Fast turn-off Thyristor
P0515WC04# to P0515WC06#

The data sheet on the subsequent pages of this document is a scanned copy of existing data for this product.
(Rating Report 85TR6 Issue 1)

This data reflects the old part number for this product which is: P270CH02-05. 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 grade 02 (200V 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

P0515	WC	♦♦	#
Fixed Type Code	Fixed Outline Code	Voltage code $V_{DRM}/100$ 04-06	Fixed Turn-off Time Code B = 12µs, C = 15µs, D = 20µs
Typical Order Code: P0515WC06C, 14mm clamp height, 600V V_{RRM}/V_{DRM}, 15µs t_q			

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WESTCODE
An IXYS Company

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QUALITY EVALUATION LABORATORY

Rating Report: 85TR6 Date: 11th July, 1985

Origin; Pages: 24

Thyristor Type P270CH02-H05

Written by: M.F.W. Dunlop Checked: MFWD Approved: BLCH.

The P270C thyristor series are diffused regenerative gate devices employing a 24 mm slice in a cold weld housing.

Ratings and Characteristics

RATINGS

Voltage Grades	:	H02-H05
V_{DSM}	;	200-500V
V_{RSM}	:	300-600V
V_{DRM}, V_{RRM}	:	200-500V
$I_{T(AV)}$: Single phase; 50 Hz, 180° sinewave	:	
Double side cooled, T_{HS} = 55°C; 85°C	:	516A; 334A
Single side cooled, T_{HS} = 85°C	:	187A
$I_{T(rms)}$ Double side cooled, T_{HS} = 25°C	:	1053A
$I_{T\ d.c.}$ Double side cooled, T_{HS} = 25°C	:	833A
I_{TSM} : t = 10 ms half sinewave; $T_{J(initial)}$ = 125°C; V_{RM} = 0.6V_{RRM} (MAX)	:	6500A
I_{TSM} : t = 10 ms half sinewave; $T_{J(initial)}$ = 125°C; $V_{RM} \leq$ 10V	:	7150A
I^2t : t = 10 ms; $T_{J(initial)}$ = 125°C; V_{RM} = 0.6$V_{RRM(MAX)}$	:	211 x $10^3 A^2S$
I^2t : t = 10 ms; $T_{J(initial)}$ = 125°C; $V_{RM} \leq$ 10V	:	256 x $10^3 A^2S$
I^2t : t = 3 ms; $T_{J(initial)}$ = 125°C; $V_{RM} \leq$ 10V	:	187 x $10^3 A^2S$
di/dt : (Repetitive) : T_J 125°C Gate: 20V. 20Ω Rise time 1uS	:	500A/uS
I_{FGM} : Anode positive with respect to cathode	:	18A
V_{FGM} : Anode positive with respect to cathode	:	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} : $T_J = 25^oC$)			: 200mA
I_H : $T_J = 25^oC$)	$V_A = 6V$: $I_A = 1A$		: 600mA
V_{GT} : $T_J = 25^oC$)			: 3V
V_O : $T_J = 125^oC$			: 0.95V
r_T : $T_J = 125^oC$			: 0.377mohms
V_{TM} : $I_{TM} = 1160A$	$T_{VJ} = 125^oC$		: 1.39V
$R_{th(J-HS)}$ Double side cooled			: $0.095^oC/W$
Single side cooled			: $0.19^oC/W$
dV/dt : Linear ramp to $0.8V_{DRM(max)}$	$T_J = 125^oC$; Gate O/C	repetitive	: 200V/uS*
I_{DRM} : $T_J = 125^oC$	: $V_{DM} = V_{DRM}$ (max)		: 30mA
I_{RRM} : $T_J = 125^oC$	: $V_{RM} = V_{RRM}$ (max)		: 30mA
Q_{RR} : $I_{TM} = 300A$	: dI/dt : 20 A/uS, 50% chord value		
V_{RM} : 50V	$T_{VJ} = 125^oC$		: 106uC Typ.
t_q : $I_{TM} = 300A$	: dI/dt : 20 A/uS : $T_J = 125^oC$	$V_{RM} = 50V$	
dV/dt = 200V/uS to $0.8V_{DRM}$			: 10-25uS
20V/uS to $0.8V_{DRM}$ Typical			: 8-20uS
Mounting force:			: 330-550Kg.F
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.

CONTENTS

Voltage Ratings

Voltage Grade 'H'	V_{DSM} V_{DRM} V_{RRM} V	V_{RSM} V	V_D V_R DC
H02	200	300	140
04	400	500	280
05	500	600	350

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 P270C thyristor series are diffused regenerative gate devices employing a 24 mm slice in a cold weld housing.

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 (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 sink)

and T_{SINK} be the heat sink temperature

Then the average dissipation will be

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

and

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

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 heat sink temperature can then be evaluated from:

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

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

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.

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 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.

