

Fast turn-off Thyristor

P0295WC12#

The data sheet on the subsequent pages of this document is a scanned copy of existing data for this product.

(Rating Report 83TR5 Issue 2)

This data reflects the old part number for this product which is: P200CH02-12. 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 only available for grade 12 (1200V V_{RRM}/V_{DRM})

Please use the following link to view an up to date outline drawing for this device
[Outline W8](#)

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			
P0295	WC	◆◆	#
Fixed Type Code	Fixed Outline Code	Voltage code $V_{DRM}/100$ 12	Fixed Turn-off Time Code D = 20μs, E = 25μs, F = 30μs
Typical Order Code: P0295WC12D, 14.4mm clamp height, 1200V V_{RRM}/V_{DRM} , 20μs t_q			

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In the interest of product improvement, Westcode reserves the right to change specifications at any time without prior notice.

Devices with a suffix code (2-letter, 3-letter or letter/digit/letter combination) added to their generic code are not necessarily subject to the conditions and limits contained in this report.

QUALITY EVALUATION LABORATORY

Rating Report: 83TR 5 (Issue 2)

Date: 29th January, 1985

Origin:

Pages: 24

Capsule Thyristor Type P200CH02-H12

Written: B.W.P. Brown

Checked:

BWPB

Approved:

BWPA

The P200CH02-H12 series of thyristors are centre regenerative gate diffused devices in cold weld capsules, a 24 mm slice is employed.

Ratings and Characteristics

Ratings

Voltage Grades	: H02-H12
V_{DSM}	: 200-1200V
V_{RSM}	: 300-1300V
V_{DRM}, V_{RRM}	: 200-1200V
$I_T(AV)$; Single phase; 50Hz, 180° sinewave	
Double side cooled, $T_{HS} = 55^{\circ}C$; 85°C	: 295A, 195A
Single side cooled, $T_{HS} = 85^{\circ}C$	: 110A
$I_T(rms)$ Double side cooled, $T_{HS} = 25^{\circ}C$	: 600A
I_T d.c. " " " $T_{HS} = 25^{\circ}C$	: 480A
I_{TSM} : $t = 10ms$ half sinewave; T_J (initial) = 125°C;	
$V_{RM} = 0.6V_{RRM}(MAX)$	: 2700A
I_{TSM} : $t = 10ms$ half sinewave; T_J (initial) = 125°C; $V_{RM} \leq 10V$	: 2970A
I^2t : $t = 10ms$; T_J (initial) = 125°C; $V_{RM} = 0.6V_{RRM}(MAX)$	: $36.5 \times 10^3 A^2 SEC$
I^2t : $t = 10ms$; T_J (initial) = 125°C; $V_{RM} \leq 10V$	: $44.1 \times 10^3 A^2 SEC$
I^2t : $t = 3ms$; T_J (initial) = 125°C; $V_{RM} \leq 10V$	: $32.4 \times 10^3 A^2 SEC$
di/dt : (Repetitive): T_J 125°C Gate: 20V. 20 μ s Rise time 1 μ s	: 500A/ μ s
I_{FGM} : Anode positive with respect to cathode	: 18A
V_{FGM} : " " " " " "	: 12V
V_{RGM} :	: 5V
$P_G(AV)$:	: 1.5W
P_{GM} :	: 60W
V_{GD} :	: 0.25V
T_{HS} operating range	: -40°C to 125°C
T_{stg} Non-operating	: -40°C to 150°C

$I_{GT} : T_J = 25^{\circ}\text{C}$	)		: 200mA
$I_H : T_J = 25^{\circ}\text{C}$	)	$V_A = 6\text{ V}$	: 600mA
$V_{GT} : T_J = 25^{\circ}\text{C}$	)		: 3V
$V_O : T_J = 125^{\circ}\text{C}$			: 1.6V
$r_T : T_J = 125^{\circ}\text{C}$			: 1.23mohms
$V_{TM} : I_{TM} = 715\text{A}$	$T_{VJ} = 125^{\circ}\text{C}$		: 2.48V
$R_{th}(J-HS)$	Double side cooled		: 0.095°C/W
	Single side cooled		: 0.19°C/W
dV/dt	Linear ramp to $0.8V_{DRM(max)}$	$T_J = 125^{\circ}\text{C}$: Gate O/C repetitive	: $200\text{V}/\mu\text{s}^*$
$I_{DRM} : T_J = 125^{\circ}\text{C}$	$V_{DM} = V_{DRM(max)}$		: 30mA
$I_{RRM} : T_J = 125^{\circ}\text{C}$	$V_{RM} = V_{RRM(max)}$		: 30mA
$Q_{RR} : I_{TM} = 300\text{A}$	$dI/dt : 20\text{ A}/\mu\text{s}$, 50% chord value		
$V_{RM} : 50\text{V}$	$T_{VJ} = 125^{\circ}\text{C}$		: 25 μC (Typical)
$t_q : I_{TM} = 300\text{A}$	$dI/dt : 20\text{ A}/\mu\text{s}$	$T_J = 125^{\circ}\text{C}$	$V_{RM} = 50\text{V}$
	$dV/dt = 200\text{V}/\mu\text{s}$	to $0.8V_{DRM}$	: 25-40 μs
	When specified	$20\text{V}/\mu\text{s}$ to $0.8V_{DRM}$	: 20-35 μs (Typical)
Mounting force:			: 330-550Kgf
Outline drawing:			: 101A212
Outline (JEDEC NO.)			: TO-200AB

Extension of Turn-off Time

This Report is applicable to other tq/reapplied dv/dt combinations when supply has been agreed by Sales/Production.

* Repetitive dv/dt

Higher dv/dt selections are available up to 1000V/us on request.

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Voltage Ratings

Voltage Grade 'H'	VDSM VDRM VRRM V	VRSM V	VD VR DC
02	200	300	140
03	300	400	210
04	400	500	260
06	600	700	420
08	800	900	560
10	1000	1100	700
12	1200	1300	810

Extension of Voltage Grades

This report is applicable to other and higher voltage grades when supply has been agreed by Sales/Production.

2. INTRODUCTION

The P200CH02-H12 thyristor series are diffused regenerative gate devices employing a 24 mm slice in cold weld housings.

3. NOTES ON THE RATINGS

a) Rate of rise of on-state current

The maximum un-primed rate of rise of on-state current must not exceed 1000A/uS at any time during turn-on on a non-repetitive basis. For repetitive performance the on-state rate of rise of current must not exceed 500A/uS at any time during turn-on. Note that these values of current rate of rise apply to the circuit external to the device and its specified snubber network and device current rates of rise will be higher.

b) Square wave ratings

These ratings are given for leading edge linear rates of rise of forward current of 100 and 500 A/uS.

c) Duty Cycle Lines

The 100% duty cycle line appears on all these ratings. These frequency ratings are presented in the form that all duty cycles may be represented by straight parallel lines.

d) Maximum operating frequency

The maximum operating frequency is set by the time required for the thyristor to turn off (t_q) and for the off-state voltage to reach full value (t_v), i.e.

$$f_{\text{max.}} = \frac{1}{t_{\text{pulse}} + t_q + t_v}$$

e) 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

Let R_{th} be the steady-state thermal resistance (junction to sink)

and T_{SINK} be the heat sink temperature

Then the average dissipation will be

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

and

$$T_{SINK} = 125 - W_{AV} \cdot R_{th}$$

4. 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:

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

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

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 heat sink temperature

The total dissipation is now given by

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

b) Determination without Measurement

In circumstances where it is not possible to measure voltage and current conditions, or for design purposes, the additional losses may be estimated from curves on page 14. A typical R-C snubber network is connected across the thyristor to control the transient reverse voltage waveform.

Let E be the value of energy per reverse cycle in joules (curves on p. 14)

Let f be the operating frequency in Hz

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

where $T_{\text{SINK new}}$ is the required maximum heat sink temperature

and $T_{\text{SINK original}}$ is the heat sink temperature given with the frequency ratings.

5. GATE DRIVE

The recommended gate drive is 20V, 20ohms with a short-circuit current rise time of not more than 1us. This gate drive must be applied when using the full di/dt capability of the device.

