Trenz Electronic GmbH operates as a provider of development services in the electronic industry since 1992. Our services include design-in support as well as turnkey designs which typically covers all steps from product specification, hardware and software design up to prototyping and production.

We are particularly specialized in the design of high-speed data acquisition, high-accuracy measurement and embedded digital signal processing systems based on FPGA and CPU architectures.

Many of our products are compatible with some widespread form factors. We also provide SoM products for Automotive industry and high-end applications.

In the event that an off-the-shelf FPGA board won’t fit the customers requirements, the design can be easily adapted by our comprehensive engineering design service.

Our in-house EMS and worldwide supply of FPGA and SoC modules complete the portfolio. All modules produced by Trenz Electronic GmbH are developed and manufactured in Germany.

Other assembly options of our modules for cost or performance optimization plus high volume prices are available on request. Also, cooling solutions and several carrier boards are at hand.

**Hardware Design**
- System architecture and design
- Hardware integration (Design-In)
- Ultrafast digital logic
- Analog and mixed signal
- Digital signal processing
- Schematic capture and PCB layout

**HDL Design**
- FPGA and System-On-Chip design
- System design and synthesis
- HDL design (VHDL, Verilog)
- Integration of soft-cores
- USB, PCI-Express, Gigabit Ethernet
- Ultrafast ADC/DAC interfaces

**Software Development**
- Device driver and application software development
- Software and Firmware development
- Extended device life cycle
- Rugged for industrial applications
- Automotive grade available
- Small and powerful
- Customizable
- Development and design service
- Rapid Prototyping
- Cooling solutions
- Carrier and testboards
- Free documentation and designs
- Sales worldwide
- In-house EMS
- Developed & produced in Germany

Trenz Electronic is certified partner in the Xilinx Partner Program.

ISO 9001:2015 (quality management) certified
ISO 14001:2015 (environmental management) certified
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### TE0717 Series
**Xilinx Spartan-7, HyperRAM, Flash, 100MHz Oscillator**

**Device list**

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connector</th>
<th>HyperRAM</th>
<th>Flash</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>S6, S15, S25, S50</td>
<td>1 x Samtec 100-pin LSHM</td>
<td>64 Mbit</td>
<td>64 Mbit</td>
<td>Baseboard available, oscillator 100 MHz, green and red LED, single supply</td>
</tr>
</tbody>
</table>

http://trenz.org/te0717-info

### AM0010 Series
**Xilinx Zynq UltraScale+, DDR4 PS connected, Flash, HyperRAM, Ethernet, USB**

**Device list**

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>e.MMC</th>
<th>Ethernet</th>
<th>USB</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZU2CG-ZU5CG, ZU2EG-ZU5EG, ZU4EV, ZU5EV</td>
<td>2 x Samtec ADM64 x 60-pin</td>
<td>2 GB DDR4 64-bit (PS) with ECC</td>
<td>128 MB</td>
<td>4-64 GB</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>Total I/O: 192, 8 MByte HyperRAM, MAC address serial EEPROM with EUI-48 node identity, security controller, crypto authentication</td>
</tr>
</tbody>
</table>

http://trenz.org/am0010-info
**NEW TE0716 Series**
Xilinx Zynq-7000, DDR3L, Flash, Ethernet, USB PHY, low power SAR ADCs

[Image of TE0716 Series]

4.5 x 6.5 cm form factor

**Device list**

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit Transceiver</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-7020</td>
<td>2 x FCI Bergstak</td>
<td>1 GB DDR3L</td>
<td>32 MB</td>
<td>1 Gbit</td>
<td>USB2.0</td>
<td>120 x HR PL</td>
<td>2 x PS MIOs</td>
<td>On board 10x 12-bit low power SAR ADCs up to 2 MSPS, low power oscillators, USB2.0 to UART/JTAG interface, EEPROM</td>
</tr>
</tbody>
</table>

**NEW TE0806 Series**
Xilinx Zynq UltraScale+, DDR4 (PS + PL domain), Flash, Ethernet, USB, e.MMC

[Image of TE0806 Series]

5.5 x 7.6 cm form factor

**Device list**

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>e.MMC max</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit Transceiver</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZU4, ZU5, ZU7, CG, EG, EV support, 900 Pin packages</td>
<td>2 x Samtec ADM6</td>
<td>8 GB DDR4 64-bit (PS) with ECC</td>
<td>4 GB DDR4 32-bit (PL)</td>
<td>512 MB</td>
<td>64 GB</td>
<td>2 x 1 Gbit</td>
<td>USB2.0 OTG</td>
<td>48 PI HD + 52 PL HP + 14 MIOs + i2C</td>
<td>Transceiver clock in/outputs, 2 x MAC address serial EEPROM, single 5-12V power required</td>
</tr>
</tbody>
</table>

http://trenz.org/te0716-info

http://trenz.org/te0806-info
## TE0865 Series
Xilinx Zynq UltraScale+, SDRAM on PS and PL, Flash, Ethernet, USB

[Image of TE0865 Series module]

7.5 x 10 cm form factor

http://trenz.org/te0865-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Pin Packages</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>Ethernet PHY</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZU11, ZU17, ZU19</td>
<td>C1760</td>
<td>4 x Samtec ADM6</td>
<td>8 GB DDR4 64-bit (PS) with ECC, 8 GB DDR4 64-bit (PL)</td>
<td>256 MB</td>
<td>1 Gbit</td>
<td>370</td>
<td>32 x GTH, 16 x GTY, 4 x GTR</td>
<td>USB PHY, e.MMC, 12V single supply</td>
</tr>
</tbody>
</table>

## TE0812 Series
Latest MPSoC chip technology in space, designed for cubesat missions

[Image of TE0812 Series module]

9 x 9 cm form factor

http://trenz.org/te0812-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Pin Packages</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>e.MMC</th>
<th>Flash</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZU6</td>
<td>C900</td>
<td>2 x B2B Samtec AP6, 1 x Debug Samtec LSHM</td>
<td>1 GB DDR4</td>
<td>2 x 32 GB</td>
<td>2 x 128 MB</td>
<td>127</td>
<td>16 (12 x PL; 4 x PS)</td>
<td>2 x 4 MByte MRAM, on board Vorago VA41630, ETH, 2x Analog input, UART, 2 x CAN, PPSin/PPSout, IG2, 12V power supply</td>
</tr>
</tbody>
</table>
COM-HPC™ is the new released PICMG standard for high-performance Computer-on-Modules (COMs). The pinout and majority of the functionality were recently officially approved.

Higher performance, more interfaces

The need for a new specification to complement COM Express is easily explained: As a result of the digital transformation, the demand for embedded computers to provide high-speed performance is growing. To serve the new class of embedded edge servers, scalability must be limitless. With its 440 pins, COM Express does not have enough interfaces for powerful edge servers. The performance of the COM Express connector is also slowly approaching its limits: While COM Express can easily handle the 8.0 GHz clock speed and 8 Gb/sec throughput of PCIe Gen 3, the verdict is still out regarding whether the connector meets certain technological advances such as PCIe Gen 4.

Source: picmg.org

Key Features

SoC/FPGA (Zynq UltraScale+)
- Package: FFVC1760, device: ZU11, ZU17, ZU19*, engine: EG, speed: -1, -2, -3*, ** temperature: I, E, (Q, M)*, **

RAM/Storage
- DDR4 (PS connected)
  - Data width: 72-bit with ECC
  - Size: def. 4 GB (up to 8 GB possible)*
- DDR4 SODIMM (PL connected)
  - 72-bit DDR4 with ECC, size: max 16 GB*
- eMMC, data width: 8-bit
  - Size: def. 8 GB (up to 64 GB possible)*
- QSPI boot Flash in dual parallel mode
  - Data width: 8-bit
  - Size: def. 128 MB (up to 512 MB possible)*
- QDDRII (optional, default not assembled)
  - Size: 18 Mbit*
- MAC address serial EEPROM with EUI-48™ node identity

On Board
- SC CPLD to SoC
  - Intel MAX 10: 10M08
- Xilinx Zynq-7 series: XC7Z010 with 128 MB QSPI and 512 MB DDR3 (16-bit)
- PLL Si5345
- Gigabit Ethernet PHY
- USB2.0 HUB
- USB2.0 PHY

Interface (2 x 400pin COM-HPC connectors)
- 1 x PCIe SMB (ZynqMP PS GTR)
- PCIe up to 48 lane (16 x GTY (32.75 Gb/s) and 32 x GTH (16.3 Gb/s)) ****
  - 1 x Gbit Ethernet
  - 4 x USB2.0
  - 1 x USB3.0 (ZynqMP PS GTR)
  - 1 x SATA (ZynqMP PS GTR)
  - 1 x SPI
  - 1 x I2C SMB
  - 3 x I2C
  - 2 x UART (1 x ZynqMP, 1 x SC Zynq)
  - 12 x GPIO (JTAG over GPIO)
  - 1 x SPI
  - 1 x I2C SMB
  - 3 x I2C
  - 2 x UART (1 x ZynqMP, 1 x SC Zynq)
  - 12 x GPIO (JTAG over GPIO)
  - 1 x SCI
  - 12 x GPIO (JTAG over GPIO)

Notes
* depends on assembly version
** not all combinations are possible
*** depends on used Zynq UltraScale+ and DDR4 combination
**** uses is limited by Zynq UltraScale+ specification
NEW **TEB0707 Carrier Board**
4 x 5 Module Carrier for CRUVI Extension Boards

http://trenz.org/teb0707-info

<table>
<thead>
<tr>
<th>Modules</th>
<th>Connectors</th>
<th>RAM/Storage</th>
<th>On Board</th>
<th>Interface</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 x 5 Trenz Electronic Modules</td>
<td>3 x High Speed CRUVI</td>
<td>EEPROM (FTDI</td>
<td>Intel Max 10 FPGA, FTDI FT2223, 6 x user LEDs (3 x green, 3 x red), 2 x status LEDs, DIP switch, push buttons</td>
<td>Gigabit RJ45 LAN socket, MicroSD card socket, MicroUSB2.0 socket, USB A socket, 4 x jumpers</td>
<td>5V input power supply</td>
</tr>
</tbody>
</table>

NEW **TEI0022 DataStorm DAQ**
M-Board FMC Carrier for M-Series Precision Converters

http://trenz.org/tei0022-info

![TEI0022 DataStorm DAQ](image)

<table>
<thead>
<tr>
<th>Device list</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>On Board</th>
<th>Interface</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclone V</td>
<td>1 GB for HPS</td>
<td>32 MB SPI for HPS</td>
<td>Up to 7 x SMA connector, temperature sensor, Intel MAX 10 for board management</td>
<td>Connectors: LPC FMC, 4 x Pmod, JTAG, UART via microUSB B (for FPGA and HPS), 4 x USB2.0 host, Ethernet, SD card, HDMI</td>
<td>Power: 12V input supply voltage</td>
</tr>
</tbody>
</table>
**TEB0835 PCIe Baseboard**

for Trenz Electronic's TE0835 RFSoC

![Image of TEB0835 PCIe Baseboard](http://trenz.org/teb0835-info)

- **Modules**
  - RFSoC TE0835
- **Connectors**
  - 2 x Samtec Razor Beam SSS
- **RAM/Storage**
  - 4 Kb EEPROM
- **On Board**
  - Programmable clock generator, I2C switch IC, 16 x RF transformation, temperature sensor, FT2232H FTDI, SDIO port expander, PCIe 6 connector
- **Interface**
  - Connectors: 21 x UMCC, 6 x SMA, 2 x UEC5, 2 x UCC8, sockets: RJ45 LAN, microSD card, other: 2 x Micro USB2.0, PCIe x8 card, 12V input supply voltage

**TE0722 DIPFORTy1 "Soft Propeller" Series**

Xilinx Zynq-7000, Flash, fits on DIP40 Pinout, Parallax Propeller Chip compatibility

![Image of TE0722 DIPFORTy1](http://trenz.org/te0722-info)

- **Device list**
  - Flash
    - Z-7010, Z-7007S
    - 16 MB
  - Total I/O
    - 46
    - +3 Input only
  - DIP40 form factor
    - 2 x 20 holes for socket pins or pin-header
  - Clock
    - 33.333 MHz (MEMS Oscillator)
  - Other Features
    - 3.3V single supply, micro SD card socket, proximity and ambient light sensor, industrial and commercial temperature range available
TE0890 "S7 Mini" Series
Xilinx Spartan-7, Fully Open-Source Module with HyperRAM

http://trenz.org/te890-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Footprint compatible</th>
<th>Config PROM</th>
<th>HyperRAM DRAM</th>
<th>Total I/O</th>
<th>Interface(s)</th>
<th>Supply</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>7S25</td>
<td>7S6, 7S15, 7S50 FTGB-196 devices</td>
<td>64 Mb</td>
<td>64 Mb</td>
<td>Dual-Pinout DIP-40 or 50pin 80 pin for 32 or 64 FPGA 3.3V I/Os</td>
<td>Standard 1x6 FTDI cable serial</td>
<td>5V input</td>
<td>23K Logic Cells, 29K Fops, 45 36Kb BRAMs, 80 mults., fully open source</td>
</tr>
</tbody>
</table>

