



» Graphics COMpendium «

Develop faster and stay relaxed!

- » The standard for graphics output with Computer-on-Modules (COM)
- » Convenient solutions shorten development times
- » Embedded success with Kontron



Graphics COMpendium

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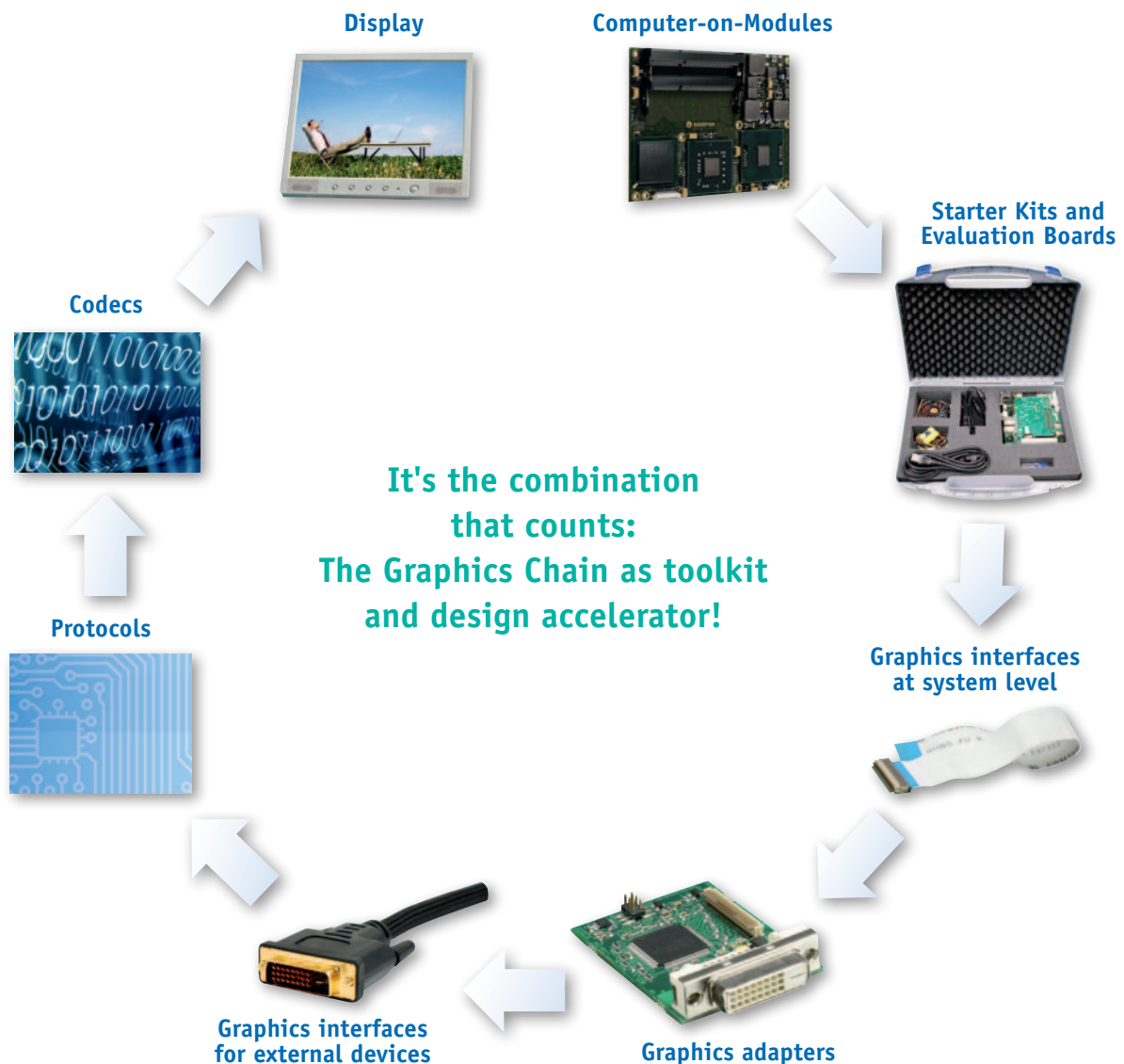
Discover the Graphics COMpendium, the new standard for graphics output with Computer-on-Modules (COM). This explains how the optimal interfaces for many different graphics connections can be realized conveniently and quickly.