7. NOTE 1

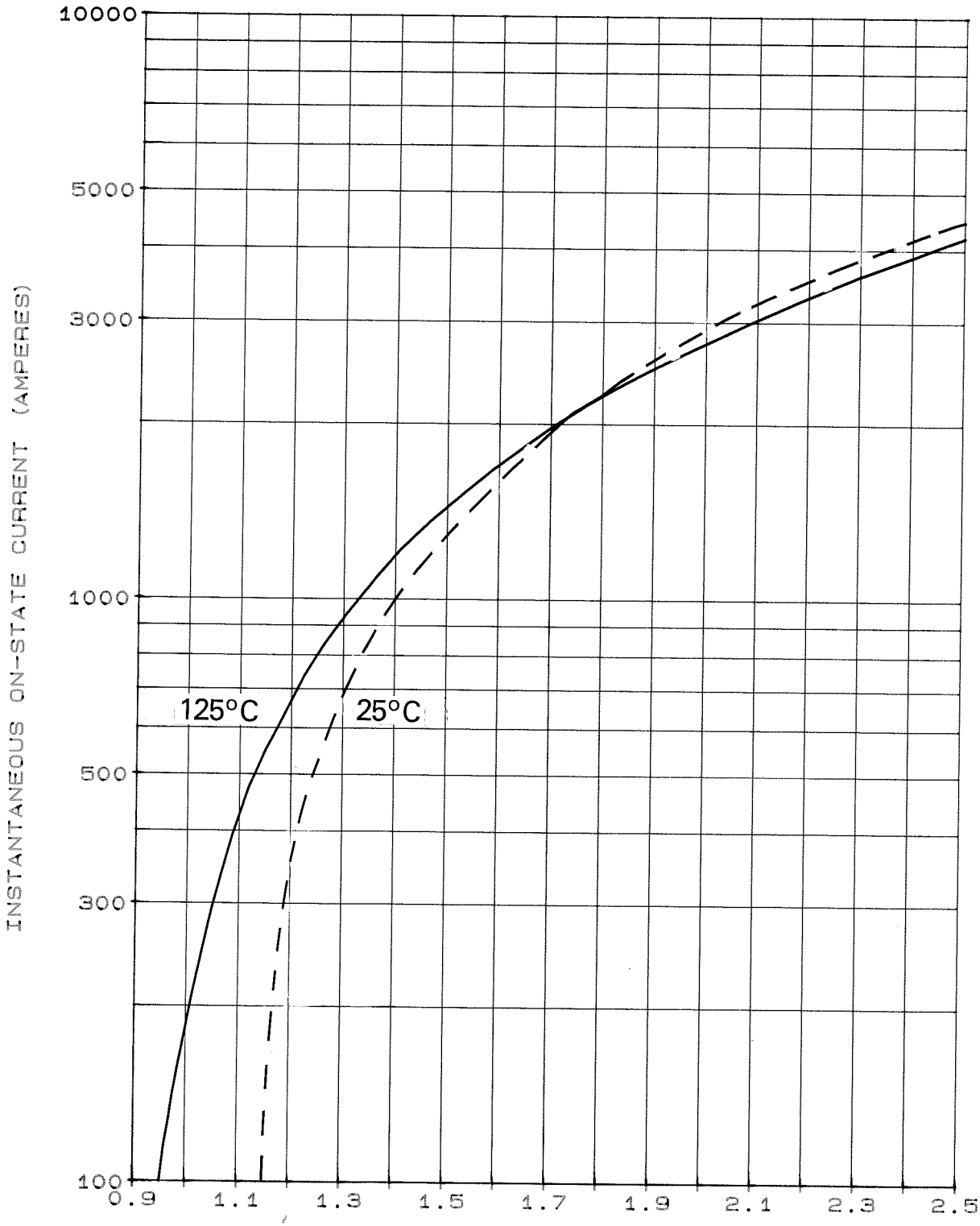
REVERSE RECOVERY LOSS BY MEASUREMENT

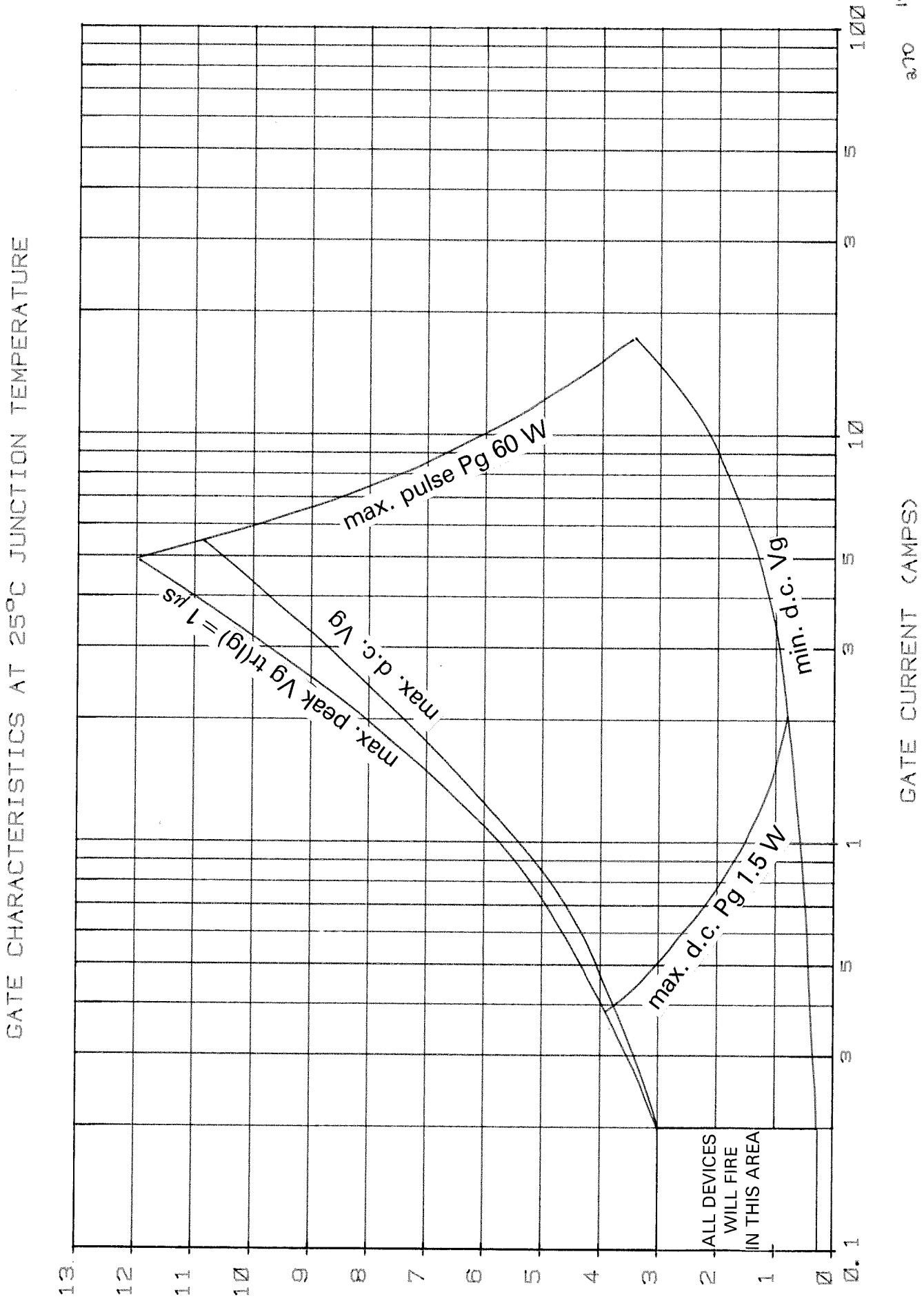
This thyristor has a low reverse recovered charge and peak reverse recovery current. When measuring the charge care must be taken to ensure that:

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.

ON-STATE CHARACTERISTIC OF LIMIT DEVICE

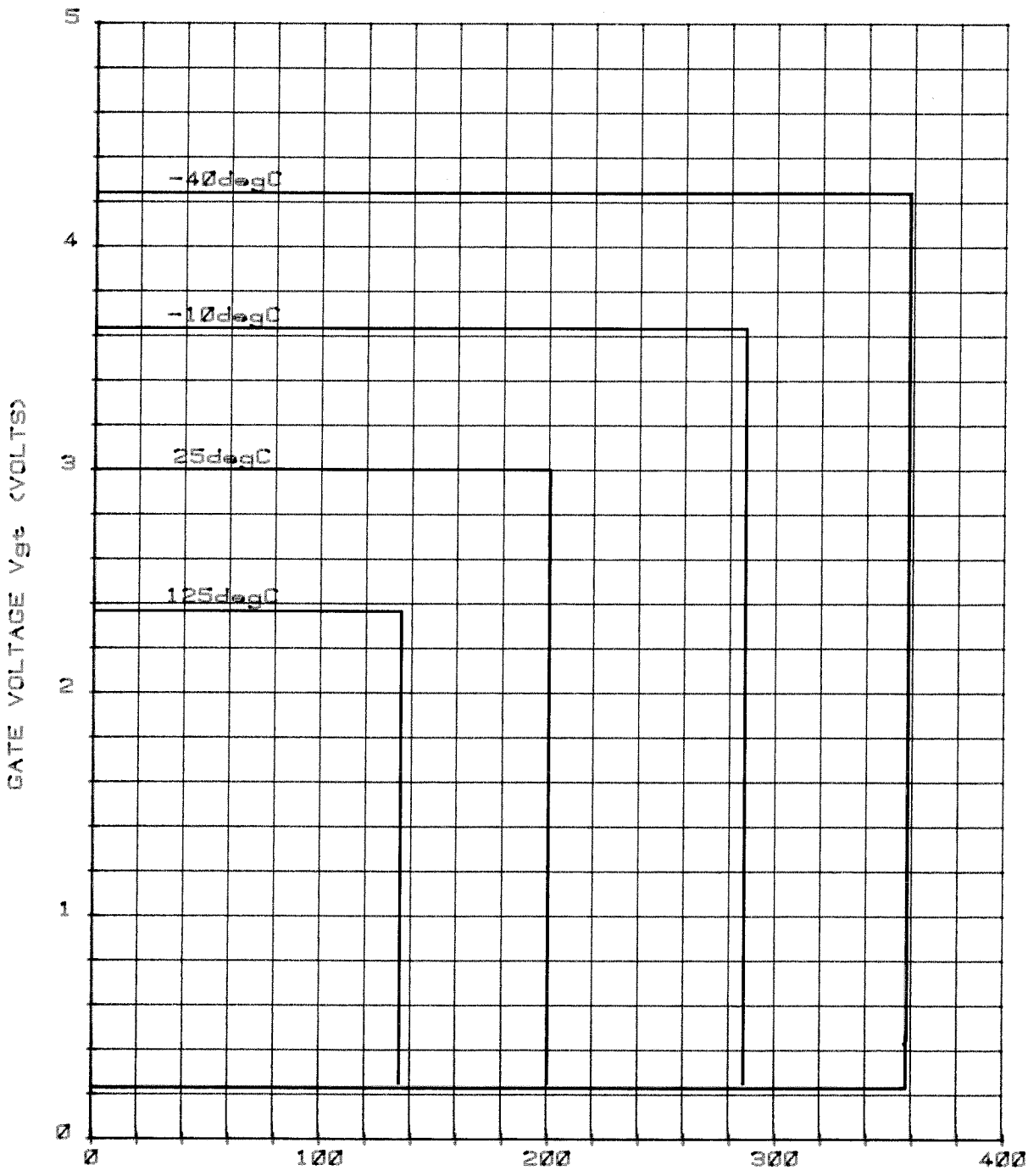



GATE CHARACTERISTICS AT 25°C JUNCTION TEMPERATURE
max. pulse Pg 60 W
max. peak Vg tr(Ig) = 1 µs
max. d.c. Vg
min. d.c. Vg
max. d.c. Pg 1.5 W
ALL DEVICES WILL FIRE IN THIS AREA
GATE VOLTAGE (Vg) (VOLTS)
GATE CURRENT (AMPS)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.1
1
3
5
10
30
50
100

