WESTCODE SEMICONDUCTORS

Technical Publication
DFC170
Issue 2
April 1988

Fast Recovery Capsule Diode Type CXC170
438 amperes average: up to 1200 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)	$I_{F(AV)}$	438A
		100°C heatsink temperature (single side cooled)	$I_{F(AV)}$	114A
R.M.S. current (max.)	T_{HS} = 25°C		$I_{F(RMS)}$	880A
D.C. forward current (max.)	T_{HS} = 25°C		I_F	727A
Peak one-cycle surge non-repetitive	10ms sine pulse	60% V_{RRM} re-applied (max.)	$I_{FSM(1)}$	4500A
		$V_{RM} \leq$ 10 volts	$I_{FSM(2)}$	4950A
Maximum surge I^2t	10ms sine pulse	60% V_{RRM} re-applied (max.)	$I^2t_{(1)}$	101000A²s
		$V_{RM} \leq$ 10 volts	$I^2t_{(2)}$	122000A²s
	3ms sine pulse	$V_{RM} \leq$ 10 volts	$I^2t_{(3)}$	91000A²s
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 635A I_{FM}	V_{FM}	1.47V
Forward conduction threshold voltage		V_O	1.02V
Forward conduction slope resistance		r	0.7mΩ
Peak reverse current	$V_{RM} = V_{RRM}$ (max.)	I_{RRM}	20mA
Thermal resistance junction to heatsink	Double side cooled	$R_{th(j-hs)}$	0.09°C/W
	Single side cooled	$R_{th(j-hs)}$	0.18°C/W
Reverse recovered charge	I_{FM} = 550A, di/dt = 40 A/μs; V_{RM} = 50V	Q_{rr}	75μC

VOLTAGE CODE →		02	04	06	08	10	12
Repetitive voltage	V_{RRM}	200	400	600	800	1000	1200
Non-repetitive voltage	V_{RSM}	300	500	700	900	1100	1300

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

S M	● ●	C X C	1 7 0
FIXED BASIC CODE	VOLTAGE CODE (see above)	FIXED OUTLINE CODE	FIXED TYPE CODE

Typical code: SM08CXC170 = 800V_{RRM} capsule diode

1. INTRODUCTION

The SM2-12CXC170 diode series comprises fast recovery cold-weld capsules with 24mm 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, when used in conjunction with those for the appropriate junction temperature rise, enable maximum operating frequencies and dissipations to be obtained.

(c) **Junction temperature rise per pulse**
Single pulse junction temperature rises are given for all rating conditions.

Let: Ep be the Energy per pulse for a given current and pulse width, in Joules

T be the appropriate junction temperature rise, in degrees Centigrade

R_θ be the steady-state thermal resistance (junction to sink)

and T_{SINK} be the heat sink temperature

the operating frequency may be obtained from

$$f = \frac{125 - T - t_{SINK}}{E_p R_\theta}$$

and the dissipation will be

$$W_{AV} = E_p f$$

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 the forward ratings. The following procedure is suggested when 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 microjoules per pulse. An additional junction temperature rise per pulse can then be evaluated from:

$$\text{Total } T_J \text{ rise per pulse} = \text{Forward } T_J \text{ rise per pulse} + \frac{A\, r_t}{t}$$

where $r_t = 1.64 \times 10^{-4} \sqrt{t}$

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

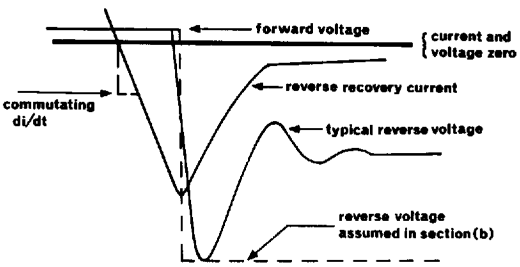
where A = Area under reverse loss waveform per pulse in microjoules

The Energy per pulse must also be modified to include the reverse recovery loss by adding

$A \times 10^{-6}$ Joules

to the forward energy per pulse values.

