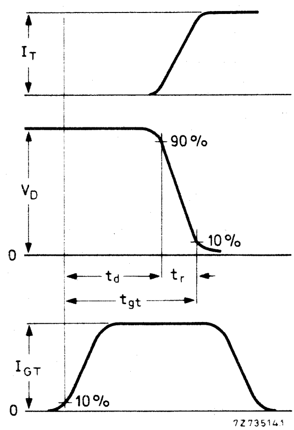


Fig. 2 Gate-controlled turn-on time definitions.

* Measured under pulse conditions to avoid excessive dissipation.

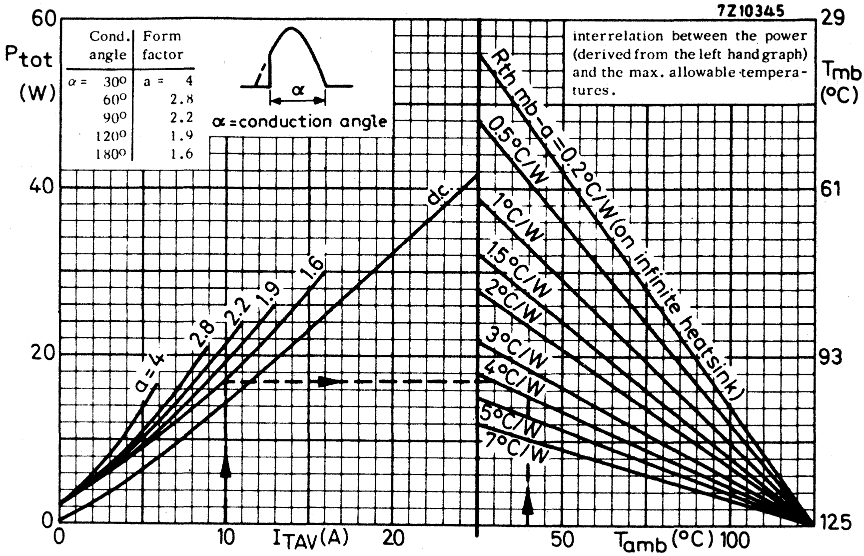

7Z10345
Ptot (W)
Cond. angle | Form factor
α = 30° | a = 4
60° | 2.8
90° | 2.2
120° | 1.9
180° | 1.6
α = conduction angle
interrelation between the power (derived from the left hand graph) and the max. allowable temperatures.
Rth mb-a = 0.2°C/W (on infinite heatsink)
0.5°C/W
1°C/W
1.5°C/W
2°C/W
3°C/W
4°C/W
5°C/W
7°C/W
a = 4
2.8
2.2
1.9
1.6
d.c.
ITAV (A)
Tamb (°C)
Tmb (°C)
60
40
20
0
0
10
20
50
100
29
61
93
125

Fig. 3.

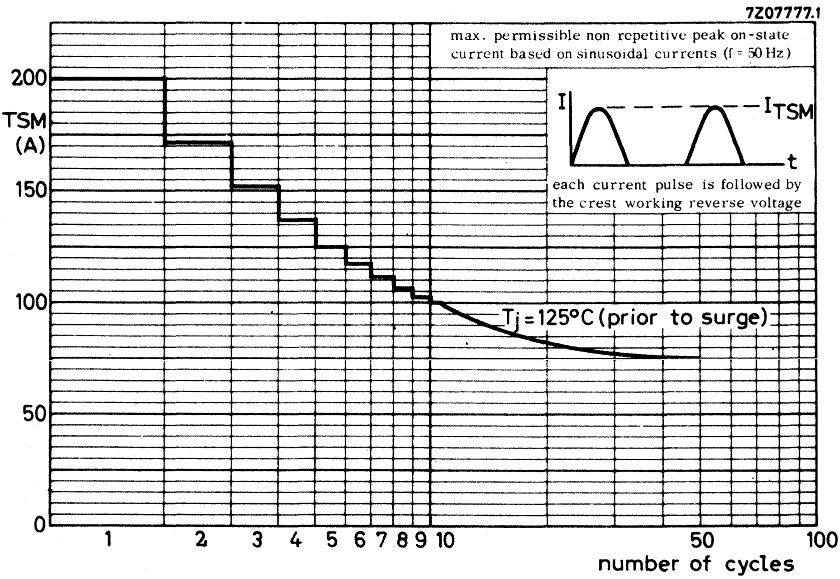

7Z07777.1
max. permissible non repetitive peak on-state current based on sinusoidal currents (f = 50 Hz)
I
ITSM
t
each current pulse is followed by the crest working reverse voltage
ITSM (A)
Tj = 125°C (prior to surge)
200
150
100
50
0
1
2
3
4
5
6
7
8
9
10
50
100
number of cycles

Fig. 4.

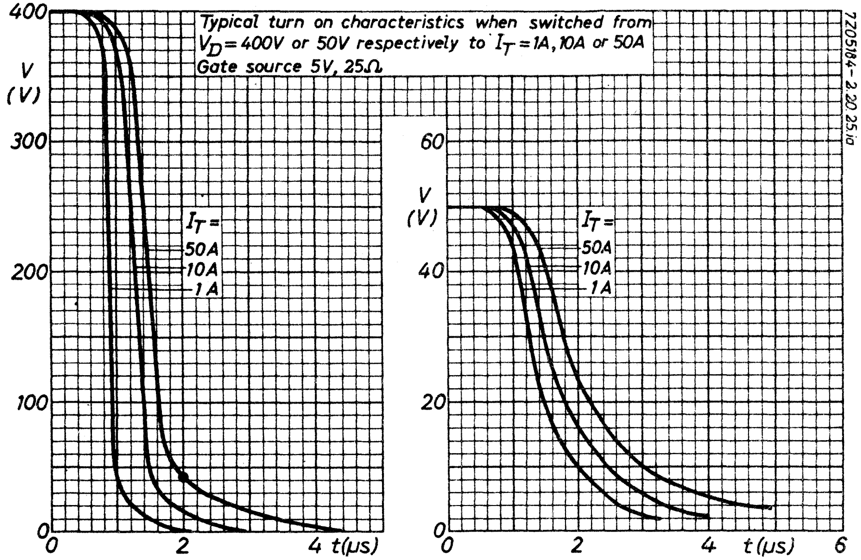

Typical turn on characteristics when switched from V_D = 400V or 50V respectively to I_T = 1A, 10A or 50A
Gate source 5V, 25Ω
7Z05184-2.20.25.ia
V (V)
400
300
200
100
0
I_T =
50A
10A
1A
0
2
4
t(μs)
60
40
20
6

Fig. 5.

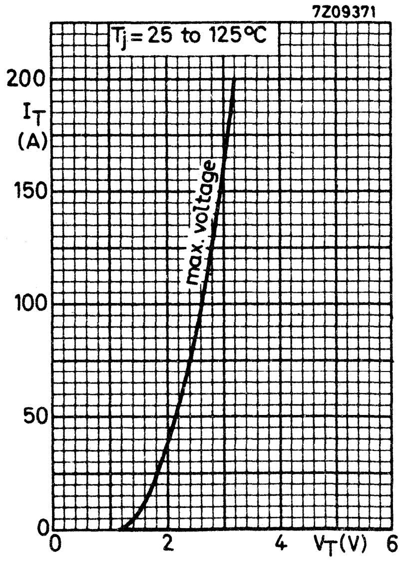

7Z09371
T_j = 25 to 125°C
I_T (A)
200
150
100
50
0
max. voltage
2
4
V_T(V)
6

Fig. 6.

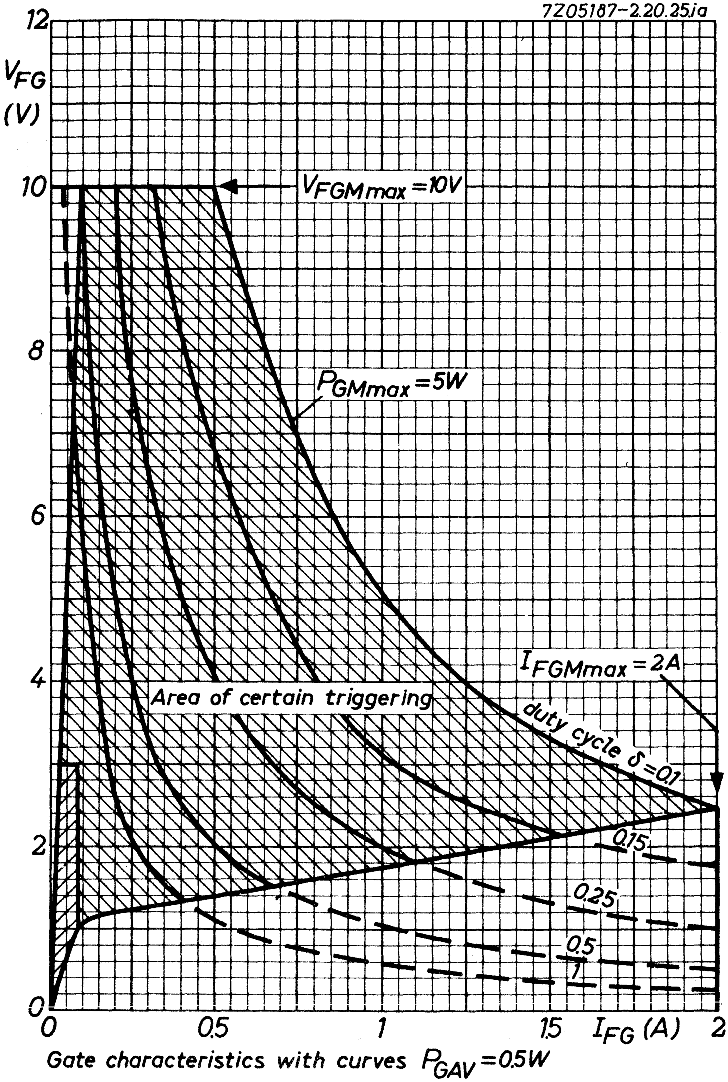

7Z05187-2.20.25.ia
12
V_{FG}
(V)
10
8
6
4
2
0
V_{FGMmax} = 10V
P_{GMmax} = 5W
I_{FGMmax} = 2A
duty cycle δ = 0.1
0.15
0.25
0.5
1
Area of certain triggering
0
0.5
1
1.5
I_{FG} (A)
2
Gate characteristics with curves P_{GAV} = 0.5W

Fig. 7.

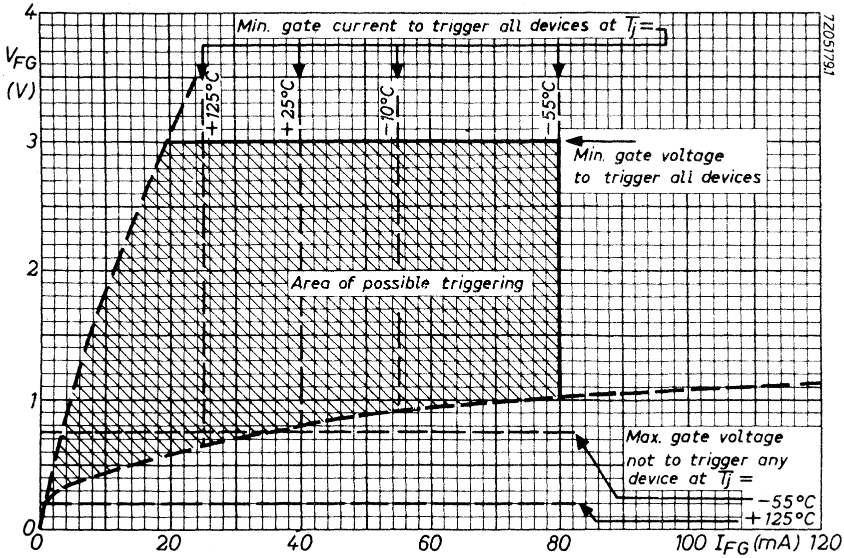

7Z05179.1
V_{FG} (V)
Min. gate current to trigger all devices at T_j =
+125°C
+25°C
−10°C
−55°C
Min. gate voltage to trigger all devices
Area of possible triggering
Max. gate voltage not to trigger any device at T_j =
−55°C
+125°C
I_{FG} (mA)
0
20
40
60
80
100
120
1
2
3
4

Fig. 8.

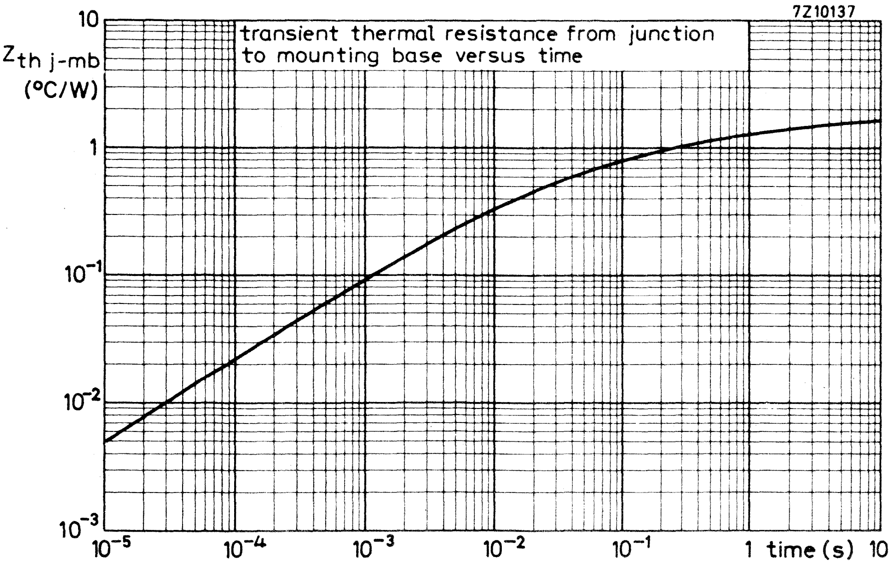

7Z10137
transient thermal resistance from junction to mounting base versus time
$Z_{th\ j\text{-}mb}$ (°C/W)
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10

Fig. 9.

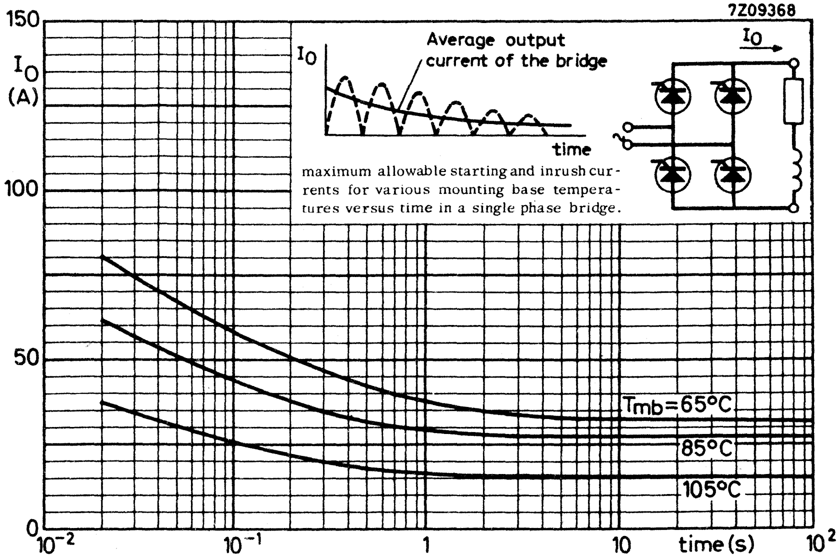

7Z09368
150
I_O
(A)
100
50
0
10^{-2}
10^{-1}
1
10
time (s)
10^2
I_O
Average output
current of the bridge
time
maximum allowable starting and inrush currents for various mounting base temperatures versus time in a single phase bridge.
T_{mb}=65°C
85°C
105°C

Fig. 10.

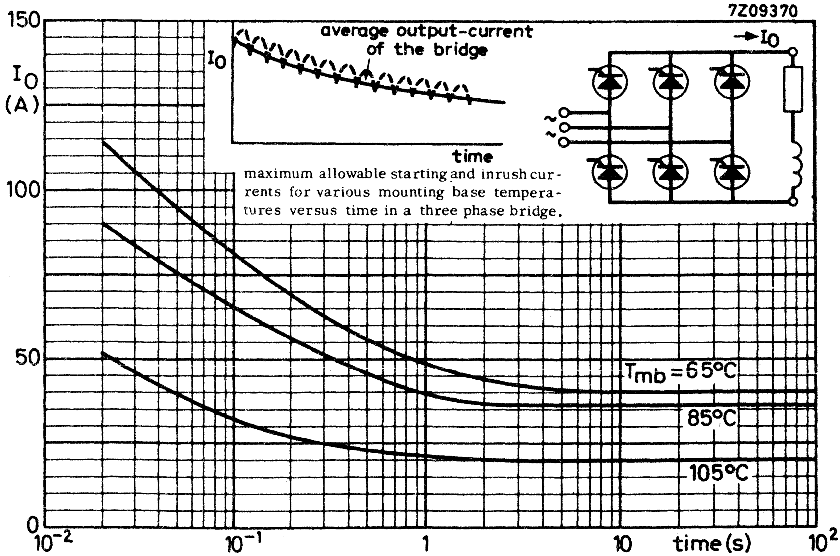

7Z09370
150
I_O
(A)
100
50
0
10^{-2}
10^{-1}
1
10
time (s)
10^2
I_O
average output-current
of the bridge
time
maximum allowable starting and inrush currents for various mounting base temperatures versus time in a three phase bridge.
T_{mb} =65°C
85°C
105°C

Fig. 11.

TRIACS

Triacs

$I_{T(RMS)max}$ A		V_{DRMmax} (V) 400	500	600	650	800	1000	1200	1400	1600
6	BT137		○	●						
10	BT138		●	●						
15	BT139		●	●						
15	BTW43G			●		●	●	●		
15	BTW43H			●		●	●	●		
25	BTX94H	●		●		●	●	●		
25	BTX94J	●		●		●	●	●		
40	BTW41G		●	●		●				
40	BTW41H		●	●		●				
55	BTW34G			●		●	●	●	●	●
55	BTW34H			●		●	●	●	●	●

TRIACS

Glass-passivated, eutectic-bonded triacs intended for use in applications requiring high bidirectional transient and blocking voltage capability, and high thermal cycling performance with very low thermal resistances, e.g. a.c. power control applications such as lighting, industrial and domestic heating and motor control and switching systems.

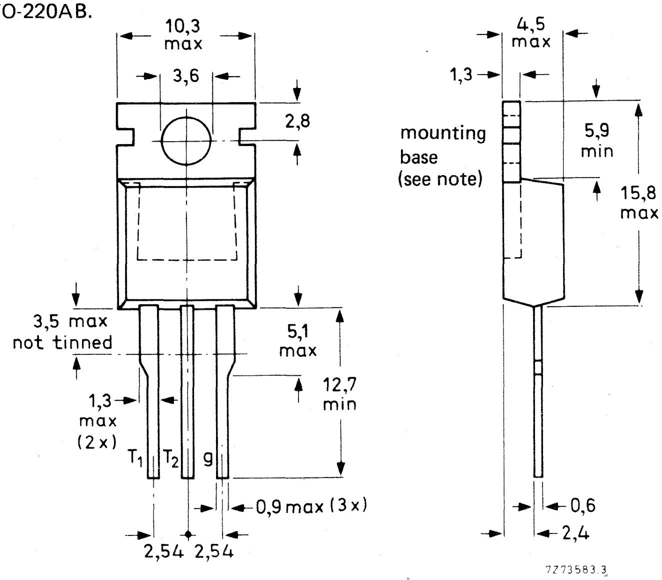
QUICK REFERENCE DATA

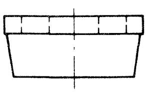
			BT137-500	600	
Repetitive peak off-state voltage	V_{DRM}	max.	500	600	V
R.M.S. on-state current	$I_{T(RMS)}$	max.	6		A
Non-repetitive peak on-state current	I_{TSM}	max.	55		A

MECHANICAL DATA

Dimensions in mm

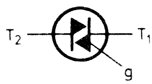
Fig. 1 TO-220AB.





Net mass: 2 g

Note: The exposed metal mounting base is directly connected to terminal T_2.



Supplied on request: accessories (see data sheets Mounting instructions and accessories for TO-220 envelopes) and a version with lower gate trigger current.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages (in either direction)

			BT137-500	600	
Non-repetitive peak off-state voltage ($t \leq 10$ ms)	V_{DSM}	max.	500	600	V*
Repetitive peak off-state voltage ($\delta \leq 0{,}01$)	V_{DRM}	max.	500	600	V
Crest working off-state voltage	V_{DWM}	max.	400	400	V

Currents (in either direction)

R.M.S. on-state current (conduction angle 360°) up to T_{mb} = 95 °C	$I_{T(RMS)}$	max.	6	A
Average on-state current for half-cycle operation (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{T(AV)}$	max.	3,8	A
Repetitive peak on-state current	I_{TRM}	max.	55	A
Non-repetitive peak on-state current; T_j = 110 °C prior to surge; t = 20 ms; full sine-wave	I_{TSM}	max.	55	A
I^2t for fusing (t = 10 ms)	I^2t	max.	15	A^2s
Rate of rise of on-state current after triggering with I_G = 200 mA to I_T = 12 A; dI_G/dt = 0,2 A/μs	dI_T/dt	max.	20	A/μs

Gate to terminal 1

POWER DISSIPATION

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0,5	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−40 to +125	°C
Operating junction temperature				
full-cycle operation	T_j	max.	110	°C
half-cycle operation	T_j	max.	100	°C

* Although not recommended, off-state voltages up to 800 V may be applied without damage, but the triac may switch into the on-state. The rate of rise of on-state current should not exceed 6 A/μs.

THERMAL RESISTANCE

From junction to mounting base		
full-cycle operation	$R_{th\ j\text{-}mb}$	= 2,0 °C/W
half-cycle operation	$R_{th\ j\text{-}mb}$	= 2,4 °C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	= 0,3 °C/W

Influence of mounting method

1. Heatsink mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$	= 0,3 °C/W
b. with heatsink compound and 0,06 mm maximum mica insulator	$R_{th\ mb\text{-}h}$	= 1,4 °C/W
c. with heatsink compound and 0,1 mm max. mica insulator (56369)	$R_{th\ mb\text{-}h}$	= 2,2 °C/W
d. with heatsink compound and 0,25 mm max. alumina insulator (56367)	$R_{th\ mb\text{-}h}$	= 0,8 °C/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	= 1,4 °C/W

2. Free-air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-point.

Thermal resistance from junction to ambient in free air:
mounted on a printed-circuit board at a = any lead length
and with a copper laminate $R_{th\ j\text{-}a}$ = 60 °C/W

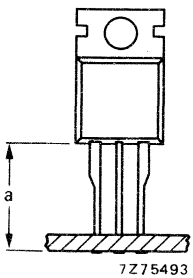


Fig. 2.

CHARACTERISTICS

Polarities, positive or negative, are identified with respect to T_1.

Voltages (in either direction)

On-state voltage I_T = 10 A; T_j = 25 °C	V_T	<	1,65 V*
Rate of rise of off-state voltage that will not trigger any device; T_j = 110 °C; see also Fig. 8; gate open circuit	dV_D/dt	<	50 V/µs
Rate of rise of commutating voltage that will not trigger any device; $-dI_T/dt$ = 5 A/ms; T_{mb} = 85 °C; $I_{T(RMS)}$ = 6 A; $V_D = V_{DWMmax}$; see also Fig. 9; gate open circuit	dV_{com}/dt	<	6 V/µs

Currents (in either direction)

Off-state current $V_D = V_{DWMmax}$; T_j = 85 °C	I_D	<	0,5 mA

		T_2 pos.	T_2 neg.	
Latching current; T_j = 25 °C				
G positive with respect to T_1	I_L	< 30	< 30	mA
G negative with respect to T_1	I_L	< 45	< 30	mA
Holding current; T_j = 25 °C				
G positive or negative	I_H	< 20	< 20	mA

Gate to terminal 1

		T_2 pos.	T_2 neg.	
Voltage and current that will trigger all devices V_D = 12 V; T_j = 25 °C				
→ G positive	V_{GT}	> 1,5	> 1,5	V
	I_{GT}	> 35	> 70	mA
G negative	$-V_{GT}$	> 1,5	> 1,5	V
	$-I_{GT}$	> 35	> 35	mA
Voltage that will not trigger any device $V_D = V_{DRMmax}$; T_j = 110 °C; G positive or negative	V_{GD}	< 250	< 250	mV

* Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

1. The triac may be soldered directly into the circuit, but the maximum permissible temperature of the soldering iron or bath is 275 °C; it must not be in contact with the joint for more than 5 seconds. Soldered joints must be at least 4,7 mm from the seal.
2. The leads should not be bent less than 2,4 mm from the seal, and should be supported during bending.
3. It is recommended that the circuit connection be made to tag T_2, rather than direct to the heatsink.
4. Mounting by means of a spring clip is the best mounting method because it offers:
   a. a good thermal contact under the crystal area and slightly lower $R_{th\ mb\text{-}h}$ values than screw mounting.
   b. safe isolation for mains operation.
   However, if a screw is used, it should be M3 cross-recess pan-head. Care should be taken to avoid damage to the plastic body.
5. For good thermal contact heatsink compound should be used between mounting base and heatsink. Values of $R_{th\ mb\text{-}h}$ given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
6. The device should not be pop-rivetted to the heatsink. However, it is permissible to press-rivet providing that rivets of soft material are used, and the press forces are slowly and carefully controlled so as to avoid shock and deformation of either heatsink or mounting tab.

OPERATING NOTES

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated in Fig. 3.

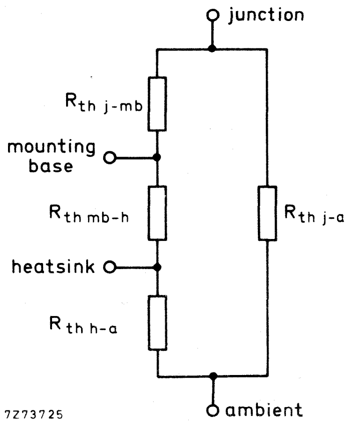


Fig. 3.

b. The method of using Figs 4 and 5 is as follows:
   Starting with the required current on the $I_{T(AV)}$ or $I_{T(RMS)}$ axis, trace upwards to meet the appropriate form factor or conduction angle curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can now be calculated from:

   $R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}$.

c. Any measurement of heatsink temperature should be made immediately adjacent to the device.

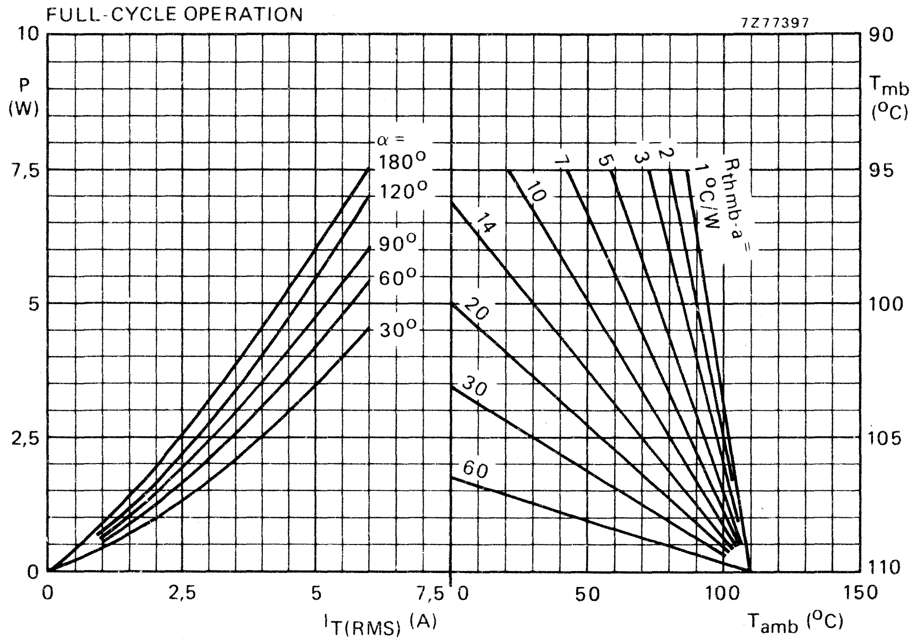
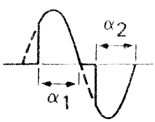


Fig. 4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.



$\alpha = \alpha_1 = \alpha_2$: conduction angle per half cycle

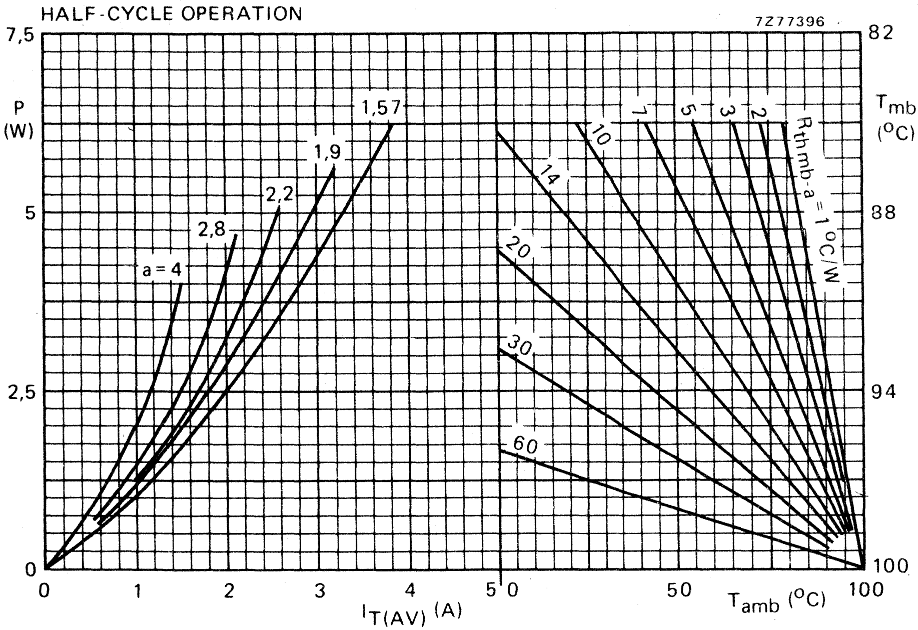
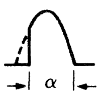


Fig. 5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.



α = conduction angle per half cycle

$$a = \text{form factor} = \frac{I_{T(RMS)}}{I_{T(AV)}}$$

α	a
30°	4
60°	2,8
90°	2,2
120°	1,9
180°	1,57

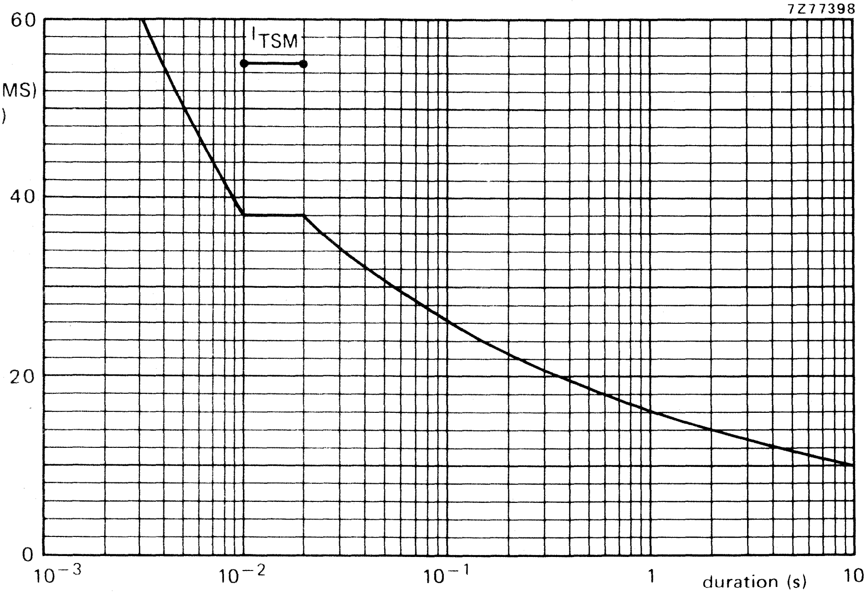
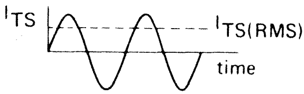


Fig. 6 Maximum permissible non-repetitive r.m.s. on-state current based on sinusoidal currents (f = 50 Hz); T_j = 110 °C prior to surge.

The triac may temporarily lose control following the surge.



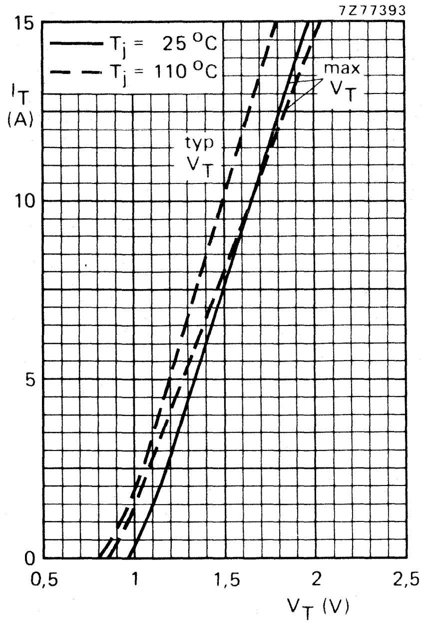


Fig. 7.

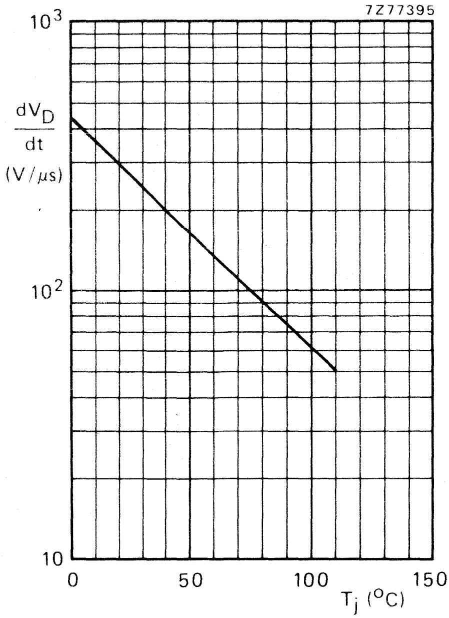
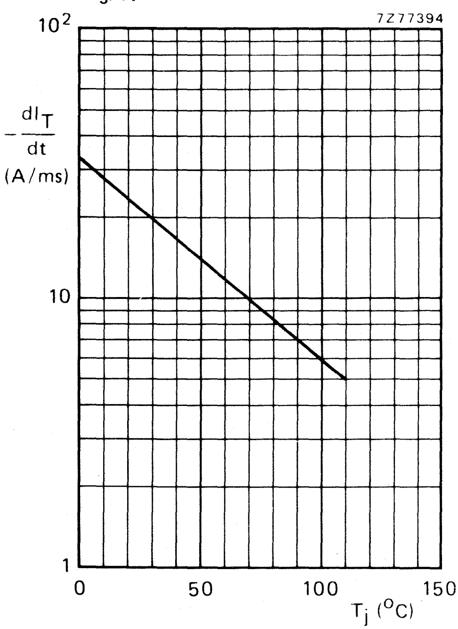


Fig. 8 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of junction temperature. Gate open circuit.



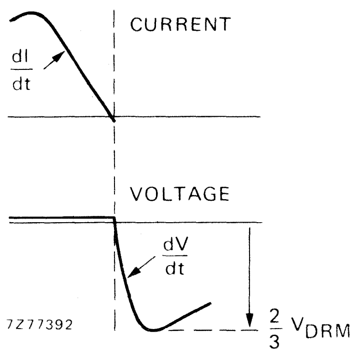


Fig. 9 Maximum rate of fall of pre-commutation current that will not trigger any device, with a post-commutation rate of rise of voltage of 6 V/μs as a function of junction temperature. Gate open circuit.

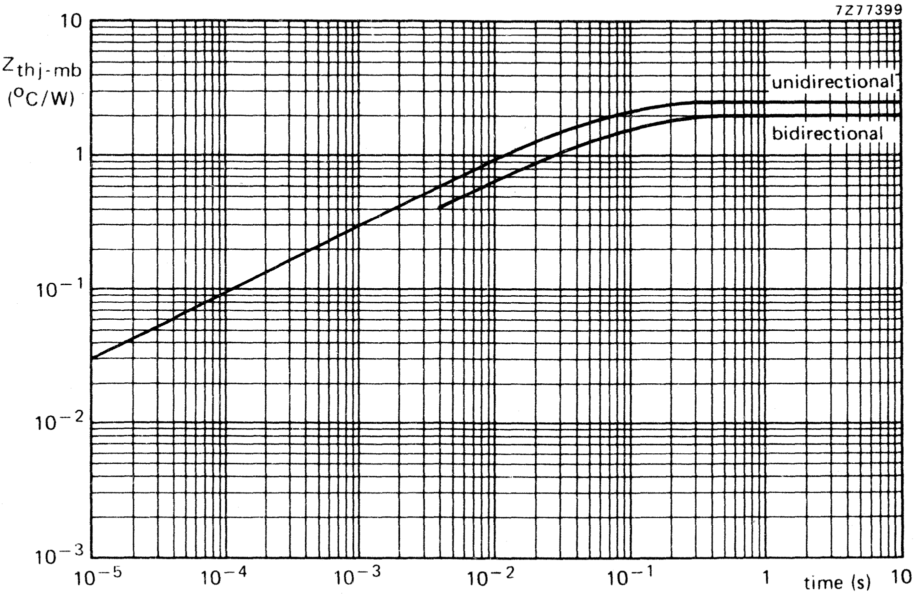

7Z77399
10
$Z_{th\,j\text{-}mb}$
($^oC/W$)
unidirectional
bidirectional
1
10^{-1}
10^{-2}
10^{-3}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10

Fig. 10.

TRIACS

Glass-passivated, eutectic-bonded triacs intended for use in applications requiring high bidirectional transient and blocking voltage capability, and high thermal cycling performance with very low thermal resistances, e.g. a.c. power control applications such as motor, industrial lighting, industrial and domestic heating control and static switching systems.

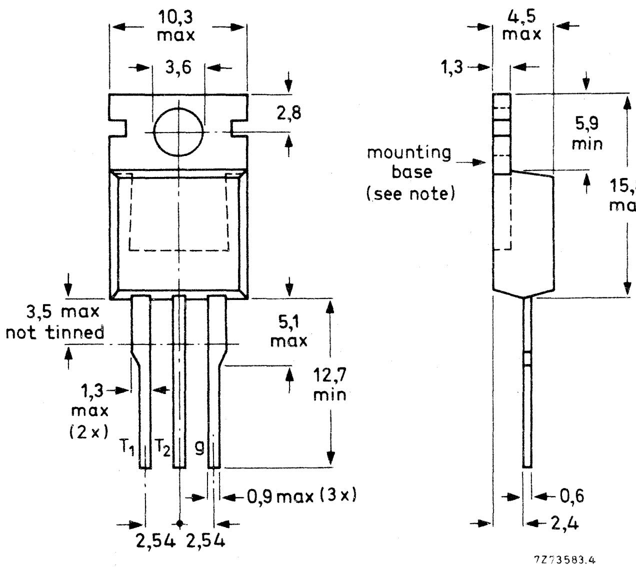
QUICK REFERENCE DATA

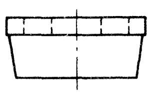
			BT138-500	600	
Repetitive peak off-state voltage	V_{DRM}	max.	500	600	V
R.M.S. on-state current	$I_{T(RMS)}$	max.	10		A
Non-repetitive peak on-state current	I_{TSM}	max.	90		A

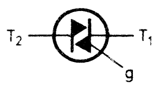
MECHANICAL DATA

Dimensions in mm

TO-220AB







Net mass: 2 g

Note: The exposed metal mounting base is directly connected to terminal T_2.

Accessories supplied on request: see data sheet Mounting instructions and accessories for TO-220 envelopes.

RATINGS

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

Voltages (in either direction)

			BT138-500	600	
Non-repetitive peak off-state voltage ($t \leq 10$ ms)	V_{DSM}	max.	500	600	V*
Repetitive peak off-state voltage ($\delta \leq 0{,}01$)	V_{DRM}	max.	500	600	V
Crest working off-state voltage	V_{DWM}	max.	400	400	V

Currents (in either direction)

R.M.S. on-state current (conduction angle 360°) up to T_{mb} = 100 °C	$I_{T(RMS)}$	max.	10	A
Average on-state current for half-cycle operation (averaged over any 20 ms period) up to T_{mb} = 88 °C	$I_{T(AV)}$	max.	6	A
Repetitive peak on-state current	I_{TRM}	max.	90	A
Non-repetitive peak on-state current; T_j = 110 °C prior to surge; t = 20 ms; full sine-wave	I_{TSM}	max.	90	A
I^2t for fusing (t = 10 ms)	I^2t	max.	40	A^2s
Rate of rise of on-state current after triggering with I_G = 200 mA to I_T = 20 A; dI_G/dt = 0,2 A/µs	dI_T/dt	max.	30	A/µs

Gate to terminal 1

Power dissipation

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0,5	W
Peak power dissipation	P_{GM}	max.	5,0	W

Temperatures

Storage temperature	T_{stg}		−40 to +125	°C
Operating junction temperature				
full-cycle operation	T_j	max.	110	°C
half-cycle operation	T_j	max.	100	°C

* Although not recommended, off-state voltages up to 800 V may be applied without damage, but the triac may switch into the on-state. The rate of rise of on-state current should not exceed 15 A/µs.

