Soft Recovery Diode
M0347WC160 to M0347WC250

The data sheet on the subsequent pages of this document is a scanned copy of existing data for this product.
(Rating Report 90NR9 Issue 2)

This data reflects the old part number for this product which is: SM16-25CXC134. This part number must **NOT** be used for ordering purposes – please use the ordering particulars detailed below.

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

M0347	WC	♦♦	**0**
Fixed Type Code	Fixed Outline Code	Voltage code V_{RRM}/100 16-25	Fixed Code
Typical Order Code: M0347WC160, 14mm clamp height, 1600V V_{RRM}			

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QUALITY EVALUATION LABORATORY

Rating Report No: 90NR9 (Issue 2)　　　　Date: 8th MARCH, 1993

Origin: Q.E.L.　　　　Pages: 26

Diode Capsule Type: SM16-25CXC134

Written by: B. Holloway　　Checked: M Baker　　Approved:

The SMxxCXC134 series of diffused, fast recovery diodes is based on a 24mm diameter silicon slice housed in a standard DO-200AA capsule.

These diodes are particularly suitable for G.T.O. snubber applications.

This supersedes 90NR9 Issue 1 dated 16.5.90.

Ratings

Voltage Grades	: 16 - 25
V_{RSM}	: 1700-2600V
V_{RRM}	: 1600-2500V
$I_{F(AV)}$: Single phase: 50 Hz, 180° half sinewave;	
Double Side Cooled T_{HS} = 55°C, 100°C	: 350A; 164A
Single Side Cooled T_{HS} = 100°C	: 90A
$I_{F(rms)}$ T_{HS} = 25°C) Double side cooled	: 690A
I_F T_{HS} = 25°C) Double side cooled	: 580A
I_{FSM} : t = 10ms half sinewave; T_J (initial) = 125°C; $V_{RM} = 0.6V_{RRM(MAX)}$	: 4250A
I_{FSM} : t = 10ms half sinewave; T_J (initial) = 125°C; $V_{RM} \leq 10V$	: 4670A
I^2t : t = 10ms T_J (initial) = 125°C; $V_{RM} = 0.6V_{RRM}(MAX)$	: 90.3 x 10^3A^2s
I^2t : t = 10ms; T_J (initial) = 125°C; $V_{RM} \leq 10V$	: 109 x 10^3A^2s
I^2t : t = 3ms; T_J (initial) = 125°C; $V_{RM} \leq 10V$	: 80.6 x 10^3A^2s
T_{HS} Operating Range	: -40 to +125°C
T_{stg} : Non-operating	: -50 to +150°C

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Characteristics

(Maximum values unless otherwise stated)

V_o :	: 1.21V
r_s :	: 1.2mΩ
A : T_j = 25°C	: 0.5115
B : T_j = 25°C	: 0.2148
C : T_j = 25°C	: 9.469×10^{-4}
D : T_j = 25°C	: -2.1073×10^{-2}
A	: -2.7312
B	: 1.0775
C	: 2.2053×10^{-3}
D	: -0.1451
V_{FM} at I_{FM} = 635A	: 1.97V
R_{th}(J-HS) Double side cooled	: 0.09 K/W
Single side cooled	: 0.18 K/W
I_{RRM} : at $V_{VRRM(MAX)}$	: 35mA
V_{fr} : at dI/dt = 400A/µs	: 37V (typical)
Reverse recovery at I_{FM} = 1000A; t_p = 200µs: di_R/dt = 150A/µs; V_{RM} = 50V	
Q_{RR} (total area)	: 350µC (typical)
Q_{RA} (50% chord)	: 230µC
t_{rr} (25% chord)	: 2.8µS (typical)
I_{RM}	: 160A
Mounting Force	: 3.3 - 3.5 kN
Outline Drawing	: 100A241
JEDEC Outline No.	: D0-200AA

NOTE : All characteristics are at $T_{VJ} = T_{Jmax}$ operating unless stated otherwise.

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Changes:
P2. I_{RRM} increased to 35mA. Q_{RR} 'typical' added.
P3. Changes added. Status box added.
P26. O/L. Dwg. updated

Voltage Ratings

Voltage Class	V_{RRM} V	V_{RSM} V
16	1600	1700
18	1800	1900
20	2000	2100
22	2200	2300
24	2400	2500
25	2500	2600

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 capsule devices with all diffused silicon slices. All these diodes have controlled reverse recovery characteristics with good "K" factors. These diodes are particularly suitable for use in G.T.O. and SCR snubber networks.

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 500 and 1000A/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, and f be the repetition rate

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

$T_{SINK} = T_{J(MAX)} - Ep \times f \times R_{th}$

(c) Housing Loss

The loss caused by coupling between housing and anode current (which gives rise to additional heating at high frequency) has been incorporated into the curves of forward energy loss per pulse.

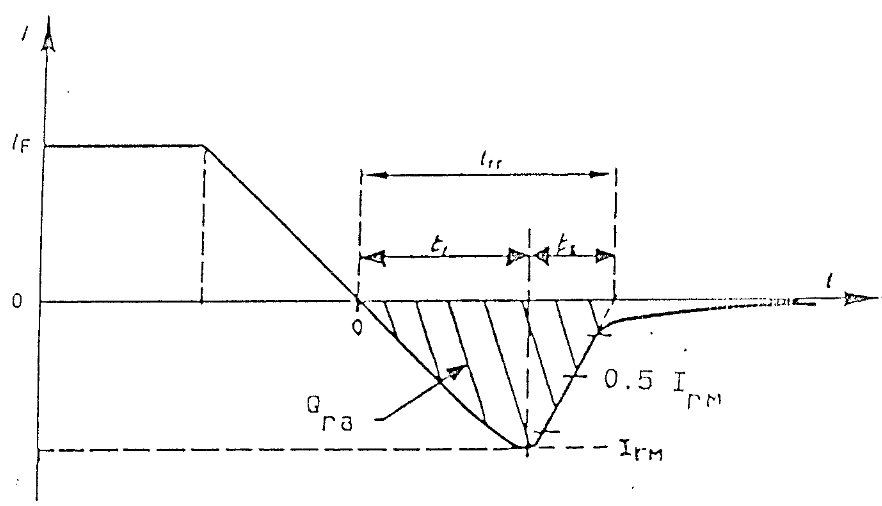
(d) ABCD Constants

These constants are the co-efficients of the semi-empirical expression for the forward characteristic given below:

$V_F = A + B \ln i_F + C\, i_F + D\sqrt{i_F}$: where i_F = instantaneous forward current

(e) Reverse recovery ratings

(i) Q_{ra} is based on 50% I_{rm} chord as shown below.



(ii) Q_{rr} is based on a 150uS integration time

$$\text{i.e. } Q_{rr} = \int_{r=o}^{150uS} I_r \cdot dt$$

(iii) K factor = t_1/t_2

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 by A joules per pulse. A new sink temperature can then be evaluated from:

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

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

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 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 waveform should be carried out with an appropriate snubber of 0.1 uF, 5 ohms connected across diode anode to cathode.

(b) Design Method

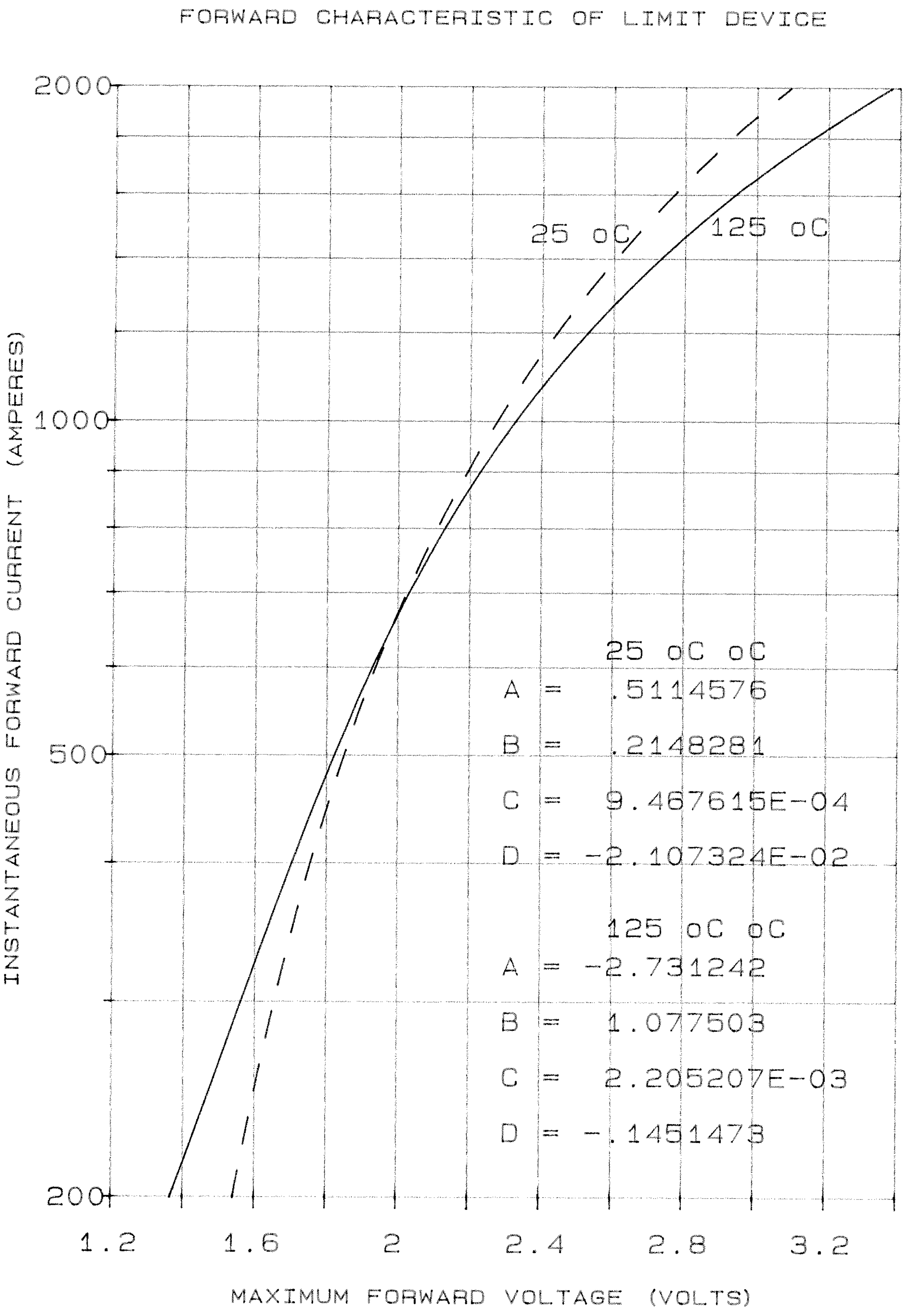
In circumstances where it is not possible to measure voltage and current conditions, or for design purposes, the additional losses may be estimated from curves on page 16.