Get to know each link in the "Graphics Chain" – all of the modules and adapters, the software, additional technologies, Starter Kits and Evaluation boards that Kontron provides to make your developer life easier, particularly when starting off.

Embedded success with Kontron

Profit from the knowledge, the ideas and the industry expertise that our 900 engineers worldwide bring to hardware and software development, for the success of our demanding partners and clients in industry, trade, services and the public sector.

Speed your project and business success with the best-of-embedded competence of Kontron. Embedded know-how from Kontron – for your Embedded Success!



Benefits at a glance



More convenient modification – means faster to market!

Costly integration and adaptation of graphics displays are now a thing of the past, you will certainly find what you are looking for in the large Kontron adapter program. Save time and effort, gain a development advantage and accelerate new market launches. Calculate yourself whether, given these optimum prerequisites it is still worthwhile for you to develop complete assemblies and complex graphics adapters.

The direct road to the *Instant prototype*

With graphics adapters that are ready for use immediately, development can start immediately with the selection of suitable hardware and suitable display: a working prototype can be presented quickly.

Parallel hardware and software development

The Kontron references make time-saving, parallel hardware and software development easier. While the hardware engineers design customer-specific Carrier Boards, the software developers can at the same time start the development on a hardware platform that is very close to the final product. The Starter Kits and the graphics adapters are also real process accelerators. Moreover the hardware developers are optimally supported through circuit diagrams and layouts that are free of charge. The inclusion of complex display solutions is enormously simplified.

Tested layouts and circuit diagrams

The use of tested circuit diagrams also simplifies the checking and testing of the entire solution. Kontron tests all adapters to the highest quality level.

Competent, consistent, efficient

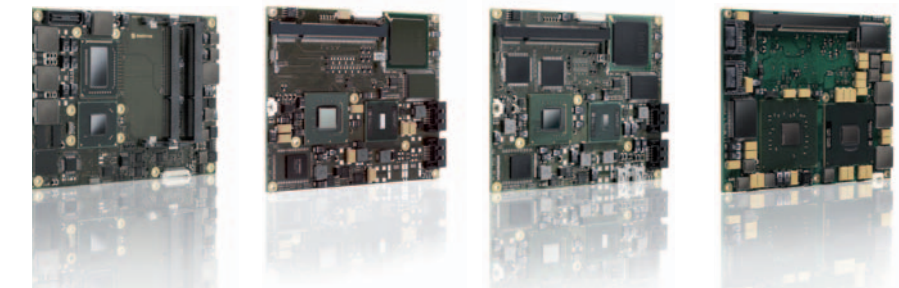
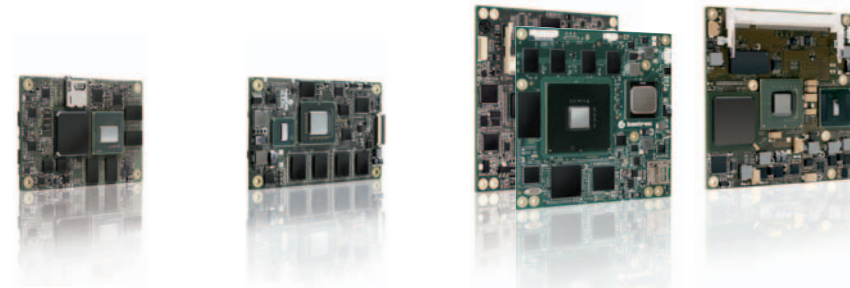
Competence, consistency and efficiency are Kontron brand values that represent real monetary value-adds for your business, because they support and secure your value creation. Kontron is one of the few manufacturers worldwide that can offer you very long-term perspectives in a time of ever-shorter product life cycles and gives you the greatest decision security and maximum sustainability. A stable foundation for your Embedded business!

