TN 906/419 - The e2v Buttable CCD Package: Design & Mounting Philosophy

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INTRODUCTION

The CCD42-90 and CCD44-82 large format CCDs have been designed and manufactured so as to allow close-packed butting in mosaic focal plane assemblies. Many features of the package are specific for this purpose. Because of their ability for close packing, the devices are particularly vulnerable to mechanical damage, and careful handling is required. The devices are shipped in custom transit carriers, and care needs to be taken in removing them for use. The package is designed so that, with appropriate handling tools and procedures, the chip cannot be damaged easily during mosaic insertion. A corresponding design of baseplate and mounting holes is required in order to use these chips optimally. This note gives details of these features. It is recommended that all of these notes be read before the CCD is unpacked or used.

THE PACKAGE

The CCD package is manufactured from several components, which include the silicon CCD on top, the Invar body of the package, and a ceramic interconnection with integral 42-pin PGA connector (which fits within the package footprint). A custom compact ZIF connector is also available if required.

Figure 1 indicates the interface drawing for the CCD42-90. The larger-pixel CCD44-82 device has almost identical package design, apart from dimensional changes. The top of the package is larger than the base, as part of the optimised design for safe insertion into mosaics. Several sets of holes and pins on the underside of the package are used:

a) Three studs labelled ‘A’ are used to retain the package to its mounting plate, when installed. Two locations ‘A1’ are near the PGA connector, and are always used. The original chip design used a third location, which is shown as ‘A2’. A recent revision has relocated the third stud to location ‘A3’ (this is to allow more room for ZIF socket connector cable extraction in mosaic assemblies). Consult e2v technologies, or the part reference, to determine which variant is applicable.

   Each stud retains a custom-machined shim, which ensures that the CCD focal plane lies at a defined height when the chip is mounted to a baseplate. Customers are not expected to remove these shim/stud assemblies in normal use.

b) Two precision pins ‘B’ are fitted on the central major axis. These are intended to define the precise location of the CCD when installed in a baseplate.

c) An M4-tapped hole ‘C’ is provided for the user to temporarily fit a ‘guide’ rod to facilitate installation.

d) An M4-tapped hole ‘D’ is provided for the user to temporarily fit a ‘handling’ rod for installation.

e) Six M2.5-tapped holes ‘E’ are provided. These are uncommitted, and may be used by the customer, e.g. for temperature sensor or cooling braid retention if desired.

When the CCD is mounted on a flat base, resting on its shims, the CCD focal plane is set to be 14.0 mm above the baseplate, with a precise flatness and parallelism (±10 μm typical, as defined in the data sheet). The package is designed for use between +20 °C and –120 °C.

BASEPLATE

Normally, mounting plates are manufactured by the customer. However, e2v technologies will design and manufacture custom plates to accommodate their CCDs, if required. e2v can ensure that flatness is maintained, and that mounting holes match package design. e2v also supply assembled mosaic plates, with CCDs precisely located. Below is an example of a baseplate design for CCD42-90 CCDs. Typical mosaic plates accommodate from two to 40 CCDs.

Figure 2 shows an example of a 4-chip baseplate design, and figure 3 shows details of holes and cut-outs. Note that in figure 3 the table indicates dimensional differences for hole separations of the CCD44-82 device.

Holes ‘W’ accommodate the three studs. Hole ‘Y’ takes the guide rod, and hole ‘Z’ takes the handling rod. Holes ‘X’ accommodate the precision pins; note that one hole is circular to define the x/y position, the other is elongated to define the angular location. To minimise the risk of precision pins jamming in the holes, it is recommended that the holes be relieved by counterboring from the back of the plate to leave 1 – 2 mm depth of precision diameter hole.

Many variations of this design are possible, depending on mosaic configuration and allowable butting gap. It is the customer’s responsibility to ensure that the chips can be safely fitted to a baseplate. These notes are intended to act as guidelines for that process.

BUTTING

The package dimensions and image area dimensions are indicated on the device data sheet, together with nominal gaps between edge of image area and edge of package. It is recommended that a gap of 0.5 mm be allowed between the edge of one package and the next. Note that the distance of the silicon from the ‘top’ and two sides is more closely defined than the distance from the ‘bottom’ of the package. The PGA connector is located at the bottom edge.

