Soft Recovery Diode
Types M0371YH350 to M0371YH450

The data sheet on the subsequent pages of this document is a scanned copy of existing data for this product.
(Rating Report 93NR4 Issue 1)

This data reflects the old part number for this product which is: SM30-45HXC164. 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:
Device no longer available for grades 30 to 34 (3000V to 3400V V_{RRM})

Please use the following link to view an up to date outline drawing for this device
Outline W3

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			
M0371	YH	♦♦	**0**
Fixed Type Code	Fixed Outline Code	Voltage code V_{RRM}/100 35-45	Fixed Code
Typical Order Code: M0371YH400, 26mm clamp height, 4000V V_{RRM}			

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Page Issue	1

QUALITY AND EVALUATION LABORATORY

Rating Report No: 93NR4

Origin: Q.E.L.

Date: 16th June, 1993

Pages: 25

Diode Capsule Type: SM30-45HXC164

M.J. Perry

Written by: M.J. Perry   Checked: M Baker   Approved:

30 mm Silicon with low recovered charge for snubber duties in high voltage gate turn-off thyristor applications; housed in a high voltage capsule.

Ratings

Voltage Grades	: 30-45
V_{RSM}	: 3100-4600V
V_{RRM}	: 3000-4500V
$I_{F(AV)}$: Single phase: 50 Hz, 180° half sinewave; (Converter Ratings)	
Double Side Cooled T_{HS} = 55°C, 100°C	: 364A; 239A
Single Side Cooled T_{HS} = 100°C	: 147A
$I_{F(rms)}$ T_{HS} = 25°C) Double side cooled	: 678A
I_F T_{HS} = 25°C) Double side cooled	: 597A
I_{FSM} : t = 10ms half sinewave; T_J (initial) = 150°C, $V_{RM} = 0.6V_{RRM(MAX)}$	: 4900A
I_{FSM} : t = 10ms half sinewave; T_J (initial) = 150°C, $V_{RM} \leq 10V$	: 5400A
I^2t : t = 10ms; T_J (initial) = 150°C; $V_{RM} = 0.6V_{RRM(MAX)}$	: 120 x 10^3A^2S
I^2t : t = 10ms; T_J (initial) = 150°C; $V_{RM} \leq$ 10V	: 146 x 10^3A^2S
I^2t : t = 3ms; T_J (initial) = 150°C; $V_{RM} \leq$ 10V	: 110 x 10^3A^2S
T_{HS} Operating Range	: -40 to +150°C
T_{stg} : Non-operating	: -40 to +150°C

R.R. No.	93NR4
R.R. Issue	1
Page Issue	1

Characteristics

(Maximum values unless otherwise stated)

V_o	: 1.05V
r_s	: 1.65mohms
A : T_J = 25°C	: 0.171044306
B : T_J = 25°C	: 0.203488535
C : T_J = 25°C	: 7.4078071E-4
D : T_J = 25°C	: 1.50068853E-2
A	: 0.125659408
B	: 0.109853554
C	: 7.39508871E-4
D	: 3.11942547E-2
V_{FM} at I_{FM} = 635A	: 2.10V
$R_{th(J-HS)}$ Double side cooled	: 0.10 K/W
Single side cooled	: 0.20 K/W
I_{RRM} : at $V_{RRM(MAX)}$	: 50mA
V_{fr} : at dI/dt = 1000A/μs	: 370V

Reverse recovery at I_{FM} = 1000A; t_p = 500μs:
di_R/dt = 200A/uS; V_{RM} = 50V

Q_{RR} (total area)	: 1560μC
Q_{RA} (50% chord)	: 640μC
t_{rr} (50% chord)	: 3.3μs
I_{RM}	: 400A
Mounting Force	: 330-550 Kgf
Outline Drawing	: 100A317
JEDEC Outline No.	:

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

R.R. No.	93NR4
R.R. Issue	1
Page Issue	1

CONTENTS

R.R. No.	93NR4
R.R. Issue	1
Page Issue	1

Voltage Ratings

Voltage Class	V_{RRM} V	V_{RSM} V
30	3000	3100
32	3200	3300
34	3400	3500
36	3600	3700
38	3800	3900
40	4000	4100
42	4200	4300
44	4400	4500
45	4500	4600

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

2. A blocking voltage derating factor of 0.13% per deg. Celsius is applicable to this device for T_J below 25°C.

R.R. No.	93NR4
R.R. Issue	1
Page Issue	1

2.0 INTRODUCTION

The diode series comprises fast recovery capsule devices with all diffused silicon slices. All these diodes have controlled reverse recovery characteristics. 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 100A/μS and 500A/μS.

(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 x f

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

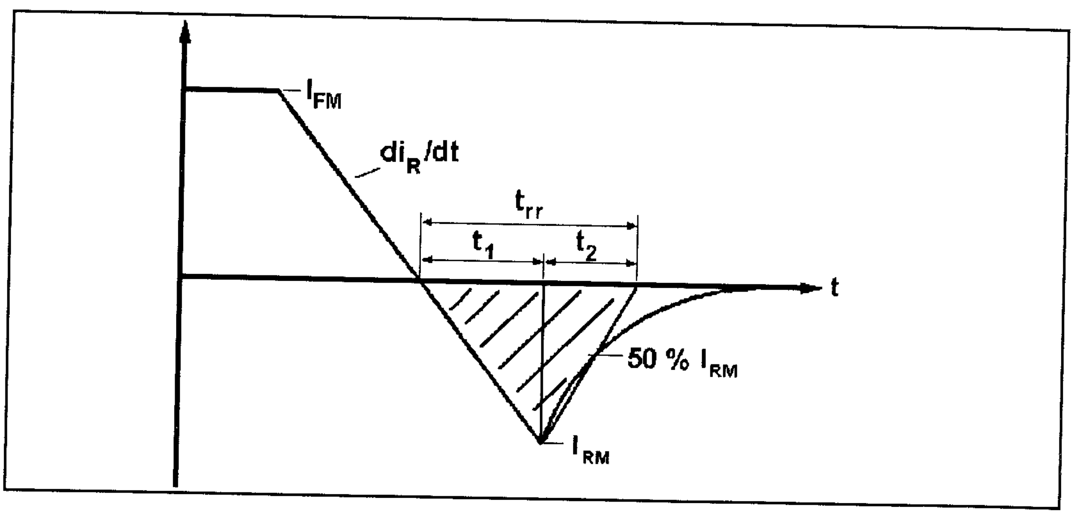
(c) ABCD Constants

These constants (applicable only over current range of V_F characteristic on page 8) are the co-efficients of the 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.

(d) Reverse recovery ratings

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



R.R. No.	93NR4
R.R. Issue	1
Page Issue	1

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

$$\text{i.e. } Q_{RR} = \int_{t=o}^{150uS} i_{RR} \cdot dt$$

(iii) K factor = t_1/t_2

4.0 Reverse Recovery Loss

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 sink temperature can then be evaluated from:

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

where r_t = 3.30E-6 x t (K/W)

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

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

(b) Determination without Measurement

In circumstances where it is not possible to measure voltage and current conditions, or for design purposes, the additional losses A in joules may be estimated from curves on page 15.

Let E be the value of energy per reverse cycle in joules (curves on p15).

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.

A suitable R-C snubber network is connected across the diode to restrict the transient reverse voltage waveform to a peak value (V_{RM}) of 0.67 of the maximum grade.

If a different grade is being used or V_{RM} is lower than 0.67 of Grade, the reverse loss may be approximated by a pro rata adjustment of the maximum value obtained from the curves provided.

R.R. No.	93NR4
R.R. Issue	1
Page Issue	1

NOTE 1

Reverse Recovery Loss by Measurement

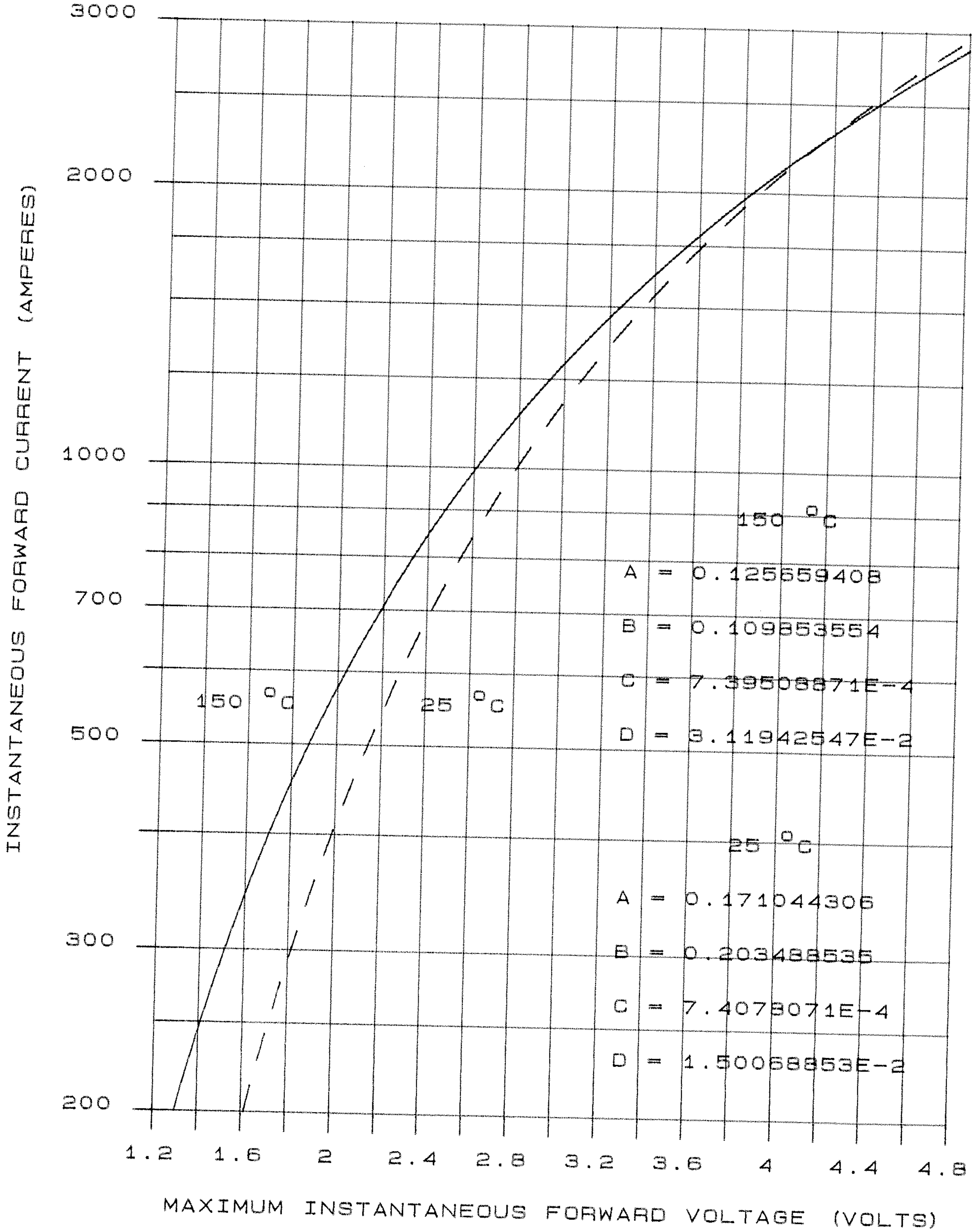
This device has a low reverse recovered charge and peak reverse recovery current. When measuring the charge care must be taken to ensure that:

