



The ABC of SBC

- an overview of embedded form factors

Embedded technology brings the power of the computer from the desktop to more challenging environments such as automation, communication, medical, transportation or entertainment.

As it 'says on the tin,' a single board computer does indeed bring all the basic functionality of a computer onto one single board, allowing it to be embedded in end systems as diverse as a heart monitor, passport reader or industrial laser. Another important distinction from the desktop market is product lifecycle. An embedded computer board would be just one design element of a more complex system. If a SBC had the typical lifecycle of a desktop motherboard - 6-9 months, it could potentially be obsolete before the project reaches volume production.

As per the principles of Moore's Law, the power and capabilities of single board computers are increasing all the time. Used in so many diverse contexts, there's no high volume 'killer application' to drive the market to one universal format. However, over the years, a handful of established form factor standards have emerged which tend to delimit the embedded SBC market.

Standards have the advantage of having a detailed, published technical specification managed by an independent organisation that will oversee and administer changes. In the SBC category, a select stable of adopted embedded

hardware standards have emerged and evolved:

- ▶ PC104, PC104+ and PCI104
- ▶ EPIC
- ▶ EBX (Biscuit)
- ▶ Computer On Modules - ETX and COM Express

The PC/104 organisation manages the PC104, EBX and EPIC specifications whilst PICMG administers the recent COM Express standard. There are no licenses, royalties, or other legal requirements to build any of these boards.

PC104, PC104+ and PCI104

PC104 gets its name from the popular desktop personal computers initially designed by IBM called the PC, and from the number of pins used to connect the cards together (104). For seriously space-constrained applications, PC104 modules are the way to go, an entire CPU system can fit on a 3.7" x 3.5" board. PC104 cards stack together removing the need for a motherboard, backplane, and/or card cage. Almost anything you can think of is available as a PC104 module. This includes functions like serial I/O ports, video Controllers, GPS receivers and wireless communications. However, bear in mind, a stack of more than three PC104 modules will be a very unwieldy build in terms of size, connectors and flexibility, should you need change any part of the stack.

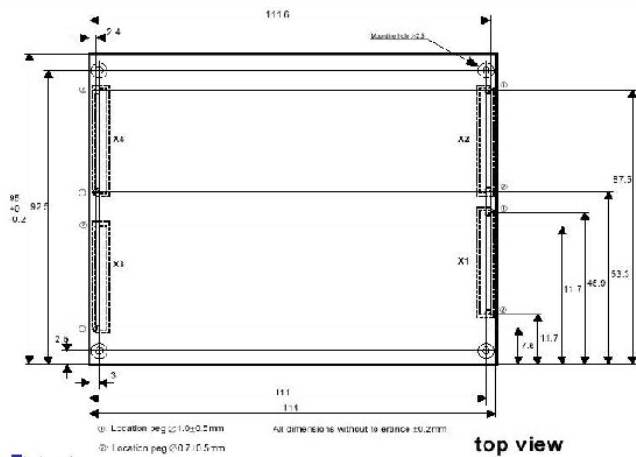
Power requirements and signal drive are reduced to meet the needs of an embedded

In 2005, a mid-range platform called EPIC was introduced to fit the size gap between the PC104 and EBX form factors. The specification is currently under review with the PC104 industry consortium. EPIC, an acronym for Embedded Platform for Industrial Computing, measures 4.5" x 6.5" twice as large as a PC/104 board, yet about half the size of an EBX board. It still supports larger, more powerful CPUs with their fans and heat sinks, and provides more space for required industry standard I/O connectors for real-world interfaces.

EPIC retains the PC104+ expansion and defines I/O zones on the board, with flexibility to implement I/O connectors as pin headers or PC-style connectors. This flexibility, coupled with extra real estate for components is EPIC's strength, any future PC104 consortium adoption would give it wide industry acceptance.