(b) **Determination without measurement**
Junction temperature rise per pulse per volt and Reverse Recovery Energy per pulse per volt curves are given for cases where it is not possible to measure the voltage and current conditions during reverse recovery. The Figure below shows the idealised situation during reverse recovery. In practice the reverse voltage has an initial overshoot (by an amount inversely proportional to the 'S' Factor) and then settles to a steady state during the recovery 'tail'. This method assumes that full voltage is present throughout the recovery.



The values obtained from these curves must be multiplied by the reverse voltage.

4. NOTE 1

REVERSE RECOVERY LOSS BY MEASUREMENT

When measuring the reverse recovered charge care must be taken to ensure that:

(a) a.c. coupled devices such as current transformers are avoided, as they tend to exaggerate the apparent charge (due to the prior passage of forward current).

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

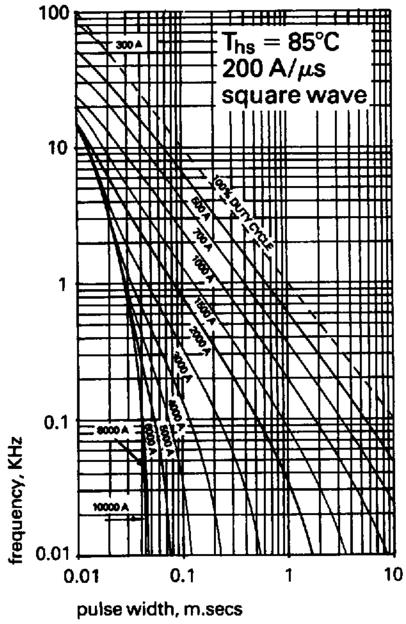


Figure 1 Frequency v. pulse width

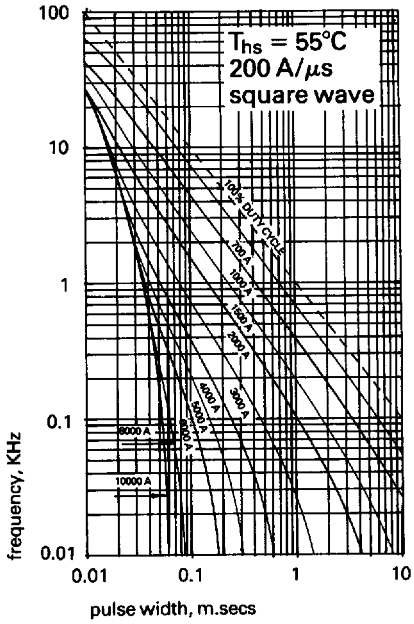