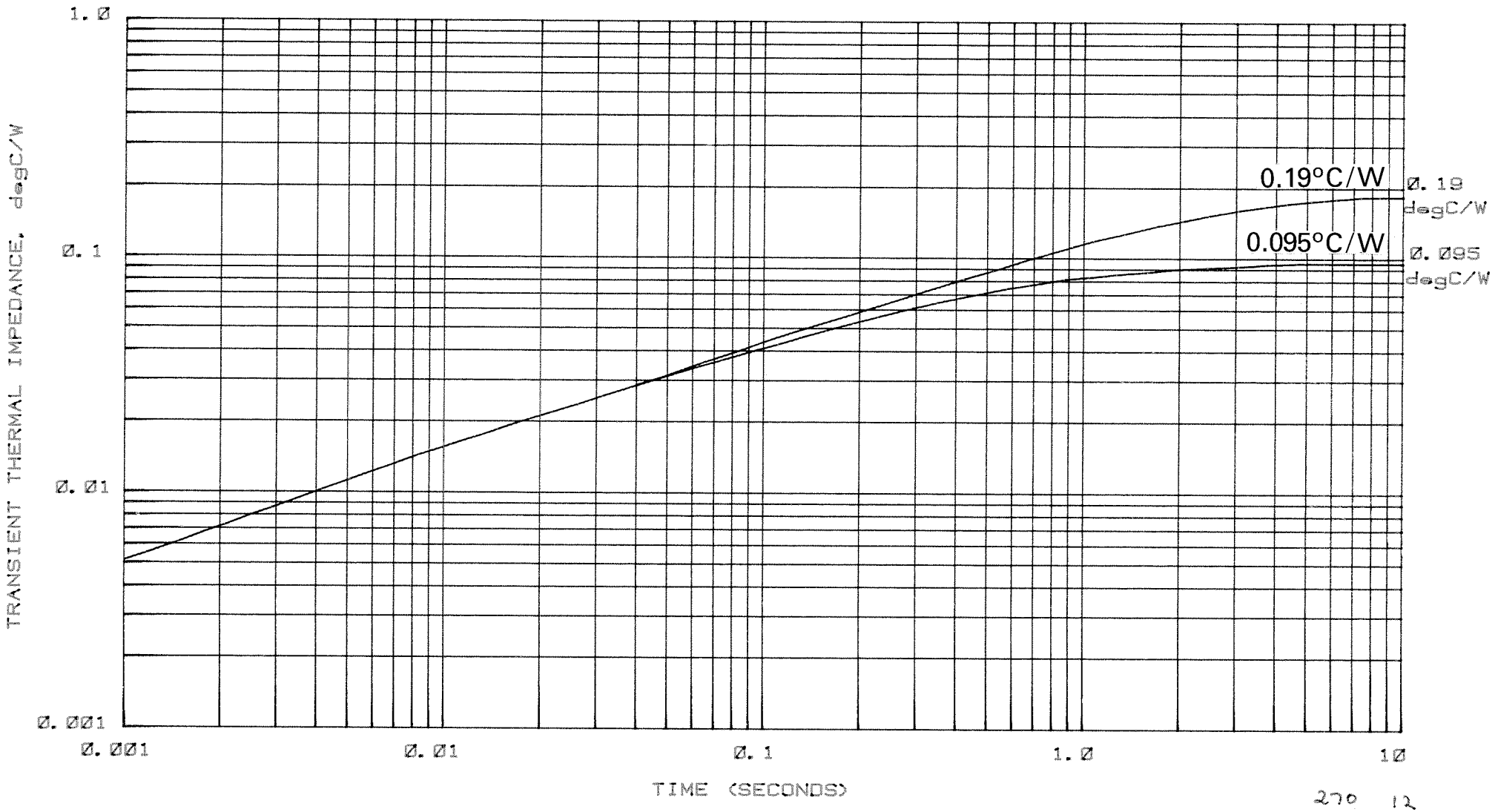
P270C Fig 15

GATE TRIGGERING CHARACTERISTICS

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



JUNCTION TO HEAT SINK TRANSIENT THERMAL IMPEDANCE

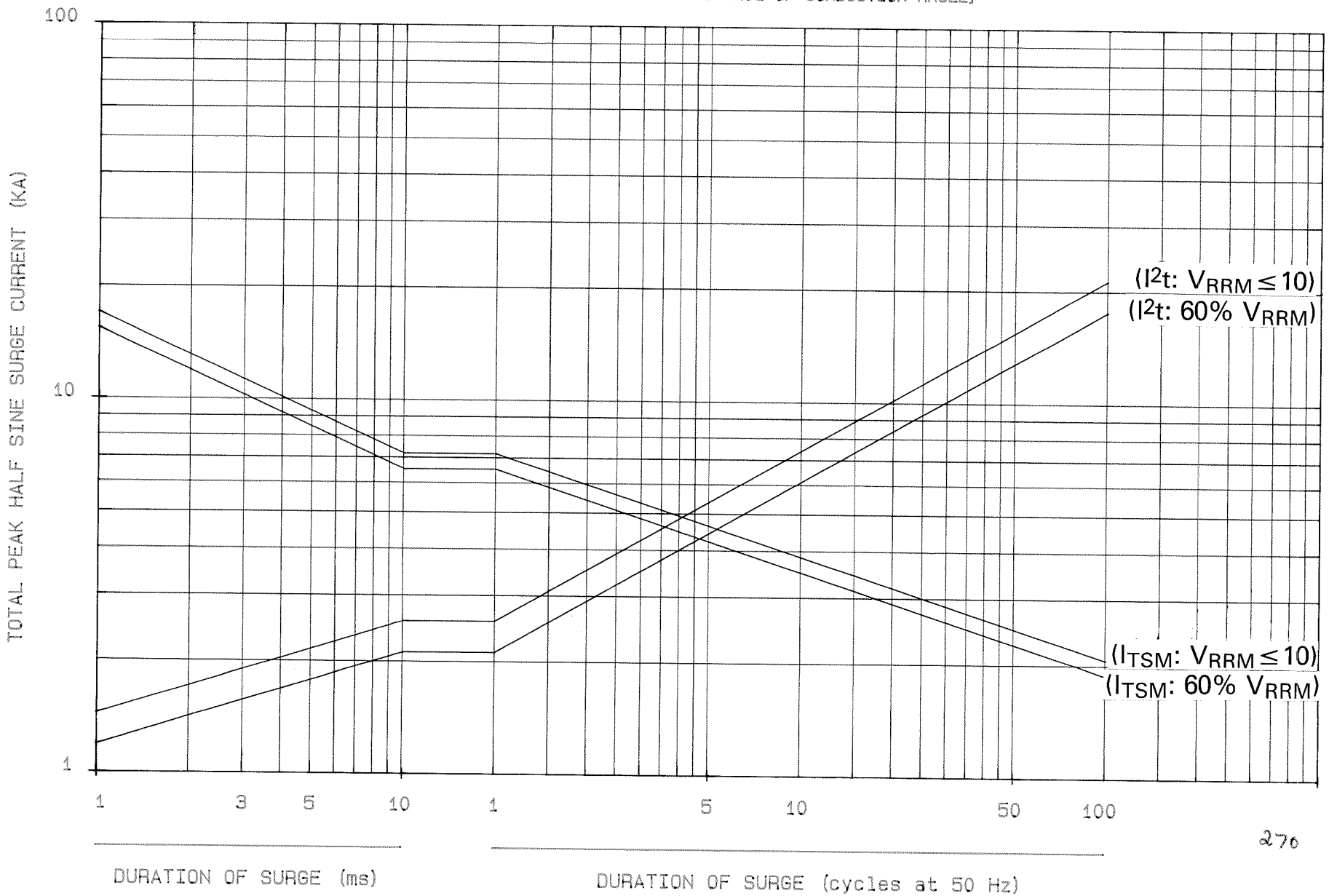


270 12

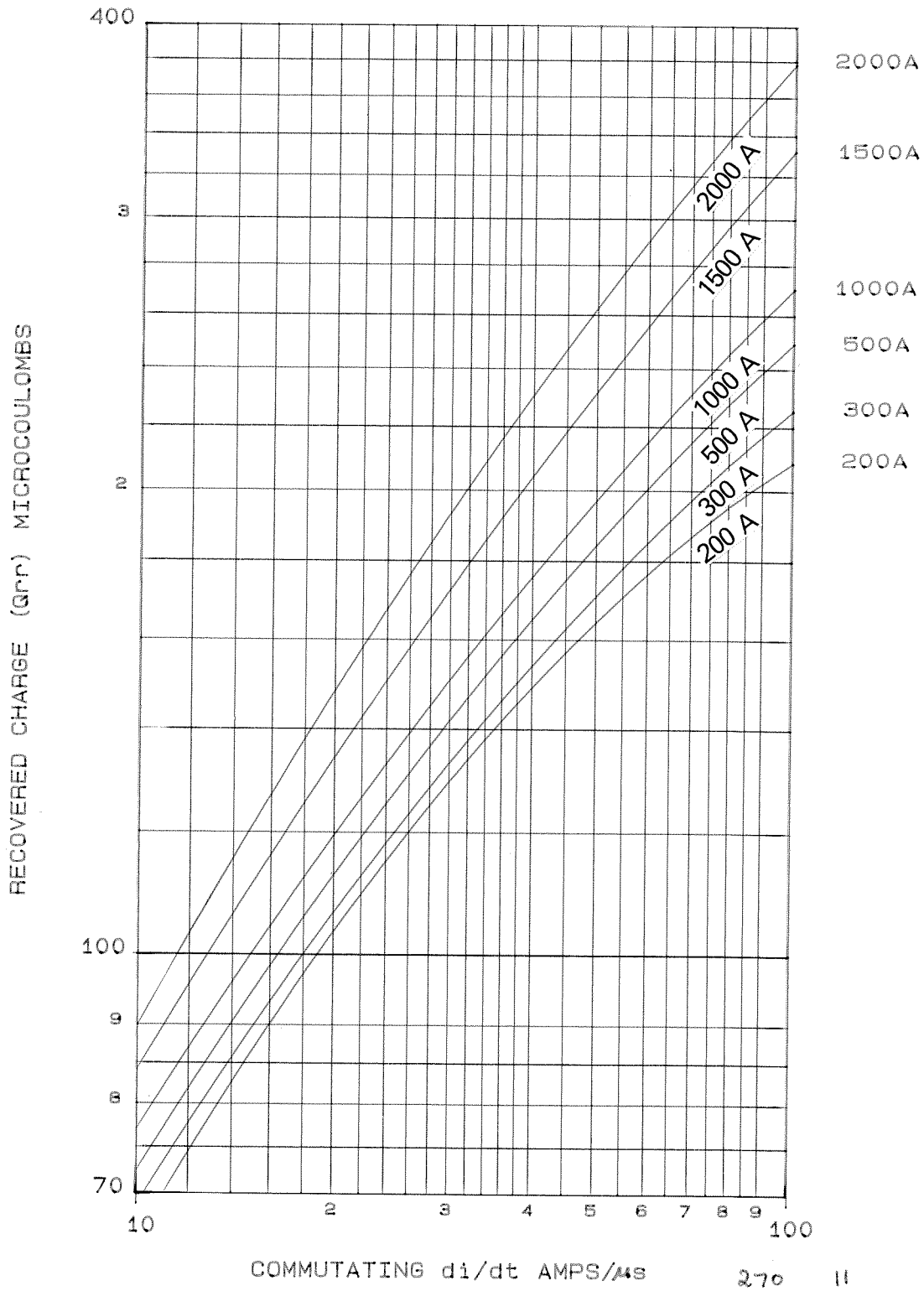
Page 178

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

[GATE MAY TEMPORARILY LOSE CONTROL OF CONDUCTION ANGLE]

