Soft Recovery Diode Types M0371YH350 to M0371YH450

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

(Rating Report 93NR4 Issue 1)

This data reflects the old part number for this product which is: SM30-45HXC164. 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 grades 30 to 34 (3000V to 3400V V_{RRM})

Please use the following link to view an up to date outline drawing for this device Outline W3

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						
M0371 YH ♦♦ 0						
Fixed Type Code	Fixed Outline Code	Voltage code V _{RRM} /100 35-45	Fixed Code			
Typical Order Code: M0371YH400, 26mm clamp height, 4000V V _{RRM}						

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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.

Page Issue 1

QUALITY AND EVALUATION LABORATORY

Rating Report No: 93NR4

Date: 16th June, 1993

Origin: Q.E.L.

Pages: 25

Diode Capsule Type: SM30-45HXC164

Written by: M.J. Perry

Checked: M Baker

Approved:

30 mm Silicon with low recovered charge for snubber duties in high voltage gate turn-off thyristor applications; housed in a high voltage

Ratings

Voltage Grades

: 30-45

VRSM

: 3100-4600V

VRRM

: 3000-4500V

 $I_{F(AV)}$: Single phase: 50 Hz, 180° half sinewave; (Converter Ratings)

Double Side Cooled $T_{\rm HS}$ = 55°C, 100°C

: 364A; 239A

Single Side Cooled $T_{\rm HS}$ = 100°C

: 147A

 $I_{F(rms)}$ $T_{HS} = 25$ °C

: 678A

 $I_F T_{HS} = 25^{\circ}C$

) Double side cooled

: 597A

 I_{FSM} : t = 10ms half sinewave; T_J (initial) = 150°C

 $V_{RM} = 0.6V_{RRM(MAX)}$

: 4900A

 I_{FSM} : t = 10ms half sinewave; T_J (initial) = 150°C

 $v_{RM} \leq 10v$

: 5400A

 $I^{2}t$: t = 10ms; T_{J} (initial) = 150°C; V_{RM} = 0.6 V_{RRM} (MAX)

: $120 \times 10^{3} \text{A}^{2} \text{s}$

 $I^{2}t$: t = 10ms; T_{J} (initial) = 150°C; $V_{RM} \leq 10V$

: $146 \times 10^3 A^2 S$

 I^2 t : t = 3ms; T_J (initial) = 150°C; V_{RM} \leq 10V

: $110 \times 10^3 A^2 S$

THS Operating Range

: -40 to +150°C

 T_{stg} : Non-operating

: -40 to +150°C

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<u>Characteristics</u>

(Maximum values unless otherwise stated)

 V_{o}

 r_s

A : $T_J = 25^{\circ}C$

B : $T_J = 25$ °C

 $C : T_J = 25^{\circ}C$

D : $T_J = 25$ °C

A

В

С

D

 V_{FM} at $I_{FM} = 635A$

 $R_{\text{th}(J\text{-HS})}$ Double side cooled

Single side cooled

 \mathbf{I}_{RRM} : at $\mathbf{v}_{RRM(MAX)}$

 $V_{\rm fr}$: at dI/dt = 1000A/ μ s

: 1.05V

: 1.65mohms

: 0.171044306

: 0.203488535

: 7.4078071E-4

: 1.50068853E-2

: 0.125659408

: 0.109853554

: 7.39508871E-4

: 3.11942547E-2

: 2.10v

: 0.10 K/W

: 0.20 K/W

: 50mA

: 370v

Reverse recovery at I_{FM} = 1000A; t_p = 500 μ s:

 $di_R/dt = 200A/uS; V_{RM} = 50V$

 Q_{RR} (total area)

 $Q_{\rm RA}$ (50% chord)

t_{rr} (50% chord)

 I_{RM}

Mounting Force

Outline Drawing

JEDEC Outline No.

: 1560µC

: 640µC

: 3.3µs

: 400A

: 330-550 Kgf

: 100A317

:

NOTE: All characteristics are at $T_{VJ} = T_{Jmax}$ operating unless stated otherwise.

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Voltage Ratings

Voltage Class	V _{RRM} V	V _{RSM} V
30	3000	3100
32	3200	3300
34	3400	3500
36	3600	3700
38	3800	3900
40	4000	4100
42	4200	4300
44	4400	4500
45	4500	4600

^{1.} This Report is applicable to higher or lower voltage grades when supply has been agreed by Sales/Production.

^{2.} A blocking voltage derating factor of 0.13% per deg. Celsius is applicable to this device for T_J below $25^{\circ}\text{C}_{\bullet}$

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2.0 <u>INTRODUCTION</u>

The diode series comprises fast recovery capsule devices with all diffused silicon slices. All these diodes have controlled reverse recovery characteristics. These diodes are particularly suitable for use in G.T.O. and SCR snubber networks.

3.0 NOTES ON THE RATINGS

(a) Square wave ratings

These ratings are given for leading edge linear rates of rise of forward current of $100 \text{A}/\mu\text{S}$ and $500 \text{A}/\mu\text{S}$.

(b) 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, and f be the repetition rate.

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

 $T_{SINK} = T_{J(MAX)} - (Ep x f x R_{thJ-HS})$

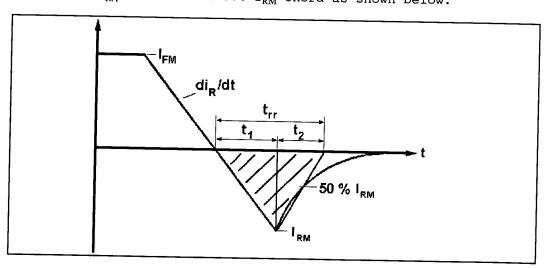
(c) ABCD Constants

These constants (applicable only over current range of $V_{\rm F}$ characteristic on page 8) are the co-efficients of the expression for the forward characteristic given below:

 V_F = A + B ln (i_F) + C i_F + D $\!\!\!/$ i_F : where i_F = instantaneous forward current.

