MLE 1000 Series Rapid Prototyping System

Versatile and compact system design and verification platform for multimedia and embedded systems, mobile internet devices (MID), electronic control units (ECU) and industrial control systems -- ready-to-run!

Overview and Technology

The Missing Link Electronics 1000 series rapid prototyping system (RPS) gives you an early copy of the target hardware running your target software. This facilitates architectural exploration at the electronic system level and enables concurrent design and live testing of hardware, software and diagnostic functions. It also reduces risk and test time during system integration. The RPS is a complete development system comprising flexible “soft” hardware and stable off-the-shelf software components.

At the hardware level, field programmable gate-array (FPGA) technology with one or more embedded CPUs is coupled with a wide array of connectivity channels. This ensures sufficient parallel signal processing power and a high degree of flexibility to connect other system components through Ethernet, USB, Bluetooth, WiFi, Controller Area Network (CAN), general purpose I/O channels (GPIO) and more. The embedded CPUs connect to DDR RAM, flash memory and peripheral hardware blocks allowing effective emulation of broad ranges of micro-controllers.

At the software level, you can pick from different operating systems such as OSEK-OS, AUTOSAR-OS, or Linux. Or we support you in porting your operating system. The RPS for Linux comprises a full Linux kernel – with or without real-time extensions such as Xenomai - and MLE customized device drivers that provide application level control of the provided connectivity channels out-of-the-box. It includes many ready-to-run software packages: different file systems, TCP/IP networking, X11, window managers, multimedia components and ftp/http/SSL web services. Many more off-the-shelf applications can easily be added via standard 3rd party SW development flows or the MLE Linux package builder tool. This allows you to focus on building your software application, fast.

Benefits and Use Cases

The Missing Link Electronics 1000 series rapid prototyping system is ready-to-run. All components are integrated, pre-installed and tested which reduces time-to-market and increases productivity for your prototyping projects. Typical use cases include:

- **Electronic Control Unit Prototyping**
  - The RPS clones your micro-controller with CAN or other standard connectivity and runs your ECU program for software and system-level testing.
  - As a light-weight appliance with automotive compliant 12V DC power supply field testing is possible. Use as Vehicle Communication Interface (VCI) for automotive and aerospace diagnostics and test.
  - In system testing one or more MLE 1000 RPS appliances can be used as system drivers (exercisers) and/or monitors (analyzers).

- **Custom Signal Acquisition and Datalogging**
  - Acquisition of analog or digital signals using high-speed general purpose I/O channels. Fast signal analysis and processing can be done inside FPGA hardware.
  - Store measurements in various formats while operating stand-alone or connected to PC.
  - The acquired data can be accessed remotely for example by adding a web server and web-based interface.

- **Embedded System Design with Linux**
  - Embedded system software can be quickly booted and tried using the provided development and debug tools.
  - The GNU-based native build environment is complemented by the MLE Linux package builder tool which supports multiple target CPU architectures.

- **IP Core Design and Test**
  - Integrate IP cores into the MLE 1000 and test them including device tree and application software using Linux as a powerful testbench.

- **Linux-based Industrial PC (IPC)**
  - Build your own cost-efficient custom IPC which supports TCP/IP networking and industry standard connectivity.
  - Gain full control of your hardware bill-of-materials and source code of all vital software.
  - Jump-start your system design with optionally available production license for PCB, FPGA and board support packages.
MLE 1000 Series Rapid Prototyping System

Hardware Platform

- **Physical Dimensions**
  - 210 mm (8.2") x 160 mm (6.3") x 30 mm (1.2")
- **Power Supply**
  - Onboard 7V to 32V DC (power consumption <15W)
  - 2nd 5V DC via WAGO-connector or standard PC power
  - 110V to 240V AC (external converter included)
- **Programmable clock generator**
  - CPLD: 144 macrocells, 5ns pin-to-pin delay
  - 128 MB DDR 400 RAM @ CL3
  - 512 Mbit NOR flash RAM
  - Push-push microSD card holder

Micro-controller Architecture Example

- **CPU**: PowerPC 405
  - 50MHz to 400 MHz (step-wise adjustable)
  - 16kB instruction + 16kB data cache
  - APU interface for custom co-processors
- **Other microcontroller architectures optional**
- **FPGA**
  - MLE1020: 19224 LCs, 8540 slices, 1224k bit BRAM
  - MLE1040: 41904 LCs, 18624 slices, 2592k bit BRAM
  - MLE1060: 56880 LCs, 25280 slices, 4176k bit BRAM
- **SoC reference design**
  - DDR and flash memory controller
  - Several IP cores for PowerPC PLB /OPB
  - OPB wrapper for OpenCores
  - Xilinx EDK compatible
- **System Features**
  - Power-up / power-down, hibernate (optional)
  - CAN / LIN wake-up
  - 8 system configuration partitions
  - Hardware watchdog with heartbeat