REMOVAL OF CCD FROM TRANSIT BOX

Before despatch from e2v technologies, the CCD is packed in a sealed transit container. Great care must be taken when removing the device, to prevent electrical or physical damage. The buttable edges of the metal package and CCD are particularly vulnerable.

It is recommended that unpacking be done in clean area conditions, as close as practicable to the point of end use. Appropriate anti-static handling precautions must be observed throughout. Clean area gloves must be worn when handling device assemblies.

Before entering the clean area, remove any outer packaging until all that remains is a heat sealed plastic bag containing the metal transit box.

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UNPACKING PROCEDURE

Cut away the sealed bag and place the metal transit box onto a flat surface with the lid uppermost. The lid should have a device identification label attached. Four cross-head captive screws secure the lid at the corners. Loosen the screws and remove the lid.

The CCD assembly is suspended underneath an insert, which is secured in the bottom of the transit box by three cross-head captive screws. Loosen these screws and lift out the insert, with device attached, and place onto a clean flat surface, still with the CCD face downwards.

The CCD device must now be separated from the insert. The device must be supported to prevent damage. It is recommended that the CCD should be securely supported on a transfer fixture while the transit pack insert is removed, and that the same fixture is used to transfer the CCD to its final location (see next section).

A slot is provided in the transit pack insert, which allows access to two tapped M4.0 holes in the Invar package. It is suggested that these holes are used for the attachment of the transfer fixture. Provision must be made for this fixture to hold the device assembly securely whilst the transit insert is removed. Failure to support the package will result in damage to the CCD. See next section for handling/guide rod discussion.

Once the CCD package is supported, the three M3.0 nuts, which attach it to the transit insert, can be unscrewed. The insert can then be lifted from the attachment studs and removed, leaving the CCD free to be transferred to its new location. See below for detailed installation guidance.

INSERTION OF CCD INTO MOSAIC BASEPLATE

It is assumed that an appropriate baseplate is available, and that the CCD has been removed from its transit box. A clean room environment is recommended. The CCD is best handled in a face down orientation to minimise contamination. The baseplate should be securely held above a work surface with its mounting surface facing downwards. The initial steps are made whilst the CCD is still supported by its transit insert.

The following procedure is designed to ensure safe and clean installation of CCDs without requiring excessive skill:

A guide rod should be screwed into package hole ‘C’. This rod should have a diameter of 5.5 mm and ideally have a tapered end. A minimum length of 35 mm is recommended to protect other chips during use. This rod should be fitted to the package before the transit insert is removed. The baseplate should have a corresponding diameter hole of, for example, 5.6 mm diameter.

A handling rod should be passed through the appropriate baseplate hole and then screwed into package hole ‘D’. This rod should have a diameter of 6.0 mm and be long enough for convenient use, e.g. 150 mm long may be sufficient, without requiring too great a length for feeding through the baseplate. This rod should have a suitable shoulder that will ensure that if released, the CCD package will remain safely suspended from the baseplate above the work surface. (In fact, it allows both hands to be free, to facilitate removal of the transit insert). The rod would normally be screwed into the package before the transit insert is removed (as above). The baseplate should have a corresponding diameter hole of, for example, 6.1 mm diameter.

Both rods need an M4 tapped thread and a well machined perpendicular shoulder behind the thread. A loose-cut thread and good shoulder should ensure that the rods are as perpendicular to the package as possible. This is particularly important if installing the CCD into a set of tightly fitting baseplate holes (e.g. in a mosaic assembly).

Thicker rods, and corresponding baseplate holes, could be used if desired, as long they are made of different diameters to avoid incorrect installation.

The separation between the guide and handling rods is 11.0 mm. This ensures that if the CCD is held by the handling rod and rotated, it is impossible for the guide rod to fall over the location of an adjacent chip and damage it during installation.

Figure 4 shows a sequence of views as a CCD is installed into a baseplate.

