BlueChip Technology

SUPPORTING GUIDE


# The Computer on Module (COM)
## - an introduction and comparison

### What is a Computer On Module (COM)?

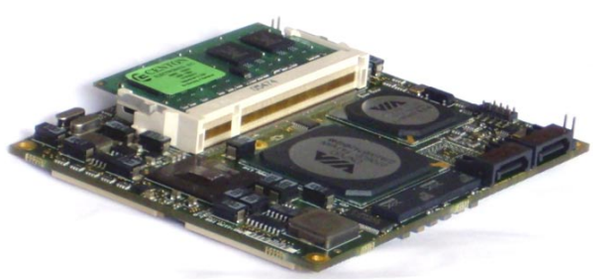
The COM (Computer on Module), sometimes referred to as SOM – (System on Module) sector is the fastest growing segment in the embedded board market. A COM based design makes it possible to launch products to market faster, minimise design risk and reduce overall development costs. The computer-on-module concept has been very successful in the small form factor arena finding applications in the medical, military, industrial and transportation sectors - anywhere and everywhere that a small, reliable 'computer' can be useful.

The Computer-on-Module approach consists of a highly integrated module that contains all the core functionality of a typical PC ie: CPU, RAM, main chipsets etc. Unlike a single board computer, the COM module will lack the standard connectors for any input/output peripherals to be attached directly to the COM board. Instead, the wiring for these peripherals is bussed out to a set of standard connectors on the COM. These connectors are used to mate to a host (or carrier) board with an application-specific feature set and system expansion. Together, the COM and host board represent a semi custom solution with all the functionality of a single-board computer.

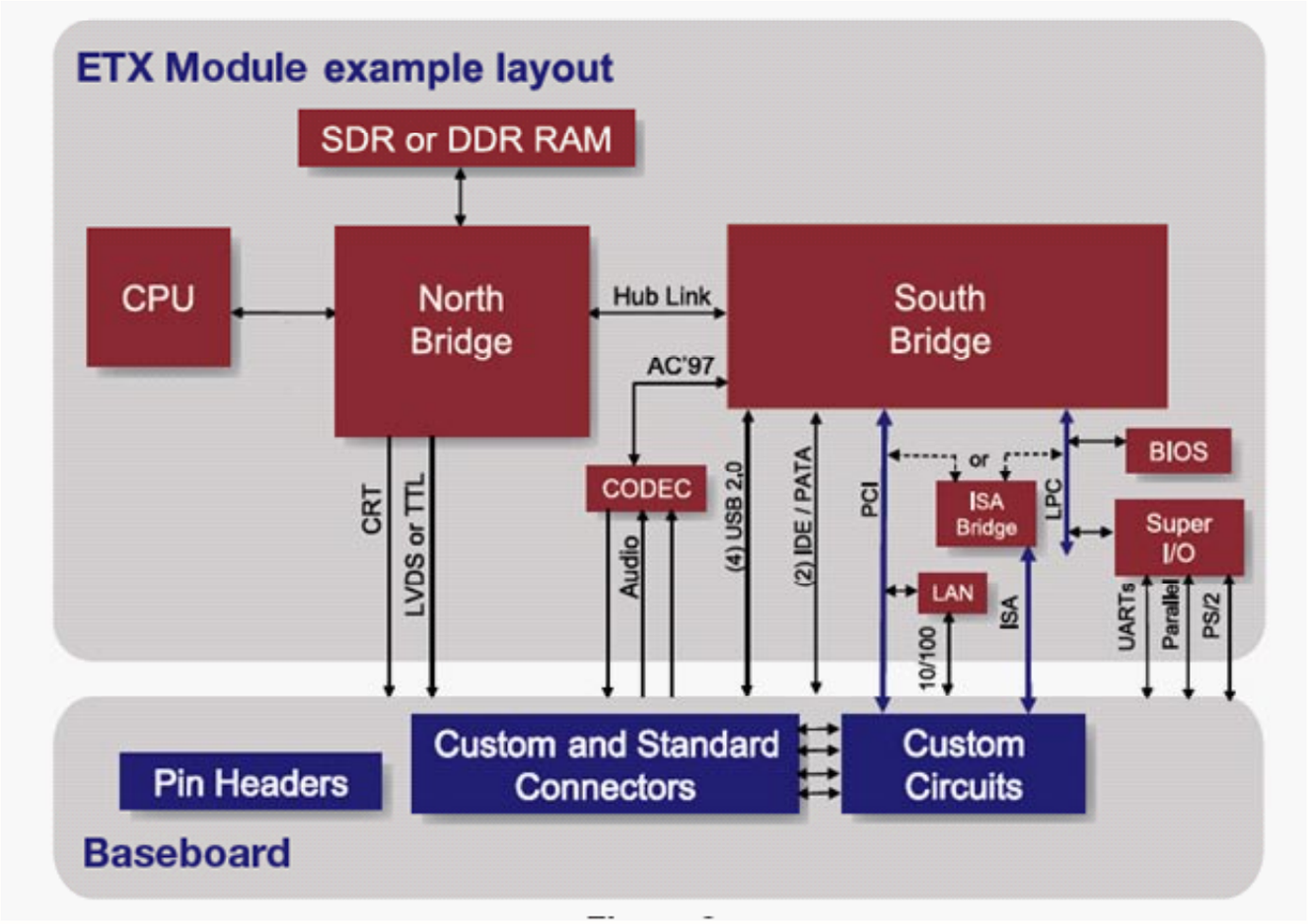
The key advantage of the COM is that by separating the most changeable elements of the computer into an off-the-shelf building block, embedded designers to stay apace of the continual improvements in processor and chipset technology by simply upgrading the core module in their host board. In summary the engineer gets a semi – custom, scalable embedded solution with an easy upgrade path and reduced development cost and risk.

