# Soft Recovery Diode
# M0433WC120 to M0433WC200

The data sheet on the subsequent pages of this document is a scanned copy of existing data for this product.
(Rating Report 80NR14 Issue 2)

This data reflects the old part number for this product which is: SM12-20CXC174. This part number must **NOT** be used for ordering purposes – please use the ordering particulars detailed below.

The limitations of this data are as follows:
This device is available for grades 12 to 20 (1200V to 2000V $V_{RRM}$)

Please use the following link to view an up to date outline drawing for this device
Outline W1

Where any information on the product matrix page differs from that in the following data, the product matrix must be considered correct

An electronic data sheet for this product is presently in preparation.

For further information on this product, please contact your local ASM or distributor.

Alternatively, please contact Westcode as detailed below.

| Ordering Particulars | | | |
|---|---|---|---|
| M0433 | WC | ♦♦ | 0 |
| Fixed Type Code | Fixed Outline Code | Voltage code $V_{DRM}$/100 12-20 | Fixed Code |
| Typical Order Code: M0433WC120, 14mm clamp height, 1200V $V_{RRM}$ | | | |

## QUALITY EVALUATION LABORATORY

Rating Report: 80NR14(Issue 2) Date: 25th February, 1986

Origin: Pages: 22

### Diode Type SM12-18CXC174

Written by: M.W. Dunlop Checked: M.W. Approved: B.E.H.

This diode consists of a diffused, fast recovery 24 mm diameter silicon slice mounted in a cold weld capsule housing.

This report supersedes Rating Report No. 80NR14.

### Ratings

| | |
|---|---|
| Voltage Grades | : 12-18 |
| $V_{RSM}$ | : 1300-1900V |
| $V_{RRM}$ | : 1200-1800V |
| $I_{F(AV)}$ : Single phase; 50 Hz, 180° half sinewave; (Converter Ratings) : | |
| Double Side Cooled $T_{HS}$ = 55°C, 100°C | : 434A; 202A |
| Single Side Cooled $T_{HS}$ = 100°C | : 114A |
| $I_{F(rms)}$ $T_{HS}$ = 25°C ) | : 870A |
| $I_F$ $T_{HS}$ = 25°C ) Double side cooled | : 724A |
| $I_{FSM}$ : t = 10ms half sinewave; $T_J$ (initial) = 125°C ; $V_{RM}$ = 0.6$V_{RRM(MAX)}$ | : 4500A |
| $I_{FSM}$ : t = 10ms half sinewave; $T_J$ (initial) = 125°C ; $V_{RM}$ 10V | : 4950A |
| $I^2t$ : t = 10ms; $T_J$ (initial = 125°C ; $V_{RM}$ = 0.6$V_{RRM}$ (MAX) | :1.01 x $10^5 A^2S$ |
| $I^2t$ : t = 10ms; $T_J$ (initial) = 125°C; $V_{RM}$ 10V | :1.22 x $10^5 A^2S$ |
| $I^2t$ : t = 3ms; $T_J$ (initial = 125°C ; $V_{RM}$ 10V | : 0.91 x $10^5 A^2S$ |
| $T_{HS}$ Operating Ramge | :-40 to +125°C |
| $T_{stg}$; Non-operating | :-40 to +150°C |

Characteristics

(Maximum values unless stated otherwise)

| | |
|---|---|
| $V_0$ : $T_J$ = 125°C | : 1.0V |
| $r_s$ : $T_J$ = 125°C | : 0.74mohm |
| $V_{FM}$ : $I_{FM}$ = 635A $T_{VJ}$ = 125°C | : 1.47V |
| $R_{th}$(J-HS) Double side cooled | : 0.09°C/W |
| Single side cooled | :0.18°C/W |
| $I_{RRM}$ : $T_J$ = 125°C $V_{RM}$ = $V_{RRM(MAX)}$ | : 20mA |
| $Q_{rr}$ : $I_{FM}$ = 550A ; dI/dt = 40A/uS (50% chord value) | : |
| $V_{RM}$ = 50V $T_{VJ}$ = 125°C | :160uC |
| $t_{rr}$ (conditions as above) | : |
| Mounting Force | : 330-550Kg.f |
| Outline Drawing | : 100A241 |
| JEDEC NO. | : DO-200AA |

CONTENTS

Voltage Ratings

| Voltage Class | $V_{RRM}$ V | $V_{RSM}$ V |
|---|---|---|
| 12 | 1200 | 1300 |
| 14 | 1400 | 1500 |
| 16 | 1600 | 1700 |
| 18 | 1800 | 1900 |

This Report is applicable to higher or lower voltage grades when supply has been agreed by Sales/Production.

## 2.0 INTRODUCTION

The diode series comprises fast recovery cold-weld capsules with all diffused silicon slices. All these diodes have controlled reverse recovery characteristics with good "S" factors.

## 3.0 NOTES ON THE RATINGS

### (a) Square wave ratings

These ratings are given for leading edge linear rates of rise of forward current of 200 and 100A/uS

### (b) Energy per pulse characteristics

These curves enable rapid estimation of device dissipation to be obtained for conditions not covered by the frequency ratings.

Let: Ep be the Energy per pulse for a given current and pulse width, in joules.

Then $W_{AV} = Ep \times f.$

and $T_{SINK} = T_{J(MAX)} - W_{AV} R_{th}$

## 4.0 REVERSE RECOVERY LOSS

On account of the number of circuit variables affecting reverse recovery voltage, no allowance for reverse recovery loss has been made in these ratings. The following procedure is recommended for use where it is necessary to include reverse recovery loss.

### (a) Determination by Measurement

From waveforms of recovery current obtained from a high frequency shunt (see Note 1) and reverse voltage present during recovery, an instantaneous reverse recovery loss waveform must be constructed. Let the area under this waveform be A joules per pulse. A new heat sink temperature can then be evaluated from:

$$T_{SINK\ (new)} = T_{SINK\ (original)} - A \left( \frac{r_t \cdot 10^6}{t} + R_{th} \times f \right)$$

where $r_t = 1.64 \times 10^{-4} \sqrt{t}$

t = duration of reverse recovery loss per pulse in microseconds

A = Area under reverse loss waveform per pulse in joules (W.S.)

f = rated frequency at the original heat sink temperature

The total dissipation is now given by

$$W_{(TOT)} = W_{(original)} + Axf$$

NOTE 1

REVERSE RECOVERY LOSS BY MEASUREMENT

This device has a low reverse recovered charge and peak reverse recovery current. When measuring the charge care must be taken to ensure that:

(a) a.c. coupled devices such as current transformers are not affected by prior passage of high amplitude forward current.

(b) The measuring oscilloscope has adequate dynamic range - typically 100 screen heights - to cope with the initial forward current without overload.

(c) Measurement of reverse recovery voltage waveform should be carried out with an appropriate snubber of 0.1uF and 5 ohms in series connected across diode anode to cathode.

(b) Design Method

In circumstances where it is not possible to measure voltage and current conditions, or for design purposes, the additional losses may be estimated from curves on page .

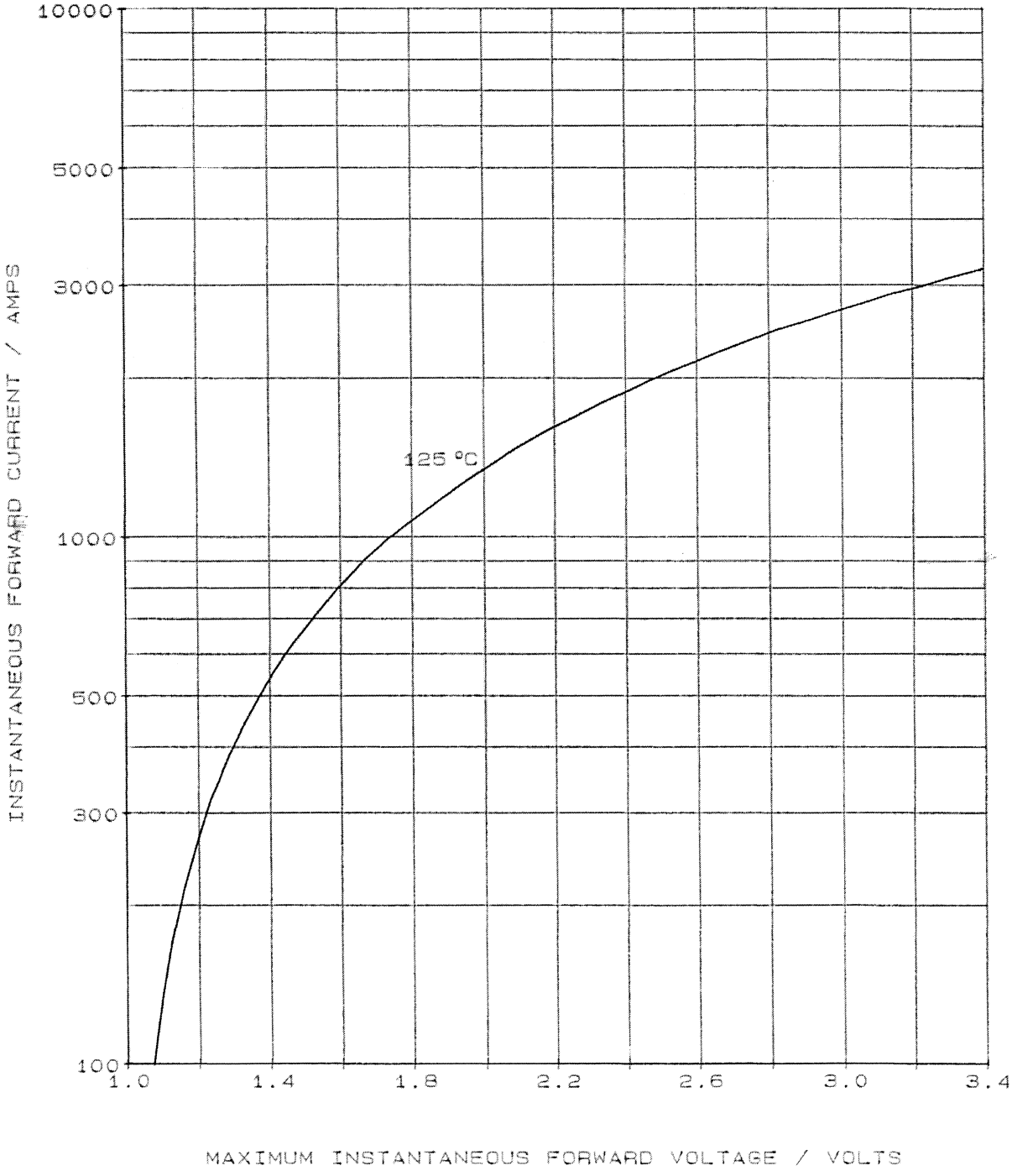
Let E be the value of energy per reverse cycle in joules (curves on page 12)