THERMAL RESISTANCE

From junction to mounting base

full-cycle operation	$R_{th\ j\text{-}mb}$	=	0,75 °C/W
half-cycle operation	$R_{th\ j\text{-}mb}$	=	1,1 °C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,1 °C/W

Influence of mounting method

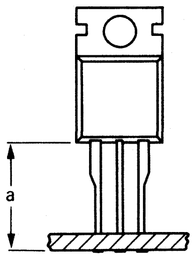
1. Heatsink mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,3 °C/W
b. with heatsink compound and 0,06 mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1,4 °C/W
c. with heatsink compound and 0,1 mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2,2 °C/W
d. with heatsink compound and 0,25 mm maximum alumina insulator (56367)	$R_{th\ mb\text{-}h}$	=	0,8 °C/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1,4 °C/W

2. Free-air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-point.
Thermal resistance from junction to ambient in free air:
mounted on a printed-circuit board at a = any lead length and with a copper laminate — $R_{th\ j\text{-}a}$ = 60 °C/W



7Z75493

CHARACTERISTICS

Polarities, positive or negative, are identified with respect to T_1.

Voltages (in either direction)

On-state voltage $I_T = 15$ A; $T_j = 25\ ^oC$	V_T	<	1,65 V*
Rate of rise of off-state voltage that will not trigger any device; $T_j = 110\ ^oC$; see also page 9; gate open circuit	dV_D/dt	<	50 V/µs
→ Rate of rise of commutating voltage that will not trigger any device; $-dI_T/dt = 5$ A/ms; $T_{mb} = 100\ ^oC$; $I_{T(RMS)} = 10$ A; $V_D = V_{DWMmax}$; see also page 9; gate open circuit	dV_{com}/dt	<	4 V/µs

Currents (in either direction)

Off-state current $V_D = V_{DWM\,max}$; $T_j = 85\ ^oC$	I_D	<	0,5 mA

			T_2 pos.	T_2 neg.	
→ Latching current; $T_j = 25\ ^oC$					
G positive	I_L	<	40	40	mA
G negative	I_L	<	60	40	mA
→ Holding current; $T_j = 25\ ^oC$					
G positive or negative	I_H	<	30	30	mA
Gate to terminal 1					
Voltage and current that will trigger all devices; $V_D = 12$ V; $T_j = 25\ ^oC$					
G positive	V_{GT}	>	1,5	1,5	V
	I_{GT}	>	35	50	mA
G negative	$-V_{GT}$	>	1,5	1,5	V
	$-I_{GT}$	>	35	35	mA
Voltage that will not trigger any device $V_D = V_{DRMmax}$; $T_j = 110\ ^oC$; G positive or negative	V_{GD}	<	250	250	mV

* Measured under pulse conditions to avoid excessive dissipation.

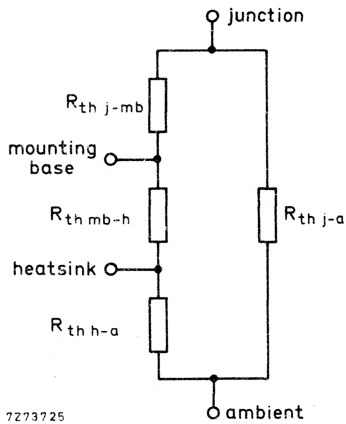
MOUNTING INSTRUCTIONS

1. The triac may be soldered directly into the circuit, but the maximum permissible temperature of the soldering iron or bath is 275 °C; it must not be in contact with the joint for more than 5 seconds. Soldered joints must be at least 4,7 mm from the seal.
2. The leads should not be bent less than 2,4 mm from the seal, and should be supported during bending.
3. It is recommended that the circuit connection be made to tag T_2, rather than direct to the heatsink.
4. Mounting by means of a spring clip is the best mounting method because it offers:
   a. a good thermal contact under the crystal area and slightly lower $R_{th\ mb\text{-}h}$ values than screw mounting.
   b. safe isolation for mains operation.
   However, if a screw is used, it should be M3 cross-recess pan head. Care should be taken to avoid damage to the plastic body.
5. For good thermal contact heatsink compound should be used between mounting base and heatsink. Values of $R_{th\ mb\text{-}h}$ given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
6. The device should not be pop-rivetted to the heatsink. However, it is permissible to press-rivet providing that rivets of soft material are used, and the press forces are slowly and carefully controlled so as to avoid shock and deformation of either heatsink or mounting tab.

OPERATING NOTES

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated below:

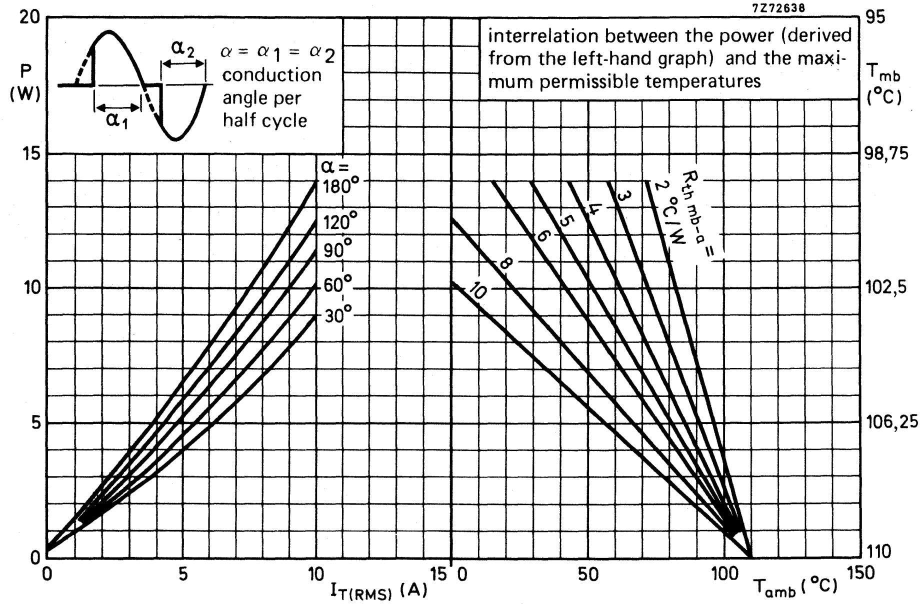


b. The method of using the graphs on page 6 is as follows:
Starting with the required current on the $I_{T(AV)}$ or $I_{T(RMS)}$ axis, trace upwards to meet the appropriate form factor or conduction angle curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can now be calculated from:

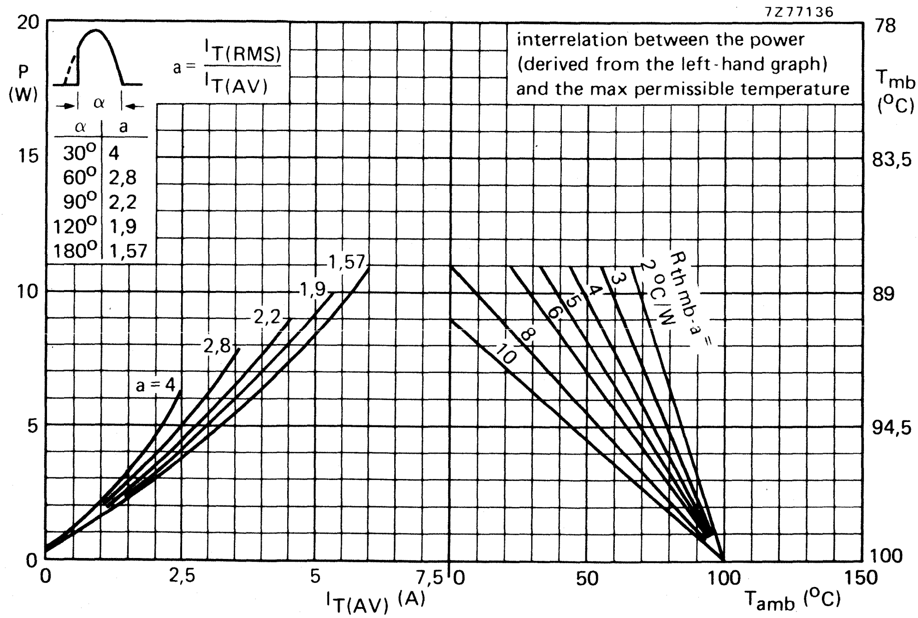
$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

c. Any measurement of heatsink temperature should be made immediately adjacent to the device.

FULL-CYCLE OPERATION

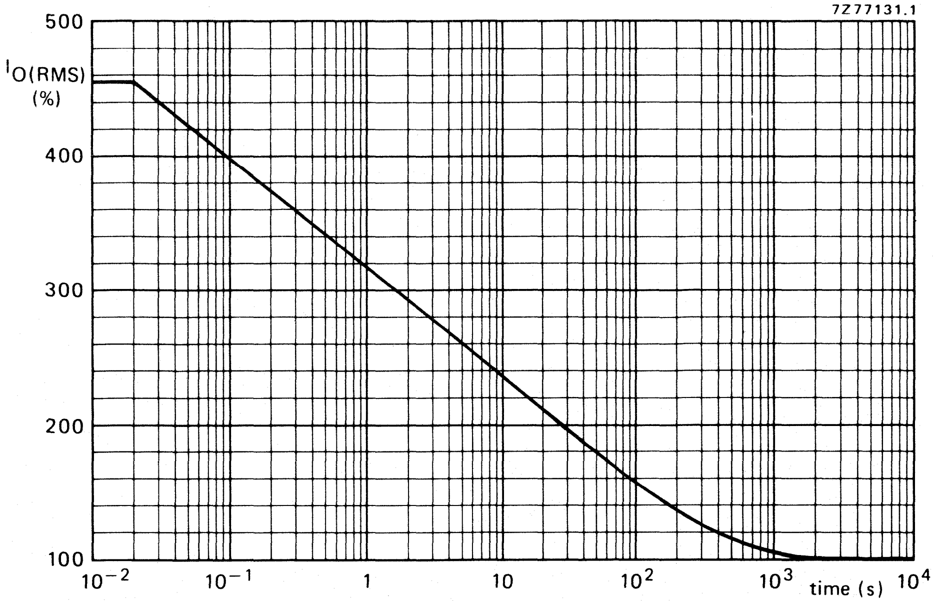


HALF-CYCLE OPERATION

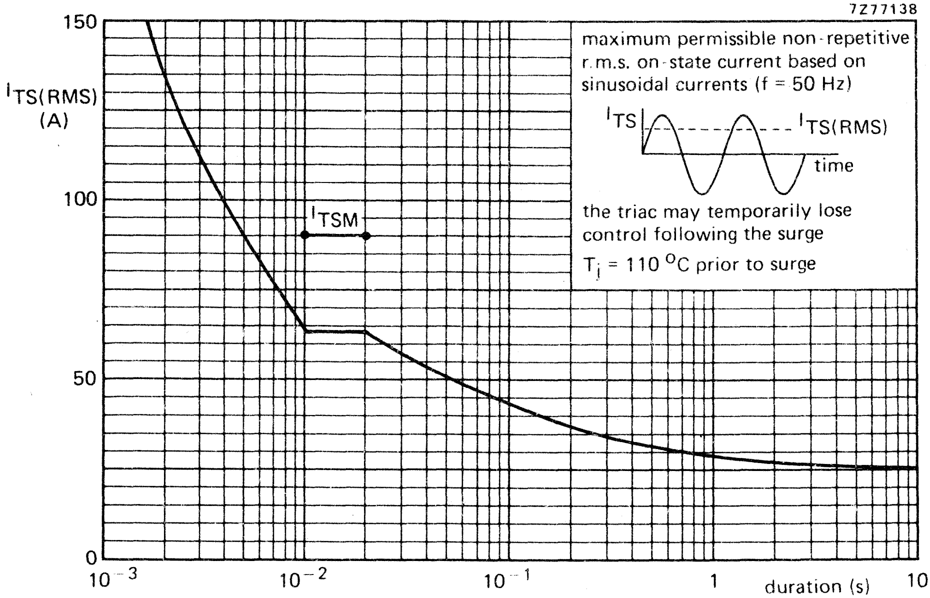


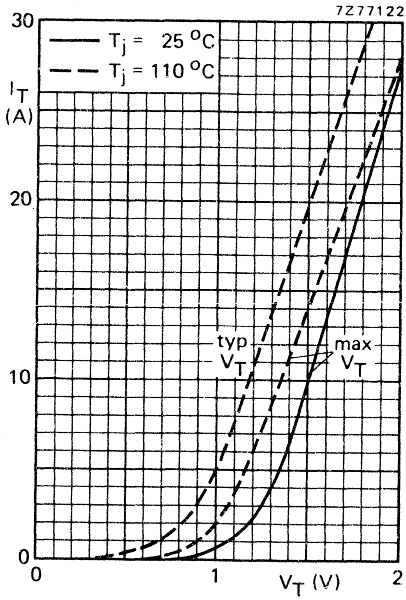
α	a
30°	4
60°	2,8
90°	2,2
120°	1,9
180°	1,57

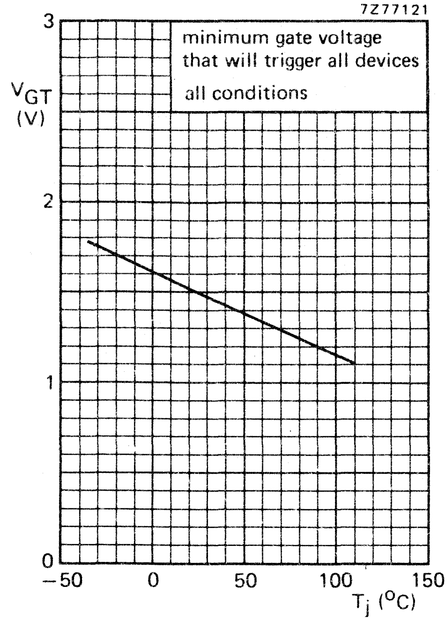
OVERLOAD OPERATION

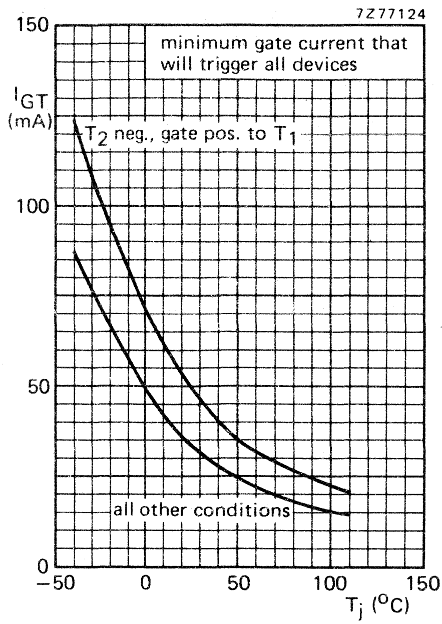


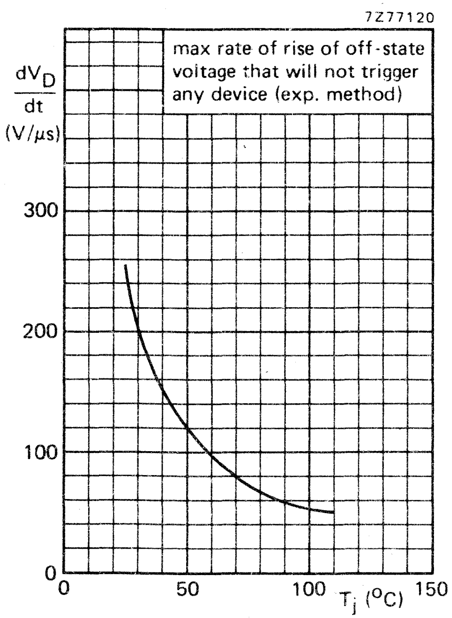
Maximum permissible duration of steady overload (provided that T_{mb} does not exceed 110 °C during and after overload) expressed as a percentage of the steady state r.m.s. rated current. For high r.m.s. overload currents precautions should be taken so that the temperature of the terminals does not exceed 125 °C. During these overload conditions the triac may loose control. Therefore the overload should be terminated by a separate protection device.

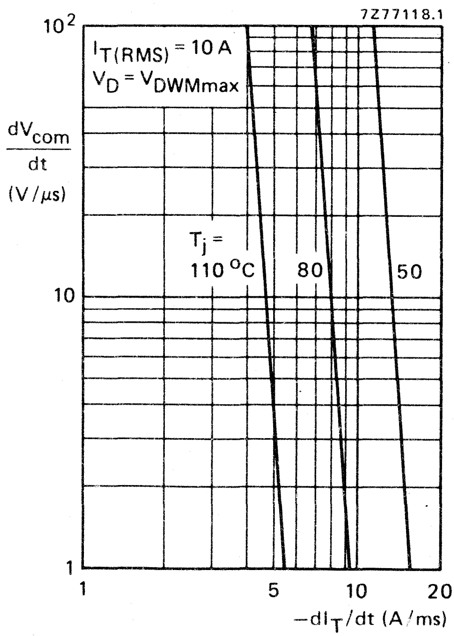

7Z77138
150
100
50
0
$I_{TS(RMS)}$ (A)
I_{TSM}
maximum permissible non-repetitive r.m.s. on-state current based on sinusoidal currents (f = 50 Hz)
I_{TS}
$I_{TS(RMS)}$
time
the triac may temporarily lose control following the surge
T_j = 110 °C prior to surge
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10


7Z77122
30
20
10
0
I_T (A)
T_j = 25 °C
T_j = 110 °C
typ V_T
max V_T
0
1
2
V_T (V)

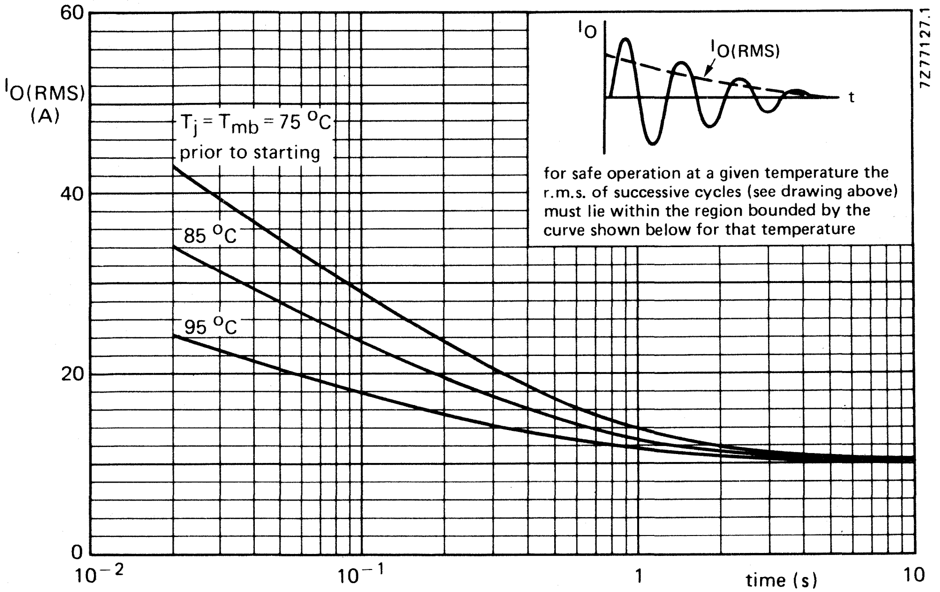

7Z77121
minimum gate voltage that will trigger all devices
all conditions
V_{GT} (V)
3
2
1
0
−50
0
50
100
150
T_j (°C)


7Z77124
minimum gate current that will trigger all devices
I_{GT} (mA)
T_2 neg., gate pos. to T_1
all other conditions
150
100
50
0
−50
0
50
100
150
T_j (°C)

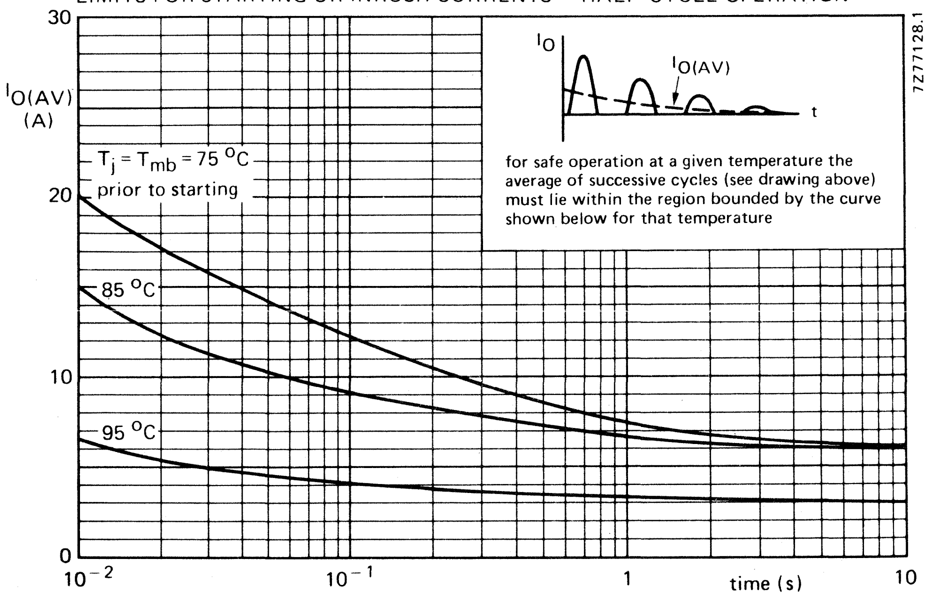

7Z77120
max rate of rise of off-state voltage that will not trigger any device (exp. method)
$\frac{dV_D}{dt}$ (V/μs)
300
200
100
0
0
50
100
150
T_j (°C)

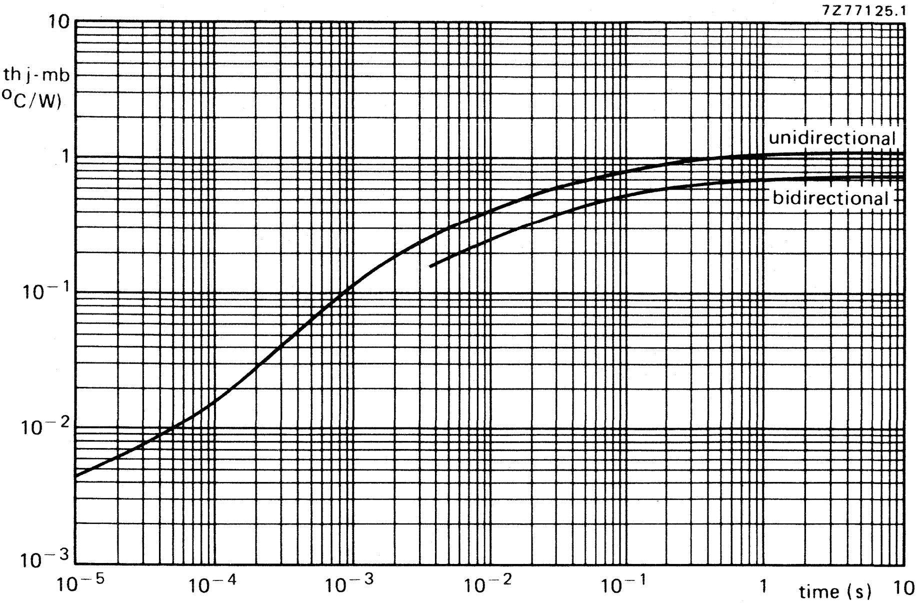

7Z77118.1
$I_{T(RMS)}$ = 10 A
$V_D = V_{DWMmax}$
$\frac{dV_{com}}{dt}$ (V/μs)
T_j = 110 °C
80
50
10^2
10
1
1
5
10
20
$-dI_T/dt$ (A/ms)

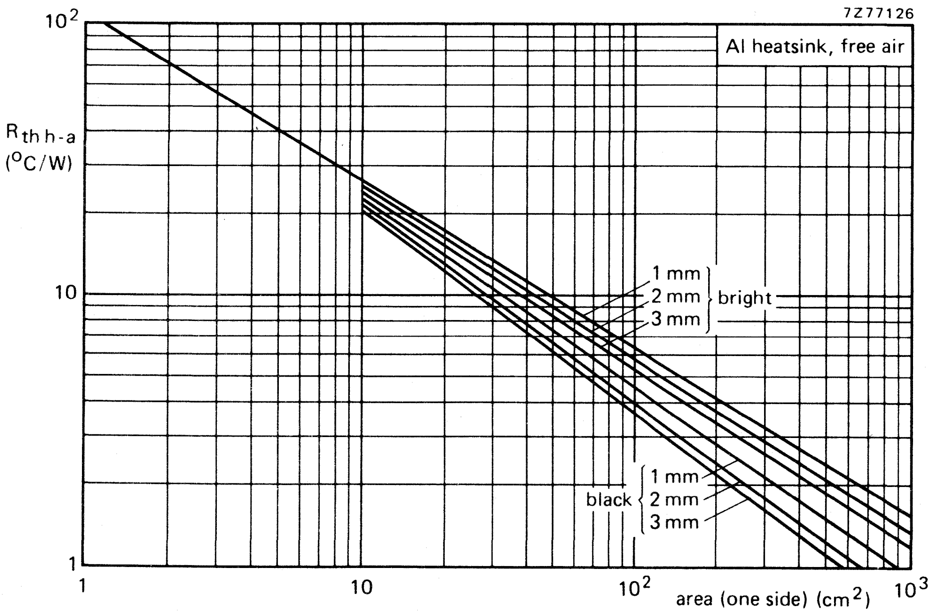
LIMITS FOR STARTING OR INRUSH CURRENTS — FULL-CYCLE OPERATION



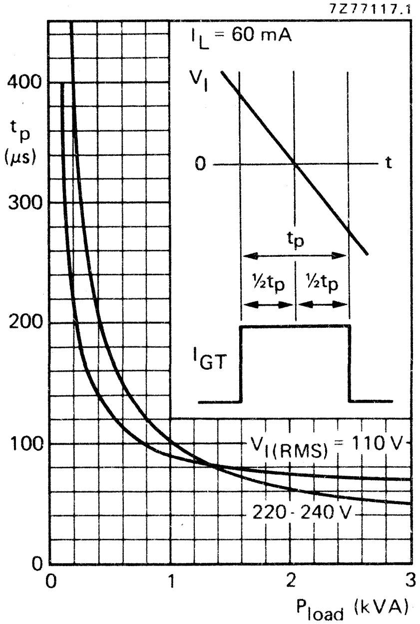
LIMITS FOR STARTING OR INRUSH CURRENTS — HALF-CYCLE OPERATION

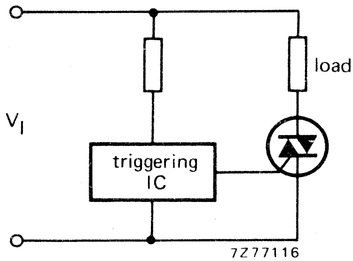



7Z77125.1
10
$Z_{th\ j\text{-}mb}$
(°C/W)
1
10^{-1}
10^{-2}
10^{-3}
unidirectional
bidirectional
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10

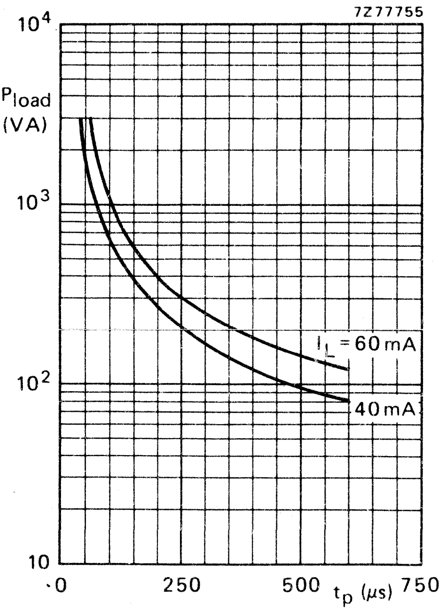

7Z77126
10^2
$R_{th\ h\text{-}a}$
(°C/W)
10
1
Al heatsink, free air
1 mm
2 mm
3 mm
bright
black
1 mm
2 mm
3 mm
1
10
10^2
area (one side) (cm^2)
10^3

APPLICATION INFORMATION





Minimum gate pulse width for zero voltage triggering as a function of the power in the load with supply voltage as parameter.



Power in the load as a function of gate pulse width. $V_{I(RMS)}$ = 220 V; f = 50 Hz; see also insertion of pulse definition in the above graph.

TRIACS

Glass-passivated eutectic-bonded triacs intended for use in applications requiring high bidirectional transient and blocking voltage capability, and high thermal cycling performance with very low thermal resistances, e.g. a.c. power control applications such as motor, industrial lighting, industrial and domestic heating control and static switching systems.

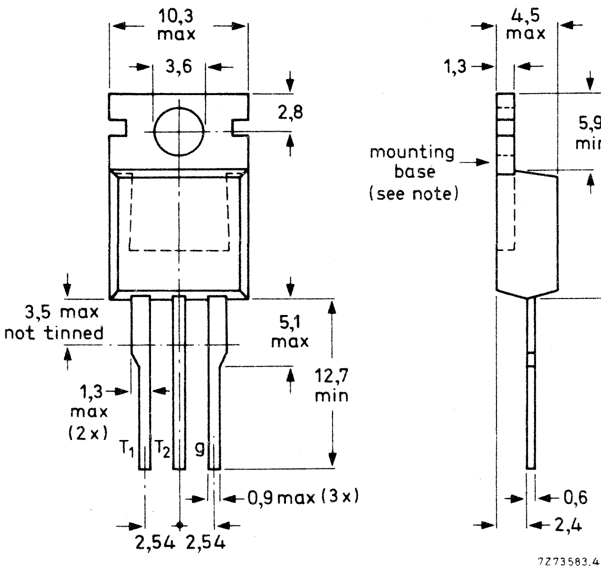
QUICK REFERENCE DATA

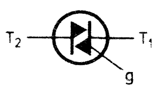
			BT139-500	600	
Repetitive peak off-state voltage	V_{DRM}	max.	500	600	V
R.M.S. on-state current	$I_{T(RMS)}$	max.	15		A
Non-repetitive peak on-state current	I_{TSM}	max.	115		A

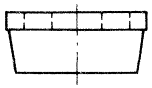
MECHANICAL DATA

Dimensions in mm

TO-220AB







Net mass: 2 g

Note: The exposed metal mounting base is directly connected to terminal T_2.

Accessories supplied on request: see data sheet Mounting instructions and accessories for TO-220 envelopes.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BT139-500	600	
Voltages (in either direction)					
Non-repetitive peak off-state voltage ($t \leq 10$ ms)	V_{DSM}	max.	500	600	V*
Repetitive peak off-state voltage ($\delta \leq 0{,}01$)	V_{DRM}	max.	500	600	V
Crest working off-state voltage	V_{DWM}	max.	400	400	V
Currents (in either direction)					
R.M.S. on-state current (conduction angle 360°) up to T_{mb} = 97 °C	$I_{T(RMS)}$	max.		15	A
Average on-state current for half-cycle operation (averaged over any 20 ms period) up to T_{mb} = 82 °C	$I_{T(AV)}$	max.		10	A
Repetitive peak on-state current	I_{TRM}	max.		115	A
Non-repetitive peak on-state current; T_j = 110 °C prior to surge; t = 20 ms; full sine-wave	I_{TSM}	max.		115	A
I^2t for fusing (t = 10 ms)	I^2t	max.		65	A^2s
Rate of rise of on-state current after triggering with I_G = 200 mA to I_T = 20 A; dI_G/dt = 0,2 A/µs	dI_T/dt	max.		30	A/µs

Gate to terminal 1

Power dissipation				
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0,5	W
Peak power dissipation	P_{GM}	max.	5	W
Temperatures				
Storage temperature	T_{stg}		−40 to +125	°C
Operating junction temperature				
full-cycle operation	T_j	max.	110	°C
half-cycle operation	T_j	max.	100	°C

* Although not recommended, off-state voltages up to 800 V may be applied without damage, but the triac may switch into the on-state. The rate of rise of on-state current should not exceed 15 A/µs.

THERMAL RESISTANCE

From junction to mounting base			
full-cycle operation	$R_{th\ j\text{-}mb}$	=	0,75 °C/W
half-cycle operation	$R_{th\ j\text{-}mb}$	=	1,1 °C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,1 °C/W

Influence of mounting method

1. Heatsink mounted with clip (see mounting instructions)

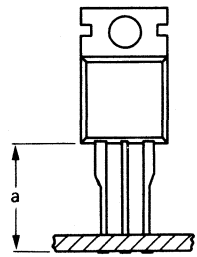
Thermal resistance from mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,3 °C/W
b. with heatsink compound and 0,06 mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1,4 °C/W
c. with heatsink compound and 0,1 mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2,2 °C/W
d. with heatsink compound and 0,25 mm maximum alumina insulator (56367)	$R_{th\ mb\text{-}h}$	=	0,8 °C/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1,4 °C/W

2. Free-air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-point.

Thermal resistance from junction to ambient in free air:
mounted on a printed-circuit board at a = any lead length
and with a copper laminate $R_{th\ j\text{-}a}$ = 60 °C/W



7Z75493

CHARACTERISTICS

Polarities, positive or negative, are identified with respect to T_1.

Voltages (in either direction)

On-state voltage $I_T = 20$ A; $T_j = 25\ ^oC$	V_T	<	1,6 V*
Rate of rise of off-state voltage that will not trigger any device; $T_j = 110\ ^oC$; see also page 9; gate open circuit	dV_D/dt	<	50 V/µs
→ Rate of rise of commutating voltage that will not trigger any device; $-dI_T/dt = 8$ A/ms; $T_{mb} = 95\ ^oC$; $I_{T(RMS)} = 15$ A; $V_D = V_{DWMmax}$; see also page 9; gate open circuit	dV_{com}/dt	<	4 V/µs

Currents (in either direction)

Off-state current $V_D = V_{DWMmax}$; $T_j = 85\ ^oC$	I_D	<	0,5 mA

		T_2 pos.	T_2 neg.	
→ Latching current; $T_j = 25\ ^oC$				
G positive	I_L	< 40	40	mA
G negative	I_L	< 60	40	mA
→ Holding current; $T_j = 25\ ^oC$				
G positive or negative	I_H	< 30	30	mA
Gate to terminal 1				
Voltage and current that will trigger all devices; $V_D = 12$ V; $T_j = 25\ ^oC$				
G positive	V_{GT}	> 1,5	1,5	V
	I_{GT}	> 35	50	mA
G negative	$-V_{GT}$	> 1,5	1,5	V
	$-I_{GT}$	> 35	35	mA
Voltage that will not trigger any device; $V_D = V_{DRMmax}$; $T_j = 110\ ^oC$				
G positive or negative	V_{GD}	< 250	250	mV

* Measured under pulse conditions to avoid excessive dissipation.

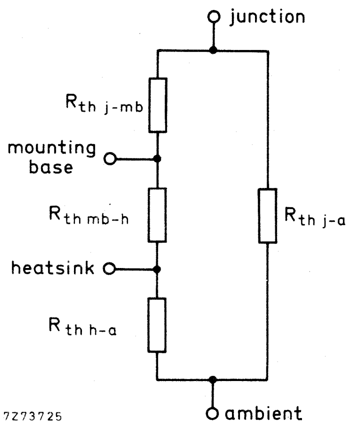
MOUNTING INSTRUCTIONS

1. The triac may be soldered directly into the circuit, but the maximum permissible temperature of the soldering iron or bath is 275 °C; it must not be in contact with the joint for more than 5 seconds. Soldered joints must be at least 4,7 mm from the seal.
2. The leads should not be bent less than 2,4 mm from the seal, and should be supported during bending.
3. It is recommended that the circuit connection be made to tag T_2, rather than direct to the heatsink.
4. Mounting by means of a spring clip is the best mounting method because it offers:
   a. a good thermal contact under the crystal area and slightly lower $R_{th\ mb\text{-}h}$ values than screw mounting.
   b. safe isolation for mains operation.
   However, if a screw is used, it should be M3 cross-recess pan head. Care should be taken to avoid damage to the plastic body.
5. For good thermal contact heatsink compound should be used between mounting base and heatsink. Values of $R_{th\ mb\text{-}h}$ given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
6. The device should not be pop-rivetted to the heatsink. However, it is permissible to press-rivet providing that rivets of soft material are used, and the press forces are slowly and carefully controlled so as to avoid shock and deformation of either heatsink or mounting tab.

OPERATING NOTES

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated below:

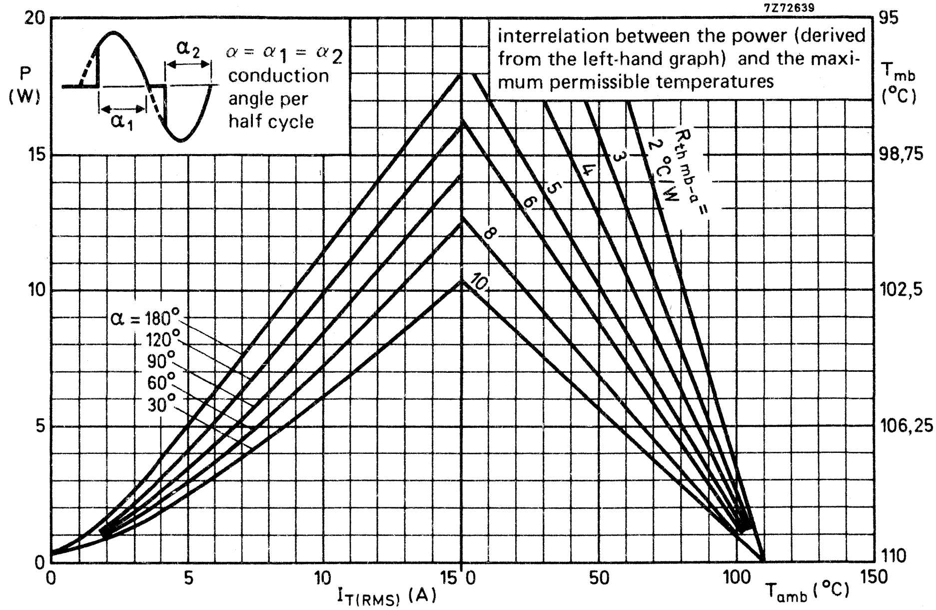


b. The method of using the graphs on page 6 is as follows:
Starting with the required current on the $I_{T(AV)}$ or $I_{T(RMS)}$ axis, trace upwards to meet the appropriate from factor or conduction angle curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can now be calculated from:

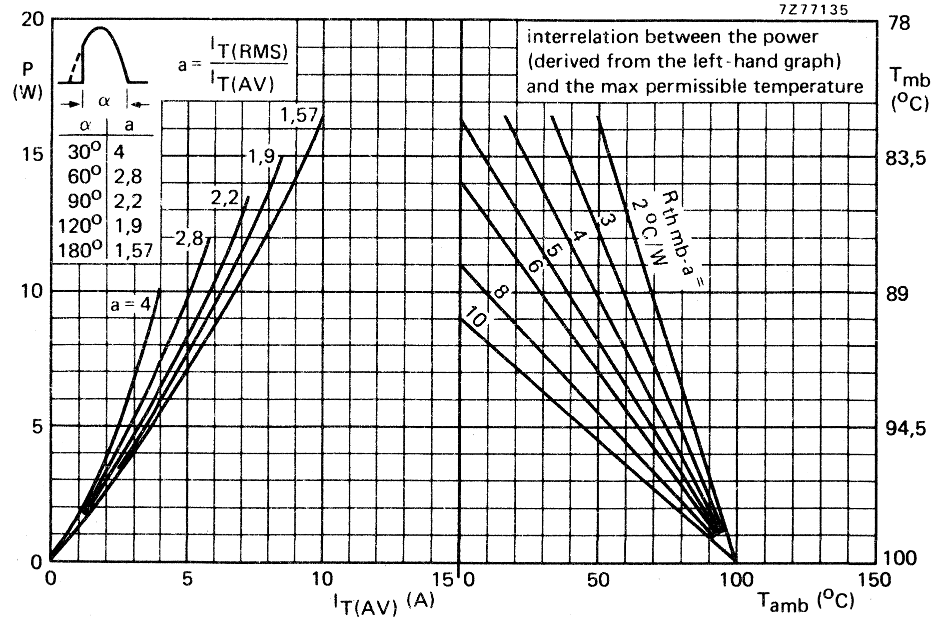
$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

c. Any measurement of heatsink temperature should be made immediately adjacent to the device.

