The ARM® Module Market is Kicking into High Gear-- and Standards are Lagging Behind.

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For a long time, a wide range of providers have divided up the embedded ARM module market between themselves with their own form factors.

With the unveiling of the ARM Cortex A9 processor, large companies from the x86 module market are now entering the ring. As is normal in the x86 market, they are now striving for standardization on the ARM module market.

The interesting question is why no standards have been established so far on the ARM module market, and whether the newly-proposed standards will gain acceptance on the market. In any case there is no unity among the large x86 companies, and as a result, alongside the proprietary systems two different standard concepts are available on the market.

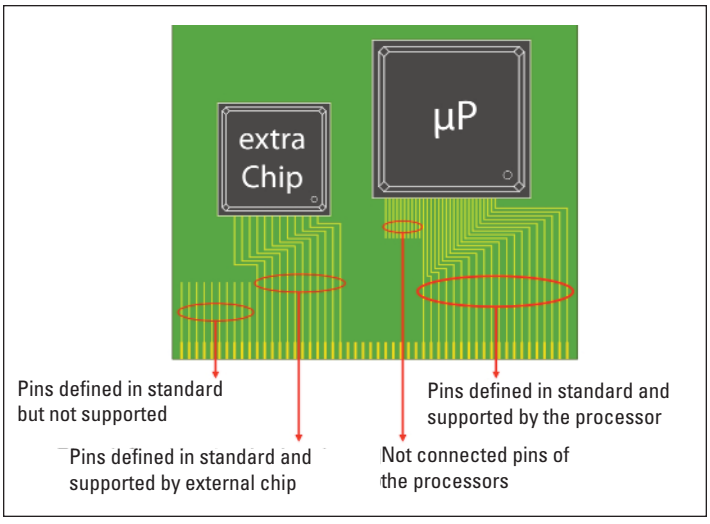
The ARM module market is now kicking into high gear--and the real question is, will standards lag too far behind?

In principle, both the board sizes as well as the pin assignment of the plug-in system are specified in a standard.

Here most pins/functions of the processor are provided via the plug-in system. In some circumstances however, a few functions of the processor are not defined in the standard, are not lead to the outside and are therefore not available for use.

Some other functions of the standard can be realized by corresponding extra chips. And finally, functions can be determined in the standard which are not supported at all. If we examine the successful standards on the x86 market, such as COM Express, we can see that all the process functions are depicted.

Depending on the processor or chip set, however, some defined functions cannot be supported in the standard, because the processor or chip set does not provide this function. For example in the COM Express standard, 8 USB 2.0 interfaces are defined which are however supported by the fewest processor/chip set combinations. Normally between 4 and 6 USB 2.0 interfaces are available. The 24 PCI express lines defined in the COM Express Standard Pinout version 2 are normally not completely supported.



An optimum standard is therefore characterized by on the one hand providing all the processor functions during application, i.e. via the plug-in system, and on the other hand by realizing all the other functions via extra chips. The less compromises have to be made regarding the offered functions and the functions required in the standard, the better a standard fits.

If the functions provided by the processor and external chips differ significantly from the functions defined in the standard, you can assume that the price/performance ratio is not ideal. For example it's easy to comprehend that a Porsche engine can't function properly in a Polo chassis, and vice versa.