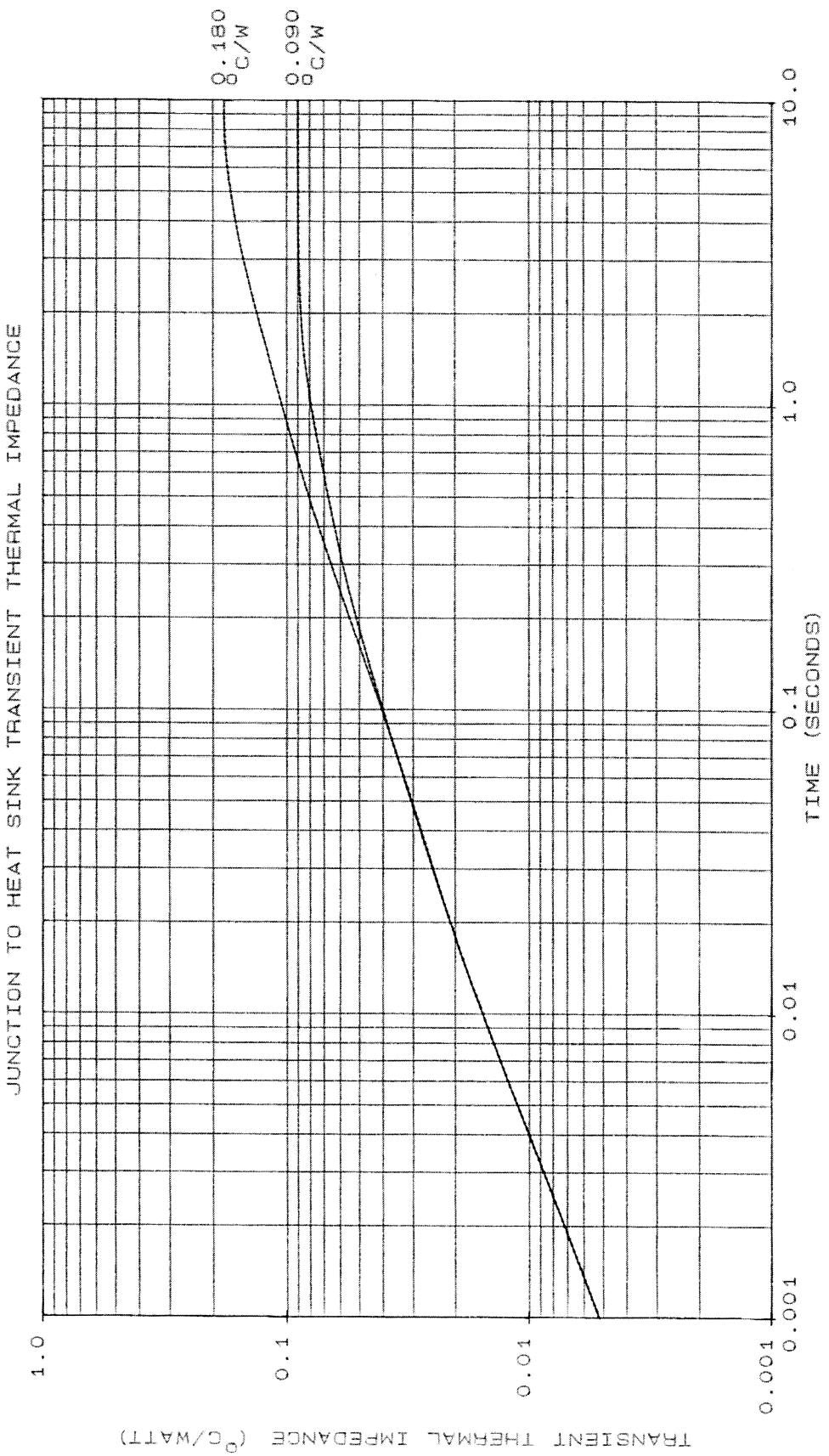
Let f be the operating frequency in Hz

Then $T_{SINK}^{(new)} = T_{SINK}(original) - E \times R_{th} \times f$

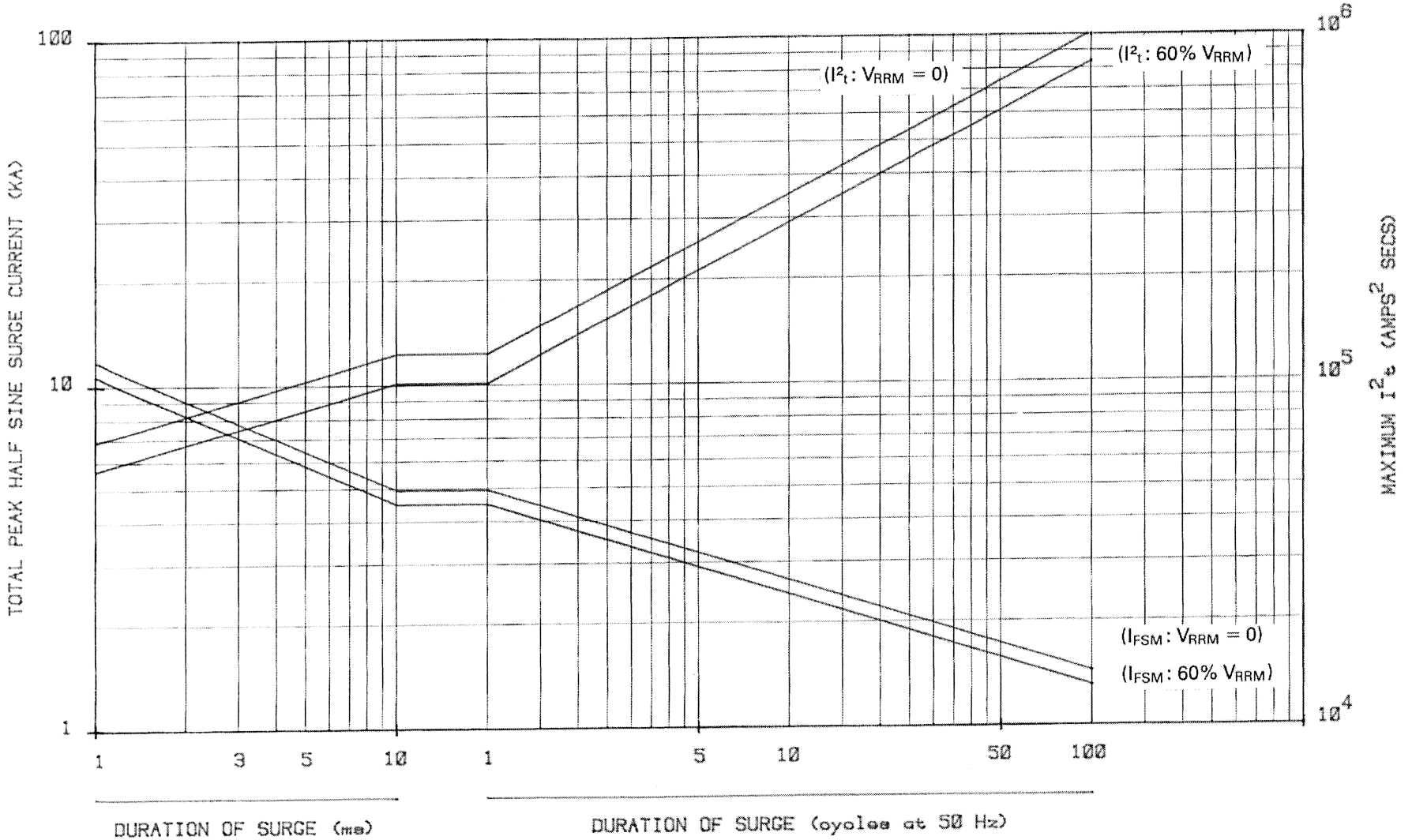
Where $T_{SINK}$ new is the required maximum heat sink temperature and $T_{SINK}$ original is the heat sink temperature given with the frequency ratings.