(d) Reverse recovery ratings

(i) $Q_{\rm RA}$ is based on 50% $I_{\rm RM}$ chord as shown below.



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(ii) Q_{RR} is based on a 150uS integration time

i.e.
$$Q_{RR}$$
 =
$$\int_{t=0}^{150uS} i_{RR} \cdot dt$$

(iii) K factor = t_1/t_2

4.0 Reverse Recovery Loss

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 sink temperature can then be evaluated from:

$$T_{SINK} \text{ (new)} = T_{SINK} \text{ (original)} - A(\frac{r_{t \times 10^6}}{t} + R_{thJ-HS} \times f)$$
 where $r_{t} = 3.30E-6 \times t$ (K/W)

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 sink temperature.

The total dissipation is now given by

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

(b) <u>Determination without Measurement</u>

In circumstances where it is not possible to measure voltage and current conditions, or for design purposes, the additional losses A in joules may be estimated from curves on page 15.

Let E be the value of energy per reverse cycle in joules (curves on p15).

Let f be the operating frequency in Hz

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

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.

A suitable R-C snubber network is connected across the diode to restrict the transient reverse voltage waveform to a peak value ($V_{\rm RM}$) of 0.67 of the maximum grade.

If a different grade is being used or $V_{\rm RM}$ is lower than 0.67 of Grade, the reverse loss may be approximated by a pro rata adjustment of the maximum value obtained from the curves provided.

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NOTE 1

Reverse Recovery Loss by Measurement

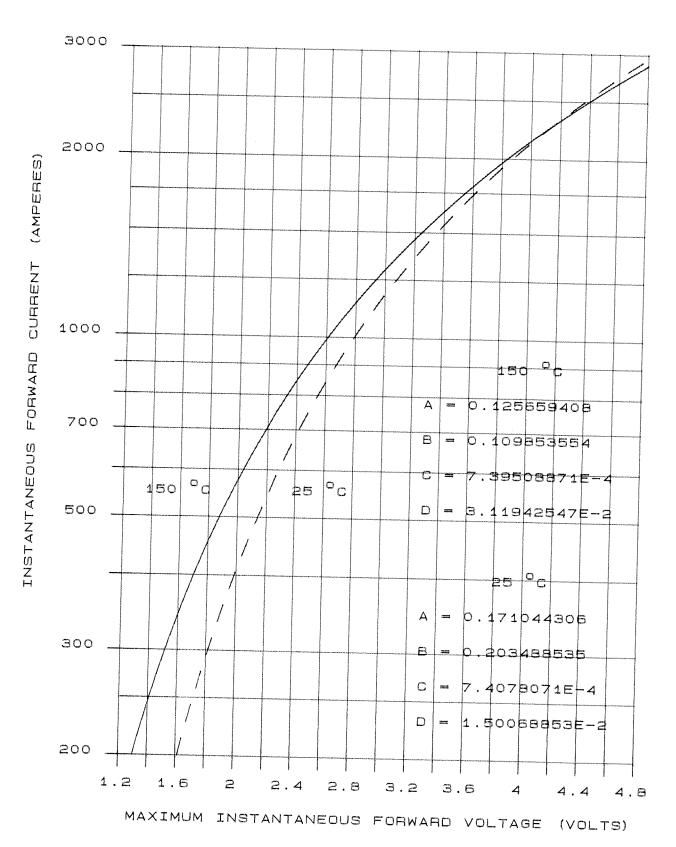
This device has a low reverse recovered charge and peak reverse recovery current. When measuring the charge care must be taken to ensure that:

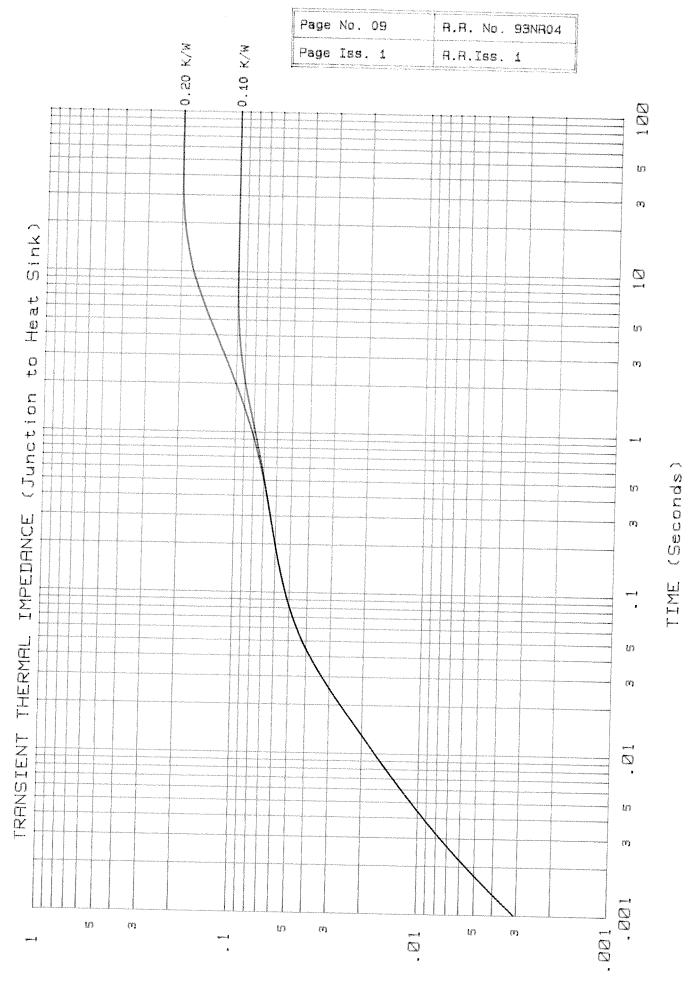
- (a) a.c. coupled devices such as current transformers are not affected by prior passage of high amplitude forward current.
- (b) A suitable, polarised, clipping circuit must be connected to the input of the measuring oscilloscope to avoid overloading the internal amplifiers by the relatively high amplitude forward current signal.
- (c) Measurement of reverse recovery waveform should be carried out with an appropriate snubber of $0.5\mu F$, 2.2ohms connected across diode anode to cathode.

