

Fast Turn-off Thyristor Stud Types P0330SX04# to P0330SX08#

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

(Rating Report 84TR19 Issue 2)

This data reflects the old part number for this product which is: P215PH02-08.
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 at grade 02 (200V 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

P0330	SX	◆◆	#
Fixed Type Code	SC - ¾" Ceramic stud SD – ¾" Ceramic stud removed	Voltage code $V_{RRM}/100$ 04-08	Fixed Turn-off time Code C = 15µs, D = 20µs
Typical Order Code: P0330SC04C, ¾" Ceramic stud, 400V V_{RRM}/V_{DRM} , 15µs 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.

WESTCODE SEMICONDUCTORS

Technical
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Inverter Grade Stud-Base Thyristor Type P215P 220 amperes average: up to 800 volts V_{RRM}/V_{DRM}

Ratings (Maximum values at 125°C T_j unless stated otherwise)

RATING	CONDITIONS	SYMBOL	
Average on-state current	Half sine wave 85°C case temperature	$I_{T(AV)}$	220 A
R.M.S. on-state current		$I_{T(RMS)}$	355 A
Continuous on-state current		I_T	355 A
Peak one-cycle surge (non-repetitive) on state current	10ms duration, 60% V_{RRM} re-applied	$I_{TSM(1)}$	5000 A
	10ms duration, $V_R \leq 10$ volts	$I_{TSM(2)}$	5500 A
Maximum permissible surge energy	10ms duration, $V_R \leq 10$ volts	$I^2t(2)$	151000 A ² s
	3ms duration, $V_R \leq 10$ volts	I^2t	112000 A ² s
Peak forward gate current	Anode positive with respect to cathode	I_{FGM}	18 A
Peak forward gate voltage	Anode positive with respect to cathode	V_{FGM}	12 V
Peak reverse gate voltage		V_{RGM}	5 V
Average gate power		P_G	1.5 W
Peak gate power	100μs. pulse width	P_{GM}	60 W
Rate of rise of off-state voltage	To 80% V_{DRM} gate open-circuit	dv/dt	*200 V/μs
Rate of rise of on-state current (repetitive)	$\left\{ \begin{array}{l} \text{Gate drive 20 volts, 20 ohms with } t_r \leq 1\mu s. \\ \text{Anode voltage } \leq 80\% V_{DRM} \end{array} \right\}$	$di/dt(1)$	500 A/μs
Rate of rise of on-state current (non-repetitive)		$di/dt(2)$	1000 A/μs
Operating temperature range		T_{CASE}	-40 + 125°C
Storage temperature range		T_{stg}	-40 + 150°C

Characteristics (Maximum values at 125°C T_j unless stated otherwise)

CHARACTERISTIC	CONDITIONS	SYMBOL	
Peak on-state voltage	At 600 A, I_{TM}	V_{TM}	1.578 V
Forward conduction threshold voltage		V_O	1.05 V
Forward conduction slope resistance		r	0.88 mΩ
Repetitive peak off-state current	At V_{DRM}	I_{DRM}	30 mA
Repetitive peak reverse current	At V_{RRM}	I_{RRM}	30 mA
Maximum gate current required to fire all devices	$\left\{ \begin{array}{l} \text{At } 25^\circ\text{C}, V_A = 6 \text{ V}, I_A = 1 \text{ A} \end{array} \right\}$	I_{GT}	200 mA
Maximum gate voltage required to fire all devices		V_{GT}	3 V
Maximum holding current		I_H	600 mA
Maximum gate voltage which will not trigger any device		V_{GD}	0.25 V
Stored charge	$I_{TM} = 300 \text{ A}, di/dt \text{ 20 A/}\mu\text{s}$ $V_{RM} = 50 \text{ V}, 50\% \text{ chord value}$	Q_{rr} typical	30 μC
Circuit commutated turn-off time available down to	$I_{TM} = 300 \text{ A}$ $di/dt = 20 \text{ A/}\mu\text{s}, V_{RM} = 50 \text{ V}$ $\left\{ \begin{array}{l} 200 \text{ V/}\mu\text{s to } 80\% V_{DRM} \\ 20 \text{ V/}\mu\text{s to } 80\% V_{DRM} \end{array} \right\}$	t_q	10–30 μs
Thermal resistance, junction to case for a device with a maximum forward volt drop characteristic		t_q typical	8–20 μs
		$R_{th(j-c)}$	0.12°C/W

VOLTAGE CODE		H02	H03	H04	H06	H08			
Repetitive peak voltages	$V_{RRM} V_{DRM}$	200	300	400	600	800			
Non-repetitive peak off-state voltage	V_{DSM}								
Non-repetitive peak reverse blocking voltage	V_{RSM}	300	400	500	700	900			

Ordering Information (Please quote device code as explained below)

P	2	1	5	P	• • •	•	•	0
Fixed type code					Voltage Code (see ratings)	dv/dt code to 80% V_{DRM} C = 20V/μs E = 100V/μs D = 50V/μs F = 200V/μs	Turn-off time H = 30 μs J = 25 μs K = 20 μs L = 15 μs N = 10 μs P = 8 μs	

Typical code: P215PH06FJ0 = 600 V_{RRM} 600 V_{DRM} 200 V/μs dv/dt to 80% V_{DRM} 25 μs turn-off

*Other values of dv/dt up to 1000 V/μs, and turn-off time may be available.

1. INTRODUCTION

The P215P thyristor series are diffused regenerative gate devices employing a 24 mm slice in a stud based top-hat housing.

2. 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 1000 A/ μ s 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 500 A/ μ s 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/ μ s.

(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, f_{max} , 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 E_p be the Energy per pulse for a given current and pulse width, in joules.

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

3. 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:

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

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

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

(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 p. 10. 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 page 10.

Let f be the operating frequency in Hz

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

where $T_{CASE} new$ is the required maximum case temperature

and $T_{CASE} original$ is the case temperature given with the frequency ratings.

4. GATE DRIVE

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

5. THE DV/DT SUPPRESSION NETWORK

The effect of a conventional resistor-capacitor snubber of 0.22 μ F 5 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.

Snubber Network Values

A series connected C-R filter may be required across the anode to cathode terminals of the thyristor for the purpose of reducing off-state voltage overshoot.

The optimum values for C and R depend partly on the circuits connected to the thyristor. For most applications the snubber design values should not exceed a maximum of 0.22 μ F or a minimum of 5 ohms. Please consult Westcode for values outside these limits.

