WESTCODE SEMICONDUCTORS

Technical Publication
DFC724
Issue 1
April 1982

Fast Recovery Capsule Diode Type CXC724
940 amperes average: up to 1800 volts V_{RRM}

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

RATING	CONDITIONS		SYMBOL	
Average forward current	Half sine wave	55°C heatsink temperature (double side cooled)	$I_{F(AV)}$	940A
		100°C heatsink temperature (single side cooled)	$I_{F(AV)}$	265A
R.M.S. current	$T_{HS} = 25°C$		$I_{F(RMS)}$	1900A
D.C. forward current	$T_{HS} = 25°C$		I_F	1680A
Peak one-cycle surge non-repetitive	10ms sine pulse	60% V_{RRM} re-applied (max.)	$I_{FSM(1)}$	14000A
		$V_{RM} \leq 10$ volts	$I_{FSM(2)}$	15400A
Maximum surge I^2t	10ms sine pulse	60% V_{RRM} re-applied (max.)	$I^2t_{(1)}$	980000A²s
		$V_{RM} \leq 10$ volts	$I^2t_{(2)}$	1186000A²s
	3ms sine pulse	$V_{RM} \leq 10$ volts	$I^2t_{(3)}$	877000A²s
Operating temperature range			T_{hs}	−40 +125°C
Storage temperature range			T_{stg}	−40 +150°C

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

CHARACTERISTIC	CONDITIONS	SYMBOL	
Peak forward volt drop	At 1450A I_{FM}	V_{FM}	1.72V
Forward conduction threshold voltage		V_O	1.24V
Forward conduction slope resistance		r	0.33mΩ
Peak reverse current	$V_{RM} = V_{RRM}$ (max.)	I_{RRM}	100mA
Thermal resistance junction to heatsink	Double side cooled	$R_{th(j-hs)}$	0.033°C/W
	Single side cooled	$R_{th(j-hs)}$	0.065°C/W
Reverse recovered charge	$I_{FM} = 1000A$, $di/dt = 60\ A/\mu s$; $V_{RM} = 50V$	Q_{rr}	175μC
Reverse recovery time		t_{rr}	3.5μs

VOLTAGE CODE →		08	10	12	14	16	18
Repetitive voltage	V_{RRM}	800	1000	1200	1400	1600	1800
Non-repetitive voltage	V_{RSM}	900	1100	1300	1500	1700	1900

Ordering Information (Please quote device code as explained below – 10 digits)

S M	● ●	C X C	7 2 4
FIXED BASIC CODE	VOLTAGE CODE (see above)	FIXED OUTLINE CODE	FIXED TYPE CODE

Typical code: SM12CXC724 = 1200V_{RRM} capsule diode

1. INTRODUCTION

The diode series comprises fast recovery cold-weld capsules with 38mm all diffused silicon slices. All these diodes have controlled reverse recovery characteristics with good 'S' factors. These devices will find applications as 'free wheel' diodes in transistor switching circuits.

2. NOTES ON THE RATINGS

(a) **Square wave ratings**
These ratings are given for leading edge linear rates of rise of forward current of 100 and 200A/μs.

(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

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

(c) **Junction temperature rise per pulse**
Junction temperature rise at end of conduction over a single pulse is given but is only required for low duty cycle ($\leq 1\%$) or single pulse operation.

$T_{SINK} = 125\text{-}T\text{-}E_p f R_{th}$

where f = number of pulses per second, Hz

and T = temperature rise for single pulse, deg. C.

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 heat sink temperature can then be evaluated from:

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

where $r_t = 6.95 \times 10^{-5} \quad \sqrt{t}$

where t = duration of reverse recovery loss per pulse in microseconds

where A = Area under reverse loss waveform per pulse in joules (W.S.)

where f = rated frequency at the original heat sink temperature

The total dissipation is now given by

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

(b) **Design Method**
In circumstances where it is not possible to measure voltage and current conditions, or for design purposes, the additional losses and transient junction temperature rise may be estimated from Figures 13 and 14.

