78K0 family

Product Letter

μPD78002x
μPD78003x

8-bit Microcontrollers

Description

The μPD78002x and μPD78(F)003x are single-chip microcontrollers in NEC's successful 8-bit 78K0 family. They integrate CPU, ROM, RAM and peripheral functions on chip. While all devices include built-in A/D converters and a full duplex UART, they are available with or without multimaster I^2C bus interface. Memory options are listed in the ordering information table.

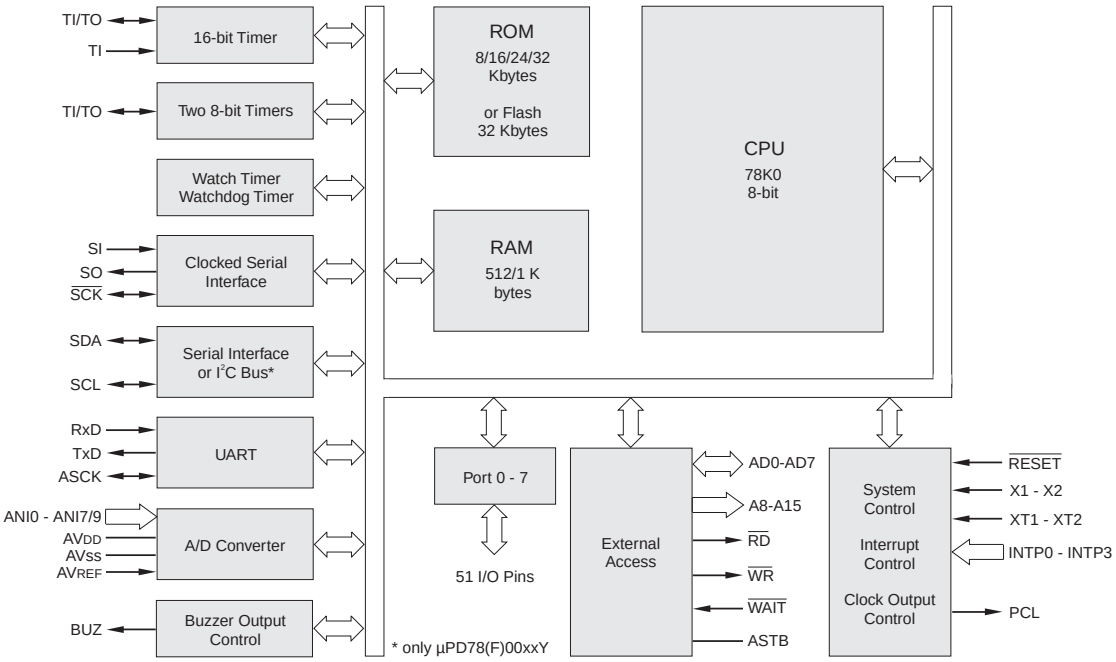
Applications

The applications for μPD78002x/μPD78(F)003x devices are in home electric appliances such as washing machines and refrigerators as well as communications equipment, including cordless telephones and pagers. Because of high electromagnetic compatibility (EMC) these controllers are also ideally suited for automotive applications.

Features

- Mask ROM and Flash versions
- 0.24 μs min. instruction execution time (8 MHz clock)
- Powerful instruction set
- Bit manipulation over entire address space
- Multiply and divide instructions
- 3 serial interfaces
- 8-bit/10-bit A/D converter
- Timer/counter
- Buzzer output
- 51 I/O ports
- Interrupt controller
- Clock generator
- Real time subsystem clock
- Clock prescaler with 4 gears
- Standby control (HALT, STOP mode)
- Power supply voltage: 1.8 – 5.5 V
- High electromagnetic compatibility (EMC)
- 64-pin QFP, LQFP or SDIP packages

Block Diagram



Functional Block Description

CPU

The heart of the 78K0 family is a powerful 8/16-bit CPU. With its 0.35 µm process technology, it was designed to achieve an excellent power performance ratio.
Four register banks with eight 8-bit registers each are provided (4 x 8 x 8-bit). Two 8-bit registers can be concatenated to a 16-bit register to support 16-bit operation, e.g. 8-bit multiplication with 16-bit result or 16-bit index addressing. A total of 63 instructions can be processed. The 64 Kbyte linear address space is accessible via a 16-bit wide address pointer. Bit manipulation operations are supported on all registers and the entire RAM address space. Subclock CPU operation to reduce system power consumption is supported as well.