6. THE DV/DT SUPPRESSION NETWORK

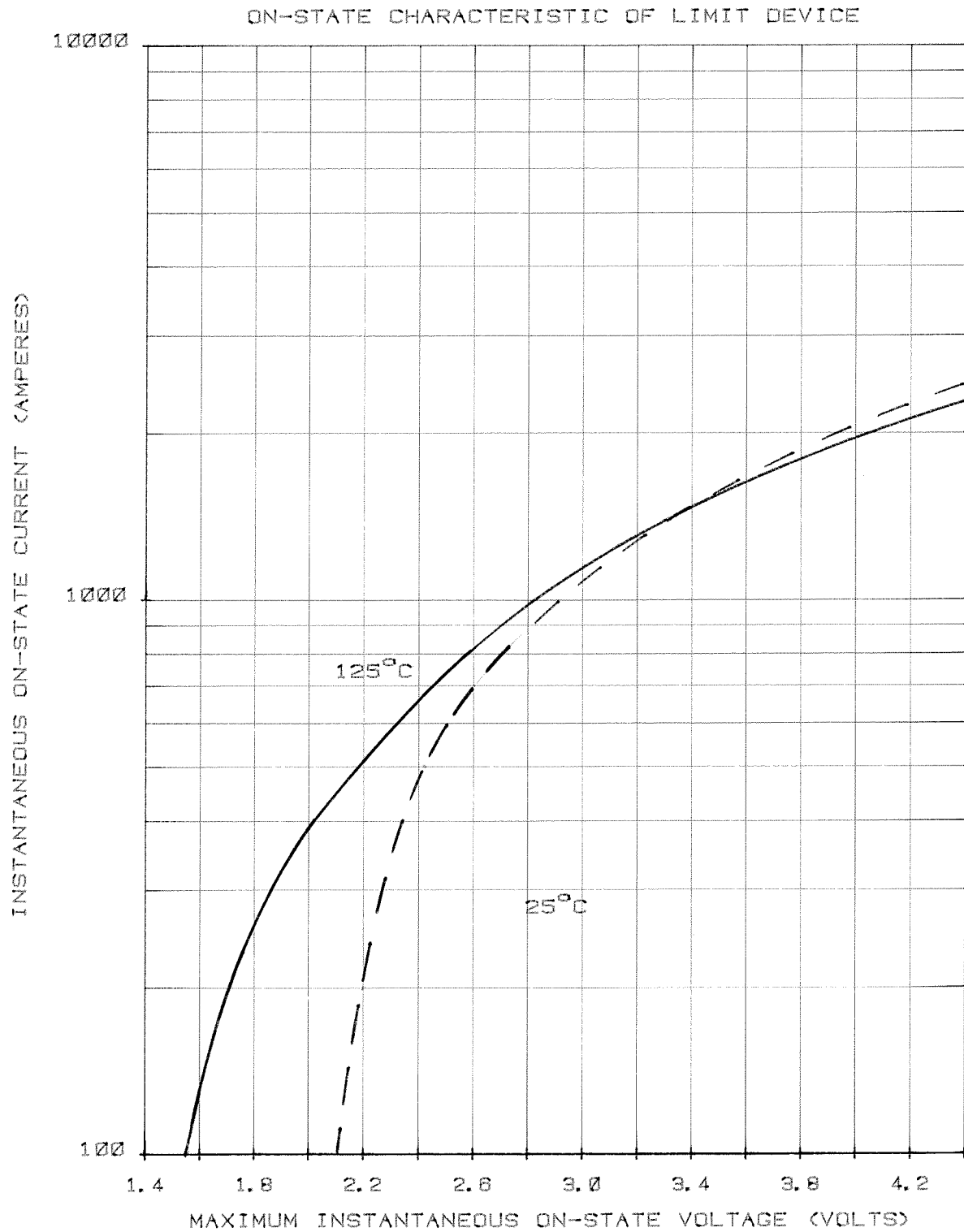
The effect of a conventional resistor-capacitor snubber of 0.22uF 22 ohms has been included in these ratings and all rating di/dt values apply to the circuit external to the thyristor and its suppression network.

7. NOTE 1

REVERSE RECOVERY LOSS BY MEASUREMENT

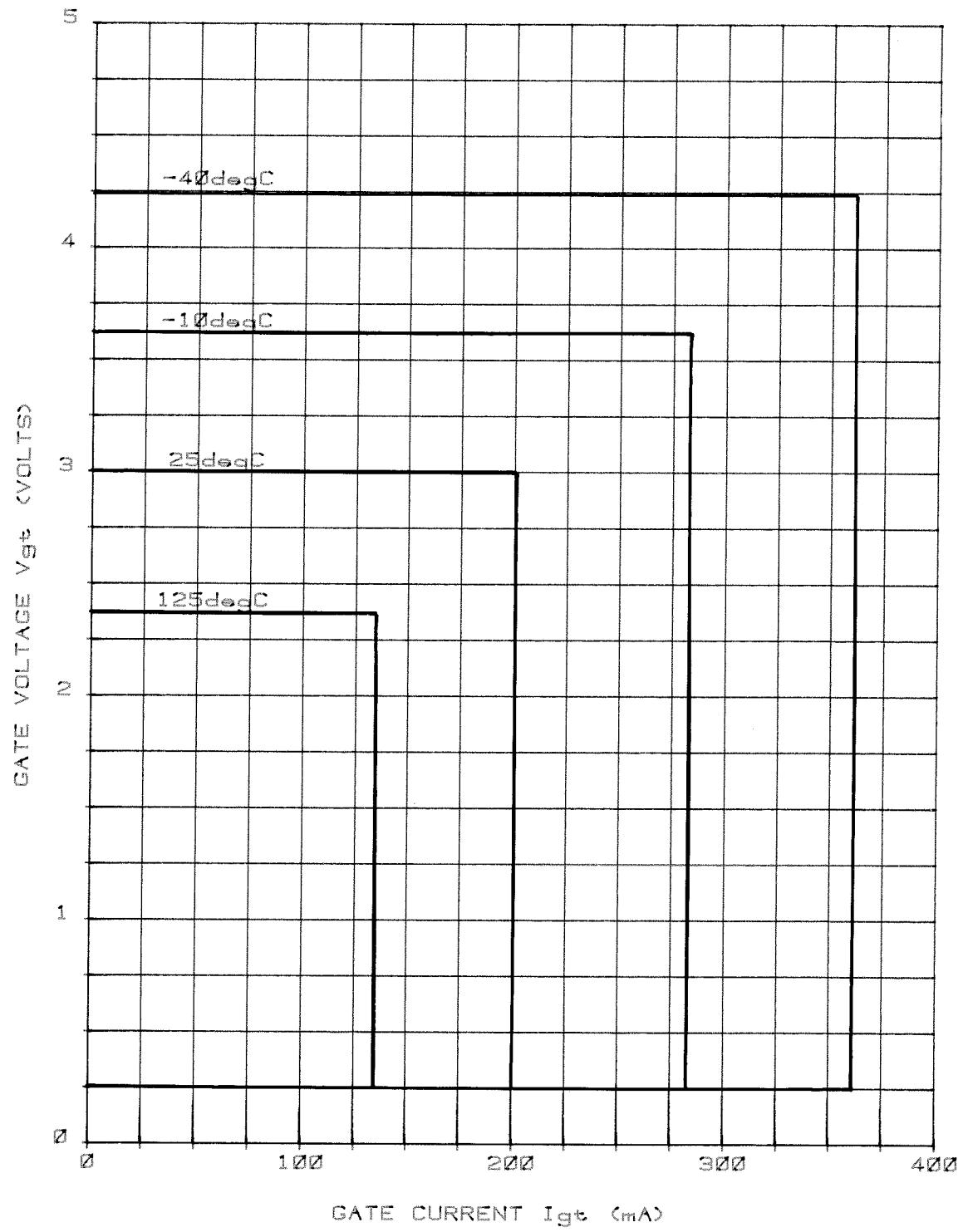
This thyristor has a low reverse recovered charge and peak reverse recovery current. When measuring the charge care must be taken to ensure that:

- 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.