Let E be the value of energy per reverse cycle in joules (Figure 13)

Let θ be the value of temperature rise per reverse recovery cycle (degrees centigrade) (Figure 14)

Let f be the operating frequency in Hz

then $T_{SINK}\text{ new} = T_{SINK}\text{ original} - \theta - ER_{th}\, f$

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

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

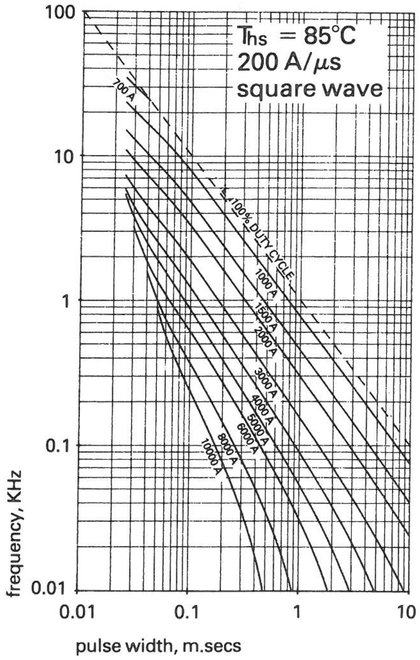


Figure 1 Frequency v. pulse width

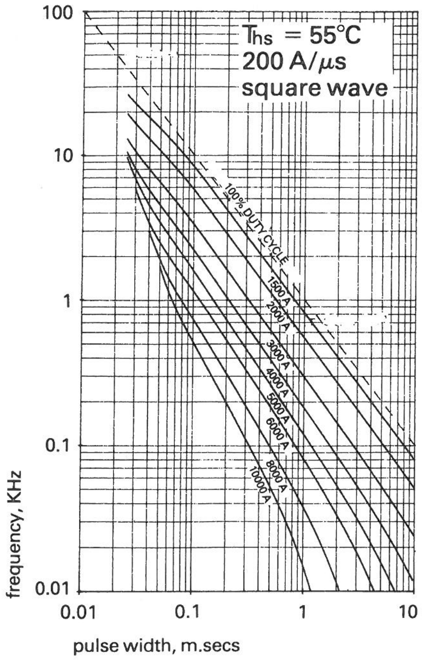


Figure 2 Frequency v. pulse width