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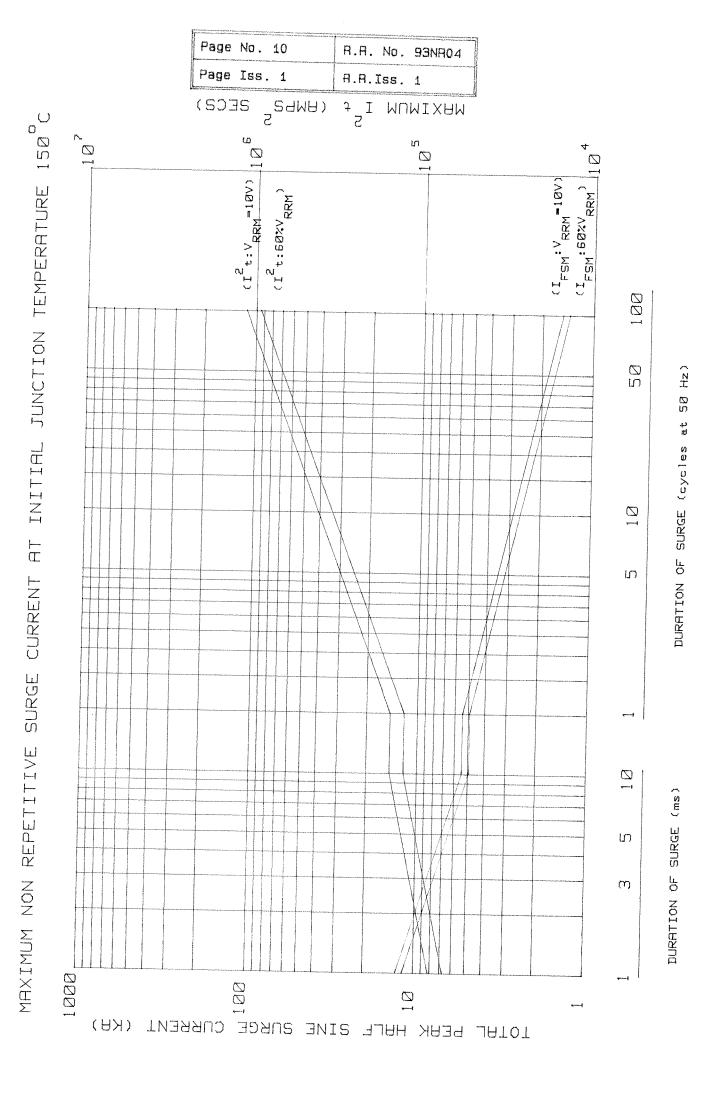
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OF LIMIT DEVICE





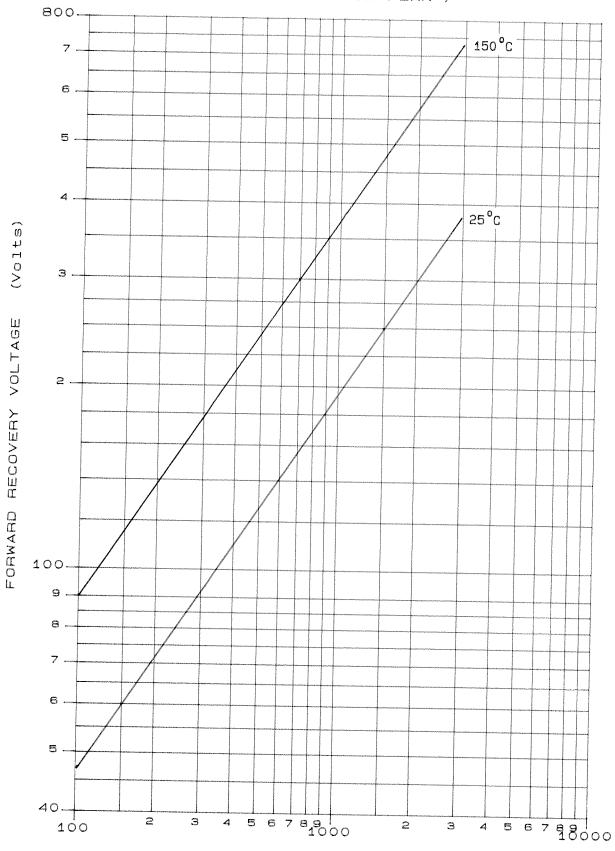
THERMAL IMPEDANCE (K/W)