TE0714 Series
Xilinx Artix-7, Flash, 4 x GTP Transceiver, Form Factor 3 x 4 cm only

http://trenz.org/te0714-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>Flash</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Config Voltage (B14)</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>15T, 35T, 50T</td>
<td>2 x Samtec LSHM</td>
<td>16 MB</td>
<td>138 + 5 (QSPI or user I/Os)</td>
<td>4 x GTP</td>
<td>3.3V or 1.8V</td>
<td>Differential MEMS oscillator for MGT clocking, XADC analog input, eFUSE bit-stream encryption (AES), single supply</td>
</tr>
</tbody>
</table>
TE0727 "ZynqBerryZero" Series
Xilinx Zynq-7000, Raspberry Pi Zero Form Factor, DDR3L, Flash, USB, mini HDMI

http://trenz.org/te0727-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>HAT header</th>
<th>Total I/O</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-7010</td>
<td>512 MB DDR3L</td>
<td>16 MB</td>
<td>40-pin</td>
<td>26 GPIO</td>
<td>2 x microUSB2.0, microSD card slot, Mini HDMI type C, CSI-2 connector (camera)</td>
</tr>
</tbody>
</table>

TE0725 Series
Xilinx Artix-7, Flash, HyperRAM, 2 x 50-pin Headers, 2.54 mm Pitch

http://trenz.org/te0725-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>HyperRAM max</th>
<th>Flash</th>
<th>EEPROM</th>
<th>Total I/O</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>15T, 35T, 50T, 75T, 100T</td>
<td>2 x 50-pin headers</td>
<td>8 MB</td>
<td>32 MB</td>
<td>16 KB</td>
<td>87</td>
<td>Optional POF fiber optical adapter (125/250 Mbit/s), single supply</td>
</tr>
</tbody>
</table>

The TE0725LP series is the same form factor, but w/o POF adapter and depending on variant 3.3 or 1.8V main power VIN, 4 diff. pairs in extra header J3, system clock 25 MHz (can be customized on request).
**TE0710 Series**
Xilinx Artix-7, DDR3, Flash, 2 x 100 Mbit Ethernet, EEPROM

- **Device list**: 35T, 50T, 75T, 100T
- **Connectors**: 2 x Samtec LSHM
- **SDRAM max**: 512 MB DDR3
- **Flash**: 32 MB
- **Ethernet PHY**: 2 x 100 Mbit
- **Total I/O**: 112 (51 differential pairs + 10 single-ended)
- **Other Features**: JTAG, 100 MHz MEMS oscillator, user LED, single supply

**TE0711 Series**
Xilinx Artix-7, Flash, USB, FTDI USB to UART/FIFO bridge, high pin count

- **Device list**: 35T, 50T, 75T, 100T
- **Connectors**: 3 x Samtec LSHM
- **SDRAM max**: 1 GB DDR3L
- **Flash**: 32 MB
- **EEPROM**: 32 MB
- **Ethernet PHY**: USB2.0 UART/FIFO
- **Total I/O**: 178 (84 differential pairs)
- **Other Features**: 4 LEDs, single supply
TE0712 Series
Xilinx Artix-7, DDR3, Flash, Ethernet, 4 x GTP Transceiver

http://trenz.org/te0712-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>EEPROM</th>
<th>Ethernet PHY</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>35T, 50T, 75T, 100T, 200T</td>
<td>3 x Samtec LSHM</td>
<td>1 GB DDR3</td>
<td>32 MB</td>
<td>MAC Address</td>
<td>100 Mbit</td>
<td>158</td>
<td>4 x GTP</td>
<td>Programmable clock generator, single supply</td>
</tr>
</tbody>
</table>

TE0713 Series
Xilinx Artix-7, DDR3L, Flash, USB3.0 to FIFO Bridge, 4 x GTP Transceiver

http://trenz.org/te0713-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>15T - 200T</td>
<td>3 x Samtec LSHM</td>
<td>1 GB DDR3L</td>
<td>32 MB</td>
<td>USB3.0</td>
<td>152</td>
<td>4 x GTP</td>
<td>Programmable clock generator, single supply</td>
</tr>
</tbody>
</table>
**TE0715 Series**

Xilinx Zynq-7000, DDR3, Flash, Ethernet, USB, 4 High Speed Serial Transceivers

![Zynq UltraScale+](http://trenz.org/te0715-info)

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash max</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-7015, Z-7030, Z-7012S</td>
<td>3 x Samtec LSHM</td>
<td>1 GB DDR3</td>
<td>32 MB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Gbit</td>
<td>USB2.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>132 + 14 MIO</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other Features**
- Programmable clock generator, real time clock, single supply

---

**TE0720 GigaZee Series**

Xilinx Zynq-7000, DDR3, Flash, Ethernet, USB, e.MMC, Automotive Grade available

![Zynq-7000](http://trenz.org/te0720-info)

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>e.MMC max</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-7020, Z-7014S, XA7Z020-1CLG484Q</td>
<td>3 x Samtec LSHM</td>
<td>1 GB DDR3</td>
<td>32 GB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Gbit</td>
<td>USB2.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>152 + 14 MIO</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other Features**
- Real time clock, MAC address, 2k serial EEPROM, 3 user LEDs, single supply

---

**Notes:**
- [Device list](http://trenz.org/te0715-info)
- [Device list](http://trenz.org/te0720-info)

---

**Other Features:**
- Programmable clock generator, real time clock, single supply
- Real time clock, MAC address, 2k serial EEPROM, 3 user LEDs, single supply

---

**Form Factor:**
- 4 x 5 cm
TE0741 Series
Xilinx Kintex-7, Flash, 8 High Speed Serial Transceivers, 25 MHz Oscillator

http://trenz.org/te0741-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>Flash</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>70T, 160T, 325T, 410T</td>
<td>3 x Samtec LSHM</td>
<td>32 MB</td>
<td>144</td>
<td>8 x MGTs</td>
<td>Programmable clock generator, single supply</td>
</tr>
</tbody>
</table>

TE0820 Series
Xilinx Zynq UltraScale+, DDR4, Flash, USB, Ethernet, e.MMC

http://trenz.org/te0820-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Pin Packages</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>e.MMC</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit Transceiver</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZU2CG, ZU5CG, ZU2EG, ZU5EG, ZU4EV, ZU5EV</td>
<td>784</td>
<td>3 x Samtec LSHM</td>
<td>4 GB DDR4</td>
<td>128 MB</td>
<td>8 - 64 GB</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>132 + 14 MIO</td>
<td>4 x PS GTR</td>
</tr>
</tbody>
</table>

http://trenz.org/te0820-info
### TE0821 Series

**Xilinx Zynq UltraScale+, DDR4, Flash, USB, Ethernet, e.MMC, 96 High Density PL I/Os**

<table>
<thead>
<tr>
<th>Device list</th>
<th>Pin Packages</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>e.MMC</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit</th>
<th>Transceiver</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZU2CG - ZU5CG, ZU2EG - ZU5EG, ZU4EV, ZU5EV</td>
<td>784</td>
<td>3 x Samtec LSHM</td>
<td>4 GB DDR4</td>
<td>128 MB</td>
<td>8 - 64 GB</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>34 × HP 96 × HD 14 MIO</td>
<td>4 × PS GTR</td>
<td>GPU/VCU depending on device, programmable clock generator, single supply</td>
<td></td>
</tr>
</tbody>
</table>

**Form factor:** 4 × 5 cm

### TE0823 Series

**Xilinx Zynq UltraScale+ Low Power FPGA, LPDDR4, Flash, USB, Ethernet, e.MMC**

<table>
<thead>
<tr>
<th>Device list</th>
<th>Pin Packages</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>e.MMC</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit</th>
<th>Transceiver</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZU2CG - ZU5CG, ZU2EG - ZU5EG, ZU4EV, ZU5EV</td>
<td>784</td>
<td>3 x Samtec LSHM</td>
<td>2 GB LPDDR4</td>
<td>128 MB</td>
<td>8 - 64 GB</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>132 HP + 14 MIO</td>
<td>4 × PS GTR</td>
<td>GPU/VCU depending on device, programmable clock generator, single supply</td>
<td></td>
</tr>
</tbody>
</table>

**Form factor:** 4 × 5 cm
### TE0841 Series
**Xilinx Kintex UltraScale, DDR4, Flash, 8 x GTH Transceiver**

#### Device list
- KU035, KU040

#### Connectors
- 3 x Samtec LSHM

#### SDRAM max
- 4 GB DDR4

#### Flash
- 64 MB

#### Total I/O
- 60 x HR I/Os
- 84 x HP I/Os

#### GBit Transceivers
- 8 x GTH

#### Other Features
- Programmable clock generator, single supply

---

### TE0724 Series
**Xilinx Zynq-7000, DDR3L, Flash, Ethernet, EEPROM, CAN**

#### Device list
- Z-7010, Z-7020

#### Connectors
- 1 x Samtec ST5

#### SDRAM max
- 1 GB DDR3L

#### Flash max
- 64 MB

#### EEPROM
- MAC Address

#### Ethernet PHY
- 1 Gbit

#### Total I/O
- PL: 80
- PS: 20

#### Other Features
- CAN, single supply
**TE0729 Series**

Xilinx Zynq-7000, DDR3, Flash, 3 x Ethernet, 3 x EEPROM, USB, e.MMC

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>e.MMC</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>EEPROM</th>
<th>Total I/O</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-7020</td>
<td>3 x Samtec LSHM</td>
<td>512 MB DDR3</td>
<td>32 MB</td>
<td>4 - 64 GB</td>
<td>2 x 100 Mbit, 1 Gbit</td>
<td>USB2.0 OTG</td>
<td>2 x MAC address</td>
<td>136 + 14 MIO</td>
<td>Real time clock, single supply</td>
</tr>
</tbody>
</table>

**TE0745 Series**

Xilinx Zynq-7000, DDR3L, Flash, USB, Ethernet, 8 x GTX

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-7030, Z-7035, Z-7045</td>
<td>3 x Samtec ST5</td>
<td>1 GB DDR3L</td>
<td>64 MB</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>250 + 6 MIO</td>
<td>8 x GTX</td>
<td>Real time clock, single supply</td>
</tr>
</tbody>
</table>
**TE0803 "UltraSoM+" Series**  
Xilinx Zynq UltraScale+, DDR4, Flash, 8 High Speed Serial Transceivers

![Diagram](image1)

Device list

<table>
<thead>
<tr>
<th>Device list</th>
<th>Pin Package</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZU2CG - ZU5CG, ZU2EG - ZU5EG, ZU4EV, ZU5EV</td>
<td>C784</td>
<td>4 x Samtec ST5</td>
<td>8 GB DDR4</td>
<td>156</td>
<td>65 MIO</td>
<td>4 x PS GTR, 4 x PL GTH (ZU4 + ZU5 only)</td>
<td>GPU/VCU depending on device, EEPROM, MAC address, programmable clock generator, single supply</td>
</tr>
</tbody>
</table>

---

**TE0807 "UltraSoM+" Series**  
Xilinx Zynq UltraScale+, DDR4, Flash, 20 High Speed Serial Transceivers

![Diagram](image2)

Device list

<table>
<thead>
<tr>
<th>Device list</th>
<th>Pin Package</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZU4CG - ZU7CG, ZU4EG - ZU7EG, ZU4EV - ZU7EV</td>
<td>B900</td>
<td>4 x Samtec ST5</td>
<td>8 GB DDR4</td>
<td>204</td>
<td>65 MIO</td>
<td>4 x GTR, 16 x GTH</td>
<td>GPU and VCU, programmable clock generator, single supply</td>
</tr>
</tbody>
</table>

---

http://trenz.org/te0803-info

http://trenz.org/te0807-info
TE0808 "UltraSoM+" Series

Xilinx Zynq UltraScale+, DDR4, Flash, 20 High Speed Serial Transceivers

Device list | Pin Package | Connectors | SDRAM max | Flash | Total I/O | Gbit Transceivers | Other Features
--- | --- | --- | --- | --- | --- | --- | ---
ZU6CG, ZU9CG, ZU6EG, ZU9EG, ZU15EG | C900 | 4 x Samtec ST5 | 8 GB DDR4 | 128 MB | 204 + 65 MIO | 4 x GTR, 16 x GTH | GPU/VCU depending on device, programmable clock generator, single supply

