Seductive Parallel Worlds:

What advantages do modules for ARM® Cortex-A9 processors *really* provide?

By Wolfgang Heinz-Fischer, Head of Marketing and PR, TQ-Group

Standardized processor modules promise their users that they will be able to change over from one manufacturer to the next.

But the devil is in the details--no module can supply signals to the outside world that are not processed by the CPU. As TQ points out, what is important here is to differentiate clearly between mere marketing and technical facts.

Whether standard or proprietary: each has its own specific advantages and disadvantages. Therefore customers must closely examine which is best suited to their particular use.

With the Cortex-A9® processor, ARM and its licensees initially have a CPU that visibly encroaches upon the area of application of an x86 processor.

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Almost all module suppliers have reacted to this and have included corresponding modules amongst the products offered by them – even those suppliers that have hitherto concentrated exclusively on x86 modules. As is usually the case in the x86 world, the first standards for ARM modules have already arisen.

However, the term *standard* here is excessive and awakens false expectations amongst users. Therefore, this article sets out to clarify what is actually meant by a *standard* and what benefits the user derives. This is because ARM module standards do not meet all expectations and are fraught with pitfalls.

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In any case, it is worth taking a detailed look at the systems offered in order to be prepared for unpleasant surprises. As so often occurs at the time of new product presentations, marketing slogans stand out – during which many statements tend to over-embellish the technical facts.

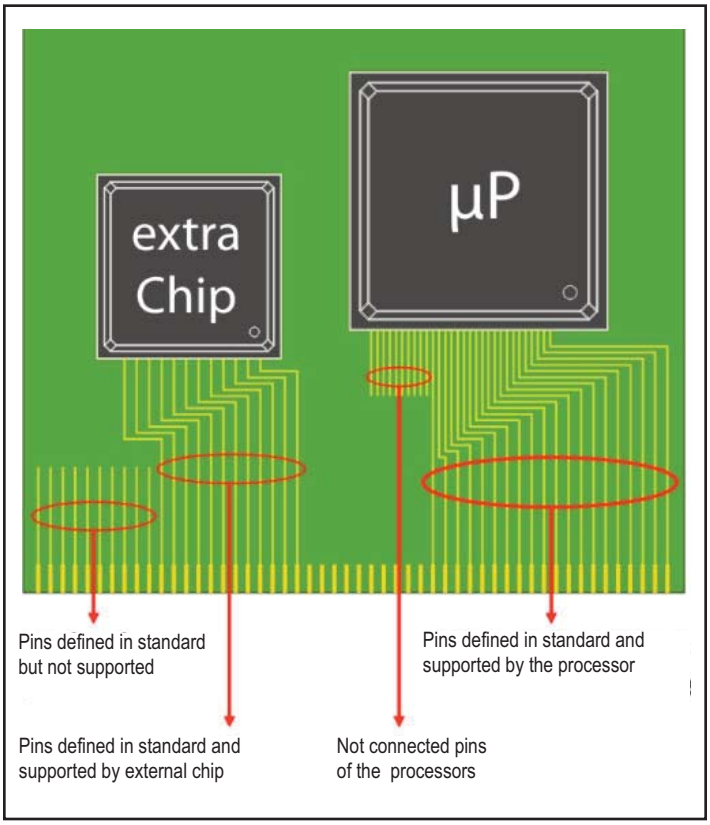
Standards and their limitations

Standards arise wherever it seems useful to set down all specifications on paper, for one reason, to guarantee compatibility between different suppliers.

In addition, embedded modules are also characterized by scalability, i.e. compatibility between different performance classes. Successful standards are usually found in the electronics industry wherever special applications are involved.

Here, the requirements made for the specifications and functions need to be clearly delineated. CompactPCI, AdvancedTCA and MicroTCA for the telephony market, and PC/104 and COM Express for the industrial PC sector, are without a doubt a few of the established standards.

Standards promise the user reliable access to the technology regardless of the success or failure of an individual supplier. If a particular processor technology is no longer available, scalability promises to ensure the continued supply with corresponding modules characterized by a superior technology.



Sometimes the chip fails to recognize a signal; sometimes the signal is not envisaged under the standard: standards, in view of the large variety of ARM processors, have their limits.

Look before you leap …

In order to ensure that compliant products really are interchangeable with one another, there are comprehensive compatibility tests for genuine standards, which are conducted by leading non-profit organizations such as the PICMG and the PC/104 consortium. However, this also means higher costs and thus higher prices for genuine standards due to the increased work involved.

All standards define the mechanical dimensions and the corresponding connector system. Genuine, successful standards are usually limited to a small number of interface specifications and are thus capable of assuring real compatibility. So, for example, only ISA, PCI and/or PCIe are defined as busses for the PC/104. In contrast, the COM Express alone has ten different configurations for interface connectors. Here, caution should be exercised when selecting the right version and examining the right configuration. For example, 24 express lanes have been specified for Version 2 of the COM Express spec. 2.0. However, the module manufactured by one supplier, fitted with an Intel® Atom N2600/N2800/ D2550 and NM10 chipset, provides two PCIe x1 slots whereas another module by the same supplier, equipped with an embedded Intel® Core i7/i5/i3 and QM67 chipset, provides five PCIe x1 slots. In addition, the module is equipped with a second LVDV interface and two SATA III interfaces.