There are a number different types of COM available on the market today – some are proprietary designs specific to one manufacturer and some are open standards offered by the majority of the key players. The most widely promoted and adopted COM offerings are ETX, XTX and COM Express.

### ETX – the standard that led the way for COM success



The ETX COM has been around for five years, successfully consolidating a largely fragmented market place around one universal standard. With a standard footprint of 144 x 95mm, the




ETX connector pin out, includes serial ports, parallel port, floppy, IDE (parallel ATA), PS/2 keyboard and mouse, and the ISA bus. In addition, Ethernet, video, and four USB ports are provided to the base-board.

**Full details on the ETX Specification can be found at http://www.etx-ig.de/.**

The ETX standard was further upgraded to ETX 3.0 to bring in two SATA connectors on the top side of the module while keeping the same pin-out for the connectors. This upgrade ensured that no carrier board re-design would be required to allow use of the new SATA hard drive.

The main limitations of an ETX board is the maximum power loading and signal speeds which exclude PCI Express. Generally, you would consider ETX when you are working with an existing ETX design, need an ISA bus or don't require PCI Express.

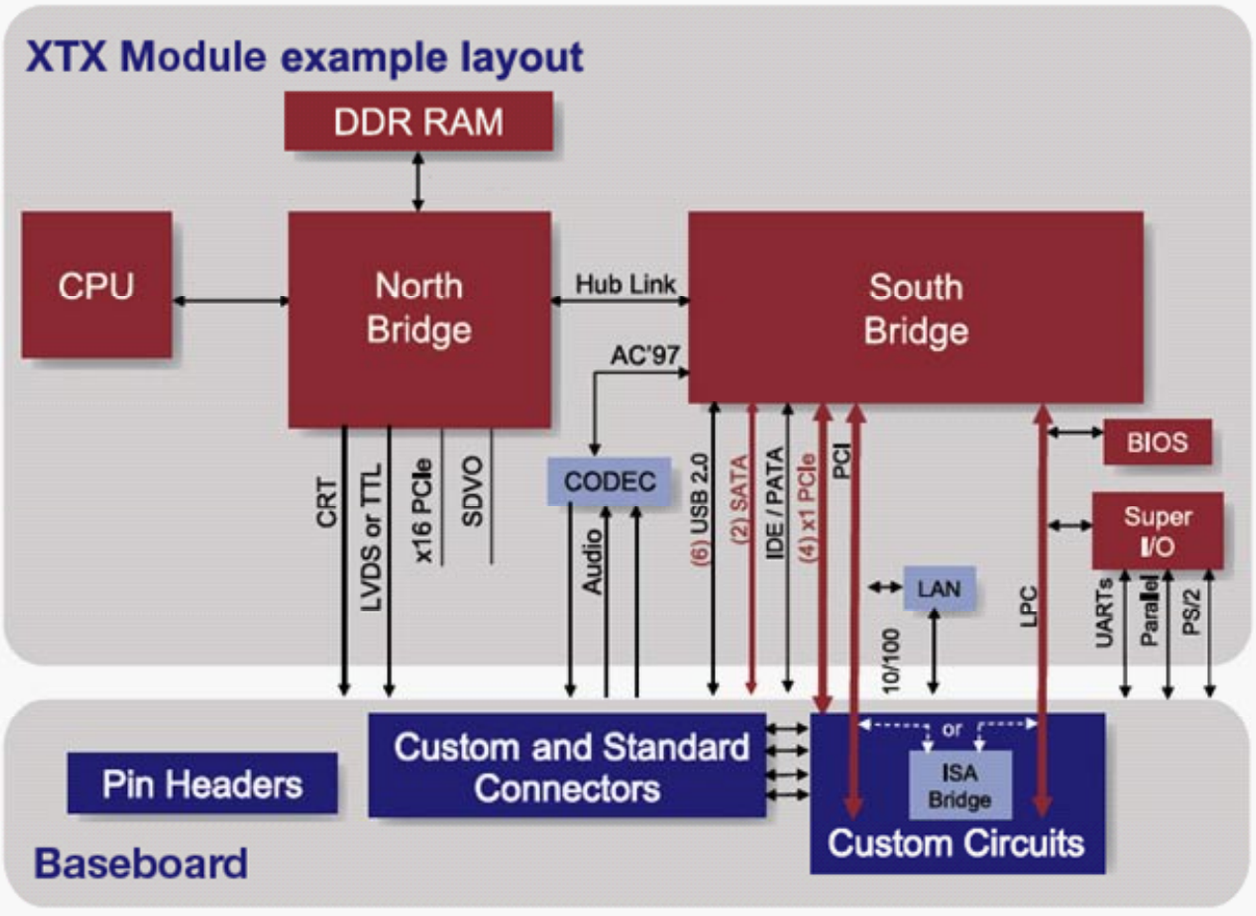