Let E be the value of energy per reverse cycle in joules (curves on page 16).

Let f be the operating frequency in Hz

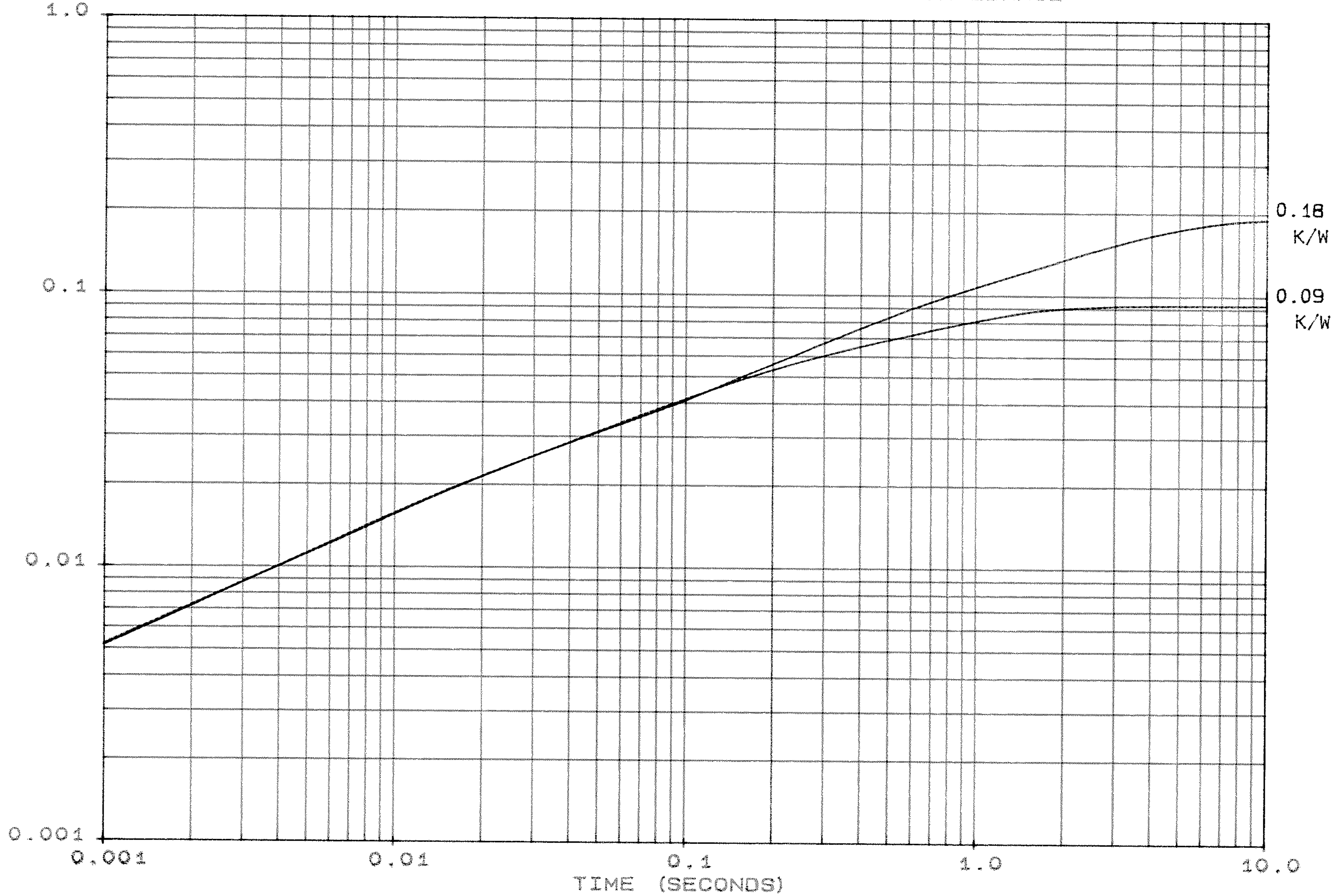
Then $T_{SINK}(new) = T_{SINK}$ original $- E \times R_{th} \times f$

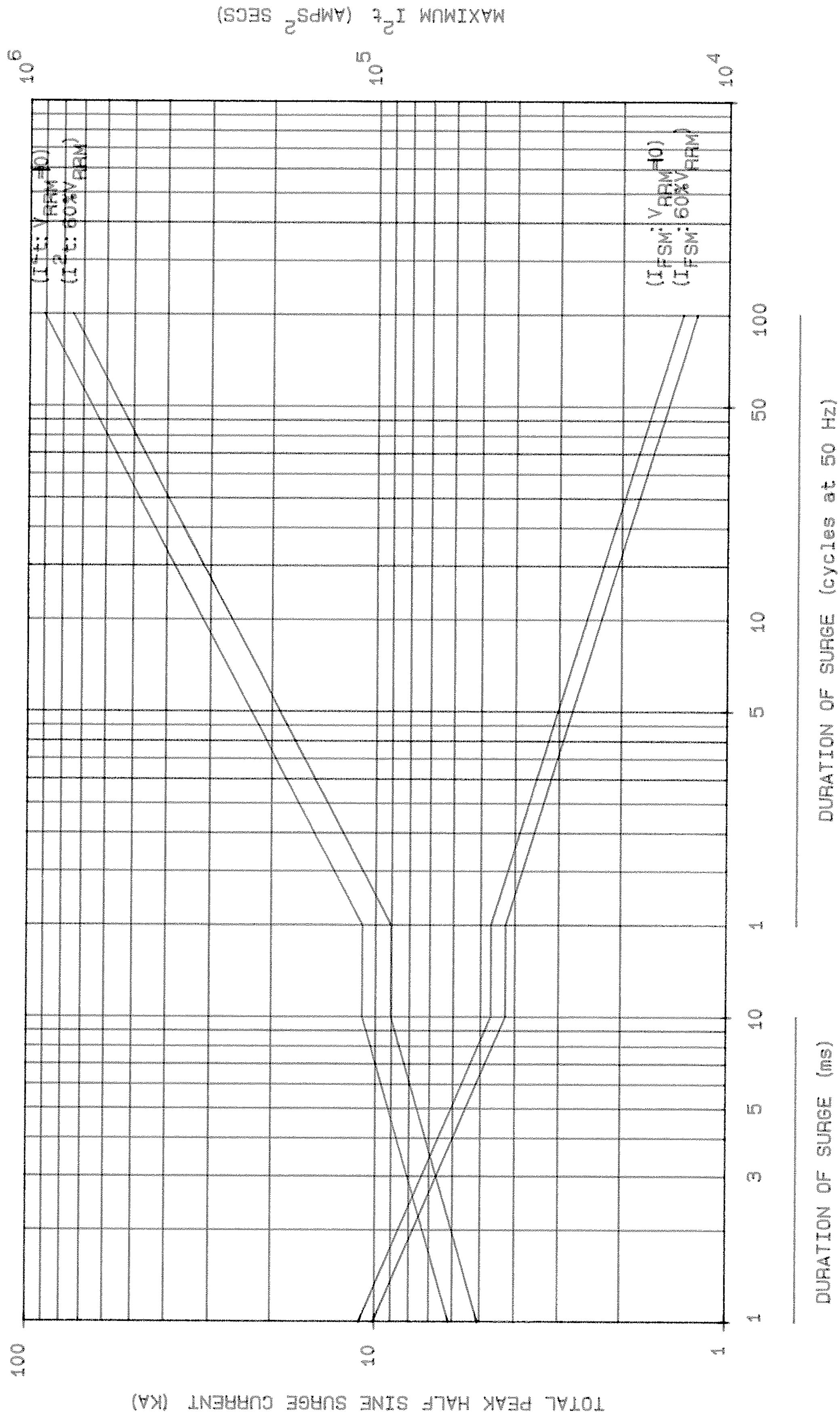
Where $T_{SINK}(new)$ is the required maximum sink temperature and T_{SINK} original is the sink temperature given with the frequency ratings.



FORWARD CHARACTERISTIC OF LIMIT DEVICE
2000
1000
500
200
1.2
1.6
2
2.4
2.8
3.2
INSTANTANEOUS FORWARD CURRENT (AMPERES)
MAXIMUM FORWARD VOLTAGE (VOLTS)
25 oC
125 oC
25 oC oC
A = .5114576
B = .2148281
C = 9.467615E-04
D = -2.107324E-02
125 oC oC
A = -2.731242
B = 1.077503
C = 2.205207E-03
D = -.1451473