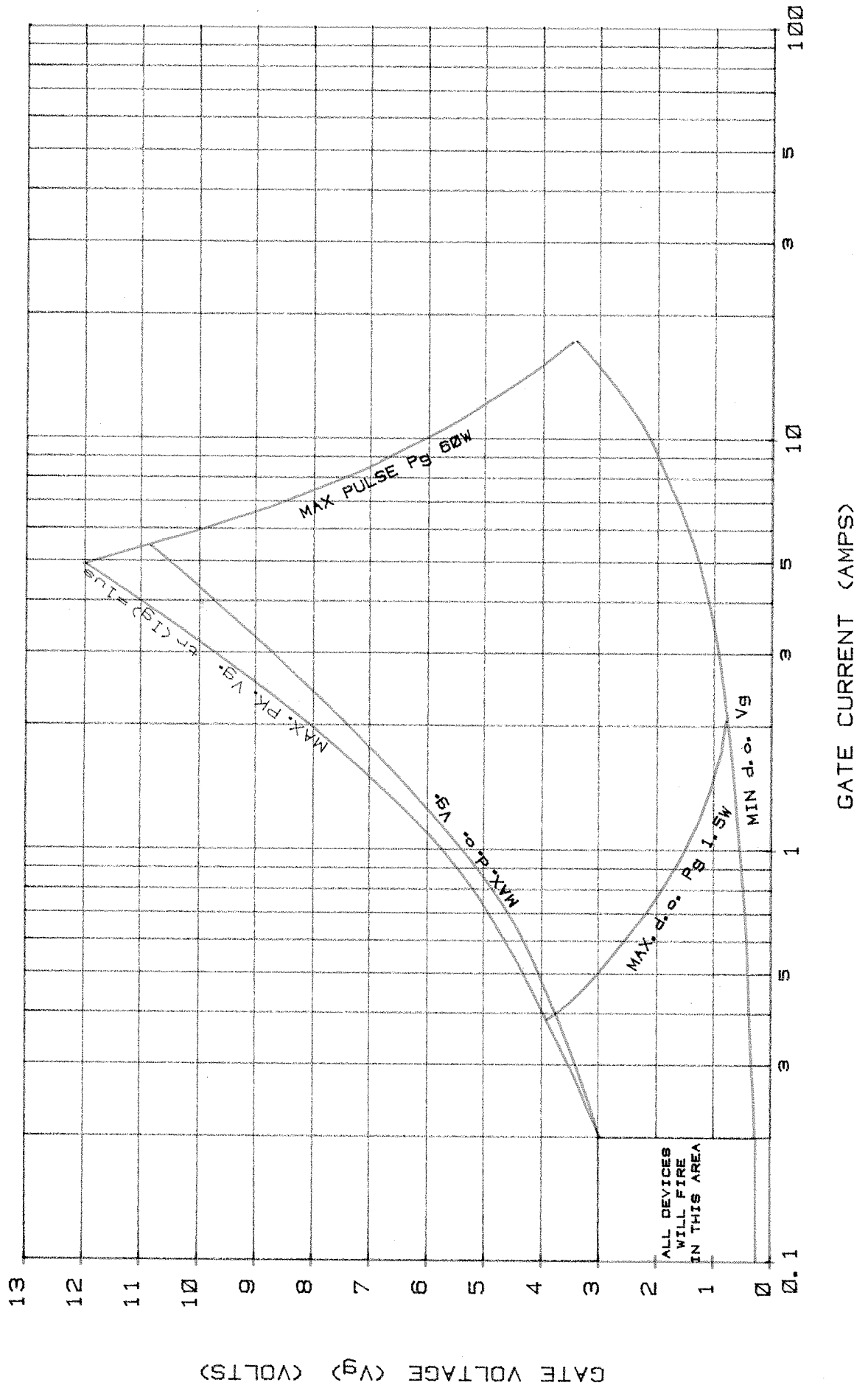


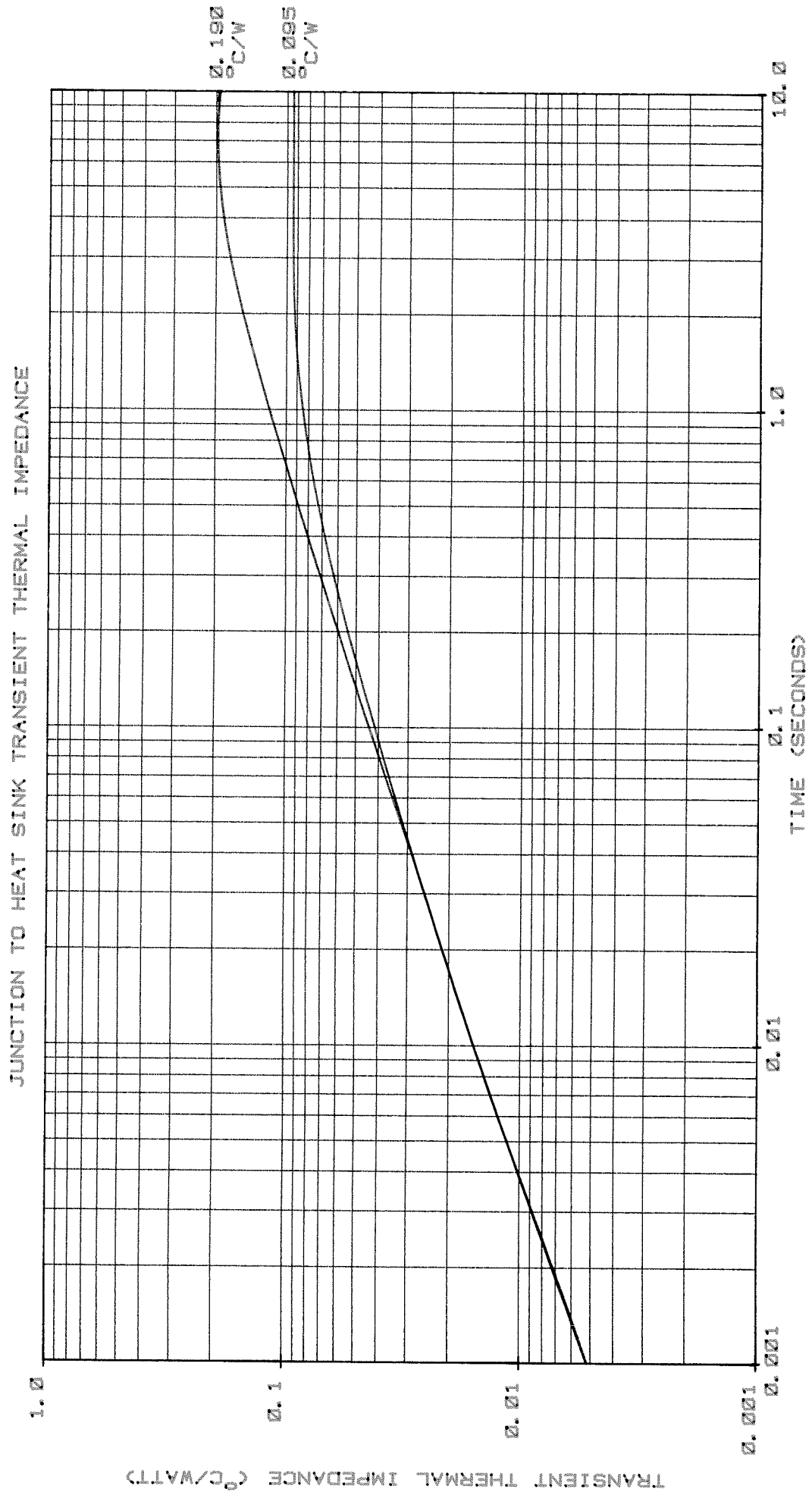
GATE TRIGGERING CHARACTERISTICS

(TRIGGER POINTS OF ALL THYRISTORS LIE IN THE AREAS SHOWN)