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

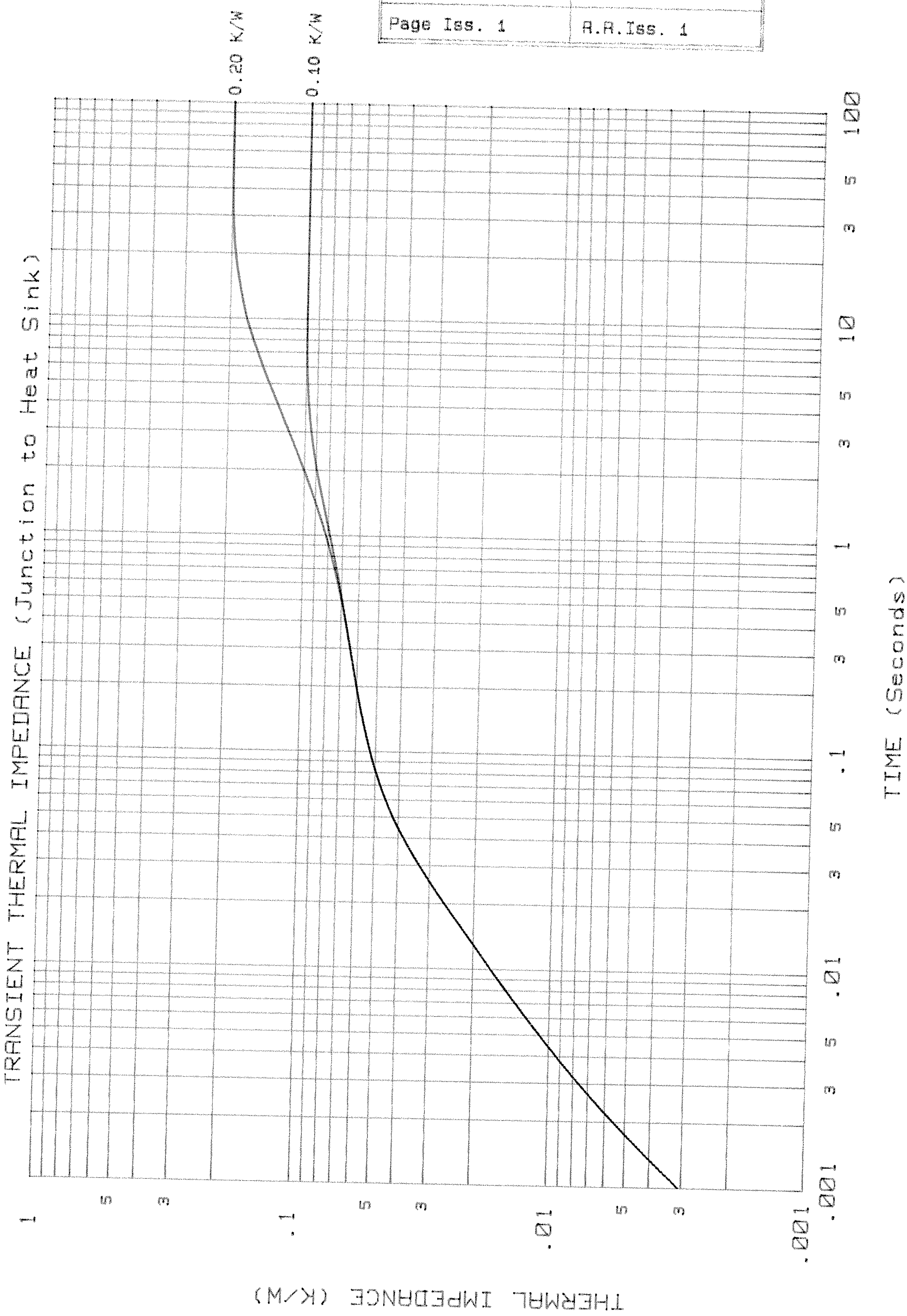
(b) A suitable, polarised, clipping circuit must be connected to the input of the measuring oscilloscope to avoid overloading the internal amplifiers by the relatively high amplitude forward current signal.

(c) Measurement of reverse recovery waveform should be carried out with an appropriate snubber of 0.5μF, 2.2ohms connected across diode anode to cathode.