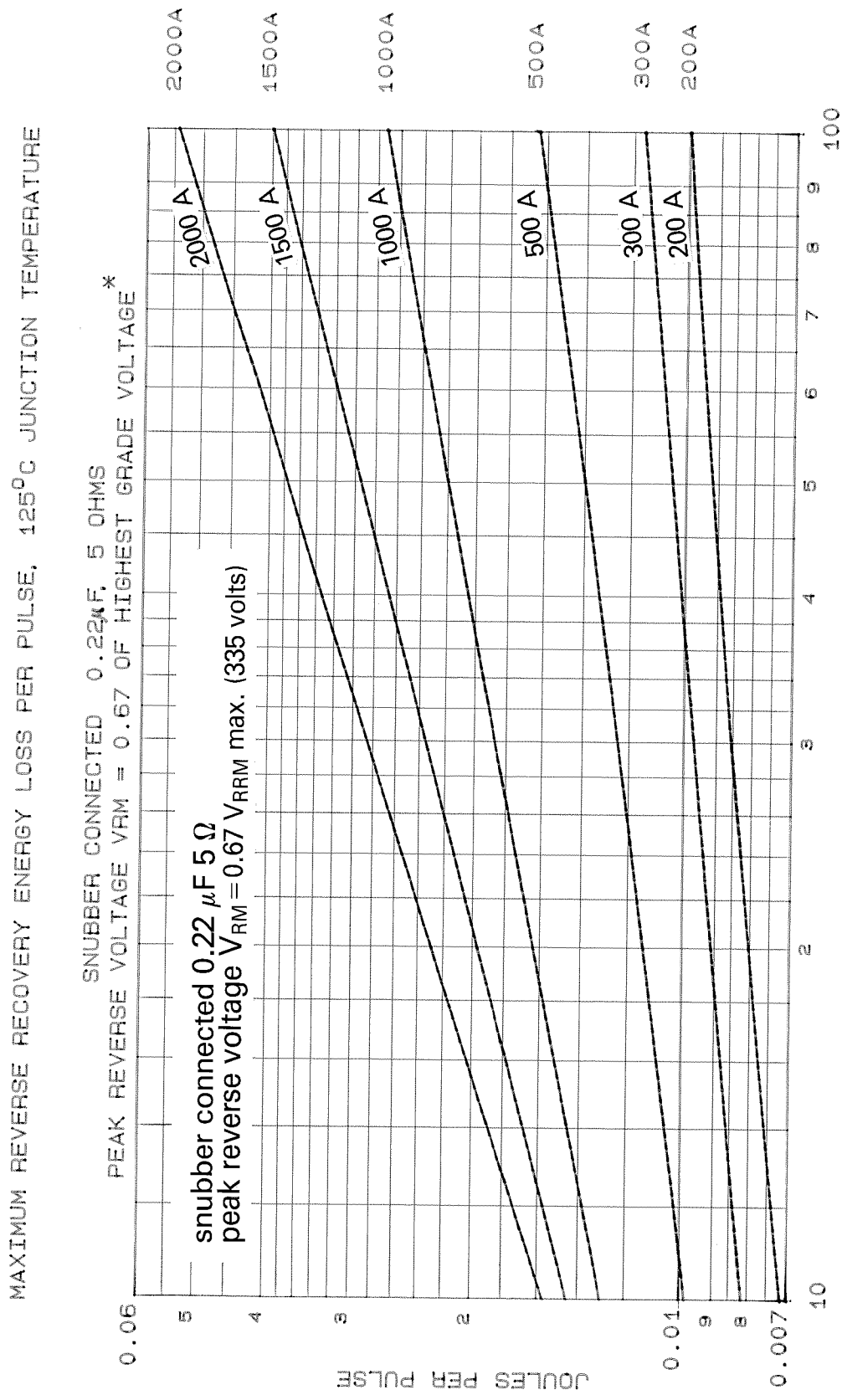


TYPICAL RECOVERED CHARGE AT 125°C JUNCTION TEMPERATURE

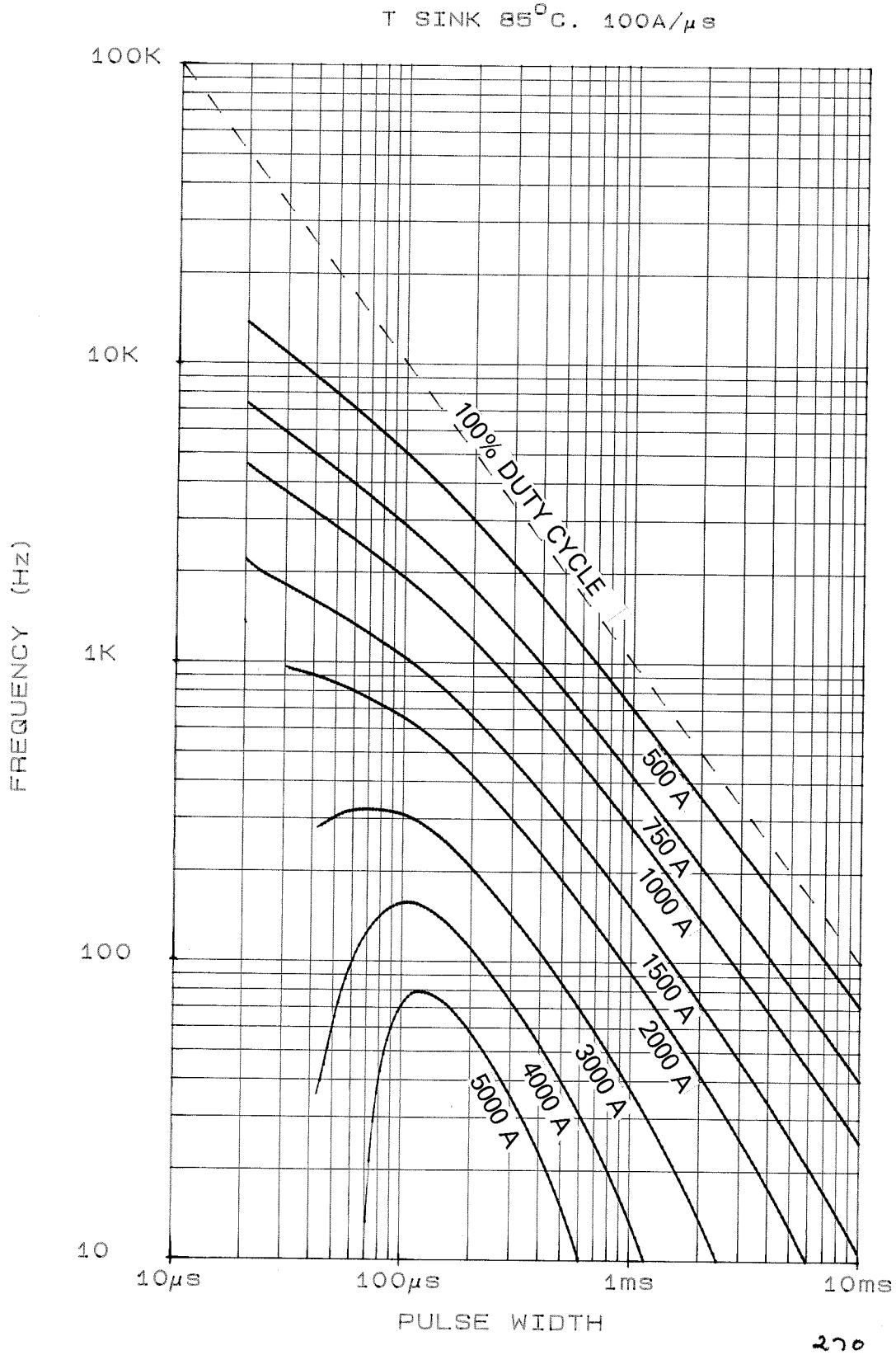


270 11

P270C F.57

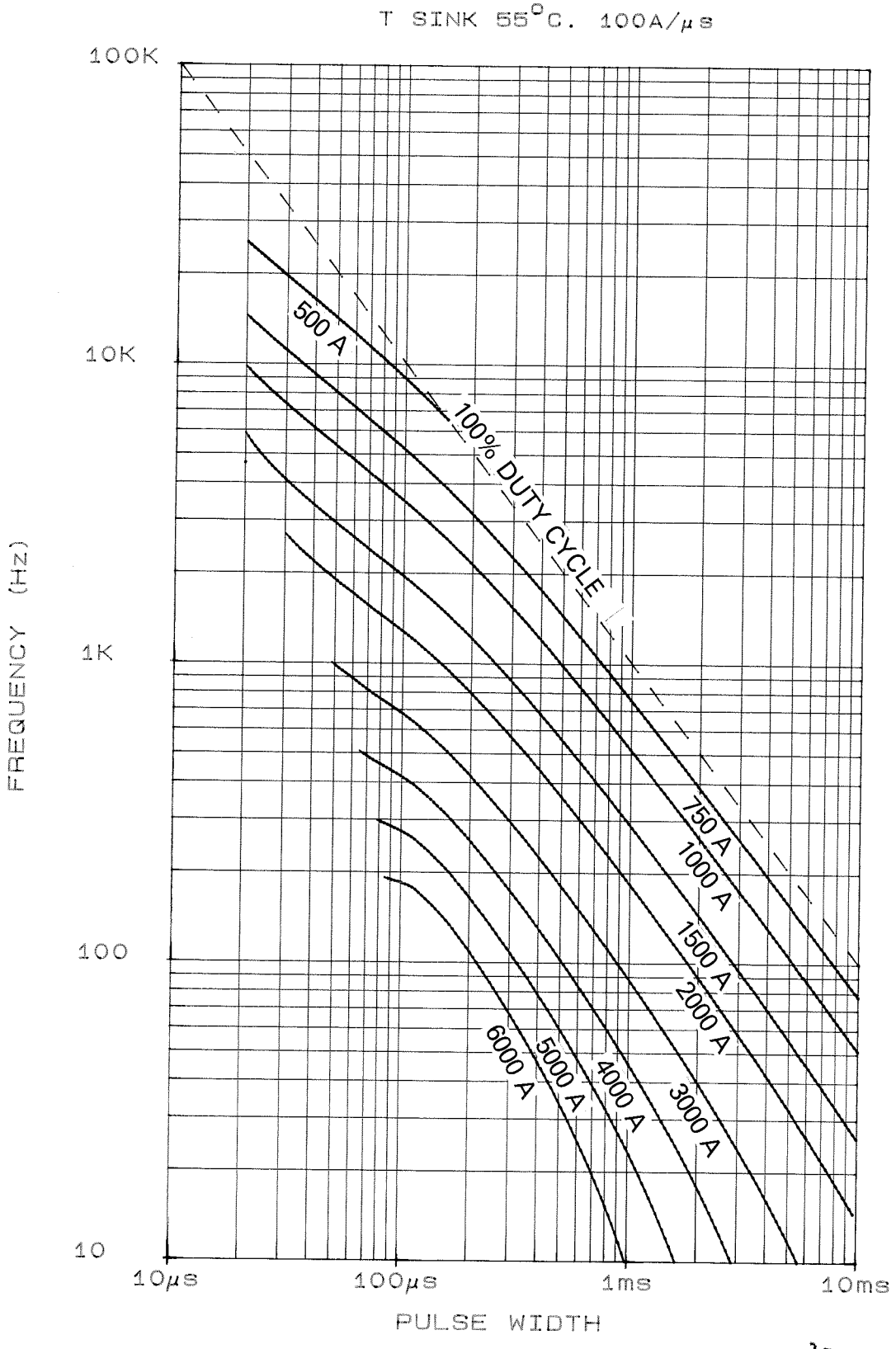

MAXIMUM REVERSE RECOVERY ENERGY LOSS PER PULSE, 125°C JUNCTION TEMPERATURE
SNUBBER CONNECTED 0.22μF, 5 OHMS
PEAK REVERSE VOLTAGE VRM = 0.67 OF HIGHEST GRADE VOLTAGE*
snubber connected 0.22 μF 5 Ω
peak reverse voltage V_{RM} = 0.67 V_{RRM} max. (335 volts)
2000 A
1500 A
1000 A
500 A
300 A
200 A
2000A
1500A
1000A
500A
300A
200A
JOULES PER PULSE
0.06
0.01
0.007
COMMUTATING di/dt AMPS/μs
*NOTE: ENERGY PER PULSE SHOULD BE ADJUSTED PRO RATA WITH APPLIED PEAK RECOVERY VOLTAGE