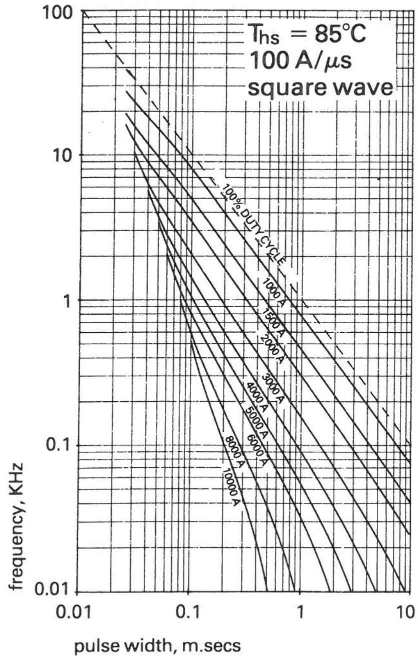


Figure 5 Frequency v. pulse width

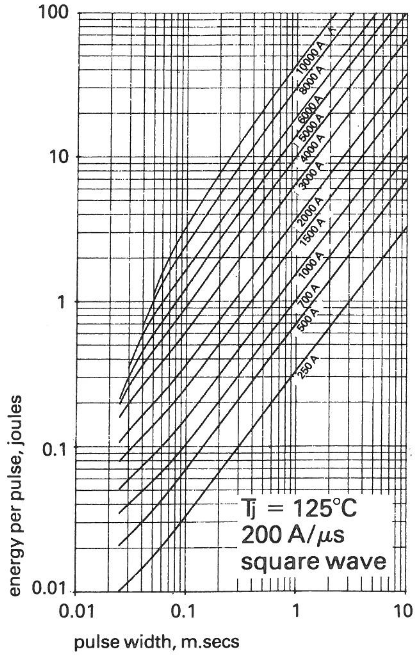


Figure 3 Energy per pulse v. pulse width

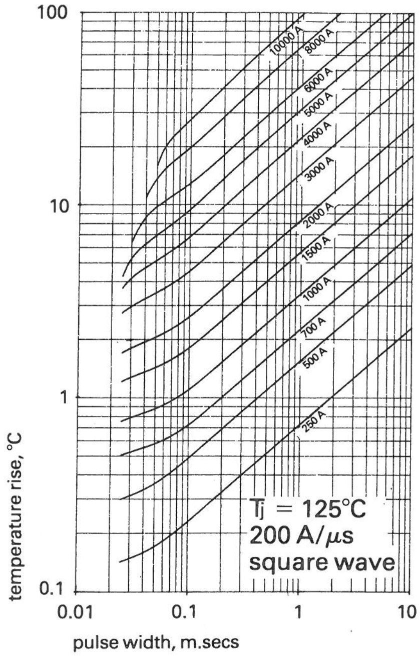


Figure 4 Temperature rise per pulse v. pulse width

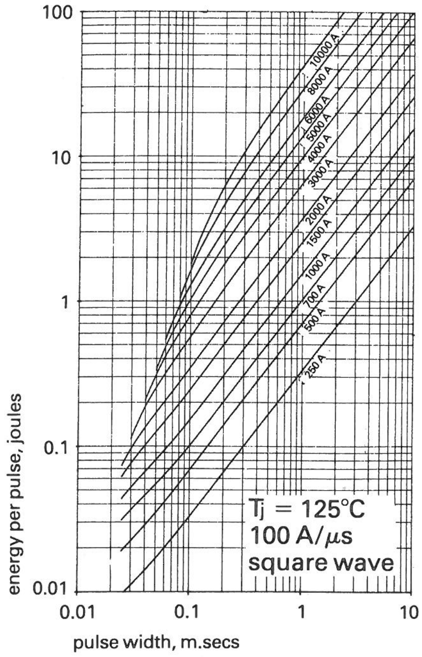


Figure 7 Energy per pulse v. pulse width

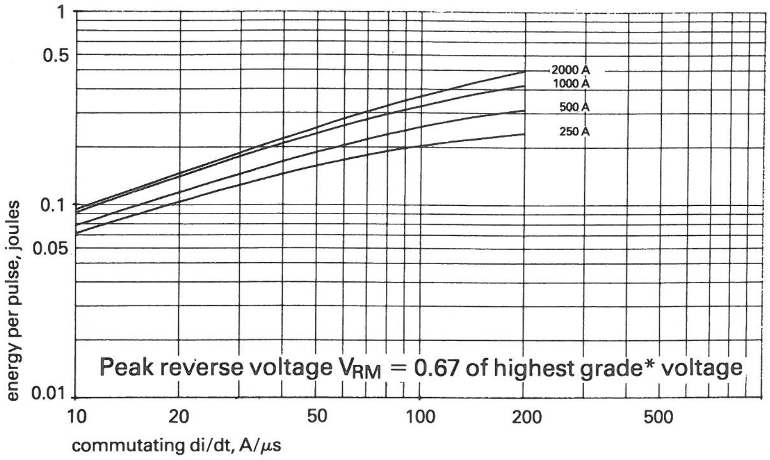


Figure 13 Max. reverse energy loss per pulse per recovery volt at T_j 125°C

*Note: Energy per pulse should be adjusted pro rata to applied peak recovery voltage