Evaluation Boards for Computer-on-Modules

Evaluation Board	COM Express® Eval Type 6	COM Express® Eval Type 2	COM Express® miniBaseboard	COM Express® Eval Type 10	COM Express® HMI Baseboard Type 1	ETX® Eval	ETX® miniBaseboard
Item number	38106-0000-00-0	38104-0000-00-0	38102-0000-00-1	34101-0000-00-1	34100-0000-00-0	18010-0000-00-0	18028-0000-00-0
Form factor/ Pin assignment	COM Express®, Pin-out Type 6	COM Express®, Pin-out Type 2	COM Express®, Pin-out Type 2	COM Express®, Pin-out Types 1 and 10	COM Express®, Pin-out Type 1	ETX® 3.0	ETX® 3.0
Outputs	1x VGA, 1x LVDS/ JILI to FFC40, 2x DisplayPort , 1x PEG 1x ADD2	1x VGA, 1x LVDS/ JILI to FFC40, 1x TVout, 1x PEG/ADD2	1x VGA, DVI-D (integrated converter SDVO to DVI), 1x LVDS/JILI to FFC40	1x DVI-D (integrated converter SDVO to DVI), 1x LVDS/JILI to FFC40	1x VGA to pin header, 1x LVDS/ JILI to FFC40	1x VGA, 1x LVDS/ JILI to FFC40	1x VGA, 1x LVDS/ JILI to FFC40

Starter Kits and Evaluation Boards are universal development platforms for Kontron Computer-on-Modules that considerably shorten the time required for the development of new Embedded systems and solutions. They include all material for a fast start and are also especially suitable

for developers who are developing graphics interfaces for the first time. All Computer-on-Modules, Starter Kits and Evaluation Boards are based on the ETX® or COM Express® standard, both being in widespread use and acknowledged across the globe.



Computer-on-Module	nanoETExpress-TT	nanoETExpress-SP	microETExpress-SP, microETExpress-XL	microETExpress-DC
Article No.	34003-xxxx-xx-x 34004-xxxx-xx-x	34001-xxxx-xx-x	36003-xxxx-xx-x	36005-0000-16-2
Form Factor/ Pin-out	COM Express® compatible ultra-small, Pin-out Type 10	COM Express® compatible ultra-small, Pin-out Type 1	COM Express® compact, Pin-out Type 2	COM Express® compact, Pin-out Type 2
VGA	-	-	-	QXGA, 2048 x 1536
LVDS	LVDS A, 18/24 bit, JILI support	LVDS A, 18/24 bit, JILI support	LVDS A, 18/24 bit, JILI support	LVDS A+B, 18-bit, JILI support
TVout	-	-	-	Yes
SDVO	1x	Optional 1x	1x	1x
DisplayPort/embedded DP	-	-	-	-
HDMI	-	-	-	-
DVI	-	-	-	-
PEG	-	-	-	-
DirectX®	9.0	9.0	9.0	9.1
OpenGL	2.0	2.0	2.0	1.4
OpenCL	-	-	-	-
PixelShader	3.0	3.0	3.0	2.0
Hardware Accelerator	H.264, MPEG2/4, VC1, WMV-9, DivX	H.264, MPEG2/4, VC1, WMV-9	H.264, MPEG2/4, VC1, WMV-9	-
Graphics Core, (Clock rate)	Intel® GMA 600, 320/400 MHz	Intel® GMA 500, 200 MHz	Intel® GMA 500, 200 MHz	Intel® GMA 950, 166 MHz