 P270C Fig 2

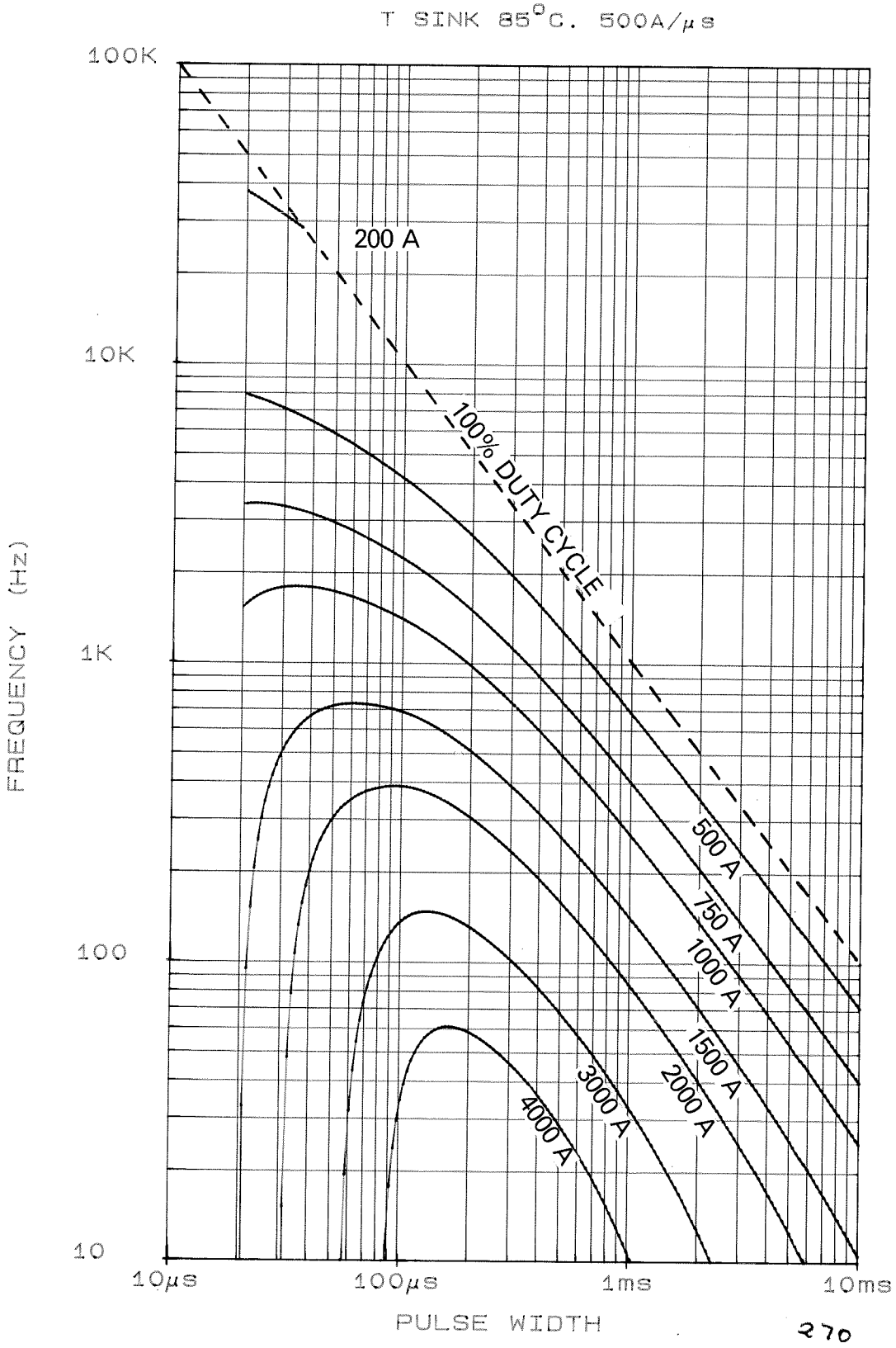


270 2

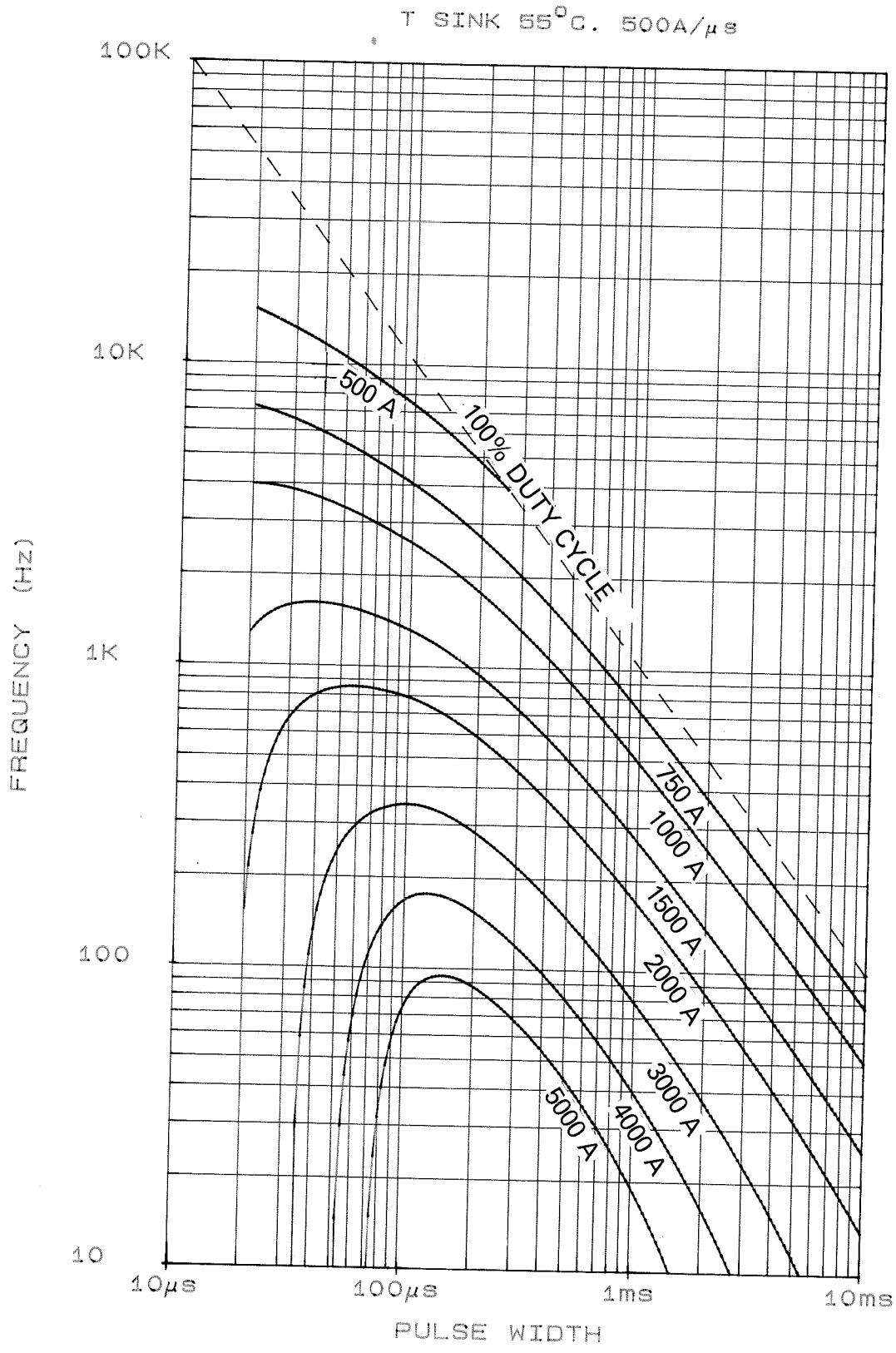
P270C Fig 4



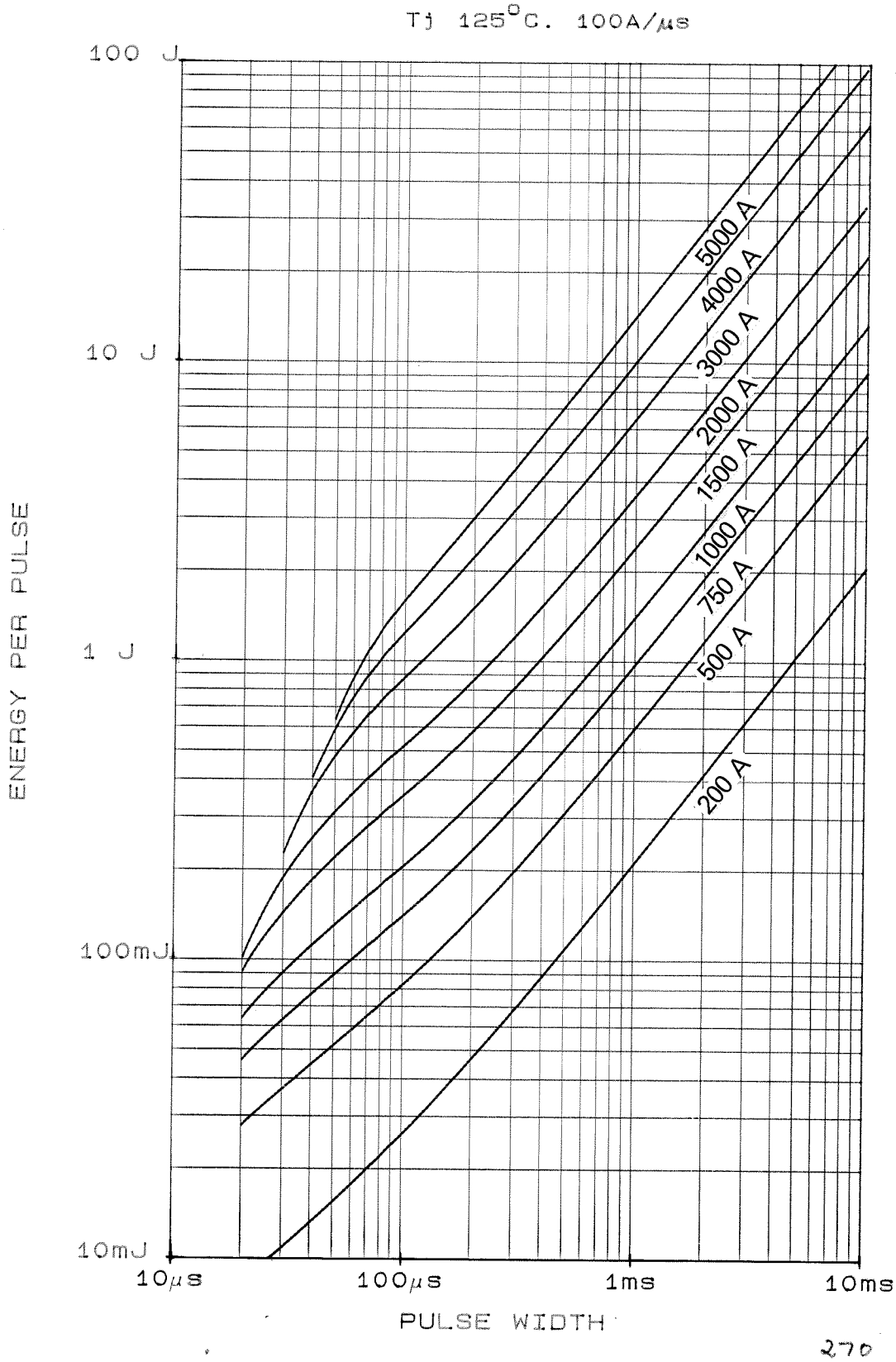
270 4


T SINK 85°C. 500A/μs
100K
10K
1K
100
10
FREQUENCY (Hz)
200 A
100% DUTY CYCLE
500 A
750 A
1000 A
1500 A