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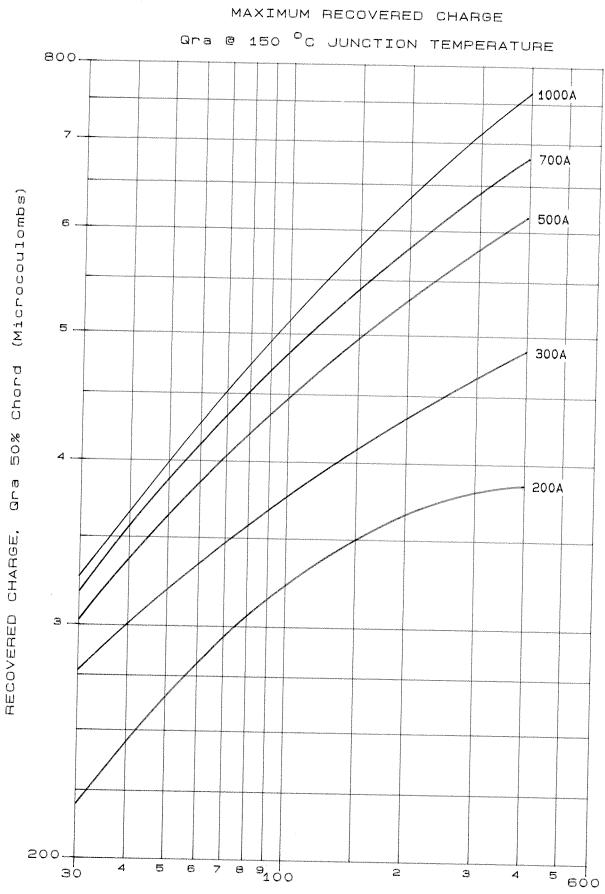
FORWARD RECOVERY VOLTAGE

(MAXIMUM PEAK)



COMMUTATING dI_F/dt (A/us)

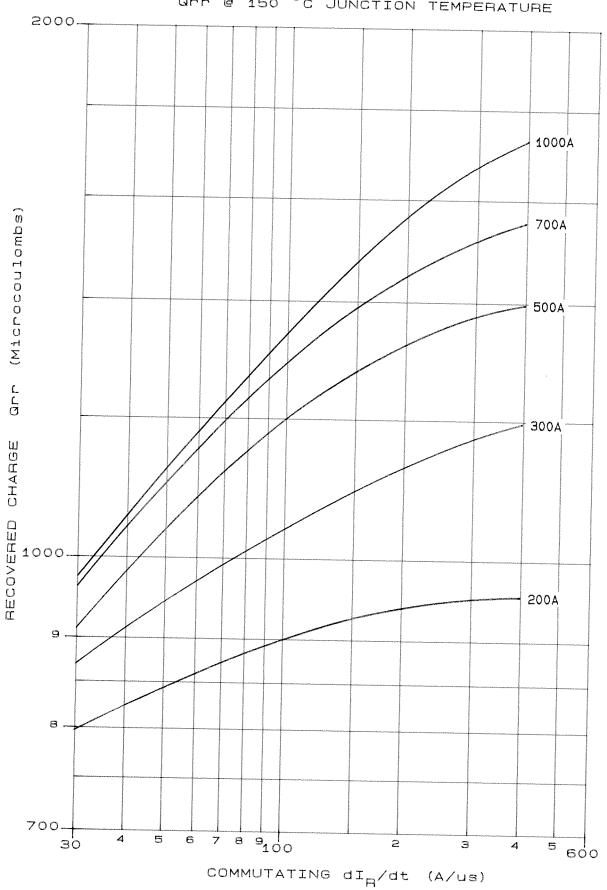
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COMMUTATING dI_A/dt (A/us)

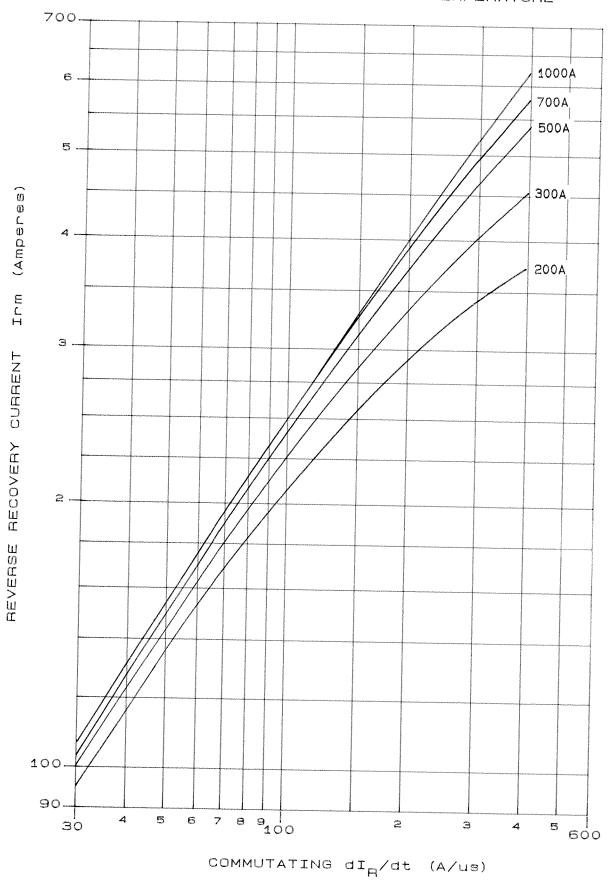
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MAXIMUM TOTAL RECOVERED CHARGE Qrr @ 150 °C JUNCTION TEMPERATURE