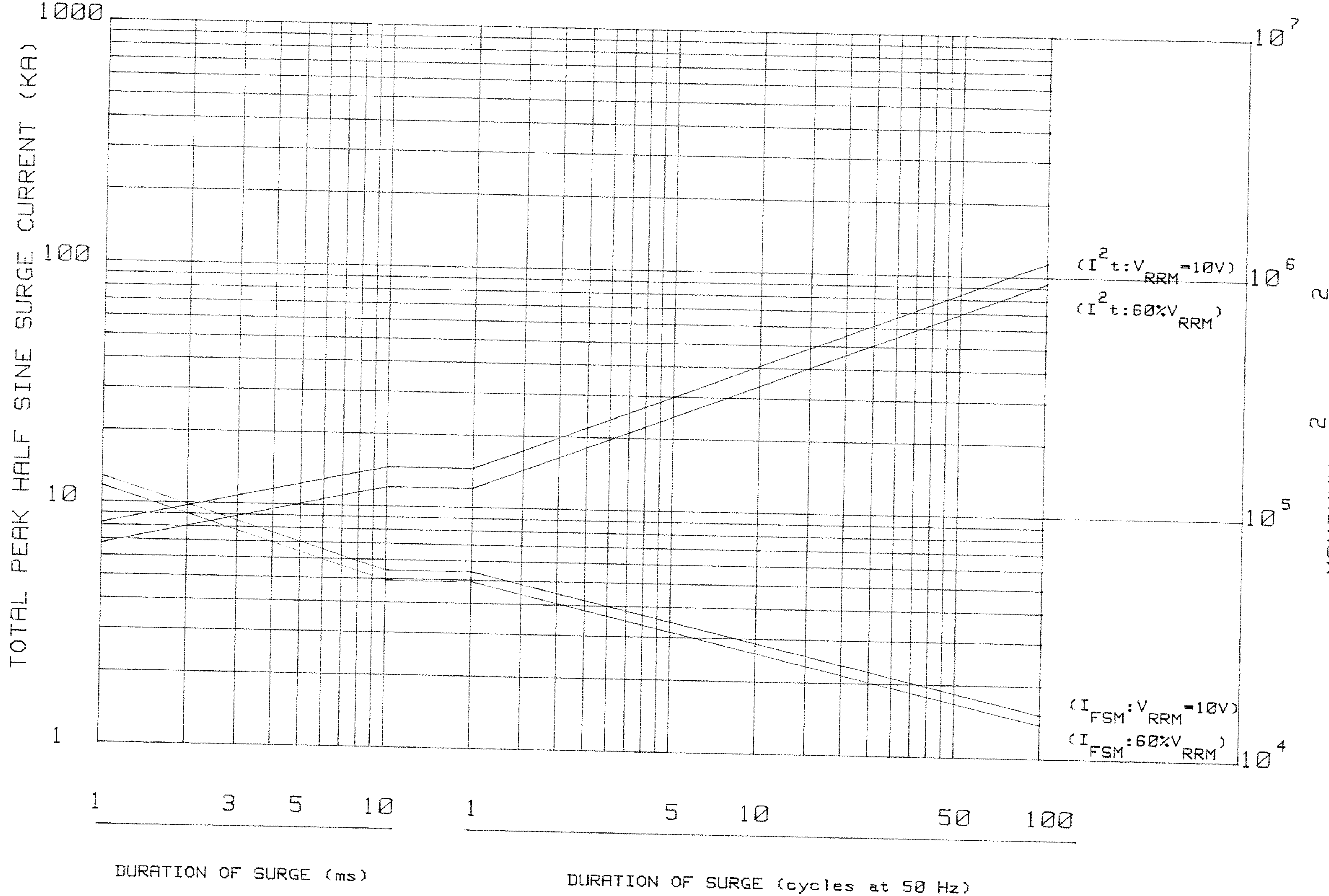
FORWARD CHARACTERISTIC OF LIMIT DEVICE



Page No. 09	R.R. No. 93NR04
Page Iss. 1	R.R.Iss. 1



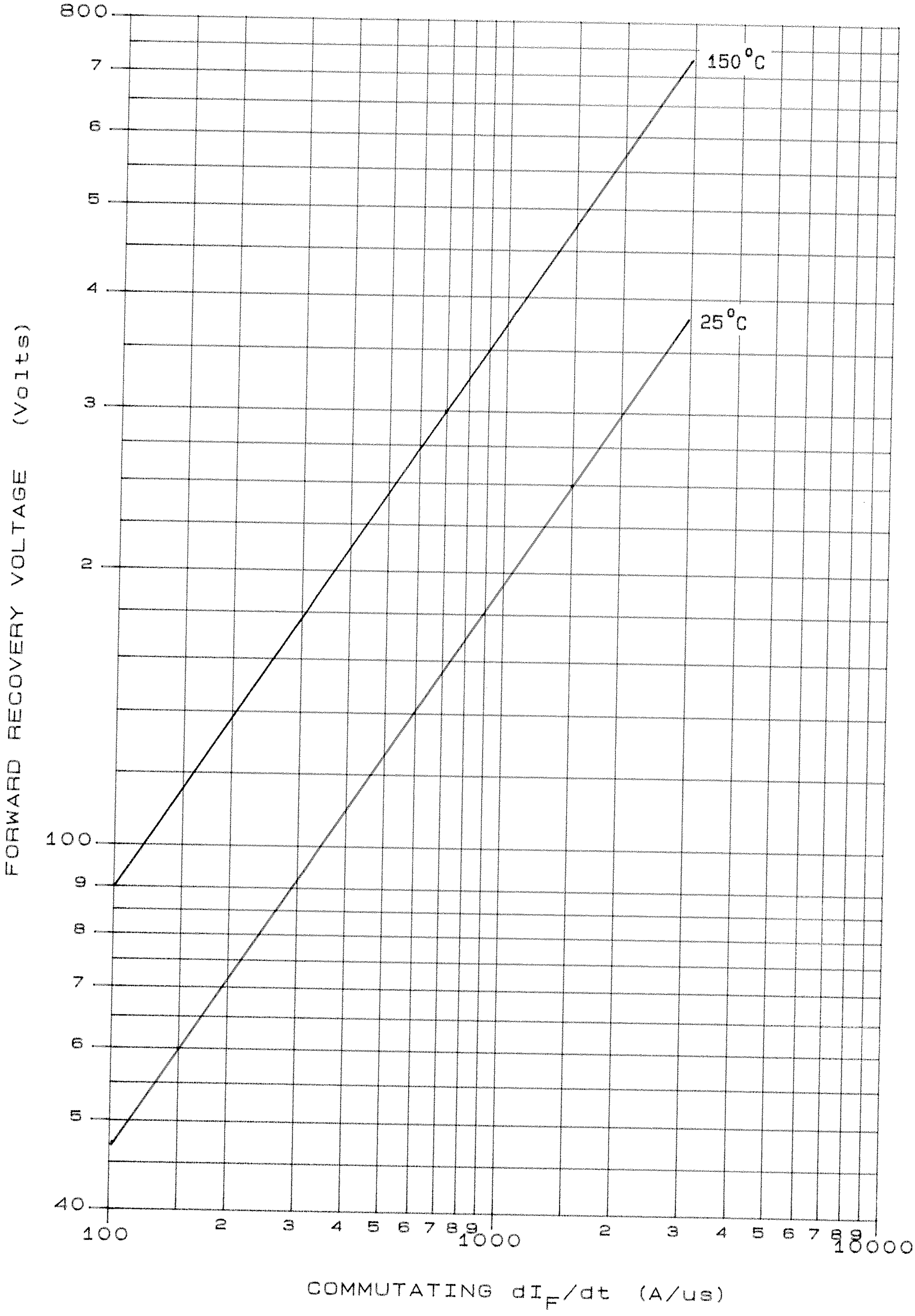
MAXIMUM NON REPETITIVE SURGE CURRENT AT INITIAL JUNCTION TEMPERATURE 150°C



Page No. 11	R.R. No. 93NR04
Page Iss. 1	R.R.Iss. 1

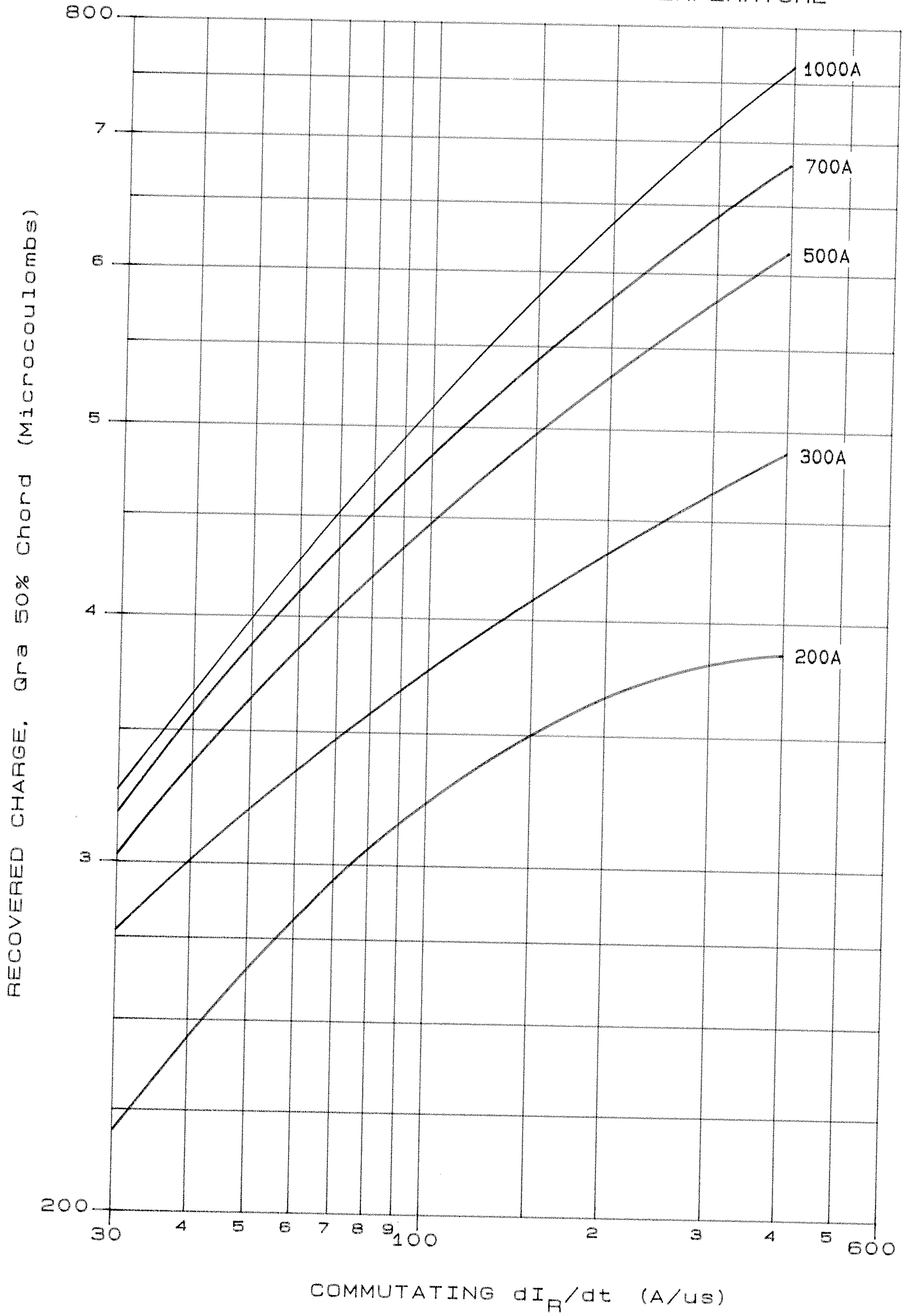
FORWARD RECOVERY VOLTAGE

(MAXIMUM PEAK)