ETX

ETX stands for Embedded Technology eXtended – this standard is the most popular market variation of a 'computer on module' design. We've already seen there's a good range of standardised embedded form factors out there – each one with its own benefits and limitations. However, the off the shelf solution always offers a compromise for a system designer with a very specific degree of functionality and interfacing. A customised board can involve longer development times and



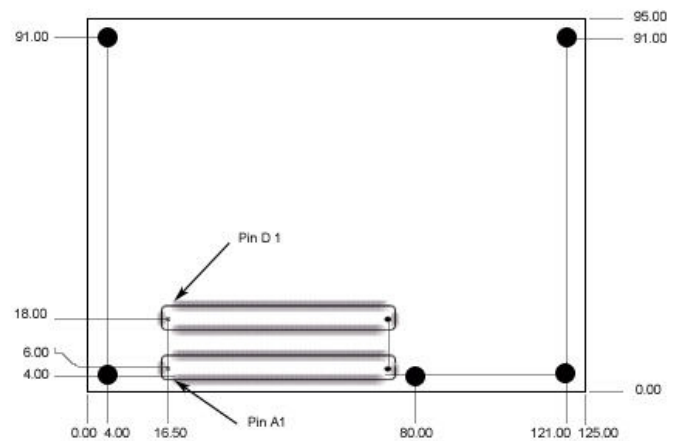
ETX mechanical drawing

increased costs. The answer lies in a modular approach, which marries a standard range of processor cores with a tailored host board. ETX modules feature a form factor of 114mm x 95mm and a standardised connector layout that carry a specified set of signals, including a PCI and ISA buses. This standardisation allows designers to focus on custom specific baseboard development, independent of the dynamic nature of CPU and chipset evolution. Furthermore, the baseboard that can accept present and future ETX modules, delivering a scalable, upgradable solution.

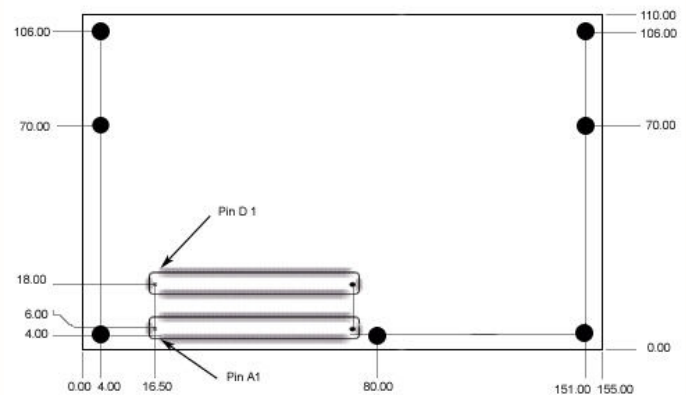
COM Express

The COM Express specification from the PCI Industrial Computer Manufacturers Group (PICMG) builds upon the ETX specification. This open COM standard is intended to offer the advantages of modular, off-the-shelf building blocks and advanced computer technologies including Serial ATA, PCI Express, USB 2.0, LVDS and Serial DVO.

COM Express includes two module footprints, a compact Basic Form Factor measuring 125 mm x 95 mm and an Extended Form factor of 155 mm x 110 mm. These form factors share the same connector and signaling definitions and have overlapping mechanical assemblies. This makes it possible to interchange a Basic Form Factor module with an Extended Form Factor module, and vice versa. The Extended Form factor makes room for double the memory capacity and dual-channel memory configurations, in addition to larger processors and chipsets. Standardized height and heat spreaders further facilitate interchangeability between modules from different manufacturers.

