

## Application note for setting disc spring type clamps

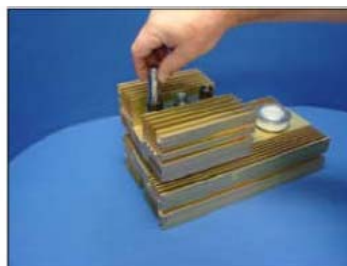
### Introduction

This application note provides instructions on how to set a disc spring type clamp. The clamp range uses a two-rod system with disc springs to apply the required clamping force on the device. This force is achieved when the top disc spring(s) are just free to move.

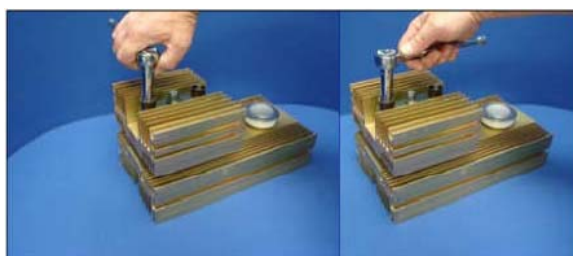
This pre-calibrated force indicator eliminates the need for any special equipment or torque wrenches.

### Instructions

1. After loosely assembling all the components with the capsule device between the heatsinks, finger tighten the two bolts.



2. Check that the top bar is parallel with the heatsink and make sure that it is centrally located i.e. not at an angle to the channel in the heatsink.
3. Using a socket (wrench) tighten each bolt by a quarter turn alternately.



4. Check the top disc spring(s) after each bolt has been quarter turned. Correct force is applied when the washers are just free to move.



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# An application note for clamps and mounting information

## Introduction

This application note aims to give guidance as to the clamps and the mounting information.

## Bar Type

The bar clamps are suitable for devices having from 19mm to 75mm diameter mounting surfaces and 450kgf to 7000kgf clamping forces.

## Coding

| CMK                  | XXXX                       | S, D or DT                                                                                                                                           | XX                          | M                           |
|----------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|
| Capsule Mounting Kit | Nominal Clamping Force kgf | S-Single side cooled ( <b>tapped</b> heatsink)<br>D-Double side cooled (through hole in heatsink)<br>DT-Double side cooled ( <b>tapped</b> heatsink) | Maximum Capsule Diameter mm | Metric Fixings M8, 10 or 12 |

## Box Type

The box clamps are suitable for devices with 19mm, 25mm or 34mm diameter mounting surfaces and of 13.8mm or 14.6mm or 26.2mm nominal thickness respectively.

## Coding

| CMK                  | XXX                        | B         | XX                                              | M                               |
|----------------------|----------------------------|-----------|-------------------------------------------------|---------------------------------|
| Capsule Mounting Kit | Nominal Clamping Force kgf | Box Clamp | Capsule Mounting Surface Diameter 19 25 or 34mm | Metric Fixing Bolts (See chart) |

## Types Available

| Type            | Fixing centres (mm) | Rod size    | Capsule devices      |                                |                        |
|-----------------|---------------------|-------------|----------------------|--------------------------------|------------------------|
|                 |                     |             | Outline              | Mounting surface diameter (mm) | Nominal thickness (mm) |
| CMK 450 X 56M   | 65                  | M8          | DO-200AA / TO-200AB  | 19.0                           | 13.6                   |
| CMK 550 X 56M   | 65                  | M8          | GTO                  | 29.5                           | 16.0                   |
| CMK 900 X 56M   | 65                  | M8          | Diode / Thyristor    | 25.1                           | 14.6                   |
| CMK1100 X 76M   | 89                  | M10         | DO-200A9 / TO-200AC  | 34.0                           | 26.2                   |
| CMK1130 X 60M*  | 70                  | M8          | DO-200AB / TO-200AC  | 34.0                           | 26.2                   |
| CMK1130 X 76M   | 69                  | M10         | DO-200AB / TO-200AC  | 34.0                           | 26.2                   |
| CMK2100 X 76M*  | 89                  | M10         | GTO                  | 47.0                           | 27.0                   |
| CMK2140 X 76M   | 09                  | M10         | DO-200 / Thyristor   | 47.0                           | 26.8                   |
| CMK2500 X 116M* | 132                 | M12         | GTO                  | 63.0                           | 26.0                   |
| CMK3000 X 116M* | 132                 | M12         | DO-200AD / Thyristor | 83.0                           | 33.0                   |
| CMK3500 X 116M* | 132                 | M12         | GTO                  | 75.0                           | 26.0                   |
| CMK4000 X 118M* | 132                 | M12         | Diode / Thyristor    | 73.0                           | 36.8                   |
| CMK5000 X 128M* | 146                 | M16         | GTO                  | 75.0                           | 26.0                   |
| CMK7000 X 126M* | 146                 | M16         | Diode / Thyristor    | 75.0                           | 26.6                   |
| CMK450B 19M     | 50 PCD              | M5x50 Bolts | DO-200AA / TO-200A9  | 19.0                           | 13.8                   |
| CMK450B 25M     | 50 PCD              | M5x50 Bolts | Diode / Thyristor    | 25.1                           | 14.6                   |
| CMK1500B 34M    | 70 PCD              | M6x75 Bolts | DO-200AB / TO-200AC  | 34.0                           | 26.2                   |

