

# 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<br>SD – ¾" Ceramic stud removed | Voltage code<br>$V_{RRM}/100$<br>10-12 | Fixed Turn-off Time Code<br>D = 20µs, E = 25µs, F = 30µs |
| Typical Order Code: P0248SC12D, ¾" Ceramic stud, 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: 83TR8 (Issue 2)

Date: 29th January, 1985

Origin:

Pages: 24

Thyristor type P200PH02-H12

Written: B.W.P. Brown

Checked: *BWP*

Approved: *SRSA*

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

|                    |             |
|--------------------|-------------|
| $V_{DSM}$          | : H02-H12   |
| $V_{RSM}$          | : 200-1200V |
| $V_{DRM}, V_{RRM}$ | : 300-1300V |
|                    | : 200-1200V |

$I_T(AV)$ : Single phase: 50Hz, 180° sinewave

: 160A

$T_{CASE} = 85^{\circ}C$

:

$I_T(rms)$  max.

: 355A

$I_T$  d.c. max.

: 355A

$I_{TSM}$  :  $t = 10ms$  half sinewave;  $T_J(initial) = 125^{\circ}C$ ;  $V_{RM} = 0.6V_{RRM}(MAX)$  : 2700A

$I_{TSM}$  :  $t = 10ms$  half sinewave;  $T_J(initial) = 125^{\circ}C$ ;  $V_{RM} \leq 10V$  : 2970A

$I^2t$  :  $t = 10ms$ ;  $T_J(initial) = 125^{\circ}C$  :  $V_{RM} = 0.6V_{RRM}(MAX)$  :  $36.5 \times 10^3 A^2 SECS$

$I^2t$  :  $t = 10ms$ ;  $T_J(initial) = 125^{\circ}C$  :  $V_{RM} \leq 10V$  :  $44.1 \times 10^3 A^2 SECS$

$I^2t$  :  $t = 3ms$ ;  $T_J(initial) = 125^{\circ}C$  :  $V_{RM} \leq 10V$  :  $32.4 \times 10^3 A^2 SECS$

$di/dt$ : (Repetitive)  $T_J 125^{\circ}C$ . Gate: 20V. 20  $\Omega$  Rise-time  $1\mu S$  : 500A/ $\mu S$

$I_{FGM}$  : 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

THS operating range

:  $-40$  to  $125^{\circ}C$

$T_{stg}$  Non-operating

:  $-40$  to  $180^{\circ}C$

### Characteristics

(maximum values unless stated otherwise)

|                                                                                   |   |                                                                |                               |
|-----------------------------------------------------------------------------------|---|----------------------------------------------------------------|-------------------------------|
| $I_{GT} : T_J = 25^{\circ}\text{C}$                                               | ) |                                                                | : 200mA.                      |
| $I_H : T_J = 25^{\circ}\text{C}$                                                  | ) | $V_A = 6 \text{ V}, I_A = 1 \text{ A}$                         | : 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                   |
| $V_{TM} : I_{TM} = 600 \text{ A}$                                                 |   | $T_{VJ} = 125^{\circ}\text{C}$                                 | : 2.34V                       |
| $R_{th} (\text{J/C})$                                                             |   |                                                                | : $0.12^{\circ}\text{C/W}$    |
| $dV/dt : \text{Linear ramp to } 0.8V_{\text{DRM(max)}} T_J = 125^{\circ}\text{C}$ |   | Gate O/C repetitive                                            | : $200\text{V}/\mu\text{s}^*$ |
| $I_{\text{DRM}} : T_J = 125^{\circ}\text{C}$                                      |   | $V_{\text{DM}} = V_{\text{DRM(max)}}$                          | : 30mA                        |
| $I_{\text{RRM}} : T_J = 125^{\circ}\text{C}$                                      |   | $V_{\text{RM}} = V_{\text{RRM(max)}}$                          | : 30mA                        |
| $Q_{RR} : I_{\text{TM}} = 300 \text{ A}$                                          |   | $dI/dt \ 20 \text{ A}/\mu\text{s}, \ 50\% \text{ chord value}$ | :                             |
| $V_{\text{RM}} : 50$                                                              |   | $T_{VJ} = 125^{\circ}\text{C}$                                 | : $25\mu\text{C (Typical)}$   |
| $t_q : I_{\text{TM}} \ 300 \text{ A}$                                             |   | $dI/dt \ 20 \text{ A}/\mu\text{s}; T_J = 125^{\circ}\text{C}$  | :                             |
|                                                                                   |   | $V_{\text{RM}} = 50\text{V}$                                   | : $25-40\mu\text{s}$          |
|                                                                                   |   | $dV/dt = 200\text{V}/\mu\text{s to } 0.8V_{\text{DRM}}$        | : $20-35\mu\text{s}$          |
|                                                                                   |   | When specified, $20\text{V}/\mu\text{s to } 0.8V_{\text{DRM}}$ | : $101\text{A}225$            |
| Outline drawing                                                                   |   | Typical                                                        | : $0.04^{\circ}\text{C/W}$    |
| $R_{th} (\text{C-H.S.})$                                                          |   |                                                                | : $2.5-2.77\text{Kg.m.}$      |
| Mounting torque                                                                   |   |                                                                |                               |

### 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<br>Grade<br><br>'H' | V <sub>DSM</sub><br>V <sub>DRM</sub><br>V <sub>RRM</sub><br>V | V <sub>RSM</sub><br><br>V | V <sub>D</sub><br>V <sub>R</sub><br><br>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 ( $t_q$ ) 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 case) and  $T_{CASE}$  be the case temperature

Then the average dissipation will be

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

and

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

#### 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:

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

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

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

##### 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

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

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.

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:

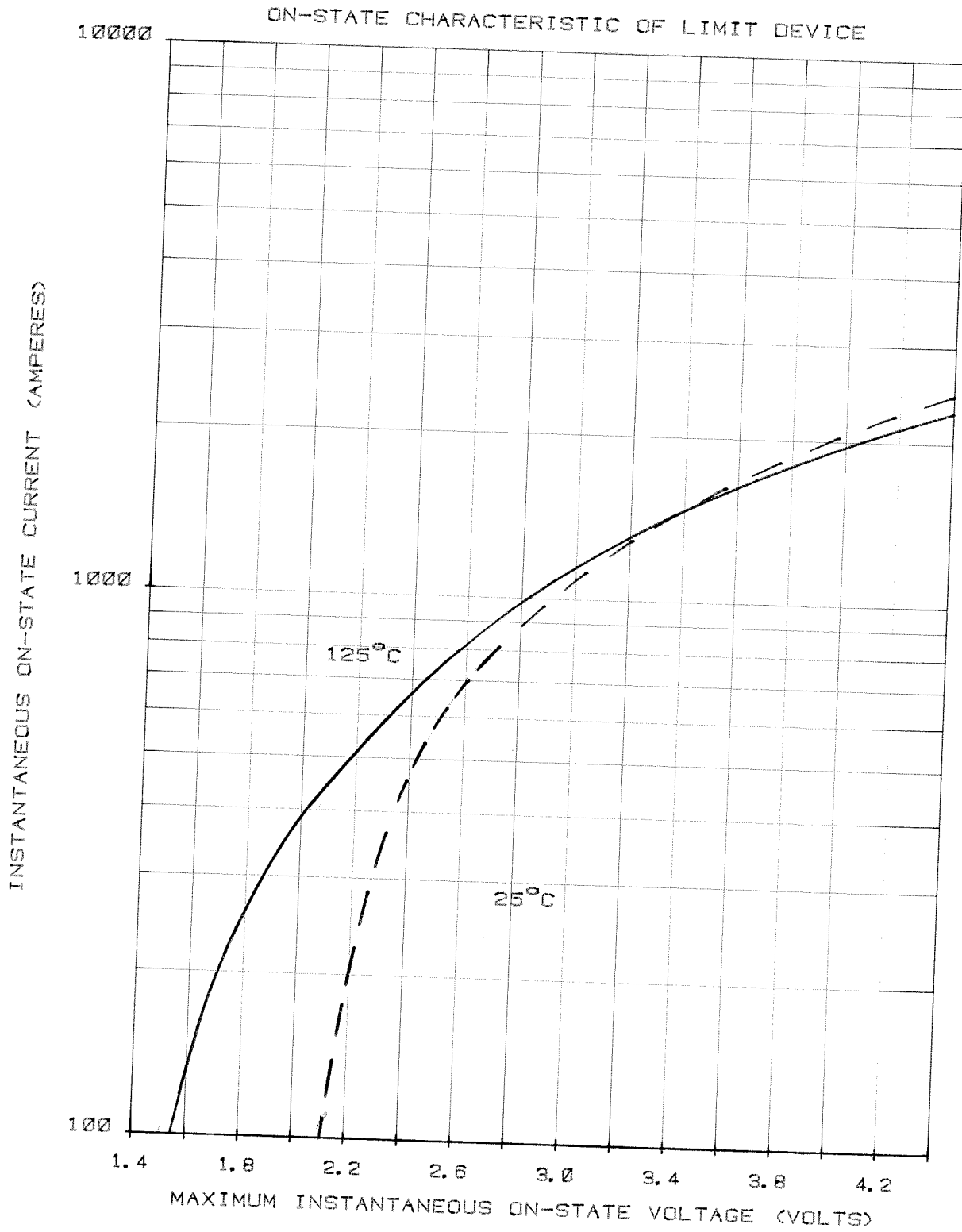
- a) a.c. coupled devices such as current transformers are not affected by prior passage of high amplitude forward current.
- b) The measuring oscilloscope has adequate dynamic range - typically 100 screen heights - to cope with the initial forward current without overload.

