

Guide to

Hierarchical interconnection technology

Committees responsible for this British Standard

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- British Telecommunications plc
- Electronic Components Industry Federation
- EEA (The Association of Electronics, Telecommunications and Business Equipment Industries)
- Ministry of Defence
- National Supervising Inspectorate
- Society of British Aerospace Companies Ltd.

The following body was also represented in the drafting of the standard, through subcommittees and panels:

- Association of Manufacturers Allied to the Electrical and Electronic Industry (BEAMA Ltd.)

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Foreword

This British Standard has been prepared under the direction of the Electronic Components Standards Policy Committee by an industrial consortium organized as an IEE Working Party, in consultation with ECL/21 and ECL/-.

Users of this British Standard are advised to consider their particular physical and operating constraints before deciding whether it is appropriate to apply hierarchical interconnection technology.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 34, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

Introduction

The value and complexity of printed circuit boards (PCBs) is increasing, as a result of developments in very large scale integration (VLSI) technology (allowing more circuitry within a chip) and packaging technology (allowing more chips on a PCB). Surface mounting technology (SMT), in particular, can bring about at least a two- to three-fold increase in packing density compared with conventional PCB technology. The possibility of mounting components with small lead-spacing close together on both sides of the PCB presents manufacturers with significant difficulties both in testing (especially in the need for generating diagnostic test programmes), and in reworking (removing and replacing soldered-in multi-pin elements).

The fact that these technologies bring about significant increases in complexity, cost, and testing difficulties of PCBs could discourage manufacturers from standardizing on large PCBs. This would conflict with well-established equipment practice, especially in the military field where double Eurocards are extensively used.

The cost of testing a PCB is heavily dependent on the way in which the board is designed and built. It is generally agreed that testability is largely determined by the extent to which internal nodes of the circuit can be controlled and observed by the test equipment. One way of increasing accessibility is to partition the circuit physically into units that are smaller and more manageable; such subdivision would also help maintenance and field service operations, where a smaller and cheaper sub-unit could be discarded without further diagnosis and repair.

Hierarchical interconnection technology (HIT) is an interconnection system and equipment practice that provides a framework for circuit board partitioning, allowing for a modular construction and solderless assembly of the sub-units. HIT also allows engineers to continue to base their designs on large boards and established equipment practices.

HIT is based on circuit units that are intermediate in size between a conventional PCB, such as a double Eurocard daughter board, and a chip carrier. The circuit units take the form of small boards (child boards) that are socketed in connectors so that they are mounted on a daughter board parallel to its face.

The HIT connectors are designed to accommodate child boards using various substrate materials and packaging technologies. Thus single-sided, double-sided, and multilayer boards using glass-epoxy, metal-clad laminates, or ceramic substrates of a range of thicknesses can all be accepted by the standard HIT connector. This allows mixed technologies to be mounted on a common daughter board, so that, for example, a phased introduction of SMT is possible, retaining established through-board construction for some regions of the daughter board rather than providing the level of capital investment and engineering effort needed to modify a complete daughter board as a single unit. By the same token, any redesign necessary either for functional enhancement or for removal of design errors can be confined to the module that needs it without involving the whole board.

Component parts of the HIT system produced by different manufacturers are designed to be interchangeable, thus permitting effective multisourcing with assured intermateability.

In designing the HIT system it was recognized that any new interconnection system has to be compatible with existing equipment practices based on mounting daughter boards in subracks and plugging daughter boards into mother boards that carry backplane wiring.

The equipment used most widely throughout Europe is based on double Eurocard daughter boards: the sizes of the rectangular HIT connectors have therefore been chosen specifically so as to fit optimally with this system. Rectangular HIT connectors could, of course, be used on daughter boards of any size, but maximal packing density will not be achieved unless the size and shape of the board is chosen with HIT in mind.

A typical system is illustrated in Figure 1, which also indicates the main relevant national and International Standards. The Eurocard system is covered by BS 5954, which specifies the dimensions of standard boards and the relationships between PCB, subrack, backplane (mother board) and higher levels in the constructional hierarchy. Connection between daughter boards and mother board can be by way of any appropriate connector system.

1.1 Scope

This British Standard provides guidance on the use of hierarchical interconnection technology (HIT), which provides a framework for circuit board partitioning, allowing a modular construction and solderless assembly of the sub-units.