Memory

The µPD78002x and µPD78003x devices offer a rich choice of on-chip memory combinations, including Flash versions (see table). Flash memory can be written even with the device mounted in the target system.

Ports

All devices have 51 input/output pins, 12 of which are capable of directly driving LEDs. 43 input/output pins feature an internal pull-up resistor, which can be enabled via software.

A/D Converter

An 8-channel A/D converter with 10-bit (µPD78002x = 8-bit) resolution is provided on chip. An external analog value, within the supply voltage range, can be converted by successive approximation into a 10-bit (8-bit) digital value. The average conversion time per channel is under 15 µs at 8 MHz. It is possible to disable the A/D resistor chain in order to reduce the overall power consumption of the system.

Serial Interface

All devices include one full-duplex UART (Universal Asynchronous Receiver Transmitter) supporting transfer rates of up to 125 kbaud. The on-chip dedicated baud rate generator generates the baud rate. Whereas the µPD78002xY and µPD78(F)003xY controllers have one CSI (Clocked Serial Interface) as well as one multimaster I^2C bus on chip, all other devices include two CSIs. The 3-wire CSI supports data transfer of up to 1.25 Mbps.

Timer

All devices have 5 timer channels. One 16-bit timer is available for basic interval timing, as a PWM peripheral or to generate programmable square waves. The two 8-bit timers have a similar functionality and can also be used as external event counters. The watch timer can simultaneously operate as a timing monitor and interval timer. The on-chip watchdog timer monitors CPU operation.

Clock Generator

The on-chip clock generator provides an operating frequency of 8.38 MHz. An external 32 kHz crystal can be connected to the terminal pair XT1/XT2 to generate the subclock frequency. Selecting the subclock mode significantly reduces power consumption.

Interrupt Controller

The interrupt controller handles various interrupt requests, maskable or non-maskable, issued by internal peripheral hardware or external devices. One of the ports is equipped with a key interrupt function which can be used to wake up the CPU from STOP or HALT mode by an external event. The STOP and HALT modes can further reduce system power consumption.

Ordering Information

Devices

Part Number	ROM (Kbytes)	Flash (Kbytes)	RAM (bytes)	A/D Converter
μPD780021	8	—	512	8 x 8-bit
μPD780022	16	—	512	8 x 8-bit
μPD780023	24	—	1 K	8 x 8-bit
μPD780024	32	—	1 K	8 x 8-bit
μPD780031	8	—	512	8 x 10-bit
μPD780032	16	—	512	8 x 10-bit
μPD780033	24	—	1 K	8 x 10-bit
μPD780034	32	—	1 K	8 x 10-bit
μPD78F0034	—	32	1 K	8 x 10-bit

Note: Device orders must specify the package code GK (LQFP), GC (QFP) or CW (SDIP). All devices are also available with I^2C bus.

Documentation

Doc Number	Device	Type
U11933EE2V0CD00	NEC Microcontrollers	CD-ROM
U12299EJ1V0DS00	μPD78002x	Data Sheet
U12300EJ1V0PM00	μPD78003x	Data Sheet
U11993EJ1V0DS00	μPD78F0034	Data Sheet
U12165EJ1V0DS00	μPD78002xY	Data Sheet
U12166EJ1V0PM00	μPD78003xY	Data Sheet
U11994EJ1V0PM00	μPD78F0034Y	Data Sheet
U12022EJ4V0UM00	μPD78002x/μPD78(F)003x	User's Manual

Tools

Order Number	Description	Type
DSWIN-I3HD-780xx	Simulator	Software
EB-78K0STARTER2	Starter Kit	Software & Hardware
78K0-TOOLSET*	Tool Kit	Software & Hardware
IE-78K0-SL-P01	Emulation Board	Hardware
EP-64GC-SL	Emulation Probe	Hardware
EP-64CW-SL	Emulation Probe	Hardware
EP-64GK-SL	Emulation Probe	Hardware
IE-780034-SL-EM4	Emulation Probe	Hardware
TGC-064SAP	LCC Socket	Hardware
TGK-064SBW	LCC Socket	Hardware
FA-64GC	Programming Adapter	Hardware
FA-64CW	Programming Adapter	Hardware
FA-64GK	Programming Adapter	Hardware
FLASHMASTER	Flash Programmer	Hardware

* TOOLSET includes C Compiler, Assembler, Debugger and In-circuit Emulator.

For further information on NEC's 78K0 family or other NEC products visit our European website at **www.nec.de**

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