Fast Turn-off Thyristor Stud
Types P0248SX10# to P0248SX12#

The data sheet on the subsequent pages of this document is a scanned copy of existing data for this product.
(Rating Report 83TR8 Issue 2)

This data reflects the old part number for this product which is: P200PH02-12.
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 grades 10 and 12 (1000V & 1200V V_{RRM}/V_{DRM})
Only SC outline drawing (W18) in datasheet

The following links will direct you to the appropriate outline drawings
Outline W18 – ¾" Ceramic stud
Outline W25 – ¾" Ceramic stud removed

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			
P0248	SX	♦♦	**0**
Fixed Type Code	SC - ¾" Ceramic stud SD – ¾" Ceramic stud removed	Voltage code $V_{RRM}/100$ 10-12	Fixed Turn-off Time Code D = 20µs, E = 25µs, F = 30µs
Typical Order Code: P0248SC12D, ¾" Ceramic stud, 1200V V_{RRM}/V_{DRM}, 20µs t_q			

IXYS Semiconductor GmbH
Edisonstraße 15
D-68623 Lampertheim
Tel: +49 6206 503-0
Fax: +49 6206 503-627
E-mail: marcom@ixys.de

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

WESTCODE
An IXYS Company

www.westcode.com

www.ixys.com

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

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

QUALITY EVALUATION LABORATORY

Rating Report: 83TR8 (Issue 2) **Date:** 29th January, 1985

Origin: **Pages:** 24

Thyristor type P200PH02-H12

Written: B.W.P. Brown **Checked:** BWPB **Approved:** BRS

The P200PH02-H12 series of thyristors are centre regenerative gate diffused devices mounted under spring pressure in a stud base, top hat housing with flexible lead. A 24mm diameter 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 T_{CASE} = 85°C	: 160A
I_T(rms) max.	: 355A
I_T d.c. max.	: 355A
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 x $10^3 A^2$SECS
I^2t : t = 10ms; T_J(initial) =125°C : $V_{RM} \leq$ 10V	: 44.1 x $10^3 A^2$SECS
I^2t : t = 3ms; T_J (initial) =125°C : $V_{RM} \leq$ 10V	: 32.4 x $10^3 A^2$SECS
di/dt: (Repetitive) T_J 125°C. Gate:20V.20Ω .Rise-time 1μS	: 500A/uS
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 to 125°C
T_{stg} Non-operating	: -40 to 150°C

Characteristics

(maximum values unless stated otherwise)

I_{GT} : T_J = 25°C)		
I_H : T_J = 25°C)	V_A = 6 V, I_A = 1A	: 200mA
V_{GT} : T_J = 25°C)		: 600mA
V_O : T_J = 125°C		: 3V
r_T : T_J = 125°C		: 1.6V
V_{TM} : I_{TM} = 600A	T_{VJ} = 125°C	: 1.23mohms
R_{th} (J/C)		: 2.34V
dV/dt : Linear ramp to $0.8V_{DRM}$(max)	T_J = 125°C: Gate O/C	: 0.12°C/W
		repetitive : 200V/uS*
I_{DRM} : T_J = 125°C	$V_{DM} = V_{DRM}$(max)	: 30mA
I_{RRM} : T_J = 125°C	$V_{RM} = V_{RRM}$(max)	: 30mA
Q_{RR} : I_{TM} = 300 A	dI/dt 20 A/us, 50% chord value	:
V_{RM} : 50	T_{VJ} = 125°C	: 25uC (Typical)
tq : I_{TM} 300 A	dI/dt 20 A/us; T_J = 125°C V_{RM} = 50V	:
	dV/dt = 200V/us to $0.8V_{DRM}$	: 25-40uS
	When specified,20V/us to $0.8V_{DRM}$ Typical	: 20-35uS
Outline drawing		: 101A225
R_{th} (C-H.S.)		: 0.04°C/W
Mounting torque		: 2.5-2.77Kg.m.

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'	V_{DSM} V_{DRM} V_{RRM} V	V_{RSM} V	V_D V_R 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 P200PH02-12 thyristor series are diffused centre regenerative gate devices employing a 24 mm diameter slice mounted on a stud base with top hat housing and flexible lead.

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 500A/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 (tq) and for the off-state voltage to reach full value (tv), i.e.

$$f_{max.} = \frac{1}{t_{pulse} + tq + tv}$$

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 Ep 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 case) and T_{CASE} be the case temperature

Then the average dissipation will be

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

and

$$T_{CASE} = 125 - W_{AV}, R_{th}$$

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 case temperature can then be evaluated from:

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

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 case temperature

The total dissipation is now given by

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

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

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

where $T_{CASE\ new}$ is the required maximum case temperature and $T_{CASE\ original}$ is the case 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 0.22 uf, 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:

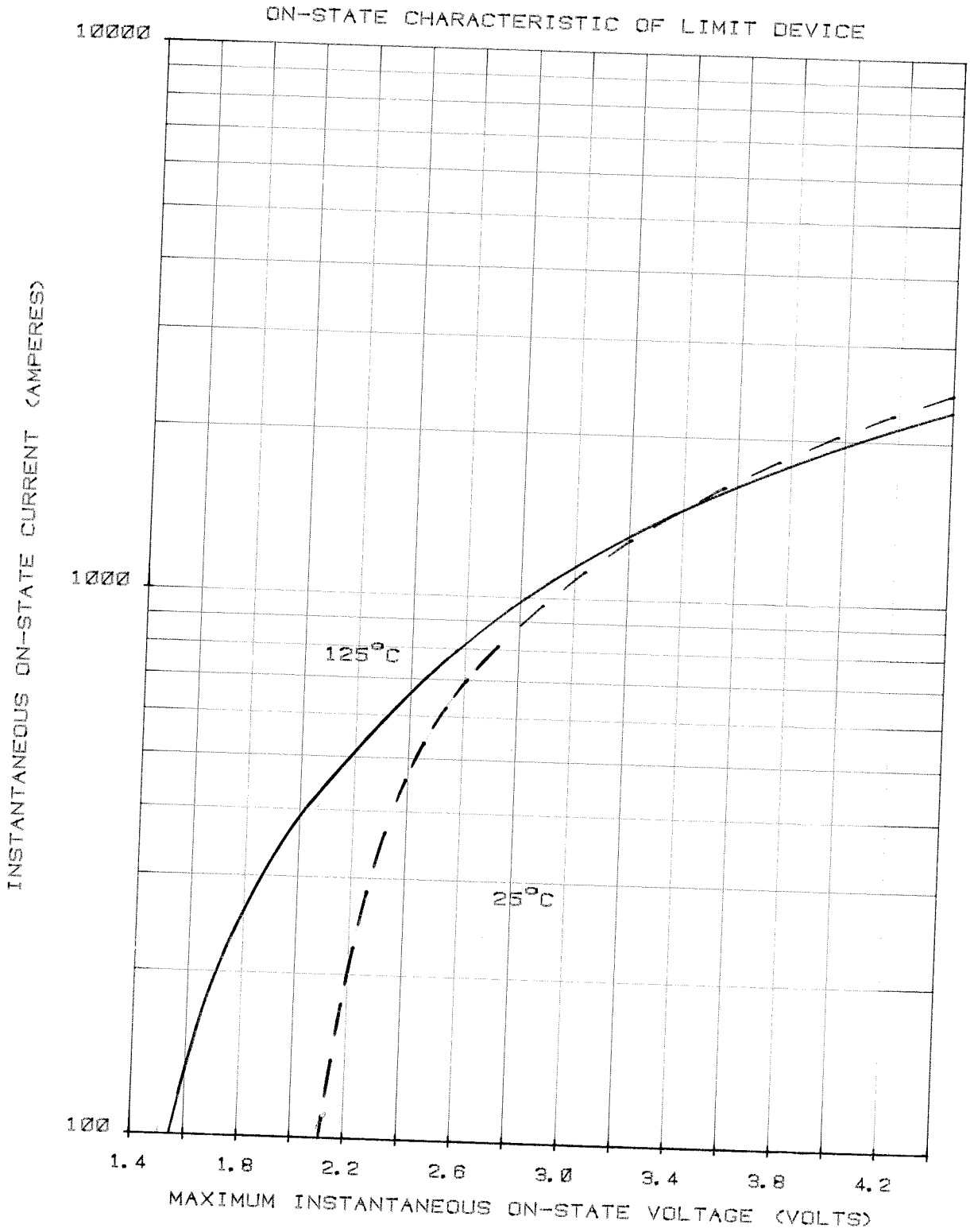
a) a.c. coupled devices such as current transformers are not affected by prior passage of high amplitude forward current.