\*M for T<sub>j</sub> up to 190°C, ML for T<sub>j</sub> 125°C, note: 1Kg = 9.8N

### **Assembly Procedure for Capsule Clamps**

The 'Bar Type' clamps use a two rod system with a straight bar spring that is bent over a central point to give the clamping force on the device. This force is achieved when the indicators (metal shims) at each end of the clamp, become pinched but able to be moved slightly with a pair of pliers.

The 'Box Type' clamps use a four bolt system with disc springs and the correct force on the device is achieved when the bottom of the box just touches the heatsink.

**As the force indication is contained within these clamps, special equipment or torque spanners are not required.** The clamps can therefore be reset to the correct force, at any time, using only a box spanner.

### **Bar Type: Double Side Cooled Assemblies**

#### **CMK450D56M, CMK1130D76M**

- A1. Screw on to one end of each rod a full nut followed by a lock nut and tighten them against each other so that there is approximately 5mm of rod projecting through the lock nut.
  - A2. Place one plain washer over each rod against the full nut.
  - A3. Fit the locating pin into the heatsink (or heatsinks) making sure that the projection is less than the depth of the hole in the capsule (typically 1.5mm).  
**Warning.** If the pin touches the bottom of the hole in the capsule or is not located in it correctly, it will not allow a good contact between the device and heatsink mounting surfaces. This will also damage the internal components of the capsule, which in turn will lead to device failure.
  - A4. Feed the rods through one Insulating block then the 0.15mm thick flexible insulator (if fitted) and then through the heatsink from the rear such that the flat surface of the block is towards the heatsink. Support the rods with the heatsink laid flat with its mounting surface uppermost.
  - A5. Prepare the heatsink and device mounting surfaces as detailed in 'Heatsink and Device Preparation'.
  - A6. Place the capsule on the heatsink located by the pin. See 'Warning' in A3.
  - A7. Place the insulating tubes over each rod and push them down through the block (if fitted).
  - A8. Position the top heatsink over the rods and lower it over the capsule. See 'Warning' in A3.
  - A9. Place the 0.15mm thick flexible insulator (if fitted) followed by the curved insulating block over the two rods with the flat surface towards the heatsink.
- Note:** The insulating tubes may need to be cut shorter to allow the block to touch the heatsink.
- A10. Place one spring gap indicator over each rod with the bend in each indicator over the ends of the block.
  - A11. Place the flat bar spring over the two rods.
  - A12. Place one plain washer over each rod and screw one full nut, finger tight, on to each rod such that the gap between the bar spring and the spring gap indicator is the same at both ends of the spring.
  - A13. Tighten each nut by a quarter turn alternately until the spring gap indicators become pinched. The indicators can be checked using a pair of pliers to ensure that the indicator can be moved slightly. At this point the correct force is applied to the device.
  - A14. When the assembly is in operation the gap between the indicator and the spring when the correct force is applied is between 0mm and 0.15mm.

#### **CMK550D56M, CMK1100D76M**

- B1. Proceed as for section A1 to A13 except in A4 feed the rods through the flat bar spring before the insulating block and in A13 tighten the nuts one sixth of a turn alternately.

#### **CMK900D56M**

- C1. Proceed as CMK450D56M except in A11 two flat bar springs are used.