6. NOTE 1

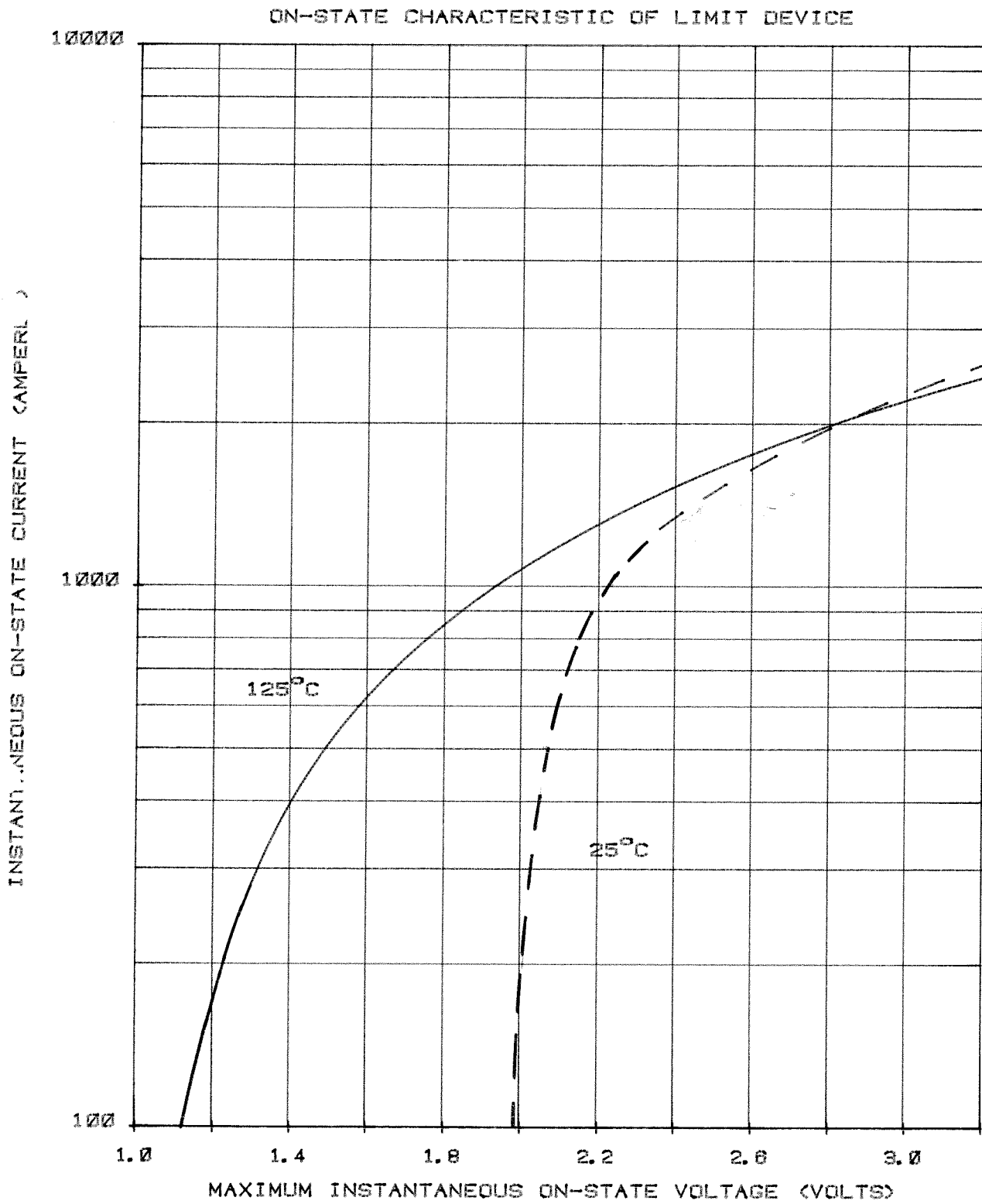
REVERSE RECOVERY LOSS BY MEASUREMENT

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

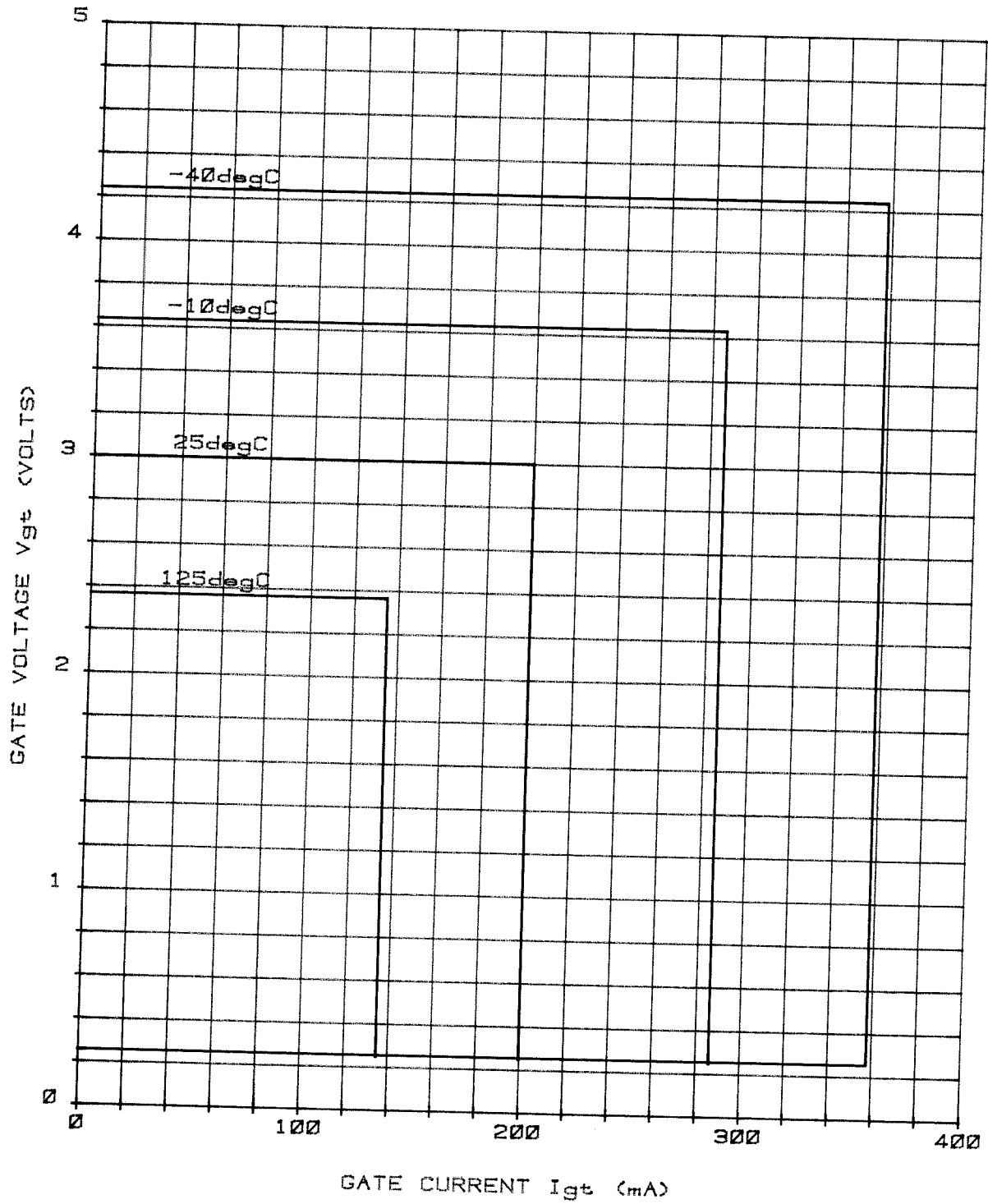
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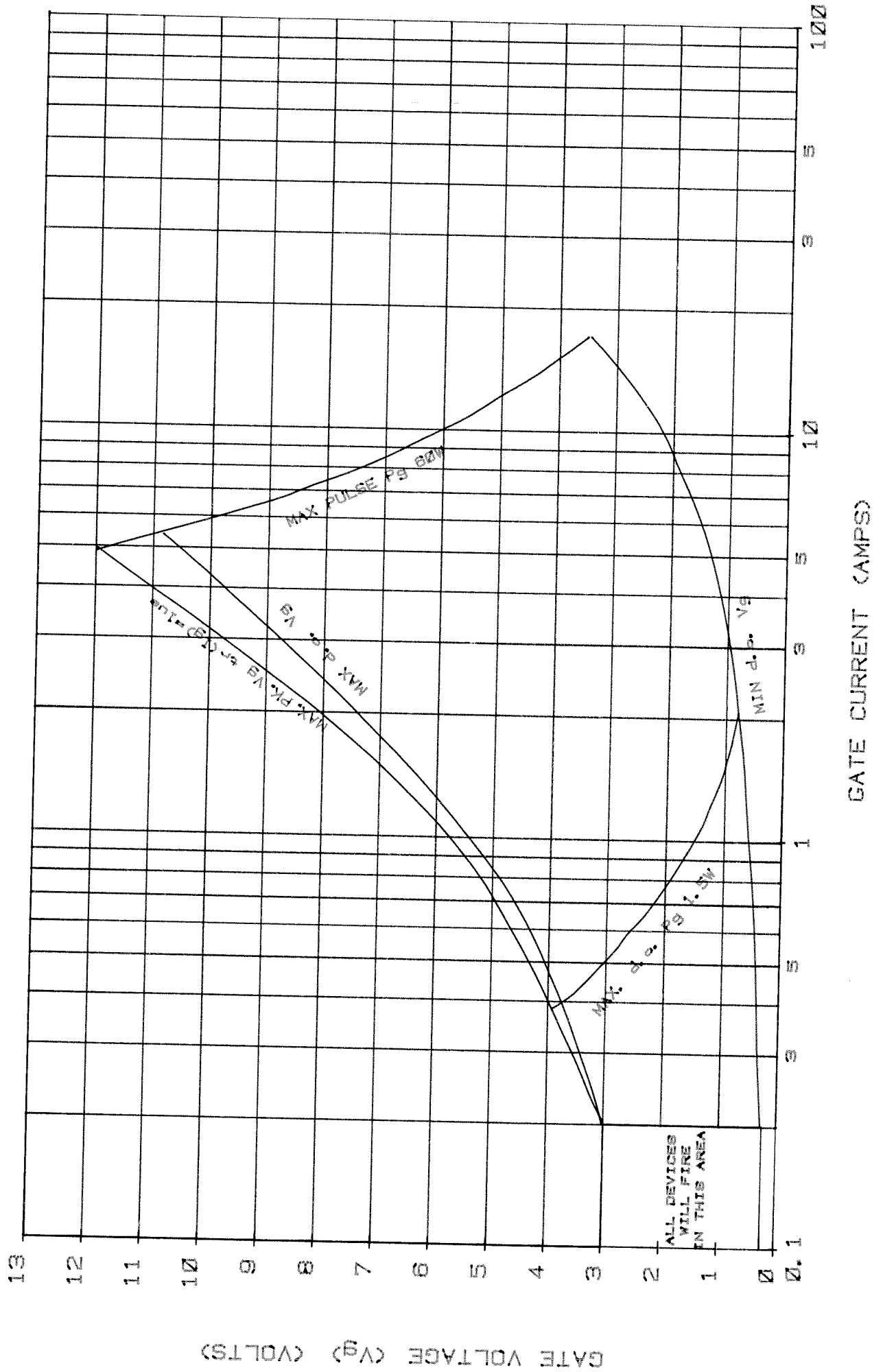