FULL-CYCLE OPERATION

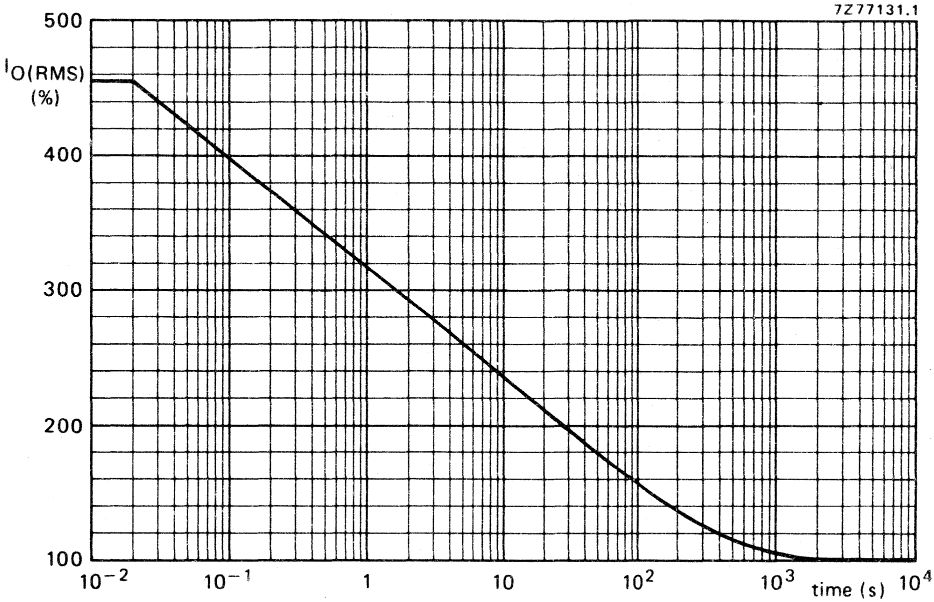


HALF-CYCLE OPERATION

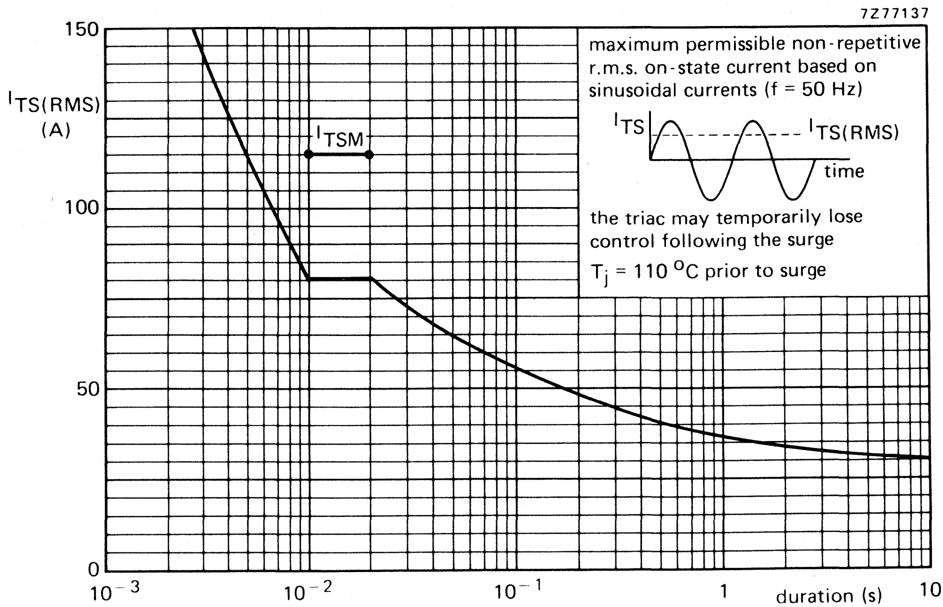


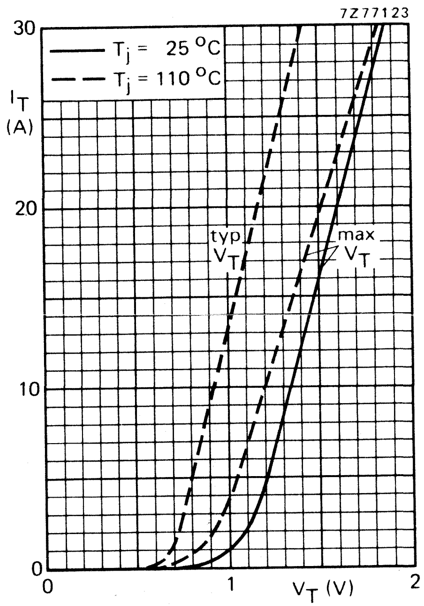
α	a
30°	4
60°	2,8
90°	2,2
120°	1,9
180°	1,57

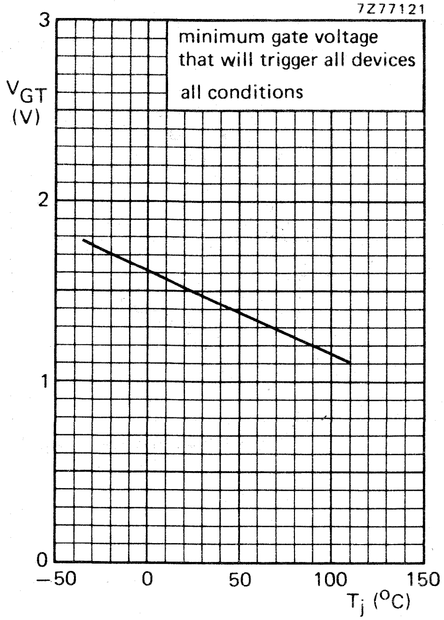
OVERLOAD OPERATION

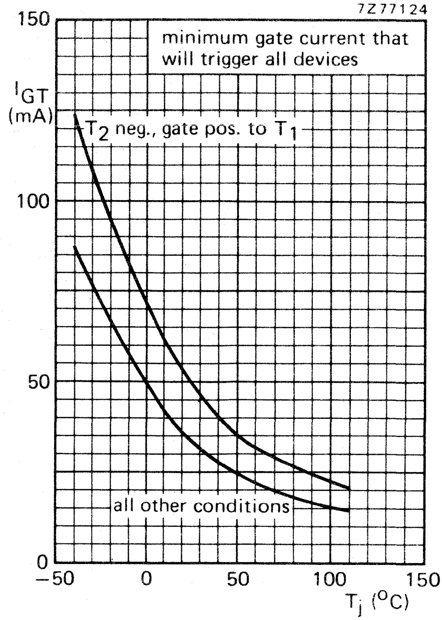


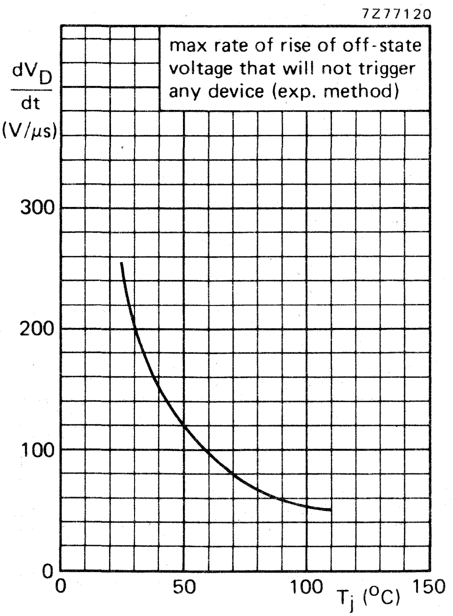
Maximum permissible duration of steady overload (provided that T_{mb} does not exceed 110 °C during and after overload) expressed as a percentage of the steady state r.m.s. rated current. For high r.m.s. overload currents precautions should be taken so that the temperature of the terminals does not exceed 125 °C. During these overload conditions the triac may loose control. Therefore the overload should be terminated by a separate protection device.

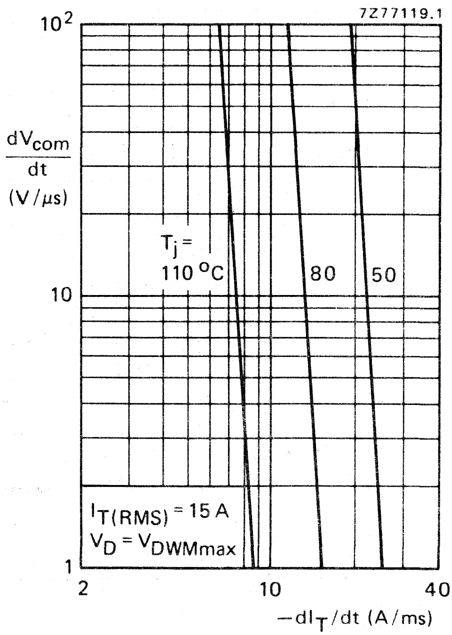

7Z77137
150
100
50
0
$I_{TS(RMS)}$
(A)
I_{TSM}
10^{-3}
10^{-2}
10^{-1}
1
10
duration (s)
maximum permissible non-repetitive r.m.s. on-state current based on sinusoidal currents (f = 50 Hz)
I_{TS}
$I_{TS(RMS)}$
time
the triac may temporarily lose control following the surge
T_j = 110 °C prior to surge

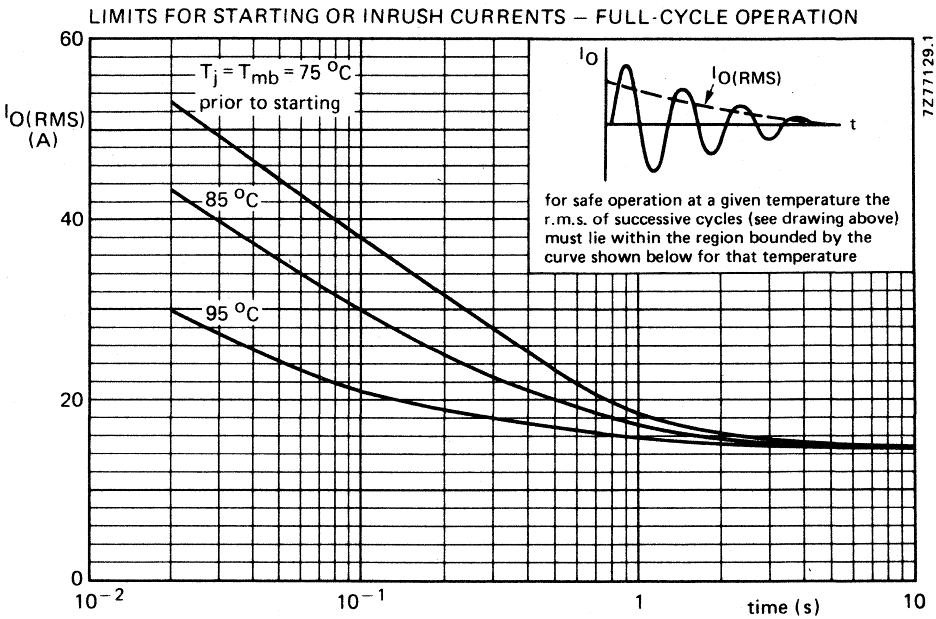

7Z77123
30
20
10
0
I_T
(A)
T_j = 25 °C
T_j = 110 °C
typ V_T
max V_T
0
1
2
V_T (V)

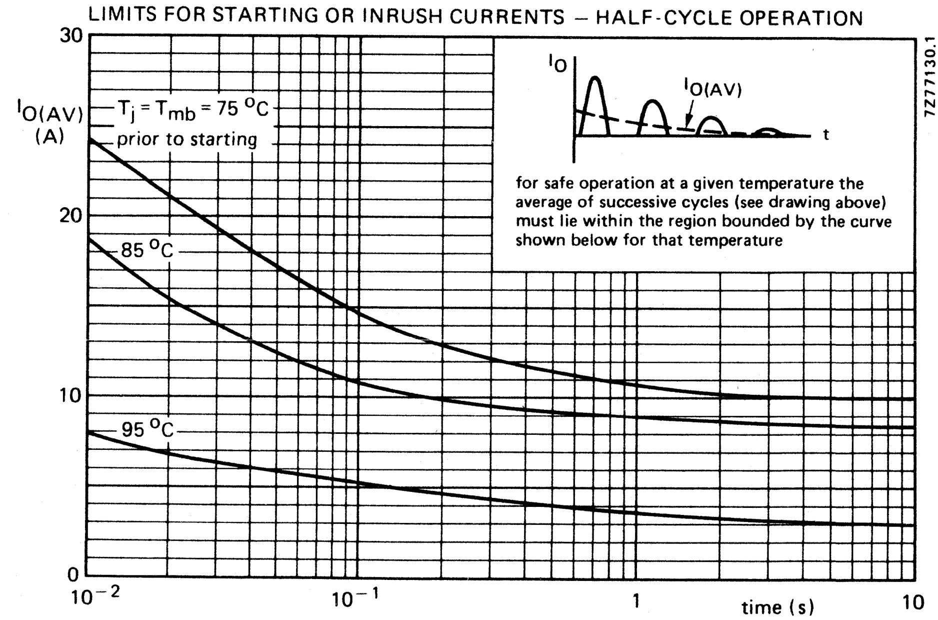

7Z77121
minimum gate voltage that will trigger all devices
all conditions
VGT (V)
3
2
1
0
−50
0
50
100
150
Tj (°C)

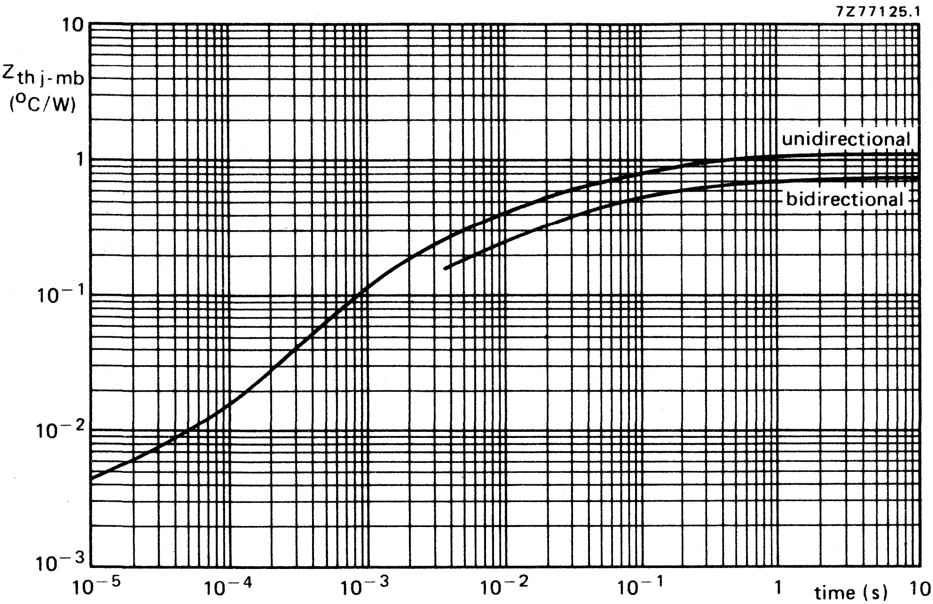

7Z77124
minimum gate current that will trigger all devices
IGT (mA)
T2 neg., gate pos. to T1
all other conditions
150
100
50
0
−50
0
50
100
150
Tj (°C)

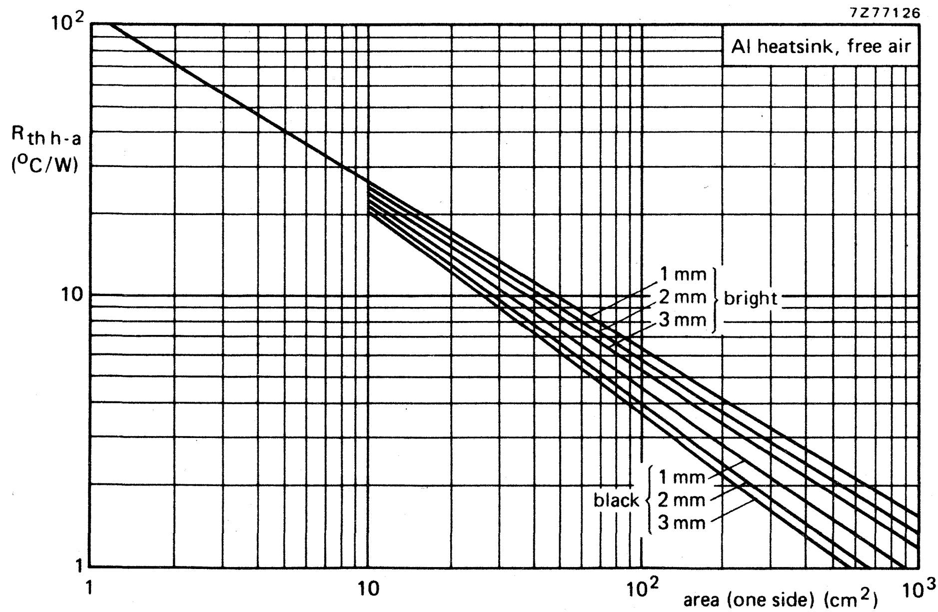

7Z77120
max rate of rise of off-state voltage that will not trigger any device (exp. method)
dVD/dt (V/μs)
300
200
100
0
0
50
100
150
Tj (°C)


7Z77119.1
dVcom/dt (V/μs)
10²
10
1
Tj = 110 °C
80
50
IT(RMS) = 15 A
VD = VDWMmax
2
10
40
−dIT/dt (A/ms)

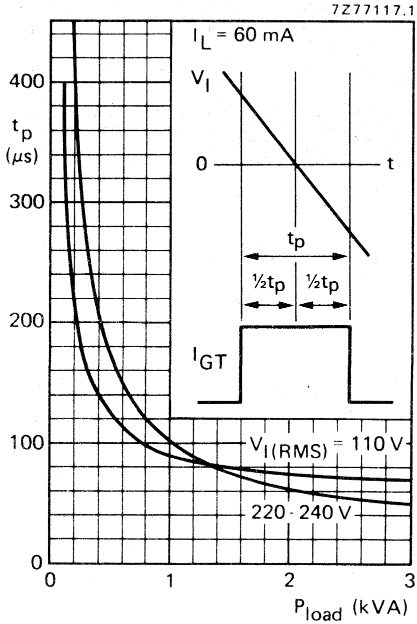

LIMITS FOR STARTING OR INRUSH CURRENTS – FULL-CYCLE OPERATION
7Z77129.1
I_O
$I_{O(RMS)}$
t
for safe operation at a given temperature the r.m.s. of successive cycles (see drawing above) must lie within the region bounded by the curve shown below for that temperature
$T_j = T_{mb} = 75\ ^oC$ prior to starting
85 °C
95 °C
$I_{O(RMS)}$ (A)
60
40
20
0
10^{-2}
10^{-1}
1
time (s)
10

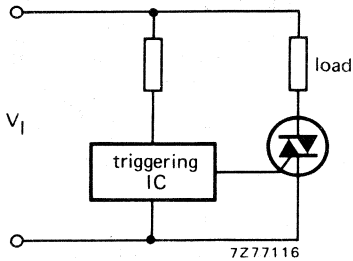

LIMITS FOR STARTING OR INRUSH CURRENTS – HALF-CYCLE OPERATION
7Z77130.1
I_O
$I_{O(AV)}$
t
for safe operation at a given temperature the average of successive cycles (see drawing above) must lie within the region bounded by the curve shown below for that temperature
$T_j = T_{mb} = 75\ ^oC$ prior to starting
85 °C
95 °C
$I_{O(AV)}$ (A)
30
20
10
0
10^{-2}
10^{-1}
1
time (s)
10


7Z77125.1
10
Z th j-mb
(°C/W)
1
10⁻¹
10⁻²
10⁻³
unidirectional
bidirectional
10⁻⁵
10⁻⁴
10⁻³
10⁻²
10⁻¹
1
time (s)
10

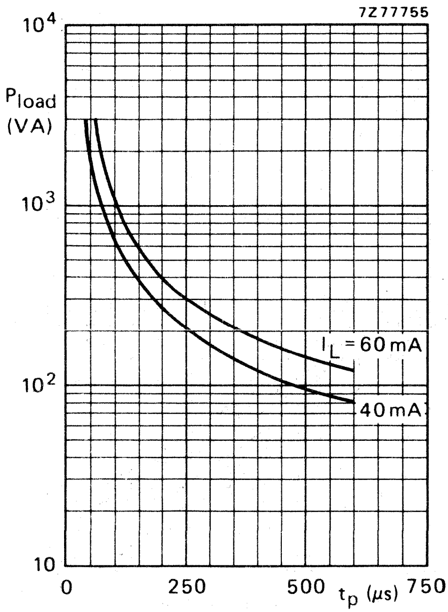

7Z77126
10²
Al heatsink, free air
R th h-a
(°C/W)
10
1
1 mm
2 mm
3 mm
bright
black
1 mm
2 mm
3 mm
1
10
10²
area (one side) (cm²)
10³

APPLICATION INFORMATION





Minimum gate pulse width for zero voltage triggering as a function of the power in the load with supply voltage as parameter.



Power in the load as a function of gate pulse width. $V_{I(RMS)}$ = 220 V; f = 50 Hz; see also insertion of pulse definition in the above graph.

TRIACS

Silicon triacs in metal envelopes, intended for industrial a.c. power control, and are particularly suitable for static switching of 3-phase induction motors. They may also be used for furnace control, lighting control and other static switching applications up to an r.m.s. on-state current of 55 A.

Two grades of commutation performance are available, 30 V/μs at 25 A/ms (suffix G) and 30 V/μs at 50 A/ms (suffix H).

QUICK REFERENCE DATA

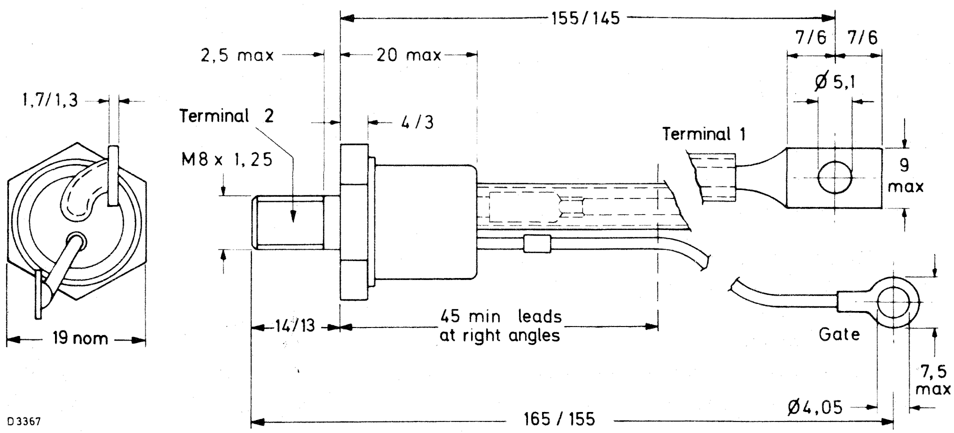
			BTW34-600	800	1000	1200	1400	1600	
Repetitive peak off-state voltage	V_{DRM}	max.	600	800	1000	1200	1400	1600	V

R.M.S. on-state current	$I_{T(RMS)}$	max.	55	A
Non-repetitive peak on-state current	I_{TSM}	max.	400	A
Rate of rise of commutating voltage that will not trigger any device (see page 3)	dV_{com}/dt	<	30	V/μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-103.



Net mass: 46 g
Diameter of clearance hole: 8,5 mm
Torque on nut: min. 4 Nm (40 kg cm)
max. 6 Nm (60 kg cm)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 13 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages (in either direction)*

			BTW34-600	800	1000	1200	1400	1600	
Non-repetitive peak off-state voltage ($t \leq 10$ ms)	V_{DSM}	max.	700	900	1100	1300	1400	1600	V**
Repetitive peak off-state voltage	V_{DRM}	max.	600	800	1000	1200	1400	1600	V
Crest working off-state voltage	V_{DWM}	max.	400	600	700	800	800	800	V

Currents (in either direction)

R.M.S. on-state current (conduction angle 360°) up to T_{mb} = 75 °C	$I_{T(RMS)}$	max.	55	A
at T_{mb} = 85 °C	$I_{T(RMS)}$	max.	45	A
Average on-state current for half-cycle operation (averaged over any 20 ms period) at T_{mb} = 85 °C	$I_{T(AV)}$	max.	21	A
Repetitive peak on-state current	I_{TRM}	max.	300	A
Non-repetitive peak on-state current T_j = 125 °C prior to surge; t = 20 ms; full sine-wave	I_{TSM}	max.	400	A
I^2t for fusing (t = 10 ms)	I^2t	max.	800	A^2s
Rate of rise of on-state current after triggering with I_G = 1 A to I_T = 100 A; dI_G/dt = 1A/µs	dI_T/dt	max.	50	A/µs

Gate to terminal 1

Power dissipation

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	2	W
Peak power dissipation	P_{GM}	max.	10	W

Temperatures

Storage temperature	T_{stg}		−55 to + 125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base full-cycle operation	$R_{th\ j\text{-}mb}$	=	0,6	°C/W
half-cycle operation	$R_{th\ j\text{-}mb}$	=	1,2	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,08	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a} < 2$ °C/W (full-cycle or half-cycle operation). For smaller heatsinks $T_{j\ max}$ should be derated (see Figs 2 and 3).

** Although not recommended, higher off-state voltages may be applied without damage, but the triac may switch into the on-state. The rate of rise of on-state current should not exceed 20 A/µs.

CHARACTERISTICS

Polarities, positive or negative, are identified with respect to T_1.

Voltages (in either direction)

On-state voltage
I_T = 65 A; T_j = 25 °C — V_T < 2,1 V*

Rate of rise of off-state voltage that will not trigger any device;
exponential method; V_D = 2/3 $V_{DRM\,max}$; T_j = 125 °C — dV_D/dt < 200 V/µs

Rate of rise of commutating voltage that will not trigger any device;
$I_{T(RMS)}$ = 45 A; V_D = $V_{DRM\,max}$; T_{mb} = 85 °C

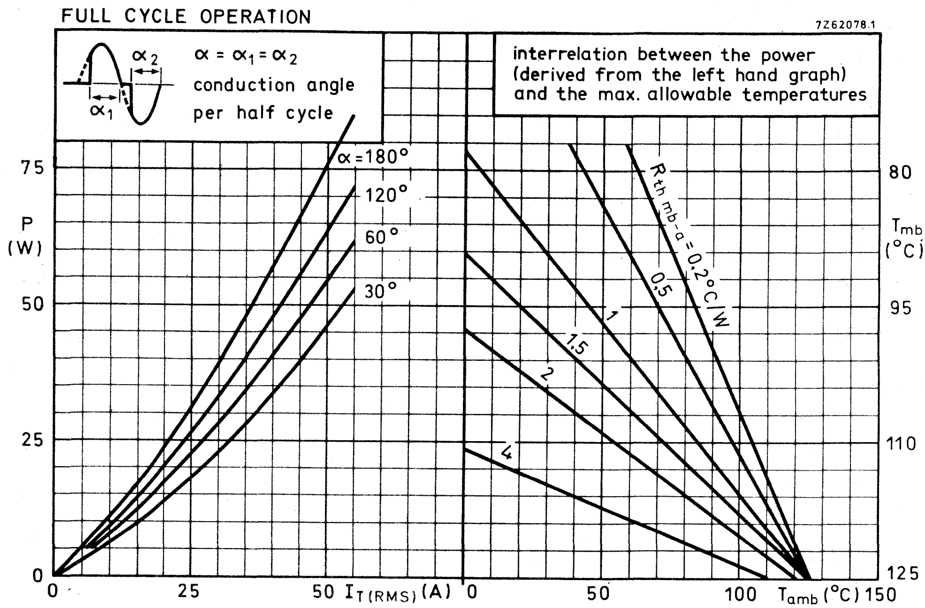
	dV_{com}/dt (V/µs)	$-dI_T/dt$ (A/ms)
BTW34-600G to 1600G	30	25
BTW34-600H to 1600H	30	50

Currents (in either direction)

Off-state current
V_D = $V_{DWM\,max}$; T_j = 125 °C — I_D < 10 mA

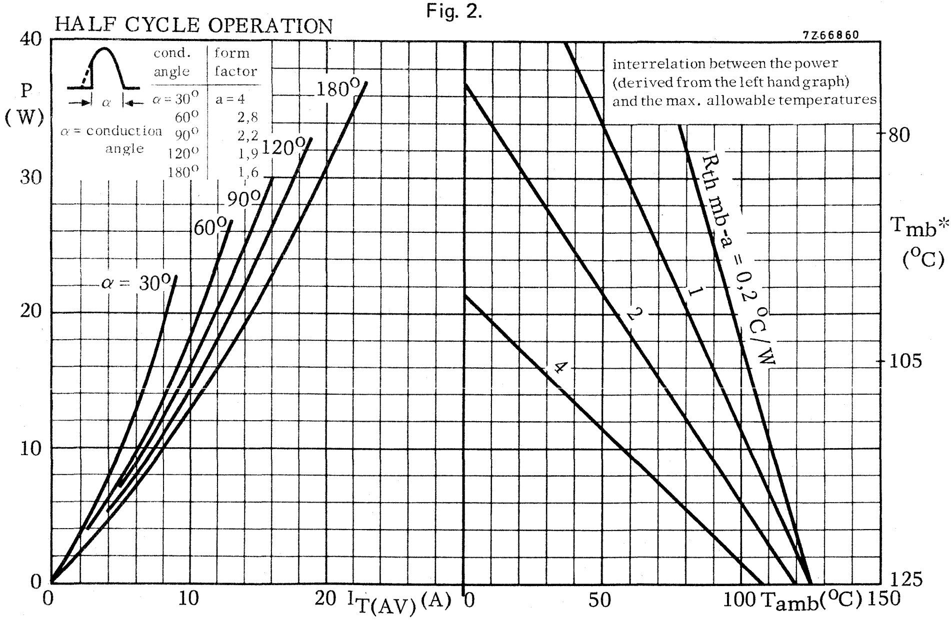
		T_2 pos.	T_2 neg.
Latching current; T_j = 25 °C			
G positive	I_L	< 250	– mA
G negative	I_L	< 500	250 mA
Holding current; T_j = 25 °C			
G positive or negative	I_H	< 200	200 mA
Gate to terminal 1			
Voltage and current that will trigger all devices			
V_D = 12 V; T_j = 25 °C			
G positive	V_{GT}	> 2,5	– V
	I_{GT}	> 200	– mA
G negative	$-V_{GT}$	> 2,5	2,5 V
	$-I_{GT}$	> 200	200 mA
Voltage that will not trigger any device			
V_D = $V_{DRM\,max}$; T_j = 125 °C; G positive or negative	V_{GD}	< 0,2	0,2 V

* Measured under pulse conditions to avoid excessive dissipation.



* T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leq 1,4\ °C/W$

Fig. 2.



* T_{mb}- scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leq 0,8\ °C/W$

Fig. 3.

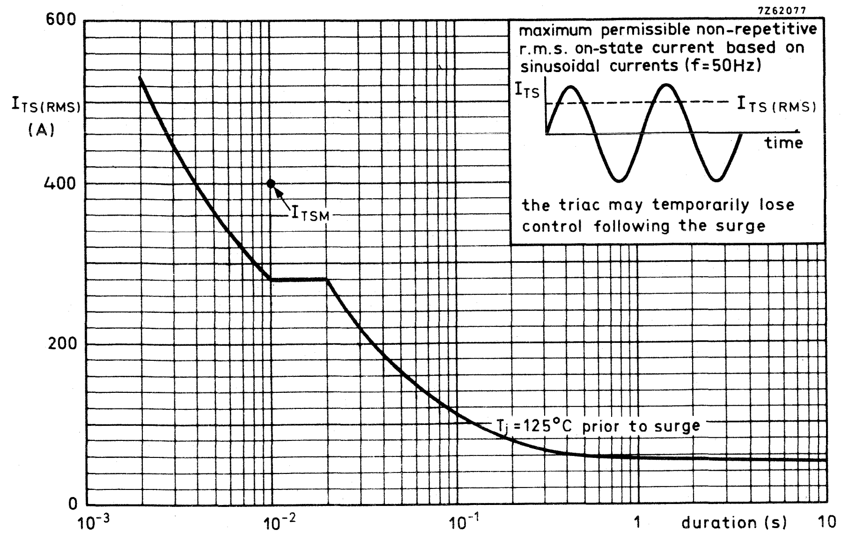

7Z62077
600
400
200
0
$I_{TS(RMS)}$
(A)
I_{TSM}
maximum permissible non-repetitive r.m.s. on-state current based on sinusoidal currents (f=50Hz)
I_{TS}
$I_{TS(RMS)}$
time
the triac may temporarily lose control following the surge
T_j=125°C prior to surge
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10

Fig. 4.

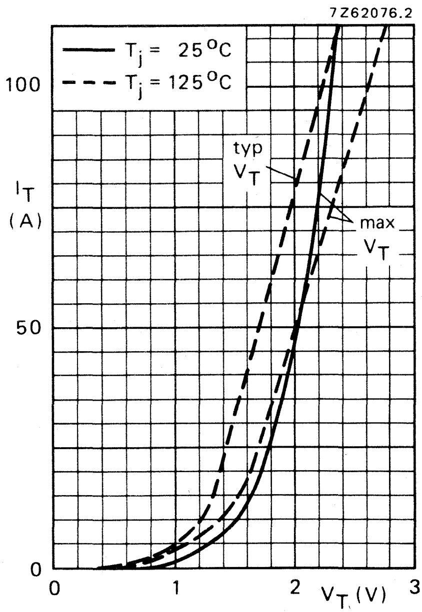

7Z62076.2
T_j = 25°C
T_j = 125°C
100
50
0
I_T
(A)
typ
V_T
max
V_T
0
1
2
3
V_T (V)

Fig. 5.

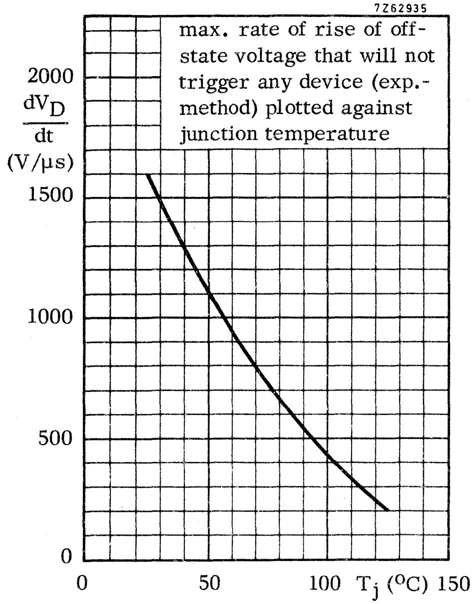


Fig. 6.

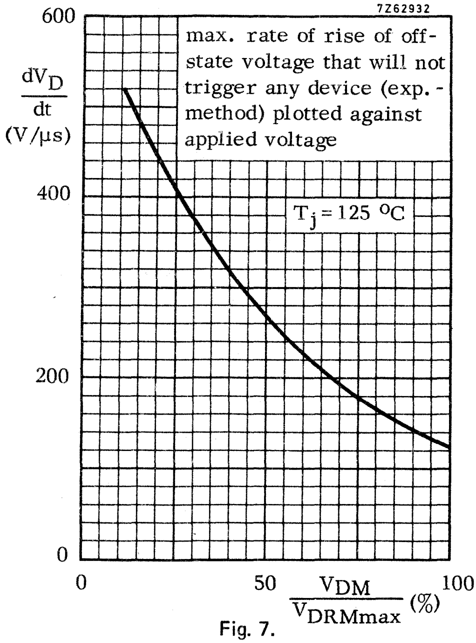


Fig. 7.

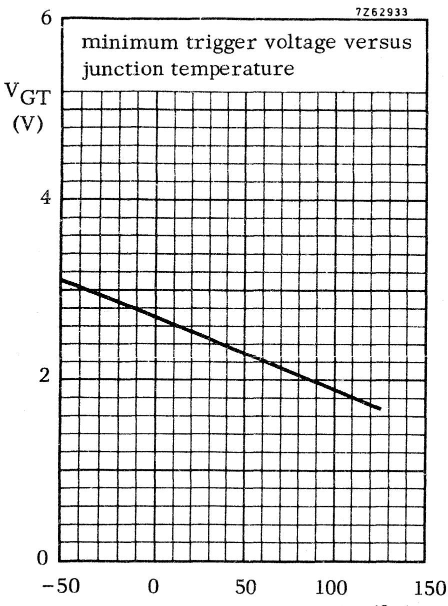


Fig. 8.

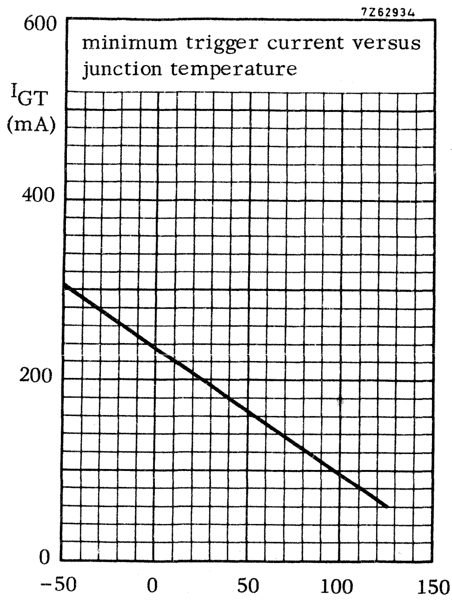


Fig. 9.

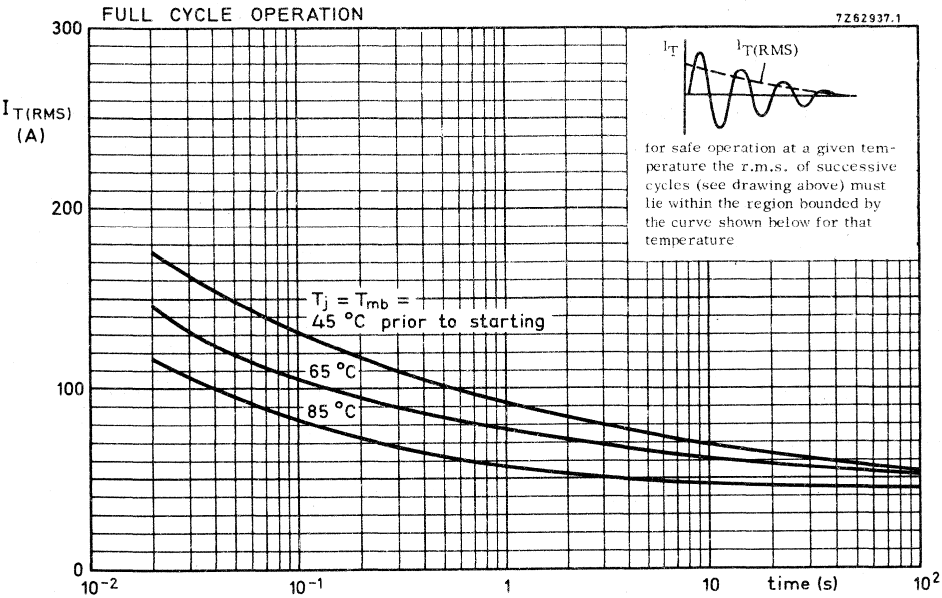

FULL CYCLE OPERATION
7Z62937.1
300
200
100
0
$I_{T(RMS)}$ (A)
I_T
$I_{T(RMS)}$
for safe operation at a given temperature the r.m.s. of successive cycles (see drawing above) must lie within the region bounded by the curve shown below for that temperature
$T_j = T_{mb} =$ 45 °C prior to starting
65 °C
85 °C
10^{-2}
10^{-1}
1
10
time (s)
10^2

Fig. 10.

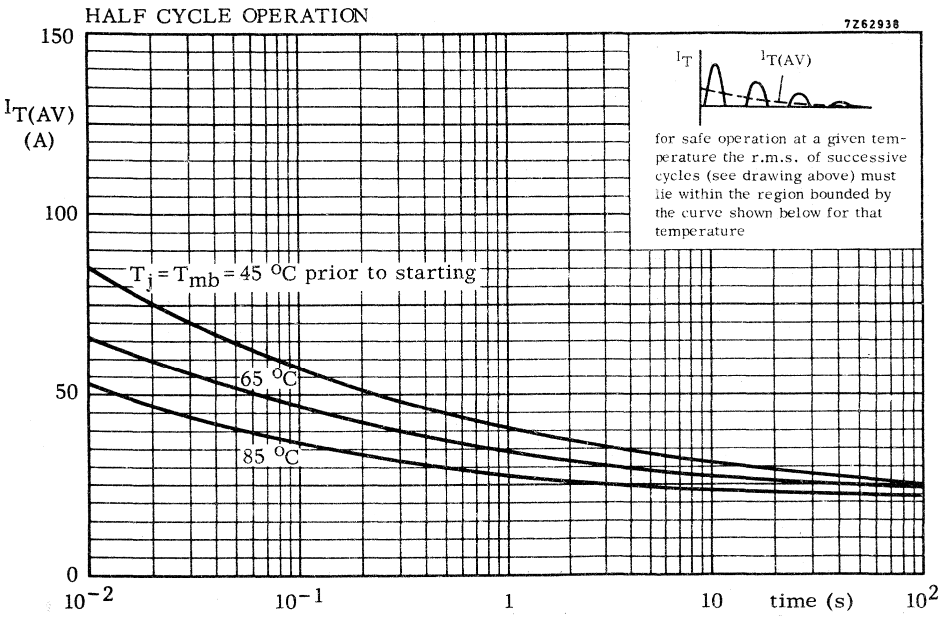

HALF CYCLE OPERATION
7Z62938
150
100
50
0
$I_{T(AV)}$ (A)
I_T
$I_{T(AV)}$
for safe operation at a given temperature the r.m.s. of successive cycles (see drawing above) must lie within the region bounded by the curve shown below for that temperature
$T_j = T_{mb} =$ 45 °C prior to starting
65 °C
85 °C
10^{-2}
10^{-1}
1
10
time (s)
10^2

Fig. 11.

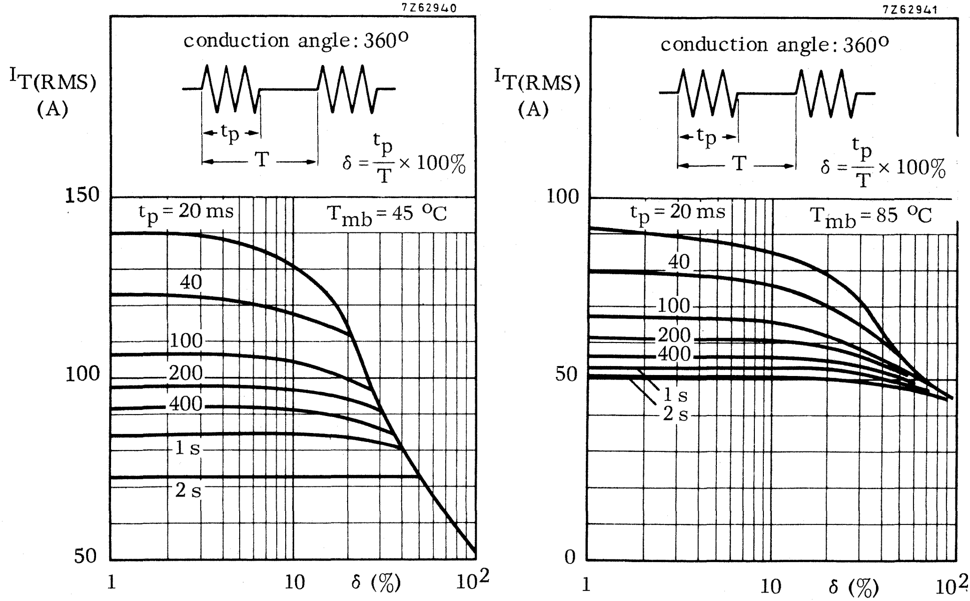


Fig. 12 Intermittent overload capability of one triac in a single phase a.c. control circuit.