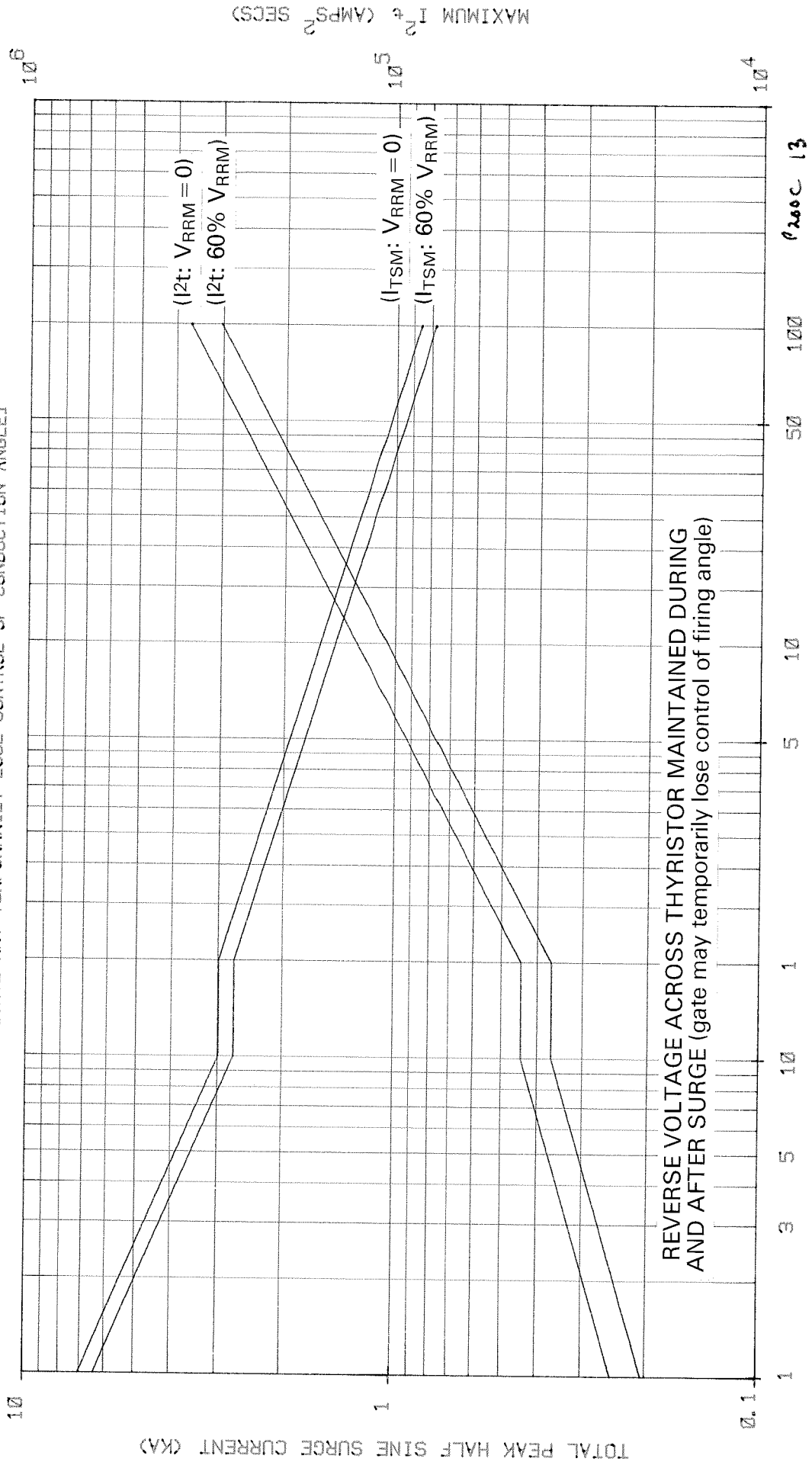
GATE CHARACTERISTICS AT 25°C JUNCTION TEMPERATURE





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

IGATE MAY TEMPORARILY LOSE CONTROL OF CONDUCTION ANGLE

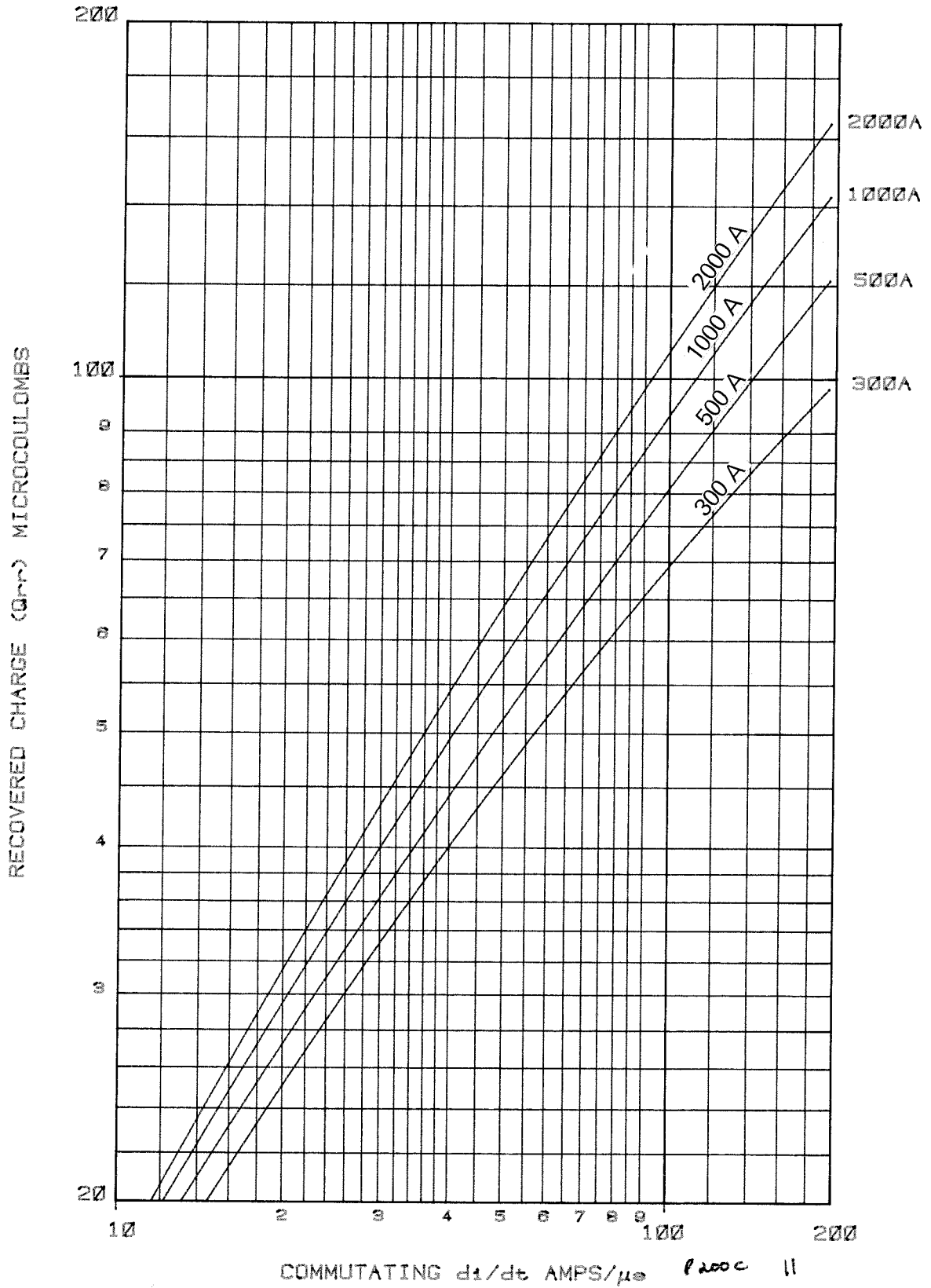


REVERSE VOLTAGE ACROSS THYRISTOR MAINTAINED DURING AND AFTER SURGE (gate may temporarily lose control of firing angle)

DURATION OF SURGE (ms) DURATION OF SURGE (cycles at 50 Hz)

