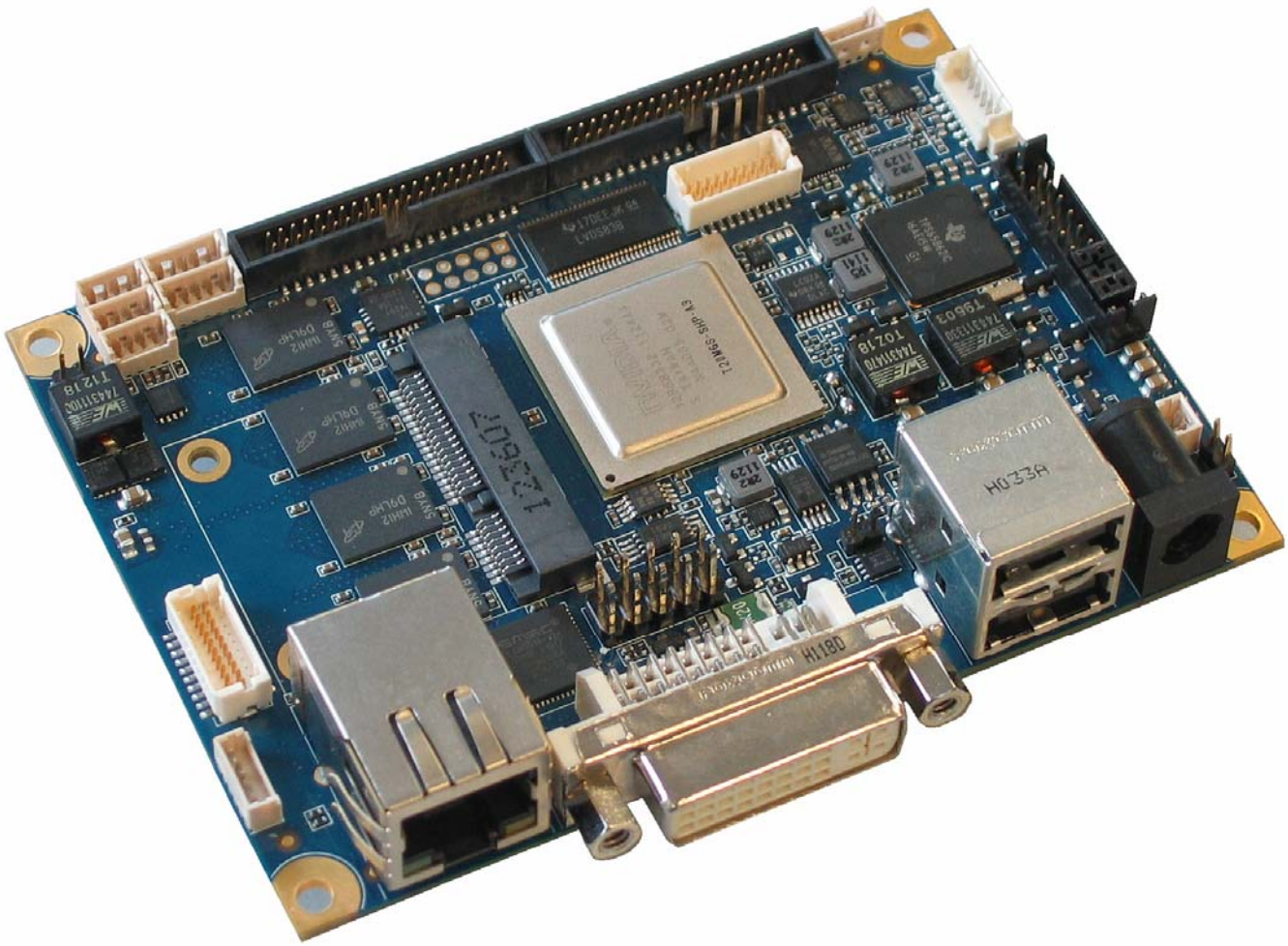
kontron

» Kontron User's Guide «



KTT20/pITX

KTD-S0044-G

Pico™

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1 User Information

1.1 About This Document

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1.3 Trademarks

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KONTRON Technology A/S is certified to ISO 9000 standards.

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This product is warranted against defects in material and workmanship for the warranty period from the date of shipment. During the warranty period KONTRON Technology A/S will at its discretion decide to repair or replace defective products.
Within the warranty period the repair of products is free of charge as long as warranty conditions are observed.
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KONTRON Technology A/S will not be responsible for any defects or damages to third party products that are caused by a faulty KONTRON Technology A/S product.

1.6 Life Support Policy

KONTRON Technology's products are not for use as critical components in life support devices or systems without express written approval of the general manager of KONTRON Technology A/S.
As used herein:
Life support devices or systems are devices or systems which
a) are intended for surgical implant into body or
b) support or sustain life and whose failure to perform, when properly used in accordance with instructions for use provided in the labelling, can be reasonably expected to result in significant injury to the user.
A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

1.7 Technical Support

Please consult our web site at **http://www.kontron.com/support** for the latest product documentation, utilities, drivers and support contacts or use the special e-mail address **sbc-support@kontron.com** for a technical problem. In any case you can always contact your board supplier for technical support.
Before contacting support please be prepared to provide as much information as possible:
Board identification:

- Type
- Part number (find PN on label)
- Serial number (find SN on label)

System environment:

- O/S type and version
- Driver origin and version
- Attached hardware (drives, USB devices, LCD panels ...)

2 Introduction

2.1 pITX Embedded Line Family

Each pITX is a member of the 2.5" SBC family of KONTRON Technology A/S based on the Pico-ITX™ specification (only mechanical outer dimensions) from the Small Form Factor Special Interest Group (SFF-SIG). pITX embedded line modules are characterized by the same front-line pinouts and interfaces for reset logic and simple power supply, 2 x USB, LAN, Audio, GPIOs, DVI® and LVDS interface. These embedded line family features allow to use of the same chassis over the whole product line and maximize design reuse.
These homogeneous features facilitate easy upgrades within the pITX embedded line product family.

2.2 KTT20/pITX Overview

Please refer to the following matrix to choose the product that suits your needs best.

Article Number	SDRAM Size	NAND Flash	LVDS Interface
03004-0505-10-0	512 MByte	----	----
03004-1005-10-0	1 GByte	✔	✔

3 Specifications

3.1 Functional Specifications

System on Chip (SoC): NVIDIA® Tegra® 250

- Dual Cortex-A9 multi-processing ARM® cores up to 900 MHz core frequency
- ARMv7 instruction set
- 32 kB data and 32 kB instruction L1 cache per core
- Shared 1 MB L2 cache
- DDR2 memory interface up to DDR2-667 with maximum size of 1 GB
- NAND flash controller with 8/16 bit data interface
- One SPI™ flash controller
- Three USB ports (EHCI) with one client interface (only two ports available)
- Audio-Video Processor (AVP, GeForce® GPU) with a dual display controller
- Integrated audio controller (AC'97 and Inter-IC Sound, called IIS or I^2S)
- One Secure Digital / MultiMedia Card (SD/MMC) controller with four instances
- Some pins are useable as GPIOs (max. 24 x 3.3V and 16 x 1.8V GPIOs) or as special function pins (e.g. keyboard functionality)
- Five UARTs with 16450/550 compatible mode (only three UARTs available)

Onchip NAND Flash Controller

- Supports PIO and DMA mode access
- Programmable error correction capability

Onchip SPI™ Flash Controller

- Supports FIFO and DMA mode access
- Maximum transfer rate of 52 Mbits/s

Onchip Universal Serial Bus (USB)

- All ports are capable to handle USB 2.0 (EHCI)
- One port supports only USB client functionality
- Supports USB 1.1 low and full speed devices without a companion USB 1.1 host controller

Onchip Graphics Processing Unit (GPU)

- Ultra low power GPU up to 333 MHz internal clock and 8 cores
- Two independent display controllers support 2D/3D graphics rendering
- 720p Video Encode Processor to deliver HD video streams
- OpenGL® ES 2.0 support
- DVI® interface (max. 1920x1080 pixel)
- Low Voltage Differential Signaling (LVDS) flatpanel interface supports 18/24 bit color depth with a maximal resolution of 1680x1050 pixel (only single channel possible)
- Full hardware acceleration of following video decode standards: H.264, MPEG4 and VC1

Onchip Audio Subsystem

- Codec interface realize the Inter-IC Sound (I^2S) specification
- The audio codec supports a maximal resolution of 24 bit with 96 kHz sample rate

Onchip SD/MMC Controller

- Only 4 bit data bus width
- Supports FIFO and DMA mode access
- Supports SDMEM/SDIO specification V2.0 up to 50/25 MHz interface speed
- Supports MMC specification V4.3 up to 52 MHz interface speed
- Supports CE-ATA Digital Protocol specification V1.1 up to 52 MHz interface speed
- Supports eSD specification V2.1
- Supports e.MMC devices

Fast Ethernet (USB connection): SMSC® LAN9514

- Fully compliant with IEEE802.3®/802.3u®
- Supports 10BASE-T and 100BASE-TX
- Full and half duplex mode with flow control