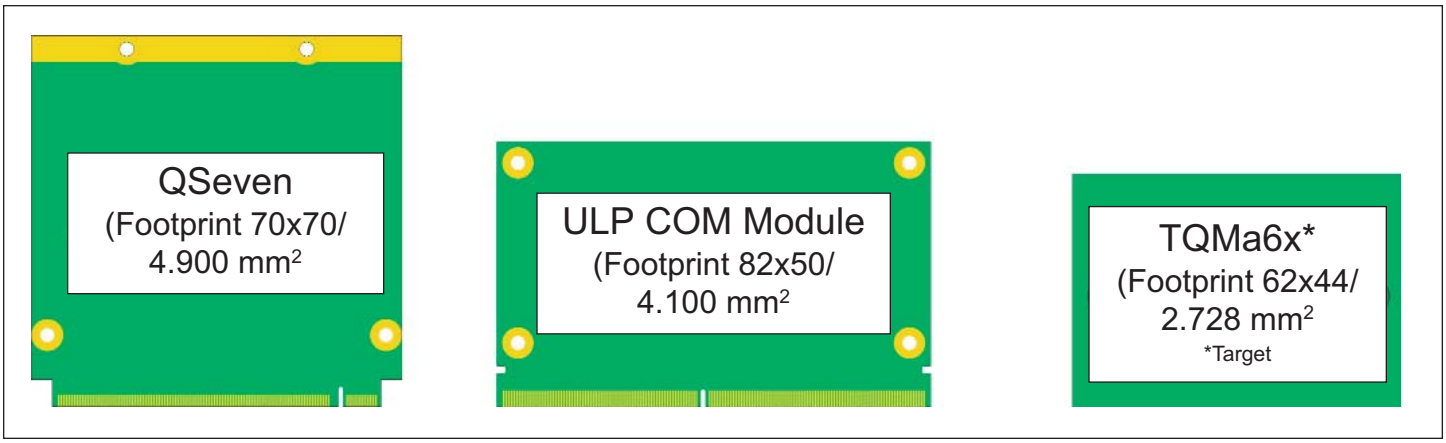
If you look at a standard using the described aspects, it soon becomes clear that it was previously impossible to define a standard on the ARM mobile market.

The difficulty of defining a standard in the past was due in a large part to the wide range of providers and form factors. The key reasons for this are the extremely different designs of the offered processors, which only have a very low common denominator.

As a rule this includes LCD graphics, Ethernet, USB and UARTs as a minimum. However, often more than 50% of the interfaces differ from other providers with the same core and therefore make an efficient standard impossible. For example each manufacturer has its "special features" depending on the market orientation. They can include a camera interface, ADC, GPIO, Keypad, SATA, MMC, SDIO and SD Card or I²C interface. The performance of the ARM processors, especially ARM9 and ARM11 are still a long way off the performance and interfaces of the simplest x86 processors. The addressed applications are mainly used in industry and less in PCs.

With the unveiling of the ARM Cortex A9 processor, the world has changed significantly. The ARM Cortex A9 processor pushes the dimensions of a low-end x86 processor and thereby penetrates traditional x86 applications. The ARM Cortex A9-based chips of the individual providers are comparable in their functions and are more and more similar to a x86 chip. They include in particular PCIe, HDMI, SATA, gigabit Ethernet and other PC-like graphics interfaces. An advantage of the ARM Cortex A9 processor compared to the x86 world, however, is the very low power loss and the normally small construction form, which predestines the ARM Cortex A9 processor for use in mobile applications. The very long availability, the application options in the extended temperature range as well as the slim operating systems, often license-free and therefore good-value, make the ARM processor an object of desire in the industry. The leading x86 board manufacturers do not want to and cannot bypass this market development without losing market share. Due to the clearly homogenous interface offer of ARM Cortex A9 processors, the question of standardization arises, especially under the afore-mentioned points. Or does the reason lie in the fact that the expectations for the anticipated quantity of new processors are in completely new areas? Alongside a range of proprietary systems, two standardization attempts on the market are vying for the affection of customers.

If we compare both standard solutions of Q7 and the ultra low-power computer-on modules (ULP-COM), initiated by Kontron, some features appear immediately. Alongside the purely technical points, special arguments which the providers are introducing for their solutions also count for users. These include the size, the plug-in system and the signals which are provided in the solution. In the plug assignment and determination of the functions the systems go fundamentally different ways. The Q7 system is striving for exchangeability with existing x86 Q7 solutions, therefore essentially defining the PC interfaces. As a result it is not the special ARM Cortex A9 functions which are addressed here, but the Q7 module that uses the clearly lower power consumption of a corresponding ARM Cortex A9 Q7 module



compared to a corresponding x86 Q7 module with similar performance and functionality. From the total of 230 pins, 177 are available for signals while the remaining 53 pins are required for the power supply and grounding. Depending on the processor used, however, not all the functions defined in the standard are realized.