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

NOTE 2

HOUSING LOSS

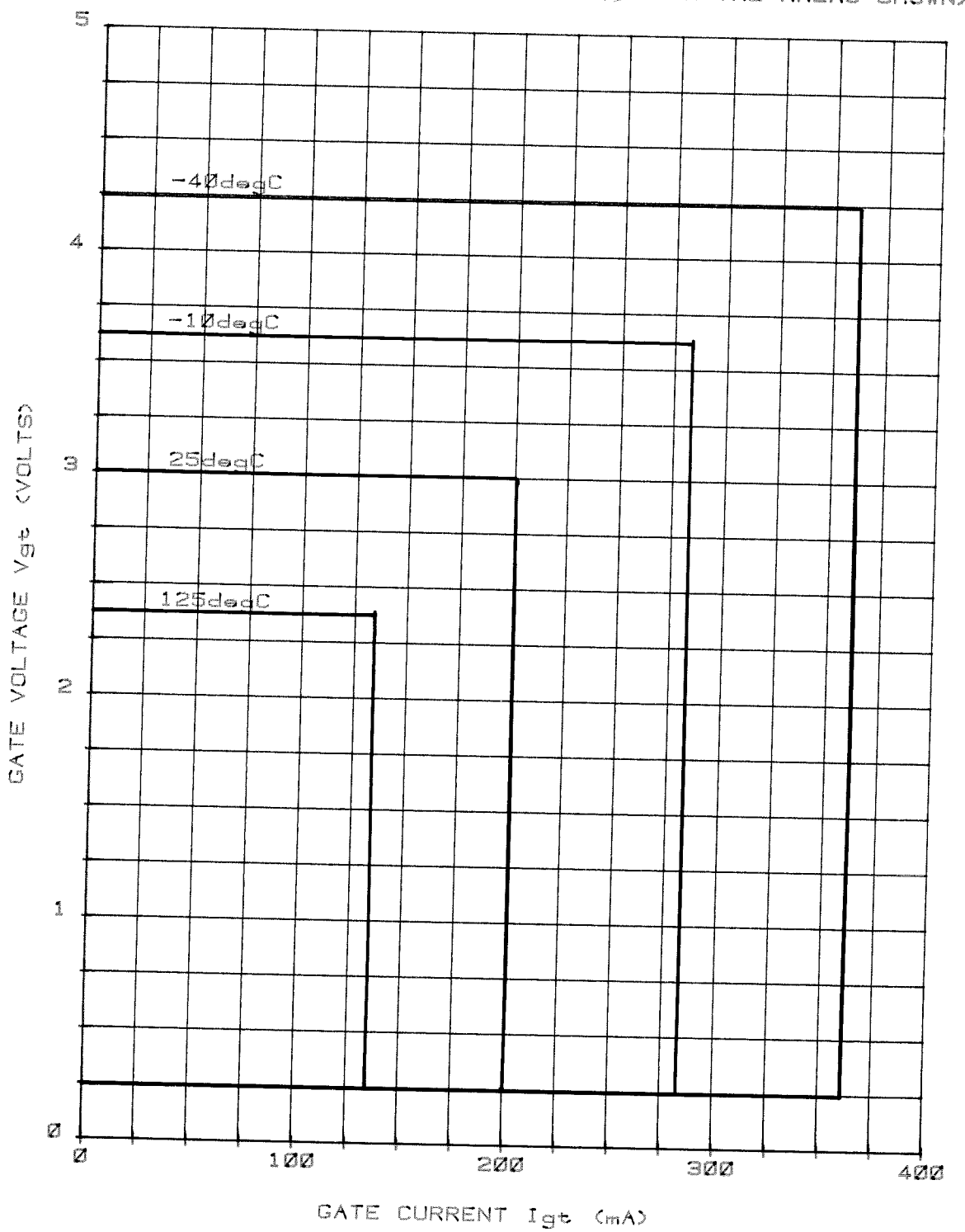
The loss caused by coupling between housing and anode current (which gives rise to additional heating at high frequency) has been incorporated into the curves of forward energy loss per pulse.

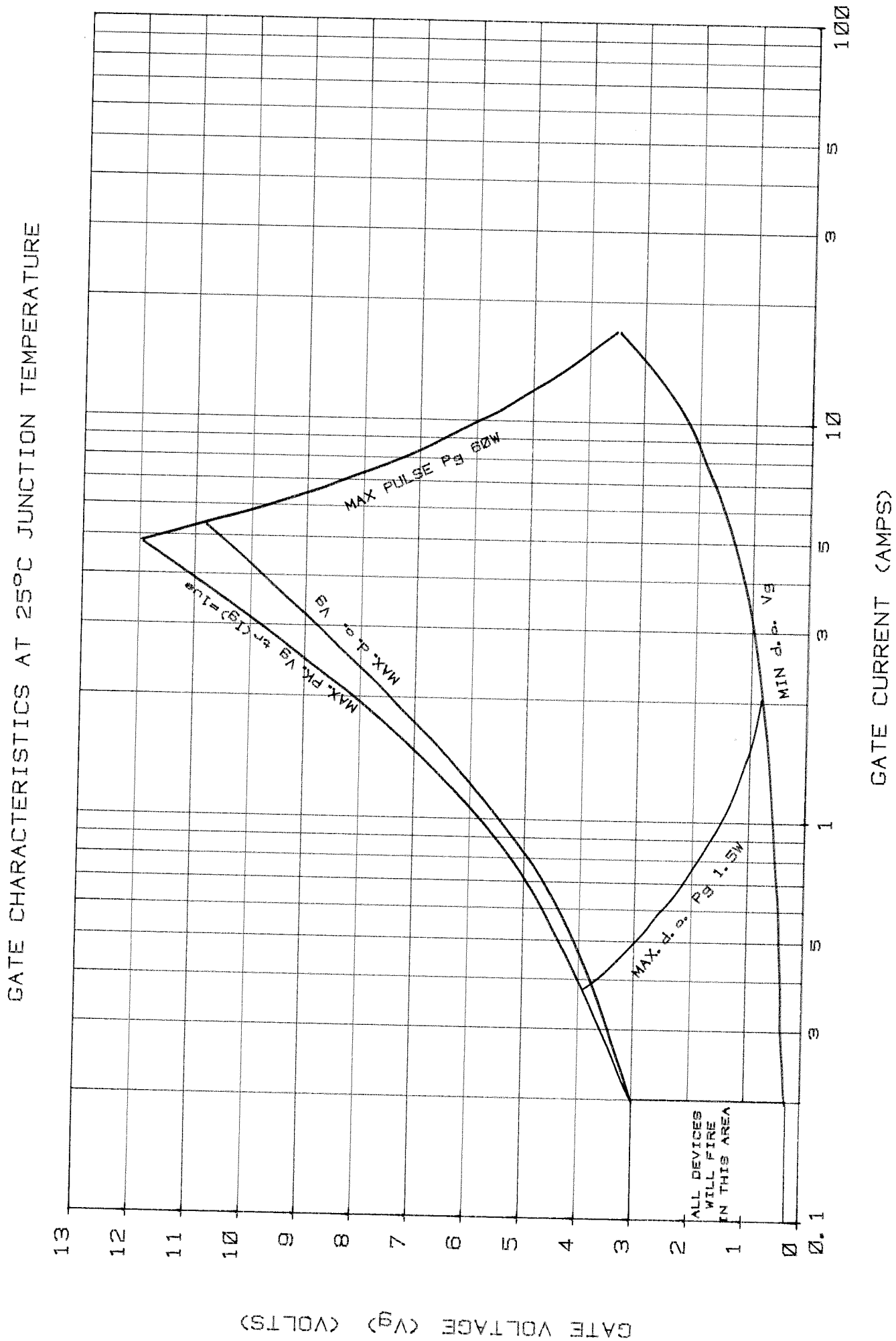

ON-STATE CHARACTERISTIC OF LIMIT DEVICE
10000
1000
100
INSTANTANEOUS ON-STATE CURRENT (AMPERES)
125°C
25°C
1.4
1.8
2.2
2.6
3.0
3.4
3.8
4.2
MAXIMUM INSTANTANEOUS ON-STATE VOLTAGE (VOLTS)

