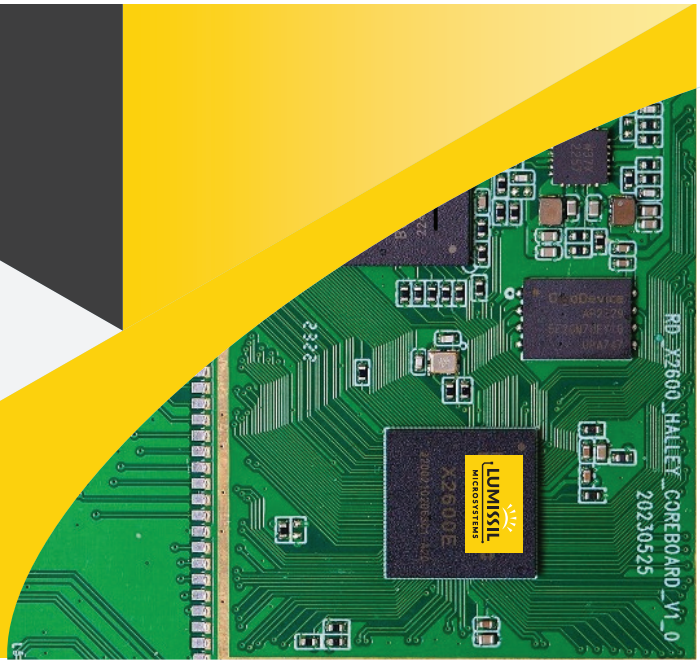
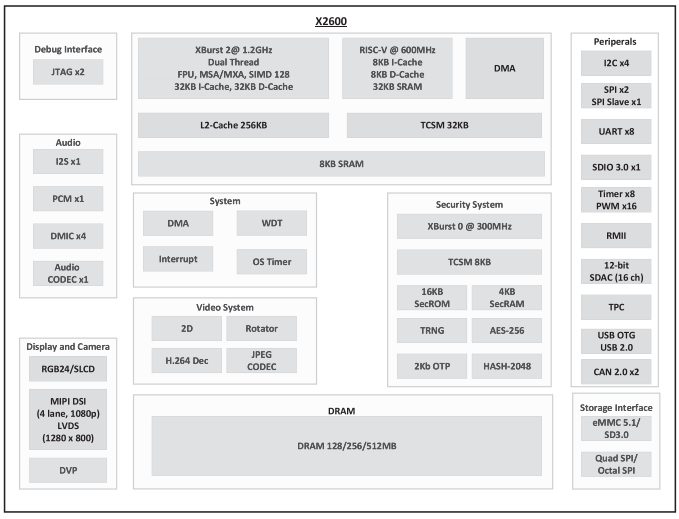
32-bit Multi-Core MPU with Co-Process Family Enables RTC, High-Resolution Displays, and 3D-Printers



This article introduces the newest product to Lumissil's Microprocessor (MPU) portfolio: the X2600 family. This family utilizes a XBurst 2, a family of MIPS processors with FPU (Floating Point Unit) as well as SIMD (Single Instruction Multiple Data) among other advanced features, a RISC-V co-processor, and a dedicated security processor. In addition to a collection of display interfaces, multiple peripheral ports, a System-in-Package (SIP) architecture is used in X2600 family to house memory. These features drive high-resolution displays, perform complex computations, enable authentication, perform encryption/decryption as well as facilitate data storage.



Block Diagram

For compute-intensive applications, the X2600 Multi-Core MPU family features XBurst 2, a CPU @ 1.2GHz, includes up to 512MB SIP DRAM and integrates a RISC-V co-processor @ 600MHz. XBurst 2 supports both single and dual-core configurations and offers options for high-performance and low-power modes while RISC-V is often used to offload real-time controlling. As a major competitiveness, the X2600 features a variety of display interfaces, including MIPI DSI configurable as a 4-lane serial bus used for high-resolution displays up to 1920 x 1080 at fast 60fps data-rate, LVDS, RGB and SLCD interfaces.

KEY FEATURES

Display interfaces offer advantages in high-speed communication between a display and processor or graphics controller. Key benefits include:

- **Increased data transfer speed:** Fast transmission of pixel data is essential for high-resolution displays. Optimal high-resolution displays ensure smooth rendering of complex graphics and videos.
- **Scalable bandwidth:** The MIPI DSI interface supports 2 or 4-lane configurations allowing for display requirement adaptability.
- **Versatility:** The interfaces support a wide range of display types, including TFT, OLED, and e-paper.
- **Fewer wires:** Compared to parallel interfaces, MIPI DSI / LVDS requires fewer wires to transmit data, simplifying PCB designs and reducing space.