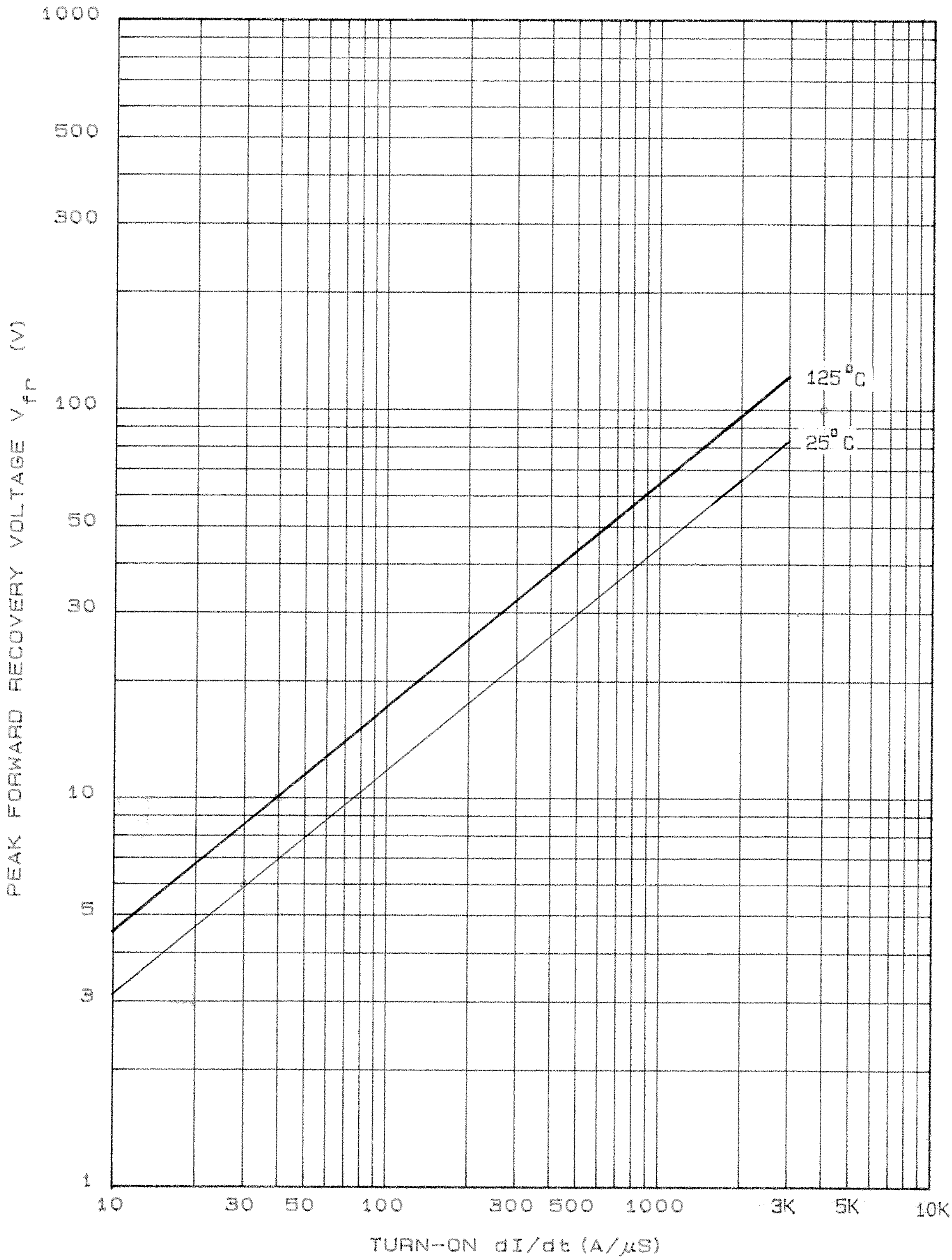
JUNCTION TO HEATSINK TRANSIENT THERMAL IMPEDANCE



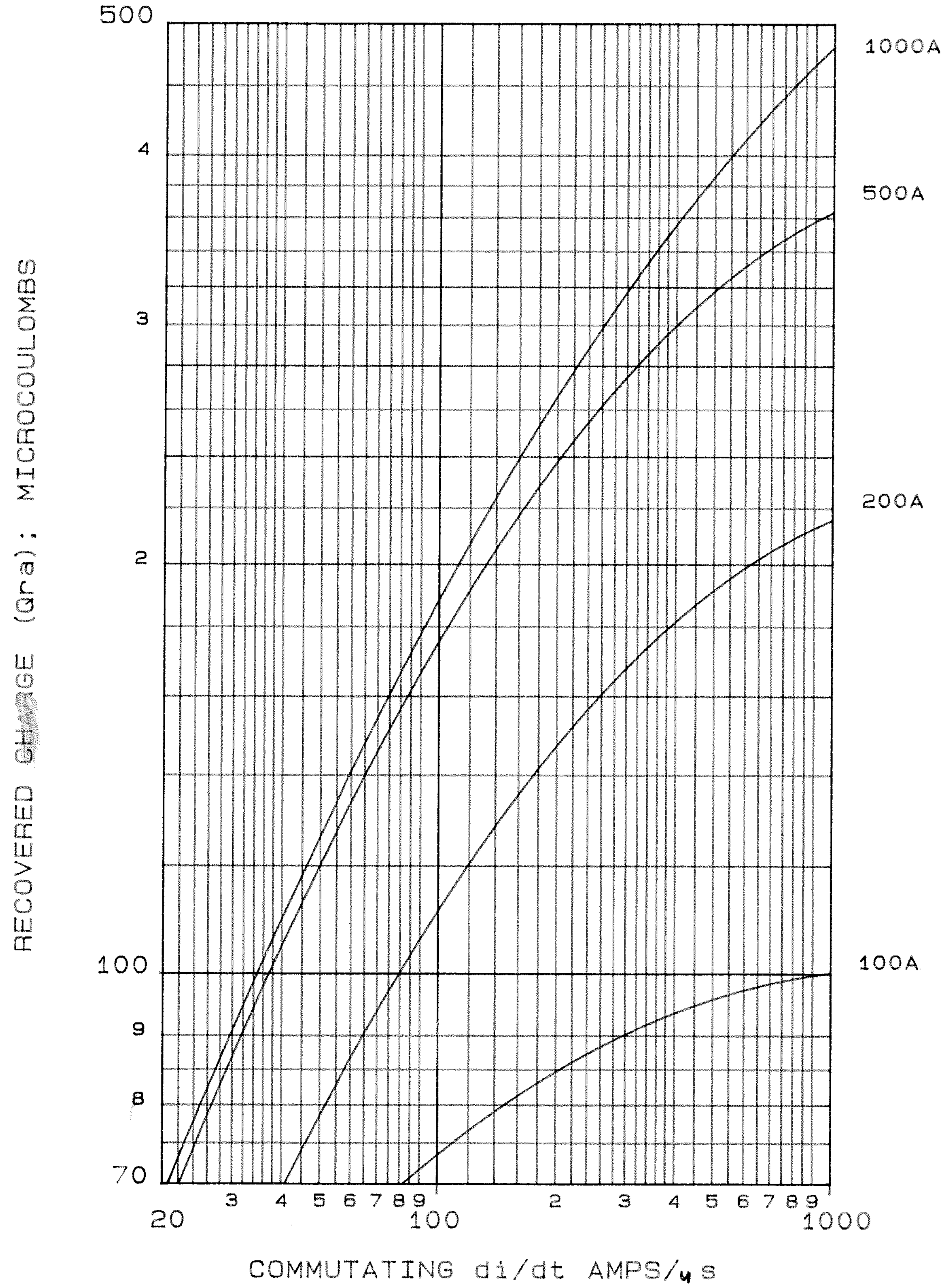


MAXIMUM NON REPETITIVE SURGE CURRENT AT INITIAL JUNCTION TEMPERATURE 125°C

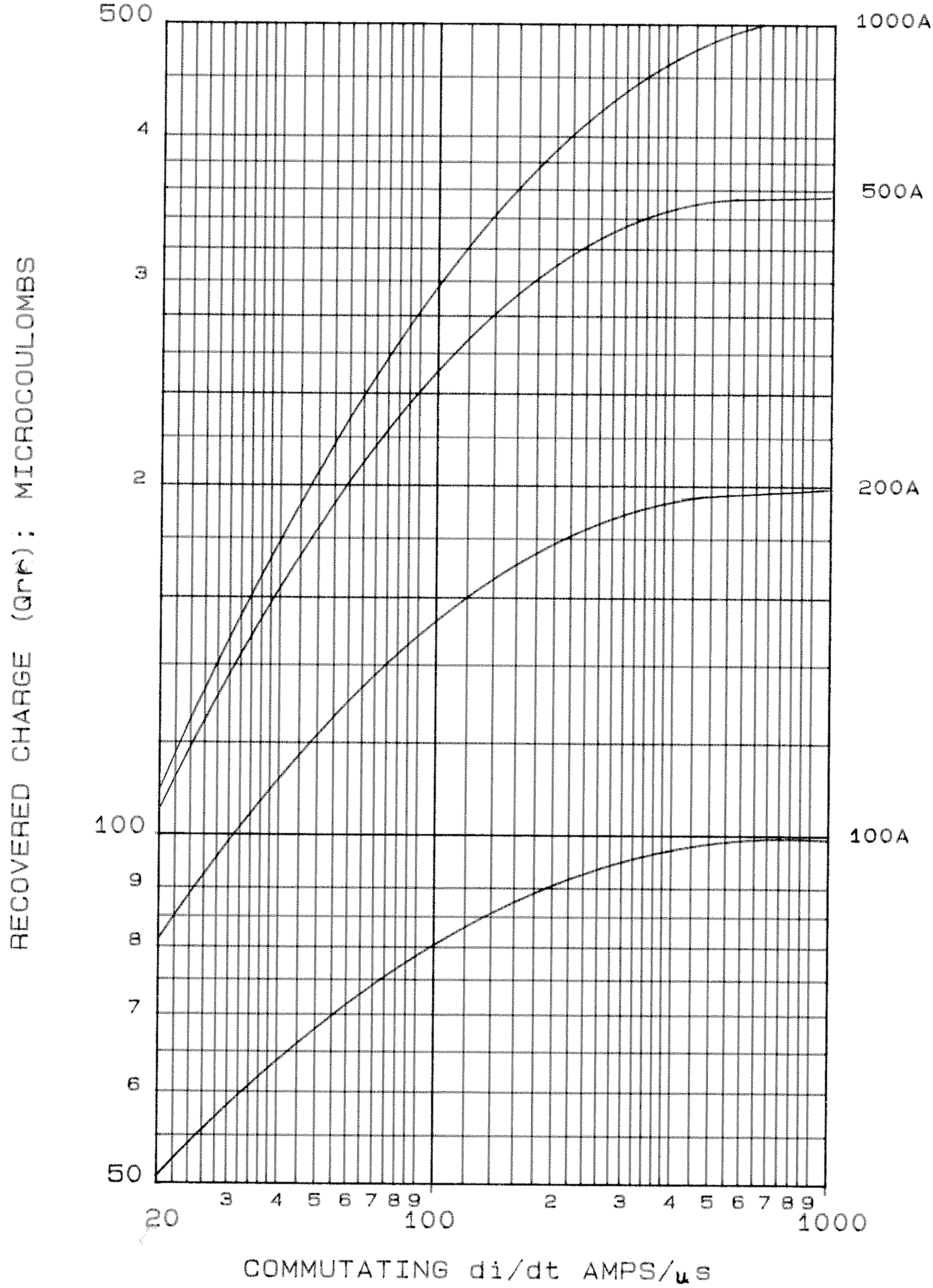
TYPICAL FORWARD RECOVERY VOLTAGE

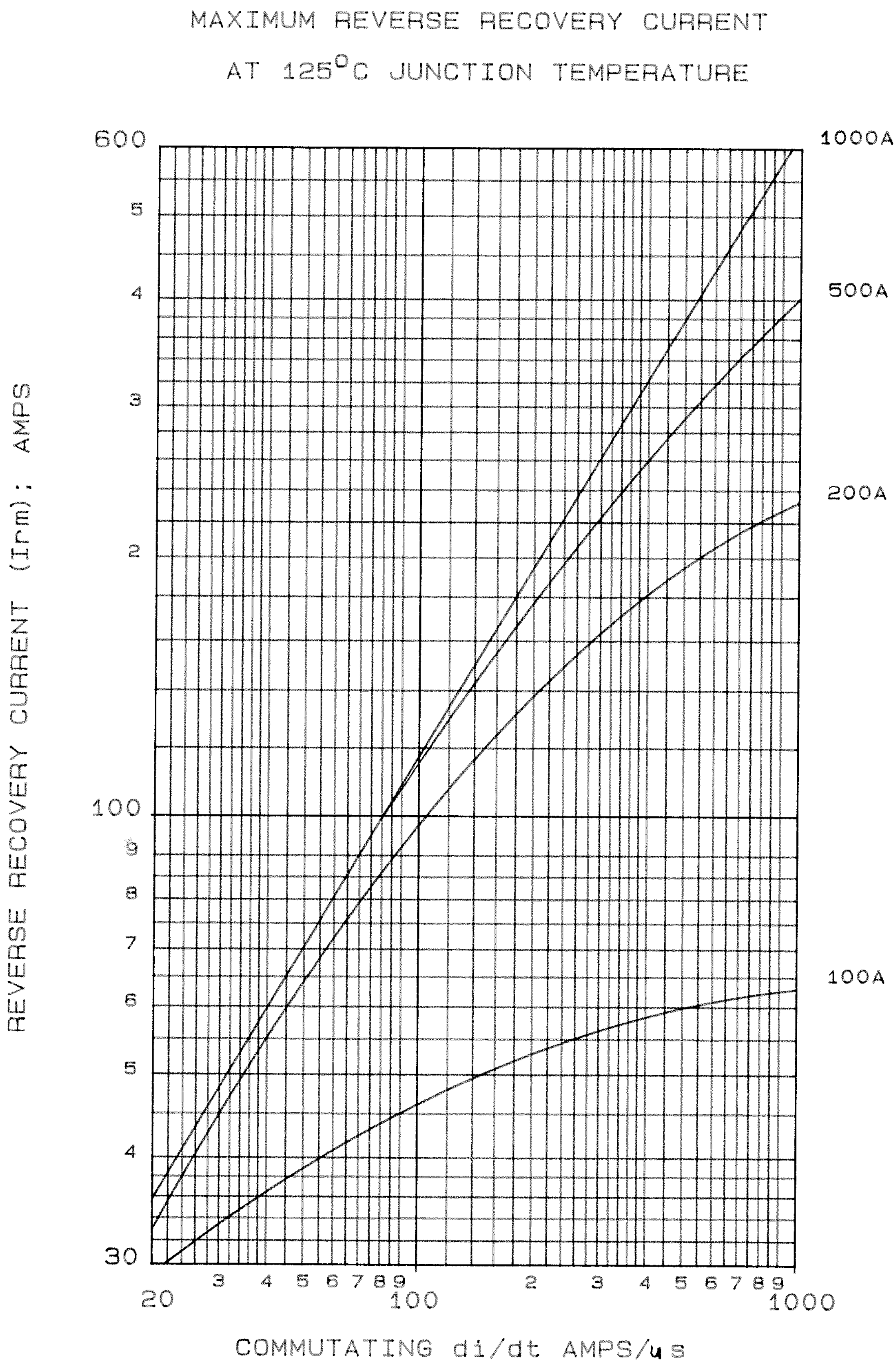