TE0728 Series

Xilinx Zynq-7000, DDR3, Flash, 2 x Ethernet, CAN, Automotive

Device list | Connectors | SDRAM max | Flash | EEPROM | Ethernet PHY | Total I/O | Other Features
--- | --- | --- | --- | --- | --- | --- | ---
XA7Z020 (automotive FPGA) | 3 x Samtec SEM | 512 MB DDR3 | 16 MB | 8 KByte | 2 x 100 Mbit | 124 + 30 MIO | Automotive, real time clock, CAN, single supply
TE0726 "ZynqBerry" Series
Xilinx Zynq-7000, Form Factor like Raspberry Pi 2, DDR3L, Flash, Ethernet, USB, HDMI

DEVICE LIST

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-7010, Z-7007S</td>
<td>40-pin &quot;HAT&quot; headers</td>
<td>512 MB DDR3L</td>
<td>16 MB</td>
<td>100 Mbit</td>
<td>4 x USB2.0 Host</td>
<td>26</td>
<td>DSI display connector, CSI-2 camera connector, micro SD card slot, 3.5 mm audio plug, HDMI type A</td>
</tr>
</tbody>
</table>

http://trenz.org/te0726-info

TE0835 RFSoC Series
Xilinx Zynq UltraScale+, RFSoC, DDR4, Flash, Ethernet, USB, EEPROM

DEVICE LIST

<table>
<thead>
<tr>
<th>Device list</th>
<th>Pin Packages</th>
<th>Connectors</th>
<th>SDRAM</th>
<th>Flash</th>
<th>Ethernet PHY</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZU25DR, ZU47DR</td>
<td>E1156, speedgrade -1</td>
<td>2 x Samtec ST5</td>
<td>4 x 1 GB DDR4</td>
<td>128 MB</td>
<td>1 x Gbit</td>
<td>40 x V/ 20 LVDS + 32 MIO</td>
<td>8 x GTY, 4 x GTR</td>
<td>USB2.0 OTG, MAC EEPROM</td>
</tr>
</tbody>
</table>

http://trenz.org/te0835-info
TE0723 "ArduZynq" Series
Xilinx Zynq-7000, Form Factor like Arduino Shield, DDR3L, Flash, USB OTG

Device list

<table>
<thead>
<tr>
<th>Connector</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arduino Pmod headers</td>
<td>512 MB DDR3L</td>
<td>16 MB</td>
<td>Micro USB OTG, micro USB, FT2232, JTAG/UART/FIFO</td>
<td>30</td>
<td>Micro SD, on-board USB JTAG and UART</td>
</tr>
</tbody>
</table>

TEF0007 Series
FMC Card with DisplayPort input and output

Device list

<table>
<thead>
<tr>
<th>Connector</th>
<th>Flash</th>
<th>Gbit Transceiver(s)</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPC FMC</td>
<td>32 MB</td>
<td>34 differential (68 single ended)</td>
<td>Data rates up to 5.4 Gbps, sink + source DP connector, 50 MHz oscillator, configurable PLL</td>
</tr>
</tbody>
</table>
The DesignWare® ARC® EM Software Development Platform is a flexible platform for rapid software development on ARC EM processors and subsystems. It is intended to accelerate software development and debug of ARC EM processor-based systems for a wide range of ultra-low power embedded applications such as IoT, sensor fusion, and voice applications. It includes an FPGA-based hardware board with commonly used peripherals and interfaces for extensibility. Downloadable platform packages containing different hardware configurations enable the board to be programmed with different ARC EM processors and subsystems. The packages also contain the necessary software configuration information for the toolchain and embARC Open Software Platform.

The development platform is supported by Synopsys’ MetaWare Development Tool Kit, which includes a compiler, debugger and libraries optimized for maximum performance with minimal code size. The embARC Open Software Platform (OSP), available online from embarc.org, gives developers online access to device drivers, FreeRTOS, middleware and examples that enables them to quickly start software development for their ARC-based embedded systems.

Each hardware configuration includes an ARC EM processor and subsystem with access to 16 MB of PSRAM, 16MB of SPI Flash and a wide range of peripherals such Audio Line In/Out, UART, SPI, I2C, and ADC. A 9-D motion sensor enable fast development of IoT applications. Two digital MEMs micro-phones can also be used for the development of voice applications. The hardware is extensible using the popular Arduino® interface and extension is also possible with Digilent Pmod Interfaces, mikroBUS headers and a 50-pin header. Debug and trace are handled with USB/JTAG interfaces and a NEXUS interface for ARC Real-Time Trace (RTT). The board includes a micro-SD card slot for loading application software.

Key Features

- Xilinx Kintex-7 XC7K325T-2FBG676C
- 32 MByte Quad-SPI Flash memory (for configuration and operation)
- USB-JTAG bridge FT2232H
- FPGA configuration through JTAG and SPI Flash memory
- SPI Flash configuration through JTAG and USB
- Connectors
  - Arduino compatible pin headers
  - MicroBUS compatible pin headers
  - 3 x Pmod compatible pin headers
  - 50 pin header 2.54mm (40 single-ended IO, 20 differential lanes, variable VCCIO)
  - Mictor debug connector
  - 10 pin debug connector 2mm
- 2 x 8 MByte PSRAM
- 32 MByte User Quad-SPI Flash memory
- Micro SDcard Socket
- 3-axis gyroscope, 3-axis accelerometer, 3-axis magnetometer
- Stereo audio codec MAX9880A
- 2 x PDM microphones
- 2 x 3.5mm RCA audio jacks (input/output)
- 100MHz user clock oscillator SIT8008
- Status LEDs, power LED
- 12V sower supply (separately included in the scope of delivery)
- Dimensions: 72.5 x 137 mm
- Article number: TEC0089-02-D2C-1-D

Available at http://trenz-electronic.de/DesignWare_ARC_EM
**TE0782 Series**

Xilinx Zynq-7000, DDR3, Flash, 2 x GBit Ethernet, 2 x USB, e.MMC, 16 x Transceivers

**TE0783 Series**

Xilinx Zynq-7000, Memory on both PS and PL, Flash, Ethernet, USB, e.MMC

---

### Device list

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>e.MMC</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-7035, Z-7045, Z-7100</td>
<td>3 x Samtec QTH</td>
<td>1 GB DDR3</td>
<td>32 MB</td>
<td>4 - 64 GB</td>
<td>2 x 1 Gbit</td>
<td>2 x USB2.0 OTG</td>
<td>250 + 2 MIO</td>
<td>16 x GTX</td>
<td>Programmable clock generator, real time clock, single supply</td>
</tr>
</tbody>
</table>

---

### Device list

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>e.MMC</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-7035, Z-7045, Z-7100</td>
<td>3 x Samtec QTH</td>
<td>1 GB DDR3 32-bit connected to PS plus 2 GB DDR3 64-bit connected to PL</td>
<td>32 MB</td>
<td>4 - 64 GB</td>
<td>1 Gbit</td>
<td>166</td>
<td>16 x GTX 4 x GT</td>
<td>USB2.0 OTG, programmable clock generator, real time clock, single supply</td>
<td></td>
</tr>
</tbody>
</table>
**Device list** | **SDRAM max** | **Flash** | **Ethernet RJ45** | **USB** | **User I/O** | **Audio** | **Other Features**
--- | --- | --- | --- | --- | --- | --- | ---
ZU2CG | 2 GB LPDDR4 | 32 MB | 1 Gbit | USB3.0 Host (type A connector) | 2 Pmod connectors | 3.5 mm jack (PWM output) | EEPROM, USB JTAG/UART microUSB, microSD card, M2 PCIe SSD support, display, power: 5V plug

**TEC0850 CompactPCI Serial Card**

**Xilinx Zynq UltraScale+, 3U Form Factor, DDR4 SODIMM, Flash, Ethernet**

**Device list** | **Form Factor** | **DDR4 SODIMM** | **Flash max** | **USB** | **Total I/O** | **Ethernet Gbps Transceivers** | **Other Features**
--- | --- | --- | --- | --- | --- | --- | ---
ZU15EG, 1156 Pin Packages | 3U | 8 GB (32 GB max) | 512 MB | USB3.0 | 32 x differential pairs | 1 Gbit | 24 on PL side, 4 on PS side, JTAG/UART via MicroUSB, 2 x EEPROM, real time clock, Zynq MPSoC cooling fan connector
**TEC0330 PCIe FMC Carrier**  
Xilinx Virtex-7, FMC HPC, 8 lane PCIe GEN2 card, DDR3 SODIMM Socket

![TEC0330 PCIe FMC Carrier](http://trenz.org/tec0330-info)

**Device list**  
- **SDRAM**: DDR3 SODIMM Socket  
- **Flash**: 32 MB

**Total I/O**
- Up to 202 FPGA I/O pins on FMC connector
- 10 on FMC
- 8 on PCIe lanes

**Gbit Transceivers**
- 13.1 Gbit/s
- FMC High Pin Count (HPC) connector, programmable clock generator

---

**TEF1001 PCIe FMC Carrier**  
Xilinx Kintex-7, FMC HPC, 4 lane PCIe GEN2 card, DDR3 SO-DIMM Socket

![TEF1001 PCIe FMC Carrier](http://trenz.org/tef1001-info)

**Device list**  
- **SDRAM**: 8 GB DDR3 (max) SODIMM Socket  
- **Flash**: 32 MB

**Total I/O**
- 160 on FMC connector
- 4 on FMC
- 4 on PCIe lanes

**Gbit Transceivers**
- Vita 57.1 FMC HPC slot, programmable clock generator, 200 MHz low jitter LVDS oscillator

---

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**TEF1002 PCIe FMC Carrier**

PCIe Carrier for Trenz Electronic 4 x 5 Modules and LPC FMC

---

**Connectors**

- LPC FMC, SFP+, PCIe x1, SATA with pin 7 power configuration for SATA-ACM, RJ45 Gigabit Ethernet, micro USB to JTAG/UART bridge, 2 x 8 LVDS (FireFly), microUSB, microSD card

**Other Features**

- MAX 10 CPLD, 4 x LED, module reset button, 10 x configuration/user dip switch

---

**TEB0912 Series**

Xilinx Zynq UltraScale+ MPSoC with FireFly socket, 4 GB SDRAM on both PL and PS

---

**Device list**

<table>
<thead>
<tr>
<th>Device list</th>
<th>FireFly sockets</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>Ethernet</th>
<th>Header</th>
<th>Connectors</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZU11 - ZU19</td>
<td>4 x to GTY (copper/optical)</td>
<td>4 GB DDR4 64-bit (PS)</td>
<td>128 MB</td>
<td>2 x RJ45</td>
<td>4x IDC for PL HD/LVDS</td>
<td>M2 PCIe SSD, M2 WAN/WLAN slot (PCIe/USB), microSD card (SD 2.0)</td>
<td>Onboard USB JTAG and UART, 2 x Si5395 low jitter PLL, single 12V input</td>
</tr>
<tr>
<td></td>
<td>4 x for custom 8 lane JESD204B ADC</td>
<td>4 GB DDR4 64-bit (PL)</td>
<td></td>
<td>1 Gigabit</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

10.66 x 16.76 cm form factor

12 x 18 cm form factor

---

http://trenz.org/tef1002-info

http://trenz.org/teb0912-info
TRENZ ELECTRONIC DEVELOPMENT BOARDS

TRENZ ELECTRONIC DEVELOPMENT PLATFORM (EDDP)

The EDDP Kit enables rapid, simplified development and evaluation of three-phase motor control applications by providing software, documentation, binary images, editable source code to run on a Xilinx Zynq®-7000 All Programmable SoC along with associated hardware. For the first time ever, the highly parallel and deterministic benefits of FPGA-based motor control, offering up to 30-40x more responsiveness than traditional embedded approaches, is available in a C/C++ development environment. Furthermore, scalability with minimal CPU burden is increasingly differentiating for developers of such systems given the industry rise in demand for multi-axis motion control.

The three main hardware components included in the EDDP Kit are the development board, TEC0053, from Trenz Electronic as the motor driver board, the Arty Z7-10 from Digilent Inc. as the reference controller board, and a three-phase permanent magnet synchronous motor from Anaheim Automation as the reference motor. The main software components are the field oriented motor control algorithm implemented with the Xilinx Vivado Design Suite and the Web UI. To edit the included design or replace with proprietary C/C++ code, users must have access to either a fully licensed seat of Vivado HLx Edition or the no-charge WebPACK Edition. Also required is the SDSoC tool, part of the SDx Development Environment, available for purchase or no cost evaluation from Xilinx. All other resources are available for free download from http://trenz.org/EDDP/.

