

Fast Recovery Diode Stud

Types M0334S/RX120 to M0334S/RX180

The data sheet on the subsequent pages of this document is a scanned copy of existing data for this product.
(Rating Report 80NR15 Issue 2)

This data reflects the old part number for this product which is: SM12-18PHN/R174.
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:
Only S/RJ outline drawing (W24) in datasheet

The following links will direct you to the appropriate outline drawings
[Outline W22](#) – 3/4" flag top ceramic stud
[Outline W24](#) – 3/4" leaded ceramic stud



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			
M0334	S/RX	◆◆	0
Fixed Type Code	S/RC - 3/4" flag top ceramic stud S/RJ - 3/4" leaded ceramic stud	Voltage code $V_{RRM}/100$ 12-18	Fixed Code
Typical Order Code: M0334RJ140, Reverse polarity, 3/4" leaded ceramic stud, 1400V V_{RRM}			

<p>IXYS Semiconductor GmbH Edisonstraße 15 D-68623 Lampertheim Tel: +49 6206 503-0 Fax: +49 6206 503-627 E-mail: marcom@ixys.de</p>	 <p style="font-size: small;">An  IXYS Company</p> <p style="text-align: center;">www.westcode.com</p> <p style="text-align: center;">www.ixys.com</p>	<p>Westcode Semiconductors Ltd Langley Park Way, Langley Park, Chippenham, Wiltshire, SN15 1GE. Tel: +44 (0)1249 444524 Fax: +44 (0)1249 659448 E-mail: WSL.sales@westcode.com</p>	
<p>IXYS Corporation 3540 Bassett Street Santa Clara CA 95054 USA Tel: +1 (408) 982 0700 Fax: +1 (408) 496 0670 E-mail: sales@ixys.net</p>		<p>Westcode Semiconductors Inc 3270 Cherry Avenue Long Beach CA 90807 USA Tel: +1 (562) 595 6971 Fax: +1 (562) 595 8182 E-mail: WSI.sales@westcode.com</p>	
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QUALITY EVALUATION LABORATORY

Rating Report: 80NR15 (Issue 2)

Date: 18th November, 1986

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Diode Type SM12-18PHN/R174

Written by:

M.W. Dunlop

Checked:

M.W.

Approved:

B.R.H.

The SM12-18PHN/R diode series employs a 24 mm silicon slice mounted under spring pressure in a stud base, top hat housing with flexible lead. The report supersedes Rating Report No. 80NR15.

RATINGS AND CHARACTERISTICS

Ratings

Voltage Grades

: 12-18

V_{RSM}

: 1300-1900V

V_{RRM}

: 1200-1800V

I_F (AV); Single phase; 50 Hz, 180°C half sinewave; $T_{CASE} = 100^\circ C$: 150A

I_F (rms) max. : 400A

I_F d.c. max. : 400A

I_{FSM} : t = 10 ms half sinewave; T_J (initial) = 125°C ; $V_{RM} = 0.6V_{RRM}^{(MAX)}$: 4500A

I_{FSM} : t = 10 ms half sinewave; T_J (initial) = 125°C ; $V_{RM} = 10V$: 4950A

I^2t : t = 10 ms; T_J (initial) = 125°C ; $V_{RM} = 0.6V_{RRM}^{(MAX)}$: $101 \times 10^3 A^2S$

I^2t : t = 10 ms; T_J (initial) = 125°C ; $V_{RM} \leq 10V$: $122 \times 10^3 A^2S$

I^2t : t = 3 ms; T_J (initial) = 125°C ; $V_{RM} \leq 10V$: $91 \times 10^3 A^2S$

T_C Operating Range : -40 to 125°C

T_{stg} Non-operating : -40 to 150°C

Characteristics

(maximum values unless otherwise stated)

$V_D; T_J = 125^\circ\text{C}$: 1.00V
$r_f; T_J = 125^\circ\text{C}$: 0.74mohms
$V_{FM}; I_{FM} = 470\text{A} \quad T_{VJ} = 125^\circ\text{C}$: 1.35V
$R_{th(J-C)}$: 0.13°C/W
$R_{th(C-HS)}$: 0.04°C/W
$I_{RRM}; T_J = 125^\circ\text{C}; V_{RM} = V_{RRM}(\text{Max})$: 20mA
$Q_{rr} (I_{FM} = 550\text{A}; dI/dt = 40\text{A}/\mu\text{s})$: 160uC
$t_{rr} (V_{RM} = 50\text{V}; T_{VJ} = 125^\circ\text{C})$:
Mounting torque	: 2.5 - 2.77 Kg.f.m.
Outline drawing	: 100A280
JEDEC Outline No.	:

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80NR15 (issue 1) changes:

P1, 4 Max grade changed
 V_{RWM} omitted
 T_B (operating range) MIN changed

Old pp 5,6,7,8 replaced

Old p9 Curves redrawn on separate sheets

Old p11 Omitted Old p15 omitted

Old p12 redrawn Old p20, 21 omitted

Old p13 redrawn Old p26 omitted

Old p14 redrawn Old pp16-27 redrawn

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 stud based devices 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: E_p be the Energy per pulse for a given current and pulse width in joules, and f be the repetition rate

$$\text{Then } W_{AV} = E_p \times f$$

$$T_{CASE} = 125 - E_p \times f \times R_{th}$$

(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.

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 case temperature can then be evaluated from:

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

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

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 case temperature

The total dissipation is now given by

$$W(\text{TOT}) = W(\text{original}) + A \times f$$

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, 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 12.

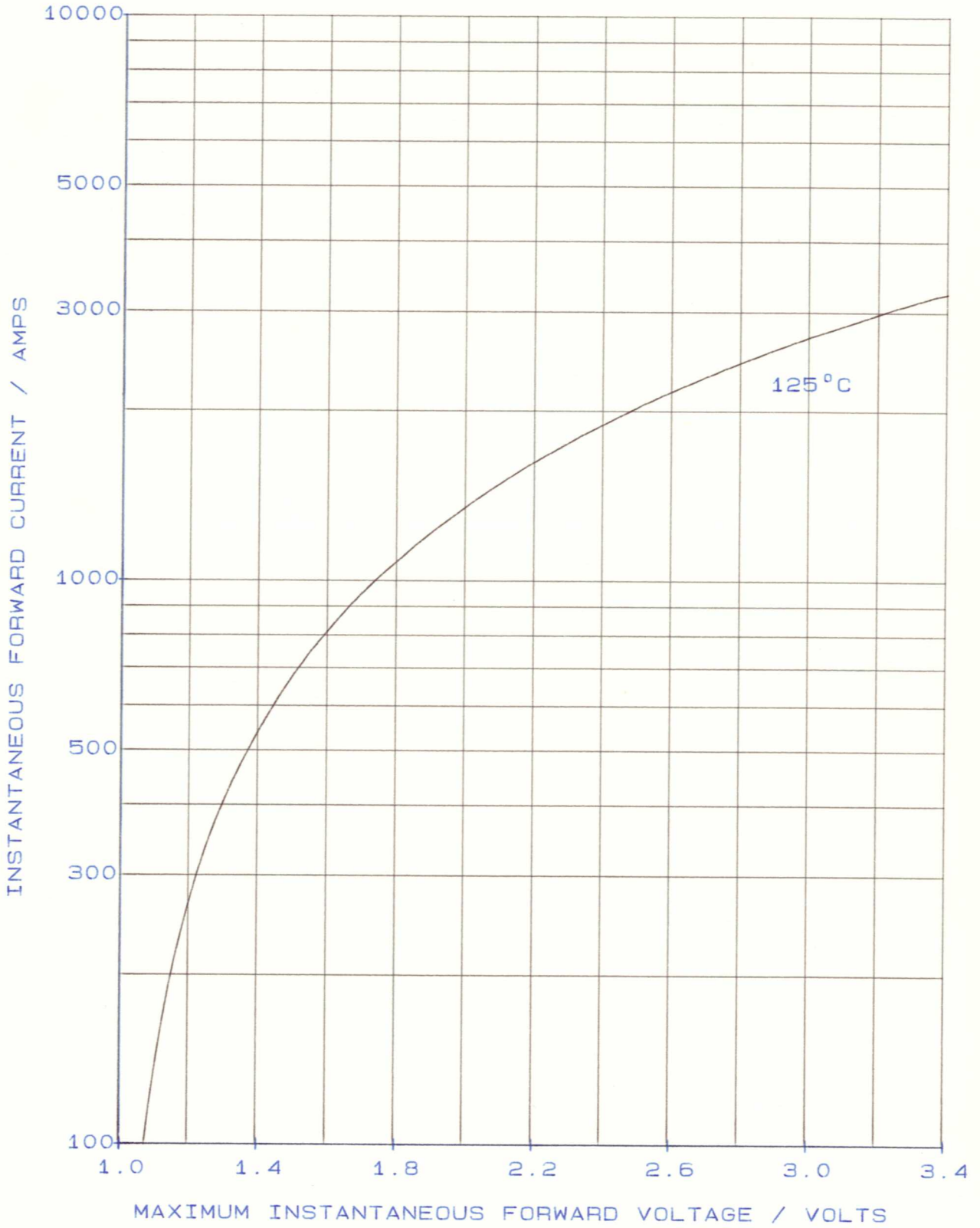
Let E be the value of energy per reverse cycle in joules (curves on page 12).