Co-Processor offers advantages in reduced latency in display data processing. Key benefits include:

- **Real-time processing:** With a co-processor for real-time control tasks and main processor for general processing, the system can achieve lower latencies, which is critical in applications where data and command feeding responsiveness is critical.

Reconfigurable High Performance/Power Savings CPU Modes offer significant advantages. This dual-mode capability allows the CPU to dynamically switch between high-performance and energy-efficient modes based on current workload demands. In high-performance mode, the CPU delivers maximum processing power, handling intensive tasks and applications with ease. Conversely, in power savings mode, the CPU optimizes energy consumption and reduces operational costs. This adaptability enhances system responsiveness and efficiency while promoting sustainability and cost-effectiveness, making the CPU versatile for both demanding and resource-constrained applications.

Dedicated Security CPU offers robust protection for customers' firmware with advanced encryption and decryption capabilities. By independently handling cryptographic operations, it

enhances the scheme of firmware protection beyond possible interference from the main CPU and user applications. As a key feature, part of the EFUSE space in X2600 is only accessible by the Security CPU, which further strengthens keys' protection.

On-board Memory: On-board memory offers significant benefits for both system performance and efficiency. By integrating memory directly, porting efforts associated with different DRAM part Nos are minimized, resulting in shorter time-to-market. Integrated memory reduces the need for external memory modules, which simplify design and reduce BOM costs.

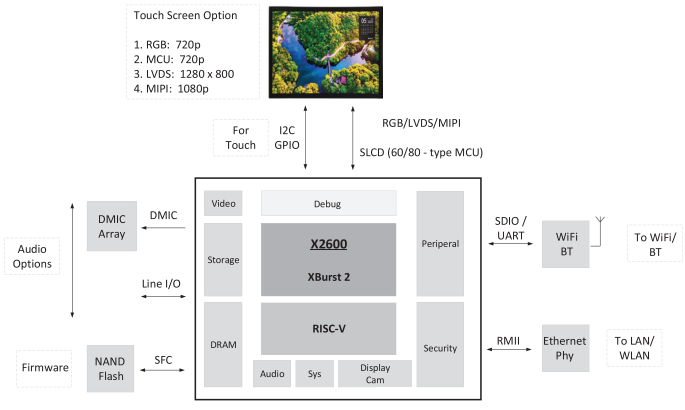
Floating Point Unit (FPU) offers substantial benefits by providing algorithm-running capabilities, crucial for tasks, such as pattern recognition, QR code/ bar code recognition and file compression. Having an on chip FPU enhances the processor's competence for lite AI based applications.

Video CODEC delivers substantial benefits for video processing systems. The integrated CODEC decompresses H.264 video streams, or coding and decoding JPEG files. This integration enables real-time stream playing with minimal latency and storage overhead.

Wide Range of Peripheral Interface ranging from JTAG to common communications ports to display and camera interfaces such as MIPI-DSI and MIPI-CSI and storage interfaces ensure flexibility and future scalability.

TARGET APPLICATIONS

MPUs are used in various real-time systems and touch screen applications where simultaneous execution and processing of data are critical. As an example, the X2600 is employed in compute-intensive Human-Machine Interaction Modules.



Real Time System with High-Def Display

Human-Machine Interaction Modules are finding their way into white goods, smart homes, access control systems, and industrial automation control stations among others. For these applications, the multiple choices for display driving, developer-friendly 2D and rotator blocks, and embedded CPU and DRAM capacity are usually a favorite combination for developers.

The X2600 is also perfect for real-time controlling applications since it features a RISC-V which can be dedicated to collaborate with external devices on a deterministic behavior basis.

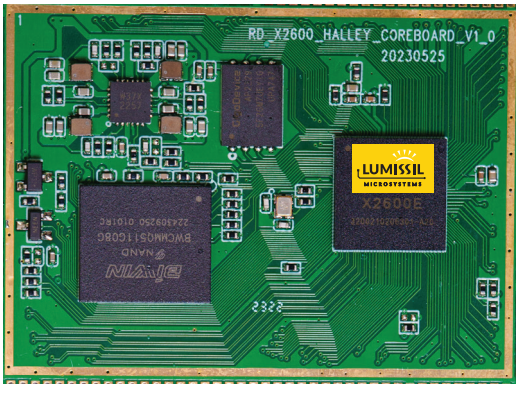
In summary, Lumissil's X2600 is perfect for user-friendly Human-Machine Interaction and real-time control applications.