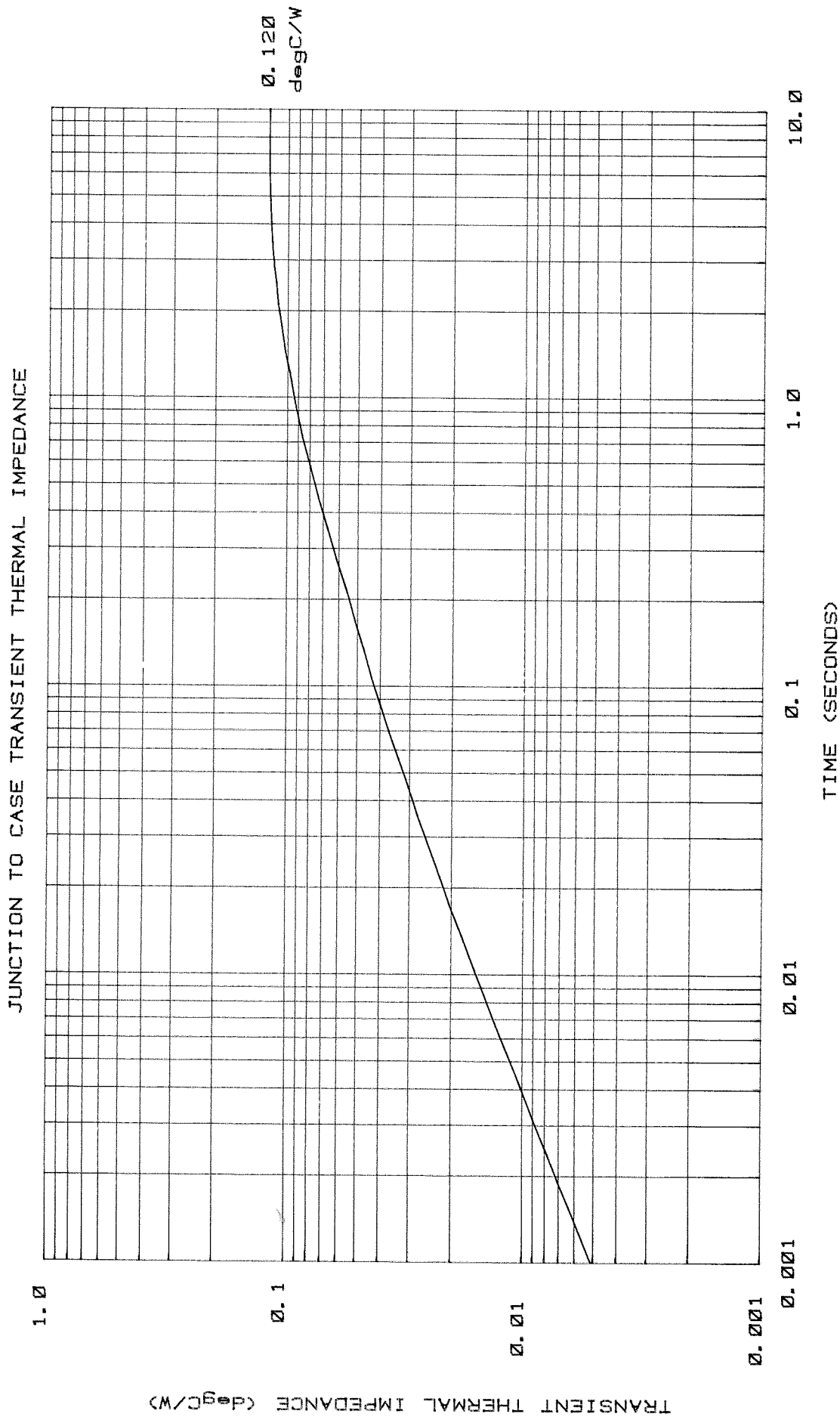
P200P
Fig 15

GATE TRIGGERING CHARACTERISTICS

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

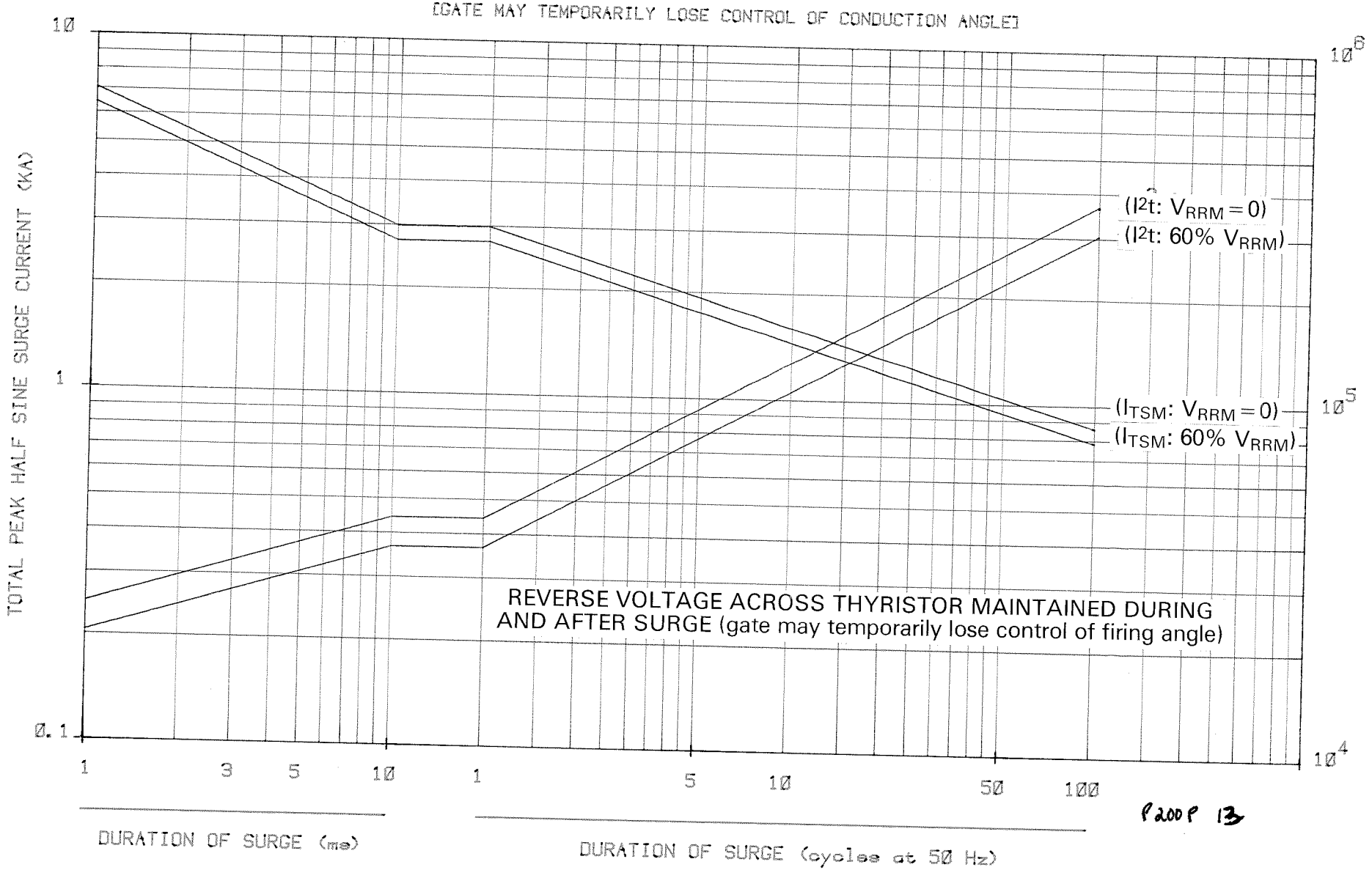



GATE CHARACTERISTICS AT 25°C JUNCTION TEMPERATURE
MAX PULSE Pg 60W
MAX. d.c. Vg
MAX. PK. Vg for (Ig) =1us
MAX. d.c. Pg 1.5W
MIN d.c. Vg
ALL DEVICES WILL FIRE IN THIS AREA
GATE VOLTAGE (Vg) (VOLTS)
GATE CURRENT (AMPS)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.1
100
50
30
10
5
3
1


JUNCTION TO CASE TRANSIENT THERMAL IMPEDANCE
0.120 degC/W
1.0
0.1
0.01
0.001
0.001
0.01
0.1
1.0
10.0
TIME (SECONDS)
TRANSIENT THERMAL IMPEDANCE (degC/W)

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

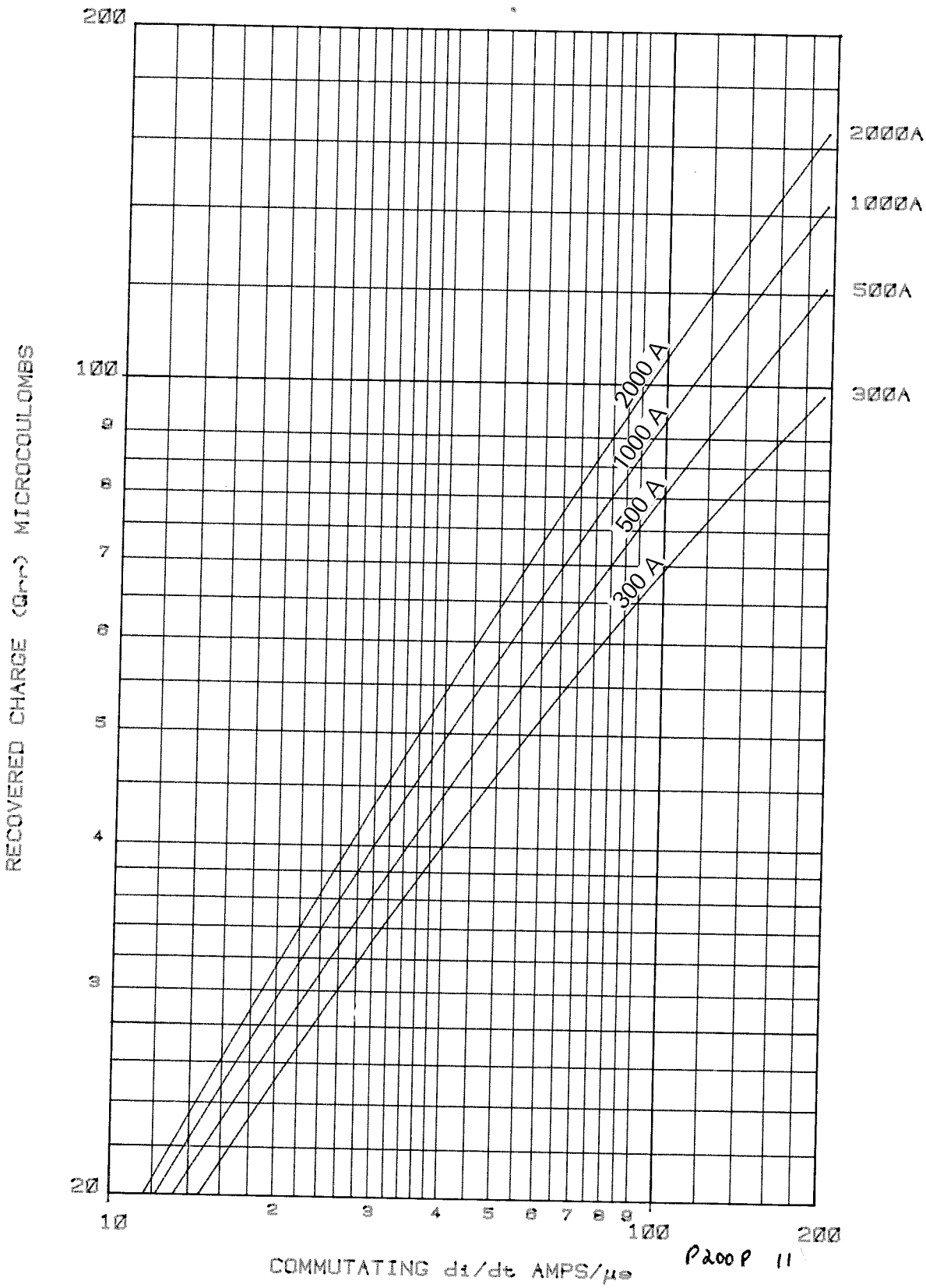
[GATE MAY TEMPORARILY LOSE CONTROL OF CONDUCTION ANGLE]