Key Features

- Development and evaluation of three-phase motor control applications
- Speed and flexibility provided by FPGA-fabric in Xilinx Zynq-7000 All Programmable SoC
- Implementation of a Field Oriented Control Algorithm with Vivado SDSoC™, offloading from processor to embedded
- Available motor control modes consist of speed control and stator current control
- Internet connectivity provided by the Linux operating system running on an ARM processor
- Web UI and Network API for the control of the motor over internet
- Runs on 12V DC power
- Optionally, the power stage can be run from a separate 5V ... 48V DC power supply
- Other assembly options for cost or performance optimization plus high volume prices available on request.

Resources


Support

A support forum especially for this product is accessible at http://trenz.org/EDDPsupport.

TEB0911 UltraRack+ Board

XILINX ZYNQ ULTRASCALE+, 6 FMC SLOTS, GIGABIT ETHERNET

The TEB0911 UltraRack+ board is integrating a Xilinx Zynq UltraScale+ MPSoC with 2 x 64 MByte Flash memory for configuration and operation, DDR4-SDRAM SO-DIMM socket with 64-bit wide data bus, 22 MGT lanes and powerful switch-mode power supplies for all on-board voltages. The TEB0911 board exposes the pins of the Zynq MPSoC to accessible connectors and provides a whole range of on-board components to test and evaluate the Zynq UltraScale+ MPSoC and for developing purposes. The board is capable to be fitted to an enclosure, whereby on the enclosure's rear and front panel, I/O's, LVDS-pairs and MGT lanes are accessible through 6 on-board FMC connectors and other standard high-speed interfaces, namely USB3, SFP+, GbE, etc.

- Xilinx Zynq UltraScale+ MPSoC
  - 1156 Pin Package
  - Assembly options: ZU6, ZU9, ZU15
- 64-bit DDR4 SODIMM (PS connected)
- M2 PCIe SSD (1-Lane)
- e.MMC (bootable)
- 2 x 64 MByte Dual QSPI Flash (bootable)
- System controller (LCMXO2-7000HC)
  - Power sequencing
  - IO expander
- Configurable PLLs
  - GTH/GTP reference CLKs

Front Panel

- 4 x FMC
  - 4 GTH per FMC
  - 68 ZynqMP PL IO per FMC
- DisplayPort (2-lanes)
- RJ45 ETH + dual USB3 combo
- Dual Stack SFP+
- SD (bootable)
- Status LEDs

Back Panel

- 2 x FMC
  - 4/2 GTH
  - 12 ZynqMP PL IO per FMC
- 56 SC IO
- USB JTAG/UART ZynqMP
- USB JTAG/GPIO FMC
- CAN FD (DB9 connector)
- SMA (external CLK)
- 5-pin 24V power connector

Additional Information

- 40.6 x 23.43 cm board size
- Other assembly options for cost or performance optimization plus high volume prices available on request.

http://trenz.org/teb0911-info
EDDP Motor Control Kit

The EDDP Kit enables rapid, simplified development and evaluation of three-phase motor control applications by providing software, documentation, binary images, editable source code to run on a Xilinx Zynq®-7000 All Programmable SoC along with associated hardware. For the first time ever, the highly parallel and deterministic benefits of FPGA-based motor control, offering up to 30-40x more responsiveness than traditional embedded approaches, is available in a C/C++ development environment. Furthermore, scalability with minimal CPU burden is increasingly differentiating for developers of such systems given the industry rise in demand for multi-axis motion control.

The three main hardware components included in the EDDP Kit are the development board, TEC0053, from Trenz Electronic as the motor driver board, the Arty Z7-10 from Digilent Inc. as the reference controller board, and a three-phase permanent magnet synchronous motor from Anaheim Automation as the reference motor. The main software components are the field oriented motor control algorithm implemented with the Xilinx Vivado Design Suite and the Web UI. To edit the included design or replace with proprietary C/C++ code, users must have access to either a fully licensed seat of Vivado HLx Edition or the no-charge WebPACK Edition. Also required is the SDSoC tool, part of the SDx Development Environment, available for purchase or no cost evaluation from Xilinx. All other resources are available for free download from http://trenz.org/EDDP/.

Key Features

- Development and evaluation of three-phase motor control applications
- Speed and flexibility provided by FPGA-fabric in Xilinx Zynq-7000 All Programmable SoC
- Implementation of a Field Oriented Control Algorithm with Vivado SDSoC™, offloading from processor to embedded
- Available motor control modes consist of speed control and stator current control
- Internet connectivity provided by the Linux operating system running on an ARM processor
- Web UI and Network API for the control of the motor over internet
- Runs on 12V DC power
- Optionally, the power stage can be run from a separate 5V … 48V DC power supply

Other assembly options for cost or performance optimization plus high volume prices available on request.

Resources
trenz.org/EDDP/ - including a Quick Start Guide, User Manual for the EDDP Kit and the EDPS motor driver board, block diagram, design database and technical specifications.

Support
A support forum especially for this product is accessible at http://trenz.org/EDDPsupport.
TEI0001 "MAX1000" and TEI0003 "CYC1000" Series
Arduino MKR Standard 2.5 x 6.15 cm

Resources http://trenz.org/tei0001-info

"MAX1000" IoT/Maker board, TEI0001 series, MAX 10 10M08SAU169C8G or 10M16SAU169C8G FPGA, 8/16 kLE, 8 to 32 MByte SDRAM (max. 64 MByte), 8 MByte Flash, USB programmer onboard, JTAG and UART over Micro USB2.0 connector, ADC 8 x 12 Bit, 12 MHz oscillator, optional MEMS oscillator, optional Pmod headers, supply USB/pins, 2 switches, 8 configurable and 2 status LEDs, power can be supplied as 5V from the USB port or via a separate pin.

CR00010 CRUVI Series
Intel MAX 10 CRUVI Carrier, SDRAM, Flash, USB

Resources http://trenz.org/tei0003-info

"CYC1000", TEI0003 series, Cyclone 10CL025YU256 C8G FPGA, 25 kLE, optional 10CL006, 10CL010, 10CL016, 8 MByte SDRAM, 2 MByte Flash, 21 I/O Arduino MKR compatible headers, JTAG and UART over Micro USB2 connector, LIS3DH 3-axis accelerometer, 2 x 14-pin headers providing 23 GPIOs, 1 x 3-pin header providing 2 GPIOs, Pmod: 2 x 6-pin support, 8 configurable and 2 status LEDs, user push button, 5V single power supply with onboard voltage regulators

Device list

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>Total I/O</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>10M08SAU169C8G</td>
<td>CRUVI (1 x HS, 1 x LS), 2 x 34 Pin Header</td>
<td>8 MB</td>
<td>8 MB</td>
<td>24 + 32</td>
<td>USB2.0, user push buttons and LED</td>
</tr>
</tbody>
</table>

http://trenz.org/cr00010-info
TEF0008 Series
FMC Card with four SFP+ 10 GBit Ports based on VITA 57.1 FMC HPC Standard

http://trenz.org/tef0008-info

It is intended for use on a FMC HPC carrier and can not be used stand-alone.

Device list

<table>
<thead>
<tr>
<th>Connector</th>
<th>Dimension</th>
<th>SFP+</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel MAX 10 10M08SAU169C8G</td>
<td>69 x 84 mm, SFP+ connector excluded (+ 5.5 mm)</td>
<td>4 SFP+ 10 Gbit ports for fiber optical SFP modules</td>
<td>Low-jitter programmable clock generator, 3.3V to 1.8V DC/DC converter, 128 Kbit EEPROM, status LED (green)</td>
</tr>
</tbody>
</table>

TEI0009 C10LP RefKit Development Board
Intel Cyclone 10 LP, Integrated USB Programmer2, 2 x 10/100 Ethernet, USB2.0

http://trenz.org/tei0009-info

Device list

<table>
<thead>
<tr>
<th>Connectors</th>
<th>SDRAM max</th>
<th>User Flash QSPI</th>
<th>HyperRAM max</th>
<th>Flash max</th>
<th>Ethernet PHY</th>
<th>USB</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclone 10 LP 10CL055YU484C8G 55 KLE in 484-pin</td>
<td>QSE (for LVDS), Pmod, Arduino, SMA</td>
<td>512 Mbit</td>
<td>Up to 512 Mbit</td>
<td>128 Mbit</td>
<td>32 Mbit</td>
<td>2 x 10/100</td>
<td>USB2.0</td>
</tr>
</tbody>
</table>
TEC0810 CompactPCI Serial Card
for Trenz Electronic modules TE0803, TE0807 and TE0808, 3U Form Factor

http://trenz.org/tec0810-info

<table>
<thead>
<tr>
<th>System controller</th>
<th>Front side interface connectors</th>
<th>EEPROM</th>
<th>Rear I/O</th>
<th>GTR/GTH</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel MAX 10</td>
<td>1 Gbit Ethernet, 3 x RS485 receiver (DSUB-9), microUSB to JTAG/UART bridge, 4 x status LEDs</td>
<td>128 Kbit</td>
<td>(32 + 16) x differential pairs on J6 and J5 backplane connectors</td>
<td>GTR and GTH of the module are not accessible</td>
<td>125 MHz LVDS oscillator, LVCMOS output 25-MHz oscillator, 2 x 4-bit DIP switch, coin cell battery holder, microSD card socket</td>
</tr>
</tbody>
</table>

TEI0180 Series
Intel Agilex F-Series, DDR4 SODIMM Memory Socket, Flash, Intel MAX 10 Controller

http://trenz.org/tei0180-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Pin Package</th>
<th>Connectors</th>
<th>DDR4 SODIMM</th>
<th>Flash</th>
<th>System Controller</th>
<th>Transceivers</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel Agilex F-Series AGFA014R24A3E3VR0</td>
<td>R24A 2486</td>
<td>2 x 400 pin Samtec</td>
<td>4 x</td>
<td>512 MB</td>
<td>Intel MAX 10</td>
<td>16 + 24</td>
<td>PLL clock generator, optional (with Agilex including HPS): 1 Gbit ETH-PHY, 8 GByte e.MMC, USB2.0 PHY</td>
</tr>
</tbody>
</table>
**TE0810 CompactPCI Serial Card**

for Trenz Electronic modules TE0803, TE0807 and TE0808, 3U Form Factor

- System controller
- Front side interface connectors
- EEPROM
- Rear I/O
- GTR/GTH

**Other Features**

Intel MAX 10
1 Gbit Ethernet, 3 x RS485 receiver (DSUB-9), microUSB to JTAG/UART bridge, 4 x status LEDs
128 Kbit (32+16) x differential pairs on J6 and J5 backplane connectors
GTR and GTH of the module are not accessible
125 MHz LVDS oscillator, LVCMOS output
25-MHz oscillator, 2 x 4-bit DIP switch, coin cell battery holder, microSD card socket

**Intel Agilex F-Series, DDR4 SODIMM Memory Socket, Flash, Intel MAX 10 Controller**

**Device list**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Package</th>
<th>Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDR4</td>
<td>SODIMM</td>
<td>2 x 400 pin</td>
</tr>
<tr>
<td>Flash</td>
<td>System Controller</td>
<td>Intel MAX 10</td>
</tr>
<tr>
<td>Transceivers</td>
<td>Other Features</td>
<td>PLL clock generator, optional (with Agilex including HPS): 1 Gbit ETH-PHY, 8 GByte e.MMC, USB2.0 PHY</td>
</tr>
</tbody>
</table>

**TEL0001 "LXO2000" Series**

Lattice X02 FPGA, Arduino MKR Standard, on-board USB/JTAG and USB/serial

http://trenz.org/tel0001-info

**Device list**

<table>
<thead>
<tr>
<th>On-Board</th>
<th>Total I/O</th>
<th>Clock Oscillator</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>X02-4000</td>
<td>USB/JTAG, USB/serial</td>
<td>22 on MKR header, 2 I/O on additional header, optional Pmod header + 8</td>
<td>100 MHz MEMS, 8 LEDs, 2 push buttons, supply: USB or 5V from pin header, RC-networks</td>
</tr>
</tbody>
</table>

**TE0876 IceZero Series**

Lattice ICE40HX, Raspberry Pi HAT compatible, SRAM, Flash, Open-Source

http://trenz.org/te0876-info

**Device list**

<table>
<thead>
<tr>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lattice ICE40</td>
<td>4 2x6-pin Pmod connectors (no default)</td>
<td>4 Mbit external SRAM</td>
<td>100 MHz user clock, 3 user LED, supported by fully open source FPGA toolchain, fast FPGA configuration from Raspberry Pi, full FPGA design flow on Raspberry Pi (all open source)</td>
</tr>
</tbody>
</table>
## TEM0001 "SMF2000" Series
Microsemi SmartFusion 2, Arduino MKR Standard, SDRAM, Flash, UART/JTAG