In this British Standard, the design of HIT has been approached as an overall system solution. This British Standard covers standardized connector and board sizes, and also makes recommendations for the way in which the system can be used to give the best results in the following matters:

- a) packaging and automatic handling (see section 4);
- b) thermal management options (see 5.2);
- c) shielding against electromagnetic coupling (see 5.3);
- d) testing and automatic test equipment (see section 6).

1.2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

1.3 Definitions

For the purposes of this British Standard, the following definitions apply.

1.3.1

child board

the part of the HIT subsystem that carries part of the electronic system (either as a self-contained functional element or as part of a larger implementation), and which is interconnected with other parts of the electronic system by being inserted into the HIT connector

1.3.2

HIT module

a child board complete with components

1.3.3

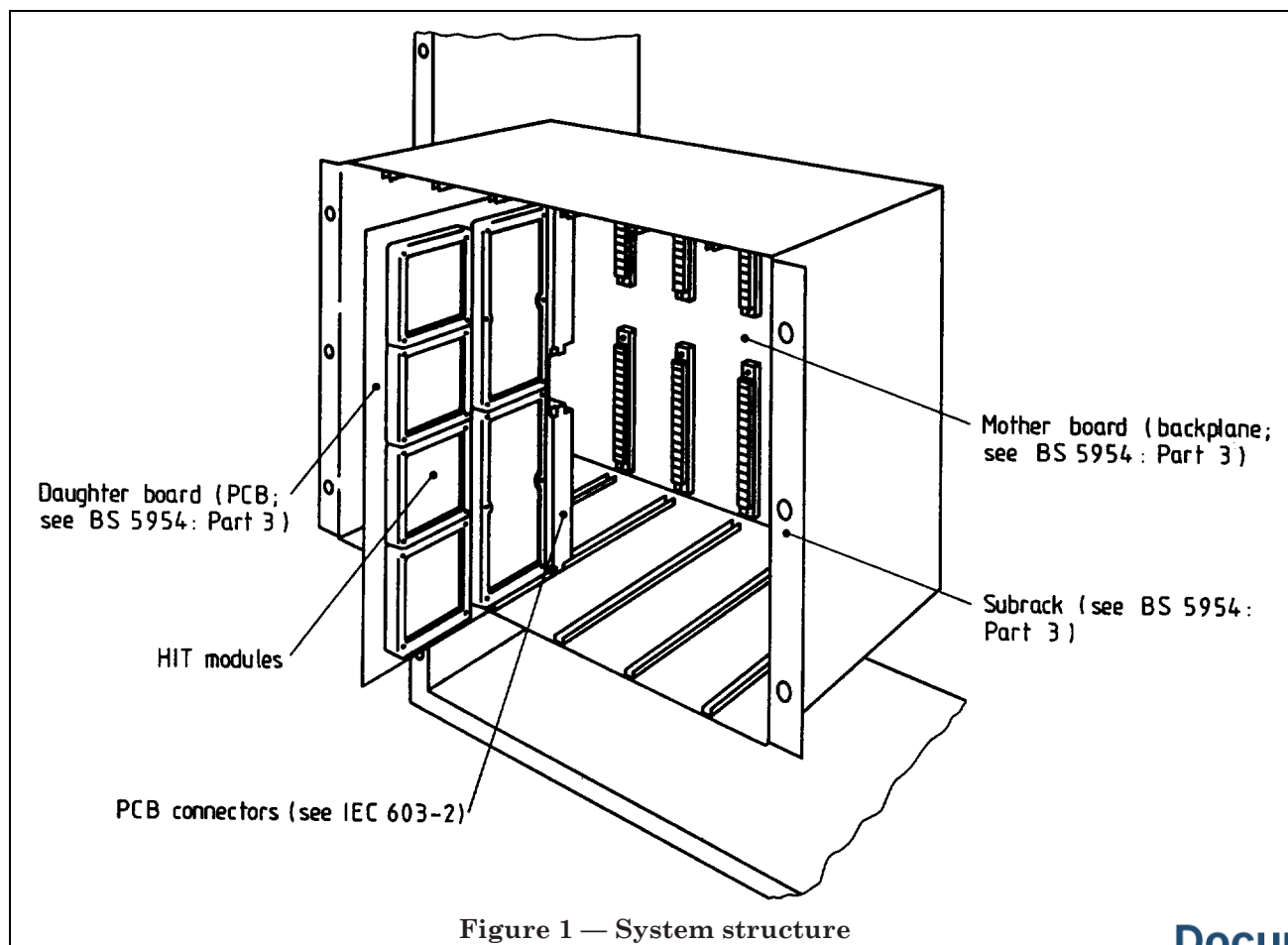
daughter board

the part of the HIT subsystem to which the HIT connector is mounted and connected. It provides a medium for the interconnection of HIT modules