P200P 13

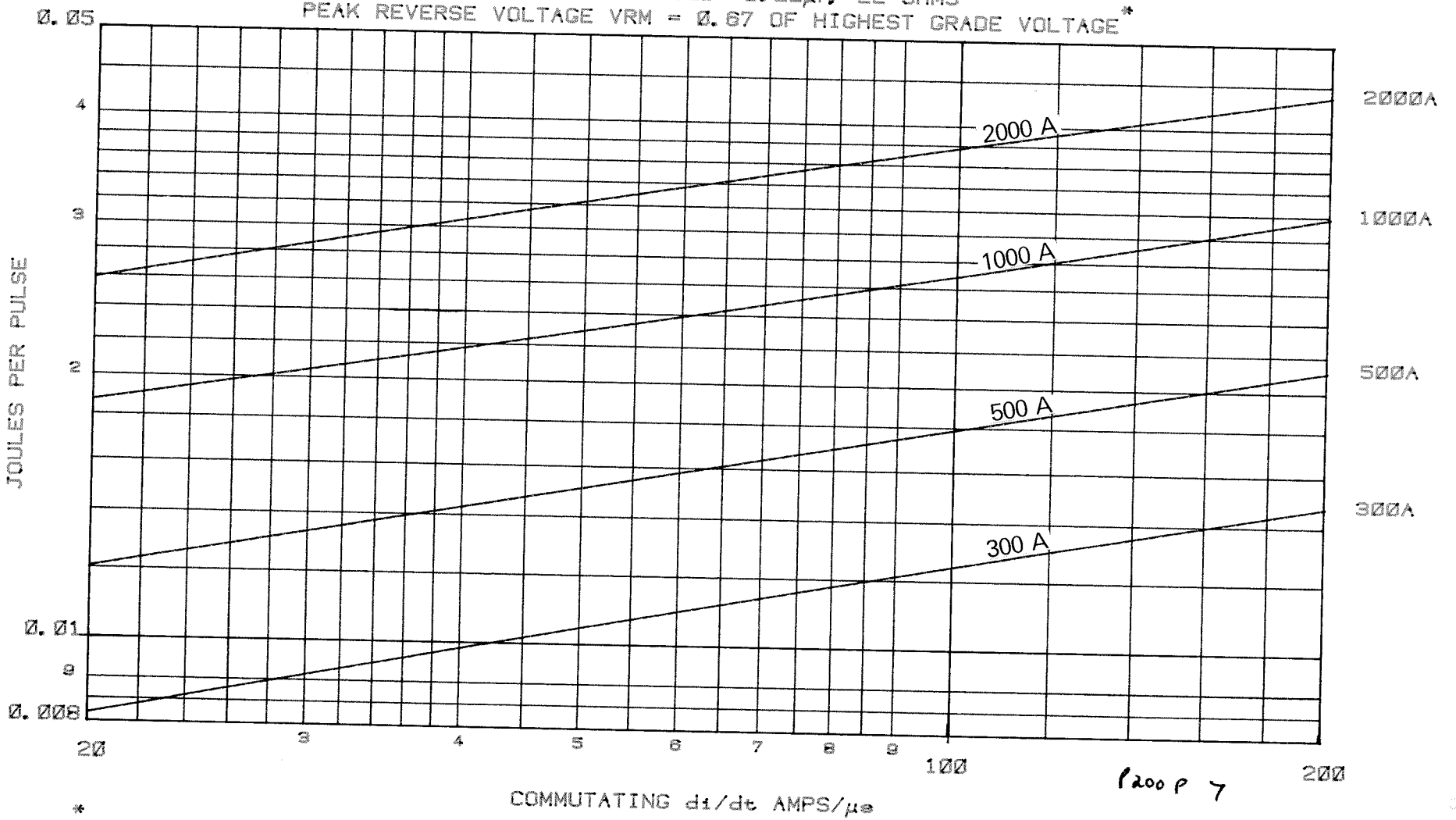
P200P FIG 11

TYPICAL RECOVERED CHARGE AT 125°C JUNCTION TEMPERATURE



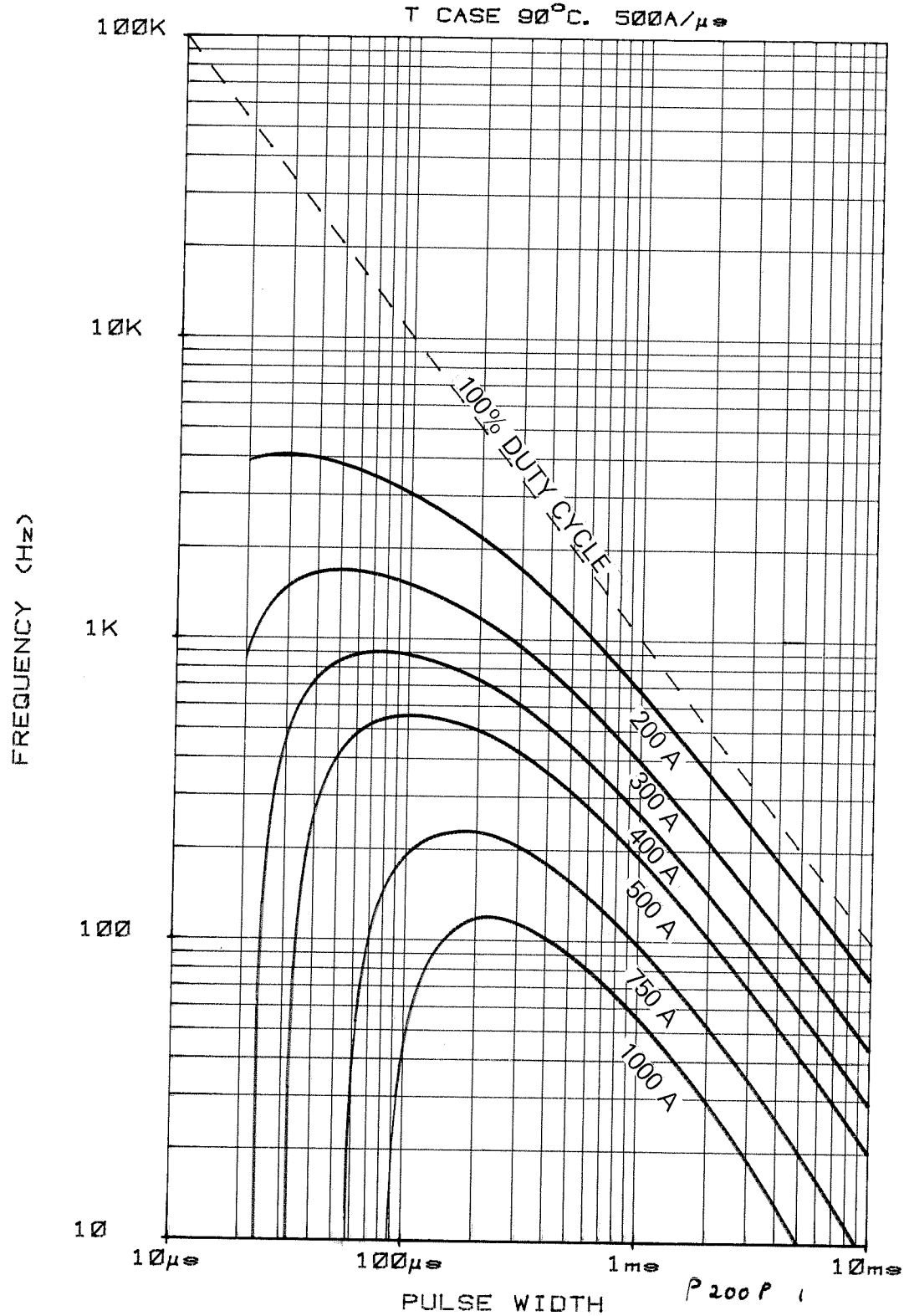
MAXIMUM REVERSE RECOVERY ENERGY LOSS PER PULSE, 125°C JUNCTION TEMPERATURE

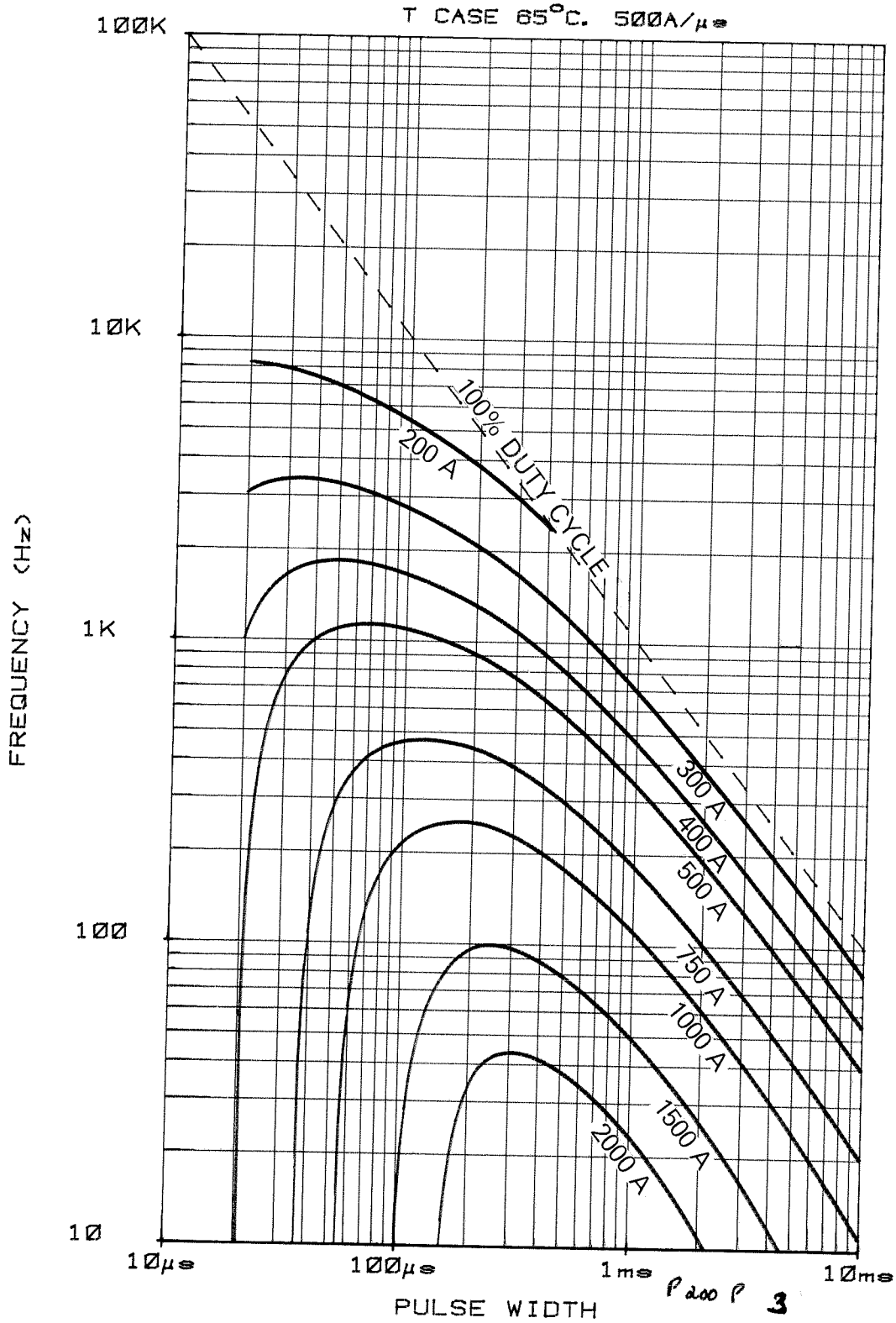