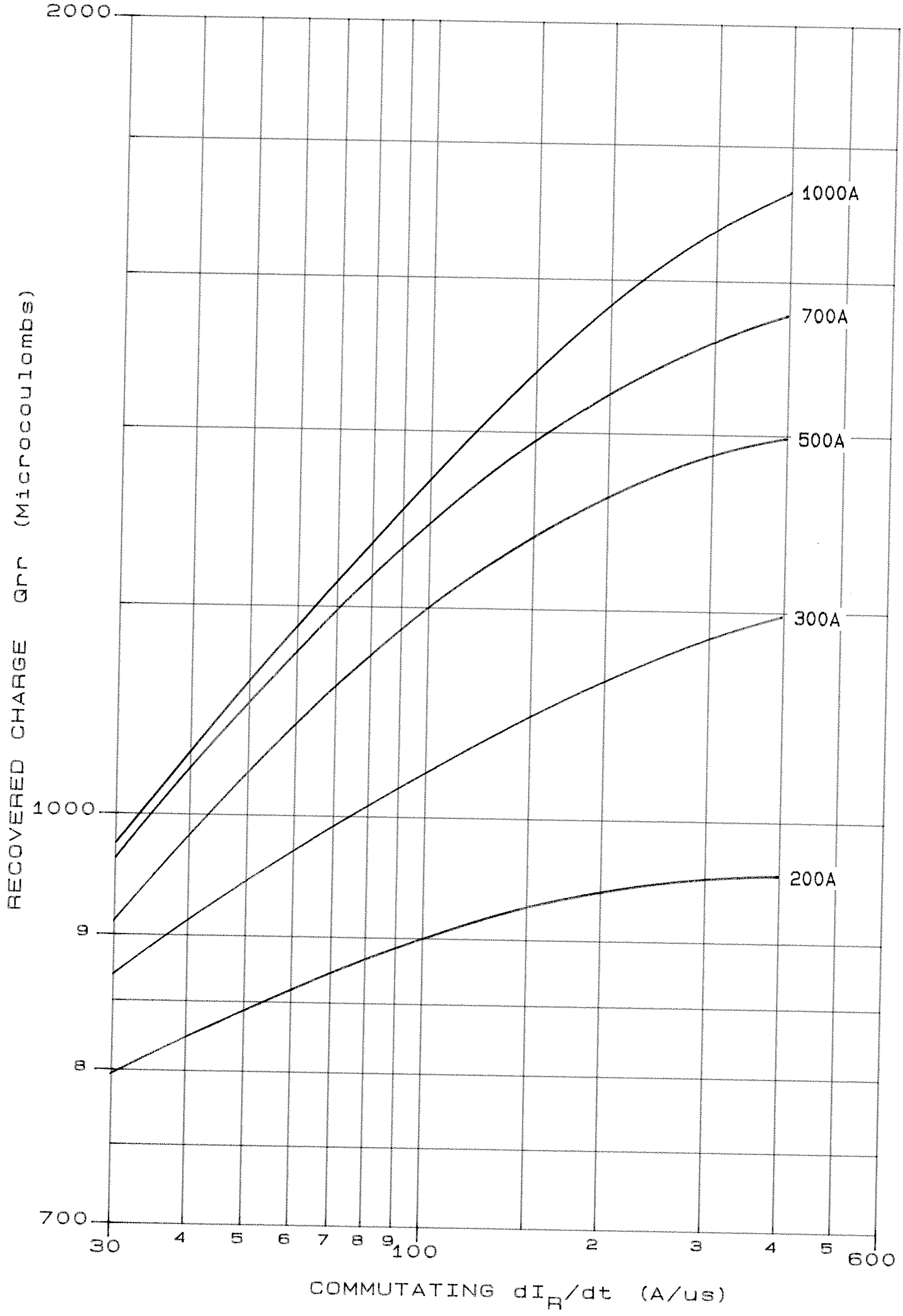
MAXIMUM RECOVERED CHARGE

Qra @ 150 °C JUNCTION TEMPERATURE



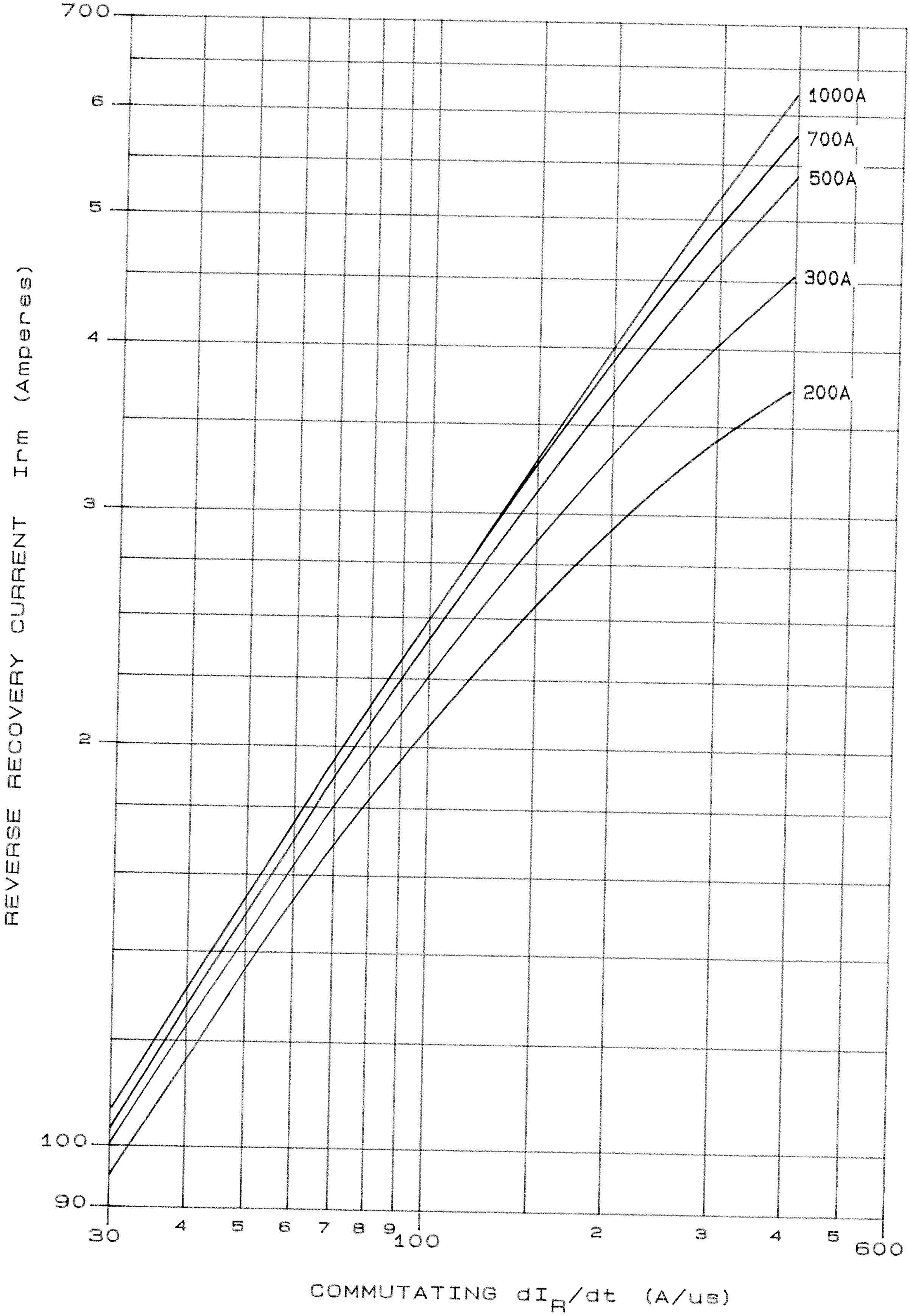
MAXIMUM TOTAL RECOVERED CHARGE

Qrr @ 150 °C JUNCTION TEMPERATURE



MAXIMUM PEAK REVERSE RECOVERY CURRENT

Irm @ 150 °C JUNCTION TEMPERATURE

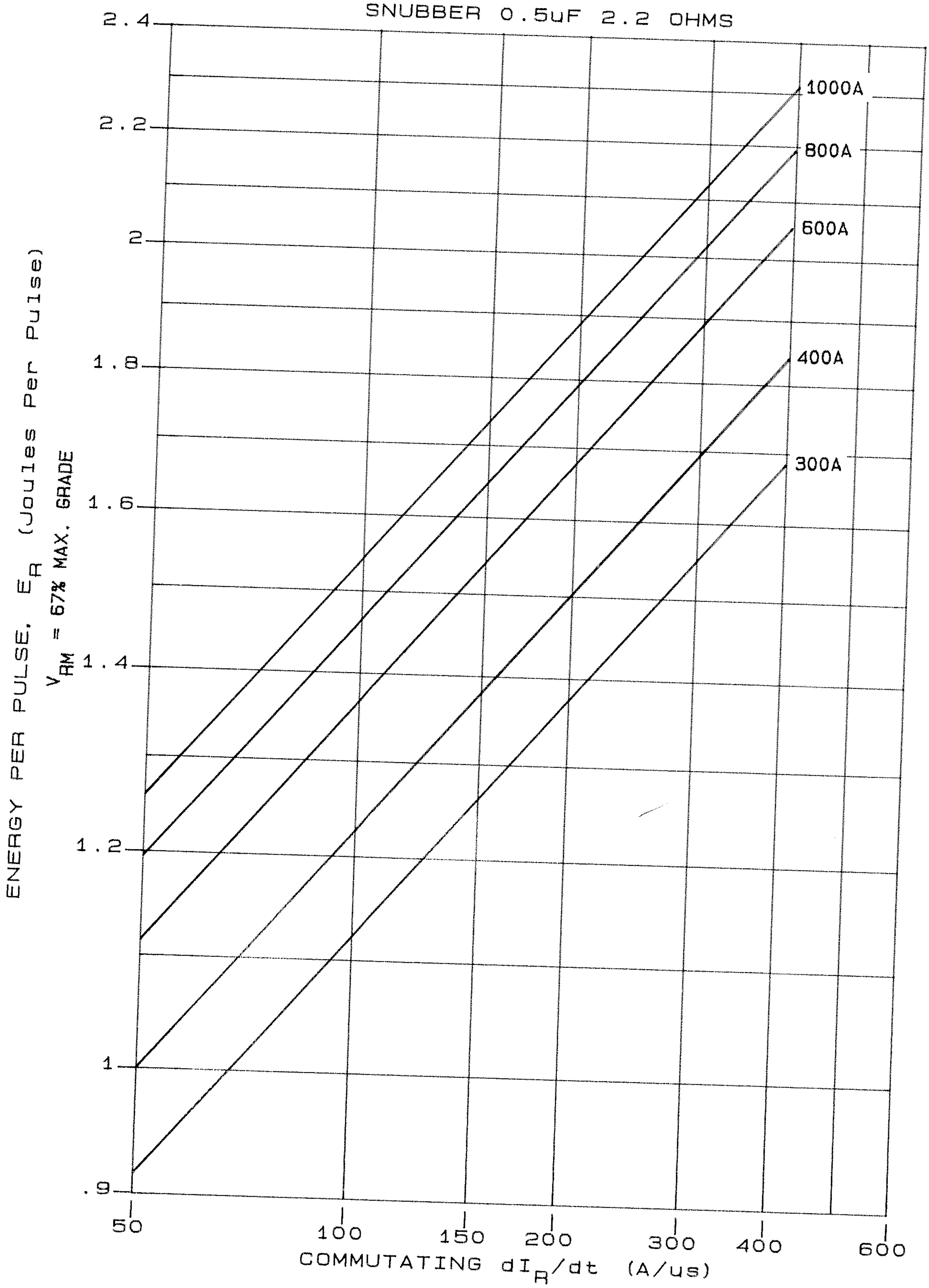


Page No. 15	R.R. No. 93NR04
Page Iss. 2	R.R.Iss. 1