Let f be the operating frequency in Hz

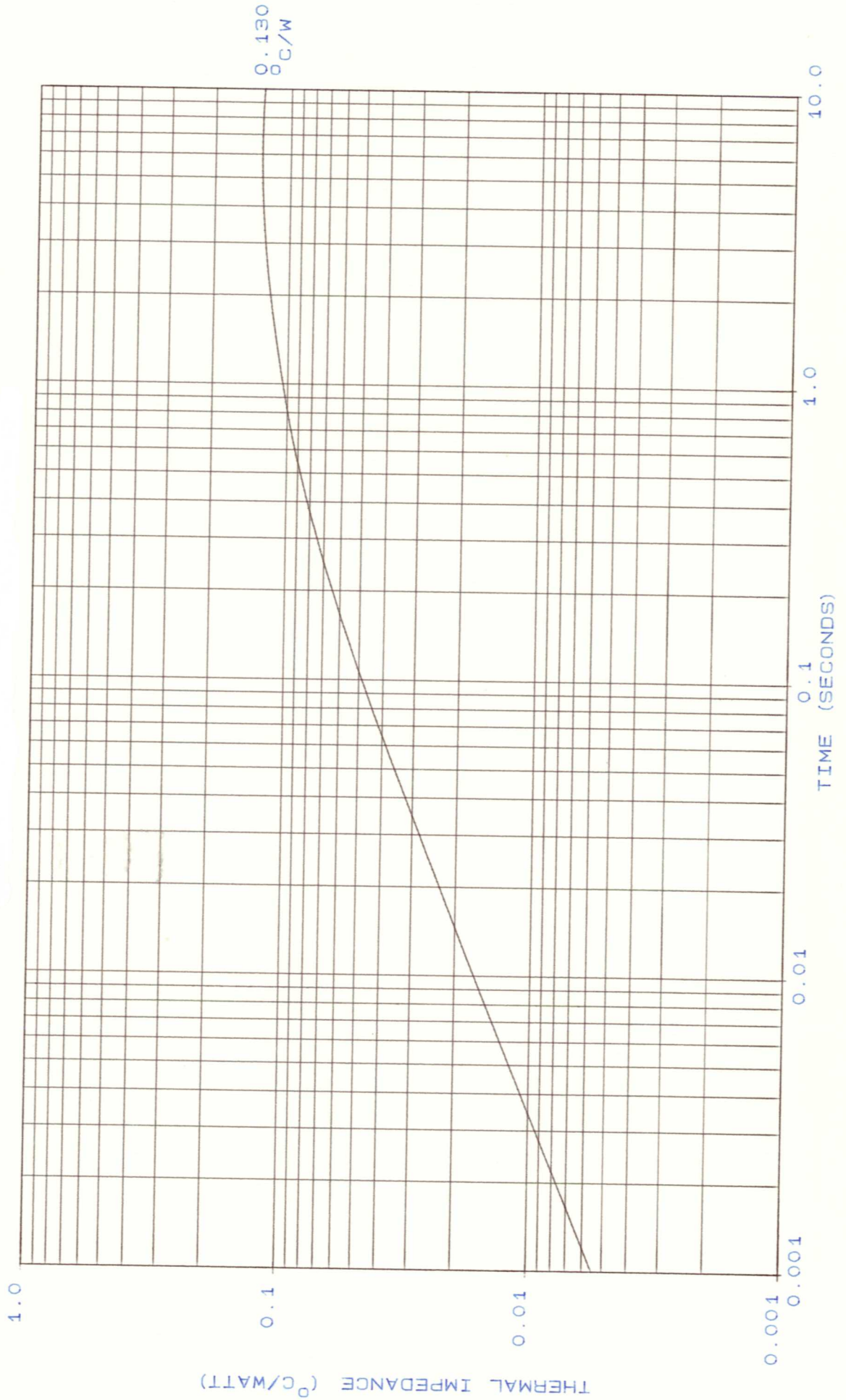
$$\text{Then } T_{\text{CASE new}} = T_{\text{CASE original}} - ER_{\text{th}} \times f$$

Where $T_{\text{CASE new}}$ is the required maximum case temperature and $T_{\text{CASE original}}$ is the case temperature given with the frequency ratings.

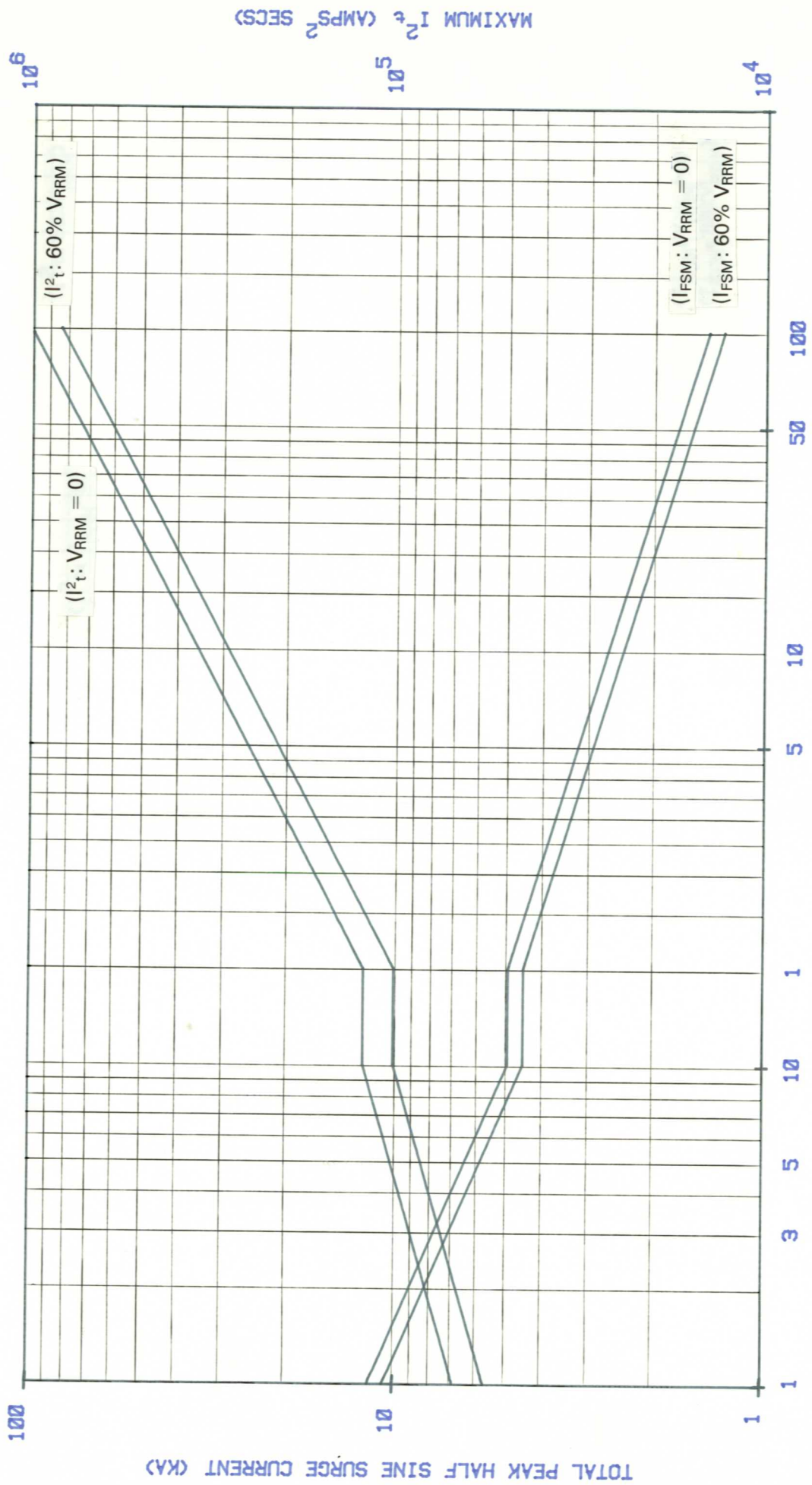
FORWARD CHARACTERISTIC OF LIMIT DEVICE



JUNCTION TO CASE THERMAL IMPEDANCE



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



DURATION OF SURGE (cycles at 50 Hz)