2000 A
3000 A
4000 A
10μs
100μs
1ms
10ms
PULSE WIDTH

Page Fig 3

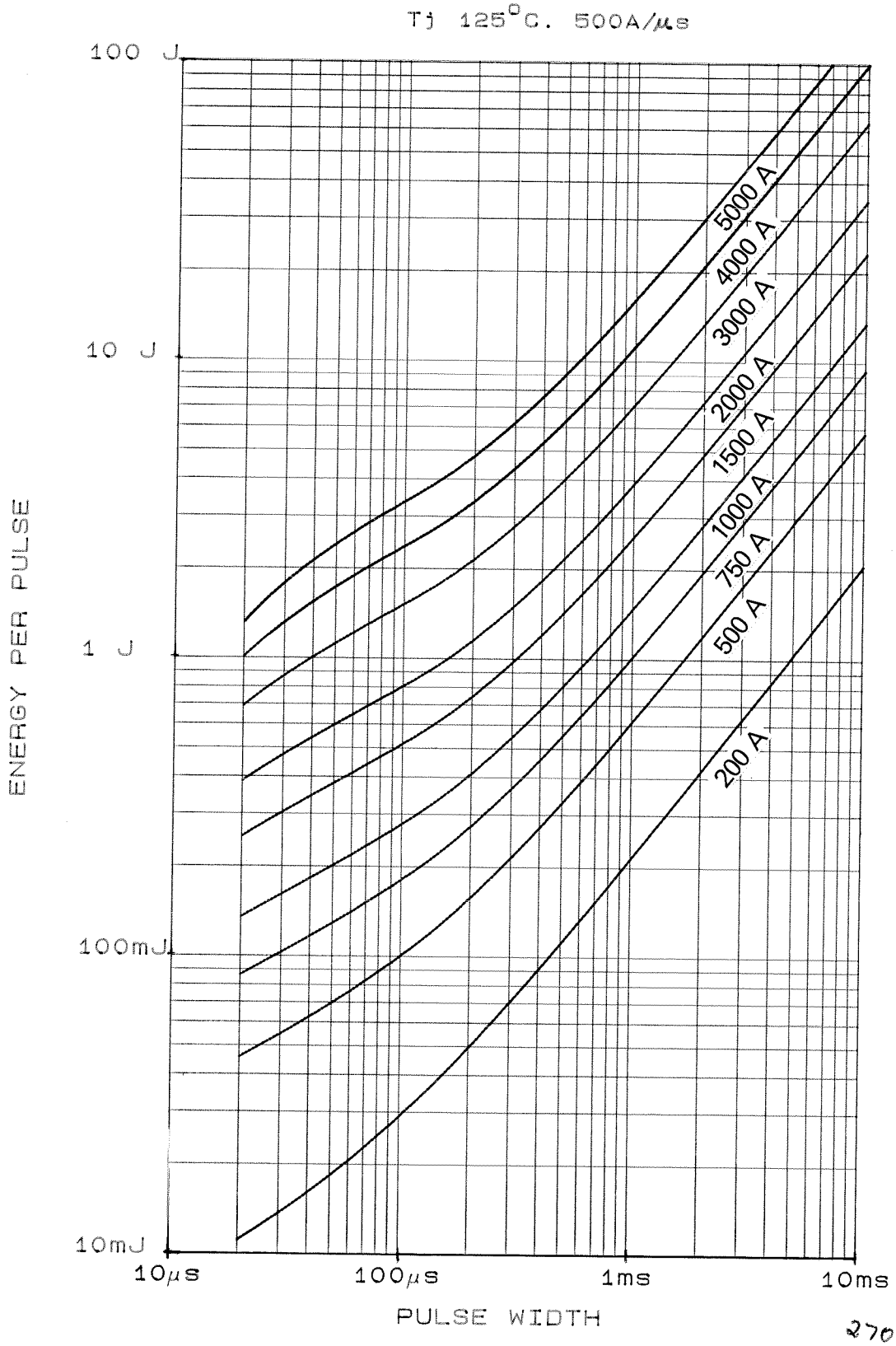


270 3


Tj 125°C. 100A/μs
100 J
10 J
1 J
100mJ
10mJ
ENERGY PER PULSE
5000 A
4000 A
3000 A
2000 A
1500 A
1000 A
750 A
500 A
200 A
10μs
100μs
1ms
10ms
PULSE WIDTH