1.3.4

mother board

a printed board on which one or more printed board assemblies may be assembled and connected



1.3.5**contact face**

the face of the child board that carries the contact pads and is directed towards the daughter board when the child board is mounted in the HIT connector

1.3.6**top face**

the face of the child board that is directed away from the daughter board when the child board is mounted in the HIT connector

Section 2. The HIT connector system

2.1 The HIT concept and range

A HIT unit consists of two elements: a HIT connector and a clamp.

The HIT connector is an insulator fitted with non-removable spring contacts: these provide resilient contact with pads along the edge of the mating child board, together with through-hole solder terminations, which provide for connection to the daughter board.

Contact pressure is provided by the clamp, which is shaped to follow the profile of the HIT connector moulding and is secured to it by captive screws engaging nuts that are captive in the insulator moulding. The HIT module is sandwiched between the clamp and the resilient contacts within the insulator moulding.

There are two basic forms of connector in the HIT range, as illustrated in Figure 2.

- a) Rectangular HIT connectors are used with standardized child boards having contacts along all four edges.
- b) Linear HIT connectors are used with child boards whose shape is unrestricted apart from contact areas along one or more edges.

In addition, some standard accessories have been designed for use in applications requiring particular attention to thermal management or electromagnetic screening.

2.2 The HIT connector system

There are two sizes of rectangular HIT connector available. These have been designated size A and size B; they are illustrated in Figure 3. In both cases, polarization is provided for glass-epoxy child boards by asymmetrical locating features. The simplified shape recommended for ceramic child boards, however, does not provide polarization (see 3.2.3). Polarization between HIT connector and daughter board is also provided: this is achieved by an asymmetrical arrangement of dowels.

Contacts of copper alloy have tin-lead plated through-board terminations, the standard contact zone finish being tin-lead. Gold plating provides an alternative contact zone finish option. The contact system for linear HIT connectors is identical to that of the rectangular HIT connector.

HIT connectors are compatible with ceramic child boards of 1.00 mm nominal thickness, as well as glass-epoxy boards.

Standard clamps for use with size A and size B HIT connectors are also shown in Figure 3. The clamping screws are cross-recessed pan head M2 with a maximum head diameter of 4.0 mm. The captive screws provided with the clamp are suitable for use with any child boards from 1.0 mm to 1.8 mm thick. Longer screws can be supplied by the manufacturers for use with child boards thicker than 1.8 mm.