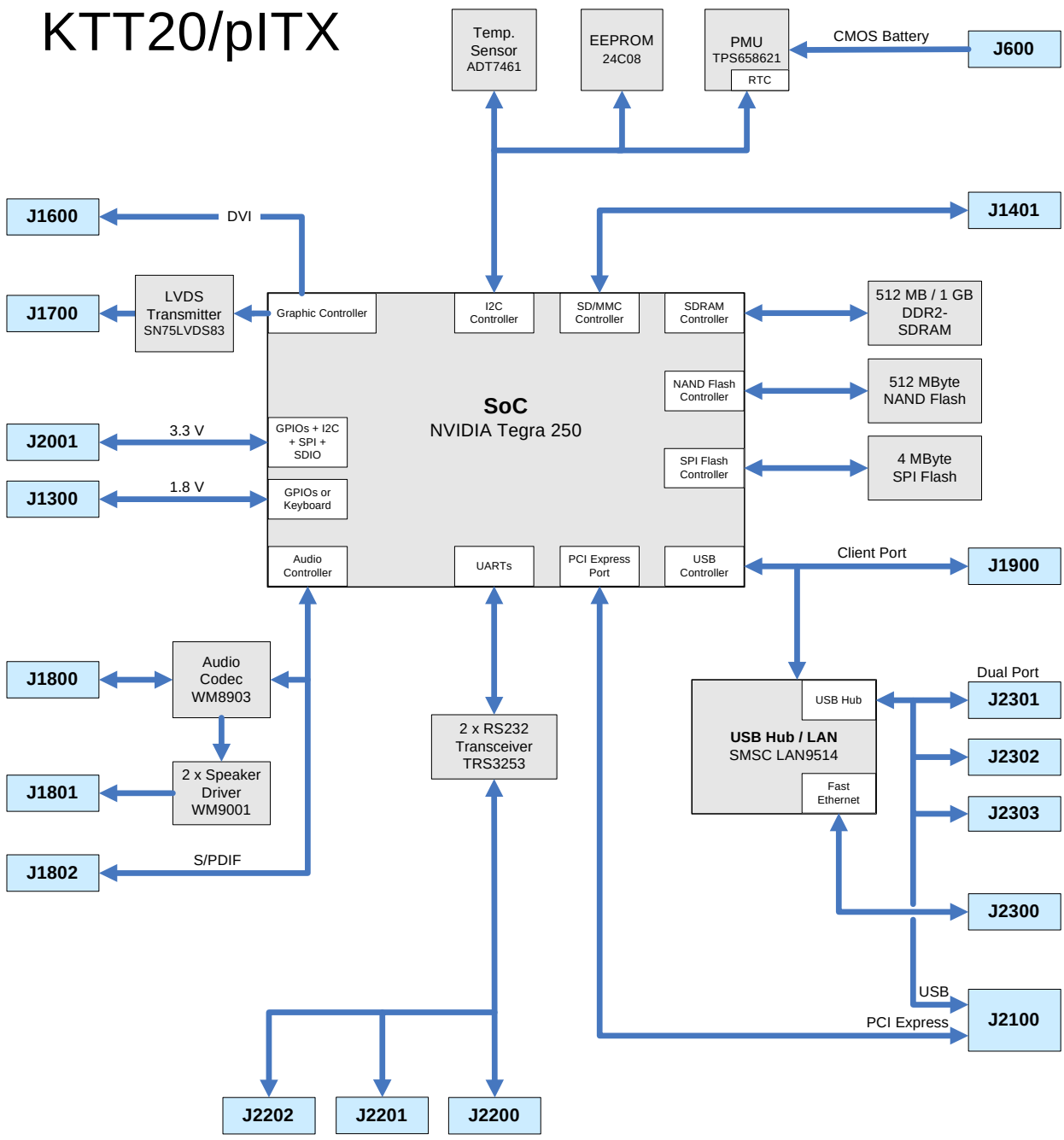
USB Hub (USB connection): SMSC® LAN9514

- Four additional USB 2.0 (EHCI) ports
- Supports USB 1.1 low and full speed devices

Temperature Monitoring (I^2C^{TM} connection): ADT7461A

- One onchip thermal sensor and one remote temperature sensor (SoC)

3.2 Block Diagram



3.3 Mechanical Specifications

Dimensions

- Pico-ITX™ form factor 100 x 72 mm ±0.2 mm (complete with all connectors 100 x 79 mm)
- Height approx. 23 mm

3.4 Electrical Specifications

Supply Voltage

- 5V DC ± 5%

Supply Voltage Ripple

- Maximum 100mV peak to peak 0 – 20 MHz

Supply Current (Linux®)

The power consumption test uses a tool to stress the CPU (100% load) and at the same time another tool to generate a high graphic throughput. The boards were tested with a DVI® monitor (SXGA resolution), USB keyboard & mouse and a 16 GByte USB key as boot device.

Variant: 512 MB SDRAM						Variant: 1 GB SDRAM					
Full Load		Idle		Deep Sleep		Full Load		Idle		Deep Sleep	
[A]	[W]	[A]	[W]	[A]	[W]	[A]	[W]	[A]	[W]	[A]	[W]
tbd.	tbd.	tbd.	tbd.	tbd.	tbd.	tbd.	tbd.	0.31	3.72	0.07	0.85

3.5 Real-Time Clock Battery

- Voltage range: +2.4V - +3.6V (typ. +3.0V)
- Typical current: 5µA @ +3.0V

Lithium battery precautions

CAUTION! Danger of explosion if battery is incorrectly replaced. Replace only with same or equivalent type recommended by manufacturer. Dispose of used batteries according to the manufacturer's instructions.	**VORSICHT!** Explosionsgefahr bei unsachgemäßem Austausch der Batterie. Ersatz nur durch den selben oder einen vom Hersteller empfohlenen gleichwertigen Typ. Entsorgung gebrauchter Batterien nach Angaben des Herstellers.
ATTENTION! Risque d'explosion avec l'échange inadéquat de la batterie. Remplacement seulement par le même ou un type équivalent recommandé par le producteur. L'évacuation des batteries usagées conformément à des indications du fabricant.	**PRECAUCION!** Peligro de explosión si la batería se sustituye incorrectamente. Sustituya solamente por el mismo o tipo equivalente recomendado por el fabricante. Disponga las baterías usadas según las instrucciones del fabricante.
ADVARSEL! Lithiumbatteri – Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Levér det brugte batteri tilbage til leverandøren.	**ADVARSEL!** Eksplosjonsfare ved feilaktig skifte av batteri. Benytt samme batteritype eller en tilsvarende type anbefalt av apparatfabrikanten. Brukte batterier kasseres i henhold til fabrikantens instruksjoner.
VARNING! Explosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.	**VAROITUS!** Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan lalteval-mistajan suosittelemaan tyyppiln. Hävitä käytetty paristo valmistajan ohjeiden mukaisesti.

3.6 Environmental Specifications

Temperature

Operating (with original KONTRON heat-sink):

- Ambient temperature: 0 to +60°C [1)]

Non operating:

- Ambient temperature: -40 to +85°C

Note: *1) It is the customer's responsibility to provide sufficient airflow around each of the components to keep them within the allowed temperature range.*

Humidity

- Operating: 10% to 90% (non condensing)
- Non operating: 5% to 95% (non condensing)

Restriction of Hazardous Substances (RoHS)

All boards in the pITX embedded line product family are RoHS compliant.

3.7 MTBF

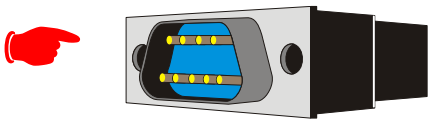
The following MTBF (Mean Time Between Failure) values were calculated using a combination of manufacturer's test data, if the data was available, and a Bellcore calculation for the remaining parts. The Bellcore calculation used is 'method 1 case 1'. In that particular method the components are assumed to be operating at a 50% stress level in a 40°C ambient environment and the system is assumed to have not been burned in. Manufacturer's data has been used wherever possible. The manufacturer's data, when used, is specified at 50°C, so in that sense the following results are slightly conservative. The MTBF values shown below are for a 40°C in an office or telecommunications environment. Higher temperatures and other environmental stresses (extreme altitude, vibration, salt water exposure, etc.) cause lower MTBF values.

- System MTBF (hours): 243526

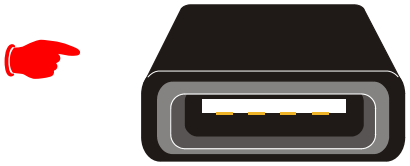
Note: *Fans usually shipped with KONTRON Technology A/S products have 50.000-hour typical operating life. The above estimation assumes no fan but a passive heat sinking arrangement. Estimated RTC battery life (as opposed to battery failures) is not included in the MTBF calculation. The RTC battery lifetime has to be considered separately. Battery life depends on both temperature and operating conditions. When the KONTRON unit has external power; the only battery drain is from leakage paths.*

4 Equipment Design Rule

If you want to change software features, repair a corrupted bootloader or for service purposes analyze the operating system serial output you should provide the following two interfaces:



Serial interface UARTC/UART3 on connector J2202



USB client interface on connector J1900

5 Getting Started

Getting started with the KTT20/pITX is easy. Take the following steps:

❶ Connect a DVI® monitor to the DVI® connector.

❷ Plug a keyboard and/or mouse to the USB connector(s).

❸ Attach a microSD™ card or a USB key to the corresponding connector, e.g. with a Linux® operating system.

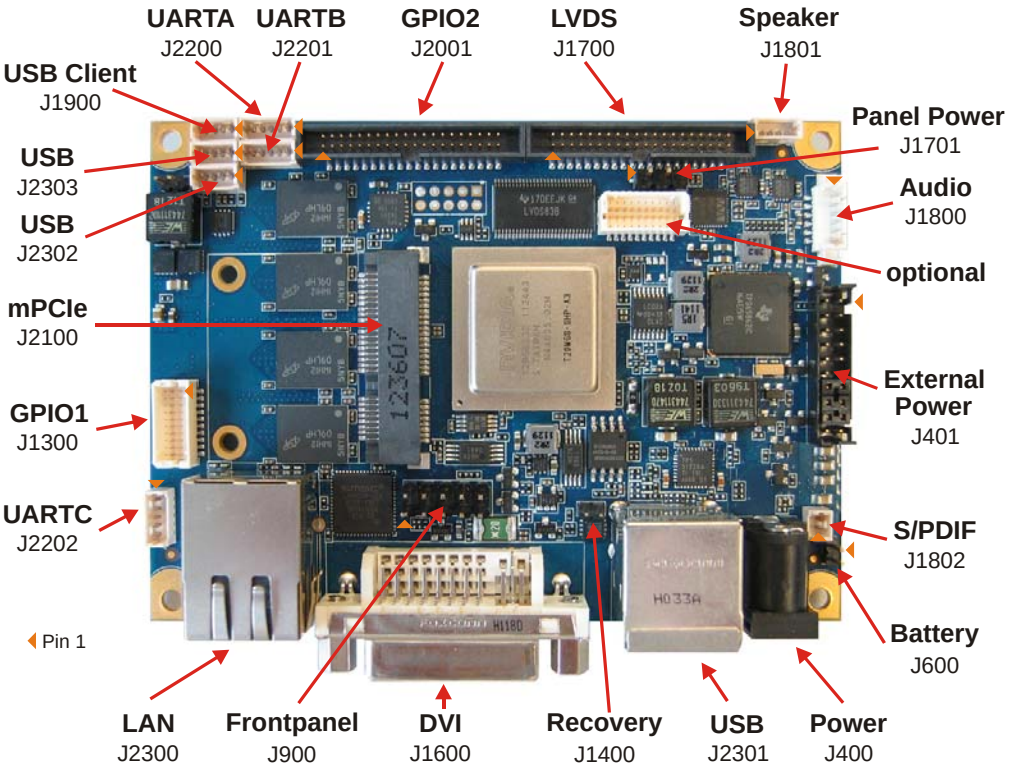
❹ Connect the power supply to the KTT20/pITX power supply connector.

❺ Turn on the board by shortening the power button pins on power front panel header (J900) for minimal two seconds.