![Image](http://trenz.org/smf2000-info)

**Device list**  
**SDRAM**  
**Flash**  
**Clocks**  
**JTAG/UART**  
**Total I/O**  
**Other Features**  

| M2S010-VFG400 | 8 MB | 8 MB | 25 MHz system clock  
| 32.768 KHz auxiliary clock | microUSB2.0 connector | 31 (8 I/O 1 x Pmod header, 23 I/O 2 x 14-pin header) | 1 x 3-pin header for LiveProbes, 9 user LEDs, 1 user push button |

## TEM0005 Series
Microsemi SmartFusion 2 SoC, DDR3, Flash, Ethernet, EEPROM

![Image](http://trenz.org/tem0005-info)

**Device list**  
**Connectors**  
**SDRAM max**  
**Flash**  
**Ethernet PHY**  
**Total I/O**  
**Other Features**  

| M2S010, supports up to M2S050 | 1 x Samtec ST5  
| 160 pin | 8 Gb DDR3, optional DDR3L | 32 MB | 100 Mbps | 105 | Optional crypto authentication device, serial EEPROM for MAC address, power supply monitor |
TEM0007 Series
Microsemi PolarFire Multi-Core RISC-V SoC FPGA, LPDDR4, Flash, Ethernet, EEPROM

http://trenz.org/tem0007-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Pin Package</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>Ethernet</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPFS250T-1</td>
<td>FCVG484I</td>
<td>3 x Samtec LSHM</td>
<td>1 GB LPDDR4</td>
<td>64 MB</td>
<td>1 Gbit</td>
<td>EEPROM MAC address, USB2.0</td>
</tr>
</tbody>
</table>

TEM0008 Series
Microsemi PolarFire Multi-Core RISC-V SoC FPGA, LPDDR4, Flash, Ethernet, USB

http://trenz.org/tem0008-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Pin Package</th>
<th>Connectors</th>
<th>SDRAM max</th>
<th>Flash</th>
<th>Ethernet</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPFS250T-1</td>
<td>FCVG484I</td>
<td>2 x Samtec ADM6</td>
<td>1 GB LPDDR4</td>
<td>64 MB</td>
<td>1 Gbit</td>
<td>EEPROM MAC address, USB2.0</td>
</tr>
</tbody>
</table>
TEM0002 SmartBerry Series
Microsemi M2S010, DDR3, Ethernet PHY with RJ45 MagJack

http://trenz.org/tem0002-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>SDRAM</th>
<th>Ethernet</th>
<th>Total I/O</th>
<th>Connectors</th>
<th>on-board</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsemi M2S010-VFG400</td>
<td>265 MB DDR3</td>
<td>1 Gbit Ethernet PHY with RJ45 MagJack</td>
<td>Raspberry Pi compatible header with 26 I/O + I2C</td>
<td>MicroSD card socket, 4 Pmod headers</td>
<td>USB/JTAG USB/serial</td>
<td>2 push buttons</td>
</tr>
</tbody>
</table>

TE0790 XMOD FTDI JTAG Adapter
XMOD Form Factor, FT2232H, Lattice X02-256 CPLD

Comes in two versions
a) compatible with Xilinx tools (TE0790-0x) or
b) not compatible with Xilinx tools (TE0790-0xL), for independent use

http://trenz.org/te0790-info

<table>
<thead>
<tr>
<th>Device</th>
<th>Form Factor</th>
<th>FT2232H</th>
<th>Total I/O</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lattice X02-256 CPLD</td>
<td>XMOD, M3 mounting hole</td>
<td>Mini USB connector, channel B RX/TX LEDs, EEPROM</td>
<td>8 universal I/O pins</td>
<td>Step down DCDC converter for optional power supply via USB-power, 4 position DIP switch</td>
</tr>
</tbody>
</table>
TEI0004 FPGA USB-Programmer2 JTAG (Arrow)
For Development with Intel FPGAs, 2.54 mm Header

http://trenz.org/tei0004-info

<table>
<thead>
<tr>
<th>Supported by</th>
<th>JTAG Connector</th>
<th>USB</th>
<th>Voltage levels</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel Quartus programmer</td>
<td>Standard 2 x 5-pin header</td>
<td>MicroUSB connector</td>
<td>1.8V - 3.3V</td>
<td>Additional support for UART, red activity LED, green power-on LED</td>
</tr>
</tbody>
</table>

TEI0005 FPGA USB-Programmer2 SMD Module
FT2232H based JTAG Programmer, Surface-Mount module

http://trenz.org/tei0005-info

<table>
<thead>
<tr>
<th>Device list</th>
<th>Supported</th>
<th>Powered</th>
<th>Compatible</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTDI FT2232H USB2.0 interface</td>
<td>by Intel Quartus (JTAG mode only)</td>
<td>via USB</td>
<td>SMT pick and place assembly process</td>
<td>Additional UART Channel available, activity LEDs, UART interface available, two I/O pins reserved for future use</td>
</tr>
</tbody>
</table>
The carrier boards are baseboards for 4 x 5 SoMs, which exposes the modules B2B-connector-pins to accessible connectors and provides a whole range of on-board components to test and evaluate Trenz Electronic 4 x 5 SoMs.

**TE0701**
- Overvoltage-, undervoltage- and reversed- supply-voltage-protection
- Barrel jack for 12V power supply
- Carrier Board System-Controller CPLD
- Mini CameraLink connector
- RJ45 Gigabit Ethernet MagJack
- FPGA Mezzanine Card (FMC-LPC) connector
- USB JTAG- and UART interface with Mini-USB connector
- HDMI transmitter with HDMI connector
- 8 x user LEDs, 2 x user push buttons, 2 x DIP switch
- Pmod connectors, Micro SD card socket and Micro-USB interface

**TE0703**
- 2 x VG96 connectors (mounting holes and solder pads)
- SDIO port expander with voltage-level translation
- Micro SD card socket
- 4 x user LEDs, 1 x user-push button, 2 x user configurable DIP switches
- Mini USB connector (USB JTAG and UART interface)
- RJ45 Gigabit Ethernet socket with 4 integrated LED’s.
- USB host connector
- Barrel jack for 5V power supply input
- DCDC step-down converter for 3.3V power supply
- USB JTAG and UART interface

**TE0705**
TE0705 is a “downgraded” version of TE0701. As little as possible has been changed in functionality except the functionality that was removed.
- Changes from TE0701
  - Pmod connectors changed to IDC headers
  - HDMI removed
  - CL connector removed
  - USB connector position changed
  - 5 pin header support added on both USB interfaces
  - 12V DC power input connector changed to different type
  - FMC connector removed and replaced by two dual row 100 mil pin headers

**TE0706**
- VG96 connector and 50-pin IDC male connector socket
- SDIO port expander with voltage-level translation
- Micro SD card socket and a USB type A connector
- One user push button, user configurable DIP switch
- Two RJ45 Gigabit Ethernet MagJack
- One Ethernet PHY
- Barrel jack for 5 V power supply input
- DCDC step- down converter for 3.3V power supply
- JTAG pins on 12-pin header
- Three VCCIO selection jumper

**TEBA0841**
Mainly for the use with TE0841 and TE0741 modules.
- XMOD (TE0790) pin header
- SFP connector
- Micro USB
- One pin header 16 pol. (JTAG, MGT-CLK, boot mode, RST, I/Os)
- One pin header 10 pol. (SD I/Os)
- Two pin headers 50 pol. (FPGA bank I/Os and power)
- One pin header for FPGA bank power VCCIOA and 1 x for VCCIOD
- LDO voltage regulator 3.3V to 2.5V
- Two user LEDs (red/green)

[http://trenz.org/te-baseboards](http://trenz.org/te-baseboards)
Trenz Electronic Carrier Boards
for modules with different form factors

Following carrier boards for specific Trenz Electronic SoMs, which exposes the module's B2B-connector-pins to accessible connectors and provides a whole range of on-board components to test and evaluate Trenz Electronic SoMs.

**TEBF0808**
- Mini-ITX form factor
- ATX power supply connector (12V only supply required)
- Optional 12V standard power plug
- USB3.0 with USB3.0 HUB
- FMC HPC slot (1.8V max VCCIO)
- MicroSD card (bootable) and eMMC (bootable)
- PCIe slot - one PCIe lane (16 lane connector)
- Fan connectors, PC enclosure, FMC fan
- Intel front panel- and HDA audio-connector
- CAN FD transceiver (10 pin IDC connector)
- Displayport Single Lane
- One SATA Connector
- Dual SFP+
- Gigabit Ethernet RJ45
- One Samtec FireFly (4 GT lanes bidir)
- One Samtec FireFly connector for reverse loopback
- 20 pins ARM JTAG connector (PS JTAG0)
- Size: 170 mm × 170 mm

**TEB0728**
- Trenz TE0728 module socket (3 x Samtec SEM connectors 80 pins)
- Two RJ45 Ethernet socket
- Micro SD card socket
- Barrel Jack for 5V power supply
- 3 x user LEDs (red/yellow/green)
- One user push button

**TEB0729**
- Trenz TE0729 module socket (2 x Samtec BTE/BSE connectors 120 pins)
- 5V board supply via DC jack
- Three RJ45 Ethernet sockets
- One MicroUSB and one SD card connector
- One 128K I2C CMOS Serial EEPROM
- One 2K I2C Serial EEPROM
- XMOD (TE0790) pin header
- Two pin header FPGA bank power supply
- One VBat pin header and two VG96 pin header
- One user push button, one LED (red), user switch FPGA boot mode

**TEB0745**
- Trenz Electronic TE0745 module socket (3 x Samtec ST5 connectors 160 pins)
- 24V power supply over ARK960/2 connecting terminal
- XMOD (TE0790) Pin Header (JTAG / UART)
- One EMU Network Filter
- MicroSD connector
- RJ45 Ethernet connector
- USB Host connector
- Eight SFP connector
- Six pin header 50 pol. (FPGA bank I/O and power)
- Six pin header 12 pol. (FPGA bank I/O and power)

**TEBA0714**
- Trenz Electronic TE0714 module socket (2 x Samtec LSHM connectors 100 pins)
- XMOD (TE0790) pin header
- Two pin headers 50 pol. (FPGA bank I/O and power)
- SFP connector
- LDO voltage regulator 3.3V to 2.5V
- Two user LEDs (red/green) and one LED (red)
- One pin header 16 pol. (JTAG, MGT-CLK, boot mode, XADC, I/O's)
- One pin header 10 pol. (I/O)
- One pin header for FPGA bank power VCCIO34
- FMC HPC slot (1.8V max VCCIO)
- One pin header for FPGA bank power V_CFG (1.8 VOUT, 2.5V, 3.3 VOUT)

http://trenz.org/te-baseboards
Trenz Electronic Starter Kits
Pre-assembled and ready-to-use

In general our Starter Kits contain a Trenz Electronic micromodule with a pre-assembled heat sink mounted on a Trenz Electronic baseboard. The TE08xx series modules are build in a black Core V1 Mini-ITX Enclosure. All this provided with a fitting power supply including different adapters, a micro SD card, a USB cable plus screws and bolts. Different module variants can be integrated on request.

<table>
<thead>
<tr>
<th></th>
<th>Starter Kit 720</th>
<th>Starter Kit 729</th>
<th>Starter Kit 803</th>
<th>Starter Kit 807</th>
<th>Starter Kit 808</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module</strong></td>
<td>TE0720</td>
<td>TE0729</td>
<td>TE0803</td>
<td>TE0807</td>
<td>TE0808</td>
</tr>
<tr>
<td><strong>FPGA</strong></td>
<td>Xilinx Zynq-7020</td>
<td>Xilinx Zynq-7020</td>
<td>Xilinx Zynq UltraScale+</td>
<td>Xilinx Zynq UltraScale+</td>
<td>Xilinx Zynq UltraScale+</td>
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<tr>
<td><strong>Baseboard</strong></td>
<td>TE0703</td>
<td>TEB0729</td>
<td>TEBF0808</td>
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<tr>
<td><strong>Enclosure</strong></td>
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<td>-</td>
<td>Core V1 Mini-ITX</td>
<td>Core V1 Mini-ITX</td>
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<tr>
<td><strong>Power Supply</strong></td>
<td>Universal power supply unit</td>
<td>Universal power supply unit</td>
<td>Be Quiet! 400W ATX Power Supply</td>
<td>Be Quiet! 400W ATX Power Supply</td>
<td>Be Quiet! 400W ATX Power Supply</td>
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<tr>
<td><strong>Heat Sink</strong></td>
<td>Heat sink for TE0720, spring-loaded embedded</td>
<td>KK0729-02TE TE custom built</td>
<td>BGA Heat sink</td>
<td>SuperGRIP/MaxiFLOW Heat sink</td>
<td>BGA Heat sink</td>
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<tr>
<td><strong>USB Cable</strong></td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td><strong>MicroSD Card</strong></td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td><strong>Screws &amp; Bolts</strong></td>
<td>✓</td>
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<td>✓</td>
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</table>
We are offering different customized cooling solutions for a selection of modules. Please ask for special solutions at sales@trenz-electronic.de.