MAXIMUM RECOVERED CHARGE AT 125°C JUNCTION TEMPERATURE



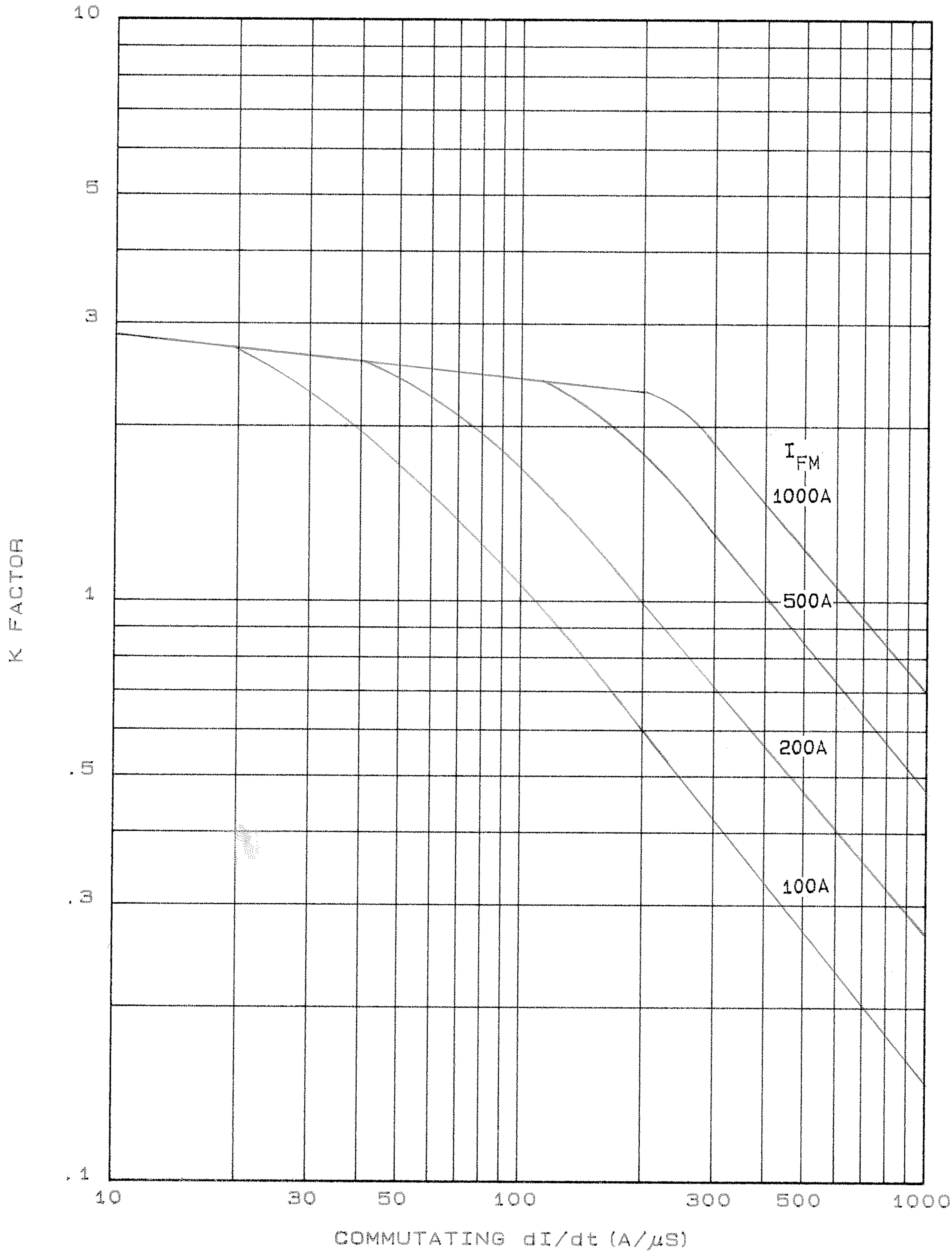
TYPICAL RECOVERED CHARGE AT 125°C JUNCTION TEMPERATURE




MAXIMUM REVERSE RECOVERY CURRENT
AT 125°C JUNCTION TEMPERATURE
REVERSE RECOVERY CURRENT (Irm); AMPS
COMMUTATING di/dt AMPS/μs
1000A
500A
200A
100A
600
5
4
3
2
100
9
8
7
6
5
4
30
20
3 4 5 6 7 8 9
100
2 3 4 5 6 7 8 9
1000