P200C'11

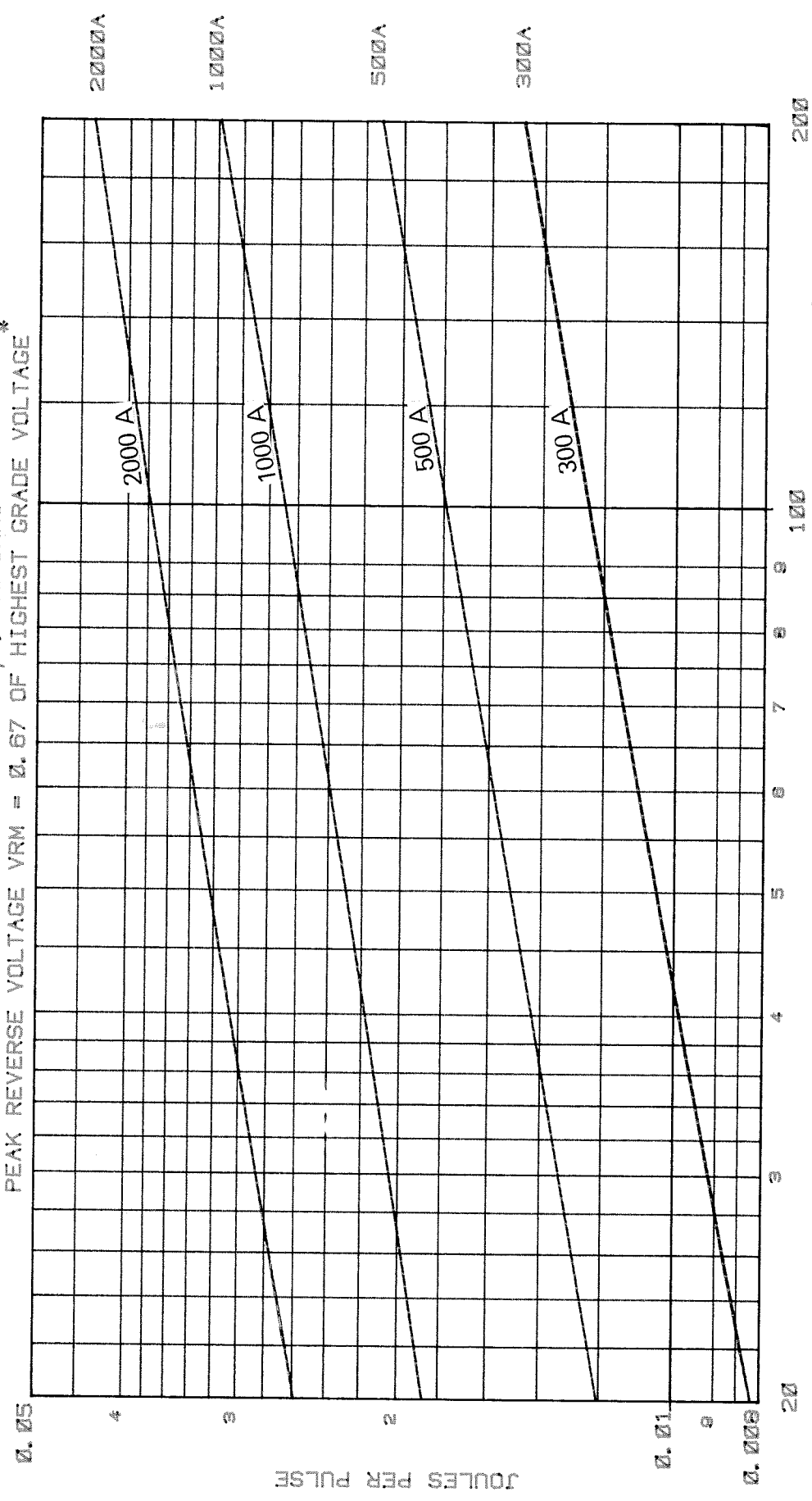
TYPICAL RECOVERED CHARGE AT 125°C JUNCTION TEMPERATURE



P200C 17

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

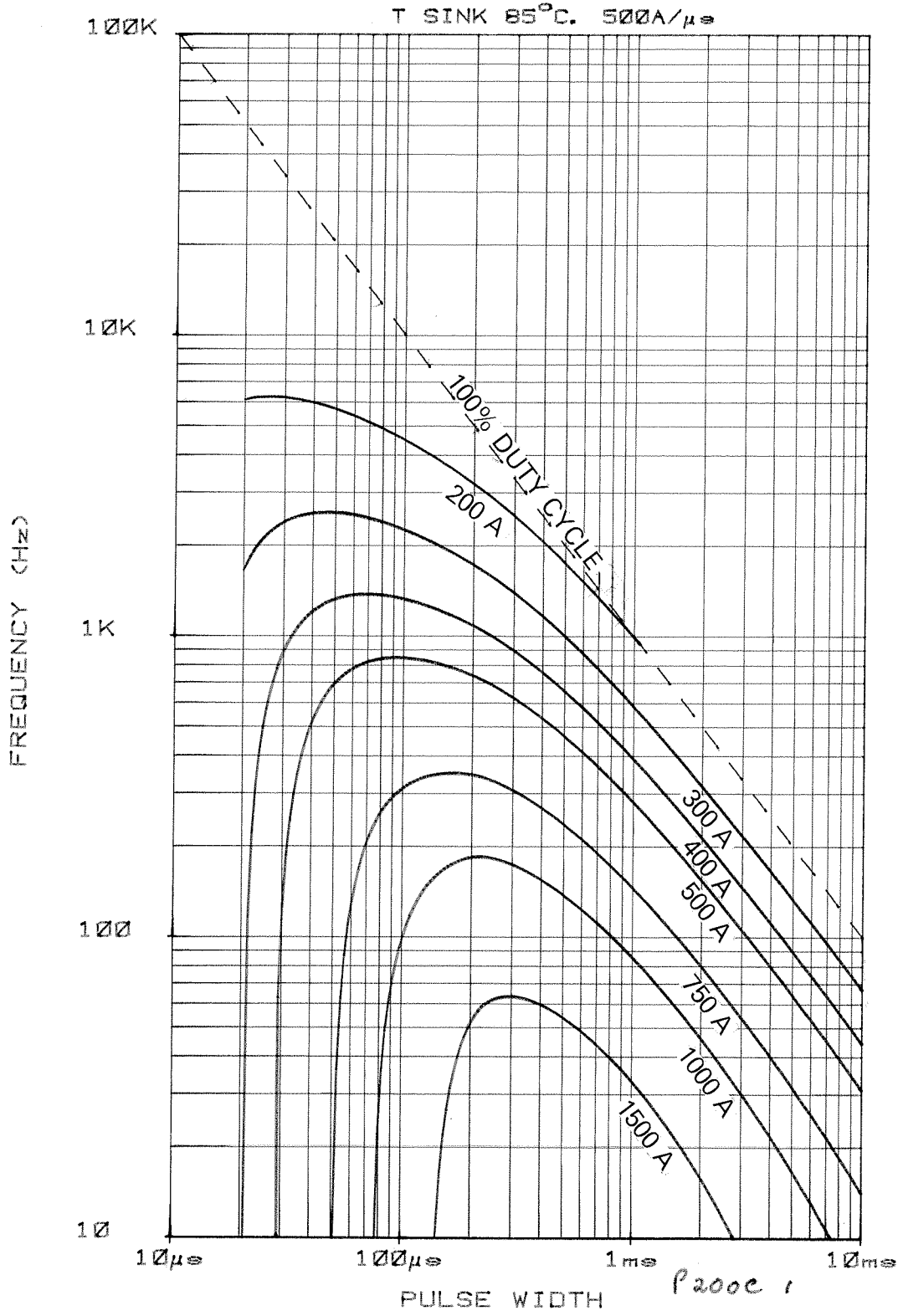
SNUBBER CONNECTED 0.22μF, 22 OHMS
PEAK REVERSE VOLTAGE VRM = 0.67 OF HIGHEST GRADE VOLTAGE*