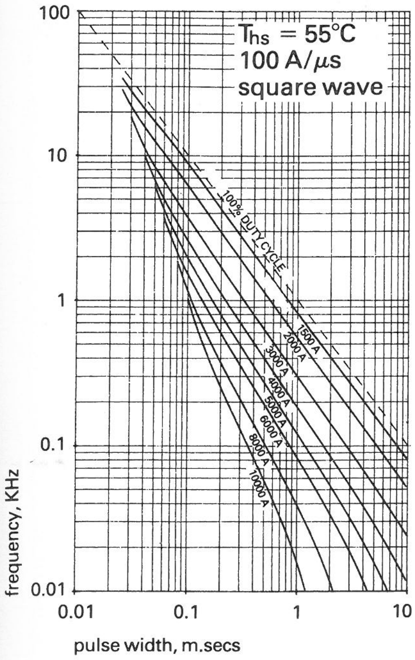


Figure 6 Frequency v. pulse width

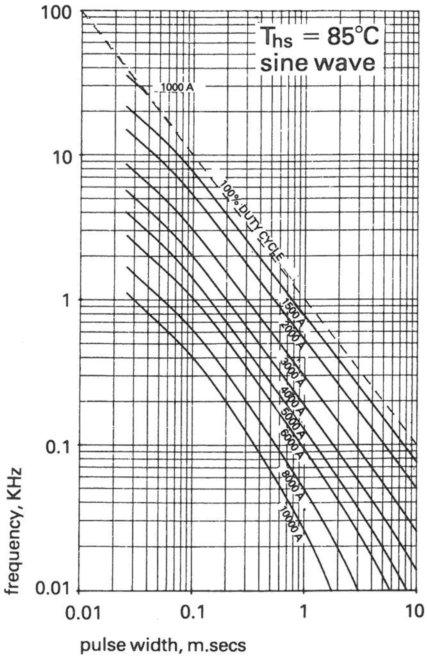


Figure 9 Frequency v. pulse width

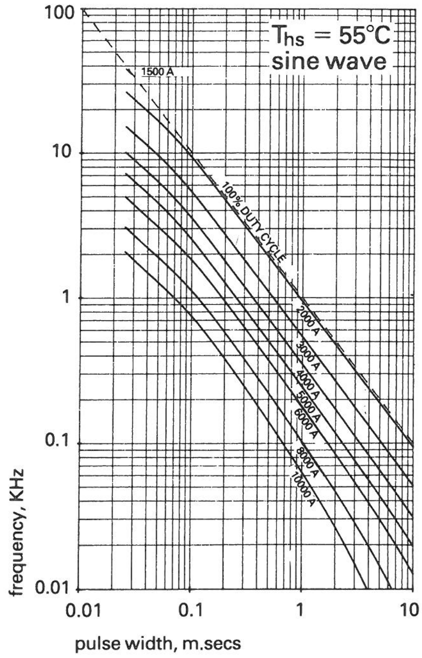


Figure 10 Frequency v. pulse width

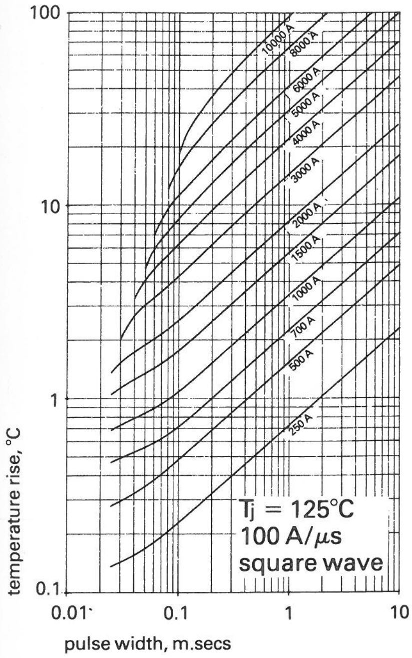


Figure 8 Temperature rise per pulse v. pulse width

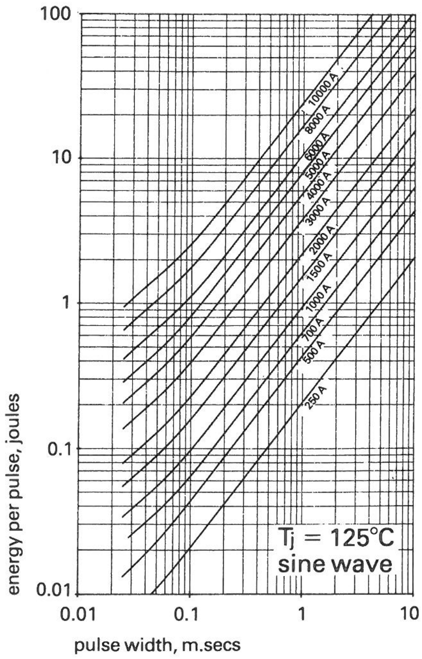