Figure 2 Frequency v. pulse width

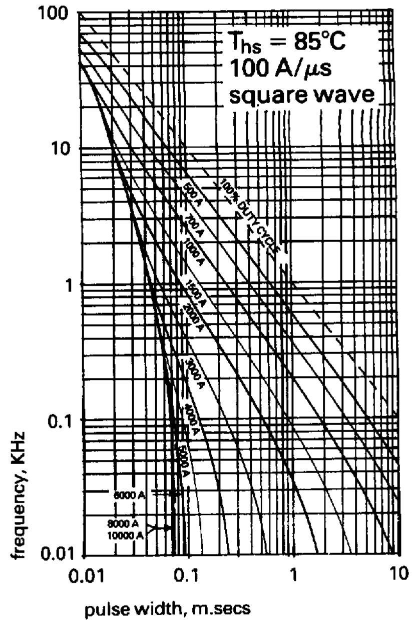


Figure 5 Frequency v. pulse width

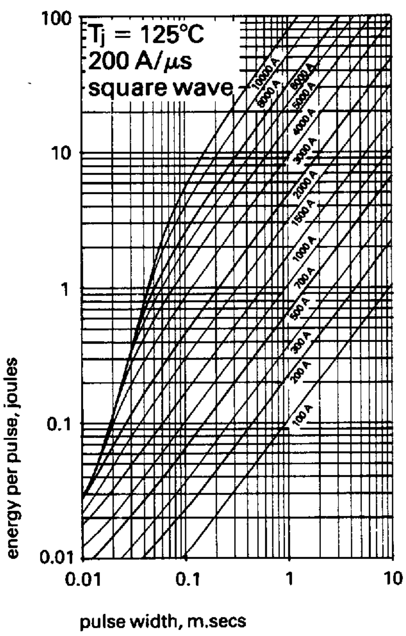


Figure 3 Energy per pulse v. pulse width

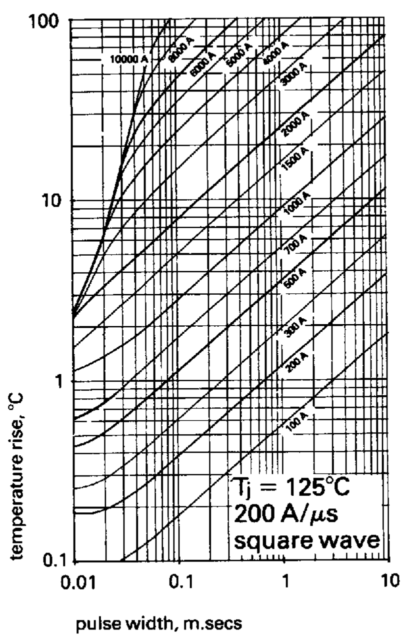


Figure 4 Temperature rise per pulse v. pulse width

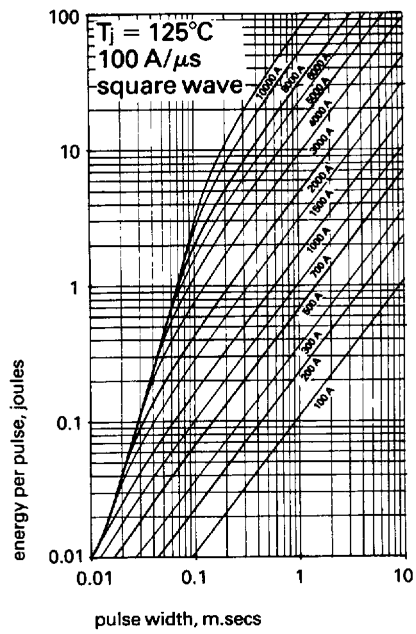


Figure 7 Energy per pulse v. pulse width

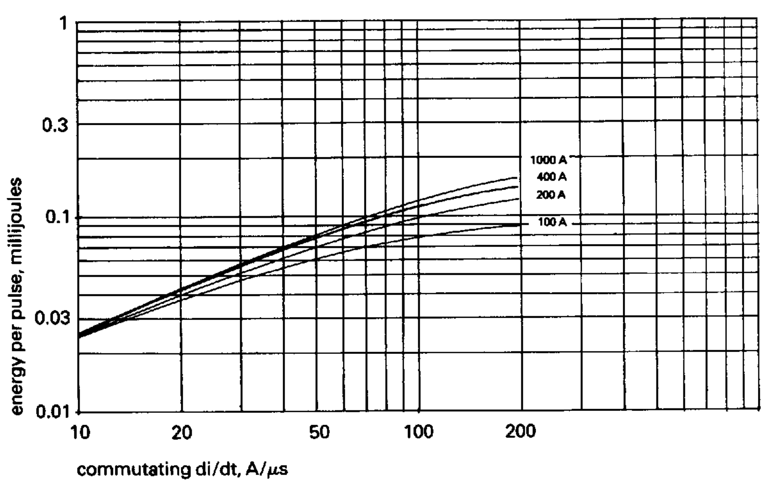


Figure 13 Max. reverse energy loss per pulse per recovery volt at T_j 125°C

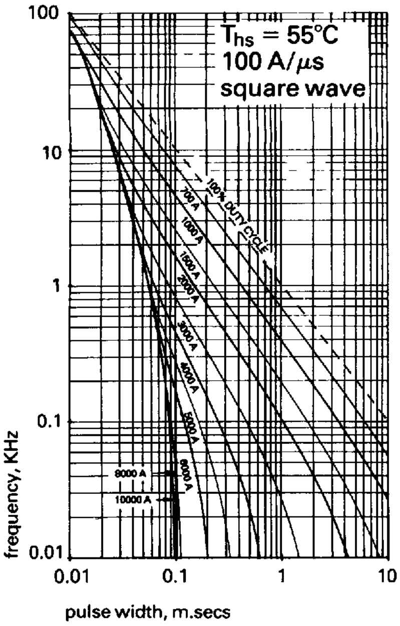


Figure 6 Frequency v. pulse width