DURATION OF SURGE (ms)

MAXIMUM I_t^2 (AMPS² SECS)

10^5

10^6

10^4

TOTAL PEAK HALF SINE SURGE CURRENT (KA)

10

100

1

1

3

5

10

1

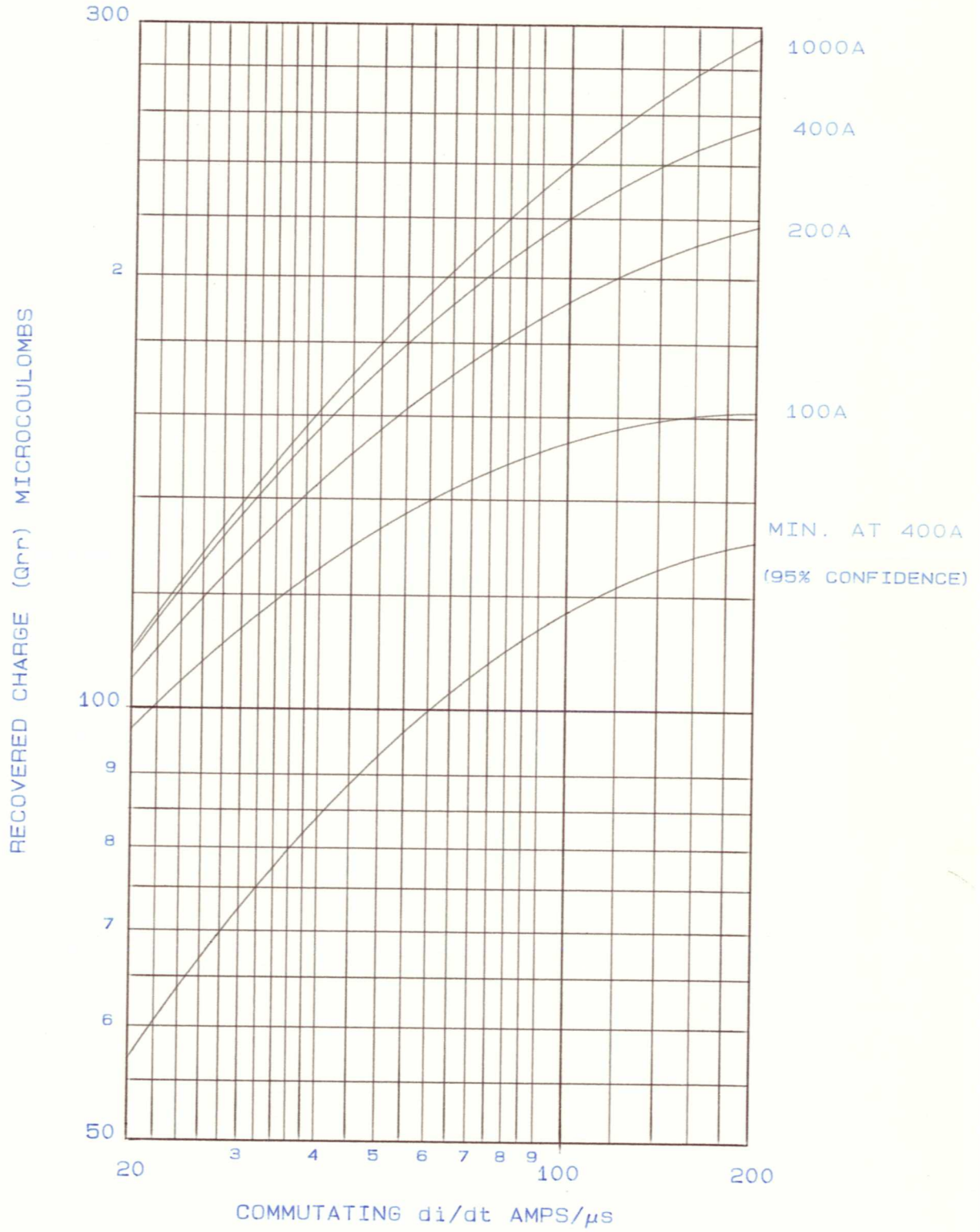
5

10

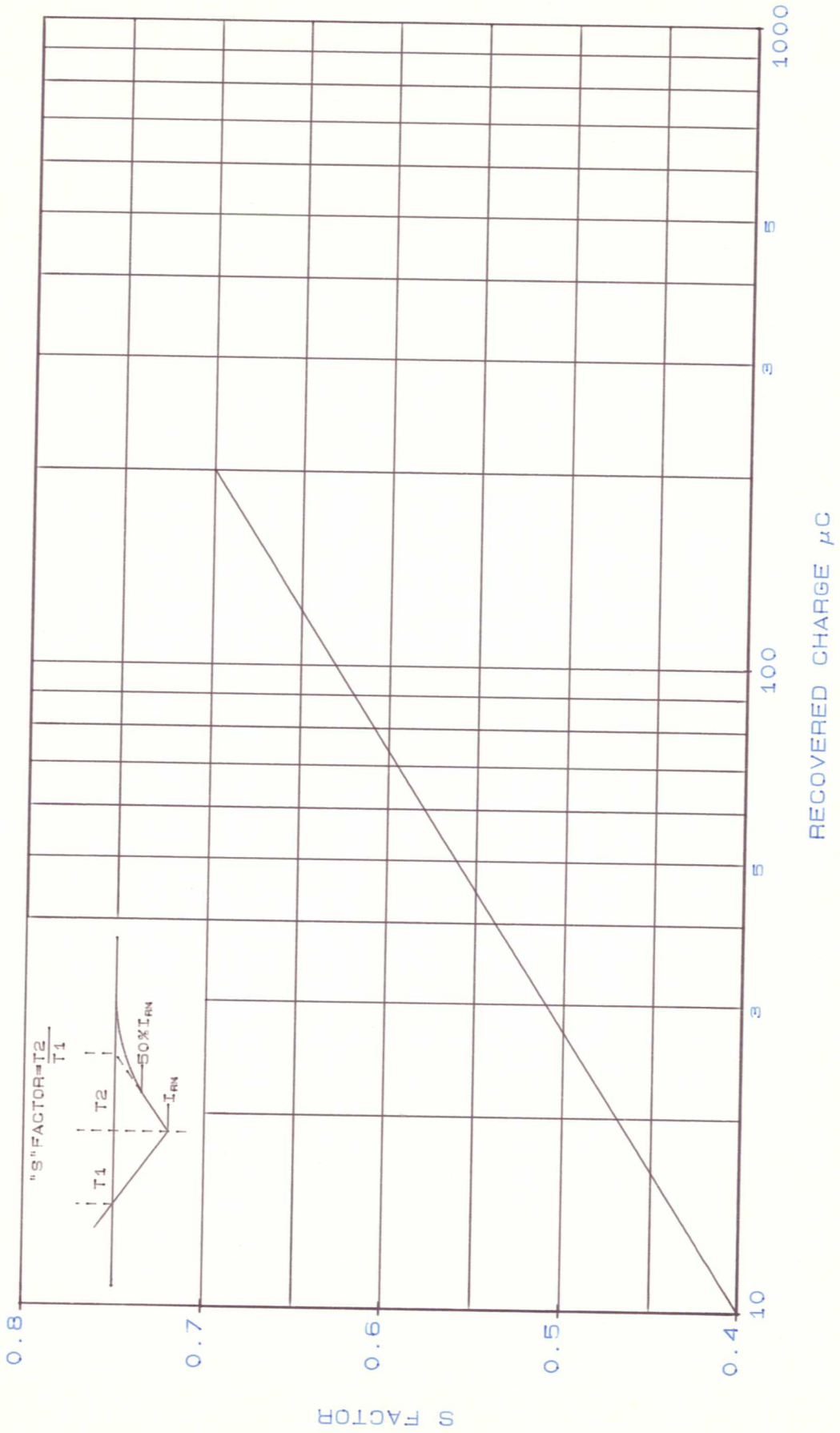
50

100

MAXIMUM RECOVERED CHARGE AT 125°C JUNCTION TEMPERATURE