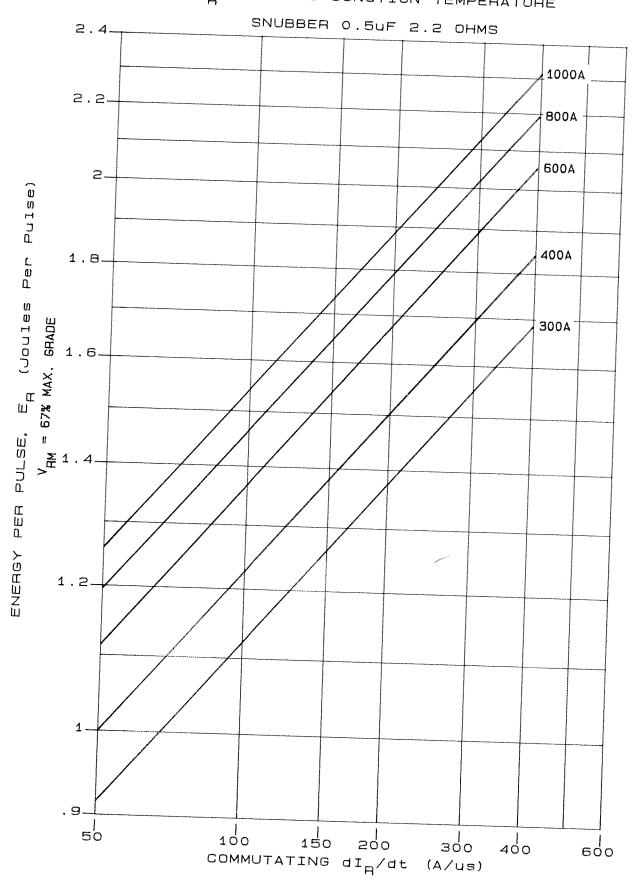
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MAXIMUM PEAK REVERSE RECOVERY CURRENT



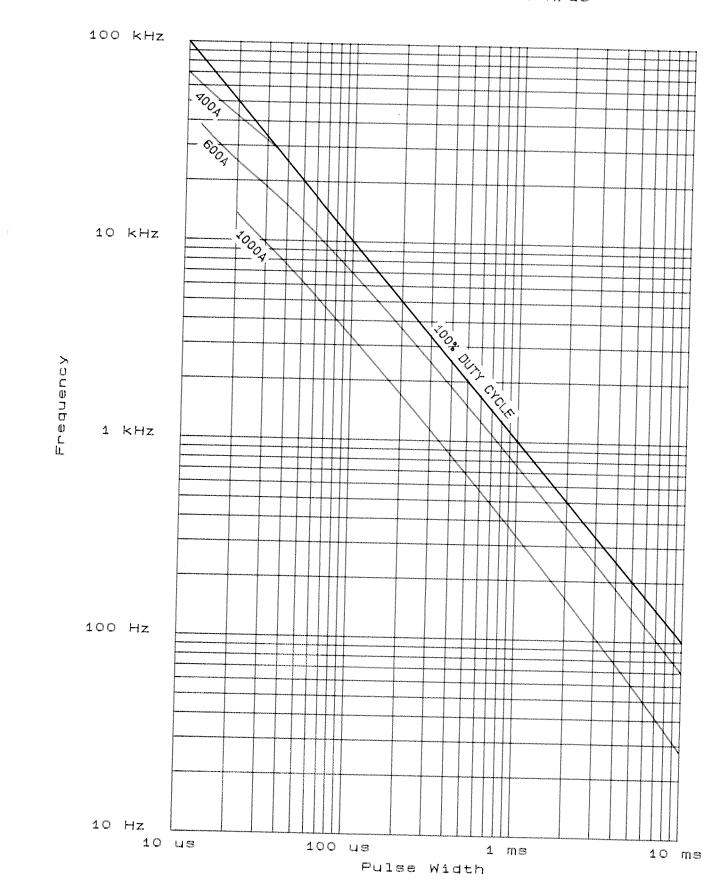
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MAXIMUM REVERSE RECOVERED ENERGY LOSS PER PULSE E_r @ 150 ^oc junction temperature



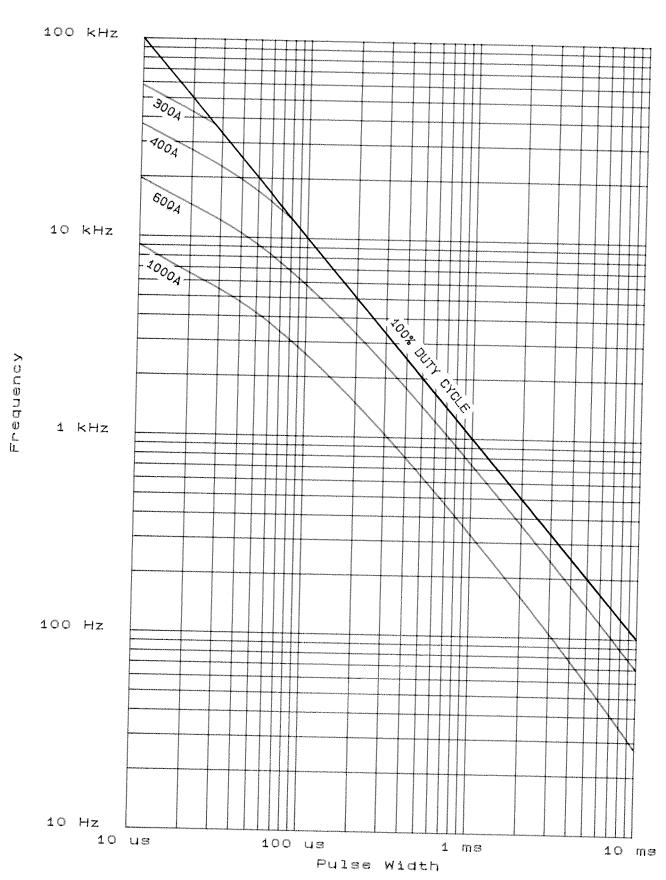
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Frequency Vs Pulse Width T Sink = $55.^{\circ}$ C. 100. A/us