GATE TRIGGERING CHARACTERISTICS

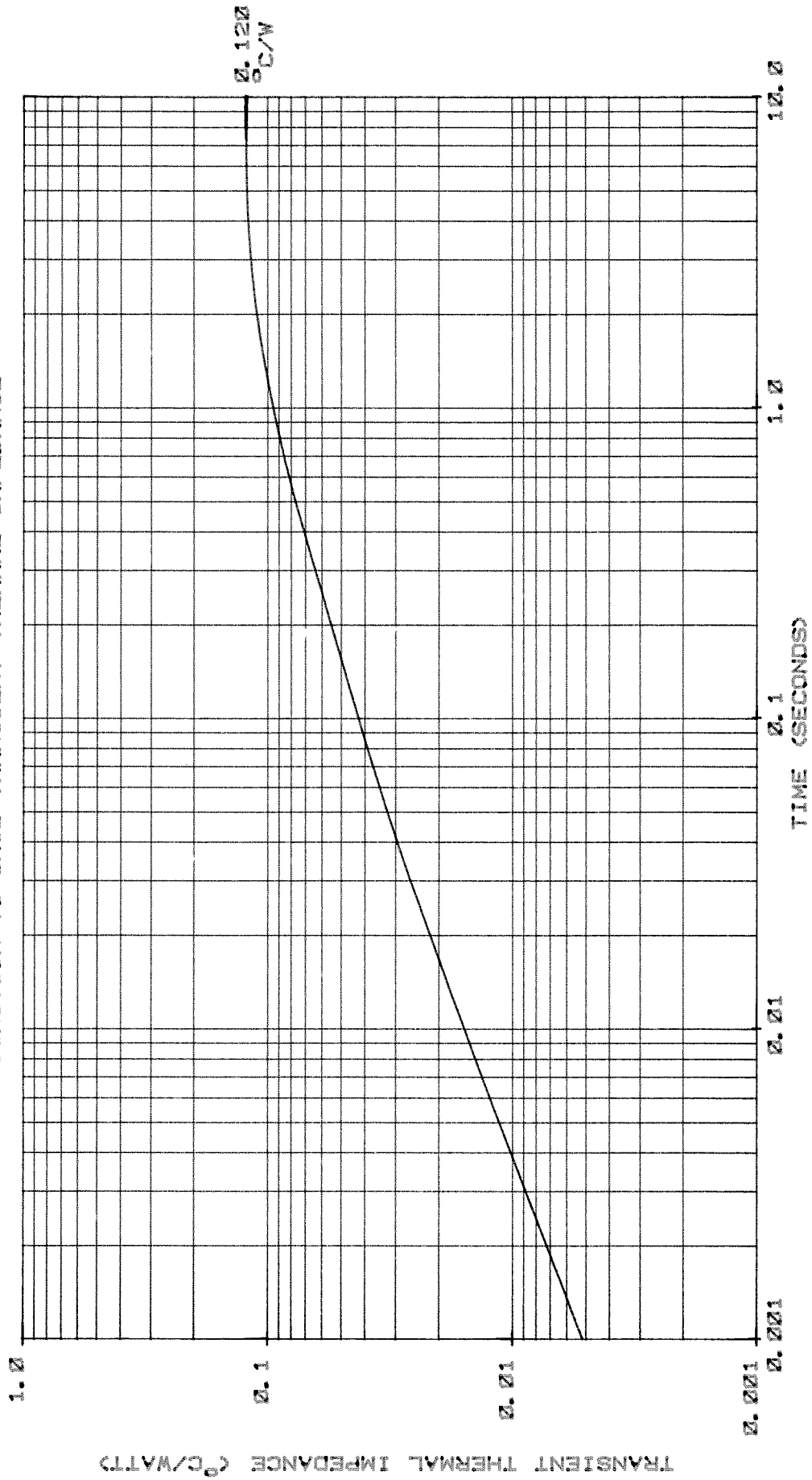
(TRIGGER POINTS OF ALL THYRISTORS LIE IN THE AREAS SHOWN)