(a) shows the beginning of the insertion sequence, as the guide rod touches the baseplate. At this stage, almost any degree of rotation (or wobble) is unlikely to damage other devices on the baseplate. It is good practice to hold the handling rod perpendicular to the baseplate to facilitate entry of the guide rod. Particularly if the baseplate is thin, it may be advantageous to use a temporary guide fixture on the other side of the baseplate to maintain perpendicularity (see figure). This fixture may be magnetically (or otherwise) clamped to the baseplate for stability.

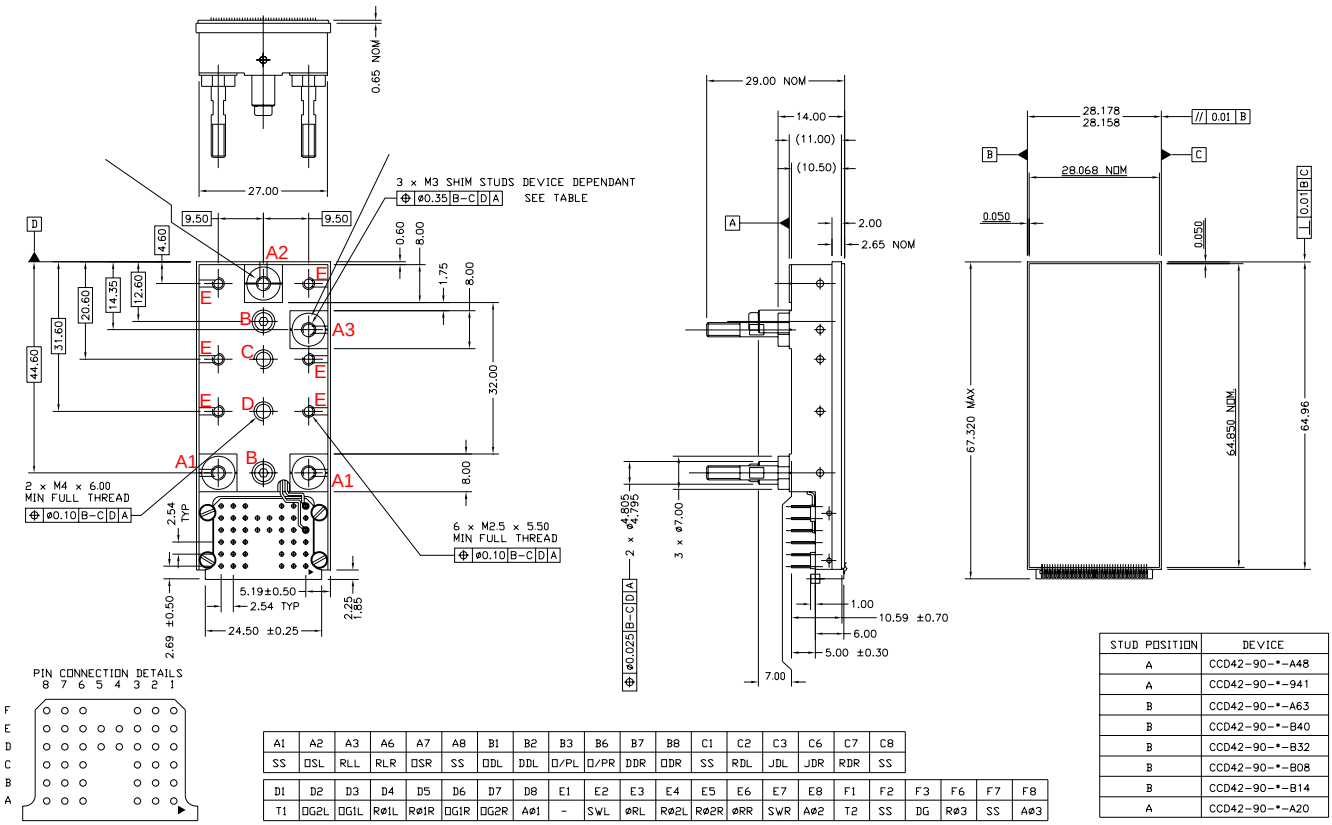
(b) shows the stage when the studs are entering the baseplate. At this point, the studs provide some constraint to movements whilst the chip is still in a higher plane than any other installed devices. When the stud is partly inserted, and before the precision pins engage, only the undercut part of the package can get close to the silicon of the adjacent CCD with a comfortable gap.