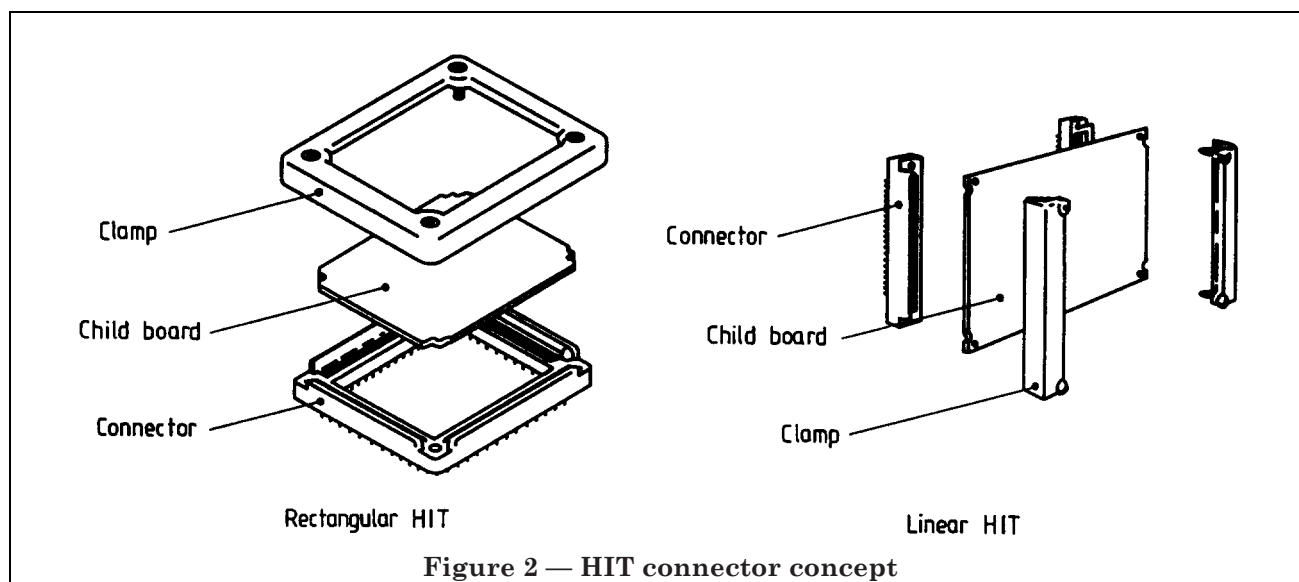
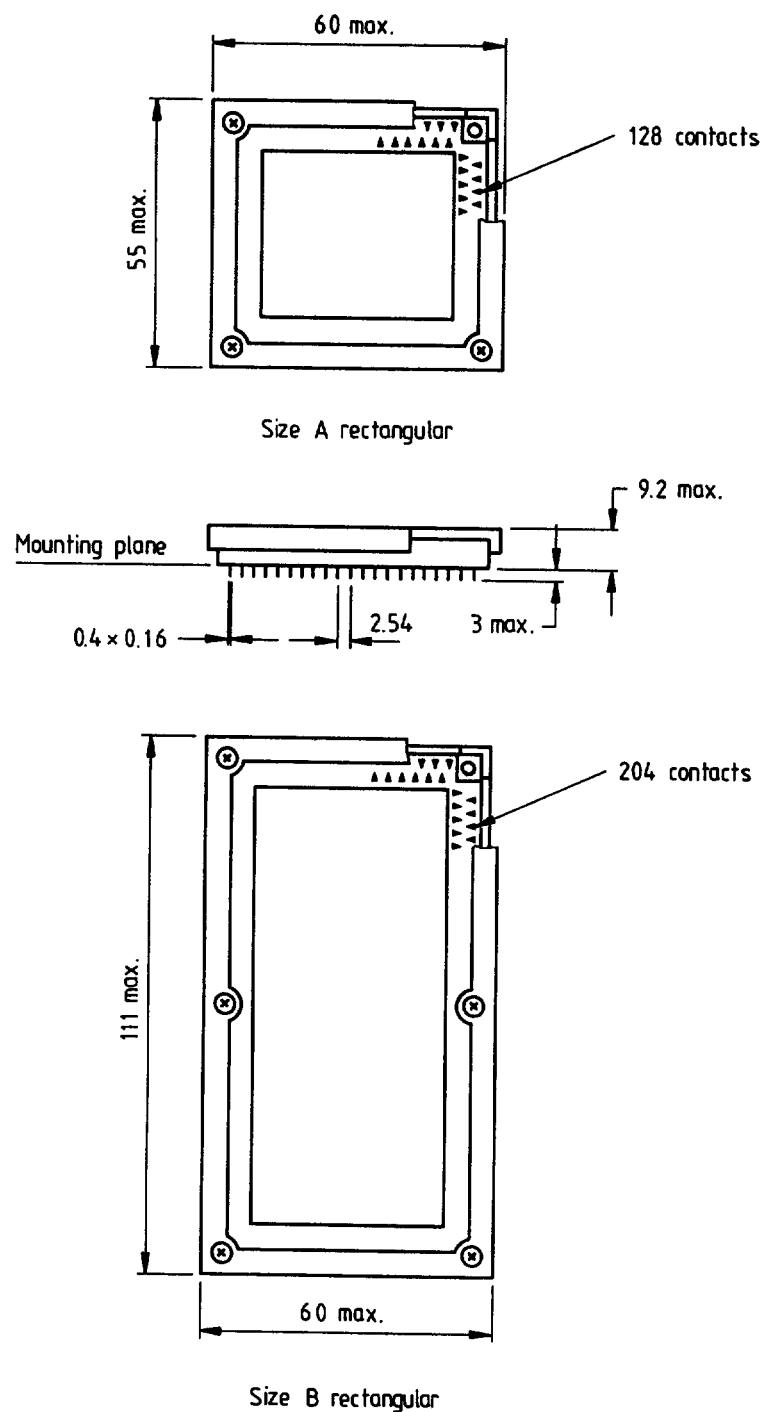


Figure 2 — HIT connector concept



Dimensions in millimetres.