MAXIMUM K FACTOR

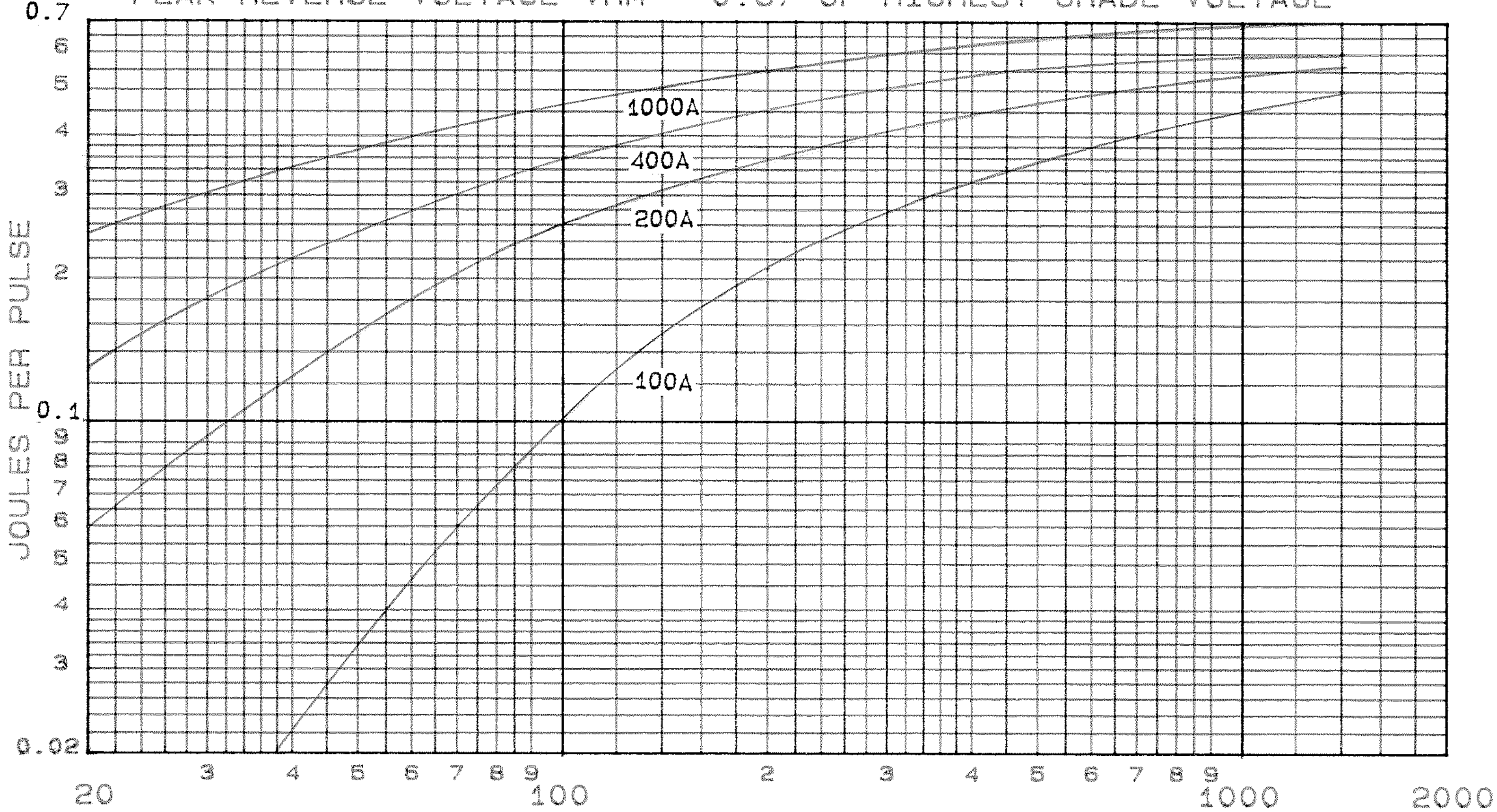
$T_j = 125^{\circ}C$



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

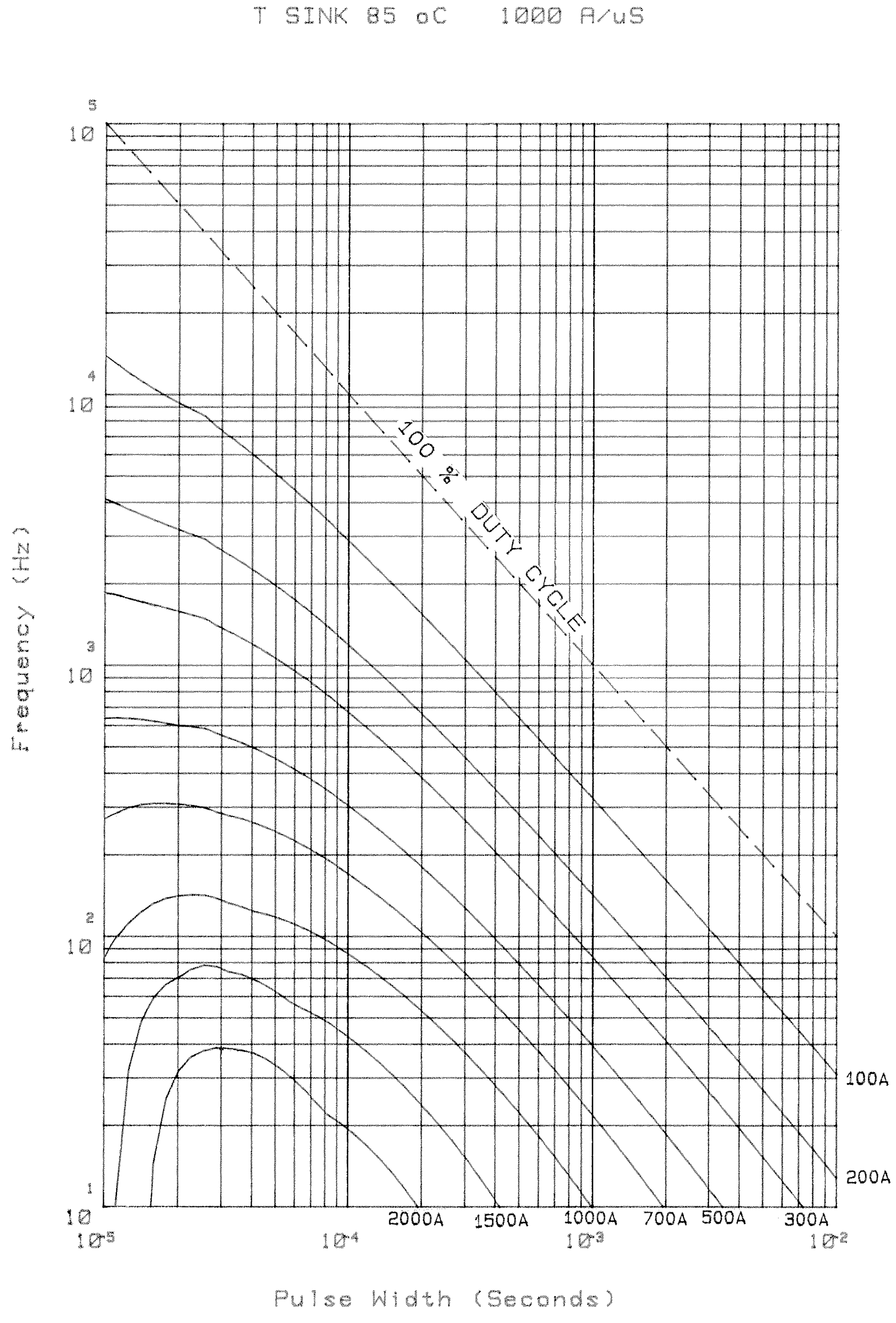
SNUBBER CONNECTED 0.1 uF 5 OHMS

PEAK REVERSE VOLTAGE VRM = 0.67 OF HIGHEST GRADE VOLTAGE*

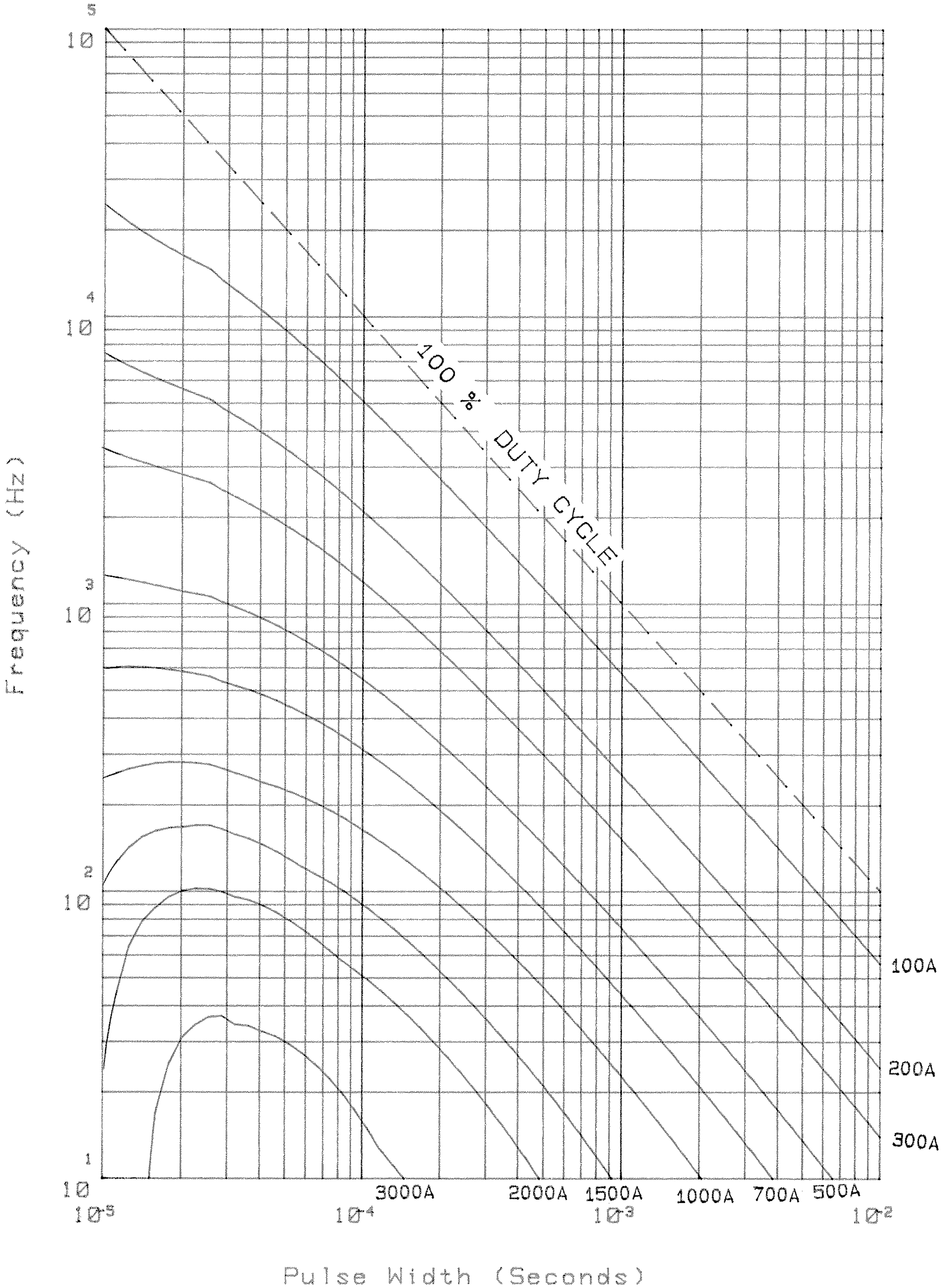


COMMUTATING di/dt AMPS/us

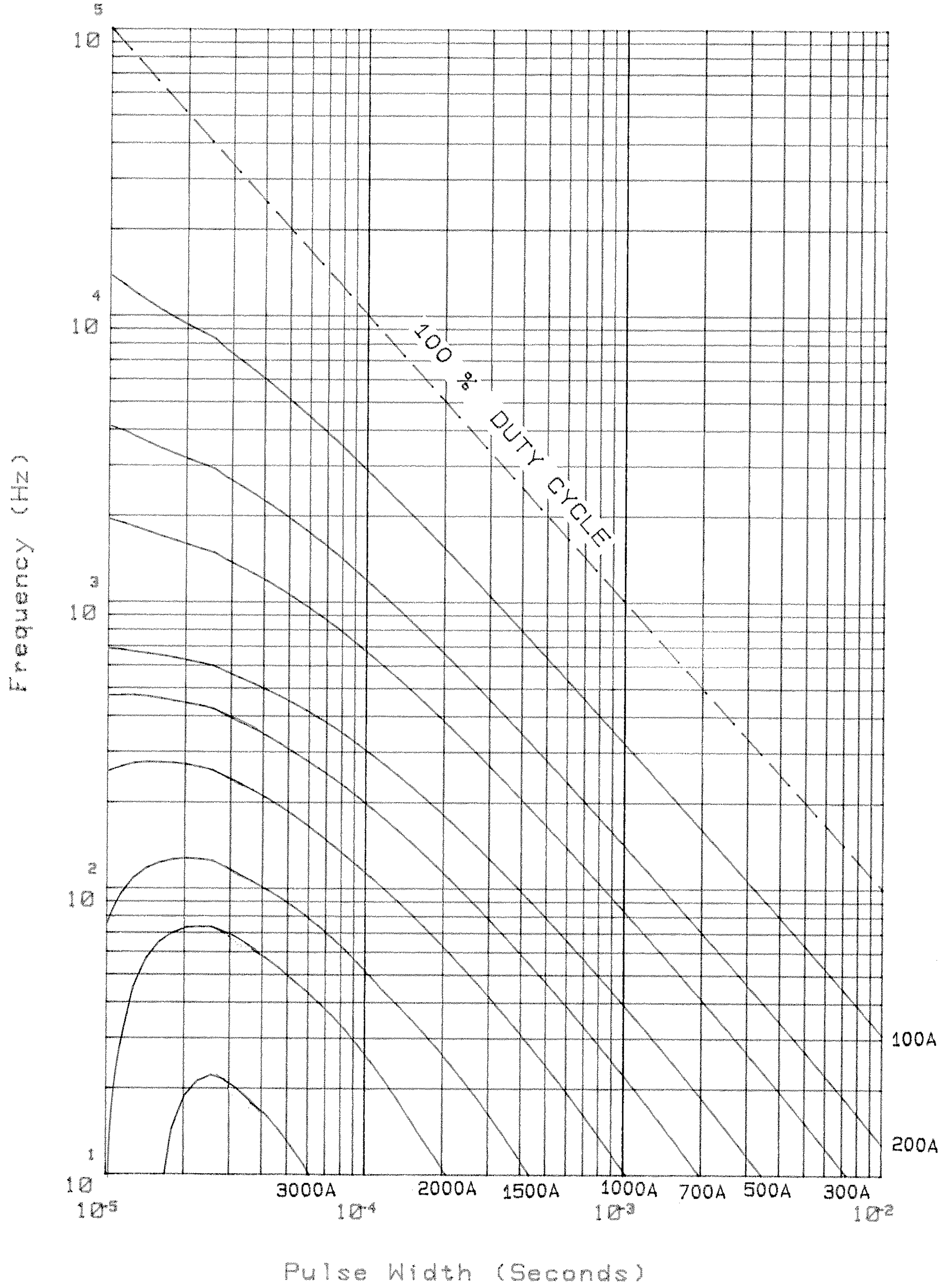
*NOTE: ENERGY PER PULSE SHOULD BE ADJUSTED PRO RATA WITH APPLIED PEAK RECOVERY VOLTAGE


T SINK 85 oC 1000 A/uS
Frequency (Hz)
10^5
10^4
10^3
10^2
10^1
100 % DUTY CYCLE
100A
200A
2000A
1500A
1000A
700A
500A
300A
10^{-5}
10^{-4}
10^{-3}
10^{-2}
Pulse Width (Seconds)