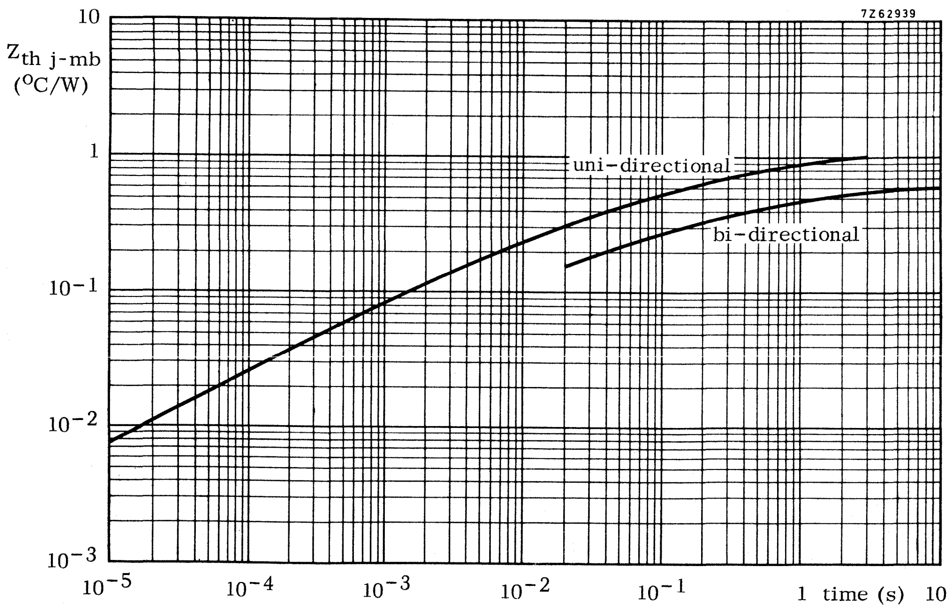


Fig. 13.

TRIACS

A range of glass-passivated triacs in plastic envelopes with push-on connectors. They are intended for use in industrial a.c. power control applications such as motor and heating controls, and switching systems.
Two grades of commutation performance are available, 5 V/μs at 12 A/ms (suffix G) and 5 V/μs at 23 A/ms (suffix H).

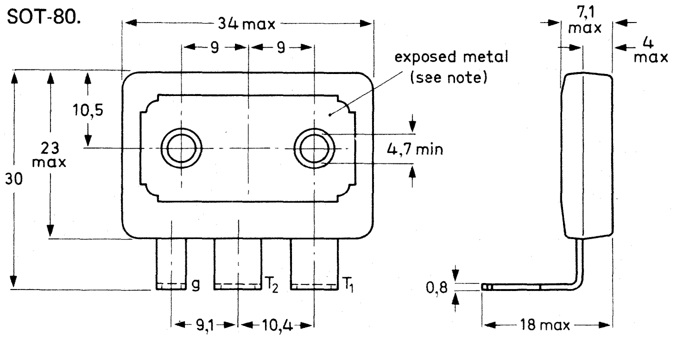
QUICK REFERENCE DATA

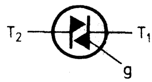
			BTW41–500	600	800	
Repetitive peak off-state voltage	V_{DRM}	max.	500	600	800	V
R.M.S. on-state current	$I_{T(RMS)}$	max.		40		A
Non-repetitive peak on-state current	I_{TSM}	max.		260		A
Rate of rise of commutating voltage that will not trigger any device (see page 3)	dV_{com}/dt	<		5		V/μs

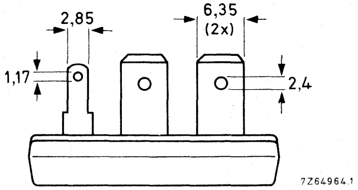
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-80.







T_1 and T_2: AMP250 series
g: AMP110 series
The exposed metal base-plate is electrically connected to main terminal T_2.

Recommended diameter of fixing screws: 3 mm (with 56358)
4 mm (without 56358)
Accessory supplied on request: 56358 (mica insulating washer, 2 insulating bushes)

Net mass: 15 g
Torque on fixing screws:
min. 0,8 Nm (8 kg cm)
max. 1,5 Nm (15 kg cm)

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages (in either direction)*			BTW41–500	600	800	
Non-repetitive peak off-state voltage ($t \leqslant 10$ ms)	V_{DSM}	max.	500	600	800	V
Repetitive peak off-state voltage	V_{DRM}	max.	500	600	800	V
Crest working off-state voltage	V_{DWM}	max.	400	500	600	V

Currents (in either direction)

R.M.S. on-state current (conduction angle 360°)				
up to T_{mb} = 60 °C	$I_{T(RMS)}$	max.	40	A
at T_{mb} = 85 °C	$I_{T(RMS)}$	max.	23	A
Repetitive peak on-state current	I_{TRM}	max.	100	A
Non-repetitive peak on-state current T_j = 110 °C prior to surge; t = 20 ms; full sine-wave	I_{TSM}	max.	260	A
I^2t for fusing (t = 10 ms)	I^2t	max.	340	A^2s
Rate of rise of on-state current after triggering with I_G = 0,5 A to I_T = 50 A; dI_G/dt = 0,5 A/µs	dI_T/dt	max.	50	A/µs

Gate to terminal 1

Power dissipation

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	1	W
Peak power dissipation	P_{GM}	max.	10	W

Temperatures

Storage temperature	T_{stg}		– 40 to + 110	°C
Junction temperature				
full-cycle operation	T_j	max.	110	°C
half-cycle operation	T_j	max.	100	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	20	°C/W
From junction to mounting base				
full-cycle operation	$R_{th\ j\text{-}mb}$	=	1,0	°C/W
half-cycle operation	$R_{th\ j\text{-}mb}$	=	1,5	°C/W
From mounting base to heatsink				
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
without heatsink compound	$R_{th\ mb\text{-}h}$	=	1,5	°C/W
with mica washer and heatsink compound	$R_{th\ mb\text{-}h}$	=	1,0	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,16	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a} < 8$ °C/W (full-cycle or half-cycle operation). For smaller heatsinks $T_{j\ max}$ should be derated (see Figs 2 and 3).

CHARACTERISTICS

Polarities, positive or negative, are identified with respect to T_1.

Voltages (in either direction)

On-state voltage			
I_T = 50 A; T_j = 25 °C	V_T	<	1,6 V*
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 V_{DRMmax}; T_j = 110 °C	dV_D/dt	<	100 V/µs

Rate of rise of commutating voltage that will not trigger any device;

$I_{T(RMS)}$ = 23 A; V_D = V_{DWMmax}; T_{mb} = 85 °C	dV_{com}/dt (V/µs)	$-dI_T/dt$ (A/ms)
BTW41-500G to 800G	< 5	12
BTW41-500H to 800H	< 5	23

Currents (in either direction)

			T_2 pos.	T_2 neg.
Off-state current V_D = V_{DWMmax}; T_j = 110 °C	I_D		<	5 mA
Latching current; T_j = 25 °C				
G positive	I_L	<	100	100 mA
G negative	I_L	<	150	100 mA
Holding current; T_j = 25 °C				
G positive or negative	I_H	typ.	50	50 mA
Gate to terminal 1				
Voltage and current that will trigger all devices				
V_D = 12 V; T_j = 25 °C				
G positive	V_{GT}	>	1,5	3,0 V
	I_{GT}	>	75	150 mA
G negative	$-V_{GT}$	>	1,5	1,5 V
	$-I_{GT}$	>	75	75 mA
Voltage that will not trigger any device				
V_D = V_{DRMmax}; T_j = 110 °C; G positive or negative	V_{GD}	<	0,25	0,25 V

* Measured under pulse conditions to avoid excessive dissipation.

FULL-CYCLE OPERATION

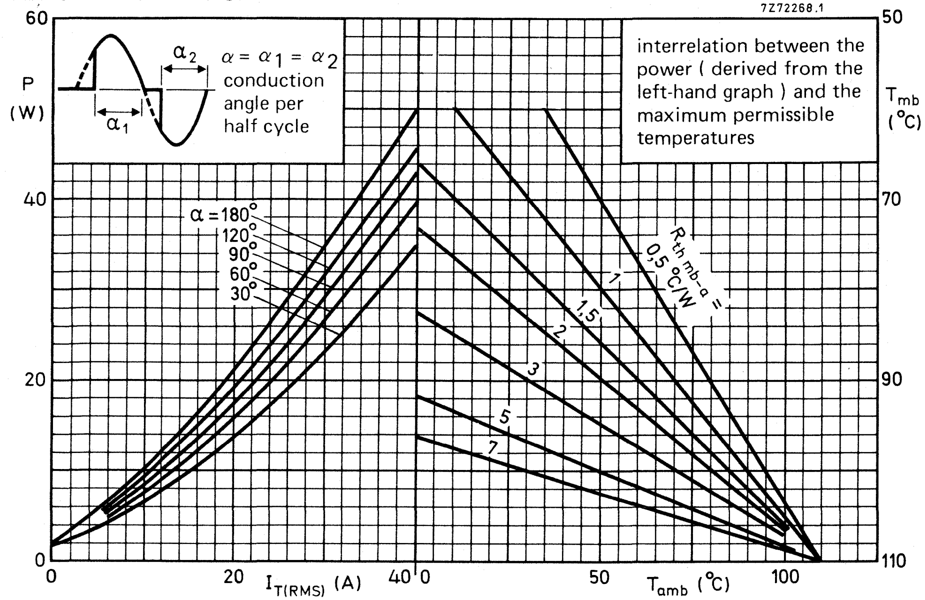


Fig. 2.

HALF-CYCLE OPERATION

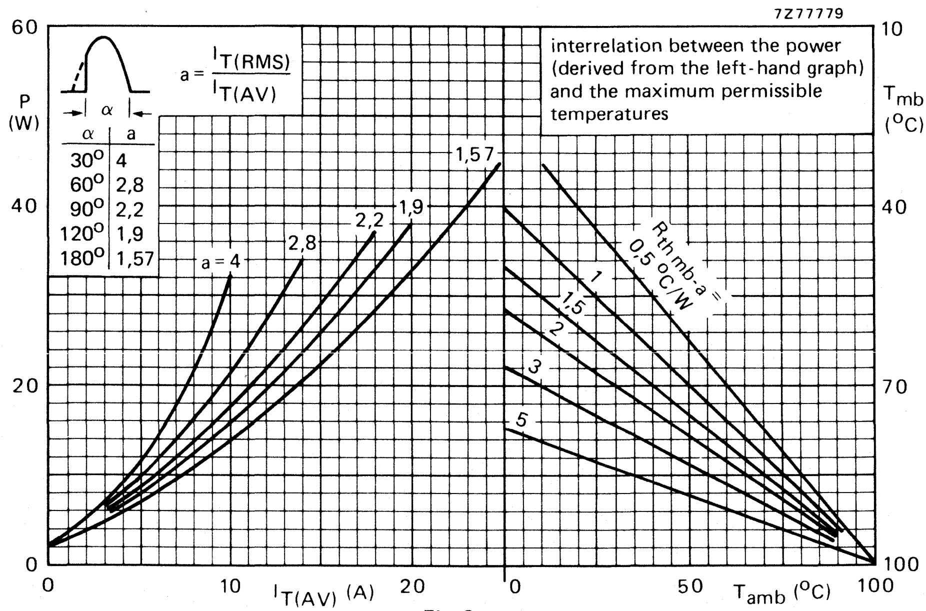


Fig. 3.

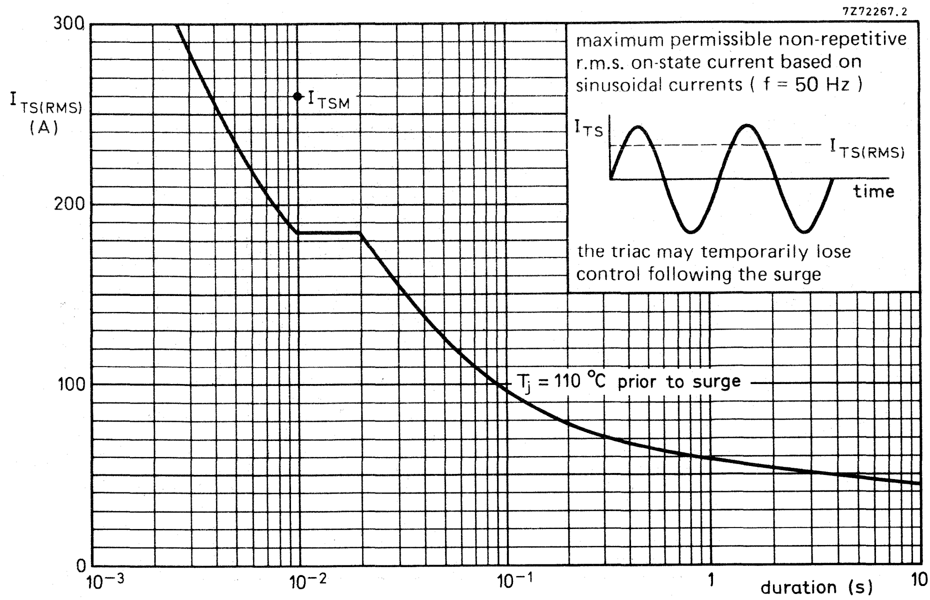

7Z72267.2
300
200
100
0
$I_{TS(RMS)}$
(A)
I_{TSM}
maximum permissible non-repetitive r.m.s. on-state current based on sinusoidal currents (f = 50 Hz)
I_{TS}
$I_{TS(RMS)}$
time
the triac may temporarily lose control following the surge
T_j = 110 °C prior to surge
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10

Fig. 4.

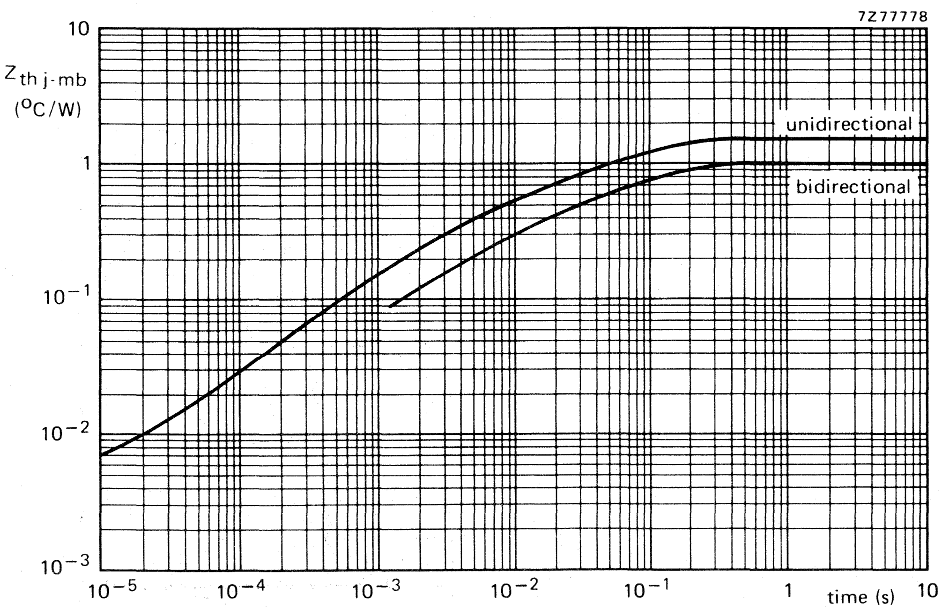

7Z77778
10
$Z_{th\ j\text{-}mb}$
(°C/W)
1
10^{-1}
10^{-2}
10^{-3}
unidirectional
bidirectional
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10

Fig. 5

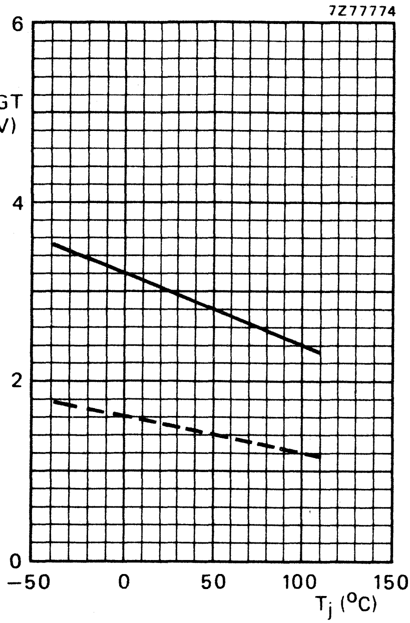


Fig. 6 Minimum gate voltage that will trigger all devices.

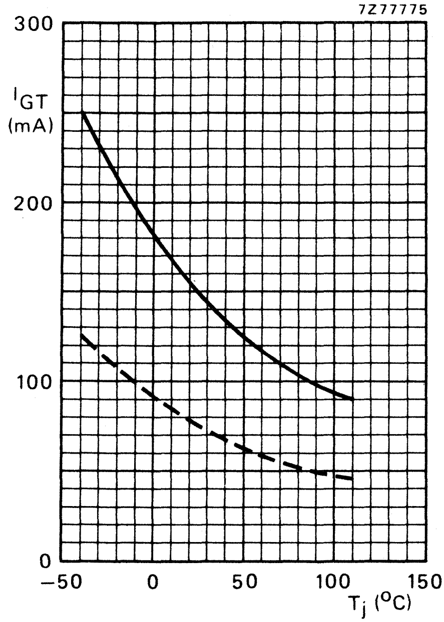


Fig. 7 Minimum gate current that will trigger all devices.

Conditions for Figs 6 and 7:

——— T_2 negative, gate positive with respect to T_1

– – – – all other conditions

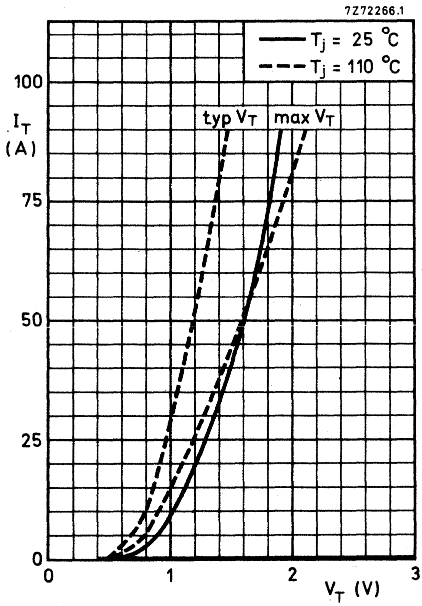


Fig. 8.

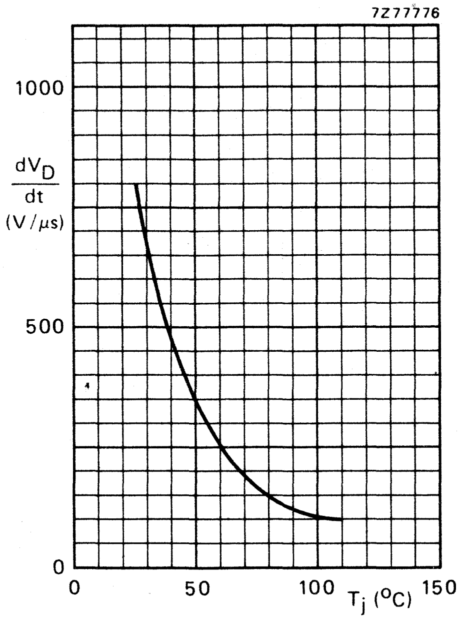


Fig. 9 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of T_j.

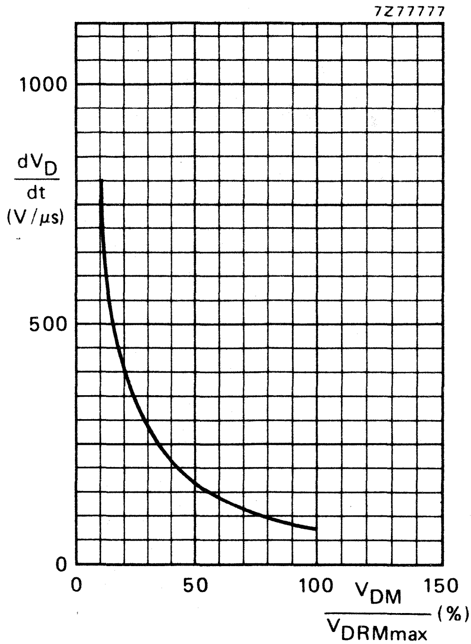


Fig. 10 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of applied voltage.

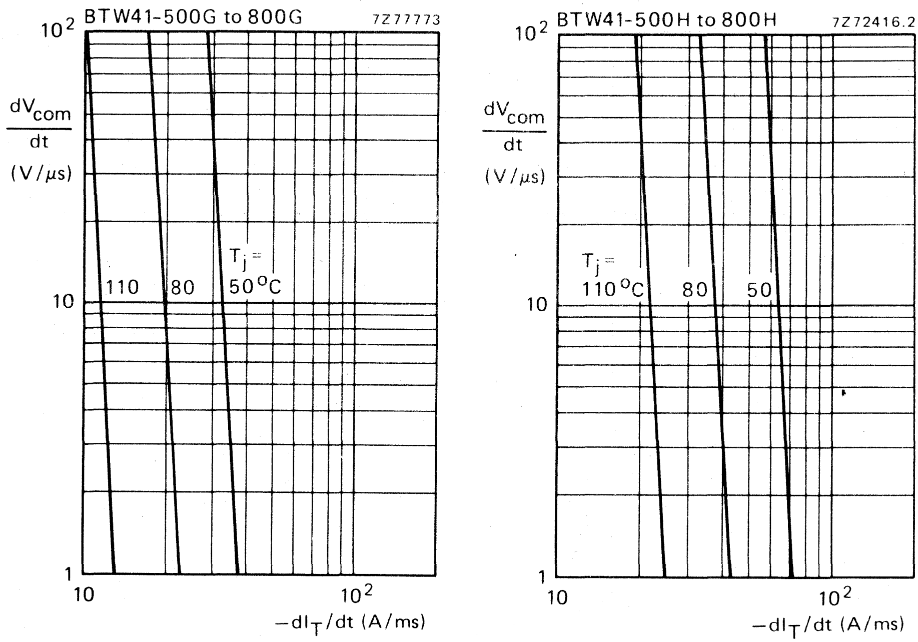


Fig. 11 Maximum rate of rise of commutating voltage that will not trigger any device as a function of rate of fall of on-state current; $I_{T(RMS)}$ = 23 A; V_D = V_{DWMmax}.

TRIACS

Silicon triacs in metal envelopes, intended for industrial a.c. power control and are particularly suitable for static switching of 3-phase induction motors. They may also be used for furnace control, lighting control and other static switching applications up to an r.m.s. on-state current of 15 A.

Two grades of commutation performance are available, 10 V/μs at 5 A/ms (suffix G) and 10 V/μs at 12 A/ms (suffix H).

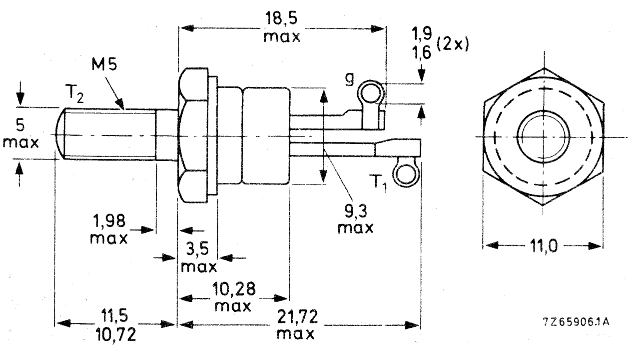
QUICK REFERENCE DATA

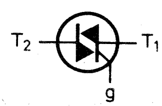
			BTW43–600	800	1000	1200	
Repetitive peak off-state voltage	V_{DRM}	max.	600	800	1000	1200	V
R.M.S. on-state current	$I_{T(RMS)}$	max.	15				A
Non-repetitive peak on-state current	I_{TSM}	max.	120				A
Rate of rise of commutating voltage that will not trigger any device (see page 3)	dV_{com}/dt	<	10				V/μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-64: with metric M5 stud (φ 5 mm).





Net mass: 7 g
Diameter of clearance hole: max. 5,2 mm
Accessories supplied on request: 56295
(PTFE bush, 2 mica washers, plain washer, tag)

Torque on nut: min. 0,9 Nm
(9 kg cm)
max. 1,7 Nm
(17 kg cm)

Supplied with the device: 1 nut, 1 lock washer
Nut dimensions across the flats: 8,0 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages (in either direction)*

			BTW43–600	800	1000	1200	
Non-repetitive peak off-state voltage ($t \leq 10$ ms)	V_{DSM}	max.	600	800	1000	1200	V
Repetitive peak off-state voltage	V_{DRM}	max.	600	800	1000	1200	V
Crest working off-state voltage	V_{DWM}	max.	400	600	700	800	V

Currents (in either direction)

R.M.S. on-state current (conduction angle 360°)				
up to T_{mb} = 75 °C	$I_{T(RMS)}$	max.	15	A
at T_{mb} = 85 °C	$I_{T(RMS)}$	max.	12	A
Average on-state current for half-cycle operation (averaged over any 20 ms period)				
up to T_{mb} = 35 °C	$I_{T(AV)}$	max.	9,5	A
at T_{mb} = 85 °C	$I_{T(AV)}$	max.	5,5	A
Repetitive peak on-state current	I_{TRM}	max.	50	A
Non-repetitive peak on-state current T_j = 125 °C prior to surge; t = 20 ms; full sine-wave	I_{TSM}	max.	120	A
I^2t for fusing (t = 10 ms)	I^2t	max.	72	A^2s
Rate of rise of on-state current after triggering with I_G = 0,5 A to I_T = 25 A; dI_G/dt = 0,5 A/μs	dI_T/dt	max.	50	A/μs

Gate to terminal 1

Power dissipation

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	1	W
Peak power dissipation	P_{GM}	max.	10	W

Temperatures

Storage temperature	T_{stg}		– 55 to + 125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base				
full-cycle operation	$R_{th\ j\text{-}mb}$	=	2,0	°C/W
half-cycle operation	$R_{th\ j\text{-}mb}$	=	4,0	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,2	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a} < 6$ °C/W (full-cycle or half-cycle operation). For smaller heatsinks $T_{j\ max}$ should be derated (see Figs 2 and 3).

CHARACTERISTICS

Polarities positive or negative, are identified with respect to T_1.

Voltages (in either direction)

On-state voltage

I_T = 20 A; T_j = 25 °C	V_T	<	2,2 V*
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 V_{DRMmax}; T_j = 125 °C	dV_D/dt	<	200 V/µs

Rate of rise of commutating voltage that will not trigger any device;

$I_{T(RMS)}$ = 12 A; V_D = V_{DWMmax}; T_{mb} = 85 °C	dV_{com}/dt (V/µs)	$-dI_T/dt$ (A/ms)
BTW43-600G to 1200G	10	5
BTW43-600H to 1200H	10	12

Currents (in either direction)

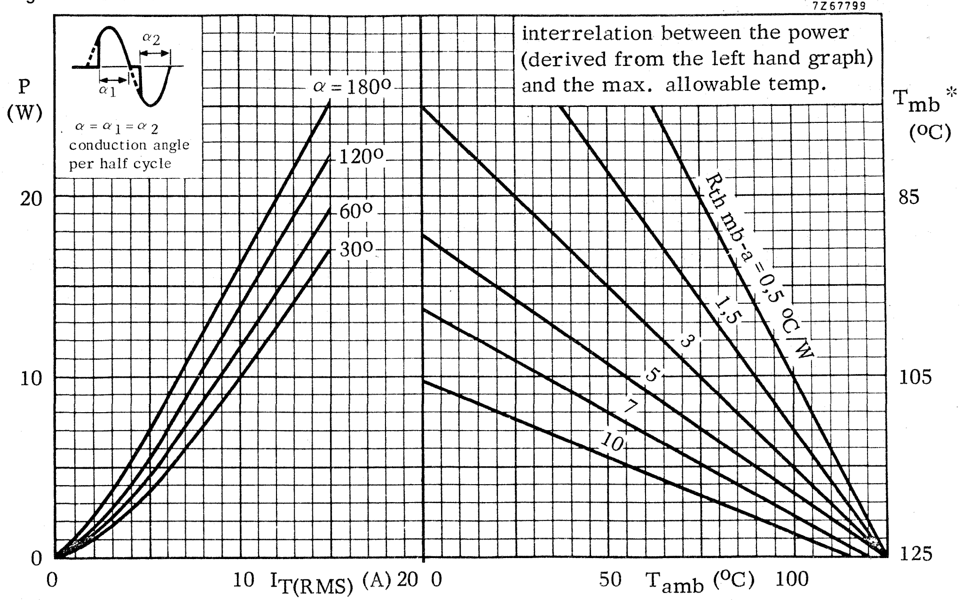
Off-state current

V_D = V_{DWMmax}; T_j = 125 °C	I_D	<	5 mA

		T_2 pos.	T_2 neg.
Latching current; T_j = 25 °C			
G positive	I_L	< 200	200 mA
G negative	I_L	< 200	200 mA
Holding current; T_j = 25 °C			
G positive or negative	I_H	< 100	100 mA
Gate to terminal 1			
Voltage and current that will trigger all devices			
V_D = 12 V; T_j = 25 °C			
G positive	V_{GT}	> 2,5	5,0 V
	I_{GT}	> 100	200 mA
G negative	$-V_{GT}$	> 2,5	2,5 V
	$-I_{GT}$	> 100	100 mA
Voltage that will not trigger any device			
V_D = V_{DRMmax}; T_j = 125 °C; G positive or negative	V_{GD}	< 0,2	0,2 V

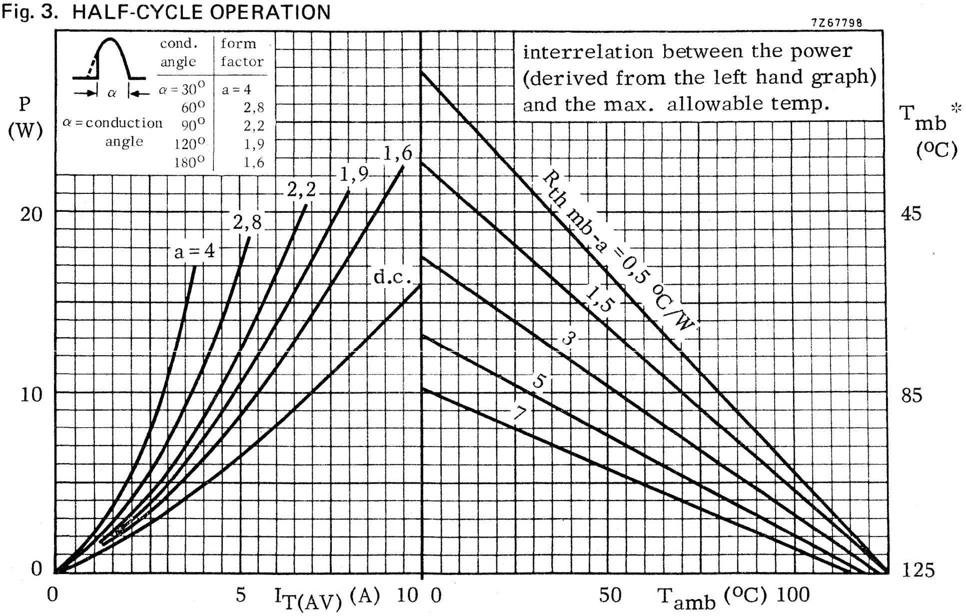
* Measured under pulse conditions to avoid excessive dissipation.

Fig. 2 . FULL CYCLE OPERATION



* T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb\text{-}a} \leqslant 4$ °C/W.

Fig. 3. HALF-CYCLE OPERATION



* T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb\text{-}a} \leqslant 2$ °C/W.

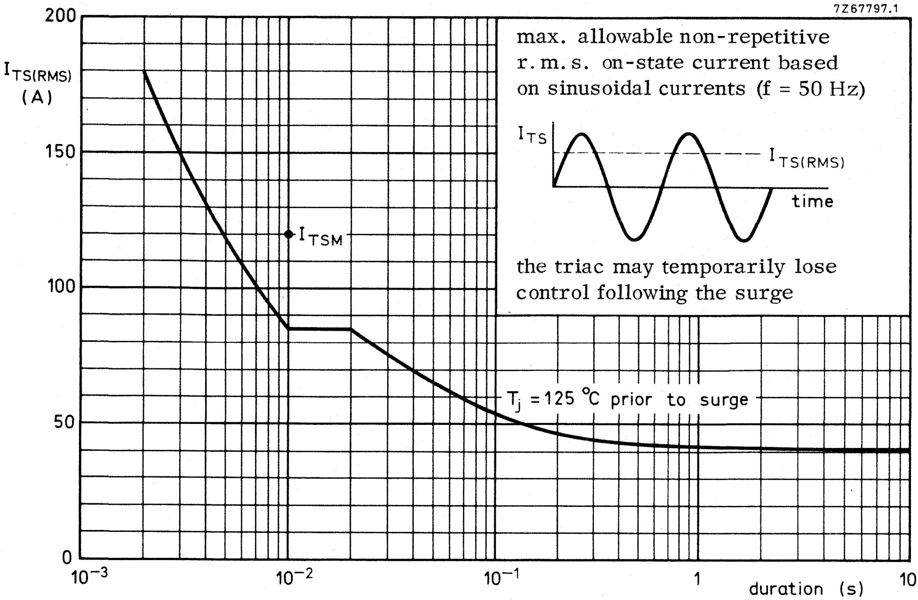

7Z67797.1
200
150
100
50
0
$I_{TS(RMS)}$ (A)
max. allowable non-repetitive r.m.s. on-state current based on sinusoidal currents (f = 50 Hz)
I_{TS}
$I_{TS(RMS)}$
time
the triac may temporarily lose control following the surge
I_{TSM}
T_j = 125 °C prior to surge
10^{-3}
10^{-2}
10^{-1}
1
10
duration (s)

Fig. 4.

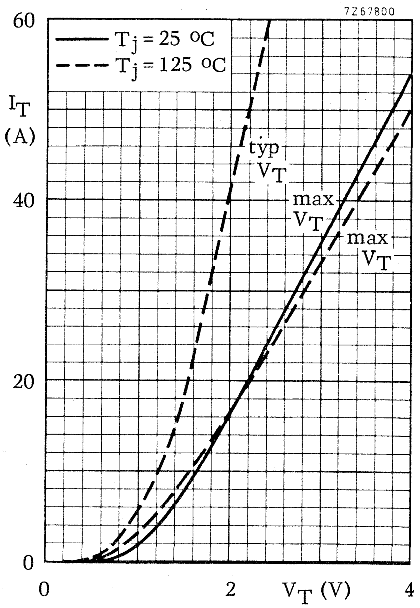

7Z67800
60
40
20
0
I_T (A)
T_j = 25 °C
T_j = 125 °C
typ V_T
max V_T
max V_T
0
2
V_T (V)
4

Fig. 5.

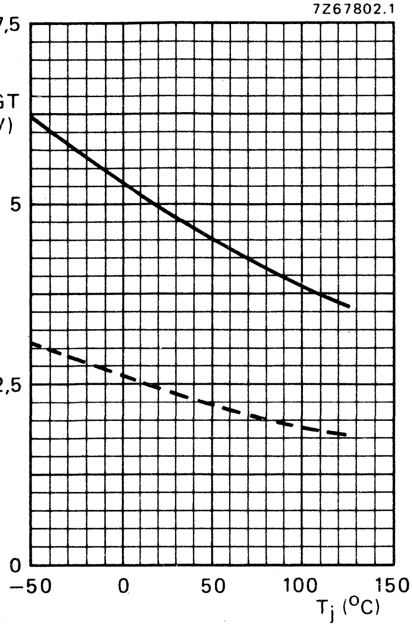


Fig. 6 Minimum gate voltage that will trigger all devices as a function of T_j.

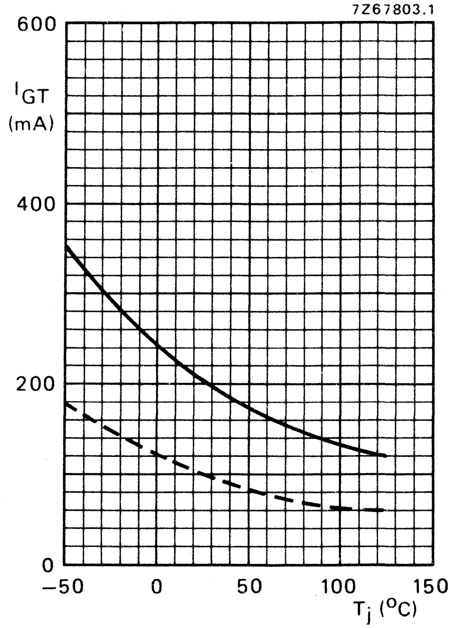


Fig. 7 Minimum gate current that will trigger all devices as a function of T_j.

Conditions for Figs 6 and 7:

——— T_2 negative, gate positive with respect to T_1
– – – – all other conditions

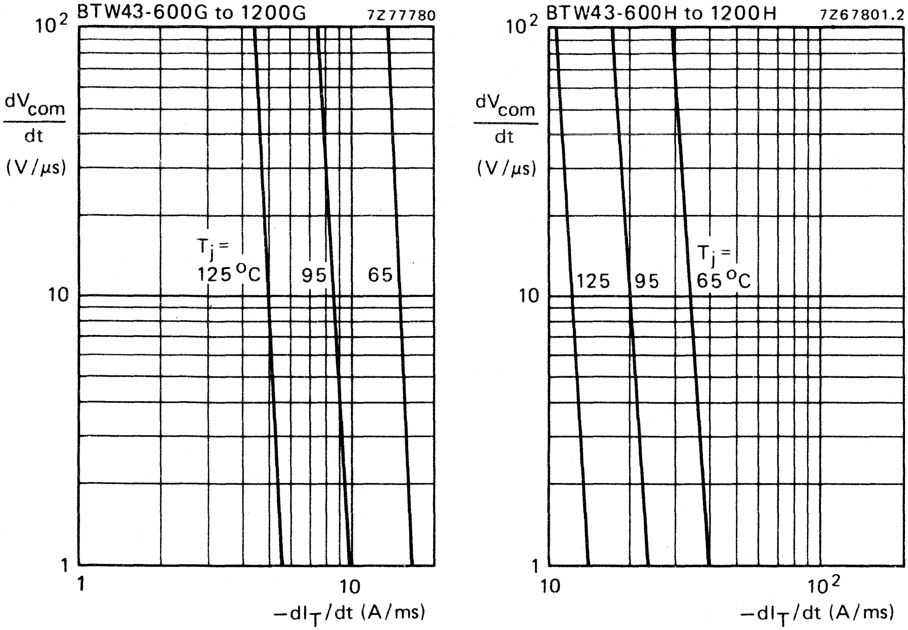


Fig. 8 Maximum rate of rise of commutating voltage that will not trigger any device as a function of rate of fall of on-state current; $I_{T(RMS)}$ = 12 A; V_D = V_{DWMmax}.

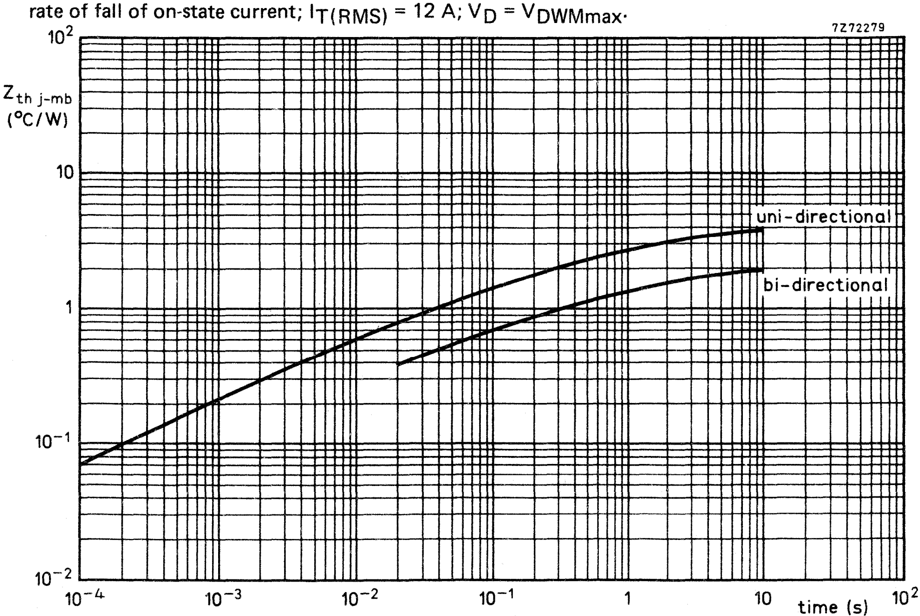


Fig. 9.