(c) shows the point at which the precision pins are partly engaged. The top parts of the CCD are close to their final butted position at this stage, and therefore most vulnerable; protection is given by the precise location of the pins into their location holes.

After full insertion, the three studs should be retained to the baseplate with M3.0 nuts. Customers should use a torque of approximately 30 cNm when fitting or removing nuts to the studs, during installation. (The studs are installed with a torque of 45 cNm). The handling and guide rods should then be removed for further use. Finally, the electrical shorting pad on the PGA must be removed before operation.

FINAL NOTE

Should any further information be required, do not hesitate to contact e2v technologies for assistance.



A1	A2	A3	A6	A7	A8	B1	B2	B3	B6	B7	B8	C1	C2	C3	C6	C7	C8
SS	DSL	RLL	RLR	DSR	SS	DDL	DDL	D/PL	D/PR	DDR	DDR	SS	RDL	JDL	JDR	RDR	SS

D1	D2	D3	D4	D5	D6	D7	D8	E1	E2	E3	E4	E5	E6	E7	E8	F1	F2	F3	F6	F7	F8
T1	DG2L	DG1L	RØ1L	RØ1R	DG1R	DG2R	AØ1	-	SWL	ØRL	RØ2L	RØ2R	ØRR	SWR	AØ2	T2	SS	DG	RØ3	SS	AØ3

STUD POSITION	DEVICE
A	CCD42-90-*-A48
A	CCD42-90-*-941
B	CCD42-90-*-A63
B	CCD42-90-*-B40
B	CCD42-90-*-B32
B	CCD42-90-*-B08
B	CCD42-90-*-B14
A	CCD42-90-*-A20

Figure 1 Interface Drawing for CCD42-90 (DAS546068AT)