MAXIMUM REVERSE RECOVERED ENERGY LOSS PER PULSE

E_R @ 150 °C JUNCTION TEMPERATURE

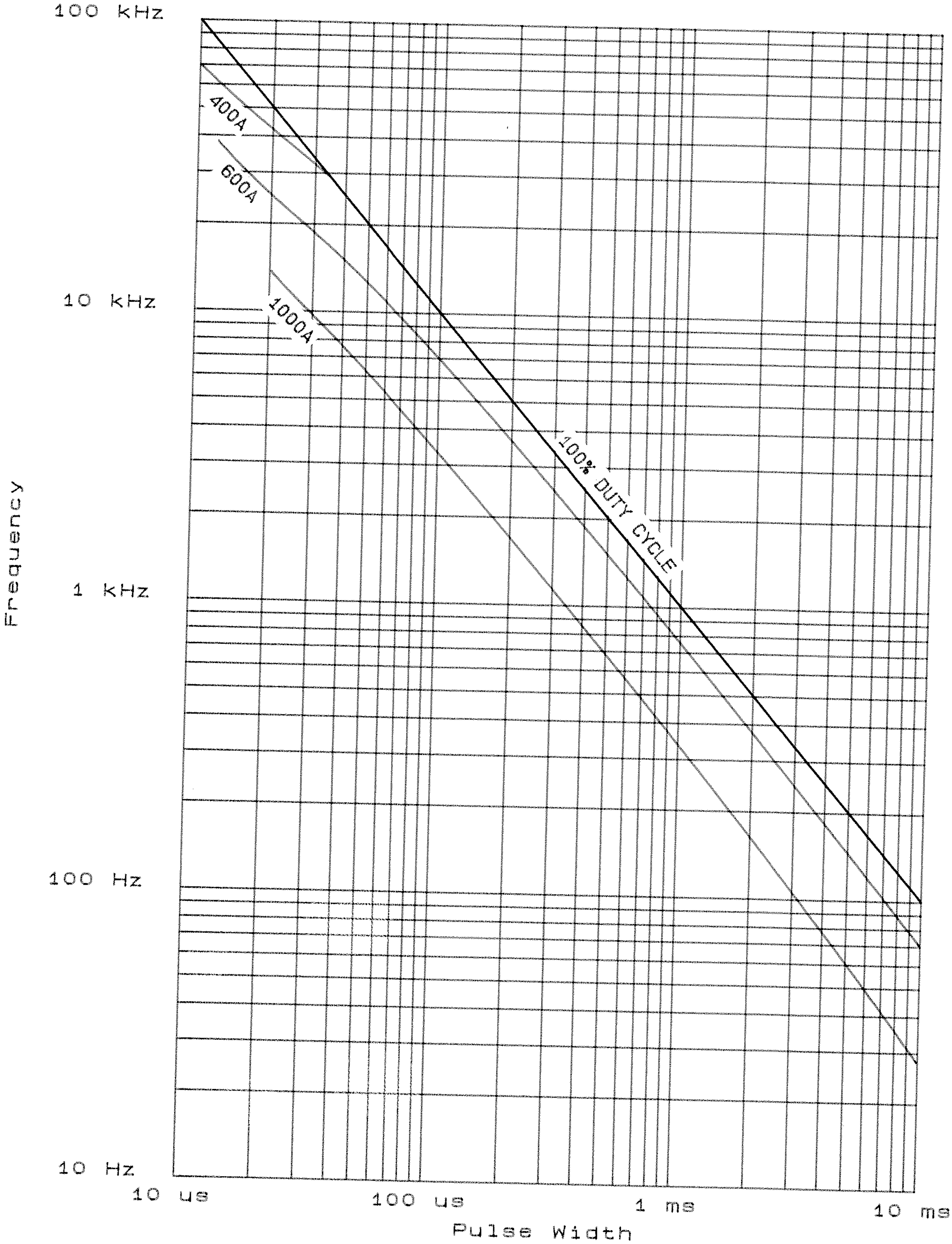
SNUBBER 0.5uF 2.2 OHMS



Page No. 16	R.R. No. 93NR04
Page Iss. 1	R.R.Iss. 1

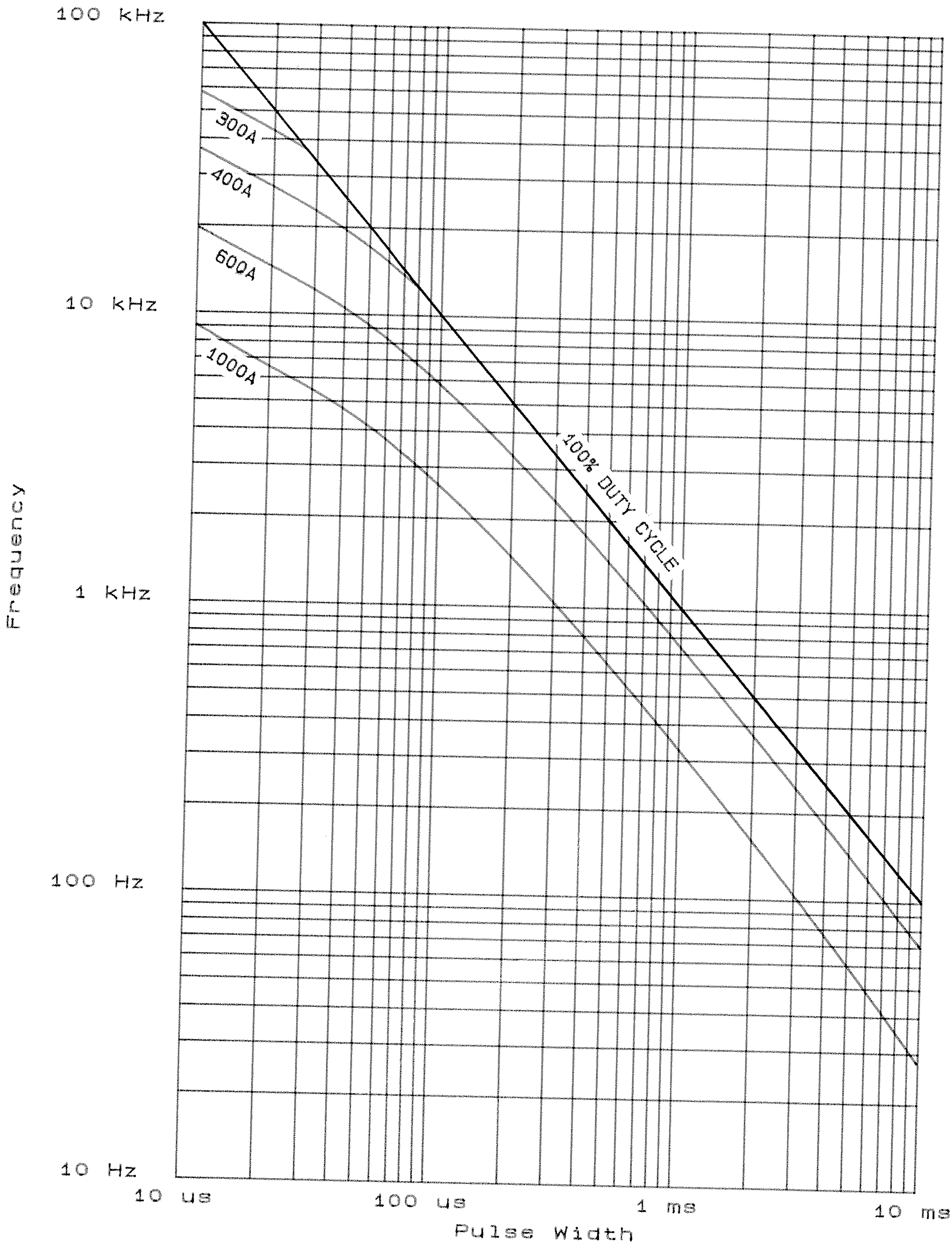
Frequency Vs Pulse Width

T Sink = 55.°C. 100. A/us



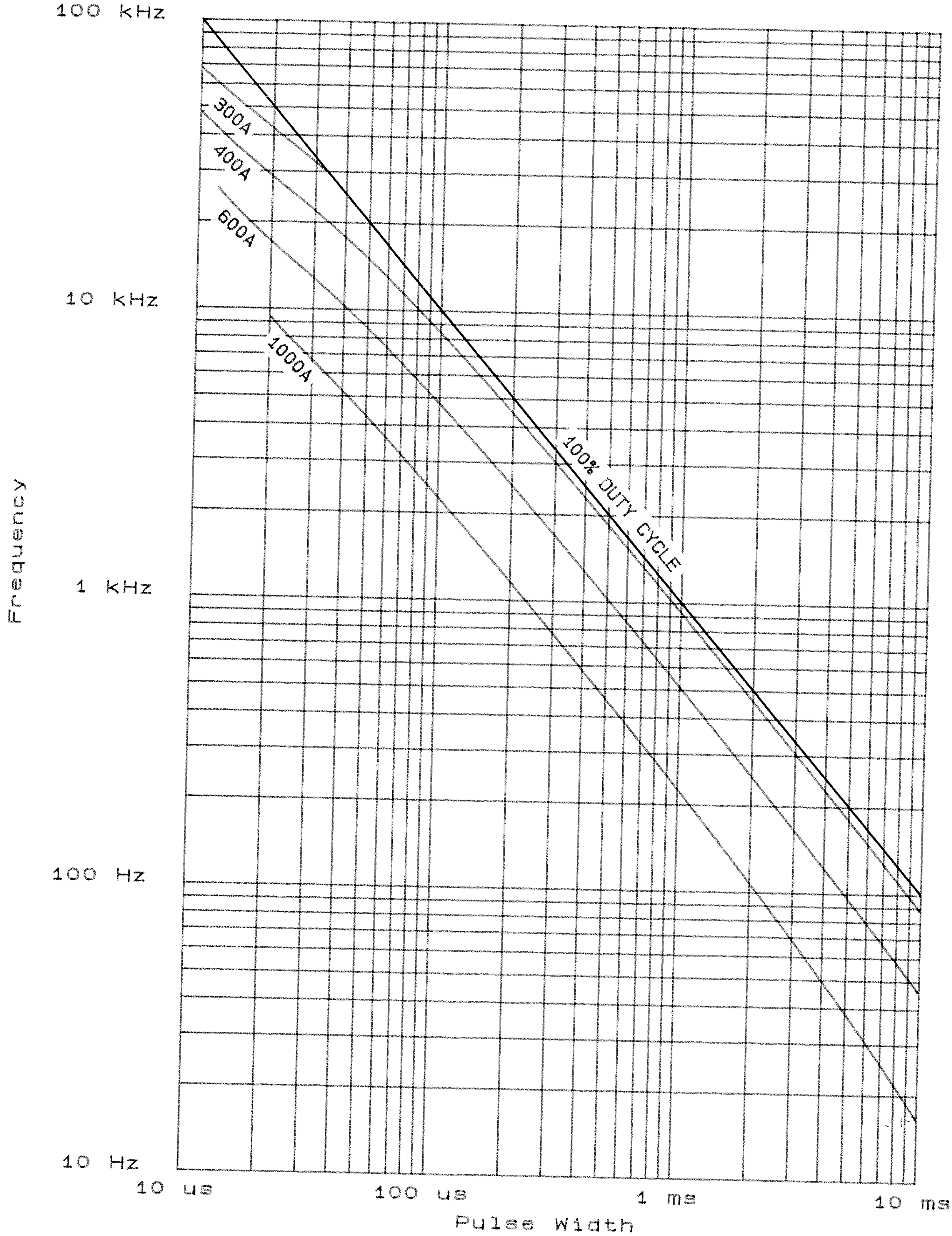
Frequency Vs Pulse Width

T Sink = 55.°C. 500. A/us



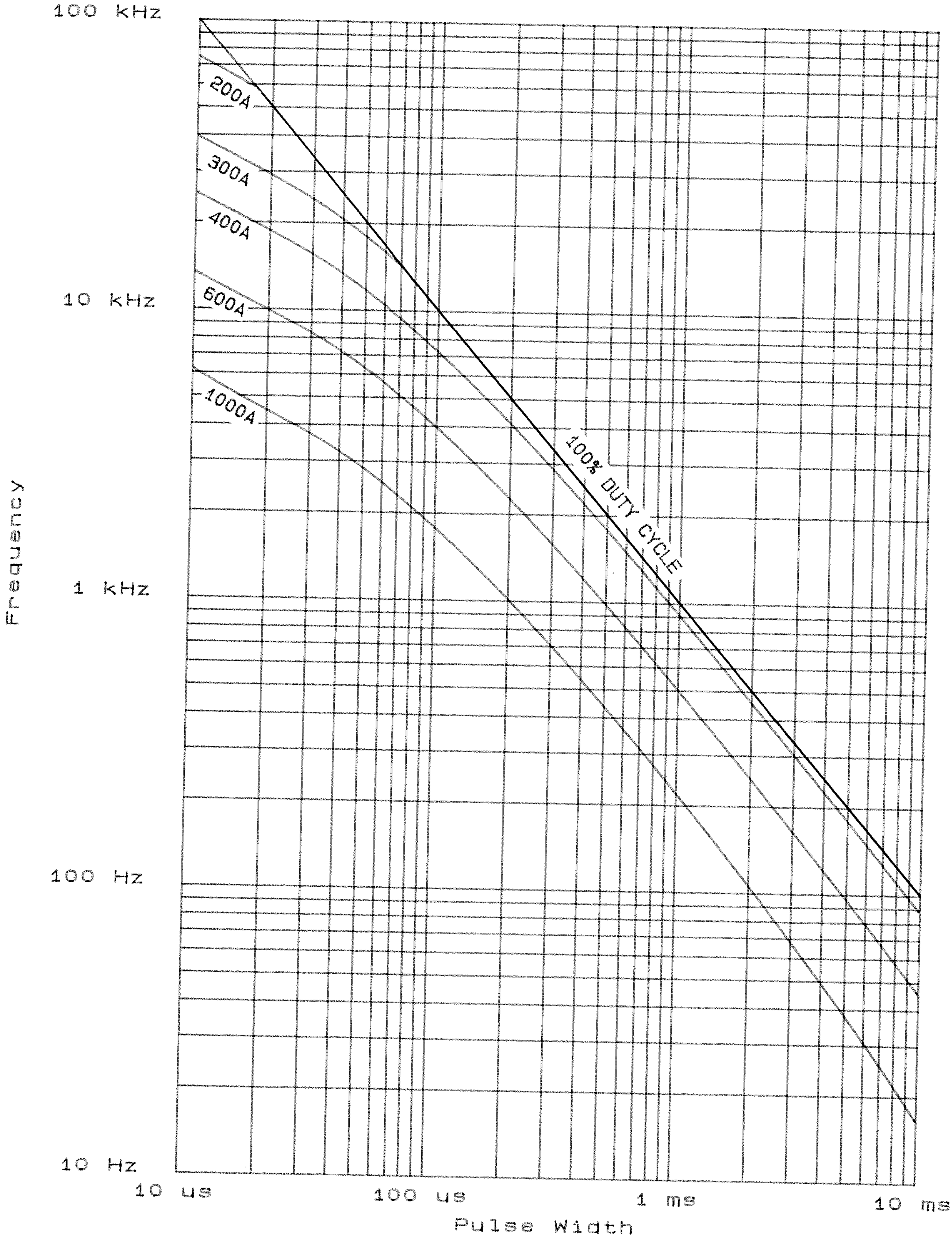