OTHER USES CASES

1. **e-Paper Tablets:** Display inerfaces in X2600 support a wide range of display types, including TFT, OLED, and e-paper displays, allowing manufacturers flexibility in displays.
2. **Home Automation:** In smart home systems, video decoders in X2600 are used for video doorbells, and CPU cores process the data and interfaces with displays.
3. **Vacuum Robots:** With the RISC-V core acting as the control agent while the XBurst 2 major core taking care of strategy optimization and other algorithm intense tasks, X2600 has made it into a variety of vacuum robots.
4. **Thermal Printers:** As there is an embedded printer controller in the IC (see the diagram for the TPC, which means Thermal Printer Controller), thermal printers are easy design with X2600. Advanced solutions consisting of POS, thermal printer, and touch screen have been released into the market.
5. **3D Printers:** These solutions take good advantage of the RISC-V secondary core. A combination of PWM, I2C, UART, DRAM and other resources found in X2600 is an excellent basis for 3D printers. All the computation and actuator controlling can be done by an individual X2600.

DEVELOPMENT KIT

Lumissil makes developing MPU applications easy with Halley 7, an X2600 development kit. As a bonus, the development kit is designed around an X2600 module to ease design.

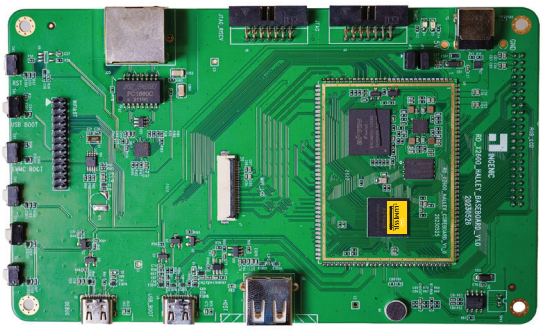


Real Time System with High-Def Display

To facilitate development, Halley 7 includes a +5Vdc input, programming interface, USB OTG interface, JTAG debug interface, DMIC interface, speaker output, RTC, LCD, camera interface and an Ethernet port. The X2600 module, on the other hand, consists of an X2600, SPI NAND flash, EMMC and PMIC whose ports are brought out in the form of stamped holes.

MODULE

Part	Description
Lumissil X2600x	Multi-Core MPU
Global Mixed-Mode Tech GMT G2257Q51U	DC/DC converter with LDO
GigaDevice GD5F2GM7UEYIG	2GB SPI NAND flash
BIWIN BWCMMQ511G08G	8GB EMMC optional storage



Halley 7

HALLEY 7

Parameter	Description
Interface	Micro USB OTG USB debug serial port RGB MIPI DSI DVP for Camera RJ45
Debug port	JTAG
Audio interface	AMIC DMIC
Speaker	Output interface
Miscellaneous	Buttons LED indicator RTC functionality

MPU FAMILY

Part	Description
X2600N	Multi-Core MPU with 128MB DDR3L/3 and 1.35/1.5V options
X2600E	Multi-Core MPU with 256MB DDR3L/3 and 1.35/1.5V options
X2600H	Multi-Core MPU with 512MB DDR3L/3 and 1.35/1.5V options

MPU KEY FEATURES

Parameters	Description
Main processor	XBurst 2 @ 1.2GHz Reconfigurable as a single or dual core CPU
Co-processor	RISC-V @ 600MHz
Security processor	XBurst 0 @ 300MHz
Main Memory	DDR3/3L, 128MB, 1.35/1.5V options DDR3/3L, 256MB, 1.35/1.5V options DDR3/3L, 512MB, 1.35/1.5V options
Cache	XBurst 2 I/D: 32/32KB RISC-V I/D: 8/8KB
FPU	Yes
Multimedia	H264 decode Audio CODEC
Display interface	MIPI DSI 2/4 lane – 1080p LVDS 1280 x 800 RGB24 SLCD
Camera interface	DVP
Storage interface	Quad SPI/Octal SPI EMMC 5.1/SD 3.0
Communications interface	USB 2.0 GPIO UART I2C SPI CAN
Ethernet	RMII 10/100Mbps
OS	Linux Open-Source FreeRTOS
Debug interface	JTAG
Package	BGA 11 x 11mm