

# V850 family

## Product Letter

# V853

## 32-bit RISC Microcontrollers

### Description

The single-chip V853 microcontroller is a member of NEC's 32-bit RISC V850 family. It integrates CPU, ROM, RAM and peripheral functions on chip. The internal bus is 32 bits wide, the external bus 16 bits wide. Controller memory options are listed in Table 1.

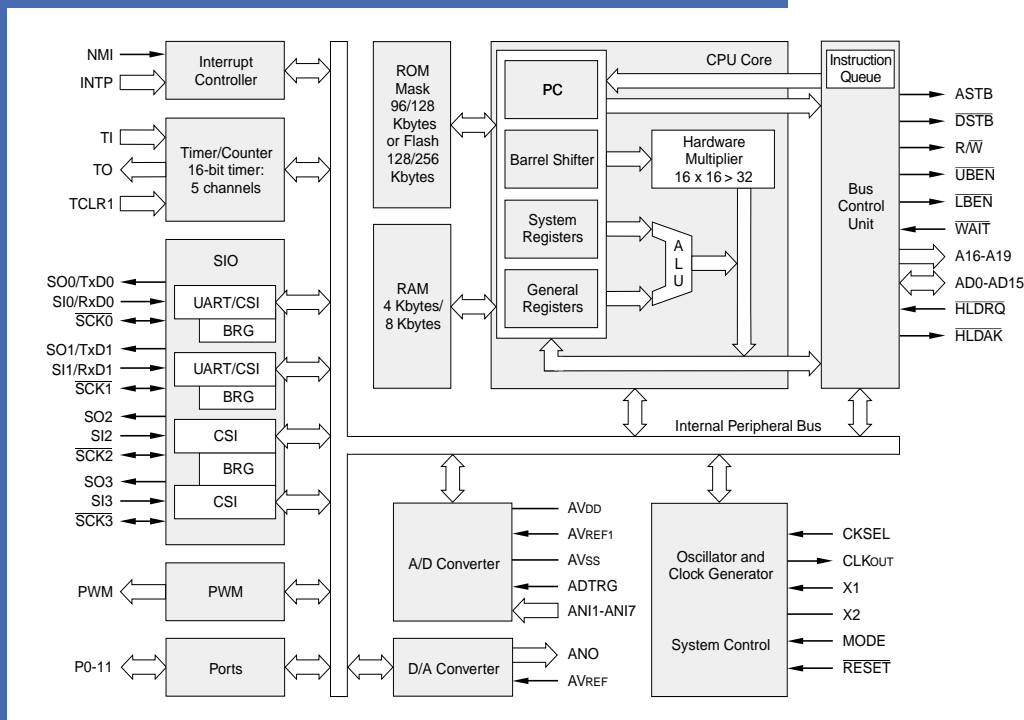
### Applications

Like other V850 series controllers, the V853 device is used for real-time control applications, such as servo motor control in computer peripherals and machine tools, for engine management control, consumer electronics and multimedia. Flash memory, a variety of serial communication channels and AD/DA converters make it the perfect choice for compact communication terminals and complete control systems. Typical benefits of Flash memory are individually programmed devices in the final production process and field upgradability. With their low power consumption and power-saving modes, V853 devices are also ideal for portable applications.

### Features

- Small 32-bit RISC CPU core
- 30 ns minimum instruction execution time (33 MHz max. clock)
- 16-Mbyte linear address space
- 1-Mbyte external address space
- 32 general-purpose registers
- 74 instructions optimized for embedded control
- DSP functionality with 16-bit multiplication and saturation logic in a single clock cycle
- Up to 8 Kbytes internal RAM
- Interrupt controller
- Real-time pulse unit/timers
- Serial interface with baud rate generator
- A/D and D/A converters
- PWM
- Clock generator
- Power save functions
- Mask ROM, Flash versions
- 100-pin LQFP package