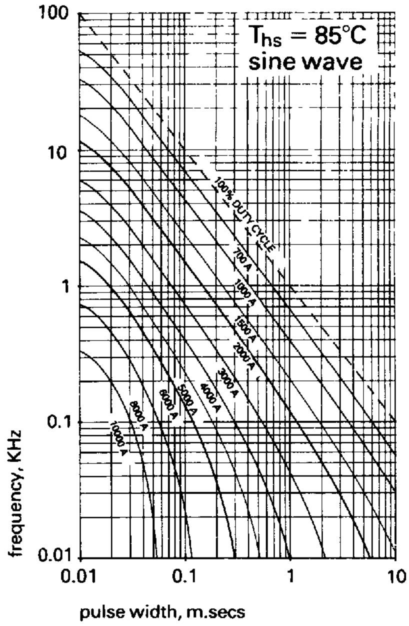


Figure 9 Frequency v. pulse width

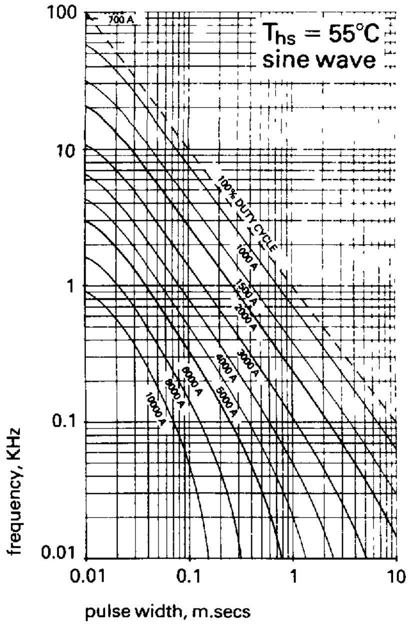


Figure 10 Frequency v. pulse width

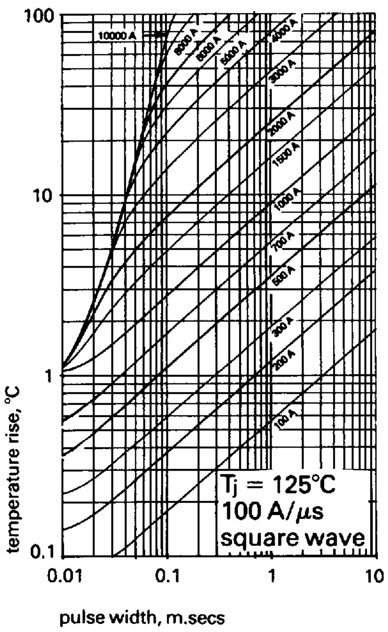


Figure 8 Temperature rise per pulse v. pulse width

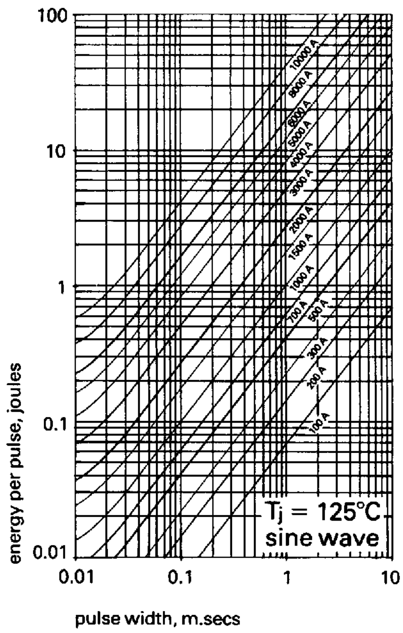


Figure 11 Energy per pulse v. pulse width

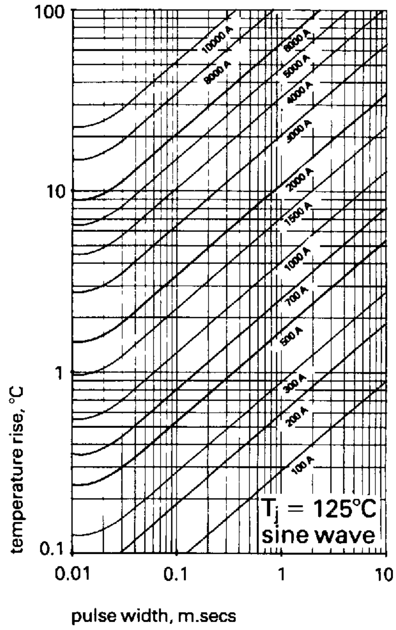


Figure 12 Temperature rise per pulse v. pulse width

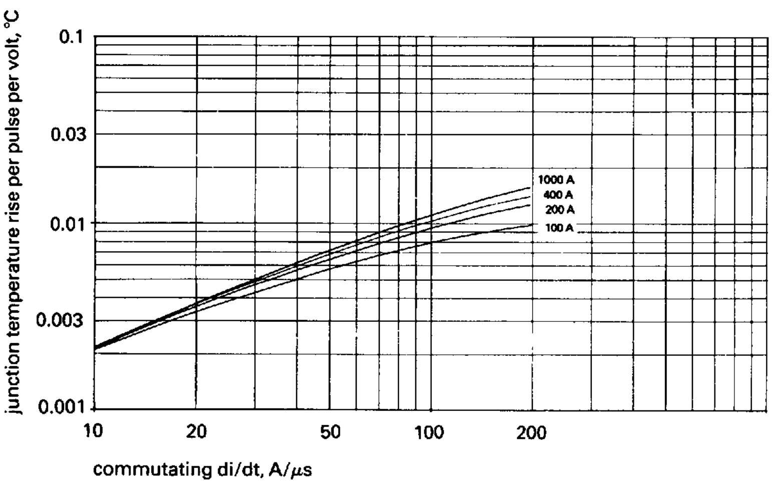


Figure 14 Max. junction temperature rise per pulse per recovery volt at T_j 125°C