Connectivity Channels

- **Configuration and Debug**
  - USB-to-JTAG bridge via FTDI
  - Xilinx Programmer JTAG
  - UART RS232 console
- **Standard Interfaces**
  - Ethernet 10/100 via RJ45
  - 4x USB 2.0 Host Full-speed
  - Xilinx RocketIO e.g. for Serial ATA
  - Inter-Integrated Circuit (IIC / SMBus)
  - SPI e.g. for microSD card memory
- **Optional Interfaces (via add-on USB modules)**
  - Bluetooth (OBEX, PAN, HFP 1.5, A2DP)
  - WLAN as NIC
  - WLAN Access Point
  - UMTS / 3G Mobile Data
- **Automotive Interfaces**
  - CAN high-speed (TJA1041)
  - CAN low-speed (TJA1054)
  - LIN (TJA1020)
- **Audio**
  - Line-in, AUX in, Mic in, Line-out, Head phone out
  - S/PDIF via TOSLINK (optionally per request)
- **Video**
  - Touch-screen TFT via LVDS
  - DVI-D, resolution VGA to UXGA
- **General Purpose I/O Interfaces**
  - 16 LVDS, 45 PWM capable single-ended GPIO
  - Plus JTAG, IIC, and power for expansion header

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System Boot

- ELF Loader
  - Starts PowerPC ELF executables from on-chip BRAM
- DENX U-Boot for flexible system startup
  - Boots system images from on-board flash memory, USB flash memory drive, microSD card, network (TFTP), etc.
- Intelligent system configuration management with integrated hardware watchdog and heartbeat
  - 8 boot partitions each for: FPGA config, boot and OS
  - Controllable from Linux runtime environment
  - Usable for system recovery or multi-user configurations

Development Tools

- FPGA design flow with Xilinx EDK and ISE
  - Integrate custom IP core for hardware acceleration or signal processing (e.g. from MATLAB/SimuLink)
- Embedded Software IDE
  - Text-based or graphical (Eclipse per request)
  - GNU compiler tool chain version 4.2.2
  - Debugging, performance and memory leak analysis, etc
- Linux distribution assembly tool
  - Debian-style Linux package management system
  - Over 500 packages supported
  - Expandable to import 3rd party and open source packages
  - Cross-compilation concept for fast re-targetting
  - Supports virtual prototyping with emulator (QEMU)
  - On-site and remote engineering services
- Design Support and Engineering Services
  - Specialization in parallel systems design and test
  - Extensive background in advanced FPGA design
  - Embedded Linux development

RPS for Linux

- Ported vanilla Linux kernel 2.6.26
  - 3rd party Linux from MontaVista, WindRiver, etc optional
- Linux board-support package (Linux kernel modules)
  - TFT and DVI drivers for 800 x 600 pixel display
  - ALSA audio driver for on-board AC'97 stereo sound
  - Ethernet 10/100 driver for Xilinx TEMAC
  - USB Driver with u-dev hotplug
  - CAN, (LIN per request), SPI, IIC drivers
  - Memory Technology Device for on-board flash memory
  - General-purpose I/O for custom expansion header
  - RS232 console I/O
- Linux Root File System
  - Basic Linux multimedia reference system
  - USB memory stick, microSD card, network file system v3
- File system
  - Ext2, Ext3, JFFS2, XFS, ReiserFS, CRAMFS, etc.
  - Networking support
    - Wired or wireless, remote access, internet access, web, email, chat, routing
    - TCP/IP , SSH, SSL, IPSec, NFSv3, VLAN, WLAN
  - Graphics support
    - X11 Windows, TWM or Matchbox window manager
  - Bluetooth connectivity via add-on module
    - OBEX, PAN, HFP 1.5, A2DP
  - Over 500 application SW packages ready-to-run

MLE 1000 Series Availability

The supported CPU architectures enjoy support by many other operating systems such as QNX, OSEK, etc. Board support packages and drivers can be made available upon request.

- RPS for Linux: MLE1020L, MLE1040L, MLE1060L
- RPS for OSEK: MLE1020O
- RPS for AUTOSAR: MLE1040A

Company Information

For more information, or to request datasheets please contact our sales representative:

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Missing Link Electronics is a technology company which addresses the growing Electronic System Level verification and validation gap by developing and marketing prototyping and testing solutions complemented by professional design and verification services.

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