Frequency Vs Pulse Width

T Sink = 85.°C. 100. A/us



Frequency Vs Pulse Width

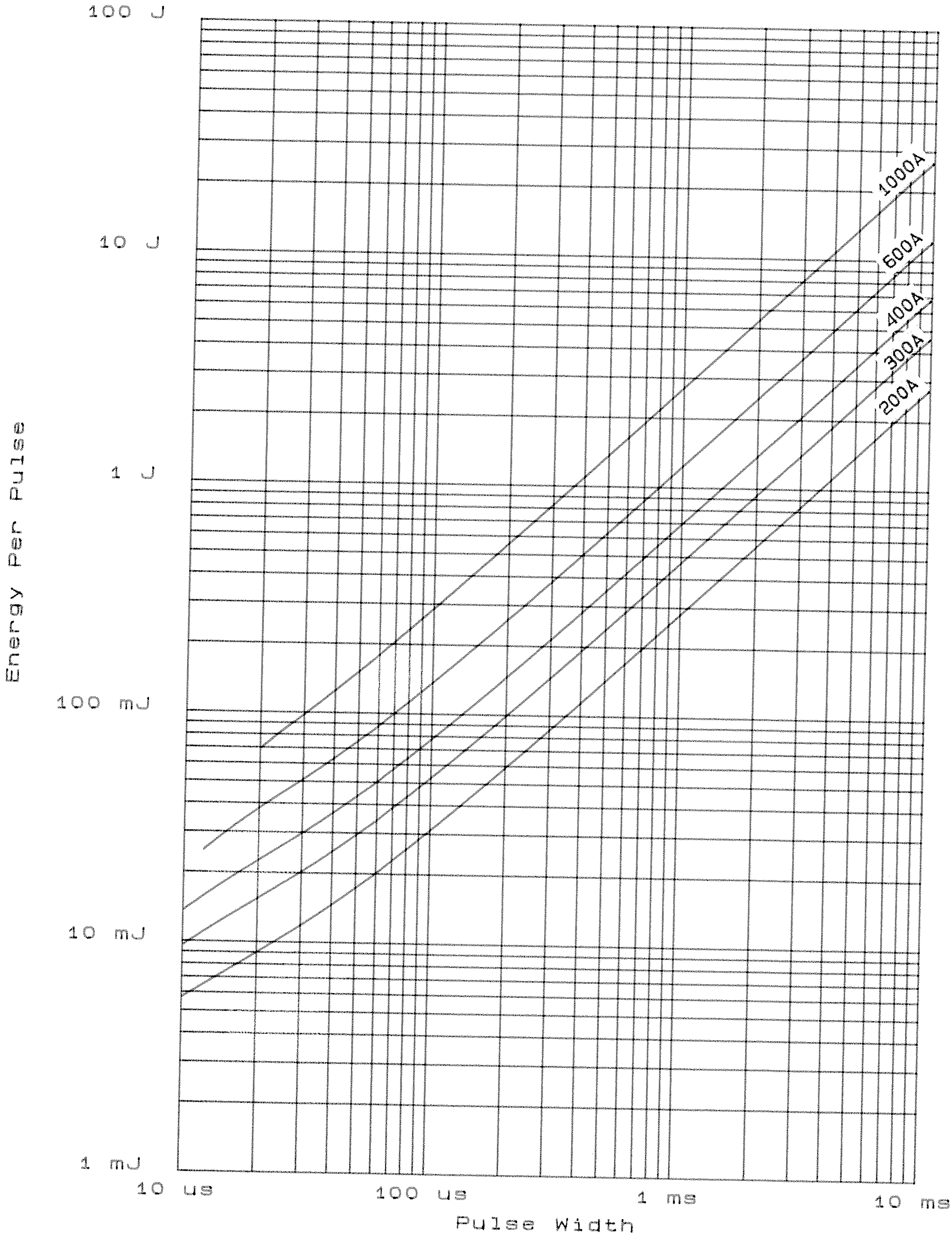
T Sink = 85. °C. 500. A/us



Page No. 20	R.R. No. 93NR04
Page Iss. 1	R.R.Iss. 1

Forward Energy Vs Pulse Width

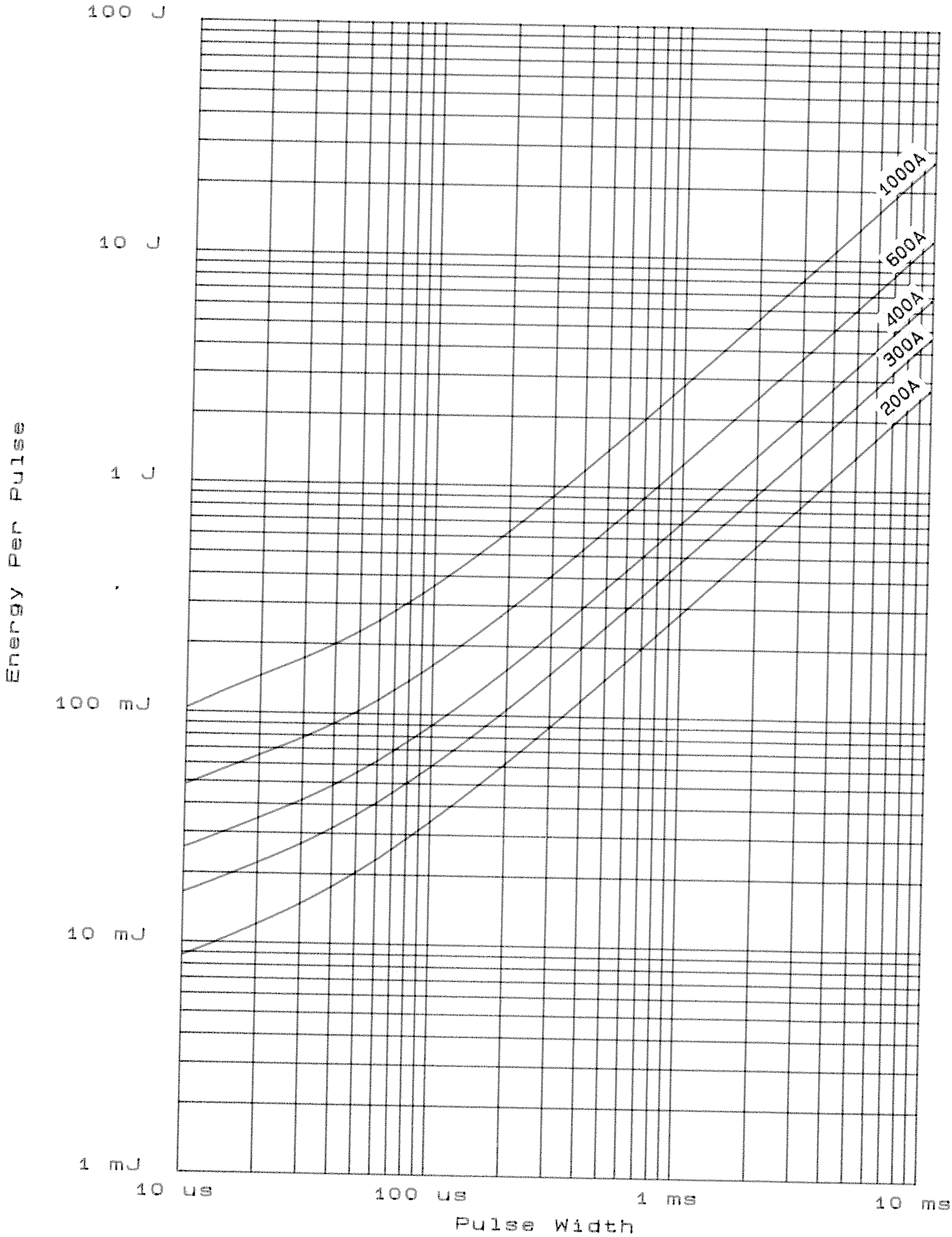
Tj = 150.°C. 100. A/us



Page No. 21	R.R. No. 93NR04
Page Iss. 1	R.R.Iss. 1

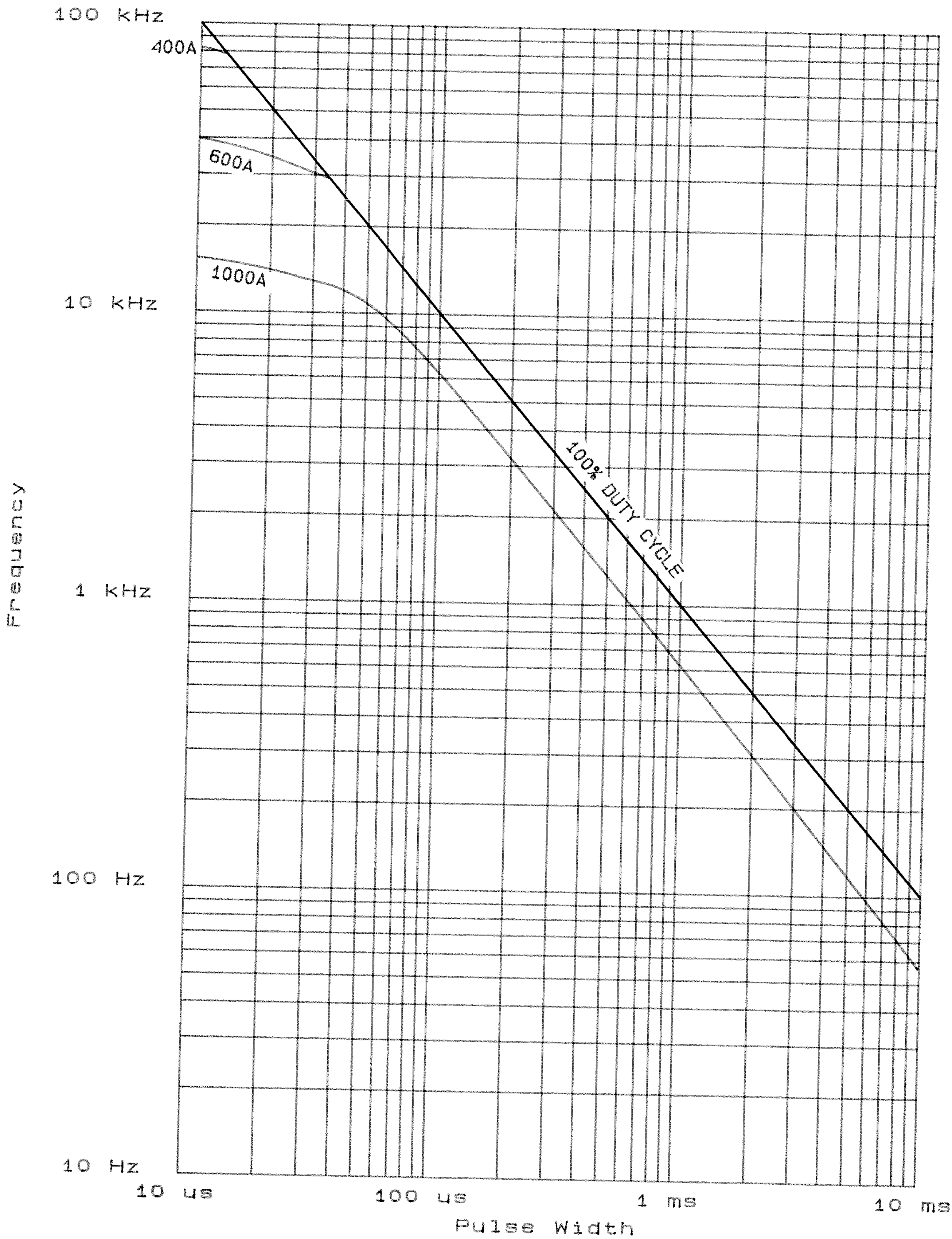