microETExpress-PV	microETExpress-OH	ETExpress-PC, microETExpress-PC	ETExpress-AI T2	ETExpress-SC T2
36007-0000-xx-x	36008-0000-xx-x	36004-0000-xx-x, 38008-0000-xx-x, 38009-0000-xx-x	38010-0000-xx-x	38013-0000-xx-x
COM Express® compact, Pin-out Type 2	COM Express® compact, Pin-out Type 6	COM Express® compact and basic, Pin-out Type 2	COM Express® basic, Pin-out Type 2	COM Express® basic, Pin-out Type 2
QXGA, 2048 x 1536	WQXGA (2560x1600)	QXGA, 2048 x 1536	QXGA, 2048 x 1536	QXGA, 2048 x 1536
LVDS A, 18-bit, JILI support	LVDS A, 18-bit, JILI support	LVDS A+B, 18-bit/24-bit JILI support	LVDS A+B, 18-bit/24-bit JILI support	LVDS A+B, 18-bit/24-bit JILI support
-	-	Yes	-	-
-	-	2x	-	1x multiplexed with PEG
-	-	DisplayPort multiplexed with PEG	embedded DP	DP/eDP multiplexed with PEG
-	1x LVDS/DP/DVI/HDMI	Multiplexed with PEG	-	Multiplexed with PEG, HDCP 1.4
-	1x DP/DVI/HDMI	-	-	Multiplexed with PEG
-	-	1 PEG x16	1 PEG x16	1 PEG x16
9.1	11.0	10.0	10.0	10.1
1.4	3.2	2.0	2.1	3.0
-	1.0	-	-	-
2.0	5.0	4.0	4.0	4.0
MPEG 2	ATI Avivo HD, H.2664, VC-1 Blu-Ray Support	MPEG2, VC-1, AVC, Blu-Ray Support	MPEG2, VC-1, AVC, Blu-Ray Support	MPEG2, VC-1, AVC, Blu-Ray Support (3D)
Intel® GMA 3150, 200/400 MHz	ATI HD6250/HD6310 280/500 MHz	Intel® GMA X4500MHD (Gen 5.5), 320/400/533 MHz	Intel® GMA HD/5700MHD (Gen 5.75), 500/566/766 MHz	Intel® iGFX HD 3000 (Gen 6)


ETExpress-SC T6	ETX-DC (18-bit LVDS)	ETX-DC (24-bit LVDS)	ETX-CD	Computer-on-Module
38014-0000-xx-x	18039-0000-16-2	18039-0000-16-4	18030-0000-xx-x	Article No.
COM Express® basic, Pin-out Type 6	ETX® 3.0	ETX® 3.0	ETX® 3.0	Form Factor/ Pin-out
QXGA, 2048 x 1536	QXGA, 2048 x 1536	QXGA, 2048 x 1536	QXGA, 2048 x 1536	VGA
LVDS A+B, 18-bit/24-bit JILI support	LVDS A+B, 18-bit/24-bit JILI support	LVDS A+B, 24-bit JILI support	LVDS A+B, 18-bit/24-bit JILI support	LVDS
-	Yes	Yes	Yes	TVout
1x SDVO/DP/HDMI/DVI (DDI) 1x on Feature connector	-	1x on Feature connector	2x on Feature connector	SDVO
1x DP/eDP/HDMI/DVI (DDI)	-	-	-	DisplayPort/embedded DP
1x DP/HDMI/ (DDI) (HDMI with HDCP 1.4)	-	-	-	HDMI
1 PEG x16 (Gen 2)	-	-	-	DVI
10.1	9.1	9.1	9.1	PEG
3.0	1.4	1.4	1.4	DirectX®
-	-	-	-	OpenGL
4.0	2.0	2.0	2.0	PixelShader
MPEG2, VC-1, AVC, Blu-Ray Support (3D)	-	-	-	Hardware Accelerator
Intel® iGFX HD3000 (Gen 6)	Intel® GMA 950, 166 MHz	Intel® GMA 950, 166 MHz	Intel® GMA 950, 250 MHz	Graphics Core, (Clock rate)