Available cooling solutions

<table>
<thead>
<tr>
<th>Module</th>
<th>Trenz Electronic Article Numbers</th>
<th>Cooling Solution</th>
</tr>
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<tbody>
<tr>
<td>TE0600</td>
<td></td>
<td>26920</td>
</tr>
<tr>
<td>TE0710</td>
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<td>26925</td>
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<td>TE0712</td>
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<td>TE0713</td>
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<td>TE0714</td>
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<td>KK0714-02</td>
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<td>TE0715</td>
<td></td>
<td>26923</td>
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<td>TE0720</td>
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<td>26922</td>
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<td>TE0729</td>
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<td>KK0729-02TE</td>
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<tr>
<td>TE0741</td>
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<td>26921</td>
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<tr>
<td>TE0745</td>
<td></td>
<td>KK0745-02</td>
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<tr>
<td>TE0803</td>
<td></td>
<td>KK0803-03A, KK0803-04, 29665</td>
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<td>TE0807</td>
<td></td>
<td>KK0807-02A</td>
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<tr>
<td>TE0808</td>
<td></td>
<td>KK0808-03, KK0808-05, 30137, 29664 (REV05 only)</td>
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<tr>
<td>TE0820</td>
<td></td>
<td>28606</td>
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<td>TE0821</td>
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<td>28606</td>
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<td>TE0823</td>
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<td>TE0841</td>
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<td>TEB0911</td>
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<td>25130</td>
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<td>TEF1001</td>
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</tr>
<tr>
<td>Heat Spreader Extension</td>
<td></td>
<td>KK0001-01</td>
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</table>

In general our Starter Kits contain a Trenz Electronic micromodule with a pre-assembled heat sink mounted on a Trenz Electronic baseboard. The TE08xx series modules are build in a black Core V1 Mini-ITX Enclosure. All this provided with fitting power supply including different adapters, a micro SD card, a USB cable plus screws and bolts. Different module variants can be integrated on request. Photo shows similar product.
## Module series comparison table
for Trenz Electronic Modules

<table>
<thead>
<tr>
<th>Device family</th>
<th>Device list</th>
<th>Form Factor/size [cm]</th>
<th>Connectors</th>
<th>Programmable logic family</th>
<th>Processing system</th>
<th>SDRAM [MiByte] max</th>
<th>Flash [MiByte]</th>
<th>EEPROM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AM0010</strong></td>
<td>Zynq UltraScale+</td>
<td>ZU2CG-ZUCG, ZU2EG-ZUEG, ZUEV-ZUSEV</td>
<td>4 x 5.6</td>
<td>2 x Samtec ADM6</td>
<td>UltraScale+</td>
<td>Up to 4 x Cortex A53 + 2 x Cortex R5</td>
<td>8192 DDR4 64-bit (PS) with ECC</td>
<td>128</td>
</tr>
<tr>
<td><strong>TE0710</strong></td>
<td>Artix-7</td>
<td>3ST, 5ST, 7ST, 10ST</td>
<td>4 x 5</td>
<td>2 x Samtec LSHM</td>
<td>Artix-7</td>
<td>MicroBlaze</td>
<td>512 DDR3</td>
<td>32</td>
</tr>
<tr>
<td><strong>TE0711</strong></td>
<td>Artix-7</td>
<td>3ST, 5ST, 7ST, 10ST</td>
<td>4 x 5</td>
<td>2 x Samtec LSHM</td>
<td>Artix-7</td>
<td>MicroBlaze</td>
<td>-</td>
<td>32</td>
</tr>
<tr>
<td><strong>TE0712</strong></td>
<td>Artix-7</td>
<td>3ST, 5ST, 7ST, 10ST, 20ST</td>
<td>4 x 5</td>
<td>3 x Samtec LSHM</td>
<td>Artix-7</td>
<td>MicroBlaze</td>
<td>1024 DDR3</td>
<td>32</td>
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<tr>
<td><strong>TE0713</strong></td>
<td>Artix-7</td>
<td>1ST - 20ST</td>
<td>4 x 5</td>
<td>3 x Samtec LSHM</td>
<td>Artix-7</td>
<td>MicroBlaze</td>
<td>1024 DDR3L</td>
<td>32</td>
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<tr>
<td><strong>TE0714</strong></td>
<td>Artix-7</td>
<td>1ST, 3ST, 5ST</td>
<td>4 x 3</td>
<td>2 x Samtec LSHM</td>
<td>Artix-7</td>
<td>MicroBlaze</td>
<td>-</td>
<td>16</td>
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<tr>
<td><strong>TE0715</strong></td>
<td>Zynq-7000</td>
<td>Z-7015, Z-7030</td>
<td>4 x 5</td>
<td>3 x Samtec LSHM</td>
<td>Z-7015: Artix-7</td>
<td>Zynq UltraScale+</td>
<td>Z-7015: 2 x Cortex A9</td>
<td>1024 DDR3</td>
</tr>
<tr>
<td><strong>TE0716</strong></td>
<td>Zynq-7000</td>
<td>Z-7020</td>
<td>4.5 x 6.5</td>
<td>2 x FCI Bergstok</td>
<td>Artix-7</td>
<td>MicroBlaze</td>
<td>1024 DDR3L</td>
<td>32</td>
</tr>
<tr>
<td><strong>TE0717</strong></td>
<td>Spartan-7</td>
<td>S6, S15, S25, S50</td>
<td>2.5 x 3.5</td>
<td>1 x Samtec LSHM</td>
<td>Spartan-7</td>
<td>MicroBlaze</td>
<td>-</td>
<td>8</td>
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<tr>
<td><strong>TE0718</strong></td>
<td>Zynq-7000</td>
<td>Z-7020</td>
<td>4 x 5</td>
<td>3 x Samtec LSHM</td>
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<td>Spartan-7</td>
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<td>32</td>
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<tr>
<td><strong>TE0724</strong></td>
<td>Zynq-7000</td>
<td>Z-7010, Z-7020</td>
<td>6 x 4</td>
<td>1 x Samtec ST5</td>
<td>Artix-7</td>
<td>Spartan-7</td>
<td>1024 DDR3L</td>
<td>64</td>
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<tr>
<td><strong>TE0728</strong></td>
<td>Zynq-7000</td>
<td>Z-7020 (automotive)</td>
<td>6 x 6</td>
<td>3 x Samtec SEM</td>
<td>Artix-7</td>
<td>Spartan-7</td>
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<tr>
<td><strong>TE0729</strong></td>
<td>Zynq-7000</td>
<td>Z-7020</td>
<td>5.2 x 7.6</td>
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<td>Spartan-7</td>
<td>512 DDR3</td>
<td>32</td>
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<tr>
<td><strong>TE0741</strong></td>
<td>Kintex-7</td>
<td>7ST, 16ST, 32ST, 41ST</td>
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<td>3 x Samtec LSHM</td>
<td>Kintex-7</td>
<td>MicroBlaze</td>
<td>-</td>
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<tr>
<td><strong>TE0745</strong></td>
<td>Zynq-7000</td>
<td>Z-7030, Z-7035, Z-7045</td>
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<td>3 x Samtec ST5</td>
<td>Artix-7</td>
<td>Spartan-7</td>
<td>1024 DDR3L</td>
<td>64</td>
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<td><strong>TE0782</strong></td>
<td>Zynq-7000</td>
<td>Z-7035, Z-7045, Z-1000</td>
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<td>3 x Samtec OTH</td>
<td>Spartan-7</td>
<td>Spartan-7</td>
<td>1024 DDR3</td>
<td>32</td>
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<td><strong>TE0783</strong></td>
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<td>Z-7035, Z-7045, Z-1000</td>
<td>8.5 x 8.5</td>
<td>3 x Samtec OTH</td>
<td>Spartan-7</td>
<td>Spartan-7</td>
<td>1024 DDR4 32-bit (PL) 2024 DDR4 64-bit (PS)</td>
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<tr>
<td><strong>TE0803</strong></td>
<td>Zynq UltraScale+</td>
<td>ZU2CG-ZUCG, ZU2EG-ZUEG, ZUEV-ZUSEV</td>
<td>5.2 x 7.6</td>
<td>4 x Samtec ST5</td>
<td>UltraScale+</td>
<td>UltraScale+</td>
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<td>128</td>
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<tr>
<td><strong>TE0806</strong></td>
<td>Zynq UltraScale+</td>
<td>ZU4, ZU5, ZU7, ZU9, ZU15, ZU17, ZU19, ZU21</td>
<td>5.5 x 7.6</td>
<td>2 x Samtec ADM6</td>
<td>UltraScale+</td>
<td>UltraScale+</td>
<td>8192 DDR4 64-bit (PS) with ECC 4096 DDR4 32-bit (PL)</td>
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<tr>
<td><strong>TE0807</strong></td>
<td>Zynq UltraScale+</td>
<td>ZU4EG-ZU7EG, ZU9EG-ZU19EG, ZU21EG-ZU31EG</td>
<td>5.2 x 7.6</td>
<td>4 x Samtec ST5</td>
<td>UltraScale+</td>
<td>UltraScale+</td>
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<td>128</td>
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<tr>
<td><strong>TE0808</strong></td>
<td>Zynq UltraScale+</td>
<td>ZU6EG, ZU9EG, ZU15EG, ZU21EG</td>
<td>5.2 x 7.6</td>
<td>4 x Samtec ST5</td>
<td>UltraScale+</td>
<td>UltraScale+</td>
<td>8192 DDR4</td>
<td>128</td>
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<tr>
<td><strong>TE0812</strong></td>
<td>Zynq UltraScale+</td>
<td>ZU6</td>
<td>9 x 9</td>
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<td>UltraScale+</td>
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<td>3 x Samtec LSHM</td>
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<td>UltraScale+</td>
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<td>3 x Samtec LSHM</td>
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<td>UltraScale+</td>
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<td>128</td>
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<td>UltraScale+</td>
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<td>Zynq UltraScale+</td>
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<td>UltraScale+</td>
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<td>UltraScale+</td>
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<td>128</td>
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<td><strong>TE0841</strong></td>
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<td>3 x Samtec LSHM</td>
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<td>UltraScale+</td>
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<td>UltraScale+</td>
<td>UltraScale+</td>
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<td>16384 DDR4 64-bit (PS) 8192 DDR4 64-bit (PL)</td>
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<td><strong>TEB0912</strong></td>
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<td>Firefly sockets</td>
<td>UltraScale+</td>
<td>UltraScale+</td>
<td>4096 DDR4 (PS) 4096 DDR4 (PL)</td>
<td>2 x 64</td>
</tr>
</tbody>
</table>