SNUBBER CONNECTED Ø.22μF, 22 OHMS
PEAK REVERSE VOLTAGE VRM = Ø.67 OF HIGHEST GRADE VOLTAGE*

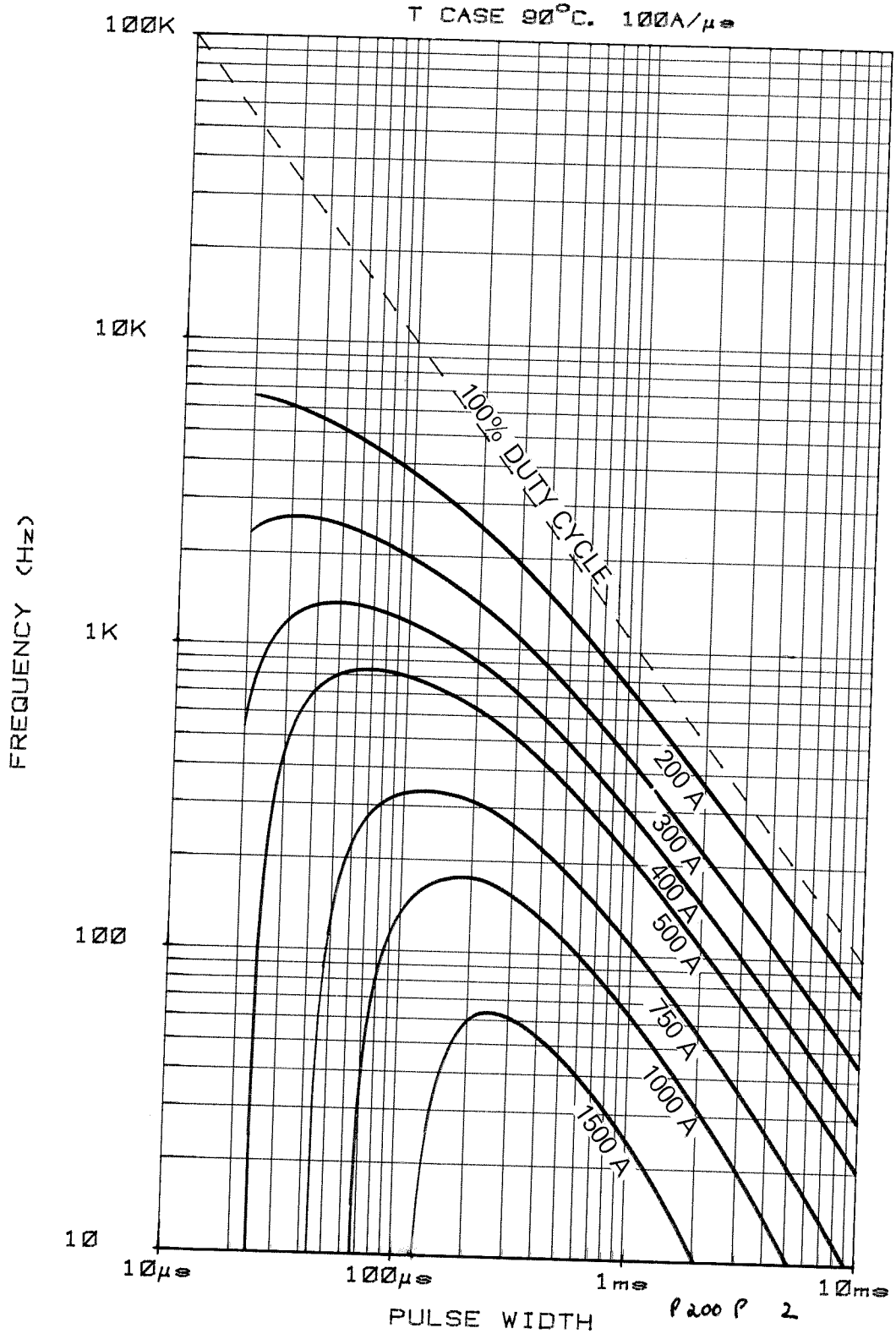


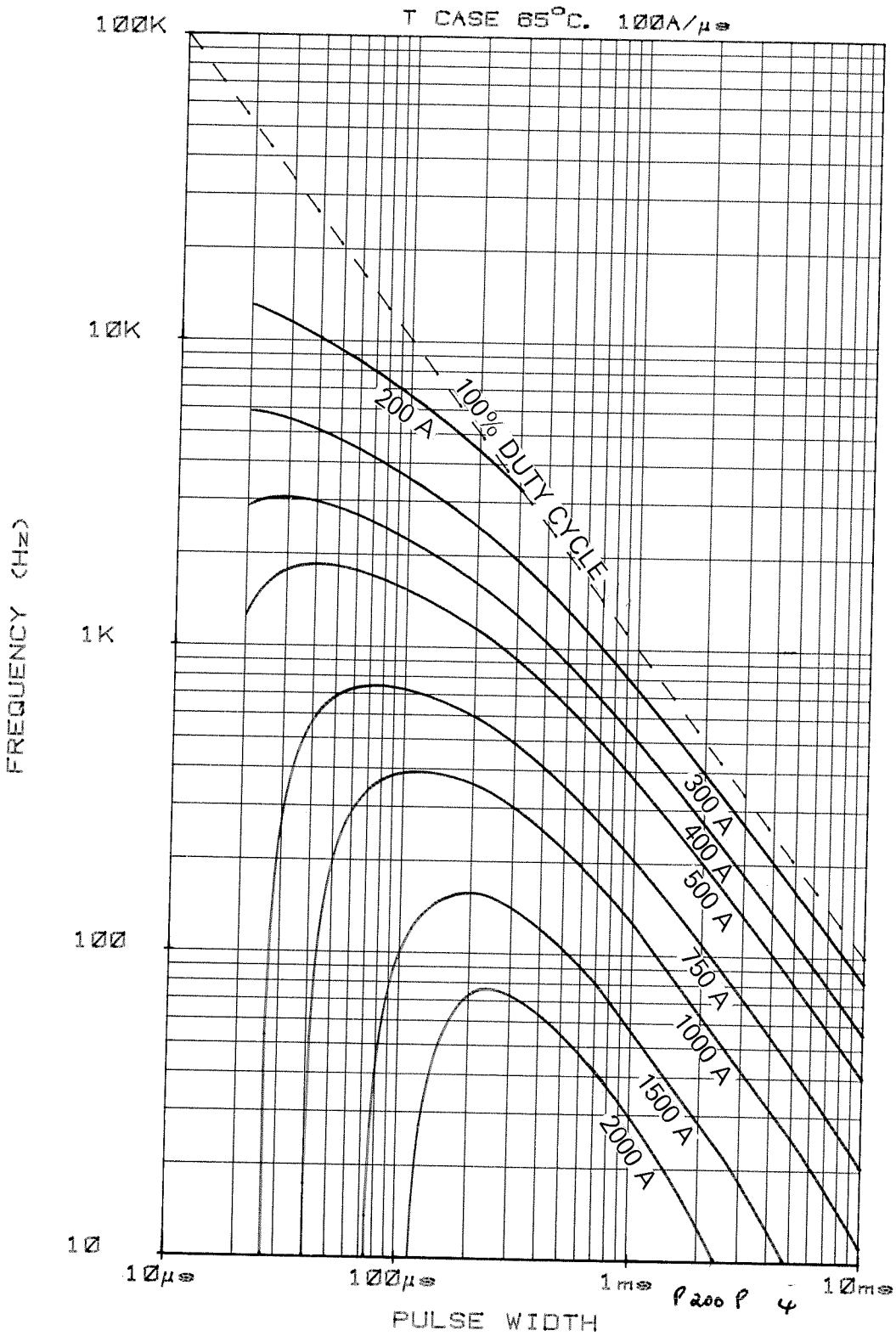
*NOTE: ENERGY PER PULSE SHOULD BE ADJUSTED PRO RATA WITH APPLIED PEAK RECOVERY VOLTAGE