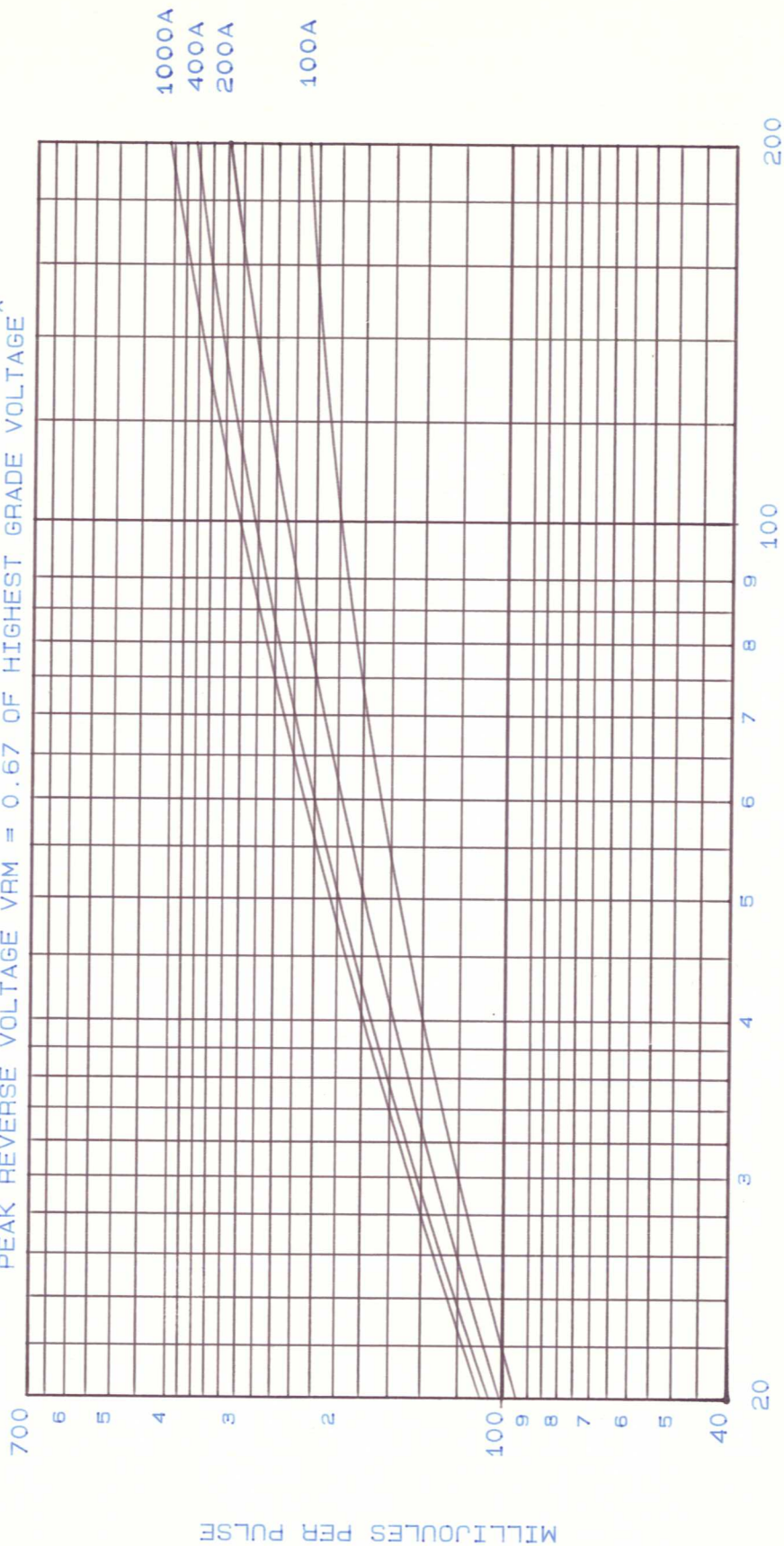


MINIMUM S FACTOR AT 125°C JUNCTION TEMPERATURE



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

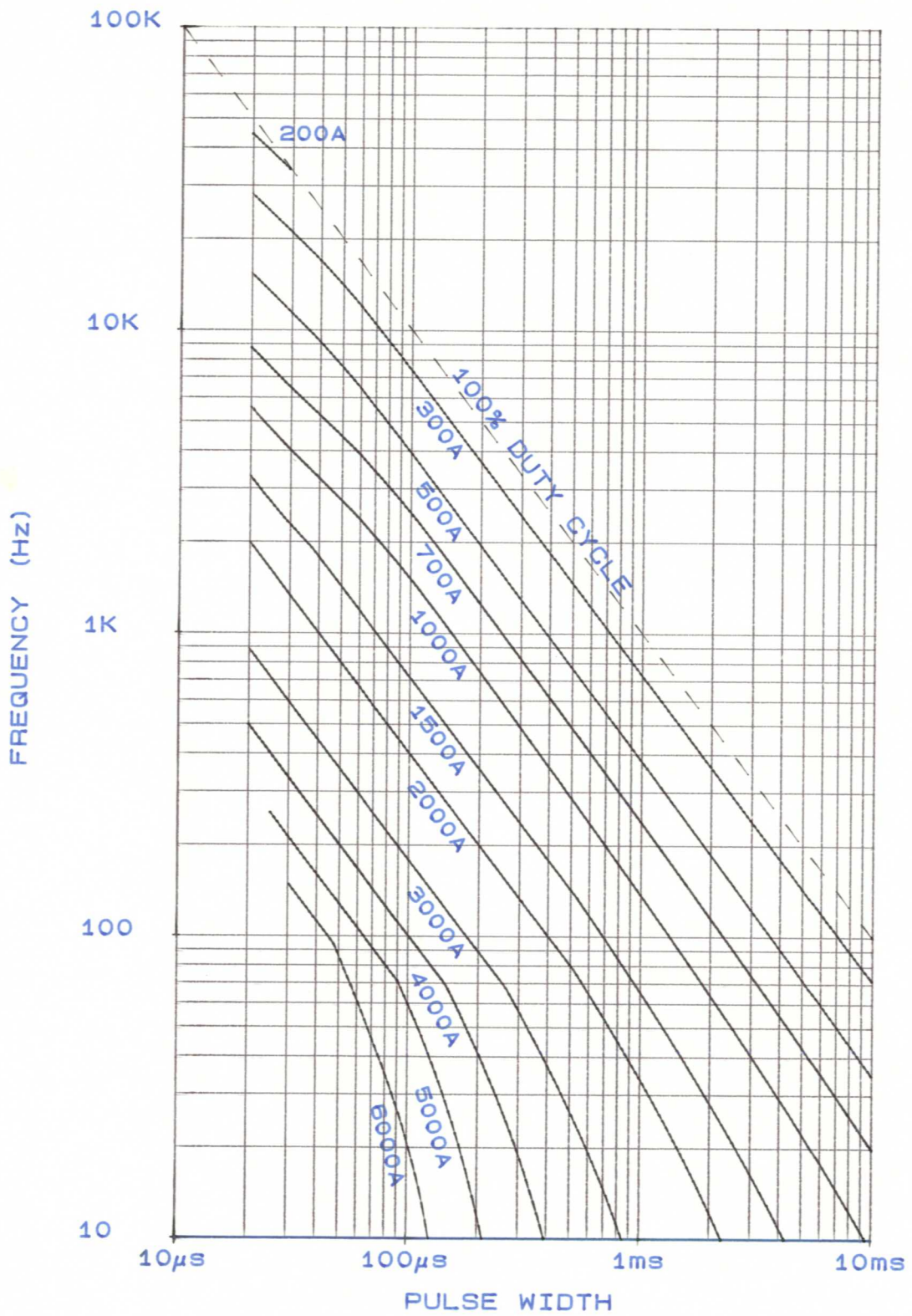
SNUBBER CONNECTED 0.10μF, 5 OHMS
PEAK REVERSE VOLTAGE VRM = 0.67 OF HIGHEST GRADE VOLTAGE*