GATE CHARACTERISTICS AT 25°C JUNCTION TEMPERATURE

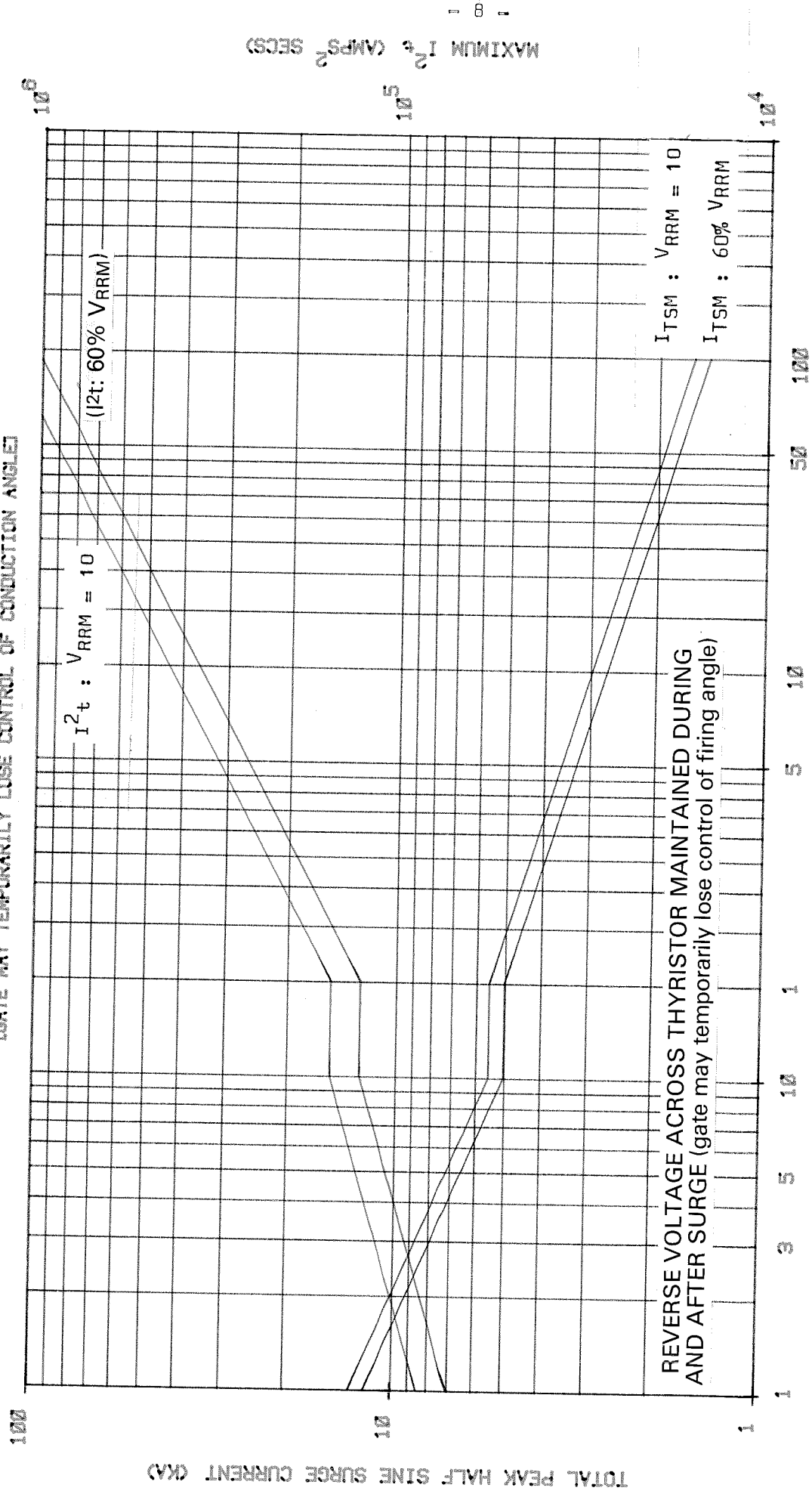


JUNCTION TO CASE TRANSIENT THERMAL IMPEDANCE



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

GATE MAY TEMPORARILY LOSE CONTROL OF CONDUCTION ANGLE

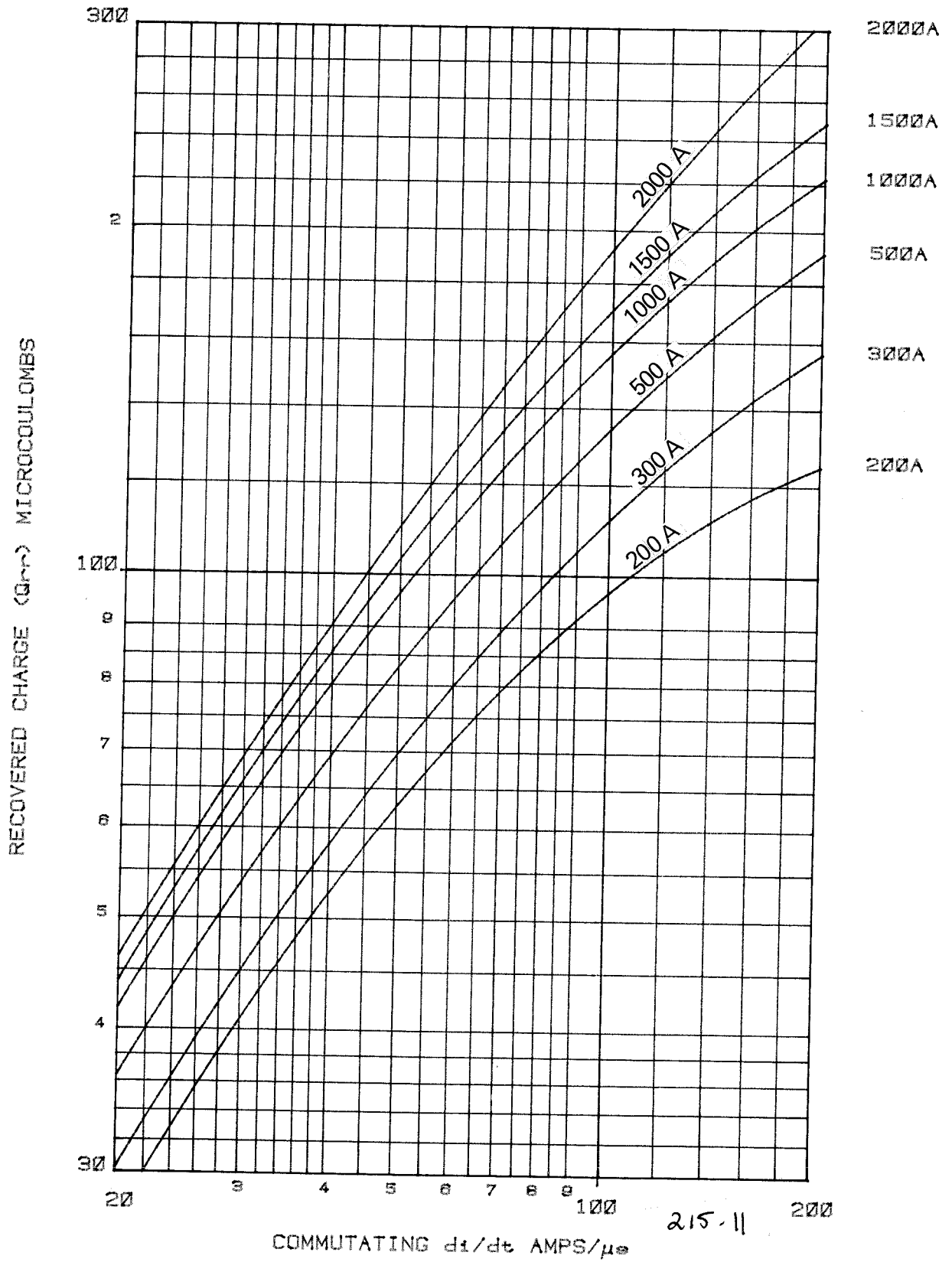


DURATION OF SURGE (cycles at 50 Hz)

DURATION OF SURGE (ms)

P215P
FIG 11

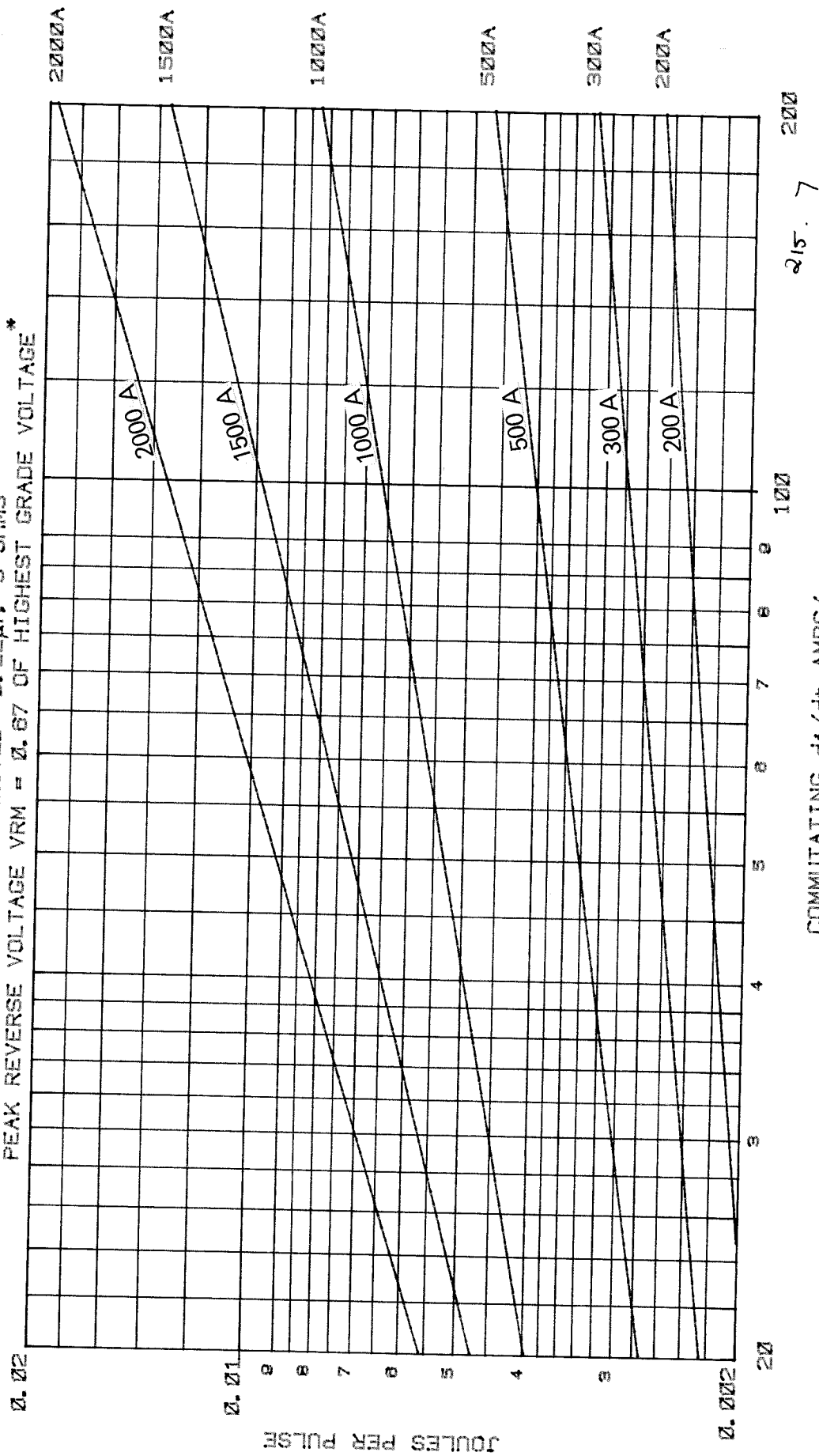
TYPICAL RECOVERED CHARGE AT 125°C JUNCTION TEMPERATURE



P215P Fig 4

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

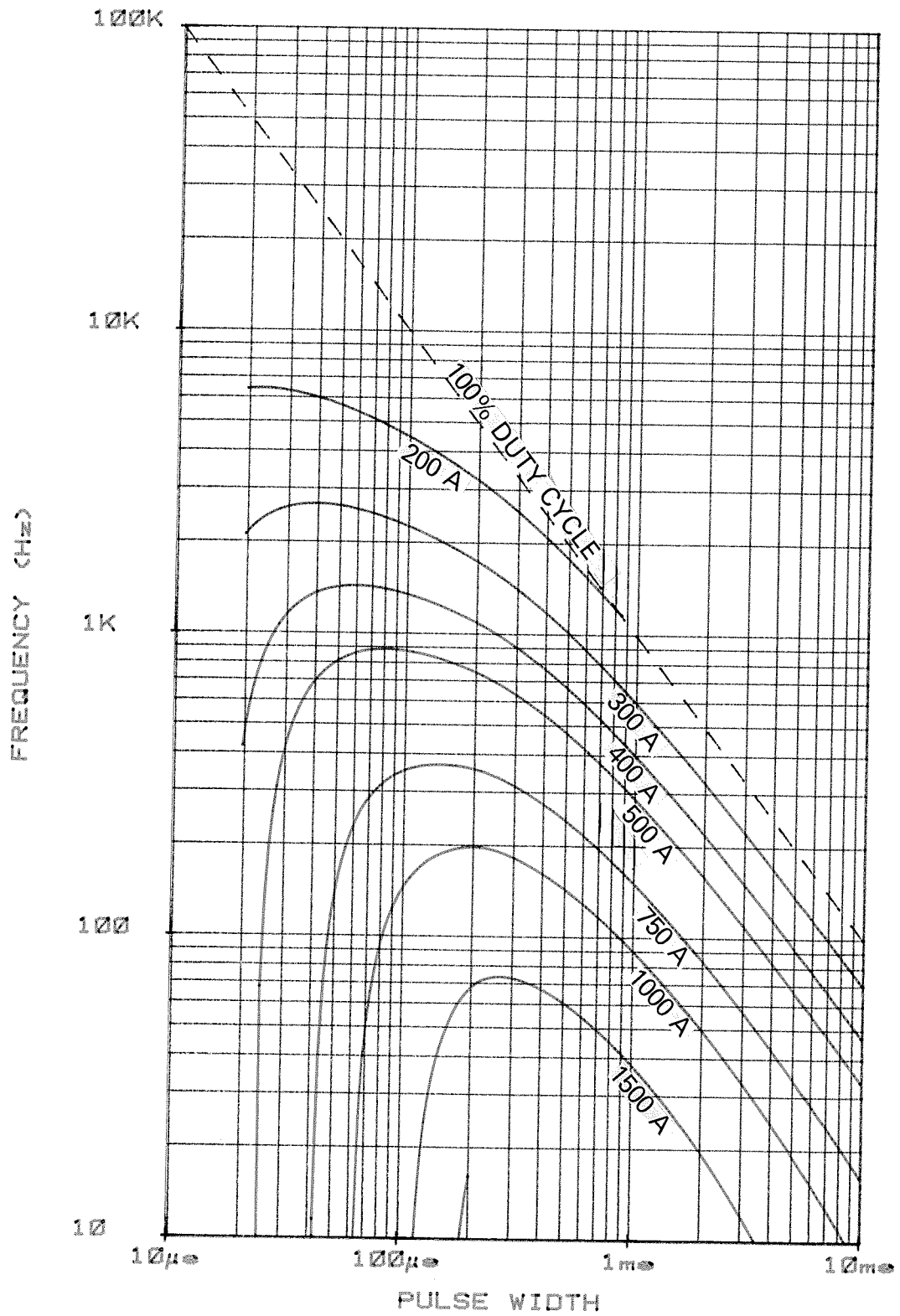
SNUBBER CONNECTED: 0.22μF, 5 OHMS
PEAK REVERSE VOLTAGE VRM = 0.67 OF HIGHEST GRADE VOLTAGE*