## Following in the Footsteps of ETX

Although things move at a more sedate pace in the industrial arena, improvements in computing technology still continually drive embedded design forward. CPU and GPU speeds continue to increase, creating a performance bottleneck around older technologies such as the ISA bus, PCI bus, AGP, ATAPI, serial and parallel port interfaces. Additionally, legacy free designs are becoming a reality with the I/O interfaces of the typical SuperIO migrating to USB (although legacy IO such as serial ports (UARTs) are still used in many industrial, medical and military devices).

These technological trends meant where a designer needed top end performance, ETX was reaching its limits. The industry has responded with two mainstream COM standards - XTX and COM Express

## XTX – a smoother migration from ETX

Based on the ETX standard, XTX re-defines the X2 connector to replace the ISA bus with the SATA and PCI Express Buses, introducing newer technologies such as PCIe, SATA, LPC, ExpressCard, high definition audio and additional USB ports. The connectors, the board geometry and the heat



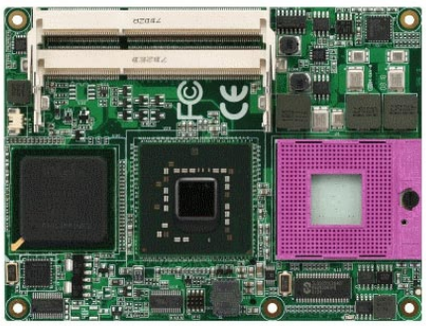

transfer are the same as ETX.

**Full technical details are available at http://www.xtx-standard.org/.**

The X1, X3 and X4 signals remain the same which mean ETX and XTX are compatible as long as you aren't trying to implement an ISA signal through an XTX host board or a PCI Express signal through an ETX hostboard.

As well as being suitable for new design projects, the XTX COM gives existing ETX users a logical and cost effective upgrade path that avoids large-scale carrier board redesign and provides access to the newest serial technologies such as PCI-Express, SATA and LPC.