FORWARD CHARACTERISTIC OF LIMIT DEVICE

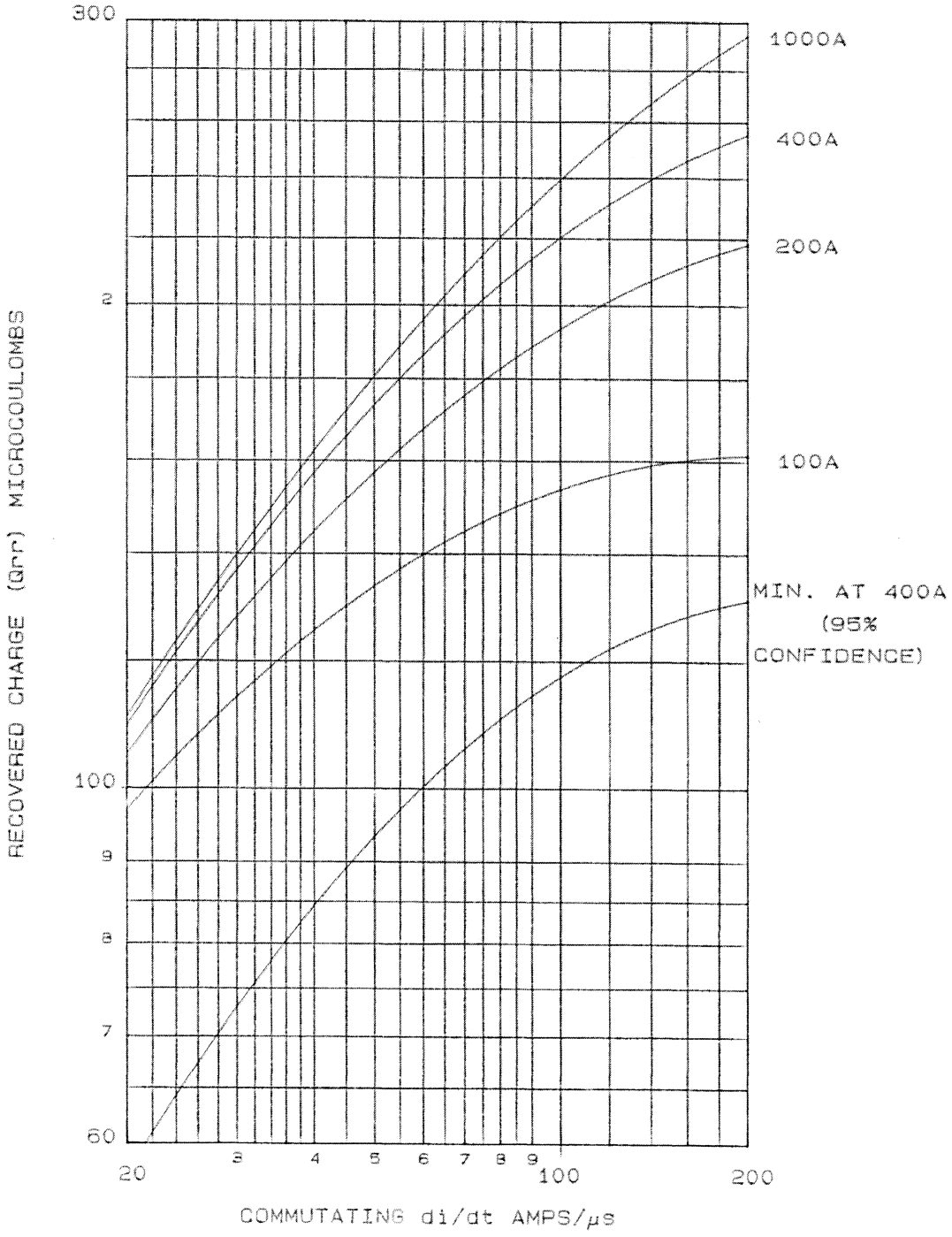


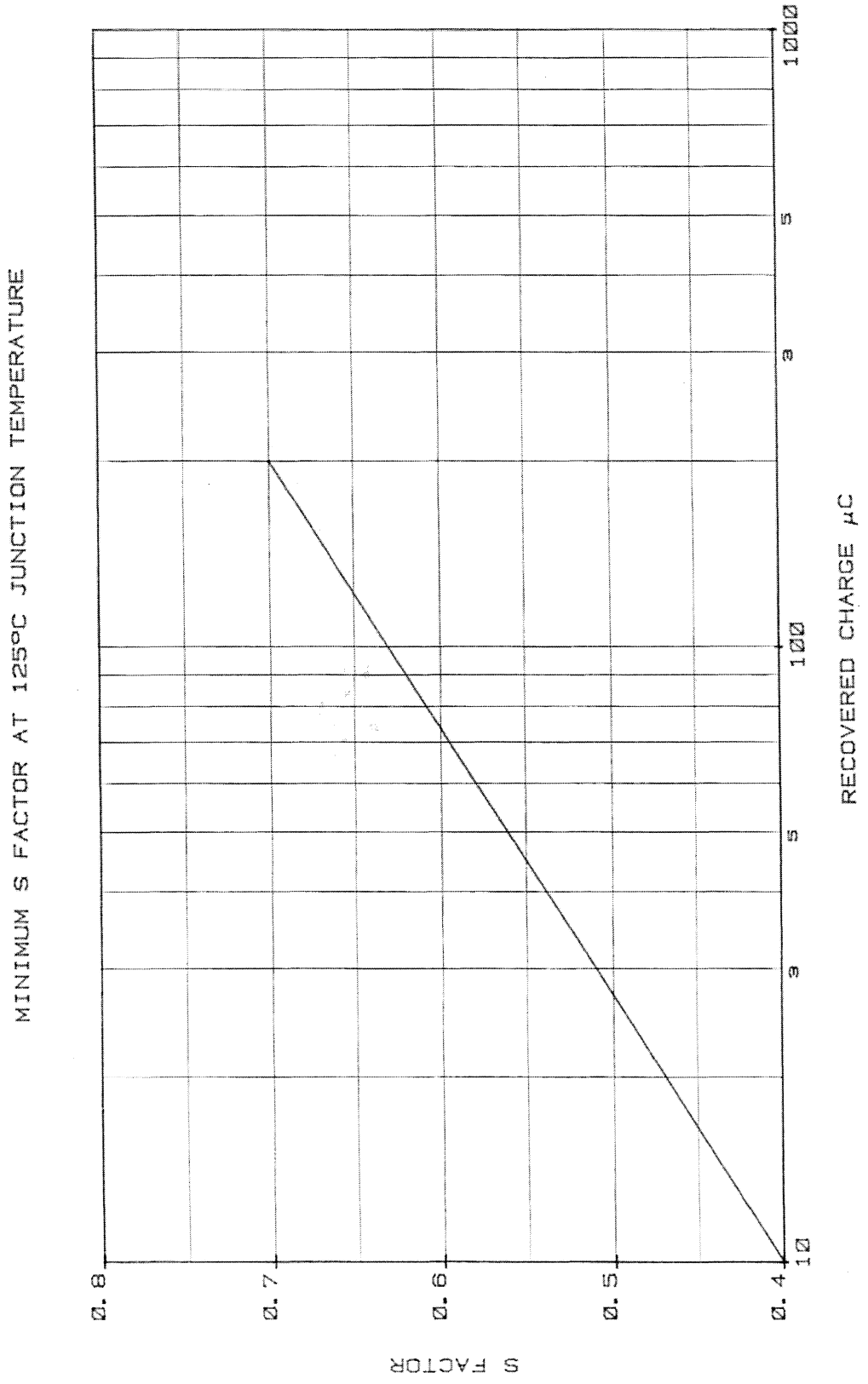

JUNCTION TO HEAT SINK TRANSIENT THERMAL IMPEDANCE
0.180 °C/W
0.090 °C/W
1.0
0.1
0.01
0.001
10.0
1.0
0.1
0.01
0.001
TIME (SECONDS)
TRANSIENT THERMAL IMPEDANCE (°C/WATT)