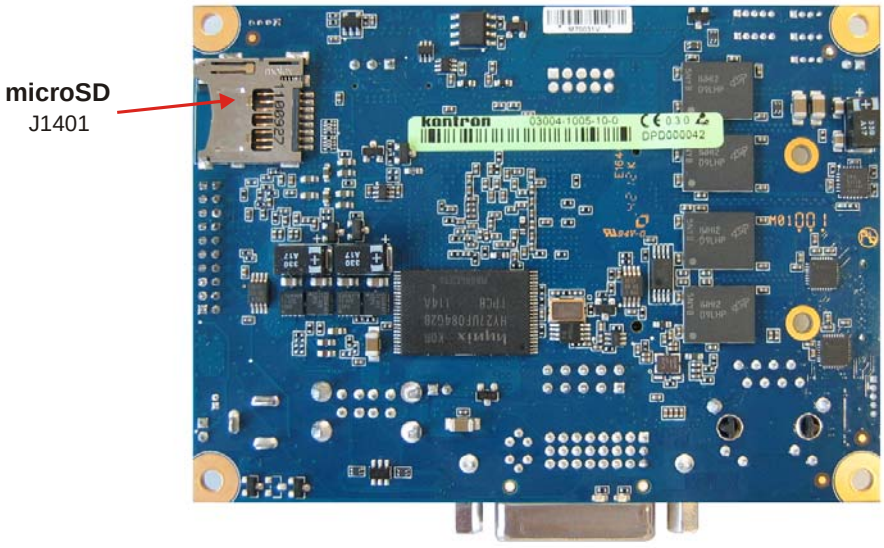
6 Connector Locations

Note: Use this picture for pin 1 identification - not the drawings in the individual chapters.

Top View



Bottom View



6.1 I/O Connector Definitions

The following sections provide pin definitions and detailed description of all onboard connectors.
The connector definitions use the following notation:

Column Name	Description
Pin	Shows the pin numbers in the connector.
Signal	The mnemonic name of the signal at the current pin. The notation "#" states that the signal is active low.
Type	AI: Analogue Input AO: Analogue Output I: Digital Input IO: Digital Input / Output IOD: Input / Open-Drain output O: Digital Output OD: Output, open-Drain DSO: Differential Signaling Output with complementary signals on two paired wires DSI: Differential Signaling Input with complementary signals on two paired wires DSIO: Differential Signaling Input / Output (combined DSO and DSI) PWR: PoWeR supply or ground reference pins NC: Not Connected Additional notations: -50 +5.0V signal voltage level, e.g. I-50 -33 +3.3V signal voltage level, e.g. O-33 -18 +1.8V signal voltage level, e.g. IO-18
Ioh/Iol	Ioh: Typical current in mA flowing out of an output pin through a grounded load while the output voltage has high level. Iol: Typical current in mA flowing into an output pin from a VCC connected load while the output voltage has low level.

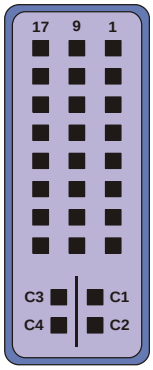
The abbreviation **tbd.** is used for specifications which are not available yet or which are not sufficiently specified by the component vendors.

7 Graphics Processing Unit

The graphics accelerator supports a HDMI®/DVI® interface with Full HD resolution and a variety of LCD panels with single clock, color depths of 18/24 bit and resolutions up to WSXGA.

7.1 DVI-I® Connector

The DVI® interface is available through the standard 29 pin DVI-I® connector J1600.

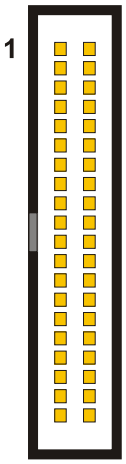


Header	Pin	Signal	Description	Type
	1	**TMDS2-**	TMDS data 2 (negative)	DSO-33
	2	**TMDS2+**	TMDS data 2 (positive)	DSO-33
	3	**GND**	Ground	PWR
	4	**N.C.**	Not connected	NC
	5	**N.C.**	Not connected	NC
	6	**DDC_CLK**	DDC clock	IO-50
	7	**DDC_DATA**	DDC data	IO-50
	8	**N.C.**	Not connected	NC
	9	**TMDS1-**	TMDS data 1 (negative)	DSO-33
	10	**TMDS1+**	TMDS data 1 (positive)	DSO-33
	11	**GND**	Ground	PWR
	12	**N.C.**	Not connected	NC
	13	**N.C.**	Not connected	NC
	14	**VCC5** 1)	Power +5V	PWR
	15	**GND**	Ground	PWR
	16	**TMDS_HPD**	Hotplug detect	I-50
	17	**TMDS0-**	TMDS data 0 (negative)	DSO-33
	18	**TMDS0+**	TMDS data 0 (positive)	DSO-33
	19	**GND**	Ground	PWR
	20	**N.C.**	Not connected	NC
	21	**N.C.**	Not connected	NC
	22	**GND**	Ground	PWR
	23	**TMDS_CLK+**	TMDS clock (positive)	DSO-33
	24	**TMDS_CLK-**	TMDS clock (negative)	DSO-33
	C1	**N.C.**	Not connected	NC
	C2	**N.C.**	Not connected	NC
	C3	**N.C.**	Not connected	NC
	C4	**N.C.**	Not connected	NC
	C5	**GND**	Ground	PWR

Note: *1) To protect the external power lines of peripheral devices make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

7.2 LVDS Flat Panel Connector

The J1700 connector (40 pins) provides the LVDS interface for flat panels on the top side of the board. A prototype cable with open ends is available (part number 821515).

Header	Pin	Signal	Description	Type
	1 - 5	**VDD** [1)]	Backlight voltage	PWR
	6	**GND**	Ground	PWR
	7	**VCC5** [1)]	Power +5V	PWR
	8	**GND**	Ground	PWR
	9	**PANELVCC** [1)]	Panel power +3.3V or +5V	PWR
	10	**PANELVCC** [1)]	Panel power +3.3V or +5V	PWR
	11 - 12	**N.C.**	Not connected	NC
	13	**BKLTADJ**	Brightness control (0V to +5V)	AO
	14	**VCCENA**	Panel power enable (PANELVCC signal)	O-33/O-50
	15	**BKLTON**	Backlight on/off	O-50
	16	**GND**	Ground	PWR
	17	**FTX0-**	First channel data 0 output (negative)	DSO-33
	18	**FTX0+**	First channel data 0 output (positive)	DSO-33
	19	**FTX1-**	First channel data 1 output (negative)	DSO-33
	20	**FTX1+**	First channel data 1 output (positive)	DSO-33
	21	**FTX2-**	First channel data 2 output (negative)	DSO-33
	22	**FTX2+**	First channel data 2 output (positive)	DSO-33
	23	**FTXC-**	First channel clock output (negative)	DSO-33
	24	**FTXC+**	First channel clock output (positive)	DSO-33
	25	**FTX3-**	First channel data 3 output (negative)	DSO-33
	26	**FTX3+**	First channel data 3 output (positive)	DSO-33
	27 - 28	**GND**	Ground	PWR
	29 - 32	**N.C.**	Not connected	NC
	33	**PANELVCC** [1)]	Panel power +3.3V or +5V	PWR
	34	**VCC5** [1)]	Power +5V	PWR
	35	**SPICLK**	SPI™ clock signal	O-18
	36	**SPISDO**	SPI™ serial data output	O-18
	37	**SPISDI**	SPI™ serial data input	I-18
	38	**SPICS#**	SPI™ chip select	O-18
	39 - 40	**GND**	Ground	PWR

Note: *1) To protect the external power lines of peripheral devices make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

Warning: *Check jumper J1701 (Panel Power) for correct settings for your panel – not doing so might cause permanent damage to your panel.*

7.3 Connecting a Flat Panel

❶ Check if you have the correct panel cable. Inspect the cable for damages. Disconnect the power from your system.

❷ Check jumper J1701 for correct panel voltage (**Pos. 1-2 = +3.3V 2-3 = +5V**).

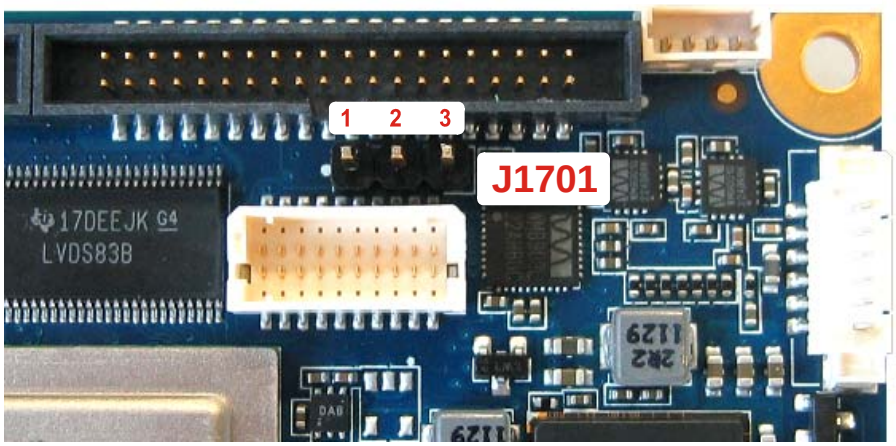
❸ Connect an external power supply for the correct backlight voltage (except the power supply complies with the backlight voltage).

❹ Connect the cable to the flat panel connector J1700 on the KTT20/pITX and connect the other end to your display.

❺ Switch on the power supply and activate/save the desired settings with help of the U-Boot bootloader (for further details see the 'Software Guide' chapter 'U-Boot Setup'). Switch off the power supply.

❻ Switch on the power supply. If you only see a blank screen contact your distributor for technical support.

7.4 Flat Panel Power Jumper



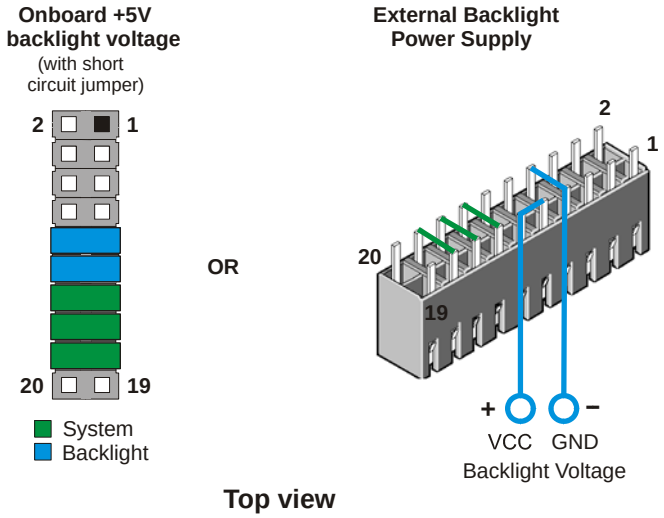
7.5 Backlight

Backlight is available through the connector J1700. The backlight voltage can be supplied from the on-board +5V voltage if you set one or two short circuit jumper on connector J401. For backlight voltages differing from +5V use pin 9 and/or 11 on connector J401 to supply the backlight (pins 7 and 8 represent the associated ground, identical with board ground).

