COM Express Type 6 as basement for visual solutions

This article is contributed by Data Modul

This article highlights how the providers of visual solutions can focus on the control technology of display solutions and embedded computing design in order to realize state of the art customer-specific solutions.

Figure 1. Baseboard and COM Express module developed especially for visual solutions

■ Customer-specific embedded computing solutions are realized on the basis of individual customer requirements, and based on the necessary market-specific specifications. Providers of visual solutions like Data Modul focus specifically on the control technology of display solutions and embedded computing design. An embedded development team conceptualizes board designs based on the pre-series releases of the appropriate processor platforms, and thereby enables the initiation of development projects for systems upon the market launch of a new platform. This speeds up the development and production times for innovative products. In this context, the FMEA (Failure Mode and Effects Analysis) that accompanies the development is just one building-block in ensuring that the aspirations surrounding the highest possible design quality of new embedded products are guaranteed.

Whether ARM or x86 based, embedded CPU boards are available in different form-factors and performance classes. In addition to a preconfigured kit consisting of the embed-

ded board, display, adapted cable set and specific OS image, providers of visual solutions also develop and implement customer-specific baseboards and operating units with integrated CPU boards, displays and touch screens. Starting from serial reference designs on the COM Express (Computer-On-Modules) form-factor, specific designs are developed on a modular basis. The validated COM modules are also used as a so-called building block for customer-specific single-board computers. This offers the customer validated core components, reduced levels of development work and a lower qualification period. With LCD controller boards and display control kits, the embedded solutions are then complete. What needs to be considered when developing a module, and what does the performance-related offering for components in embedded computing and modular embedded PC solutions look like at present?

A sustainable reference platform, including for customer-specific SBC designs, is the COM Express standard as defined by the PICMG. In this standard, which is by far the

most widespread worldwide, various pin-outs are defined. In addition to the current type 6 pin-out, the type 7 pin-out is to be approved soon. In this context, video outputs are completely dispensed with and it is therefore particularly suitable for headless server systems.

As before, COM Express Type 6 remains a perfect solution for systems with display and touch. The modules are available with low power SOCs (such as Intel Atom Class) through to high performance CPUs (such as Intel i Core Class). The dimensions, mounting holes and pin assignment (pin-out type) of the connections with the carrier board, with their typical, serial PC interfaces, such as PCI Express, USB, audio, graphics and Ethernet are specified. The specification of the pin assignment also guarantees the interchange ability of COM Express modules. If the system developer keeps 100% to the defined standard, an upgrade with new, next-generation COM Express computer-on-modules is possible at any time. Since the launch of the Intel Core platform Kaby Lake, which, like the predecessor platform Broadwell and