MAXIMUM NON REPETITIVE SURGE CURRENT AT INITIAL JUNCTION TEMPERATURE 125°C

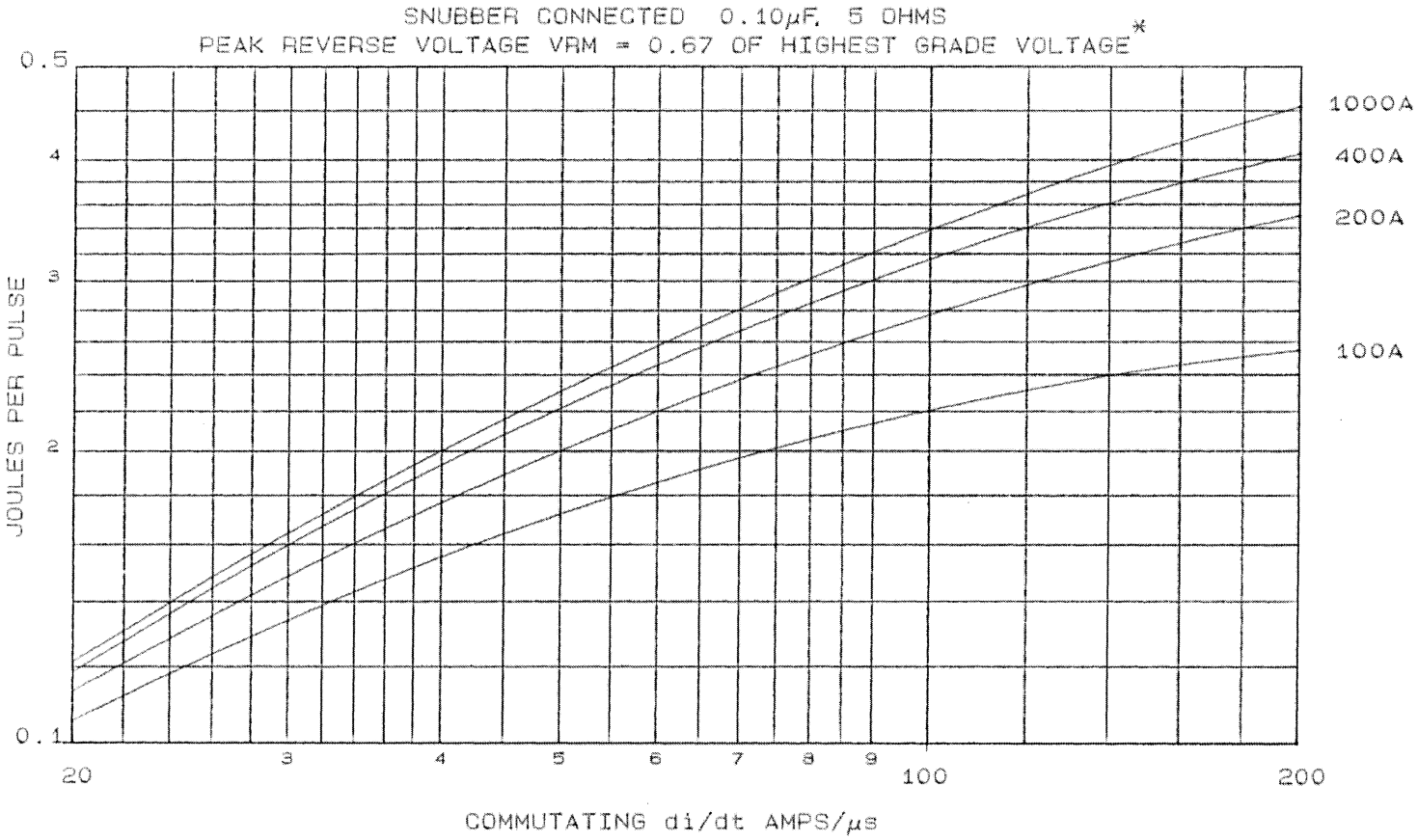


MAXIMUM RECOVERED CHARGE AT 125°C JUNCTION TEMPERATURE



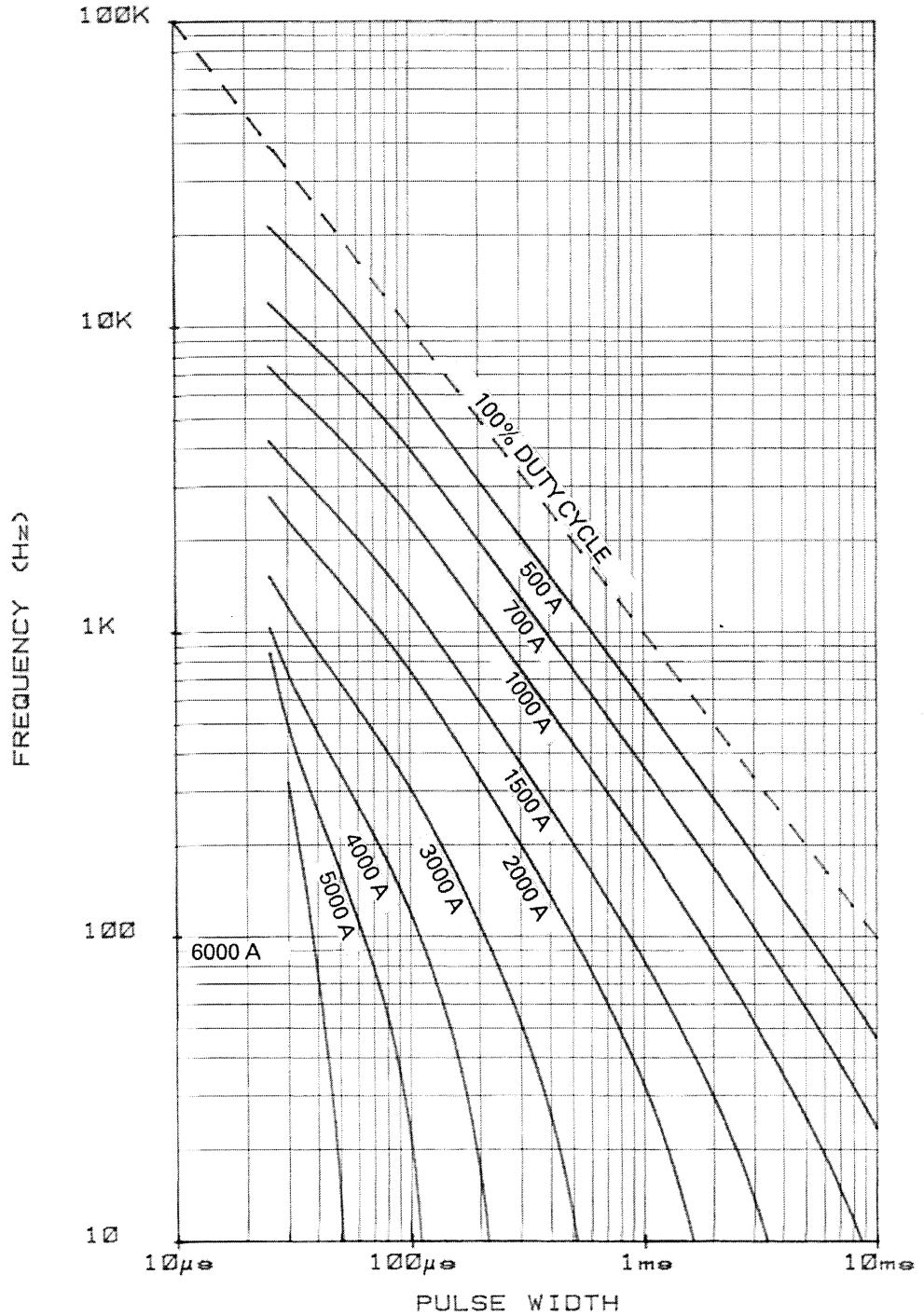

MINIMUM S FACTOR AT 125°C JUNCTION TEMPERATURE
S FACTOR
Ø.8
Ø.7
Ø.6
Ø.5
Ø.4
RECOVERED CHARGE μC
10
3
5
100
3
5
1000

MAXIMUM REVERSE RECOVERY ENERGY LOSS PER PULSE, 125°C JUNCTION TEMPERATURE

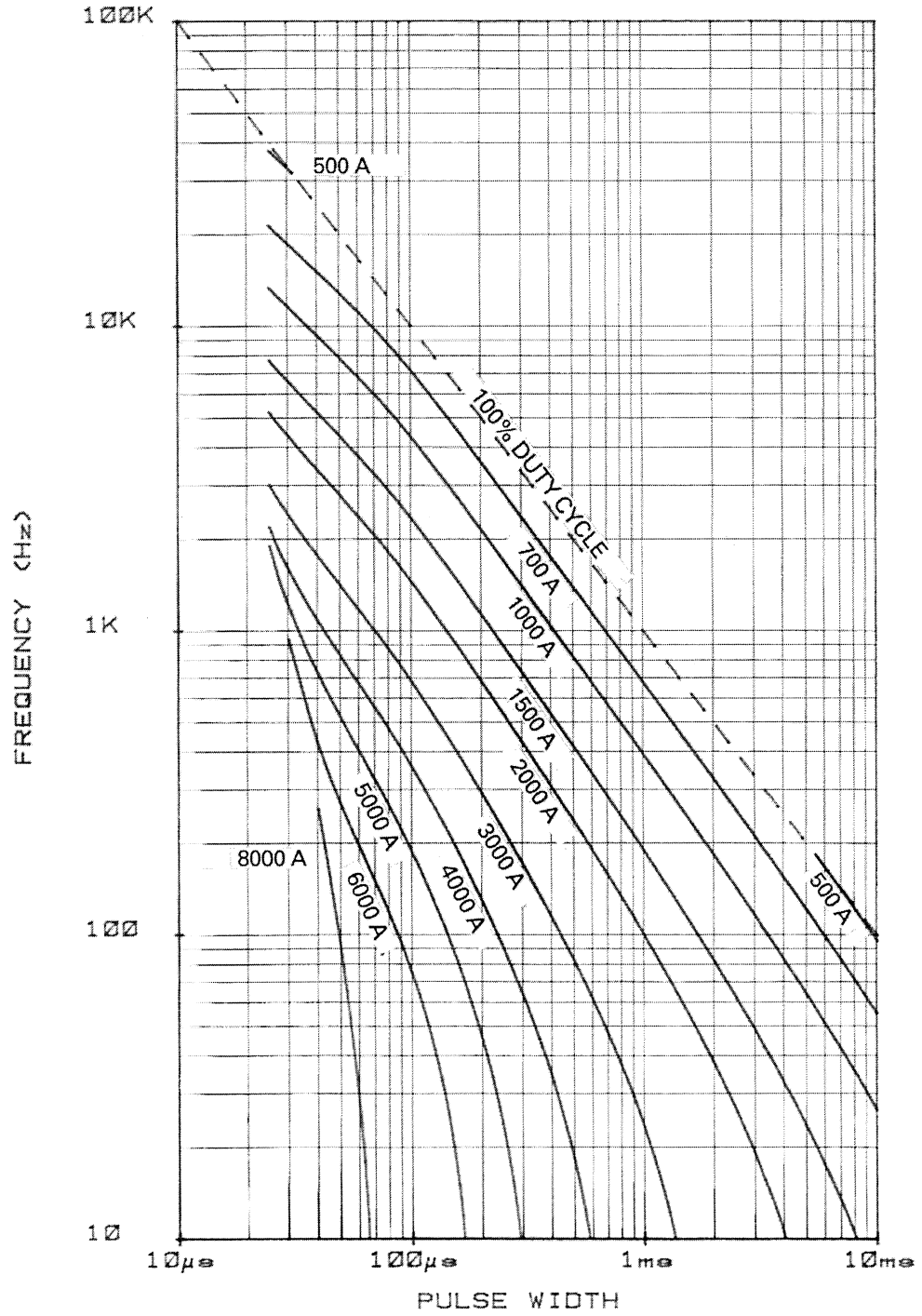



*NOTE: ENERGY PER PULSE SHOULD BE ADJUSTED PRO RATA WITH APPLIED PEAK RECOVERY VOLTAGE