### Block Diagram



RISC by NEC:  
Know-how<sup>2</sup>

# NEC

## Functional Block Description

|  |  |
|--|--|
| <b>CPU</b>                               | The internal CPU, based on Harvard architecture, is a very compact 32-bit RISC engine. Most instructions are executed in a single clock cycle under control of a 5-stage pipeline. It also includes a 16 x 16-bit hardware multiplier with 32-bit result and saturation logic. A 32-bit barrel shifter and bit manipulation instructions accelerate complex bit operations.  |
| <b>Bus Control Unit (BCU)</b>            | The BCU initiates the bus cycles based on the physical addresses generated by the CPU. When an instruction stored in external memory is executed and no bus cycle initiation is requested by the CPU, the BCU creates a prefetch address to prefetch an instruction code which is then inserted in the internal instruction queue.   |
| <b>RAM</b>                               | The internal RAM, with a capacity of 4 or 8 Kbytes, is mapped from address FFFFE000H. The CPU can access any data in one clock cycle.  |
| <b>ROM</b>                               | The internal ROM (96 or 128 Kbytes) or Flash ROM (128 or 256 Kbytes) is mapped from 00000000H. The CPU can access any instruction from the ROM/Flash ROM in one clock cycle.   |
| <b>PROM Programming</b>                  | The Flash memory can be written and erased electrically.   |
| <b>Ports</b>                             | The V853 has 67 input/output port pins that can be used alternatively as control pins.   |
| <b>Interrupt Controller</b>              | The interrupt controller handles the interrupt request issued by internal peripheral hardware and external sources. Up to 8 interrupt priority levels can be specified for each interrupt request.   |
| <b>Clock Generator</b>                   | The clock generator produces the CPU operating clock. The internal frequency can be selected as 5x or 1x of crystal frequency by using the internal PLL or 1/2x crystal frequency without PLL. An external clock can be used instead of the clock generator. A clock-out signal is available.  |
| <b>Real-time Pulse Unit (RPU)/Timers</b> | The RPU includes a 5-channel 16-bit timer/counter unit.  |
| <b>Serial Interface</b>                  | The serial interface includes two channels of CSI (Clocked Serial Interface) and two channels which can be operated in the UART (Asynchronous Serial Interface) or the CSI mode. The UART transfers data via the TxD and RxD pins. The baud rate is determined by the on-chip dedicated baud rate generator. The CSI transfers data via the SO, SI and SCK pins at a baud rate determined by the on-chip dedicated baud rate generator or an external clock. |
| <b>A/D Converter</b>                     | An 8-channel A/D converter with 10-bit resolution and a 2-channel 8-bit D/A converter are integrated.  |
| <b>PWM</b>                               | A 2-channel PWM unit with different operating modes is available on chip.  |

## Ordering Information

## Devices

| Part Number       | Max. freq.<br>(MHz) | ROM<br>(Kbytes) | Flash<br>(Kbytes) | RAM<br>(Kbytes) |
|-------------------|---------------------|-----------------|-------------------|-----------------|
| μPD703004AGC-25   | 25                  | 96              | -                 | 4               |
| μPD703004AGC-33   | 33                  | 96              | -                 | 4               |
| μPD703003AGC-25   | 25                  | 128             | -                 | 4               |
| μPD703003AGC-33   | 33                  | 128             | -                 | 4               |
| μPD70F3004AGC-25  | 25                  | -               | 128               | 4               |
| μPD70F3004AGC-33  | 33                  | -               | 128               | 4               |
| μPD70F30025AGC-25 | 25                  | -               | 256               | 8               |
| μPD70F30025AGC-33 | 33                  | -               | 256               | 8               |
| μPD7030025AGC-25  | 25                  | 256             | -                 | 8               |
| μPD7030025AGC-33  | 33                  | 256             | -                 | 8               |

## Documentation

| Doc Number      | Devices              | Type                |
|-----------------|----------------------|---------------------|
| U13919EE2V0CD00 | NEC Micro-Components | CD-ROM              |
| U10243EJ6V0UM00 | V850                 | Architecture Manual |
| U10913EJ5V0UM00 | V853                 | User's Manual       |
| U13188EJ2V1DS00 | V853 Mask            | Data Sheet          |
| U13189EJ2V0DS00 | V853 Flash           | Data Sheet          |

## Tools

| Order Number           | Devices      | Description               | Type                |
|------------------------|--------------|---------------------------|---------------------|
| V850-IAR-Toolset       | V850         | ICE + C Compiler          | Hardware & Software |
| IE-703003-MC-EM1       | V853         | Emulation Board           | Hardware            |
| CPDW95/NT-CDR-V800     | V850         | C/C++ Compiler (GHS)      | Optional Software   |
| FA100-GC               | 100-pin LQFP | Programming Adapter       | Hardware            |
| SC100SDN               | V850         | Emulation Probe Extension | Optional Hardware   |
| StartWARE-GHS-V850/SA1 | V850         | Starter Kit               | Hardware & Software |
| FlashMASTER            | V850         | Programmer                | Hardware            |

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