COMMUTATING di/dt AMPS/μs

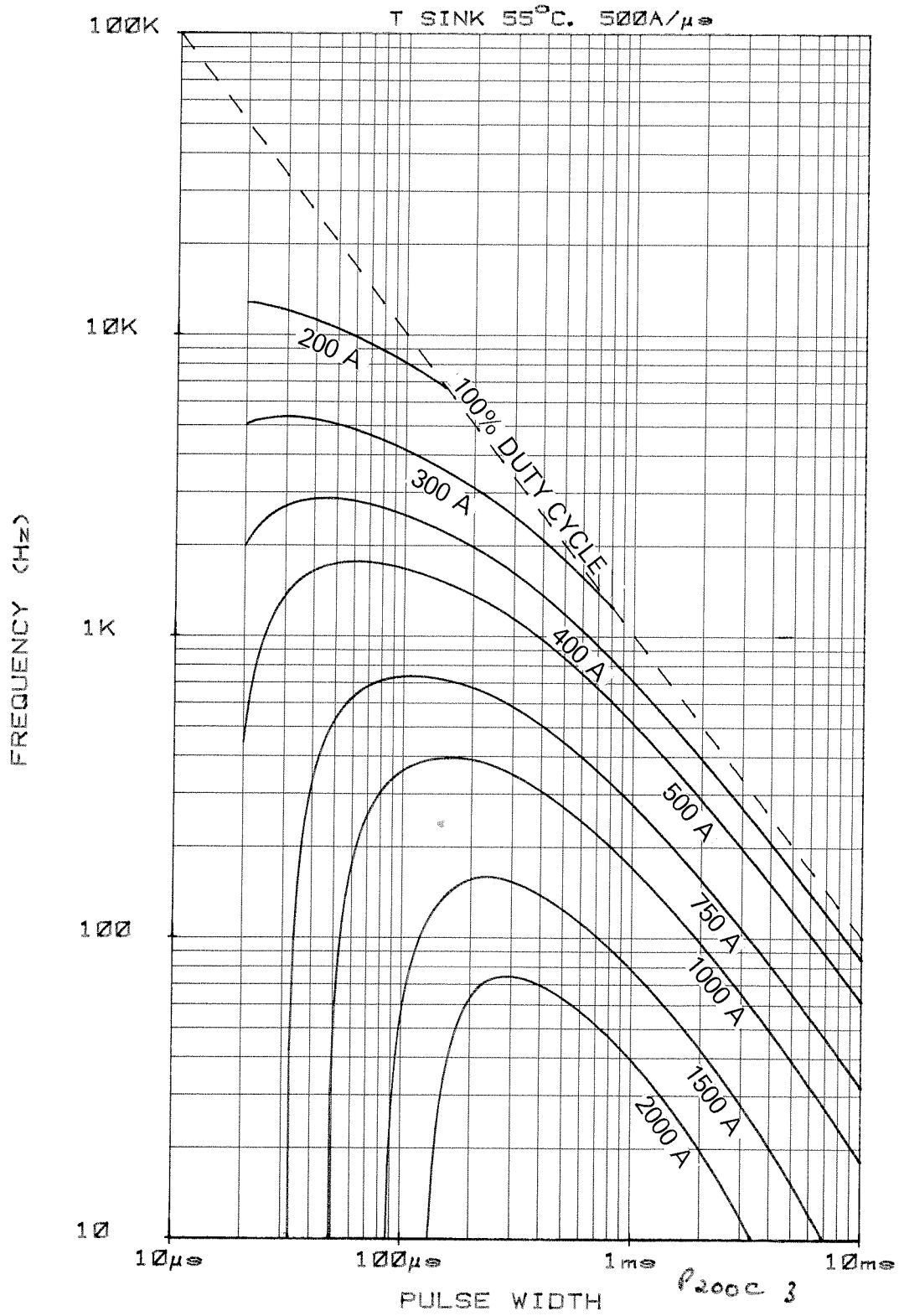
* NOTE: ENERGY PER PULSE SHOULD BE ADJUSTED PRO RATA WITH APPLIED PEAK RECOVERY VOLTAGE

P200C / 1



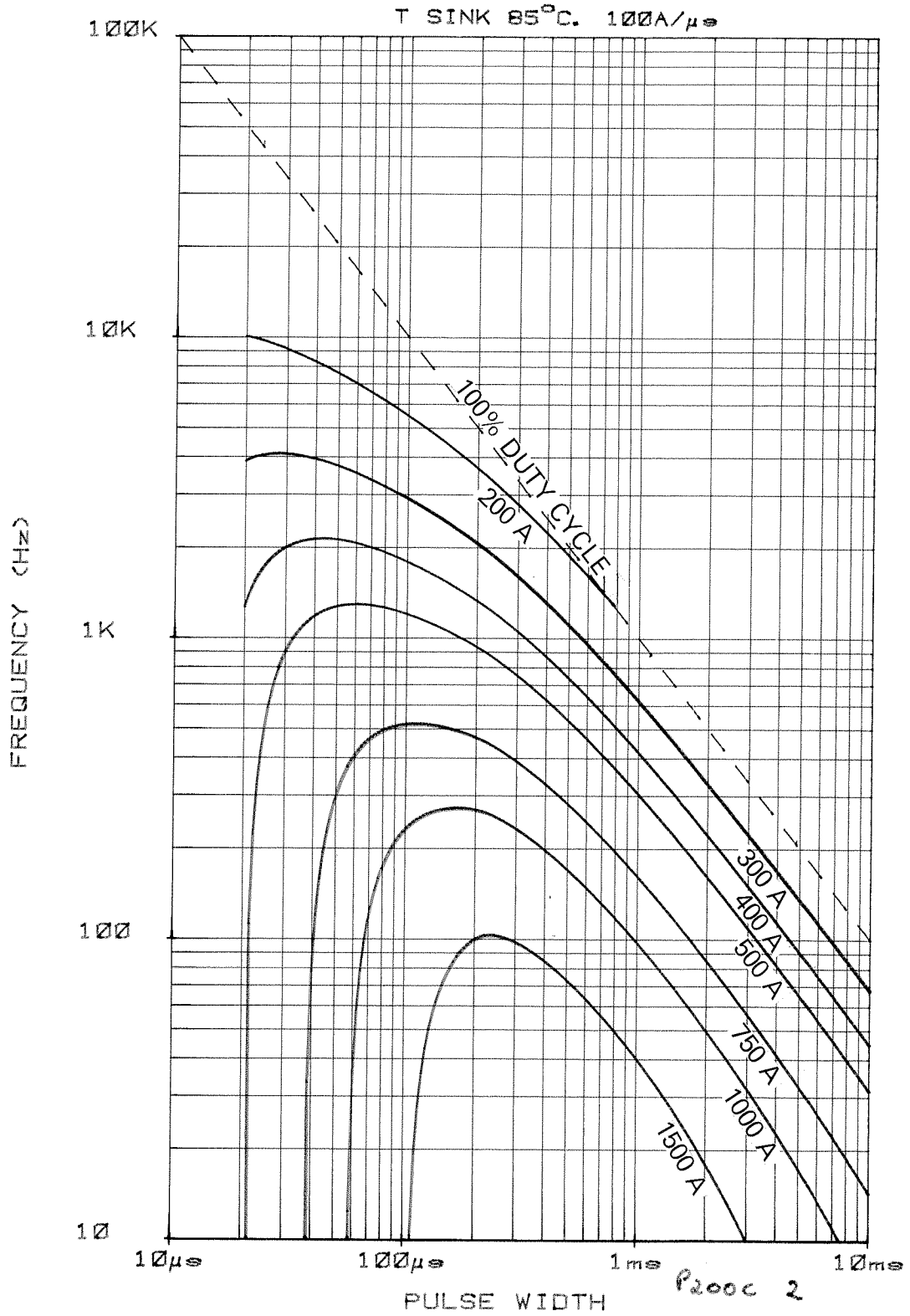
P200C '3

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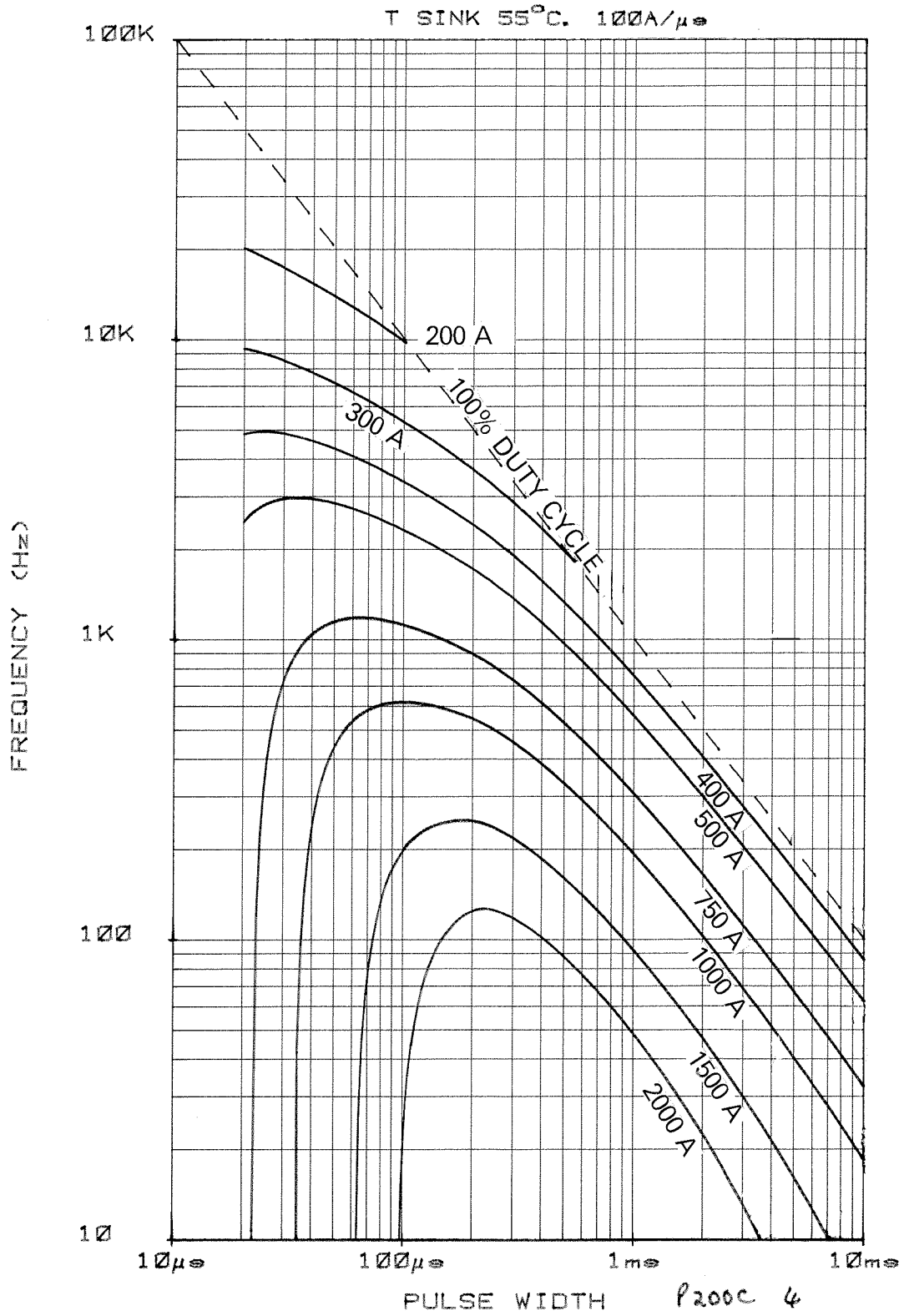
P200C '2