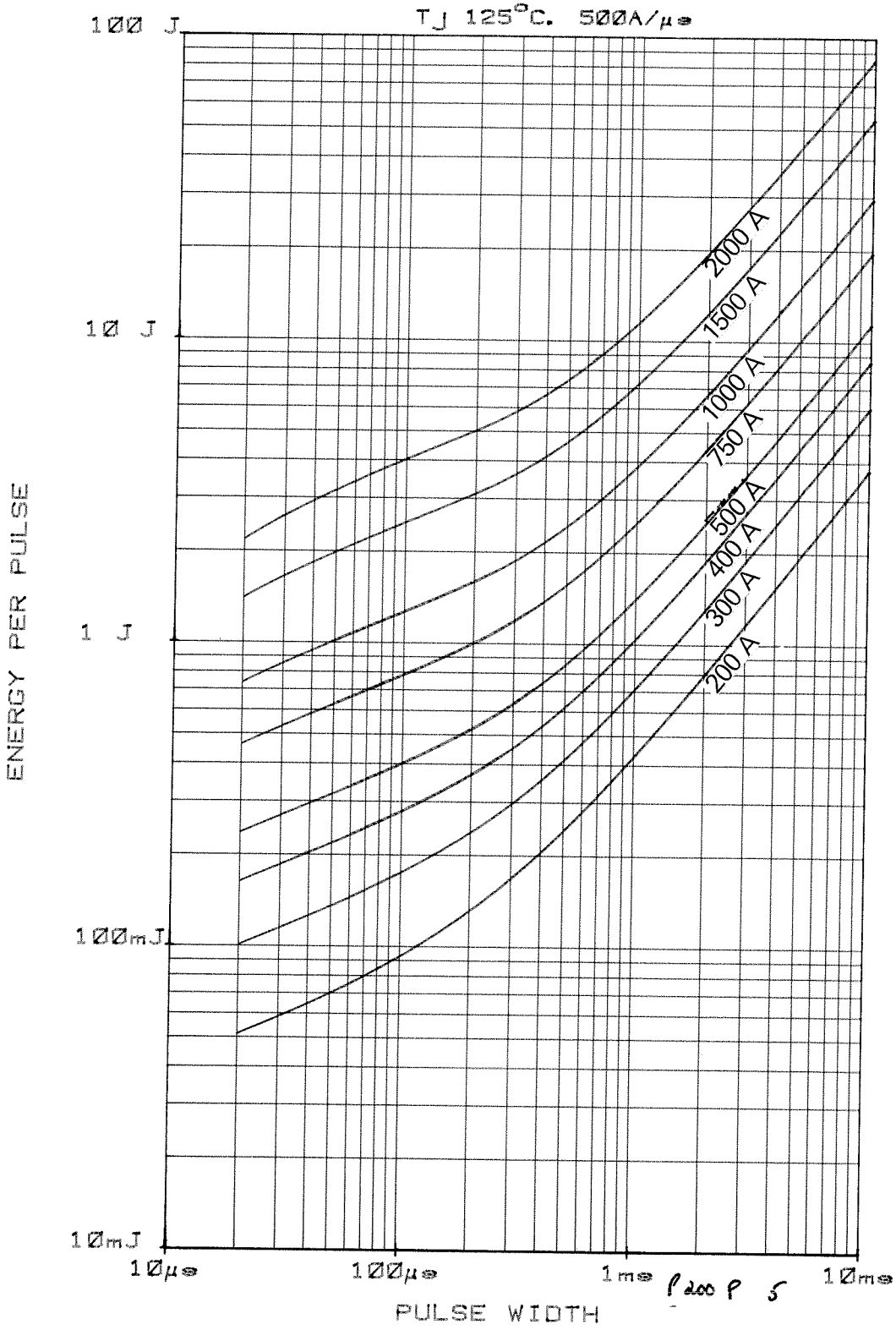
P200P
Fig 1


T CASE 90°C. 500A/µs
100K
10K
1K
100
10
FREQUENCY (Hz)
100% DUTY CYCLE
200 A
300 A
400 A
500 A
750 A
1000 A
10µs
100µs
1ms
10ms
PULSE WIDTH
P200P 1

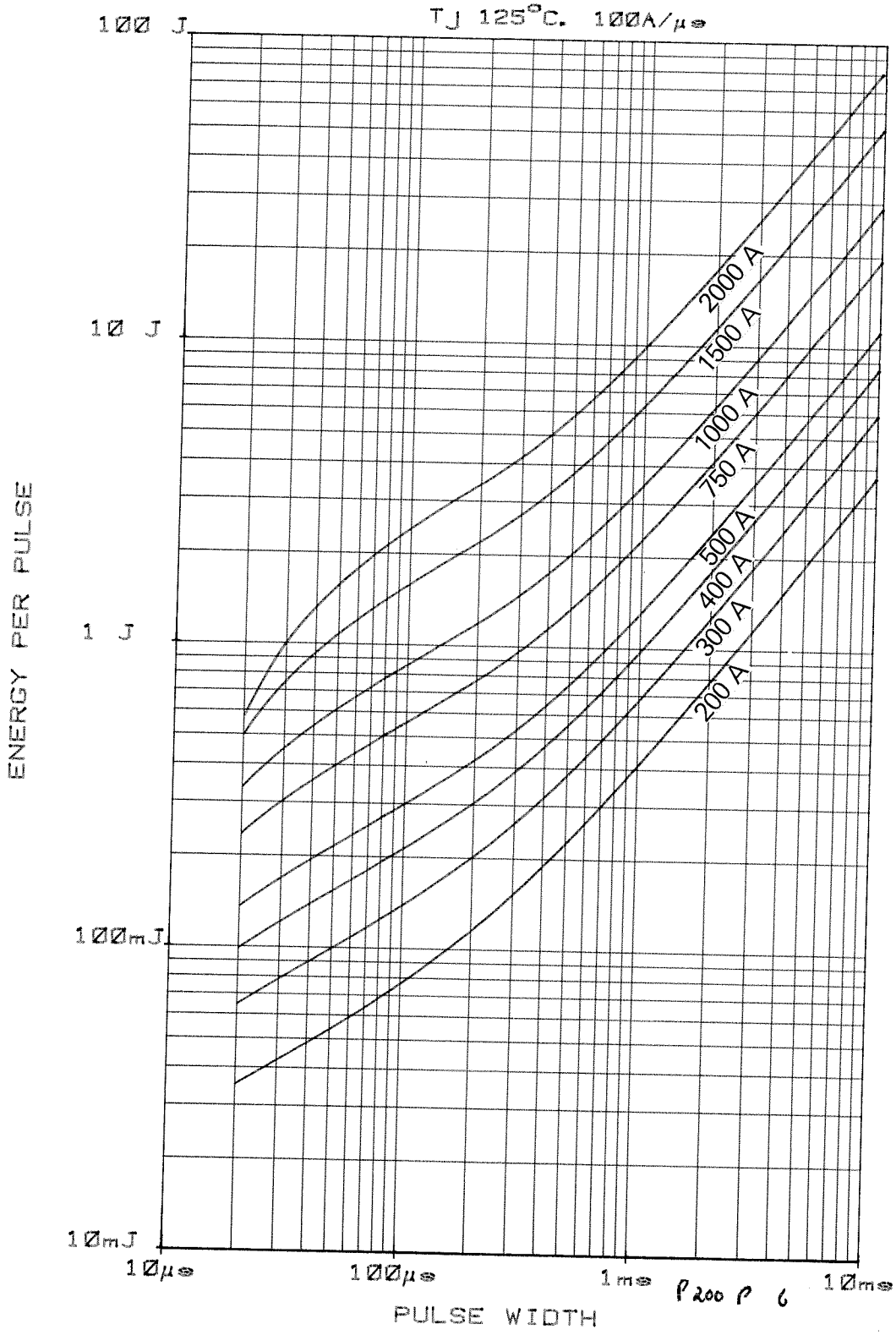

T CASE 85°C. 500A/μs
100K
10K
1K
100
10
FREQUENCY (Hz)
100% DUTY CYCLE
200 A
300 A
400 A
500 A
750 A
1000 A
1500 A
2000 A
10μs
100μs
1ms
10ms
PULSE WIDTH