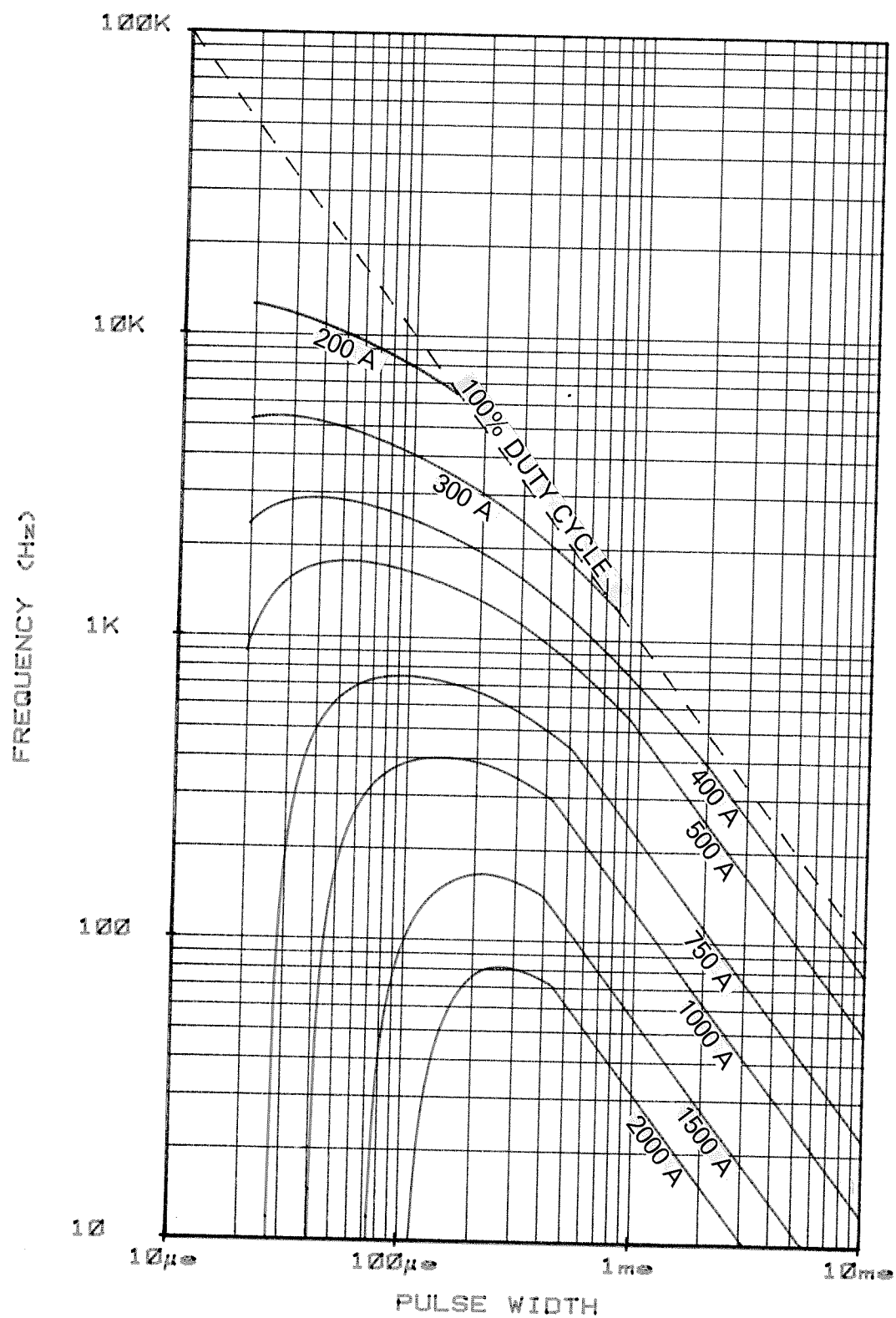
COMMUTATING di/dt AMPS/μs

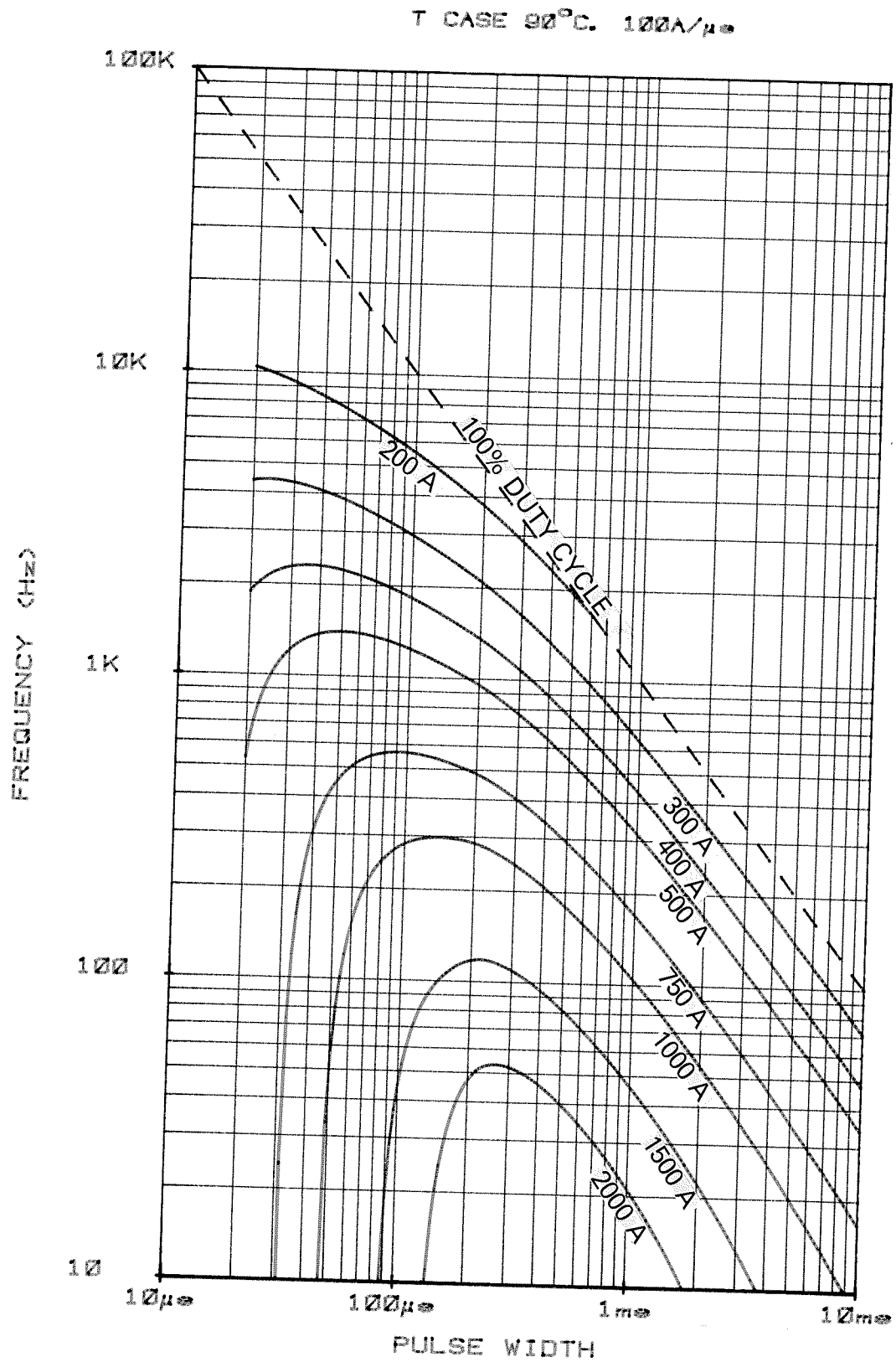
* NOTE: ENERGY PER PULSE SHOULD BE ADJUSTED PRO RATA WITH APPLIED PEAK RECOVERY VOLTAGE