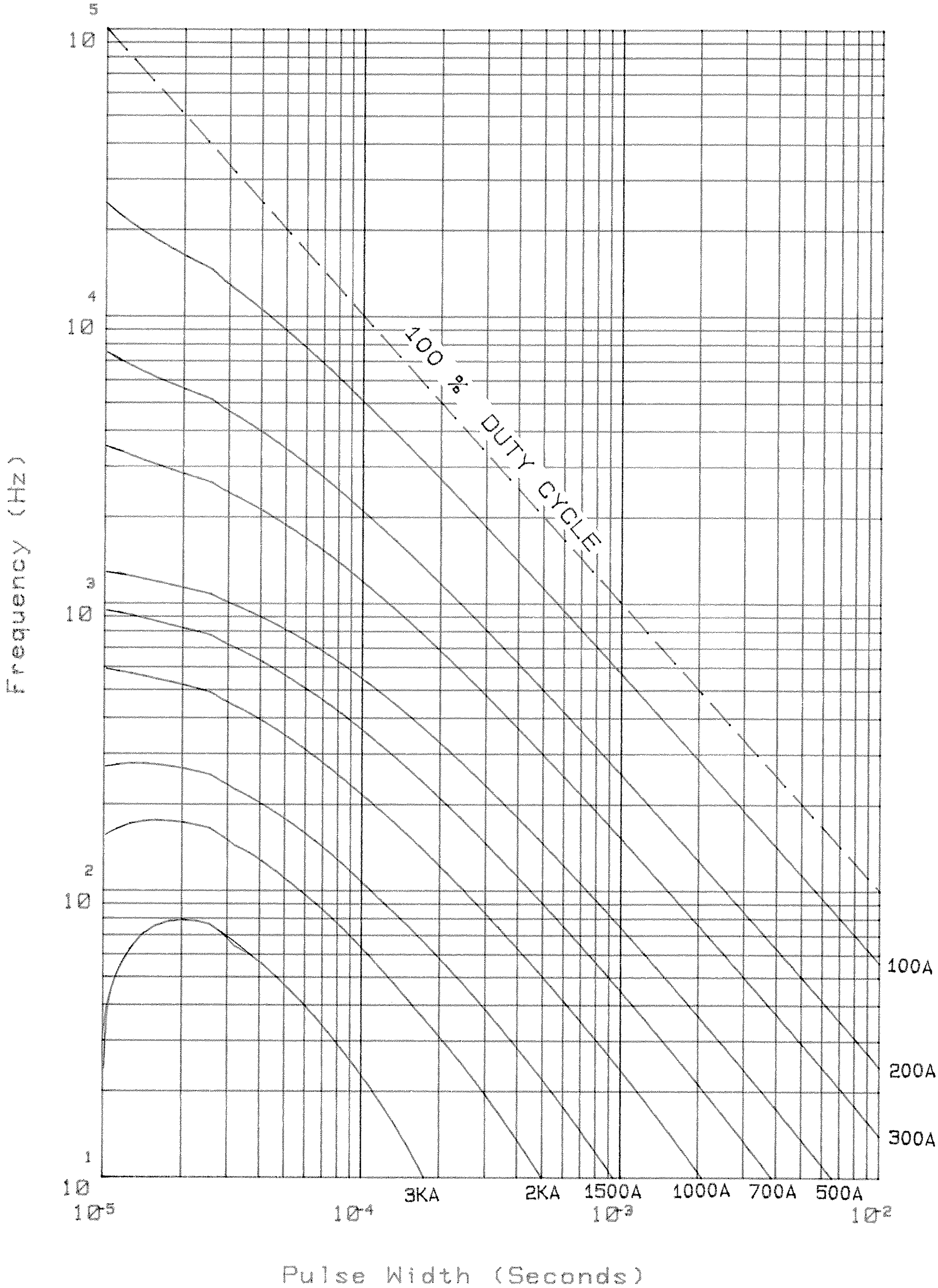
T SINK 55 oC 1000 A/uS



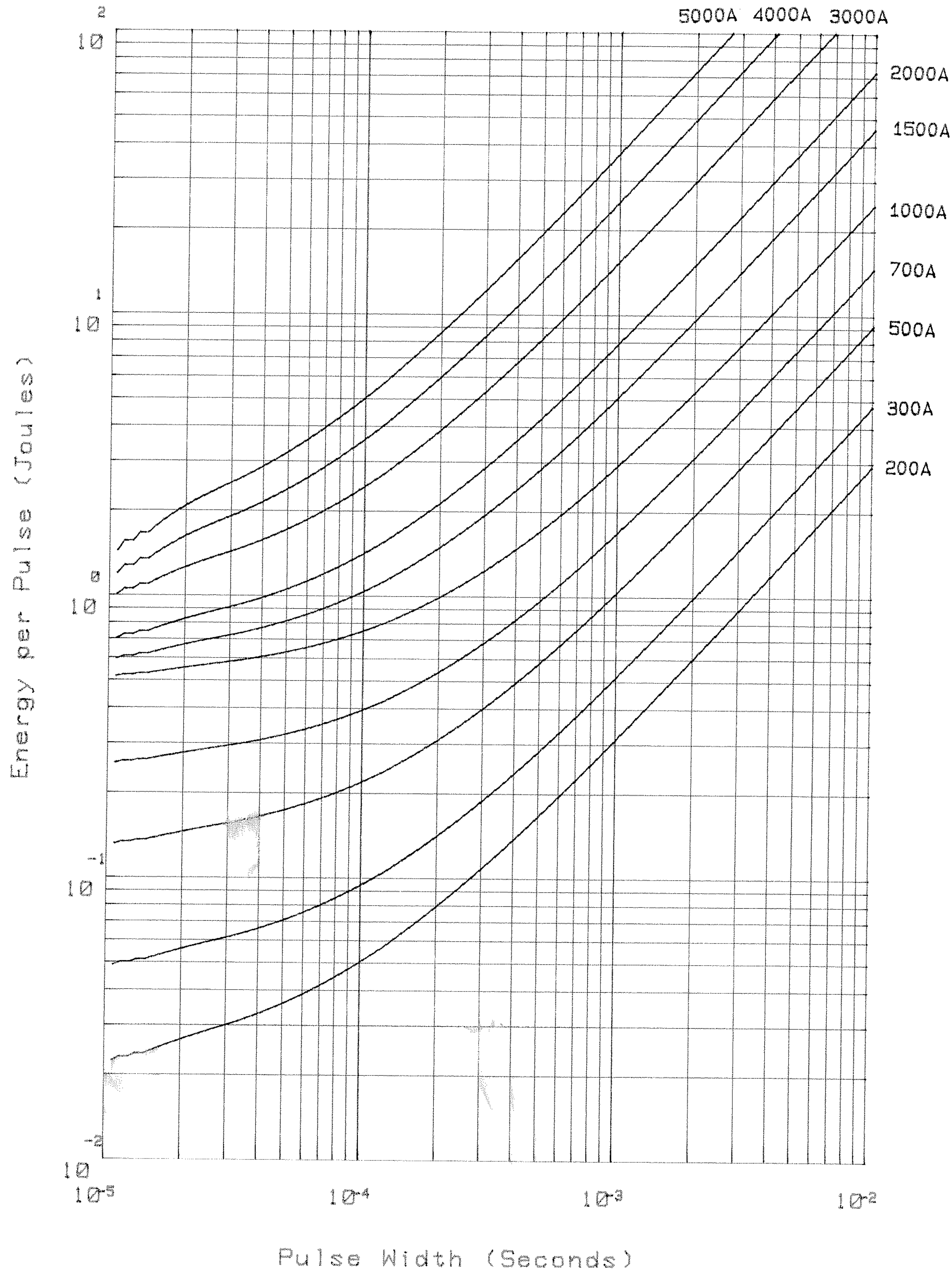
T SINK 85 oC   500 A/uS



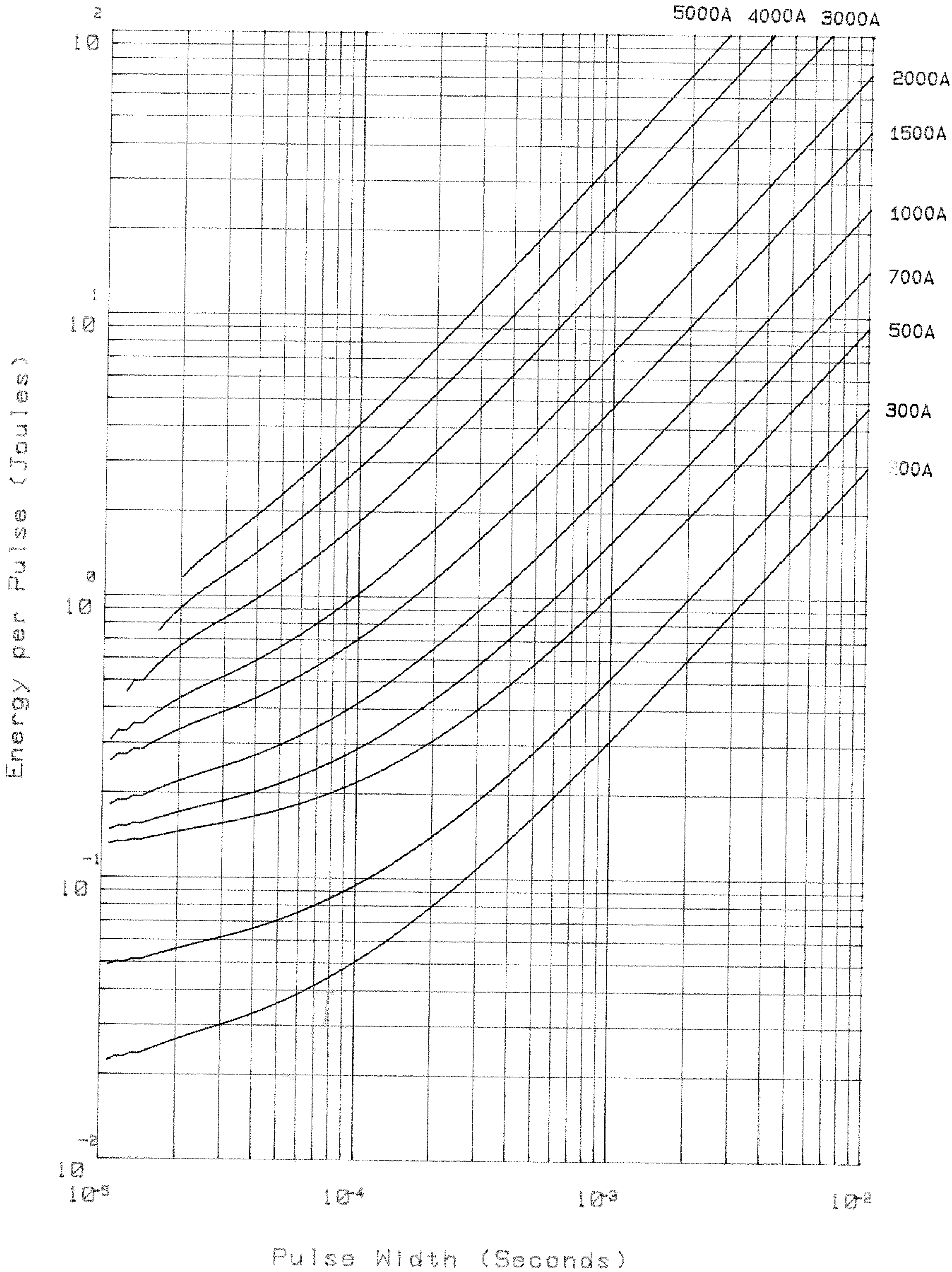
T SINK 55 oC   500 A/uS



Tj 125 oC   1000 A/uS

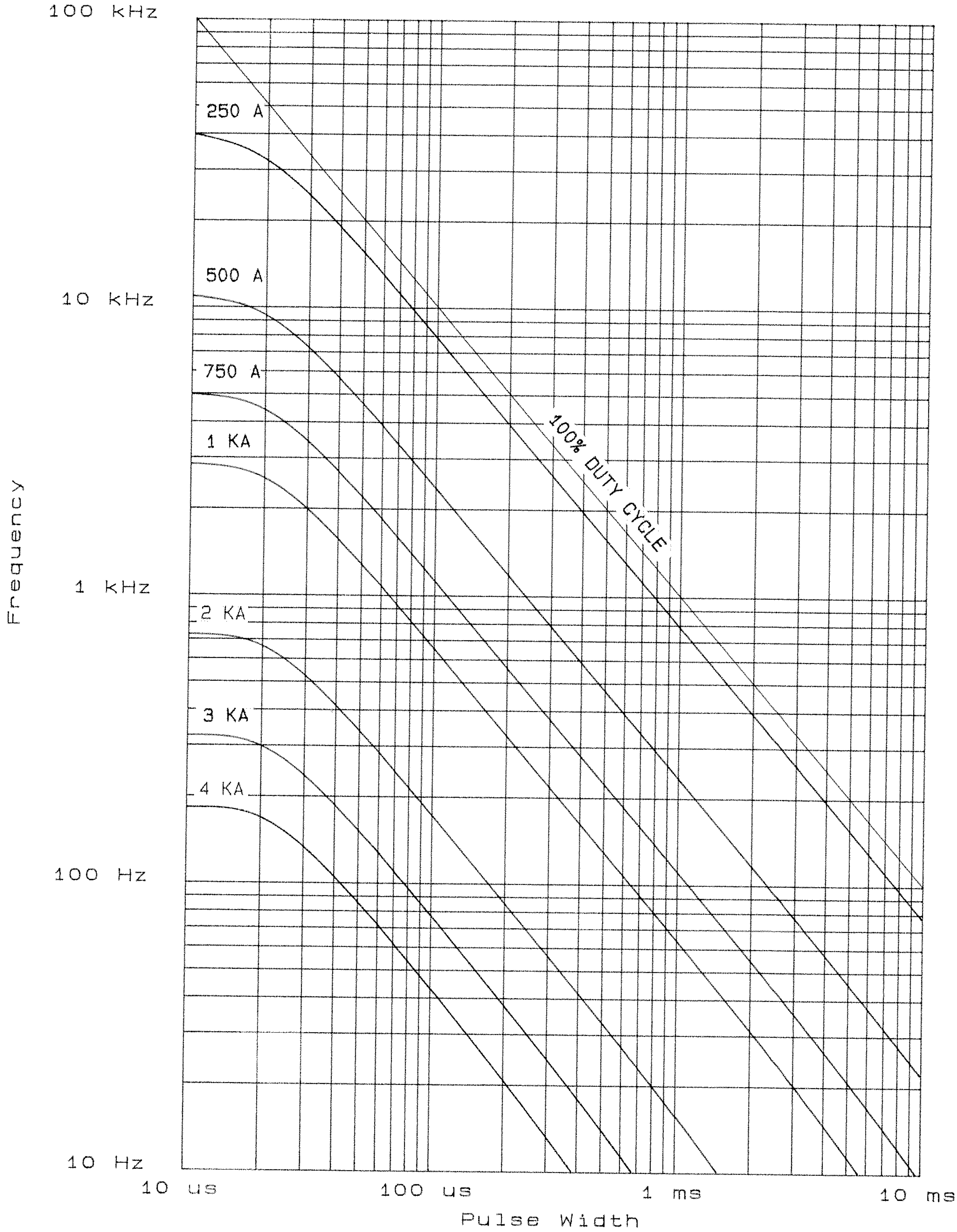


Tj 125 oC **500** A/uS



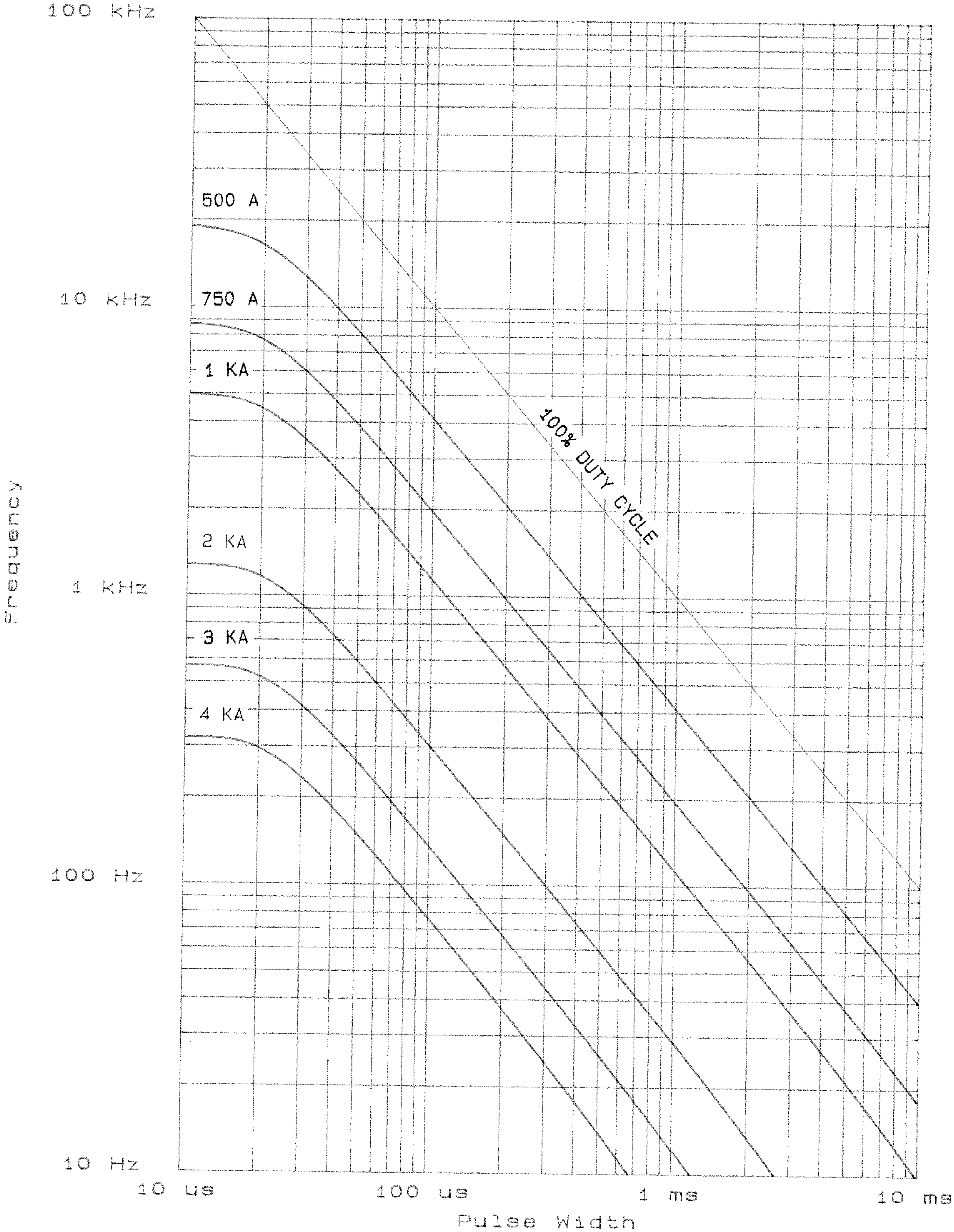
Frequency Vs Pulse Width

T Sink = 85.°C. Sine Wave

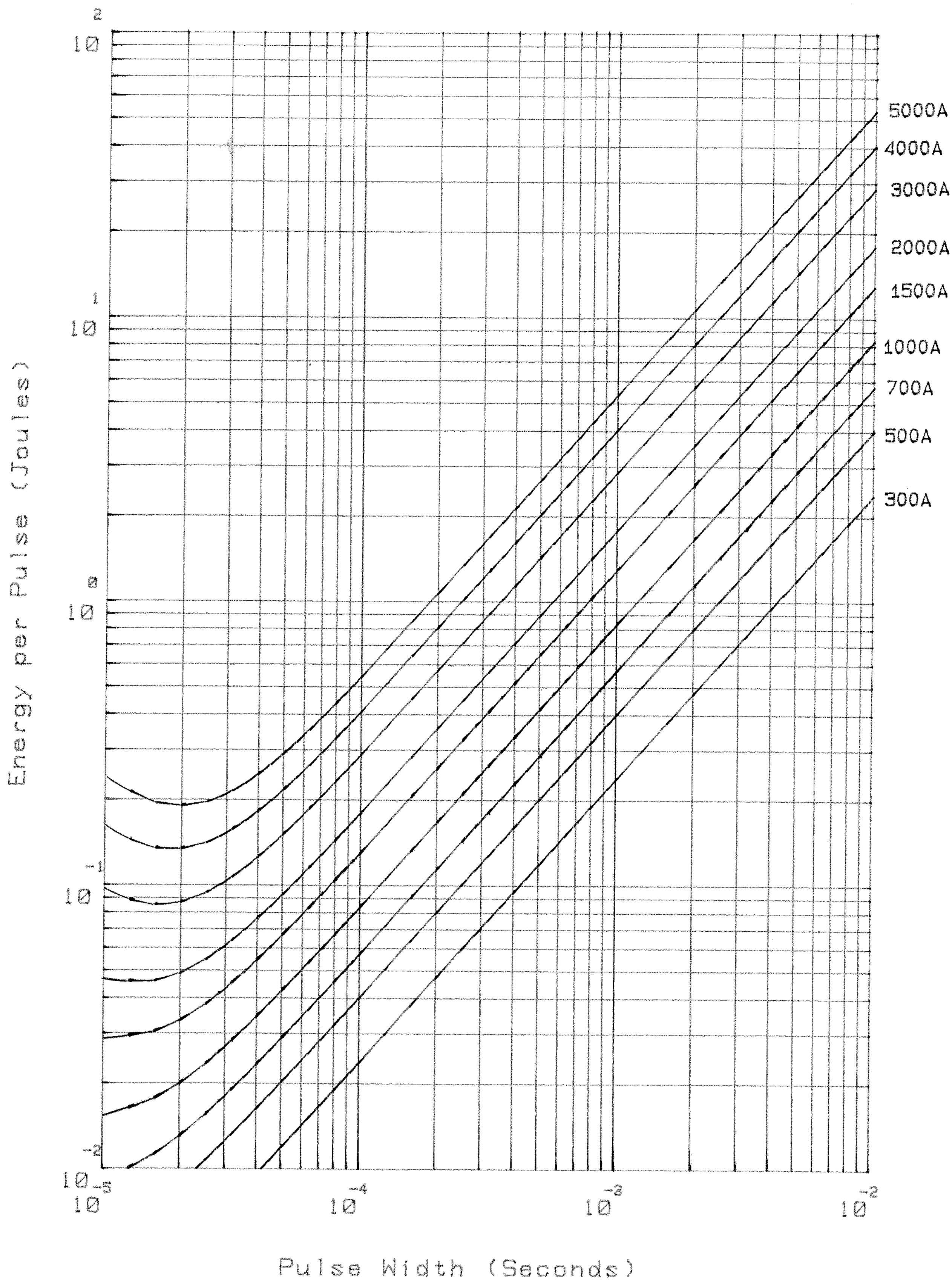