**CMK1130D60M**

- D1. Proceed as CMK1100D76M except that the domed washers are fitted to the spring (detailed in G3 - flat part of domed washer towards the heatsink in A4, A10) and in A10 two spring gap indicators are used at each end.

**CMK2100D76M**

- E1. Proceed as CMK2140D76M except in A4 the curved block is replaced by two flat bar springs followed by the shaped metal block, with the flat surface towards the heatsink, and the flat insulating block. In A13 tighten the nuts one sixth of a turn alternately.

**CMK2140D76M**

- F1. Proceed as CMK1130D76M except that in A9 the curved insulating block is replaced by a flat insulating block followed by a shaped metal block with the flat surface towards the heatsink and in all two flat bar springs are used.

**CMK2500/4000D116M, CMK5000/7000D116M**

- G1. Screw the rods approximately 22mm into the metal block (fix with liquid thread lock if required).
- G2. Proceed as A3, A4, A5, A6, A7, AB and A10 (indicator bend away from the heatsink).
- G3. Fit the locating pin to the domed washer and assemble to the flat bar spring with a small amount of silicone grease between the washer and spring.
- G4. As A11, A12 and A13 (flat part of domed washer towards the heatsink in A11 and in A12) apply a small amount of silicone grease to the rods before fitting the nuts.
- G5. Fit the insulating cover (if supplied) to the metal block on the lower heatsink with the insulating screws.

**CMK450DT56M, CMK1130DT76M**

- H1. Screw the rods into the heatsink (typically 25mm) with sufficient rod out of the heatsink to accommodate the clamp components (fix with liquid thread lock if required).
- H2. Proceed as A3, A5 to A13.

**CMK900DT56M**

- J1. Proceed as CMK450DT56M except in A11 two flat bar springs are used.

**CMK1130DT60M**

- K1. Proceed-as CMK1130DT76M except that the domed washer is fitted to the spring (detailed in G3 - flat part of domed washer towards the heatsink in A9) and in A10 two spring gap indicators are used at each end.

**CMK2140DT76M**

- L1. Proceed as CMK1130DT76M except in A9 the curved insulating block is replaced by a flat insulating block followed by a shaped metal block, with the flat surface towards the heatsink and in A11 two flat bar springs are used.

**Single Side Cooled Assemblies****CMK450S56M, CMK1130S76M**

- M1. Proceed as CMK450DT56M except at A8 position the conducting right angle bar on the device in place of the top heatsink.

**CMK550S56M**

- N1. Proceed as CMK450S56M except at A8 position the steel circular spacer between the conducting right angle bar and the insulating block.

**CMK900S56M**

- P1. Proceed as CMK450S56M except in A11 two flat bar springs are used.

### **CMK1130S60M**

- R1. Proceed as CMK1130DT60M except that at A7 position the conducting right angle bar on the device in place of the top heatsink.

### **CMK2100S76M**

- S1. Proceed as CMK2140S76M except at A7 position the steel circular spacer between the conducting right angle bar and the insulating block.

### **CMK2140S76M**

- T1. Proceed as CMK2140DT76M except at A8 position the conducting right angle bar on the device in place of the heatsink.

### **CMK3000S116M, CMK4000S116M**

- U1. Proceed as CMK3000D116M except at A4 leave out the flat insulating block and at A7 position the conducting right angle bar on the device followed by the steel circular spacer. Followed by the flat insulating block followed by the flat steel block, in place of the heatsink. The cover detailed in F5 is not required.

## **Box Type**

### **CMK450B19M, CMK450B25M, CMK1500B34M**

- V1. Prepare the heatsink and device as detailed in 'Heatsink and Device Preparation':  
V2. Position the box clamp over the device making sure that the pins are correctly located see 'Warning' in A3.  
V3. Position the square plate over the top of the central rod.  
V4. Place a shake-proof washer (spring and plain on CMK1500B34M) on each of the four bolts and feed the bolts through the clamp whilst holding it in place.  
V5. Screw the bolts into the heatsink finger-tight to the top of the square plate so that the distance from the bottom of the box and the heatsink is equal all the way around.  
V6. Screw the bolts up a quarter turn at a time alternately (taking them clockwise 1, 2, 3 and 4 the tightening sequence is 1, 3, 2 and 4) until the box just touches the heatsink all the way around.