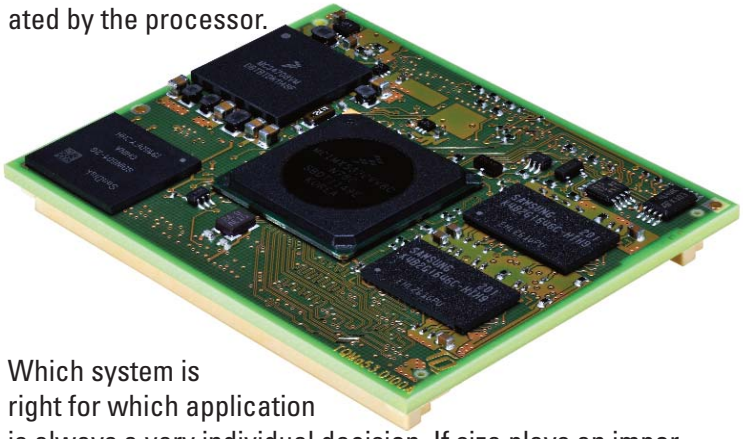
The maximum available functions defined in the standard include 4 PCI Express lanes, 1x gigabit Ethernet, 8 USB ports, 1x CAN bus, 1x I²C, 1x SPI, 1x LPC bus, 2x SATA, 1x 8 bit SDIO, 2x express card, HDA/AC'97, dual channel LVDS 24 bit, display port and diverse power and module management pins. A Q7 module which is fitted for example with a Freescale ARM Cortex A9 i.MX6 processor, only provides approx. 80 to 85% of the signals defined in the standard, while the rest of the signals of the processor are not available. On the other hand, the 2 PCI Express lanes, LPC bus, express card, display port and SM bus are not operated and only 2x USB and one SATA is realized. With other offered Q7 modules with low-power ARM processors the deviation is even greater. The question about when which ARM processor makes sense on a Q7 module is therefore decisive.

The ULP-COM system has another fundamental approach. The definition of the system places more emphasis on the specific functions of the ARM processors and does not strive for direct exchangeability with a corresponding x86 module, as with COM Express, for example. Depending on the requirement of the application a ULP-COM or a COM express module is therefore used here. COM Express is always used if a lot of USB interfaces and a range of PCI Express lanes are needed. If diverse displays, serial interfaces and, for example, a camera interface are necessary, the ARM solution is the better approach. The ULP-COM system attempts to determine the highest possible common denominator of the high-end ARM processors of various manufacturers as standard. Here the following also applies: depending on the processor used not all the functions are realized. Of the 314 pins, 257 are signal pins and 57 are supply pins.

The maximum functions include 3 PCI Express lanes, 1x gigabit Ethernet, 3 USB ports, 4x serial, 2x CAN bus, 5x I²C, 2x SPI, 1x SATA, 1x 4 bit SDIO, 1x 8 bit eMMC, I2S/HDA, single channel LVDS 18/24 bit, 24 bit parallel LCD, HDMI, 1x SPDIF, 2x camera interface, GPIO and diverse power and module management pins. It also applies that depending on the fitting, some of the signals defined in the standard are not supported by the processor and not all the processor signals are available on the plug.

If you compare the system with a Q7 and a fitting with a Freescale ARM Cortex A9 i.MX6 processor, around 85% of the approx. 270 signal pins of the processor are provided at the ULP-COM plug.

A proprietary system, like the TQ Cortex A9 module TQMa6x, can of course ideally represent the processor. Ideally the module has a minimum size and provides all the signals of the processor on the plug. Contrary to the standardized versions, the module has no pins which are not operated by the processor.



Which system is right for which application is always a very individual decision. If size plays an important role and the functions of the specific processor are important, the proprietary systems are advantageous. If the shock and vibration requirements are decisive, the plug-in system used plays an important role. If a Q7 or COM Express module is used and if the new system is only intended to use less electricity, a Q7 or ULP-COM could be the correct decision. In any case the user has to be clear that a direct exchange between the existing x86 solutions and the ARM solutions is not possible without corresponding adjustments. And in case of a change, as a rule the application board is also optimized and revised. Mechanical exchangability is therefore not so important.

In any case-- the good news is, the ARM embedded module market is finally kicking into high gear.

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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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Through the combination of electronics services and finished system components, TQ offers customer-specific products as ODM products and thereby addresses customers who would like to receive finished products and at the same time benefit from the advantages of a customer-specific solution. ODM products are provided on time and economically using a comprehensive solution kit. The kit includes finished electronic, mechanical and software components including certification and licenses.The TQ Group employs more than 900 colleagues at their sites in Seefeld, Murnau, Peißenberg, Wetter/Ruhr, Chemnitz, Fontaines (Switzerland) and Shanghai (China). Further information on TQ can be found at www.tq-group.com