7.5.1 Power Connector Backlight Pins

The following table is an extract of the J401 connector overview. For further details about pin 1 see chapter 'Default Power Configuration'.

Pin	Signal	Description	Type
9	**VDD** [1)]	External backlight voltage input	PWR IN
10	**VCC5** [1)]	Onboard power +5V	PWR
11	**VDD** [1)]	External backlight voltage input	PWR IN
12	**VCC5** [1)]	Onboard power +5V	PWR
7	**GND**	Backlight ground	PWR
8	**GND**	Backlight ground	PWR



CAUTION!

If you use an external backlight power supply do not forget the three System links (pin 13 to 18) otherwise the board does not start.

7.5.2 LVDS Connector Backlight Pins

The following table is an extract of the J1700 connector overview.

Pin	Signal	Description	Type
1 - 5	**VDD** 1)	Normal backlight voltage	PWR
6 and 8	**GND**	Ground	PWR

Note: *1) To protect the external power lines of peripheral devices make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

7.5.3 External Backlight Voltage Parameter

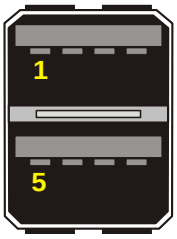
Parameter	Min.	Typ.	Max.	Units
Backlight voltage	+5.0	+12.0	+15.0	V
Continuous current fixed power +5V			tbd.	A
Continuous current per pin on connector J401			0.5	A

8 USB Interface

The USB interface comes with five USB ports which follow the EHCI specification (USB 2.0 compliant). You can expand the amount of USB connections by adding external hubs. Two ports are available on a standard connector and more ports on three extension connectors. All ports support USB 1.1 low and full speed devices without a companion USB 1.1 host controller.

8.1 Standard Connector

Two USB ports are available through the standard USB connector J2301 (8 pins).

Header	Pin	Signal	Description	Type
	1	**VCC5** 1)	Power +5V	PWR
	2	**USB0-**	USB port 0 (negative)	DSIO-33
	3	**USB0+**	USB port 0 (positive)	DSIO-33
	4	**GND**	Ground	PWR
	5	**VCC5** 1)	Power +5V	PWR
	6	**USB1-**	USB port 1 (negative)	DSIO-33
	7	**USB1+**	USB port 1 (positive)	DSIO-33
	8	**GND**	Ground	PWR

8.2 Extension Connectors

The other USB ports are available through the extension connectors J1900, J2302 and J2303 (4 pins).
If you want a standard USB interface connector an adapter cable is required (KAB-USB-2, part number 96054-0000-00-2).
Important: The connector J1900 provides only the USB client functionality.

Header	Pin	Signal	Description	Type
	1	**GND**	Ground	PWR
	2	**USBn+**	USB port n (positive)	DSIO-33
	3	**USBn-**	USB port n (negative)	DSIO-33
	4	**VCC5** 1)	Power +5V	PWR

Note: *1) To protect the external power lines of peripheral devices make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

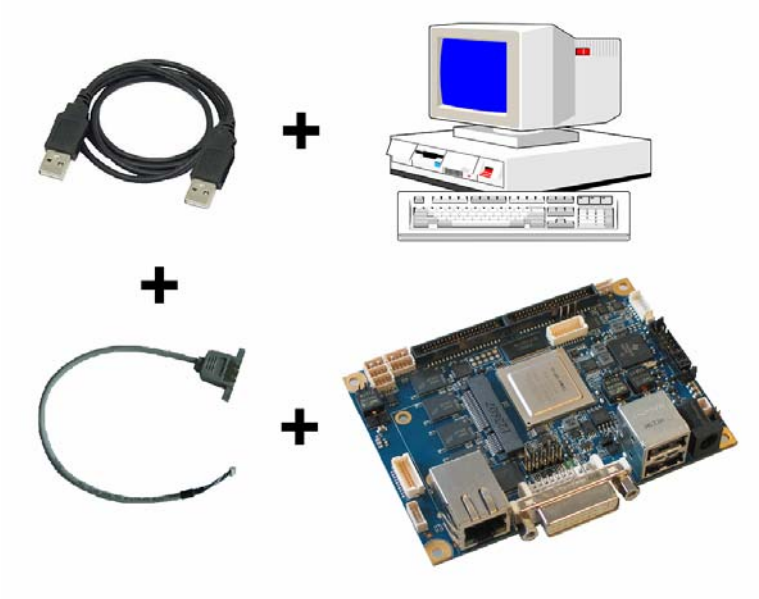
8.3 Limitations

The contacts for USB devices are protected and suitable to supply USB devices with a maximum input current of 500mA. Do not supply external USB devices with higher power dissipation through these pins.

8.4 USB Client Interface

The connector J1900 provides the client interface. You need the client functionality for changing the bootloader or update a corrupted bootloader. Together with the recovery pin (see chapter 'Crisis Management') and dedicated software on a desktop computer as well as a standard USB cable (both ends with Type-A connector) and a special KONTRON USB adapter cable (KAB-USB-2, part number 96054-0000-00-2) the upload is easy.

KAB-USB-2



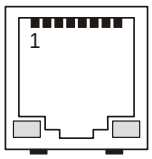
Typical Configuration

9 LAN Controller

The KTT20/pITX uses a SMSC® LAN9514 Fast Ethernet LAN controller which supports 10/100 Base-T interfaces. The controller auto-negotiates the management of a 10 or 100 Mbps connection. Additionally you can boot up the board via a network connection from a PXE server.

9.1 Connector

The LAN interface is available through the standard RJ45 connector J2300 (8 pins).

Header	Pin	Signal	Description	Type
	1	**TXD+**	10/100 transmit (positive)	DSO
	2	**TXD-**	10/100 transmit (negative)	DSO
	3	**RXD+**	10/100 receive (positive)	DSI
	4	**GND**	Ground (shield)	PWR
	5	**GND**	Ground (shield)	PWR
	6	**RXD-**	10/100 receive (negative)	DSI
	7	**GND**	Ground (shield)	PWR
	8	**GND**	Ground (shield)	PWR

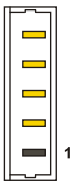
10 Serial Interface

Three serial ports provide asynchronous serial communication with RS-232 interfaces. They are 16450/16550 UART compatible and support 16-byte FIFO buffers for transfer rates from 50 Baud to 115.2 kBaud. Following the connector assignment:

J2200 → **UARTA**/UART1
J2201 → **UARTB**/UART2
J2202 → **UARTC**/UART3

10.1 Connector

The serial ports are available through the connectors J2200, J2201 and J2202 (5 pins).

Header	Pin	Signal	Description	Type
	1	**TXD**	Transmit serial data	O
	2	**RXD**	Receive serial data	I
	3	**RTS#**	Request to send	O
	4	**CTS#**	Clear to send	I
	5	**GND**	Ground (shield)	PWR

10.2 Serial Console

Most operating systems have a defined serial console. The KTT20/pITX uses the third serial port (UARTC/UART3) on connector J2202 for this purpose. Normally the serial console needs only three signal lines (TXD, RXD and GND). The serial port is assigned to the environment variables **stdin**, **stdout** and **stderr**. If you use U-Boot as bootloader you can interact with U-Boot via a USB keyboard and a standard terminal program on a desktop computer. The following overview shows the default serial settings:

- Baudrate 115 kBaud
- Data bits 8
- Stop bits 1
- Parity No

11 Audio Interface

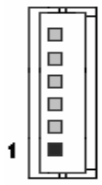
The SoC supports an Inter-IC Sound (I^2S) codec with 24 bit resolution and 96 kHz sample rate (the maximum rate of 96 kHz only unidirectional). The analogue-to-digital part of the codec uses 24 bit, 128x oversampled sigma-delta ADCs. The digital-to-analogue part contains two 24 bit sigma-delta DACs. The interface includes LINE OUT, LINE IN, MICROPHONE IN and a digital S/PDIF output.

11.1 Audio Hardware Features

Parameter	Values	Units
Output resolution (LINE OUT, S/PDIF)	16/20/24	bit
Output sample rate (LINE OUT, S/PDIF)	44.1/48/96	kHz
Output signal-to-noise ratio (LINE OUT)	96	dB
Input resolution (LINE IN)	16/20/24	bit
Input sample rate (LINE IN)	44.1/48/96	kHz
Input signal-to-noise ratio (LINE IN)	92	dB

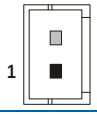
11.2 Analog Connector

The analog audio interface uses the connector J1800 (6 pins). A prototype adapter cable (open ended) is deliverable (KAB-SOUND-CMP-2, part number 96063-0000-00-1).

Header	Pin	Signal	Description	Type
	1	**LINE_IN_L**	Line input left	AI
	2	**MIC_IN**	Microphone input	AI
	3	**LINE_IN_R**	Line input right	AI
	4	**LINE_OUT_L**	Line output left	AO
	5	**GND**	Ground	PWR
	6	**LINE_OUT_R**	Line output right	AO

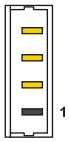
11.3 Digital Connector (S/PDIF)

The digital audio output is available through the connector J1802 (2 pins).

Header	Pin	Signal	Description	Type
	1	**SPDIF_OUT**	S/PDIF output	O-33
	2	**GND**	Ground	PWR

11.4 Speaker Connector

The audio codec also supports a speaker driver interface. With both speaker drivers it is possible to realize a passive stereo loudspeaker system. The drivers have a thermal shutdown feature. If the junction temperature exceeds approximately 150^{0}C then the output will be disabled. The speaker interface is available through the connector J1801 (4 pins).

Header	Pin	Signal	Description	Type
	1	**SPK_R#**	Speaker right (negative)	AO
	2	**SPK_R**	Speaker right (positive)	AO
	3	**SPK_L#**	Speaker left (negative)	AO
	4	**SPK_L**	Speaker left (positive)	AO

11.4.1 Speaker Hardware Features

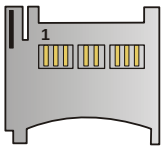
Parameter	Values	Units
Maximal output power	1 @ 8Ω	W
Output signal-to-noise ratio	97	db
Speaker mode	Class D	

12 Secure Digital and Multimedia Card

The SD/MMC interface uses only a microSD™ card socket. The controller supports the SD specification revision 2.0 (implies the SDSC and SDHC families) and the MMC specification revision 4.3. The data bus width accounts four bits, the SD transfer rate can be up to 50 MHz and MMC rate up to 52 MHz.

12.1 Connector

The microSD™ card socket is named J1401 (8 pins).