## **MODULE PM2**

1. Prepare the heatsink and device as detailed in 'Heatsink and Device Preparation'.
2. Loosen and remove the M5 nuts from the four hexagonal headed screws.
3. Position the module on the heatsink and screw the four M5 screws into the heatsink finger-tight so that the distance between the bottom of the grey box and the black plastic base plate is equal all the way around.
4. Tighten the four screws alternately until the grey box just touches the black plastic base plate.

Note: The cheese head (slotted) screws, recessed below the black coated steel top plate, are for initial assembly only by IXYS UK WESTCODE, to hold the PM2 unit together during transit. Under no circumstances should any attempt be made to loosen or tighten these screws.

## **Heatsink and device preparation**

### **Aluminium Heatsinks Capsule and Flat Base Devices**

- W1. Refer to application note 2008AN01.  
W2. Where a locating pin is used, ensure that the device is accurately located upon the pin. Ensure that the pin projects from the heatsink less than the depth of the hole in the device. See 'Warning' in A3.

## **Stud Base Devices**



- Y1. Ensure the device contact face is clean and then apply a thin film of mounting grease before mounting the device. Ensure that the threads are clean and free of mounting grease. Do not apply a turning force to any part of the device other than the hexagonal base. Ensure that the specific torque is applied using a suitable torque wrench.

### **Plated Copper Heatsinks**

- Z1. When mounting capsule, flat base and stud devices on plated copper, ensure that the contact area of the device and heatsink is clean and apply a thin film of mounting grease to the contact face of the device only.

### **Notes**

- (1) The lower insulating block must be backed up by a heatsink thickness suitable for the device loading otherwise the insulating block will break.
- (2) Do not position the circular steel spacer between the device and conducting right angle bar as this will give rise to additional volt drop.
- (3) Press the locating pin into the conducting right angle bar and circular spacer (if fitted) prior to assembling the clamp making sure that the projection is less than 1.5mm on either side see 'Warning' in A3.
- (4) Recommended mounting grease -ILEX SCX13 or PENETROX a-13.
- (5) Recommended machining tolerances over the device mounting area: Flatness,  $W_t=30\mu\text{m}$ , Roughness  $R_a=1.6\mu\text{m}$ .
- (6) It is permissible to use a scouring pad such as 'Scotchbrite' to remove stubborn dirt from device and heatsink contact surfaces followed by a clean rag or tissue.
- (7) Recommended lubrication - silicone grease RS555-083 or Rhone Poulenc 'Pate 4'.

### **Dismounting Procedure**

It is as important to use the correct dismounting procedure as it is the mounting procedure. Where it is possible, the assembly should be removed from the equipment and placed horizontal on a clean workbench.

### **CAPSULE devices**

With 'bar' clamps, the nuts should be loosened half a turn alternately (as for assembly), until they are 'finger tight'. The nuts can now be fully removed. Carefully lift off the top of the clamp. In the case of double side cooled units, the top heatsink should be lifted off and placed, upside down, on the work bench.