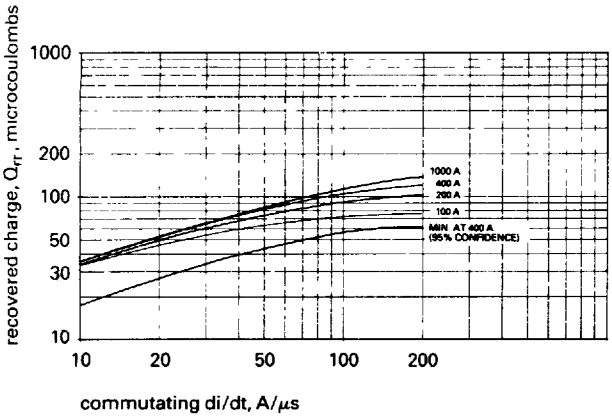


Figure 15 Maximum recovered charge at T_j 125°C

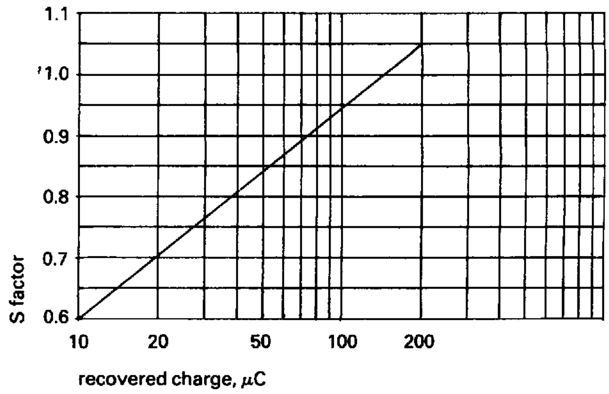


Figure 16 Minimum S factor at T_j 125°C

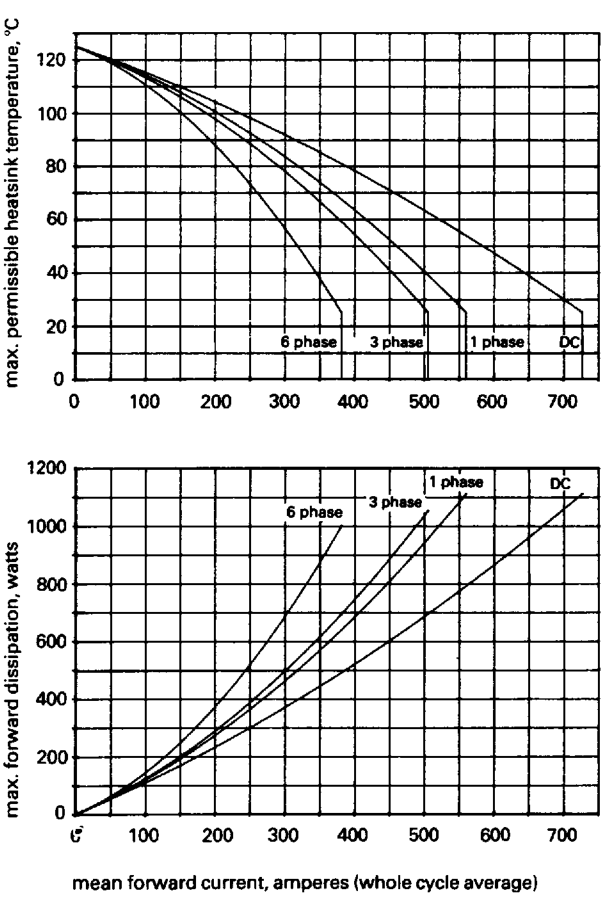


Figure 17 Dissipation and heatsink temperature v. current (double side cooled), 50Hz

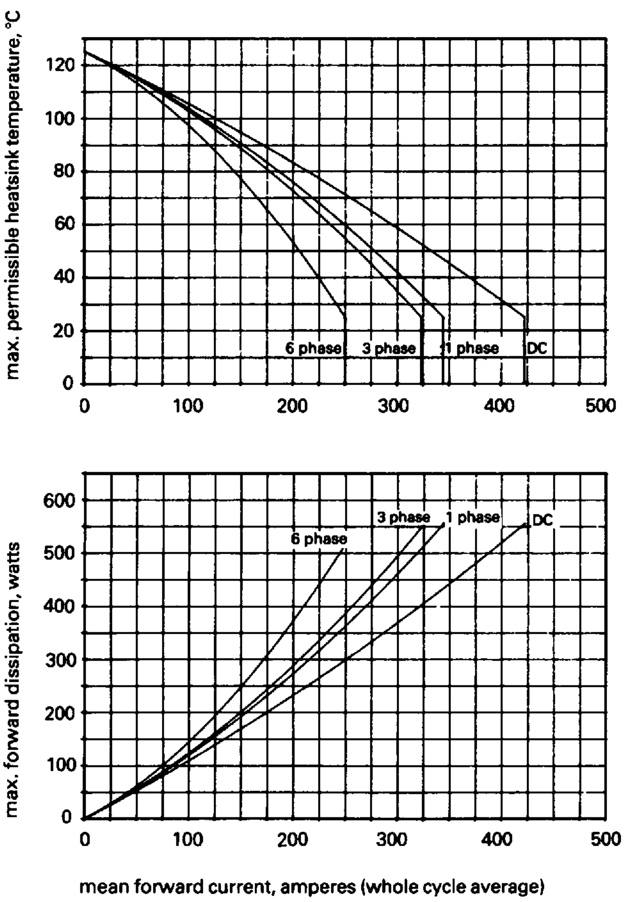


Figure 18 Dissipation and heatsink temperature v. current (single side cooled), 50Hz