Header	Pin	Signal	Description	Type
	1	**DATA2**	Data bit 2	IO-33
	2	**CD / DATA3**	Card detect / Data bit 3	IO-33
	3	**CMD**	Command line	IO-33
	4	**VCC3** 1)	Power +3.3V	PWR
	5	**CLK**	Clock	O-33
	6	**GND**	Ground	PWR
	7	**DATA0**	Data bit 0	IO-33
	8	**DATA1**	Data bit 1	IO-33

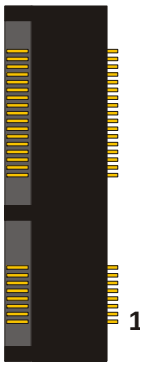
Note: *1) To protect the external power lines of peripheral devices make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

13 PCI Express® Interface

NVIDIAs® Tegra® 250 supports the PCI Express® specification 1.1 with 2.5 GT/s (GigaTransfers/s - identical with Gigabits/s by one lane). One port with one lane is provided for free usage. KONTRON Technology A/S cannot guarantee that all available cards on the market function smoothly.

13.1 Connector

The mini PCI Express® port is available through the connector J2100 (52 pins).



Pin	Signal	Description	Type	Pin	Signal	Description	Type
1	**WAKE#**	Wake event	I-33	2	**VCC3** [1)]	Power +3.3V	PWR
3	**N.C.**	Not connected	NC	4	**GND**	Ground	PWR
5	**N.C.**	Not connected	NC	6	**VCC1** [1)]	Power +1.5V	PWR
7	**CLKREQ#**	PCIe® clock request	I-33	8	**N.C.**	Not connected	NC
9	**GND**	Ground	PWR	10	**N.C.**	Not connected	NC
11	**PE_CLK-**	PCIe® clock (neg.)	DSO	12	**N.C.**	Not connected	NC
13	**PE_CLK+**	PCIe® clock (pos.)	DSO	14	**N.C.**	Not connected	NC
15	**GND**	Ground	PWR	16	**N.C.**	Not connected	NC
17	**N.C.**	Not connected	NC	18	**GND**	Ground	PWR
19	**N.C.**	Not connected	NC	20	**W_DISABLE#**	Wireless disable	O-33
21	**GND**	Ground	PWR	22	**PE_RST#**	PCIe® reset	O-33
23	**PE_RX-**	PCIe® receive (neg.)	DSI	24	**VCC3** [1)]	Power +3.3V	PWR
25	**PE_RX+**	PCIe® receive (pos.)	DSI	26	**GND**	Ground	PWR
27	**GND**	Ground	PWR	28	**VCC1** [1)]	Power +1.5V	PWR
29	**GND**	Ground	PWR	30	**I2C_CLK**	I^2C^{TM} clock	O-33
31	**PE_TX-**	PCIe® transmit (neg.)	DSO	32	**I2C_DATA**	I^2C^{TM} data	IO-33
33	**PE_TX+**	PCIe® transmit (pos.)	DSO	34	**GND**	Ground	PWR
35	**GND**	Ground	PWR	36	**USB-**	USB port (neg.)	DSIO-33
37	**GND**	Ground	PWR	38	**USB+**	USB port (pos.)	DSIO-33
39	**VCC3** [1)]	Power +3.3V	PWR	40	**GND**	Ground	PWR
41	**VCC3** [1)]	Power +3.3V	PWR	42	**N.C.**	Not connected	NC
43	**GND**	Ground	PWR	44	**N.C.**	Not connected	NC
45	**N.C.**	Not connected	NC	46	**N.C.**	Not connected	NC
47	**N.C.**	Not connected	NC	48	**VCC1** [1)]	Power +1.5V	PWR
49	**N.C.**	Not connected	NC	50	**GND**	Ground	PWR
51	**N.C.**	Not connected	NC	52	**VCC3** [1)]	Power +3.3V	PWR

Note: *1) To protect the external power lines of peripheral devices make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

CAUTION!

The PCI Express® USB port uses the same lines as the standard USB port on the external connector J2303. Do not use both ports at the same time.

14 Digital I/O Interface

The digital I/O interface is a subset of a multifunction part from NVIDIAs® Tegra® 250 SoC. Most of the I/O pins have additional functionalities which can be changed by software using two I/O connectors with different signal voltages.

14.1 Multifunction Overview

The following table informs about the dependencies.

I/O Pin	NVIDIA® Label	Second Function	Voltage	Connector
GPIO0	R.05	Keyboard row 5	1.8V	J1300
GPIO1	R.06	Keyboard row 6	1.8V	J1300
GPIO2	R.07	Keyboard row 7	1.8V	J1300
GPIO3	S.00	Keyboard row 8	1.8V	J1300
GPIO4	S.01	Keyboard row 9	1.8V	J1300
GPIO5	S.02	Keyboard row 10	1.8V	J1300
GPIO6	S.04	Keyboard row 12	1.8V	J1300
GPIO7	S.05	Keyboard row 13	1.8V	J1300
GPIO8	Q.00	Keyboard column 0	1.8V	J1300
GPIO9	Q.01	Keyboard column 1	1.8V	J1300
GPIO10	Q.02	Keyboard column 2	1.8V	J1300
GPIO11	Q.03	Keyboard column 3	1.8V	J1300
GPIO12	Q.04	Keyboard column 4	1.8V	J1300
GPIO13	Q.05	Keyboard column 5	1.8V	J1300
GPIO14	Q.06	Keyboard column 6	1.8V	J1300
GPIO15	Q.07	Keyboard column 7	1.8V	J1300
GPIO16	B.02	I^2C^{TM} clock	3.3V	J2001
GPIO17	B.03	I^2C^{TM} data	3.3V	J2001
GPIO18	T.02	$SPI1^{TM}$ MOSI	3.3V	J2001
GPIO19	T.03	$SPI1^{TM}$ MISO	3.3V	J2001
GPIO20	B.04	$SPI1^{TM}$ clock	3.3V	J2001
GPIO21	B.05	$SPI1^{TM}$ chip select	3.3V	J2001
GPIO22	T.04	---------	3.3V	J2001
GPIO23	D.05	SDIO2 command line	3.3V	J2001
GPIO24	L.00	SDIO2 data 0	3.3V	J2001
GPIO25	L.01	SDIO2 data 1	3.3V	J2001
GPIO26	L.02	SDIO2 data 2	3.3V	J2001
GPIO27	L.03	SDIO2 data 3	3.3V	J2001
GPIO28	L.04	SDIO2 data 4	3.3V	J2001
GPIO29	L.05	SDIO2 data 5	3.3V	J2001

GPIO30	**D.06**	---------	3.3V	J2001
GPIO31	**D.07**	---------	3.3V	J2001
GPIO32	**T.00**	SDIO2 clock	3.3V	J2001
GPIO33	**T.01**	---------	3.3V	J2001
GPIO34	**H.01**	---------	3.3V	J2001
GPIO35	**I.05**	---------	3.3V	J2001
GPIO36	**L.06**	SDIO2 data 6	3.3V	J2001
GPIO37	**L.07**	SDIO2 data 7	3.3V	J2001
GPIO38	**A.00**	---------	3.3V	J2001
GPIO39	**D.02**	---------	3.3V	J2001
GPIO40	**BB.01**	---------	3.3V	J2001
GPIO41	**J.07**	---------	3.3V	J2001

14.2 Electrical Specifications

Digital Inputs

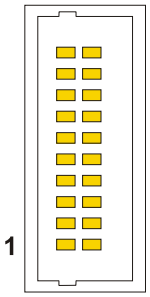
Parameter	Min.	Typ.	Max.	Units
I/O Voltage 1.8V				
Input LOW voltage			+0.4	V
Input HIGH voltage	+1.4	1.8	+2.3	V
I/O Voltage 3.3V				
Input LOW voltage			+0.8	V
Input HIGH voltage	+2.5	3.3	+3.8	V
General				
Input rate (U-Boot)			tbd.	kHz

Digital Outputs

Parameter	Min.	Typ.	Max.	Units
I/O Voltage 1.8V				
Output LOW voltage			+0.3	V
Output HIGH voltage	+1.5		+1.8	V
I/O Voltage 3.3V				
Output LOW voltage			+0.5	V
Output HIGH voltage	+2.8		+3.3	V
General				
Output LOW/HIGH current			tbd.	mA
Switching rate (U-Boot)			tbd.	kHz

14.3 Connector 1

The digital I/O interface with I/O voltage 1.8V is available through the connector J1300 (20 pins).

Header	Pin	Signal	Description	Type
	1	**VCC1** 1)	Power +1.8V	PWR
	2	**VCC1** 1)	Power +1.8V	PWR
	3	**GPIO0**	I/O **R.05** or keyboard row 5	IO-18
	4	**GPIO1**	I/O **R.06** or keyboard row 6	IO-18
	5	**GPIO2**	I/O **R.07** or keyboard row 7	IO-18
	6	**GPIO3**	I/O **S.00** or keyboard row 8	IO-18
	7	**GPIO4**	I/O **S.01** or keyboard row 9	IO-18
	8	**GPIO5**	I/O **S.02** or keyboard row 10	IO-18
	9	**GPIO6**	I/O **S.04** or keyboard row 12	IO-18
	10	**GPIO7**	I/O **S.05** or keyboard row 13	IO-18
	11	**GPIO8**	I/O **Q.00** or keyboard column 0	IO-18
	12	**GPIO9**	I/O **Q.01** or keyboard column 1	IO-18
	13	**GPIO10**	I/O **Q.02** or keyboard column 2	IO-18
	14	**GPIO11**	I/O **Q.03** or keyboard column 3	IO-18
	15	**GPIO12**	I/O **Q.04** or keyboard column 4	IO-18
	16	**GPIO13**	I/O **Q.05** or keyboard column 5	IO-18
	17	**GPIO14**	I/O **Q.06** or keyboard column 6	IO-18
	18	**GPIO15**	I/O **Q.07** or keyboard column 7	IO-18
	19	**GND**	Ground	PWR
	20	**GND**	Ground	PWR

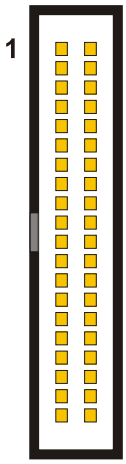
CAUTION!

Do not use signal voltages above 1.8V. All I/O signals are unprotected against overvoltage.

Note: *1) To protect the external power lines of peripheral devices make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

14.4 Connector 2

The digital I/O interface with I/O voltage 3.3V uses the connector J2001 (40 pins). A prototype cable with open ends is available (part number 821515).