Compatible graphics adaptor				
1 ADA-COMeType1-FFC30	x	x		
2 ADA-SDVO-PEG16	x	x		
3 ADA-SDVO30-DVI	x	x		
4 Addin-Card-DP Addin-Card-HDMI				
5 ADA-LVDS-DVI	x (18-/24-bit variant)	x (18-/24-bit variant)	x (18-/24-bit variant)	x (18-/24-bit variant)
6 ADA-ETX-CD-FC4 ADA-SDVOB-FC5				
7 ADA-SDVOB-LVDS	x (ADA-COMeType1-FFC30 reqd.)	x (ADA-COMeType1-FFC30 reqd.)	x	x
8 KAB-ADAPT-LVDS	x	x	x	x
9 ADD2-DVI-DUAL-Internal-External ADD2-DVI-DUAL-Internal	x (ADA-COMeType1-Type2 reqd.) x (ADA-COMeType1-Type2 reqd.)	x (ADA-COMeType1-Type2 reqd.) x (ADA-COMeType1-Type2 reqd.)	x	x
10 ADD2-CRT-Internal	x (ADA-COMeType1-Type2 reqd.)	x (ADA-COMeType1-Type2 reqd.)	x	x

		x		x
		x		x
x (18-bit variant)	x (18-bit variant)	x (18-/24-bit variant)	x (18-/24-bit variant)	x (18-/24-bit variant)
x		x		x
x	x	x	x	x
x		x		x
x		x		x
x		x		x


				Compatible graphics adaptor
				ADA-COMeType1-FFC30
				ADA-COMeType1-Type2
				ADA-SDVO-PEG16
				ADA-SDVO30-DVI
				Addin-Card-DP
				Addin-Card-HDMI
x (18-/24-bit variant)	x (18-bit variant)	x (24-bit variant)	x (18-/24-bit variant)	ADA-LVDS-DVI
	x	x	x	ADA-ETX-CD-FC4
	x	x	x	ADA-SDVOB-FC5
x	x	x	x	ADA-SDVOB-LVDS
x	x	x	x	KAB-ADAPT-LVDS
x				ADD2-DVI-DUAL-Internal-External
x				ADD2-DVI-DUAL-Internal
x				ADD2-CRT-Internal

1 ADA-COMeType1-FFC30, ADA-COMeType1-Type2




Article No.: 34120-0000-00-1 (FFC30), 34120-0000-00-2 (Type 2)
Function: Routes optional SDVO signals from nanoETExpress to flatfoil or Type 2 connector
Input Connector: COM Express® Type 1/10 connector
Output Connector: Flatfoil FFC30 cable or COM Express® Type 2
Requirements: nanoETExpress with option SDVO

2 ADA-SDVO-PEG16




Article No.: 34120-0000-00-0
Function: Routes SDVO from flatfoil to PEG (for ADD2 cards)
Input Connector: SDVO on flatfoil FFC30 cable
Output Connector: SDVO on PEG (ADD2)
Requirements: ADA-COMeType1-FFC30 and nanoETExpress with option SDVO

3 ADA-SDVO30-DVI




Article No.: 34121-0000-00-0
Function: Converts SDVO to DVI-D
Input Connector: SDVO on flatfoil FFC30 cable
Output Connector: DVI-D-jack
Requirements: ADA-COMeType1-FFC30 and nanoETExpress with option SDVO

4 ADA-TYPE2-DP3




Article No.: 96006-0000-00-7
Function: Routes DDI signals (DisplayPort/DVI/HDMI) from PEG on COM Express® Pin-out Type 2 to DisplayPort
Input Connector: COM Express® Pin-out Type 2 connector
Output Connector: 3x DisplayPort jacks, Adapter for DisplayPort to DVI/HDMI available