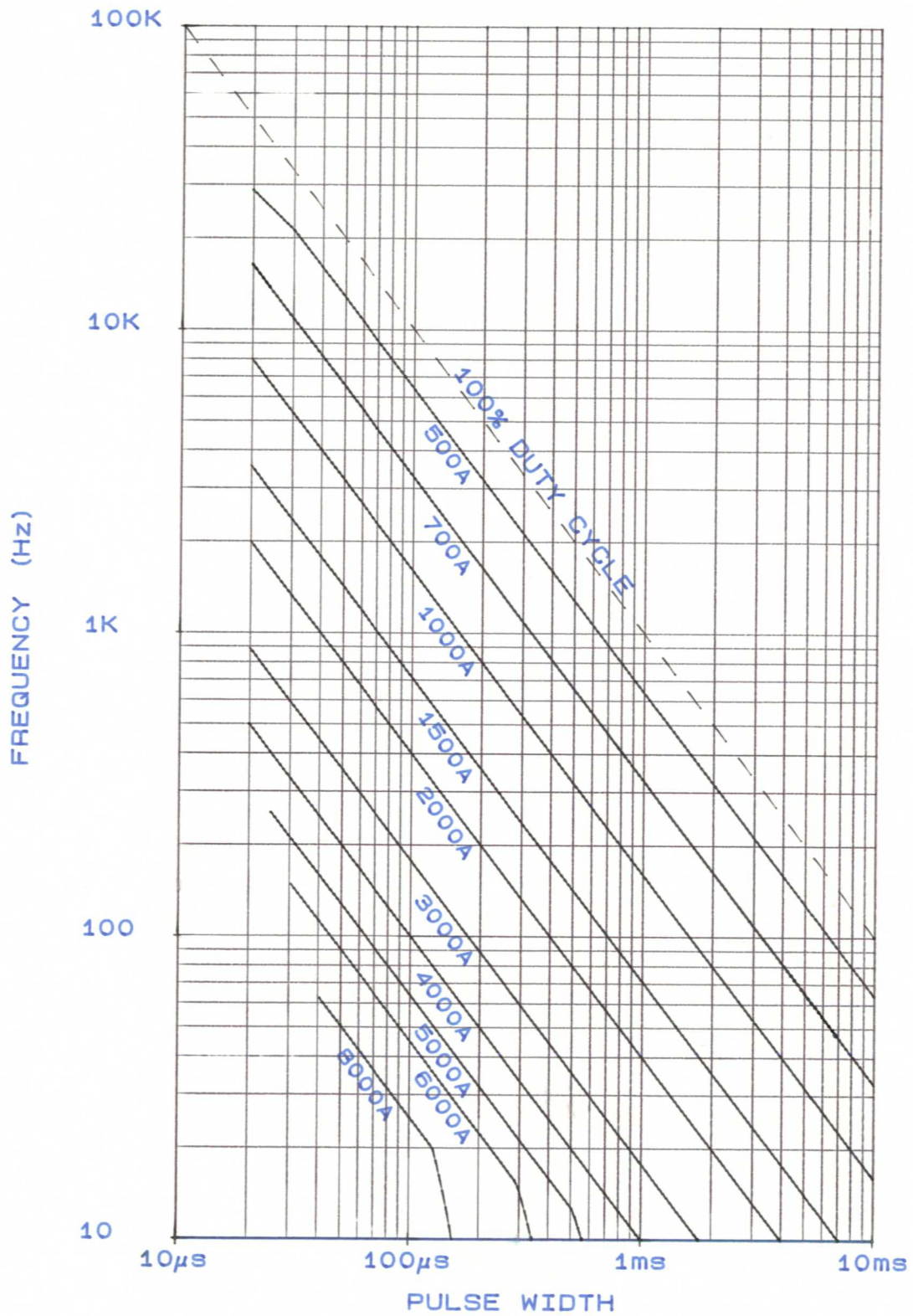
* NOTE: ENERGY PER PULSE SHOULD BE ADJUSTED PRO RATA WITH APPLIED PEAK RECOVERY VOLTAGE
COMMUTATING di/dt AMPS/μs