Header	Pin	Signal	Description	Type
	1 - 2	**GND**	Ground	PWR
	3	**GPIO17**	I/O **B.03** or I²C™ data	IO-33
	4	**GPIO16**	I/O **B.02** or I²C™ clock	IO-33
	5 - 6	**VCC3** [1)]	Power +3.3V	PWR
	7	**GPIO19**	I/O **T.03** or SPI1™ MISO	IO-33
	8	**GPIO18**	I/O **T.02** or SPI1™ MOSI	IO-33
	9	**GPIO20**	I/O **B.04** or SPI1™ clock	IO-33
	10	**GPIO21**	I/O **B.05** or SPI1™ chip select	IO-33
	11 - 12	**GND**	Ground	PWR
	13	**GPIO23**	I/O **D.05** or SDIO2 command line	IO-33
	14	**GPIO22**	I/O **T.04**	IO-33
	15	**GPIO25**	I/O **L.01** or SDIO2 data 1	IO-33
	16	**GPIO24**	I/O **L.00** or SDIO2 data 0	IO-33
	17	**GPIO27**	I/O **L.03** or SDIO2 data 3	IO-33
	18	**GPIO26**	I/O **L.02** or SDIO2 data 2	IO-33
	19	**GPIO29**	I/O **L.05** or SDIO2 data 5	IO-33
	20	**GPIO28**	I/O **L.04** or SDIO2 data 4	IO-33
	21	**GPIO31**	I/O **D.07**	IO-33
	22	**GPIO30**	I/O **D.06**	IO-33
	23	**GPIO33**	I/O **T.01**	IO-33
	24	**GPIO32**	I/O **T.00** or SDIO2 clock	IO-33
	25 - 26	**VCC3** [1)]	Power +3.3V	PWR
	27 - 28	**GND**	Ground	PWR
	29	**GPIO34**	I/O **H.01**	IO-33
	30	**GPIO35**	I/O **I.05**	IO-33
	31	**GPIO36**	I/O **L.06** or SDIO2 data 6	IO-33
	32	**GPIO39**	I/O **D.02**	IO-33
	33	**GPIO37**	I/O **L.07** or SDIO2 data 7	IO-33
	34	**GPIO38**	I/O **A.00**	IO-33
	35	**GPIO40**	I/O **BB.01**	IO-33
	36	**GPIO41**	I/O **J.07**	IO-33
	37 - 38	**VCC3** [1)]	Power +3.3V	PWR
	39 - 40	**GND**	Ground	PWR

CAUTION!

Do not use signal voltages above 3.3V. All I/O signals are unprotected against overvoltage.

Note: *1) To protect the external power lines of peripheral devices make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

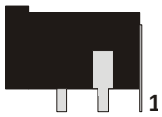
Attention: *The KONTRON Board Support Packages (BSPs) do not support most of the second functionality (e.g. keyboard input).*

15 Power Supply

The KTT20/pITX SBC has a power input voltage range from +4.75V to +5.25V DC. All other voltages are generated onboard (e.g. +3.3V / +1.8V system voltage).

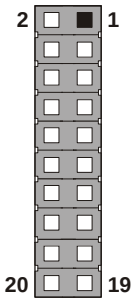
15.1 DC Power Connector

The power supply is injected through the connector J400 (3 pins, DC power jacket 2.1mm).

Header	Pin	Signal	Description
	1	**VCC_IN** [1)]	DC power supply input +5V
	2	**GND**	Ground
	3	**GND**	Ground

15.2 External Power Connector

The connector J401 (20 pins) can also be used to power the board instead of the round power jacket. In any case the green sections should be connected together (pin 13 with pin 14, pin 15 with pin 16 and pin 17 with pin 18).

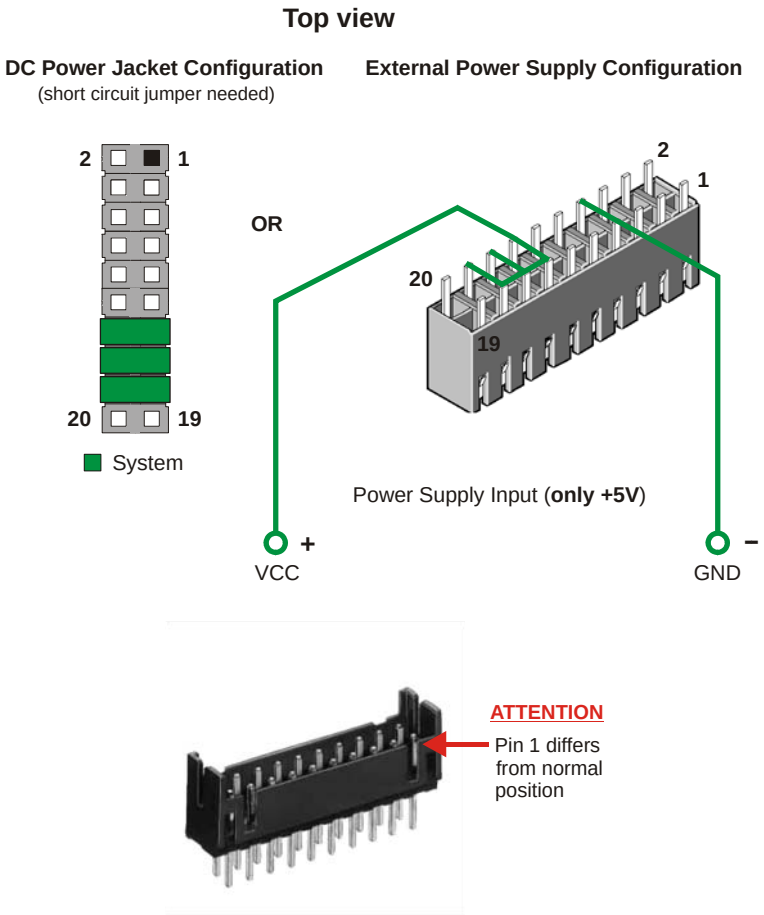
Header	Pin	Signal	Description	Type
	1	**GND**	Ground	PWR
	2	**GND**	Ground	PWR
	3	**I2C_SDA**	I^2C^{TM} data	IO-50
	4	**I2C_SCL**	I^2C^{TM} clock	IO-50
	5	**RSVD**	Reserved for future use	---
	6	**RSVD**	Reserved for future use	---
	7	**GND**	Ground	PWR
	8	**GND**	Ground	PWR
	9	**VDD** [1)]	External backlight voltage input	PWR IN
	10	**VCC5**	Onboard power +5V	PWR
	11	**VDD** [1)]	External backlight voltage input	PWR IN
	12	**VCC5**	Onboard power +5V	PWR
	13	**VCC_IN** [1)]	DC power supply input +5V	PWR IN
	14	**VCC5**	Onboard power +5V	PWR
	15	**VCC_IN** [1)]	DC power supply input +5V	PWR IN
	16	**VCC5**	Onboard power +5V	PWR
	17	**VCC_IN** [1)]	DC power supply input +5V	PWR IN
	18	**VCC5**	Onboard power +5V	PWR
	19	**N.C.**	Not connected	NC
	20	**N.C.**	Not connected	NC

Warning: *Do not overload the onboard system voltage +3.3V resp. 1.8V (microSD™ card socket, digital I/O connector). The maximum current should not exceed 250mA.*

Note: *1) To protect the external power lines of peripheral devices make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

15.3 Default Power Configuration

In the delivery state the three short circuit jumpers are set (DC power jacket configuration). As far as possible all three pins should be used (each VCC_IN and VCC) to minimize the current load per pin.

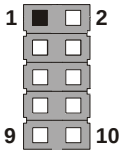


CAUTION!

If you use an external power supply do not use another voltage then +5V DC.

15.4 Power Front Panel Header

The power button and other power signals are available through the pin header J900 (10 pins).

Header	Pin	Signal	Description	Type
	1	**RST_BTN+**	Reset button (positive)	I-18
	2	**PWR_BTN+**	Power button (positive)	I-18
	3	**RST_BTN-**	Reset button (negative) = GND	PWR
	4	**PWR_BTN-**	Power button (negative) = GND	PWR
	5	**POWER_LED-**	Power LED (negative) = GND	PWR
	6	**RSVD**	Reserved	---
	7	**POWER_LED+**	Power LED (positive)	O-33 / PWR
	8	**RSVD**	Reserved	---
	9	**RSVD**	Reserved	---
	10	**RSVD**	Reserved	---

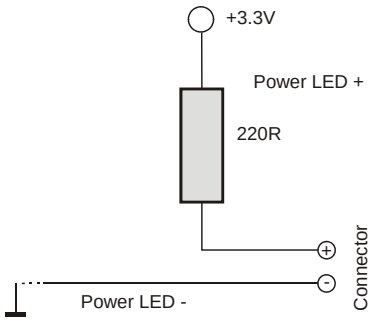
Note: *1) The label PWR_BTN (power button) is identical with NVIDIAs® 'ONKEY' button.*

CAUTION!

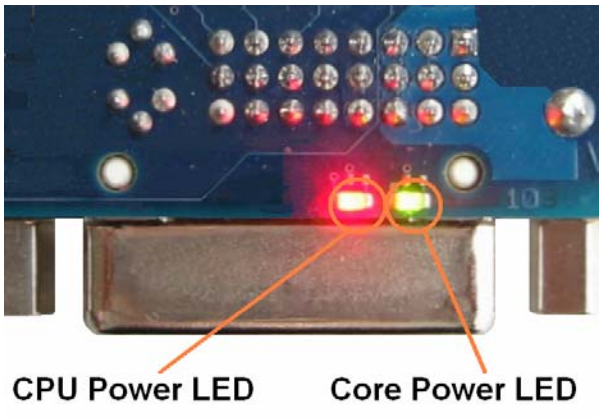
If you apply a discrete logic circuit instead the standard buttons to control the reset respectively power button inputs then you should use open drain outputs without a pullup resistor.

15.4.1 Power LED

The following picture illustrates the onboard wiring.



15.5 Onboard Status LEDs

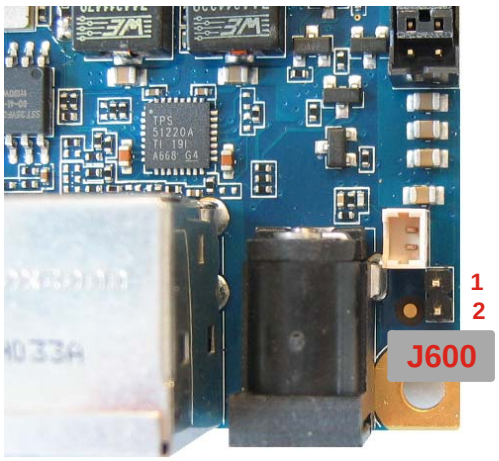


15.6 Real-Time Clock Battery Connector

An external battery is only needed if time and date should be saved when the board turns off. The battery interface uses the pin header J600 (2 pins).

Header	Pin	Signal	Description	Type
1 ■ □ 2	1	**GND**	Ground	PWR
	2	**VBAT3** [1]	Battery input voltage +3V	PWR IN

Note: *1) To protect the external power lines of peripheral devices make sure that*
- the wires have the right diameter to withstand the maximum available current.
- to enclosure of the peripheral device fulfills the fire-protecting conditions of IEC/EN 60950.