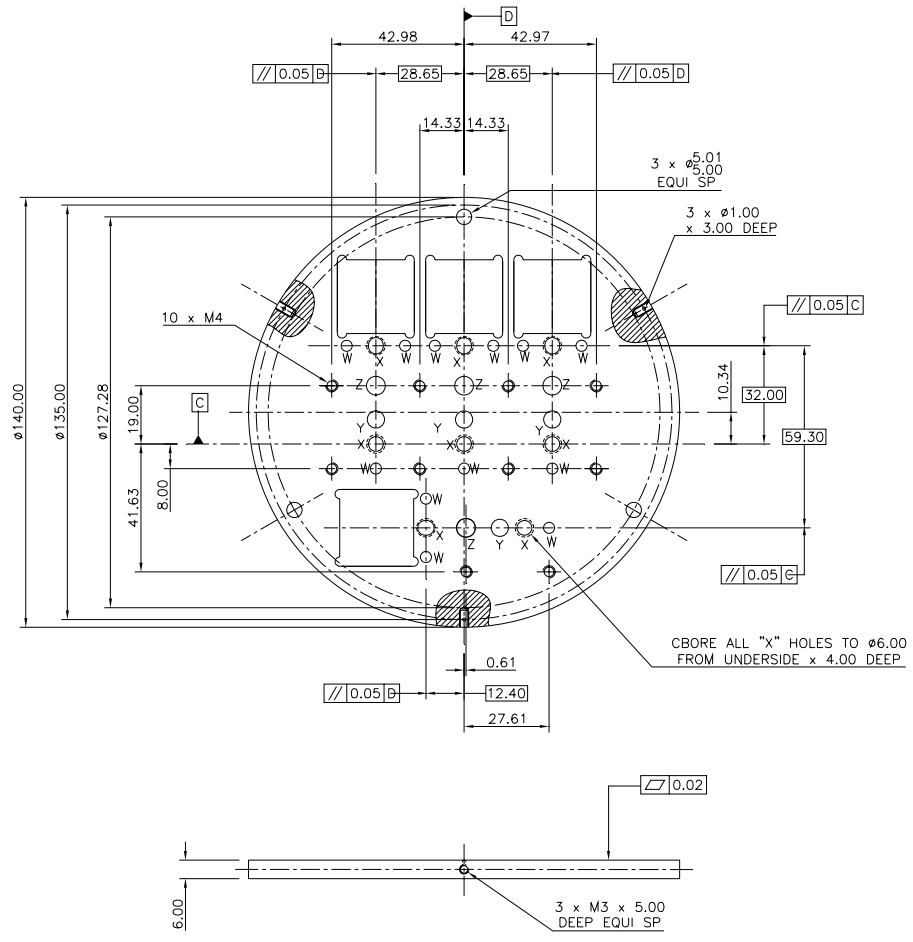
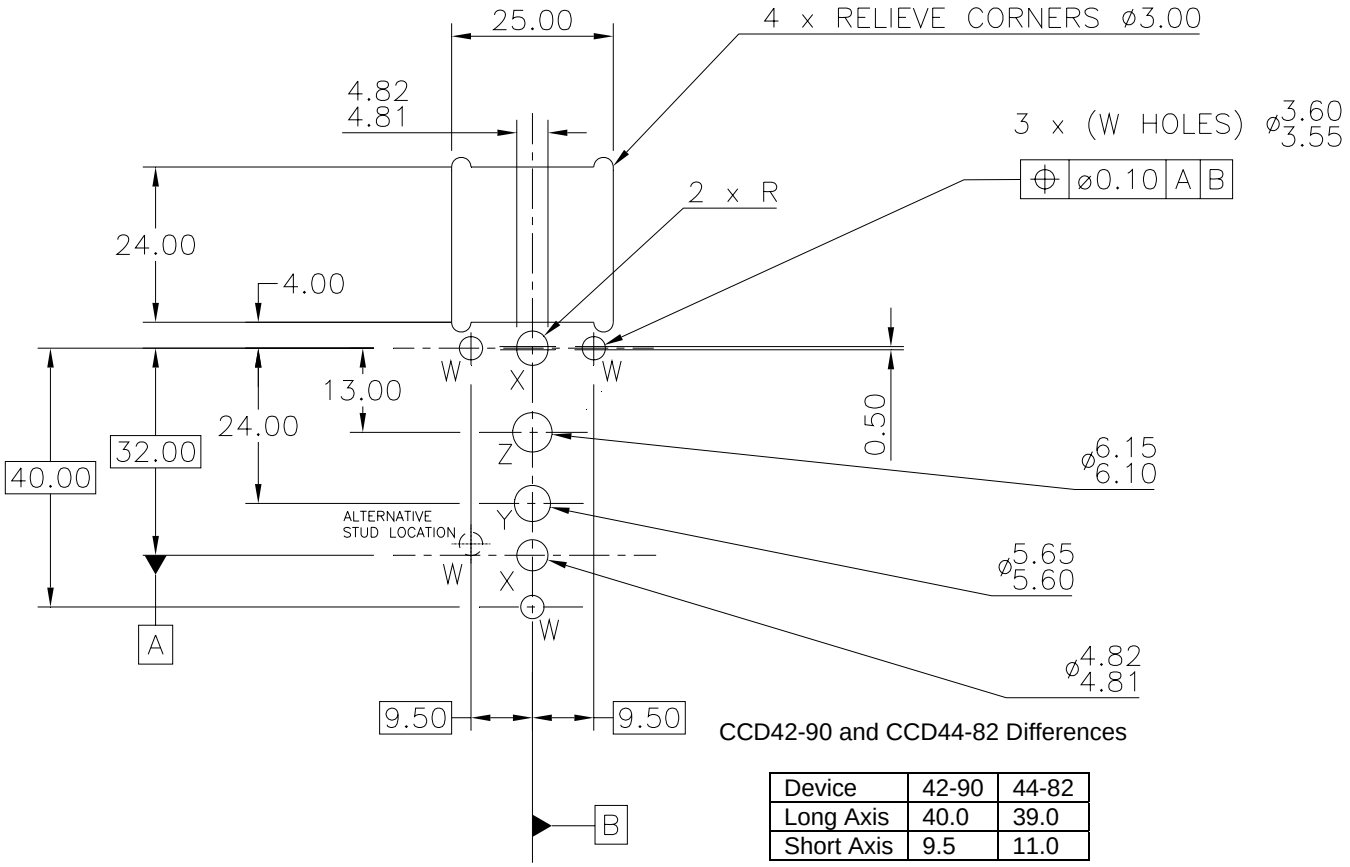