5 ADA-LVDS-DVI




Article No.: 96007-0000-00-1 (24 bit LVDS), 96007-0000-00-2 (18 bit LVDS)
Function: Converts LVDS to DVI-D
Input Connector: LVDS on flatfoil cable (40-pin JILI/LVDS)
Output Connector: DVI-D jack
Requirements: Kontron COM Express® or ETX® Eval Board

6 ADA-ETX-CD-FC4, ADA-SDVOB-FC5



Article No.: 96006-0000-00-4 (2x DVI), 96006-0000-00-5 (1x DVI)
Function: Converts SDVO to DVI-D
Input Connector: SDVO on flatfoil FFC45 cable
Output Connector: DVI-D-jack(s)


7 ADA-SDVOB-LVDS



Article No.: 96006-0000-00-6
Function: Converts SDVO to LVDS
Input Connector: SDVO on flatfoil FFC45/FFC30 cable or on PEG-Port
Output Connector: LVDS on JILI30/40-connector, backlight supply
Requirements: Kontron COM Express® or ETX® Eval Board

Please consult Kontron Support for necessary configuration setting.


8 KAB-ADAPT-LVDS



Article No.: 61032
Function: Mechanical implementation JILI LVDS on JILI30/40-connector
Input Connector: LVDS on flatfoil cable (40-pin JILI/LVDS)
Output Connector: LVDS on JILI30/40-connector, backlight supply
Requirements: Kontron COM Express® or ETX® Eval Board

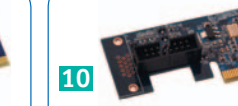
Please consult Kontron Support for necessary configuration setting.

9 ADD2-DVI-DUAL-INTERNAL-EXTERNAL, ADD2-DVI-DUAL-INTERNAL



Article No.: 820952, 820951, 820955, 820958
Function: Converts SDVO to DVI-D
Input Connector: SDVO on ADD2
Output Connector: 2x DVI-D
Requirements: COM Express® Eval Board Type 2 (38104-0000-00-0) or COM Express® Eval Board Type 6 (38106-0000-00-0)

10 ADD2-CRT-INTERNAL



Article No.: 820954
Function: Converts SDVO to VGA
Input Connector: SDVO on ADD2
Output Connector: 1x VGA
Requirements: COM Express® Eval Board Type 2 (38104-0000-00-0) or COM Express® Eval Board Type 6 (38106-0000-00-0)

Graphics interfaces at system level

These interfaces are intended for use at board level in the housing. For this reason, connector systems and cables are usually not defined. Tracks and flatfoil cables are customary, the possible cable length is restricted to system level.

DVO/SDVO

Serial Digital Video Out (SDVO) is an Intel® technology. SDVO is the serial continuation of the earlier parallel Digital Video Out (DVO). From the SDVO signal, one can convert to almost all conceivable interfaces such as LVDS, DVI, HDMI or CRT. Only the GPU integrated into the chip set imposes restrictions. Because display devices do not support DVO/SDVO directly, conversion to another interface standard is necessary. Since the SDVO signals are mostly multiplexed on the PEG slot, reference cards for the converter are generally available as ADD2 cards. The maximal range is defined as 17.5 cm (7 inches).

LVDS

Low Voltage Differential Signaling (LVDS) is a serial, digital interface standard for data transmission. Current displays support LVDS directly, so that if a suitable choice is made, no conversion is necessary. Due to the bandwidth, only a resolution of around 1366 x 768 can be transmitted over an LVDS channel. With two bundled channels (LVDS A and B), a display with higher resolutions of up to 1600 x 1200 or 1920 x 1200 can be addressed. In COM Express® compatible modules, this bundling is normal. The maximum range is recommended as being around 17 cm (6.75 inches), for flatfoil cables a maximum of around 50 cm is recommended. For LVDS, Kontron and other manufacturers mostly use the JILI interface.