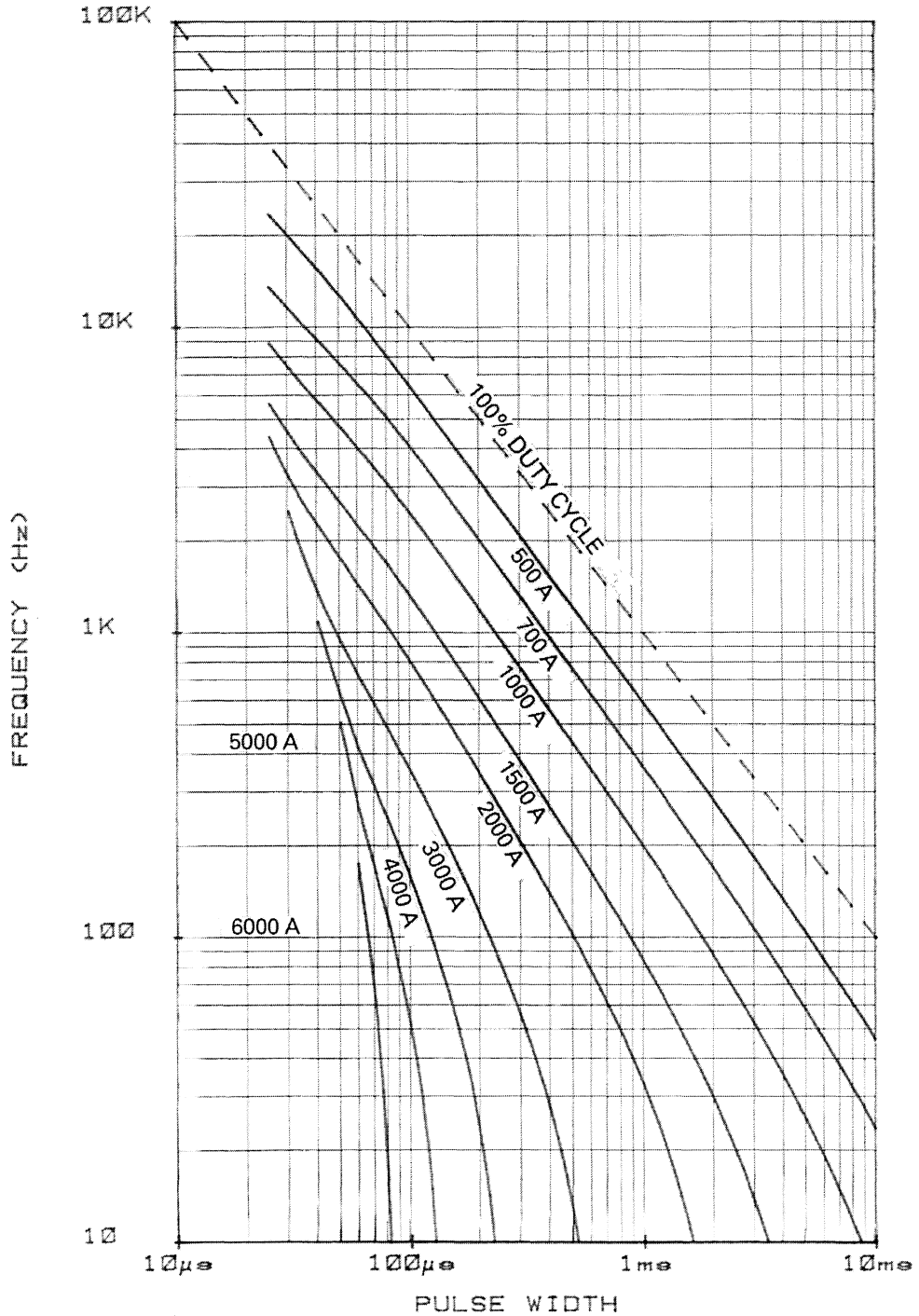
T SINK 85°C. 200A/μs



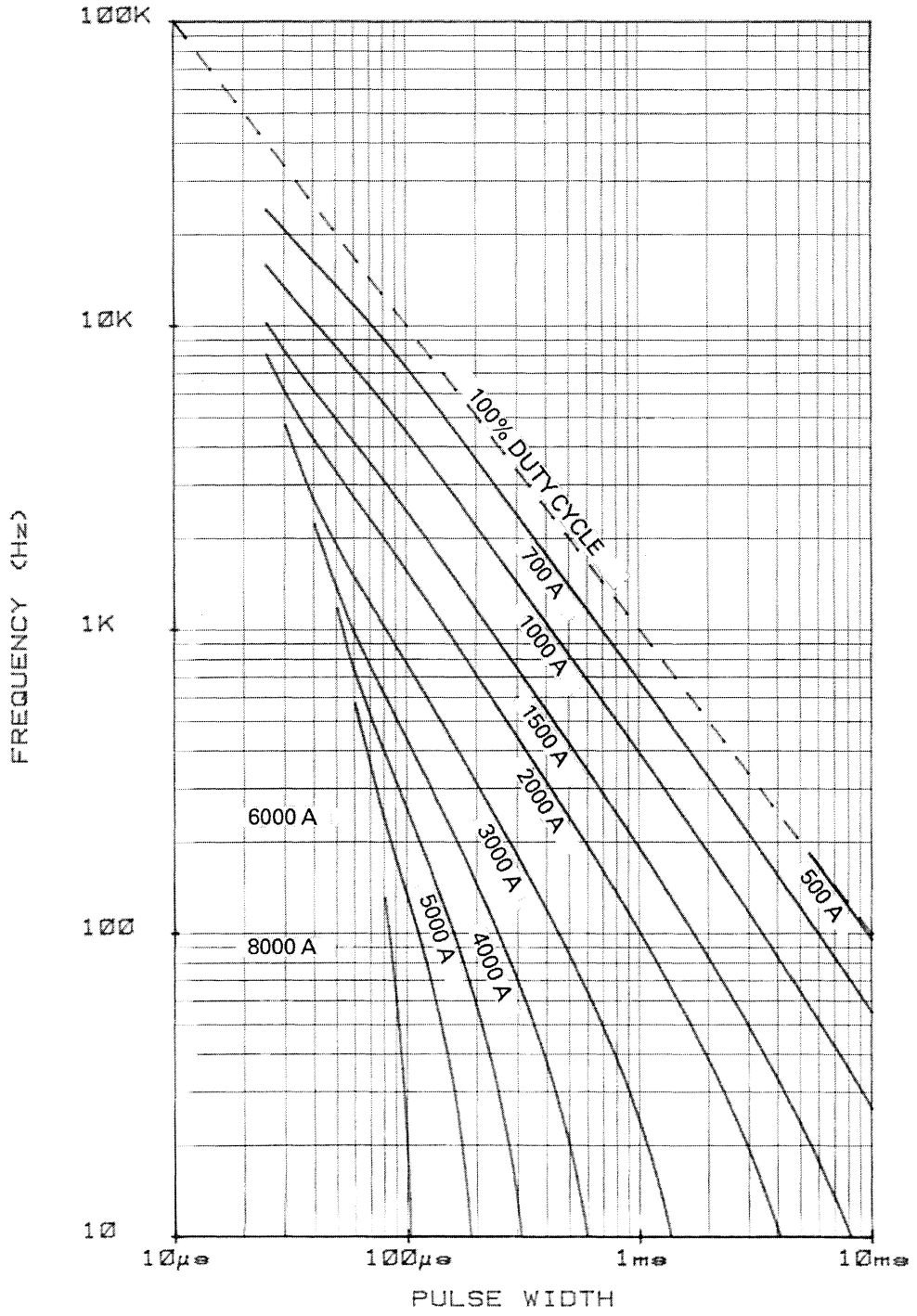
T SINK 55°C. 200A/μs



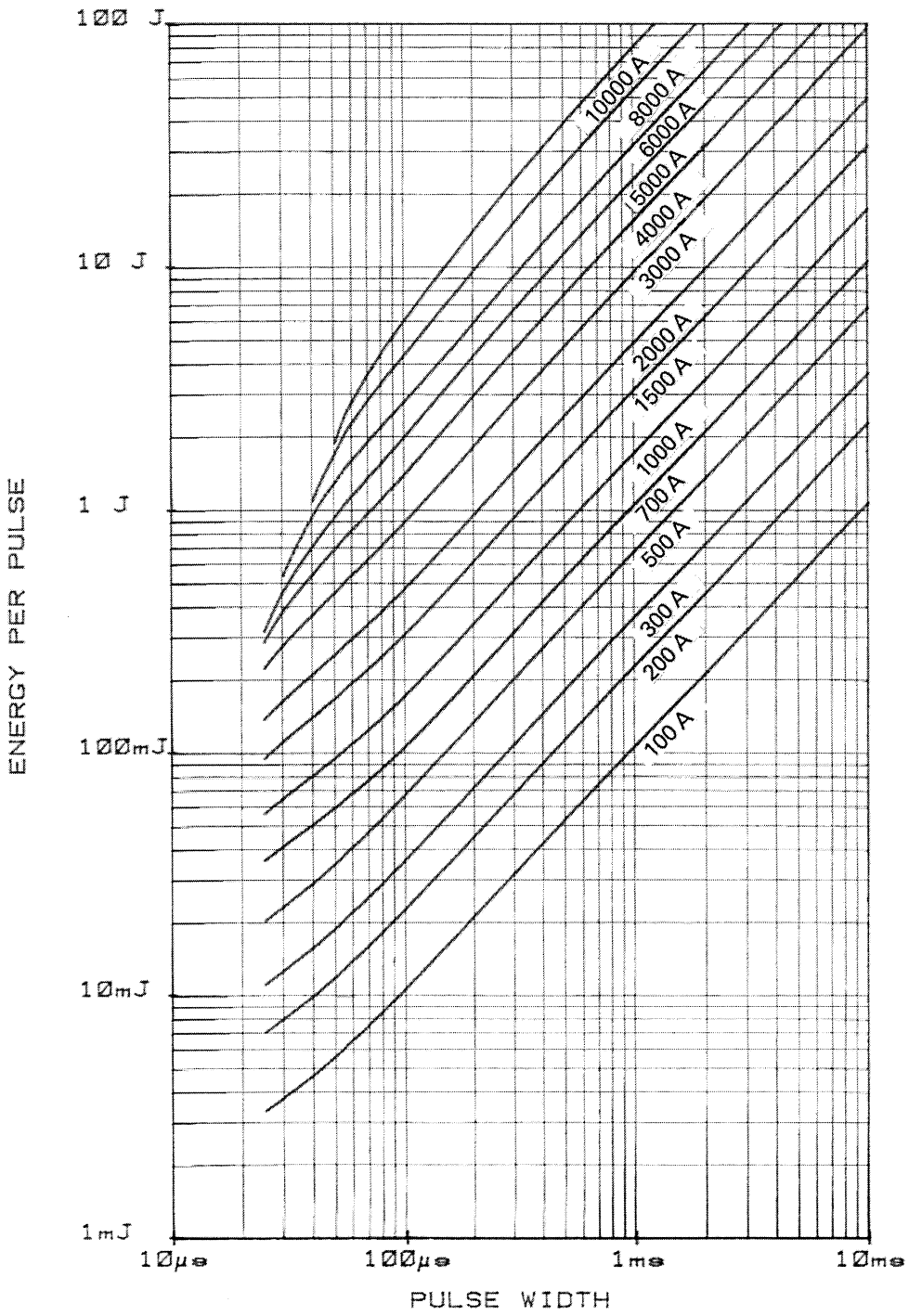
T SINK 85°C. 100A/μs



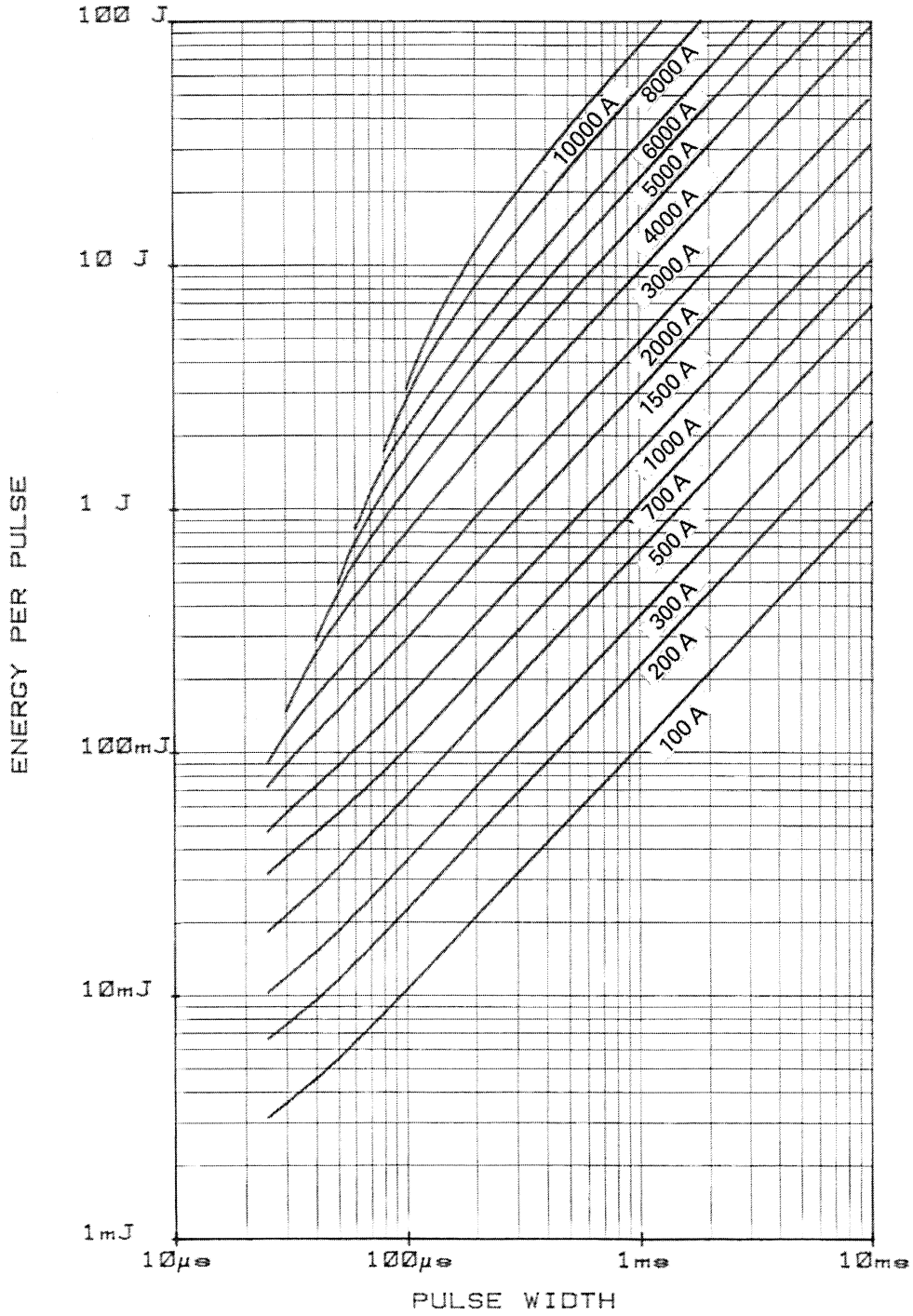
T SINK 55°C. 100A/μs



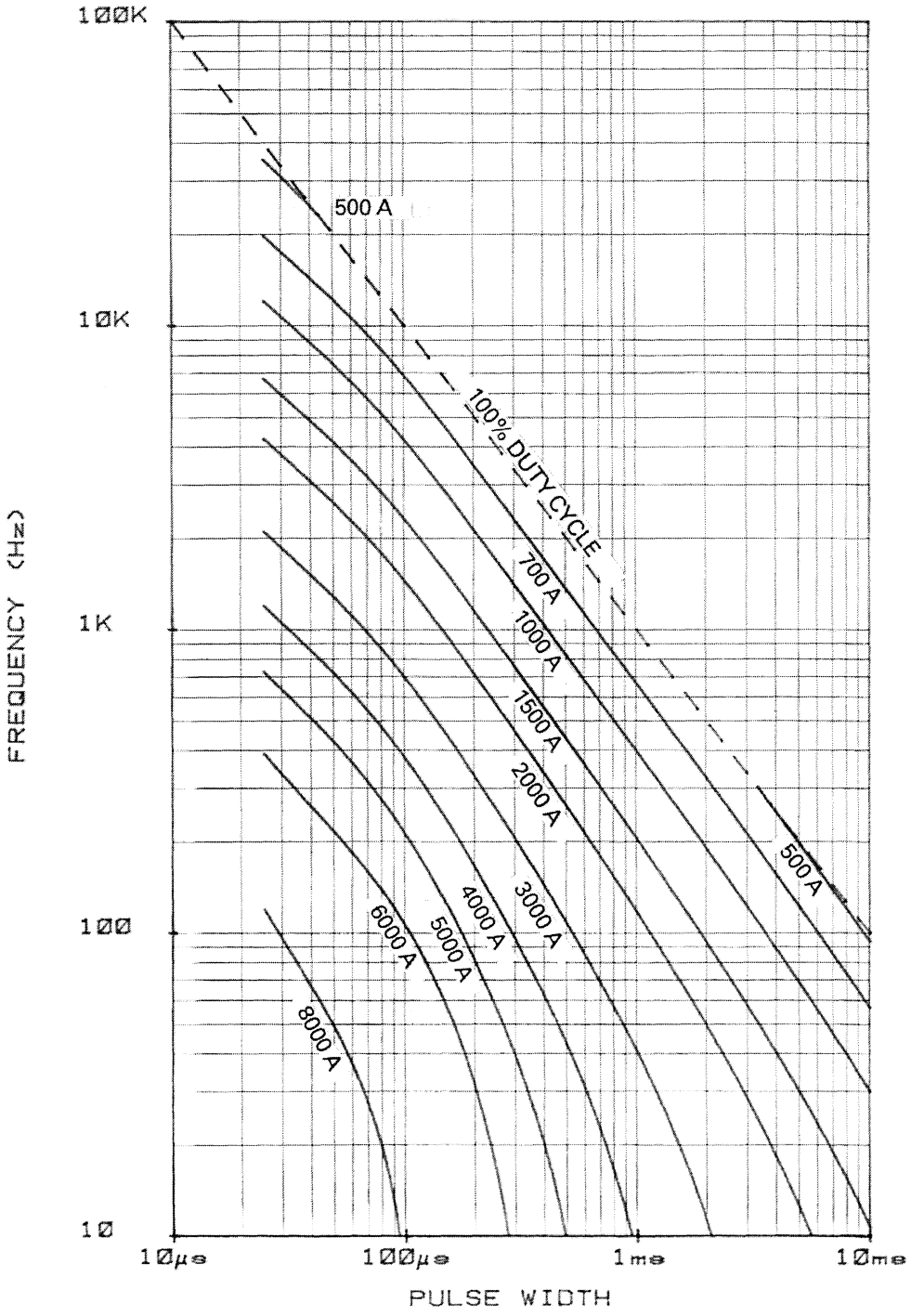
$T_J$ 125°C. 200A/µs



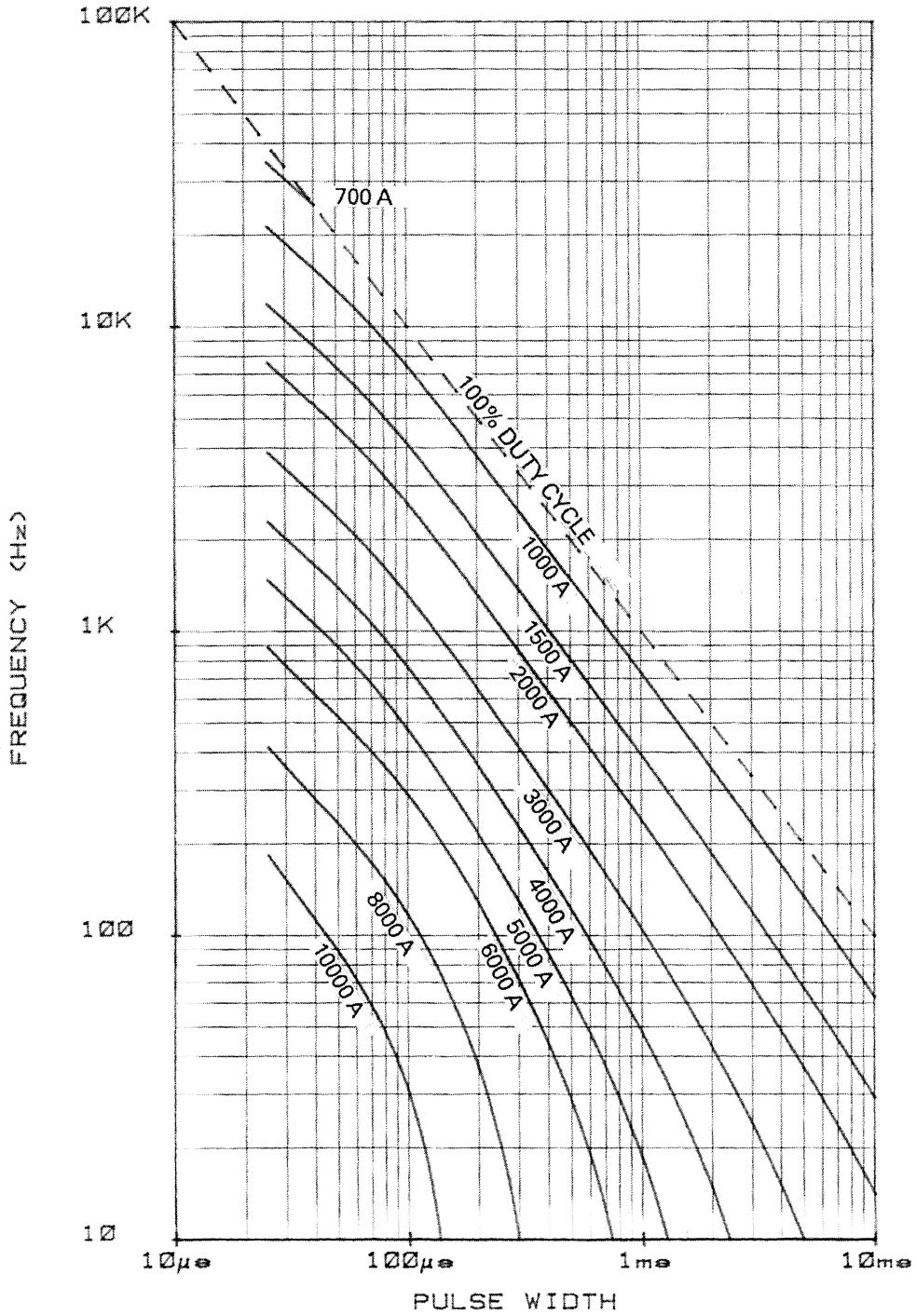
$T_J$ 125°C. 100A/µs



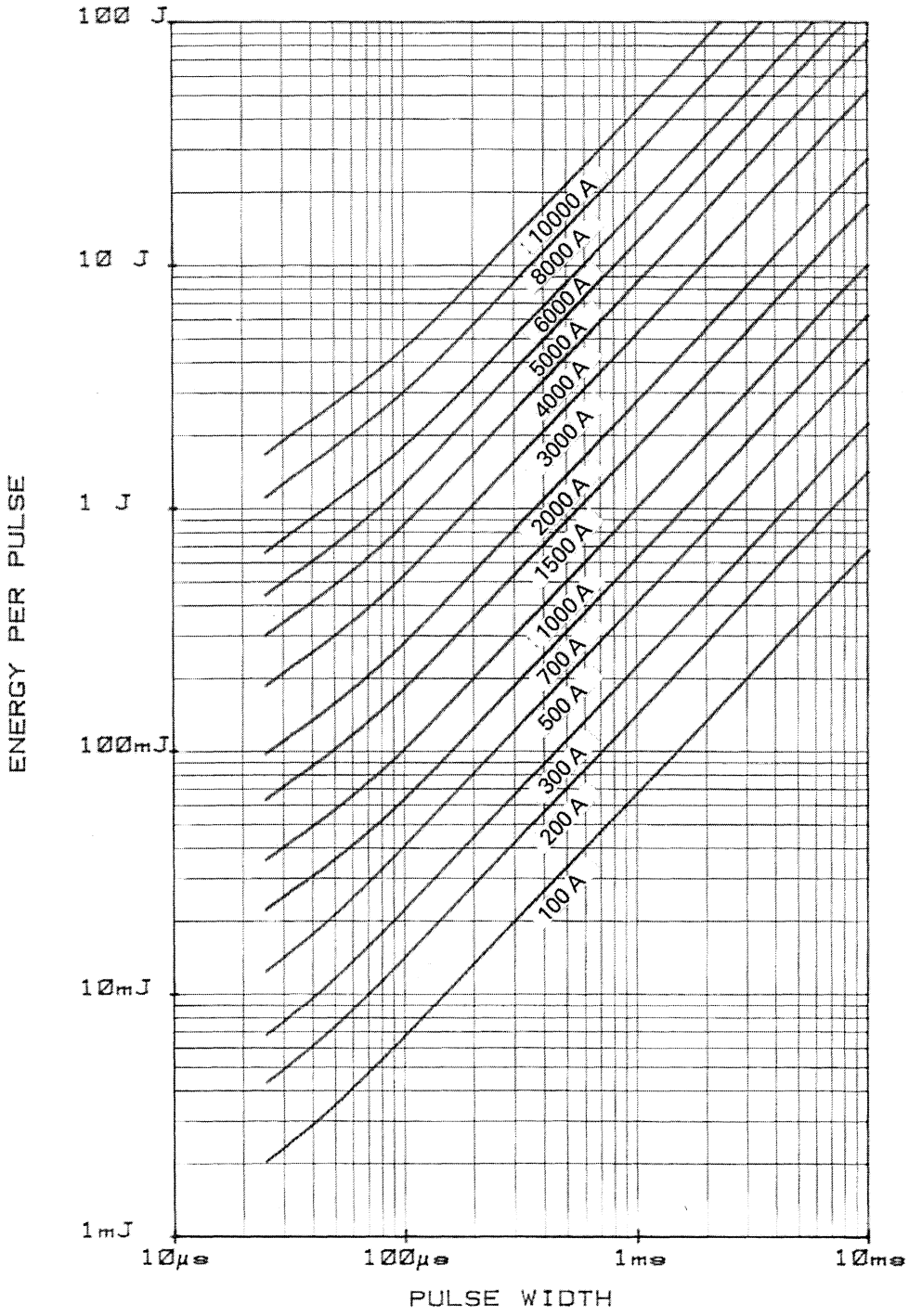
T SINK 85°C. SINE WAVE



T SINK 55°C. SINE WAVE