* notice: new modules (TE0813/817/818) with improved connectors - Samtec ADM6 - will be available in the UltraSoM+ product family
<table>
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<tr>
<th>e.MMC</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit Transceiver</th>
<th>Other Features</th>
</tr>
</thead>
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<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>192</td>
<td>4 x GTR, 4 x GTH</td>
<td>GPU/VCU depending on device, security controller, crypto authentication</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>2 x 100 Mbit</td>
<td>112</td>
<td>-</td>
<td>Single supply</td>
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<tr>
<td>-</td>
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<td>USB2.0 UART/FIFO</td>
<td>170</td>
<td>-</td>
<td>Single supply</td>
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<td>-</td>
<td>100 Mbit</td>
<td>-</td>
<td>158</td>
<td>4 x GTP</td>
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<tr>
<td>-</td>
<td>-</td>
<td>USB3.0</td>
<td>152</td>
<td>4 x GTP</td>
<td>Programmable clock generator, single supply</td>
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<td>-</td>
<td>144</td>
<td>4 x GTX</td>
<td>Differential MEMS osc, for MGT clocking, XADC analog input, GT reference clock input, single supply</td>
</tr>
<tr>
<td>-</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>132 + 14 MIO</td>
<td>2-7015: 4 x GTX 2-7030: 4 x GTX</td>
<td>Programmable clock generator, real time clock, single supply</td>
</tr>
<tr>
<td>-</td>
<td>1 Gbit</td>
<td>USB2.0</td>
<td>120 x 16 MIO</td>
<td>2 x PS MIOs</td>
<td>On board 16 x 12-bit low power SAR ADCs to up to 2 MSPS, low power oscillators, USB2.0 to UART/JTAG interface, single supply</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>72 HR</td>
<td>-</td>
<td>HyperRAM, 100 MHz clock oscillator, red and green LED, single supply</td>
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<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>144</td>
<td>8 x GTX</td>
<td>Programmable clock generator, single supply</td>
</tr>
<tr>
<td>4 - 64 GByte</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>152 + 14 MIO</td>
<td>-</td>
<td>Real time clock, single supply, automotive grad available</td>
</tr>
<tr>
<td>-</td>
<td>1 Gbit</td>
<td>-</td>
<td>PL: 80 PS: 20</td>
<td>-</td>
<td>CAN, single supply</td>
</tr>
<tr>
<td>-</td>
<td>2 x 100 Mbit</td>
<td>-</td>
<td>124 + 34 MIO</td>
<td>-</td>
<td>Automotive, real time clock, CAN, single supply</td>
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<tr>
<td>4 - 64 GByte</td>
<td>2 x 100 Mbit, 1 Gbit</td>
<td>USB2.0 OTG</td>
<td>136 + 14 MIO</td>
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<td>Real time clock, single supply</td>
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<td>-</td>
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<td>-</td>
<td>144</td>
<td>8 x GTX</td>
<td>Programmable clock generator, single supply</td>
</tr>
<tr>
<td>-</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>250 + 6 MIO</td>
<td>8 x GTX</td>
<td>Real time clock, single supply</td>
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<tr>
<td>4 - 64 GByte</td>
<td>2 x 1 Gbit</td>
<td>2 x USB2.0 OTG</td>
<td>250 + 2 MIO</td>
<td>16 x GTX</td>
<td>Programmable clock generator, real time clock, single supply</td>
</tr>
<tr>
<td>4 - 64 GByte</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>166 + 12 MIO + 40 CPLD muxed ID</td>
<td>16 x GTX</td>
<td>Programmable clock generator, real time clock, single supply</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>156 + 65 MIO</td>
<td>4 x GTR</td>
<td>GPU/VCU depending on device, programmable clock generator, single supply</td>
</tr>
<tr>
<td>4-64 GByte</td>
<td>2 x 1 Gbit</td>
<td>USB2.0 OTG</td>
<td>48 PI HD + 52 PL HD, 14 MIOs + I/O</td>
<td>4 x GTR, 16 x ETH</td>
<td>GPU/VCU depending on device, transceiver clock in/output, single 5-12V power required</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>204 + 65 MIO</td>
<td>4 x GTR, 16 x GTH</td>
<td>GPU/VCU depending on device, programmable clock generator, single supply</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>204 + 65 MIO</td>
<td>4 x GTR, 16 x GTH</td>
<td>GPU/VCU depending on device, programmable clock generator, single supply</td>
</tr>
<tr>
<td>2 x 128 GByte</td>
<td>2x RAM1 (1x Debug) 100 Mbit for SC</td>
<td>-</td>
<td>127</td>
<td>16 (12 x PL, 4 x PS)</td>
<td>2 x 4 MByte SRAM, on-board Virtex VA41630, 2 x analog input, UART, 2 x CAN, FIPS1/FIPS2, 1x I/O, 12V power supply</td>
</tr>
<tr>
<td>8 - 64 GByte</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>132 + 14 MIO</td>
<td>4 x GTR (PS)</td>
<td>GPU/VCU depending on device, programmable clock generator, real-time clock, single supply</td>
</tr>
<tr>
<td>8 - 64 GByte</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>34 HP 96 HD + 14 MIO</td>
<td>4 x GTR (PS)</td>
<td>GPU/VCU depending on device, programmable clock generator, single supply</td>
</tr>
<tr>
<td>8 - 64 GByte</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>132 HP + 14 MIO</td>
<td>4 x GTR (PS)</td>
<td>GPU/VCU depending on device, programmable clock generator, single supply</td>
</tr>
<tr>
<td>64 GByte</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>32 (15 diff.)</td>
<td>12 x GPO</td>
<td>SC CPLD Intel MAX10 &amp; Xilinx Zynq7C7010 on-board, interface: PCIe SMB, PCIe up to 48 lane, 4 x USB2.0, 1 x USB 3.0, 2 x UART, 1 x I2C SMB, 3 x I2C, DDI, SATA</td>
</tr>
<tr>
<td>-</td>
<td>1 Gbit</td>
<td>USB2.0 OTG</td>
<td>132 + 14 MIO</td>
<td>4 x GTR (PS)</td>
<td>Programmable clock generator, real time clock, single supply</td>
</tr>
<tr>
<td>-</td>
<td>1 Gbit</td>
<td>-</td>
<td>144</td>
<td>8 x GTH</td>
<td>Programmable clock generator, single supply</td>
</tr>
<tr>
<td>8 GByte</td>
<td>1 Gbit</td>
<td>USB2.0</td>
<td>350</td>
<td>32 x GTH, 16 x GTY, 4 x GTR</td>
<td>12V single supply</td>
</tr>
<tr>
<td>8 GByte</td>
<td>1 Gbit</td>
<td>USB2.0</td>
<td>408</td>
<td>22 x GTH</td>
<td>Active heat sink, GPU/VCU depending on device, M2 PCIe SSD, system controller; DisplayPort, RJ45 ETH + Dual USB3 Combo, Dual Stack SFP+, SD (bootable), USB JTAG/UART ZynqMP, USB JTAG/GPO PMC, CAN FD (DSI Connector), SMA (internal CLK), 5-pair 24 V power connector</td>
</tr>
<tr>
<td>-</td>
<td>2 x Gbit</td>
<td>USB2.0</td>
<td>184</td>
<td>32 x GTH, 16 x GTY</td>
<td>4 x I2C for PL, HD I2C/UDS, M2 PCIe SSD, M2 WAN/WLAN slot (PCIe/USB), on-board USB JTAG and UART, CAN, real time clock, single supply</td>
</tr>
</tbody>
</table>
**Device family**

<table>
<thead>
<tr>
<th>Device family</th>
<th>Device list</th>
<th>Form Factor/size [cm]</th>
<th>Connectors</th>
<th>Programmable logic family</th>
<th>Processing system (HW/SW)</th>
<th>SDRAM [MByte] max</th>
<th>Flash [MByte]</th>
<th>EEPROM</th>
<th>EEPROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR00010</td>
<td>MAX 10</td>
<td>10M08</td>
<td>4.48 x 5.6</td>
<td>CRUVI (1 x HS, 1 x LS)</td>
<td>MAX 10</td>
<td>-/+</td>
<td>8</td>
<td>8</td>
<td>Config.</td>
</tr>
<tr>
<td>TEI0001</td>
<td>MAX 10</td>
<td>10M08</td>
<td>2.5 x 6.15</td>
<td>-</td>
<td>MAX 10</td>
<td>-/+</td>
<td>8-64</td>
<td>8</td>
<td>Config.</td>
</tr>
<tr>
<td>TEI0003</td>
<td>Cyclone 10 LP</td>
<td>10CL025, 10CL006, 10CL016, 10CL016</td>
<td>2.5 x 6.15</td>
<td>-</td>
<td>Cyclone 10 LP</td>
<td>-/+</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>TEI0006</td>
<td>Cyclone 10 GX</td>
<td>10CX220, 10CX150, 10CX105</td>
<td>6 x 8</td>
<td>3 x Samtec ST5</td>
<td>Cyclone 10 GX</td>
<td>-/+</td>
<td>20/4 DDR3</td>
<td>256</td>
<td>2 Kbit</td>
</tr>
<tr>
<td>TEI0009</td>
<td>Cyclone 10 LP</td>
<td>10CL055</td>
<td>9.5 x 11</td>
<td>-</td>
<td>Cyclone 10 LP</td>
<td>-/+</td>
<td>64</td>
<td>64</td>
<td>2 x MAC</td>
</tr>
<tr>
<td>TEI0010</td>
<td>MAX 10</td>
<td>10M08</td>
<td>2.5 x 6.15</td>
<td>-</td>
<td>MAX 10</td>
<td>-/+</td>
<td>8</td>
<td>8</td>
<td>Config.</td>
</tr>
<tr>
<td>TEI0022</td>
<td>Cyclone V</td>
<td>SC5EMAS01S1C8N</td>
<td>13 x 16</td>
<td>-</td>
<td>Cyclone V</td>
<td>+/-</td>
<td>1024 DDR3</td>
<td>32</td>
<td>2 Kbit</td>
</tr>
<tr>
<td>TEI0100</td>
<td>Agilex F</td>
<td>AGFA014R224A3V90</td>
<td>16 x 16, COM</td>
<td>-</td>
<td>Agilex F</td>
<td>optional+</td>
<td>4 x SDIMM DDR4</td>
<td>512</td>
<td>optional</td>
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</tbody>
</table>

**Device list**

<table>
<thead>
<tr>
<th>Device list</th>
<th>Connectors</th>
<th>SDRAM</th>
<th>Flash</th>
<th>Ethernet</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclone 10 GX</td>
<td>3 x Samtec ST5</td>
<td>2 GB DDR3</td>
<td>256 MB</td>
<td>1 Gbit</td>
<td>Intel MAX 10 as power sequencer, EEPROM, 4 LEDs, 5V input voltage</td>
</tr>
</tbody>
</table>

**TEI0006 Series**

Intel Cyclone 10 GX SoM, DDR3, Flash, Ethernet, MAX 10 as power sequencer

http://trenz.org/tei0006-info
## Module series comparison table for Trenz Electronic Modules

<table>
<thead>
<tr>
<th>Device family</th>
<th>Device list</th>
<th>Form Factor/size [cm]</th>
<th>Connectors</th>
<th>Programmable logic family</th>
<th>Processing system (HW/SW)</th>
<th>SDRAM [MByte] max</th>
<th>Flash [MByte]</th>
<th>EEPROM</th>
<th>e.MMC</th>
<th>Ethernet PHY</th>
<th>USB PHY</th>
<th>Total I/O</th>
<th>Gbit Transceiver</th>
<th>Other Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR00010</td>
<td>MAX 10</td>
<td>4.48 x 5.6</td>
<td>CRUVI (1 x HS, 1 x LS)</td>
<td>2 x 34 pin header</td>
<td>+/−</td>
<td>8</td>
<td>8</td>
<td>−</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>8</td>
<td>User Push Buttons and LED</td>
</tr>
<tr>
<td>EPI0001</td>
<td>MAX 10</td>
<td>2.5 x 6.15</td>
<td>−</td>
<td>+/−</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>−</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>−</td>
</tr>
<tr>
<td>EPI0003</td>
<td>Cyclone 10 LP</td>
<td>2.5 x 6.15</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>2</td>
<td>2</td>
<td>−</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>3-axis accelerometer, Pmod: 2 x 6 pin support, 8 user LED, 1 user push button, single supply</td>
</tr>
<tr>
<td>EPI0006</td>
<td>Cyclone 10 GX</td>
<td>6 x 8</td>
<td>3 x Samtec ST5</td>
<td>2024 DDR3</td>
<td>−/−</td>
<td>256</td>
<td>2 Kbit</td>
<td>1 Gbit</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>Intel MAX 10 as system controller (CPLD), programmable oscillator, single supply, baseboard available</td>
</tr>
<tr>
<td>EPI0009</td>
<td>MAX 10</td>
<td>2.5 x 6.15</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>64</td>
<td>64</td>
<td>−</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>Up to 128 MByte HyperRAM, integrated USB Programmer, Arduino and Pmod compatible pin headers, Grove connector, D-Sub connector for VGA, SMA connectors, 7-segment display</td>
</tr>
<tr>
<td>TEI0006</td>
<td>Cyclone 10 LP</td>
<td>9.5 x 11</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>−</td>
<td>2 x MAC address</td>
<td>−</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>3-axis accelerometer, fully calibrated single-chip temperature sensor, smoke detector, USB/JTAG programmer, single supply</td>
</tr>
<tr>
<td>TEI0010</td>
<td>MAX 10</td>
<td>2.5 x 6.15</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>8</td>
<td>8</td>
<td>−</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>−/−</td>
<td>3-axis accelerometer, Pmod: 2 x 6 pin support, 8 user LED, 1 user push button, single supply</td>
</tr>
<tr>
<td>TEI0022</td>
<td>Cyclone V</td>
<td>13 x 16</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>1024 DDR3 (HPS)</td>
<td>32 for HPS</td>
<td>32 for FPGA</td>
<td>32 (Pmod), 72 (FMC)</td>
<td>−</td>
<td>−/−</td>
<td>−/−</td>
<td>Intel MAX 10 as system controller, Intel MAX 10 for board management, Connectors: LPC FMC, 4 x Pmod, JTAG, UART via microUSB B (for FPGA&amp;HPS), SD card, HDMI, 12V input supply voltage</td>
<td></td>
</tr>
<tr>
<td>TEIB0006</td>
<td>Development Carrier Board for Trenz Electronic's TEI0006 FPGA Module</td>
<td>12 x 15 cm</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
</tbody>
</table>

### TEI0006 Key Features

**RAM/Storage**
- EEPROM

**On Board**
- 3 x LEDs (power, 2 x user)
- 3 x I/O expanders
- 3 x push buttons (2 x user, system controller config)
- DIP switch

**Interface**
- 2 x SFP connectors
- 3 x Samtec ST5 B2B connectors
- FMC HPC connector (10 x transceiver, 34 x LVDS on LA, 10 x LVDS on HA), VADJ = 1.8V
- Gigabit Ethernet connector
- USB2.0 - microUSB (JTAG/UART)
- USB3.0 - type C

**Power**
- 12V input voltage

[http://trenz.org/tei0006-info](http://trenz.org/tei0006-info)
Sundance VCS-1
Vision, Control and Sensors, the all in one control system for precision robotics.