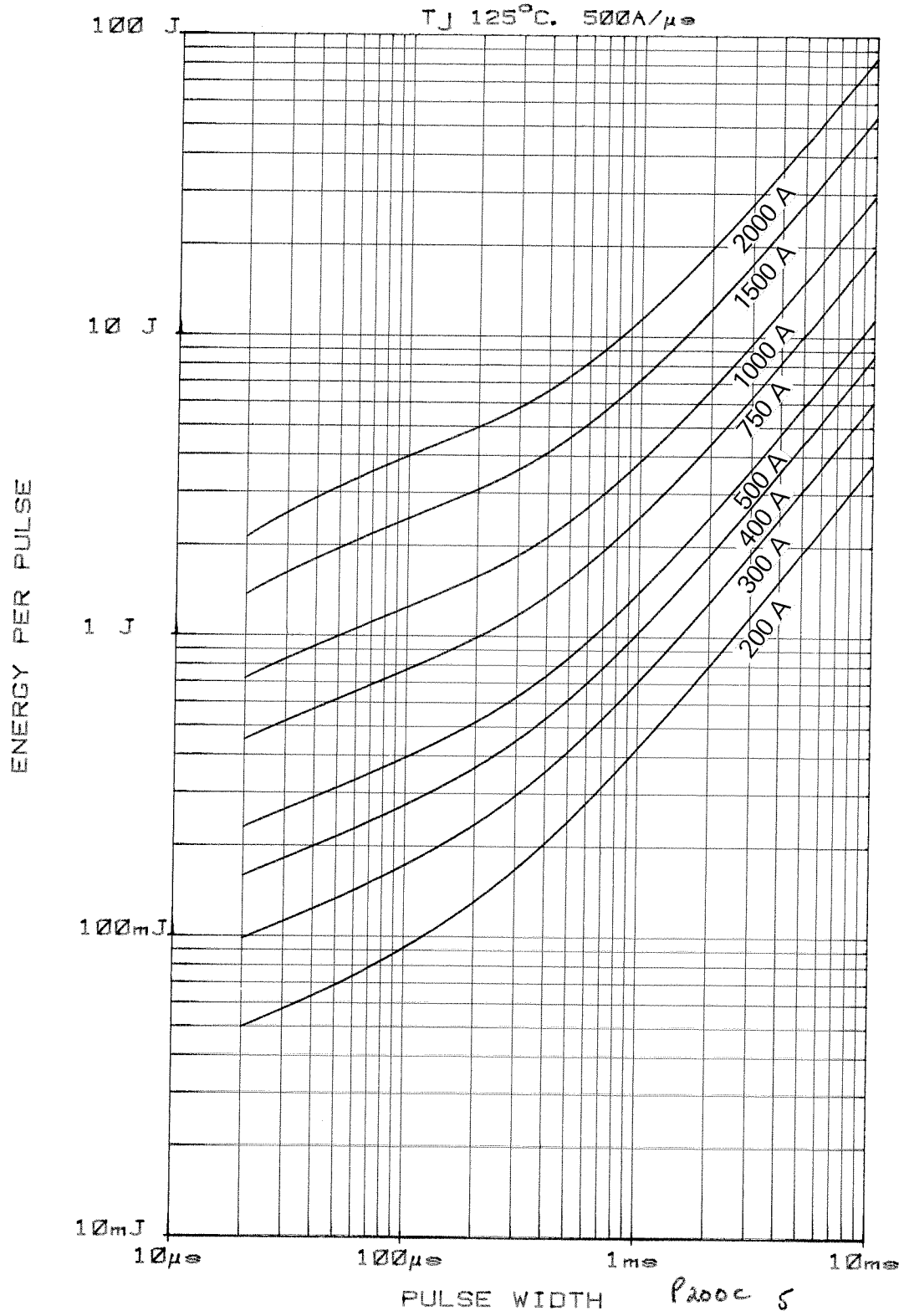
- 17 -



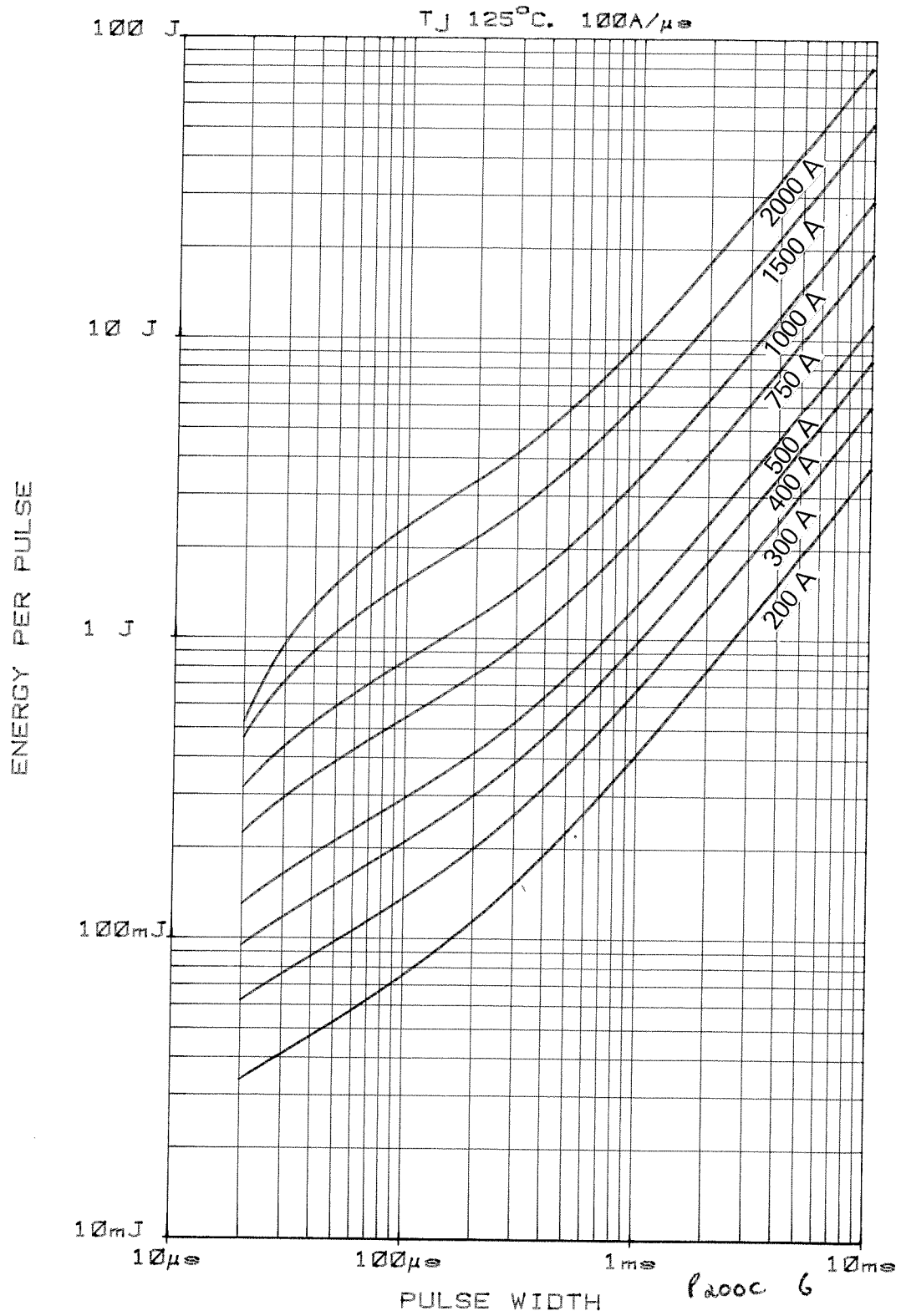
P200C'4

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