NOTE 2

HOUSING LOSS

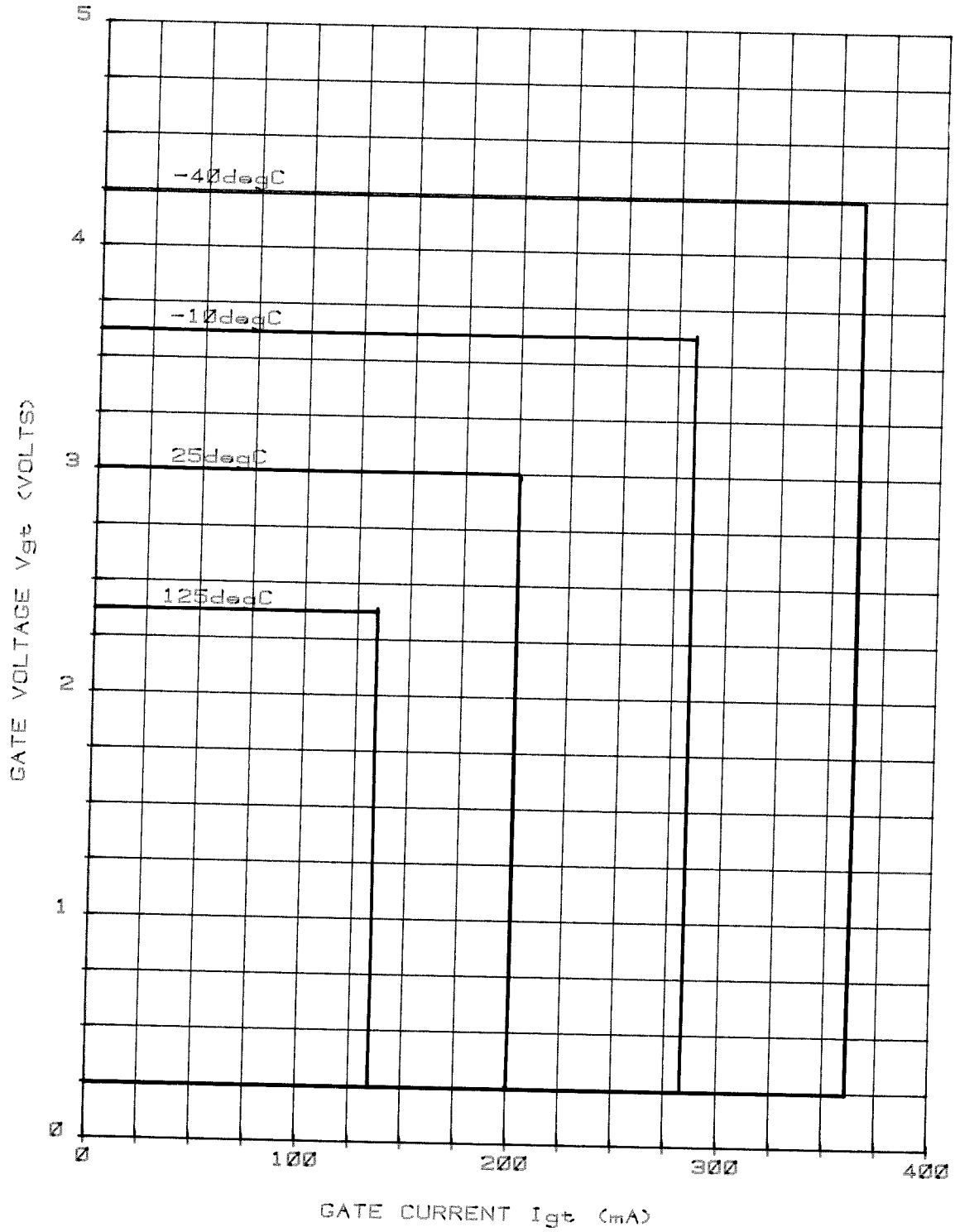
The loss caused by coupling between housing and anode current (which gives rise to additional heating at high frequency) has been incorporated into the curves of forward energy loss per pulse.