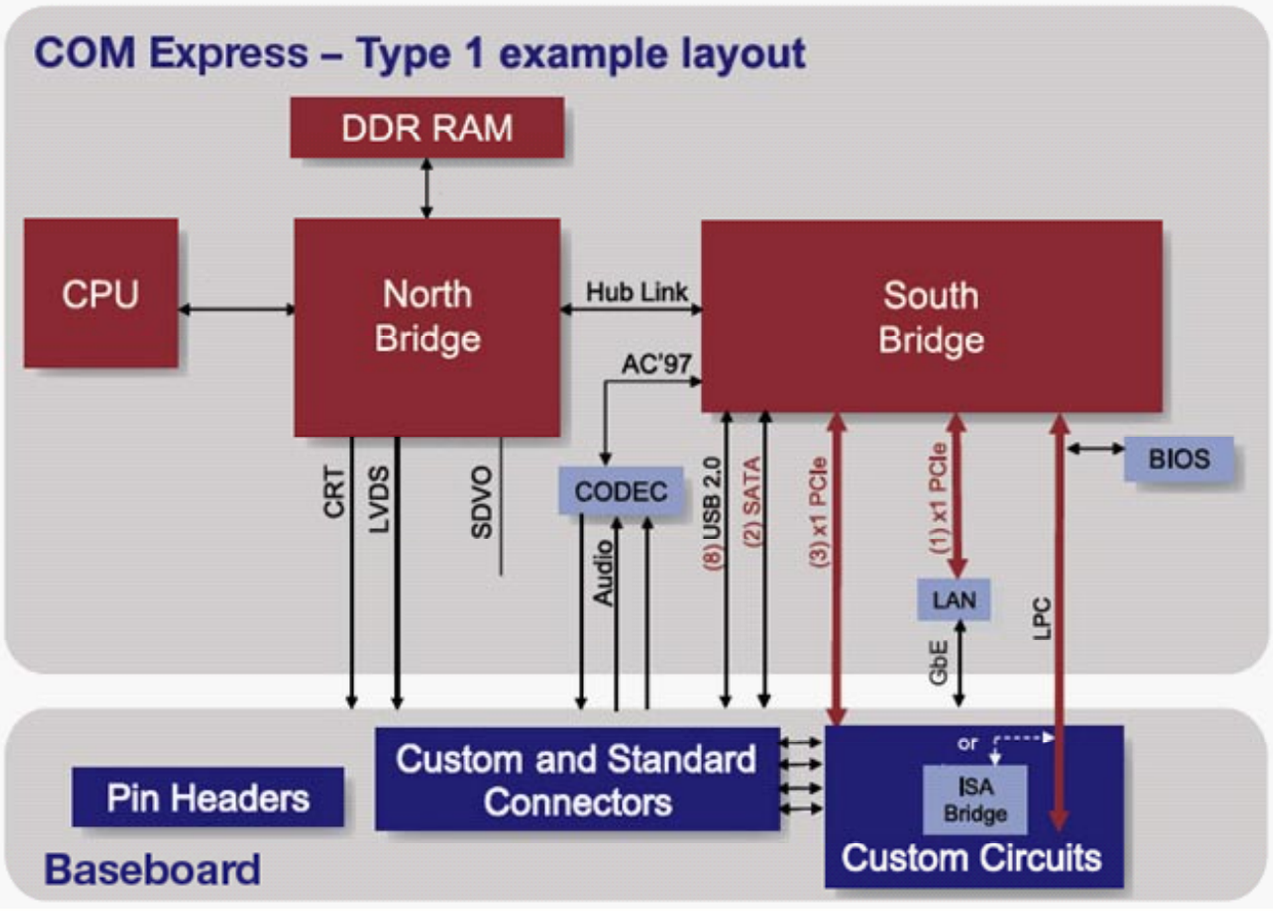
## COM Express – designed for the long game