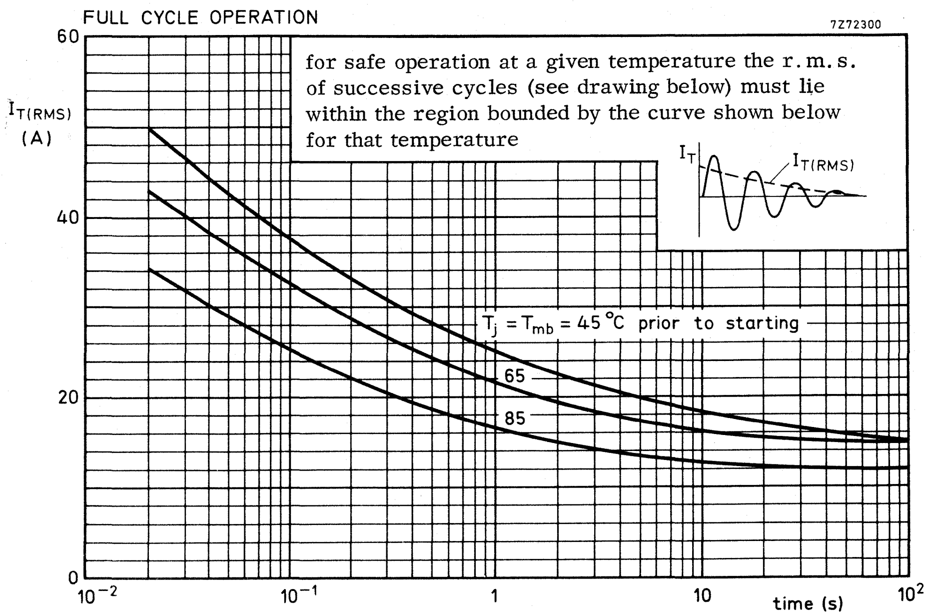

FULL CYCLE OPERATION
7Z72300
$I_{T(RMS)}$ (A)
60
40
20
0
for safe operation at a given temperature the r.m.s. of successive cycles (see drawing below) must lie within the region bounded by the curve shown below for that temperature
I_T
$I_{T(RMS)}$
$T_j = T_{mb} = 45\ ^\circ C$ prior to starting
65
85
10^{-2}
10^{-1}
1
10
10^2
time (s)

Fig. 10.

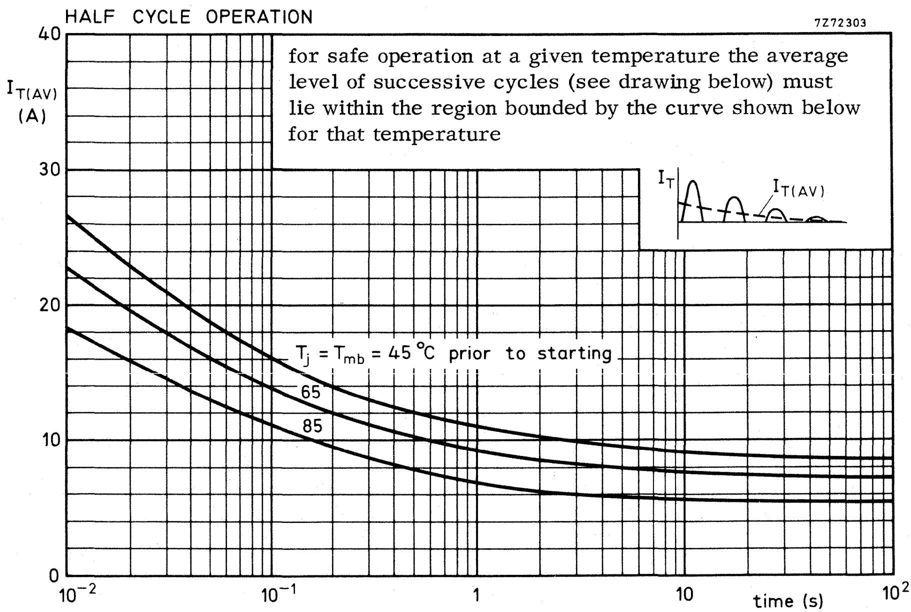

HALF CYCLE OPERATION
7Z72303
$I_{T(AV)}$ (A)
40
30
20
10
0
for safe operation at a given temperature the average level of successive cycles (see drawing below) must lie within the region bounded by the curve shown below for that temperature
I_T
$I_{T(AV)}$
$T_j = T_{mb} = 45\ ^\circ C$ prior to starting
65
85
10^{-2}
10^{-1}
1
10
10^2
time (s)

Fig. 11.

TRIACS

Silicon triacs in metal envelopes, intended for industrial single-phase and three-phase inductive load applications such as regenerative motor control systems. They are also suitable for furnace temperature control and static switching systems.
Two grades of commutation performance are available, 30 V/μs at 25 A/ms (suffix H) and 30 V/μs at 50 A/ms (suffix J).

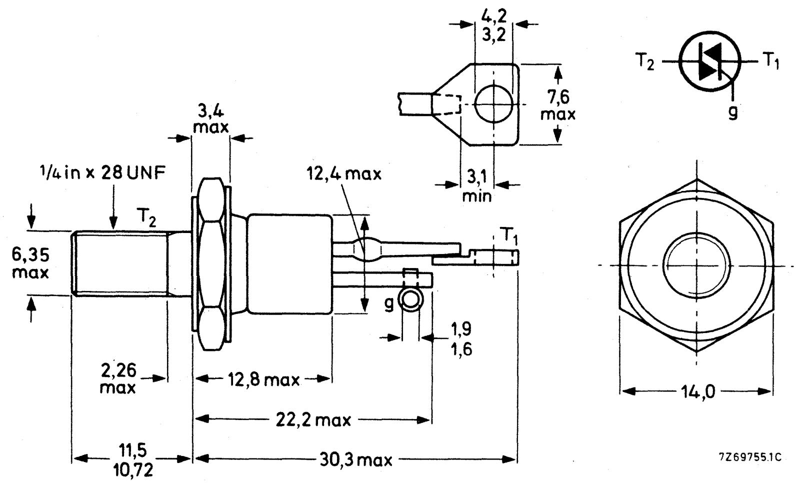
QUICK REFERENCE DATA

			BTX94-400	600	800	1000	1200	
Repetitive peak off-state voltage	V_{DRM}	max.	400	600	800	1000	1200	V
R.M.S. on-state current	$I_{T(RMS)}$	max.					25	A
Non-repetitive peak on-state current	I_{TSM}	max.					250	A
Rate of rise of commutating voltage that will not trigger any device (see page 3)	dV_{com}/dt	<					30	V/μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-48.



Net mass: 14 g
Diameter of clearance hole: max. 6,5 mm
Accessories supplied on request: 56264A
(mica washer, insulating ring, soldering tag)

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)
Supplied with the device:
1 nut, 1 lock washer
Nut dimensions across the flats; 11,1 mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages (in either direction) *

			BTX94-400	600	800	1000	1200	
Non-repetitive peak off-state voltage ($t \leqslant 10$ ms)	V_{DSM}	max.	400	600	800	1000	1200	V **
Repetitive peak off-state voltage	V_{DRM}	max.	400	600	800	1000	1200	V
Crest working off-state voltage	V_{DWM}	max.	200	400	600	700	800	V

Currents (in either direction)

R.M.S. on-state current (conduction angle 360°) at T_{mb} = 85 °C	$I_{T(RMS)}$	max.	25	A
Repetitive peak on-state current	I_{TRM}	max.	100	A
Non-repetitive peak on-state current T_j = 125 °C prior to surge; t = 20 ms; full sine-wave	I_{TSM}	max.	250	A
I^2t for fusing (t = 10 ms)	I^2t	max.	320	A^2s
Rate of rise of on-state current after triggering with I_G = 750 mA to I_T = 100 A	dI_T/dt	max.	50	A/μs

Gate to terminal 1

Power dissipation

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	1	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−55 to + 125	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base full-cycle operation	$R_{th\ j\text{-}mb}$	=	1,0	°C/W
half-cycle operation	$R_{th\ j\text{-}mb}$	=	2,0	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,12	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a} < 3{,}5$ °C/W (full-cycle or half-cycle operation). For smaller heatsinks $T_{j\ max}$ should be derated (see Figs 2 and 3).

** Although not recommended, higher off-state voltages may be applied without damage, but the triac may switch into the on-state. The rate of rise of on-state current should not exceed 50 A/μs.

CHARACTERISTICS

Polarities, positive or negative, are identified with respect to T_1.

Voltages (in either direction)

On-state voltage

$I_T = 50$ A; $T_j = 25$ °C — V_T < 2 V *

Rate of rise of off-state voltage that will not trigger any device; exponential method;

$V_D = 2/3\ V_{DRMmax}$; $T_j = 125$ °C — dV_D/dt < 100 V/µs

Rate of rise of commutating voltage that will not trigger any device;

$I_{T(RMS)} = 25$ A; $V_D = V_{DWMmax}$; $T_{mb} = 85$ °C

	dV_{com}/dt (V/µs)	$-dI_T/dt$ (A/ms)
BTX94-400H to 1200H	30	25
BTX94-400J to 1200J	30	50

Currents (in either direction)

Off-state current

$V_D = V_{DWMmax}$; $T_j = 125$ °C — I_D < 5 mA

		T_2 pos.	T_2 neg.
Latching current; $T_j = 25$ °C			
G positive	I_L	< 150	150 mA
G negative	I_L	< 350	150 mA

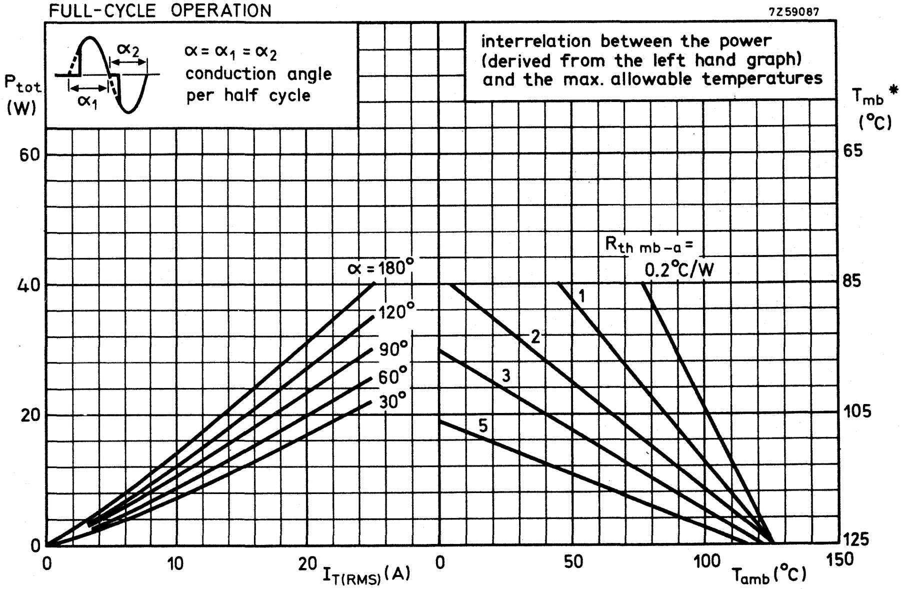
Gate to terminal 1

Voltage and current that will trigger all devices

$V_D = 12$ V; $T_j = 25$ °C

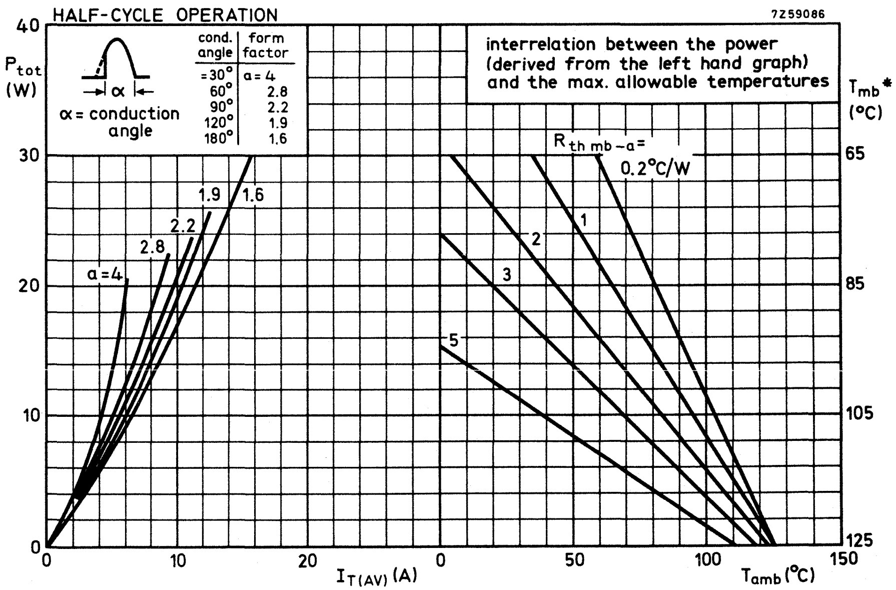
		T_2 pos.	T_2 neg.
G positive	V_{GT}	> 3,0	5,0 V
	I_{GT}	> 150	200 mA
G negative	$-V_{GT}$	> 3,0	3,0 V
	$-I_{GT}$	> 150	150 mA

* Measured under pulse conditions to avoid excessive dissipation.



* T_{mb} – scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leq 2.5\ °C/W$

Fig. 2.



* T_{mb} – scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leq 1.5\ °C/W$

Fig. 3.

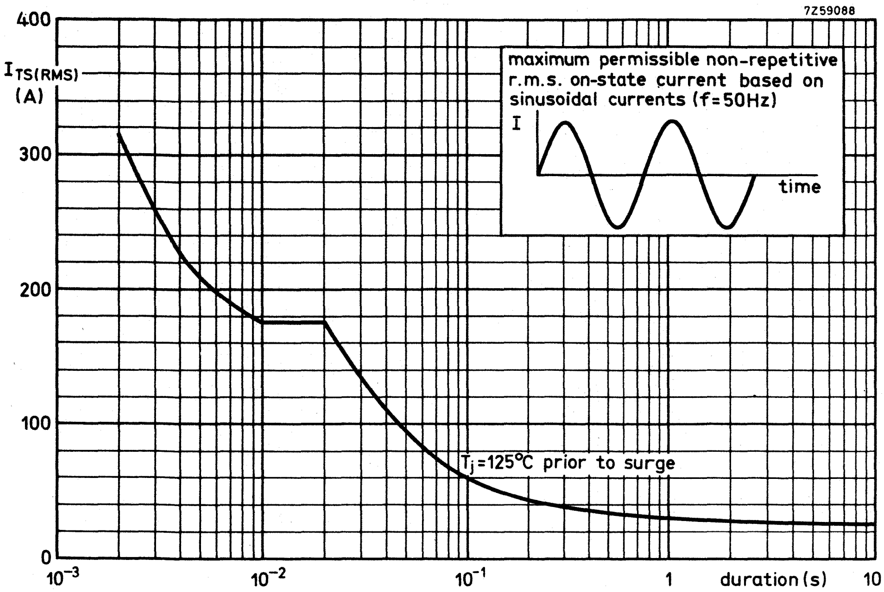

7Z59088
400
$I_{TS(RMS)}$
(A)
300
200
100
0
maximum permissible non-repetitive r.m.s. on-state current based on sinusoidal currents (f=50Hz)
I
time
T_j=125°C prior to surge
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10

Fig. 4.

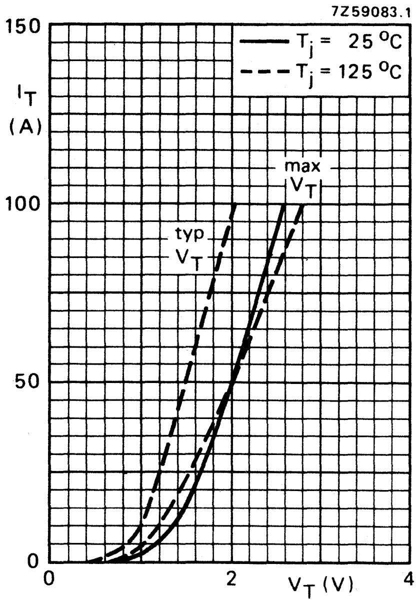

7Z59083.1
150
I_T
(A)
100
50
0
T_j = 25 °C
T_j = 125 °C
max
V_T
typ
V_T
0
2
V_T (V)
4

Fig. 5.

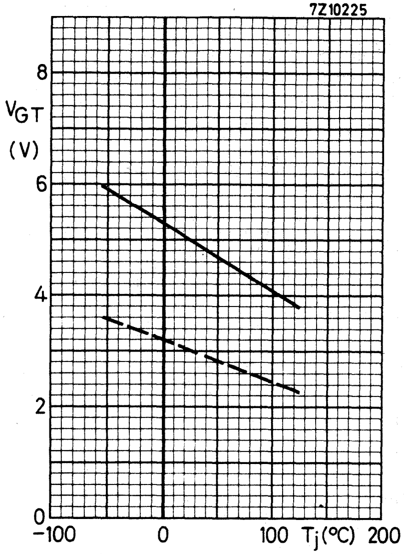


Fig. 6 Minimum gate voltage that will trigger all devices as a function of T_j.

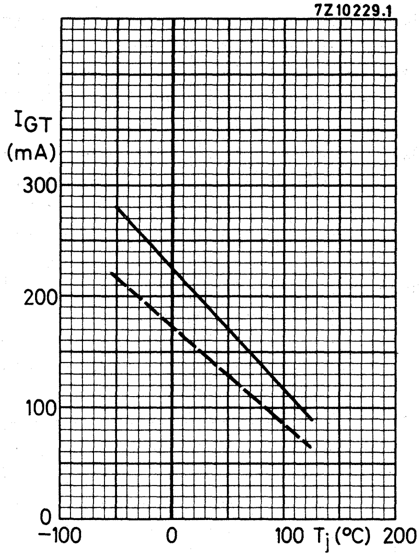


Fig. 7 Minimum gate current that will trigger all devices as a function of T_j.

Conditions for Figs 6 and 7:

——— T_2 negative, gate positive with respect to T_1
– – – all other conditions

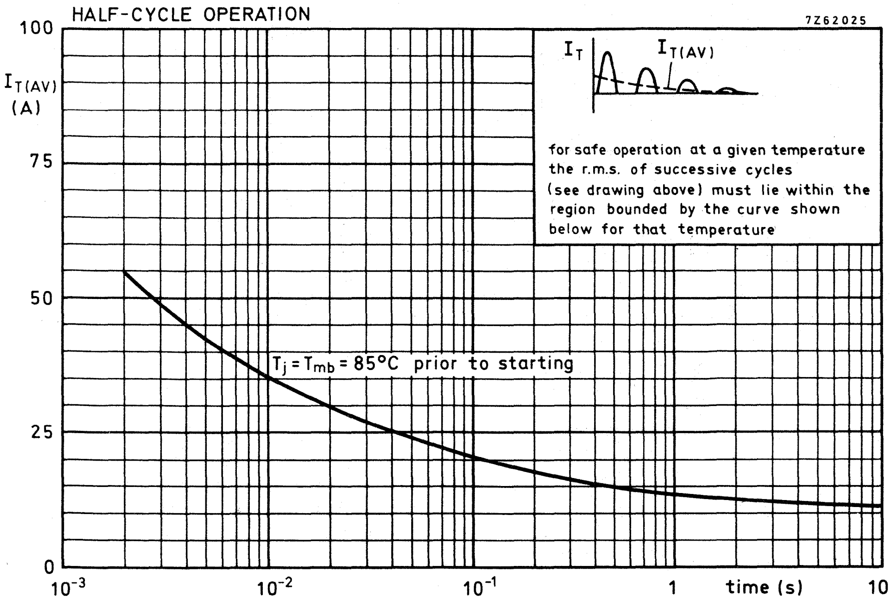

HALF-CYCLE OPERATION
7Z62025
$I_{T(AV)}$ (A)
100
75
50
25
0
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10
I_T
$I_{T(AV)}$
for safe operation at a given temperature the r.m.s. of successive cycles (see drawing above) must lie within the region bounded by the curve shown below for that temperature
$T_j = T_{mb} = 85°C$ prior to starting

Fig. 8.

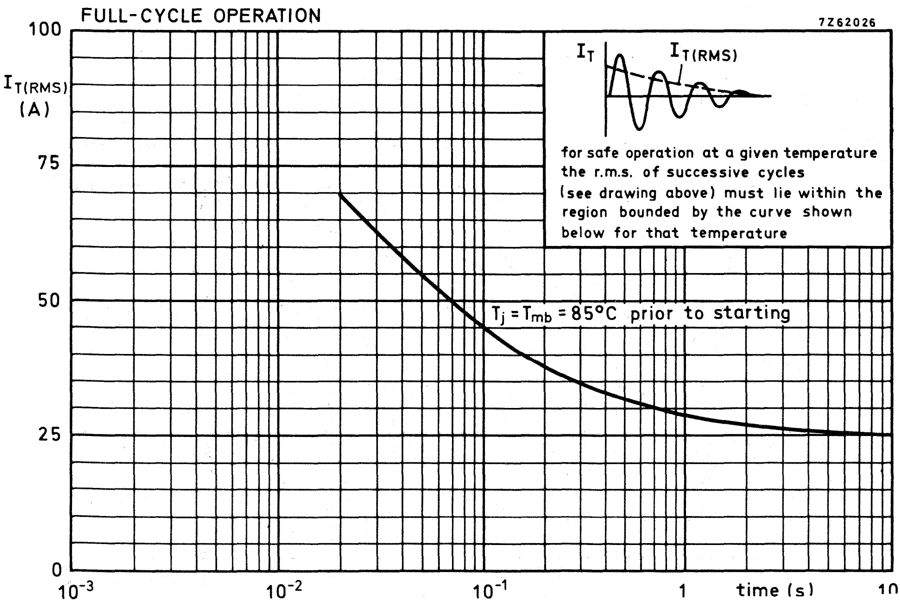

FULL-CYCLE OPERATION
7Z62026
$I_{T(RMS)}$ (A)
100
75
50
25
0
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10
I_T
$I_{T(RMS)}$
for safe operation at a given temperature the r.m.s. of successive cycles (see drawing above) must lie within the region bounded by the curve shown below for that temperature
$T_j = T_{mb} = 85°C$ prior to starting

Fig. 9.

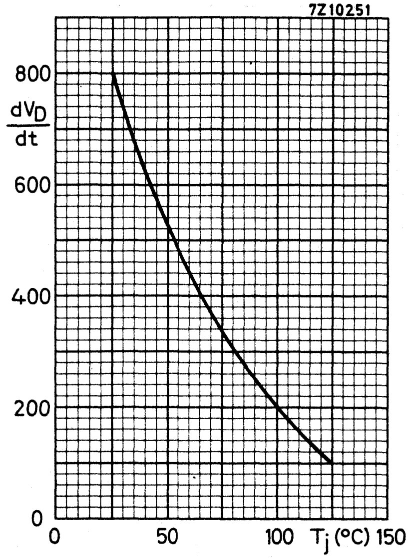


Fig. 10 Maximum rate of rise of off-state voltage that will not trigger any device (exponential method) as a function of T_j.

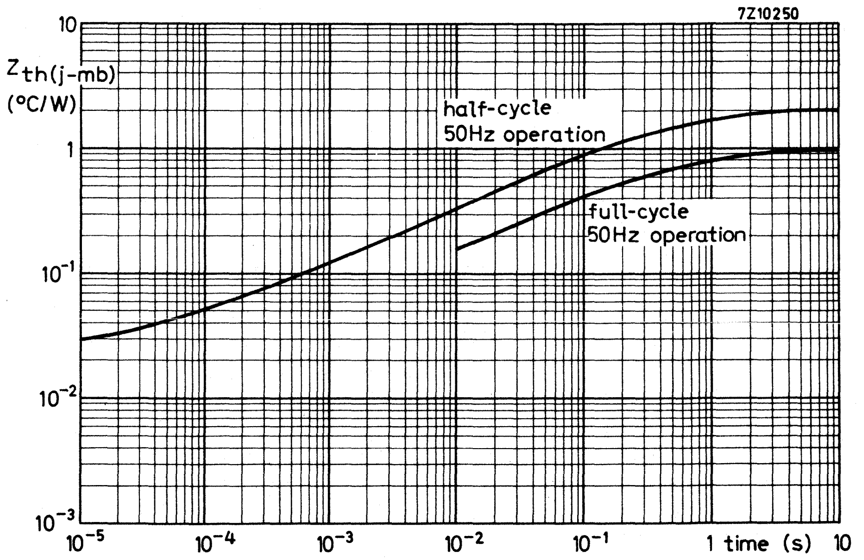


Fig. 11.

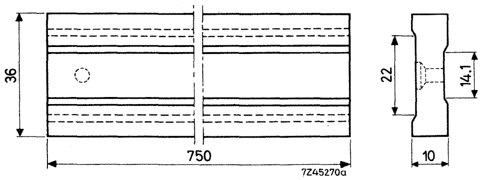
ACCESSORIES

MOUNTING STRIPS

56233

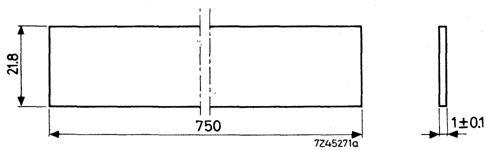
MECHANICAL DATA

Dimensions in mm



mounting strip of insulating material

Weight with cover:
330 g

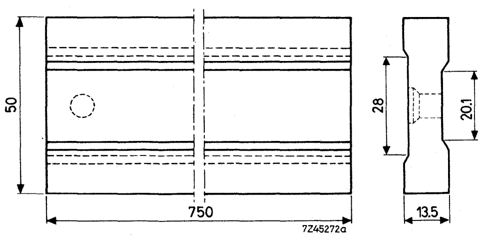


insulating plate (cover)

56234

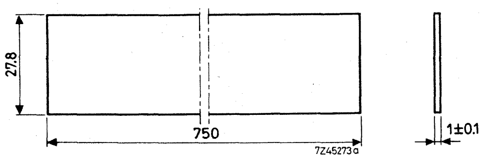
MECHANICAL DATA

Dimensions in mm



mounting strip of insulating material

Weight with cover:
615 g

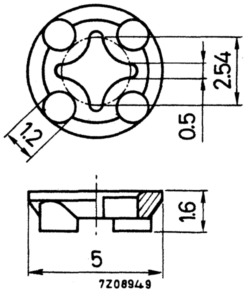


insulating plate (cover)

DISTANCE DISC

MECHANICAL DATA

Dimensions in mm



Insulating material

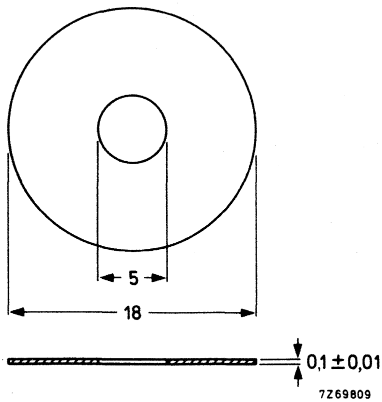
TEMPERATURE

Maximum allowable temperature $T_{max} = 100\ ^{o}C$

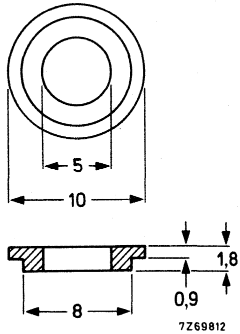
MOUNTING ACCESSORIES

MECHANICAL DATA

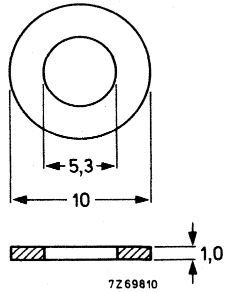
Dimensions in mm



mica washer



insulating ring



plain washer
material: brass, nickel plated

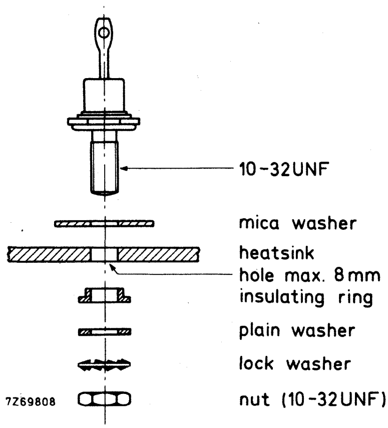
THERMAL RESISTANCE

From mounting base to heatsink (with mica washer)	$R_{th\,mb\text{-}h}$	=	5	$^{o}C/W$

TEMPERATURE

Maximum permissible temperature	T_{max}	=	125	^{o}C

MOUNTING INSTRUCTIONS

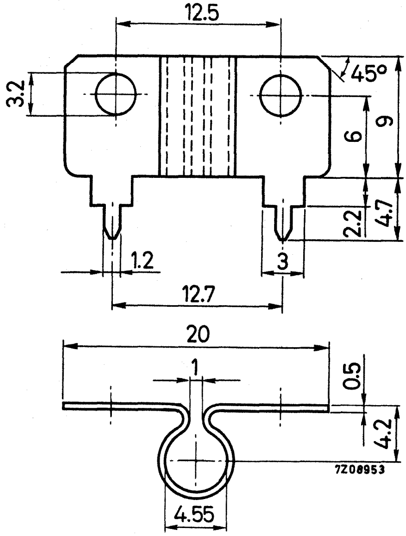


Note: When using a tag for electrical contact insert tag between nut and plain washer or replace plain washer by tag.

COOLING FIN

MECHANICAL DATA

Dimensions in mm



Fin material: copper, tin plated

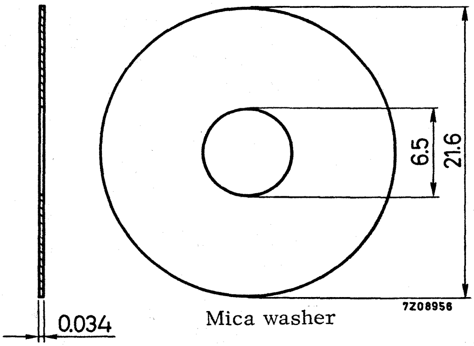
THERMAL RESISTANCE

From case to ambient $R_{th\,c-a} = 100\ ^{o}C/W$

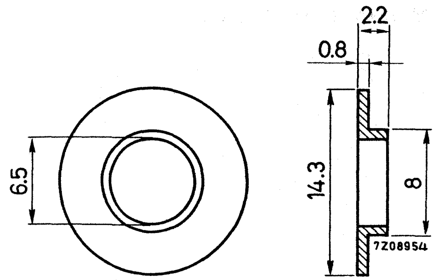
MOUNTING ACCESSORIES

MECHANICAL DATA

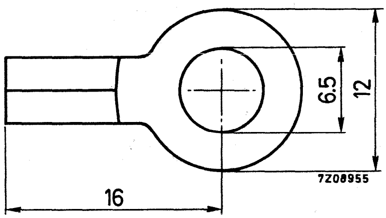
Dimensions in mm



Mica washer



Insulating ring



Soldering tag

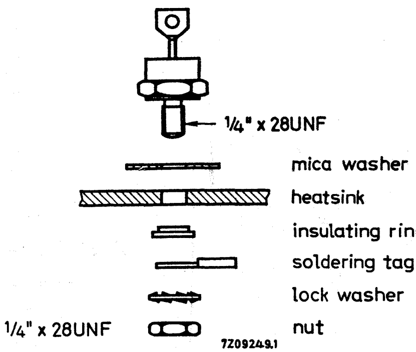
THERMAL RESISTANCE

From mounting base to heatsink with mica washer $R_{th\,mb\text{-}h}$ = 4 $^{o}C/W$

TEMPERATURE

Maximum allowable temperature T_{max} = 175 ^{o}C

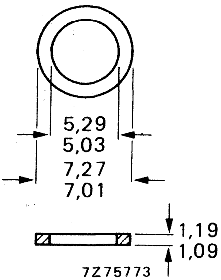
MOUNTING INSTRUCTIONS



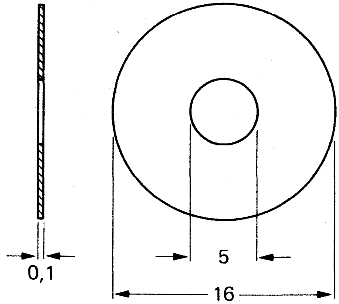
MOUNTING ACCESSORIES

MECHANICAL DATA

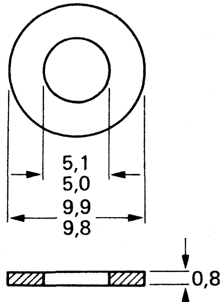
Dimensions in mm



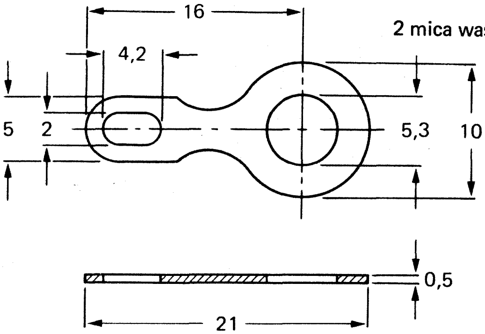
7Z75773
PTFE bush



7Z75775
2 mica washers



7Z75774
plain washer



terminal tag
7Z75772

THERMAL RESISTANCE

From mounting base to heatsink

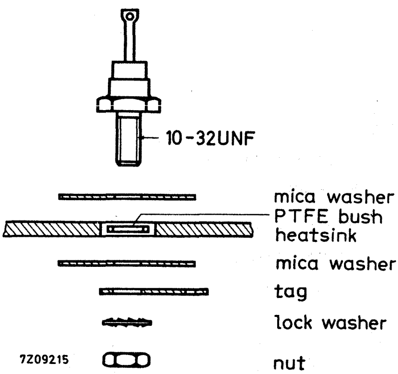
$R_{th\ mb\text{-}h} = 5\ ^{o}C/W$

TEMPERATURE

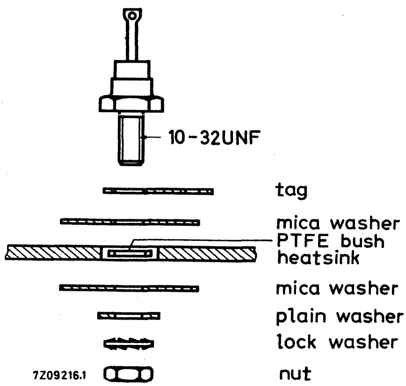
Maximum allowable temperature

$T_{max} = 175\ ^{o}C$

MOUNTING INSTRUCTIONS



7Z09215

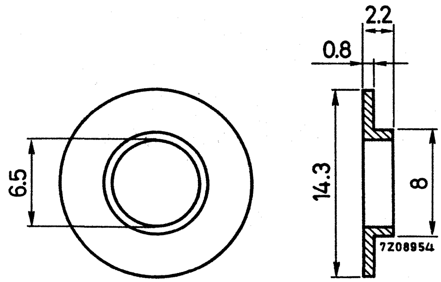


7Z09216.1

INSULATING RING

MECHANICAL DATA

Dimensions in mm

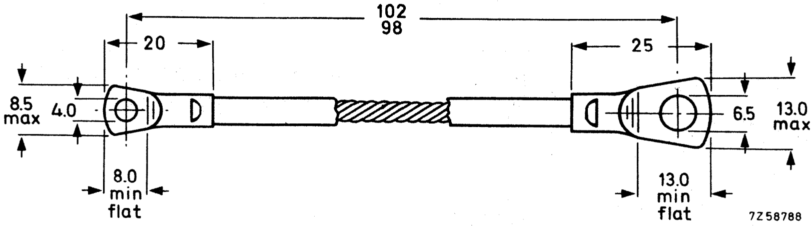


Accessories 56299 is the insulating ring of 56264A

Maximum operating temperature T_{max} = 175 °C

EXTERNAL LEAD

MECHANICAL DATA Dimensions in mm

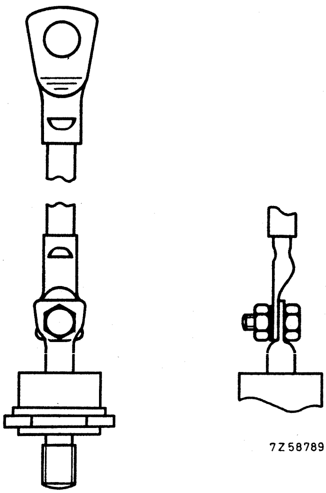


Net weight: 12 g

56309B: External anode lead (blue lead)

56309R: External cathode lead (red lead)

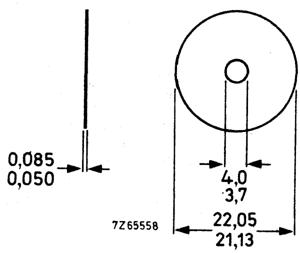
MOUNTING METHOD



MICA WASHER

MECHANICAL DATA

Dimensions in mm

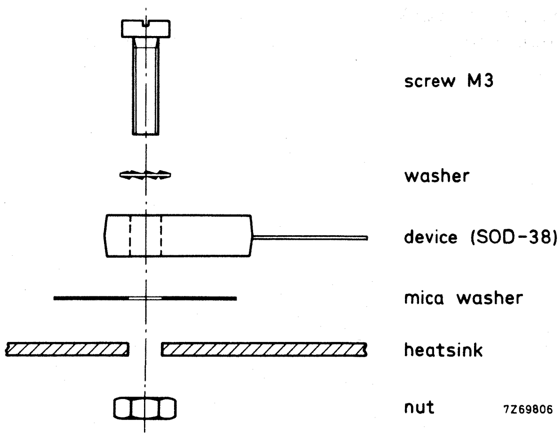


THERMAL RESISTANCE

From mounting base to heatsink

with heatsink compound	$R_{th\ mb\text{-}h}$	=	1,2 $^{o}C/W$
without heatsink compound	$R_{th\ mb\text{-}h}$	=	2,3 $^{o}C/W$

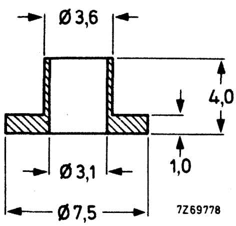
MOUNTING INSTRUCTIONS



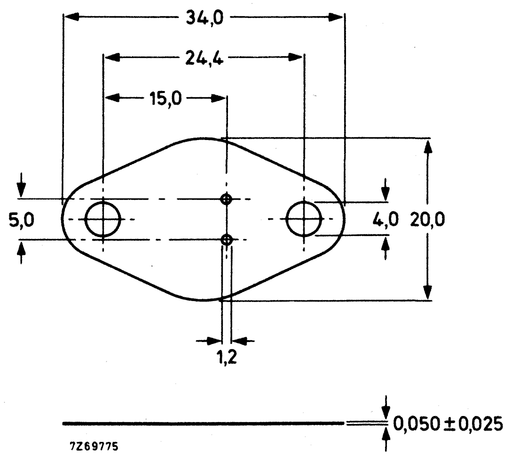
MOUNTING ACCESSORIES

MECHANICAL DATA

Dimensions in mm



2 insulating bushes



mica washer

THERMAL RESISTANCE

From mounting base to heatsink
with heatsink compound $R_{th\ mb\text{-}h}$ = 1 °C/W

MOUNTING ACCESSORIES FOR SOT-80

MECHANICAL DATA

Dimensions in mm

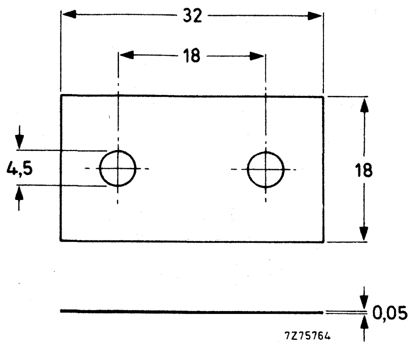


Fig. 1 Mica insulator.

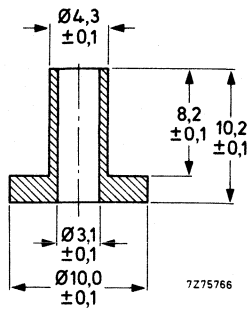


Fig. 2 Two insulating bushes; material: glass-filled nylon.

THERMAL RESISTANCE

From mounting base to heatsink
with heatsink compound $R_{th\ mb-h}$ = 1 °C/W
without heatsink compound $R_{th\ mb-h}$ = 2 °C/W

TEMPERATURE

Maximum permissible temperature of insulating bush T_{max} = 150 °C

INSTRUCTIONS FOR SCREW MOUNTING SOT-80

Insulated mounting

- *through heatsink with nuts*

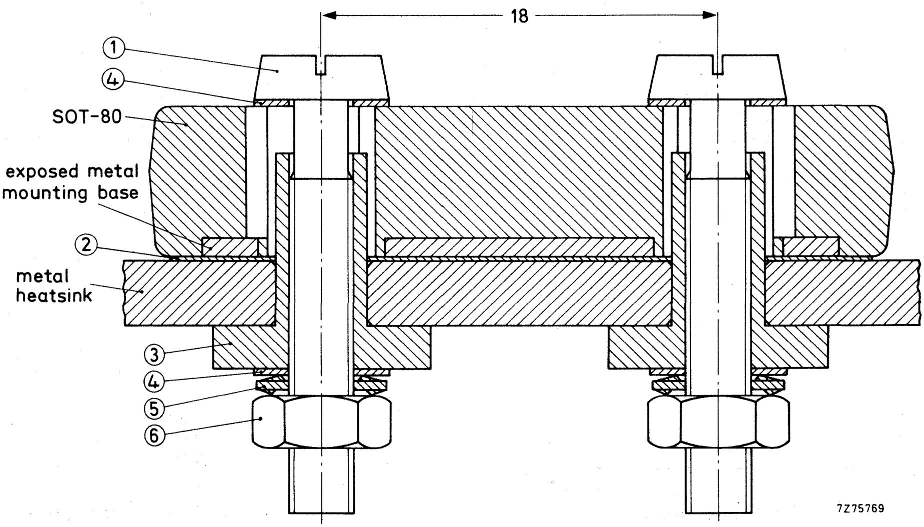


Fig. 3 Assembly.