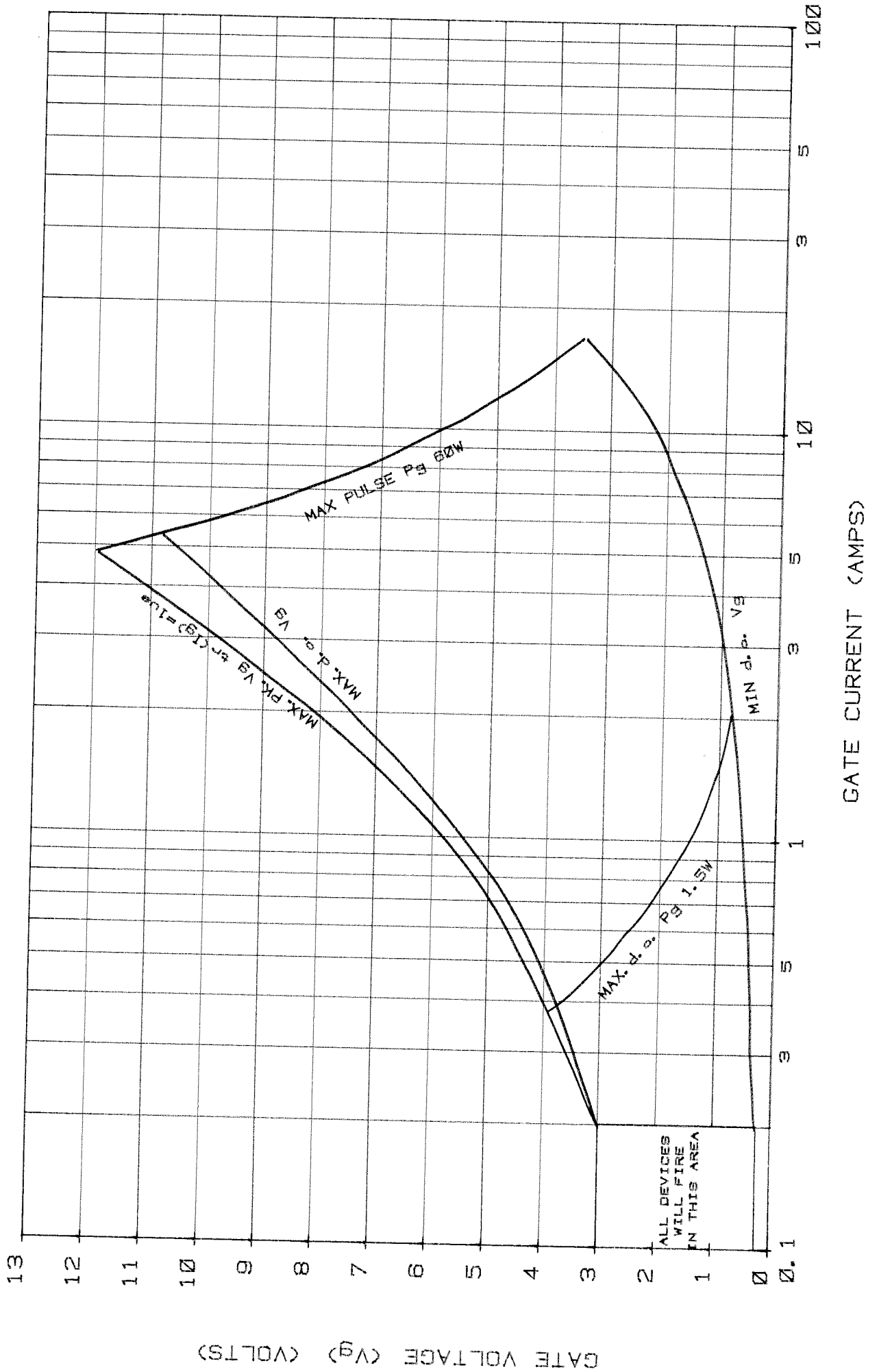
# GATE TRIGGERING CHARACTERISTICS

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

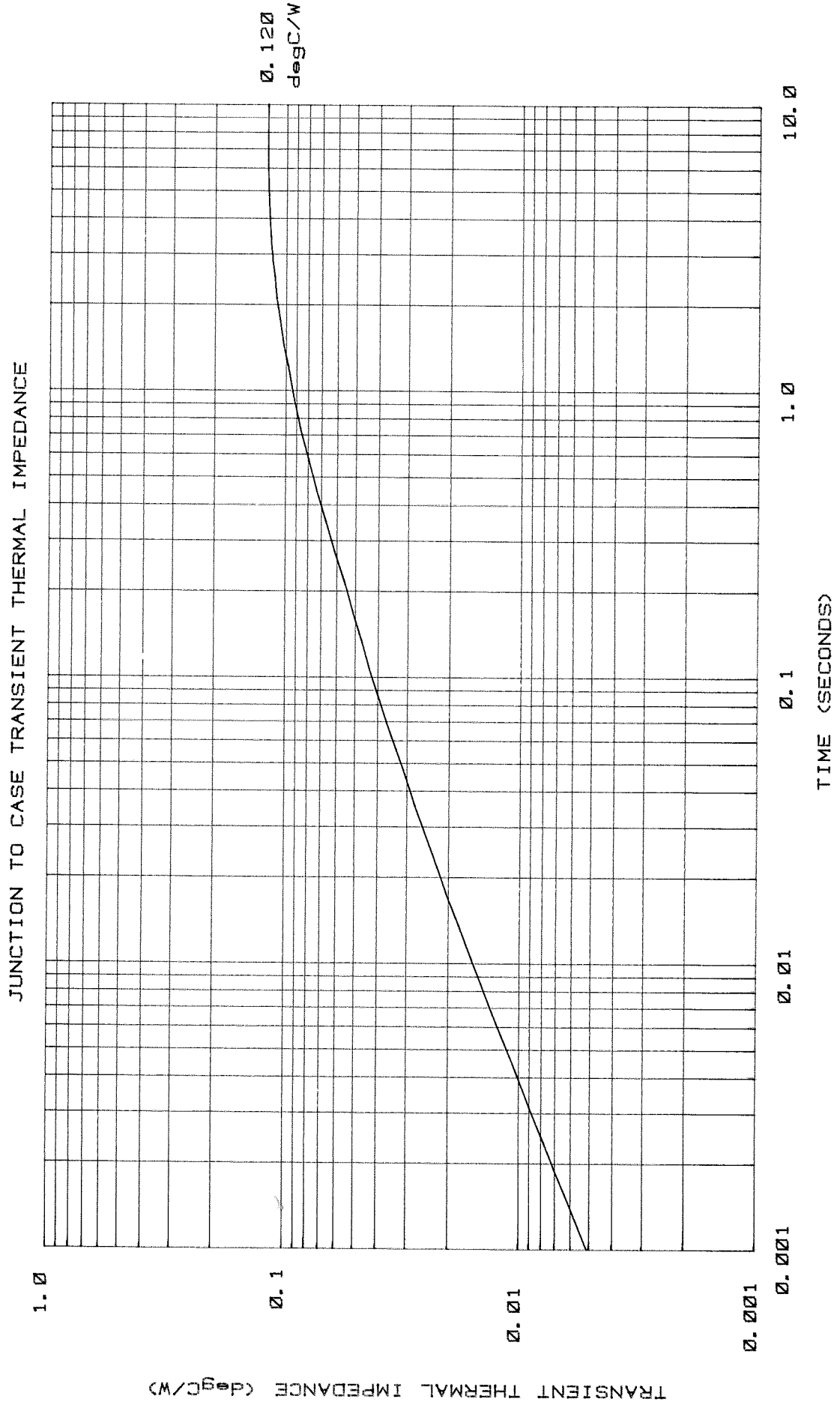


P20010  
T.S. 14

# GATE CHARACTERISTICS AT 25°C JUNCTION TEMPERATURE

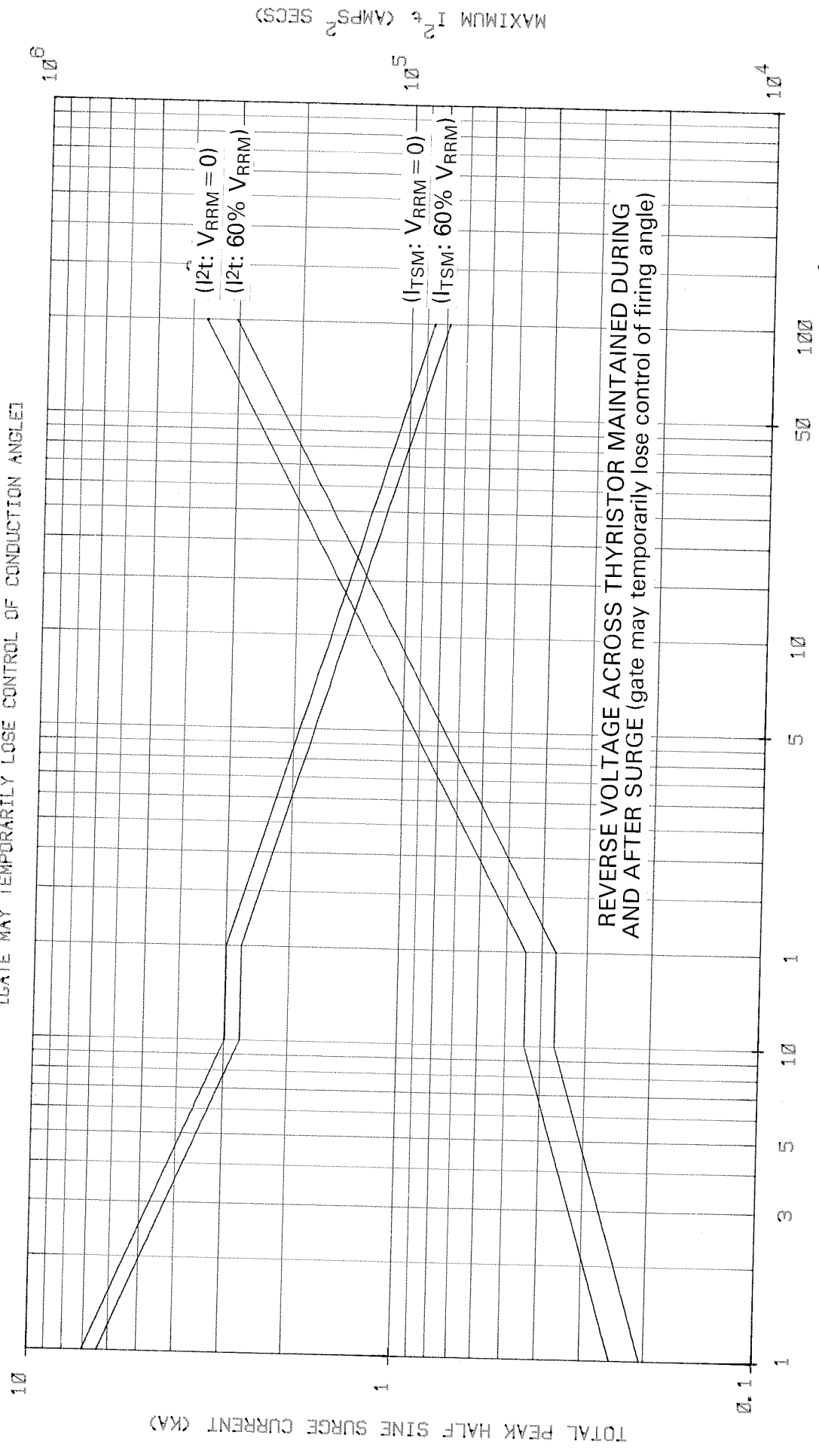


W-000  
Fig. 12



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

[GATE MAY TEMPORARILY LOSE CONTROL OF CONDUCTION ANGLE]



