

# System-on-Chip

## Product Letter

# SYSTEM-ON-CHIP LITE+

Extended ARM7TDMI-S™-based,  
customizable microcontroller

- ARM7TDMI-S-based customizable microcontroller
- Development platform for ARM7TDMI-S-based System-on-Chip design
- Easy development and verification flow

## Description

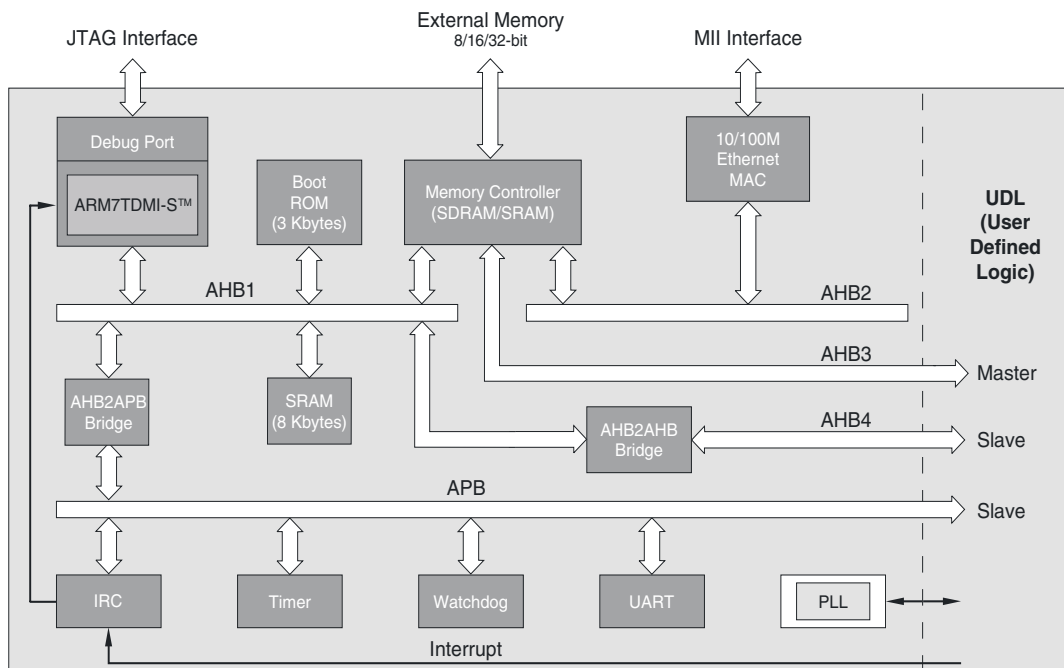
System-on-Chip Lite+ is part of NEC's System-on-Gate-Array family concept for low- to mid-volume system-on-chip and ARM-based microcontroller solutions. The System-on-Chip Lite+ single-chip device is based on standard ASIC technology and consists of two blocks: an ARM7TDMI-S-based subsystem and a sea-of-gates type gate array ASIC area. These blocks are interconnected via the AMBA™ AHB and APB buses. In System-on-Chip Lite+, the subsystem features a multi-port memory controller, a 10/100M Ethernet™ Media Access Controller (MAC) and an AHB-to-AHB bridge for accessing the AHB bus from the gate array area. The subsystem also includes an interrupt controller, a timer, a watchdog timer and a UART. This subsystem block is fully pre-designed and pre-verified as a supermacro. Using the gate array area connected to this supermacro, the customer can expand system capabilities significantly by implementing additional custom logic or special peripheral functions.

An important component of the System-on-Chip Lite+ product is the FPGA-based development board that functionally represents the final System-on-Gate-Array device. Using the development board with an FPGA and System-on-Chip Lite+ prototype chip (ie, the microcontroller subsystem only), the target device is pre-generated by the designer using a familiar FPGA design flow. Then in the final short step to System-on-Chip Lite+ the FPGA RTL-netlist is converted to the ASIC design environment.

## Applications



System-on-Chip Lite+ is designed for Ethernet-ready embedded control applications requiring high data transfer rates and fast access to the external memory. System-on-Chip Lite+ can be used for a wide range of applications, including factory automation, industrial bus systems, card readers, business phones, terminals and home communication equipment. Because of its low unit cost, low NRE cost and short prototyping turnaround times, System-on-Chip Lite+ is an ideal solution especially for emerging applications where market acceptance is as yet uncertain.