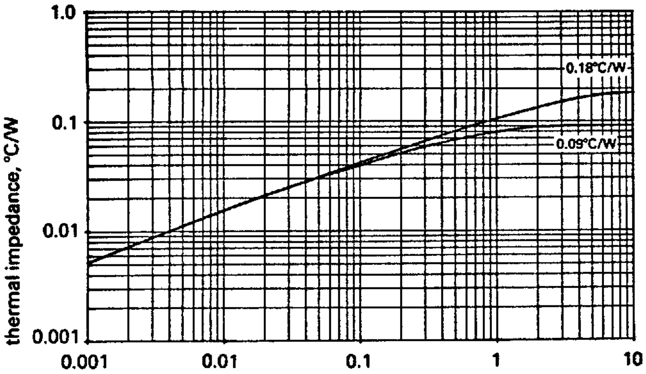


Figure 19 Junction to heatsink transient thermal impedance

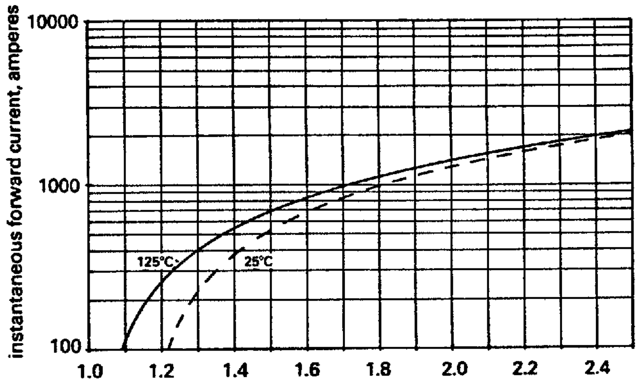


Figure 20 Forward voltage characteristic of limit diode

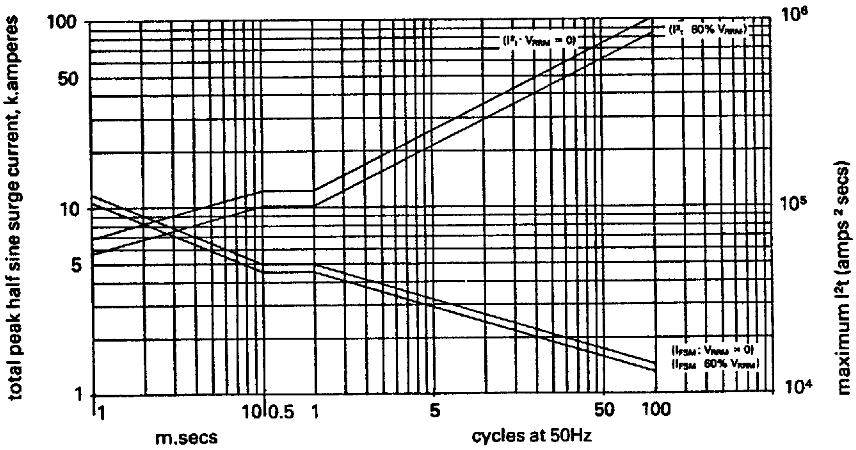
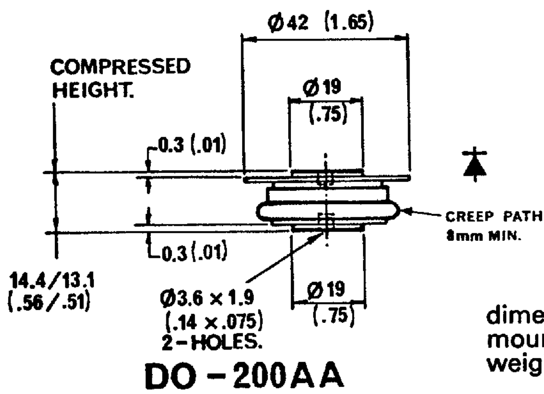


Figure 21 Max. non-repetitive surge current at initial junction temperature 125°C



dimensions in mm (inches)
mounting force: 330-550Kgf
weight: 70 grams

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

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