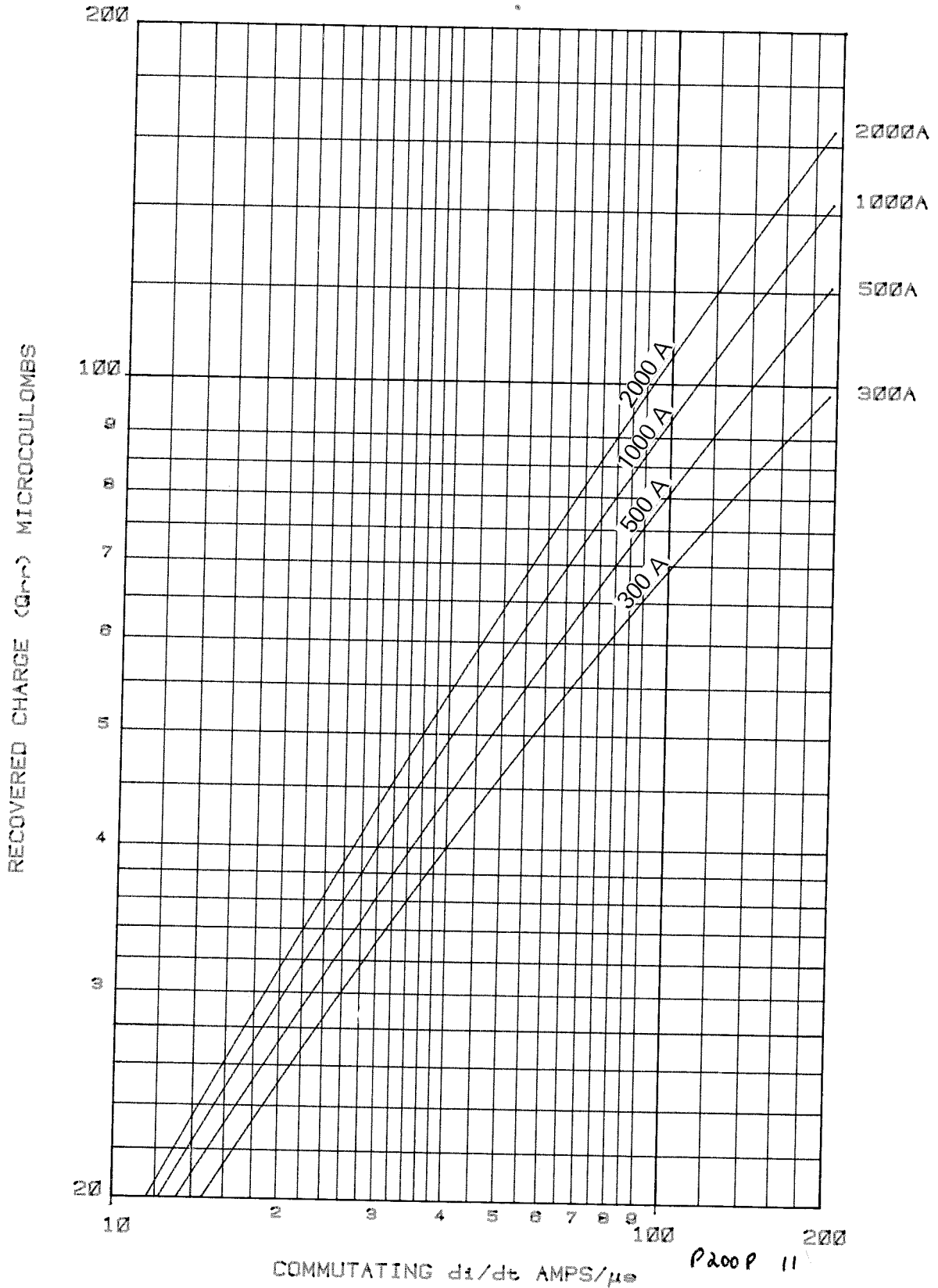
DURATION OF SURGE (ms)

DURATION OF SURGE (cycles at 50 Hz)