Figure 11 Energy per pulse v. pulse width

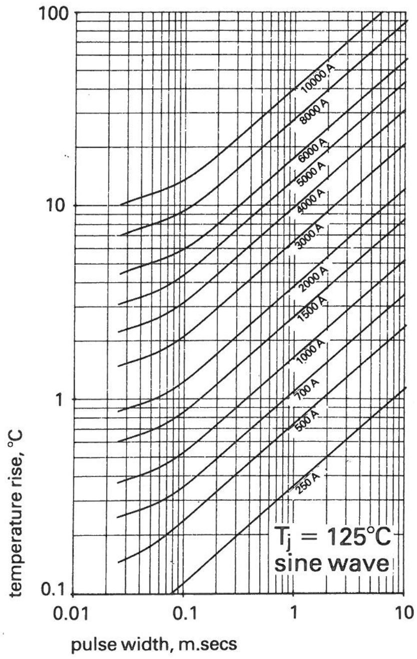


Figure 12 Temperature rise per pulse v. pulse width

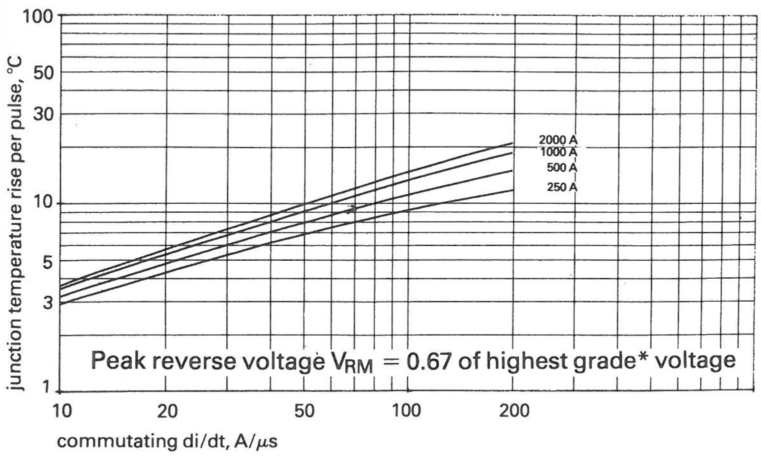


Figure 14 Max. junction temperature rise per pulse per recovery volt at T_j 125°C

*Note: T_j rise per pulse should be adjusted pro rata to applied peak recovery voltage