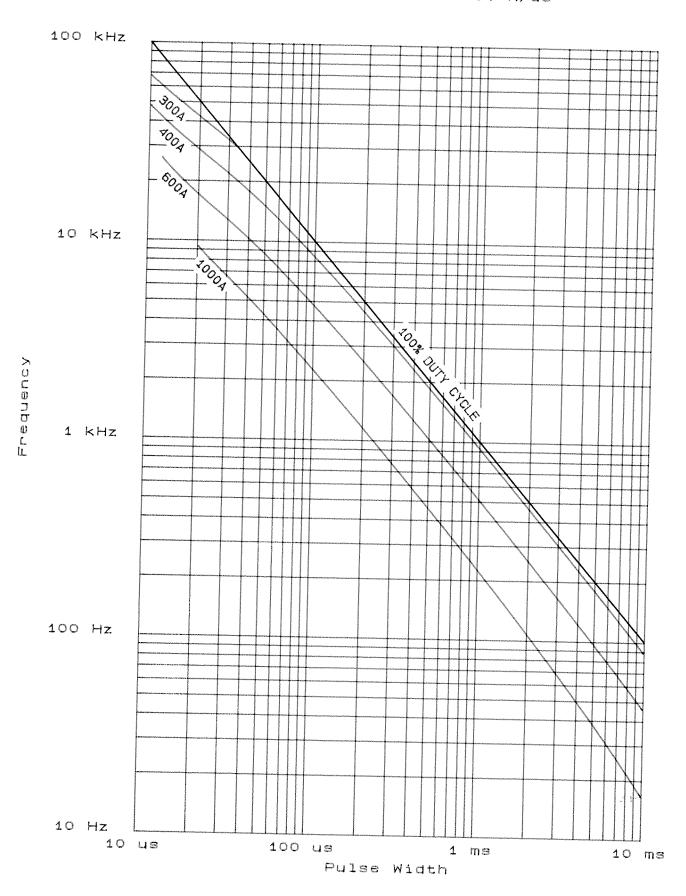
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Frequency Vs Pulse Width T Sink = 55.°C. 500. A/us



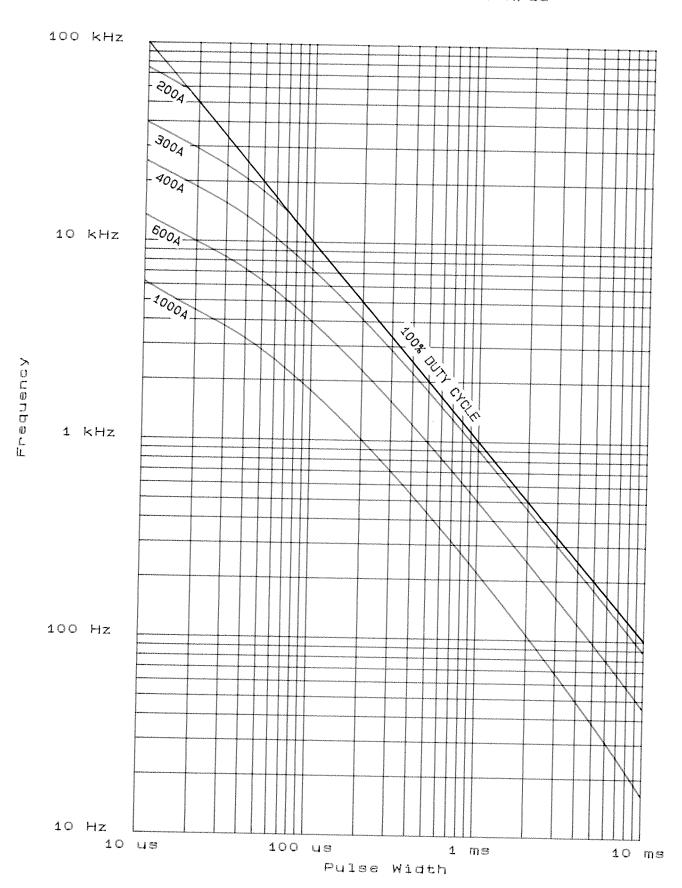
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Frequency Vs Pulse Width T Sink = $85.^{\circ}$ C. 100. A/us