Page 13

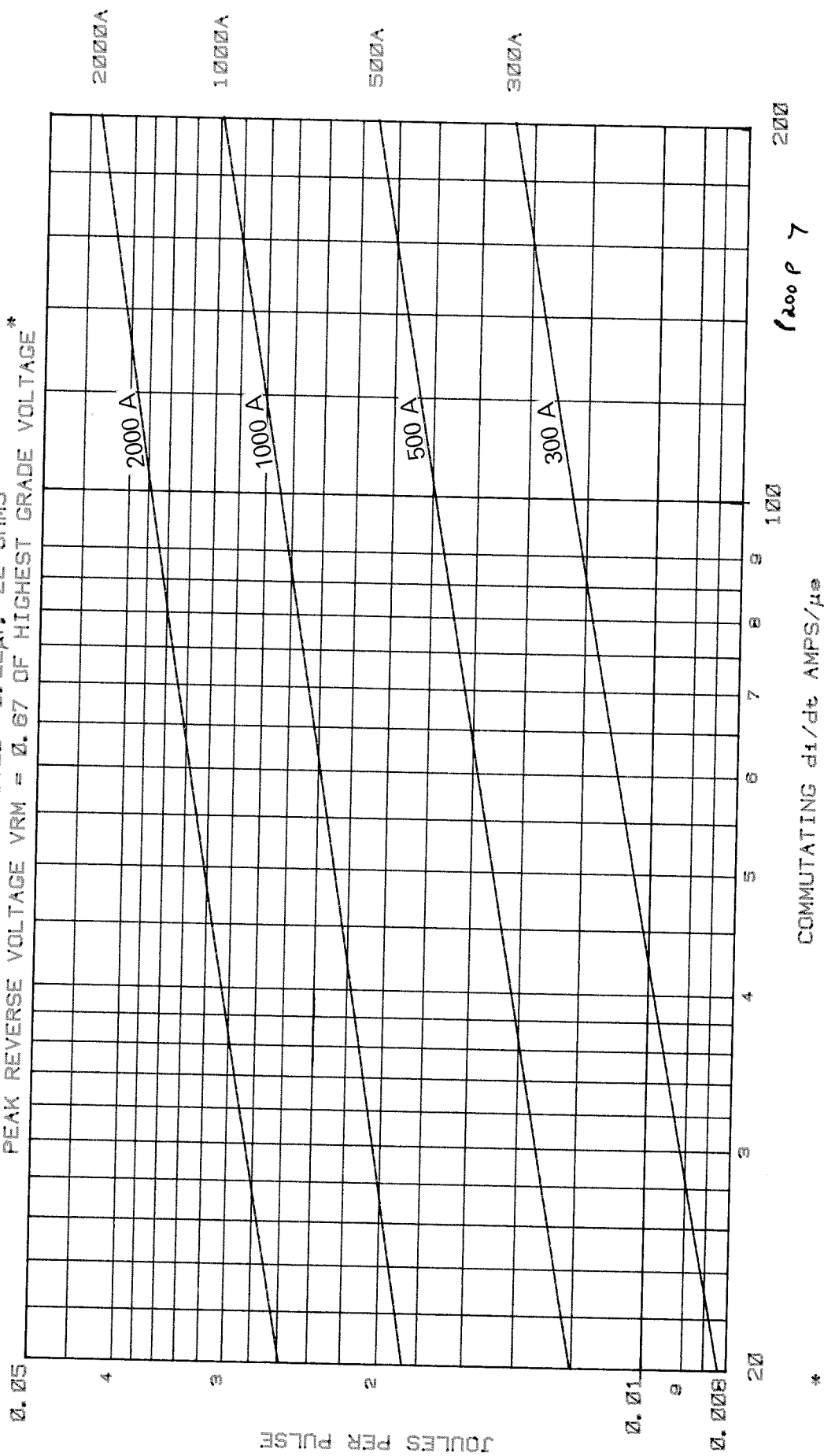
2250P  
Fig 13

TYPICAL RECOVERED CHARGE AT 125°C JUNCTION TEMPERATURE



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\*

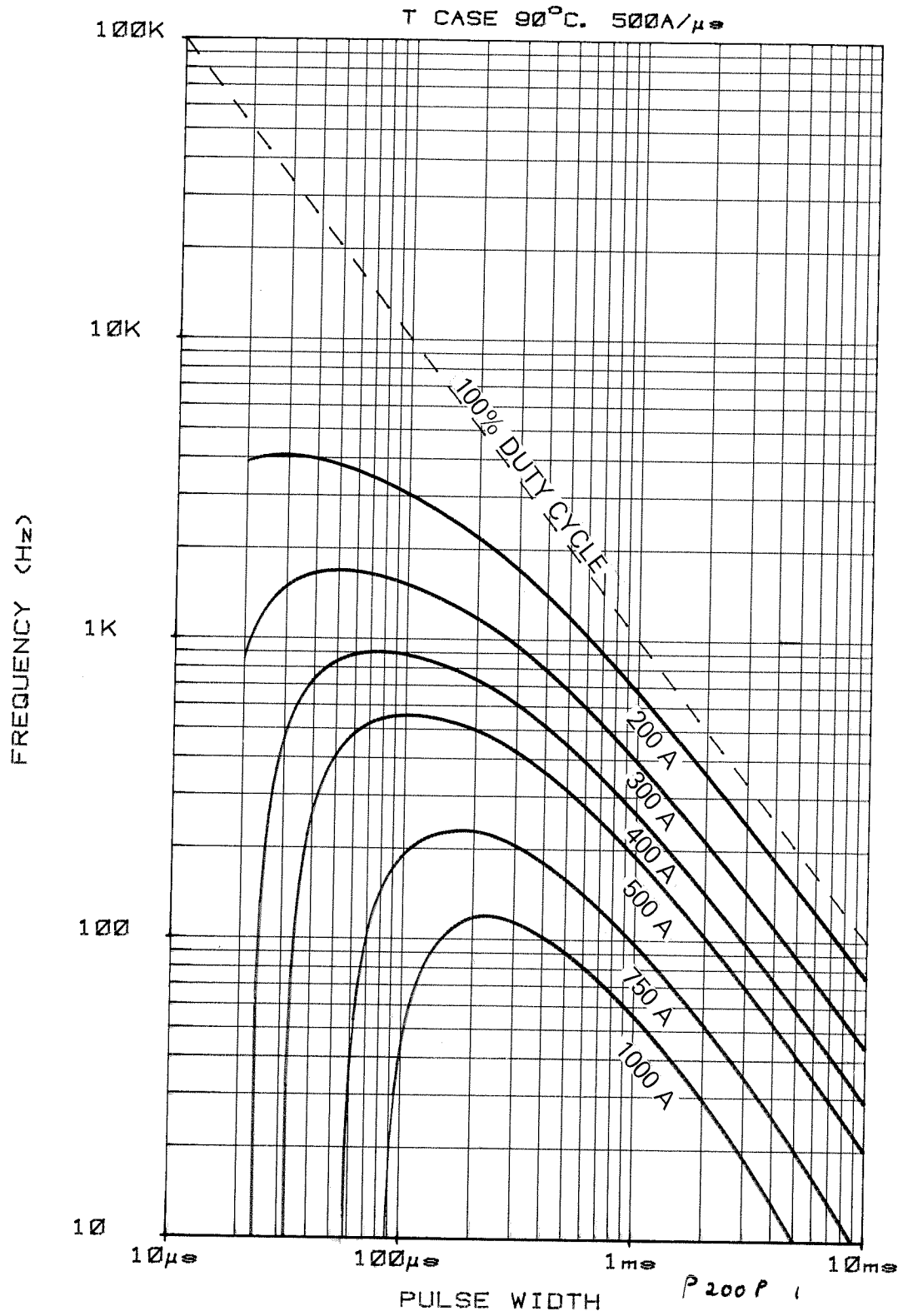


COMMUTATING  $di/dt$  AMPS/ $\mu$ s

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

P200P  
Fig. 1

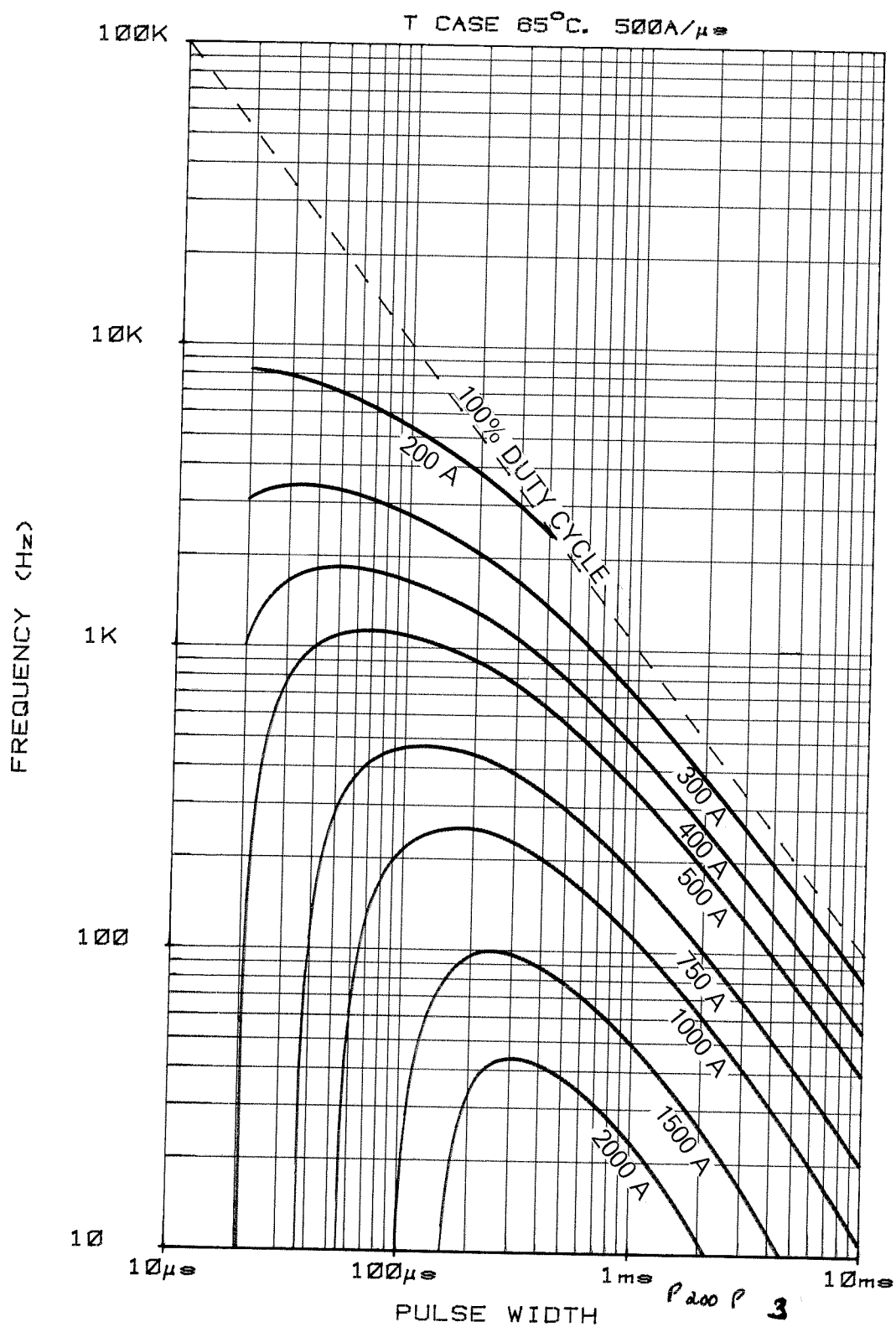
- 15 -





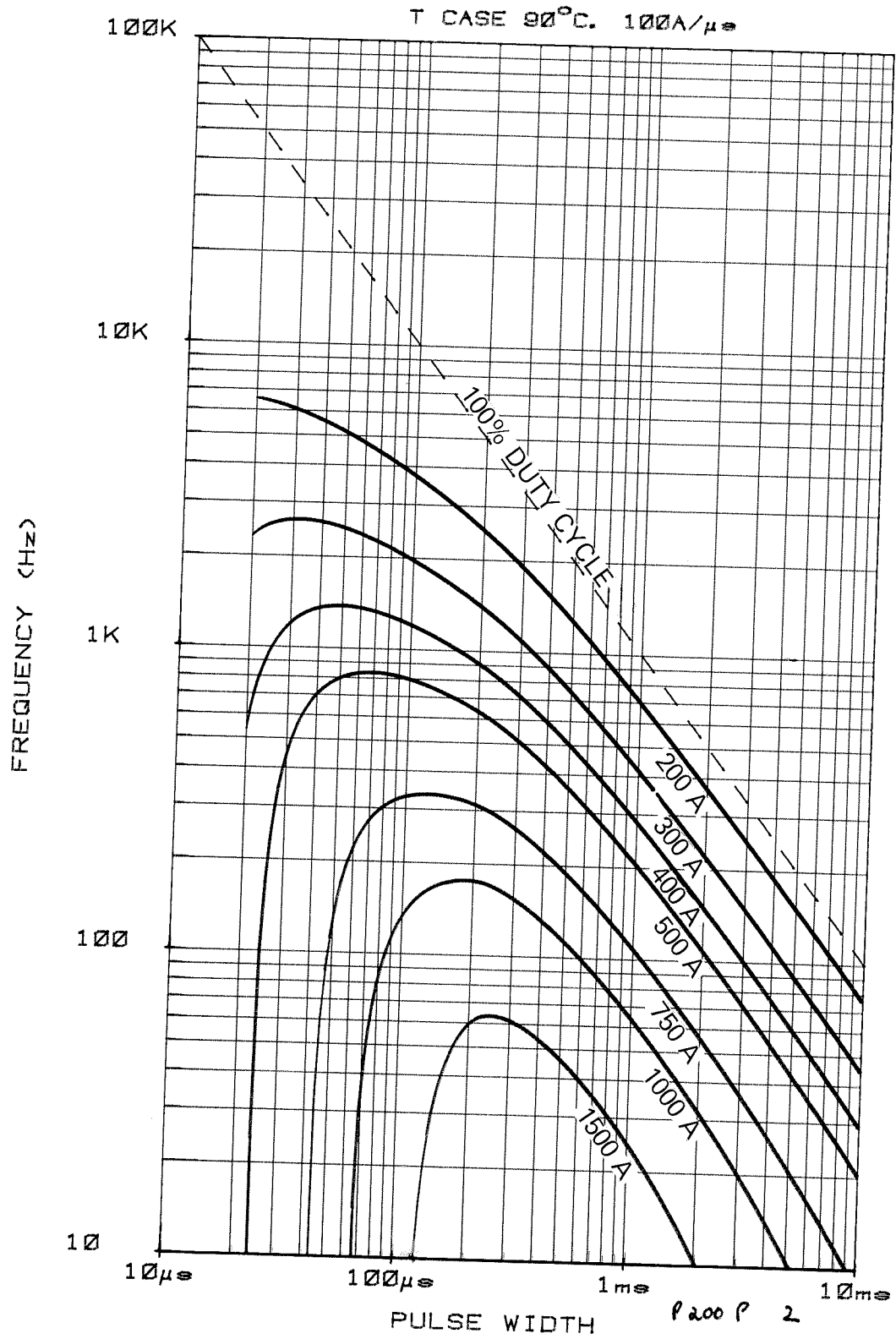