PEG/ADD2

PCI Express for Graphics (PEG) is a PCI-Express interface that is specially intended for the use of dedicated graphic cards. The graphics image is first produced in the graphics card (GPU) and then output to another interface (for example DVI or LVDS). PEG is multiplexed with SDVO in current Intel® chip sets. If the SDVO signal is output via the PEG slots in place of PEG, these slots are frequently also known as ADD2. This allows corresponding ADD2 converters to be used in order to convert SDVO to other interfaces.

eDP

The eDP (embedded DisplayPort) is based on the specification of DisplayPort. For use at the system level, the specification is expanded in areas such as power supply or backlighting. eDP has a good chance of becoming the successor to LVDS.

DDI

Digital Display Interface (DDI) is a generic term promoted by Intel® for a graphics interface that can transmit SDVO, DisplayPort, embedded DisplayPort, DVI or HDMI as desired. However DDI does not specify that all optional interfaces must be always truly available.



Graphics interfaces for external devices

Uniform connector systems and longer transmission distances are defined in graphical interfaces for external devices. Because computers usually do not support these interfaces internally, conversion may be necessary. In general, amplifiers are available that drastically increase the range. These interfaces can, however, also be used at system level.

HDMI



High Definition Multimedia Interface (HDMI) is in widespread use in the entertainment industry. HDMI exist in several versions from 1.0 to 1.4a and beside the option to transmit up to 8 channel audio, it transmits images with resolutions up to 2560x1600@75Hz or even 4096x2160@24Hz. Color depth up to 48 bit is possible. HDMI 1.4 also supports a channel for Fast Ethernet. Electrically, the TMDS signal is used; adapters from HDMI to DVI-D can be realized simply and inexpensively.

The maximum transmission range is defined as 5 meters, but up to 15 meters is possible if low resolutions are used. The connectors are defined for five different sizes according to application: From Type A (typically for TV sets) up to Type E, which is for Automotive Connection System. HDMI is not a free standard; appropriate license fees must be paid to the HDMI organization.

DVI



Digital Visual interface (DVI) is a digital standard that will probably succeed VGA. Therefore it offers the possibility to also transmit analog VGA signals (DVI-A, Digital-Visual-Interface-Analog). If only digital signals are transmitted on a TMDS basis, one speaks of DVI-D (Digital-Visual-Interface-Digital). Adapters from DVI-D to HDMI are thus very simple and inexpensive. If both DVI-A and DVI-D are integrated in one connector, this adapter is called DVI-I (Digital-Visual-Interface-Integrated). In DVI-D, one distinguishes between Single-Link and Dual-Link: Single-Link transmits 1920 x 1200@60Hz, Dual-Link offers more transmission lines and manages resolutions up to 2560 x 2048@60Hz. The range is normally around 5 meters. Since there are many variants of DVI-I, DVI-D and DVI-A, cables must be carefully selected. DVI supports hot plug.

DisplayPort



DisplayPort (DP) is a new, serial and digital standard that logically transmits the data in packet-based form. As well as image data, further data such as audio can be transmitted, and there is also a back channel from the display device to the image source. Even the transmission for several displays can be realized over a DisplayPort. DisplayPort defines a connector with good fixing possibilities and it is directly supported by the newer Intel® chip sets. The range is defined up until around 15 meters, the maximum resolution is up to 4096 x 2560. **Dual-mode DisplayPort (DP++)** offers in addition the possibility to output DVI and HDMI signals. This achieves better interoperability and the possibility of inexpensive passive adapters from the DisplayPort to DVI or HDMI. The DDI interface normally offers exactly this functionality (at system level).

TMDS

Transition Minimized Differential Signaling (TMDS) was developed by Silicon Image in order to transport uncompressed image data digitally and serially to a device. TMDS is an electrical transmission procedure and therefore not an independent external graphics interface, but rather the basis for DVI and HDMI.