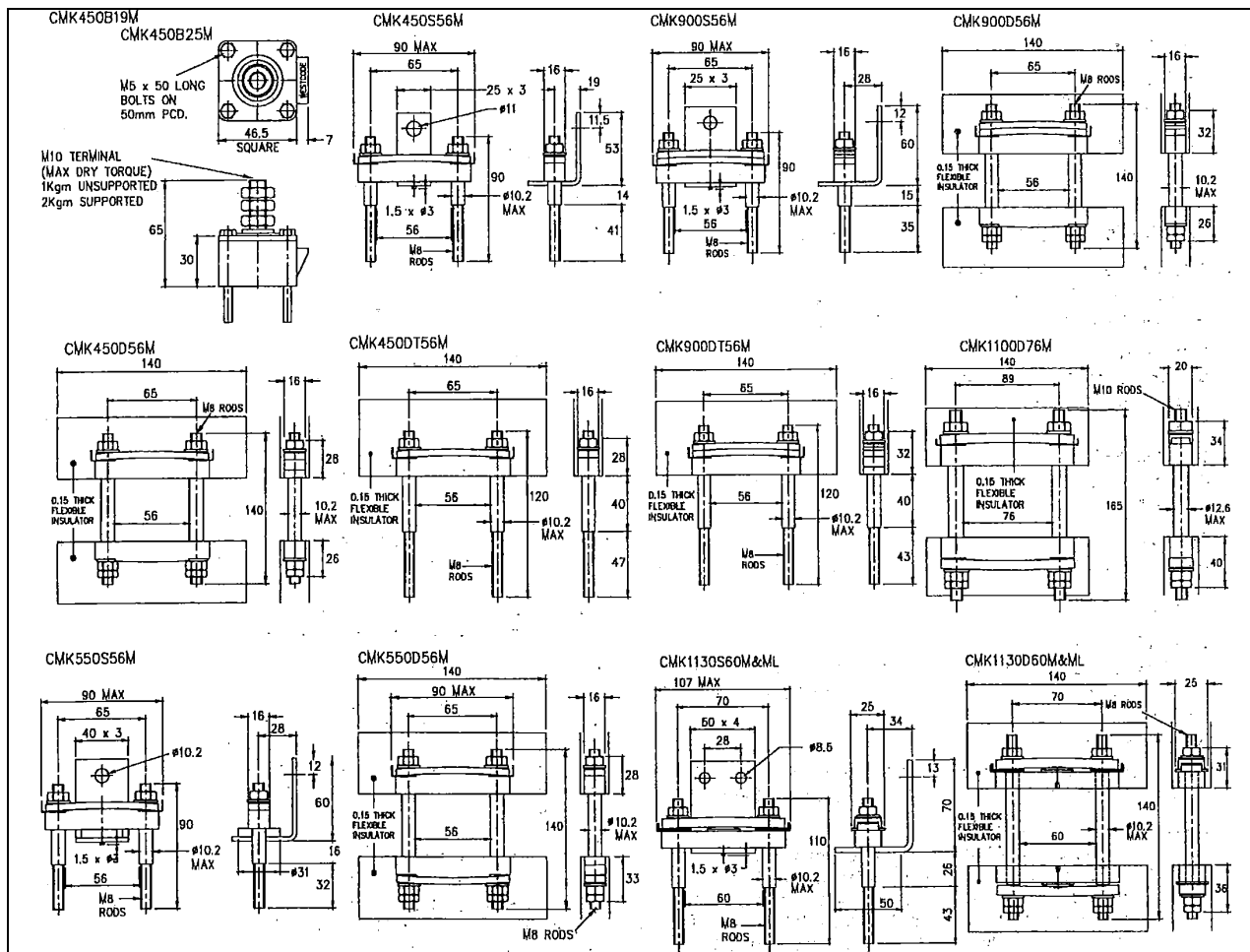
Note: the capsule semiconductor may stay attached to this heatsink, so care must be taken to avoid dropping it. Some form of protection for the mounting surface should be used - a clean cloth for example. If the capsule semiconductor remains firmly attached to a heatsink, it should be gripped firmly in the hand and rotated to attempt to release it. It may be necessary to remove the capsule from the heatsink by levering. Care must be taken to avoid damaging the ceramic or metal parts of the capsule,

If a 'box' clamp is used, release the four screws half a turn in rotation. Otherwise the procedure is as above.