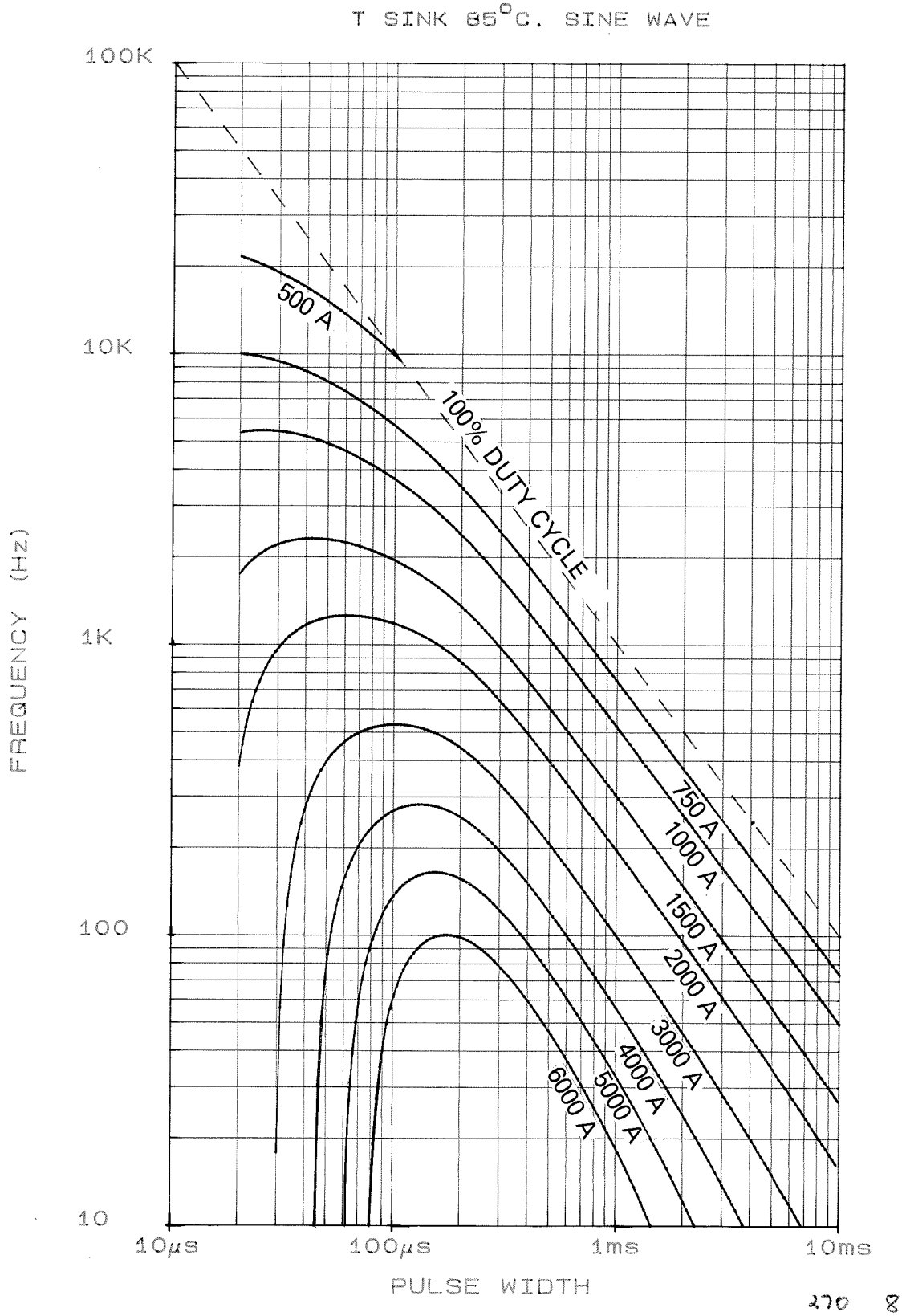
270 6

9J100 Fig 5

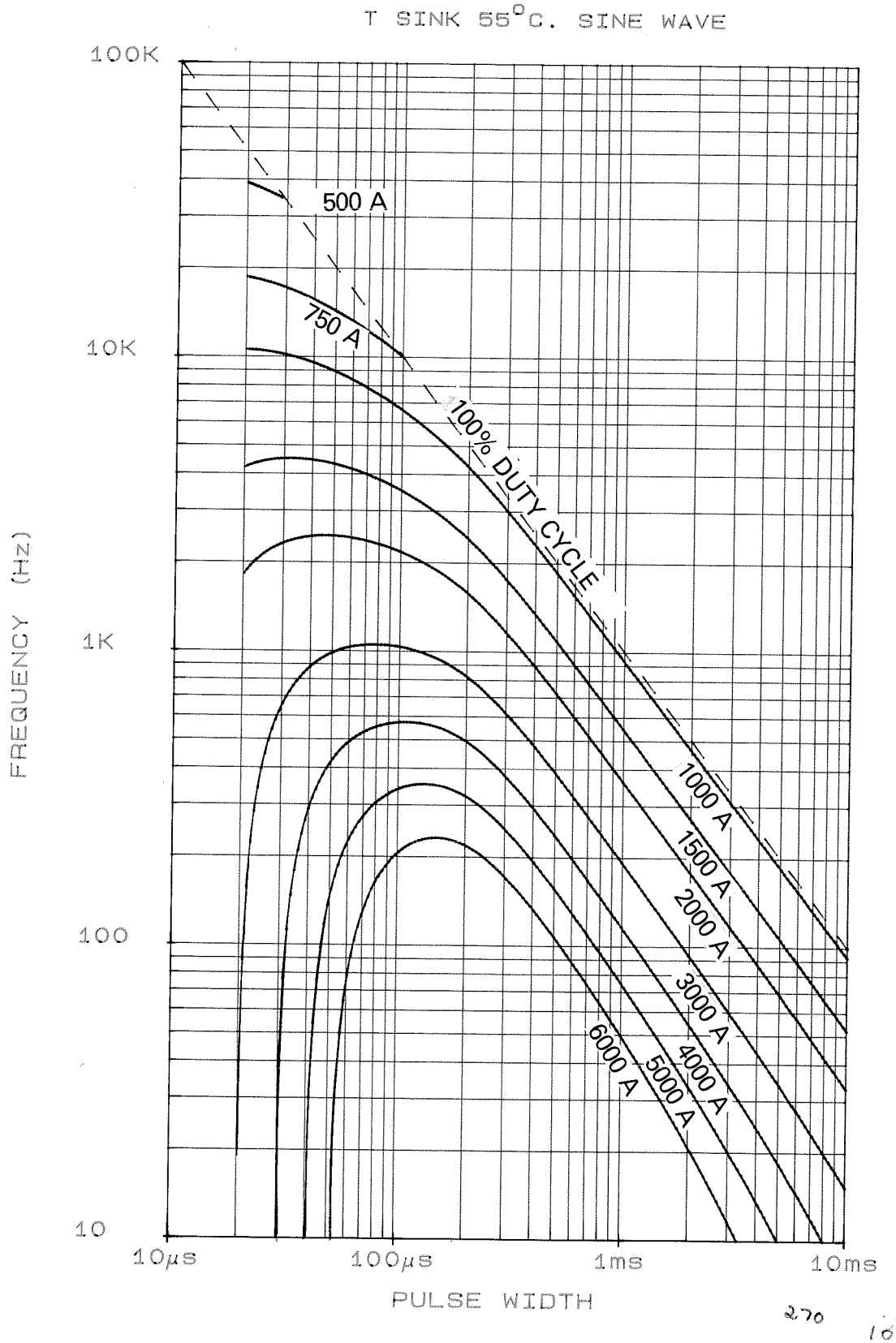


270 5

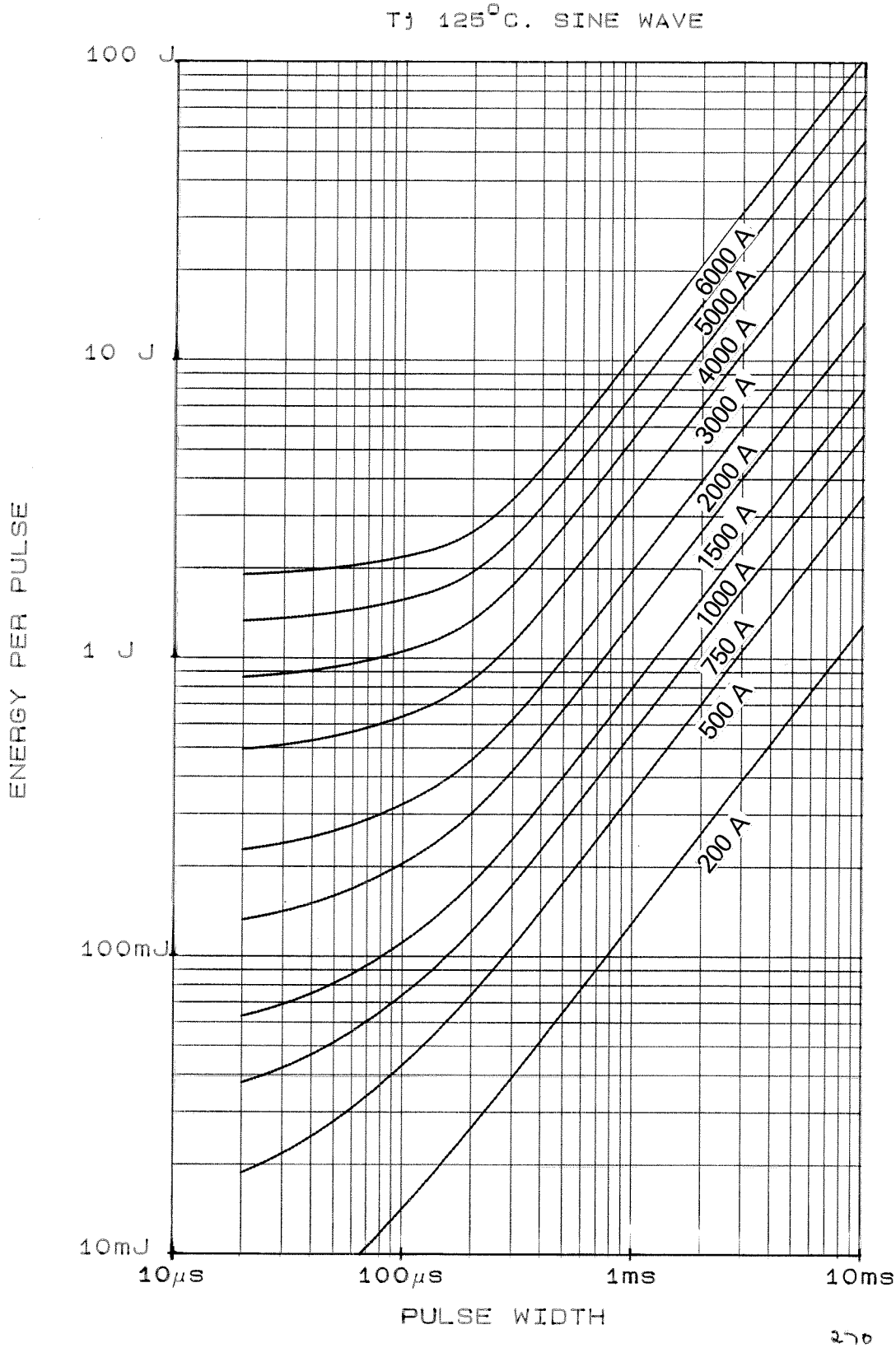
P270 Fig 8



270 8


T SINK 55°C. SINE WAVE
100K
10K
1K
100
10
FREQUENCY (Hz)
500 A
750 A
100% DUTY CYCLE
1000 A
1500 A
2000 A
3000 A
4000 A
5000 A
6000 A
10µs
100µs
1ms
10ms
PULSE WIDTH

P370C Fig 9



370 9

SCALE	1/1
DRN	
CHKD	
APPD	
	~~GEC~~ 1
	CS 1
	QA 1
	LP 2
	HP 2
S	6
S	NI

INTERNATIONAL OUTLINE No. TO-200AB

WEIGHT. 70 GRAMS.

FINISH. NICKEL PLATE.

DEVICE MARKING INCLUDES MONOGRAM, TYPE No., SPEC. No. AND POLARITY SYMBOL.

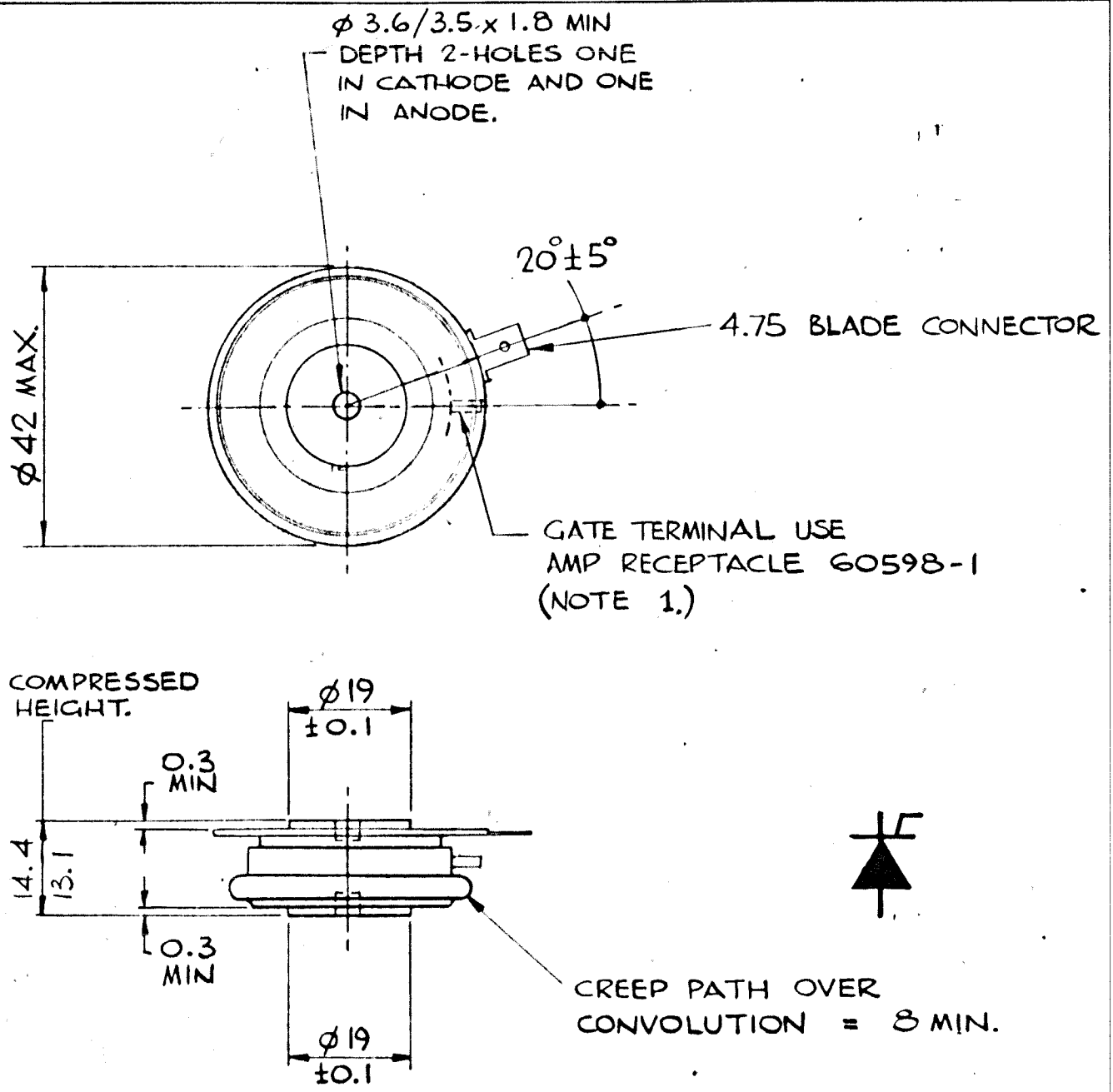
DEVICE MOUNTING: CLAMPING FORCE TO BE APPLIED ON ℄ OF LOCATION HOLES AND BE EVENLY DISTRIBUTED OVER AREA OF CONTACT. FLAT TOL ON SURFACES TO WHICH DEVICE IS CLAMPED TO BE 0.04 WIDE.