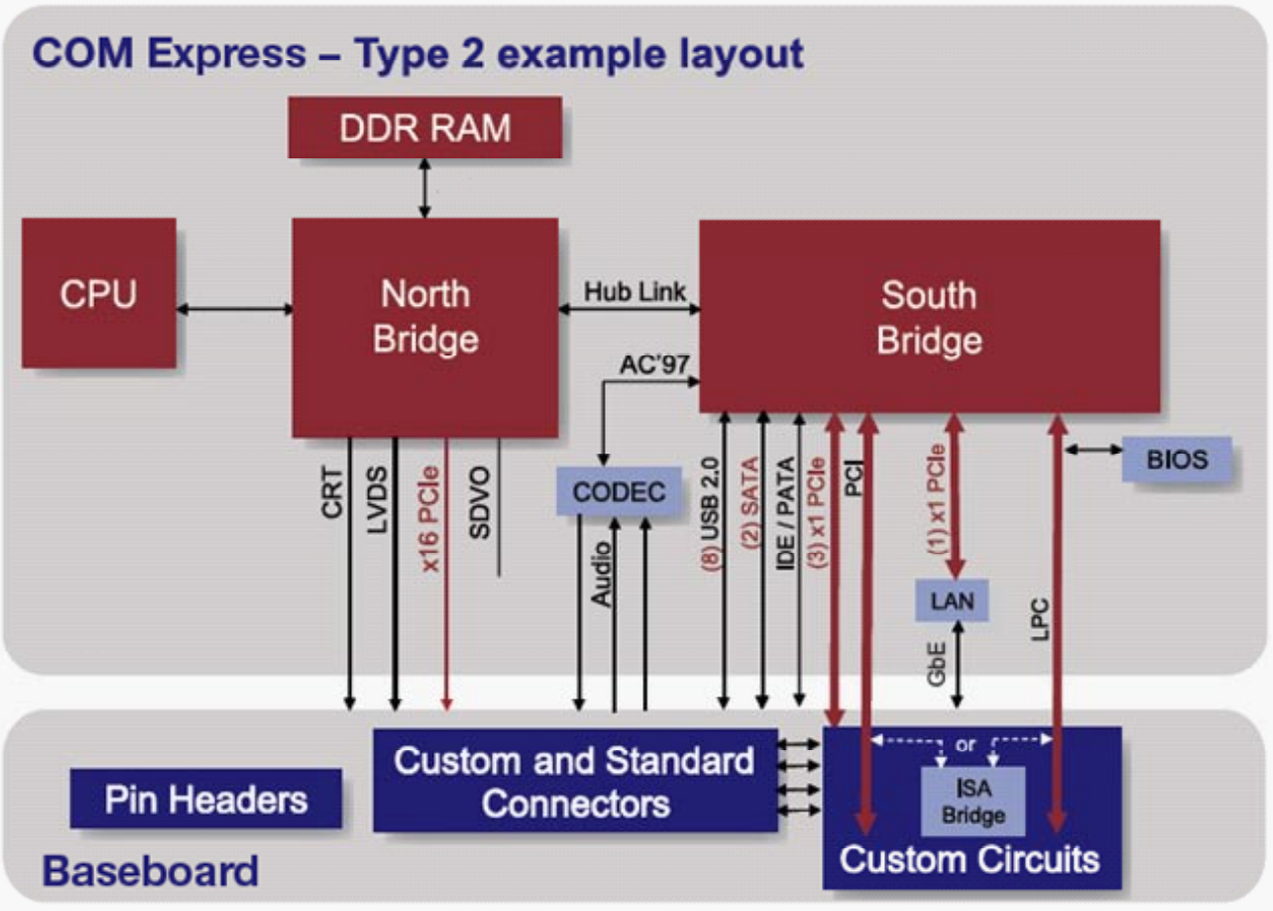


COM Express was originally put forward by a core group of embedded manufacturers and then taken up by a PICMG working group. Their aim was to create a solution for designers with a long term requirement, a high end application, heavy duty PCI Express needs and wanted the comfort factor of a formally ratified standard.

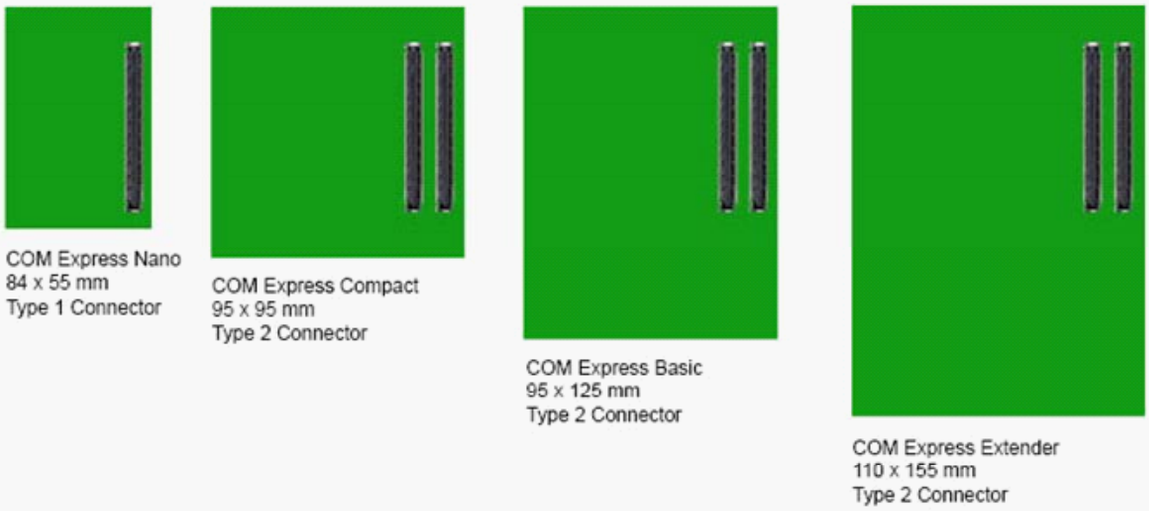
The resulting standard included two board sizes (Basic 95 mm x 125 mm and Extended 110 mm x 155mm) and five incompatible pin outs with many optional signals per pin out. This very wide approach initially caused confusion in the marketplace but eventually the industry consolidated its COM Express offerings around the Type 2 Connector. Another issue was that the high performance positioning of COM Express did exclude a lot customers not requiring a top end performance and not willing accept the associated space, power or cost premium.