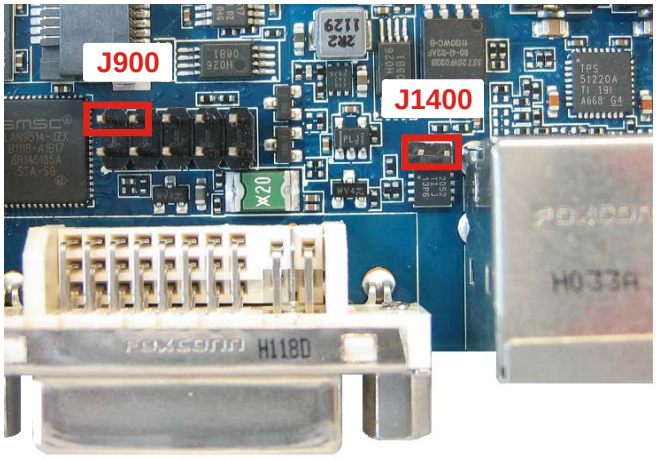


16 Crisis Management or Custom Firmware

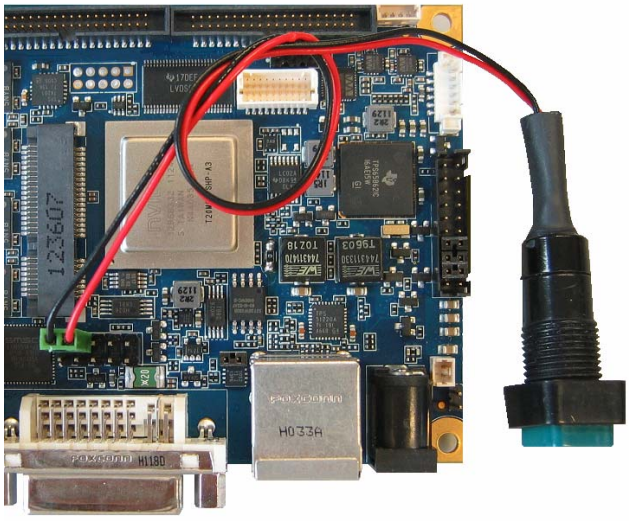
If the board does not boot up or in the case of custom firmware usage (for example the replacement of the KONTRON bootloader) you can overwrite the content of the SPI™ flash. The following parts are necessary:

- A desktop PC with a Windows® or Linux® operating system
- A special NVIDIA® USB driver (only Windows®)
- One USB Type A cable and the KONTRON adaptor cable KAB-USB-2
- Two pushbuttons or one pushbutton and one jumper or something similar
- An actual bootloader image file

For the next step you should create a link from the KTT20/pITX client port to a desktop PC (see chapter 'USB Client Interface'). Make sure that you have the power cable plugged-in. Then connect the pushbuttons or a pushbutton/jumper combination to the pin header J1400 (button or jumper) and J900 (button).



To set the board into recovery mode first the pushbutton J1400 (if you use two buttons) and then the pushbutton J900 must be pressed until the LEDs go on.



If not already done install the special USB driver on the desktop PC. Open the device manager to check the driver activity. After some seconds you must see the entry **USB Client Port Driver (CPD)**. The last step includes the download of the bootloader image file with NVIDIAs® NVFLASH tool. For further details see the 'KTT20/pITX Software Guide' chapter 'NVFLASH Download Tool'.

Appendix A: System Resources

A.1 Memory Area

The first 512 MB or 1 GB of SDRAM involve the working memory. All registers of the Tegra® 250 processor are memory-mapped. Do not write to the register range if you have no knowledge about the register function.

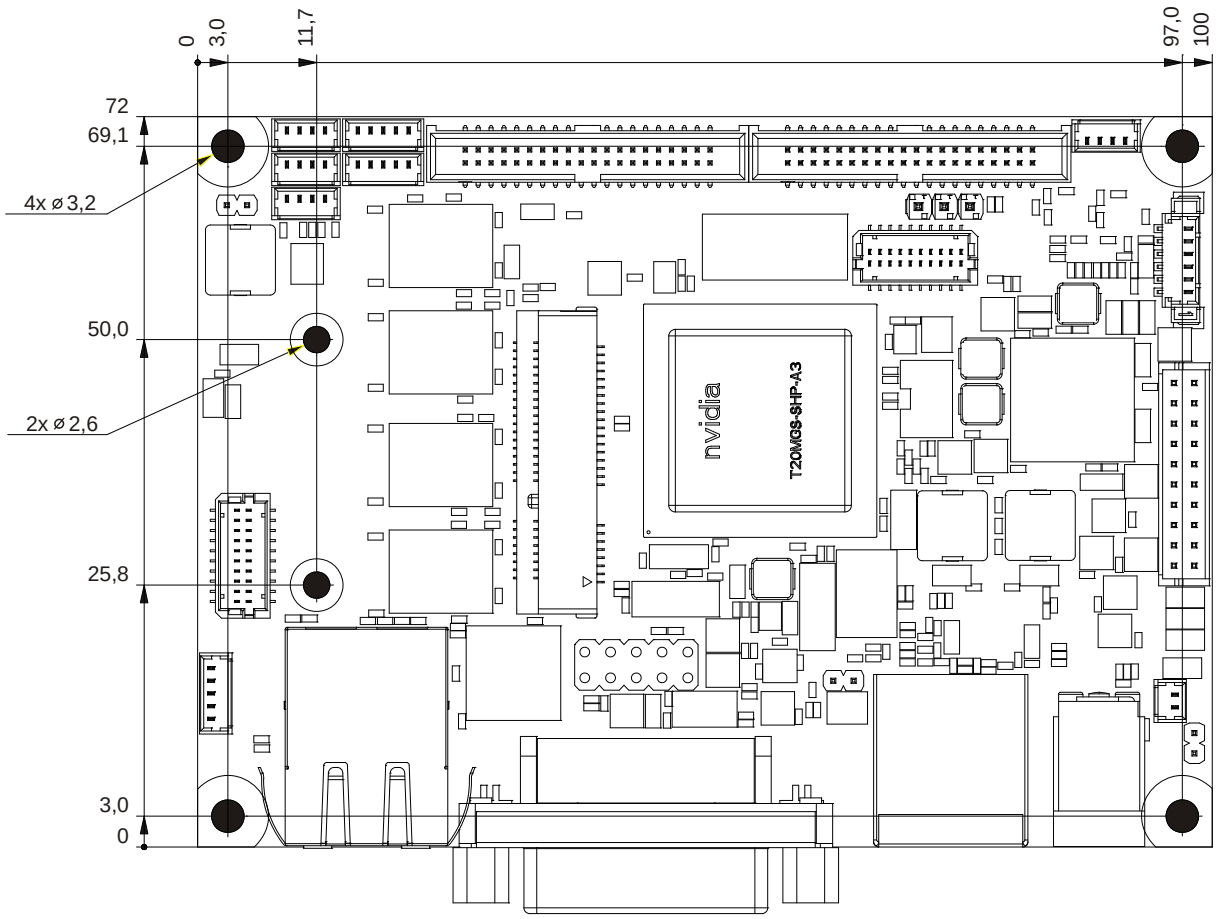
Memory Range	Used for	Available	Comment
00000000h - 3FFFFFFFh	External SDRAM	Yes	
40000000h - 4003FFFFh	Internal RAM (IRAM)	No	Normally do not access the IRAM
50000000h - FFFFFFFFh	Processor register	No	

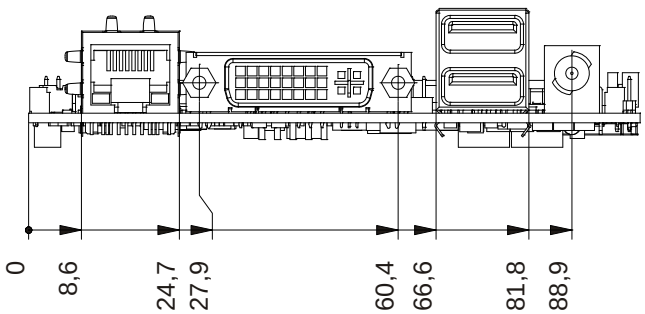
A.2 I²C™ Bus

The KTT20/pITX uses two I²C™ busses. Only one bus is available on a peripheral connector. The other bus cannot be used for external devices.

I²C™ Address	NVIDIA® Label	Device	Comment
68h / 69h	**Z.06 / Z.07**	Power management unit	
98h / 99h	**Z.06 / Z.07**	Temperature sensor	
A0h / A1h	**Z.06 / Z.07**	Identification EEPROM	
34h / 35h	**T.05 / T.06**	Audio controller	16 bit access

Appendix B: Mechanical Dimensions





Appendix C: Connector Overview

C.1 Mating Connectors

The table notes mating connectors.

Identifier	Mating Connector	Comment
J401	2.0 mm 20 pin (HIROSE DF11-20DS-2C**)	external power connector
J1300	1.0 mm 20 pin (HIROSE DF20A-20DS-1C + HIROSE DF20F-2830SCFA or comp.)	GPIO connector 1
J1700	1.27 mm 40 pin (SAMTEC FFSD-20-D-XX-01-N or comp.)	for LVDS interface
J1800	1.25 mm 6 pin (MOLEX 51021-0600 or comp.)	for analog audio interface
J1801	1.25 mm 4 pin (MOLEX 51021-0400 or comp.)	for speaker interface
J1802	1.25 mm 2 pin (MOLEX 51021-0200 or comp.)	for S/PDIF support
J1900 J2302 - J2303	1.25 mm 4 pin (MOLEX 51021-0400 or comp.)	for USB adapter
J2001	1.27 mm 40 pin (SAMTEC FFSD-20-D-XX-01-N or comp.)	GPIO connector 2
J2200 - J2202	1.25 mm 5 pin (MOLEX 51021-0500 or comp.)	for serial interfaces