Protocols and Codecs

JILI

Jumpteck* Intelligent LVDS Interface (JILI) is an explicitly developed total concept that enables a Computer-on-Module to recognize a connected LVDS display automatically and to make the correct settings. The transmission of the data takes place via I²C in a similar way as DDC. This enabled Kontron to offer a flexible solution to the Embedded industry on the lines of the open standards of the monitor market. JILI also defines a 30-pole connector system for simple connection to differing display input connectors.

EDID

The VESA Extended Display Identification Data (EDID) standard defines a data structure that describes the characteristics and capabilities of a monitor. The definition, however, restricts itself to external devices based on VGA, DVI or HDMI. EDID has restricted applicability to the important LVDS interface and is therefore not common. EDID describes, among other things, the manufacturer and display size and the optimal as well as the supported resolutions with the associated timing, color and transmission characteristics.

DisplayID

DisplayID is the most current VESA standard for monitor recognition and defines, in contrast to EDID, an expanded data structure, which makes important information such as channel distribution or mapping information more flexible and easier to use. Through the contribution of Kontron in the VESA standard, it is possible to describe the necessary information for a display in a DisplayID data record. DisplayID and the JILI interface form an ideal solution for the Embedded industry.

HDCP/DPCP

High bandwidth Digital Content Protection (HDCP) and DisplayPort Content Protection (DPCP) are encryption procedures that protect the transmission between player (here the module) and display device. This prevents the contents being output to unauthorized devices such as Blu-Ray writers. HDCP is defined for DVI-D, HDMI and DisplayPort, DPCP only for DisplayPort. In practice, HDCP prevents the digital copying of Blu-Ray media. The technologies belong to the area of Digital Rights Management (DRM).

* JUMPTec GmbH became Kontron Embedded Modules GmbH through a merger process in 2002.

Codecs

Codecs are specific logical descriptions of pictures or films with the help of mathematical methods. Codecs (compress, encode, code) serve mainly, in addition to reducing storage requirements, to make transmission simpler. Higher computing power is however needed to subsequently decode the picture or film and display it in full. Because the decoding requires a great deal of CPU computing power, this is often swapped out to the graphics kernel where specialized hardware accelerators are used. The video can then be played back without jerks even though the CPU is hardly loaded.

MPEG

Motion Picture Experts Group (MPEG) describes codes for film and audio. MPEG-2 is used for video CDs and also normal DVB television. MPEG-4 is planned for high-resolution films (HD-DVD, Blu-Ray) and high resolution television (HDTV). In MPEG, it is important to pay attention to the version number.

VC-1, H.264

Both are Codecs especially for high-resolution films. H.264 is in the meanwhile part of MPEG-4. VC-1 is the current Codec for Blu-Ray storage media.

WMV-9

WMV-9 is a Codec from Microsoft® for normal and high resolution films and is distributed by means of Windows® systems.

DirectX®/OpenGL

Both describe software interfaces that among other things permit graphics kernel commands to be addressed in standardized fashion independently of the manufacturer. 3-D graphics calculations in particular can be easily and efficiently swapped out to the GPU. DirectX® is distributed by Microsoft®, OpenGL is an open standard from the industry consortium Khronos Group.

OpenCL

OpenCL is a software interface which enables any application to access the computation power of GPU for non-graphical computing. Thus, GPUs can be used for parallel computing and unload the CPU. OpenCL was standardized by Khronos Group in 2008.

» Find out more «

Kontron Academy

Kontron seminars offer a solid basis for the use, the development and the design-in of Kontron boards. Essential seminar objectives are the practical use of development environments and imparting knowledge of the entire

development process including programming interfaces. With its wide selection of seminars, Kontron optimally covers the many hardware and software requirements in development. Find out more at:

www.kontron.com/academy

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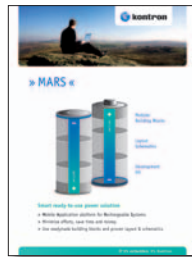
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