## Features

- ARM® subsystem
  - ARM7TDMI-S™ core
    - 32-bit ARM® and 16-bit Thumb® instruction set
    - 32-bit x 8-bit Multiplier
  - SRAM: 8 Kbytes
  - Mask-ROM: 3 Kbytes
  - Operating frequency: up to 60 MHz
  - 10/100M Ethernet™ MAC
  - Multi-port memory controller supporting:
    - SDRAM, Flash (standard/page mode), SRAM and ROM
  - Programmable interrupt controller:
    - 32 interrupts, 8 priority levels
  - Peripherals: UART, timer, reset, watchdog,
  - JTAG interface for debug and boundary scan
- User-defined logic (UDL) area for custom function integration
  - Sea-of-Gates type 0.25 µm drawn gate length Gate Array ASIC architecture
  - Two UDL size options:
    - Option A: up to 250K raw gates
    - Option B: up to 440K raw gates
  - AHB and APB interconnection to the ARM7TDMI-S™ subsystem
- Operating voltage: 2.5 V ± 0.25 V
- I/O voltages: 2.5, 3.3 and 5 V compatible
- Temperature range: -40 to +85°C
- Packages:
  - 240-pin FPBGA for UDL option A
  - 256-pin BGA for UDL option B

## Functional Block Description

### CPU

The System-on-Chip Lite+ CPU is the popular ARM7TDMI-S, an ARM7 32-bit RISC processor core with the Thumb extension, on-chip debugging and 32 x 8 multiplier. Thumb offers 32-bit RISC performance at 16-bit system cost through “compression” of the original ARM instruction set, resulting in high code density that saves memory space. The Thumb instructions are “decompressed” on the fly into full 32-bit ARM instructions. It is also possible to select between ARM and Thumb modes during instruction execution.

### Bus System

The ARM7TDMI subsystem includes a fully AMBA compliant bus system structure. Two main buses – AHB and APB – connect the different macros. The AHB is a high-speed multi-master bus for connection to high-speed macros like CPU and memory controller. The APB is the standard bus for peripherals like UART, timer, etc. Both buses are 32 bits wide. The AHB and the APB and any additional signals required for interrupts and reset are made available to the UDL.

### Memory

The memory subsystem features an internal 8-Kbyte RAM and a small 3-Kbyte ROM. The ROM contains a bootstrap loader program, selectable via an external pin.

### Memory Controller

The System-on-Chip Lite+ multi-port memory controller supports SDRAM (at up to 100 MHz), static memory-mapped devices including SRAM, ROM and Flash (standard/page mode). The address range per chip select is 64 Mbytes.

### 10/100 Ethernet™ Media Access Controller (MAC)

The 10/100M Ethernet MAC is compatible with the IEEE802.3 standard, featuring an address checker, control and statistics registers. It is connected to the multi-port memory controller via the AHB bus to enable high data throughput and to the system AHB bus for configuration. Interfacing to the outside world is via a Media Independent Interface (MII).

### Interrupt Controller

The interrupt controller supports 32 interrupts: 29 interrupts from the UDL and 3 from the ARM subsystem. All interrupts are priority-controlled, individually or globally maskable and selectable by triggering the IRQ of the ARM core.

### Peripherals

The subsystem contains a simple UART supporting auto-synchronization and a timer consisting of a 32-bit down counter with load registers. A configurable prescaler generates the timer clock frequency. A second timer is used as a watchdog timer, generating a reset on overflow.

### UDL

System-on-Chip Lite+ will be available in two options: with up to 250k raw gates or 440k raw gates in a sea-of-gates-type gate array area. The UDL area is connected with the subsystem via the AHB and the APB bus and is available for custom functions. These can be additional peripheral blocks, third-party intellectual property blocks and hardwired logic function blocks (eg, for DSP-type functions). The custom logic is implemented in the System-on-Chip Lite+ chip using NEC's gate array ASIC design flow. NEC supports the customer during the implementation phase. NEC also offers FPGA conversion services for customers who are not familiar with the standard ASIC design flow.

## Ordering Information

### Devices

Part number	Package	Brand name
μPD66702-Pxx (up to 250 K raw gates)	240-pin FPBGA	System-on-Chip Lite+
μPD66703-Pxx (up to 440 K raw gates)	256-pin BGA	System-on-Chip Lite+

Note: Two digits (xx) are reserved for the customer specific suffix number

### Documentation

Doc reference	Topic	Type
A17158EE	System-on-Chip Lite+	User's Manual
A17364EE	System-on-Chip Lite+	Data Sheet
A16902EE	System-on-Chip Lite+	Brochure
A17207EE	Development Board	Product Letter
A17459EE	Development Board	User's Manual
A15047EE	Design Flow	Product Letter
A17646EE	Start it! Development Board	User's Manual

### Tools

Order number	Description
EB-SOCLITEPLUS-EP1S60V1	Development Board
EB-SOCLITEPLUSSTARTIT-V1	Starter Kit "Start it!"

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### With compliments