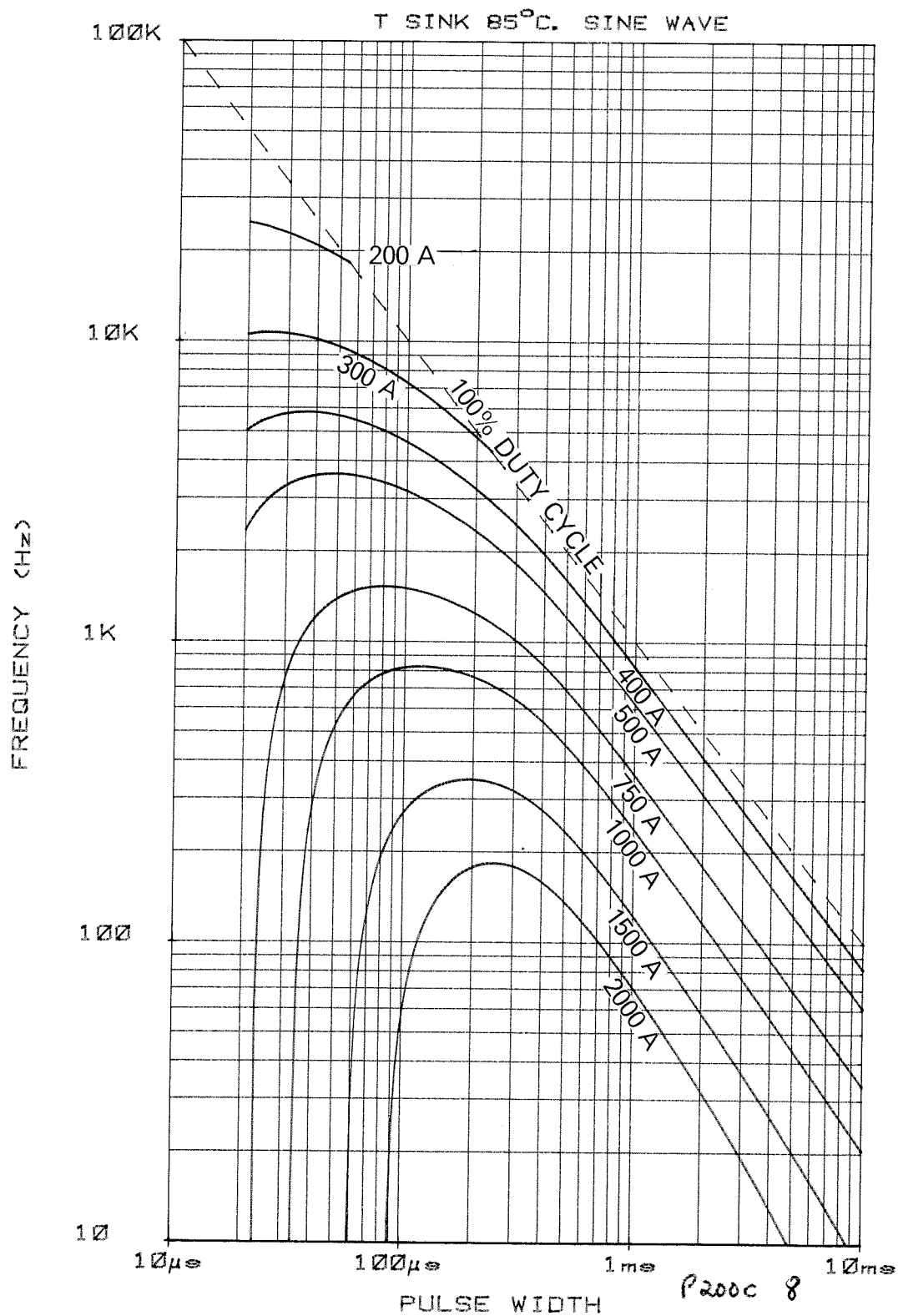


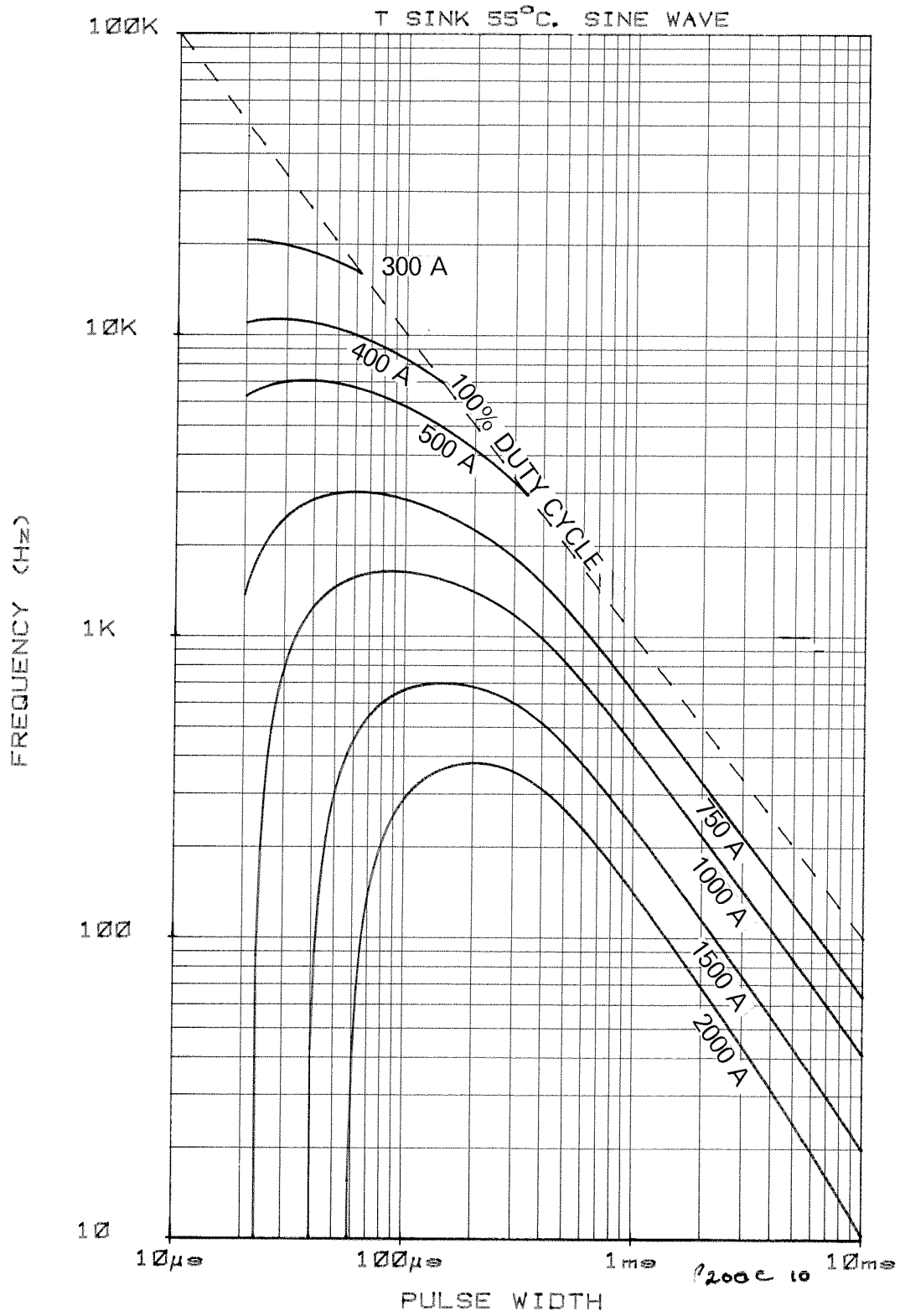
P2000-6



P200C'8

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P200C '9