The Sundance VCS system is a PC/104 Linux stack that is ideally suited to controlling all forms of high precision robotics. It is comprised of two main components, namely the EMC2 board which is a PCIe/104 OneBank™ carrier for a Trenz Electronic compatible SoC Module and the FM191 expansion card that fans out the I/Os from the SoC to the outside world.

A Xilinx Zynq® MPSoC is the heart of the VCS-1 and provides 64-bit processor scalability while combining real-time control with soft and hard engines for graphics, video, waveform, and FPGA acceleration, using a Trenz Electronic TE0820 SoM.

The versatility of the VCS system is derived from the modular concept of the SoM processing element on a PC/104 board, combined with a separate I/O Module. This gives it plenty of ADC, DAC, I/O and expansion possibilities with PC/104 options.

Sundance Lynsyn Lite
Power measurement utility board for Xilinx, Nvidia and Raspberry Pi systems

- Using the Lynsyn Lite to measure the power usage of each section of source code in a system is simple and the results are both detailed and precise.
- 3 sensors that measure both current and voltage.
- Correlates power measurements with source code by sampling program counters over JTAG.
- Up to 10kHz sampling frequency.
- JTAG sampling supports ARM Cortex A cores (currently A9, A53 and A57).
Sundance SMT-FMC311
2-Channel DAQ Module - Low-Pin-Count

For the ADC the SMT-FMC311 includes a single TI ADC3244 device. This is a dual 14-bit ADC able to sample from 15 up to 125MSPS. It has a maximum power dissipation of 325mW (typically 233mW). SNR is typically around 72dBFS and SFDR around 90dBc.

On the DAC side the module has a single Analog Devices AD9747 device. This is a dual 16-bit DAC able to operate from 0 up to 250MSPS. Power dissipation is 355mW maximum (typically 310mW). SFDR is around 82dBc.

Analog input connectors are either SMA or SSMC. If SMA is selected, then only the ADC and DAC connections are available on the module itself. Access to the triggers and clocks is via underside mounted MMCX connectors. A mezzanine board is available that converts from MMCX to SMA.

- VITA57.1 FMC-LPCTM (subset, no MGT) mezzanine.
- One dual channel ADC.
- One dual channel DAC.
- PLL clock synthesizer.
- External clock and trigger inputs.

TULIP Project Book
Available to purchase now

The focus of the Tulp project was the development of high-performance, energy-efficient embedded systems for the growing range of increasingly complex image processing applications. This book is the final outcome of the project and highlights the benefits of using a Xilinx Zynq® MPSoC for Edge-AI, Robotics and Vision system.

A key objective of Tulp was to carve out a path towards increased reuse and collaboration within industrial high-performance embedded image processing in Europe. This is not a simple task as future gains, such as those achieved through reuse and collaboration, are typically secondary to the immediate concern of getting products to the market.

- Discusses the development of high-performance, energy-efficient embedded systems for the growing range of increasingly complex image processing applications
- Covers the hardware architecture of embedded image processing systems, novel methods, tools and libraries for programming those systems as well as embedded operating systems to manage those systems
- Demonstrates results with several challenging applications, such as medical systems, robotics, drones and automotive

To purchase a copy: https://bit.ly/Tulipp_Zynq_Book
Full details of the project: www.tulipp.eu
Ndigo6G-12 - versatile pulse acquisition platform

The Ndigo6G-12 offers 6.4 Gsps sample rate, 12 bits resolution and a greatly improved readout rate of 6.0 GB/s.

The Ndigo6G-12 is a hybrid ADC/TDC-solution for the acquisition of short pulses. It builds on the established platform of the Ndigo5G-10, but takes it to the next level in both, performance and flexibility. The Ndigo6G-12 is particularly well-suited for time of flight applications like LIDAR or TOF mass spectrometry. Pulse arrival times can be measured with an accuracy down to 5 ps in combination with information on pulse shape such as area or amplitude. Four channels at 1.6 Gsps with 12 Bits resolution can be recorded independently or combined to two or one channel(s) with higher dynamic range or up to 6.4 Gsps. The Ndigo6G-12 comprises, in addition, four TDC channels with a resolution of 13 ps.

Zero suppression
Detect pulses above a certain threshold and only acquire the relevant data to massively reduce the amount of data that needs to be copied and analysed.

Configurable DC offset
When acquiring unipolar pulses, shift the baseline to the edge of the ADC range to double your dynamic range.

Flexible utility functions
A multitude of useful details help you to create a highly integrated setup with a minimum of external components. Using the integrated TiGer timing pattern generator can provide digital pulse patterns to control your experiment or internal triggers. Use gate and veto functions with our gating logic. This also works across channels or from the additional digital input with a flexible trigger matrix.

Streaming architecture
The buffers of the Ndigo6G-12 are only limited by the size of your PC’s main memory. Data is streamed at a rate of 6.0 GByte/s concurrently to data acquisition. There is no dead time and latency is minimized.
**TimeTagger - low cost, mid resolution time-to-digital converter**

If a resolution of 500ps is insufficient, the TimeTagger4G can replace our high end TDCs at a lower cost.

**Time to digital converter**
cronologic has a wide series of high performance time to digital converters (TDC) with resolutions starting at 3ps. The current lineup contains boards with up to 10 channels.

cronologic presents an exiting series of low cost, mid resolution time-to-digital converters. The boards feature 500ps to 1ns single shot resolution at a high readout bandwidth.

Time Taggers are ideally suitable in applications that do not require highest single shot timing resolution, but high data acquisition rates and lowest multiple hit deadtime. These include certain types of mass spectroscopy (TOF-MS), time correlated single photon counting (TCSPC) and frequency counting applications.

The TimeTagger4-1G features a bin size of 1 ns. The TimeTagger4-2G provides a bin size of 500 ps.

**Low cost**
The TimeTagger4 is available at the lowest cost, while still providing picosecond resolution.

**Bipolar**
The threshold discriminators can use positive or negative threshold with configurable voltage. This allows you to use the xTDC with a wide range of detectors or constant fraction discriminators (CFD).

**TiGer timing generator**
All inputs can also be used to output periodic pulse patterns to control your setup. The exact timing of these is measured by the TDC.

### TimeTagger - Data

<table>
<thead>
<tr>
<th>Optimized for</th>
<th>low cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDC channels @ bin size</td>
<td>4 @500 ps</td>
</tr>
<tr>
<td>Connectors</td>
<td>5x LEMO 00</td>
</tr>
<tr>
<td>Bin size</td>
<td>500 ps</td>
</tr>
<tr>
<td>Double pulse resolution</td>
<td>1 ns</td>
</tr>
<tr>
<td>Multihit</td>
<td>1000x per start event</td>
</tr>
<tr>
<td>Dead time between groups</td>
<td>none</td>
</tr>
<tr>
<td>Resolution</td>
<td>12 bits</td>
</tr>
<tr>
<td>Readout rate</td>
<td>48 MHits/s</td>
</tr>
<tr>
<td>Maximum bandwidth</td>
<td>TBD</td>
</tr>
<tr>
<td>Range</td>
<td>8 ms, 2.147 s extended</td>
</tr>
<tr>
<td>Common start/stop</td>
<td>yes / no</td>
</tr>
<tr>
<td>Readout interface</td>
<td>PCIe x1</td>
</tr>
<tr>
<td>Time base</td>
<td>50 ppb on board</td>
</tr>
</tbody>
</table>
Ndigo Crate

With the Ndigo Crate it is possible to use up to 8 PCIe boards with a PC. The connection of the external chassis to the PC happens over PCIe 2 x16 for a full duplex bandwidth of 2x 8 GByte/s.

The enclosure was specifically designed to operate multiple synchronized cronologic digitizer boards to create a high speed data acquisition system. It can also be used to house other DAQ cards, GPUs for high performance computing, storage adapters or networking equipment.

The extension is fully transparent. The operating system can't distinguish between boards in the PCIe expansion box and boards inside the PC itself. No drivers are required.

The slot covers are on the front side of the enclosure to easily see status information and plug in cables during operation.

The crate is delivered as a set with cable and PC link board.

<table>
<thead>
<tr>
<th>Facts</th>
<th>Crate</th>
<th>Crate-3</th>
<th>Crate-5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connection to Host</strong></td>
<td>PCIe 2.0 x16</td>
<td>PCIe 2.0 x16</td>
<td>PCIe 2.0 x16</td>
</tr>
<tr>
<td><strong>Bandwidth to Host</strong></td>
<td>8 GByte/s</td>
<td>8 GByte/s</td>
<td>8 GByte/s</td>
</tr>
<tr>
<td><strong>Performance relative to 10Gbps Thunderbolt link</strong></td>
<td>8x</td>
<td>8x</td>
<td>8x</td>
</tr>
<tr>
<td>PCIe3 x16 slots with 8 lanes</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PCIe3 x16 slots with 4 lanes</td>
<td>-</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PCIe2 x16 slots with 4 lanes</td>
<td>8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PCI slots 5V, 32 Bit, 33MHz</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>PCI slots 3V, 32 Bit, 66MHz</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td><strong>Availability</strong></td>
<td>now</td>
<td>now</td>
<td>now</td>
</tr>
<tr>
<td><strong>Cable and link boards</strong></td>
<td>included</td>
<td>included</td>
<td>included</td>
</tr>
<tr>
<td><strong>Cable Length</strong></td>
<td>3 meters (1m, 2m and 5m upon request)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
With the Ndigo Crate it is possible to use up to 8 PCIe boards with a PC. The connection of the external chassis to the PC happens over PCIe 2 x16 for a full duplex bandwidth of 2x 8 GByte/s. The enclosure was specifically designed to operate multiple synchronized cronologic digitizer boards to create a high speed data acquisition system. It can also be used to house other DAQ cards, GPUs for high performance computing, storage adapters or networking equipment. The extension is fully transparent. The operating system can't distinguish between boards in the PCIe expansion box and boards inside the PC itself. No drivers are required. The slot covers are on the front side of the enclosure to easily see status information and plug in cables during operation.

The crate is delivered as a set with cable and PC link board.

**Facts**

<table>
<thead>
<tr>
<th>Crate</th>
<th>Crate-3</th>
<th>Crate-5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connection to Host</strong></td>
<td>PCIe 2.0 x16</td>
<td>PCIe 2.0 x16</td>
</tr>
<tr>
<td><strong>Bandwidth to Host</strong></td>
<td>8 GByte/s</td>
<td>8 GByte/s</td>
</tr>
<tr>
<td><strong>Performance relative to 10Gbps Thunderbolt link</strong></td>
<td>8x</td>
<td>8x</td>
</tr>
<tr>
<td><strong>PCIe3 x16 slots with 8 lanes</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>PCIe3 x16 slots with 4 lanes</strong></td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td><strong>PCIe2 x16 slots with 4 lanes</strong></td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td><strong>PCI slots 5V, 32 Bit, 33MHz</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>PCI slots 3V, 32 Bit, 66MHz</strong></td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td><strong>Availability</strong></td>
<td>now</td>
<td>now</td>
</tr>
<tr>
<td><strong>Cable and link boards</strong></td>
<td>included</td>
<td>included</td>
</tr>
<tr>
<td><strong>Cable Length</strong></td>
<td>3 meters (1m, 2m and 5m upon request)</td>
<td>-</td>
</tr>
</tbody>
</table>

Trenz Electronic SMD In-house Production
Full SMT production since 2014, smallest SMD part 01005

- Full SMT production since 2014
- Smallest SMD part 01005
- Two Myronic MY700 (direct solder printing)
- Inline PCB feeder Myronic MY300 and MY100, pick and place
- Myronic automatic SMD storage system
- Myronic VI Technology 5K 3D (AOI)
- Two IBL vapor phase ovens
- Two PI series 3D SPI (Solder Paste Inspection)
- PCB cleaning system (ÖKO 1000)
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