Forward Energy Vs Pulse Width

Tj = 150.°C. 500. A/us



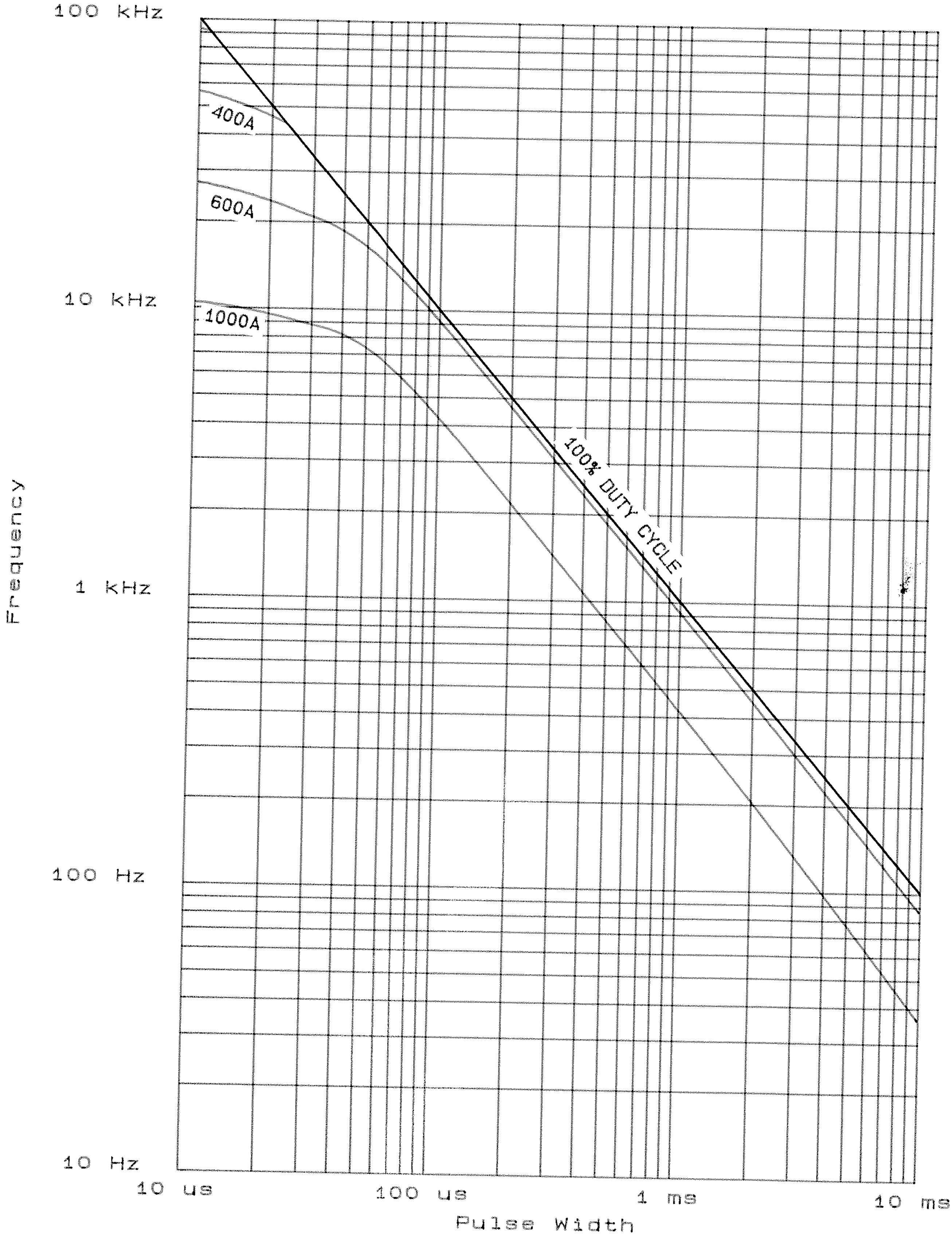
Frequency Vs Pulse Width

T Sink = 55.°C. Sine Wave



Frequency Vs Pulse Width

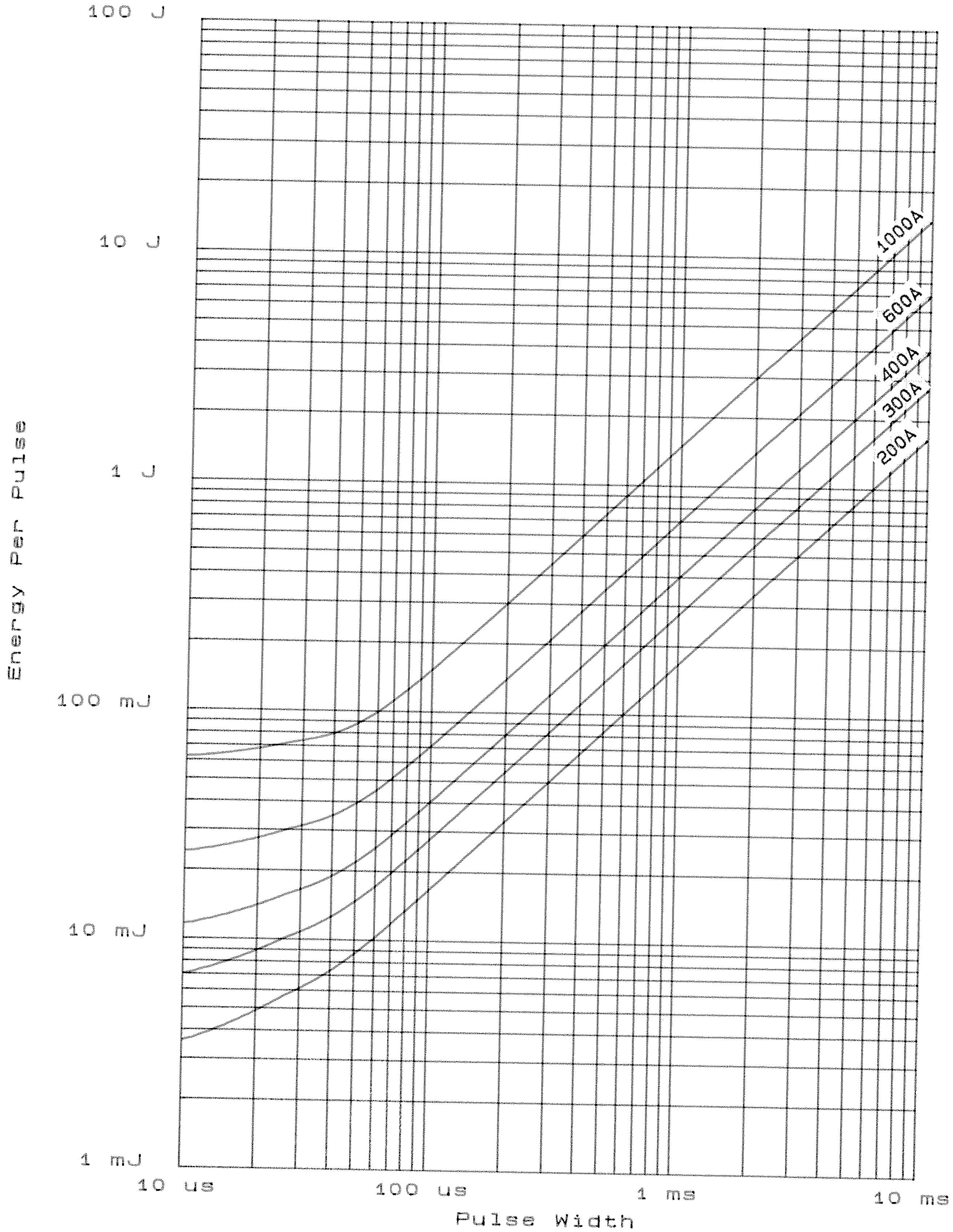
T Sink = 85.°C. Sine Wave



Page No. 24	A.A. No. 93NR04
Page Iss. 1	A.A.Iss. 1

Forward Energy Vs Pulse Width

Tj = 150.°C. Sine Wave

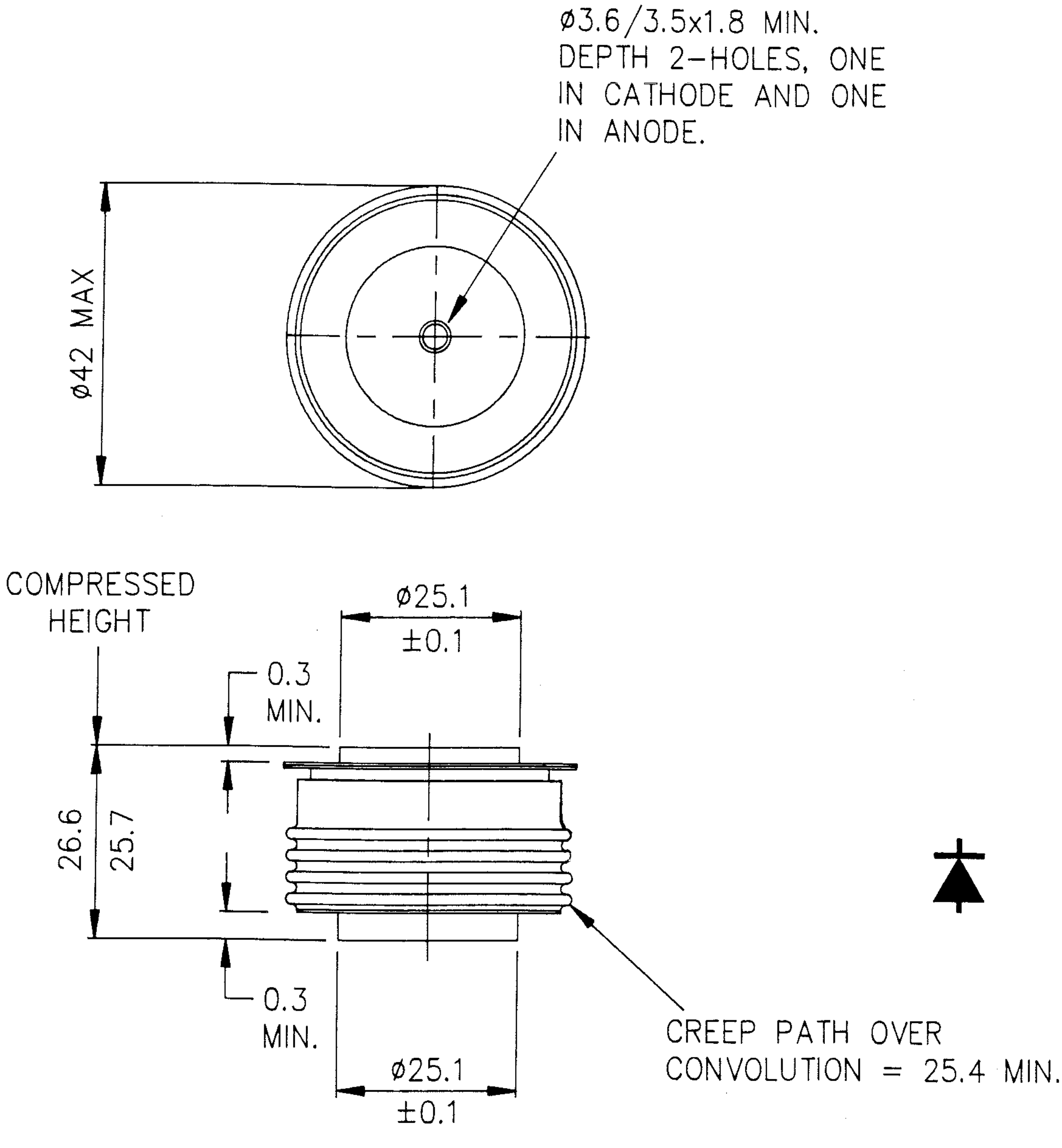


ACAD REF: 100A317

INTERNATIONAL OUTLINE No.
G.A. DWG No. 159B100H126
WEIGHT. 141 GRAMS
FINISH. NICKEL PLATE

TYPE NUMBER
HXC084
HXC164

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.



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THIRD ANGLE PROJECTION.
DWG. COMPLIES WITH BS 308.
DIMNS. IN MILLIMETRES.
DWG No. 100A317

SCALE 1/1
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