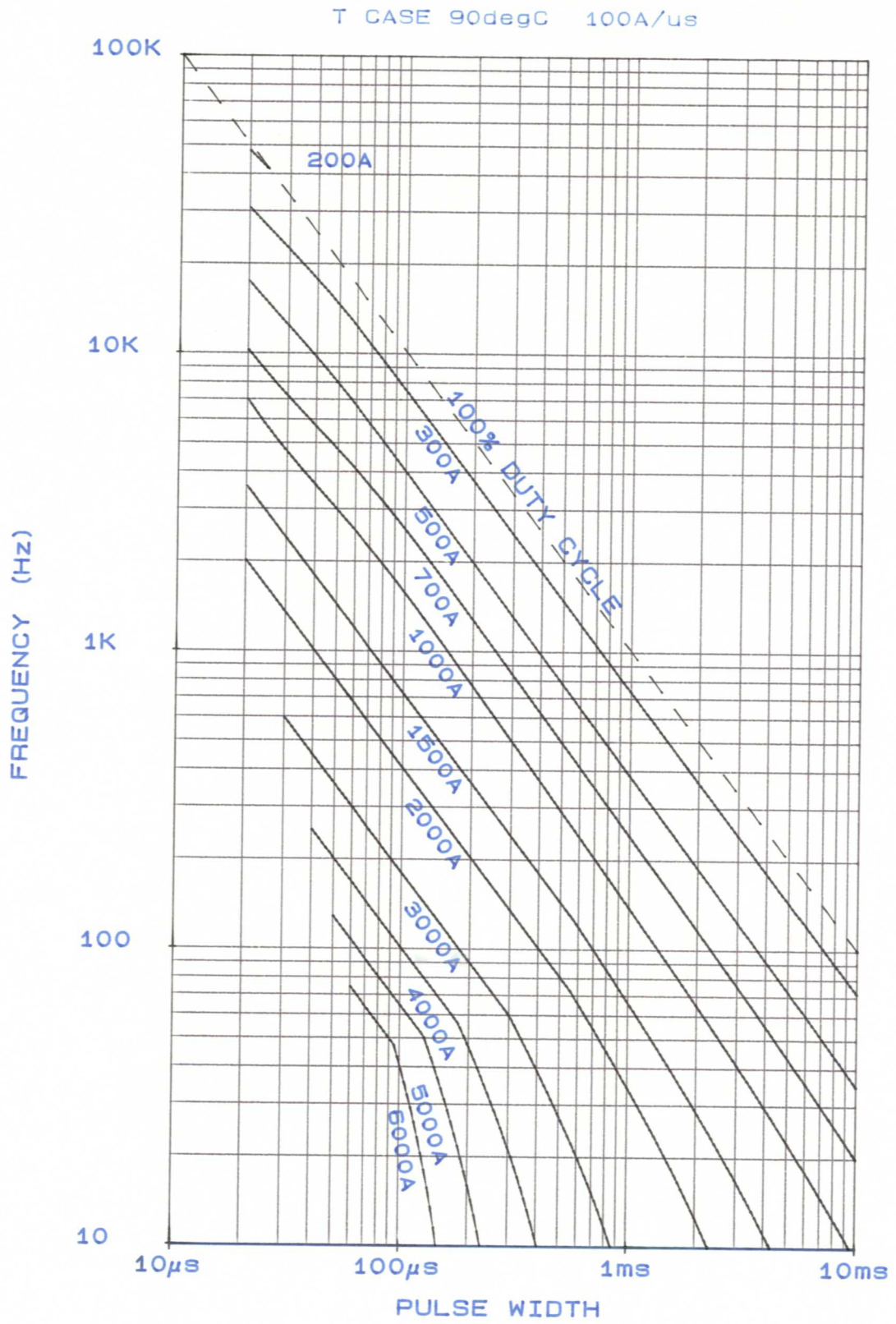
MILLIJOULES PER PULSE

T CASE 90degC, 200A/ μ s

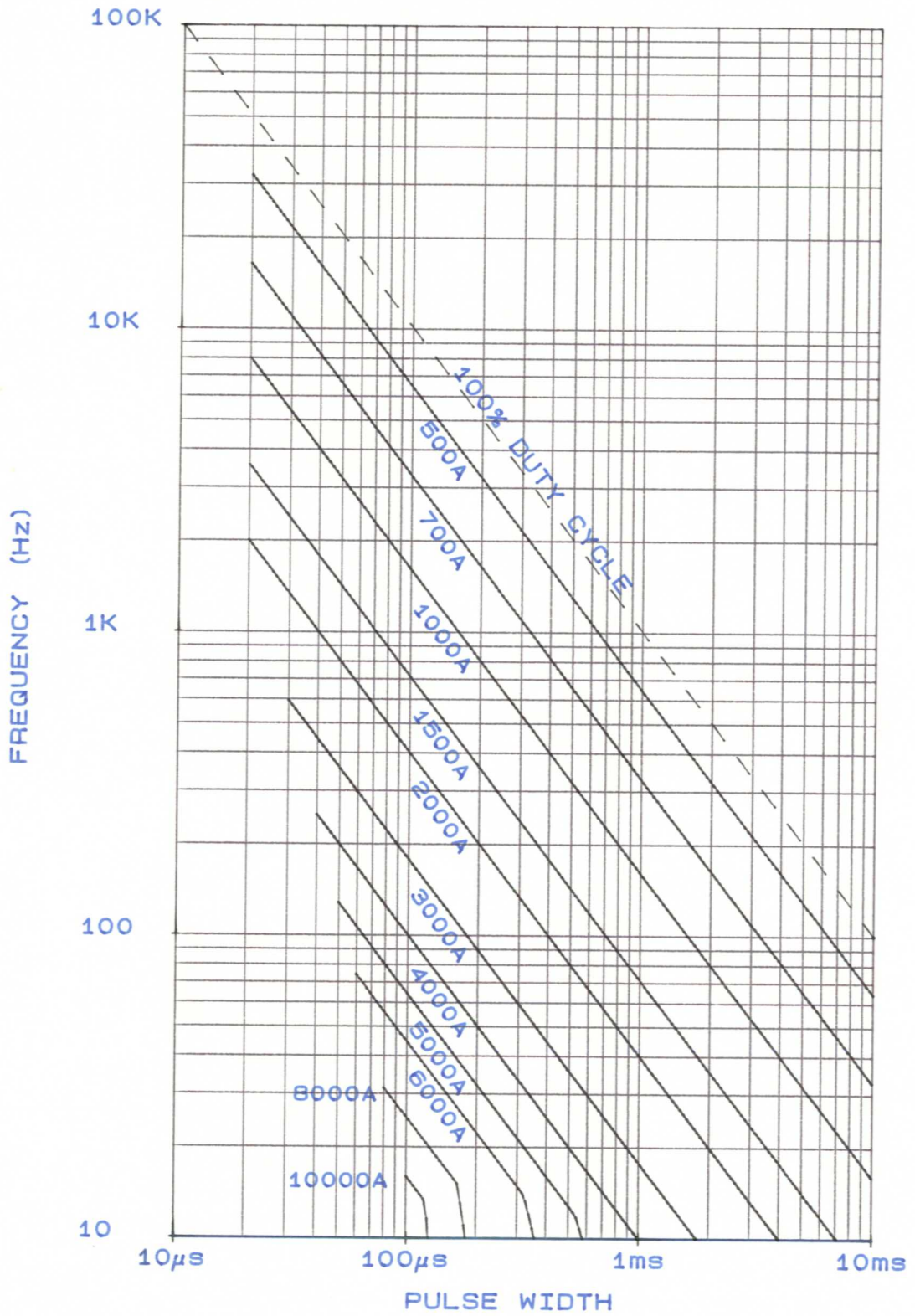


T CASE 60degC, 200A/ μ s

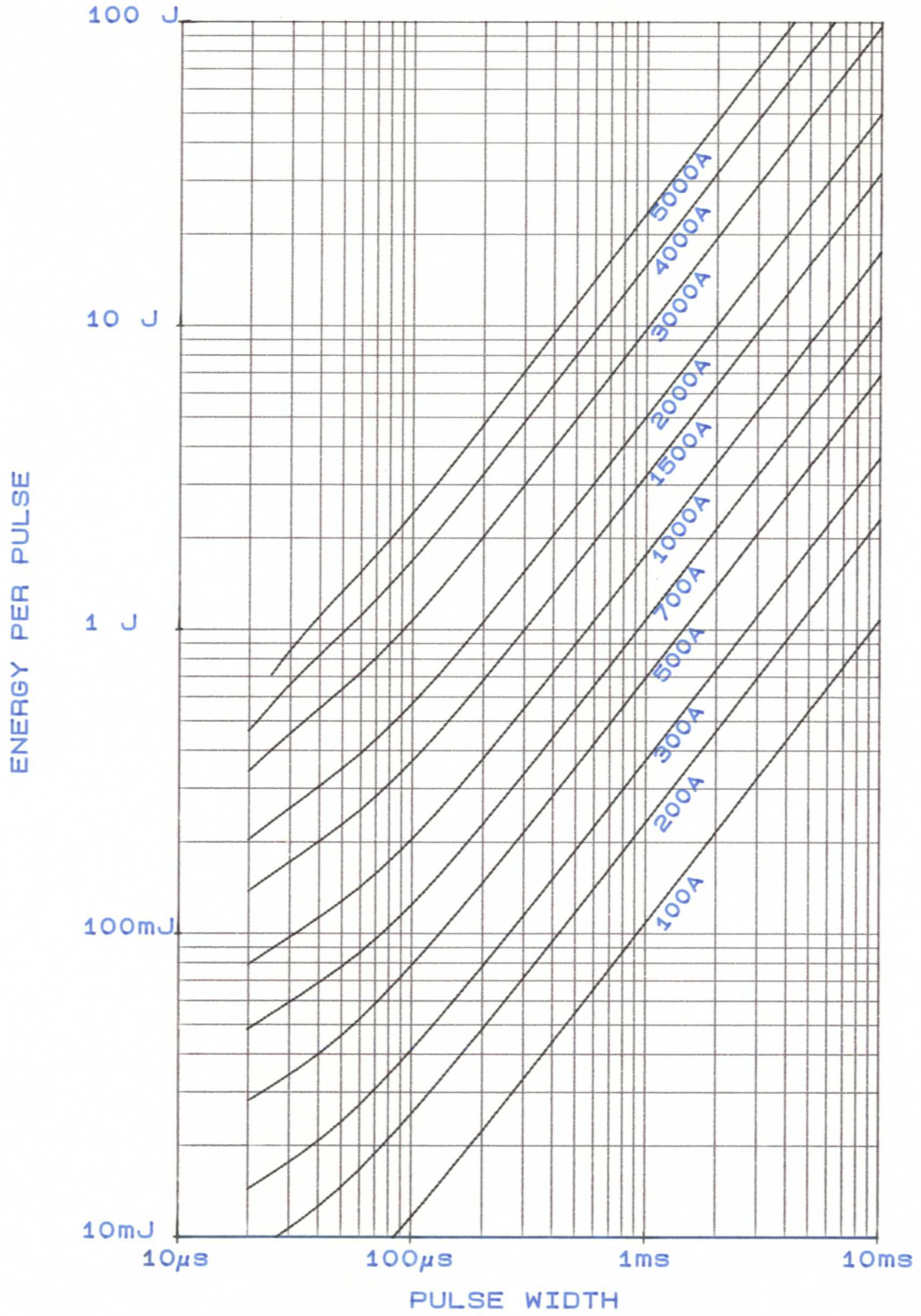




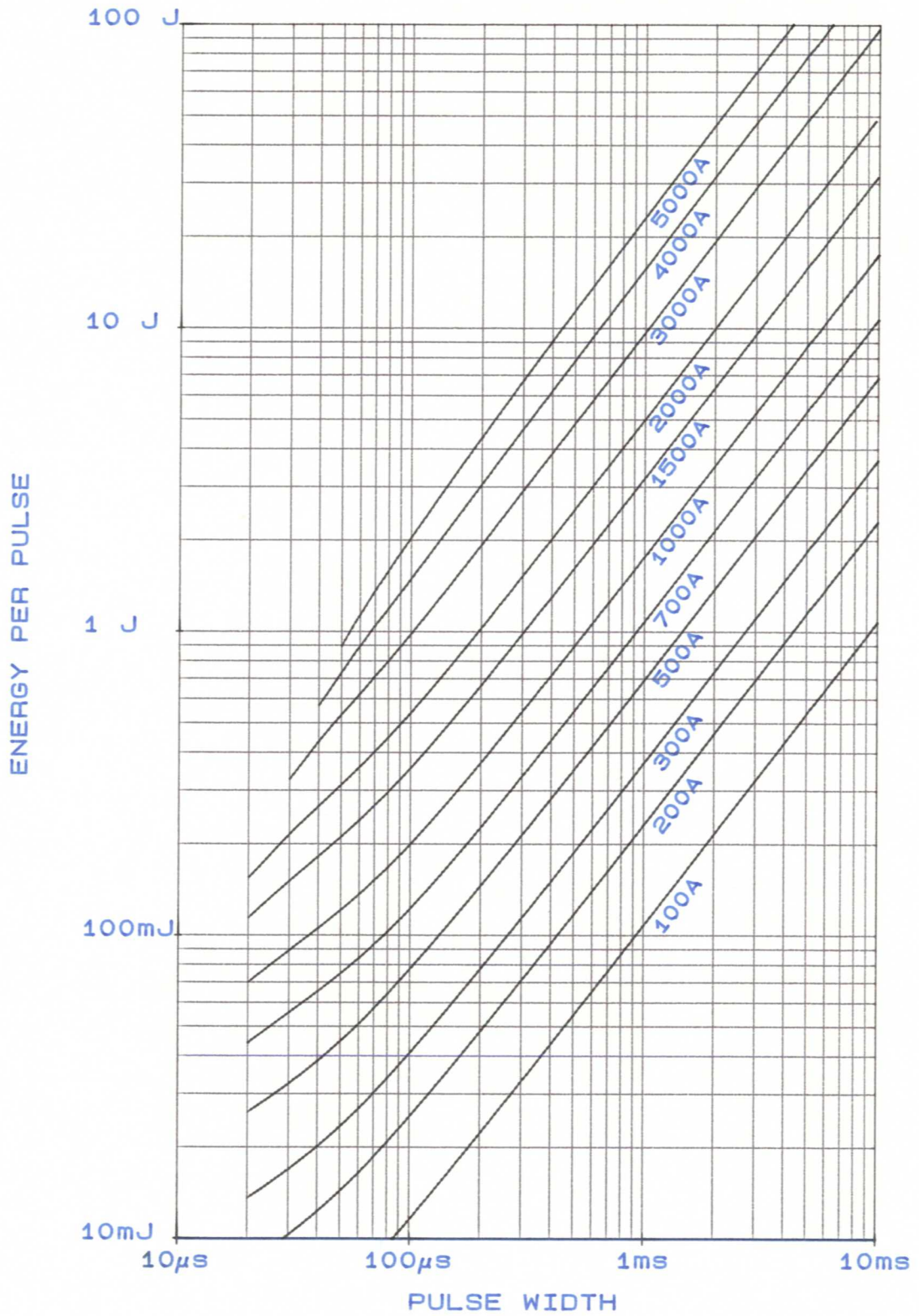
T CASE 60degC, 100A/ μ s



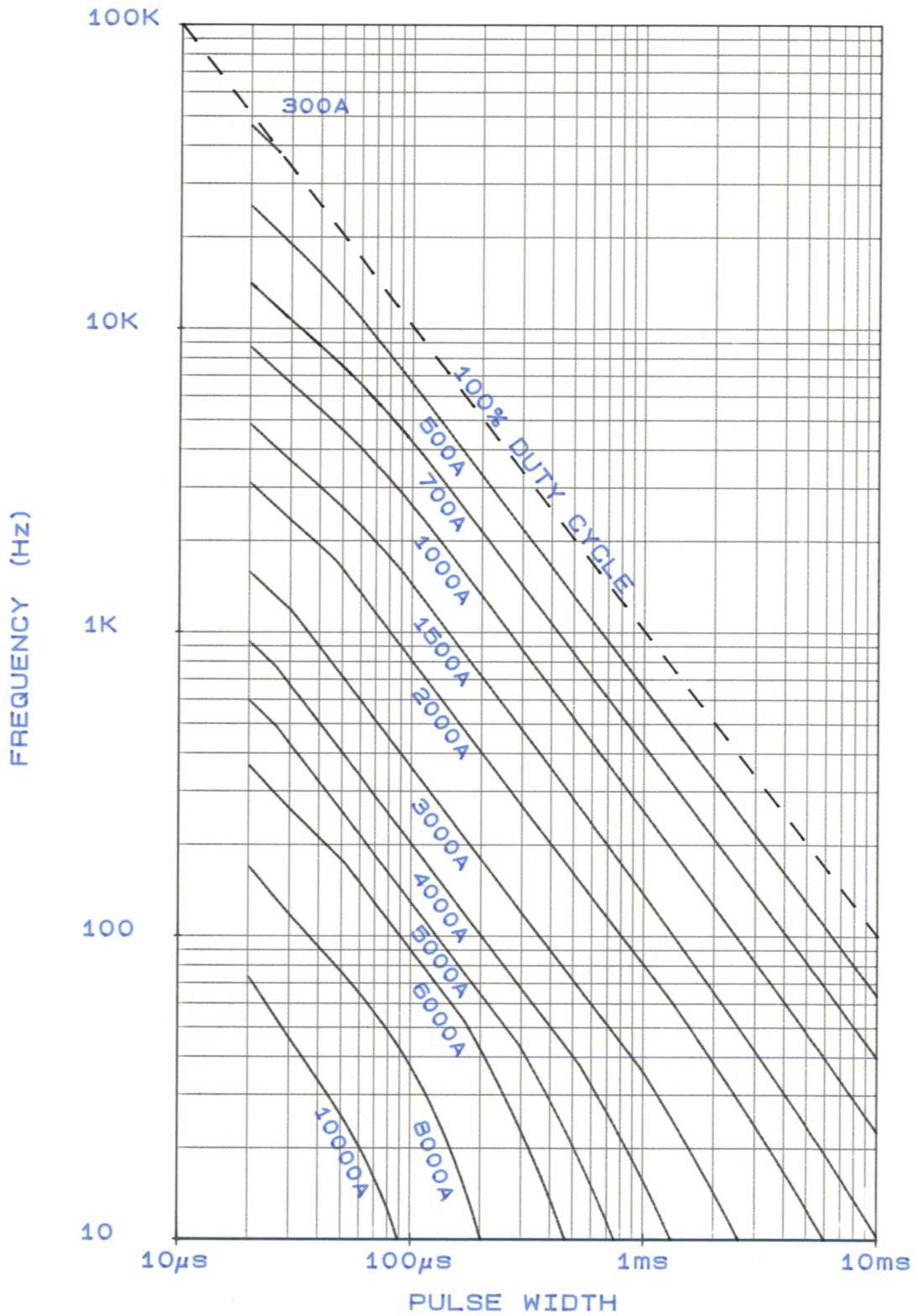
Tj 125°C. 200A/μs

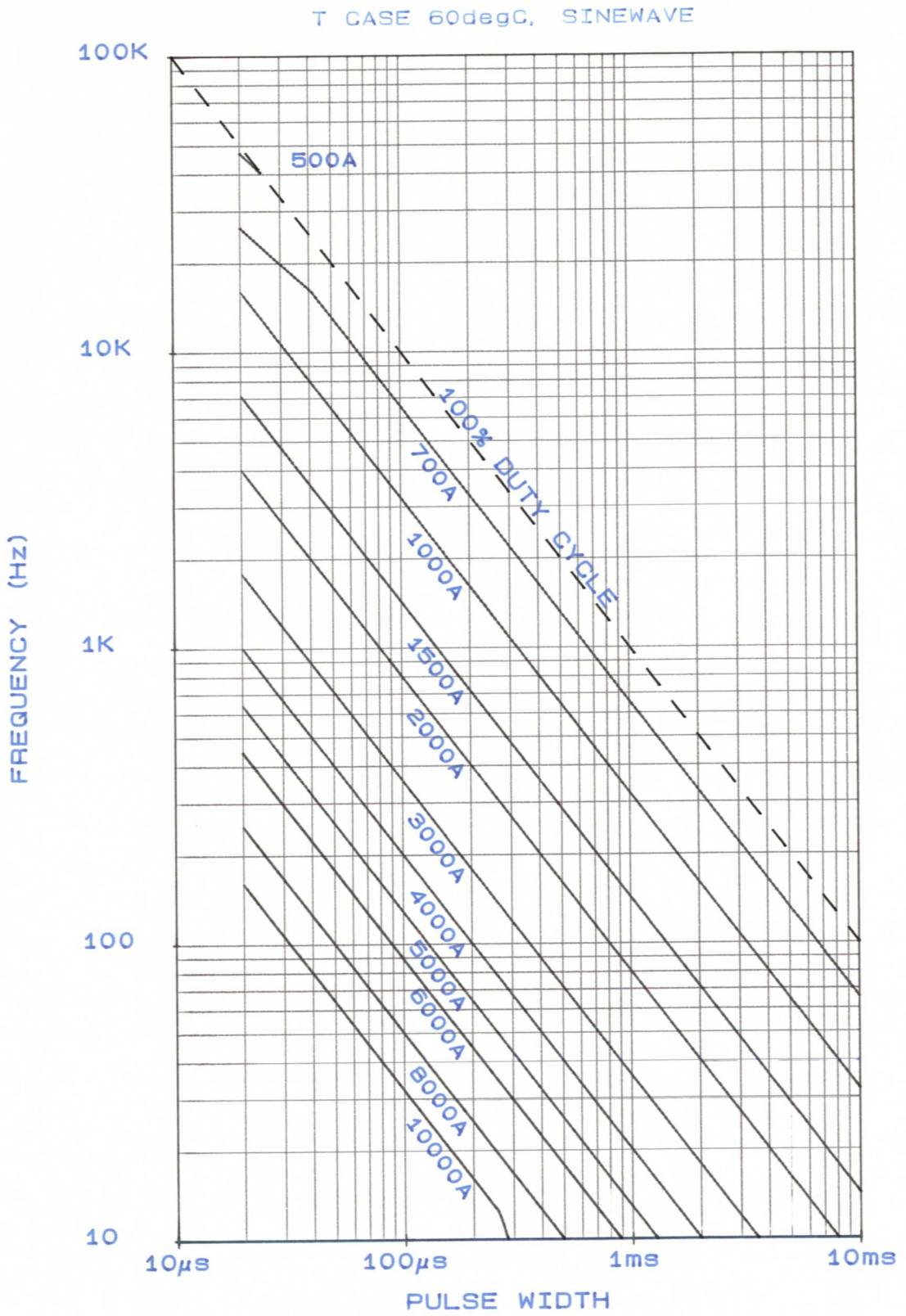