1 = M3 screw, 20 mm long
2 = mica insulator (56358)
3 = insulating bush (56358)
4 = plain washer
5 = lock washer, internal teeth
6 = M3 nut

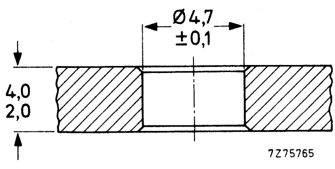


Fig. 4 Heatsink requirements.

Insulated mounting

- *into tapped heatsink*

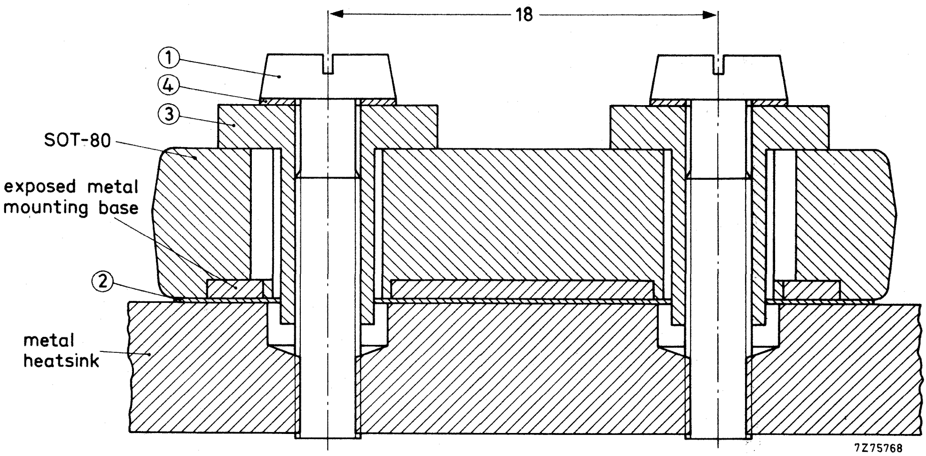


Fig. 5 Assembly.

1 = M3 screw, 15 mm long
2 = mica insulator (56368)
3 = insulating bush (56368)
4 = plain washer

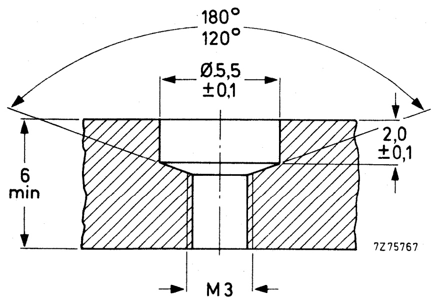


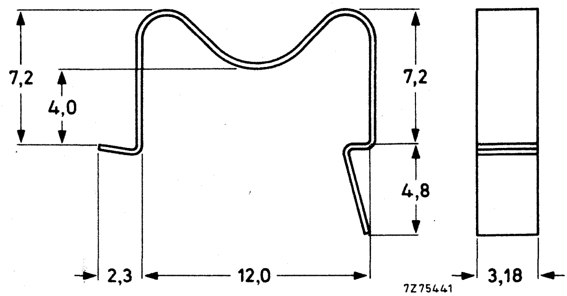
Fig. 6 Heatsink requirements.

CLIPS FOR TO-220 ENVELOPES

MECHANICAL DATA

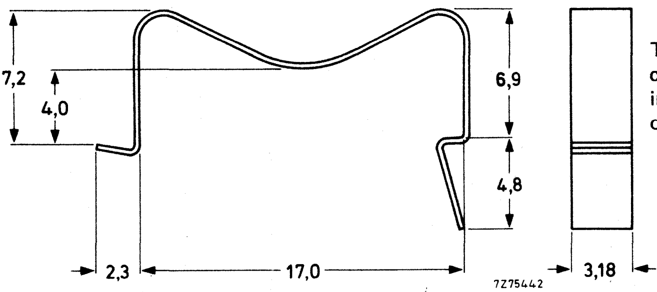
Dimensions in mm

56363



Spring clip for direct mounting on heatsink of 1,0 to 2,0 mm;
material: steel, zinc-chromate passivated.

56364



To be used in conjunction with insulators **56367** or **56369**.

Spring clip for insulated mounting on heatsink of 1,0 to 2,5 mm;
material : steel, zinc-chromate passivated.

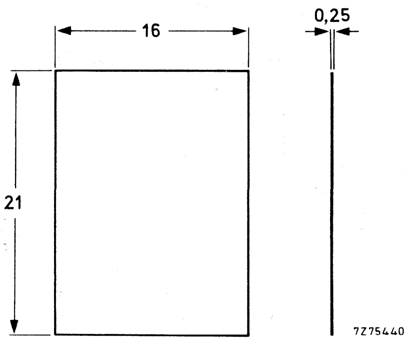
Mounting instructions with R_{th} values are given separately.

INSULATORS FOR TO-220 ENVELOPES

MECHANICAL DATA

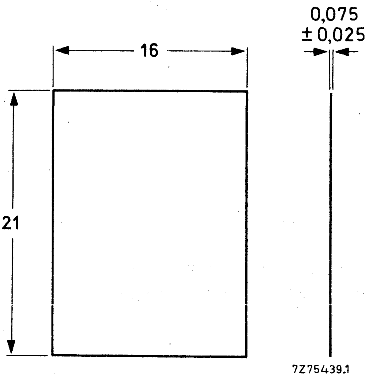
Dimensions in mm

56367



Alumina insulator (up to 2 kV) to be used in conjunction with spring clip **56364**; material: 96-alumina.*

56369



Mica insulator (up to 2 kV) to be used in conjunction with spring clip **56364**.

Mounting instructions with R_{th} values are given separately.

* Because alumina is brittle, extreme care must be taken, when mounting devices, not to crack the alumina, particularly when used without heatsink compound.

CLIP FOR SOT-112 ENVELOPE

MECHANICAL DATA

Dimensions in mm

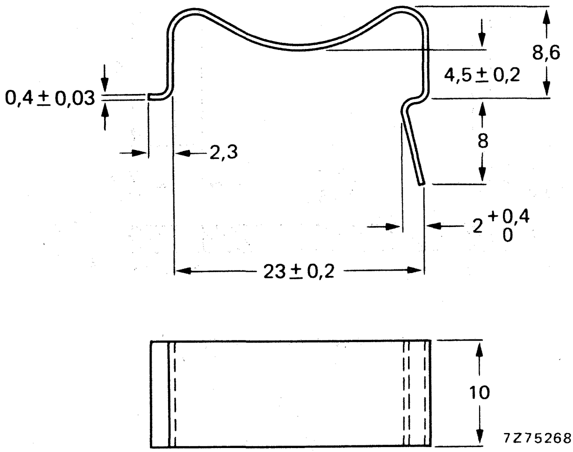


Fig. 1 Clip; material: steel, blackened (zinc-chromate passivated).

THERMAL RESISTANCE

From mounting base to heatsink			
with a metallic oxide-loaded compound	$R_{th\ m\text{-}h}$	=	1,0 °C/W
without heatsink compound	$R_{th\ m\text{-}h}$	=	2,0 °C/W

MOUNTING INSTRUCTIONS

1. Place the device on the heatsink, applying a metallic oxide-loaded compound to the mounting base.
2. Push the short end of the clip into the narrow slot of the heatsink with the clip at an angle 10° to 30° to the vertical.
3. Push down the clip over the device until the long end of the clip snaps into the wide slot. The clip should bear on the middle of the plastic body.

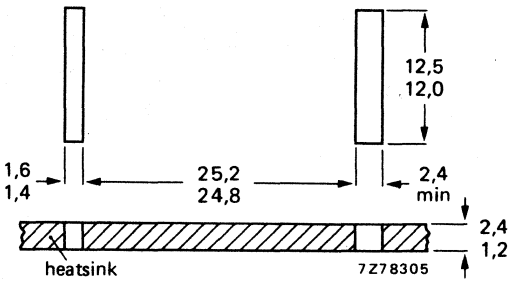


Fig. 2 Hole pattern for clip in heatsink.

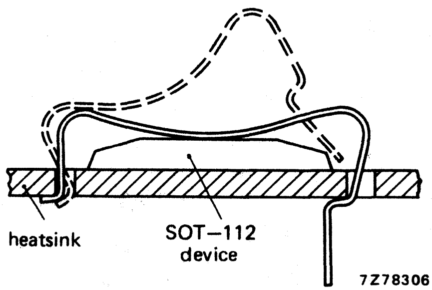


Fig. 3 Mounting of the clip.

MOUNTING INSTRUCTIONS FOR TO-220 ENVELOPES

GENERAL DATA AND INSTRUCTIONS FOR HEATSINK OPERATION

General rules

1. First fasten the devices to the heatsink before soldering the leads.
2. Use of heatsink compound is recommended.
3. Avoid axial stress to the leads.
4. Keep mounting tool (e.g. screwdriver) clear of the plastic body.
5. It is recommended that the circuit connections be made to the leads rather than direct to the heatsink.

Heatsink requirements

Flatness in the mounting area: 0,02 mm maximum per 10 mm.
Mounting holes must be deburred.

Heatsink compound

Values of the thermal resistance from mounting base to heatsink ($R_{th\ mb\text{-}h}$) given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. The compound should be an electrical insulator and be applied sparingly and evenly to both interfaces. Ordinary silicone grease is not recommended.

For insulated mounting, the compound should be applied to the bottom of both device and insulator.

Mounting methods for thyristors and triacs

1. Clip mounting.

   Mounting by means of spring clip offers:
   a. A good thermal contact under the crystal area, and slightly lower $R_{th\ mb\text{-}h}$ values than screw mounting.
   b. Safe insulation for mains operation.

   Recommended force of clip on device is 120 N (12 kgf).

2. M3 screw mounting.

   Care should be taken to avoid damage to the plastic body. It is therefore recommended that a cross-recess pan-headed screw be used. Do not use self-tapping screws.

   Mounting torque for screw mounting:

Minimum torque (for good heat transfer)	0,55 Nm (5,5 kgcm)
Maximum torque (to avoid damaging the device)	0,80 Nm (8,0 kgcm)

   N.B.: When a nut or screw is not driven direct against a curved spring washer or lock washer, the torques are as follows:

Minimum torque (for good heat transfer)	0,4 Nm (4 kgcm)
Maximum torque (to avoid damaging the device)	0,6 Nm (6 kgcm)

   N.B.: Data on accessories are given in separate data sheets.

3. Rivet mounting (only possible for non-insulated mounting)

   The device should not be pop-rivetted to the heatsink. However, it is permissible to press-rivet providing that eyelet rivets of soft material are used, and the press forces are slowly and carefully controlled so as to avoid shock and deformation of either heatsink or mounting tab.

Thermal data

			clip mounting	screw mounting	
Thermal resistance from mounting base to heatsink					
with heatsink compound, direct mounting	$R_{th\ mb\text{-}h}$	=	0,3	0,5	°C/W
without heatsink compound, direct mounting	$R_{th\ mb\text{-}h}$	=	1,4	1,4	°C/W
with heatsink compound and mica insulator 56369	$R_{th\ mb\text{-}h}$	=	2,2	–	°C/W
with heatsink compound and alumina insulator 56367	$R_{th\ mb\text{-}h}$	=	0,8	–	°C/W

Lead bending

Maximum permissible tensile force on the body, for 5 seconds is 5 N (0,5 kgf).

The leads can be bent through 90° maximum, twisted or straightened. To keep forces within the above-mentioned limits, the leads are generally clamped near the body. The leads should neither be bent nor twisted less than 2,4 mm from the body.

Soldering

Lead soldering temperature at 4,7 mm from the body; $t_{sld} < 5$ s: $T_{sld\ max} = 275$ °C.

Avoid any force on body and leads during or after soldering: do not move the device or leads after soldering.

It is not permitted to solder the metal tab of the device to a heatsink, otherwise its junction temperature rating will be exceeded.

INSTRUCTIONS FOR CLIP MOUNTING

Direct mounting with clip 56363

1. Place the device on the heatsink, applying heatsink compound to the mounting base.
2. Push the short end of the clip into the narrow slot in the heatsink with the clip at an angle of 10^o to 30^o to the vertical (see Fig. 1).
3. Push down the clip over the device until the long end of the clip snaps into the wide slot in the heatsink. The clip should bear on the plastic body, not on the tab (see Fig. 1(c)).

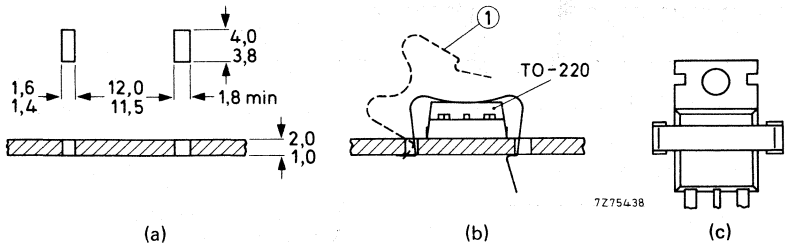


Fig. 1 (a) Heatsink requirements; (b) mounting (1 = spring clip); (c) position of the device (top view).

Insulated mounting with clip 56364

With the insulators 56367 or 56369 insulation up to 2 kV is obtained.

1. Place the device with the insulator on the heatsink, applying heatsink compound to the bottom of both device and insulator.
2. Push the short end of the clip into the narrow slot in the heatsink with the clip at an angle of 10^o to 30^o to the vertical (see Fig. 2).
3. Push down the clip over the device until the long end of the clip snaps into the wide slot in the heatsink. The clip should bear on the plastic body, not on the tab (see Fig. 2(c)). There should be minimum 3 mm distance between the device and the edge of the insulator for adequate creepage.

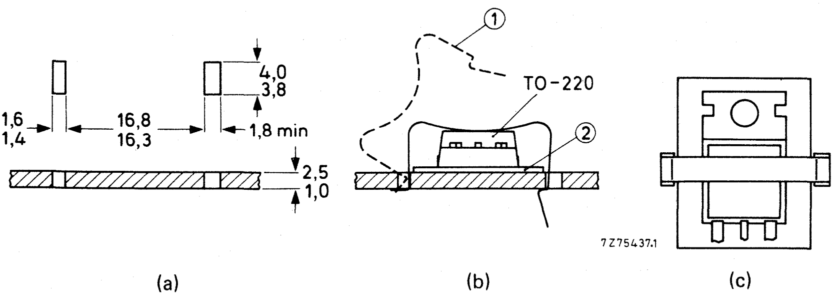
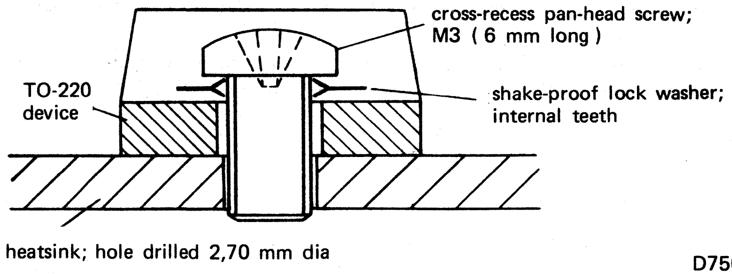


Fig. 2 (a) Heatsink requirements; (b) mounting (1 = spring clip, 2 = insulator 56369 or 56367); (c) position of the device (top view).

INSTRUCTIONS FOR SCREW MOUNTING

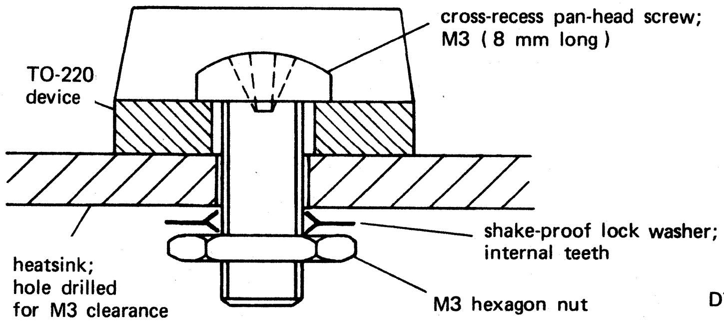
Direct mounting with screw

- *into tapped heatsink*



D7509 A

- *through heatsink with nut*



D7510A

HEATSINKS

General
Flat heatsinks
Diecast heatsinks
Heatsink extrusions

Heatsinks are used where a semiconductor device is unable of itself to dissipate the heat generated by its internal power losses without the junction temperature exceeding its maximum. The simplest form of heatsink is a flat metal plate, but for economy in weight, size, and cost, more complex shapes are usually used.
Apart from information on heat transfer and the construction of assemblies, this Section shows how to take advantage of reverse polarity types, describes three types of heatsink, and gives calculation examples.

HEAT TRANSFER PATH

In, for example, a silicon rectifier the heat is generated inside the wafer and flows mainly by way of the base, through a heatsink to the ambient air.
The heat flow can be likened to the flow of electric current, with thermal resistance (R_{th} in ^{o}C/W) analogous to the electric resistance (R in Ω).
Fig. 1 shows the heat path from junction to ambient as three thermal resistances in series:

$R_{th\ j\text{-}mb}$ The thermal resistance from junction to mounting base. Its value is given in the data sheets of a device.

$R_{th\ mb\text{-}h}$ The thermal resistance from mounting base to heatsink (contact thermal resistance). It is caused by the imperfect nature and limited size of the contact between the two. Its value is also given in the data sheets.

$R_{th\ h\text{-}a}$ The thermal resistance between the contact surface mentioned above and the ambient air.

For thermal balance air warmed by the heatsink must be replaced by cool, i.e., there must be an air flow.
From Fig. 1: $T_j - T_{amb} = P \times (R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a})$

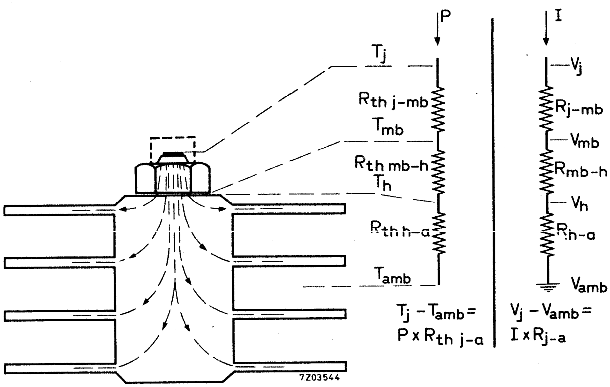


Fig. 1

IMPROVING HEAT TRANSFER

Heat transfer can be improved by reducing the thermal resistance of the contact and the thermal resistance of the heatsink.

Contact thermal resistance

- Make the contact area large
- Make the contact surfaces plane parallel by attention to drilling an punching, and make them burr-free.
- Apply sufficient pressure. Use a torque spanner adjusted to at least the rated minimum torque.
- Use silicon grease to fill air pockets. The thermal resistance of a thin film of grease (e.g. Dow Corning 340) is much less than that of a thin layer of air.

Heatsink thermal resistance

- Paint or anodise the surface to improve radiation
- Increase the flow of cooling air
- Use a larger heatsink

The simplest form of air flow is natural convection. Mount the fins vertically, make intake and outlet apertures large, avoid obstructions, create a draught (chimney effect). A blower or fan must be used where free convection is not enough or where a smaller heatsink is wanted.

INSULATED MOUNTING

Where a semiconductor must be insulated from its heatsink (e.g., in bridge rectifiers) by a mica or teflon washer, the contact thermal resistance will be about ten times higher than without insulation. This must be compensated by a reduction in $R_{th\,h\text{-}a}$ to keep the total thermal resistance below the maximum given for P and T_{amb}. A larger heatsink may be necessary.

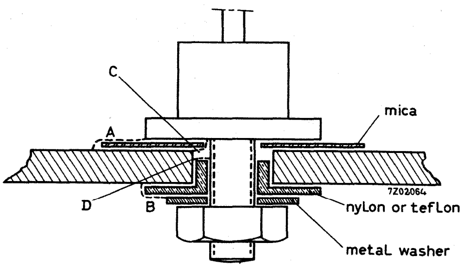


Fig. 2 Creepage distances with an insulated diode

Note: care must be taken that the creepage distances, see Fig. 2, are sufficient for the voltage involved. While A and B can be made large enough, C and D are likely to be the critical ones.

CONSTRUCTIONS

Good thermal coupling is essential to semiconductors connected in parallel to ensure good current sharing in view of the forward characteristics, and semiconductors in series in view of the reverse characteristics.
Mounting the semiconductors on the same heatsink not only saves mounting costs but also provides the needed thermal coupling.
Fig. 3 shows the construction for a plain heatsink, and Fig. 4 the construction for an extruded heatsink. The electrical connection is made with a copper strip at least 1 mm thick. For two diodes a plain heatsink should be twice the area, and an extruded heatsink twice the length needed for a single diode.
Reverse polarity devices are covenient for series connection of two diodes on a common heatsink. Figs. 5, 6 and 7 show how the use of normal polarity and reverse polarity diodes simplifies the construction of single-phase and three-phase bridge rectifiers.

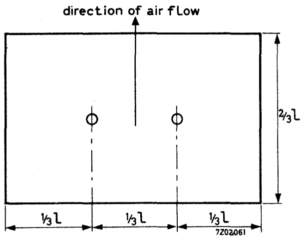


Fig. 3 Plain cooling fin with two diodes

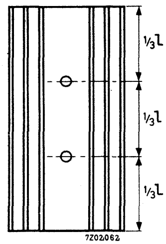
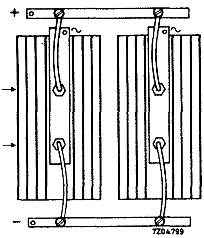


Fig. 4 Extruded aluminium heatsink with two diodes



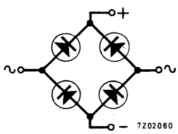


Fig. 5 Single phase full wave rectifier with diodes of different polarity on extruded aluminium heatsinks

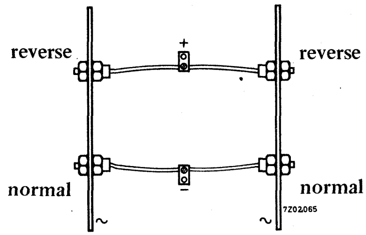


Fig. 6 Single phase full wave rectifier with diodes of different polarity on plain cooling fins (top view)

CONSTRUCTIONS (continued)

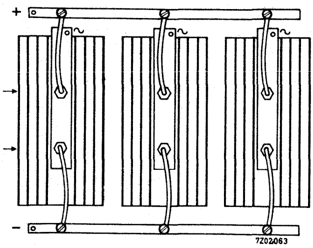
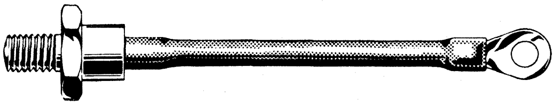


Fig. 7 Three phase full wave rectifier with diodes of different polarity on extruded aluminium heatsinks

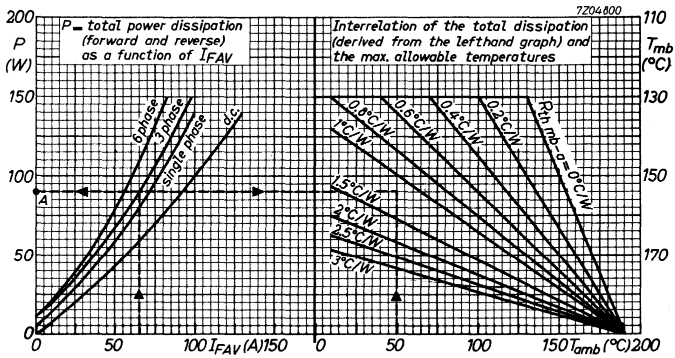
EXAMPLES OF HEATSINK CALCULATION

1. Devices without controlled avalanche properties.
Assume that the diode of which the outlines are shown, is used in a three phase 50 Hz rectifier circuit at T_{amb} = 50 °C. Further assume: average forward current per diode $I_{F(AV)}$ = 65 A; contact thermal resistance $R_{th\ mb\text{-}h}$ = 0,1 °C/W.



Stud: M12
Mounting base, across the flats: max. 27 mm

From the data of the diode the graph to be used is shown below.



From the lefthand graph it follows that P_{tot} = 90 W per diode (point A).
From the righthand graph it follows that $R_{th\ mb\text{-}a} \approx$ 1, 2 °C/W.
Thus $R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}$ = (1, 2 − 0, 1) °C/W = 1, 1 °C/W.
This may be achieved by different types of heatsinks as shown below.

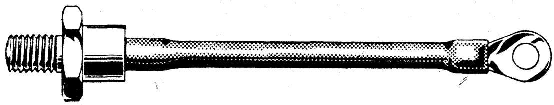
Type	Free convection	Forced cooling
flat, blackened bright	– –	125 cm²; 2 m/s or 300 cm²; 1 m/s 175 cm²; 2 m/s
diecast 56280	applicable	
extrusion 56230 bright blackened 56231 bright blackened	 ℓ = 12 cm ℓ = 8 cm ℓ = 7 cm ℓ = 5 cm [1])	 ℓ = 5 cm [1]); 1 m/s ℓ = 5 cm [1]); 1 m/s

[1]) Practical minimum length

EXAMPLES OF HEATSINK CALCULATION (continued)

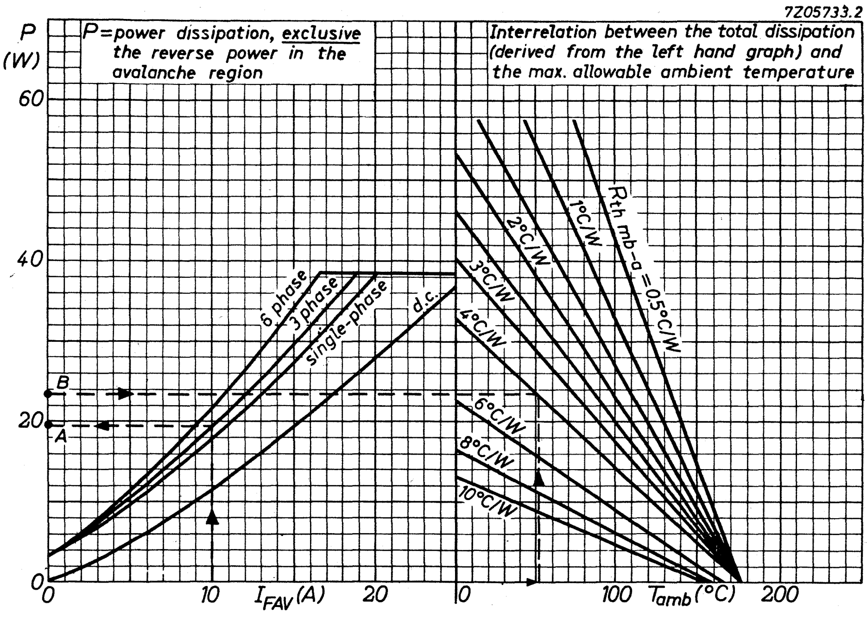
2. <u>Devices with controlled avalanche properties</u>

Assume that the diode of which the outlines are shown, is used in a three phase 50 Hz rectifier circuit at T_{amb} = 40 °C. Further assume: average forward current per diode $I_{F(AV)}$ = 10 A; contact thermal resistance:
$R_{th\ mb\text{-}h}$ = 0, 5 °C/W; repetitive peak reverse power in the avalanche region (t = 40 μs) P_{RRM} = 2 kW (per diode).



Stud: M12
Mounting base, across the flats: max. 27 mm

From the data of this diode the graph to be used is shown below.



From the lefthand graph it follows that P_{tot} = 19,5 W per diode (point A). The average reverse power in the avalanche region, averaged over any cycle, follows from

$P_{R(AV)} = \delta \times P_{RRM}$, where the duty cycle $\delta = \frac{40\ \mu s}{20\ ms} = 0,002$.

Thus $P_{R(AV)}$ = 0, 002 x 2 kW = 4 W.

Therefore the total device power dissipation P_{tot} = 19,5 + 4 = 23,5 W (point B). From the righthand graph it follows that $R_{th\ mb\text{-}a}$ = 4 °C/W. Hence the heatsink thermal resistance should be:

$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h} = (4 - 0,5)\ ^{o}C/W = 3,5\ ^{o}C/W.$$

A table of applicable heatsinks, similar to that on the foregoing page, can de derived for this case.

heatsinks

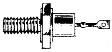
selection guide

Rectifier diodes
Thyristors
Triacs

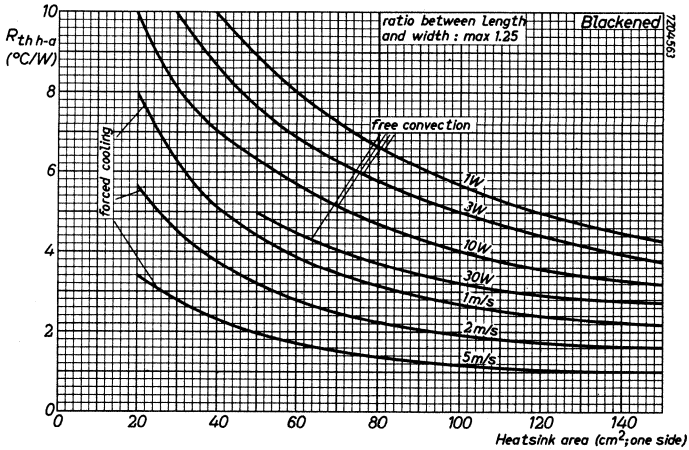
K-code to DIN-41882	K15	K9	K9	K5	K5	K3	K3	K3	K3	K3
type	**56268**	**56256**	**56350**	**56334**	**56349**	**56319**	**56253**	**56312**	**56271**	**56348**
BYX38	●									
BYX39	●	●								
BYX50	●									
1N3879 to 82	●									
1N3889 to 92	●	●		●						
BYX98	●	●								
BYX42	●	●		●						
BYX99		●		●						
BYX30		●		●						
BYX25		●		●		●				
BYX46		●		●		●				
BYW30		●	●	●	●					
BYW31			●	●	●	●				●
BYX96										●
BYW92							●	●		
BYX56							●			
BYX97								●		
BYX32										
BYX52							●			
BTY79	●	●		●		●				
BTW38	●		●		●					●
BTW42			●		●					●
BTY87							●			
BTY91							●			
BTW47								●		
BTW30								●		
BTW45								●		
BTW40								●		
BTW92								●		
BTW31								●		
BTW24										
BTW33										
BTW23										
BTW43			●		●					
BTX94							●			
BTW34										

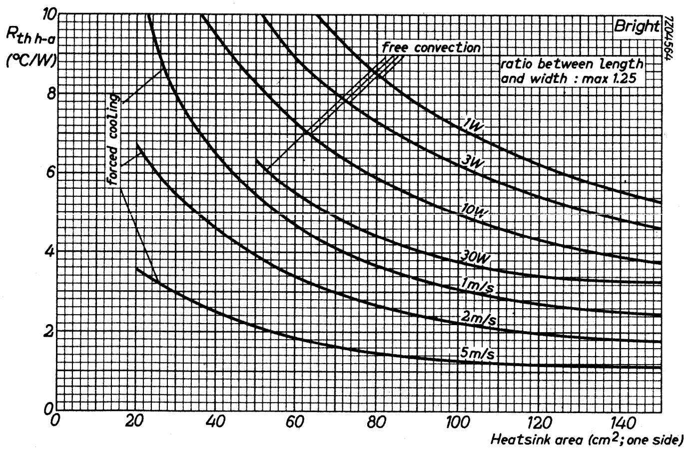
K-code to DIN-41882	K1,1	K1,1	K1,1	K1,1	K0,55	K0,55	Extrusions			
type	**56278**	**56313**	**56314**	**56280**	**56318**	**56315**	**56230**	**56231**	**56290**	**56293**
BYX38							●		●	
BYX39							●		●	
BYX50							●		●	
1N3879 to 82							●		●	
1N3889 to 92							●	●	●	
BYX98							●	●	●	
BYX42							●	●	●	
BYX99							●	●	●	
BYX30							●	●	●	
BYX25							●	●	●	
BYX46							●	●	●	
BYW30										
BYW31										
BYX96							●	●		●
BYW92	●	●					●	●		●
BYX56	●						●	●		●
BYX97		●					●	●		●
BYX32				●		●				●
BYX52	●						●	●		●
BTY79									●	
BTW38									●	
BTW42									●	
BTY87	●						●	●	●	
BTY91	●						●	●	●	
BTW47		●					●	●	●	
BTW30		●					●	●	●	
BTW45		●					●	●	●	
BTW40		●					●	●	●	
BTW92		●					●	●	●	
BTW31		●					●	●	●	
BTW24			●		●		●	●		●
BTW33				●		●				●
BTW23				●		●				●
BTW43									●	
BTX94	●						●	●	●	
BTW34			●		●		●	●		●

Thermal resistance of flat heatsinks of 2 mm copper or 3 mm aluminium.
The graphs are valid for the combination of device and heatsink.

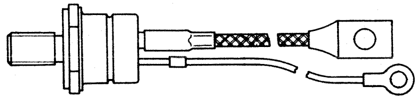


Studs: 10-32UNF
Mounting bases, across the flats: max. 11,0 mm

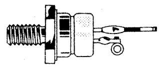




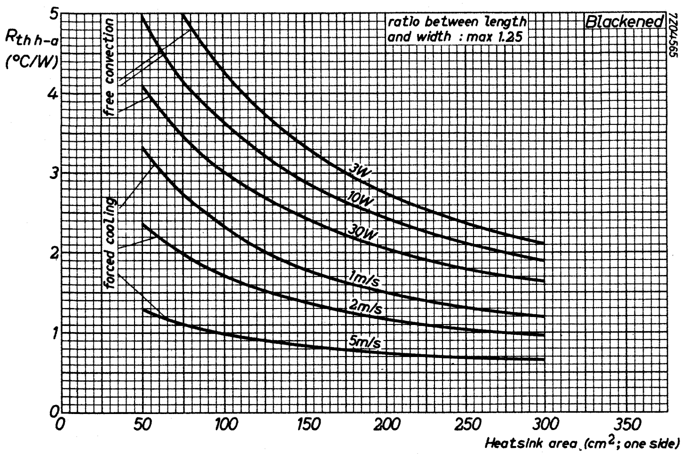
Thermal resistance of flat heatsinks of 2 mm copper or 3 mm aluminium.
The graphs are valid for the combination of device and heatsink.

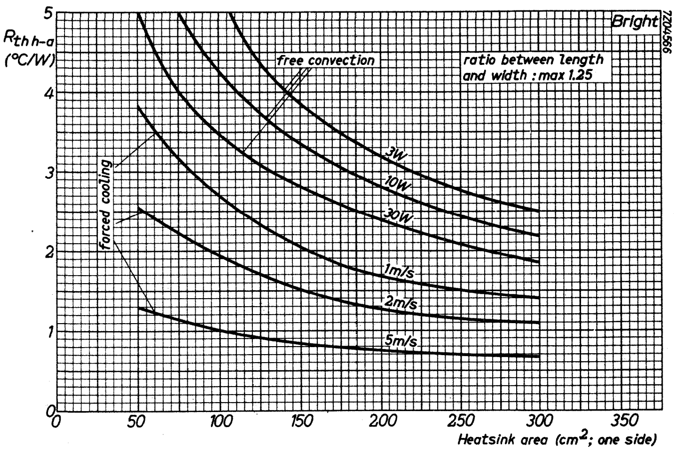


Stud: M8
Mounting base, across the flats: max. 19 mm

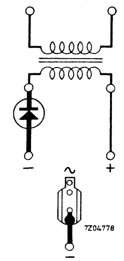
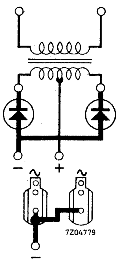
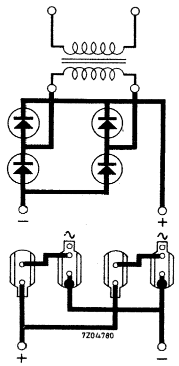
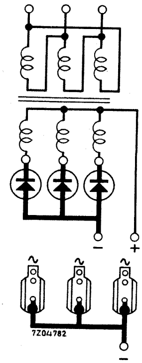


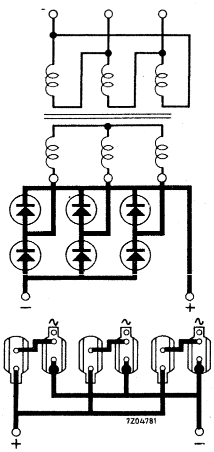
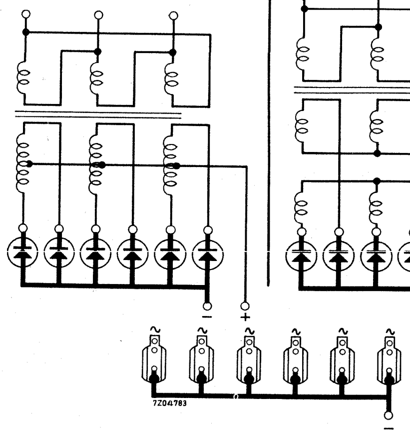
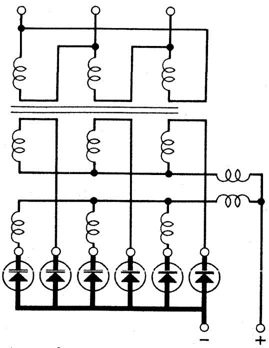
Stud: M6
Stud: $\frac{1}{4}$" x 28 UNF
Mounting base, across the flats: max. 14,0 mm

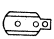


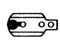


RECTIFIER CIRCUITS ON SINGLE HEATSINKS

Single phase half wave	Two phase half wave	Single phase full wave (Single phase bridge)	Three phase half wave (Three phase star)
			

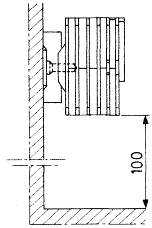
Three phase full wave (Three phase bridge)	Six phase half wave (Six phase star)	Three phase double Y with interphase transformer
		

Diecast heatsink without insulator 

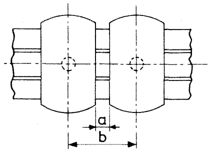
Diecast heatsink with insulator 

MOUNTING INSTRUCTION FOR DIECAST HEATSINKS

1. At free convection cooling or forced air flow < 0, 5 m/s the heatsinks should be mounted with the fins vertical and with a distance to the chassis bottom > 100 mm.

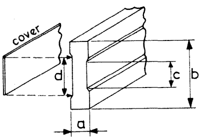


2. At forced air flow > 0, 5 m/s the heatsinks may be mounted in any position.
3. Minimum distance between heatsinks in a row.



Heatsink	Distance (mm)	
	a	b
56256/268	> 5, 0	> 25, 0
56334	> 5, 0	> 40, 0
56253/334	> 10, 0	> 50, 0
56271	> 10, 0	> 50, 0

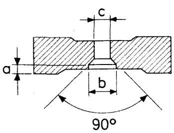
4. The rectifier devices should be fixed to their heatsinks with the torques specified in the relevant published data. Use the torque spanner.
5. For insulated mounting of heatsinks two sizes of mounting strips made of insulating material are available.



Length 750 mm

Strip	Dimensions (mm)				Weight (g) (with cover)
	a	b	c	d	
56233	10, 0	36	14, 1	22	330
56234	13, 5	50	20, 1	28	615

6. Mounting holes to be made in the strips:



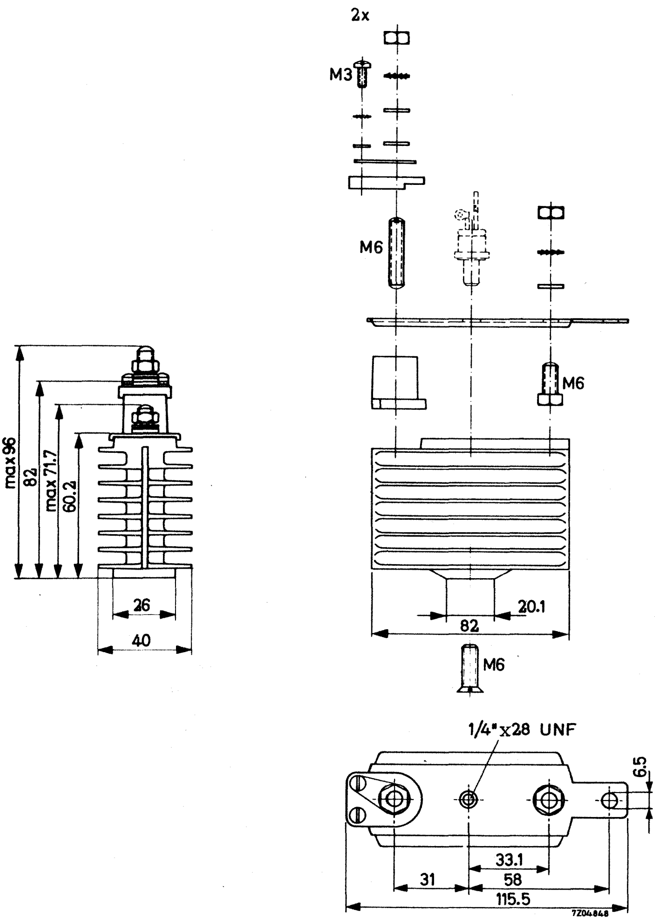
Heatsink	Strip	Dimensions in mm		
		a	b	c
56256/268	56233	< 1, 5	7, 5	4, 3
56253/271	56234	< 1, 3	10, 2	6, 3
56277/334	56234	< 1, 3	10, 2	6, 3

DIECAST HEATSINK

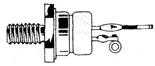
Diecast heatsink of aluminium alloy, painted black, with 1/4" x 28 UNF tap hole for rectifier device.