Frequency Vs Pulse Width

T Sink = 55.°C. Sine Wave



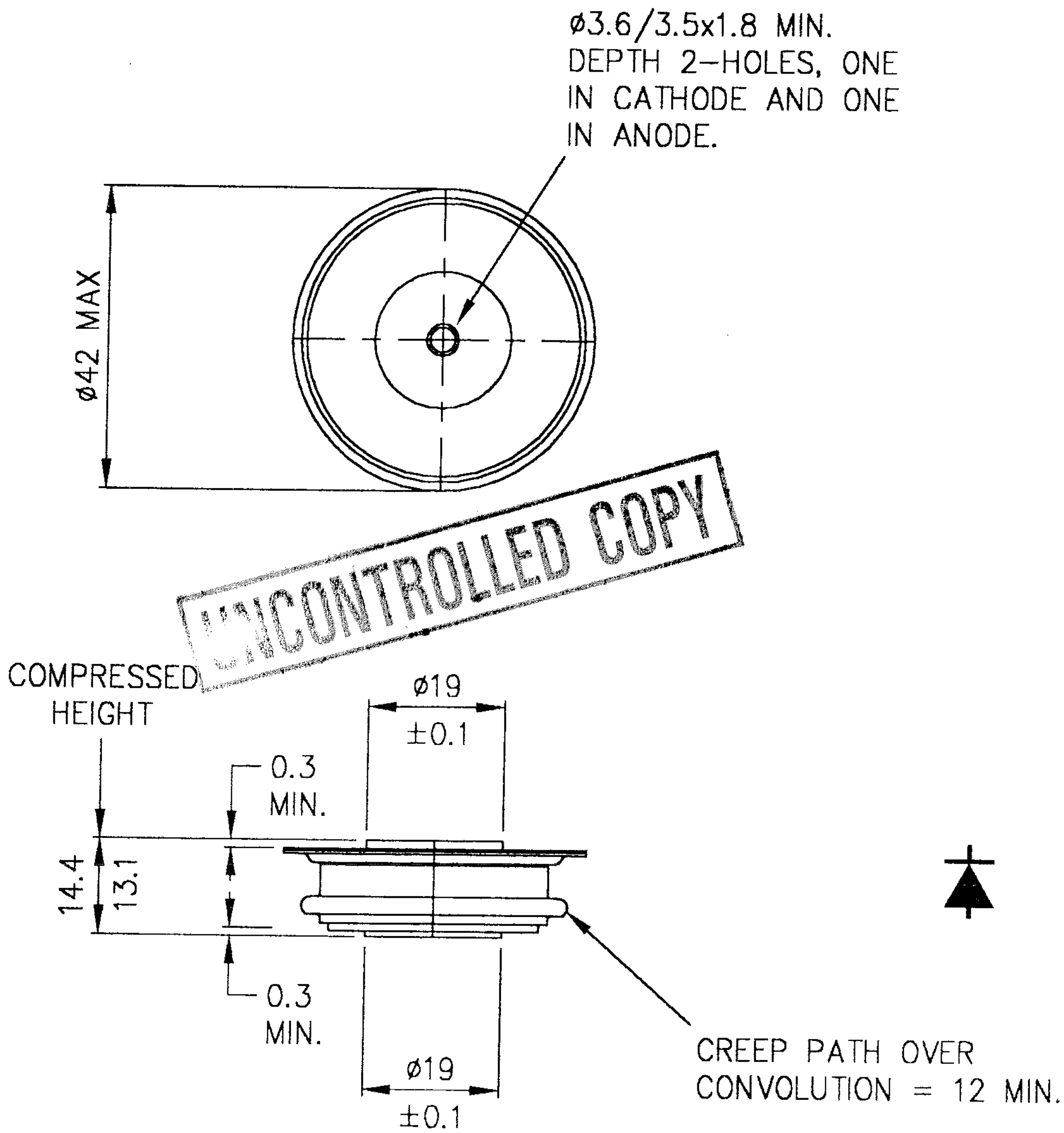
Tj 125 SINE WAVE



ACAD REF: 100A241

INTERNATIONAL OUTLINE No. DO-200AA
G.A. DWG No. 159B100H100-H110.
WEIGHT. 70 GRAMS
FINISH. NICKEL PLATE
DEVICE MOUNTING: CLAMPING FORCE TO BE APPLIED ON CENTRE LINE 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. (3.3-5.5kN).

TYPE NUMBER	
CXC100	CXC197
CXC115	CXC300
CXC134	CXC320
CXC144	CXC380
CXC170	CXC400
CXC174	CXC470



ISS	REVISIONS
1	10.9.76. P118.
10	10-09-90 REDRAWN ON CAD HDN
11D	10.1.94. M2408. TYPE NUMBERS UPDATED, CLAMPING FORCE IN kN ADDED. HN
12 C	25.4.96. M2991 TYPE No. CXC115 ADDED. HN

SCALE 1/1
DRAWN HDN
DIST: A

THIRD ANGLE PROJECTION.
DWG. COMPLIES WITH BS 308.
DIMNS. IN MILLIMETRES.
DWG No. 100A241

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