C.2 Pinout Tables

Pin	DVI-I® J1600	LVDS J1700	PCIe® J2100	GPIO 2 J2001
1	TMDS2-	VDD	WAKE#	GND
2	TMDS2+	VDD	VCC3	GND
3	GND	VDD	N.C.	GPIO17
4	N.C.	VDD	GND	GPIO16
5	N.C.	VDD	N.C.	VCC3
6	DDC_CLK	GND	VCC1	VCC3
7	DDC_DATA	VCC5	CLKREQ#	GPIO19
8	RSVD	GND	N.C.	GPIO18
9	TMDS1-	VCC3/VCC5	GND	GPIO20
10	TMDS1+	VCC3/VCC5	N.C.	GPIO21
11	GND	N.C.	PE_CLK-	GND
12	N.C.	N.C.	N.C.	GND
13	N.C.	BKLTADJ	PE_CLK+	GPIO23
14	VCC5	VCCENA	N.C.	GPIO22
15	GND	BKLTON	GND	GPIO25
16	TMDS_HPD	GND	N.C.	GPIO24
17	TMDS0-	FTX0-	N.C.	GPIO27
18	TMDS0+	FTX0+	GND	GPIO26
19	GND	FTX1-	N.C.	GPIO29
20	N.C.	FTX1+	W_DISABLE#	GPIO28
21	N.C.	FTX2-	GND	GPIO31
22	GND	FTX2+	PE_RST#	GPIO30
23	TMDS_CLK+	FTXC-	PE_RX-	GPIO33
24	TMDS_CLK-	FTXC+	VCC3	GPIO32
25 / C1	RSVD	FTX3-	PE_RX+	VCC3
26 / C2	RSVD	FTX3+	GND	VCC3
27 / C3	RSVD	GND	GND	GND
28 / C4	RSVD	GND	VCC1	GND
29 / C5	GND	N.C.	GND	GPIO34
30		N.C.	I2C_CLK	GPIO35
31		N.C.	PE_TX-	GPIO36
32		N.C.	I2C_DATA	GPIO39
33		VCC3/VCC5	PE_TX+	GPIO37
34		VCC5	GND	GPIO38
35		SPICLK	GND	GPIO40
36		SPISDO	USB-	GPIO41
37		SPISDI	GND	VCC3
38		SPICS#	USB+	VCC3
39		GND	VCC3	GND
40		GND	GND	GND
41			VCC3	
42			N.C.	
43			GND	
44			N.C.	
45			N.C.	
46			N.C.	
47			N.C.	
48			VCC1	
49			N.C.	
50			GND	
51			N.C.	
52			VCC3	

Pin	GPIO 1 J1300	External Power J401	Power Front Header J900
1	VCC1.8	GND	RST_BTN+
2	VCC1.8	GND	PWR_BTN+
3	GPIO0	I2C_SDA	RST_BTN-
4	GPIO1	I2C_SCL	PWR_BTN-
5	GPIO2	RSVD	POWER_LED-
6	GPIO3	RSVD	RSVD
7	GPIO4	GND	POWER_LED+
8	GPIO5	GND	RSVD
9	GPIO6	VDD	RSVD
10	GPIO7	VCC5	RSVD
11	GPIO8	VDD	
12	GPIO9	VCC5	
13	GPIO10	VCC_IN	
14	GPIO11	VCC5	
15	GPIO12	VCC_IN	
16	GPIO13	VCC5	
17	GPIO14	VCC_IN	
18	GPIO15	VCC5	
19	GND	N.C.	
20	GND	N.C.	

Pin	LAN J2300	USB Standard J2301	USB Extension J1900/J2302/J2303
1	TXD+	VCC5	GND
2	TXD-	USB0-	USBn+
3	RXD+	USB0+	USBn-
4	GND	GND	VCC5
5	GND	VCC5	
6	RXD-	USB1-	
7	GND	USB1+	
8	GND	GND	

Pin	microSD™ Socket J1401	Serial Ports J2200 - J2202	Battery J600
1	DATA2	TXD	GND
2	CD / DATA3	RXD	VBAT3
3	CMD	RTS#	
4	VCC3	CTS#	
5	CLK	GND	
6	GND		
7	DATA0		
8	DATA1		

Pin	Audio J1800	Speaker J1801	S/PDIF J1802
1	LINE_IN_L	SPK_R#	SPDIF_OUT
2	MIC_IN	SPK_R	GND
3	LINE_IN_R	SPK_L#	
4	LINE_OUT_L	SPK_L	
5	GND		
6	LINE_OUT_R		

Appendix D: Reference Documents

KONTRON Technology A/S can't guarantee the availability of internet addresses.

Document	Internet Address
NVIDIA® Development	http://developer.nvidia.com/tools/Development
Tegra® 2 Technical Reference Manual	http://developer.nvidia.com/tegra-2-technical-reference-manual
Linux® for Tegra®	http://developer.nvidia.com/linux-tegra
Digital Visual Interface (DVI®)	http://www.ddwg.org
Open LVDS Display Interface Standard Spec. (Open LDI™)	http://www.national.com/analog/displays/open_ldi
IEEE 802.3® Specification (Ethernet)	http://standards.ieee.org/getieee802
Universal Serial Bus Specification (USB)	http://www.usb.org/developers/docs
SD™ Specification (SD Card)	http://www.sdcard.org/developers/tech/sdio/sdio_spec

Appendix E: Certifications

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-11130-01-00

paconsult

TEST REPORT
No. 12-4861

Test Specimen: KTT20/pITX Boards

Client: Kontron Technology A/S
Hamburger Straße181
D-22083 Hamburg

Present Persons:

Purpose:

In connection with a laboratory simulation three Boards –KTT20/pITX– should be tested to vibration- and shock strains. The tests were given by the client and are described in the IEC 60068-2-64 and 60068-2-27 standards.

Summary:

The qualification tests were performed successfully. During the tests the specified function of the boards was checked and could be demonstrated. The detailed analysis of the specimen will be performed by the client.

Date of delivery: 10th of December, 2012

Testing Period: 10th to 11th of December, 2012

Pages: 16

Appendix: 1

Revision: 0

Written: Dipl.-Ing. J.Lüttmann _____ 13th of December 2012
(Laboratory Test Engineer) Signature

Reviewed: Dr.-Ing. K.Esfahlani _____ 13th of December 2012
(Managing Director) Signature

paconsult GmbH · Environmental Testing Laboratory · Birkenau 3 · D-22087 Hamburg · Tel 040-229 48 79-0 · Fax 040-229 48 79-1 ·
e-mail info@paconsult.de

NOTICE OF COMPLETION AND AUTHORIZATION TO APPLY THE UL MARK

01/22/2013

Kontron Technology A/S

Dr Neergaards Vej 5d
Hoersholm 2970, Dk

Our Reference:	File E194252-A22, Vol. X1	Project Number	12CA65254
Your Reference:	29-NOV-2012		
Project Scope:	cURus - Motherboard type KTT20/pITX		

Congratulations! UL's investigation of your product(s) has been completed under the above Reference Number and the product was determined to comply with the applicable requirements. This letter temporarily supplements the UL Follow-Up Services Procedure and serves as authorization to apply the UL Mark at authorized factories under UL's Follow-Up Service Program. To provide your manufacturer(s) with the intended authorization to use the UL Mark, you must send a copy of this notice to each manufacturing location currently authorized under File E194252-A22, Vol. X1 and *including any special instructions as indicated in the addendum to this letter.*

Records in the Follow-Up Services Procedure covering the product are now being prepared and will be sent in the near future. Until then, this letter authorizes application of the UL Mark for 90 days from the date indicated above.

Additional requirements related to your responsibilities as the Applicant can be found in the document "Applicant responsibilities related to Early Authorizations" that can be found at the following web-site:
http://www.ul.com/EAResponsibilities

Any information and documentation provided to you involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

We are excited you are now able to apply the UL Mark to your products and appreciate your business. Feel free to contact me or any of our Customer Service representatives if you have any questions.

Very truly yours,

Torben B. Pedersen
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Senior Engineering Associate
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Reviewed by:

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HRVCE4A-535AE7

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Page 1 of 1

» Kontron Quality Data «

» KTT20-pITX Reliability Report

The following MTBF (Mean Time Before Failure) values were calculated using a combination of manufacturer's test data, if the data was available, and the Telcordia (Bellcore) issue 2 calculation for the remaining parts.

The Telcordia calculation used is "Method 1 Case 3" in a ground benign, controlled environment (GB,GC). This particular method takes into account varying temperature and stress data and the system is assumed to have not been burned in.

Figure 1 below shows MTBF de-rating for the E1 temperature range in an office or telecommunications environment. Other environmental stresses (extreme altitude, vibration, salt water exposure, etc) lower MTBF values.

» System MTBF (hours) = 243526 @ 40°C

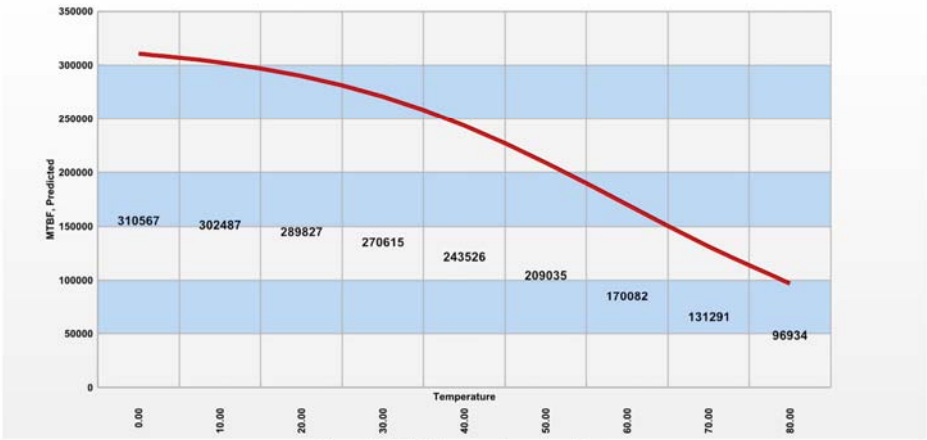

Figure 1. MTBF temperature de-rating.

Fans usually shipped with Kontron Technology products have 70,000-hour typical operating life(@ 40 degrees C). The above estimates assume no fan, but a passive heat sinking arrangement. Estimated RTC battery life (as opposed to battery failures) is not accounted for in the above figure and needs to be considered for separately. Battery life depends on both temperature and operating conditions. When the Kontron unit has external power; the only battery drain is from leakage paths.

Appendix F: Document Revision History

Revision	Date	Author	Changes
S0044-G	02/12/13	M. Hüttmann	Added UL certification and chapter 'Mechanical Dimensions'
S0044-F	02/04/13	M. Hüttmann	Changed some minor USB client text passages, added Appendix D
S0044-E	11/13/12	M. Hüttmann	All pictures replaced for hardware version 2.00
S0044-D	10/26/12	M. Hüttmann	Pin 1 marks replaced. Some other little changes
S0044-C	09/25/12	M. Hüttmann	New KONTRON design. Charger chapter removed and new external power connector added. Connector drawing removed and connector picture added. In all tables TYPE column added. PCI Express chapter added
S0044-B	07/05/12	M. Hüttmann	CRT interface removed
S0044-A	06/07/12	M. Hüttmann	Added chapter 'Equipment Design Rule' and some mating connectors, remove 'Video In' as second functionality of GPIOs (replaced with SDIO2)
S0044-0	05/09/12	M. Hüttmann	Created preliminary manual

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