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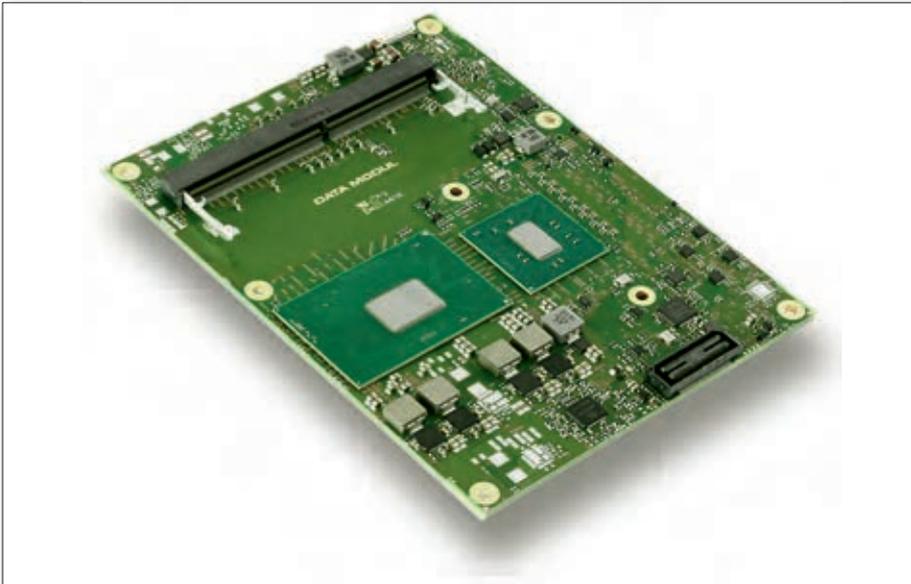
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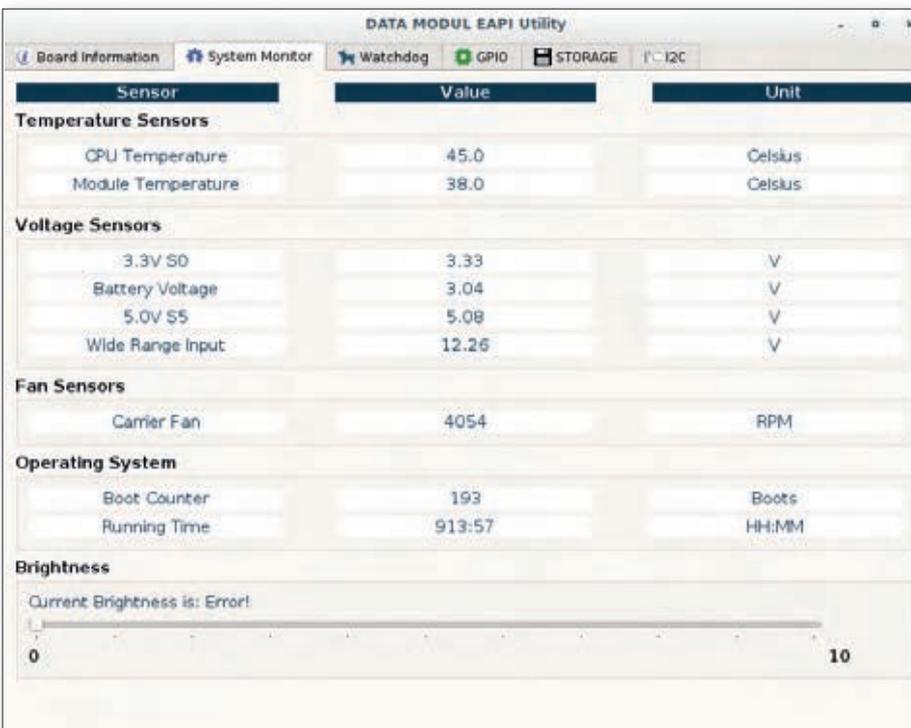
Figure 2. COM Express module Kaby Lake eDM_Comb_KL6

DATA MODUL EAPI Utility

| Board Information | System Monitor | Watchdog | GPIO | STORAGE | I²C I2C |

Sensor	Value	Unit
Temperature Sensors		
CPU Temperature	45.0	Celsius
Module Temperature	38.0	Celsius
Voltage Sensors		
3.3V S0	3.33	V
Battery Voltage	3.04	V
5.0V S5	5.08	V
Wide Range Input	12.26	V
Fan Sensors		
Carrier Fan	4054	RPM
Operating System		
Boot Counter	193	Boots
Running Time	913:57	HH:MM
Brightness		

Current Brightness is: Error!

0   10

Figure 3. Data Modul EAPI utility with system monitor data

displays with a resolution of 4k@60Hz can be simultaneously controlled with different contents. In addition to 3 x DP ++/HDMI 1.4 / DVI, 1 x VGA (optional) also dual-channel 24-bit LVDS is available as display interface. As BOM option eDP (Embedded DisplayPort) can be equipped instead of LVDS. This allows the new, high-resolution 4k TFTs with eDP input to be used without the need to redesign the customer plug & play baseboard.

The new Intel memories are supported by Kaby Lake and operate as current system accelerators for computers with seventh-generation Intel Core i processors. According to Intel, Intel Optane offers an exceptional performance, short boot times and rapid-response browsing for large-volume bulk memory systems without compromising any memory capacity. To be able to offer 100% specification-compliant modules, the board controller is a possible solution. Data Modul implements all the solutions with its proprietary Data Modul Embedded Controller DMEC, which is based on a FPGA (Field Programmable Gate Array). It also offers additional embedded features that make a module into a real embedded module. These very small but essential details distinguish standard PCs from embedded PCs. In addition to this, in this instance, an essential basis is created to develop systems for industrial use.

As the connection to the main processor via LPC-BUS is set to be phased out for future processor generations, Data Modul has prepared the eSPI-BUS for the FPGA at an early stage. This means that future modules can also be supplied in compliance with the specifications. Two UARTs with up to 115,200 bauds have been designed, the I/O addresses and IRQs of which can be set in BIOS setup. UART1 can also optionally be supplemented with RTS/CTS signals via the available GPIOs. An I²C controller enables up to three I²C buses to be operated via the integrated multiplexer. The Automatic Bus Clear feature prevents possible interruptions to the bus. In addition to this, Multi-Master and FastMode + are supported. In this respect, up to 400 kHz can be set in the normal mode, and up to 800 kHz in the FastMode+.