Weight 305 g

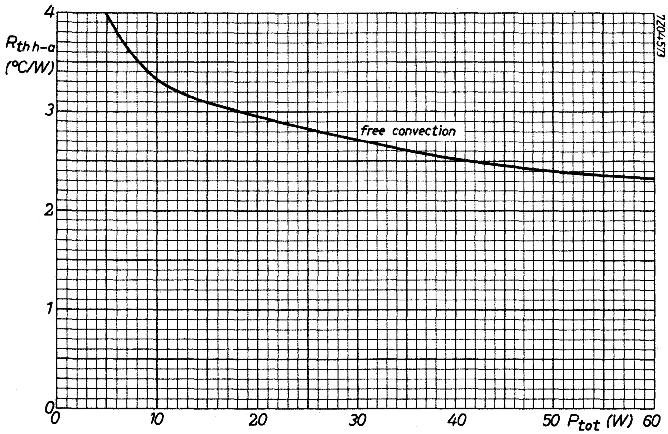
Dimensions in mm

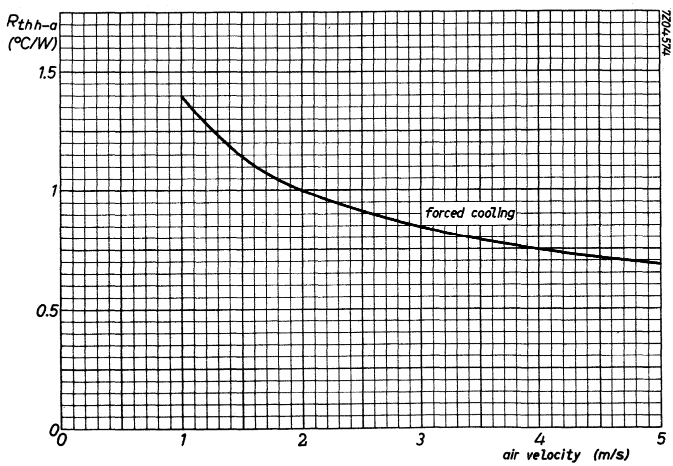


The graphs are valid for the combination of device and heatsink.



Stud: $\frac{1}{4}$" x 28 UNF
Mounting base, across the flats: max. 14,0 mm



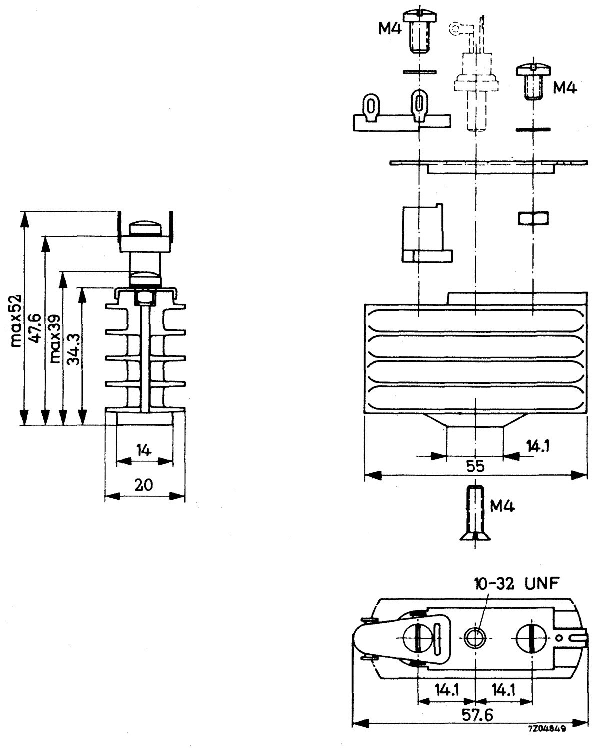


DIECAST HEATSINK

Diecast heatsink of aluminium alloy, painted black, with 10-32 UNF tap hole for rectifier device.

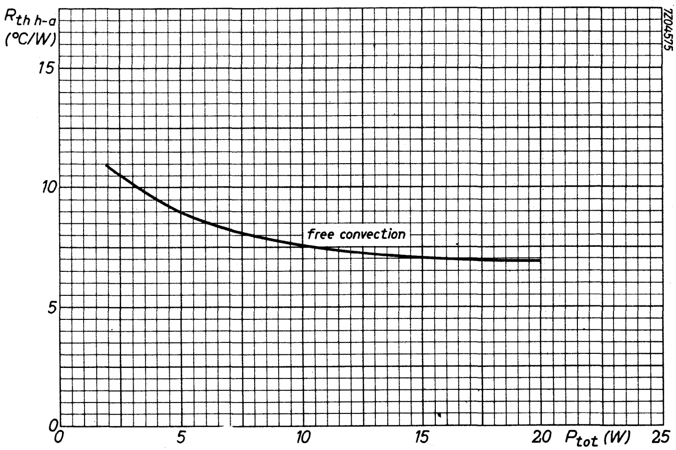
Weight: 55 g

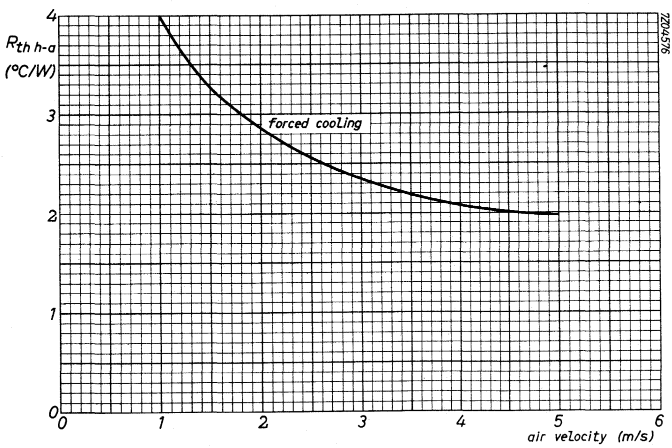
Dimensions in mm



The graphs are valid for the combination of device and heatsink.

Stud: 10 - 32 UNF
Mounting base, across the flats: 11,0 mm



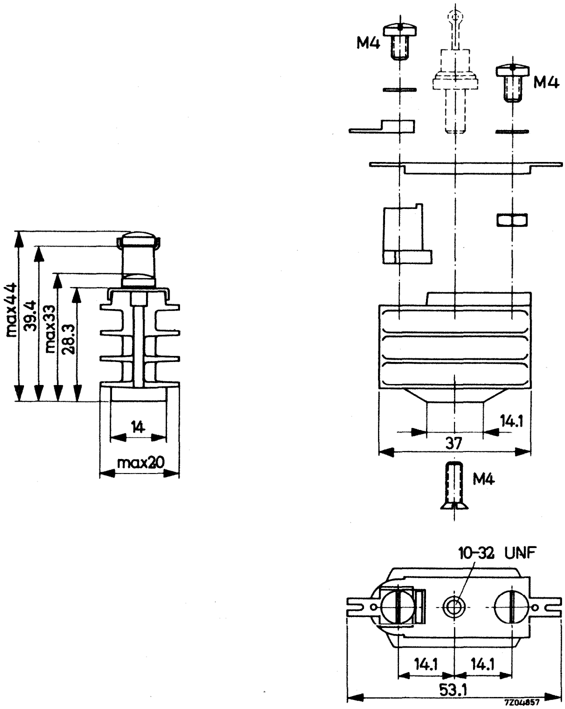


DIECAST HEATSINK

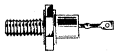
Diecast heatsink of aluminium alloy, painted black, with 10-32UNF tap hole for rectifier device.

Weight: 33 g

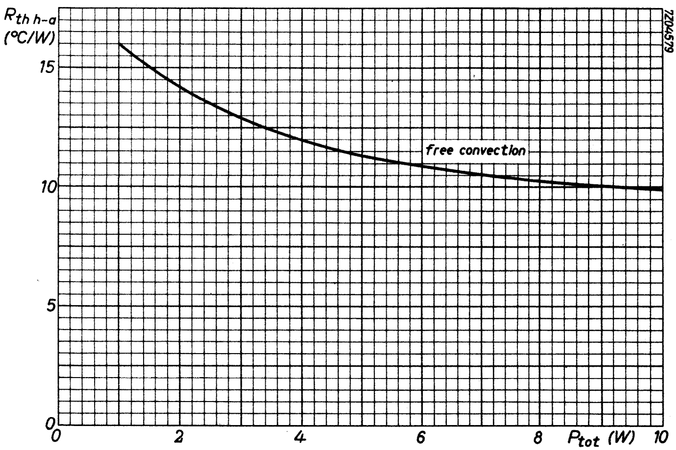
Dimensions in mm

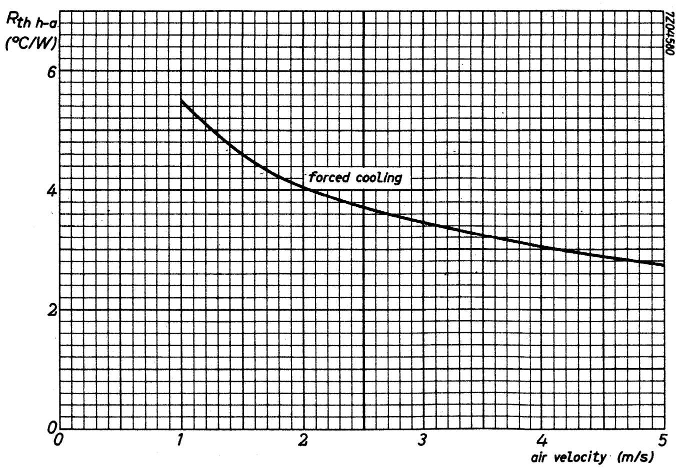


The graphs are valid for the combination of device and heatsink.



Stud: 10 - 32 UNF
Mounting base, across the flats: 11,0 mm



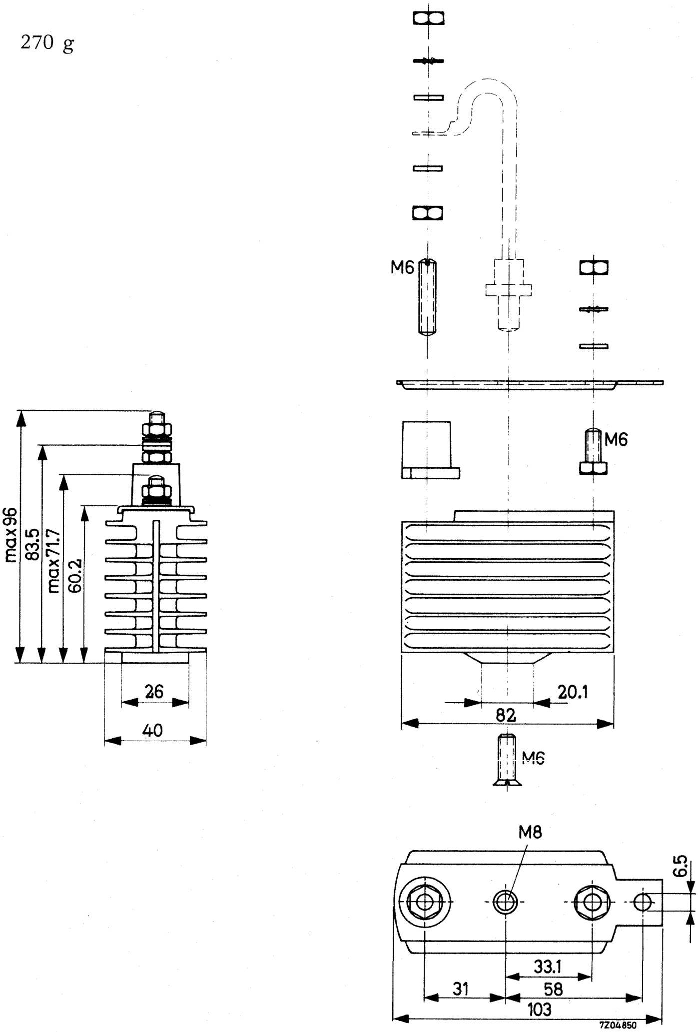


DIECAST HEATSINK

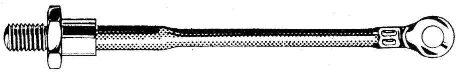
Diecast heatsink of aluminium alloy, painted black, with M8 tap hole for rectifier device.

Weight: 270 g

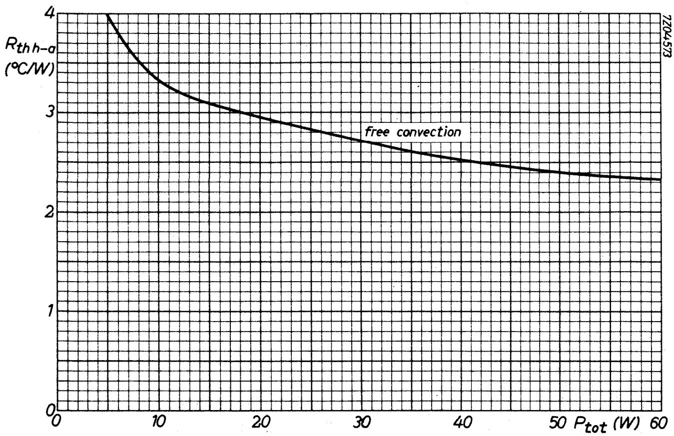
Dimensions in mm

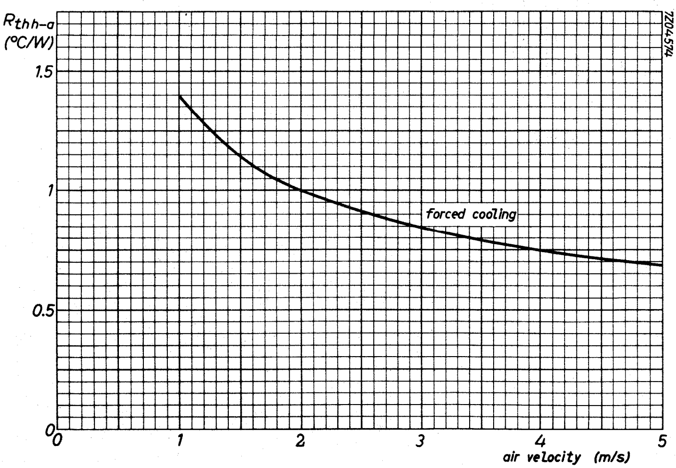


The graphs are valid for the combination of device and heatsink.



Stud: M8
Mounting base, across the flats: 17,0 mm



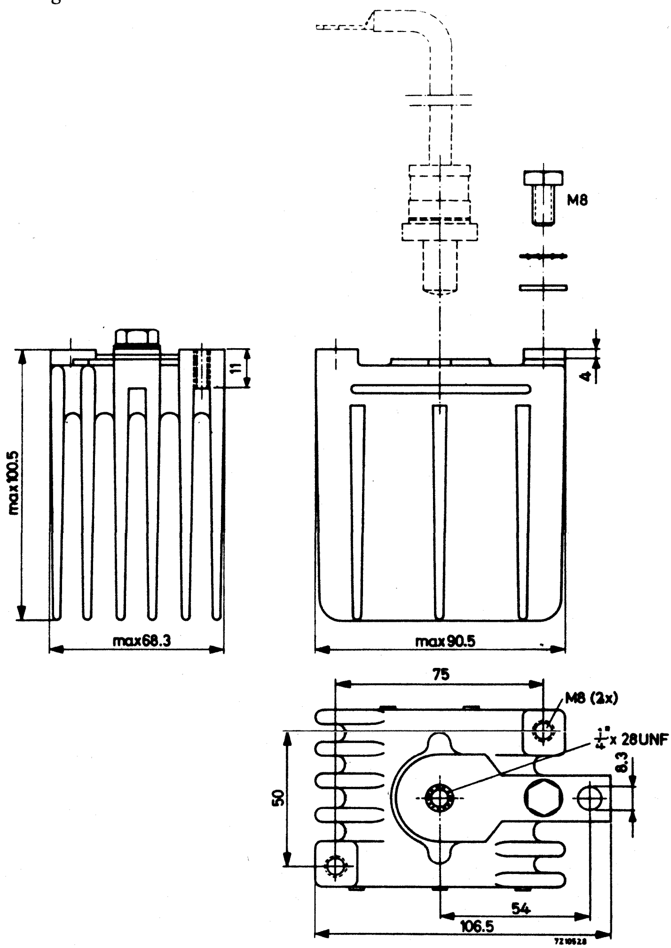


DIECAST HEATSINK

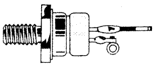
Diecast heatsink of aluminium alloy, painted black, with $\frac{1}{4}$"x 28 UNF tap hole for rectifier device.

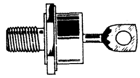
Weight: 690 g

Dimensions in mm



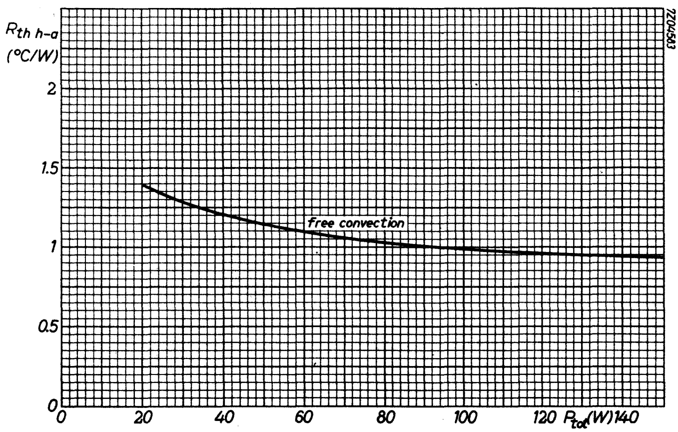
The graphs are valid for the combination of device and heatsink.

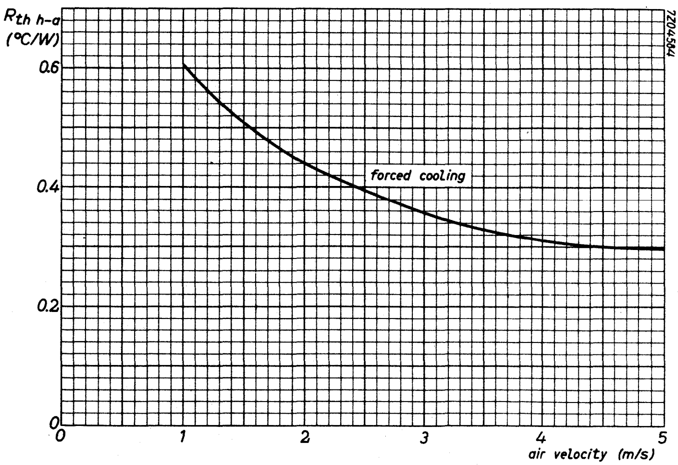




Studs: $\frac{1}{4}$" x 28 UNF

Mounting bases across the flats: 14,0 mm resp. 17,0 mm



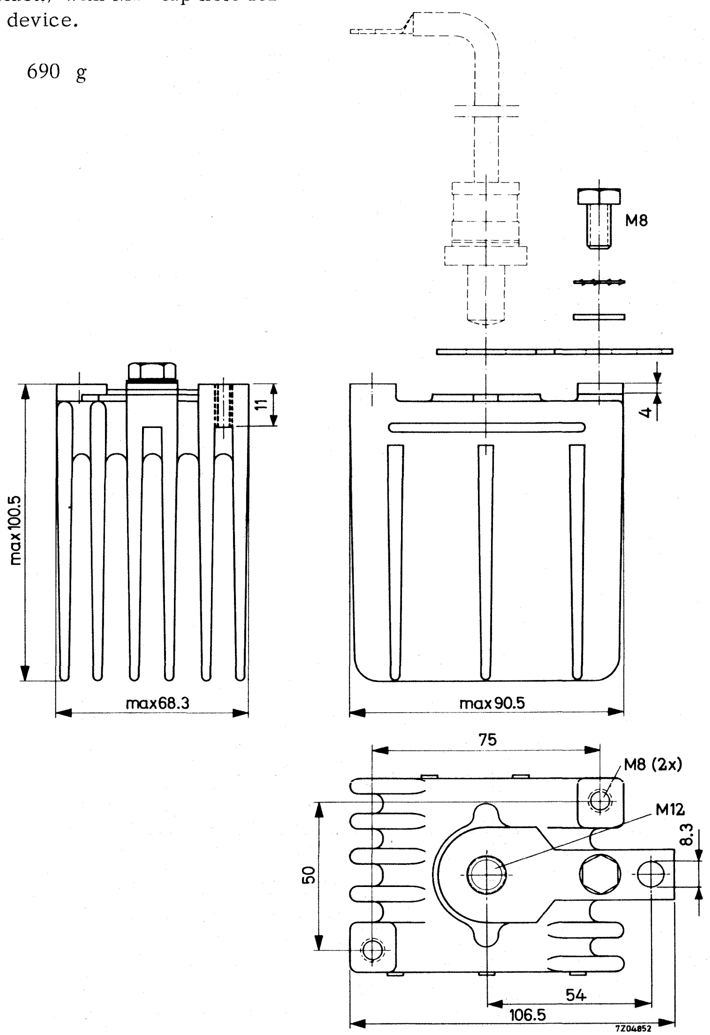


DIECAST HEATSINK

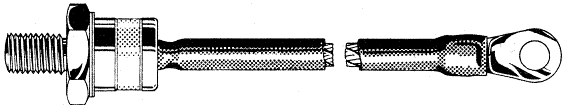
Diecast heatsink of aluminium alloy, painted black, with M12 tap hole for rectifier device.

Weight: 690 g

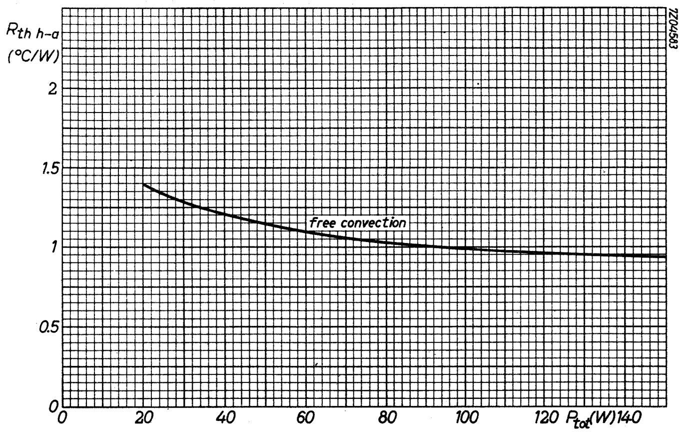
Dimensions in mm

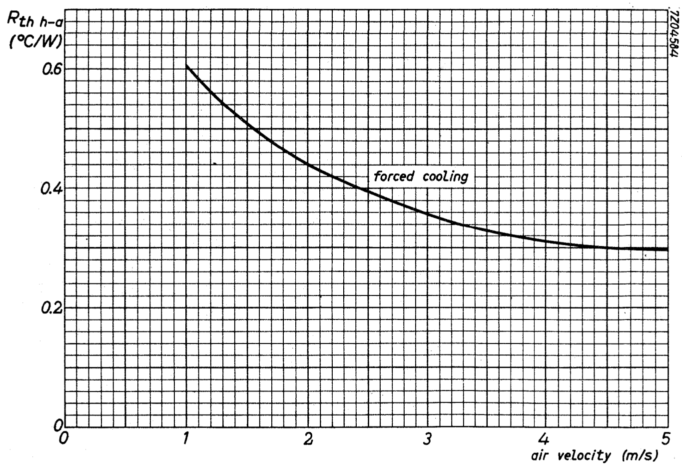


The graphs are valid for the combination of device and heatsink.



Stud: M12
Mounting base, across the flats: 27,0 mm

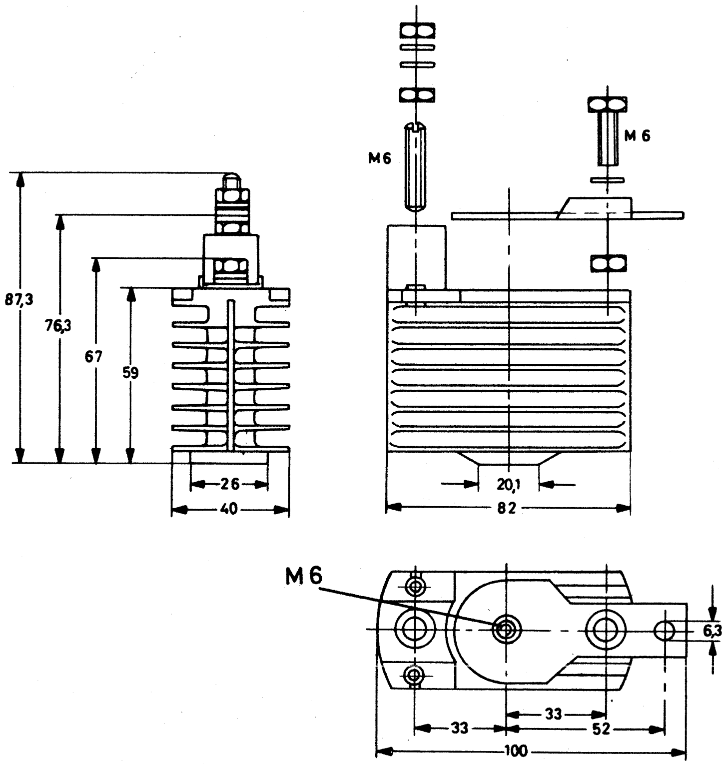




DIECAST HEATSINK

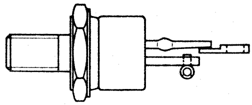
Weight: 270 g

Dimensions in mm

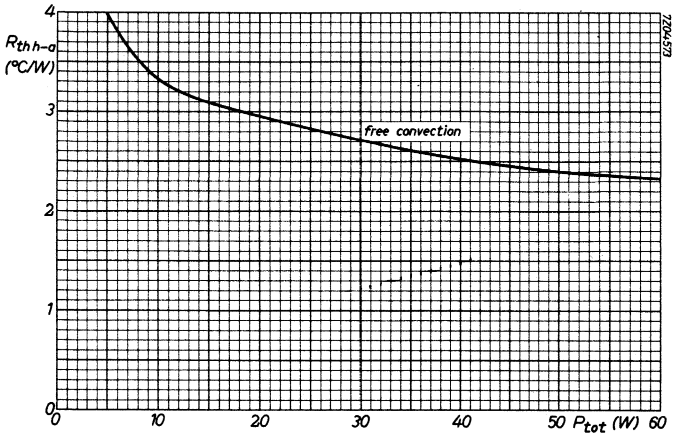


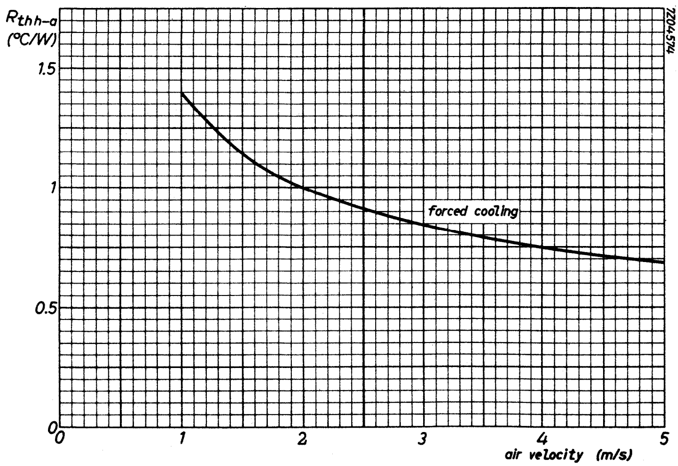
Tap hole for fixing the heatsink: M8

The graphs are valid for the combination of device and heatsink.



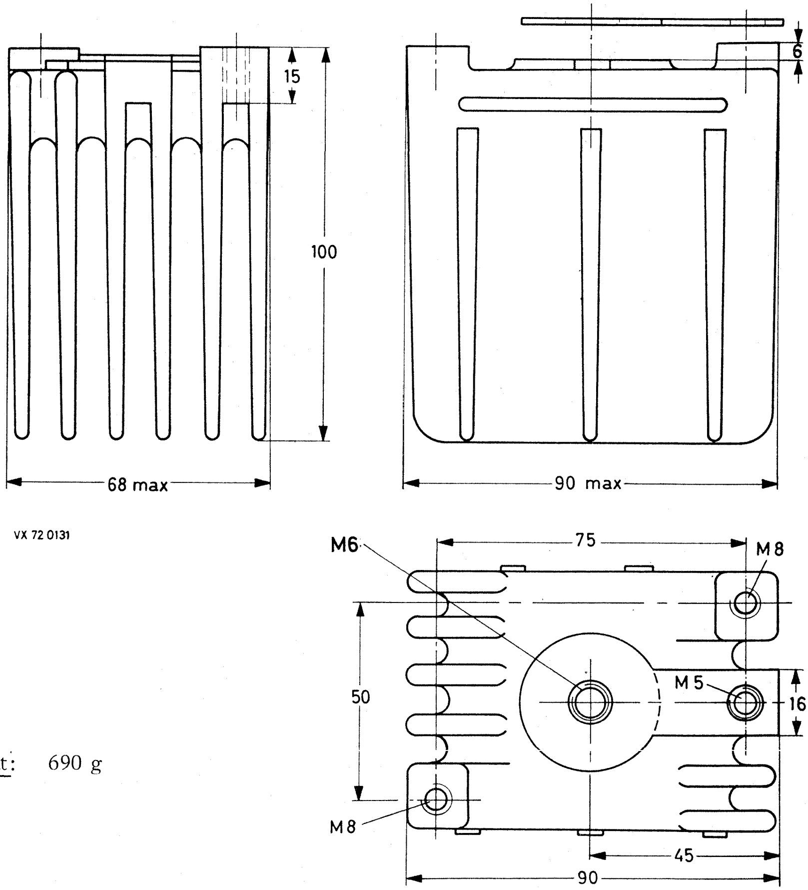
Stud: M 6
Mounting base, across the flats: max. 14,0 mm





DIECAST HEATSINK

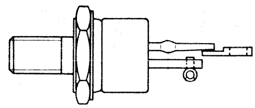
Dimensions in mm



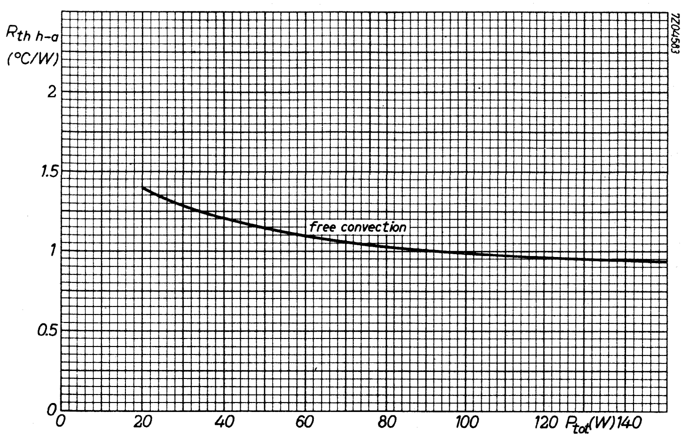
VX 72 0131

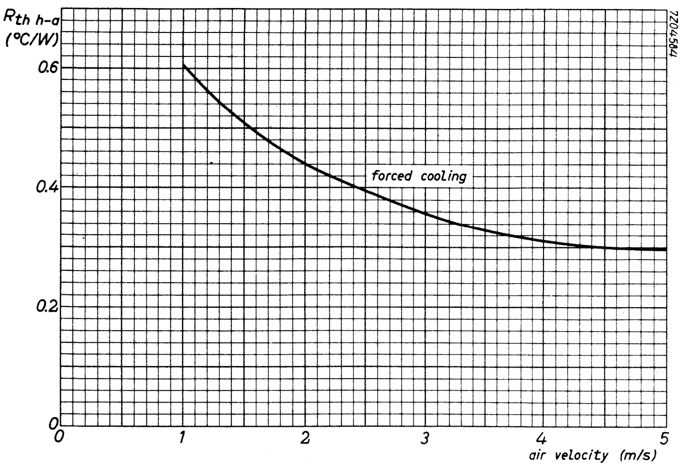
Weight: 690 g

The graphs are valid for the combination of device and heatsink.



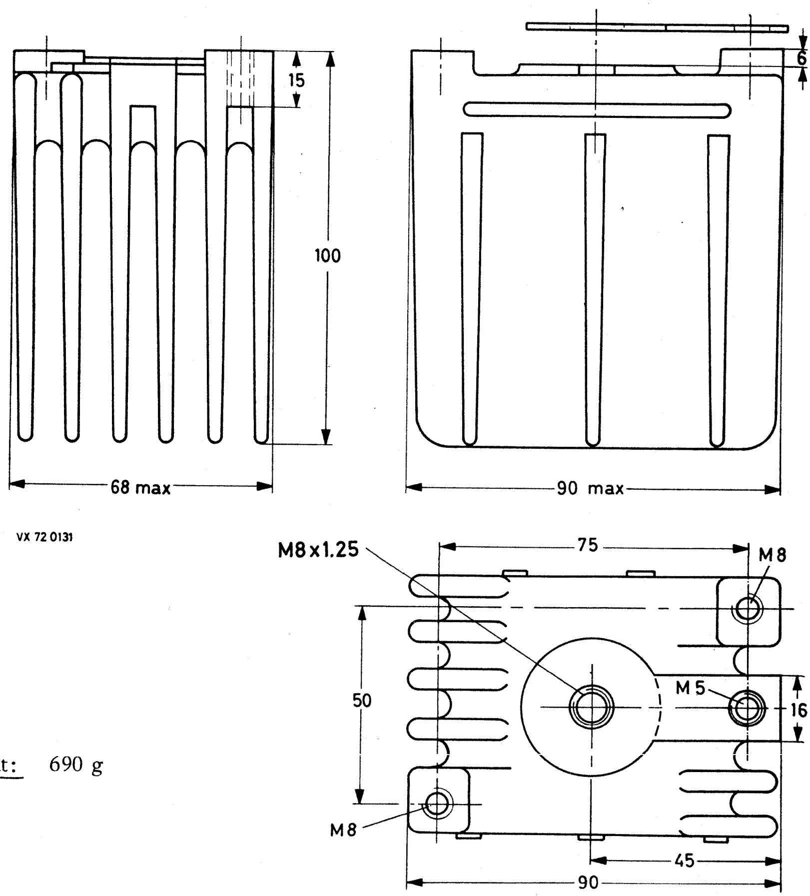
Stud: M6
Mounting base, across the flats: max. 14,0 mm





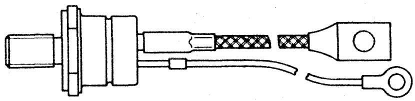
DIECAST HEATSINK

Dimensions in mm

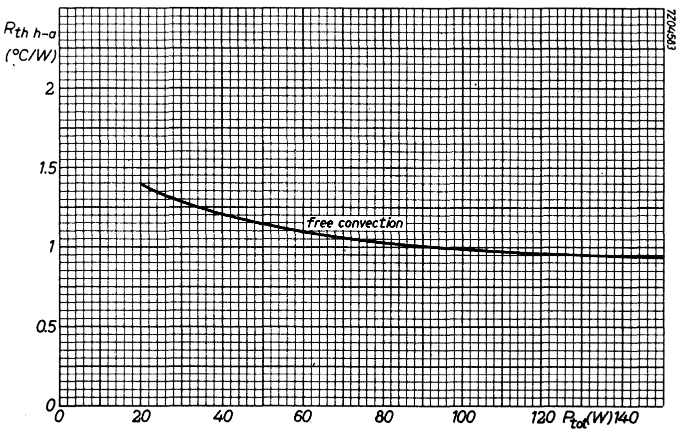


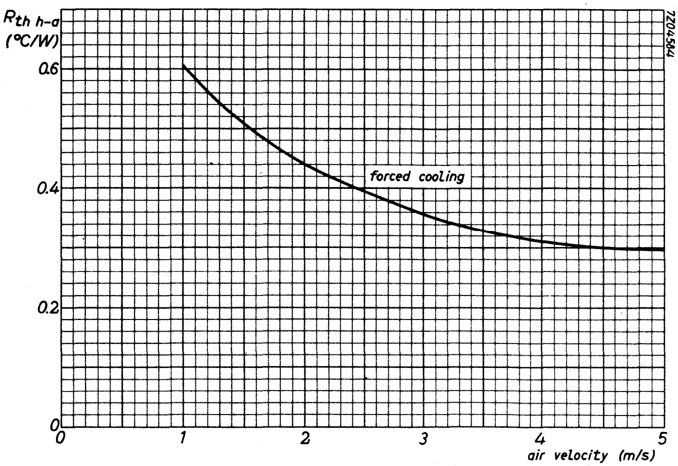
Weight: 690 g

The graphs are valid for the combination of device and heatsink.



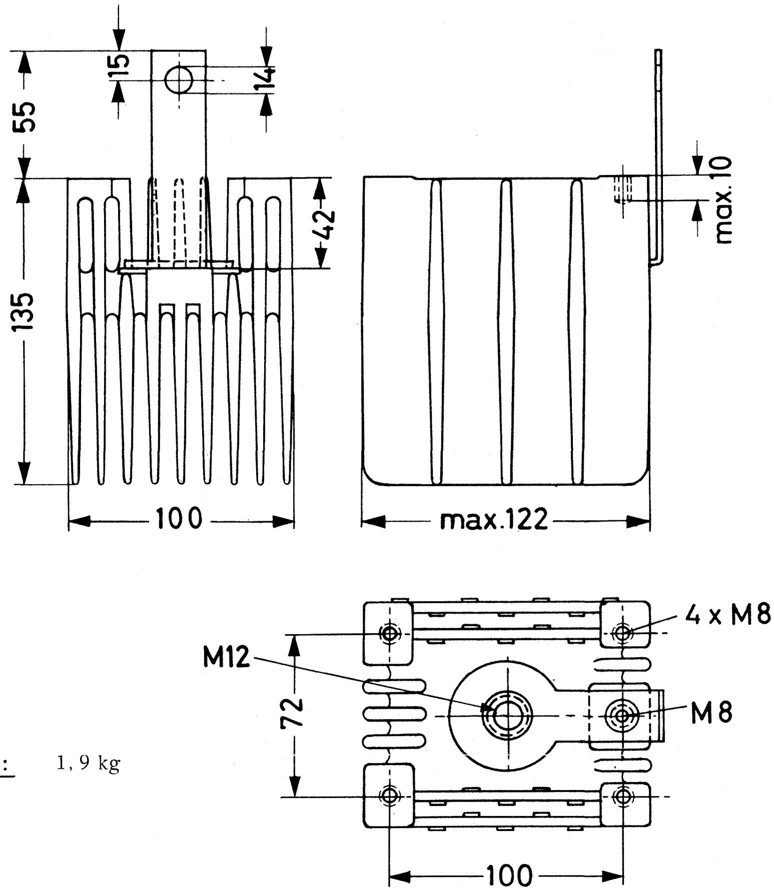
Stud: M8 x 1, 25
Mounting base, across the flats: max. 19,0 mm





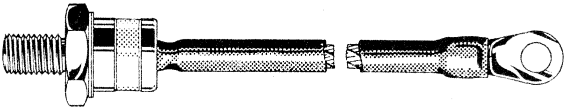
DIECAST HEATSINK

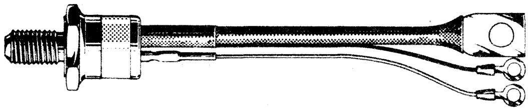
Dimensions in mm



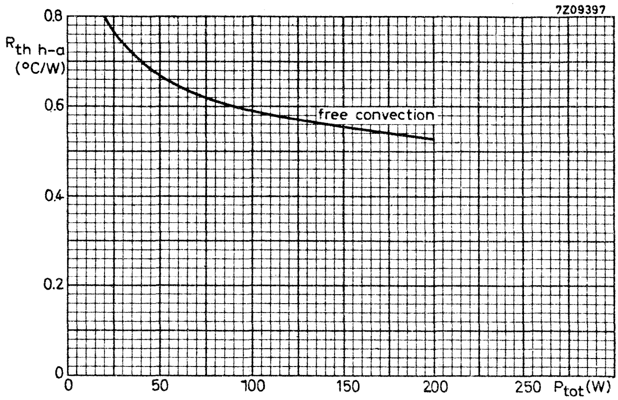
Weight: 1, 9 kg

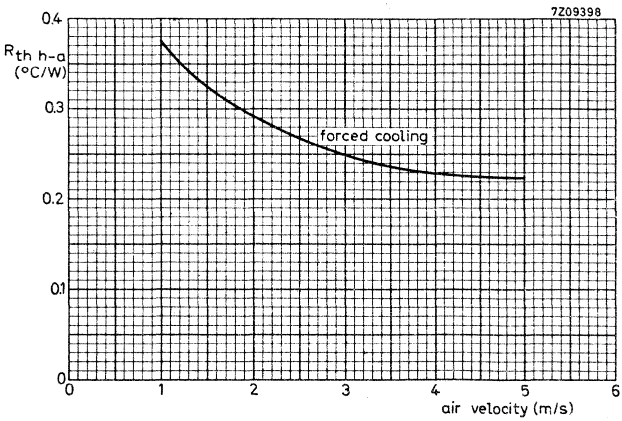
The graphs are valid for the combination of device and heatsink.