Consequently two new smaller derivatives of COM Express emerged – COM Express Compact using the Type 2 connector and COM Express Nano utilising the Type 1 pin out. These new designs particularly suit smaller chip architectures and reduced power consumption requirements such as the Atom based CPU cores. According to the latest research from VDC (Venture Development Corporation), COM Express Connector Type 1 and 2 will gain a market share of 93 percent, making them the de facto standard within the COM Express™ specification.


COM Express – Type 1 example layout
DDR RAM
CPU
North Bridge
Hub Link
South Bridge
AC'97
CRT
LVDS
SDVO
CODEC
Audio
(8) USB 2.0
(2) SATA
(3) x1 PCIe
(1) x1 PCIe
BIOS
LAN
GbE
LPC
Pin Headers
Custom and Standard Connectors
or
ISA Bridge
Custom Circuits
Baseboard


COM Express – Type 2 example layout
DDR RAM
CPU
North Bridge
Hub Link
South Bridge
AC'97
CRT
LVDS
x16 PCIe
SDVO
CODEC
Audio
(8) USB 2.0
(2) SATA
IDE / PATA
(3) x1 PCIe
PCI
(1) x1 PCIe
BIOS
LAN
GbE
LPC
Pin Headers
Custom and Standard Connectors
or
ISA Bridge
Custom Circuits
Baseboard

## COM Express Module Comparison



COM Express Nano
84 x 55 mm
Type 1 Connector

COM Express Compact
95 x 95 mm
Type 2 Connector

COM Express Basic
95 x 125 mm
Type 2 Connector

COM Express Extender
110 x 155 mm
Type 2 Connector

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type 1 Pin Out (Nano) | A1 | GB LAN | GB LAN | GB LAN | SATA | SATA | AC97/HD Audio | USB | USB | USB | USB | PCIe | PCIe | PCIe | GPIO/ SDIO | LVDS | LVDS | Power | Power |
| | B1 | LPC | SMB | I2C | SATA | SATA | AC97/HD Audio | USB | USB | USB | USB | PCIe | PCIe | PCIe | GPIO/ SDIO | LVDS | 5V stby | VGA/ TVout | Power |
| Type 2 Pin Out (Compact, Basic, Extended) | C1 | IDE | PCI | PCI | PCI | PCI | PCI | PEG | PEG | PEG | PEG | PEG | PEG | PEG | PEG | Power | Power | Power | Power |
| | D1 | IDE | PCI | PCI | PCI | PCI | PCI | PEG | PEG | PEG | PEG | PEG | PEG | PEG | PEG | Power | Power | Power | Power |

Note: PEG denotes PCIe graphics

**Full technical details can be found here - http://www.comexpress-extension.com.**

The primary difference between the nano module, the compact module, the basic module and the extended module is the over-all physical size and the performance envelope supported by each. The Extended, Basic and Compact modules all use the Type 2 pin out, the Extended module is the largest, typically supporting multicore processor and larger memory solutions.

The Nano is the latest and smallest addition to the COM Express family, just the size of a credit card and low power consumption suiting mobile and battery applications. Nano uses the Type 1 connector which includes Gigabit Ethernet, 1x SATA port, 8x USB 2.0 (one client-enabled) and a PCI-Express x1 lane for customized enhancements, the power supply range was also extended downwards to include 5V supplies.

## Conclusion

Each existing standard has its respective merits and industry fan club. ETX is a proven technology with legacy support which will continue to have an important role to play over the next five years. Where the designer needs the power of PCI Express - XTX and COM Express are both legitimate options although XTX offers a smoother migration path for customers who have already worked with ETX.

The key point is choosing your COM vendor is as important as choosing the COM standard as the final success of a design will depend as much on the technical skills and customer support of a long-term board partner, not the details of the standard itself. Get that right and a COM based design lets the customer focus on their business application knowing the computer building blocks are all taken care off.

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