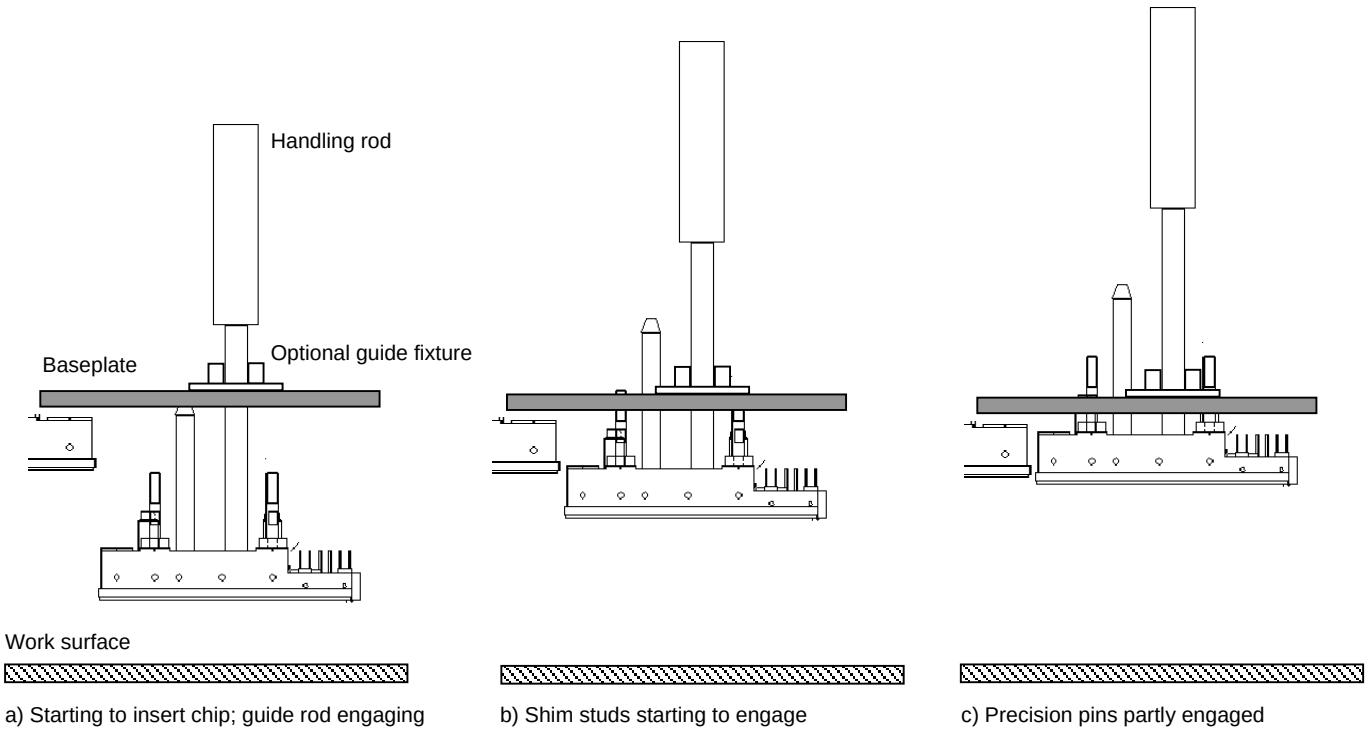
Figure 2 An Example of a Custom Invar Baseplate Designed for Cryogenic Use of Four CCD42-90s



CCD42-90 and CCD44-82 Differences

Device	42-90	44-82
Long Axis	40.0	39.0
Short Axis	9.5	11.0

Figure 3 CCD42-90 Hole Details



a) Starting to insert chip; guide rod engaging

b) Shim studs starting to engage

c) Precision pins partly engaged

Figure 4 Insertion Sequence for CCD into Mosaic Baseplate