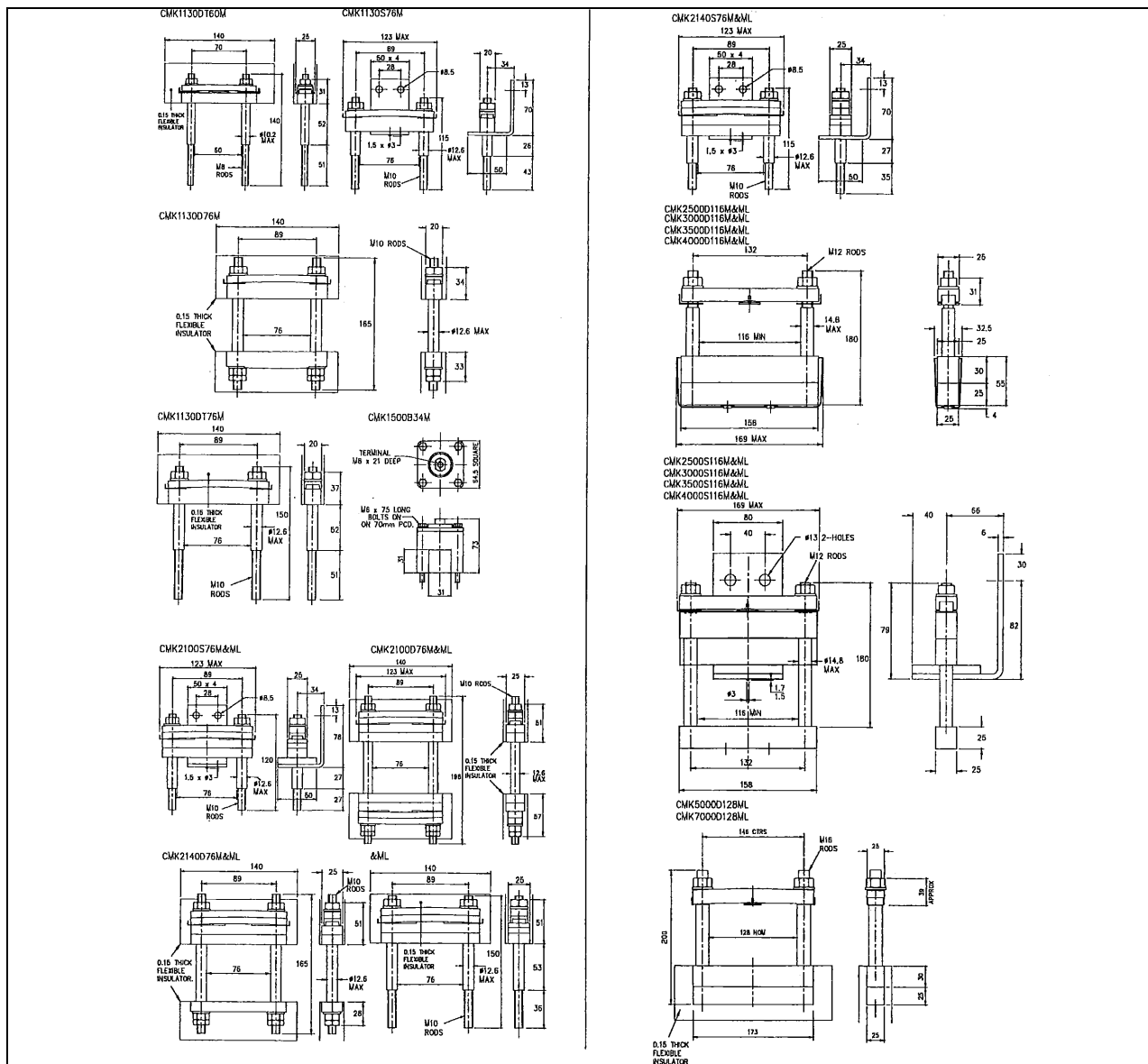
Clean the mounting surfaces with a clean cloth. It should not be necessary to use a solvent liquid.

### **STUD BASE DEVICES**

The same type of socket should be used as that for assembling. Pliers or similar devices should not be used as damage to the heatsink can be caused. When re-assembling, follow "Assembly Procedure".







**IXYS Semiconductor GmbH**

Edisonstraße 15  
D-68623 Lampertheim  
Tel: +49 6206 503-0  
Fax: +49 6206 503-627  
E-mail: [marcom@ixys.de](mailto:marcom@ixys.de)

**IXYS Corporation**

1590 Buckeye Drive  
Milpitas CA 95035-7418 USA  
Tel: +1 (408) 457 9000  
Fax: +1 (408) 496 0670  
E-mail: [sales@ixys.net](mailto:sales@ixys.net)



[www.ixysuk.com](http://www.ixysuk.com)

[www.ixys.com](http://www.ixys.com)

**IXYS UK Westcode Ltd**

Langley Park Way, Langley Park,  
Chippenham, Wiltshire, SN15 1GE.  
Tel: +44 (0)1249 444524  
Fax: +44 (0)1249 659448  
E-mail: [sales@ixysuk.com](mailto:sales@ixysuk.com)

**IXYS Long Beach**

2500 Mira Mar Avenue  
Long Beach CA 90815 USA  
Tel: +1 (562) 296 6584  
Fax: +1 (562) 296 6585  
E-mail: [service@ixyslongbeach.com](mailto:service@ixyslongbeach.com)

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