$T_J$ 125°C. SINE WAVE



| | |
|---|---|
| SCALE | 1/1 |
| DRN | |
| CHKD | |
| APPD | |
| | A |
| S | NI |

INTERNATIONAL OUTLINE No. DO-200AA.
WEIGHT. 70 GRAMS.
FINISH. NICKEL PLATE.

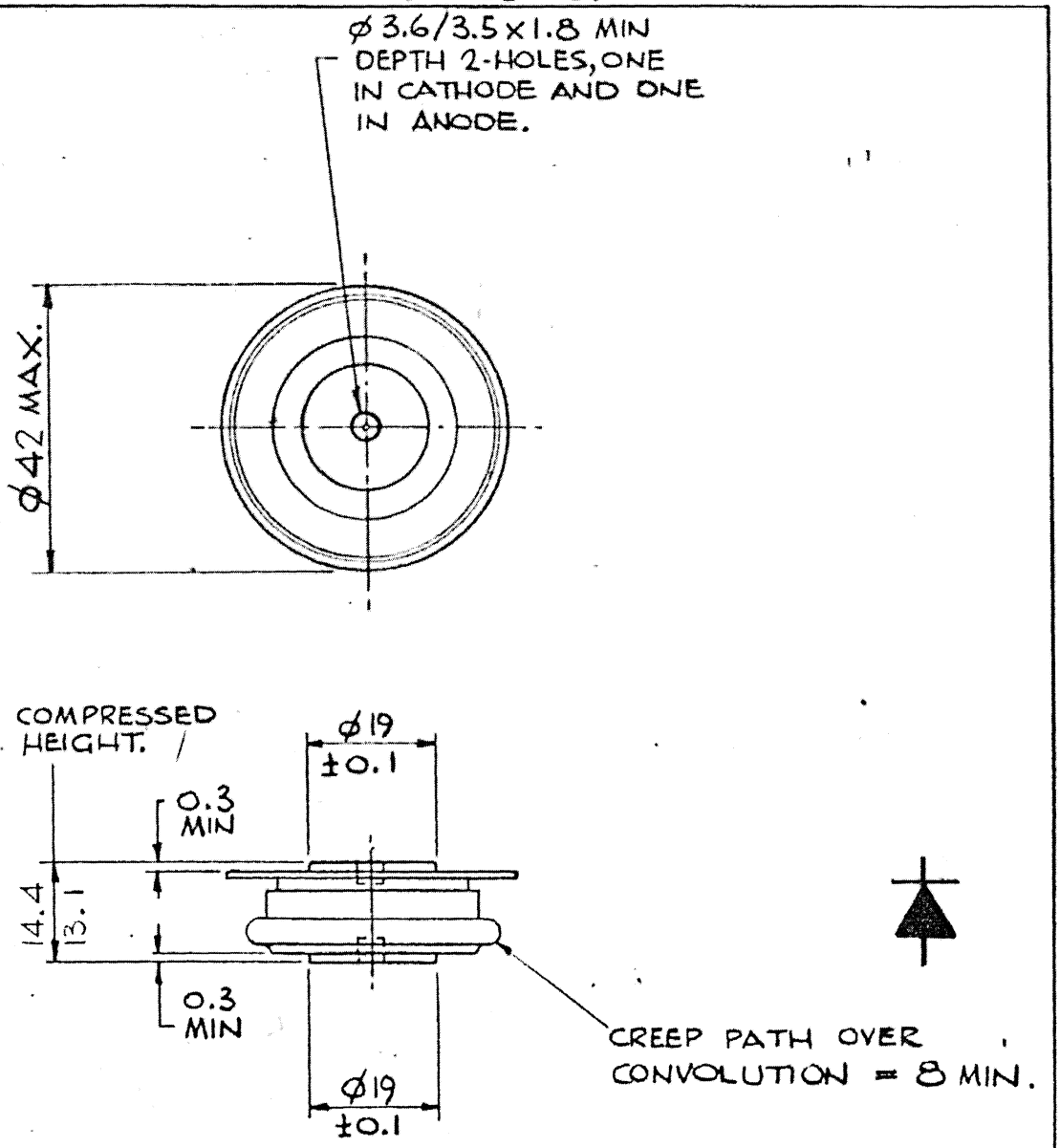


DEVICE MARKING INCLUDES MONOGRAM, TYPE No., SPEC. No. AND POLARITY SYMBOL.

DEVICE MOUNTING: CLAMPING FORCE TO BE APPLIED ON ℄ OF LOCATION HOLES AND BE EVENLY DISTRIBUTED OVER AREA OF CONTACT. FLAT TOL ON SURFACES TO WHICH DEVICE IS CLAMPED TO BE 0.04 WIDE.
CLAMPING FORCE = 330 - 550kgf.