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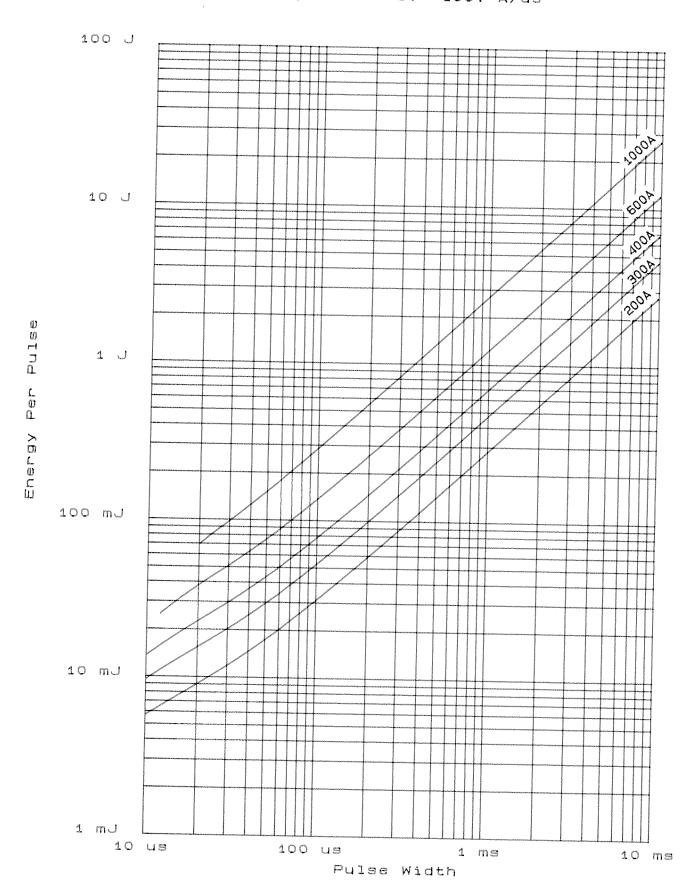
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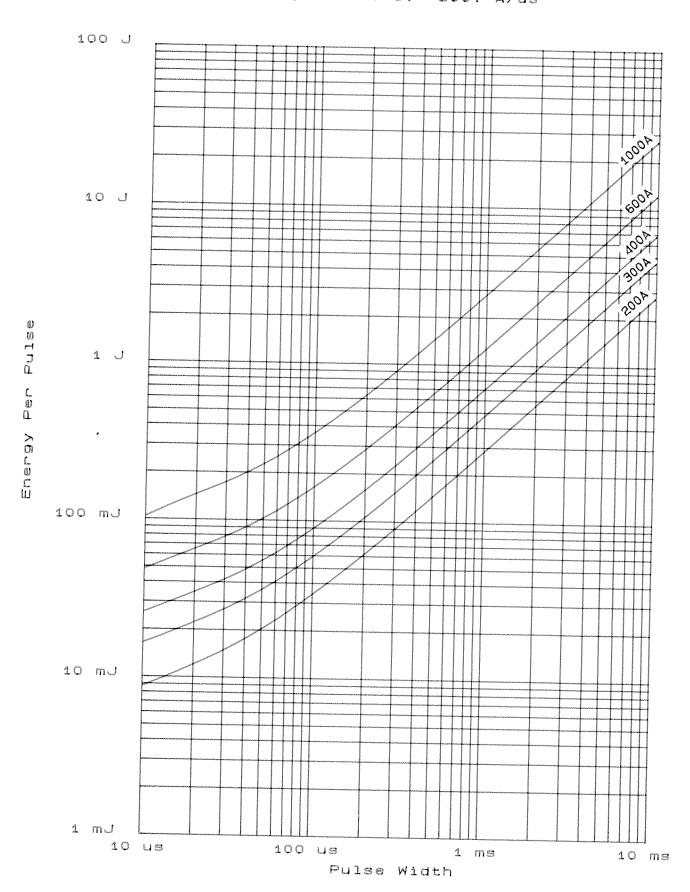
Forward Energy Vs Pulse Width

Tj = 150. °C. 100. A/us



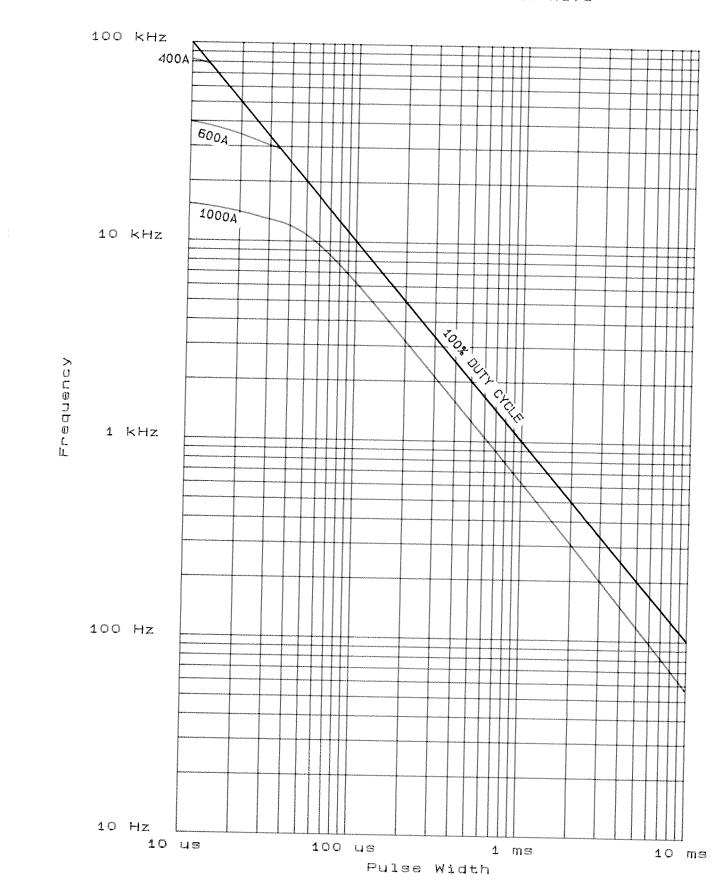
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Forward Energy Vs Pulse Width Tj = 150.°C. 500. A/us