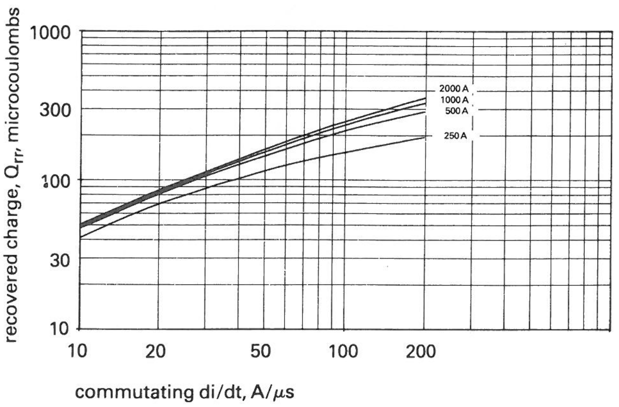


Figure 15 Maximum recovered charge at T_j 125°C

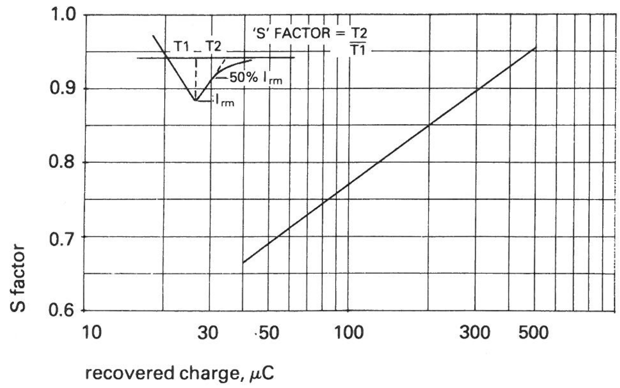


Figure 16 Minimum S factor at T_j 125°C

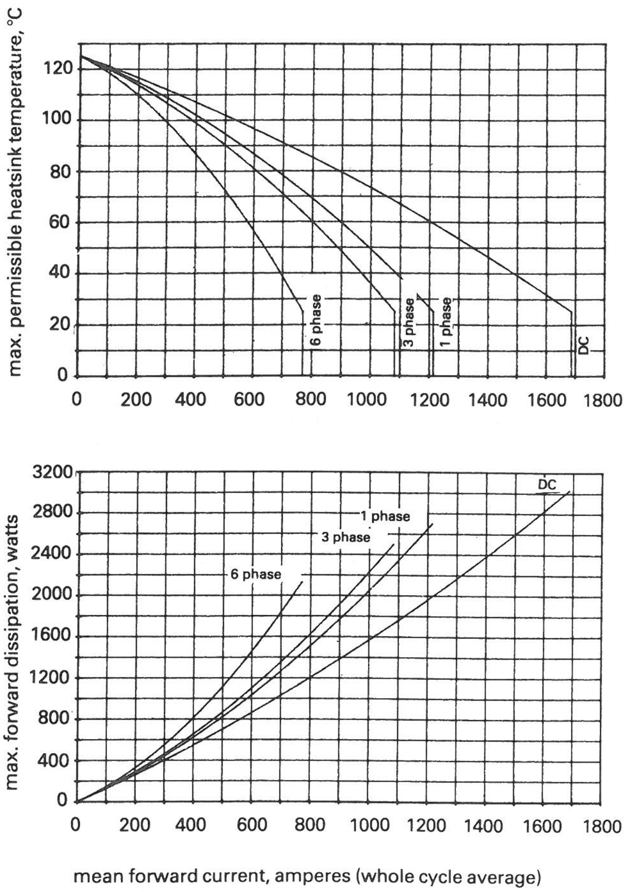


Figure 17 Dissipation and heatsink temperature v. current (double side cooled), 50Hz

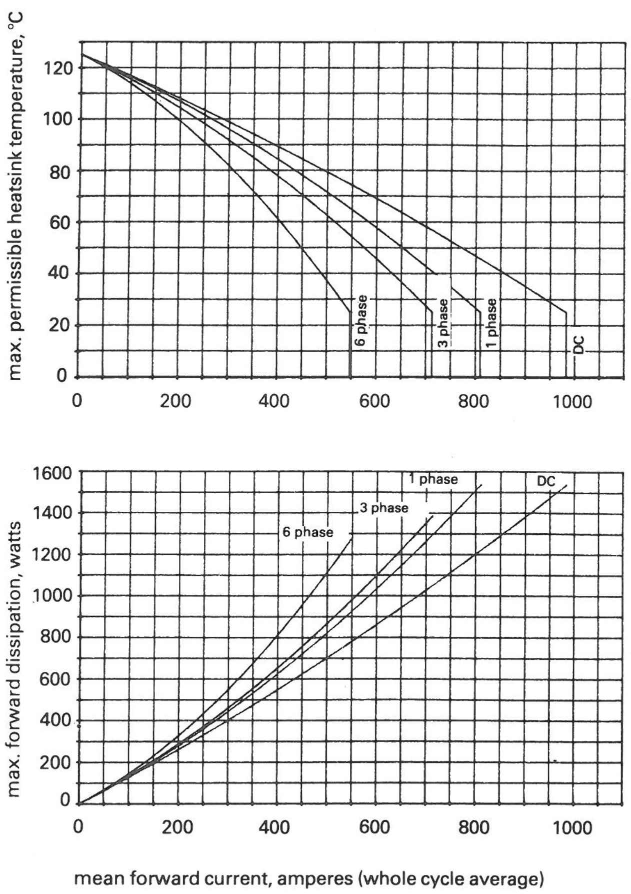


Figure 18 Dissipation and heatsink temperature v. current (single side cooled), 50Hz