This example shows that in the case of a genuine standard such as COM Express, 100% compatibility and thus guaranteed interchangeability can only be guaranteed to a certain ex tent. If the design has been based on and optimized for the low-end Atom processor this means that the main board will have to be modified and a new design and layout will be needed if higher performance is required and the intention is to use a more powerful module.

Almost certainly, it will be possible to carry over some parts of the circuit during this step and a software adaptation will also be relatively easy.

Two standards for ARM: Q7 and SMARC

There are two competing standards on the market in the world of ARM modules: the Q7 Group on the one hand and the ULP-COM Group on the other hand. Note: The working name of the ULP-COM standard was recently redefined and presented as SMARC ("Smart Mobility ARChitecture")

It is clear that there is no universal, generally valid solution in the ARM area otherwise there would not be two strong groups on the market, each with its own particular solution, and its own standard.

Taking a closer look at specs and definitions

Here, it is also worth taking a closer look from the aforementioned points of view. What does the specification actually define and which functions, if any, are supported by the fully-equipped processor? And which functions are provided by the processor that are not connected, (i.e. not available in the application)?

It is also worth taking a look behind the scenes: one module supplied by one manufacturer and equipped with a Freescale i.MX6 processor offers two CAN interfaces and a PCIe interface (among other things), while another supposedly compatible module supplied by the same manufacturer, equipped with a Nvidia Tegra 3, does not offer any CAN interface, although it does have two PCIe interfaces.

The standard with three defined PCIe interfaces does not fulfill either of the two processors. Only a detailed comparson reveal where the differences lie and that interchangeability isn't possible. Similar considerations and comparisons may be performed for the solution offered by the Q7 Group – all with the same result.

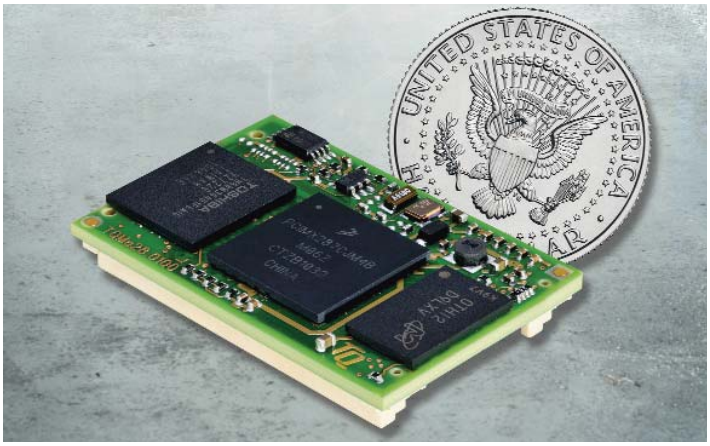
Limitations to the standards in the ARM Market

The obvious conclusion is that a real standard with guaranteed compatibility and thus interchangeability in the ARM market is only possible to a certain extent. The extremely differing characteristics that continue to exist between the processors supplied by individual chip manufacturers mean that any standard, such as the existing standard in the x86 module family with the COM Express, is only applicable with severe limitations.

The conclusion is--interchangeability is only possible in the case of ARM modules if an extremely limited number of signals are used.

One of the main arguments for standards--interchangeability-- is only possible in the case of ARM modules if an extremely limited number of signals are used. A user wishing to make use of the full range of capabilities offered by the currently most powerful ARM processor on the module, the Cortex-A9, must fall back on the 'special cut' provided by the module supplier.

All of this means that it is a proprietary system that, nevertheless, continues to be bound to the standard as regards board size, memory system, connector system and other aspects. Even more limitations become evident if various manufacturer standards are scrutinized.



In the TQMa28, TQ relies on proprietary technology in order to ensure that all the features of the Freescale i.MX28 can be used on the smallest possible space.

You're better off planning for a proprietary system right from the start.

In contrast, the freedom and advantage offered by a proprietary system is that the supplier can tailor it to a particular processor or processor family. In so doing, the board size can usually be significantly smaller than standard boards. All or the overwhelming majority of interfaces can be made available in the connector system. From the point of view of the ability to use a processor platform for as long as possible, such a module offers the greatest possible freedom to the user.

The TQ modules were and continue to be developed with this in mind – maximum performance with the highest possible degree of integration, availability of all signals, a robust and reliable connector system, long-term availability and all this in the smallest possible module size. There is no doubt that in the ARM module market, just as it occurs in the x86 market, different solutions will continue to exist side-by-side and find their users.

About the TQ-Group: As an electronics service provider (E²MS supplier and CEM) TQ offers the complete range of services from development, through production and service right up to product life cycle management. The services cover assemblies, equipment and systems including hardware, software and mechanics. Customers can obtain all services from TQ on a modular basis as individual services and also as a complete package according to their individual requirements. Standard products such as finished microcontroller modules (minimodules) complete the range of services.
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