CLAMPING FORCE = 330 - 550 kgf.

NOTE 1. 300mm LONG GATE LEADS ARE AVAILABLE IF REQD.

G.A. DRG. No. 159B100H100-H110. 103B211. 103B212.

TYPE NUMBER		
N086C	P070C	P205C
N105C	P086C	P214C
N140C	P095C	P215C
N170C	P105C	P270C
N195C	P200C	
N275C	P202C	
	P204C	
	P100C	



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

WESTCODE ® SEMICONDUCTORS

ISS	REVISIONS
1	9.9.76 P118
2	P304 17.5.78 REDRAWN. ø19 WAS ø29. 0.3 ADDED. 15.2/14 WAS 15.2/12.5. LEADS ADDED.
3	M613 14.6.78 LEAD COLOURS CHANGED.
4	M636 7.8.78 LEADS DELETED
5	11.9.78 CLAMP FORCE WAS 500-1200 kgf. ø42 WAS ø43. NOTE 1 ADDED. 14.35/13.08 WAS 15.2/14.
6	19.9.78 14.4/13.1 WAS 14.35/13.08
7	30.10.78 M670 TYPE Nº ADDED
8	17.9.79 M773 550kgf WAS 700kgf.

THIRD ANGLE PROJECTION

DIMNS. IN MILLIMETRES

DRG. No. 101A212