T CASE 90°C. 100A/μs
100K
10K
1K
100
10
FREQUENCY (Hz)
100% DUTY CYCLE
200 A
300 A
400 A
500 A
750 A
1000 A
1500 A
10μs
100μs
1ms
10ms
PULSE WIDTH

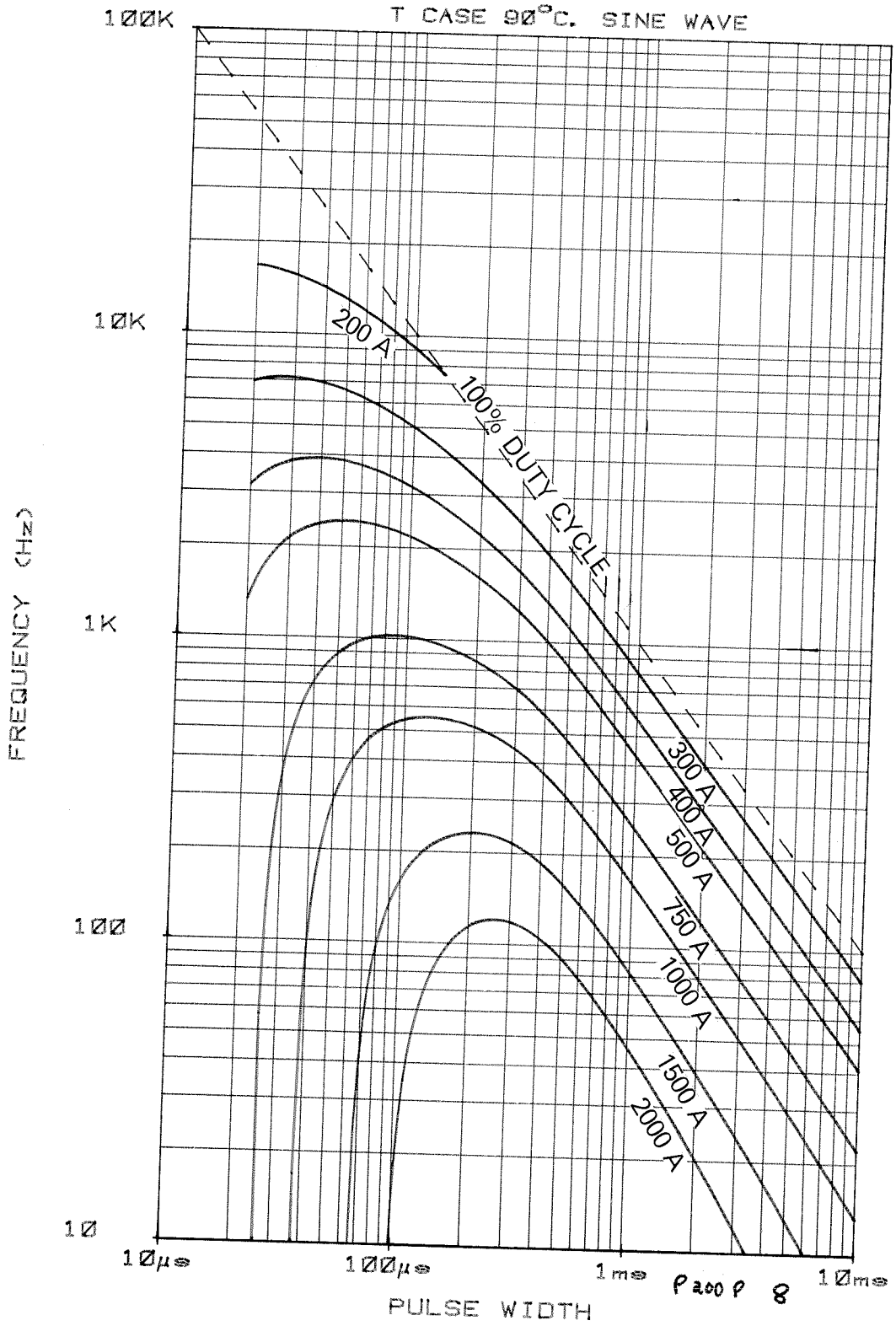

T CASE 65°C. 100A/μs
100K
10K
1K
100
10
FREQUENCY (Hz)
100% DUTY CYCLE
200 A
300 A
400 A
500 A
750 A
1000 A
1500 A
2000 A
10μs
100μs
1ms
10ms
PULSE WIDTH

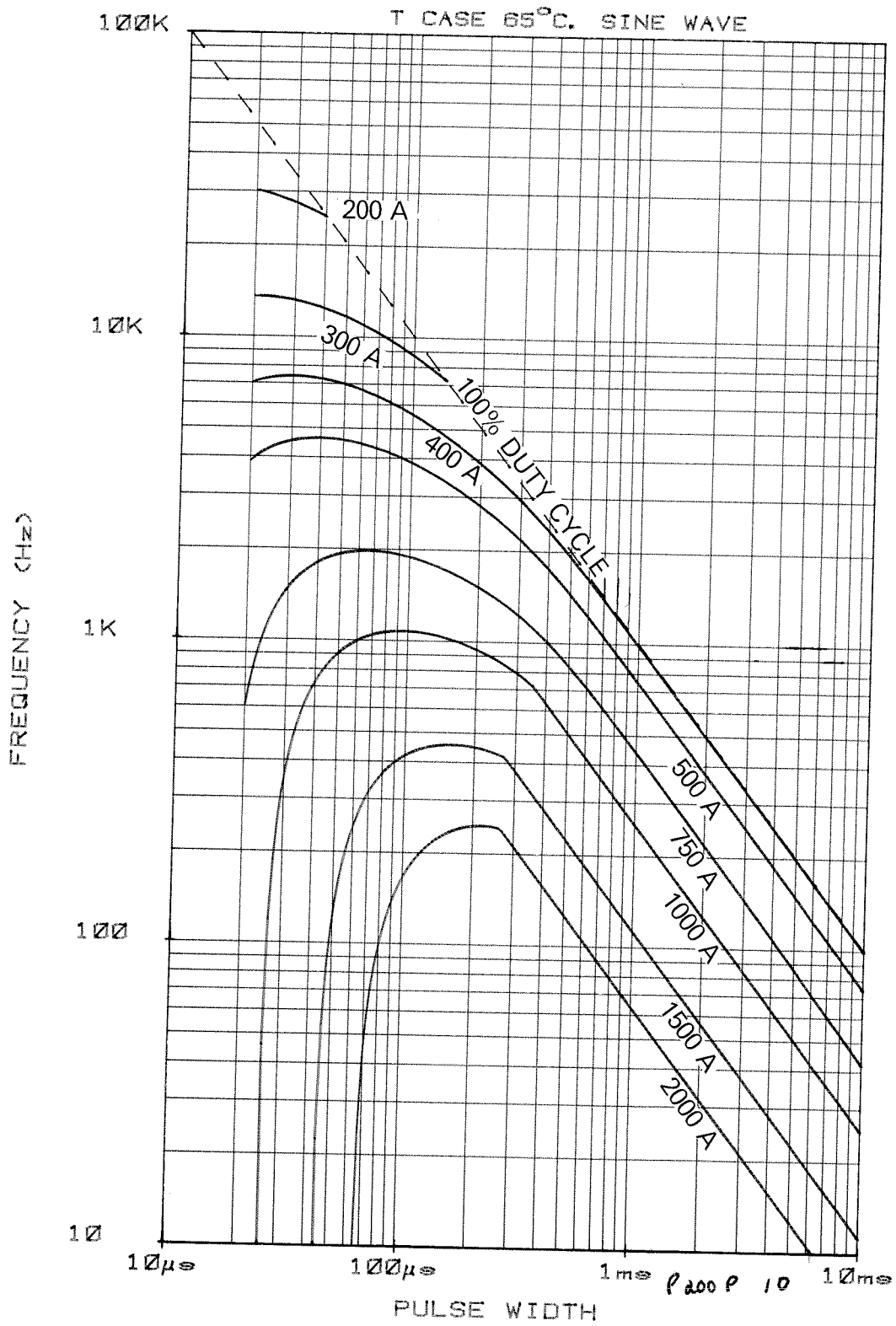

TJ 125°C. 500A/μs
100 J
10 J
1 J
100mJ
10mJ
ENERGY PER PULSE
2000 A
1500 A
1000 A
750 A
500 A
400 A
300 A
200 A
10μs
100μs
1ms
10ms
PULSE WIDTH