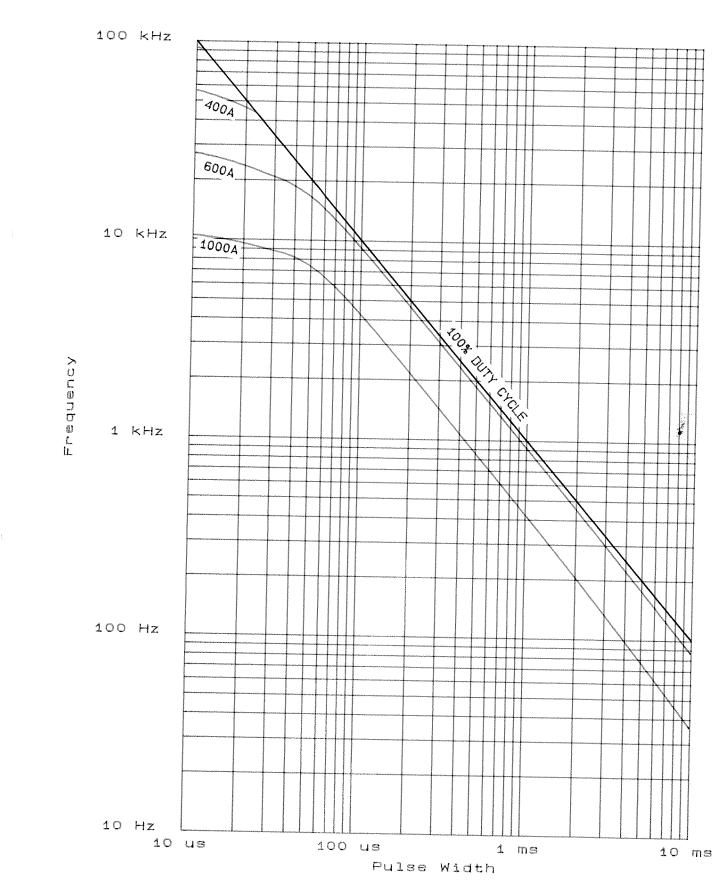
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Frequency Vs Pulse Width
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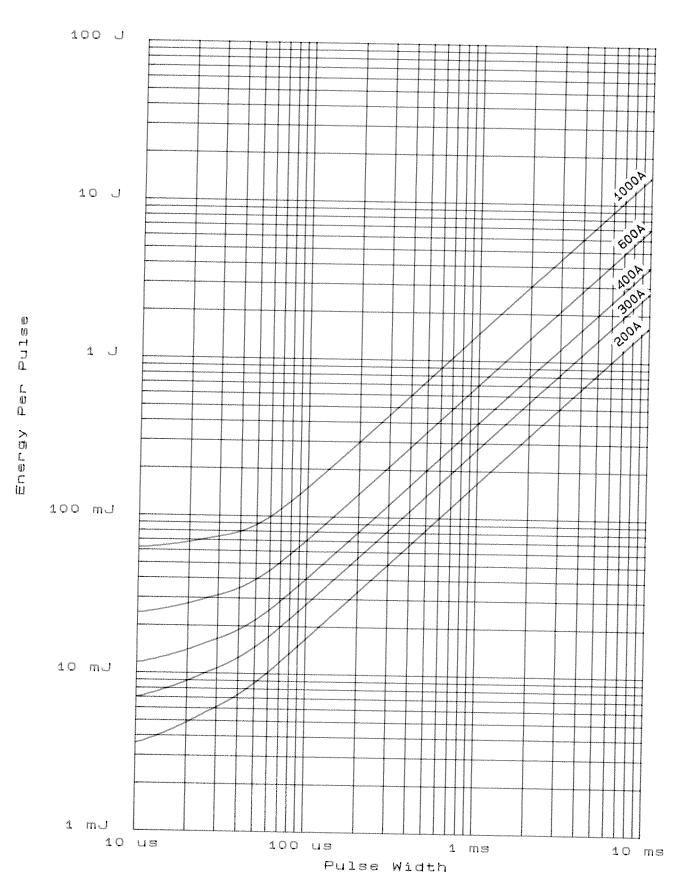
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Frequency Vs Pulse Width
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Forward Energy Vs Pulse Width $T_j = 150.$ C. Sine Wave



ACAD REF: 100A317

INTERNATIONAL OUTLINE No. G.A. DWG No. 159B100H126

WEIGHT. FINISH.

WESTCODE

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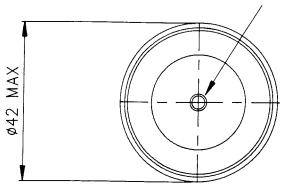
NICKEL PLATE

DEVICE MOUNTING: CLAMPING FORCE TO BE APPLIED ON CENTRE LINE 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 = 330-550kgf.

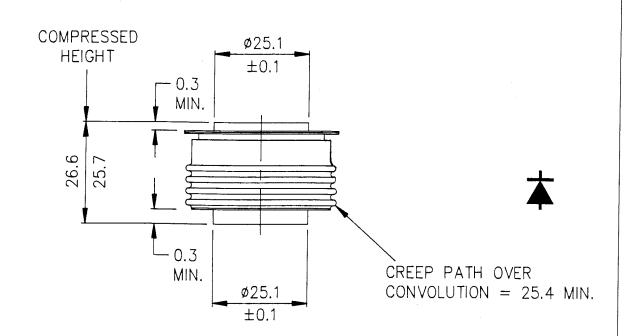
TYPE NUMBER

HXC084 HXC164

 $\phi 3.6/3.5 \times 1.8$ MIN. DEPTH 2-HOLES, ONE IN CATHODE AND ONE IN ANODE.



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REVISIONS

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THIRD ANGLE PROJECTION. \bigoplus DWG. COMPLIES WITH BS 308. DIMNS. IN MILLIMETRES.

DWG No.

100A317

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