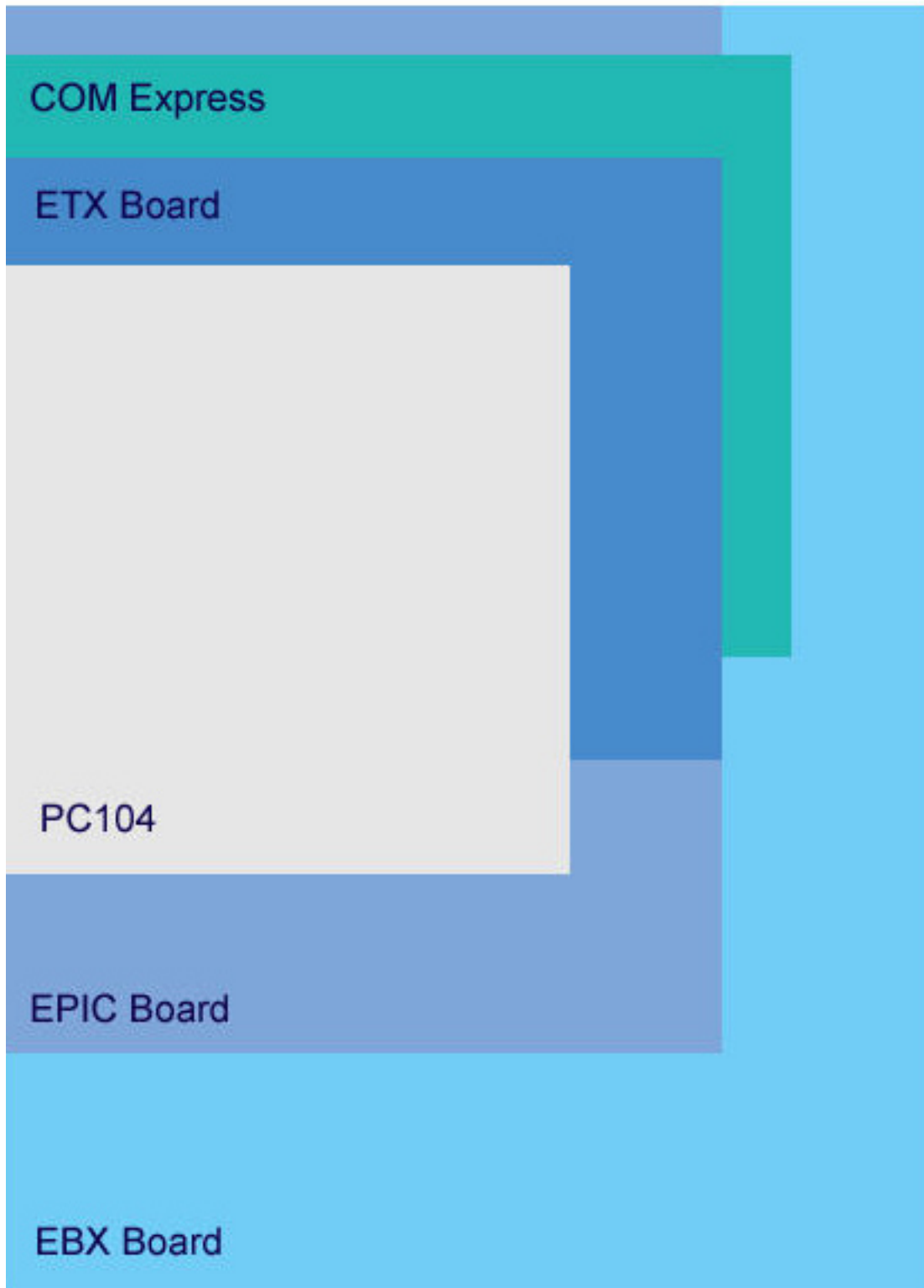


COM Express mechanical drawing (basic)



COM Express mechanical drawing (extended)

COM Express became an approved standard in July 2005, ready-to-run computer cores modules are increasingly being seen as the answer to taking cost and risk out of development cycles.



Form factor footprint comparison (actual size)

Useful Links

<http://www.etxexpress.com/>
www.pc104.org
www.pc104.com
www.picmg.org/