In the standard mode, the integrated Window Watchdog supports three stages. The initialization of the watchdog is only permitted within a specific timeframe, and covers scenarios in which the software hangs up in a loop within the watchdog trigger routine. An NMI, reset or even an IRQ can be triggered (if activated in the BIOS setup). The support of Auto Reload makes it possible to use the watchdog as an event ticker. A register block which aims to prevent the deactivation of the watchdog and a change of its configuration in

Skylake, is based on a 14-nm process, it has been possible to provide industrial customers with samples of the corresponding COM Express Basic Type 6 modules. Kaby Lake offers higher clock rates and adjustments to the media features. In this context, Data Modul has developed the eDM-COMB-KL6 module, which is suitable for industrial products with high-performance requirements and a low level of power consumption. It is equipped with the latest 14nm Quad Core Intel Core i7 and Xeon processors, and offers 8 MB L2 cache at a TDP of 25-45 watts. For the middle level, it is equipped with Quad

Core Intel Core i5 and dual core Intel Core i3, which offer 6MB and/or 3MB L2 cache at a TDP of 25-45 watts. Intel Smart Sound Technology will bring significant improvements in the area of voice control. The integrated graphics are offered by the latest Intel Gen 9 HD Graphics Generation GT2. DirectX 12, OpenGL 4.3, OpenCL 2.0, hardware MPEG-2 decoding, WMV9 (VC-1), H.264 (AVC) and Ultra HD Blu-ray are all supported, ensuring the high-quality playback of HD video material. The new HDCP 2.2 support with HDMI 1.4 also facilitates the processing of 4k content (Premium UHD). Up to three independent

Figure 4. Baseboard reference design for medical applications

safety-critical applications is an equally essential component and fully configurable via the BIOS setup.

In addition to the boot counter, the integrated runtime logger (RTM) includes the possibility of tracking the time in which the module has run at too high temperature. The thermal trip point can be set in order to determine the temperature which is to be rated as excessively high. With the IO-Multiplexer, it is also possible to realize programmed customer-specific features. In this respect, an SPI Bus, a PWM signal generator and a CAN Controller can now be integrated without any additional hardware costs.

On the software side, the standard functions which are also defined in COM Express are accessible via so-called EAPI calls. For this purpose, for Windows and Linux, EAPI drivers are available for the complete portfolio and all future upgrades. This means that many important functions and information can be incorporated into the application software for the subsequent system. The various possibilities can be evaluated on the standard modules using the provided Data Module EAPI utility. This utility features a clearly-designed graphic user interface that enables the testing and use of all the aforementioned API functions. The following functions are supported: board information, real-time information, I2C bus, watchdog, GPIO, and user storage area. The key features are described in more detail below. It is possible to retrieve all the most important board information, for example.

The system monitor displays the continuously updated information from the hardware monitor, the running time meter, and the brightness of the backlight. With the values of the temperature sensor, the fan sensor and the backlight, it is also possible to control the embedded PC accordingly. To program the watchdog described in detail already, it is also possible to use the straightforwardly-configured EAPI utility.

For systems with high performance requirements that are equipped with the long-lifespan (up to 2031) Skylake module eDM-COMB-SL6, for example, it is necessary for up to 47 watts to be dissipated on a small area. In this context, the optimum cooling solutions require a connection with additional fastenings to ensure the specified contact pressure. This requires both a special engineering solution and specific know-how. Recently developed standard solutions can now be integrated in a casing via thermos-simulation on an optimum basis.

As the market leader for industrial displays in Europe, Data Modul offers a database with EDID 1.4 files for more than 500 different TFT displays. These data sets have been tested and certified for the scaler cards (eMotion series) which have been supplied for many years. These files are also used on a one-by-one basis in all embedded CPU solutions. This means that it is no longer necessary to think about the different timings and settings for the desired TFT. The developer simply orders the panel file for the required display and saves it on the module and they are all done! The portfolio of leading display manufacturers includes diagonals from 1.2 " to 100". Industrial customers and their developers have a variety of configuration options, and with the many differing features and components, the optimal system solution can only arise on the basis of interdisciplinary collaboration. ▪