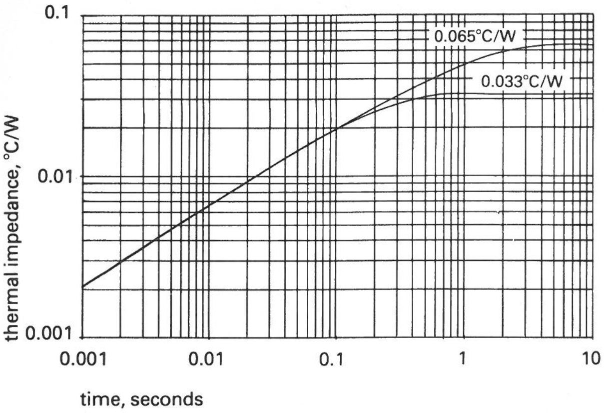


Figure 19 **Junction to heatsink transient thermal impedance**

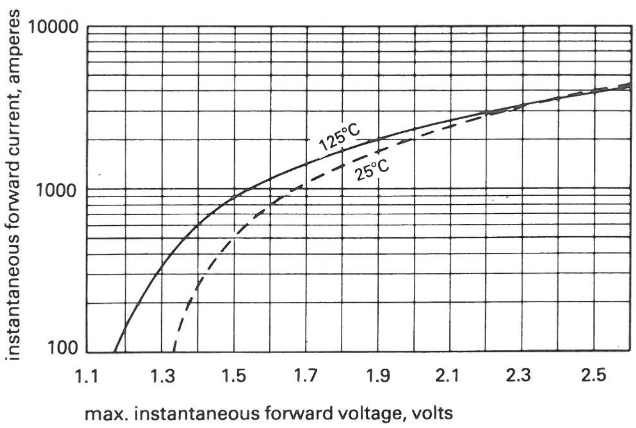


Figure 20 **Forward voltage characteristic of limit diode**

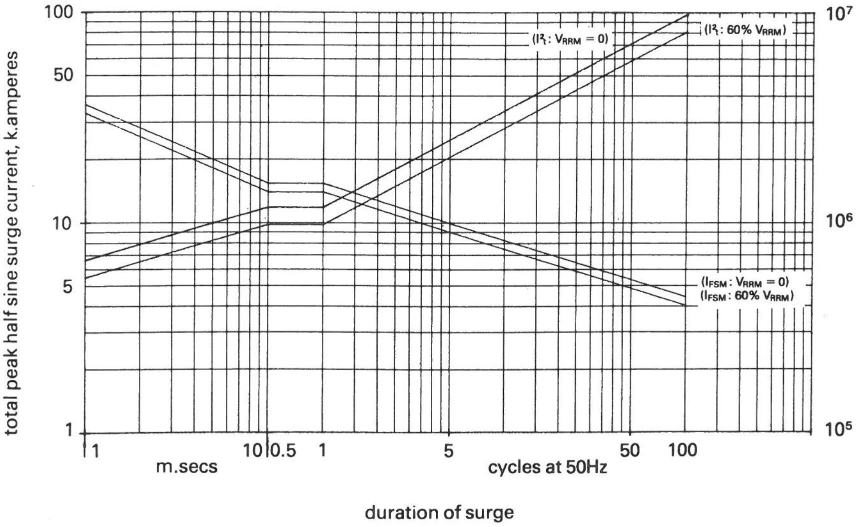
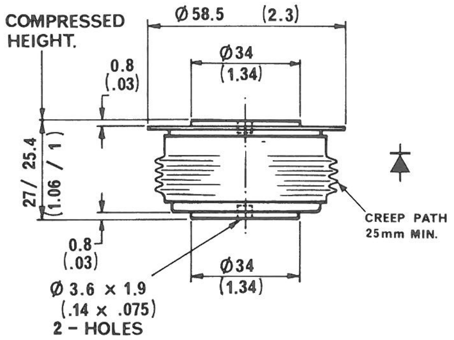


Figure 21 **Max. non-repetitive surge current at initial junction temperature 125°C**



DO - 200AB

dimensions in mm (inches)
mounting force: 1000-2000Kgf
weight: 340 grams

In the interest of product improvement, Westcode reserves the right to change specifications at any time without notice.

WESTCODE SEMICONDUCTORS

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