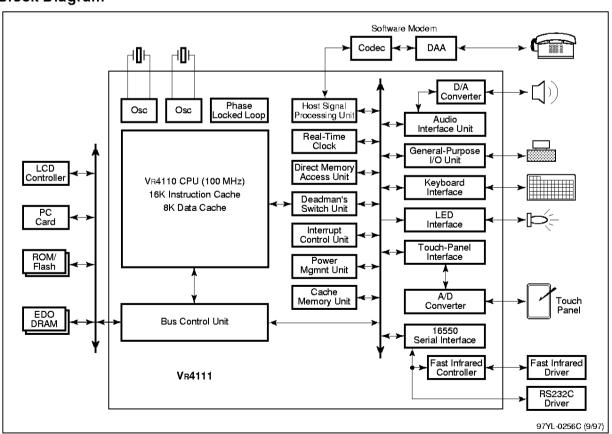## Description

The 64-bit VR4111™(µPD30111) microprocessor is a member of NEC's VR Series™ devices created for Windows® CE-based embedded consumer applications. Designed around the popular MIPS® RISC architecture, the VR4111 offers excellent power consumption and performance in a high-integration, low-cost system on a chip.

This microprocessor is the first NEC device to use the VR4110™ CPU core, an ultra-low power consumption device based on advanced 0.25-micron technology. The VR4110 CPU has a 16K instruction cache, 8K data cache, multiply-and-accumulate (MAC) unit, memory management unit, and an optimized 100-MHz five-stage pipeline that deliver high performance in a compact, low-cost chip. Integrated peripherals include a power management unit, direct memory access unit, interrupt control unit, timers, real-time clock, serial interface, IrDA® interface, keyboard interface, touch-panel interface, LED interface, host signal processing unit (software modem), and A/D and D/A converters.

The VR4111 complies with MIPS I/II/III and MIPS16 instruction set architectures (ISAs). The MIPS16 ISA compliance enables the VR4111 to incorporate 16-bit instructions with conventional 32-bit instructions in a compact code size that reduces the memory requirement and thus system cost.

The VR4111 is an easy choice for VR4102™ customers in terms of upgrade because the VR4111 and VR4102 are fully pin compatible in the 224-pin FPBGA package. The VR4111 microprocessor's high speed, compact size, and low power consumption make it ideal for use in a battery-driven, portable handheld system.

Block Diagram

97YL-0256C (9/97)

NEC

Features

❏ VR4110 CPU core
- MIPS I, II, III ISA-compliant (without FPU, LL, LLD, SC, and SCD instructions)
- MIPS16 ISA-compliant for compact code density
- Five-stage pipeline running at 100 MHz (130 Dhrystone MIPS)
- Single-cycle MAC instruction for DSP operations

❏ Memory management unit
- 32-bit physical addressing range of 4 GB with 40-bit virtual address space
- 32 double-entry TLBs supporting a 1K to 256K page size
- Up to 64 MB DRAM and 64 MB flash/mask ROM

❏ Cache memory unit
- 16K direct-mapped instruction cache
- 8K data cache
- Write-back cache for reducing store operations

❏ Bus control unit
- 32-bit and 16-bit addressing mode
- Dynamic bus sizing (subset of ISA bus)

❏ Power management unit
- 180 mW at full-speed power (typical)
- 30 mW in standby mode
- 10 mW in suspend mode
- 240 mW in hibernate mode

❏ Clock generator unit
- Built-in phase-locked loop for frequency multiplication
- External bus frequency of 16/33 MHz
- 32-kHz and 18-MHz resonators

❏ Real-time clock with four built-in timers

❏ Interrupt control unit with internal and external interrupts

❏ DMA address unit and DMA control unit with four different DMA channels

❏ General-purpose I/O unit with 49 general-purpose I/O pins

❏ Keyboard (96-key), touch-panel, and LED interface

❏ Serial interface unit (16550 compliant)
- Up to 115 kbps
- Separate serial debugging port

❏ Fast infrared unit operating at 0.5 to 4 Mbps (IrDA 1.1 standard communication)

❏ Audio interface unit and 10-bit D/A converter with audio output and microphone input sampling

❏ Host signal processing unit (software modem)

❏ AC/DC specifications
- 100-MHz maximum frequency
- 2.5-V and 3.3-V operation
- 180 mW typical power consumption

❏ 224-pin FPBGA package

VR4102 and VR4111 Comparison

	VR4102	VR4111
CPU	VR4100	VR4110
Pipeline clock	66 MHz	100 MHz
Performance	80 Dhrystone MIPS	130 Dhrystone MIPS
Cache size	Instruction: 4K Data: 1K	Instruction: 16K Data: 8K
Instruction set	MIPS I, II, III	MIPS I, II, III MIPS16
Operating voltage	3.3 volts	2.5 volts (core), 3.3 volts
Integrated peripherals	Same	Same
Memory interface	32 M DRAM 32 M ROM	64 M DRAM 64 M ROM
Power consumption	250 mW	180 mW
Package	216-pin LQFP 224-pin FPBGA	224-pin FPBGA
Process technology	0.35 micron	0.25 micron

Ordering Information

Part Number	Package	Operating Frequency
µPD30111S1-100-3C	224-pin FPBGA	100 MHz
µPD30111S1-80-3C	224-pin FPBGA	80 MHz
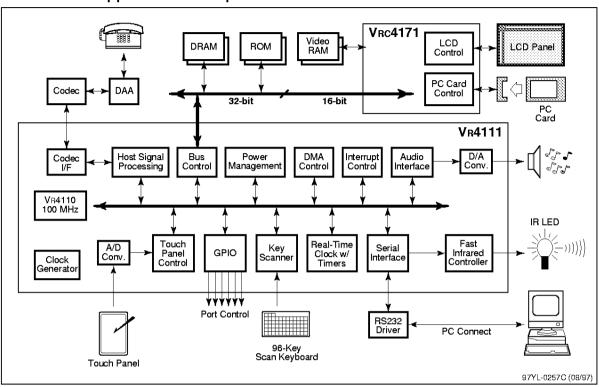
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Windows and Windows CE are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
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Handheld PC Application Example

97YL-0257C (08/97)

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1-800-366-9782
or FAX your request to: **1-800-729-9288**