Figure 3 — Rectangular HIT connectors

Alternative clamps have been designed for use in applications where thermal management or electromagnetic compatibility (EMC) shielding poses particular problems. These clamps provide the necessary contact pressure using the same mechanical structure as the standard clamps. Descriptions of the special clamps, together with comments on their use, are given in section 5.

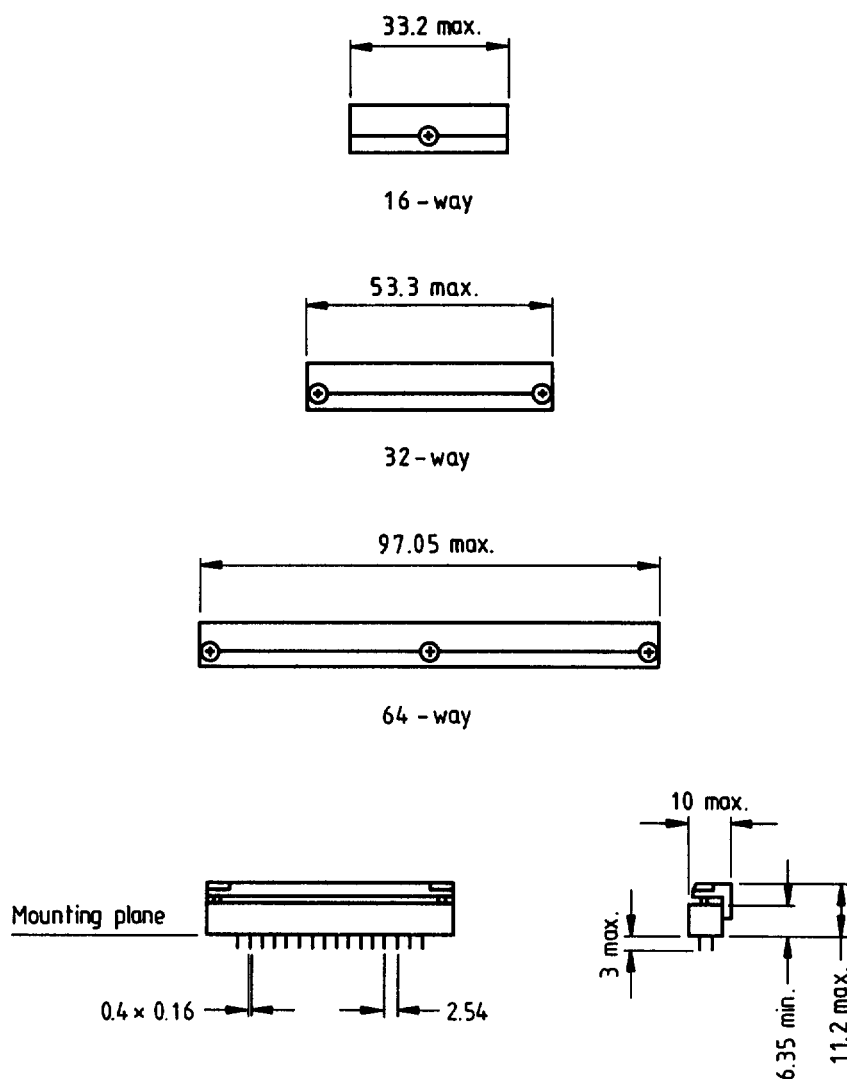
The clamping arrangements for linear HIT connectors are similar in principle to those used for rectangular HIT connectors, using captive screws through the clamp to engage with captive nuts in the HIT connector moulding; the number of clamp screws required depends on the number of contacts in the HIT connector. Linear HIT connectors are made in various sizes: representative HIT connectors, having 16, 32, and 64 contacts, are shown with their clamps in Figure 4.

2.3 Component accommodation

The overall dimensions of rectangular child boards are as follows:

size A: 53.25 mm × 48.15 mm max.

size B: 53.25 mm × 104.05 mm max.



Dimensions in millimetres.

Figure 4 — Linear HIT connectors

The capacity for the accommodation of components on the child board is limited by two factors: board area and component height.

a) *Board area.* The board area available is restricted by the need to allow for the contact pads on the contact face and for the clamp engagement area on the top face. This leaves the following usable area as illustrated in Figure 5 and Figure 6.

	Top face	Contact face
size A:	46.0 mm × 41.0 mm	39.0 mm × 34.0 mm
size B:	46.0 mm × 97.0 mm	39.0 mm × 90.0 mm

As indicated on Figure 5, an additional area that can be used for placing via holes is available on standard profile boards.