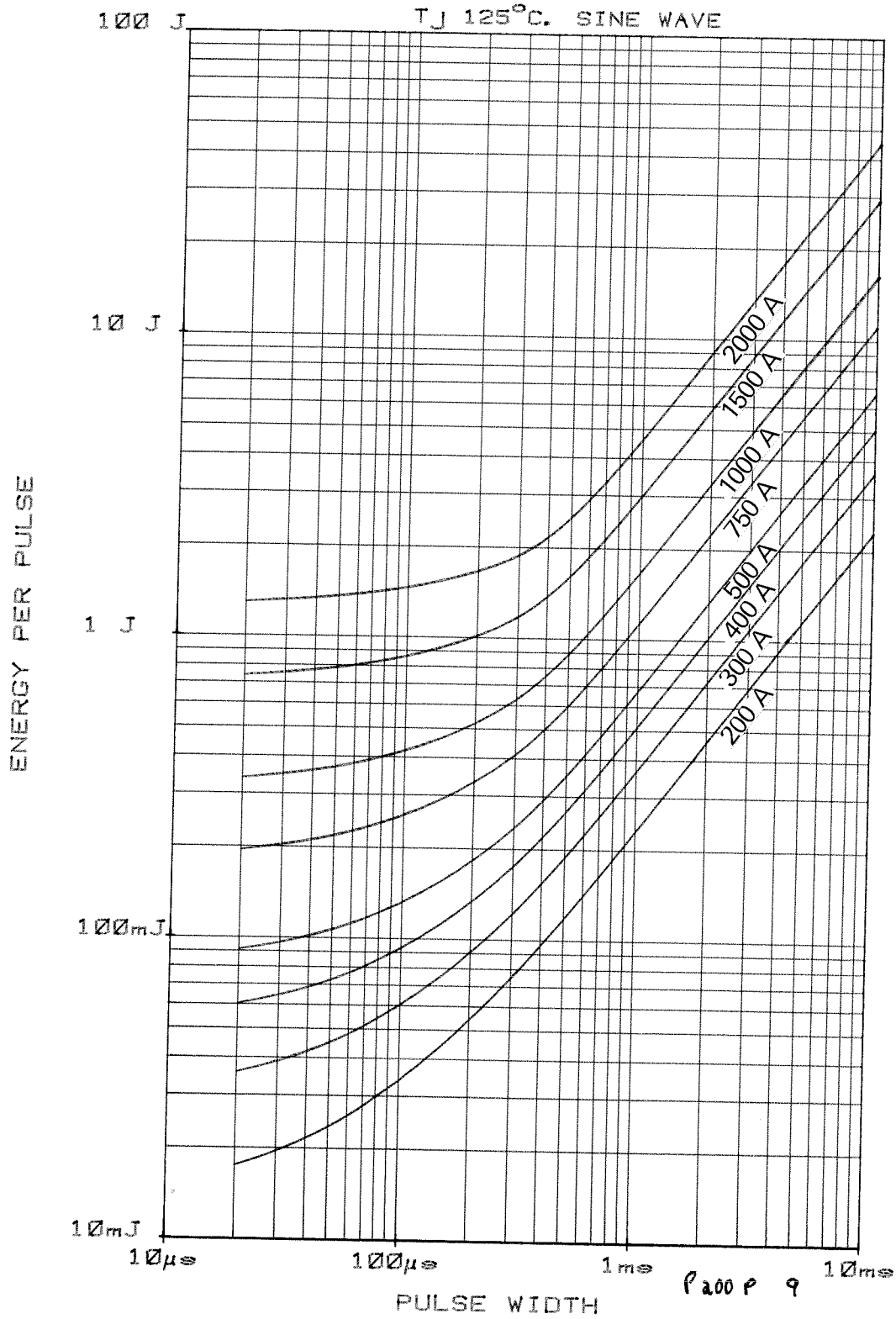
P200 P Fig 6



P200 P 6


T CASE 90°C. SINE WAVE
100K
10K
1K
100
10
FREQUENCY (Hz)
200 A
100% DUTY CYCLE
300 A
400 A
500 A
750 A
1000 A
1500 A
2000 A
10µs
100µs
1ms
10ms
PULSE WIDTH


T CASE 65°C. SINE WAVE
100K
10K
1K
100
10
FREQUENCY (Hz)
200 A
300 A
100% DUTY CYCLE
400 A
500 A
750 A
1000 A
1500 A
2000 A
10µs
100µs
1ms
10ms
PULSE WIDTH


100 J
TJ 125°C. SINE WAVE
10 J
1 J
100mJ
10mJ
ENERGY PER PULSE
2000 A
1500 A
1000 A
750 A
500 A
400 A
300 A
200 A
10µs
100µs
1ms
10ms
PULSE WIDTH

SCALE	1/1
DRN	
CHKD	
APPD	
S	A
S	NI

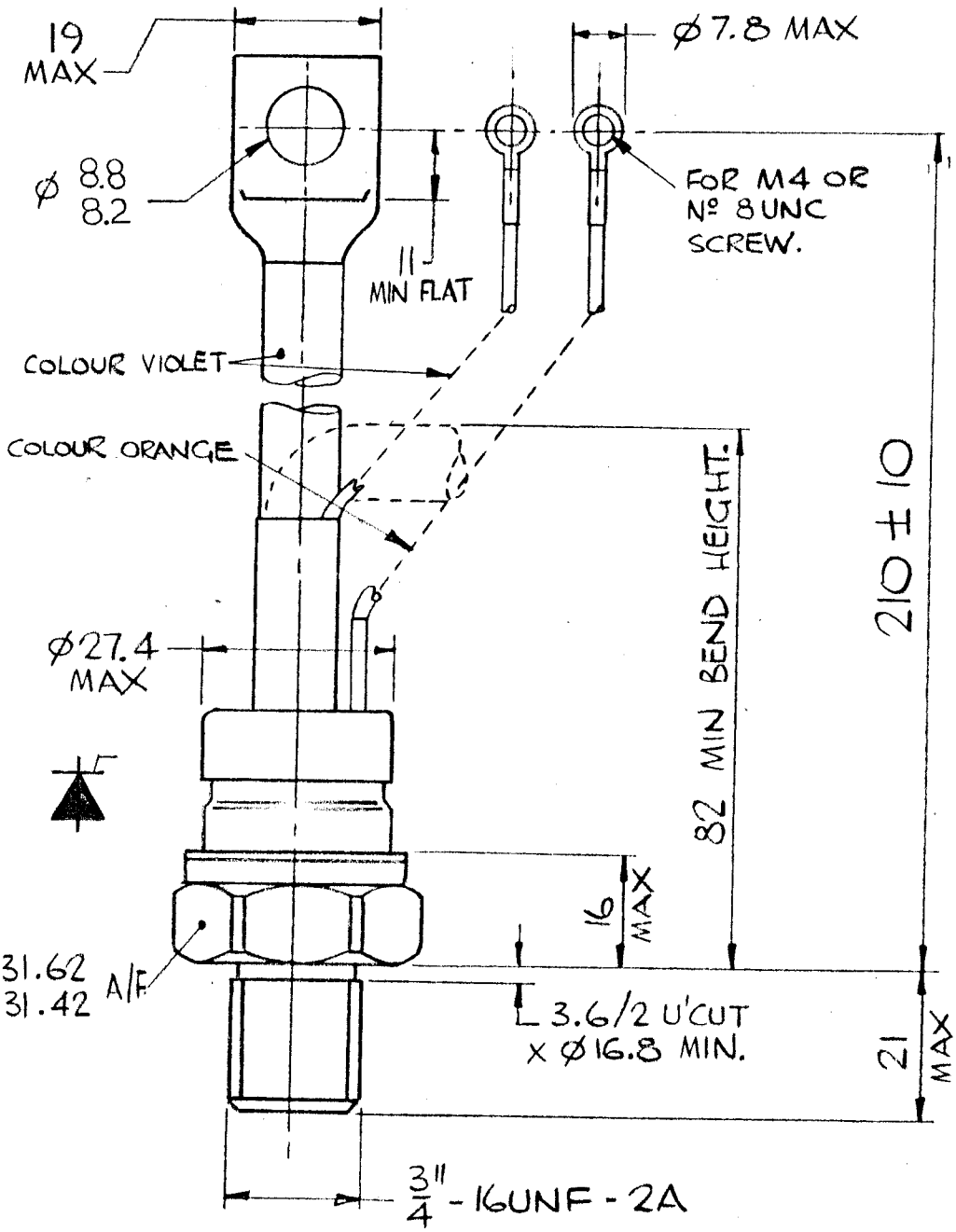
INTERNATIONAL OUTLINE No.
WEIGHT. 280 GRAMS APPX.
FINISH. BRIGHT NICKEL PLATE. - 24 -
DEVICE MARKING INCLUDES MONOGRAM, TYPE No., SPEC. No. AND POLARITY SYMBOL.
DEVICE MOUNTING: MOUNTING TORQUE 27 - 24.5 Nm (2.77 - 2.5 kgF-m). THREAD MUST NOT BE LUBRICATED.

NOTES.

G.A. DRG. No. 103A162

TYPE NUMBER

N170P	P205P
N195P	P215P
N275P	P202P
	P200P
	P204P
	P214P



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

WESTCODE ® SEMICONDUCTORS

THIRD ANGLE PROJECTION

DIMNS. IN MILLIMETRES

DRG. No. 101A225

ISS	REVISIONS
1	19.9.78
2	17.11.78 M670 TYPE Nº ADDED
3	ø 8.8/8.2 HOLE WAS 10.7/10.2
4	17.12.79 M817 19 WAS 21.4
5	27.11.84 M1218 FIN WAS ET.