| TYPE NUMBER | |
|---|---|
| CXC300 | |
| CXC320 | CXC170 |
| CXC380 | CXC174 |
| CXC400 | |

G.A. DRG. No. 159B100H100-H110. 102B213.

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WESTINGHOUSE BRAKE AND SIGNAL CO. LTD.
CHIPPENHAM, WILTSHIRE, SN15 1JD, ENGLAND.

WESTCODE ® SEMICONDUCTORS

THIRD ANGLE PROJECTION

DIMNS. IN MILLIMETRES

DRG. No. 100A241

| ISS | REVISIONS |
|---|---|
| 1 | 10.9.76 P118 |
| 2 | REDRAWN. 15.2/14 WAS 15.2/12.5. ϕ19 WAS ϕ29. P304 18.5.78 |
| 3 | CLAMPING FORCE WAS 500-1200kgf. 7.9.78 |
| 4 | 11.9.78 ϕ42 WAS ϕ43 14.35/13.08 WAS 15.2/14. CLAMP FORCE WAS 400-700kgf |
| 5 | 19.9.78 14.4/13.1 WAS 14.35/13.08 |
| 6 | 30.10.78 M1670 TYPE Nº ADDED |
| 7 | 17.9.79 M1773 550kgf WAS 700 kgf. |

# Drawing Number – W1

# Outline Number – 100A241

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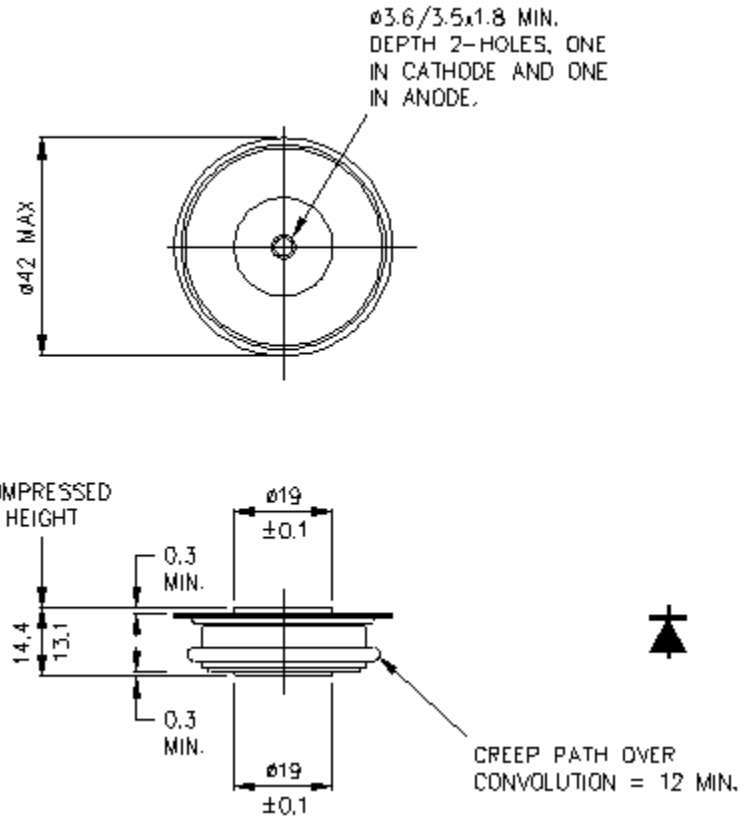


**Weight 70g**

**Westcode Customer Services email:** wsl.sales@westcode.com **Telephone: +44 (0)1249 444524 Fax: +44 (0)1249 659448**