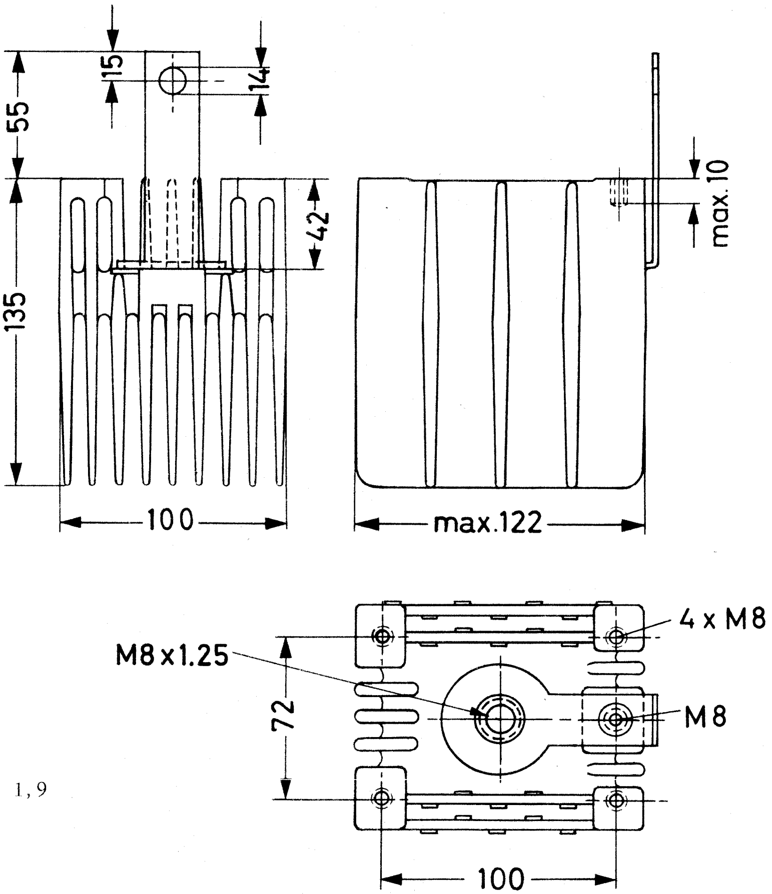
Studs: M12
Mounting base, across the flats: max. 27,0 mm





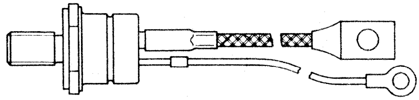
DIECAST HEATSINK

Dimensions in mm

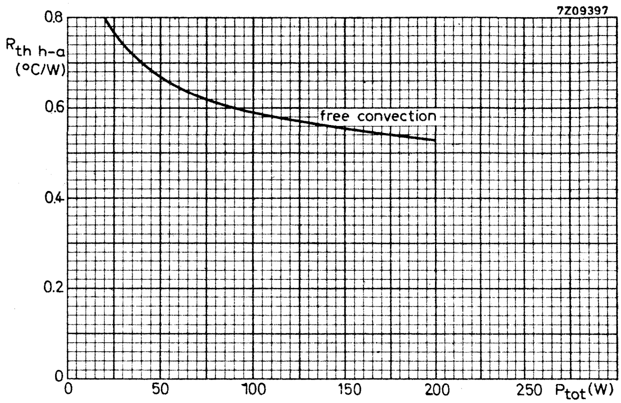


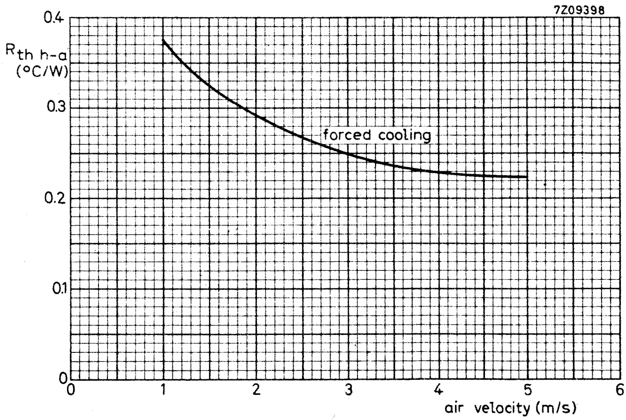
Weight: 1,9

The graphs are valid for the combintation of device and heatsink.



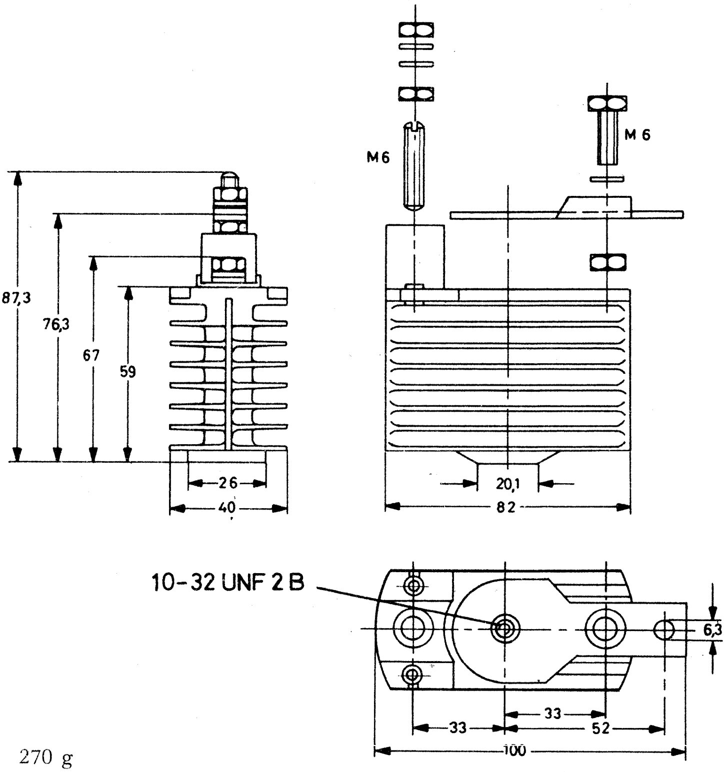
Stud: M8 x 1,25
Mounting base, across the flats: max. 19,0 mm





DIECAST HEATSINK

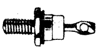
Dimensions in mm



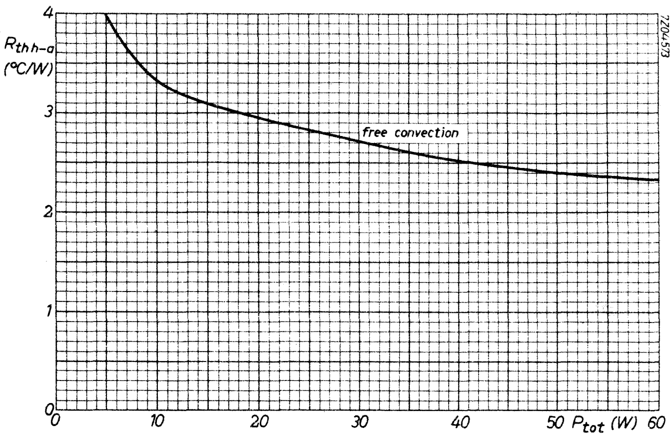
Weight: 270 g

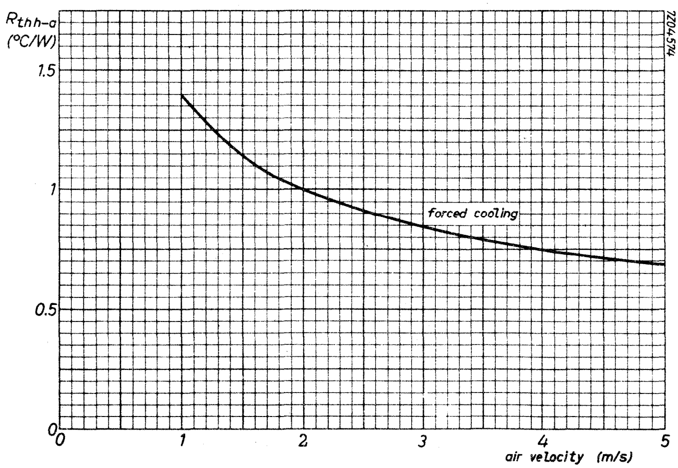
Tap hole for fixing the heatsink: M8

The graphs are valid for the combination and heatsink.



Stud: 10-32 UNF
Mounting base, across the flats:
max. 11,0 mm



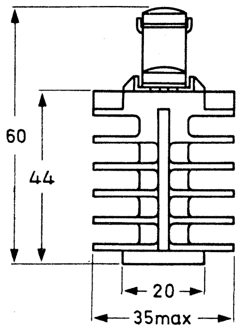


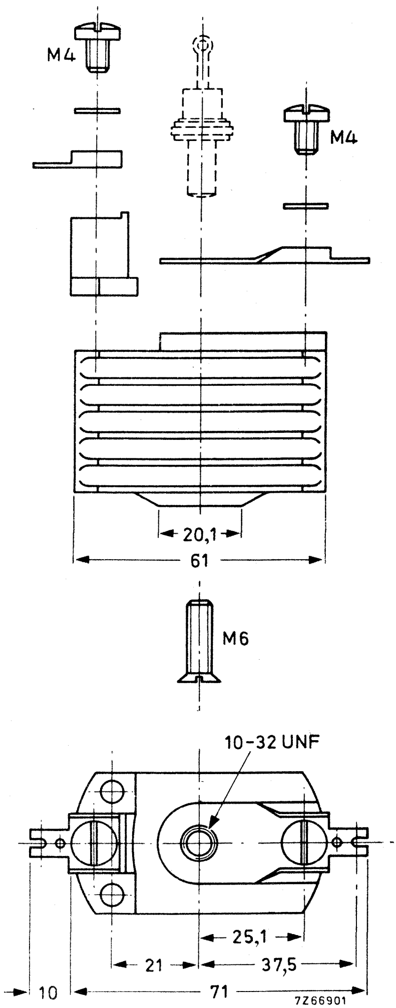
DIECAST HEATSINK

Diecast heatsink of aluminium alloy, painted black, with 10-32UNF tap hole for rectifier device.

Dimensions in mm

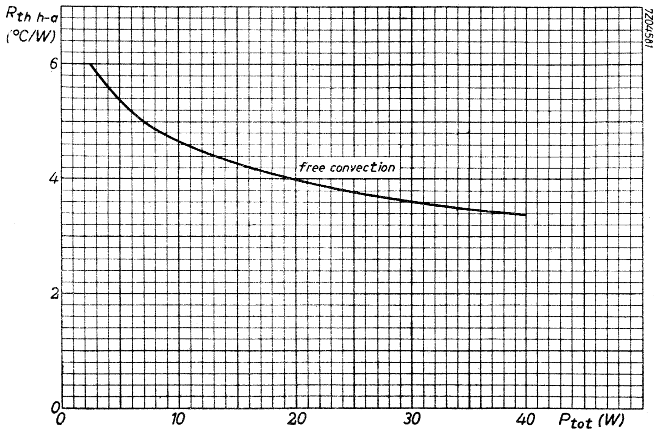
Weight: 135 g

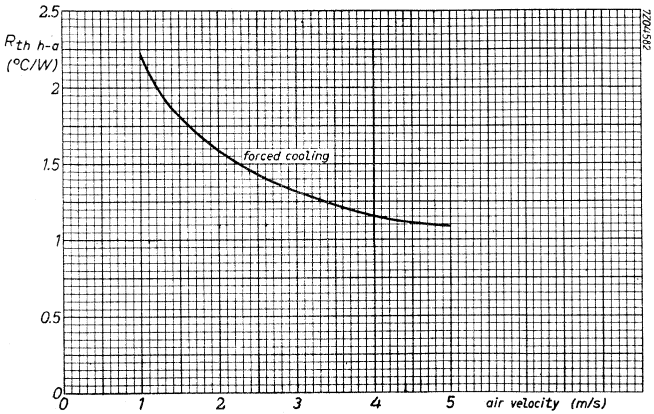




The graphs are valid for the combination of diode and heatsink.

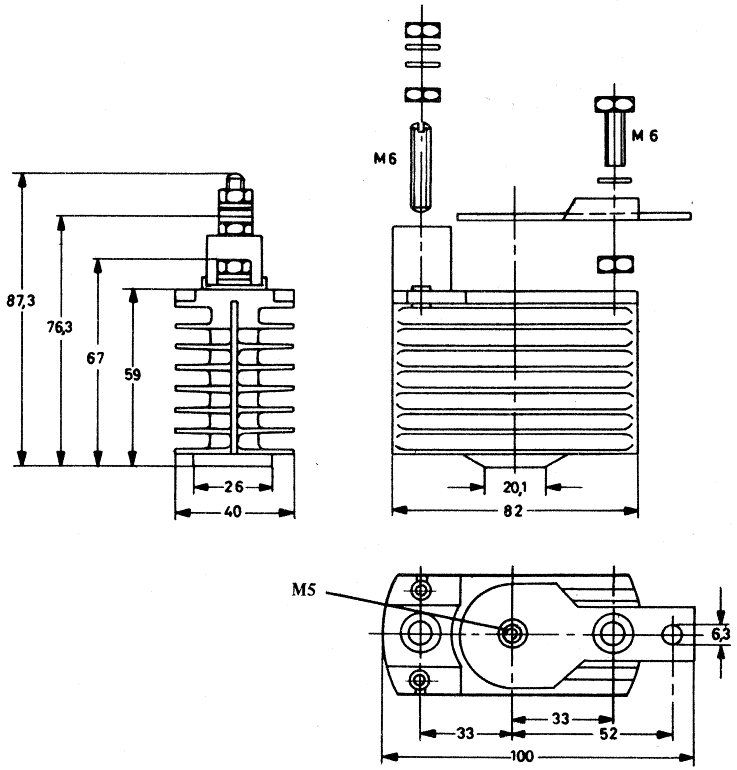
Stud: 10-32 UNF
Mounting base, across the flats: 11,0 mm





DIECAST HEATSINK

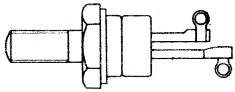
Dimensions in mm



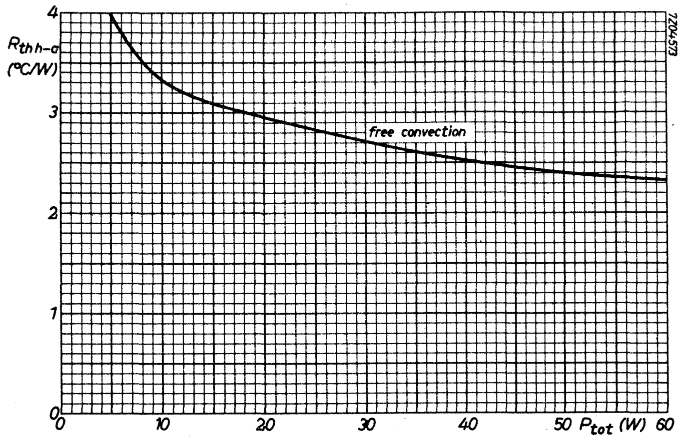
Weight : 270 g

Tap hole for fixing the heatsink : M8

The graphs are valid for the combination of device and heatsink.



Stud: M5
Mounting base across the flats: max. 11,0 mm

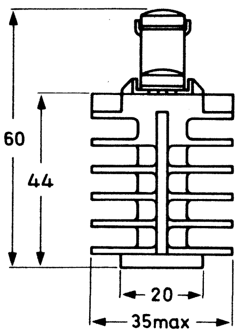


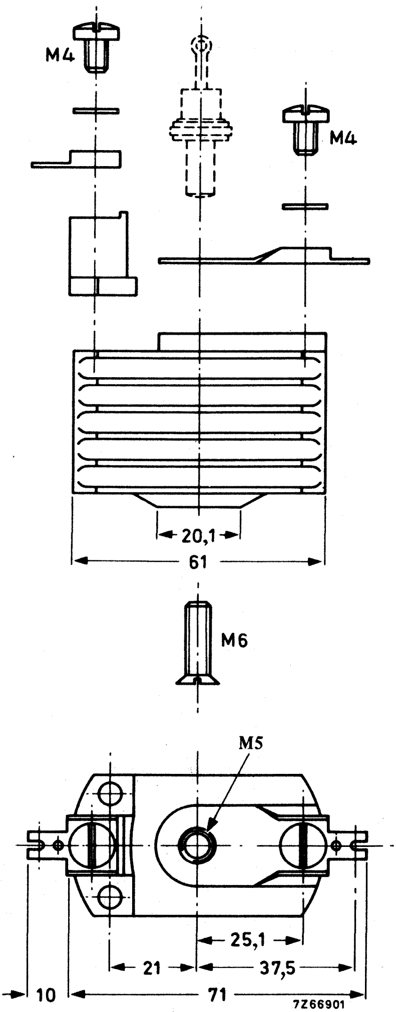
DIECAST HEATSINK

Diecast heatsink of aluminium alloy, painted black, with M5 tap hole for rectifier device.

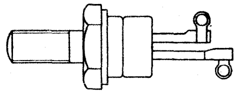
Dimensions in mm

Weight: 135 g

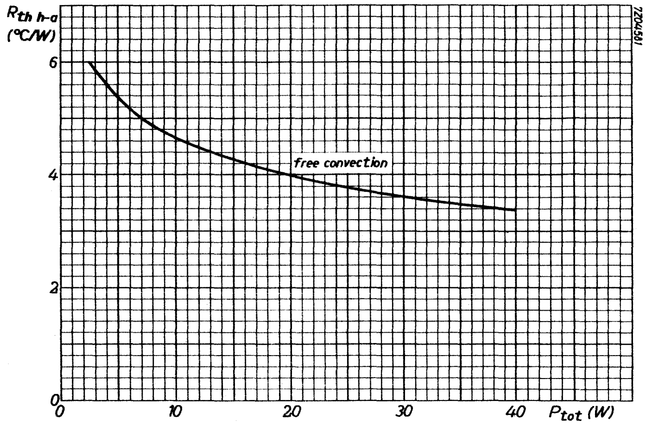


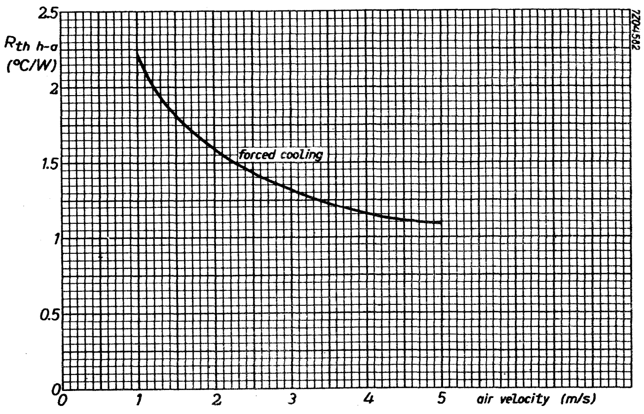


The graphs are valid for for the combination of device and heatsink.



Stud: M5
Mounting base, across the flats: 11,0 mm



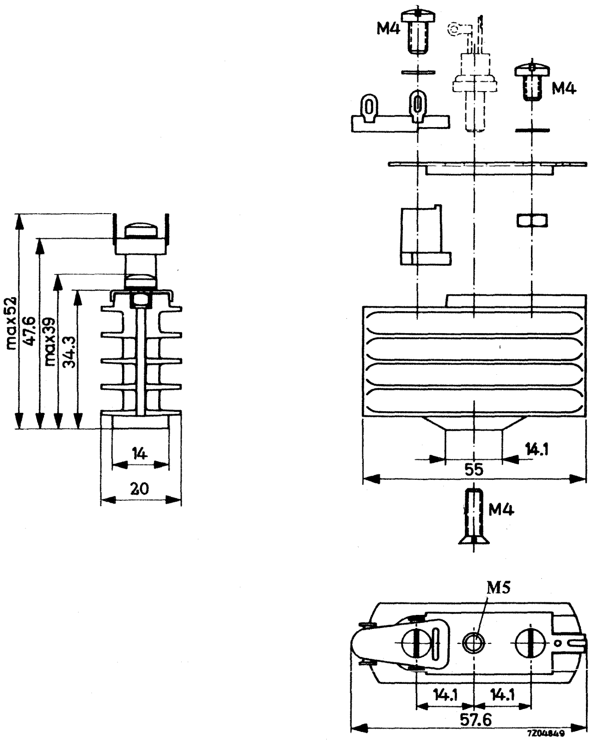


DIECAST HEATSINK

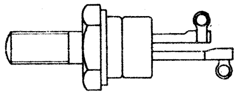
Diecast heatsink of aluminium alloy, painted black, with M5 tap hole for rectifier device.

Weight : 55 g

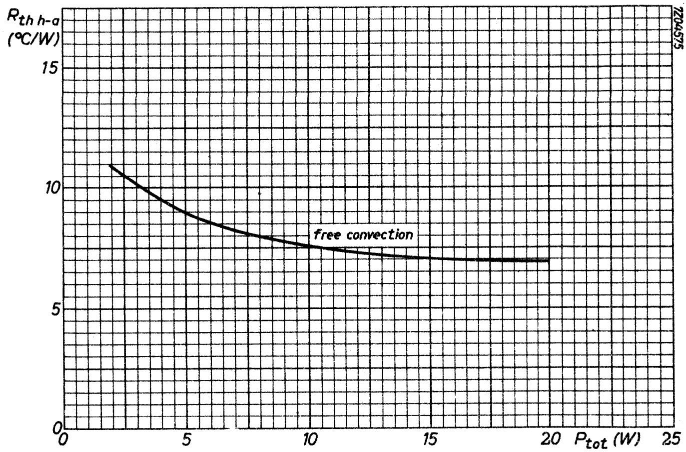
Dimensions in mm

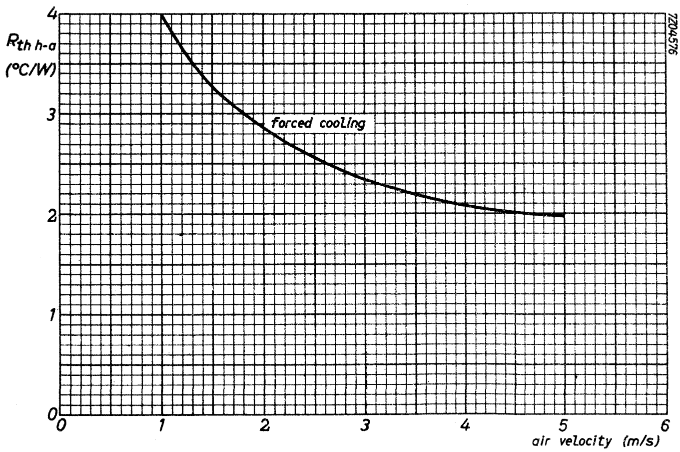


The graphs are valid for the combination of device and heatsink.



Stud: M5
Mounting base, across the flats: 11,0 mm



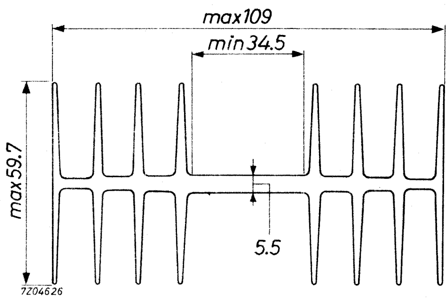


EXTRUDED ALUMINIUM HEATSINK

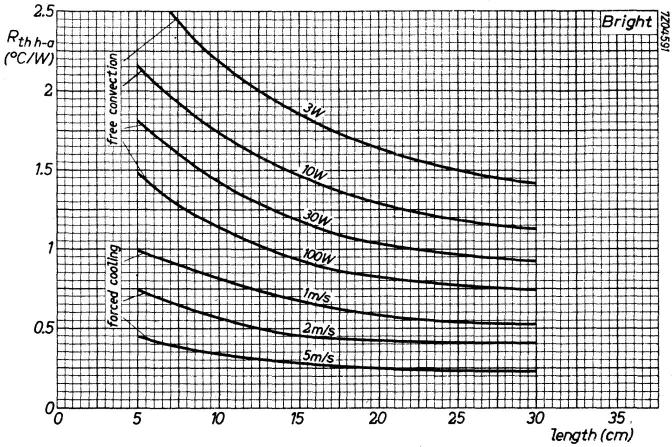
Extruded heatsink of aluminium alloy.
The extrusion is supplied unpainted, in lengths of 1,5 m

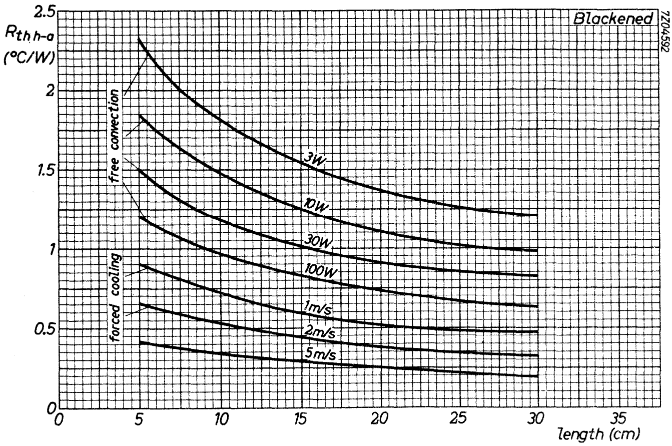
Weight: 4 kg per 1,5 m.

Dimensions in mm



The graphs are valid for the combination of device and heatsink.

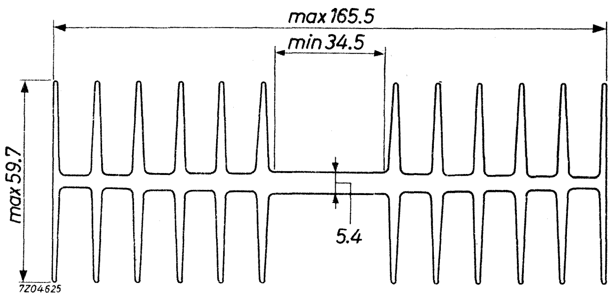




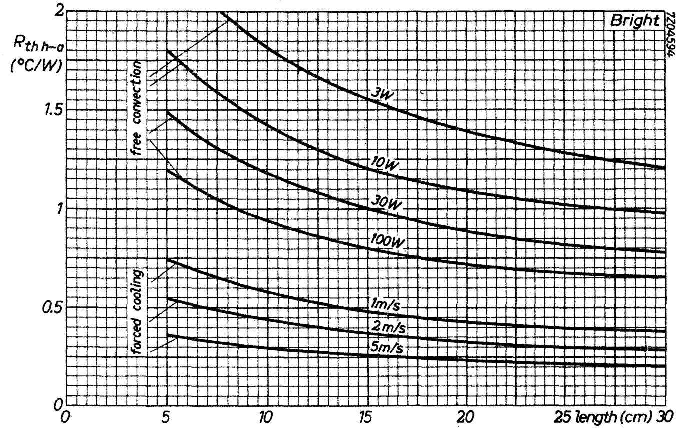
EXTRUDED ALUMINIUM HEATSINK

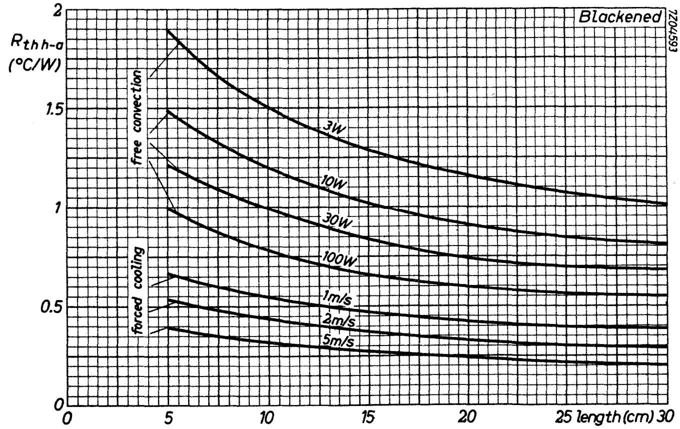
Extruded heatsink of aluminium alloy.
The extrusion is supplied unpainted, in lengths of 1,5 m.

Weight: 6 kg per 1,5 m. Dimensions in mm



The graphs are valid for the combination of device and heatsink.



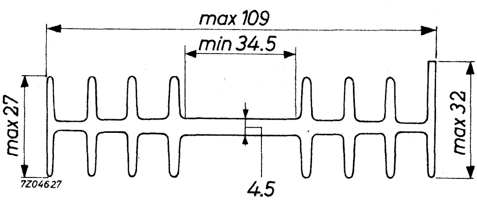


EXTRUDED ALUMINIUM HEATSINK

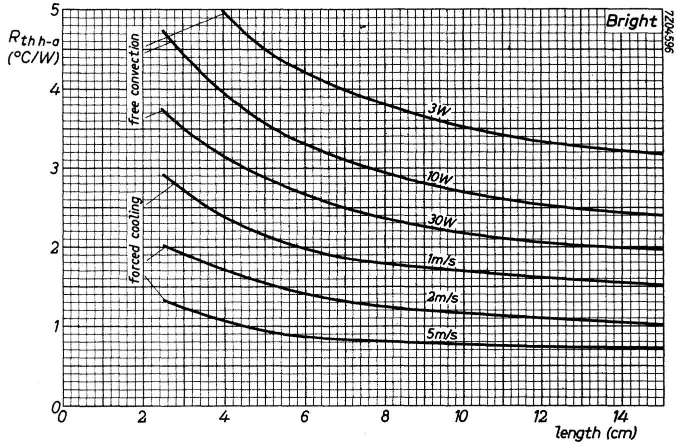
Extruded heatsink of aluminium alloy.
The extrusion is supplied unpainted, in lengths of 1,5 m.

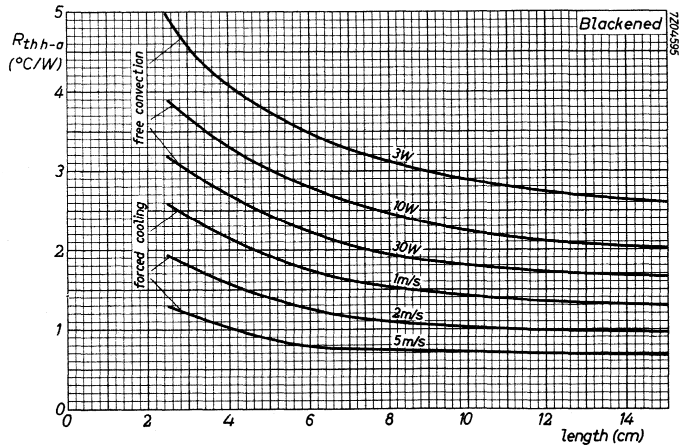
Weight: 2,4 kg per 1,5 m.

Dimensions in mm



The graphs are valid for the combination of device and heatsink.



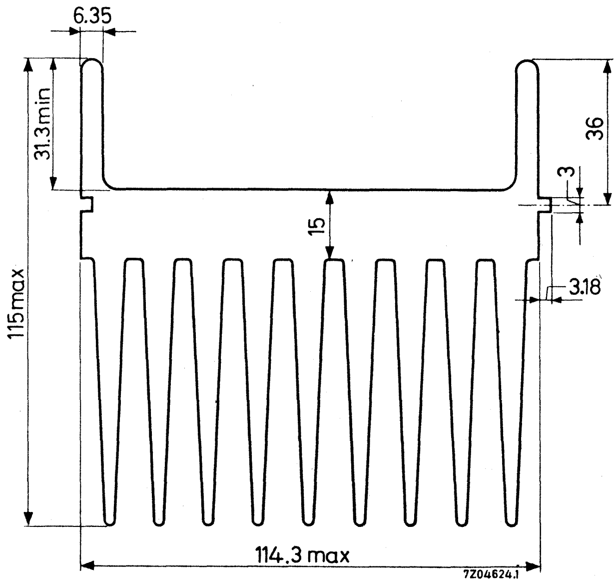


EXTRUDED ALUMINIUM HEATSINK

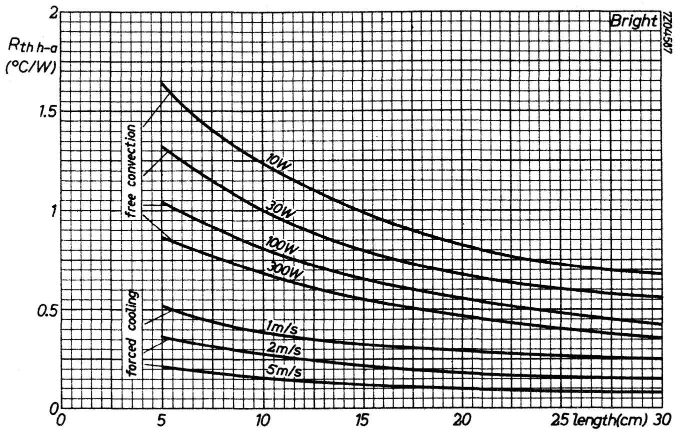
Extruded heatsink of aluminium alloy.
The extrusion is supplied unpainted, in lengths of 1, 5 m.

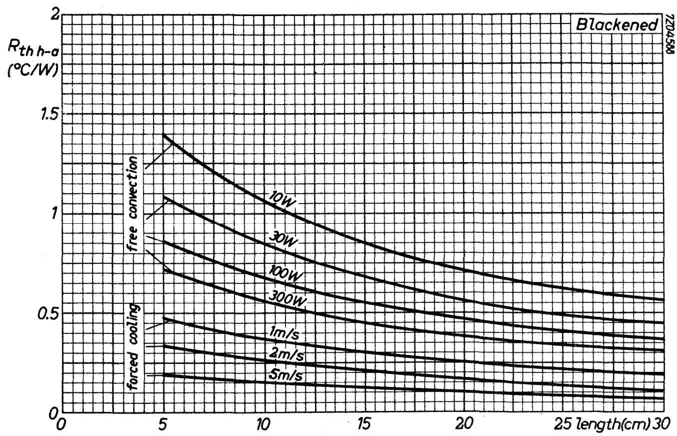
Weight: 16, 2 kg per 1, 5 m.

Dimensions in mm



The graphs are valid for the combination of device and heatsink.





INDEX OF TYPE NUMBERS

Data Handbooks SC1a to SC4c

The inclusion of a type number in this publication does not necessarily imply its availability.

type no.	part	section
AA119	1b	PC
AAZ15	1b	GB
AAZ17	1b	GB
AAZ18	1b	GB
AC125	2	LF
AC126	2	LF
AC127	2	LF
AC128	2	LF
AC128/01	2	LF
AC132	2	LF
AC187	2	LF
AC187/01	2	LF
AC188	2	LF
AC188/01	2	LF
AD161	2	P
AD162	2	P
AF367	3	HFSW
ASZ15	2	P
ASZ16	2	P
ASZ17	2	P
ASZ18	2	P
BA100	1b	AD
BA102	1b	T
BA145	1a	R
BA148	1a	R
BA157	1a	R
BA158	1a	R
BA159	1a	R
BA182	1b	T
BA216	1b	WD
BA217	1b	WD
BA218	1b	WD
BA219	1b	WD
BA220	1b	WD
BA221	1b	WD
BA222	1b	WD
BA243	1b	T
BA244	1b	T
BA280	1b	T
BA314	1b	Vrg
BA314A	1b	Vrg
BA315	1b	Vrg
BA316	1b	WD
BA317	1b	WD
BA318	1b	WD
BA379	1b	T
BAS16	4c	Mm
BAT17	4c	Mm
BAT18	4c	Mm
BAV10	1b	WD
BAV18	1b	WD
BAV19	1b	WD
BAV20	1b	WD
BAV21	1b	WD
BAV45	1b	Sp
BAV70	4c	Mm
BAV99	4c	Mm
BAW21A	1b	WD
BAW21B	1b	WD
BAW56	4c	Mm
BAW62	1b	WD
BAX12	1b	WD
BAX12A	1b	WD
BAX13	1b	WD
BAX14	1b	WD
BAX14A	1b	WD
BAX15	1b	WD
BAX16	1b	WD
BAX17	1b	WD
BAX18	1b	WD
BAX18A	1b	WD
BB105A	1b	T
BB105B	1b	T
BB105G	1b	T
BB106	1b	T
BB110B	1b	T
BB110G	1b	T
BB117	1b	T
BB119	1b	T
BB204B	1b	T
BB204G	1b	T
BB205A	1b	T
BB205B	1b	T
BB205G	1b	T
BBY31	4c	Mm
BC107	2	LF
BC108	2	LF
BC109	2	LF
BC140	2	LF
BC141	2	LF

AD = Silicon alloyed diodes
GB = Germanium gold bonded diodes
HFSW = High-frequency and switching transistors
LF = Low-frequency transistors
Mm = Discrete semiconductors for hybrid thick and thin-film circuits
P = Low-frequency power transistors
PC = Germanium point contact diodes
R = Rectifier diodes
Sp = Special diodes
T = Tuner diodes
Vrg = Voltage regulator diodes
WD = Silicon whiskerless diodes

DT = Dual transistors
FET = Field-effect transistors
LF = Low-frequency transistors
Mm = Discrete semiconductors for hybrid thick and thin-film circuits
P = Low-frequency power transistors

FET = Field-effect transistors
HFSW = High-frequency and switching transistors
Mm = Discrete semiconductors for hybrid thick and thin-film circuits
P = Low-frequency power transistors

FET = Field-effect transistors
HFSW = High-frequency and switching transistors
Mm = Discrete semiconductors for hybrid thick and thin-film circuits
PDT = Photodiodes or transistors
R = Rectifier diodes
Th = Thyristors
Tra = Transmitting transistors

+ = series.

FET = Field-effect transistors
HFSW = High-frequency and switching transistors
Mm = Discrete semiconductors for hybrid thick and thin-film circuits
P = Low-frequency power transistors
R = Rectifier diodes
Th = Thyristors
Tri = Triacs

+ = series.

GB = Germanium gold bonded diodes
LED = Light-emitting diodes
Mm = Discrete semiconductors for hybrid thick and thin-film circuits
PhC = Photocouplers
R = Rectifier diodes
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes

type no.	part	section	type no.	part	section	type no.	part	section
OA90	1b	PC	1N827	1b	Vrf	1N5744B	1b	Vrg
OA91	1b	PC	1N829	1b	Vrf	1N5745B	1b	Vrg
OA95	1b	PC	1N914	1b	WD	1N5746B	1b	Vrg
OA200	1b	AD	1N914A	1b	WD	1N5747B	1b	Vrg
OA202	1b	AD	1N916	1b	WD	1N5748B	1b	Vrg
ORP10	4b	I	1N916A	1b	WD	1N5749B	1b	Vrg
ORP13	4b	I	1N916B	1b	WD	1N5750B	1b	Vrg
ORP23	4b	Ph	1N3879	1a	R	1N5751B	1b	Vrg
ORP52	4b	Ph	1N3880	1a	R	1N5752B	1b	Vrg
ORP60	4b	Ph	1N3881	1a	R	1N5753B	1b	Vrg
ORP61	4b	Ph	1N3882	1a	R	1N5754B	1b	Vrg
ORP62	4b	Ph	1N3889	1a	R	1N5755B	1b	Vrg
ORP66	4b	Ph	1N3890	1a	R	1N5756B	1b	Vrg
ORP68	4b	Ph	1N3891	1a	R	1N5757B	1b	Vrg
ORP69	4b	Ph	1N3892	1a	R	2N918	3	HFSW
OSB9110	1a	St	1N4009	1b	WD	2N929	2	LF
OSB9210	1a	St	1N4148	1b	WD	2N930	2	LF
OSB9310	1a	St	1N4150	1b	WD	2N1613	3	HFSW
OSB9410	1a	St	1N4151	1b	WD	2N1711	3	HFSW
OSM9110	1a	St	1N4154	1b	WD	2N1893	3	HFSW
OSM9210	1a	St	1N4446	1b	WD	2N2218	3	HFSW
OSM9310	1a	St	1N4448	1b	WD	2N2218A	3	HFSW
OSM9410	1a	St	1N5060	1a	R	2N2219	3	HFSW
OSS9110	1a	St	1N5061	1a	R	2N2219A	3	HFSW
OSS9210	1a	St	1N5062	1a	R	2N2221	3	HFSW
OSS9310	1a	St	1N5729B	1b	Vrg	2N2221A	3	HFSW
OSS9410	1a	St	1N5730B	1b	Vrg	2N2222	3	HFSW
RPY58A	4b	Ph	1N5731B	1b	Vrg	2N2222A	3	HFSW
RPY71	4b	Ph	1N5732B	1b	Vrg	2N2297	3	HFSW
RPY76A	4b	I	1N5733B	1b	Vrg	2N2368	3	HFSW
RPY82	4b	Ph	1N5734B	1b	Vrg	2N2369	3	HFSW
RPY84	4b	Ph	1N5735B	1b	Vrg	2N2369A	3	HFSW
RPY85	4b	Ph	1N5736B	1b	Vrg	2N2483	2	LF
RPY86	4b	I	1N5737B	1b	Vrg	2N2484	2	LF
RPY87	4b	I	1N5738B	1b	Vrg	2N2894	3	HFSW
RPY88	4b	I	1N5739B	1b	Vrg	2N2894A	3	HFSW
RPY89	4b	I	1N5740B	1b	Vrg	2N2904	3	HFSW
1N821	1b	Vrf	1N5741B	1b	Vrg	2N2904A	3	HFSW
1N823	1b	Vrf	1N5742B	1b	Vrg	2N2905	3	HFSW
1N825	1b	Vrf	1N5743B	1b	Vrg	2N2905A	3	HFSW

AD = Silicon alloyed diodes
HFSW = High-frequency and switching transistors
I = Infrared devices
LF = Low-frequency transistors
PC = Germanium point contact diodes
Ph = Photoconductive devices
R = Rectifier diodes
St = Rectifier stacks
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes
WD = Silicon whiskerless diodes

A = Accessories
DH = Diecast heatsinks
FET = Field-effect transistors
HE = Heatsink extrusions
HFSW = High-frequency and switching transistors
I = Infrared devices
P = Low-frequency power transistors
Tra = Transmitting transistors

MAINTENANCE TYPE LIST

The type numbers listed below are not included in this handbook except for those marked with an asterisk.

Detailed information will be supplied on request.

* BA145
* BA148
* BT126
* BT128 series
* BT129 series
BTW32 series
* BY126
* BY127
* BY176
* BY187
* BY209
* BYX29 series
BYX48 series
* BZW93 series
* BZW95 series
* BZW96 series
* BZZ14 to 29

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