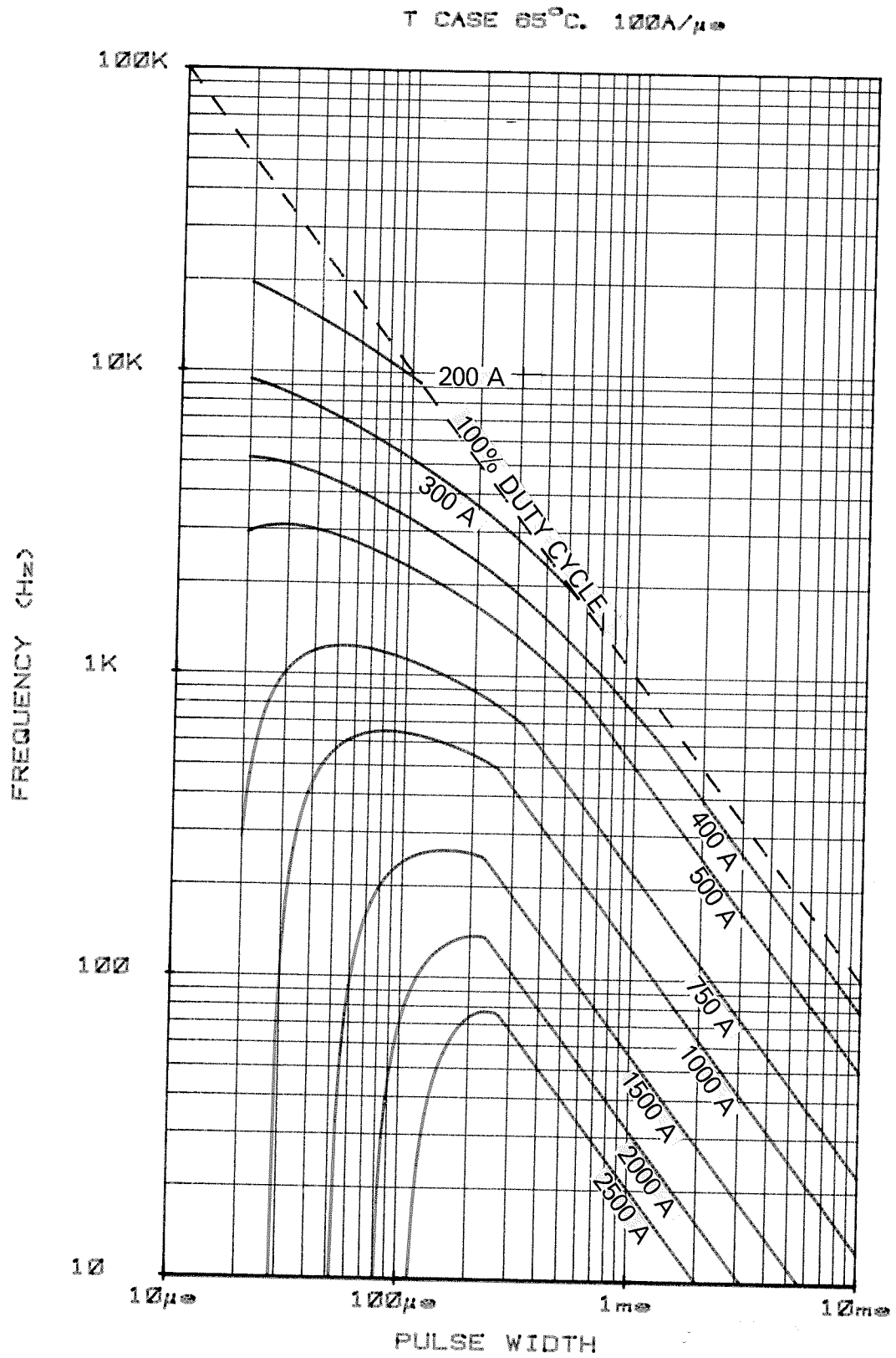
T CASE 90°C. 500A/μs



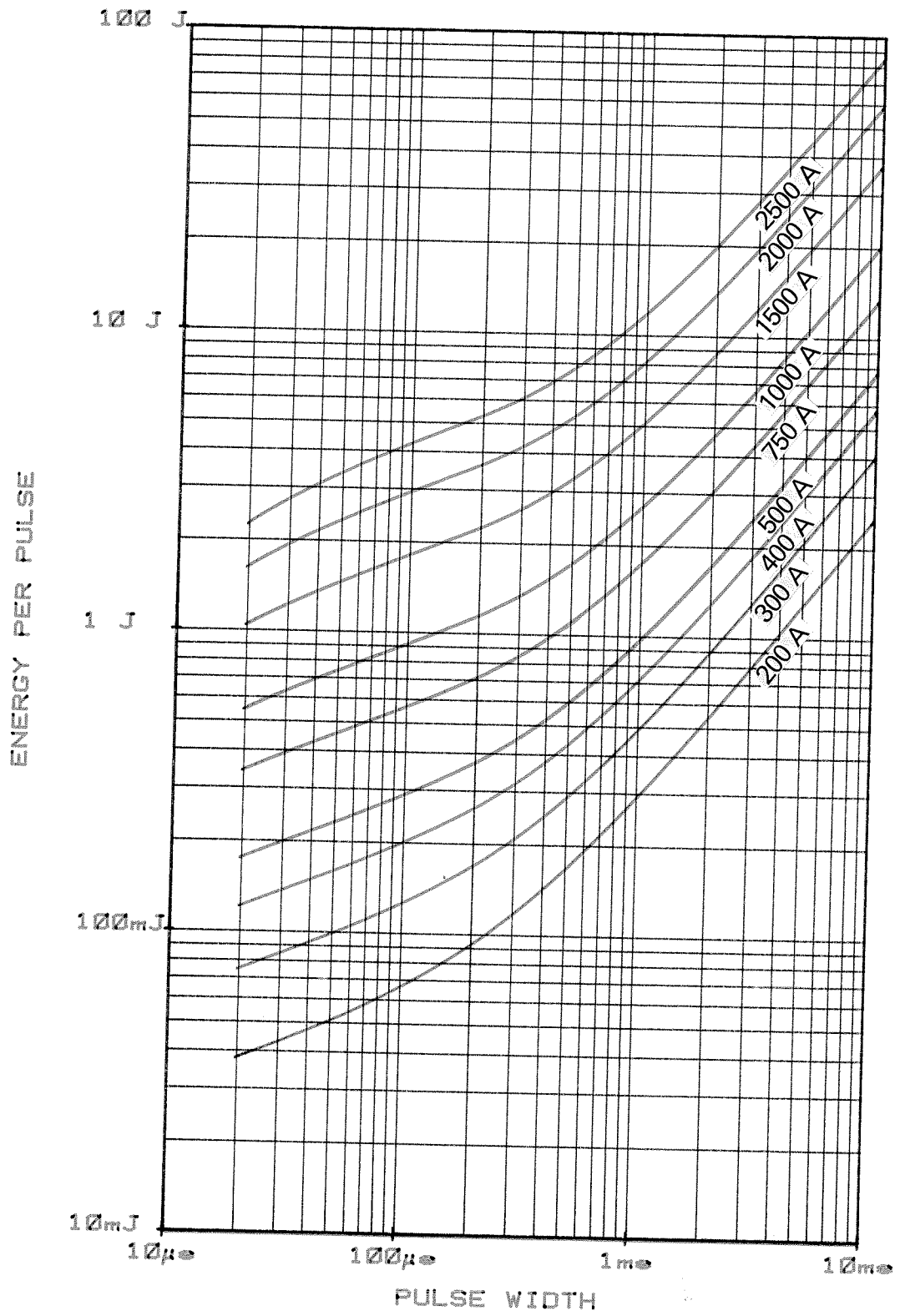
T CASE 85°C. 500A/μs



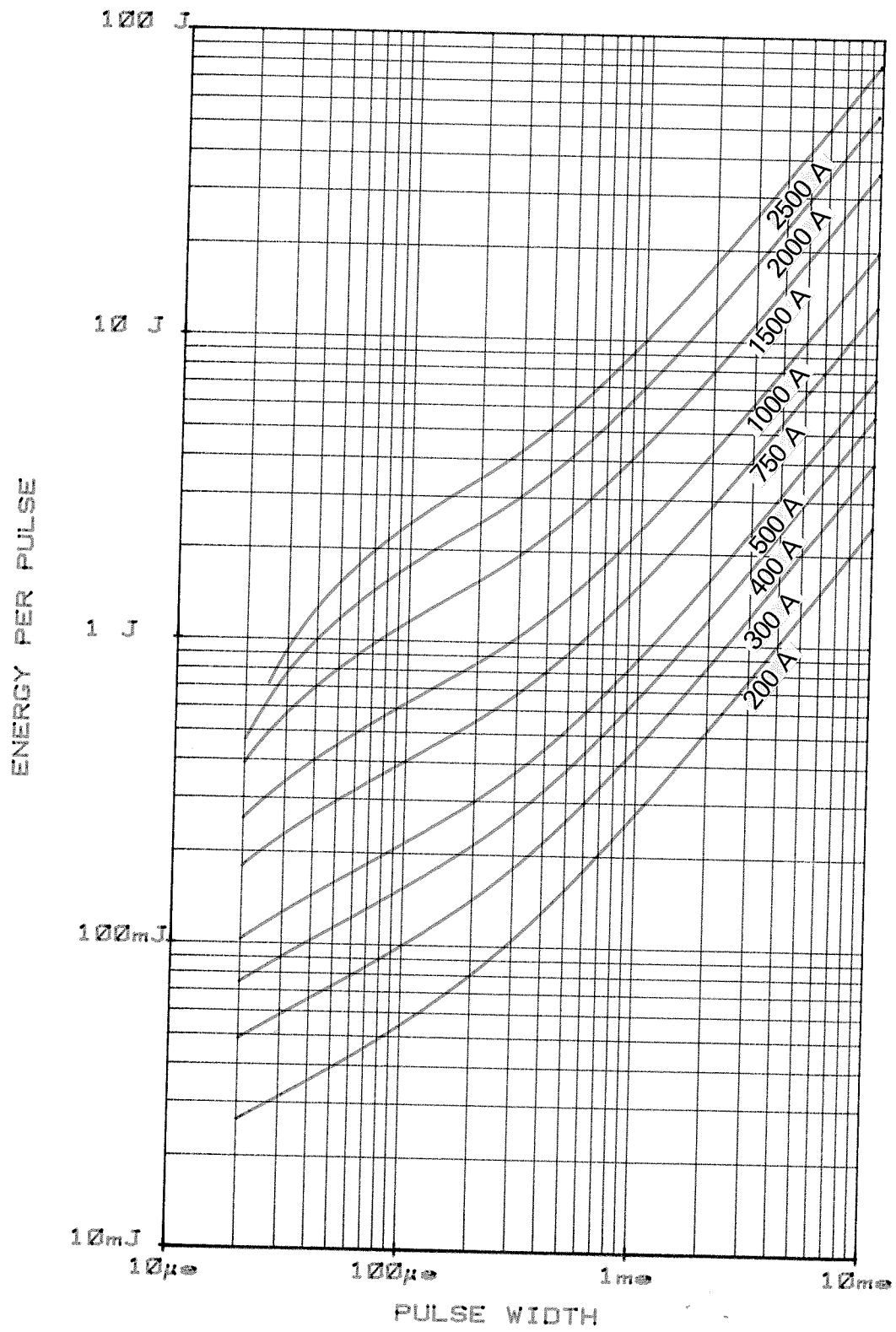




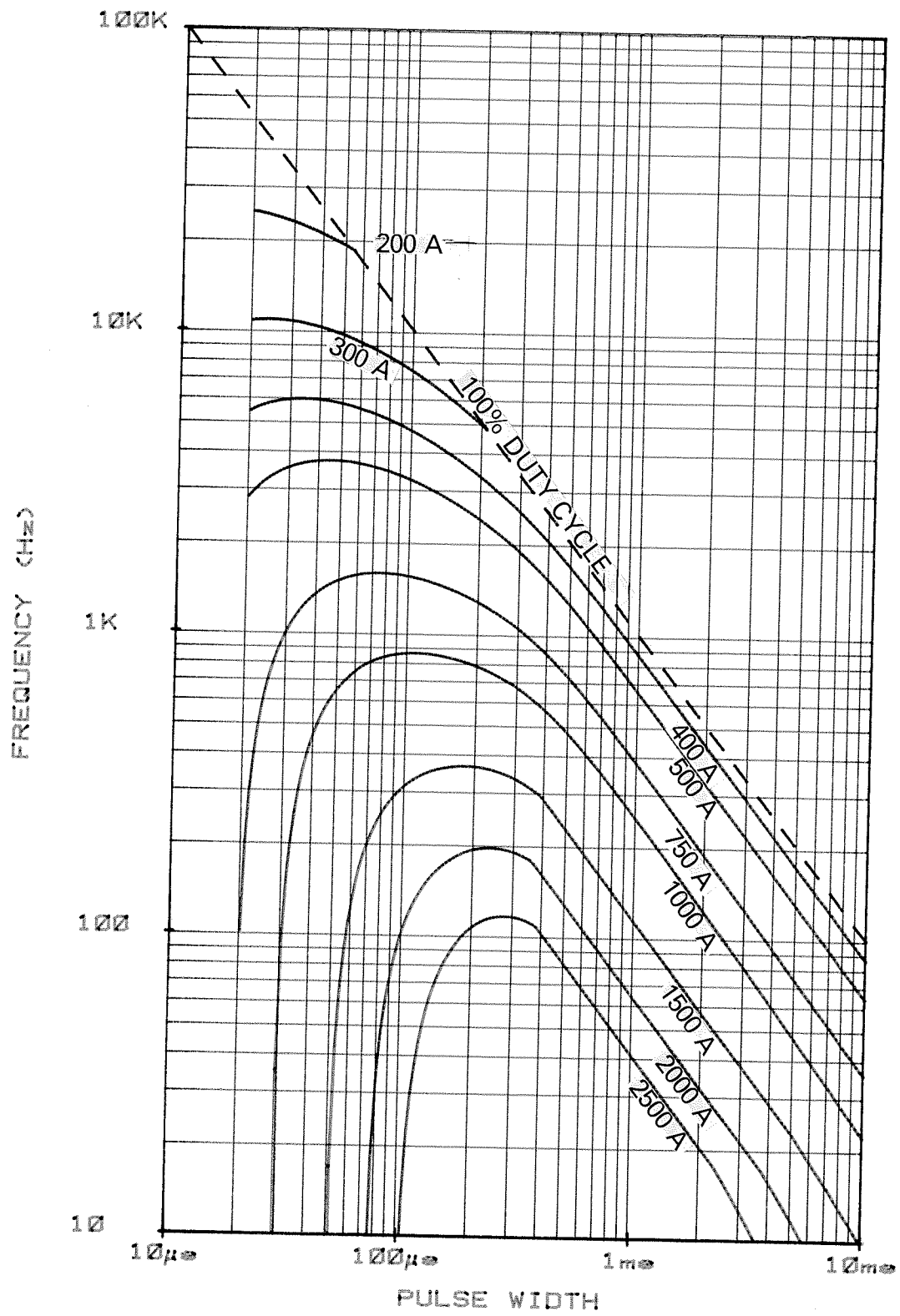
T_J 125°C. 500A/μs



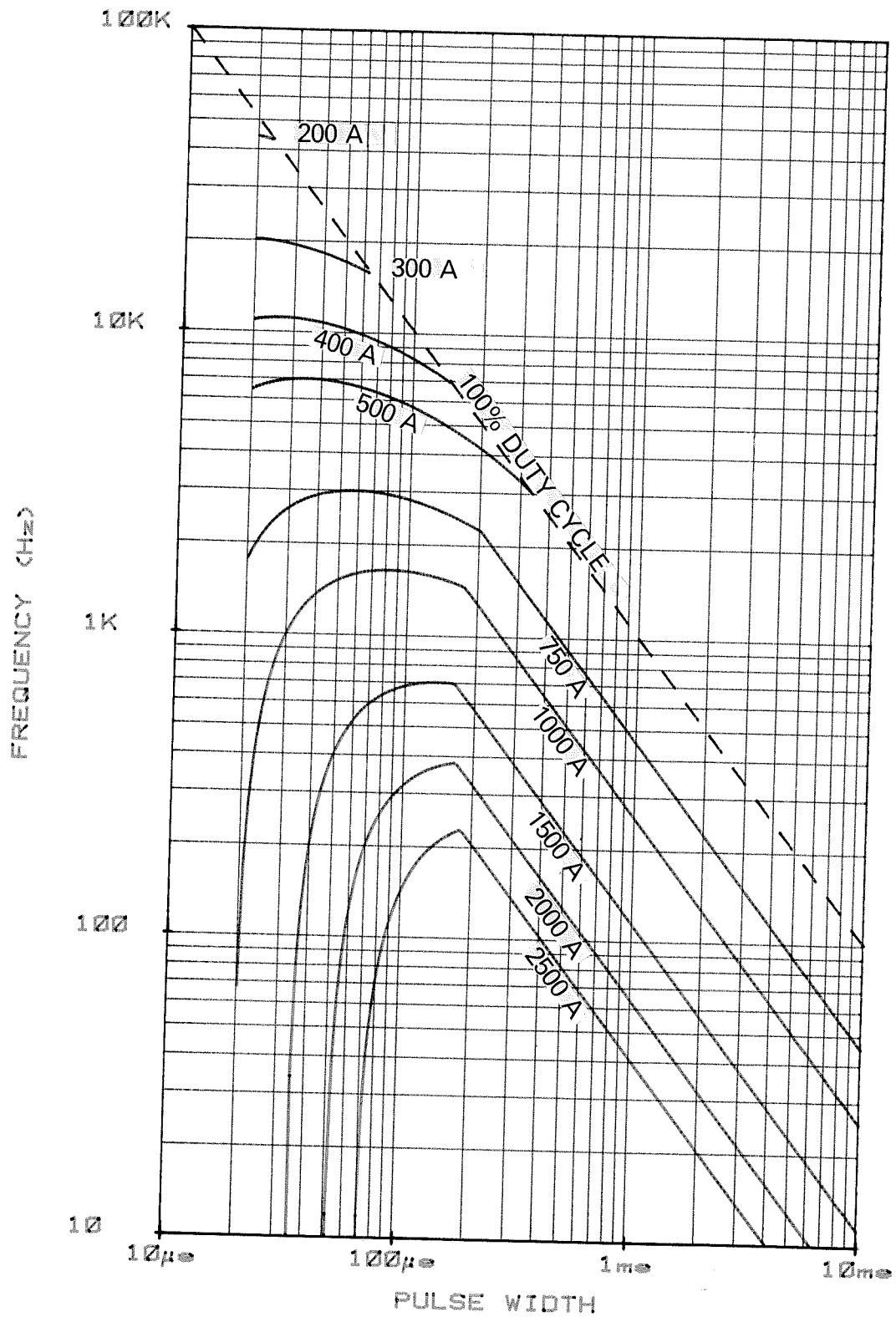
TJ 125°C. 100A/μs

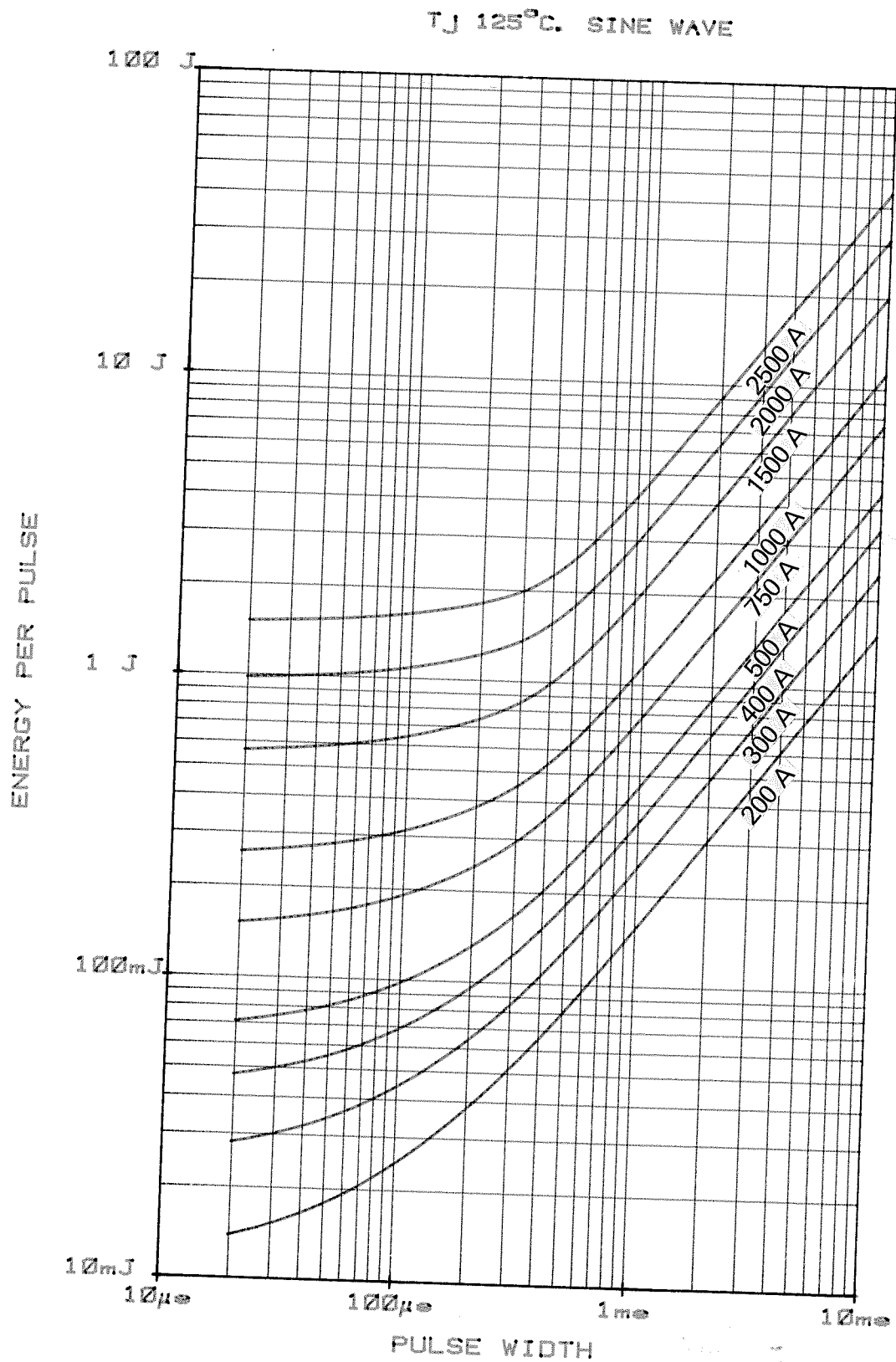


T CASE 90°C. SINE WAVE



T CASE 65°C. SINE WAVE