T_j 125°C. 100A/ μ s

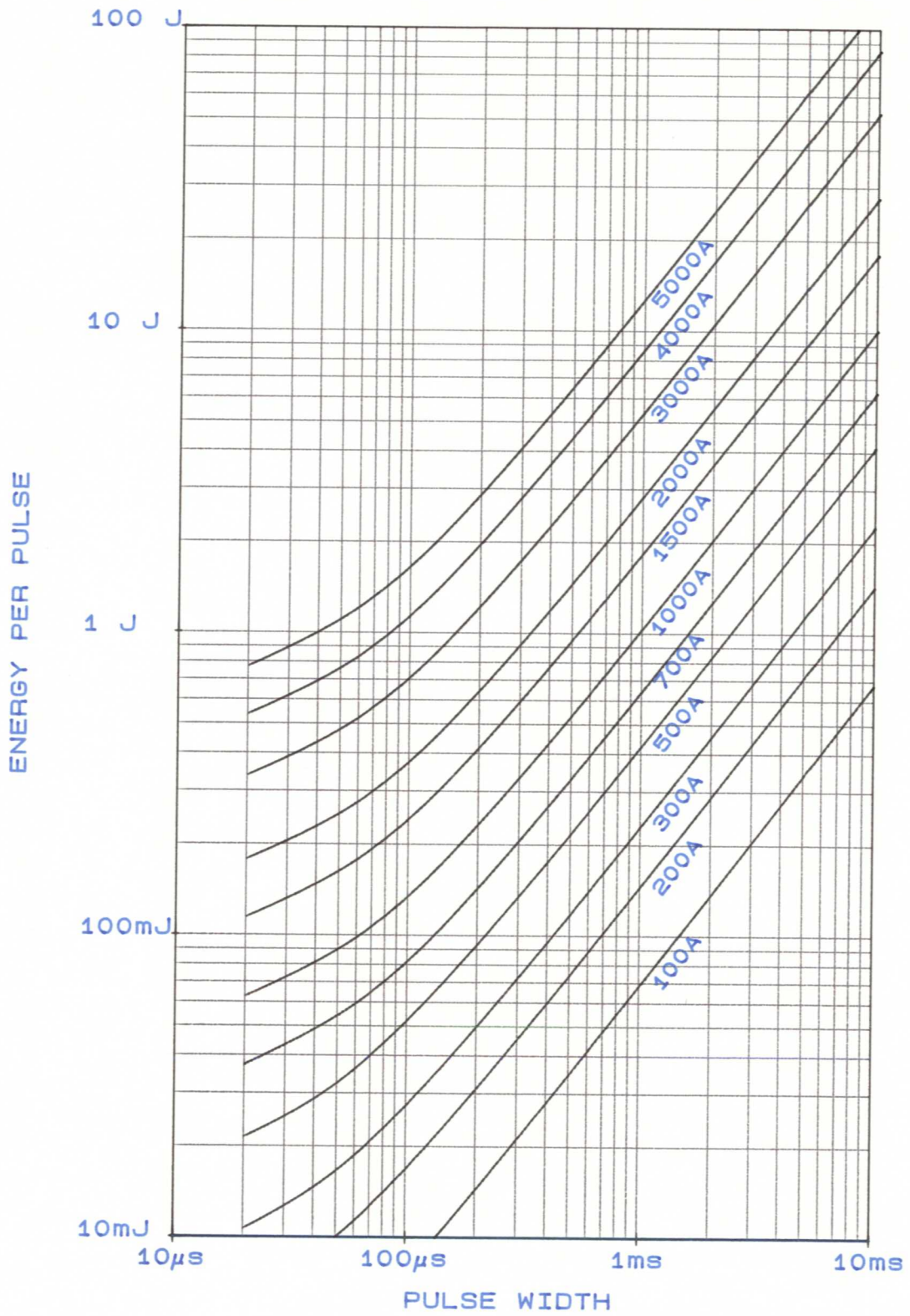


T CASE 90degC, SINEWAVE





T_J 125°C. SINE WAVE

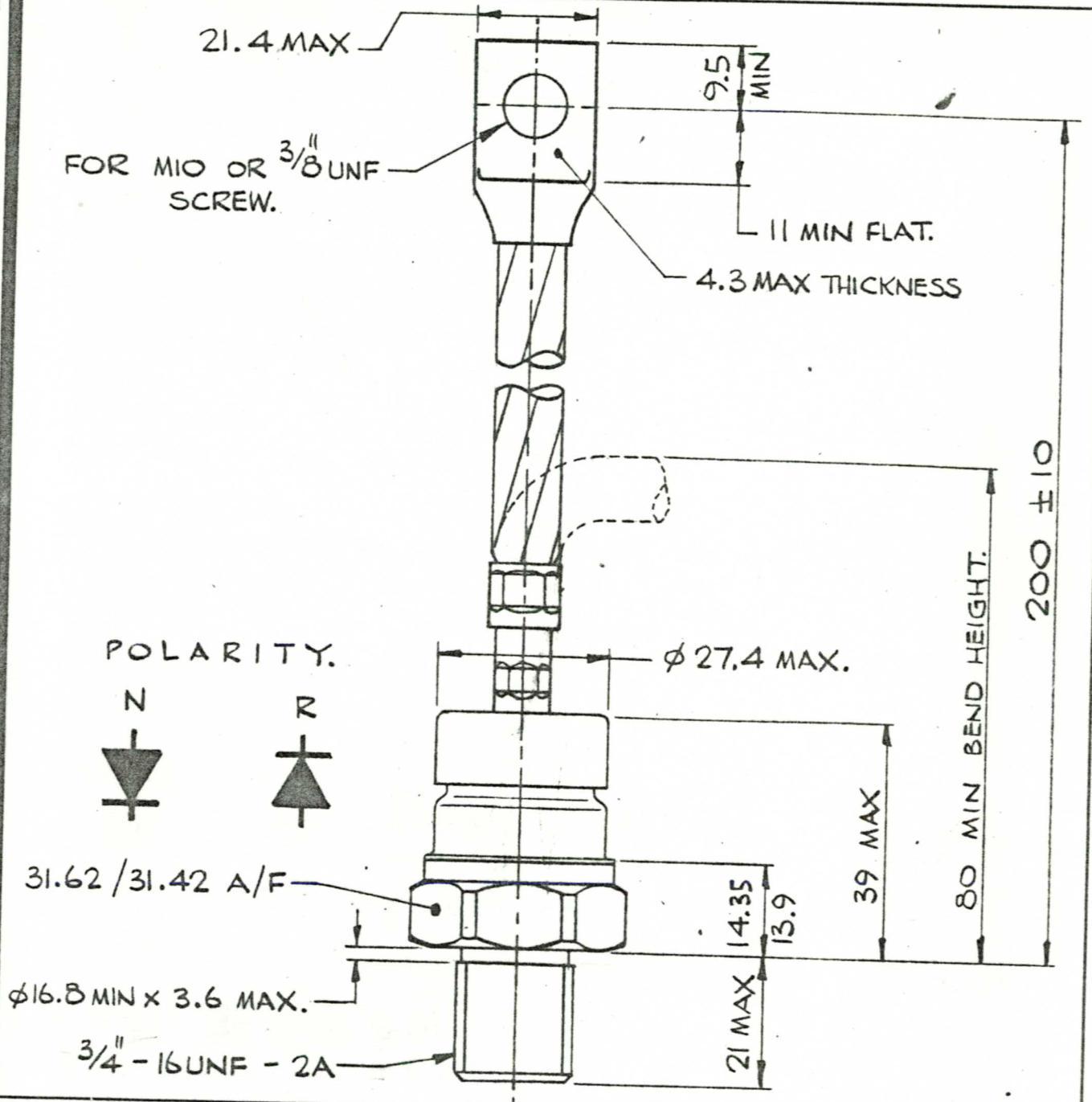


SCALE	1/1
DRN	68
CHKD	68
APPD	
S	A
S	NI

INTERNATIONAL OUTLINE No. 22
 WEIGHT. 250 GRAMS.
 FINISH. BRIGHT NICKEL PLATE.
 DEVICE MARKING INCLUDES MONOGRAM, TYPE No., SPEC. No. AND POLARITY SYMBOL.
 DEVICE MOUNTING:
 MOUNTING TORQUE TO BE 27 - 24.5 Nm (2.77 - 2.5 kgf m).
 THREAD MUST NOT BE LUBRICATED.

DIODE TYPE NUMBER
 PHN/R 380
 PHN/R320
 PHN/R174

G.A. DRG. No. 102A216H04.



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ISS	REVISIONS
1	11.9.78.
4	12.12.79 M806 REDRAWN. DRG No WAS 100A257.
5	27.11.84 M218 FIN WAS ET

DRG. No. 100A280