P900P  
FIG 3

- 16 -

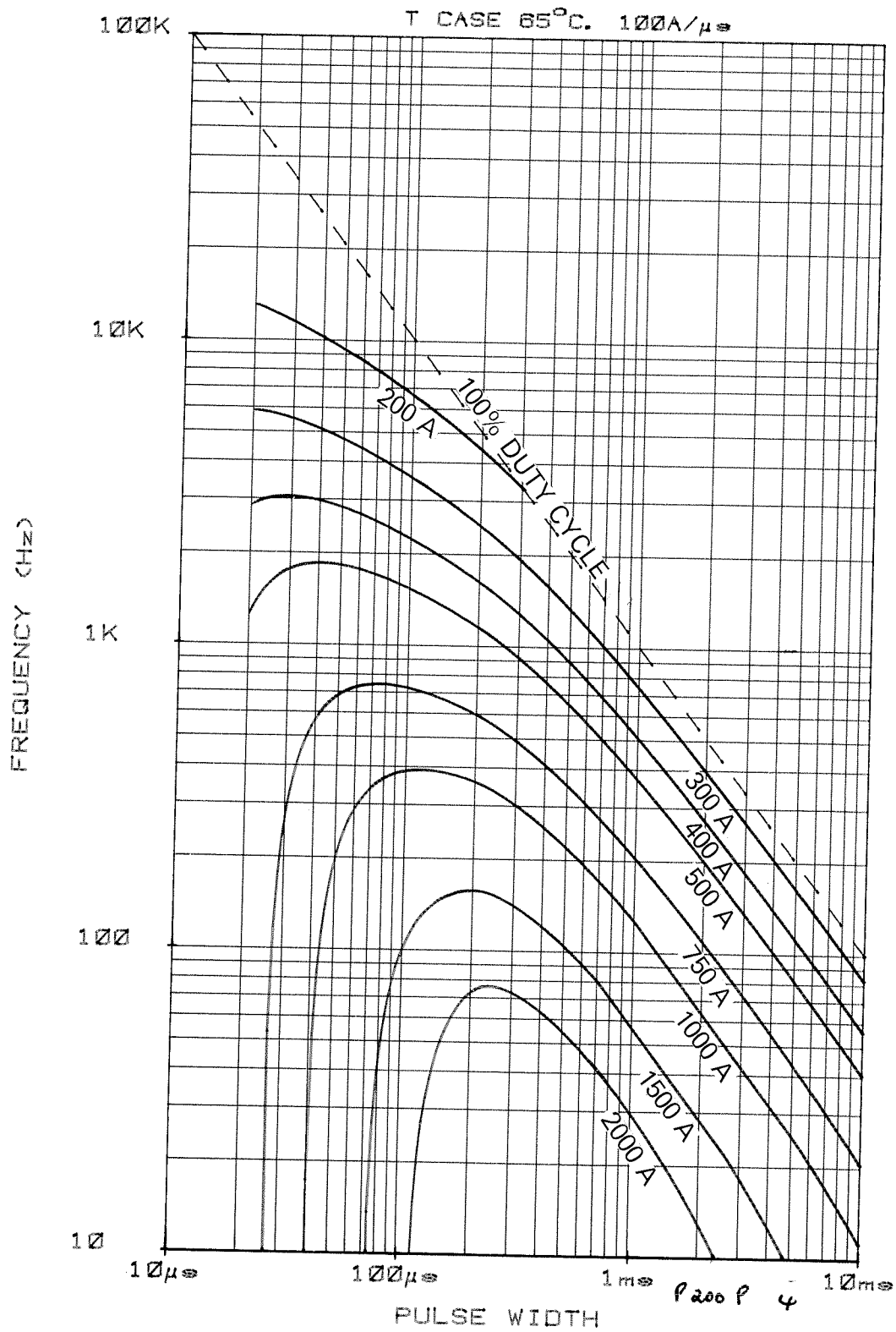


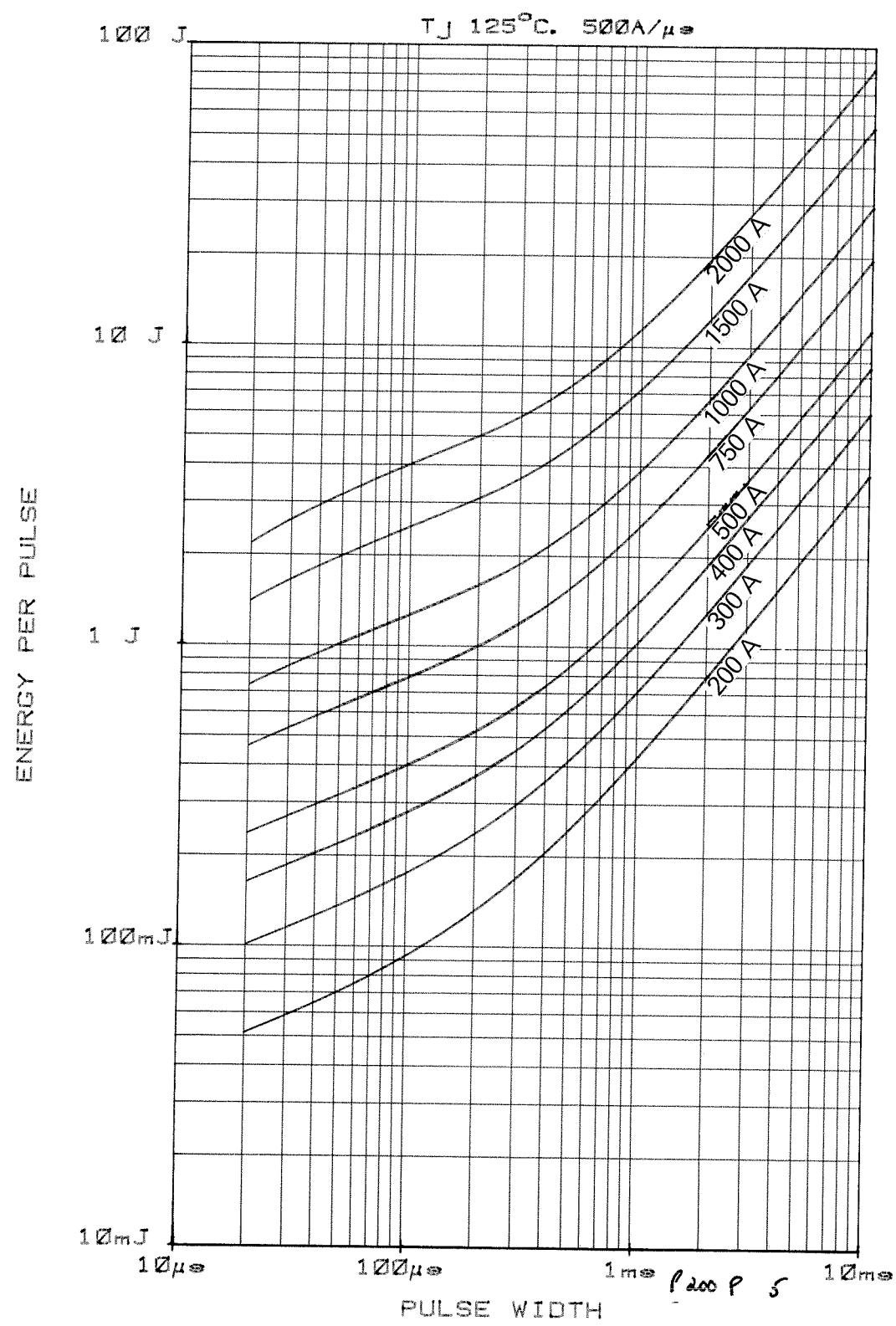
P200P

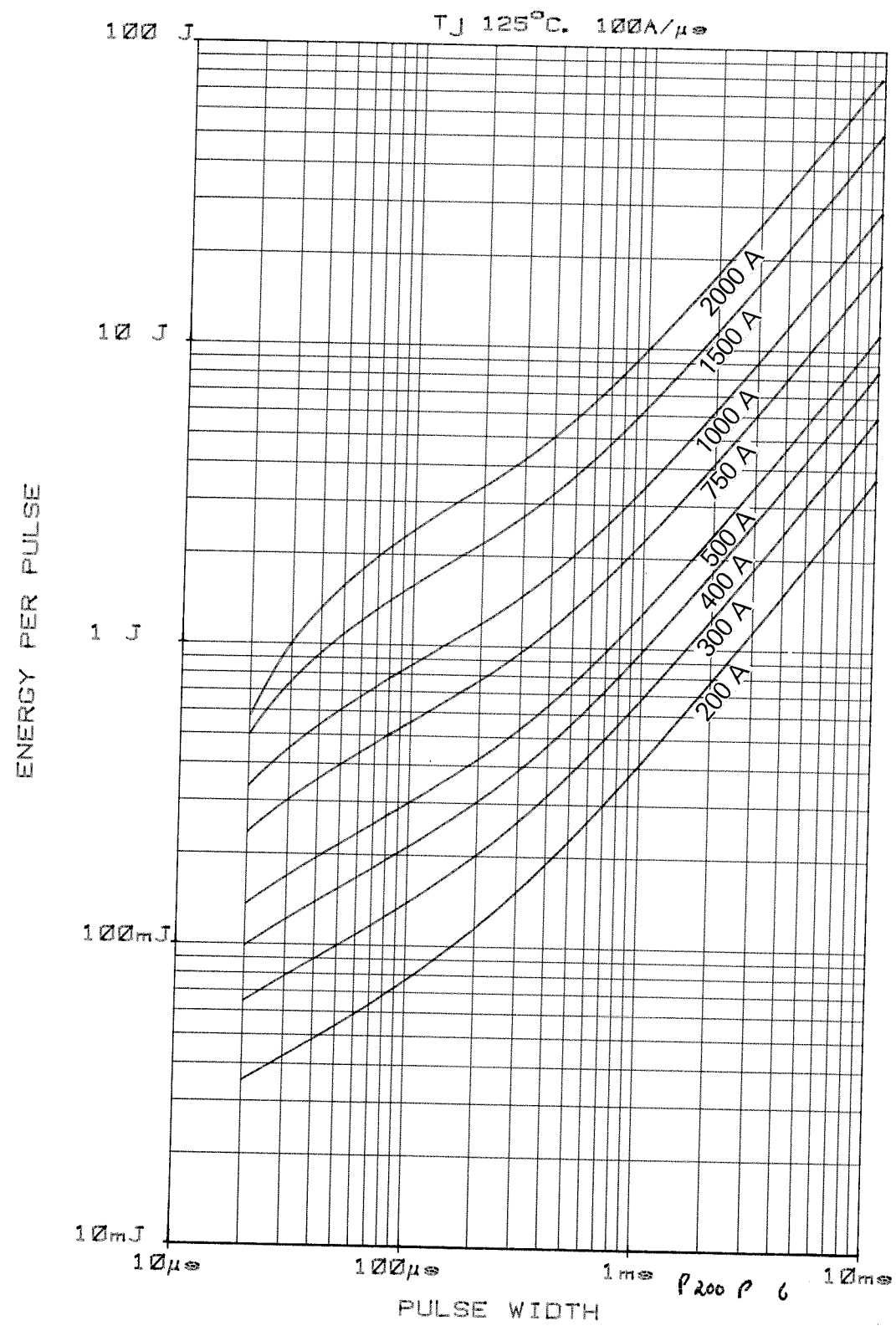
Fig 2

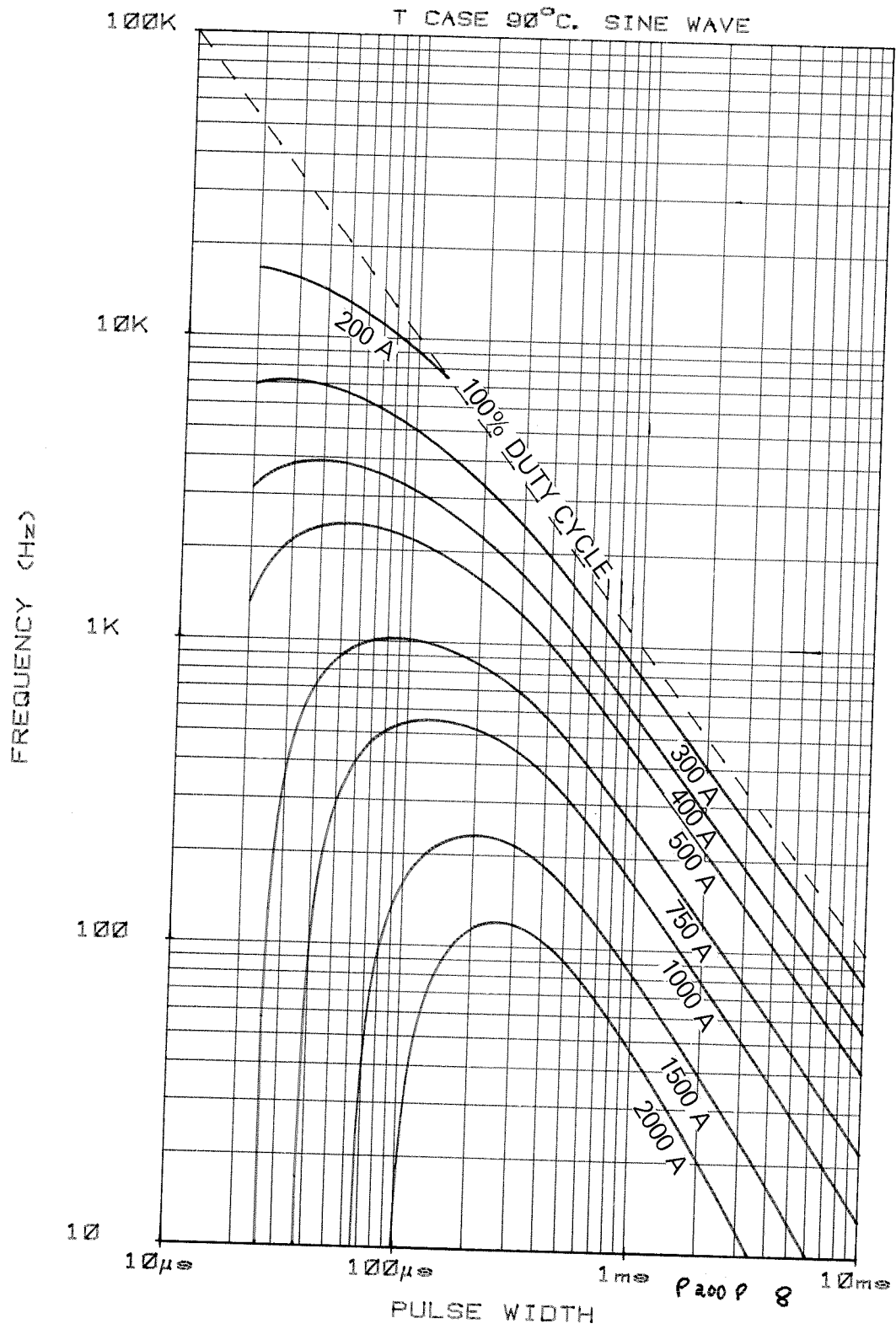


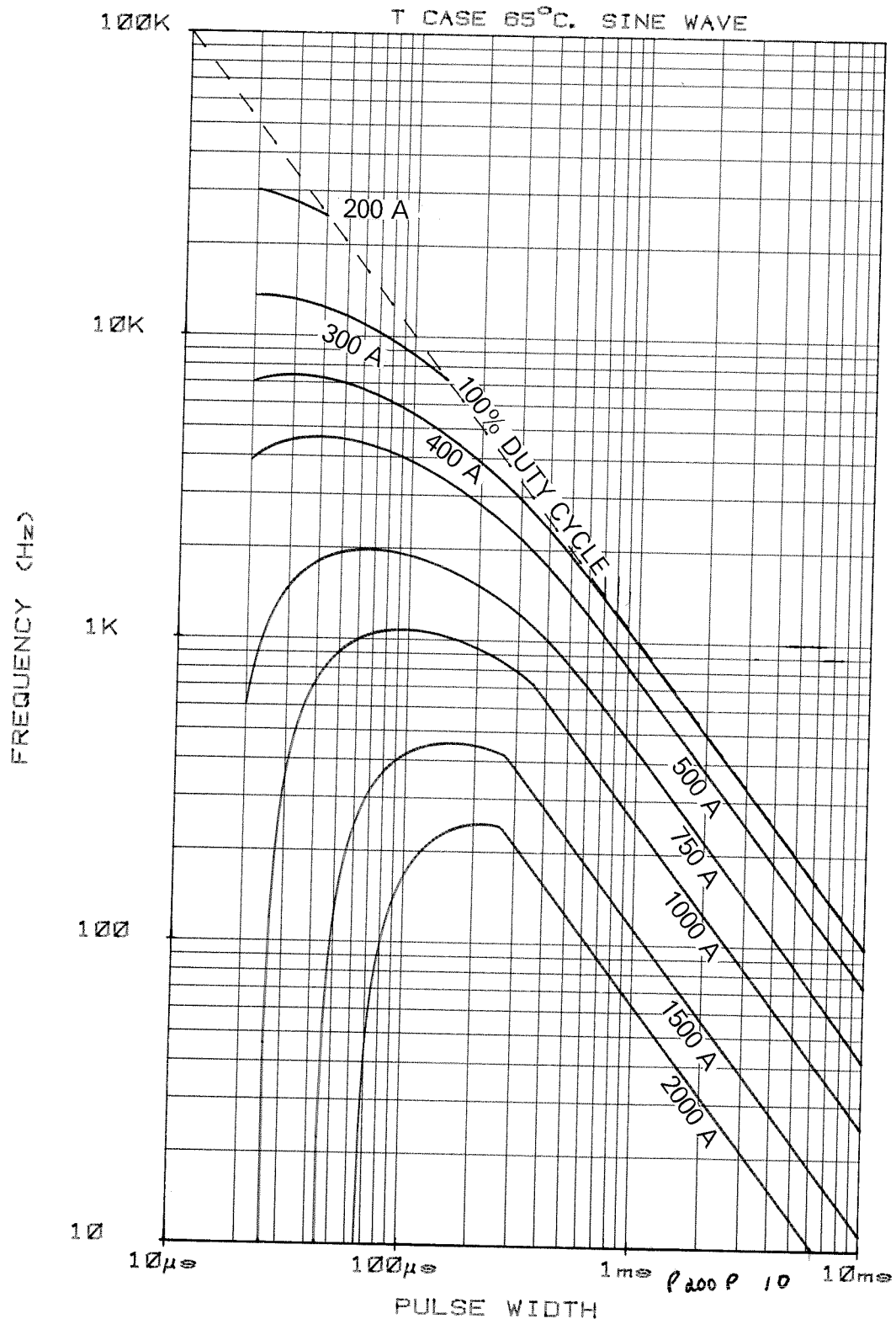
9/2001  
Fig 4

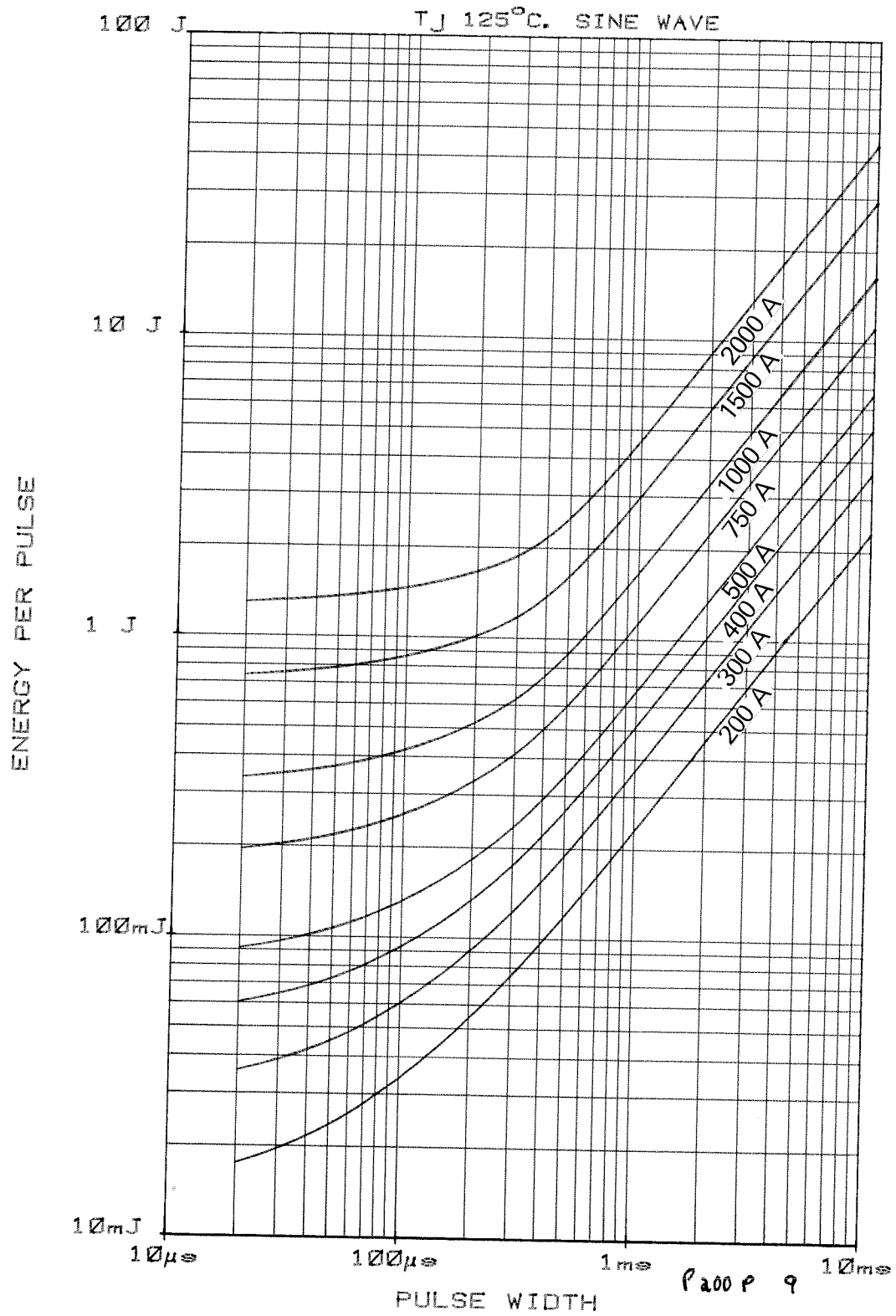














|       |     |
|-------|-----|
| SCALE | 1/1 |
| DRN   | 1/1 |
| CHKD  |     |