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

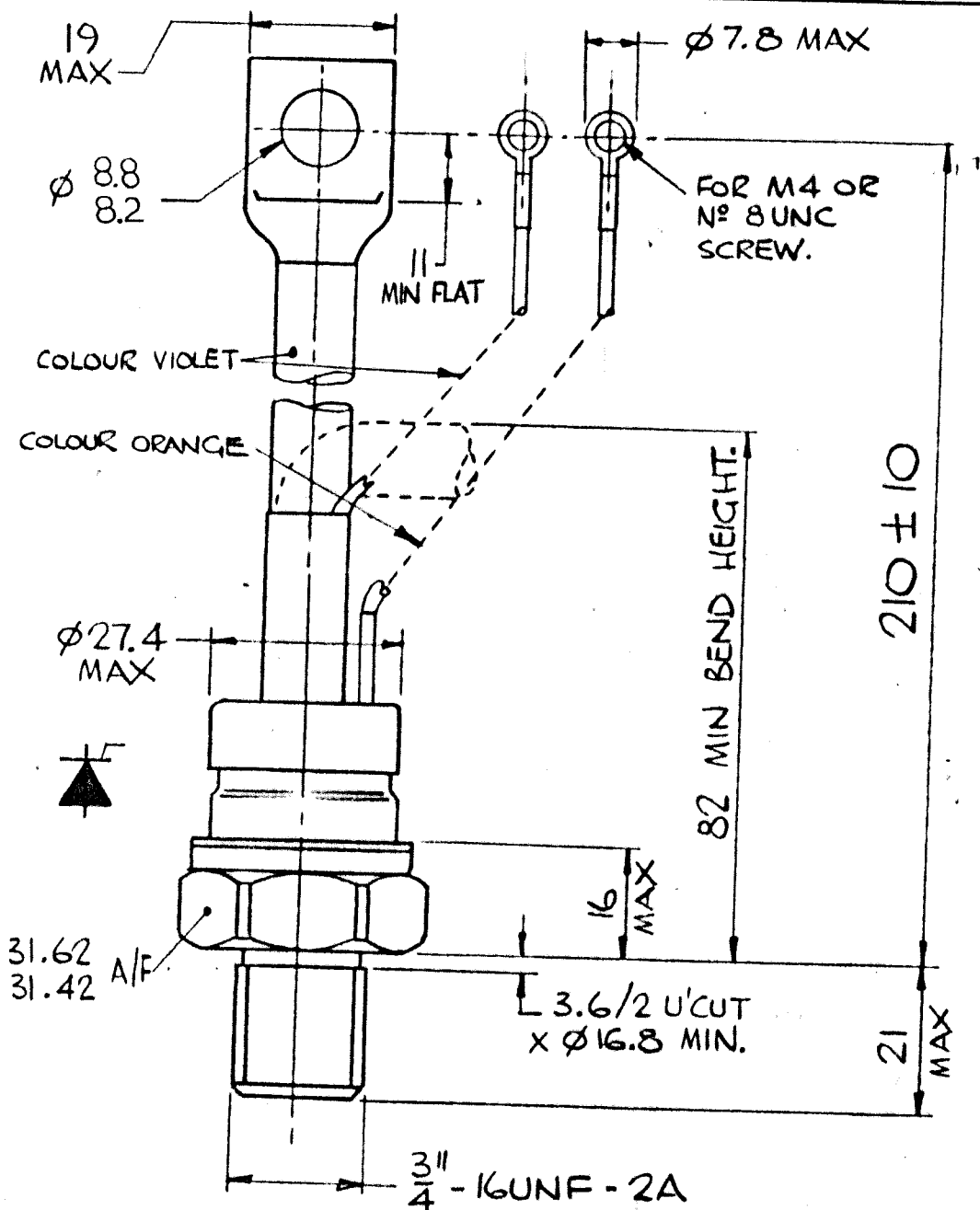
INTERNATIONAL OUTLINE No.
 WEIGHT. 280 GRAMS APPX.
 FINISH. BRIGHT NICKEL PLATE. - 20 -
 DEVICE MARKING INCLUDES MONOGRAM, TYPE No., SPEC.
 No. AND POLARITY SYMBOL.
 DEVICE MOUNTING: MOUNTING TORQUE
 27-24.5 Nm (2.77-2.5 kgF-m).
 THREAD MUST NOT BE LUBRICATED.

TYPE NUMBER

N170P P205P
 N195P P215P
 N275P P202P
 P200P
 P204P
 P214P

NOTES.

G.A. DRG. No. 103A162



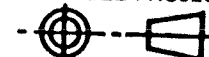
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WESTCODE®
 SEMICONDUCTORS

THIRD ANGLE PROJECTION



DIMNS. IN MILLIMETRES

DRG. No.

101A225

ISS	REVISIONS
1	19.9.78
2	17.11.78 M670 TYPE N° ADDED
3	$\phi 8.8/\phi 8.2$ HOLE WAS 10.7/10.2 H4
4	17.12.79 M817 19 WAS 21.4
5	27.11.84 M1218 FIN WAS ET.