| APPD  |     |
|       |     |
|       |     |
| S     | A   |
| S     | NI  |

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.

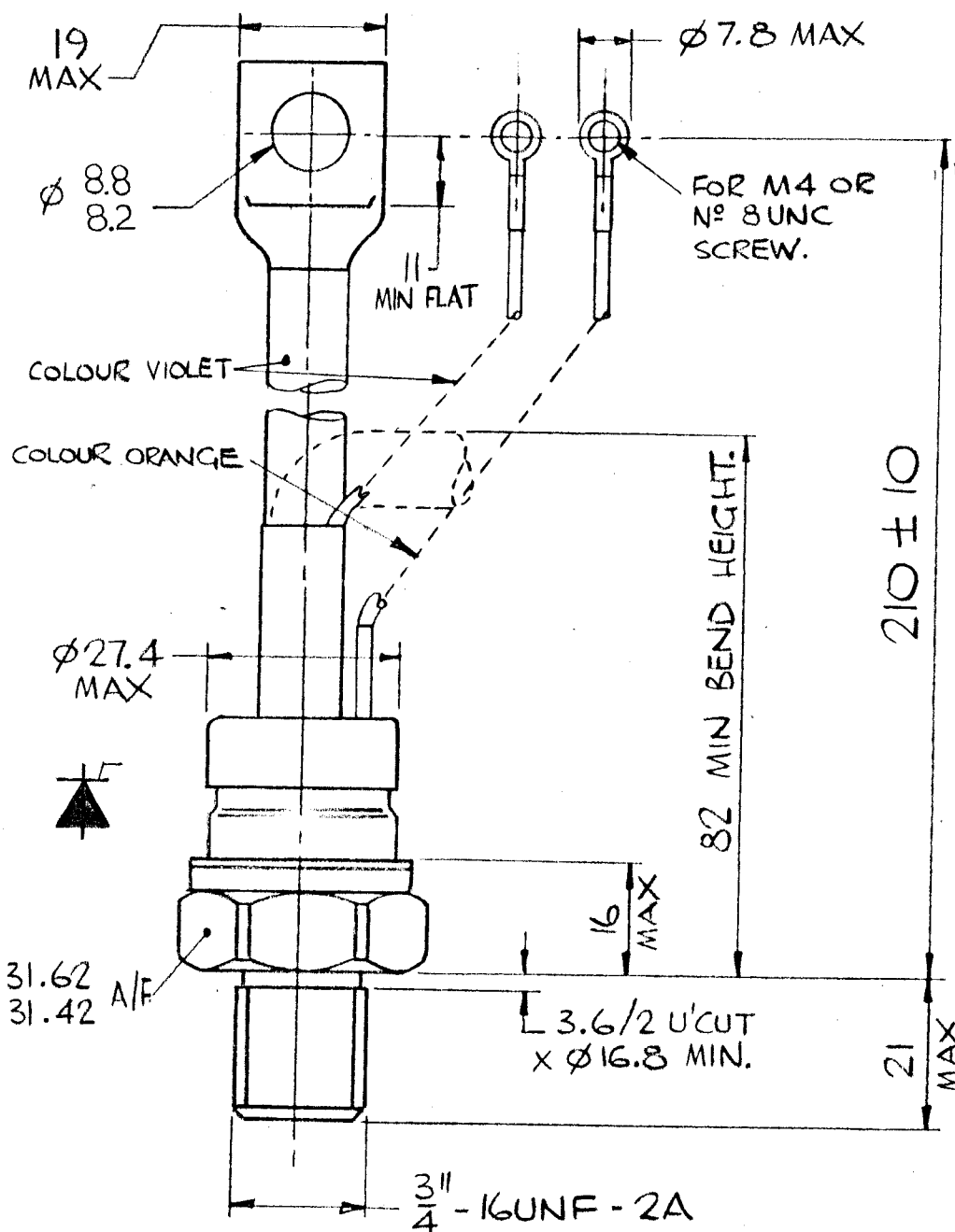
TYPE NUMBER

N170P P205P  
 N195P P215P  
 N275P P202P  
 P200P  
 P204P  
 P214P

NOTES.

G.A. DRG. No.

103A162



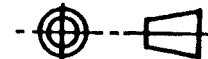
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WESTCODE®  
 SEMICONDUCTORS

THIRD ANGLE PROJECTION



DIMNS. IN MILLIMETRES

DRG. No.

101A225

| ISS | REVISIONS                              |
|-----|----------------------------------------|
| 1   | 19.9.78                                |
| 2   | 17.11.78 W670<br>TYPE N° ADDED         |
| 3   | Ø 38/8.2 HOLE<br>WAS 10.7/10.2<br>Hole |
| 4   | 17.12.79 M817<br>19 WAS 21.4           |
| 5   | 27.11.84 M121B<br>FIN WAS ET.          |